

Hilton Lakes Complex Fishery Management Guidelines

State of California
Department of Fish and Wildlife
Heritage and Wild Trout Program
Region 6



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2024



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Executive Summary

The Hilton Lakes were originally designated in sequence. Lake 1 (Davis Lake) was designated in 2016, Lake 2 was designated in 2017, Lake 4 in 2018, followed by Lake 5 in 2019. These designations were replaced in 2023 with the designation of the entirety of the Hilton Lakes Complex, including Hilton Lakes 1-10 and Hilton Creek upstream of Davis Lake. As a Wild Trout Water, the Hilton Lakes Complex contains self-sustaining populations of Rainbow Trout, Brook Trout, Brown Trout and introgressed California Golden Trout.

The Hilton Lakes Complex provides a unique opportunity to catch multiple trout species within a wilderness area. The lakes are managed as a fast action fishery that has the potential to grow trophy-sized Brown Trout. Currently, there are no known stressors to this fishery. Angling pressure and satisfaction are measured annually through voluntary angler survey forms provided at the Rock Creek trailhead Angler Survey Box. Population demographics are monitored on average every five years, but little data exists on the upper lakes in the complex. Collection of habitat and limnological data is needed to establish a baseline for future reference. Management will continue to strive towards maintaining the health of this diverse fishery.

This document provides an overview of current characteristics and survey information of the Hilton Lakes Complex for management purposes.

Designation Background

California Fish and Game Code (Chapter 7.2, Section 1726.4 (b)) states that it is the intent of the Legislature that “the department [specifically, the California Department of Fish and Wildlife (CDFW) Heritage and Wild Trout Program (HWTP)], in administering its existing [heritage and] wild trout program, shall maintain an inventory of all California trout streams and lakes to determine the most suitable angling regulations for each stream or lake. The department shall determine for each stream or lake whether it should be managed as a wild trout fishery, or whether its management should involve the temporary planting of native trout species to supplement wild trout populations that is consistent with this chapter.” Section 1726.4 (b) additionally states that “biological and physical inventories prepared and maintained for each stream, stream system, or lake shall include an assessment of the resource status, threats to the continued well-being of the fishery resource, the potential for fishery resource development, and recommendations, including necessary changes in the allowed take of trout, for the development of each stream or lake to its full capacity as a fishery.”

Furthermore, California Fish and Game Code (Chapter 7.2, Section 1727 (d)) requires that the CDFW “shall prepare and complete management plans for all wild trout waters not more than three years following their initial designation by the commission, and to update the management plan every five years following completion of the initial management plan.” For clarification, wild trout waters, as stated above, represent waters that have been formally designated by the California Fish and Game Commission (hereafter, “Commission”) as Heritage and/or Wild Trout Waters.

Wild Trout Waters are those that support self-sustaining trout populations, are aesthetically pleasing and environmentally productive, provide adequate catch rates in terms of numbers or size of trout, and are open to public angling. Wild Trout Waters may not be stocked with catchable-sized hatchery trout. Heritage Trout Waters are a sub-set of Wild Trout Waters that highlight wild populations of native California trout found within their historic drainages.

In an effort to comply with existing policy and mandates, the HWTP has prepared these fishery management guidelines. These guidelines are intended largely for internal planning purposes and to communicate management direction to the public, other agencies, and trout angling organizations. This document is intended to provide direction and list actions necessary to sustain the recreational fishery for the benefit and enjoyment of the angling public. However, actions associated with these guidelines are initiated independently, thus any environmental review/permits needed to implement the actions are separate from this guidance document.

Resource status

Area description

The Hilton Lake Complex includes Hilton Lakes 1-10 and Hilton Creek above Hilton Lake 1 (Davis Lake), which range in elevation from 9,840ft to 11,188ft above sea level. In total, the area designated contains 157 acres of lake habitat and 3 miles of stream habitat in the south-eastern corner of Mono County and north-western corner of Inyo County. This basin feeds Long Valley Reservoir (Crowley Lake) and the Upper Owens River.

Geomorphologically, the Hilton Creek drainage is typical of eastern Sierra watersheds: a series of glacial moraines and cirques created lakes and cascade features punctuated by hanging valleys. Hilton Lake 1 (Davis Lake) is the lower-most lake in the watershed and is formed by a terminal moraine dam that backs water into a small hanging valley. This results in extensive shoaling formed

around the flooded valley directly adjacent to deeper habitat within a glacial cirque.

The Hilton Lakes Complex is located within the John Muir Wilderness Area, on land managed by the Inyo National Forest. It is accessible via trail from the community of Crowley Lake and from the Rock Creek Lake Resort. The surrounding area supports many lake and stream-based wild trout fisheries in an extremely aesthetically pleasing alpine environment. The Hilton Lake Complex is one in a series of "Wilderness" Wild Trout Waters the HWTP has proposed to the Commission for designation to provide for and establish active management of remote, high quality recreational fisheries across the Sierra Nevada and other remote mountain locations statewide.

