TERRESTRIAL ECOSYSTEM ACTIVITIES

A. 1. Monitoring and Inventory of Terrestrial Resources

Purpose: To measure and quantify change over time of linked terrestrial resources in relationship to operations of Glen Canyon Dam. Monitoring to detect change in linked resources, specifically, vegetation, insect fauna, riparian breeding birds, lizards and waterfowl addresses AMP Goal 6 regarding riparian and spring communities (see appendix). This project is associated with management objectives listed under goal 6, specifically CMIN 6.1, 6.1.1, 6.2.1, 6.3.1, 6.4.1, and 6.5.1, 6.7.1, 6.7.2 and support RIN's 6.4, 6.7.3. This is the third year of a three-year project.

Objectives:

- Understand how yearly operational patterns affect vegetation composition and structure in bird survey patch sites.
- Understand how composition and structure of patches influences bird abundance and distribution.
- Understand how vegetation composition affects invertebrate abundance and composition as a food base for avifauna and other vertebrates.
- Understand how vegetation composition and density changes relative to stage/discharge relationship and to geomorphic reach system-wide.
- Included in this work is an effort to merge tribal perspectives into the status of resources in the CRE.

Monitoring scale:

- Bird habitat patch (minimum 100 m). 50-60 patches in spring. Vegetation structure and composition is recorded for each patch measured.
- Bird/lizard walking transect within vegetation patches 50-60 patches/3 times/year. Birds encountered or heard are recorded. 15 to 20 most common birds are tracked. SWWF is also monitored.
- Overwintering and waterfowl survey in February.
- Small mammal, invertebrate sampling at camping sites 4 times per year to determine relative densities and seasonal changes of foodbase.
- Vegetation density transects for reach-based estimates of vegetation cover and system-wide change. Transects at 60k, 45k, 35k, 25k and 15k cfs stages. 60 sites per year.

Products:

- Annual and final report
- Fact sheet
- Annual data delivery
- Coordination meetings with participating tribes and Park

Budget: $320,000

A.2. Monitoring Kanab ambersnail

Purpose: to determine the abundance of kanab ambersnails that inhabit the Vaseys Paradise Springs vegetation and to determine how snail densities change relative to time and to available habitat, as habitat is influenced by operations and discharge from the spring. Monitoring of Kanab ambersnail densities, size classes and utilized habitat: (1) allows managers to assess the status of this endangered species; (2) provides data that allows identification and interpretation of linkages between physical and biological variables within the Colorado River ecosystem; (3) provides data on the effect of periodic management of sediment through high flows under the Record of Decision on the population dynamics and habitat interactions of this species. This project meets MO 5.1 and 5.2 and CMIN's 5.1.1 and 5.2.1.

Objectives:

- Provide yearly estimates of adult snails at Vaseys Paradise.
- Provide habitat estimates and change detection of habitat for varying stage levels.
- Provide data to use in population model development for snails at Vaseys Paradise.

Methods:

Population estimates:

- Sampling in the spring for over winter survival and in the fall for recruitment
- Sub-sampling vegetation patches for snails and developing estimates using boots strapping methods.

Habitat estimates:

- Traditional survey of perimeter of habitat and areas subsequently generated.
- Estimation of habitat available or affected by discharges > 30,000 cfs.
- Investigate feasibility of photogrammetry for habitat estimates.

Products:

- Yearly report of status and trend of Kanab ambersnail and habitat change.
- Trip reports following each trip providing area estimates of vegetation and general description of status of snail at V.P.
- Fact sheet

Budget: $64,000

A.3. Kanab ambersnail taxonomy

Purpose: The purpose of this project is to examine and resolve the taxonomic relationship of the snail at Vaseys Paradise relative to Kanab ambersnail associated at its type locality and to other outgroups. Responds to MO 5.1, RIN 5.1, 5.2.

Objectives:

- Understand the relationship of Oxyloma haydeni complex and the status of the taxon at Vaseys paradise within this complex.

Methods:
Utilize a phylogenetic approach to resolve the taxonomy of the complex including morphological, geographical, genetic characters for tree construction.

Products:

- Yearly progress reports and a final report in year 4. Anticipated that this will be used to fund a doctoral program so a peer reviewed publication should result from this work.

Budget: $20,000/year for 4 years to support a graduate student. Additional funds would need to be found to support field collection and laboratory work.

