UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OR 97232-1274

Refer to NMFS No:
WCRO-2022-00230

December 13, 2023

Christina Miller
Planning and Compliance Lead
Olympic National Park
600 E. Park Ave.
Port Angeles, Washington 98362

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Olympic National Park Fire Management Plan. Fourth Field HUCs: 17110020, 1710021, 17100101, 17100102, 17110018, 17110017, Olympic National Park. NPS No. L7617 (OLYM-S)

Dear Ms. Miller:

Thank you for your email on December 10, 2018, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the National Park Services' (NPS) proposed Olympic National Park (ONP) Fire Management Plan (FMP). In this opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook, PS steelhead, or Lake Ozette sockeye salmon. The project is also not likely to result in the destruction or adverse modification of critical habitat designated in the action area for all three species.

As required by section 7 of the Endangered Species Act, the National Marine Fisheries Service provided an incidental take statement with the biological opinion. The incidental take statement describes reasonable and prudent measures the NMFS considers necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions. Incidental take from actions that meet the term and condition will be exempt from the ESA take prohibition.

NMFS also reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)), and concluded that the action would adversely affect the EFH of Pacific Coast salmon. Therefore, we have included the results of that review in Section 3 of this document.

Please contact Tyler Yasenak of the Oregon Washington Coastal Office at (206) 207-0092, or by email at tyler.yasenak@noaa.gov if you have any questions concerning this Section 7 consultation, or if you require additional information.

Sincerely,

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the

Olympic National Park Fire Management Plan
Olympic National Park, Washington

NMFS Consultation Number: WCRO-2022-00230

Action Agency: National Park Service

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Puget Sound (PS) Chinook *(Oncorhynchus tshawytscha)*	Threatened	Yes	No	Yes	No
PS steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No
Lake Ozette sockeye salmon (*Oncorhynchus nerka*)	Threatened	Yes	No	Yes	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: December 13, 2023

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1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file Oregon and Washington Coastal Office.

1.2 Consultation History

The biological opinion and EFH consultation are based on the information provided in the National Park Service (NPS) biological evaluation (BE) of the parks proposed Fire Management Plan (FMP) as well as other sources containing best available science. The NPS requested informal consultation on December 10, 2018. NMFS initiated formal consultation on December 17, 2018. This was followed by the lapse in government funding which caused a 5-week shut down of NMFS operations, delaying our analysis of the proposed action. On September 9, 2023, NMFS requested additional information regarding project effects. A complete record of this consultation is on file at the Oregon Washington Coastal Office located in Lacey, Washington.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

The NPS concluded that the proposed action may affect, and is likely to adversely affect (LAA) Puget Sound (PS) Chinook (*Oncorhynchus tshawytscha*), PS steelhead (*Oncorhynchus mykiss*), and Lake Ozette sockeye salmon (*Oncorhynchus nerka*). All three species have critical habitat in the action area and NPS determined the habitat may be affected, and is likely to be adversely affected. NMFS agrees with the NPS determinations.

NMFS also reviewed the likely effects of the proposed action on EFH, and concluded that we agree with the NPS in that the action would adversely affect the EFH of Pacific Coast salmon.

1.3 Proposed Federal Action

For ESA, "Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). For EFH, federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

Pursuant to the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C), the NPS is preparing an Environmental Assessment (EA) for an FMP. The NPS, U.S. Department of the Interior, and interagency policies have changed since the 2005 FMP was written (NMFS Biological Opinion 2003/01016, dated April 2005). The purpose of the federal action is to update the FMP for the park to comply with the NPS's wildland fire policy directives and Director's Order 18 (DO-18), Wildland Fire Management. DO-18 requires that parks "with burnable vegetation must have an approved Fire Management Plan that will address the need for adequate funding and staffing to support its fire management program" (NPS 2008). In addition, the purpose of the revision is to modify the management approach for using wildfire for multiple objectives, including the protection of listed species' habitat.

The revision of the FMP is needed to address wildfire on a landscape scale and allow fire management activities to continue within the park, while addressing the resource needs of the park. Furthermore, the number of Fire Management Units (FMUs) can be simplified to reflect the adoption of wildfire for multiple objectives by the neighboring Olympic National Forest. The proposed plan would update the park's FMP to reflect current federal regulation and guidance, and the best available science and practices in regard to fire management. Additionally, it would provide a range of strategies and tactics that could be used to respond to changes in the environment and the specific needs of individual firefighting efforts.
Table 1 points out the proposed changes to the FMP

