

California Fish and Game Commission
NOTICE OF FINDINGS
Northern California Summer Steelhead
(*Oncorhynchus mykiss*)
(4/21/2022)

NOTICE IS HEREBY GIVEN that the California Fish and Game Commission (Commission), at a meeting on June 16, 2021, found pursuant to California Fish and Game Code Section 2075.5, that the information contained in the petition to list northern California summer steelhead (*Oncorhynchus mykiss*) (hereinafter "NCSS") and other information in the record before the Commission, warrants adding NCSS to the list of endangered species under the California Endangered Species Act (CESA) (Fish and Game Code, Section 2050 et seq.). (See also California Code of Regulations, Title 14, Section 670.1, subsection (i))

NOTICE IS ALSO GIVEN that, at its April 20-21, 2022, meeting, the Commission adopted the following findings outlining the reasons for its determination.

I. Background and Procedural History

Petition History

On September 28, 2018, the Friends of the Eel River submitted a petition to the Commission to list NCSS as endangered under CESA. The Commission reviewed the petition for completeness, and pursuant to Section 2073 of the California Fish and Game Code, referred the petition to the California Department of Fish and Game (Department) on October 8, 2018 for evaluation. The Commission gave public notice of receipt of the petition on October 26, 2018 (California Regulatory Notice Register 2018, No. 43-Z, p. 1915). The Department requested a 30-day extension of the 90-day review period which was granted by the Commission at its December 12-13, 2018 meeting. The Department transmitted to the Commission the Department's petition evaluation on January 24, 2019, and on February 6, 2019, the Commission formally received the Department's petition evaluation.

At its June 2019 meeting, FGC determined that listing may be warranted, and subsequently provided notice regarding NCSS's protected, candidate species status (California Regulatory Notice Register 2019, No. 26-Z, p. 954).

Status Review Overview

The Commission's action designating NCSS as a candidate species triggered the Department's process for conducting a status review to inform the Commission's decision on whether to list the species. At a public meeting in August 2019, the Commission approved a request for a 6-month extension to complete the status review.

On March 29, 2021, the Department transmitted to the Commission the Department's report to the Commission titled *California Endangered Species Act Status Review for Northern California Summer Steelhead (Oncorhynchus mykiss)* (status review) dated March 11, 2021. On April 14, 2021, the Commission formally received the Department's status review during a public meeting. On June 16, 2021, the Commission found that the information contained in the petition to list NCSS and other information in the record before the Commission warranted listing NCSS as an endangered species under CESA.

Species Description

Steelhead

Oncorhynchus mykiss is a species of salmonid native to cold-water tributaries of the Pacific Ocean in Asia and North America. *Oncorhynchus mykiss* includes multiple subspecies and several ecotypic forms, including resident and anadromous forms which are detailed in the petition and status review. Steelhead are the anadromous¹ ecotype of *Oncorhynchus mykiss* and are found in Asia and North America, occurring in North American watersheds from Alaska to Southern California (Light et al. 1989; CDFW 2021). Steelhead are the most widely present ecotype of all the Pacific salmonids, occupying nearly all ocean-connected streams throughout their range (Garza et al. 2014; CDFW 2021).

There are numerous non-taxonomic units or runs (below the species level), or nontaxa, of *Oncorhynchus mykiss* in California (Friends of Eel River 2018). The most commonly recognized nontaxa are defined by their migration types (i.e., anadromous or resident) or their seasonal run timing (i.e., summer or winter), though *Oncorhynchus mykiss* cannot be differentiated by seasonal run timing or anadromy through classical taxonomy (Behnke 1972; Wilson et al. 1985; Hayes et al. 2008).

Steelhead exhibit two seasonal run types; winter, also called ocean-maturing or mature migrating, and summer, also called stream-maturing or premature migrating (Withler 1966; CDFW 2021). The names of these two run types are reflective of the time of year the fish reenter the estuaries and rivers as adults in their upriver migration to reproduce (Busby et al. 1996; Moyle 2002).

