

California Department of Fish and Wildlife
North Central Region
Sierra District

Summary of the 2020 Clear Lake Hitch Survey
on Clear Lake

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Prepared By:

Ben Ewing
District Fishery Biologist
Alpine, Amador, Calaveras, and Lake Counties

Summary

In an effort to evaluate the Clear Lake Hitch (*Lavinia exilicauda chi*) (HCH-C) fishery in Clear Lake, a Schnabel and Schumacher-Eschmeyer mark-recapture survey was conducted from March 17, 2020 through April 15, 2020. A total of 431 HCH-C were collected this season compared to 184 in 2019 (Ewing 2019). A record drought from 2012 – 2016, a below average rainfall in 2020 (California Department of Water Resources 2020), and canceling half of the surveys in 2020 may be reasons for the low number of HCH-C collected in 2020. It is unknown how many HCH-C may have been missed during these periods where sampling was not conducted. The data from this survey in conjunction with the 2021 - 2023 data will be used to monitor the status of this fishery. Also, data collected from previous surveys will be incorporated to the overall study to help manage the fishery.

Introduction

The objectives of this survey were to:

- Determine the number of HCH-C spawning in Holiday Harbor, Konocti Casino Harbor, Clear Lake State Park, and Soda Bay
- Determine the average size of HCH-C spawning in Clear Lake
- Collect population data with which to compare future survey efforts

In September of 2012, The Center for Biological Diversity submitted a petition to the California Department of Fish and Wildlife (CDFW) to list the HCH-C as threatened under the California Endangered Species Act (CESA) (Fish and Game Code, 2050). In August 2014, the California Fish and Game Commission voted to list the HCH-C as threatened under CESA.

In 2013, CDFW conducted a survey in two tributaries to Clear Lake, Cole and Kelsey Creeks, to estimate the abundance and distribution of HCH-C (Ewing 2013). This estimate was done to assist in the status review process under CESA. From 2014 - 2017, CDFW conducted surveys in Adobe and Kelsey Creeks to estimate the abundance and distribution of HCH-C (Ewing 2014, Ewing 2015, Ewing 2016, Ewing 2018). CDFW is currently gathering information on the HCH-C to allow for informed

decisions on future fisheries management at Clear Lake.

The 2020 report aims to present a more accurate estimate of population size with 95% confidence intervals, mean length, catch per unit effort (CPUE), population estimate, and numbers of HCH-C seen for the survey period. The estimate of population size with accompanying confidence intervals was based on multiple mark and recapture survey efforts.

Holiday Harbor, Konocti Casino, Soda Bay, and Clear Lake State Park are four historically HCH-C spawning areas in Clear Lake (**Figure 1**).

