Appendix 64
Excerpt from Hungry Horse Scientific Framework (Marotz 2002)

Hungry Horse Scientific Framework

The federal action agencies produced their 4-H's plan to recover Columbia River fish species listed as threatened or endangered under the Endangered Species Act (ESA). The 4-H's refer to hydropower, habitat, harvest and hatcheries (Federal Caucus 2000). Our fisheries mitigation program adopted a similar scientific framework, then designed our program to address fisheries issues in varying levels of scope, descending from basin-wide, over-arching mitigation requirements to site-specific actions. The following paragraphs summarize information about impacts and strategies to address the 4-Hs in the Flathead Subbasin.

Hydropower

The Hungry Horse Mitigation Plan estimated that improvements to dam operation would offset roughly half of the fisheries losses caused by the construction and operation of Hungry Horse and Libby Dams (MFWP et al. 1991 and 1993).

This mitigation program developed quantitative biological models to assess the biological consequences of various dam operation strategies on the reservoir biota. Model simulations were used to develop integrated rule curves (IRCs) for the operation of Hungry Horse and Libby Dams (Marotz et al. 1996 and 1999). The Northwest Power Planning Council adopted the IRCs in 1994 (NWPPC 1995). The empirically calibrated reservoir model HRMOD was used to evaluate system-wide impacts and solutions (SOR EIS 1985). The reservoir model was also useful to the Army Corps of Engineers (ACOE) in developing their new variable flow, system flood control strategy called VARQ (ACOE 1999). The ACOE is currently producing environmental documents (EIS and EA) on the implementation of VARQ. Implementation of VARQ at Hungry Horse and Libby Dams was called for by the 2000 Biological Opinions (BiOp) on the operation of the Federal Columbia River Power System (FCRPS) by both the National Marine Fisheries Service (NMFS 2000) and US Fish and Wildlife Service (USFWS 2000). The endangered Kootenai white sturgeon Recovery Team also adopted the IRC/VARQ operation in the white sturgeon recovery plan (USFWS 1999, also see appendices).

Dam operations essentially reversed the natural annual river hydrograph. Dam operation stored reservoir inflows during the spring runoff and summer for power production during fall and winter. Dam discharges were high during the cold months when flows were historically low. Consequently, dam operations produced an unproductive varial zone, increased substrate embeddedness, and a less diverse and productive invertebrate community downstream of the dam. The instream flow study (IFIM) recommended dam operations to balance the requirements of fish in the river and reservoir. This project also performed research to assess seasonal limits to river flows and flow ramping rates using the empirically calibrated Instream Flow Incremental Methodology (IFIM). The resulting limits to flow fluctuations were included as recovery actions in the USFWS 2000 BiOp. A sliding-scale minimum flow strategy was implemented in the South Fork downstream of Hungry Horse Dam (Marotz and Muhlfeld 2000).

Thermal modeling conducted by this project resulted in the installation of selective withdrawal structures on the four penstocks on Hungry Horse Dam (Christenson et al. 1996 and Marotz et al. 1996). The device controls water temperatures in the dam discharge and restores a natural annual thermal regime in the Flathead River downstream of Hungry Horse Dam (Deleray et al. 1999). Observations indicate that artificially cooled water temperatures during summer may have been more tolerable to nonnative lake trout.

Prior to construction of Hungry Horse Dam , river temperatures were as high as 20 ° C during the summer. Lake trout prefer water temperatures below 10° C . Many factors, such as variations in population size, influence lake trout occurrence in the river. Nonetheless, since selective withdrawal became operational , there as been an apparent reduction in lake trout captures during the summer. We also documented an apparent exodus of radio tagged lake trout when river temperatures rose to 14 ° C.

Habitat

Hungry Horse Dam, completed in 1952, impounded the South Fork of the Flathead River. a tributary to the Columbia River by creating the 36-mile Hungry Horse Reservoir. Inundation of 78 miles of the South Fork Flathead River and low gradient tributary habitat occurred when Hungry Horse Reservoir filled. Protection of the remaining pristine areas and reconnection of fragmented habitats are a high priority.