The life cycle, physiology, diet, and habitat needs are detailed in the petition and status review.

Northern California Summer Steelhead (NCSS)

NCSS currently occupy fluvial habitat from Redwood Creek in northern Humboldt County south to the Mattole River, though they do not occur in all watersheds within this range (CDFW 2021). NCSS are categorized by the Department, for purposes of evaluating this potential listing, within a larger Northern California steelhead distinct population segment (DPS) as one of two regional ecotypes –summer and winter (Pearse et al. 2019; CDFW 2021).

NCSS are included in two NMFS-defined geographic diversity strata: Northern Coastal and North Mountain Interior; these two diversity strata encompass 10 historically functionally independent summer steelhead populations (NMFS 2016b). The NCSS range encompasses Redwood Creek, the Mad River, and the Mattole River as well as sectors of the Eel River watershed including the Middle Fork Eel River and the Van Duzen River (Moyle et al. 2017).

II. Statutory and Legal Framework

The Commission, as established by the California State Constitution, has exclusive statutory authority under California law to designate endangered, threatened, and candidate species under CESA. (Cal. Const., art. IV, § 20, subd. (b); Fish & G. Code, § 2070.) The CESA listing process for NCSS began in the present case with the petitioners' submittal of the petition to the

¹ Anadromous referring to the trait of migrating to the ocean as juveniles, and from the sea up into fresh water to spawn.

Commission. The regulatory and legal process that ensued is described in some detail in the preceding section, along with related references to the Fish and Game Code and controlling regulation. The CESA listing process generally is also described in some detail in published appellate case law in California, including:

- *Mountain Lion Foundation v. California Fish and Game Commission* (1997) 16 Cal.4th 105;
- *California Forestry Association v. California Fish and Game Commission* (2007) 156 Cal.App.4th 1535;
- *Center for Biological Diversity v. California Fish and Game Commission* (2008) 166 Cal.App.4th 597;
- *Natural Resources Defense Council v. California Fish and Game Commission* (1994) 28 Cal.App.4th 1104;
- *Central Coast Forest Association v. California Fish and Game Commission* (2017), 2 Cal. 5th 594; and
- *Central Coast Forest Association v. California Fish and Game Commission* (2018) 18 Cal. App. 5th 1191.

The “is warranted” determination at issue here stems from Commission obligations established by Fish and Game Code Section 2075.5. Under the provision, the Commission is required to make one of two findings for a candidate species at the end of the CESA listing process; namely, whether listing a species is warranted or is not warranted. Here, with respect to NCSS, the Commission made the finding under Section 2075.5(e)(2) that listing NCSS is warranted.

The Commission was guided in making its determinations by statutory provisions and other controlling law. The Fish and Game Code, for example, defines an endangered species under CESA as “a native species or subspecies of a bird, mammal, fish, amphibian, reptile or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, over exploitation, predation, competition, or disease.” (Fish & G. Code, § 2062.) Similarly, the Fish and Game Code defines a threatened species under CESA as “a native species or subspecies of a bird, mammal, fish, amphibian, reptile or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by this chapter.” (*Id.*, § 2067.)

The Commission also considered Title 14, Section 670.1, subsection (i)(1)(A), of the California Code of Regulations in making its determination regarding NCSS. This provision provides, in pertinent part, that NCSS shall be listed as endangered or threatened under CESA if the Commission determines that its continued existence is in serious danger or is threatened by any one or any combination of the following factors:

1. Present or threatened modification or destruction of its habitat;
2. Overexploitation;
3. Predation;

4. Competition;
5. Disease; or
6. Other natural occurrences or human-related activities.

Fish and Game Code Section 2070 provides similar guidance, providing that the Commission shall add or remove species from the list of endangered and threatened species under CESA only upon receipt of sufficient scientific information that the action is warranted. Similarly, CESA provides policy direction not specific to the Commission per se, indicating that all state agencies, boards, and commissions shall seek to conserve endangered and threatened species and shall utilize their authority in furtherance of the purposes of CESA. (Fish & G. Code, § 2055.) This policy direction does not compel a particular determination by the Commission in the CESA listing context. Nevertheless, “[l]aws providing for the conservation of natural resources’ such as the CESA are of great remedial and public importance and thus should be construed liberally.” (*California Forestry Association v. California Fish and Game Commission*, supra, 156 Cal. App.4th at pp. 1545-1546, citing *San Bernardino Valley Audubon Society v. City of Moreno Valley* (1996) 44 Cal.App.4th 593, 601; Fish & G. Code, §§ 2051, 2052.)

