GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 01**
FY-2004 PROPOSED SCOPE OF WORK for:

Feasibility Study on Nonnative Fish Removal in the Lower Little Colorado River

Lead Agency: US Fish and Wildlife Service, Arizona Game and Fish Department, Navajo Nation
Submitted By: Pam Sponholtz
US Fish and Wildlife Service
Flagstaff, Arizona
Date: April 21, 2003
Category:

Expected Funding Source:

__ Ongoing Project
__ Ongoing Revised Project
X Requested New Project
__ Unsolicited Proposal

__ Annual Funds
__ Capital Funds
_X_ Other (Explain) BOR, USGS

I. **Title of Proposal:** Feasibility Study on Nonnative Fish Removal in the Lower Little Colorado River
II. **Relationship To Programs:** This section provides insight into the relationship between the proposed action and the Adaptive Management Program goals and objectives, Recovery Goals for the humpback chub, and the Biological Opinion RPAs on Glen Canyon Dam operations.

Adaptive Management Program: The goals and management objectives of the Adaptive Management Program that apply are:

Goal 2. Maintain or attain viable populations of existing native fish, remove jeopardy for humpback chub and razorback sucker, and prevent adverse modification to their critical habitat.

Management Objective 2.1: Maintain or attain humpback chub abundance and year-class strength in the LCR and other aggregations at appropriate levels for viable populations and to remove jeopardy. (Sequence order 1, 1.5 and 2)

Management Objective 2.2: Sustain or establish viable HBC spawning aggregations outside the LCR in the Colorado River ecosystem below Glen Canyon Dam to remove jeopardy. (Sequence order 2, 2.5, and 3)

Goal 2. Maintain or attain viable populations of existing native fish, remove jeopardy for humpback chub and razorback sucker, and prevent adverse modification to their critical habitat.

Management Objective 2.1: Maintain or attain humpback chub abundance and year-class strength in the LCR and other aggregations at appropriate levels for viable populations and to remove jeopardy. (Sequence order 1, 1.5 and 2)

Management Objective 2.2: Sustain or establish viable HBC spawning aggregations outside the LCR in the Colorado River ecosystem below Glen Canyon Dam to remove jeopardy. (Sequence order 2, 2.5, and 3)

Recovery Goals: The site-specific management actions and objective, measurable criteria from the Humpback Chub Recovery Goals that apply are:

5.2.2.3 Factor C.—Adequate protection from diseases and predation

Management Action C-3.—Control problematic nonnative fishes as needed.

Task C-3.1.—Develop rainbow trout, channel catfish, black bullhead, and common carp control programs in the Little Colorado River to identify levels of control that will minimize predation on humpback chub (see section 4.3.2 and A.8 for discussion of effects of nonnative fishes).

Task C-3.2.—Implement identified levels (as determined under Task C-3.1) of rainbow trout, channel catfish, black bullhead, and common carp control in the Little Colorado River.

Biological Opinion: Elements of the Reasonable and Prudent Alternative that apply are as follows. Successful completion of the RPA is necessary to remove jeopardy to the humpback chub from the proposed action (operation of Glen Canyon Dam under a Modified Low Fluctuating Flow alternative described in the Final EIS and ROD).

Element 2. Protect humpback chub spawning population and habitat in the LCR by being instrumental in developing a management plan for this river (i.e., Little Colorado River).

III. Study Background/Rationale and Hypotheses: Recovery Goals amend the Humpback chub Recovery Plan and establish "Site-Specific Management Actions to Achieve Recovery." For Grand Canyon, it states the need to:

- Develop and implement rainbow trout, channel catfish, black bullhead, and common carp control programs in the Little Colorado River to identify levels of control that will minimize predation on humpback chub.

In response to this requirement and the Goals and Management Objectives contained in the AMP, the Adaptive Management Work Group ad hoc committee outlined the following action to achieve these purposes:

●Initiate Removal of Nonnative Fishes in the Little Colorado River (lower 17.5 km) by targeting nonnative fishes, including carp, fathead minnow, channel catfish, yellow/black bullhead and red shiner

This recommendation was modified in the March 12th meeting to focus more on a feasibility or experimental type project to examine different types of techniques and to find specific measures to detect changes in nonnative and native densities within the LCR.

IV. Study Goals, Objectives, End Product:

Study Goal

Explore the feasibility of reduction/removal of nonnative fishes in the Little Colorado River (lower 17.5 km) by targeting carp, channel catfish, and yellow/black bullhead. Investigate the level of control necessary to reduce large bodied nonnatives, including most efficient removal methods, including reduction of bycatch.

Study Objectives (Performance Measures)

1. In cooperation with concurrent studies to identify methods to effectively capture nonnative cyprinids and ictalurids, use species-specific methods to reduce nonnative predator loads in lower 17.5 km of the Little Colorado River
2. Determine effect of removal efforts on nonnative and native fish densities, including how long do suppression efforts take for an effect to be measurable and how long do suppression efforts last
3. Determine habitat overlap between natives and nonnatives
4. Monitor changes in biomass and reproductive potential of nonnatives in response to removal efforts
5. Work at the watershed level to identify upstream sources of nonnative fish that may be potential sources during high flow events
6. Work with local landowners on conservation agreements to manage upstream habitats to remain free of nonnative fish

End Product

Develop and implement a plan to effectively control channel catfish, black/yellow bullhead, and common carp in the Little Colorado River to levels that will minimize predation on humpback chub.

V. Study Area: Lower 17.5 km of the Little Colorado River.

VI. Study Methods/Approach: Removal methods will include trammel nets, fyke nets, hoop nets and angling. Feasibility of electroshocking using canoes

or rafts will also be explored as it relates to species specific capture frequencies and minimization of incidental bycatch. Sample size will be related to initial capture densities and be modified based on success or failure of a particular method.

VII. Task Description and Schedule:

VIII. FY-2004 Work: This project was initiated in 2002 and is expected to be completed in 2006.

IX. Budget Summary:

FY 2003-2003: $100,000-150,000 (BOR, USGS)

X. Reviewers:
Peer reviewers (1999)
AMWG and TWG (1999 and 2003)
Science Advisors (2003)

XI. References

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 02**
FY-2004 PROPOSED SCOPE OF WORK for:

Emergency Response/Contingency Plan for Protection of Downstream Humpback Chub Populations and Critical Habitat from Hazardous-Materials Spills into the Little Colorado River.

Lead Agency: Environmental Protection Agency

Submitted By: William E. Davis
EcoPlan Associates, Inc.
701 W. Southern Avenue, Suite 203
Mesa, Arizona 85210
480-733-6666/FAX 480-733-6661
E-mail: **bdavis@ecoplanaz.com**

Date: March 13, 2003

Category:

Expected Funding Source:

__ Ongoing Project
__ Ongoing Revised Project
X Requested New Project
__ Unsolicited Proposal

__ Annual Funds
__ Capital Funds
X Other (Explain) Possible EPA Clean Water Act Grant, Navajo Nation EPA, Arizona Department of Environmental Quality Grant, BIA Grant, USFWS

I. Title of Proposal: Development of Emergency Response/Contingency Plan for Protection of Downstream Humpback Chub Populations and Critical Habitat from Hazardous-Materials Spills into the Little Colorado River at Highway 89 and Highway 40.

II. Relationship To Programs: This section provides insight into the relationship between the proposed action and the Adaptive Management Program goals and objectives, Recovery Goals for the humpback chub, and the Biological Opinion RPAs on Glen Canyon Dam operations.

Adaptive Management Program: The goals and management objectives of the Adaptive Management Program that apply are:

Goal 2. Maintain or attain viable populations of existing native fish, remove jeopardy for humpback chub and razorback sucker, and prevent adverse modification to their critical habitat.

Management Objective 2.1: Maintain or attain humpback chub abundance and year-class strength in the LCR and other aggregations at appropriate levels for viable populations and to remove jeopardy. (Sequence order 1, 1.5 and 2)

Management Objective 2.2: Sustain or establish viable HBC spawning aggregations outside the LCR in the Colorado River ecosystem below Glen Canyon Dam to remove jeopardy. (Sequence order 2, 2.5, and 3)

Goal 7. Establish water temperature, quality and flow dynamics to achieve GCDAMP ecosystem goals.

Management Objective 7.2: Maintain water quality in the mainstem of the Colorado River ecosystem. (Sequence order 4.5)

Recovery Goals: The site-specific management actions and objective, measurable criteria from the Humpback Chub Recovery Goals that apply are:

5.2.2.4 Factor D. – Adequate existing regulatory mechanisms

Management Action D-2 – Provide for the long-term management and protection of humpback chub populations and their habitats.

Task D-2.1 – Identify elements needed for the development of conservation plans that are necessary to provide for the long-term management and protection of humpback chub populations.

Task D-2.2 – Develop and implement conservation plans and execute agreements among State agencies, Federal agencies, Native American tribes, and other interested parties to provide reasonable assurances that conditions needed for recovered humpback chub populations will be maintained.

5.2.2.5 Factor E. – Other natural or manmade factors for which protection has been provided.

Management Action E-1. Minimize the risk of hazardous-materials spills in critical habitat.

Task E-1.1 – Review and recommend modifications to State and Federal hazardous-materials spills emergency-response plans to ensure adequate protection for humpback chub populations from hazardous-materials spills, including prevention and quick response to hazardous-materials spills.
Task E-1.2 – Implement State and Federal emergency-response plans that contain the necessary preventive measures for hazardous-materials spills.

Task E-1.3 – Identify measures to minimize the risk of hazardous-materials spills from transport of materials along U.S. Highway 89 at and near the two Cameron bridges spanning the Little Colorado River.

Task E-1.4 – Implement measures to minimize risk of hazardous-materials spills from transport of materials along U.S. Highway 89 at and near the two Cameron bridges spanning the Little Colorado River.

Biological Opinion: Elements of the Reasonable and Prudent Alternative that apply are as follows. Successful completion of the RPA is necessary to remove jeopardy to the humpback chub from the proposed action (operation of Glen Canyon Dam under a Modified Low Fluctuating Flow alternative described in the Final EIS and ROD).

Element 2. Protect humpback chub spawning population and habitat in the LCR by being instrumental in developing a management plan for this river (i.e., Little Colorado River).

III. Study Background/Rationale and Hypotheses: Recovery Goals amend the Humpback chub Recovery Plan and establish "Site-Specific Management Actions to Achieve Recovery." For Grand Canyon, it states the need to:

- Review and modify, if necessary, state and federal hazardous spills emergency response plans to insure adequate protection from spills, including prevention and quick response to spills; develop and implement a hazardous spills protocol for the two Cameron Bridges.

In response to this requirement and the Goals and Management Objectives contained in the AMP, the Adaptive Management Work Group ad hoc committee outlined the following action to achieve these purposes:

- Develop a well-designed Contingency Plan providing details about each step involved in preventing, preparing for, and responding to, spills of hazardous materials into the Little Colorado River channel at the two Cameron Bridges on Highway 89 and Holbrook Bridge on Highway 40 for the express purpose of protecting the humpback chub and its critical habitat in the Little Colorado River. Designated critical habitat for humpback chub in the Little Colorado River is from river mile 8 (about "Atomizer Falls" or "Chute Falls") to the confluence with the Colorado River.

IV. Study Goals, Objectives, End Product:

<u>Study Goal</u>

Develop a well-designed Contingency Plan providing details about each step involved in preventing, preparing for, and responding to, spills of materials into the Little Colorado River channel at the two Cameron Bridges on Highway 89 and the Holbrook or Winslow Bridges on Hwy. 40 for the express purpose of protecting humpback chub and their critical habitat in the Little Colorado River.

Study Objectives

1. Identification of Background Information

a. Identify protection from hazardous materials spills in existing regulations of Arizona Department of Environmental Quality (ADEQ).
b. Description of highway corridor, including types and volume of traffic, specific destinations, links to other highways.
c. Description of natural setting of Protected Corridor, including biology, habitat, specific species of concern.
d. Description of Protected Corridor including dimensions of the channel, surface water flow rates, seasonal variations, occurrence of groundwater, soil types, geology.
e. Identification of access points along Protected Corridor.
f. Listing of response personnel including names and phone numbers of individuals who work with tribal, state, and federal agencies, plus local people and private companies who can help with the response.
g. Description and location of response equipment available in the area.
h. Description of communications systems that will be used to coordinate the various personnel and agencies involved in the control and cleanup effort.

2. Identification of Spill Scenarios

a. Description of hazardous materials transportation practice affecting bridge including types/volume of hazardous materials crossing bridge, any posted restrictions on hazardous materials.
b. Description of non-hazardous materials that may also adversely impact sensitive species and their occurrence at bridge crossing.
c. Development of potential spill scenarios including, but not limited to, the kind of spill that is “most likely” to occur, and the “worst case” scenario.
d. Identification of physical, chemical, and biological techniques that can be used to contain or clean up a spill.
e. Description of potential necessary response time for protection of species, based on developed scenarios (i.e. higher risk to lower risk).
f. Describe preventative measures that could be involved such as signage, notices, speed limits,

3. Identification of Response Actions

a. Notification procedures to tribal and government authorities and agencies, and private companies responsible for cleanup efforts.
b. Procedures for getting trained personnel and equipment to site, establishing communications.
c. Procedures for establishing protection of personnel health and safety.
d. Delegation of responsibilities for identifying the type of spill, potential fate and transport scenario, potential for impacting sensitive species.
e. Directions for spill containment, removal, and disposal.
f. Description of follow up reporting and communication requirements**.**

End Product

An acceptable, effective Contingency Plan that will provide the best response to spills into the Little Colorado River at highway bridges at Cameron, Holbrook, and Winslow.

V. Study Area: State Highway 89 bridges over the Little Colorado River at Cameron and Interstate Highway 40 bridges over the Little Colorado River at Holbrook and Winslow.

VI. Study Methods/Approach: Three elements will be completed including: Identification of Background Information; Identification of Spill Scenarios; and Identification of Response Actions. Within each element, a series of sub-elements will be completed as described above under IV. Study Objectives. Extensive coordination and communication with responsible entities, agencies and individuals will be needed to achieve a successful Contingency Plan.

VII. Task Description and Schedule: Objective 1: Identification of Background Information, including sub-elements *a-g* will be prepared in the first three months after notice to proceed. Objective 2: Identification of Spill Scenarios, including sub-elements *a-f* will be prepared within the first six months. Objective 3: Identification of Response Actions, including sub-elements *a-f* will be completed within the first nine months. A draft Contingency Plan will be completed within 10 months and a final within 12 months.

VIII. FY 2004 Work: We anticipate work beginning October 1, 2004 and being completed by September 30, 2005.

IX. Budget Summary:

Objective 1:	$30,000
Objective 2:	$30,000
Objective 3:	$40,000

X. Reviewers:

XI. References

US Fish and Wildlife Service, Recovery Goals for the Humpback Chub (*Gila cypha*) of the Colorado River Basin: A supplement and amendment to the Humpback chub Recovery Plan, Mountain-Prairie Region (6), Denver, Colorado. 2002.

Adaptive Management Work Group, Glen Canyon Adaptive Management Program. Final Draft Information Needs, November 7, 2002.

U.S. Fish and Wildlife Service, Biological Opinion on Operation of Glen Canyon Dam, 1993.

U.S. Fish and Wildlife Service, Recovery Goals for the Humpback chub (*Gila cypa*) of the Colorado River Basin. 2002.

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 03**
FY-2004 PROPOSED SCOPE OF WORK for:

Pollution Control Plan For Little Colorado River Watershed.

Lead Agency: Environmental Protection Agency

Submitted By: William E. Davis
EcoPlan Associates, Inc.
701 W. Southern Avenue, Suite 203
Mesa, Arizona 85210
480-733-6666/FAX 480-733-6661
E-mail: **bdavis@ecoplanaz.com**

Date: April 15, 2003

Category:

Expected Funding Source:

__ Ongoing Project
__ Ongoing Revised Project
X Requested New Project
__ Unsolicited Proposal

__ Annual Funds
__ Capital Funds
X Other (Explain) Possible EPA Clean Water Act Grant, Navajo Nation EPA, Arizona Department of Environmental Quality Grant, BIA Grant

I. Title of Proposal: Develop pollution control plan for Little Colorado River watershed that includes capability.

II. Relationship To Programs: This section provides insight into the relationship between the proposed action and the Adaptive Management Program goals and objectives, Recovery Goals for the humpback chub, and the Biological Opinion RPAs on Glen Canyon Dam operations.