Land ownership/administration

- | | | |
|---|--|----------------------------------|
| <input checked="" type="checkbox"/> U.S. Forest Service | <input type="checkbox"/> Bureau of Land Management | <input type="checkbox"/> Private |
| <input type="checkbox"/> State Parks | <input type="checkbox"/> CDFW | <input type="checkbox"/> Other |
| <input type="checkbox"/> National Parks | | |

Public access

- | | | |
|-----------------------------------|--|-------------------------------|
| <input type="checkbox"/> Roadside | <input checked="" type="checkbox"/> Remote/hike-in | <input type="checkbox"/> Boat |
|-----------------------------------|--|-------------------------------|

Designations

- | | |
|--|--|
| <input checked="" type="checkbox"/> Wild Trout Water | <input checked="" type="checkbox"/> Wilderness |
| <input type="checkbox"/> Heritage Trout Water | <input type="checkbox"/> Other |
| <input type="checkbox"/> Federal Wild and Scenic River | |

Area Maps

Hilton Lakes Complex Designated Wild Trout Waters - 2023

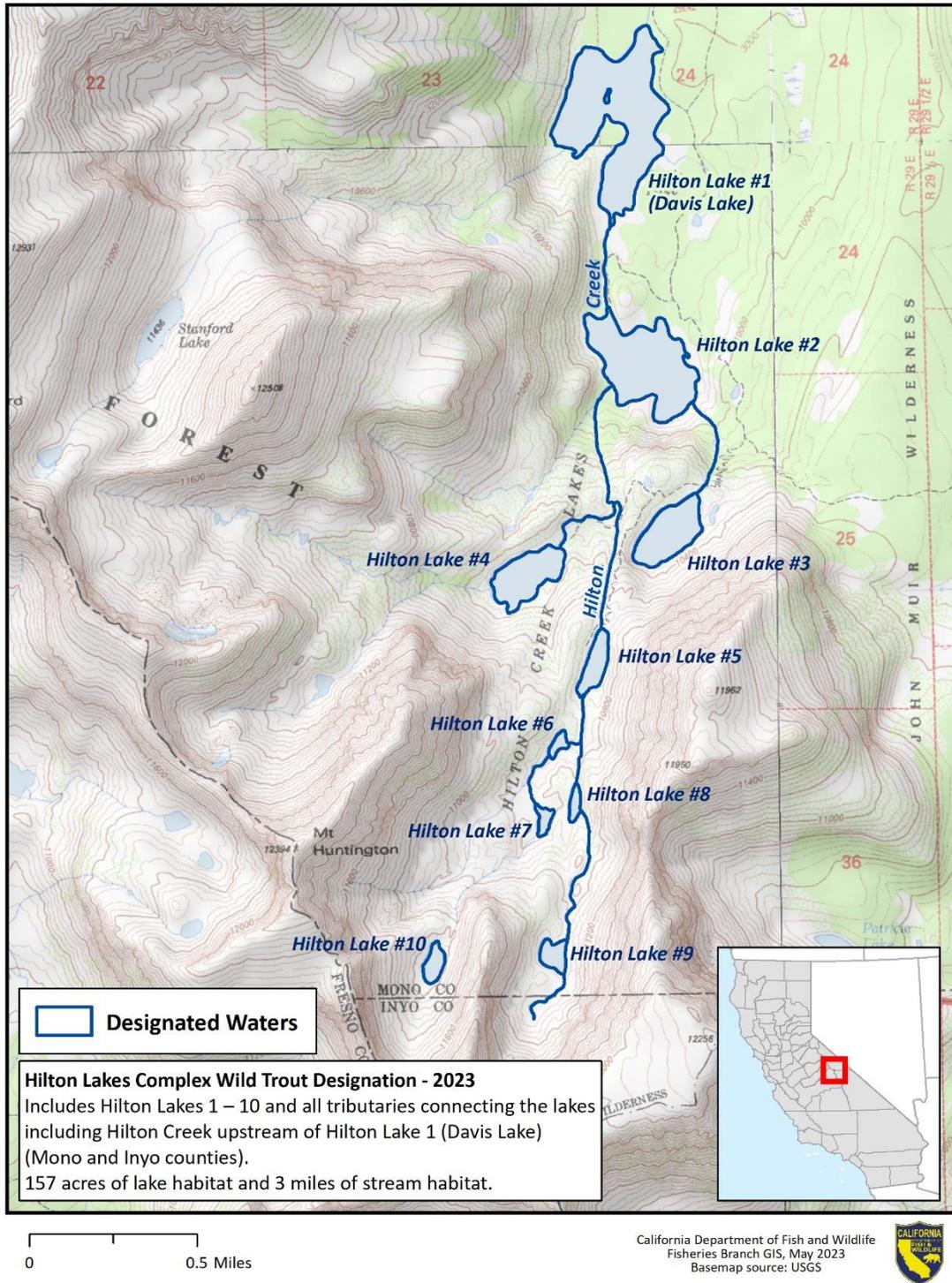


Figure 1. Map of the designated Wild Trout water in the Hilton Lakes Basin.

Fishery description

The Hilton Lakes Complex productivity is limited by its elevation and source; however, shoaling created by the inundated hanging valley results in an extensive littoral zone. High Sierra lakes- like the Hilton Lakes- are dimictic, with varying degrees of stratification occurring in the winter and summer months (Williams & Melack, 1991). Ice cover is variable but tends to average about four to five months each year: ice-up typically occurs in late November and ice-out occurs in April or May. Sierra Lake epilimnion temperatures range from 50°F to 64°F in the summer and hypolimnion temperatures to remain about 39-40°F (Williams & Labou, 2017). Collection of baseline limnological data from the Hilton Lakes has been identified as a task for future management plan revisions.

The Hilton Lakes Complex supports self-sustaining populations of Rainbow Trout (*Oncorhynchus mykiss* ssp.), Brook Trout (*Salvelinus fontinalis*), Brown Trout (*Salmo trutta*), and introgressed California Golden Trout (*Oncorhynchus mykiss augabonita*). CDFW's stocking records for the Hilton Creek Basin date to the 1950's, but CDFW historical survey data show that Brook Trout and Brown Trout were present in the lake prior to this period. There is no record of Brown Trout stocking in Davis Lake; they were introduced prior to 1940. Brook Trout were stocked until 1951, and strains of Rainbow and Golden trout were stocked from the 1960's until 2001.