Finally, in considering the six identified factors, CESA and controlling regulations require the Commission to actively seek and consider related input from the public and any interested party. (See, e.g., Id., §§ 2071, 2074.4, 2078; Cal. Code Regs., tit. 14, § 670.1, subd. (h).) The related notice obligations and public hearing opportunities before the Commission are also considerable. (Fish & G. Code, §§ 2073.3, 2074, 2074.2, 2075, 2075.5, 2078; Cal. Code Regs., tit. 14, § 670.1, subds. (c), (e), (g), (i); see also Gov. Code, § 11120 et seq.) The referenced obligations are in addition to the requirements prescribed for the Department in the CESA listing process, including an initial evaluation of the petition, a related recommendation regarding candidacy, and a review of the candidate species’ status, culminating with a report and recommendation to the Commission as to whether listing is warranted based on the best available science. (Fish & G. Code, §§ 2073.4, 2073.5, 2074.4, 2074.6; Cal. Code Regs., tit. 14, § 670.1, subds. (d), (f), (h).)

III. Factual and Scientific Bases for the Commission’s Final Determination

The factual and scientific bases for the Commission’s determination that designating NCSS as an endangered species under CESA is warranted are set forth in detail in the Commission’s record of proceedings, including the petition (Friends of the Eel River 2018); the Department’s petition evaluation report; the Department’s status review (CDFW 2021); written and oral comments received from members of the public, the regulated community, tribal entities, and the scientific community; and other evidence included in the Commission’s record of proceedings.

The Commission determines that the continued existence of NCSS in the State of California is in serious danger or threatened by one or a combination of the following factors as required by the California Code of Regulations, Title 14, Section 670.1, subsection (i)(1)(A):

1. Present or threatened modification or destruction of its habitat;
2. Overexploitation;
3. Predation;

4. Competition;
5. Disease; or
6. Other natural occurrences or human-related activities.

The Commission also determines that the information in the Commission's record constitutes the best scientific information available and establishes that designating NCSS as an endangered species under CESA is warranted. Similarly, the Commission determines that NCSS is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease.

The items highlighted here and detailed in the following section represent only a portion of the complex issues aired and considered by the Commission during the CESA listing process for NCSS. Similarly, the issues addressed in these findings represent some, but not all of the evidence, issues, and considerations affecting the Commission's final determination. Other issues aired before and considered by the Commission are addressed in detail in the record before the Commission, which record is incorporated herein by reference.

Background

The Commission has previously listed units at a lower level than a taxonomic subspecies, in each case making a factually-specific determination as to whether the unit was appropriate to list under CESA. In 2004, the Commission listed two evolutionarily significant units (ESUs) of coho salmon, a decision that was upheld in *California Forestry Association v. California Fish and Game Commission*. In 2016, the Commission listed an ESU of fisher. In 2020, the Commission listed five clades of the foothill yellow-legged frog; a clade, also referred to as a monophyletic group, is a branch on a phylogenetic tree that contains a group of lineages comprised of an ancestor and all its descendants. In 2021, the Commission listed an ecotype of Chinook salmon – the Upper Klamath-Trinity Spring Chinook Salmon – as a threatened species.

