UTAH NATURAL RESOURCES

Wildlife Resources

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memorandum

January 22, 1997

TO: John Hamill
Angela Kantola

FROM: Leo Lentsch

SUBJECT: FY98 RIPRAP changes and Program Guidance

Following are the recommendations for RIPRAP changes and Program Guidance from the State of Utah. We believe that all of the below projects are important, however, there is flexibility with regards to initiating these projects. Because of potential budget constraints, we have ranked our guidance as high, medium, and low priority.

High Priority - FY1997, Immediate Needs

A water tank is needed at Wahweap. With the completion of the new building at Wahweap, the water tank becomes even more critical. Approximately $40-50K should be adequate for the tank. Netting also needs to be purchased for ponds. Two to four ponds will likely be holding bonytail next fall. Netting will cost up to $10,000/pond, but may be completed for less. We have not used approximately $100,000 approved for capitol construction at this facility. Primarily, we are asking to redirect some of these funds to accomplish these tasks. Please note that the RIP approved the $100,000 but our contract with BOR never included the funds.

FY1998 High Priority - New Starts

1) TITLE: ***Determination of Potential Hybridization Impacts of Reintroduction of Bonytail on Humpback chub and Roundtail Chub***

RIPRAP ITEM NUMBER:
General Recovery Program Support:

IV.	Manage genetic integrity and augment or restore populations
IV.A.5.	Develop and Implement basinwide bonytail restoration plan
IV.A.5.a.	Implement bonytail chub restoration plan
IV.A.5.a.(1)	Conduct high-priority lab/field studies

identified in bonytail reintroduction plan

RATIONALE/PROBLEM STATEMENT: The reintroduction plan for bonytail in the Upper Colorado River identified hybridization impacts as a primary concern (Lentsch et al. 1996). The impact of hybridization from reintroduced bonytail with humpback chub and roundtail chub, however, remains unresolved. The reintroduction plan called for evaluating the potential hybridization impacts by 1) genetic monitoring of existing populations of *Gila* in the basin to determine if hybridization was occurring, and 2) quantification of the viability of laboratory-produced hybrid crosses relative to laboratory-produced pure crosses. We propose that the UBRIP initiate this study to investigate the viability of hybrid crosses as a measure of the potential impacts of reintroduced bonytail on humpback chub and roundtail chub.

Samples of *Gila* from natural populations generally contain various forms of hybrids (i.e., *G. elegans* x *G. robusta*, *G. elegans* x *G. cypha*). The appearance of hybrids, however, does not necessarily reflect the amount of spawning that occurs between species in the field. For example, the number of hybrids that reach sexual maturity may be only a small fraction relative to offspring of pure crosses. To determine the relative fitness of hybrids, therefore, crosses will be produced in the laboratory that will allow a direct comparison of survivorship and performance between pure species and each possible cross.

The occurrence of interspecific hybridization within the genus *Gila* has been well documented (DeMarais et al. 1992). However, the fitness of hybrids relative to the pure species has not been ascertained. The risk of long-term effects of hybridization to pure species of *Gila* following reintroduction of bonytail (*Gila elegans*) into the Upper Basin is directly related to the fitness of the various *Gila* hybrids. Naturally reproducing populations of pure roundtail chub (*G. robusta*) and humpback chub (*G. cypha*) occur in the Upper Basin. The purpose of this study is to determine the potential risk of reintroduction of bonytail into the Upper Basin on roundtail chub and humpback chub due to increased opportunity for hybridization.

PROJECT GOALS AND OBJECTIVES: Quantification of the viability of laboratory-produced hybrid *Gila* crosses relative to laboratory-produced pure *Gila* crosses.

Goal: To determine the relative fitness of all possible hybrid crosses and thus the potential risk of hybridization among pure species following reintroduction of bonytail.

Objectives:

A. Perform all possible crosses in the laboratory (Table 1) and monitor relative viability of offspring (to pure parentals) (e.g.

hatching rate, survivorship, growth, abnormalities etc.).