Water source(s)

The Hilton Lakes watershed is small (3.8 sq. miles), steep (average gradient of 800 ft/mile), and high elevation (9,800 to 12,500 feet above sea level) with limited established conifer forest (<5% of the watershed) (United States Geological Survey, Accessed January 2021). The basin averages 36 inches of liquid precipitation per year- the majority of which accumulates as over-winter snowpack. The underlying bedrock is comprised of Mesozoic granodiorite rocks associated with the central Sierra Nevada batholith (Frost, 1987). Granitic and granodioritic rocks are highly resistant to chemical weathering, limiting any autochthonic ionic loading from the Hilton Creek watershed (Williams & Melack, 1991).

No specific nutrient or ionic data is available for the Hilton Lakes; however, nearby high Sierra Lakes are typically oligotrophic, phosphorous-limited systems. Seven nearby lakes of comparable elevation and size in the central Sierra Nevada have been sampled for ionic and nutrient concentrations since 1985 (Williams & Labou, 2017). The measured concentration of dissolved organic nitrogen ranged from 0.05 and 0.18 mg/L, the dissolved organic phosphorus

ranged from 0.0015 and 0.0009 mg/L, and the average N/P ratio was 90:1 (the ideal ratio for primary productivity is approximately 16:1) in these lakes. Nitrate and phosphate are the dominant nutrient species present in most lakes, but high use lakes (such as those located along the John Muir Trail) often have elevated levels of ammonia, particularly in the epilimnion (Williams & Labou, 2017). Silica concentrations range from 0.7 to 2.1 mg/L.

The generally barren watershed surrounding the Hilton Lakes ensures excellent water quality for trout production, but it also intrinsically limits the aquatic food web.

Water source(s)

- Spring Rain Snow Tailwater

Gradient

- Low (< 2%) High (>4%)
 Medium (2-4%) N/A

Fish species

Table 1. Fish species present in Hilton Lakes. The term "Native" indicates the species is native to this watershed.

Common name	Scientific name	Native (Y/N)	Listing status
Rainbow Trout	<i>Oncorhynchus mykiss</i> ssp.	N	None
Brown Trout	<i>Salmo trutta</i>	N	None
Brook Trout	<i>Salvelinus fontinalis</i>	N	None
California Golden Trout (introgressed)	<i>Oncorhynchus mykiss aguabonita</i>	N	None

Other aquatic species

Table 2. Additional aquatic species incidentally observed while conducting Sierra Nevada Yellow Legged Frog surveys and/or fish surveys in the Hilton Lakes watershed. Other species may occur but have not been observed during these

surveys. The term “Native” indicates the species is native to this watershed.

Common name	Scientific name	Native (Y/N)	Listing status
Sierra chorus frog	<i>Pseudacris sierrae</i>	Y	none

Fisheries and habitat assessments

Recent fisheries data are limited to: (1) angling surveys conducted by the Heritage and Wild Trout program in 2019 and 2021; (2) a gillnet survey and growth study completed by regional staff on Hilton Lakes 1 and 2 in 2021; and (3) self-reported angling data collected at an ASB box at the trailhead along Rock Creek (see Angler survey data section).

Angling surveys conducted by CDFW in 2019 and 2021 confirmed the presence of all four trout species in the Hilton Lakes (Table 3). Lakes 1, 2, and 6 maintain their status as fast action fisheries. Multiple size classes of trout were caught in 2021 hook and line surveys at Davis Lake (Figure 2). Hook and line sampling appears biased towards capturing Rainbow and Brown trout compared to the proportions of each species captured by gill net at Davis Lake (Figure 2 and Figure 3).

Available gill net data from 2021 shows one or two age-classes of each species present in the system. Brook Trout are the most abundant species in both Davis Lake and Lake 2. Brook and Rainbow Trout do not reach large sizes (

Figure 3 and Figure 6). In contrast, Brown Trout do occasionally reach larger sizes (>400mm total length) in Davis Lake (

Figure 3). Unlike both Rainbow and Brook Trout (which tend to remain secondary consumers) Brown Trout can undergo an ontogenic shift in diet if sufficient forage is available. Brown Trout will switch from a primarily invertebrate-dominated diet comprised of insects and zooplankton to a diet comprised of other fish and large invertebrates. This change in diet is often correlated with increased growth rates and massive increases in size. (Moyle, 2002). Due to the low densities of Brown Trout, further investigation is needed to determine if there has been a shift to piscivory in Davis Lake, which would create the potential for a trophy-sized wild trout fishery.

Otolith analysis generated growth curves that were more linear than logarithmic for Brown Trout in Davis Lake and Brook Trout in Hilton Lake 2, indicating slow initial growth (Figure 4 and Figure 7). Presumably, this growth characteristic is caused by the constrained food web and limited productivity of alpine lakes.

The majority of fish in Hilton Lake 2 and larger fish in Davis Lake are below ideal body condition (a Fulton's Condition Factor (K) of 1.0 means an individual fish is the expected weight for a given length (Figure 5 and Figure 8). This indicates that the fish populations may be over the carrying capacity of the lake.

Table 3. Results from CDFW angling surveys conducted in the Hilton Lakes Basin.

Year	Water	Species Present	CPUE (fish/hr)
2021	Davis Lake (Lake 1)	Brook Trout, Brown Trout, Rainbow Trout	2.5
2019	Hilton Creek (between Lakes 1 and 2)	Brook Trout, Brown Trout	4.4
2019	Lake 2	Brook Trout, Rainbow Trout	1.5
2019	Lake 3	Rainbow Trout	0.4
2019	Lake 5	Brook Trout, Rainbow Trout, Golden Trout	1.8
2019	Lake 6	Brook Trout	4.3
2019	Lake 7	Brook Trout	0.8
2019	Lake 8	Golden Trout	0.3
2019	Lake 9	NA	0
2019	Lake 10	NA	0