Adaptive Management Program: The goals and management objectives of the Adaptive Management Program that apply are:

Goal 2. Maintain or attain viable populations of existing native fish, remove jeopardy for humpback chub and razorback sucker, and prevent adverse modification to their critical habitat.

Management Objective 2.1: Maintain or attain humpback chub abundance and year-class strength in the LCR and other aggregations at appropriate levels for viable populations and to remove jeopardy. (Sequence order 1, 1.5 and 2)

Management Objective 2.2: Sustain or establish viable HBC spawning aggregations outside the LCR in the Colorado River ecosystem below Glen Canyon Dam to remove jeopardy. (Sequence order 2, 2.5, and 3)

Goal 7. Establish water temperature, quality and flow dynamics to achieve GCDAMP ecosystem goals.

Management Objective 7.2: Maintain water quality in the mainstem of the Colorado River ecosystem. (Sequence order 4.5)

Recovery Goals: The site-specific management actions and objective, measurable criteria from the Humpback Chub Recovery Goals that apply are:

5.2.2.4 Factor D. – Adequate existing regulatory mechanisms

Management Action D-2 – Provide for the long-term management and protection of humpback chub populations and their habitats.

Task D-2.1 – Identify elements needed for the development of conservation plans that are necessary to provide for the long-term management and protection of humpback chub populations.

Task D-2.2 – Develop and implement conservation plans and execute agreements among State agencies, Federal agencies, Native American tribes, and other interested parties to provide reasonable assurances that conditions needed for recovered humpback chub populations will be maintained.

5.2.2.5 Factor E. – Other natural or manmade factors for which protection has been provided.

Management Action E-1. Minimize the risk of hazardous-materials spills in critical habitat.

Task E-1.1 – Review and recommend modifications to State and Federal hazardous-materials spills emergency-response plans to ensure adequate protection for humpback chub populations from hazardous-materials spills, including prevention and quick response to hazardous-materials spills.

Task E-1.2 – Implement State and Federal emergency-response plans that contain the necessary preventive measures for hazardous-materials spills.

Biological Opinion: Elements of the Reasonable and Prudent Alternative that apply are as follows. Successful completion of the RPA is necessary to remove jeopardy to the humpback chub from the proposed action (operation of Glen Canyon Dam under a Modified Low Fluctuating Flow alternative described in the Final EIS and ROD).

Element 2. Protect humpback chub spawning population and habitat in the LCR by being instrumental in developing a management plan for this river (i.e., Little Colorado River).

III. Study Background/Rationale and Hypotheses: Recovery Goals amend the Humpback chub Recovery Plan and establish "Site-Specific Management Actions to Achieve Recovery." For Grand Canyon, it states the need to:

- Review and modify, if necessary, state and federal hazardous spills emergency response plans to insure adequate protection from spills, including prevention and quick response to spills.

In response to this requirement and the Goals and Management Objectives contained in the AMP, the Adaptive Management Work Group ad hoc committee outlined the following action to achieve these purposes:

- Develop a Pollution Control Plan for The Little Colorado Rvier that provides a comprehensive evaluation of threats to the humpback chub and its critical habitat that may arise from activities in the watershed and suggest potential actions to ameliorate these threats.

IV. Study Goals, Objectives, End Product:

Study Goal

Develop a Pollution Control Plan for The Little Colorado Rvier that provides a comprehensive evaluation of threats to the humpback chub and its critical habitat that may arise from activities in the watershed and suggest potential actions to ameliorate these threats.

Study Objectives (Performance Measures)

Review potential threats to the humpback chub population that may arise from activities in the watershed and suggest potential actions to ameliorate these threats.

1. Identification of Background Information

a. Description of state and federal water quality standards, water quality control plans and pollutant sources.
b. Description of natural setting of watershed, including biology, habitat, and specific species of concern.
c. Description of watershed, including surface water flow rates, seasonal variations, occurrence of groundwater, soil types, and geology.
d. Identification of nonpoint pollutant sources in the watershed.

e. Listing of responsible entities, including names and phone numbers of individuals who work with tribal, state, and federal agencies, plus local people and private companies.
f. Description and location of response equipment available in the area in the event of a spill, upset or other unauthorized discharge of pollutants.
g. Description of communications systems that will be used to coordinate the various personnel and agencies involved in control and cleanup efforts.

2. Identification of Pollution Scenarios

h. Description of pollution control practices affecting water quality including types/volume of pollutants, locations, and treatment methods.
i. Development of potential spill scenarios including, but not limited to, the kind of spill that is "most likely" to occur, and the "worst case" scenario.
j. Identification of physical, chemical, and biological techniques that can be used to contain or clean up a spill, upset or other unauthorized discharge of pollutants.
k. Description of potential necessary response time for protection of species, based on developed scenarios (i.e. higher risk to lower risk).

3. Identify Response Actions

l. Notification procedures to tribal and government authorities and agencies, and private companies responsible for cleanup efforts.
m. Procedures for getting trained personnel and equipment to site, establishing communications.
n. Procedures for establishing protection of personnel health and safety.
o. Delegation of responsibilities for identifying the type of spill, potential fate and transport scenario, potential for impacting sensitive species.
p. Directions for spill containment, removal, and disposal of pollutants.
q. Description of follow up reporting and communication requirements

End Product

A Pollution Control Plan for The Little Colorado Rvier that provides a comprehensive evaluation of threats to the humpback chub and its critical habitat that may arise from activities in the watershed and suggest potential actions to ameliorate these threats.

V. Study Area: Principally in the Little Colorado River watershed as little to no buffer exists between humpback chub critical habitat and sources of potential pollutants; however, other potential pollutant sources in other areas tributary to humpback chub habitats would be included in the plan depending on the perceived risk.

VI. Study Methods/Approach:

<<Information Needed>>

VII. Task Description and Schedule:

<<Information Needed>>

VIII. FY 2004 Work: We anticipate work beginning October 1, 2003 and being completed by September 30, 2005.

IX. Budget Summary:

Depending on the availability of existing watershed pollution control plans, this could take up to $100,000 over 24 months to complete.

X. Reviewers:

XI. References

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 05**
FY-2004 PROPOSED SCOPE OF WORK for:

Comprehensive Action Plan to Conserve, Protect, and Enhance Humpback Chub Populations in Grand Canyon.

Lead Agency: To be determined, but might include: GCMRC, USFWS, AGFD, SWCA, Valdez, and others
Submitted By: Rob Simmonds
Date: April 15, 2003
Category:

Expected Funding Source:

__ Ongoing Project
__ Ongoing Revised Project
X Requested New Project
__ Unsolicited Proposal

__ Annual Funds
__ Capital Funds
__ Other (Explain) Possible

I. Title of Proposal: Develop a Comprehensive Action Plan for Actions Necessary to Conserve, Protect, and Enhance Humpback Chub Populations in Grand Canyon.

II. Relationship To Programs: This section provides insight into the relationship between the proposed action and the Adaptive Management Program goals and objectives, Recovery Goals for the humpback chub, and the Biological Opinion RPAs on Glen Canyon Dam operations.

Adaptive Management Program: The goals and management objectives of the Adaptive Management Program that apply are:

Goal 2. Maintain or attain viable populations of existing native fish, remove jeopardy for humpback chub and razorback sucker, and prevent adverse modification to their critical habitat.

Management Objective 2.1: Maintain or attain humpback chub abundance and year-class strength in the LCR and other aggregations at appropriate levels for viable populations and to remove jeopardy. (Sequence order 1, 1.5 and 2)

Management Objective 2.2: Sustain or establish viable HBC spawning aggregations outside the LCR in the Colorado River ecosystem below Glen Canyon Dam to remove jeopardy. (Sequence order 2, 2.5, and 3)

Goal 7. Establish water temperature, quality and flow dynamics to achieve GCDAMP ecosystem goals.

Management Objective 7.2: Maintain water quality in the mainstem of the Colorado River ecosystem. (Sequence order 4.5)

Recovery Goals: The site-specific management actions and objective, measurable criteria from the Humpback Chub Recovery Goals that apply are:

5.2.2.4 Factor D.—Adequate existing regulatory mechanisms

Management Action D-2.—Provide for the long-term management and protection of humpback chub populations and their habitats.

Task D-2.1.—Identify elements needed for the development of conservation plans that are necessary to provide for the long-term management and protection of humpback chub populations; elements of these plans may include (but are not limited to) provision of flows for maintenance of adequate habitat conditions for all life stages of humpback chub, regulation and/or control of nonnative fishes, minimization of the risk of hazardous-materials spills, minimization of risks of parasites, and monitoring of populations and habitats (see section 4.4 for discussion of need for conservation plans).

Task D-2.2.—Develop and implement conservation plans and execute agreements among State agencies, Federal agencies, American Indian tribes, and other interested parties to provide reasonable assurances that conditions needed for recovered humpback chub populations will be maintained.

III. Study Background/Rationale and Hypotheses: Recovery Goals amend the Humpback chub Recovery Plan and establish "Site-Specific Management Actions to Achieve Recovery." For Grand Canyon, it states the need to:

<<Information Needed>>

In response to this requirement and the Goals and Management Objectives contained in the AMP, the Adaptive Management Work Group ad hoc committee outlined the following action to achieve these purposes:

<<Information Needed>>

IV. Study Goals, Objectives, End Product:

<u>Study Goal</u>

Develop a plan of attack that will identify, coordinate, and eventually foster the completion of actions to benefit humpback chub in Grand Canyon.

Study Objectives (Performance Measures)

1. Develop list of necessary actions.
2. Develop study plans (or at least detailed outlines) for each project. Must be detailed enough to develop accurate time line and budget.
3. Compile individual study plans into a comprehensive action plan that coordinates all projects (i.e., identifies the required course of actions needed to complete the projects) and includes annual budget requirements. This action plan would be evaluated and updated annually to acknowledge progress and to accommodate new information.

End Product

A Conservation Plan that will identify, coordinate, and foster completion of management actions to benefit humpback chub in Grand Canyon.

V. Study Area: Actions identified in plan would cover areas in the Colorado River from Glen Canyon Dam to Lake Mead, including tributaries therein.

X. Study Methods/Approach:

<<Information Needed>>

XI. Task Description and Schedule:

<<Information Needed>>

XII. FY 2004 Work: We anticipate work beginning April 2003 and being completed by December 2003.

XIII. Budget Summary:

FY03-04: $100,000-150,000

If feasible, I suggest that one individual coordinate/oversee the effort and a group of experts (paid) be convened to develop study plans.

X. Reviewers:

XI. References

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 06**
FY-2004 PROPOSED SCOPE OF WORK for:

Complete Feasibility Study of Selective Withdrawal on Glen Canyon Dam

Lead Agency: Bureau of Reclamation
Submitted by: Dennis Kubly
Date: April 9, 2003
Category:

Expected Funding Source:

_ Ongoing project
_ Ongoing-revised project
X Requested new project
_ Unsolicited proposal

X Annual funds
_ Capital funds
_ Other (explain)

I. Title of Proposal: Complete feasibility study of selective withdrawal on Glen Canyon Dam and, if feasible, finish compliance, construct, and test the device

II. Relationship To Programs:

Recovery Goals:

Humpback Chub 5.2.2.1 Factor A. - Adequate habitat and range for recovered populations provided

Management Action A-3. - Investigate the anticipated effects of and options for providing warmer water temperatures in the mainstem Colorado River through Grand Canyon that would allow for range expansion of the Grand Canyon numpback chub population and provide appropriate water temperatures if determined feasible and necessary for recovery.

Task A-3.1 - Determine the effects and feasibility of a temperature control device for Glen Canyon Dam under the Glen Canyon Dam Adaptive Management Program (U.S. Bureau of Reclamation 1999) to increase water temperatures in the mainstem Colorado River through Grand Canyon that would allow for range expansion of humpback chub.

Task A-3.1.2. - Implement a temperature control device for Glen Canyon Dam if determined feasible and necessary for recovery of humpback chub.

Biological Opinion:

Element 1C: Determine responses of native fishes in Grand Canyon to various temperature regimes and river flows of the experimental flows and other operations of Glen Canyon Dam. Studies will emphasize collection of information necessary to

remove jeopardy to federally-listed species and identify actions necessary to enhance their recovery. Reclamation will provide technical assistance and funding for research to accomplish the following studies:

i. Determine the effects of water temperature on reproductive success, growth, and survivorship of Grand Canyon fishes.

vii. Determine the effects of dam operations, including modifications to regulate water temperature, on the parasites and disease organisms of endangered and native fishes in Grand Canyon.

III. Study Background/Rationale and Hypotheses:

Cold-water releases from Glen Canyon Dam are below optimal for the existing trout fishery and far below those temperatures needed to allow the humpback chub to thrive in the mainstem of the Colorado River. Cold-water releases make it easy for trout to prey on young, native, warm-water fish.

Thermal shock from cold mainstem temperatures has been recognized as a likely cause of mortality for young endangered fish leaving seasonally warmed tributaries. In their integration report on studies in Glen and Grand Canyons, Valdez and Carothers (1999) concluded that, “We believe that most larval flannelmouth suckers, bluehead suckers, and humpback chub descending from warm natal tributaries into the cold mainstem die of thermal shock or from predation elicited by erratic swimming behavior. For those fish old enough to survive the transition, swimming ability may be reduced by as much as 98 percent by cold mainstem temperatures.” Early results from FWS studies at their Willow Beach National Fish Hatchery show no appreciable growth in young humpback chub after 90 days at 12□C while growth is rapid at 24□C and intermediate at 18□C. Clearly the life history data, growth studies, the extinction of several species, and endangered status of humpback chub amount to reasonable evidence that native fish are likely injured (at least in part) by cold releases.

Increasing the temperature of dam releases could be an effective tool to reduce thermal shock during the relatively short period of time that the humpback chub are descending into the mainstem.

Ho_1: Warming Glen Canyon Dam releases through the use of a selective withdrawal structure will neither significantly increase the range nor significantly increase the recruitment of humpback chub.

Ho_2: Warming Glen Canyon Dam releases through the use of a selective withdrawal structure will not detrimentally alter the aquatic foodbase, particularly in the Lees Ferry reach.

Ho_3: Warming Glen Canyon Dam releases through the use of a selective withdrawal structure will not significantly benefit non-native fish to the detriment of the humpback chub in the CRE.

IV. Study Goals, Objectives, End Product: Through a combination of the Science Advisors' risk assessment and completion of a NEPA document, the proposal to construct a selective withdrawal structure on Glen Canyon Dam will be evaluated. The end product is a decision by the Department of the Interior on this proposal.

V. Study area: Colorado River mainstem between Glen Canyon Dam and the western boundary of Grand Canyon National Park.

VI. Task Description and Schedule:

Task 1. Complete risk assessment by AMP Science Advisors, July 2003.
Task 2. Complete NEPA compliance document, Dec 2003.
Task 3. Complete design for selected structural alternative, September 2004.
Task 4. Complete construction, June, 2007.
Task 5. Implement AMP testing program following construction.

VII. Study Methods/Approach:

Evaluation of the selective withdrawal structure will be accomplished through a NEPA process, which would include an assessment of the risks associated with construction and operation. While many of these risks may only be answered by actually constructing the structure, the assessment will help guide both the decision process and the formulation of a science plan for testing its operation.

If constructed, testing of the selective withdrawal structure will be accomplished through the AMP using a science plan developed by GCMRC in cooperation with the Science Advisors and the Technical Work Group. Funding for monitoring will be from a combination of AMP funds and Section 8 CRSP appropriated funds. The latter funds will be available for 3 years, primarily to ensure the adequacy of the construction using Reclamation's authority under the 1956 CRSP Act. Under the 2001 Energy and Water appropriations bill, monitoring and research for ESA issues would be handled within the AMP. These tasks would be accomplished within the AMP budget.