The Commission bases its “is warranted” finding for NCSS most fundamentally on its determination that NCSS qualifies as a “subspecies” as specified in CESA sections 2062 and 2067. The qualification is based on the discreteness (when compared to other ecotypes) and significance of NCSS within the state of California (Fraser 2001; Waples 1991, 1995; Moran et al. 1994; de Guia and Saitoh 2007), coupled with the threats faced due to relatively small abundances, habitat loss and alteration, overexploitation, and climate change (Friends of the Eel River 2018; CDFW 2021; Moyle et al. 2008). Construing “subspecies” under this framework supports the preservation of important elements of genetic diversity, which has been shown to support long-term species conservation (Frankham 2005; Frankham 1996; Waples and Lindley 2018) and is important to fulfill the purpose of CESA of biodiversity preservation.

Qualification for Listing

The petition specifically refers to NCSS as a subspecies. and argues as to why NCSS should be considered as such. In making a recommendation to the Commission, the Department deemed that NCSS was best understood as an ecotype of a larger combined Northern California steelhead DPS composed of NCSS and Northern California winter steelhead, and

from that the Department concluded that NCSS does not itself constitute an independent subspecies. Following from this conclusion, the Department recommended against listing NCSS (CDFW 2021). The Commission must make its own factually-specific determination as to whether NCSS qualifies for listing, supported by CESA and relevant case law.

Although summer and winter steelhead are not thought to be separate taxonomic subspecies, the genetics of NCSS distinguishes it from individuals in the winter ecotype, due to a specific genomic region highly correlated with migration timing (Hess et al. 2016; Prince et al. 2017; Micheletti et al. 2018; Ford et al. 2020). Summer and winter steelhead are more closely related within individual watersheds (Chilcote et al. 1980; Waples et al. 2004; Kinziger et al. 2013; Arciniega et al. 2016), and the National Marine Fisheries Service, accordingly, defines steelhead DPSs largely by geography (NMFS 2016a; Laird et al. 1995). Nevertheless, the summer and winter steelhead ecotypes do exhibit meaningful distinction in run time, and NCSS represents an important diversity component of the species (Kannry et al. 2020; Ford et al. 2020).

Summer and winter steelhead interbreed and can form heterozygous offspring at the GREB 1L/ROCK 1 gene region (Prince et al. 2017; Pearse et al. 2019), and these heterozygous fish are themselves capable of breeding. Heterozygotes may exhibit intermediate run timing, in the late summer to fall (Pearse et al. 2019; Greacen 2021). Adult heterozygotes may have reduced fitness (Pearse et al. 2019; Micheletti et al. 2018; Greacen 2021; Papa et al. 2007), and fish that migrate at that time may face substandard conditions, including river temperature (Quinn et al. 2016; Willis et al. 2020), although specific NCSS heterozygote persistence patterns have yet to be studied in detail. High heterozygote numbers may be a consequence of relatively small populations and disconnection from upstream habitats (Ford et al. 2020; Greacen 2021). Heterozygotes are likely an important mechanism for the spread and maintenance of the early migration alleles over long time scales (Ford et al. 2020).

The genetically-based run-time discreteness of summer and winter life history variants is meaningful, given that it expresses as the seasonal run in a very precise (albeit not perfectly exact) relationship (Hess et al. 2016; Prince et al. 2017; Micheletti et al. 2018; Ford et al. 2020). Although the two ecotypes are not completely distinct, and future developments may refine the understanding of how genetics (including GREB1L) define summer and winter runs (Ford et al. 2020), the two ecotypes are notably separate from each other as a consequence of genetic, ecological, and behavioral factors (e.g., Leider et al. 1984).

The summer run-time of NCSS provides a unique, adaptive contribution to the species. The run-time differentiation allows access to disparate habitat conditions during the return migration, conferring a significant adaptive consequence but also makes them particularly vulnerable to habitat degradation (Ford et al. 2020; Pearse et al. 2019). The summer-run metapopulation² brings important diversity to the species that increases its chances of surviving when faced with natural and human-caused environmental change and environmental stochasticity. This critical life history variant, shared across watersheds despite their more distant evolutionary lineage through isolation by distance (Bjorkstedt et al. 2005;

² The metapopulation framework can be a useful concept to understand NCSS dynamics because (i) the various NCSS spawning habitats are discrete and are separated by a matrix of unsuitable habitat; (ii) there is sufficient asynchrony in the population dynamics of local populations, such that some may persist while others may not, and (iii) some NCSS stray from their natal population, linking the disparate populations via dispersers.