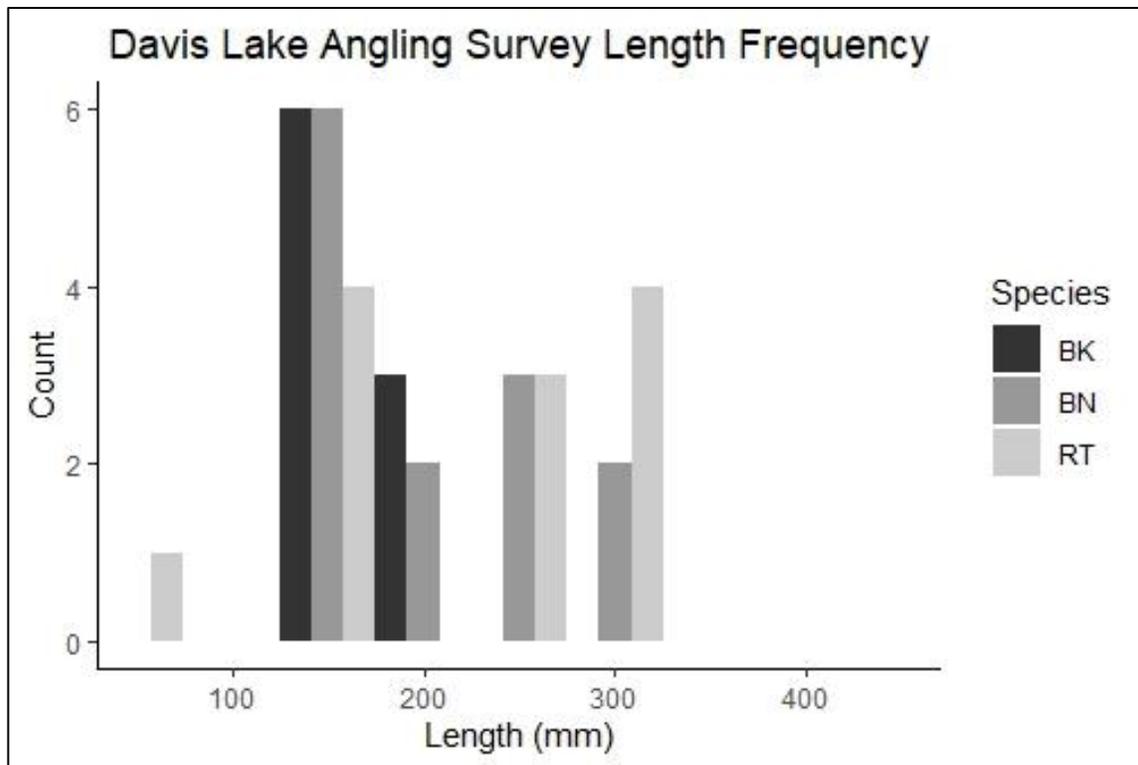


Figure 2. Length frequency of trout in Davis Lake caught during 2021 hook and line surveys.

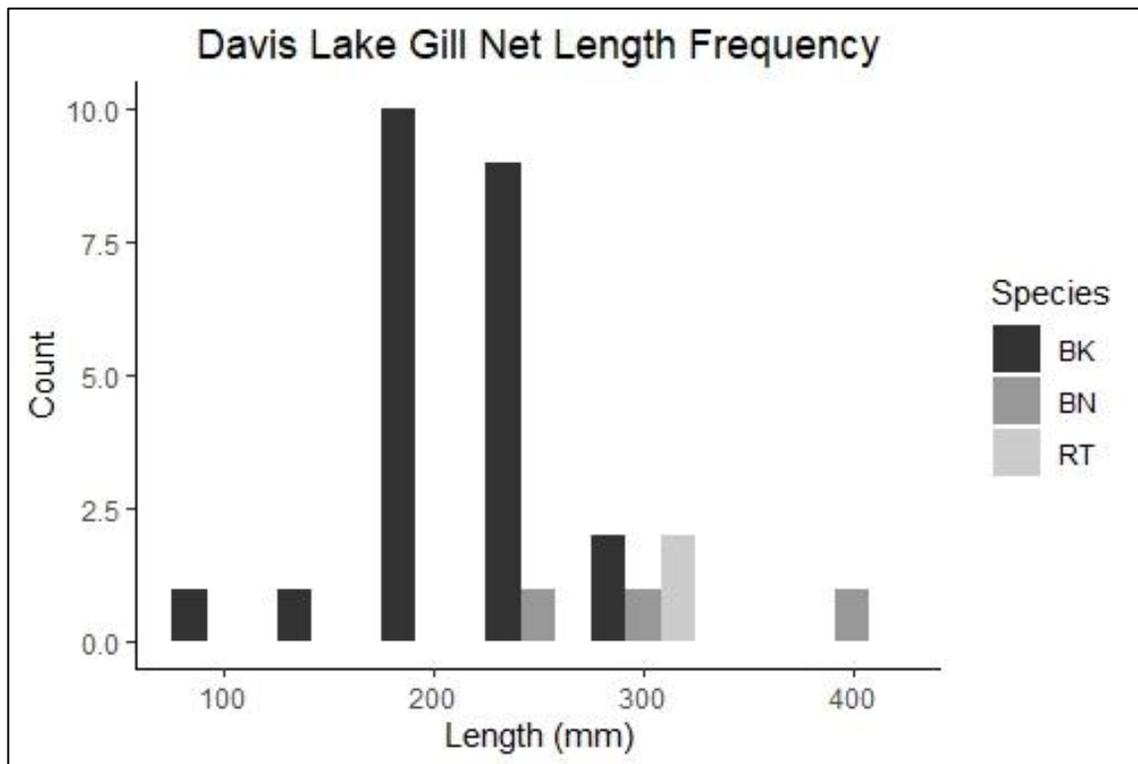


Figure 3. Length frequency of trout in Davis Lake caught during 2021 gill net surveys.