VIII. FY-2003 Work

Task 1 - Deliverables/Due Dates
- Science Advisors workshop, May 2003
- Draft report, June 2003
- Report at AWMG meeting, July 2003
- Final report, August 2003
- Budget: Total $80,000

Task 2 - Deliverables/Due Dates
- Draft NEPA document, September 2003
- Budget: Total $50,000

FY-2004 Work
Task 2 - Deliverables/Due Dates
- Final NEPA document/decision, December 2003
- Budget: Total $50,000

Task 3 - Deliverables/Due Dates
- Design preparation, September 2004
- Budget: $150,000

Task 4 - Deliverables/Due Dates
- Construction
- Budget: $4,000,000

FY-2005 Work
Task 4 - Deliverables/Due Dates
- Construction
- Budget: $4,000,000

FY-2006 Work
Task 4 - Deliverables/Due Dates
- Construction
- Budget: $4,000,000

FY-2007 Work
Task 4 - Deliverables/Due Dates
- Complete construction
- Budget: Balance to complete and schedule dependent on selected alternative

FY-2008 through 2010 Work
Task 5 - Deliverables/Due Dates
- Complete performance testing
- Budget: $300,000 / year

IX. Budget Summary:

FY-2003	$80,000 AMP, $50,000 Reclamation appropriations
FY-2004	$200,000 Reclamation appropriations
FY-2005	$4,000,000 Reclamation appropriations
FY-2006	$4,000,000 Reclamation appropriations
FY-2007	unknown - Reclamation appropriations
FY-2008 - FY-2010	$300,000 for three years - Reclamation appropriations

Total: Dependent on structural alternative selected.

X. Reviewers:

Peer reviewers (1999)
AMWG and TWG (1999 and 2003)
Science Advisors (2003)

XI. References

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 07**
FY-2004 PROPOSED SCOPE OF WORK for:

Assess Humpback Chub at Willow Beach NFH as Potential Broodstock.

Lead Agency: U.S. Fish and Wildlife Service, may include others
Submitted By: Rob Simmonds
Date: April 15, 2003
Category:

Expected Funding Source:

__ Ongoing Project
__ Ongoing Revised Project
X Requested New Project
__ Unsolicited Proposal

__ Annual Funds
__ Capital Funds
X_ Other (Explain) Possible

I. Title of Proposal: Assess Humpback Chub Currently at Willow Beach NFH as Potential Broodstock.

II. Relationship To Programs: This section provides insight into the relationship between the proposed action and the Adaptive Management Program goals and objectives, and the Biological Opinion RPAs on Glen Canyon Dam operations.

Adaptive Management Program: The goals and management objectives of the Adaptive Management Program that apply are:

Goal 2. Maintain or attain viable populations of existing native fish, remove jeopardy for humpback chub and razorback sucker, and prevent adverse modification to their critical habitat.

Management Objective 2.1: Maintain or attain humpback chub abundance and year-class strength in the LCR and other aggregations at appropriate levels for viable populations and to remove jeopardy. (Sequence order 1, 1.5 and 2)

Management Objective 2.2: Sustain or establish viable HBC spawning aggregations outside the LCR in the Colorado River ecosystem below Glen Canyon Dam to remove jeopardy. (Sequence order 2, 2.5, and 3)

Biological Opinion: Elements of the Reasonable and Prudent Alternative that apply are as follows. Successful completion of the RPA is necessary to remove jeopardy to the humpback chub from the proposed action (operation of Glen Canyon Dam under a Modified Low Fluctuating Flow alternative described in the Final EIS and ROD).

Element 2: Establish a second spawning aggregation of humpback chub downstream of Glen Canyon Dam.

III. Study Background/Rationale and Hypotheses:

IV. Study Goals, Objectives, End Product:

Study Goal

Develop a brood stock of humpback chub from the Little Colorado River population.

Study Objectives (Performance Measures)

Determine if humpback chub currently on station at Willow Beach NFH would be suitable as a potential broodstock.

1. Collect tissues from fish at Willow Beach NFH and any other available archived tissues (approx. 120 from Willow Beach NFH plus 40-50 reference samples).
2. Perform microsatellite analysis using existing loci.
3. Perform statistical analysis and report.
4. Using genetic information, develop captive broodstock management plan.

End Product

An assessment of the suitability of the humpback chub currently at the Willow Beach National Fish Hatchery as a potential brood stock.

V. Study Area: Willow Beach NFH.

VI. Study Methods/Approach:

VII. Task Description and Schedule:

VIII. FY 2004 Work:

June 2003 - December 2004.

IX. Budget Summary:

FY03-04: $120,000

X. Reviewers:

XI. References:

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 08**
FY-2004 PROPOSED SCOPE OF WORK for:

Program to Augment the Population of Humpback Chub in Grand Canyon.

Lead Agency: Arizona Fishery Resources Office-Flagstaff, GCMRC
Submitted By: Rob Simmonds
Date: April 21, 2003
Category:

Expected Funding Source:

__ Ongoing Project
__ Ongoing Revised Project
X Requested New Project
__ Unsolicited Proposal

__ Annual Funds
__ Capital Funds
X_ Other (Explain) Possible

I. Title of Proposal: Feasibility of Developing a Program to Augment the Population of Humpback Chub (*Gila cypha*) in Grand Canyon

II. Relationship To Programs: This section provides insight into the relationship between the proposed action and the Adaptive Management Program goals and objectives, and the Biological Opinion RPAs on Glen Canyon Dam operations.

Adaptive Management Program: The goals and management objectives of the Adaptive Management Program that apply are:

Goal 2. Maintain or attain viable populations of existing native fish, remove jeopardy for humpback chub and razorback sucker, and prevent adverse modification to their critical habitat.

Management Objective 2.1: Maintain or attain humpback chub abundance and year-class strength in the LCR and other aggregations at appropriate levels for viable populations and to remove jeopardy. (Sequence order 1, 1.5 and 2)

Management Objective 2.2: Sustain or establish viable HBC spawning aggregations outside the LCR in the Colorado River ecosystem below Glen Canyon Dam to remove jeopardy. (Sequence order 2, 2.5, and 3)

Biological Opinion: Elements of the Reasonable and Prudent Alternative that apply are as follows. Successful completion of the RPA is necessary to remove jeopardy to the humpback chub from the proposed action (operation of Glen Canyon Dam under a Modified Low Fluctuating Flow alternative described in the Final EIS and ROD).

Element 2: Establish a second spawning aggregation of humpback chub downstream of Glen Canyon Dam.

III. Study Background/Rationale and Hypotheses:

IV. Study Goals, Objectives, End Product:

Study Goal

Study Objectives (Performance Measures)

1. Examine the feasibility of establishing a supplemental stocking program for humpback chub in Grand Canyon using wild caught young of year (YOY) humpback chub removed from the Little Colorado River (LCR) and grown out to a large size in captivity.
2. Examine the feasibility of developing a captive broodstock to be used for a captive breeding program for humpback chub.
3. Examine the feasibility of establishing a second spawning (or expand the current) population of humpback chub in Grand Canyon.

End Product (Performance Measures

1. For the feasibility of supplemental stocking using growout facilities, the project will answer the following questions:
   a. Where could the supplemental fish be grown?
   b. What size fish should be collected, how, from where, and when?
   c. What is the best size to grow out captive fish before release?
   d. How many fish will need to be released into the wild in order sufficiently supplement the population of humpback chub in Grand Canyon?
   e. Where and when will fish be released back into the wild?

2. For the feasibility of establishing a supplemental population using broodstock, the project will answer the following questions:
   a. Is a captive adult broodstock needed at this point in time, and what will it contribute?
   b. Identification of components necessary to develop a broodstock management plan.
   c. Where to hold broodstock, where to raise fish, what size to raise fish, how many, where/when to release?

3. For the feasibility of establishing a second population, the project will focus on:
   a. Transplanting fish above Chute Falls
   b. Refugia population in Havasu Creek

4. Report and evaluation of each objective, including recommendations for future action.

V. Study Area: Colorado River Basin

VI. Study Methods/Approach:

VII. Task Description and Schedule:

VIII. FY 2004 Work:

June 2003 - December 2004.

IX. Budget Summary:

FY 2003: $23,000

X. Reviewers:

XI. References:

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 09**
FY-2004 PROPOSED SCOPE OF WORK for:

Remove humpback chub from mainstem Colorado River at 30-Mile to maintain genetic stock in refugia.

Lead Agency: To be determined. USFWS and AGFD

Submitted By: Bill Persons
Research Program Supervisor
Arizona Game and Fish Department
2221 West Greenway Road
Phoenix, AZ 85023
bpersons@gf.state.az.us
(V) 602-789-3375
(F) 602-789-3918

Date: April 2, 2003

Category:

Expected Funding Source:

__ Ongoing Project
__ Ongoing Revised Project
X Requested New Project
__ Unsolicited Proposal

__ Annual Funds
__ Capital Funds
X_ Other (Explain) Possible AMWG, Seek USFWS, Arizona Heritage, or Arizona State Wildlife Grant funding

I. Title of Proposal: Remove humpback chub from mainstem Colorado River at 30-Mile to maintain genetic stock in refugia.

II. Relationship to Adaptive Management Program, Recovery Goals, and Biological Opinion

Goal 2 in the AMP Strategic Plan (August 17, 2001) is "Maintain or attain viable populations of existing native fish, remove jeopardy from humpback chub and razorback sucker, and prevent adverse modification to their critical habitat". Management Objective 2.2 is to "Sustain or establish viable HBC spawning aggregations outside the LCR in the Colorado River ecosystem below Glen Canyon Dam to remove jeopardy."

The Adaptive Management Work Group, in their April 24, 2002 meeting, recommended that the Secretary "Initiate all needed activities (consultation [include HBC], compliance, development of a science plan, public outreach, development of a captive breeding population of Grand Canyon Humpback Chub.)"

The Biological Opinion requires a second spawning population of humpback chub (in addition to the Little Colorado River (LCR) aggregation). The 30-Mile aggregation of HBC has been documented to spawn occasionally and young fish have been collected immediately downstream of the 30-Mile location however there appears to be no recruitment to the aggregation. The genetic relationship between the 30-Mile aggregation and the Little Colorado River (LCR) aggregation are unknown. Genetics studies are currently underway (GCMRC), but it is unknown if they will identify any unique characteristics of the 30-Mile fish.

A genetics management plan and refugia plan are desired prior to removal of fish from the wild. However, if the wild stock is only comprised of 50 old adults, and they represent a unique genetic stock, it may be critical to remove fish before a genetics management plan and refugia plan are fully developed.

III. Study Background/Rationale and Hypotheses:

Valdez and Ryel (1995) estimated a population of approximately 52 HBC at 30-Mile, comprised primarily of large (> 350 mm) adults and occasionally young-of-the-year (y.o.y.) fish. Young-of-the-year fish were collected in 1993, 1994, and 1995 between 30-Mile and 45-Mile, frequently in a backwater at 44.27 mile (GCMRC unpublished data). These young-of-the-year fish were presumed to have originated from the 30-Mile aggregation. However, juvenile sized fish (> 125 mm to < 330 mm) have not been collected near 30-Mile. The 30-Mile aggregation is likely comprised of old, large adults with little or no recruitment to the spawning population. There is a concern that if the 30-Mile aggregation represents a unique stock of fish that are better suited to mainstem spawning they should be protected. If the 30-Mile HBC are not recruiting, natural mortality may eliminate the few remaining adults, thus there is a need to evaluate removal of fish for protection in a hatchery facility. It is probably more desirable to remove gametes or y.o.y. fishes than to remove the few remaining adults, however it will likely be more difficult to capture y.o.y. fishes or gametes.

IV. Study Goals, Objectives, End Product:

1. Develop a refugia plan and secure necessary permits for removing fish from the wild and holding them.
    i. Development of a refugia plan may include examination of genetic samples to evaluate uniqueness of 30-Mile HBC. Development of a refugia plan should be coordinated with development of a genetics management plan.
2. Collect adult or juvenile HBC or gametes from the 30-Mile aggregation.
    i. Number to be collected will be determined as part of the planning process and genetics analysis.
3. Prepare annual progress report and final report.

4. End product is a refugia population of 30-Mile HBC.

V. Study area

1. 30-Mile and vicinity.

VI. Study Methods/Approach

1. A refugia plan will be developed by May 2004 and permits will be secured.
2. Adult fish will be collected by trammel net during the May-June 2004 period. Young-of-the-year fish will be collected by hoop-net, seine, and minnow trap if available and desired, during the July – October period. If gametes are to be removed, sampling should likely take place during May-June. Fish will be removed by the most appropriate method depending on NPS regulations. Fish may be transported to the Little Colorado River for helicopter transport to a suitable hatchery facility.

VII. Task Description and Schedule

1. 2003-2004 Develop plan and secure permits.
2. 2004 Collect and remove fish or gametes.
3. 2005-2020? Maintain fish.

VIII. FY-2003-2004 Work

1. Estimated $25,000 - $50,000 to develop a plan; to evaluate and select a refugia location; and to secure permits for removal of genetic material.
2. Estimated $40,000 to secure space at a suitable refugia location.
3. Estimated $120,000 to capture and move fish from 30-Mile to a refugia location.
4. Estimated $10,000/year to maintain fish, depending on brood-stock management plan and genetics evaluation.

IX. Budget Summary

FY-2003	$ 90,000
FY-2004	$125,000
FY-2005	$ 10,000
Total:	$225,000

X. Reviewers

XI. References

Valdez, R.A. and R.J. Ryel. 1995. Life history and ecology of the humpback chub (*Gila cypha)* in the Colorado River, Grand Canyon, Arizona. Final report to the Bureau of Reclamation, Salt Lake City, Utah, Contract No. 0-CS-40-09110. BIO/WEST Report No. TR-250-8. BIO/WEST, Inc., Logan Utah.

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 10**
FY-2004 PROPOSED SCOPE OF WORK for:

Monitoring Fish Parasites and Diseases.

Lead Agency: To be determined. USGS, National Wildlife Health Center, AGFD, USFWS.

Submitted by: Bill Persons
Research Program Supervisor
Arizona Game and Fish Department
2221 West Greenway Road
Phoenix, AZ 85023
bpersons@gf.state.az.us
(V) 602-789-3375
(F) 602-789-3918

Date: April 2, 2003

Category:

Expected Funding Source:

__ Ongoing Project
__ Ongoing Revised Project
X Requested New Project
__ Unsolicited Proposal

__ Annual Funds
__ Capital Funds
X_ Other (Explain) Possible AMWG, Seek USGS State Partnership Grant, Arizona Heritage, Arizona State Wildlife Grant funding

I. Title of Proposal: Monitoring fish parasites and diseases, Colorado River Ecosystem.

II. Relationship to Adaptive Management Program, Recovery Goals, and Biological Opinion

Goal 2 in the AMP Strategic Plan (August 17, 2001) is "Maintain or attain viable populations of existing native fish, remove jeopardy from humpback chub and razorback sucker, and prevent adverse modification to their critical habitat". Management Objective 2.2 is to "Sustain or establish viable HBC spawning aggregations outside the LCR in the Colorado River ecosystem below Glen Canyon Dam to remove jeopardy."

Management Objective 2.5 refers to attaining native fish disease and other parasite levels at an appropriate, but as yet undetermined level.

Recovery Goals:

5.2.2.3 Factor C.—Adequate protection from diseases and predation

Management Action C-1.—Control Asian tapeworm as needed.

Task C-1.1.—Develop an Asian tapeworm control program in the Little Colorado River to identify the levels of control that will minimize the negative effects of parasitism on the humpback chub population (see section 4.3.1 and Appendix A for discussion of diseases and parasites).

Task C-1.2.—Implement identified levels (as determined under Task C-1.1) of Asian tapeworm control in the Little Colorado River.

