

#### **4.0 Strategy for Improving Conditions for Humpback Chub**

Our goal is to remove jeopardy and assist in achieving recovery goals for humpback chub in Grand Canyon by expanding the population size and reducing threats to the humpback chub. This will be accomplished by (1) expanding the range of spawning and rearing in Grand Canyon for humpback chub, (2) increasing survival and recruitment of humpback chub, and (3) reducing the threat of catastrophic events or unintended consequences that may negatively affect the wild population of humpback chub. We also want to utilize outreach to inform the public of management activities to reduce these threats and improve conditions for the humpback chub.

##### **Expanding the Range of Spawning and Rearing for Humpback Chub**

The primary mechanism for expanding range would be to increase the suitability of the mainstem for reproduction and recruitment of humpback chub. This would be accomplished by warming dam releases and providing flows necessary for spawning and rearing.

Until the TCD is approved and constructed, actions such as the translocation of young humpback chub from the LCR into Grand Canyon tributaries and/or mainstem could provide safe refugia for wild fish and possibly expand the current range of humpback chub. To be successful, translocations would need to occur concurrently with non-native control efforts, and with consideration of other factors such as water quality, flows, and tribal concerns. Use of a grow-out facility may be considered to increase growth and survival of wild fish to be translocated. If there are genetic concerns, these would need to be addressed, perhaps through establishing connectivity between the tributary populations and the mainstem population or other actions. These genetic concerns will be evaluated by conservation geneticists.

##### **Increasing Survival and Recruitment of Humpback Chub**

This would be accomplished through a combination of temperature modification, non-native control, dam operations, turbidity management, control of disease and parasites, reduce impacts of scientific and recreational activities, and prevent invasion of new non-native species. These actions include:

- (1) Construct and test a temperature control device with the intent of improving spawning and rearing habitat in the mainstem for humpback chub. Providing adequate temperatures for mainstem spawning and rearing may increase other threats such as non-native predation and parasitic infestation.
- (2) Control non-native predators and competitors to reduce impacts to humpback chub and other native species. This would also help ensure that any negative impacts from temperature modification would not be on top of an already high predator/competitor load. Additional research may be needed to determine which non-natives have the greatest impact on humpback chub mortality. Mainstem and tributary control actions would target the most harmful species using a variety of methods. Monitoring of

native and non-native fish species must be able to detect changes in these populations that may result from management action, e.g., non-native control efforts and the warming of dam releases.

- (3) Use experimental dam releases to reduce mortality of young-of-year (YOY) humpback chub leaving the LCR, particularly prior to operation of the TCD. These actions may include releases that would impound the LCR during periods when young humpback chub are leaving the LCR, stabilize habitat near the LCR confluence, reduce non-native spawning and recruitment, displace or disadvantage non-native fish, and maintain levels of turbidity that reduce feeding behavior of sight feeders in the mainstem. Following construction of the TCD, the focus of dam operations might change to improving spawning and rearing habitat for native fish in the mainstem and controlling the spread of non-natives and parasites.
- (4) Control parasites and diseases. Additional monitoring and research is needed to determine the level of infestation and to develop control methods. Warmer dam releases may increase the spread or impact of parasites on humpback chub in the mainstem.
- (5) Use other management actions such as sediment/turbidity augmentation to disadvantage non-native fish and provide cover for native species, invasive species management plans, and impact reduction from scientific and recreational uses.

### **Reducing the Threat of Catastrophic Events**

There is a risk of extirpation from catastrophic events in the LCR because it is currently the principle spawning location for humpback chub in Grand Canyon and is occupied by much of the population in a given year. Also, operation of the TCD and other management actions intended to benefit the humpback chub carry the risk of unintended consequences that may negatively affect the humpback chub population. The Science Advisors are currently evaluating the risks associated with the TCD, and the NEPA evaluation of the TCD will include actions that would be taken if negative consequences occur.

The top priorities to protect against such risks are (1) expand of the range of the population both above and below the LCR confluence (both mainstem and tributaries) so that a catastrophic event is less likely to negatively affect the population, (2) develop and implement an action plan to alleviate threats that originate in the LCR watershed, and (3) establish of a captive breeding population for restoring the Grand Canyon population in case of extirpation.

A genetics management plan should be prepared that guides preservation of the genetic diversity of the humpback chub in Grand Canyon. Developing a captive breeding population needs to follow this peer-reviewed comprehensive plan as well as USFWS policy on controlled propagation. Developing the broodstock should not compromise the viability of any extant aggregations (i.e., it may be appropriate only to collect gametes or YOY from the mainstem aggregations). YOY, gametes or adult fish may be collected specifically for a new captive breeding population following the comprehensive plan and genetic analysis. The disposition and use of the existing Willow Beach population must

be determined, and may include research or a portion of a founder captive breeding population.