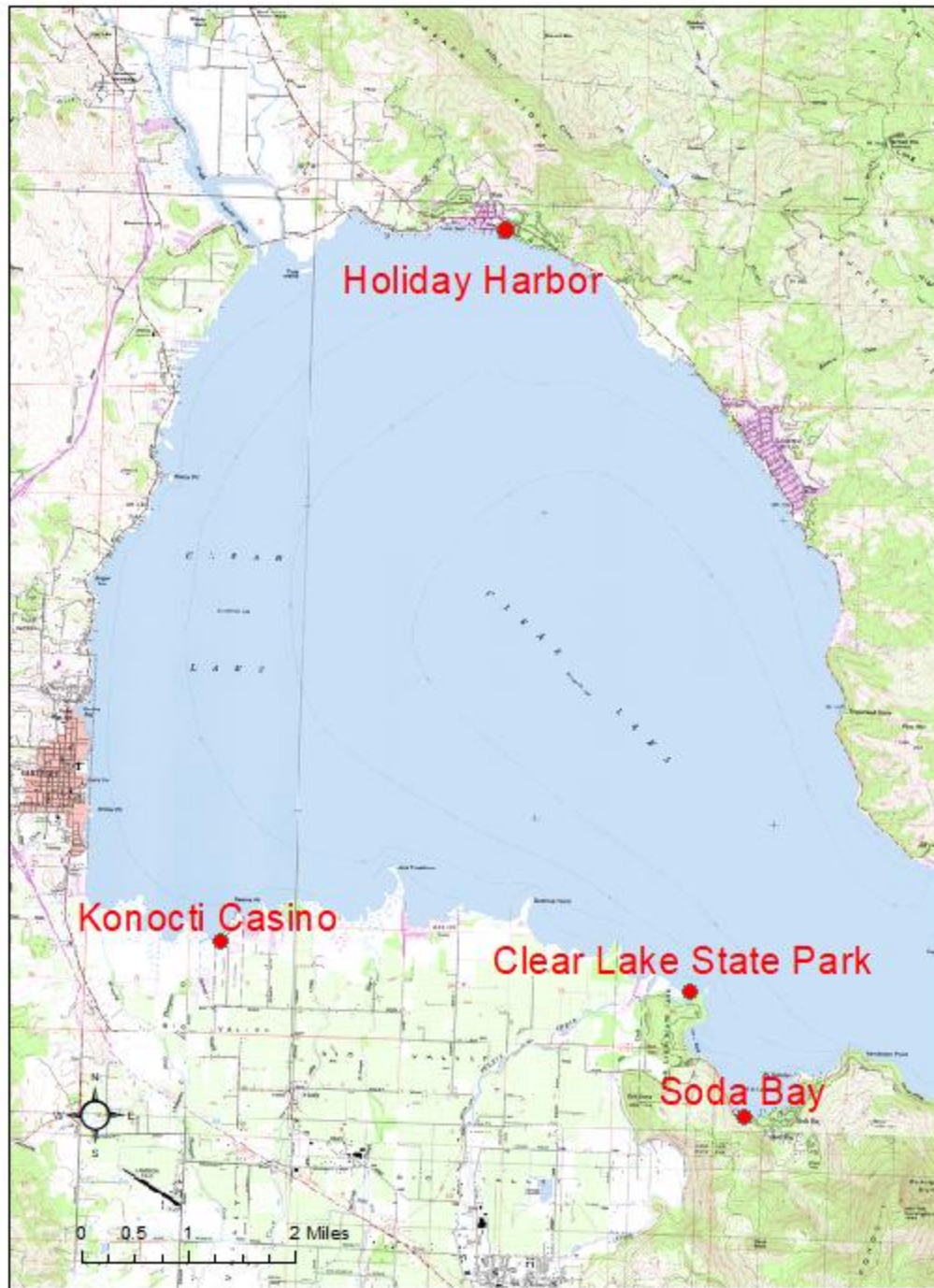


Figure 1. Locations of Holiday Harbor, Konocti Casino, Clear Lake State Park, and Soda Bay E-fishing transects in Spring, 2020.

Methods and Materials

In estimating the population of HCH-C in these historic spawning areas, CDFW considered the populations to be “closed” with the Schnabel (SM) and Schumacher-Eschmeyer (SEM) Methods to be used as the statistical analysis. These two methods were used to further solidify CDFW’s confidence in the population estimate. According to Krebs (1999) and Seber (1982), the following assumptions must be met for the estimates to be reliable:

- (a) The population is closed, so that N (the population) is constant
- (b) All animals have the same probability of being caught in the first sample
- (c) Marking does not affect the catchability of an animal.
- (d) The second sample is a simple random sample, i.e. each of the possible samples has an equal chance of being chosen.
- (e) Animals do not lose their marks in the time between the two samples.
- (f) All marks are reported on recovery in the second sample.

Due to the COVID-19 pandemic, only four sampling efforts were conducted to mark and recapture HCH-C on Clear Lake. The population estimates will only be for HCH-C collected in Holiday Harbor, Konocti Casino Harbor, Clear Lake State Park, and Soda Bay.

Each electrofishing sampling effort took two days, using one boat. Electrofishing was completed using an 18 - foot Smith-Root SR electrofishing boat. Pulsed DC current (2-6 amps) was used to “stun” the fish. The crew consisted of two forward netters, one or more persons marking/checking for recaptures at the live-well if available, and one boat operator. The boat navigated in a continuous line parallel to shore. HCH-C under galvanotaxis were netted and placed in a holding tank. An effort was made to capture all shocked HCH-C; however, sometimes HCH-C eluded capture on the outer edge of the electrical field.

The start and stop times for time spent electrofishing were recorded. Water temperatures were also recorded at the same time for each effort. The first 100 HCH-C collected, regardless of the site where they were collected, were measured in total length (inches, in.) (**Figure 2**). HCH-C that were 5.0 in. (127 mm) and greater in total length were given a single hole punch on the upper caudal fin using a single, handheld paper hole puncher. HCH-C that were less than 5.0 in. total length received a small fin

clip in their caudal fin. This was done in order to protect these fish during this delicate life stage. The hole punch and fin clip markings were used because they were temporary marks that would remain identifiable throughout the three-month survey. The mean total length, CPUE, relative population estimate, and numbers of HCH-C collected would be calculated.



Figure 2. Juvenile HCH-C being measured (S. Newton, 3/13/14).