III. Study Background/Rationale and Hypotheses:

At least four exotic parasites are known to infect fishes of the LCR. Two of these parasites, Asian fish tapeworm *Bothriocephalus acheilognathi* (Cestoda) and anchor worm *Lernaea cyprinacea* (Copepoda) infect humpback chub at a higher rate than any other species in the system (Brouder and Hoffnagle 1997; Hoffnagle and Cole 1999; Hoffnagle et al 2000). Both *B. acheilognathi* and *L. cyprinacea* have been reported as pathogenic and potentially fatal (directly or indirectly) to fish of various age classes (Schäpperclaus 1986). *Bothriocephalus acheilognathi* has caused high mortality in native fishes that it has infected outside of its native range (Hoffman and Schubert 1984). These parasites cannot complete their life cycles in the mainstem Colorado River under present, cold water conditions. However, they may be transported by infected individuals to other warmer tributaries, such as Kanab Creek.

Information on disease and parasite distribution, and impact of water temperature regimes is requested managers for making decisions regarding the future operation of Glen Canyon Dam and the proposed multi-level intake structure. Previous studies (Brouder and Hoffnagle 1997, Hoffnagle and Cole 1999, Hoffnagle et al 2000, Cole et al 2002) have identified parasites of native and non-native fishes of the lower LCR but have not surveyed fish diseases and parasites of the colder Colorado River and other tributaries in Grand Canyon. These studies should be conducted as part of the evaluation possible impacts of a temperature control device.

IV. Study Goals, Objectives, End Product:

Monitor fish parasites and diseases in the Colorado River ecosystem. Inventory parasites and diseases present in the mainstem Colorado River and larger tributaries. Examine distribution and abundance of parasites and diseases in relation to water temperature and river location. In addition, laboratory studies examining the impact of *B. acheilognathi* on growth and survival chub are being proposed through other funding sources (Cole 2002).

V. Study area

Colorado River ecosystem from Glen Canyon Dam to Lake Mead, including selected tributaries. Tributaries considered for re-establishment of native fishes should be surveyed for existing disease and parasites.

VI. Study Methods/Approach

Fish parasites and diseases will be monitored during 2004 following the methods of Cole et al (2002a). The effort will require one river trip of approximately 15 days. The work will require a separate river trip because investigators need to examine fish in the field immediately after capture in order to detect various bacteria and viruses that are not able to be preserved for later examination.

VII. Task Description and Schedule

1. September 2003 – February 2004. Fully develop study plan, secure funding and secure necessary permits.
2. February 2004 – June 2004. Obtain necessary supplies and equipment for field sampling.
3. June 2004 – August 2004. Conduct fieldwork; collect samples and complete preliminary analyses of samples.
4. August 2004 – January 2005. Prepare draft report.

VIII. FY-2003-2004 Work

IX. Budget Summary

Task	Start	Finish	Estimated Cost
Secure funding or issue rfp thru GCMRC	Sept 2003	Oct 2003	$9,000.00
Develop study plan and secure permits	Sept 2003	Febr 2004	$15,000.00
Collect samples	June 2004	Aug 2004	$12,000.00
Lab analysis	June 2004	Aug 2004	$12,000.00
Data analysis	June 2004	Aug 2004	$12,000.00
Prepare reports	Aug 2004	Jan 2005	$12,000.00
Total			$126,600.00

X. Reviewers

XI. References

Brouder, M. J. and T. L. Hoffnagle. 1997. Distribution and prevalence of the Asian fish tapeworm, *Bothriocephalus acheilognathi*, in the Colorado River and tributaries, Grand Canyon, Arizona, including two new host records. Journal of the Helminthological Society of Washington 64:219-226.

Cole, R.A. 2002. Proposal to investigate life cycle and impact of *Truttaedacnitis truttae* on Lees Ferry rainbow trout and conduct preliminary parasite inventory on flannelmouth sucker from the Lees Ferry reach. Proposal submitted to USGS State Partnership Grant and Grand Canyon Monitoring and Research Center, 2002.

Hoffman, G. L. and G. Schubert. 1984. Some parasites of exotic fishes. Pages 233-261 *in* W. R. Courtney, Jr. and J. R. Stauffer, Jr., editors. Distribution, biology, and management of exotic fishes. Johns Hopkins University Press, Baltimore.

Hoffnagle, T. L. and R. A. Cole. 1999. Distribution and prevalence of *Lernaea cyprinacea* in fishes of the Colorado River and tributaries in Grand Canyon, Arizona. Proceedings of the Desert Fishes Council 29:45-46.

Hoffnagle, T. L., A. Choudhury and R. A. Cole. 2000. Parasites of native and non-native fishes of the lower Little Colorado River, Arizona. 2000 Annual Report. Arizona Game and Fish Department, Phoenix.

Schäpperclaus , W. 1986. Fish diseases, volume 2. Akademie-Verlag, Berlin.

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 11**
FY-2004 PROPOSED SCOPE OF WORK for:

Transport of HBC above Chute Falls

Lead Agency: US Fish and Wildlife Service, Arizona Game and Fish Department, Navajo Nation
Submitted By: Pam Sponholtz
US Fish and Wildlife Service
Flagstaff, Arizona
Date: April 15, 2003
Category:

Expected Funding Source:

__ Ongoing Project
__ Ongoing Revised Project
X Requested New Project
__ Unsolicited Proposal

__ Annual Funds
__ Capital Funds
_X_ Other (Explain) BOR, USGS

I. **Title of Proposal:** Transport of HBC above Chute Falls

II. **Relationship To Programs:**

III. **Study Background/Rationale and Hypotheses:**

IV. **Study Goals, Objectives, End Product:**

The short-term objective of this project would address the question of whether or not transplanted fish would remain above Chute Falls in the Little Colorado River (LCR). Geomorphology of this section of the LCR includes narrow, canyon bound stretches subject to scouring flows. Small life history stages of HBC may not be able to maintain position in high flows and be washed downstream. However, if lower volume flows and baseflow conditions occur over the 2003 and 2004 seasons, HBC may be able to exploit available habitat and remain in this upstream section until they reach larger sizes. The second objective of this project is a direct management action to try and prevent the large-scale loss of HBC in the 30-60mm size class. Data suggest that once smaller life history stages enter the Colorado River either through high flows or downstream drift, that a combination of cold temperatures and predation significantly reduce recruitment. It appears that once HBC exceed the 150-200 size range that survival significantly increases. If HBC can remain in the LCR longer to reach these larger size classes, they may have an increased chance of survival once they enter the mainstem Colorado. The longer-term objective of this project is the establishment of a spawning population above Chute Falls.

V. Study area

Little Colorado River

VI. Study Methods/Approach

A reconnaissance-level trip will be performed in June 2003 to assess water quality (CO_2, pH, temperature, turbidity), densities of nonnative fishes and to determine potential helicopter landing/sling loading areas for subsequent fish transfer above Chute Falls. Capture methods used will include seining, minnow traps and snorkeling surveys. Although water quality above the Atomizer Falls Complex has been adequately documented (Mattes 1993, Robinson et. al 1996, Strength 1997), we propose to obtain limited samples to ensure water quality conditions for subsequent fish release.

In July 2003, USFWS biologists (3) will be taken to the lower end of the Little Colorado River at Boulder's Camp to obtain approximately (300) 50-100mm HBC. Near the confluence of the Colorado River, HBC are most vulnerable to being washed into the mainstem and long-term survival is reduced. While this size range is outside the range identified by the BO, it is imperative that all fish are individually marked so that monitoring efforts can detect movement of translocated fish into areas downstream of Chute Falls. The minimum size that HBC can be elastomer marked is approximately 50mm total length. Due to the limited number of fish being moved, every opportunity to detect fish movement downstream and be able to identify translocated individuals needs to be pursed. In addition, Robinson 1996 found between 20-30% mortality of age-0 fish (26-40mm) during cage experiments at river kilometer 15 and 12.5 suggesting some handling induced mortality from transport. Mortality was reduced to 0% when age-1 fish (40-100mm) were used. Larger size classes may increase survival in transplanted sections.

Capture methods used will include seining, minnow traps and hoop nets. Since it is unknown how long it will take to capture this many HBC within the specific size class, logistics of subsequent helicopter contact and transport will have to be further developed. Due to the warm ambient air temperatures in the LCR during summer, all capture efforts will be conducted during early morning and late afternoon to reduce stress and mortality of captured fishes. Captured fish will be measured for length, and implanted with an elastomer tag with a unique color. Pending approval by the Navajo Nation, all captured nonnative fishes will be sacrificed. All other fishes will be returned to point of capture. All captured HBC will be held in 1/8 mesh live cars until transport upstream. Fish will be transported to the release site in an aerated tank or cooler stored within the helicopter. At the release site, fish will be tempered both for temperature and CO_2 levels until differences between parameters are within 1 mg/l and 1°C. Following tempering, translocated fish will be held in live cars at several locations in the LCR between river kilometer 15 and 17.5. At each location fish will monitored for stress and mortality for a minimum of 24 hours. Following 24 hours of monitoring, fish will be released into the LCR.

Monitoring of released fish will occur in November 2003 for 5 days to determine whether or not any retention above Chute Falls has occurred. Capture methods used will include seining, minnow traps baited hoop nets and snorkeling. Captured HBC will be measured for length and if they exceed 150 mm total length, be implanted with a pit tag. In addition, USFWS population estimate trips will occur in September and October 2003 as well as in spring 2004 and could potentially capture transplanted fish during sampling along the lower 14 kilometers. Unique identification via elastomer tags will provide insight as to how many fish were transported downstream during the 2-3 month time frame. An interim report will be submitted by December 31, 2003 that summarizes the June 2003 reconnaissance trip, July 2003 translocation trip and November 2003 monitoring efforts. This report can then be used to determine subsequent levels of effort and size classes based on initial effort in 2003.

To evaluate how transplanted fish persist following winter flows, monitoring of transplanted fish will occur in late spring 2004. To reduce handling effects on fish, spring monitoring will consist of snorkeling surveys as the primary method to assess presence/absence of transplanted fish. Other methods such as baited minnow traps and seines may be used should turbid water conditions exist during spring monitoring efforts. In June/July 2004, an additional translocation trip will occur using similar methods as described above. Monitoring will occur to assess post monsoon survival in November 2004. The specific date will depend on when the spring 2004 spawn occurred for HBC. An interim report will be submitted by December 31st 2004 that summarizes the spring 2004 monitoring, June/July 2004 translocation trip and the 2004 November monitoring.

Final monitoring will occur in spring 2005, followed by a final report that will be submitted in June 2005. The final report will include a synthesis of all translocations, monitoring efforts and recommendations for future action.

VII. Task Description and Schedule

Summer 2003-Summer 2005

Performance Measures:

1. June 2003: Reconnaissance survey to collect water quality, nonnative fish densities and helicopter staging areas, 5 days
2. July 2003: Translocation trip at confluence of LCR and mainstem Colorado, 3-5 days
3. November 2003: Post monsoon monitoring trip, 5 days
4. December 31, 2003: Interim 2003 Report due
5. Spring 2004: Post winter flow monitoring (snorkeling surveys), 5 days
6. June/July 2004: Translocation trip at confluence of LCR and mainstem Colorado, 2-5 days

7. November 2004: Post monsoon monitoring, 5 days
8. December 31, 2004: Interim 2004 Report Due
9. Spring 2005: Post winter flow monitoring (snorkeling surveys), 5 days
10. June 2005: Final report due

VIII. FY-2003-2004 Work

IX. Budget Summary

FY2003: $24,000
FY 2004: $30,000
FY 2005: $26,000

X. Reviewers

XI. References

Mattes, W.P. 1993. An evaluation of habitat conditions and species composition above, in and below the Atomizer Falls complex of the Little Colorado River. The University of Arizona. 105pp.

Robinson, A.T., D.M. Kubly, R.W. Clarkson, and E.D. Creef. 1996. Factors limiting the distributions of native fishes in the Little Colorado River, Grand Canyon, Arizona. The Southwestern Naturalist. 41: 378-387.

Strength, D.A. 1997. Travertine deposition in the Little Colorado River, Arizona and habitat for the endangered humpback chub. Northern Arizona University. 99pp.

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 12**
FY-2004 PROPOSED SCOPE OF WORK for:

Mechanical removal of non-native fishes (primarily salmonids) from the Colorado River near the confluence with the Little Colorado River.

Lead Agency: USGS/GCMRC, AGFD.

Submitted by: Bill Persons
Research Program Supervisor
Arizona Game and Fish Department
2221 West Greenway Road
Phoenix, AZ 85023
bpersons@gf.state.az.us
(V) 602-789-3375; (F) 602-789-3918

Date: April 2, 2003

Category:

Expected Funding Source:

__ Ongoing Project
__ Ongoing Revised Project
X Requested New Project
__ Unsolicited Proposal

__ Annual Funds
__ Capital Funds
X Other (Explain) Possible AMWG, Seek USGS State Partnership Grant, Arizona Heritage, Arizona State Wildlife Grant funding

I. Title of Proposal: Mechanical removal of non-native fishes from the Colorado River near the confluence with the Little Colorado River.

II. Relationship to Adaptive Management Program, Recovery Goals, and Biological Opinion

Goal 2 in the AMP Strategic Plan (August 17, 2001) is "Maintain or attain viable populations of existing native fish, remove jeopardy from humpback chub and razorback sucker, and prevent adverse modification to their critical habitat". Management Objective 2.6 is to "Reduce native fish mortality due to non-native fish predation as a percent of overall mortality".

III. Study Background/Rationale and Hypotheses:

A hypothesized factor in the decline in humpback chub recruitment in recent years is negative interactions (predation and competition) with non-native fish. Interaction with non-native fish is implicated in the decline and extinction of native fishes throughout the Colorado River basin. Increased recruitment of rainbow (RBT) and brown trout (BNT) has occurred since initiation of Modified Low

Fluctuating Flows (MLFF), and populations in the Colorado River have increased dramatically. This project is the continuation of a multi-objective study to evaluate the potential effect of RBT and BNT predation on HBC recruitment and the efficacy of mechanical removal of RBT and BNT from the LCR Inflow reach. The project was initiated by Grand Canyon Monitoring and Research Center in 2002 and was proposed as a multi-year treatment (GCMRC 2003).

IV. Study Goals, Objectives, End Product:

Study goals, objectives and end products were identified in the original proposal (GCMRC 2003). Hypotheses include:

H_o: Mechanical removal of RBT and BNT using electrofishing methods is an effective method of reducing adult RBT and BNT abundance in the LCR Inflow reach.
H_o: Abundance of adult RBT and BNT in the LCR Inflow reach prior to each removal event is similar.
H_o: No changes occur in adult RBT and BNT size composition in response to removal events.
H_o: Trout immigration (Seasonal and Annual) into the LCR Inflow reach between removal events is undetectable.
H_o: There are no seasonal differences in trout diet use.
H_o: There are no spatial (upstream versus downstream) differences in trout diet use.
H_o: There are no size-class differences in trout diet use.
H_o: Determine if differences in feeding patterns are related to flow characteristics.
H_o: There is no incidence of predation by RBT and BNT on HBC in the LCR reach.
H_o: Incidence of predation is unrelated to size-class and other meristic characteristics (e.g., gape-width, body-depth, length) of both the predator and prey.
H_o: The incidence of predation by RBT and BNT does not change (±) in response to predator abundance.
H_o: Particular cohorts are more vulnerable to predation due to differences in size, relative prey abundance or relative predator abundance.

V. Study area

Colorado River near Little Colorado River confluence (56.2 RM - 65.7 RM).

VI. Study Methods/Approach

Methods are fully described in GCMRC (2003).

VII. Task Description and Schedule

Tasks and schedules are fully described in GCMRC (2003).

VIII. FY-2003-2004 Work

Sampling trips are scheduled for Jan. Feb. Mar, Jul. Aug. and Sept. 2003.
Interim reports are to be provided to the AMWG on a 6-month schedule.

IX. Budget Summary

Estimated cost is $600,000 - $650,000 /year for calendar years 2003 and 2004.