B. Following sexual maturity of F_1 individuals produced by the above crosses, they will be used to 1) backcross with pure parentals (F_1 x *Gila* spp. and 2) cross with each other (F_1 x F_1).

EXPECTED PRODUCT: Report documenting the viability of laboratory-produced *Gila* hybrid crosses relative to laboratory-produced *pure Gila* crosses. The report will have recommendations for future bonytail reintroduction efforts relative to *Gila* hybridization.

RECOMMENDED APPROACH/METHODS: All possible crosses between *Gila* will be performed in the laboratory. Crosses within pure species will serve as controls (Tables 1 and 2). Relative viability of offspring to pure parentals (e.g., hatching rate, survivorship, growth, abnormalities etc.) will be monitored. Following sexual maturity of F_1 individuals produced by the above crosses, they will be used to A) backcross with pure parentals (F_1 x *Gila* spp. and B) cross with each other (F_1 x F_1).

Viability of F_1 Progeny

Possible crosses between species of *Gila*:

B = Bonytail
H = Humpback
R = Roundtail

Female x Male	Male x Female
B X B	B X B
H X H	H X H
R X R	R X R
B X H	B X H
B X R	B X R
H X R	H X R
H X B	H X B
R X B	R X B

Table 1. All possible crosses (N=81) using 3 replicates to estimate among-male and among-female variance.

Males

		B1	B2	B3	H1	H2	H3	R1	R2	R3
F	B1	B1xB1	B2xB1	B3xB1	H1xB1	H2xB1	H3xB1	R1xB1	R2xB1	R3xB1
	B2	B1xB2	B2xB2	B3xB2	H1xB2	H2xB2	H3xB2	R1xB2	R2xB2	R3xB2

e	B3	B1xB3	B2xB3	B3xB3	H1xB3	H2xB3	H3xB3	R1xB3	R2xB3	R3xB3
m	H1	B1xH1	B2xH1	B3xH1	H1xH1	H2xH1	H3xH1	R1xH1	R2xH1	R3xH1
a	H2	B1xH2	B2xH2	B3xH2	H1xH2	H2xH2	H3xH2	R1xH2	R2xH2	R3xH2
l	H3	B1xH3	B2xH3	B3xH3	H1xH3	H2xH3	H3xH3	R1xH3	R2xH3	R3xH3
e	R1	B1xR1	B2xR1	B3xR1	H1xR1	H2xR1	H3xR1	R1xR1	R2xR1	R3xR1
s	R2	B1xR2	B2xR2	B3xR2	H1xR2	H2xR2	H3xR2	R1xR2	R2xR2	R3xR2
	R3	B1xR3	B2xR3	B3xR3	H1xR3	H2xR3	H3xR3	R1xR3	R2xR3	R3xR3

Assessment of relative viability of progeny of hybrid crosses

Following crosses these variables will be measured:

Subsequent to free-swimming fry stage:

Hatching rate (i.e., time to first hatch, time to 50% hatch)
Mortality rate
Time to free-swimming stage
Fry mortality

Post free-swimming fry stage:

Variables to be measured:

Growth rate
Mortality rate
Bilateral asymmetry (this will be measured once individual fry are > 70 mm in length)

Once fry are over (approximately) 60 mm in length they will be pooled and reared in a common environment. Subsamples will be measured once every 3 weeks for 4 months and once every 2 months subsequently to quantify growth rate (length and weight) and survivorship of crosses relative to parentals.

Viability of F_2 Progeny

Once F_1 individuals have reached sexual maturity they will be used to perform F_1 x pure *Gila* spp. backcrosses and F_1 x F_1 crosses.