Results

Holiday Harbor

In 2020, ninety - seven HCH-C were collected and a portion measured in Holiday Harbor compared to two in 2019 (Ewing 2019). Ninety - three HCH-C were marked with a single hole punch with no hole punch recaptures. Four HCH-C were marked with a fin clip with no fin clip recaptures. Of the four sampling efforts, no initial mortalities were documented. Initial mortalities would be deaths immediately associated to processing the HCH-C. In 2020, average total length for HCH-C collected in Holiday Harbor was 8.2 in. compared to 9.6 in. in 2019. In 2020, CPUE was 1.47 fish per minute compared to 0.03 fish per minute in 2019.

Konocti Casino Harbor

In 2020, one hundred twenty - nine HCH-C were collected and a portion

measured in Konocti Casino Harbor compared to 27 in 2019 (Ewing 2019). One hundred twenty-seven HCH-C were marked with a single hole punch with no hole punch recaptures. Two HCH-C were marked with a fin clip with no fin clip recaptures. Of the four sampling efforts, no initial mortalities were documented. In 2020, average total length for HCH-C collected in Konocti Casino Harbor was 9.9 in. compared to 11.2 in. in 2019. In 2020, CPUE was 1.11 fish per minute compared to 0.13 fish per minute in 2019.

Clear Lake State Park

In 2020, thirty - four HCH-C were collected in Clear Lake State Park compared to 155 in 2019 (Ewing 2019). All HCH-C collected were marked with a single hole punch with no hole punch recaptures. Of the four sampling efforts, no initial mortalities were documented. In 2020, CPUE was 0.09 fish per minute compared to 0.23 fish per minute in 2019.

Soda Bay

In 2020, one hundred seventy - one HCH-C were collected in Soda Bay compared to zero in 2019 (Ewing 2019). Eighty-one HCH-C were marked with a single hole punch with two, hole punch recaptures. Eighty-five HCH-C were marked with a fin clip with three, fin clip recaptures. Of the four sampling efforts, no initial mortalities were documented. In 2020, CPUE was 3.0 fish per minute. No HCH-C were collected in Soda Bay in 2019.

Overall, four hundred thirty-one HCH-C were collected in 2020 (**Table 1**) compared to 184 in 2019. In 2020, average total length of HCH-C was 8.5 in. compared to 12.2 in. in 2019.

Table 1. Mark-recapture sample data for 2020. Ct = Total number of individuals caught in sample t. Rt = Number of individuals already marked when caught in sample t. Ut = Total number of individuals caught and marked for first time in sample t. Mt = Total number of individuals marked in the population at sample t.

Date	Ct	Rt	Ut	Mt
3/17 and 3/18/2020	164		164	
3/30 and 3/31/2020	56	1	55	164
4/7 and 4/8/2020	60	4	56	219
4/14 and 4/15/2020	151	0	151	275
Total	431	5	426	

The HCH-C population for the four sampled sites was estimated at 12,770 (95% C.I. 5,713 and 32,411) using the SM. A slightly higher estimate of 15,195 (95% C.I. 4,738 and NA) was calculated using the SEM. Due to the combination of low recaptures, number of total marked HCH-C, and low number of surveys, an inaccurate upper confidence value was obtained for the SEM, thus the NA.

Discussion

Although CDFW was able to calculate a relative population for HCH-C in 2020, no comparison could be made to the 2019 population estimate. This was due to no HCH-C recaptures collected in 2019. The number of HCH-C collected in 2020 was well above the number collected in 2019, but still below what CDFW had anticipated collecting. Due to the COVID-19 pandemic, CDFW staff was forced to cancel the final four weeks of visual surveys. It is possible that more HCH-C would have been collected had not the surveys been cancelled.

Due to the below average rainfall totals for Clear Lake and the large percentage of tributaries that had little to no water in 2020, many HCH-C may have tried to spawn in Clear Lake rather than the tributaries. This may have been one of the reasons why more HCH-C were collected in 2020 than 2019. Historically these four sampling locations sampled have held thousands of HCH-C at each site, thus the reason they were chosen for sampling. It is possible the record drought that California experienced from 2012 – 2016 may have negatively impacted the spawning of HCH-C. Many of the tributaries that would have normally held suitable water to spawn in, were limited or not available for HCH-C during the drought. The negative side-effects of that drought now

may be showing the impacts it had on the HCH-C. The decrease of HCH-C average total length in 2020 compared to 2019 may suggest that one year's cohort was absent (Moyle 2002).

Regardless of the low numbers collected, CDFW was able to gather a baseline estimate for comparison to future years. This baseline estimate will be used for comparison at the same four sites until at least 2023 for consistency.

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