X. Reviewers

XI. References

Grand Canyon Monitoring and Research Center. 2003. Proposed Two-Year Science Plan for Experimental Flow Treatments and Mechanical Removal Activities in WY's 2002-2004

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 13**
FY-2004 PROPOSED SCOPE OF WORK for:

Use Dam Operations to Benefit Humpback Chub

Lead Agency: Bureau of Reclamation
Submitted by: Dennis Kubly
Date: April 9, 2003
Category:

Expected Funding Source:

_ Ongoing project
_ Ongoing-revised project
X Requested new project
_ Unsolicited proposal

X Annual funds
_ Capital funds
_ Other (explain)

I. **Title of Proposal:** Use Dam Operations to Benefit Humpback Chub

II. **Relationship to Recovery Goals:**

Humpback Chub 5.2.2.1 Factor A. - Adequate habitat and range for recovered populations provided

Management Action A-1. - Investigate the role of the mainstem Colorado River in maintaining the Grand Canyon humpback chub population and provide appropriate habitats in the mainstem as necessary for recovery.

Task A-1.1 - Identify life stages and habitats of humpback chub in the mainstem Colorado River and determine the relationship between individuals in the mainstem Colorado River and Little Colorado River.

Task A-1.2 - Provide appropriate habitats for humpback chub in the mainstem Colorado River (as determined necessary under Task A-1.1).

Management Action A-2 - Provide flows necessary for all life stages of humpback chub to support a recovered Grand Canyon population, based on demographic criteria.

Task A-2.1 - As determined necessary and feasible, continue to operate Glen Canyon Dam water releases under adaptive management to benefit humpback chub in the mainstem Colorado River through Grand Canyon.

Task A-2.3 - Provide flow regimes (as determined under Tasks A-2.1 and A-2.2 that are necessary for all life stages of humpback chub to support a recovered Grand Canyon population.

III. Study Background/Rationale and Hypotheses:

As identified in the 1996 Glen Canyon Dam FEIS and the 1995 FWS Biological Opinion, the operation of Glen Canyon Dam directly and indirectly affects the endangered humpback chub. There are linkages between such variables as temperature, flow, food base, native / non-native interactions, and water quality. Beginning in 1996, the AMP has conducted numerous ecosystem experiments designed to test specific physical and biologic hypotheses (1996 Beach/Habitat Building Flow, 1997 and 1999 Habitat Maintenance Flows, 2000 Low Steady Summer Flow, Spring LCR Ponding Flow and Habitat Maintenance Flow, and the 2003 - 2004 experiment underway).

These experiments not only investigated the ecosystem reaction to flow perturbations, but also attempted to determine what habitat conditions are necessary to sustain a recovered population of humpback chub. Future flow experiments are also expected in conjunction with the selective withdrawal structure, if it is constructed. Examples of potential research hypotheses include:

Ho_1: The emergence of larval humpback chub from the LCR are unrelated to seasonal timing or water flow levels in the LCR.

Ho_2: This is no relationship between dam operations and the timing or success of humpback chub spawning.

Ho_3: Dam operations have no effect on habitat occupied by larval humpback chub emerging from the LCR.

Ho_4: Spring dam operations that impound the LCR have no effect on survival or recruitment of larval humpback chub emerging from the LCR.

Ho_5: Fluctuating dam releases during the winter have no effect on spawning, survival, or recruitment of trout.

Ho_6: Dam operations have no effect on tributary spawning of native or non-native fish.

IV. Study Goals, Objectives, End Product:

The 1994 Biological Opinion on the operation of Glen Canyon Dam contains an element of the reasonable and prudent alternative that addresses dam releases. The biologic information available at that time led the FWS to opine that steady flows (high in the spring and low the remainder of the year) would remove jeopardy from the humpback chub. Recent monitoring has shown that in some months of the year, flow stabilization from post-ROD dam operations has dramatically increased the non-native fish population, with adverse

consequences to the humpback chub. Reclamation has committed to implement a program of experimentation to benefit the humpback chub through the adaptive management program. It has engaged the AMP in numerous discussions during the last two years on this topic, resulting in the current 2003 - 2004 experimental flow effort and the proposed 16-year experimental flow design, both from GCMRC scientists. With respect to the humpback chub, the program of experimentation and this comprehensive strategy will attempt to determine what actions are necessary to support a recovered population as instructed by the Recovery Goals.

V. Study Area:

Colorado River mainstem between Glen Canyon Dam and the western boundary of Grand Canyon National Park.

VI. Study Methods/Approach:

Task 1. Literature review to identify habitat requirements at each life stage. Conduct monitoring of mainstem near-shore and backwater habitats to identify temporal emergence of larval humpback chub from the LCR and resulting survival.
Task 2. Literature review of basinwide research of humpback spawning cues. Analysis of historic data to identify relationships between spawning and dam releases.
Task 3. Identify specific hypotheses related to near-shore habitat condition and HBC recruitment. Identify sampling protocols and analyses to evaluate survival and recruitment results sooner than would be obtained from age 4+ adult HBC population estimates. Monitor temperature, nutrients, turbidity, and velocity of these habitats as well as the status of native and non-native fish using these habitats during fall experimental flow conditions. Compare results with monitoring of ROD operations during 2001 and 2002.
Task 4. Review historic temperature and velocity data at the mouth of the LCR to evaluate effect of flow levels in both rivers on larval habitat. Using the results of Task 1, recommend experimental dam releases during humpback chub larval emergence following 2003 - 2004 experiment. Include other tributaries in Grand Canyon that may be suitable humpback chub habitat in an analysis of habitat suitability. In conjunction with non-native control and humpback chub range expansion efforts, conduct test of tributary impounding dam releases.
Task 5. Using Lees Ferry trout population estimates and results of 2003 - 2004 experiment, predict population response to various winter flow scenarios. Identify flow regime to limit Lees Ferry population to Management Objective targets.
Task 6. Using advice from Science Advisors and results from Tasks 1 - 5, design a program of experiments that are intended to benefit the humpback chub, that will identify those aspects of dam operations and other management actions

necessary to support of recovered humpback chub population, and that will allow the identification of cause and effect relationships.

VII. Task Description and Schedule:

Task 1. Determine habitat requirements (thresholds and optima) and timing for each life stage of HBC in both the LCR / Grand Canyon tributaries and the mainstem Colorado River that can be affected by dam operations (e.g. spawning, incubation, emigration from tributaries).
Task 2. Determine spawning cues for HBC and evaluate impact of dam operations on HBC spawning.
Task 3. Conduct fall steady / minor fluctuating flow regime as part of the Autumn Sediment Input Scenario of the 2003 – 2004 experiment now in progress. If this scenario does not occur in 2003, test effect of a similar fall flow regime during September - October 2003.
Task 4. Evaluate the effects of an LCR-ponding spring flow on humpback chub survival and recruitment.
Task 5. Following completion of 2003 – 2004 experiment, review results of non-native fish suppression releases and make recommendations for future flow-related actions to limit non-native fish populations in the Grand Canyon.
Task 6. Develop a program of experimentation that includes dam releases. Such flows would be implemented in conjunction with other factors that address threats to the humpback chub. These may include non-native control actions as recommended by Valdez et al. (1999) and with the Temperature Control Device as proposed by GCMRC (2002).

VIII. FY-2003 Work

Task 1 - Deliverables/Due Dates
- Literature review, September 2003
- Budget: $10,000

Task 2 - Deliverables/Due Dates
- Literature review, September 2003
- Budget: $10,000

Task 4 - Deliverables/Due Dates
- Literature review, September 2003
- Budget Total $10,000

FY-2004 Work
Task 1 - Deliverables/Due Dates
- Monitoring of larval emergence from LCR, September 2004
- Final report, December 2004
- Budget: $50,000

Task 2 - Deliverables/Due Dates
- Analysis of historic spawning data, December 2003
- Final report, December 2003
- Budget: $20,000

Task 3 - Deliverables/Due Dates
- Fall experimental flow data collection, October 2003
- Final report, September 2004
- Budget: $80,000

Task 5 - Deliverables/Due Dates
- Evaluation of trout spawning suppression flows, September 2004
- Budget: Included in 2003 - 2004 experiment

FY-2005 Work
Task 6 - Deliverables/Due Dates
- Design of experimentation program, January 2005
- Budget: $20,000

IX. Budget Summary:

FY-2003	$30,000 AMP
FY-2004	$150,000 AMP
FY-2005	$20,000 AMP

Total:

X. Reviewers:

XI. Comments Received:

YOY larval HBC leave the LCR in free drift in early April/May and larger YOY HBC swept out by high LCR flows later in the summer. Timing of monsoon events may be related to YOU survival (HBC reaching some minimum size). Relationship between LCR and mainstem flows may be important (ponding of LCR flows). Add LCR temperature data during 45,000 cfs flows as well as Gonzales and Protiva data.

Add Black Rocks data attempting to correlate flows and time of spawning. Purpose of Task 2 is to determine if there is a relationship between dam operations and spawning cues. Some type of synthesis of existing data would be helpful.

2000 LSSF fall 31,000 cfs spike flow significantly reduced numbers of flannelmouth and bluehead suckers utilizing backwater and near shore habitats. Concern over reduction of Lees Ferry foodbase as a result of low steady flows. Such flow reductions may have different effects depending on the relative level of water year releases (high vs. low release years). Suggestion to have synthesis

and presentation at future TWG meeting. Concern over confounding current 2003 – 2004 experiment by moving to steady fall flows next year.

There is an obligation to push forward on conducting Biological Opinion flows during 8.23 maf years. Need to analyze the sequence of things we need to do to move forward with an experiment.

Suggestion to replace “the public” with “ratepayers”.

XII. References

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 14**
FY-2004 PROPOSED SCOPE OF WORK for:

Threats of Scientific Work on Humpback Chub Populations in the Grand Canyon Area

Lead Agency: GCMRC
Submitted by: Gary Burton,
WAPA, A7400
P.O. Box 281213
Lakewood CO 80228
720-962-7259 – Office; 720-962-7263 – FAX
burton @ wapa.gov

Date: March 27, 2003 Sequence Priority: #5 of 23

Category:

Expected Funding Source:

_ Ongoing project
_ Ongoing-revised project
X Requested new project
_ Unsolicited proposal

X AMP funds
_ Agency Appr. funds
_ Other (explain)

I. **Title of Proposal:** Understand the effect and identify the threats of scientific work on humpback chub populations in the Grand Canyon area (review Upper Basin Recovery Program, etc.).

II. **Relationships:**

a. Recovery Goals: Humpback Chub 5.2.2.2 Factor B.-– Protection from overutilization for commercial, recreational, scientific, or educational purposes.

Management Action B-1.--Protect humpback chub populations from overutilization for commercial, recreational, **scientific**, or educational purposes.

Task B-1.1. --Reevaluate and, if necessary, identify actions to ensure adequate protection from overutilization for commercial, recreational, **scientific**, or educational purposes; not currently identified as an existing threat (see section 4.2).

Task B-1.2.--Implement identified actions (as determined under Task B-1.1.) to ensure adequate protection from overutilization for commercial, recreational, **scientific**, or educational purposes.

b. Biological Opinion Elements (or parts there of):

RPA Element 1. – "…Therefore, Reclamation shall develop an adaptive management program that will include implementation of studies required to determine impact of flows on listed and native fish fauna, recommend actions to further their conservation, and implement those recommendations as necessary to increase the likelihood of both survival and recovery of the listed species."

Incidental Take ¶ 2. – "The Service anticipates that the proposed operation of Glen Canyon Dam according to the operating and other criteria of the MLFF, as described in the Draft EIS, and as changed by the reasonable and prudent alternative will result in incidental take of the Humpback chub…."

c. AMP Goals and MOs:

Goal 12: "Maintain a high quality monitoring, research, and adaptive management program."

M.O. 12.2: "Attain or improve monitoring and research programs to achieve the appropriate scale and sampling design needed to support science-based adaptive management recommendations."

III. Study Background/Rationale and Hypotheses:

HO_1: Repetitive disturbance, recapture, and handling associated with aquatic research and monitoring protocols in the AMP do not negatively impact humpback chub populations in the CRE.

HO_2: Research and monitoring protocols cannot remain effective if they are modified to reduce negative impacts to humpback chub populations in the CRE.

The Humpback Chub (HBC) populations of the Grand Canyon, particularly the Little Colorado River population, have endured significant environmental manipulation and individual physical handling for the last 20 years. PIT tagging efforts alone have resulted in a majority of adult HBC being recognized individually from multiple recaptures over time. Sediment, flow, and (soon) temperature studies, among others, affect mainstem populations to some degree through habitat disruption and invasion by investigative crews and equipment. Targeted studies affect HBC directly; studies targeting other species affect HBC indirectly, as an unintended consequence. Repetitive disturbance, recapture, and handling are continual sources of stress, health risk, and potential injury for individuals and the population as a whole. One handling estimate indicates adult HBC may suffer a one in ten chance of mortality after handling (Kubly & Walters, personal communication), but this estimate has not been verified.

Upper basin managers and investigators have similar concerns, but have not initiated specific studies to directly quantify the effect. They have, however, produced several studies investigating the impacts of electrofishing on native fish

and developed modified protocols to minimize the risks (Muth, 1996, Hawkins, 2002, others). They, also, have limited population estimate efforts to three initial estimate years followed by alternating two years off and two years on to reduce the stress of population monitoring on HBC populations (Tom Chart & Tom Czapla, personal communication, Valdez & Ryel 2000).

Scientific investigation and monitoring must continue in support of the knowledge base we rely on to address CRE issues. However, in trying to learn more and more about very limited resources, the threat exists that the same activities intended to help target species, may in fact have a detrimental effect. This effect is ongoing for the foreseeable future (see attached Canyon Activities and Fish Sampling Trip spreadsheets for 2003, as examples of the level of ongoing scientific effort) and may have immediate consequences for HBC as long as intensive scientific effort is focused on this species and their habitat. The physical risk of injury and death associated with repeated handling and disturbance needs to be evaluated. Research and monitoring protocols modified to reduce frequency and severity of handling and disturbance could allow continued data collection with minimal impact to HBC. However, the cost of implementing such modified protocols must be weighed against the sacrifice of scientific and statistical precision required to make appropriate adaptive management decisions.

IV. Study Goals, Objectives, End Product:

Evaluate the impacts of repetitive recapture, handling, and habitat disturbance on Grand Canyon humpback chub populations and develop modified protocols to maximize information collected while minimizing the impacts of continued scientific investigation on HBC individuals and populations. Progress or final results reports on each active study task will be presented at the end of each calendar year. The three final results reports will be combined into a final project report with implementable recommendations for AMWG approval in January 2008.

V. Study Area:

Colorado River below Lees Ferry, including the Little Colorado River and other significant tributaries, to the inflow of Lake Mead.

VII. Study Methods/Approach

Task 1. Statistical analysis of existing capture/recapture data and any related mortality

that might establish a pattern and rate of handling mortality related to gear types and existing handling protocols. Laboratory study using excess, cultured HBC or a surrogate species (roundtail chub or excess bonytail?) to establish the handling mortality rates associated with various levels and methods of repeated capture, handling, and surgical or other techniques.

Task 2. To be determined. Possibilities include a noninvasive, bioenergetics modeling approach to determine the energetic cost of disturbance, or stable isotope distribution from specific river sites before and after disturbance events, or underwater surveys (SCUBA, video, acoustic?) before and after disturbance events.

Task 3. Test various modified protocols for capture gear types and methods (settings, configuration, placement, duration, timing, frequency, etc.) using excess, cultured HBC or a surrogate species to identify the most effective methods for study purposes that produce the least negative effect on HBC. Compare the levels of scientific precision associated with standard and modified sampling protocols.

Task 4. Progress or final reports on the status or findings of each task will be prepared at the end of each FY and reported at the end of each calendar year. All results reports will be synthesized to provide combined recommendations for presentation to the AMWG.

Task 5. Maintain liaison with related Upper Basin investigations, evaluate those findings, and recommend incorporation of appropriate modified methods and sampling protocols.