B = Bonytail
H = Humpback
R = Roundtail

Possible F_1 hybrids
BH = Bonytail (female)-Humpback (male) hybrid

BR = Bonytail (female) - Roundtail (male) hybrid
HR = Humpback (female)-Roundtail (male) hybrid
HB = Bonytail (male)-Humpback (female) hybrid
RB = Bonytail (male) - Roundtail (female) hybrid
RH = Humpback (male)-Roundtail (female) hybrid

18 Possible crosses:

Female x Male

B X B	BH X BH	BH X BR	BR X BH	HB X HB	HB X RB
H X H	BR X BR	BH X HR	HR X BH	RB X RB	HB X RH
R X R	HR X HR	BR X HR	HR X BR	RH X RH	RB X RH

Assessment of relative viability of backcrossed hybrids and hybrids to each other

Following crosses, these variables will be measured:

Hatching rate (i.e., time to first hatch, time to 50% hatch)
Mortality rate
Time to free-swimming stage
Fry mortality

Subsequent to free-swimming fry stage:

Variables to be measured:

Growth rate
Mortality rate
Bilateral asymmetry (this will be measured once individual fry are > 70 mm in length)

SCHEDULE: FY1998-2002 (will depend on when *Gila* crosses become sexually mature)

COST RANGE: $50-60,000/year

RECOMMENDED PRINCIPAL INVESTIGATORS: UDWR and USU

2) TITLE: **Monitoring Genetic effects of reintroduction of bonytail on roundtail chub and humpback chub**

Genetic markers (allozymes and mitochondrial DNA RFLPs) are available that can be used to distinguish among *Gila* species (DeMarais et. al 1992). Genetically "unique" differences among these species permits identification of hybrids. Prior to reintroduction, natural levels of *Gila* hybrids will be quantified in those sites likely to be affected by bonytail reintroduction. This will serve as a background level by which to monitor the

potential effects of hybridization due to increased numbers of bonytail. Following reintroduction, levels of hybridization will be monitored on a yearly basis and/or in accordance with any additional introduction of bonytail.

RIPRAP ITEM NUMBER:
General Recovery Program Support:

IV. Manage genetic integrity and augment or restore populations

IV.A.5. Develop and Implement basinwide bonytail restoration plan

IV.A.5.a. Implement bonytail chub restoration plan

IV.A.5.a.(1) Conduct high-priority lab/field studies identified in bonytail reintroduction plan

RATIONALE/PROBLEM STATEMENT: The reintroduction plan for bonytail in the Upper Colorado River identified hybridization impacts as a primary concern (Lentsch et al. 1996). The impact of hybridization from reintroduced bonytail with humpback chub and roundtail chub, however, remains unresolved. The reintroduction plan called for evaluating the potential hybridization impacts by 1) genetic monitoring of existing populations of *Gila* in the basin to determine if hybridization was occurring, and 2) quantification of the viability of laboratory-produced hybrid crosses relative to laboratory-produced pure crosses. We propose that the UBRIP initiate this study to monitor the genetic of existing populations of Gila to evaluate the potential impacts of bonytail reintroduction.

PROJECT GOALS AND OBJECTIVES: Quantification of the viability of laboratory-produced hybrid *Gila* crosses relative to laboratory-produced pure *Gila* crosses.

Goal: To monitor the impact of bonytail reintroduction on populations of pure humpback and roundtail.

Objective: Obtain background information on frequency of bonytail, roundtail, humpback and all possible hybrids in 1) areas directly targeted for bonytail reintroduction and 2) those with populations prone to the effects of bonytail migration (e.g. areas with large numbers of humpback up or down stream).

Objective: Monitor same areas subsequent to introduction o FY bonytail over a period of years. Genetic markers will be used to identify 1) a change in frequency of humpback and roundtail subsequent to introduction of bonytail due to competition with bonytail for environmental reasons (e.g. competition for food, preferred habitat etc.) and 2) a potential change in frequency of pure species due to hybridization.

EXPECTED PRODUCT: An annual report documenting the genetic impacts of bonytail reintroduction on wild humpback chub and rountail chub. The report will have recommendations for future bonytail reintroduction efforts relative to *Gila* hybridization.

RECOMMENDED APPROACH/METHODS:

The first site identified for reintroduction (Site #1) is at Moab (Colorado River). This site has been chosen based on the fact that few, if any, humpbacks have been documented at this site in recent years. This site has a low potential for impact of hybridization. However, several humpback have been observed at Westwater (upstream from Moab) and these are potentially at risk of hybridization with introduced bonytail.

