# A NON-LETHAL STOMACH PUMP TO RECOVER STOMACH CONTENTS OF HUMPBACK CHUB

## A PILOT STUDY

**Submitted To**

Mr. Frank Baucom
U.S. Fish and Wildlife Service
500 Gold Ave. S.W.
Albuquerque, N.M. 87101-31152

**Submitted By**

Richard A. Valdez, Ph.D.
and
Anthony Wasowicz

BIO/WEST
1063 W. 1400 N.
Logan, Utah 84321

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## Introduction

The purpose of this pilot study is to determine the feasibility of using non-lethal stomach pumps to assess food habits of humpback chub in the Grand Canyon. This pilot study will be used to determine: (1) if damage occurs to the pharyngeal mill of processed fish, and (2) efficiency of stomach flushing.

Stomach content analysis is critical in characterizing the life history and ecology of the humpback chub in the Grand Canyon. Food habits, combined with food availability information from drift and benthic samples, would be assessed primarily to determine if dam operations are affecting the availability of food sources as well as the timing of availability. Sampling humpback chub during changes in flow will enable us to decide if changes in behavior (i.e. additional movement) are induced by greater food availability or changes in habitat. Leibfried (1988) found that rainbow trout below Glen Canyon Dam ingest large quantities of Cladophera, deriving nutritional benefit through digestion of lipid-rich diatoms epiphytic on the algae. It is important to know if humpback chubs exhibit similar feeding strategies since Cladophera production is closely linked to stream flow and, hence, dam operations.

The study of feeding habits is important in the study of aquatic ecosystems. Often, food habit studies have required that many fish be killed for stomach removal and examination. In systems with low fish populations, the removal of fish can seriously deplete the population. Studies have shown stomach pumping to be an effective technique for the removal of stomach contents without damaging the fish. Fish species which have been tested effectively include a variety of salmonids, centrarchids, ictalurids, percids, and esocids (Meehan and Miller 1978, Swenson and Smith 1973, Seaburg and Moyle 1964). Stomach pumps have also been used successfully with roundtail chub in the upper Colorado River basin (Personal communication R.A. Valdez, BIO/WEST). In all cases, the removal of stomach contents with pumps has not been injurious to the fish. Meehan and Miller (1978) flushed the stomachs of juvenile salmonids and found no significant difference in survival between treated and control fish after 30 days. Gengerke et al. (1973) reported pumping 864 stomachs of nine species of fish with no resultant mortality. Another advantage of this technique is its efficiency. Fish sacrificed by Gengerke et al. (1973) following stomach flushing contained no food items in their stomachs. Prey items recovered from the stomachs of 155 salmonids (rainbow trout, cutthroat trout, and coho salmon) comprised 93% of the total prey consumed by number, and 85% by weight (Meehan and Miller 1978); the stomach pump effectively flushed out adult and larvae macroinvertebrates of all sizes, as well as small crayfish, sculpins, snail shells, stones, and large wood pieces. In a review of various methods for removing stomach contents from live fish, Hyslop (1980) concluded stomach pumping to be the most generally applicable.

## Methods

Stomach pumps would be designed and constructed based on Gengerke's modification of the original Seaburg design (Gengerke 1973, Seaburg 1957). A sketch of the proposed apparatus is presented in Figure 1. Basically, a clear tube is inserted into the buchal cavity of the fish and a stream of water is pumped through the inlet tube and into the stomach. Food items are subsequently flushed out of the stomach through the outlet tube and into a collecting jar. flexible tubing would minimize any damage to the esophagus, and a hand-held rubber pump would allow precision in dictating water flow. Different sized, interchangeable nozzles allow for efficient flushing of various sized fish.

Initial tests would be conducted on two humpback chub sampled with gillnets from the LCR Reach on the mainstem of the Colorado River between January 7 - 10, 1990. Since chub feeding is likely crepuscular, the two specimens would be taken from nets set in the early evening or morning. Nets would be set for as short a period of time as possible so that digestion and regurgitation by entangled chub is minimized. The fish will be mildly anesthetized with MS-222 before pumping. All flushed prey items will be preserved and labeled in collecting jars. Observations will be made on stress to the fish from handling and stomach pumping, and total operation time will be recorded.

Following processing, the chubs will be euthanized with MS-222, and a small incision will be made on the right ventral aspect of the fish to extract the stomach and gut for further analysis. The chubs will then be frozen in dry ice, transported out of the canyon by a biologist via Tanner Trail, and immediately transferred to the nearest available refrigeration system. Both chubs will be examined in the laboratory to check for possible damage to the pharyngeal teeth and esophagus, if any, and to determine the efficiency of the technique. All dissection will be carefully performed to minimi7e specimen damage. The volume of both the preserved prey items and the residual contents in the chub stomachs will be measured, as well as identification of the specific prey items. Efficiency will be expressed as the percentage (by volume) of food items recovered from the fish by stomach pumping. A more detailed protocol for stomach content analysis will be developed if the pilot test is successful and the ACT agrees that we should proceed. All aspects of the pilot study will be carefully photographed. Subsequent disposition of specimens will be coordinated with Dr. Wayne Starnes, Holt Williamson, and representatives of the United States Fish and Wildlife Service, Regions 2 and 6, as well as Arizona Fish and Game, and the National Park Service.