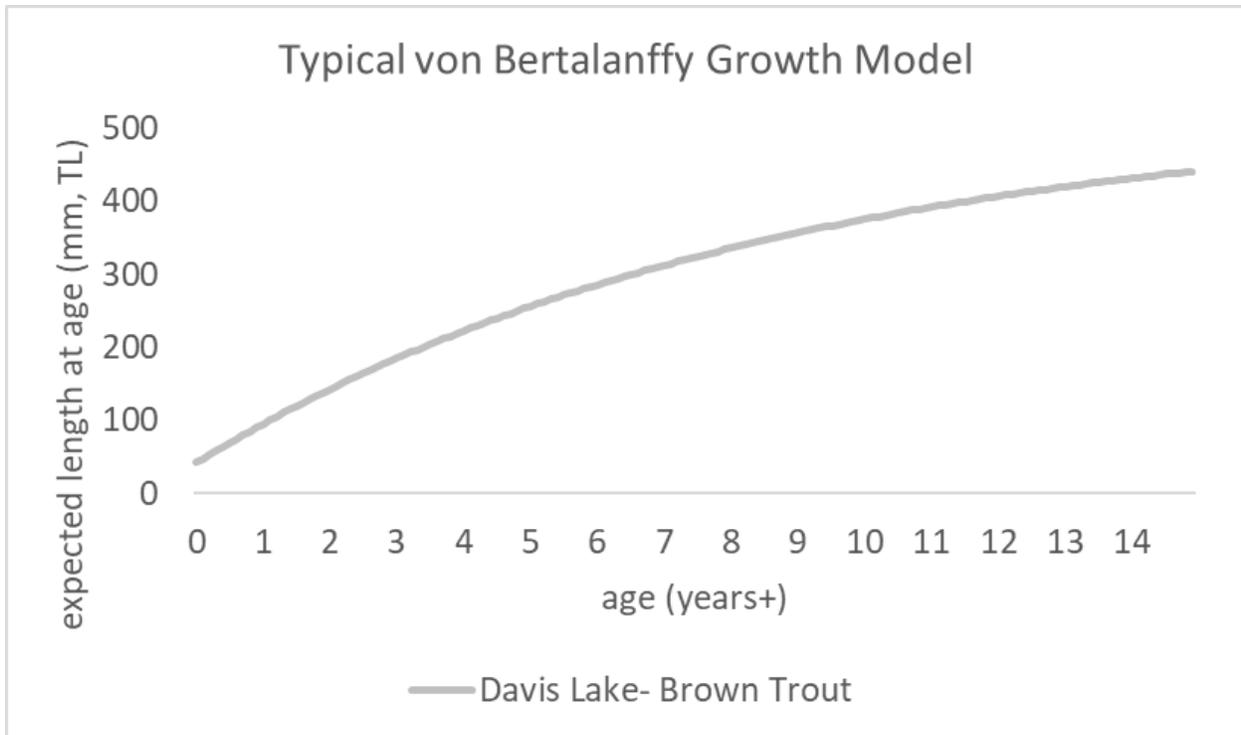


Figure 4. Growth curve of Brown Trout at Davis Lake 2021.

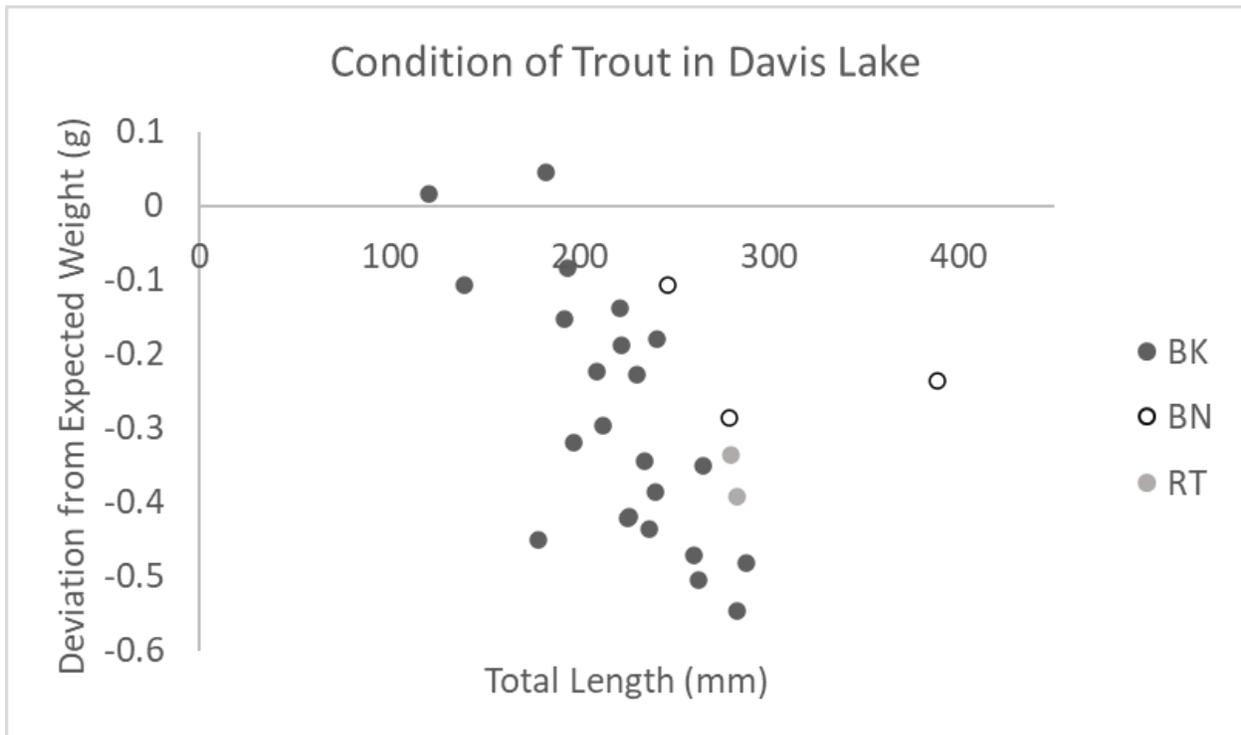


Figure 5. Deviation from expected weight of trout in Davis Lake, calculated using Fulton's Condition Factor formula.