Collections:

Tissue samples from up to 100 individuals (bonytail, roundtail, humpback, and/or hybrids) will be collected from: 1) Below Moab (near Canyonlands), 2) Moab, and 3)Westwater (above Moab) before reintroduction of bonytail into Moab (Site #1). These collections will include a **random** sample (i.e. should be representative of frequencies in population) of all individuals identified as humpback, roundtail, bonytail or hybrid.

Tissue: Muscle plugs or fin clips
Storage: Liquid nitrogen/Dry ice/-80°C

SCHEDULE: FY1998-2002

COST RANGE: $10-15,000/year

RECOMMENDED PRINCIPAL INVESTIGATORS: UDWR and USU

3) TITLE: Develop and implement an augmentation plan for razorback sucker on the Middle and Lower Green River

RIPRAP ITEM NUMBER:

Green River Action Plan-Mainstem:

IV.	Manage Genetic Integrity and Augment or Restore Populations
IV.A.	Augment or restore populations as needed
IV.A.1.	Razorback sucker
IV.A.1.a.	Develop augmentation plan
IV.A.1.b.	Seek Program acceptance of augmentation plan
IV.A.1.d.	Implement augmentation plan on lower Green River

RATIONALE/PROBLEM STATEMENT: Razorback sucker stocking plans have been developed for the Middle Green River and the upper Colorado/Gunnison rivers. A plan needs to be developed, approved by the Program, and implemented before the razorback sucker population in the lower Green River drops below the minimum viable population size and becomes extinct.

PROJECT GOALS AND OBJECTIVES: Develop a razorback sucker stocking

plan for the lower Green River, gain Program acceptance, and implement the plan.

EXPECTED PRODUCT: A razorback sucker stocking plan for the lower Green River.

RECOMMENDED APPROACH/METHODS: Develop a plan with the assistance of the other existing razorback sucker plans.

SCHEDULE: FY1998 - Develop the plan and gain Program acceptance

COST RANGE: FY1998 - $10K,. If the basinwide monitoring plan is expanded to include the lower Green River, this program could cover the implementation of the augmentation plan (see comments below under the section FY1998 High Priority - New Tasks in Ongoing Projects.

RECOMMENDED PRINCIPAL INVESTIGATORS: UDWR

4) TITLE: An evaluation of the importance of the San Rafael River to recovery of the endangered fishes.

RIPRAP ITEM NUMBER:

General Recovery Program Support:

V.	Monitor populations and habitat and conduct research to support recovery actions (research, monitoring, and data management)

Green River Action Plan: Mainstem

I.	Habitat Management
I.D.	San Rafael River
I.D.1.	Assess recovery potential

RATIONALE/PROBLEM STATEMENT: The overall importance of the San Rafael River to recovery of the endangered fishes needs to be assessed. Surveys have been conducted on other tributaries of the Green and Colorado rivers (e.g., Dolores, Gunnison, and currently the Price River), but it has been 15-20 years since the San Rafael River has been surveyed. Limited fisheries work during the last 2 years by UDWR has demonstrated that the San Rafael River, like the Price River, contains a "good" population of native fishes. Roundtail chub have been found in the Black Box area, and flannelmouth sucker have been found below the Black Box. Larval razorback sucker also have been found at the San Rafael/Green River confluence. UDWR biologists believe that the San Rafael is a potential spawning area for razorback sucker in the Lower Green River, therefore, we feel that work on the San Rafael River should begin in FY1998. When the importance of the San Rafael River has been assessed, decisions can be made on its management (e.g., whether UDWR should provide additional flows for the San Rafael and Green River through UDWR owned land or possibly growout razorback sucker at river side ponds on the San Rafael River to increase the lower Green River population).

PROJECT GOALS AND OBJECTIVES: The overall goals of this study are to determine if or how extensively the endangered fishes (primarily razorback sucker and Colorado squawfish) utilize the San Rafael River, to determine the biological importance of the San Rafael River to the Green River system and recovery of the endangered fishes, and to determine if sites exist for river side culture activities.