Native fish populations have declined due to a complex combination of anthropogenic influences (i.e. construction and operation of dams, logging, mining, road building, development etc.) and hybridization, predation and competition with non-native species. Mitigation to offset the impacts of Hungry Horse Dam were designed by first identifying limiting factors, then implementing projects to improve instream habitat, fish growth and survival. A system-wide habitat and fish passage plan, developed over time as site plans accumulated, was published in 1997 (Knotek et al. 1997). Habitat projects include the restoration of degraded stream reaches and associated riparian areas, improvement of fish passage into blocked spawning areas or barrier installation to protect pure native trout stocks. The Crossover Creek project created a wetland in the reservoir varial zone. Other projects include the installation of complex structure in lakes, lakeshore restoration and revegetation of the reservoir varial zone. Implementation of the planned projects require permit applications, landowner agreements, environmental assessments, and special service contracts. Baseline data acquisition and subsequent monitoring are used to evaluate the effectiveness of mitigation techniques.

Fish passage projects reconnect access to blocked spawning and rearing habitat. Habitat projects in spring creeks, streams, lakes, and reservoir environments emphasize passive restoration with conventional, biotechnical, or experimental approaches. Projects address riparian degradation, major sediment and nutrient sources, channel and bank instability, and non-native fish introductions. A specific monitoring strategy, including pre- and post-treatment sampling, is designed for each restoration project. These are combined with watershed level evaluations of spawning runs, substrate coring and scoring, redd counts, electrofishing, and gill net monitoring series to assess direct and indirect effects of the program.

Preventing the introduction and spread of invasive aquatic nuisance species (ANS) is an over-arching priority in our mitigation program. Invasive species include plants invertebrates and exotic fish species. Once established, ANS can permanently alter habitat supporting native aquatic species. Offsite projects, particularly lake rehabilitation, have been successful in removing hybridized fish populations, creating genetic reserves for native fish, drastically improving fisheries, and eliminating source populations for further illegal introductions. Completed and ongoing projects were identified primarily through past watershed assessments and research. These remain active components of the program to help ensure quality projects in the future

Harvest

Montana's fishing regulations were designed to direct angler harvest away from sensitive recovery areas. Fishing for bull trout is now banned in all waters, except Swan Lake in the Flathead watershed, to prevent harvest and reduce incidental capture. MFWP game wardens have increased patrols on all primary spawning tributaries to reduce illegal harvest when migrating adult bull trout are most vulnerable. Certain tributaries that are designated as core bull trout areas are closed to fishing year long to protect spawners and rearing juveniles. Combined, these actions have reduced angler mortality and appear to be facilitating increases in bull trout populations.

A mandatory catch and release regulation was enacted for westslope cutthroat trout in nearly all contiguous river systems. Harvest has been regulated to three fish under 12 inches in designated wilderness. Harvest of westslope cutthroat is allowed in lakes where populations are stable or supported by the hatchery program. Harvest limits for rainbow trout have been increased where the nonnative trout are threatening the genetic integrity of westslope cutthroat.

Public survey has determined that roughly half of the angling public is unable to differentiate fish species. MFWP therefore initiated a program to teach anglers how to identify the fish they catch and techniques for releasing native trout unharmed. After a two year grace period during which anglers received a courtesy citation for possessing regulated fish species, wardens began citing all violators.

Hatcheries

The habitat and hatchery portions of the Plan are co-dependent. Rehabilitated sites can be rapidly stocked with genetically compatible hatchery fish. Conversely, the survival of hatchery out-plants is largely dependent on the availability of quality habitat, especially if we are to avoid conflicts with wild stocks. Cooperation between multiple agencies and staff within MFWP has increased through time. Cost-shares with the Bureau of Reclamation, U.S. Forest Service, National Fish and Wildlife Foundation and other BPA funded projects have extended the effectiveness of this mitigation program.