Arciniega et al. 2016; Nielsen 1999; Pearse et al. 2007; Garza et al. 2014; Reisenbichler et al. 1992), allows NCSS to persist in a unique ecological setting, with dissimilar habitat conditions to its winter counterpart, providing the (taxonomic) species with population diversity and protection against adverse winter conditions.

The best available genetic and evolutionary information indicates that run-timing genetics (at the GREB1L/ROCK1 locus) manifested from a single evolutionary event (Prince et al. 2017; Ford et al. 2020). Given its evolutionary history, run-timing in the summer is unlikely to evolve again in northern California steelhead over ecological time scales should it disappear (Ford et al. 2020; Prince et al. 2017). In the case of reestablishment following localized losses, there is evidence (from other species) to suggest that reintroduction through intra-basin migration from another source population (Thompson et al. 2020) or through heterozygotes (CDFW 2021) may be possible, but ultimately the likelihood of success is unknown (Greacen 2021).

Although the relationship between the genetic makeup of a particular fish is very closely related to its run timing, some variation is recognized in when it may choose to return from the ocean, even among homozygous individuals (Ford et al. 2020). That is, an individual with homozygous summer alleles may return well into the winter, and vice versa. Ultimately however, the strong associative link between observed run timing and NCSS's genetic composition (Hess et al. 2016; Prince et al. 2017; Micheletti et al. 2018; Ford et al. 2020) suggests an important genetic role in its inclination to migrate at a particular time of year. Therefore, the fundamental determinant of whether a fish is a NCSS is its genetic makeup; only North Coast steelhead that possess homozygous alleles associated with the summer return are classified as NCSS, for the purposes of this CESA listing.

Based on the foregoing factors, the Commission finds NCSS qualifies as a subspecies under CESA.

Threats

NCSS is endangered due to:

- present or threatened modification of its habitat;
- overexploitation;
- predation; and
- other natural events or human-related activities

NCSS is protected as threatened under the federal Endangered Species Act, as part of the listed Northern California steelhead DPS, which includes NCSS and winter steelhead (50 Code of Fed. Regs. 17.11 and 223.102).

Present or Threatened Modification or Destruction of Habitat

While there is spatial overlap between summer and winter steelhead, which can foster interbreeding, NCSS can often be found in higher reaches of watersheds in which they occur (Friends of the Eel River 2018). They specialize in climbing river roughs and difficult-to-navigate water stretches, to reach pools and other upstream holding areas that are difficult to reach for winter steelhead (Kannry et al. 2020). Still, major dams do obstruct passage to historic spawning habitat, including Matthews Dam on the Mad River and Scott Dam on the Eel

River (NMFS 2005; Cooper 2017). The majority of NCSS are in the Eel and Mad Rivers combined (NOAA 2016; Greacen 2021). Additionally, dams and other large barriers may prevent anadromy in steelhead populations that have been isolated above them (Kannry et al. 2020).

Particularly problematic natural obstructions may also isolate significant portions of habitat, particularly during sustained periods of lower flows (CDFW 2021). Even small migration barriers may cause losses to genetic diversity (Waples et al. 2008).

Because NCSS hold for nine to twelve months before spawning, they may be subject to amplified exposure to adverse riverine conditions – even temporary perturbations. To complete their reproductive cycle, they require (1) deep, cold pools with riparian cover for holding (Baigún 2000, 2003; Nakamoto 1994; High et al. 2006; Nielsen and Lisle 1994), (2) loose gravel and adequate flows for spawning, and (3) sufficient flows, cool temperatures, and protection from predators for rearing (CDFW 2021). Changes in these factors have been suspected in the historical alteration of steelhead migration patterns (Robards and Quinn 2002).