EXPECTED PRODUCT: Final product documenting endangered fish usage and physical habitat attributes of the San Rafael River. If razorback sucker spawn in the San Rafael River, a spawning location will be located. Recommendations on the importance of the San Rafael River to endangered fish recovery.

RECOMMENDED APPROACH/METHODS: A systematic survey similar to the Price River and Duchesne River study.

SCHEDULE: FY1998-FY2000

COST RANGE: $60-70K/year

RECOMMENDED PRINCIPAL INVESTIGATORS: UDWR

5) TITLE: Investigate options for batch marking large numbers of hatchery produced endangered fishes for stocking.

RIPRAP ITEM NUMBER:

General Recovery Program Support Action Plan
IV. Manage genetic integrity and augment or restore populations

RATIONALE/PROBLEM STATEMENT: As stocking activities are increased (e.g., razorback sucker in the Green River and bonytail), the cost of PIT-tagging will limit the number of fish that the Program will be able to stock. For example, if the needed/ desired number of fish to stock is 25,000, the cost of PIT-tagging will exceed $100K. An issue paper on batch marking techniques for hatchery fish needs to be developed. The possibility exists to mark fish with two techniques (e.g., tetracycline at swim-up and freeze brand/spray mark/fin clip/etc. before stocking). If the above scenario is followed, a fish found in the field with the freeze brand/spray mark/fin clip could be PIT-tagged at that time. If the external mark is lost and a fish is suspected of being stocked, the fish could be sacrificed to determine if it was indeed stocked (e.g., look for the tetracyline mark). If the RIP truly feels that the genetic integrity of the hatchery broodstock is adequate, techniques need to be developed to increase stocking efforts.

PROJECT GOALS AND OBJECTIVES: Develop a feasibility study on the potential of batch marking large numbers of hatchery fish

EXPECTED PRODUCT: The above referenced feasibility study.

RECOMMENDED APPROACH/METHODS: Develop the above referenced feasibility study.

SCHEDULE: FY1998 - Complete feasibility study, FY1999 - Start marking actions from the feasibility study

COST RANGE: FY1998 - $10,000

RECOMMENDED PRINCIPAL INVESTIGATORS: UDWR

6) TITLE: Nonnative control at the mouth of small tributaries in the lower Green River

RIPRAP ITEM NUMBER:

General Recovery Program Support:
III. Reduce negative impacts of nonnative fishes
III.A. Reduce negative interactions between nonnative and endangered fishes
III.A.2. Identify and implement viable active control measures

Green River Action Plan: Mainstem

I. Habitat Management
I.D. San Rafael River
I.D.1. Assess recovery potential
III. Reduce negative impacts of nonnative fishes

RATIONALE/PROBLEM STATEMENT: Larval razorback sucker (392) have been captured in the lower Green River since 1993. In 1996, 30 larval razorback sucker were caught in the mouth of the San Rafael River. Floodplain areas (or any low-velocity waters) are limited in the lower Green River, consequently tributary/wash mouths are important for larval razorback sucker. Non-native fish densities are relatively low in the lower Green River, however, tributary/wash mouths appear to be the major source areas where their densities are high. A reduction in non-native densities in these areas would likely lead to increased survival of larval razorback sucker, leading to an increase in recruitment to the lower Green River razorback sucker population.

PROJECT GOALS AND OBJECTIVES: Reduce non-native densities in tributary mouths/wash mouths (source areas) in the Lower Green River. Determine if a reduction in non-native densities in these areas would lead to an increase in relative densities of larval razorback sucker.

EXPECTED PRODUCT: Report discussing the effectiveness of non-native fish control measures in the lower Green River and the razorback sucker response to non-native fish removal. Recommendations will be made for future non-native control measures in the lower Green River.

RECOMMENDED APPROACH/METHODS: Seining, electrofishing, trap netting, trammel nets, etc. would be set in tributary mouths and wash mouths in the lower Green. Sampling would be conducted pre-razorback sucker spawn and during the time that larval razorback sucker would be utilizing these areas. The areas where larval razorback sucker have been found (e.g., mouth of the San Rafael River) would be concentrated on first.