A.4. New Research in Terrestrial Ecosystems

General Project Description: Selection of a specific project will be done in consultation with the TWG in the spring of 2002. Potential uses of these funds include:

- Population model for Kanab ambersnail that examines operational scenarios and predicts outcomes.
- Used to augment mapping project if appropriated funds are not fully provided.
- Used to develop a leopard frog monitoring program that can be incorporated into KAS monitoring or general terrestrial monitoring.
- Used to determine the impacts of scientific study on the recreational experience.

Budget: $50,000

A.6 Terrestrial Mapping and Inventory

Purpose: To measure, record and map terrestrial habitat that includes old and new high water vegetation and marsh habitats, including beach areas. The utility of this map will provide a basis to select sampling sites within a GIS framework for future terrestrial monitoring surveys that further define good, fair and poor quality terrestrial habitats for biological resources. This project addresses MO's under Goal 6 including CMIN 6.1.2, 6.2.1, 6.3.1, 6.4.1. 6.5.1.

Objectives:

- Provide a baseline of vegetated and open terrestrial habitat that can be used for long-term, community-based change detection.
- Develop a spatial database of sampled and unsampled areas to help quantify characters that define good vs. bad habitat for terrestrial invertebrates and vertebrates.

Products:

- Vegetation coverage for GIS network.
- Randomized sampling design for terrestrial resource survey.

Budget: $180,000/year. Two year project.

AQUATIC ECOSYSTEM ACTIVITIES

B.1. Phytobenthic Monitoring

Purpose: The project serves two purposes: 1. to collect organic carbon (invertebrates to dissolve organic carbon) to characterize carbon production and usage in the aquatic system on a yearly and seasonal basis relative to discharge and abiotic factors (suspended sediment, turbidity, pH, temperature, DO). 2. to sample for benthic organism to document composition along the river corridor. Monitoring of phyto-benthic communities and evaluating their quality for utilization: (1) allows managers to assess the status of this community throughout the Colorado River ecosystem; (2) provides data that allows identification and interpretation of linkages between physical and biotic variables; (3) provides data on the effect of periodic management of sediment through high flows under the Record of Decision on the phyto-benthic community and higher trophic levels. This project addresses MO 1.2, 1.4, 1.5: CMIN 1.4.1, 1.5.1

Objective:

- To understand the relationship of organic carbon inputs from heterotrophic and autotrophic sources and their relative contribution to carbon budget in the aquatic system on a temporal and spatial scale.
- To begin to understand how carbon values relate to fish community densities and distributions.
- To determine the composition and density of benthos along the river corridor and describe these data relative to previously collected data.

Products:

- Quarterly and annual report on productivity and benthic composition, linked with water quality data collection
- Fact sheet in association with water quality data
- Data delivery on quarterly basis.

Budget: $227,000: Year two of three year project.

B.2. Monitoring Downstream Fish

Purpose: To collect data that monitors the status and trends of native and non-native fishes in the mainstem, including those native fish found (e.g., Flannelmouth suckers) in the Glen Canyon reach. This will be the third year of a three year effort to evaluate long-term monitoring methods and efforts. With the intent that 2004 will see a comprehensive long-term monitoring program developed and ready for implementation. Addresses Goal 2, MO 2.1, 2.2, 2.3, 2.8: CMIN2.1.1, 2.2.1, 2.3.1, 2.6.1, 2.8.1.

Objectives:

- Provide population estimates for adult native fish (HBC, FMS, BHS).
- Determine potential cohort strength for Humpback chub at age 1.5 (> 120 mm).
- Determine population estimates for rainbow and brown trout in mainstem below Paria riffle
- Track distribution and relative abundance of these (above) and other fish species including carp, catfish, and other potential warm water competitors.

Methods:

- Mark recapture for YOY to adult for native fish
- Depletion and mark/recapture for brown and rainbow fish
- Randomized sampling for general survey of fish abundance and distribution.

Products:

- Yearly stock assessment/synthesis report for native and non-native fish.
- Yearly Fact Sheet
- Trip reports following each trip that summarizes general catch effort and preliminary results.
- Evaluation of alternative sampling designs that may be tested.
- Data delivery following every sampling trip.

Budget: $760,000

B.3. Monitoring Lees Ferry Trout

Purpose: To collect data to determines that proportional stock density, condition and population estimates of age II+ rainbow trout in Lees Ferry/Glen Canyon Reach as it relates to Glen Canyon Dam operations. This project addresses Goal 4 and M.O. 4.1, CMIN 4.1.1, 4.1.2, 4.1.3, 4.1.4.