Significant land uses that adversely affect conditions necessary for the NCSS life cycle include water use (particularly from noncompliant sites), mining, timber production, deforestation, road construction and maintenance, livestock grazing, and agriculture (CDFW 2021; Dillis et al. 2019). Effects from illegal cannabis operations can include both water diversions and the introduction of pollutants. Flood events (Jowett and Richardson 1989) and unstable geology have also contributed to NCSS habitat loss (Waples et al. 2008; CDFW 2021; Becker and Reining 2009), the effects of which can be amplified when experienced by small abundances. Wildfires present an ever-increasing threat to riparian habitat (Friends of the Eel River 2018). These threats have contributed to an overall contraction of available habitat for NCSS, and on balance the threats facing NCSS are increasing.

Therefore, the Commission finds habitat modification and destruction to be a significant threat to the continued existence of NCSS.

Overexploitation

There are currently no fisheries that target NCSS for harvest. (CDFW 2021). However, anecdotal evidence of poaching exists, especially in remote areas of NCSS watersheds (CDFG 1966 – 2018; CDFW 2021). There are no directed studies that quantify illegal take or identify poaching to be at a level that would affect NCSS abundance, though illegal activities are notoriously difficult to quantify. Still, NCSS are unusually vulnerable to fishing pressure given their high visibility and tendency to remain in holding pools, even when disturbed (CDFW 2021). Poaching continues to plague NCSS due to the difficulties with providing substantial law enforcement in such remote areas (Moyle et al. 2008). Even when released after being caught, steelhead can suffer an increased risk of mortality (Twardek et al. 2018), which can be exacerbated by warmer temperatures (Taylor and Barnhart 1996).

Therefore, the Commission finds overexploitation to be a significant threat to the continued existence of NCSS.

Predation

NCSS life history renders the species significantly more vulnerable to predation than winter run steelhead, particularly when the adults are in-river. With very small populations of NCSS in some of the watersheds where NCSS occur, high predation rates on adults could reduce or even eliminate successful spawning at a given location for a particular year.

The introduction of Sacramento pikeminnow to the Eel River watershed has significantly increased the impact of predation on NCSS (Yoshiyama and Moyle 2010; NMFS 2005). While pikeminnow are native to California, and even to the Russian River immediately to the south, they are not native to the Eel River. Recent geomorphic and hydrological changes in the upper Eel River are conducive to growing pikeminnow populations (Yoshiyama and Moyle 2010), particularly warmer water (Good et al. 2005). Negative effects from pikeminnow may be amplified when steelhead abundances are low, and pikeminnow may prove a significant barrier to recovery in the Eel River (Yoshiyama and Moyle 2010).

Predation in the marine environment is less understood. Increases in pinniped abundances and the relatively high prevalence of predatory wounds on returning steelhead may signal that ocean predation may warrant greater concern (CDFW 2021).

NCSS are particularly susceptible to impacts from these predation threats due to the very low population numbers (Friends of the Eel River 2018). Additionally, water depth and complex habitat structure may help salmonids deal with predation (Lonzarich and Quinn 1995), so changes in habitat configurations may increase the level and significance of predation. Overall, predation is likely a moderate threat on NCSS, although when combined with other threats (e.g., warming temperatures that stress fish, declines in habitat quality that degrade NCSS ability to handle predators), predation impacts may increase in the future.

Therefore, the Commission finds predation to be a significant threat to the persistence of NCSS.

Other Natural Occurrences or Human-Related Activities

Small Populations

Small, isolated populations are inherently vulnerable to increased impacts from other identified threats and extinction generally. NCSS populations are likely far below historical abundances (CDFW 2021). NCSS populations in Redwood Creek have been declining recently, Middle Fork Eel River populations (the most robust of all NCSS populations) have been declining over a longer term. While other populations show either no statistically significant trends or do not have reliable trend estimates, all surveyed populations are either at low-to-moderate numbers or have already been extirpated. All NCSS population segments face a high risk of extinction (CDFW 2021).

