

Counting Devils Hole Pupfish

The highest priority during the pupfish count is to ensure the safety of researchers and pupfish.

History:

Since the early 1970s, researchers and resource managers have conducted population counts of the Devils Hole pupfish (*Cyprinodon diabolis*). These population counts have remained relatively standardized as methods were passed down from the original research teams.

Population counts are conducted two to four times a year, and are timed so as to avoid the peak spawning period. The first dive is generally started by 0800 and the last dive is generally completed by 1500.

Due to the physical complexity of Devils Hole, it is impossible to count every fish in the population. Therefore, the population census in Devils Hole is an estimate of the current population size. Census methods are standardized and redundant so that population size estimates and length frequencies can be compared among count dates.

Underwater Monitoring Activities:

The Dive Team

- The Dive Team is composed of a lead and secondary team, each having a safety diver and a research diver (no more than four total divers).
- One additional standby diver is on site and prepared to deploy in the event of an emergency.
- All divers must possess NPS certifications for performing work in Devils Hole, including a cave diving certification, and have sufficient experience to ensure protection of the fragile pupfish habitat and team safety.

Any Member Of The Dive Team Can Terminate A Dive At Any Time.

Entering Devils Hole

- A critical aspect of the dive is that the divers approach and enter the pool carefully so as not to disturb the breeding ledge or the algal mats on the west wall. The entry is made by carefully climbing down the ladder and easing into the pool to limit surface disturbance.

The Population Census

- The first step in the census is to descend to Anvil Rock, which is about 75 feet below the surface. The cave is divided into four levels. The beginning of the count is at the lowest level (Counting Area 1). The divers work in pairs through each level.
- Each dive takes approximately an hour to complete
- The two research divers do not communicate the census results with each other at any time during the actual dive. This is done to avoid any biasing of the data. Both research divers transmit their numbers independently to the surface recorder.

Diving Contingencies

- Conditions may exist in Devil's Hole or on the surface at the time of the census, which warrant a temporary modification (e.g. change in number of dives or divers, modification of diver duties, etc.). The reasons for modifying the protocol on site are limited as much as possible, to those conditions that may jeopardize the safety of the dive team and/or present an unacceptable risk to the pupfish population.

Devils Hole Pupfish Surface Count:

An important part of the Devils Hole pupfish census is the surface count on the spawning shelf (divided into three areas). The final surface count consists of an average of three separate fish counts conducted by a team of three counters.

The Count

- When the first count, a practice count, is completed, the time and the numbers for each area are noted on the data sheet. After the numbers are totaled from the practice count, the next three counts proceed in the same fashion as the practice count.
- After each individual surface count, the results are recorded on the data sheet. Once all four counts are complete, the average of the last three counts is calculated and noted on the data sheet.
- The final count number is arrived at by adding the average of the three surface counts to the lead diver's count total, to derive a total for that

count. Generally, two dive counts are conducted and the higher of the two counts for the day is considered the total for that day.

Disinfection for all Equipment Entering Devils Hole:

The introduction of exotic (non-native) organisms is one of the leading causes for the decline of native species. Scientific journals and literature contain dozens of examples of how the unintentional and intentional introduction of non-native fishes have impacted historical fish populations. Numerous articles also suggest that disease pathogens can be transferred between fish populations in different areas. A smaller body of literature also suggests that non-native invertebrates (e.g. red-rimmed melania snails) can be inadvertently transferred between wetlands. The transfer of aquatic vegetation (vascular and non-vascular forms) between different areas has also occurred, and can act to dramatically alter historical plant communities.

The eradication of non-native species from new localities has rarely been possible, and for every successful management action, there are dozens of cases where carefully planned eradication efforts failed to meet their objectives. Wise management therefore suggests that is better to prevent the introduction of non-native organisms than to attempt to eradicate those species once they are introduced. Implementation of this approach, particularly at Devils Hole, is important because the fish's distribution is historically limited to the single site, and the depth of the habitat suggests that it would be a very difficult environment to eradicate undesirable species.