VII. Task Description and Schedule:

1. Quantify recapture and handling induced mortality (existing data and lab), FY-2004.
2. Evaluate habitat disturbance effects on displaced HBC (bioenergetics modeling, stable isotope, or stock assessment approach?), FY-2004-6.
3. Evaluate possible modifications to gear applications or experimental protocols (research/monitoring) that would reduce effects of scientific efforts on HBC. Assess the loss of scientific precision associated with implementing modified protocols, FY-2006-7.
4. Prepare annual progress reports and final report, 2004-7.
5. Maintain liaison with Upper Basin to exchange and incorporate new techniques, ongoing.

VIII. FY-2004 Work:

Task 1 Deliverables/Due Dates

- Initiate and complete handling mortality evaluation, April 2004
- Complete Task 1 Results Report (Task 4), September 2004
- Budget: Labor, Travel, Equipment, Other
  Total = $10,600

Task 2 Deliverables/Due Dates

- Initiate year 1 of HBC disturbance evaluation, summer 2004
- Complete Task 2 Progress Report (Task 4), September 2004
- Budget: Labor, Travel, Equipment, Other
  Total = $30,600

Task 5 Deliverables/Due Dates

- Ongoing Communication/Information Exchange – No additional cost

- Report any appropriate advances annually

FY-2005 Work

Task 2 Deliverables/Due Dates

- Conduct year 2 of HBC disturbance evaluation, spring/summer 2005
- Update Task 2 Progress Report (Task 4), September 2005
- Budget: Labor, Travel, Equipment, Other
  Total = $30,600

Task 5 Deliverables/Due Dates

- Ongoing Communication/Information Exchange – No additional cost
- Report any appropriate advances annually

FY-2006 Work

Task 2 Deliverables/Due Dates

- Complete HBC disturbance evaluation, spring/summer 2006
- Complete Task 2 Results Report (Task 4), September 2006
- Budget: Labor, Travel, Equipment, Other
  Total = $30,600

Task 3 Deliverables/Due Dates

- Initiate year 1 of gear and protocol evaluations,
- Complete Progress Report (Task 4), September 2006
- Budget: Labor, Travel, Equipment, Other
  Total = $45,600

Task 5 Deliverables/Due Dates

- Ongoing Communication/Information Exchange – No additional cost
- Report any appropriate advances annually

FY-2007 Work

Task 3 Deliverables/Due Dates

- Complete gear and protocol evaluations, summer 2007
- Complete Results Report (Task 4), September 2007
- Budget: Labor, Travel, Equipment, Other
  Total = $45,600

Task 5 Deliverables/Due Dates

- Ongoing Communication/Information Exchange – No additional cost
- Report any appropriate advances annually

FY-2008 Work

Task 4 Deliverables/Due Dates

- Complete Task 1, 2, and 3 Synthesis and Recommendations Report, and present to AMWG, December 2007
- Budget: Labor, Travel, Equipment, Other
  Total = $1,400

Task 5 Deliverables/Due Dates

- Ongoing Communication/Information Exchange – No additional cost

- Report any appropriate advances annually

IX. Budget Summary

Task 1.	$ 10,000	$ 10,000 (1yr)
2.	$ 30,000 (/yr)	$ 90,000 (3 yrs)
3.	$ 45,000 (/yr)	$ 90,000 (2 yrs)
4.	$ 600 (/interim report)	$ 3,600 (4 yrs)
	$ 1,400 (final report)	$ 1,400 (1 yr)
5.	$ 0	$ 0 (5 + yrs)
		$195,000

FY-2004 - $41,200
FY-2005 - $30,600
FY-2006 - $76,200
FY-2007 - $45,600
FY-2008 - $ 1,400

Total: $195,000

X. **Reviewers:** AMWG HBC ad hoc

XI. **Comments Received**:
- March 12: Needs to include discussion about handling the fish. Comment on importance of this work, since all other projects will likely increase the amount of fish handling. Question about how to accomplish. Add upper basin electrofishing report reference and population estimate protocol. Include calendar of all scheduled Canyon activities to demonstrate amount of disturbance occurring.
- April 1: Change "Funding Sources" to "AMP funds" and "Agency Appropriations." Change item II to "Relationships" and add appropriate BO RPAs, and AMP Goals/MOs. Add a sequencing priority with regard to the other proposed projects. Modify HO_2 to read "protocols cannot remain effective <u>if they are modified</u> to reduce…." Indicate that Walter's handling mortality rate estimate must be verified. Include two levels of risk assessment; one to assess physical risk to individual fish and the population and one to assess the risk to scientific precision of altering standard protocols. Add a task to coordinate with and incorporate upper basin findings and methods.

XII. References:

Hawkins, J. 2002. X-Ray Assessment of Electrofishing Injury of Colorado Pikeminnow. Larval Fish Laboratory, Colorado State University, Fort Collins.

U.S. Fish and Wildlife Service. 2002. Humpack Chub (*Gila cypha*) Recovery Goals: amendment and supplement to the Humpback Chub Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

Muth & Rupert, Effects of Two Electrofishing Currents on Captive Ripe Razorback Suckers and Subsequent Egg-Hatching Success, 1996.

Valdez, R.A. and R.J. Ryel. 2000. Statistical guidelines: population estimates of Colorado pikeminnow and humpback chub in the Upper Colorado River Basin. Unpublished report. SWCA, Inc., Flagstaff, Arizona.

XII. Attachments:

- Canyon Activities Calendar (2003 example)
- Fish Trip Schedule (2003 example)

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 15**
FY-2004 PROPOSED SCOPE OF WORK for:

Joint Population Estimates of Humpback Chub in the LCR and Mainstem.

Lead Agency: GCMRC
Submitted by: Steven P. Gloss (project manager)
Lew Coggins (principal investigator)

Grand Canyon Monitoring & Research Center
U.S. Geological Survey
2255 N. Gemini Drive
Flagstaff, AZ 86001 USA
928-556-7376 (direct); 928-556-7094 (office); 928-556-7092 (fax)
lcoggins@usgs.gov
Date: April 9, 2003
Category:

Expected Funding Source:

_ Ongoing project
_ Ongoing-revised project
X Requested new project
_ Unsolicited proposal

X Annual funds
_ Capital funds
_ Other (explain)

I. Title of Proposal: Conduct concurrent estimates of HBC in LCR and mainstem to develop/confirm population estimates. Evaluate the age group survivability for all age classes, including recruitment.

II. Relationship to Programs:
AMP Management Objectives:

Management Objective 2.1-Maintain and attain humpback chub abundance and year class strength in the LCR and other aggregations at appropriate target levels for viable populations and to remove jeopardy.

Core Monitoring Objective 2.1.2-Determine and track abundance and distribution of all sizes of HBC in the LCR and mainstem.

Recovery Goals:

5.3.1.1.2 Lower basin recovery unit

1. The Grand Canyon population is maintained as a core over a 5-year period, starting with the first point estimate acceptable to the Service, such that:

a. the trend in adult (age 4+; 200 mm TL) point estimates does not decline significantly, and
b. mean estimated recruitment of age-3 (150–199 mm TL) naturally produced fish equals or exceeds adult mortality, and
c. each core population point estimate exceeds 2,100 adults (MVP).

III. Study Background/Rationale and Hypotheses:

Currently population estimates for HBC are conducted in the LCR in the fall of each year to estimate abundance of smaller chub and to get a 'first' signal about the survival and potential recruitment of a given year class. Sampling is also conducted in the spring primarily aimed at marking as large a number of chub as feasible to provide information through capture and subsequent recapture for stock assessment models. Depending on the quality of data with respect to meeting assumptions of mark-recapture population estimation models, these spring data may also be used to generate a point estimate of the population size. There has and continues to be uncertainty regarding how well point estimates derived solely from LCR sampling may represent the status and trends of the 'LCR population' individuals from which are known to spend time in both the LCR and mainstem-with movement in and out associated primarily with spawning activity in the adult population. There is also concern about adopting consistent population estimation procedures for populations of HBC in the Upper and Lower Basin vis-à-vis Recovery Goals.

IV. Study Goals, Objectives, End Product:

This project will produce estimates of abundance for HBC in the LCR and LCR confluence area of the CRE in spring of 2004 and 2005. These estimates will be used to compare with estimates obtained using only LCR sampling and using various stock synthesis models

V. Study Area:

Little Colorado River upstream 9 miles from confluence with CR and Mainstem CR from RM 56-65

VI. Study Methods/Approach :

This project would expand sampling effort in the spring to include the mainstem Colorado River near the LCR confluence from RM 56-65. Sampling would be done with a combination of hoop nets and trammel nets. HBC would be marked with either a temporary mark or PIT tag depending on size. Sampling will involve a single marking and recapture trip. These data would also be used as input data for the annual stock assessment model runs.

An additional option being considered in conjunction with this proposed action and the 'routine' LCR sampling is the implantation of sonic tags in adult HBC to yield additional information regarding the frequency and extent of movement of fish in and out of the LCR, as well as to try and determine the proportion of LCR fish which may not spawn every year, i.e. skip spawners.

Considerations- Movement and distribution of HBC seasonally complicate finding the ideal sampling schedule for this effort. It is assumed that 'most' of the population goes into the LCR for spawning and may or may not remain there during part or all of the mark-recapture sampling there, i.e. the timing of movement in and out varies from year to year and we have not good predictors of when it will occur between about March and June. Sampling in the spring would add information about the distribution of fish and their movement but could violate model assumptions for simple mark-recapture population estimation. Simulation modeling of population estimates using estimated capture probabilities and various levels of hypothetical populations suggest that the best population estimates will be obtained using the above procedures.

VII. Task Description and Schedule:

This project would be implemented in the spring of FY04 & FY05

VIII. FY-2004 Work

- Deliverables/Due Dates: Annual Report – December, 2004
- Budget:
- $220,000 two population estimation trips, $50,000 sonic tags and detectors

FY-2005 Work

- Deliverables/Due Dates: : Annual Report – December, 2005
- Budget estimate:
- $220,000 two population estimation trips,

FY-2005 etc. (for multi-year study)

IX. Budget Summary *[Provide total AND break-out by funding target (e.g. station)]*[*]

FY-2004 : $270,000
FY-2005: $220,000

Total: $490,000

X. Reviewers

GCAMP AMWG HBC AdHoc

XI. References

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 16**
FY-2004 PROPOSED SCOPE OF WORK for:

Development of an Adaptive Management Work Group Outreach Program.

Lead Agency: AMWG members, USBR.

Submitted by: Bruce Taubert
Assistant Director
Arizona Game and Fish Department
2221 West Greenway Road
Phoenix, AZ 85023
btaubert@gf.state.az.us
(V) 602-789-3301; (F) 602-789-3918

Date: April 2, 2003

Category:

Expected Funding Source:

X Ongoing project
__ Ongoing-revised project
___Requested new project
__ Unsolicited proposal

_ Annual funds
_ Capital funds
X Other (explain) AMWG, AMWG members

I. Title of Proposal: Development of an Adaptive Management Work Group Outreach Program.

II. Relationship to Adaptive Management Program, Recovery Goals, and Biological Opinion

Goal 12 of the Adaptive Management Program is "Maintain a high quality monitoring, research, and adaptive management program". Management Objective 12.9 is to "build AMP public support".

III. Study Background/Rationale and Hypotheses:

AMWG has been established to develop consensus recommendations to the Secretary of the Interior on the operations of Glen Canyon Dam. Direction for AMWG can be found in the Grand Canyon EIS and the Grand Canyon Protection Act. Without an active outreach plan and program AMWG has suffered from "Agency Writers Cramp", with very little information getting to the public and what does reach the public is, normally, only from a single agencies perspective and not AMWG. For example, when the decision was made to reduce the population of trout near the LCR there was not a coordinated press release. The press ran with information from one source or another and most of us were left picking up the pieces. Rumors abounded about elimination of trout from the entire river,

fluctuating flows scouring the riverbed, and attempts to break the backs of angling guides. Of course none of the rumors were true. In addition, because we do not have a coordinated outreach program, we were unable to relay a consistent message to the public. Along with the development of a comprehensive plan for humpback chub, a public outreach plan is necessary to inform the public of our goals and objectives, as well as to inform them of ongoing activities that may impact them.

IV. Study Goals, Objectives, End Product:

The goal of this project is to develop a single, consistent, and coordinated outreach program. AMWG needs to develop a process by which it can agree on the intent and content of all press releases and other outreach mechanisms.

V. Study Area

VI. Study Methods/Approach

1. An AMWG Outreach Committee will be developed, consisting of, at a minimum a representative of each governmental agency that is member of AMWG as well as Grand Canyon Monitoring and Research Center. Participation on the Outreach Committee will be limited to AMWG members or their alternates.
2. The committee will develop an outreach plan by 2004 to guide AMWG's outreach process for the next 10 years.
3. Each AMWG governmental agency will assign a Public Information Officer (PIO) to be a member of a team for coordination of all press releases. The PIO's will develop a mechanism of having input to each press release before it is presented. While desirable, the PIO may be a representative other than an AMWG member.
4. AN AMWG Outreach Team (consisting of the AMWG Outreach Committee and the PIO's) will meet twice each year prior to each AMWG meeting.
5. A representative from the AMWG Outreach Team will brief AMWG on its activities each AMWG meeting.

VII. Task Description and Schedule

July 2003 – January 2004	Develop AMWG outreach committee comprised of AMWG members.
July 2003 – January 2004	Assign PIO's to outreach team.
January 2004 – July 2004	Meet to develop an outreach plan. Estimate a need for a 3-day meeting followed by Email and conference calls.
July 2004	Draft outreach plan delivered to AMWG.
January 2005	Outreach plan approved by AMWG.

January 2005 – January 2007 Conduct outreach activities, review progress at each AMWG meeting.

VIII. FY-2003-2004 Work

Develop AMWG outreach committee and PIO's.
Draft outreach plan

IX. Budget Summary

Task	Start	Finish	Cost
Revitalize the AMWG outreach committee	April 2003	July 2003	$400.00
AMWG outreach committee meeting after July AMWG meeting	July 2003	July 2003	
Develop 10-year outreach plan	July 2003	August 2003	
Governmental agencies assign PIO to committee	August 2003	August 2003	
PIO's conduct outreach activities and participate in 2 annual AMWG meetings	October 2003	Sept 2004	$72,000.00
Travel costs for PIO's SLC 2 PHX Plus lodging	July 2003	January 2004	$2,520.00
Outreach team to brief AMWG at each AMWG meeting	July 2003	January 2004	$2,400.00
Publication costs, educational materials, printing,	2003	2004	$7,680.00
Total	April 2003	Sept 2004	$85,000.00

X. Reviewers

XI. References

Grand Canyon Monitoring and Research Center. 2003. Proposed Two-Year Science Plan for Experimental Flow Treatments and Mechanical Removal Activities in WY's 2002-2004

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 17**
FY-2004 PROPOSED SCOPE OF WORK for:

Monitoring Program for the Colorado River Downstream of Diamond Creek.

Lead Agency: Grand Canyon Monitoring and Research Center
Submitted By: Steven P. Gloss, Program Manager-Biological Resources
Grand Canyon Monitoring & Research Center
U.S. Geological Survey
2255 N. Gemini Drive, Rm. 340
Flagstaff, AZ 86001

William E. Davis
EcoPlan Associates, Inc.
701 W. Southern Avenue, Suite 203
Mesa, Arizona 85210
Date: April 9, 2003
Category:

Expected Funding Source:

__Ongoing Project
X Ongoing Revised Project
__Requested New Project
_ Unsolicited Proposal

X_ Annual Funds
__ Capital Funds
X_ Other (Explain) Lower Colorado River MSCP

I. Title of Proposal:

Develop a monitoring program for the Colorado River downstream of Diamond Creek to detect changes in habitat and fish communities resulting from operation of Glen Canyon Dam and Lake Mead.

II. Relationships

This section provides insight on the relationship between the proposed action and the Adaptive Management Program goals and objectives, the Lower Colorado River Multi-Species Conservation Program performance standards, Recovery Goals for the humpback chub, and the Biological Opinion RPAs on Glen Canyon Dam operations.