SCHEDULE: FY1998-FY2000

COST RANGE: $40-50K/year, depending on intensity

RECOMMENDED PRINCIPAL INVESTIGATORS: UDWR

7) TITLE: Identify the flow mechanism(s) for reducing cyprinids

RIPRAP ITEM NUMBER:

General Recovery Program Support:

III. Reduce negative impacts of nonnative fishes
III.A. Reduce negative interactions between nonnative and endangered fishes

The following RIPRAP items should be added:

III.A.3. Identify passive control measures

III.A.3.a. Identify flow mechanisms for reducing cyprinid abundance

RATIONALE/PROBLEM STATEMENT: In addition to the proposed guidance of mechanical removal of cyprinids in the Colorado River system, the following study would likely answer more questions and lead to a plan that would reduce cyprinid abundance and increase native fish abundance for less time and effort.

More emphasis within the Program is being directed toward controlling nonnative fishes; consequently determining the flow mechanism that reduces cyprinid abundance will become increasingly important. Correlative evidence demonstrated that relative abundance of red shiner, sand shiner, fathead minnow, and redside shiner is negatively affected by high river discharges and associated lower water temperatures (McAda and Kaeding 1989; Osmundson and Kaeding 1989, 1991; Valdez 1990; Muth and Nesler 1993). This finding suggests that management of flow regimes to approximate natural hydrographs and periodically providing above average magnitudes in spring and summer discharges would suppress their abundance. Muth and Nesler (1993) also found that moderate-high daily mean discharges were associated with later initiation of spawning and a shorter spawning season for the red shiner, sand shiner, and fathead minnow. Higher discharges resulted in an earlier initiation of spawning for the redside shiner, probably due to the redside shiner's preference for cooler water. Cause and effect relationships between discharge and cyprinid abundance still need to be determined.

PROJECT GOALS AND OBJECTIVES: 1) Determine flow magnitude and duration required to reduce cyprinids. 2) Determine the frequency of flow manipulations required for reducing cyprinids. 3) Determine what effects the temperature regimes associated with the above flow regimes have on cyprinid abundance. 4) Quantify cyprinid abundance before and after flow/temperature manipulations. 5) Quantify the above affects on native fish abundance.

EXPECTED PRODUCT: A report stating what effects that different flow/temperature manipulations have on cyprinid abundance. This information would be tied in with the findings of ISMP and basinwide monitoring for razorback sucker to correlate to Colorado squawfish and razorback sucker larval abundance. Recommendations would be made for the flow/temperature regimes to reduce cyprinid abundance.

RECOMMENDED APPROACH/METHODS: Before the development of a monitoring plan for nonnatives can be efficiently carried out, past data collections should be reviewed, tabulated and even re-enumerated (Task 1). Data sets such as the ISMP, nursery habitat sampling and various other collections should be organized by

sampling place and date so that discharge and temperature data can be combined. Re-organization of past data should allow us to determine those data that are being collected under other sampling programs while also allowing the identification of data not currently being collected. The final plan will identify sampling locations, times (to capture important life-history data) and methodologies for each life stage. Following the monitoring plan for nonnative cyprinids (specifically for red shiner) developed in Task 1 (FY98), a sampling protocol will be implemented like those currently in place for target native species (Task 2). Data collection, enumeration and synthesis with other supplemental programs will be initiated. Specific cause and effect relationships between control actions (primarily flow management) and cyprinid population response will be documented. Following the evaluation of previously collected data (Task 1) as well as those obtained from Task 2, both laboratory and field experiments will be designed to test linkages between specific life-history stages of red shiners (as a model for nonnative cyprinids) and flow/temperature fluctuations (Task 3). Examples of possible experimental relationships include: 1) flow/spawning gravel stability; 2) temperature effects on reproductive output, egg hatching success, and larval development rate/success; 3) flow effects on habitat availability for specific life stages.