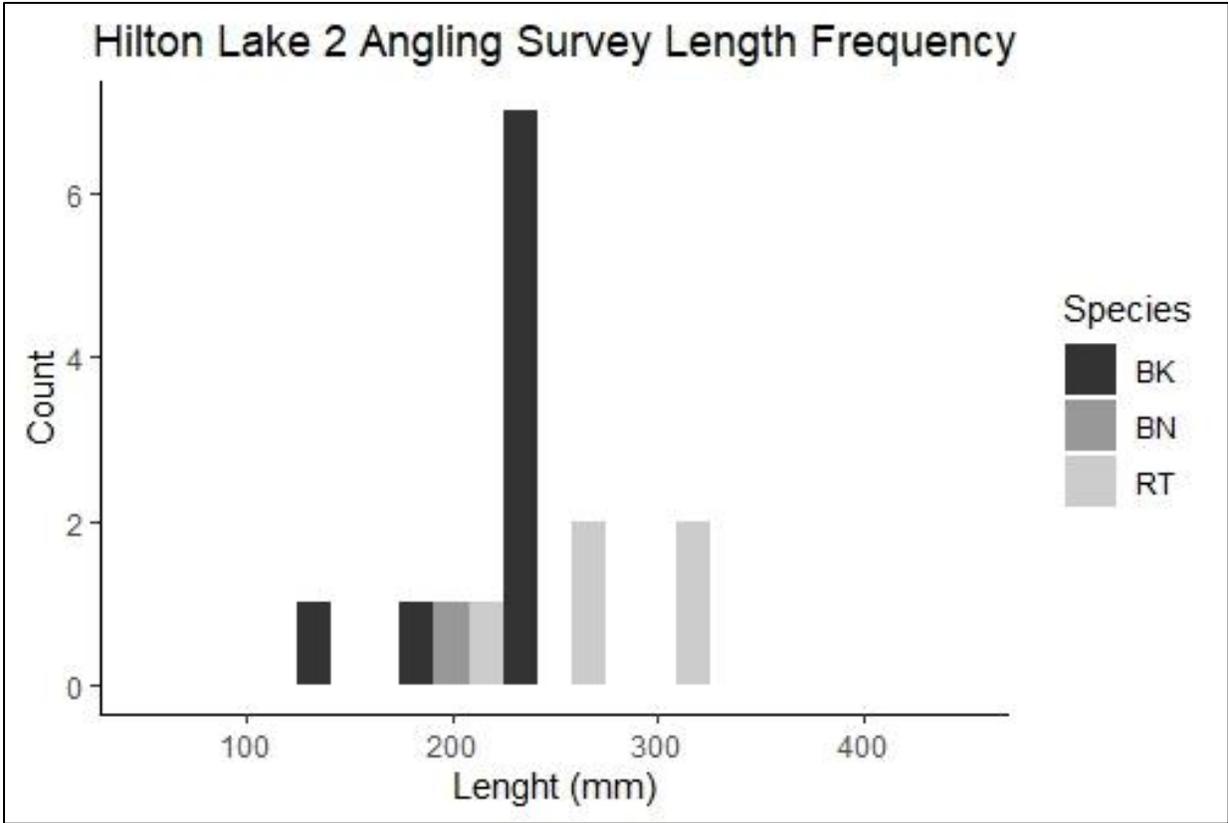


Figure 6. Length frequency of trout in Hilton Lake 2 caught during 2021 gill net surveys.