Objectives:

- Sample in such a manner to provide population estimates for age II+ trout annually.
- Determine relative densities of trout in relationship to habitat sampled to refine population estimates.
- Continue to input data into stock assessment model to establish status and trends for trout in Glen Canyon reach.
- Determine annual growth rates of trout and incorporate into status of fishery.

Products:

- Annual report of status and trends of fishery
- Fact sheet of fishery
- Data delivery following each sampling period.
- Trip report following each sampling period.

Budget: $140,000 third year of three year program.

B.4 Native and Non-native Fish Interactions Research

Purpose: To determine if predator suppression is feasible in Grand Canyon. The target species is brown trout with the expected result being a positive response by native fish as it relates to recruitment to juvenile and adult populations, primarily HBC and FMS. This would be proposed as a three year project to cover at least one cohort of brown and native fish.

Objectives:

- Determine the feasibility of deploying a weir and resistivity counter in Bright Angel Creek to collect brown trout and to count numbers of fish entering the creek.
- Determine if by reducing the number of spawning brown trout adults if subsequent cohort strength declines for brown trout—linked to downstream fish monitoring project (may be and indication that spawning occurs other places that Bright Angel Creek).
- Determine if by reducing the number of year II+ brown trout increases recruitment to juvenile and adult native fish species via LTM mark/recapture program.

Products:

- Yearly report of brown trout removed and fish counted in Bright Angel Creek.
- Delivery of data sheets following each sampling period.
- Recommendations regarding effectiveness of predator suppression in Grand Canyon and how might be applies to other identified species that pose a threat to native fish recruitment.

Budget: $70,000

B.5. Ongoing Population Genetics of Humpback Chub

Purpose: To determine patterns of genetic diversity within and between Humpback chub aggregations in the mainstem and tributaries as well as with individuals from the upper basin. By determining if fish in the mainstem originate from the LCR, this information will help define monitoring needs for humpback chub, and may help define operational scenarios for a temperature control device. Addresses Goal 2, MO 2.4, RIN 2.4.1. This is the third year of a three-year project.

Objectives:

- To understand to what degree of mixing occurs among aggregations
- To understand how much the LCR aggregation contributes to other aggregations
- To understand how distinct the Grand Canyon population is to upper basin populations.

Expected Products:

- Delivery of a preliminary and final report on the genetic diversity of humpback chub aggregates in the Colorado River ecosystem.
- Cataloguing of voucher specimens for public access.
- Delivery of data sheets following each sampling trip.

Schedule: This will be the second of a two year funded project through contract and (or) cooperative agreements.

Budget: $ 0.00

B.6. Integrated Water Quality Monitoring Downstream Activities

Purpose: To collect data that characterizes the physical, chemical and biological quality of water from the draft tubes and downstream as they relate to operations of Glen Canyon Dam and to higher trophic level interactions including primary production and carbon cycling within the aquatic ecosystem. Addresses Goal 7, MO 7.1, 7.2, CMIN 7.1, CMIN 7.2

Objectives:

- To understand how standard water quality parameters change longitudinally downstream and in relation to discharge.
- To determine if changes are additive downstream or are characteristic by reach
- To collect data in a manner that compliments and is available to make linkages with primary productivity and carbon cycling in the aquatic ecosystem.

Products:

- Quarterly and annual report of water quality with links to productivity
- Fact sheet for water quality and productivity
- Data delivery on a quarterly basis.

Budget: $150,000 Year two of three year project.

B7. Integrated Water Quality Program Lake Powell

Purpose: To collect data that describes the physical, chemical and biological character of the water in the Lake Powell Reservoir and to determine how operations of Glen Canyon Dam and inflows into the dam affect water quality parameters. These data are necessary for downstream ecosystem monitoring and for monitoring of the lake ecosystem which is done by other entities (e.g., GCNRA, State of Utah). There are no management objectives for the Lake Powell program, but this project addresses the following information needs 1, 4, 5.

Objectives

- To know the season pattern and state of the parameters measured in Lake Powell
- To understand how inflows and release volumes affect water quality at the dam and tailwaters.
- To begin to use the knowledge of the reservoir dynamics to predict/hypothesize water quality changes and use monitoring data to validate hypotheses.

Products:

- Quarterly and yearly reports of water quality in reservoir
- Fact sheet for Lake Powell
- Data delivery following each trip

Budget: $300,000