SCHEDULE: FY1998-FY2003

COST RANGE: $50K for FY1998, $75-90K for out years

RECOMMENDED PRINCIPAL INVESTIGATORS: UDWR, LFL, USU

8) TITLE: Investigate options for reducing impact of selenium laced waters of Ashley Creek on spawning razorback suckers

RIPRAP ITEM NUMBER:

Green River Action Plan-Mainstem:
II.D. Support actions to reduce or eliminate contaminant impacts at Ashley Creek and Stewart Drain

RATIONALE/PROBLEM STATEMENT: Green River investigations over the past 20 years have indicated that the area encompassing the confluences of Ashley Creek and Stewart Lake Drain with the Green River is an important staging site for razorback suckers during the annual spawning migration. Investigations by USFWS, BOR, USGS and others have shown that waters from Ashley Creek and Stewart Lake have levels of selenium greatly in excess of threshold levels for health effects to man and wildlife (aquatic and terrestrial). Additional recent research conducted in Yankton, SD shows that razorback suckers exposed to high levels of selenium prior to spawn have low reproductive success.

A high percentage of the already depressed razorback sucker population stages in this area, therefore, some effort needs be expended to alleviate the impacts that selenium contamination will have on these fish. Two programs already exist that may accomplish this. The first is reclamation of the Vernal City/Uintah County sewage treatment ponds on Ashley Creek. These have been found to be the primary culprit in selenium loading of Ashley Creek. There is impetus by state and federal agencies to reconstruct these ponds; the RIP should be in a position to support such activities. BOR also is investigating possibilities for diverting selenium laced irrigation drain waters from Stewart Lake, and reconfiguring the lake to remove contaminated sediment. The RIP should not ignore the possibility of supporting this operation and, perhaps, becoming involved in Stewart Lake remediation will benefit fish as well as wildlife.

Although efforts to remove selenium contamination from these sources have begun, accomplishment dates are uncertain. The RIP cannot afford to continue to allow razorback sucker reproduction and health to be impacted by Ashley Creek and Stewart Lake Drain. A feasibility study needs to be completed on the potential of blocking native fish use at these sites by erecting fish barriers to prevent access. Although this would not completely remove razorback suckers from exposure to selenium laced waters, it may discourage congregations in this area and, therefore, exposure time. Decreased exposure time should result in decreases in selenium contamination, therefore preventing destructive effects to gametes of mature fish. Monitoring and maintenance would be required to determine effectiveness and cost benefit analysis. In addition, as Stewart Lake remediation plans may involve rerouting irrigation drains directly into the Green River, the RIP may have to deal with blocking fish access to these drain sites. Studies of fish barrier effectiveness at Ashley Creek and Stewart Lake Drain would be invaluable in assisting in the design of such drains.

Fish barriers at these tributaries may also help control nonnative predators. Both Ashley Creek and Stewart Lake Drain are known to harbor concentrations of northern pike and channel catfish during the spring run-off period. Eliminating these sites for congregation by all species my decrease native fish susceptibility to predation.

PROJECT GOALS AND OBJECTIVES: Develop a feasibility study on the potential of blocking native fish use at the mouth of Ashley Creek and Stewart Lake drain by erecting fish barriers to prevent access.

EXPECTED PRODUCT: The above referenced feasibility study.

RECOMMENDED APPROACH/METHODS: Develop the above referenced feasibility study.

SCHEDULE: FY1998 - Complete feasibility study, FY1999 - Start

actions from the feasibility study

COST RANGE: FY1998 - $15K

RECOMMENDED PRINCIPAL INVESTIGATORS: UDWR

High Priority - New Tasks in Ongoing Projects

1) Expand the razorback sucker monitoring program.

Razorback sucker are the species of highest priority for the RIP. When the monitoring program was being developed, the project was severely reduced in scope because FY97 funds were limited. The program took another cut when projects were discussed at the July 1996 Biology Committee meeting. The basinwide monitoring program should be expanded to that of its original intent. If the razorback monitoring program is expanded, there should be sufficient efforts to evaluate the razorback sucker stockings in the Middle Green River and the Lower Green River (proposed above).