Hatchery technology provides useful tools for reestablishing native fish populations and to create harvest opportunities. Past actions taken to achieve these two desirable outcomes have complemented each other, or been in direct conflict. The result depends on the introduced species' ability to survive and expand its range after introduction, as influenced by biological interactions with the original fauna.

Native species recovery is often hampered when nonnative fish, or genetically introgressed stocks, are introduced to the same habitat. Numerous researchers have documented the spread of introduced species through interconnected water bodies, with mixed results for the fishery. Introduced species may provide a desirable nonnative fishery, with varying impacts to the aboriginal fish community. If the introduced species competes with, preys on or hybridizes with the native stocks, native species recovery is compromised. In many cases, fish introductions have harmed the systems' ability to provide harvestable surplus or support a recreational fishery. For this reason, fisheries managers have strongly attempted to curtailed fish introductions, although illegal fish introductions continue to be discovered during annual surveys.

Fisheries managers must now make decisions that are limited by the site-specific attributes of each location. Anglers demand both native species protection and diverse recreational opportunities, while fisheries managers have limited ability to influence established species assemblages. Native species' core areas should be protected and enlarged where possible. Small lakes, and isolated stream reaches, present the greatest potential for native species restoration. Genetic reserves can be created for use in recovery efforts elsewhere, and fishing opportunities for native trout can be reestablished to sustain public interest in the species.

This project has chemically rehabilitated several small, closed-basin lakes to remove illegally introduced species and create recreational opportunity for harvest. Small lakes generally provide the greatest hatchery-to-creel harvest potential (MFWP unpublished files). Where possible, this project utilizes Montana's captive westslope cutthroat broodstock to restock the lakes and provide fishing opportunities for native trout. The state of Montana funds hatchery production of westslope cutthroat at the Washoe park State Fish Hatchery in Anaconda, Montana. The broodstock was founded using wild stocks from the South Fork Flathead River drainage and a small number of wild adults captured in from the Clark Fork River drainage. Genetic monitoring has revealed little change in the captive broodstock over time and Montana has determined the stock is appropriate for cutthroat restoration in many locations.

The Hungry Horse Mitigation program has initiated experiments to replicate locally adapted stocks from selected wild donor populations. Our goal is to reestablish naturally sustaining spawning in waters where native populations have been extirpated. Only the progeny of wild adults will be used for restoration actions where genetically pure, wild stocks can not be restored naturally. When completed, the Sekokini Springs Natural Rearing Facility will raise up to four genetic strains of wild cutthroat trout in nearly natural habitat to maintain their wild behavior and pure genetic integrity. The isolated habitat at Sekokini Springs has limited capacity, so MFWP is funding the renovation of a second isolation facility at the state's Rose Creek site, where MFWP plans to rear a portion of each family group developed at Sekokini Springs. In the future, gametes and/or juveniles from the captive population will be used to reestablish naturally reproducing westslope cutthroat trout populations where the species has been extirpated.

Experimentation is ongoing to determine the most cost-effective method to reestablish spawning runs where wild trout have been extirpated. Remote site incubators (RSIs) have been successfully used to rear eyed eggs to emergence in a tributary containing limited spawning habitat. The otoliths of fry reared in the RSIs have been marked using cold water treatments to enable researchers to identify these fish at older ages. Trout from RSIs and fingerling plants have survived to rear naturally in the stream through the smolt stage and emigration. Future experiments will determine if the fish return as adults to spawn. The two techniques will be compared for cost-effectiveness in initiating natural reproduction.

Where nonnative species are irreversibly established and native species recovery is not feasible, managers can enhance biological productivity and improve angler harvest. Recreational fisheries are usually supplemented with rainbow trout supplied by state funded hatcheries. Closed-basin lakes, especially valley floor lakes that attract high recreational use, are often sustained through hatchery supplementation. Many have a long history of species introductions, contain self-reproducing mixed-stock fisheries and represent poor candidates for native species restoration.