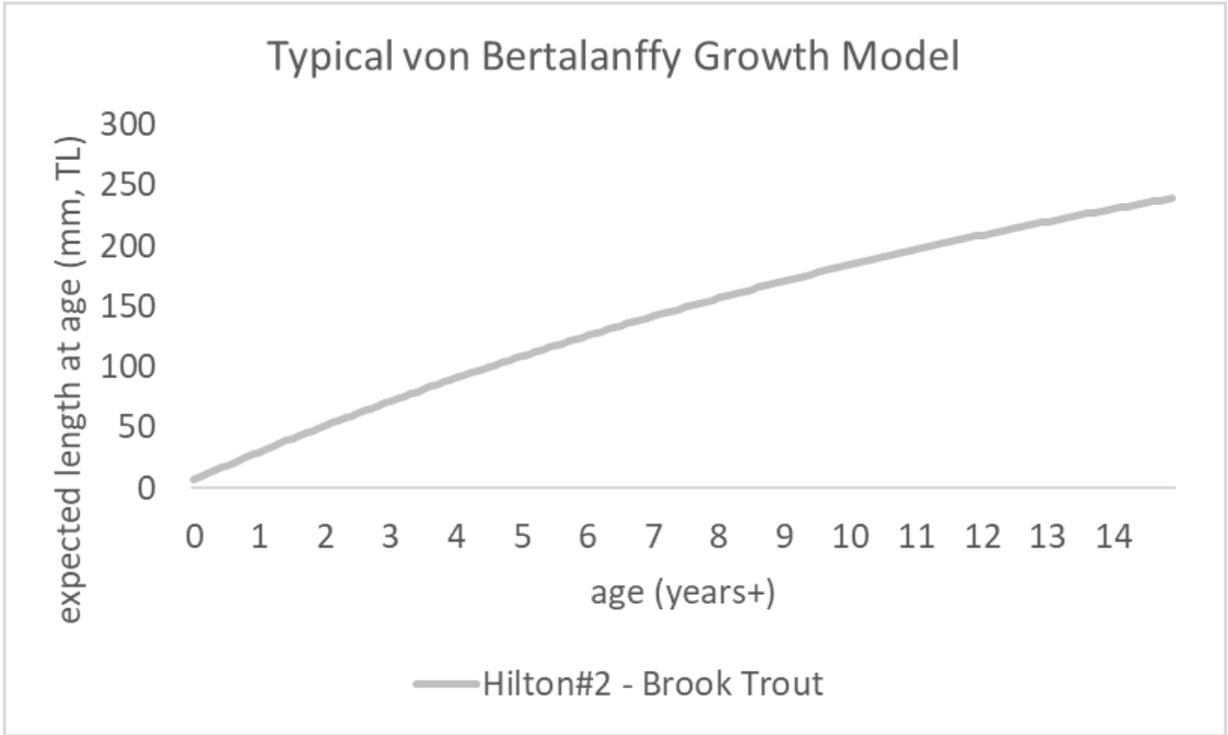


Figure 7. Growth curve of Brook Trout in Lake 2 in 2021.

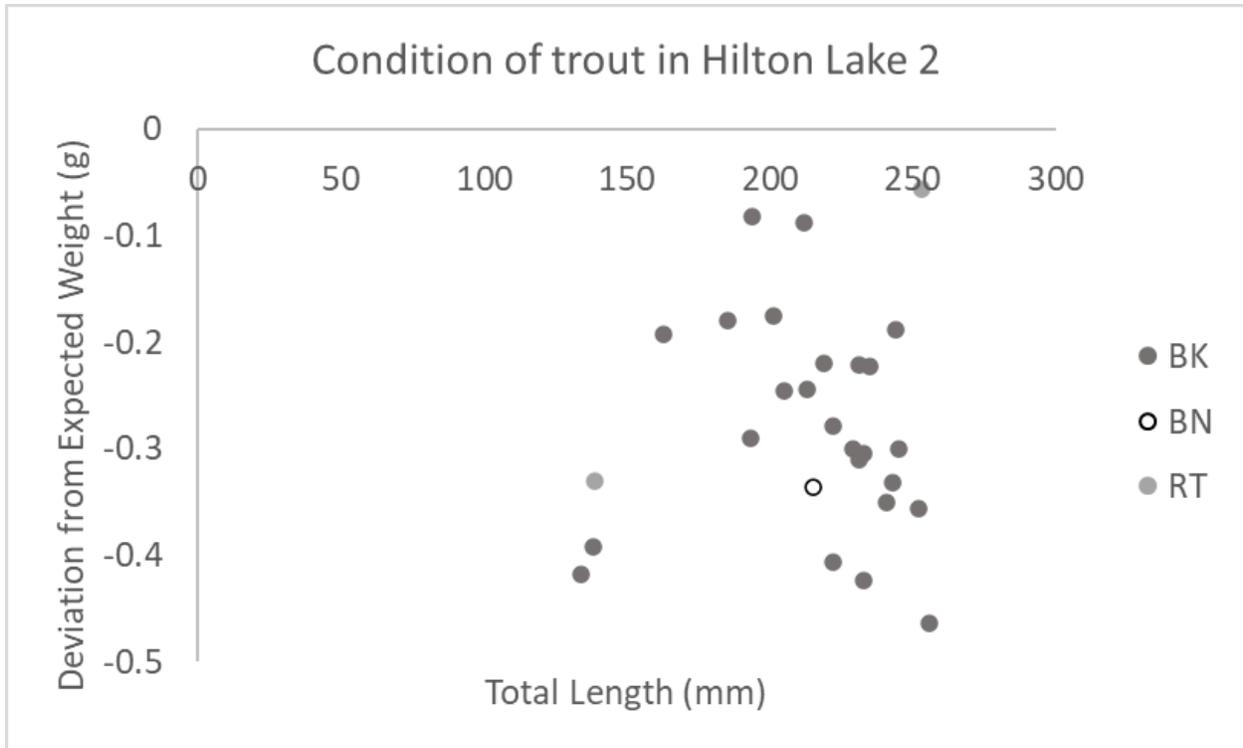


Figure 8. Deviation from expected weight of trout in Hilton Lake 2, calculated using Fulton's Condition Factor formula.

Angler survey data

Table 4. Summary of Angler Survey Box data from 2022.

# Forms	Fish caught per hour	Species composition- Brown Trout	Species composition- Rainbow Trout	Species composition- Brook Trout
15	3.48	36%	22%	42%

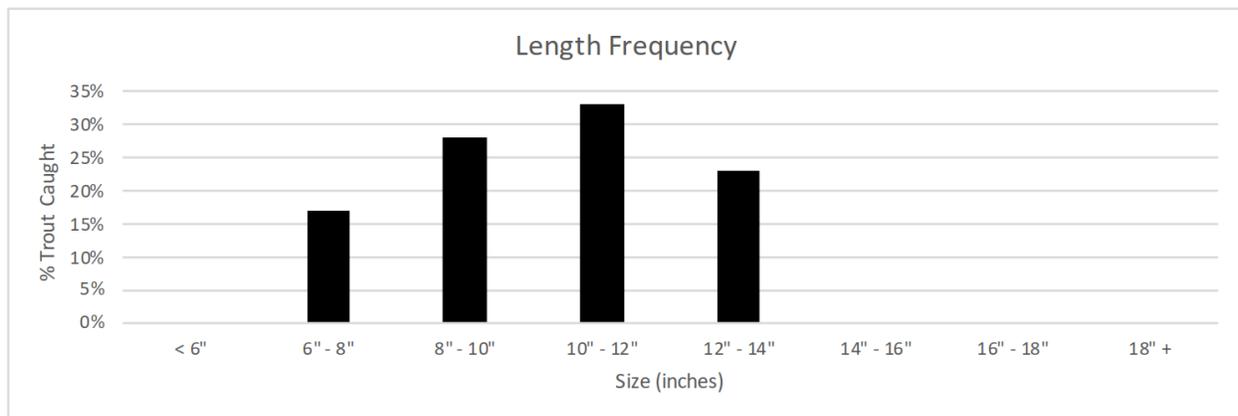


Figure 9. Histogram of size classes reported in the Angler Survey Box in 2022.