Adaptive Management Program:

Goal 2. Maintain or attain viable populations of existing native fish, remove jeopardy for humpback chub and razorback sucker, and prevent adverse modification to their critical habitat.

Management Objective 2.1: Maintain or attain humpback chub abundance and year-class strength in the LCR and other aggregations at appropriate levels for viable populations and to remove jeopardy. (Sequence order 1, 1.5 and 2)

Management Objective 2.2: Sustain or establish viable HBC spawning aggregations outside the LCR in the Colorado River ecosystem below Glen Canyon Dam to remove jeopardy. (Sequence order 2, 2.5, and 3)

Management Objective 2.3: Monitor HBC and other native fish condition and disease/parasite numbers in LCR and other aggregations at an appropriate level for viable populations and to remove jeopardy. (Sequence order 2, 3 and 3.5).

Management Objective 2.4: Reduce native fish mortality due to non-native fish predation/competition as a percentage of overall mortality in the LCR and mainstem to increase native fish recruitment. (Sequence order 2, 2.5, 3)

Management Objective 2.5: Attain Razorback sucker abundance and critical habitat condition sufficient to remove jeopardy as feasible and advisable in the Colorado River ecosystem below Glen Canyon Dam. (Sequence order 4.5)

Management Objective 2.6: Maintain (flannelmouth sucker, bluehead sucker and speckled dace) abundance and distribution in the Colorado River ecosystem below Glen Canyon Dam for viable populations. (Sequence order 5 and 6)

Goal 7. Establish water temperature, quality and flow dynamics to achieve GCDAMP ecosystem goals.

Management Objective 7.1: Attain water temperature ranges and seasonal variability in the mainstem necessary to maintain or attain desired levels of desirable biological resources (e.g., native fish, foodbase and trout). (Sequence 3, 4, 5)

Management Objective 7.2: Maintain water quality in the mainstem of the Colorado River ecosystem. (Sequence order 4.5)

Lower Colorado River Multi-Species Conservation Program:

The LCR-MSCP has established basic performance standards to meet to be in compliance with terms and conditions of an incidental take permit for covered projects. The LCR-MSCP identified the need to provide a level of support to the AMP for humpback chub:

Provide $10,000/year for 50 years ($500,000) to the Glen Canyon Dam Adaptive Management Workgroup to support implementation of planned, but unfunded, species conservation measures and, as appropriate, to fund species conservation measures in the lower canyon of the Colorado River upstream of Lake Mead.

Recovery Goals:

Site-specific Management Actions to Achieve Recovery

Lower Basin recovery Unit

5.2.2.1 Factor A – Adequate habitat and range for recovered populations provided

Management Action A-1 – Investigate the role of the mainstem Colorado River in maintaining the Grand Canyon humpback chub population and provide appropriate habitats in the mainstem as necessary for recovery.

Task A-1.1 - Identify life stages and habitats of humpback chub in the mainstem Colorado River and determine the relationship between individuals in the mainstem Colorado River and Little Colorado River.

Task A-1.2 - Provide appropriate habitats for humpback chub in the mainstem Colorado River (as determined necessary under Task A-1.1)

Management Action A-2 – Provide flows necessary for all life stages of humpback chub to support a recovered Grand Canyon population, based on demographic criteria.

Task A-2.1 - As determined necessary and feasible, continue to operate Glen Canyon Dam water releases under adaptive management to benefit humpback chub in the mainstem Colorado River through Grand Canyon.

Task A-2.3 - Provide flow regimes that are necessary for all life stages of humpback chub to support a recovered Grand Canyon population.

Management Action A-3 – Investigate the anticipated effects of and options for providing warmer water temperatures in the mainstem Colorado River through Grand Canyon that would allow for range expansion of the Grand Canyon humpback chub population and provide appropriate water temperatures if determined feasible and necessary for recovery.

Task A-3.1 – Determine the effects and feasibility of a temperature control device for glen Canyon Dam under the Glen Canyon Dam Adaptive Management Program to increase water temperatures in the mainstem Colorado River through Grand Canyon that would allow for range expansion of humpback chub.

5.2.2.3 Factor C. – Adequate protection from diseases and predation

Management Action C-3 – Control problematic nonnative fishes as needed.

Task C-3.3 – Develop brown trout and rainbow trout control programs in the Colorado River through Grand Canyon to identify levels of control that will minimize predation on humpback chub.

Task C-3.4 – Implement identified levels of brown trout and rainbow trout control in the Colorado River through Grand Canyon.

5.2.2.4 Factor D. – Adequate existing regulatory mechanisms

Management Action D-1. – Legally protect habitat necessary to provide adequate habitat and sufficient range for all life stages of humpback chub to support a recovered Grand Canyon population, based on demographic criteria.

Task D-1.1 – Determine mechanisms for legal protection of adequate habitat in the mainstem Colorado River through Grand Canyon and the Little Colorado River through instream-flow rights, contracts, agreements, or other means.

Task D-1.2 – Implement mechanisms for legal protection of habitat in the mainstem Colorado River and the Little Colorado River that are necessary to provide adequate habitat and sufficient range for all life stages of humpback chub to support a recovered Grand Canyon population.

Management Action D-2 – Provide for the long-term management and protection of humpback chub populations and their habitats.

Task D-2.1 – Identify elements needed for the development of conservation plans that are necessary to provide for the long-term management and protection of humpback chub populations; elements of these plans may include…minimization of the risk of hazardous-materials spills…

Task D-2.2 – Develop and implement conservation plans and execute agreements among State agencies, Federal agencies, Native American tribes, and other interested parties to provide reasonable assurances that conditions needed for recovered humpback chub populations will be maintained.

5.225 Factor E. – Other natural or manmade factors for which protection has been provided.

Biological Opinion:

Elements of the Reasonable and Prudent Alternative. Successful completion of the RPA is necessary to remove jeopardy to the humpback chub from the proposed action (operation of Glen Canyon Dam under a Modified Low Fluctuating Flow alternative described in the Final EIS and ROD).

1A. Experimental flows will include high steady flows in the spring and low steady flows in summer and fall carried out during low water years (releases of approximately 8.23 maf).
1B. During moderate and high release years, Reclamation shall operate Glen Canyon Dam according to requirements of the MLFF.
3.A Determine the responses and impacts on endangered and native fishes in Grand Canyon by experimental flows provided in element 1 and obtain information necessary to adjust operational criteria so they are beneficial for the endangered fishes and other resources affected by Glen Canyon Dam.
5. Make every effort to establish a second spawning aggregation of humpback chub downstream of Glen Canyon Dam.
6. Reclamation shall determine the feasibility of a selective withdrawal program for Lake Powell waters using the following guidelines (A-F).
7. Reclamation shall develop an adaptive management program that will afford flexibility to provide for adequate studies to review impacts to endangered and native fish species and recommend actions to further their conservation.

III. Study Background/Rationale and Hypotheses:

In the Lower Colorado River Basin, the humpback chub's largest extant population occurs in and around the confluence of the Little Colorado River and the Colorado River (River Mile (RM) 61). This is about 178 miles upstream of Separation Canyon (RM 239.5), considered the uppermost influence of Lake Mead, and 215 miles upstream of Grand Wash Cliffs, the western boundary of Grand Canyon National Park. Small aggregations of humpback chub occur up- and downstream of the LCR population. They are routinely found upstream and within 25 miles of Separation Canyon (RM 215) and adults have been captured on occasion downstream of Separation Canyon (R.Valdez (1994) "Effects of Interim Flows from Glen Canyon Dam on the Aquatic Resources of the Lower Colorado River from Diamond Creek to Lake Mead," Annual Report – 1993 to Hualapai Wildlife Management Dept. and Glen Canyon Environmental Studies, BIO/WEST Report No. TR-354-01). Critical habitat for humpback chub ends at RM 208.

Lake Mead's full pool elevation is at 1229 feet (NGVD). At this elevation, the inflow area of Colorado River is influenced by the reservoir as far upstream as approximately Separation Rapids (RM 239.5). This location is about 37 miles upstream of Grand Wash Cliffs (RM 276.5), the western boundary of Grand Canyon National Park and the eastern boundary of Lake Mead National Recreation Area. The 1992 Grand Canyon Protection Act (GCPA) uses Grand Wash Cliffs as the western boundary of the Adaptive Management Program. Under the Act, an Adaptive Management Program (AMP) was set up to provide recommendations to the US Bureau of Reclamation on Glen Canyon Dam operations to "protect, mitigate adverse impacts to and improve" downstream National Park Service resources without interfering with the "Law of the River." The Grand Canyon National Park western boundary at Grand Wash Cliffs defines the extent of responsibility for the AMP under the GCPA.

Factors such as cyclic drought and wet hydrologic periods and downstream water demands result in fluctuating Lake Mead levels. By responding to these factors, USBR reservoir and dam operations alter the inflow habitat conditions. In most respects, the inflow area alternatively changes from a lentic (slack water) environment to a lotic (moving water) environment. Such changes can dramatically affect aquatic species like fish. Changes occur to such key components as metabolic energy demands, foraging conditions, food sources, predators and competitors, shelter and spawning and rearing conditions. Although there have been and will continue to be upstream actions by USBR and others through the AMP to enhance habitat conditions and population numbers for humpback chub, these actions may be enhanced, neutralized or degraded through independent actions by the USBR and others at Lake Mead.

This area overlaps with the planning area for the Lower Colorado River Multi-Species Conservation Program (MSCP). The MSCP participants are committed to developing and implementing a program to meet a three-part goal, the first part reading as follows: "conserve habitat and work toward the recovery of threatened and endangered species, as well as reduce the likelihood of additional species listings under the federal ESA and CESA." Conserving the humpback chub not only fits within the MSCP program goal but

by joining with the AMP to implement portions of its actions, the MSCP can assist in meeting recovery goals for the chub. The MSCP has indicated an interest in providing some financial support to the AMP to achieve this end.

It is unknown whether humpback chub are currently adversely affected by operations of Glen Canyon Dam or MSCP covered activities that would benefit from conservation measures. No comprehensive fish surveys have been conducted in the reach below Diamond Creek in nearly 10 years. It is difficult to prove the negative (that they are not present nor adversely affected) and yet we do know they were present in the recent past.

IV. Study Goals, Objectives, End Product:

Study Goal

Develop a monitoring program for the Colorado River downstream of Diamond Creek to detect changes in habitat and fish communities resulting from operation of Glen Canyon Dam and Lake Mead.

Study Objectives

1. Define parameters unique to lentic and lotic environments, e.g., flow, food sources, shelter, temperature, turbidity, predation, etc.
2. Inventory past data sets and assess usefulness.
3. Establish an acceptable monitoring program including parameters, locations, frequency, etc.
4. Implement monitoring program.
5. Assess fish community indices relationship to habitat values.
6. Prepare annual progress report.

End Product

An acceptable, effective monitoring program that will track the condition of native fish populations or aggregations, and specifically humpback chub, as well as their aquatic habitats, so that trends may be determined and used to adaptively manage.

V. Study Area:

The Colorado River ecosystem downstream of Diamond Creek to Grand Wash Cliffs.

VI. Study Methods/Approach:

Methods and approach will be integrated with and consistent with existing and ongoing fish and aquatic habitat monitoring efforts of the GCMRC.

VII. Task Description and Schedule:

VIII. FY 2004 Work:

We anticipate work beginning October 1, 2004 and to continue as part of an ongoing CRE monitoring program.

IX. Budget Summary:

Estimated $50,000 in the first year and $25,000 in subsequent years.

X. Reviewers:

XI. References:

Grand Canyon Protection Act of 1992. Section 1805. Long-term Monitoring of the effect of the Secretary's actions on resources of Grand Canyon National Park and Glen Canyon National Recreation Area.

Adaptive Management Work Group, Glen Canyon Adaptive Management Program. Final Draft Information Needs, November 7, 2002.

Lower Colorado River Multi-Species Conservation Program, Memorandum of Agreement, August 1995.

Lower Colorado River Multi-Species Conservation Program, Memorandum of Clarification, July 1996.

U.S. Fish and Wildlife Service, Biological Opinion on Operation of Glen Canyon Dam, 1993.

U.S. Fish and Wildlife Service, Recovery Goals for the Humpback chub (*Gila cypa*) of the Colorado River Basin. 2002.

Lower Colorado River Multi-Species Conservation Program, Lower Colorado River Conservation Program Reclamation/States Conservation Proposal, April 1, 2003.

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 18**
FY-2004 PROPOSED SCOPE OF WORK for:

Efficacy of a Weir in Bright Angel Creek to Capture Brown Trout.

Lead Agency: Grand Canyon National Park
Submitted By: Dr. Jeffrey Cross
Grand Canyon National Park
Bill Leibfried and Helene Johnstone, SWCA Environmental Consultants
Date: April 15, 2003
Category:

Expected Funding Source:

__Ongoing Project
X Ongoing Revised Project
__Requested New Project
_ Unsolicited Proposal

X_ Annual Funds
__ Capital Funds
X_ Other (Explain) Lower Colorado River MSCP

I. Title of Proposal:

Evaluate the use of a temporary weir in Bright Angel Creek to remove non-native salmonids from the Colorado River Ecosystem during 2002 and 2003.

II. Relationship to Programs:

Recovery Goals:

Factor C.—Adequate protection from diseases and predation.

8. Brown trout and rainbow trout control programs developed and implemented to identify levels of control that will minimize predation on humpback chub in the Colorado River through Grand Canyon (Task C-3.3).

III. Study Background/Rationale and Hypotheses:

This project should move to the management phase (rather than evaluation) after NEPA compliance in 2003 and may include removal of all exotic species and evaluation of removal at Clear Creek and Tapeats Creek. Project may also expand to include collection and tagging of native fishes during the spring (primarily flannelmouth and bluehead suckers).

IV. Study Goals, Objectives, End Product:

Performance Measures:

1. Evaluate the use of a temporary weir in Bright Angel Creek to remove non-native salmonids.
2. Remove brown trout (*Salmo trutta*) from the Creek.
3. Examine size, stage of sexual condition and diet of brown trout.
4. Examine all brown trout and native fish for presence of PIT tags.
5. Mark and release all rainbow trout (*Oncorhynchus mykiss*)
6. Prepare an annual progress report and final report.

V. Study Area:

Bright Angel Creek

VI. Study Methods/Approach:

VII. Task Description and Schedule:

November 2002 – February 2003

VIII. FY 2002-2003: $30,000 BOR, Contract with SWCA.
FY 2003-2006 $562,000, National Park Service for implementation if feasible and after NEPA compliance

IX. Budget Summary:

X. Reviewers:

XI. References:

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM Project 19
FY-2004 PROPOSED SCOPE OF WORK for:

Sediment Augmentation to Benefit Native Fish

Lead Agency: Bureau of Reclamation
Submitted by: Dennis Kubly
Date: April 9, 2003

Category:

Expected Funding Source:

_ Ongoing project
_ Ongoing-revised project
X Requested new project
_ Unsolicited proposal

X Annual funds
_ Capital funds
_ Other (explain)

I. Title of Proposal: Consider sediment augmentation to benefit native fish (e.g. sediment pipeline from San Juan River), both long-term feasibility and short term experiment

II. Relationship to Recovery Goals: Humpback Chub 5.2.2.1 Factor A. - Adequate habitat and range for recovered populations provided

Management Action A-1. - Investigate the role of the mainstem Colorado River in maintaining the Grand Canyon humpback chub population and provide appropriate habitats in the mainstem as necessary for recovery.

Task A-1.2 - Provide appropriate habitats for humpback chub in the mainstem Colorado River (as determined necessary under Task A-1.1 [of the Recovery Goals]).

III. Study Background/Rationale and Hypotheses:

Ho_1: Increasing the turbidity of mainstem Colorado River water below the Paria River will not significantly increase the recruitment of humpback chub.

Ho_2: Increasing the turbidity of mainstem Colorado River water below the Paria River will not significantly decrease non-native fish predation and competition on humpback chub.