Table 1. FMP proposed changes

Main Program Elements	Proposed Action
(1) Fire Management Units (FMUs)	Two units: Non-Wilderness, Wilderness
(2) Wildfire Management	Wildfire in both FMUs would be expected as follows: * An average of 1,200 acres of wildfire per year based on current conditions and recent fire history. * Wildfire for Multiple Objectives would be allowed under appropriate safety and resource conditions. The need for fire suppression repair, BAER, or BAR activities would be assessed.
(3) Manual and Mechanical Treatment	Maximum of 100 acres per year in the Non- Wilderness FMU. * In the Wilderness FMU, treatments may be used in accordance with the PMRA when wilderness infrastructure is in immediate risk from wildfires, until final decisions are made in the Wilderness Stewardship Plan.
(4) Prescribed Fire: Pile Burning and Debris Disposal	* Maximum of combined 20 acres per year of pile burning and debris disposal (Non-Wilderness FMU only). * Pile burning/debris disposal by fire in the Wilderness FMU is not authorized under this consultation. Future use of this element will be addressed in the Wilderness Stewardship Plan and will trigger reinitiation.
(5) Prescribed Fire: Broadcast Burns	* Broadcast burns in either FMU under the revised FMP is not authorized under this consultation. Future use of this element will be addressed in the Wilderness Stewardship Plan and will trigger reinitiation.
(6) Activities in Wilderness	* PMRA as presented in the EA will be followed. The completion of the Wilderness Stewardship Plan may identify additional PMRA requirements; however, this will trigger reinitiation. Likewise, methods and tools outside the parameters of the PMRA would result in reinitiation.
(7) Minimum Impact Strategies and Tactics (MIST)	MIST (referred to as Mitigation Measures in this document) would continue to be used on all fire management activities.
(8) Resource Advisors	Assigned to wildfires based on the values at risk per Wildland Fire Decision Support System and Resource Advisor Guide.

(1) Fire management units

Under the proposed action, ONP would be divided into two FMUs: the Wilderness Unit (876,447 acres) and the Non-Wilderness Unit (46,204 acres). Each FMU follows a set of management strategies which affect the level and extent of actions to be taken.

Fire management of the Wilderness FMU would focus on maintaining the natural fire regime and preserving wilderness character, while including standards and limitations necessary to protect other natural, cultural, or infrastructure resources. Elevation ranges from near sea level to almost 8,000 feet. Ground access is difficult in many areas of the Wilderness FMU due to generally very steep slopes (many greater than 80 percent) and lack of roads or trails. The Wilderness FMU encompasses all vegetation zones and non-forested areas in higher elevations. Streams and rivers flow east toward Hood Canal, north into the Strait of Juan de Fuca, and west to the Pacific Ocean.

The Non-Wilderness FMU includes scattered clusters of human developments such as developed visitor use areas and administrative areas, and access roads. These developments can be immediately adjacent to the Wilderness FMU. The Non-Wilderness FMU would focus on protecting infrastructure, reducing the potential for wildfire to spread from, or to, adjacent lands, and may include components that enhance cultural or natural resource conditions. The elevation in the Non-Wilderness FMU ranges from sea level to about 7,200 feet and includes all vegetation zones except the Douglas-fir Zone.

(2) Wildfire Management

Wildfire Response

All unplanned natural and human-caused ignitions in the Non-Wilderness FMU would receive a suppression-oriented response to protect front-country developments and reduce the potential for wildfire to spread from, or to, adjacent lands. In the Wilderness FMU, naturally ignited wildfires would be evaluated through a deliberative risk analysis and systematic decision-making process using the Wildland Fire Decision Support System (WFDSS) to determine the appropriate response. A wildfire or portions of a wildfire in the Wilderness FMU may receive a suppression-oriented response to protect firefighter and public safety, and values at risk. In the Wilderness FMU, naturally ignited wildfire would be evaluated to protect, maintain, and enhance resources, and be allowed to function untrammeled in its natural ecological role to the extent practicable, in accordance with the current Guidance for Implementation of Federal Wildland Fire Management Policy (U.S. Department of the Interior and U.S. Department of Agriculture 2009).

Wildfire Suppression

In accordance with NPS Reference Manual 18, the "initial actions on human-caused wildfires will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety." Wildfire suppression strategies would continue to be implemented to curtail fire spread and minimize threats from an unwanted fire, either of human or natural origin. Depending on the location and nature of each fire, ground and/or aerial firefighting resources would be used to contain a fire to the smallest possible size. A range of fire suppression techniques would be used to break the continuity of forest fuels, cool a fire, and slow the advance of a flaming front. Actions may include construction of fire lines; cutting of vegetation; and application of water, foam, or retardant. The application of fire is another fire suppression technique that can be used to consume (burn up) fuels between the advancing wildfire and a constructed fireline.

Small wildfires would be suppressed using hand tools-sometimes supported with a chainsaw for cutting fuels, a fire engine (only in non-wilderness) or portable pump for delivering water, and/or a helicopter to transport water, supplies, and firefighters. Larger fires or fires with greater spread potential may require the use of drip torches, fuses, fireline explosives, or retardant-filled aircraft or extensive water drops. All wildfire suppression activities would provide for firefighter and public safety as the highest consideration, but minimize loss of resource values, economic expenditures, and the use of critical firefighting resources. Unmanned aircraft systems may be used to gather information regarding fire size and fire behavior, which would minimize noise impacts when compared to larger aircraft. Within wilderness, all proposed methods and tools would need to meet the parameters within the fire management programmatic Minimum Requirements Analysis (PMRA).