Table 5. Results of 2022 angler satisfaction survey: -2 (low) to 2 (high).

Average angler experience	Average angler rating of fish size	Average angler rating of fish numbers
1.8	1.5	1.7

Angling regulations

Brook Trout (T14 CCR §5.84) (a) Open season: All year. (b) Limit: Ten. (c) Size limit: Less than 10 inches total length. (d) Brook Trout bag limits may be taken in addition to the statewide trout daily bag and possession limits specified in Section 5.85.

Trout (T14 CCR § 5.85), (a) General Statewide Regulations: (1) All inland lakes, reservoirs, and ponds; including these types of waters residing on private lands, are open to fishing all year with a five-trout daily bag limit, and 10 trout possession limit, except those waters listed in subsection 7.50(b).

Known stressors

None known. Angling pressure is unknown, but recreational fishing pressure is assumed to be light at most wilderness locations. This fishery is largely protected from stressors due to its remote, high elevation location within the John Muir Wilderness. There were no measured impacts from the 2015 drought, and the most recent climate models indicate that the Hilton Lakes watershed will likely continue to remain predominately snowmelt fed over the next 50 years. The low conductivity precludes the establishment of Dressinid mussels and New Zealand Mudsail, *Potamopyrgus antipodarum* (Herbst, Bogan, & Lusardi, 2008). Signal Crayfish (*Pacifastacus leniusculus*) do not occur in Hilton Creek and are unlikely to be introduced given the remote location of the lake. The Hilton Lakes trail appears to be popular during summer and fall when the aspen leaves turn color.

Management

Management goals and objectives

- Fast action (catch rates \geq 2 fish/hour)
- Trophy (trout \geq 18 inches)
- Heritage trout
- Other

CDFW plans to manage and monitor the Hilton Basin Complex to ensure the fishery and its associated benefits are maintained to provide a quality trout fishery for public use and enjoyment. CDFW's HWTP specific goals are:

1. Maintain high quality trout habitat.

The Hilton Lakes capability to produce abundant trout is dependent on high-quality quality habitat. CDFW's management will include fostering land use and water management activities that maintain the exceptional productivity of the watershed. CDFW will engage with the Inyo National Forest to ensure land and recreation management is consistent with our management objectives.

2. Maintain a diversity of angling opportunities.

The Hilton Lakes Complex appears to support sufficient recruitment of trout to provide for anglers interested in harvesting trout and for anglers interested in catch-and-release fishing. CDFW will continue to evaluate trout recruitment and angler use and adjust management (mainly through fishing regulations) to maintain a quality fast action and trophy fishery with public use benefits.

3. Maintain a trout monitoring plan.

The Hilton Lakes can produce abundant wild trout. CDFW will monitor angler use, habitat, and trout population dynamics to inform habitat restoration actions and/or angling regulations to maintain the wild trout population at levels producing high quality angling opportunities.

Monitoring

- Gill netting
- Sonar
- Mark-recapture
- Spawning survey
- Hook and Line
- Angler survey box (ASB)

The principal short-term monitoring need is to collect updated information on the upper portion of the fishery. Gill net data from 2021 indicates a self-sustaining fishery with potential for trophy catches. Angling data from 2019 and 2021 indicates a high catch-per-unit-effort for some of the lakes. Due to its somewhat remote location and apparent absence of stressors, this fishery requires a low frequency of long-term monitoring.

CDFW's monitoring efforts may entail the following:

- (1) *Fisheries monitoring*: At least once every five years, CDFW will use a

combination of gill net, sonar survey, hook-and-line, and visual (fall monitoring of inlet and outlet streams for spawning activity) survey methods to assess the recreational fishery potential and status of the fish population. CDFW will extract otoliths from fish captured in gill nets to determine baseline size-at-age and generate Von Bertalanffy growth models.

(2) *Habitat monitoring*: Baseline limnological data (temperature and dissolved oxygen profiles, specific conductivity, and secchi depth) will be collected to use as a comparison for future conditions. Visual assessments and photos of the inlet and spawning creeks will be collected at least once during the next five years. In addition, we will map the barriers to upstream trout migration from each lake, as that will limit the available spawning and rearing habitat for adfluvial trout.

(3) *Recreational fishery monitoring*: Recreational use of the basin is likely dominated by backpackers, and some level of angling pressure does exist. Installation of angler survey boxes has already occurred to ascertain angler use, satisfaction, and success.

Angling regulations

Current angling regulations for the Hilton Lakes Complex were proposed/adopted to provide protection for the trout population while maintaining management goals/objectives. The Department shall monitor the fishery along with angler satisfaction/preferences to guide and direct any future regulatory changes if warranted. Regulations will be used in an adaptive manner to optimize angler opportunities while adhering to the management goals/objectives set forth in these guidelines.

Addressing stressors

No stressors to the fishery or surrounding habitats have been identified. We will collect additional habitat data in the event future stressors become apparent.

Adaptive strategies

This document provides guidance and management direction for wild trout resources in the Hilton Lakes Complex. These management recommendations are based on existing conditions and should be used in accordance with updated information over time. Long-term monitoring of the fishery and associated angler preferences should play a critical role in future management prescriptions. Any changes to the prescribed management goals and objectives should be based on updated quantifiable data, stakeholder input,

HWTP Policy (Bloom and Weaver 2008), the Strategic Plan for Trout Management (CDFW 2022), and collaborative (CDFW Headquarters and Regional) HWTP review.

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