Cohort Replacement Rate, one indicator of NCSS productivity, has been declining for all population segments in the most recent years (CDFW 2021). NMFS viability targets (2500 adult summer steelhead per generation) have not been met for all NCSS population segments with long-term survey data (CDFW 2021). Competition from brown trout (CDFW 2021) may also exacerbate the risks from small population sizes.

Therefore, the Commission finds small population sizes to be a threat to the persistence of NCSS.

Climate Change

The Earth's climate is warming, and the primary causes are greenhouse gas emissions and deforestation (IPCC 2007; USGCRP 2009; USGCRP 2017). Since 1900, global average temperature has increased 0.7° C (NRC 2006) due to carbon dioxide emissions. Ice core data indicates that atmospheric carbon dioxide is currently 30% greater than its peak in the last 800,000 years. Over the last 150 years, carbon dioxide levels have increased 37.5% (CDFW 2021).

Greenhouse gas increases have resulted in changes in seasonal precipitation, decreased snowpack, earlier snowmelt, and increased storm severity (USGCRP 2009; USGCRP 2017), 0.1° C increase in seas surface temperature since 1961 and increased ocean acidification (USGCRP 2009), 203 mm increase in sea level after approximately 2000 years of stability (USGCRP 2009), and approximately a 20% decrease in the amount of arctic sea ice since the 1950s (Curran et al. 2003).

If current conditions remain unchanged, studies project that global climate will change drastically. Projections include an increase of 1.1 – 6.4° C in average global surface temperature (USGCRP 2009), sea level rise of 1 – 3 m (IPCC 2007; USGCRP 2009; USGCRP 2017), and greater extremes in storm events and wildfire (Krawchuck et al. 2009).

A warming climate is likely to result in poorer future environmental conditions for California's salmonids in general (Isaak et al. 2018; Katz et al. 2012; Crozier et al. 2019), including for steelhead in other areas (McCarthy et al. 2009; Sloat and Osterback 2013; Robards and Quinn 2002), and for NCSS specifically (CDFW 2021).

With the impending effects of climate change, the limited amount of NCSS habitat will likely continue to decline in quality and extent; California's north coast may experience pronounced climate change impacts including rising water temperatures, intensified flooding, more frequent and persistent drought conditions, lower summer baseflows, altered hydrography especially in watersheds impacted by snowmelt and large-scale historical logging, ocean acidification, increased wildfires, and sea level rise (CDFW 2021).

Additionally, changing climate could adversely affect marine habitats during the life stages in which NCSS inhabits the ocean (Hayes et al. 2016; CDFW 2021; Thalmann et al. 2020), including changes in temperature, salinity, pH, and nutrient availability, influencing the availability of food, predation rates, and other factors.

Therefore, the Commission finds climate change to be a threat to the persistence of NCSS.

Therefore, the Commission finds the natural occurrences or human-related activities discussed above to be a significant threat to the continued existence of NCSS.

Conclusion

The continued existence of NCSS is in serious danger or threatened by significant threats, including present or threatened modification or destruction of habitat, overexploitation, predation, and other natural events or human-related activities.

IV. Final Determination by the Commission

The Commission has weighed and evaluated the information for and against designating NCSS as an endangered species under CESA; this information includes scientific and other general evidence in the petition; the Department's petition evaluation report; the Department's status review; the Department's related recommendations; written and oral comments received from members of the public, the regulated community, various public agencies, and the scientific community; and other evidence included in the Commission's record of proceedings.

Based upon the evidence in the record the Commission has determined that the best scientific information available indicates that the continued existence of NCSS is in serious danger or threatened by present or threatened modifications or destruction of the species' habitat, overexploitation, predation, or other natural occurrences or human-related activities, where such factors are considered individually or in combination. (See generally California Code of Regs., tit. 14, § 670.1, subd. (i)(1)(A); Fish & G. Code, §§ 2062, 2067.) The Commission determines that there is sufficient scientific information to indicate that designating NCSS as an endangered species under CESA is warranted at this time, and that with adoption and publication of these findings NCSS, for purposes of its legal status under CESA, shall be listed as endangered.

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