Ho_3: Increasing the sediment concentration of mainstem Colorado River water below the Paria River will not significantly affect humpback chub habitat during normal GCD powerplant operations.

Ho_4: Increasing the sediment concentration of mainstem Colorado River water below the Paria River will not significantly affect the formation of backwater and near-shore humpback chub habitats during Beach/Habitat Building Flows.

IV. Study Goals, Objectives, End Product:

Evaluate the effects of increased turbidity on native and non-native fish, particularly near the confluence with the LCR. A feasibility analysis will be performed which investigates the potential for sediment augmentation and an experimental test of increased turbidity is proposed to determine the ecological impacts of such augmentation. In conjunction with the ongoing 2003 - 2004 experimental flow regime, evaluate the effects that increased sediment concentrations have on sandbar and native fish habitat reworking.

V. Study Area:

Colorado River mainstem between the Paria River confluence and the western boundary of Grand Canyon National Park.

VI. Study Methods/Approach:

Task 1. Evaluate alternatives for long term sediment augmentation of the mainstem Colorado River downstream of the Paria River confluence. Alternatives should focus on increasing turbidity to assist native fish, but should also consider broader implications and possibilities for increasing the sediment load through Grand Canyon to benefit other resources.

Task 2. Test effects of increasing turbidity of mainstem Colorado River downstream near the LCR confluence. This experiment would attempt to determine whether sediment augmentation is necessary for the recovery of the humpback chub. This would include monitoring of non-native predation rates, effects of increased turbidity on near shore and backwater habitats, and impacts on the food base.

VII. Task Description and Schedule:

Task 1. Develop feasibility estimates for various sediment augmentation alternatives.

Task 2. Test effects of increasing turbidity of mainstem Colorado River downstream near the LCR confluence.

VIII. FY-2004 Work

Task 1 - Deliverables/Due Dates

- Final feasibility report, September 2004
- Budget: Total $200,000

Task 2 - Deliverables/Due Dates

- Develop experimental hypotheses, concept, science plan, September 2004

- Budget: Total $10,000

FY-2005 Work
Task 2 - Deliverables/Due Dates
- Conduct experiment as part of comprehensive HBC strategy, September 2005
- Budget: $1,000,000 (monitoring and research)

FY-2006 Work
Task 2 - Deliverables/Due Dates
- Final monitoring/research reports, September 2006
- Budget: $0

IX. Budget Summary:

FY-2004 $210,000 AMP
FY-2005 $1,000,000 AMP

Total: $1,210,000.

X. Reviewers:

XI. Comments Received:

Proposal should be tied to a demonstrated need for sediment augmentation. Alternatively, there may be need for augmentation for both sand conservation and turbidity for native fish purposes. Add " turbidity management" to performance measures. Feasibility analysis should be broad in scope. Higher turbidity may decrease non-native fish feeding and increase native fish activity. Focus should be on turbidity over sediment augmentation. Attention should be paid to impacts on food base.

XII. References:

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM Project 20
FY-2004 PROPOSED SCOPE OF WORK for:

NO LONGER A PROJECT

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM **Project 21**
FY-2004 PROPOSED SCOPE OF WORK for:

COLORADO RIVER RECOVERY PROGRAM Project No.:
FY_2003 PROPOSED SCOPE OF WORK for:
Invasive species management plan for the Colorado River Ecosystem (CRE)

Lead Agency: U.S. Fish and Wildlife Service - Arizona Fisheries Resource Office
Submitted by: Rob Simmonds
Assistant Project Leader
Arizona Fishery Resources Office (AZFRO)
P.O. Box 39, 1684 E. White Mountain Blvd., Suite 7
Pinetop, AZ 85935
Phone: (928)367-1953; Fax: (928)367-1957
rob_simmonds@fws.gov

Arizona Game and Fish Department
2221 W. Greenway Road
Phoenix, AZ 85023
@gf.stste.az.us

USGS,

BOR,

Date: April 15, 2003

Category:
Expected Funding Source:
_ Ongoing project
_ Ongoing-revised project
_ Requested new project
_ Unsolicited proposal
_ Annual funds
_ Capital funds
_ Other (explain)

I. Title of Proposal: Develop an invasive species management plan for the Colorado River Ecosystem (CRE)

II. Relationship to RIPRAP: *[Action plan(s), task number(s) and title(s) in the most recent RIPRAP which are correlated with this project]*

III. Study Background/Rationale and Hypotheses: *[If applicable] [Include description of expected study results and how those results will be integrated into the overall recovery effort.]*

IV. Study Goals, Objectives, End Product: Develop a response plan to detect and quickly act should additional nonnative species become established in the CRE as well as development of additional measures to prevent further introductions. The focus should be to prevent further introductions, yet with potential temperature modification, a coordinated response that acts quickly to contain the nonnative introduction and prevent further spread is necessary.

V. Study area: Lower Basin Colorado River and tributaries

VI. Study Methods/Approach *[provide a clear description of sampling methods, gear types, numbers and life stages of fish to be collected, statistical analyses to be used, etc.]*

VII. Task Description and Schedule:

- 2003: Develop plan, and implement immediately and indefinitely
- 2004-?: Modify plan as necessary

- Evaluate effective ways to detect new species within CRE
- Designate interagency response team to respond to new introductions. Participant time should be funded by project monies
- Develop a response plan that would go into effect if new introductions were detected, including necessary NEPA compliance
- Report and evaluation of response, including recommendations for future action

VIII. FY_2003 Work

_ Deliverables/Due Dates
_ Budget: $50,000 for development of plan and response team
_ Labor
  _ Travel
  _ Equipment
  _ Other
  _ Total

FY_2004 Work (for multi_year study)

_ Deliverables/Due Dates
_ Budget estimate

FY_2005 etc. (for multi_year study)

IX. Budget Summary *[Provide total AND break-out by funding target (e.g. station)]*[*]

FY_2003 $50,000 for development of plan and response team

FY-2004 $100,000-$200,000 if response action is needed to address new nonnative introduction into the CRE, will depend on extent of introduction and how quickly team members can initiate action.

FY_2005

Total:

X. Reviewers *[For new projects or ongoing-revised projects, list name, affiliation, phone, and address of people who have reviewed this proposal.]*

XI. References

[*] Do NOT include overhead costs on funds transferred from Reclamation to the Service (10%) **EXCEPT FOR CAPITAL PROJECTS**. IF YOU ARE UNSURE WHETHER YOUR PROJECT WILL BE FUNDED WITH CAPITAL OR ANNUAL FUNDS, PLEASE SHOW THE POTENTIAL OVERHEAD COST AS A LINE ITEM. If you have questions about this, please call Angela Kantola at 303/969-7322, ext. 221.

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM Project 22
FY-2004 PROPOSED SCOPE OF WORK for:

Review of LCR Watershed Management Plan

Lead Agency: Bureau of Reclamation
Submitted by: Dennis Kubly
Date: April 9, 2003
Category:

Expected Funding Source:

_ Ongoing project
_ Ongoing-revised project
X Requested new project
_ Unsolicited proposal

X Annual funds
_ Capital funds
_ Other (explain)

I. **Title of Proposal:** Reclamation will lead a review of Little Colorado River (LCR) watershed management plan

II. **Relationship to Recovery Goals:** Humpback Chub 5.2.2.4 Factor D. - Adequate existing regulatory mechanisms

Management Action A-2 - Provide flows necessary for all life stages of humpback chub to support a recovered Grand Canyon population, based on demographic criteria.

Task A-2.2 - Identify, implement, evaluate, and revise (as necessary through adaptive managment) a flow regime in the Little Colorado River to benefit humpback chub.

Management Action D-2. - Provide for the long-term management and protection of humpback chub populations and their habitat..

Task D-2.2 - Develop and implement conservation plans and execute agreements among State agencies, Federal agencies, American Indian tribes, and other interested parties to provide reasonable assurances that conditions needed for recovered humpback chub populations will be maintained..

III. **Study Background/Rationale and Hypotheses:**

This project does not necessarily involve hypothesis testing or research, but focuses on the improvement and protection of the LCR watershed to ensure appropriate habitat conditions downstream on the LCR in the area occupied by the humpback chub. Potential issues to be addressed include surface and groundwater quantity and quality, pesticides and other hazardous substances, and non-native fish stocking.

The LCR watershed is a large area with many political jurisdictions and authorities. For this effort to be successful, these parties must work cooperatively together as they bring their various ideas and responsibilities. The Little Colorado River Multi-Objective Management (LCRMOM) group has been organized to facilitate discussions among these various interests. Reclamation, AGFD, and FWS have been involved in past discussions of the group. The purpose of Project 22 is to review the status of the LCRMOM and its development of a watershed management plan, then assist in the development and implementation of such a plan.

IV. Study Goals, Objectives, End Product:

This project will assist in meeting the Recovery Goal of assuring continued protection of conditions needed for humpback chub recovery. This will be accomplished through assisting the development of a watershed management plan for the Little Colorado River.

V. Study Area:

Little Colorado River basin above the confluence with the Colorado River..

VI. Study Methods/Approach:

Task 1. Work with Executive Director of the LCRMOM in determining current status of the LCRMOM and what options exist for development of a watershed management plan. Identify agencies, tribes, local governments, and organizations, including watershed groups, who have authority, responsibility, or interest in future of endangered humpback chub in Grand Canyon. Review Recovery Goals document and other GCDAMP publications to compile list of threats to humpback chub that arise in the LCR basin, both internal and external to the CRE.

Task 2. Convene one or more workshops to identify actions that should be taken to address these threats, to identify authorities for addressing these threats, and to lay the foundation for a watershed-based management plan to integrate authorities, threats, and actions.

Task 3. Cooperatively develop a watershed-based management plan to provide a strategy for protecting the endangered humpback chub and other federally listed species while at the same time continuing with necessary water and resource development, prioritize necessary actions to achieve these goals, identify funding sources, construct management objectives and targets for measuring success, develop the framework for cooperative agreements, and identify a timeline for completion of tasks and measurement of successes.

VII. Task Description and Schedule:

Task 1. Review status of LCRMOM and evaluate current/projected threats to humpback chub.
Task 2. Conduct workshop with LCRMOM.
Task 3. Assist in development of watershed management plan.

VIII. FY-2004 Work:

Task 1 - Deliverables/Due Dates
- Final overview report, May 2004
- Budget: $5,000

Task 2 - Deliverables/Due Dates
- Convene workshop(s), September 2004
- Budget: $15,000

FY-2005 Work
Task 3 - Deliverables/Due Dates
- Assist in preparation of LCR watershed management plan, September 2005
- Budget: $30,000

IX. Budget Summary:

FY-2004	$20,000 Reclamation
FY-2005	$30,000 Reclamation

Total: $50,000.

X. Reviewers:

XI. Comments Received:

Need to better understand the goals of the LCR MOM, which may be organized more from an information perspective than an action perspective. Possibility for increased interaction between GCD AMP and the LCR MOM. Need some specific reason for watershed management, emphasizing partnering, that ties upper watershed management with issues in lower end of watershed. Discussion about what exactly should be in the watershed plan. Rich already included many of these threats in the Recovery Goal document. Next step is threat identification, MOM attendance, and FWS involvement in watershed activities (ESA section 9 & 10).

XII. References

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM Project 24
FY-2004 PROPOSED SCOPE OF WORK for:

Genetic Relationships Within and Among Populations of Humpback Chub

Lead Agency: GCMRC
Submitted by: Steven P. Gloss (project manager)
Marlis Douglas & Michael Douglas & Kevin Bestgen

Dept of Fishery and Wildlife Biology
Colorado State University
Fort Collins, CO 80523
970-491-1819 (voice); 970-491-5091 (fax)
email: mrd@cnr.colostate.edu
Date: April 9, 2003
Category:

Expected Funding Source:

X Ongoing project
_ Ongoing-revised project
X Requested new project
_ Unsolicited proposal

X Annual funds
_ Capital funds
_ Other (explain)

I. Title of Proposal: Genetic Relationships Within and Among Populations of the Endangered *Gila cypha* (Humpback Chub) in the Colorado River Ecosystem

II. Relationship to AMP Management Objectives:

Management Objective 2.2- Sustain or establish viable HBC spawning aggregations outside of the LCR in the Colorado River Ecosystem below Glen Canyon Dam to remove jeopardy.

Research Information Need 2.2.1 –What is a viable population and what is the appropriate method to assess population viability of native fish in the CRE. What is an acceptable probability of extinction over what management time period for humpback chub throughout the CRE

Research Information Need 2.2.4-.What is the relationship between the "aggregations" in the mainstem and LCR? Are mainstem aggregations "sinks" of the LCR? Are aggregations real or due to sampling bias?

III. Study Background/Rationale and Hypotheses:

Currently population estimates for HBC are conducted in the LCR in the fall of each year to estimate abundance of smaller chub and to get a 'first' signal about the survival and potential recruitment of a given year class. Sampling is also

conducted in the spring primarily aimed at marking as large a number of chub as feasible to provide information through capture and subsequent recapture for stock assessment models. Depending on the quality of data with respect to meeting assumptions of mark-recapture population estimation models, these spring data may also be used to generate a point estimate of the population size. There has and continues to be uncertainty regarding how well point estimates derived solely from LCR sampling may represent the status and trends of the 'LCR population' individuals from which are known to spend time in both the LCR and mainstem-with movement in and out associated primarily with spawning activity in the adult population. There is also concern about adopting consistent population estimation procedures for populations of HBC in the Upper and Lower Basin vis-à-vis Recovery Goals.

IV. Study Goals, Objectives, End Product:

This project will produce estimates of abundance for HBC in the LCR and LCR confluence area of the CRE in spring of 2004 and 2005. These estimates will be used to compare with estimates obtained using only LCR sampling and using various stock synthesis models

V. Study Area:

Little Colorado River upstream 9 miles from confluence with CR and Mainstem CR from RM 56-65

VI. Study Methods/Approach :

This project would expand sampling effort in the spring to include the mainstem Colorado River near the LCR confluence from RM 56-65. Sampling would be done with a combination of hoop nets and trammel nets. HBC would be marked with either a temporary mark or PIT tag depending on size. Sampling will involve a single marking and recapture trip. These data would also be used as input data for the annual stock assessment model runs.

An additional option being considered in conjunction with this proposed action and the 'routine' LCR sampling is the implantation of sonic tags in adult HBC to yield additional information regarding the frequency and extent of movement of fish in and out of the LCR, as well as to try and determine the proportion of LCR fish which may not spawn every year, i.e. skip spawners.

Considerations- Movement and distribution of HBC seasonally complicate finding the ideal sampling schedule for this effort. It is assumed that 'most' of the population goes into the LCR for spawning and may or may not remain there during part or all of the mark-recapture sampling there, i.e. the timing of movement in and out varies from year to year and we have not good predictors of when it will occur between about March and June. Sampling in the spring

would add information about the distribution of fish and their movement but could violate model assumptions for simple mark-recapture population estimation. Simulation modeling of population estimates using estimated capture probabilities and various levels of hypothetical populations suggest that the best population estimates will be obtained using the above procedures.

VII. Task Description and Schedule:

This action item, if adopted, would be implemented in the near term, beginning in the fall of 2003 or spring of 2004, and pursued for at least two years. Annual budgets for this proposed action are estimated as follows:

Option	Cost
2-trip spring or fall only	$ 220,000
3 trip spring or fall only	330,000
2 trip spring & fall	440.000
3 trip spring & fall	660,000
Sonic tags and detectors (50-100; one time cost)	50,000

VIII. FY-2004 Work

- Deliverables/Due Dates: Annual Report – December, 2004
- Budget:
- $220,000 two population estimation trips, $50,000 sonic tags and detectors

FY-2005 Work

- Deliverables/Due Dates: : Annual Report – December, 2005
- Budget estimate:
- $220,000 two population estimation trips,

FY-2005 etc. (for multi-year study)

IX. Budget Summary *[Provide total AND break-out by funding target (e.g. station)]*[*]

FY-2004 : $270,000
FY-2005: $220,000

Total: $490,000

X. Reviewers

GCAMP AMWG HBC AdHoc

XI. References