2) Expand the bonytail reintroduction effort to include habitat and food preferences of bonytail. As more bonytail are stocked, we need to and will be able to learn more about this species in the wild. We need to determine the potential for habitat overlaps between bonytail, roundtail and humpback chub. Will these *Gila* species utilize similar micro- and meso-habitats? These are the types of questions we need to start answering. This information can be obtained through lab and field experiments. Habitat preference field experiments will involve radio-tracking of stocked bonytail as well as wild humpback and roundtail chub. Habitat preference lab work will include placing different sizes of bonytail, roundtail and humpback chub (some fish will be ripe adults) into large, circular streams, both separately and in combination in various flow/substrate regimes. Observations and measurements on flow selection, depth selection and substrate preferences will be made using time-lapse videography techniques. Habitat overlaps and potential reproductive isolating mechanisms within the *Gila* complex will be identified. Food preference lab work will include adding food (freeze-dried krill) via feeding tubes for determination of feeding behaviors. The fish treatments will be the same as those outlined above. Food will be presented as either benthic, surface or mid-water drift. Again, videography will be used to determine the specific feeding behaviors and potential overlap among the three Gila species. Cost - $50-60K beyond the monitoring effort.

3) Expand propagation efforts at Wahweap to include the development of a bonytail broodstock for the Upper Basin. FY1998 costs - $600K for 6 additional 0.4 acre ponds.

4) Expand ISMP to include sampling the fish communities in Westwater Canyon, Desolation/Gray Canyons, and Cataract Canyon.

These canyon stretches likely support the strongest population of large river species (humpback chubs, roundtail chub, flannelmouth and bluehead sucker) in the lower portion of the Green and Colorado rivers. Humpback chubs need to be included in the ISMP. Originally the ISMP called for sampling the Westwater population every third year. Tri-annual monitoring is adequate if the program is concerned with the response of this species and these canyon fish communities to the proposed flows and other recovery activities (in particular Bonytail stocking). Nor do results in Westwater necessarily indicate what is happening in Desolation and Cataract canyons. With the Aspinall and Flaming Gorge studies, Westwater on the Colorado and Deso/Gray on the Green have received intensive sampling effort since 1992. To accomplish the objectives of the ISMP a single monitoring trip should be conducted in each canyon. Westwater and Cataract should be monitored in the Fall. Deso/Gray has been monitored in the summer to coincide with Colorado squawfish spawning. We recommend continuing with that sampling schedule to maintain consistency in those databases. Both YOY and adult fishes can be monitored simultaneously. One trip in each of these canyons per year would represent a significant de-emphasis of effort (in Desolation and Westwater) from the Flaming Gorge and Aspinall studies. The Cataract Canyon trip would be a new activity. UDWR could sample all three canyons for $20-30K/year.

FY1998 Medium Priority - New Projects

1) Studies have indicated that in the Colorado River inflow to Lake Powell, high densities of young Colorado squawfish and razorback suckers occur. We believe that interaction with nonnatives in the inflow (most likely via predation) prevent these fish from recruiting into the riverine population. Therefore, it is important to understand these interactions with nonnatives and develop strategies to protect the native fish in the inflow area until they are able to recruit into the riverine population and move back upstream.

2) Control escapement of nonnative fishes from Moab Sloughs. Field personnel from our Moab Field Station observed nonnative fish escapement from the Moab Sloughs again this year. Gambusia are numerous in the Moab Sloughs and consequently they occupy the river near the sloughs. Gambusia are virtually nonexistent in other parts of the river around the sloughs, so Gambusia numbers are maintained via escapement from the sloughs. Similar trends were observed with other nonnative species as well.

FY1998 Low Priority - New Projects

1) Initiate projects to answer data deficiencies provided by the IMO's, as identified in the RIPRAP. For example, gathering

information for the humpback chub model has demonstrated a deficiency in life history attributes for this species. Westwater currently contains a "good population" of humpback chub, however we are not able to obtain a population estimate because this was not an objective of the current study. Any estimates will be weak at best. Given a specific effort directed at Westwater Canyon, we could come up with some strong estimates of Humpback chub and Roundtail chub population sizes in Westwater Canyon, as well as additional life history information. A potential exists for a study in Westwater after the IMO's have identified life history/data deficiencies that are the highest priority.