In order to better determine the efficiency of our stomach pump design, 10 rainbow trout would be also sampled, pumped, and dissected in the field. Again, efficiency would be expressed as the volume of prey items recovered. Results could be compared to efficiency of stomach flushing salmonids as reported by Meehan and Miller (1978).

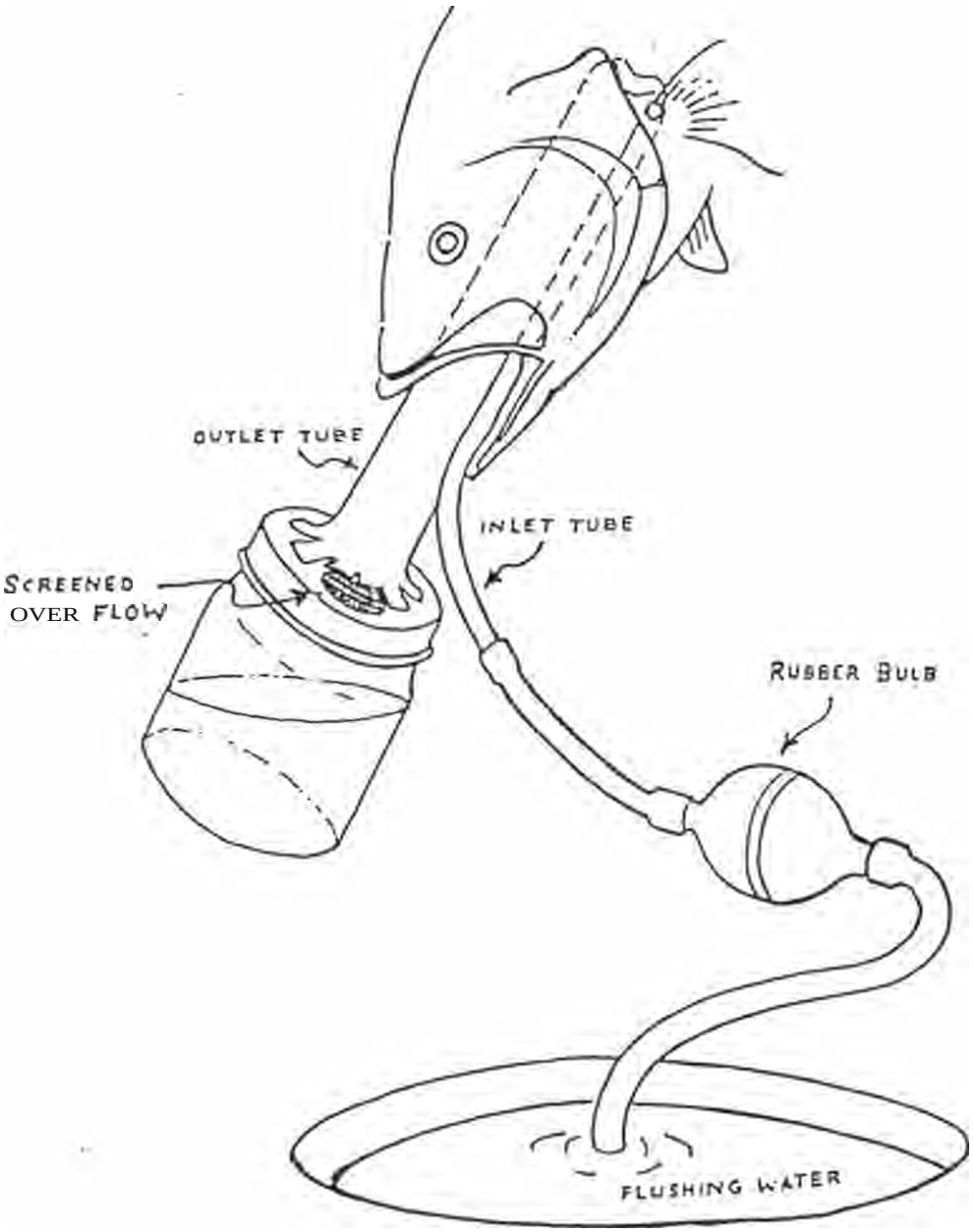


Figure 1. Stomach pump used for pilot study on food habit analysis of humpback chub in the Grand Canyon. Sketch taken from Seaburg and Moyle (1964).

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