Other suppression actions include mop-up activities such as extinguishing or removing burning material near firelines, felling snags, trenching logs to prevent rolling after an area has burned to ensure control of the fire, or reducing residual smoke. Patrolling the area provides information to help prevent, detect, and suppress spot fires and hot spots beyond the fireline. Fire suppression could also involve vegetation clearing for helispots. Staging areas for equipment and fire crews, as well as incident command centers, would likely be established within the park in non-wilderness. Spike camps could be located in wilderness or non-wilderness. Electronic devices including but not limited to global positioning units for mapping and locating fires, and cell phones and portable radios for communications would be in use.

Fire suppression repair is a series of immediate post-fire actions taken to repair damage and minimize potential soil erosion and impacts resulting from fire suppression activities and usually begins before the fire is contained and before the demobilization of an Incident Management Team. This work would include the repair of firelines, roads, trails, safety zones, and drop points used during fire suppression efforts.

A Burned Area Emergency Response (BAER) team may be called in during or after the suppression effort to develop a plan to rehabilitate park resources impacted by wildfire. The BAER team would identify emergency threats to human life, property, and critical natural and cultural resources. Non-emergency, longer-term threats and damages to minor infrastructure would be addressed via Burned Area Rehabilitation (BAR). BAER/BAR treatments are developed based on impacts observed or anticipated. These may include treatments to address soil disturbance, erosion and compaction, sediments or excessive debris entering waterways, damage to roads and trails, spread of nonnative invasive plant species, damage to cultural resource sites, and hazardous trees near public use areas. BAER activities would likely require a stand-alone, minimum requirements analysis (MRA).

Retardants/Foams

The use of retardants in fire suppression within the park is rare, having last been used in 2003. They are only used when human life and safety are under imminent threat. Superintendent approval is required prior to their use and the chemical agents must be on an approved list for use by the USFS and DOI. Fire retardant is intended to be applied at distances greater than 300 feet from a waterway and often on the upper one third of slopes. Commonly used long-term retardants are Phos-Chek D75-F, Phos-Chek D75-R, and Fire-Trol GTS-R. These are mixtures of diammonium sulphate, diammonium phosphate, monoammonium phosphate, gum thickeners, iron oxide coloring agent, and preservatives. Long-term fire retardants are typically fertilizer salts which are mixed with water to ensure uniform dispersal. After the water has evaporated, the retardant remains effective until it is removed by rain or erosion. Chemicals form a combustion barrier after the evaporation of the water carrier, and their effectiveness depends on the amount of retardant per unit surface area. The ammonium salts chemically combine with cellulose as the fuels are heated, effectively removing the fuel. Short-term retardants may also be used and share characteristics of foam described below.

Foam is used more often than fire retardants in the park; however, its usage is still rare and requires superintendent approval. Foam is typically applied in conjunction with fire engines although it may be applied via helicopter bucket drops. Foam intrusion into buffers are rare because they are applied at smaller quantities and usually with ground resources. Foam may be applied to fires along roadways and around buildings and park structures. Unlike the long-term retardants which remain effective after the water has evaporated, foams (and short-term fire retardants) depend on the water they contain to retard or suppress the fire. Commonly used foams include Ansul Silv-Ex, Angus ForExpan S, Fire Quench, 3M Firebreak and Phos-Chek WD-881, and all contain surfactants, foaming, and wetting agents. The foaming agents affect the rate at which water drains from the foam, and how well it adheres to the fuel. The surfactants and wetting agents increase the ability of the drained water to penetrate fuels thus reducing their ability to ignite. Fuels are insulated from heat, and air contact is also reduced. These retardants lose their effectiveness once the water has evaporated or is drained from them. Foams are typically applied between 0.1 percent and 1.0 percent by volume. The NPS will only use federally approved retardants and foams.

Fire chemical use within floodplains, wetlands, and other sensitive areas would adhere to the Interagency Policy for Aerial and Ground Delivery of Wildland Fire Chemicals Near Waterways and Other Avoidance Areas, as described in Chapter 12 of the Interagency Standards for Fire and Fire Aviation Operations (US DOI 2018) or future revised version. To the fullest extent practicable, the following mitigation measures would be implemented (protecting human life and safety is the condition for variance):

- The use of chemicals would be avoided when there is a potential for contamination of waterways (based on proximity, wind direction, wind speed, size and frequency of loads, etc.).
- Actions would avoid the use of retardant or foam within 300 feet of streams or within designated critical habitat.
- The use of retardant should also be avoided in areas with oligotrophic lakes, bogs, or swamps as effects on aquatic biota may be prolonged.
- Consult with resource advisors (see section 8 below)
- No pumping directly from streams if chemical products are going to be injected into the pump or pumping system. If chemicals are needed, a fold-a-tank from which to pump water would be used.

Managing Wildfire for Multiple Objectives

Managing wildfire for multiple objectives, including resource benefit, is a strategy that is used to accomplish predetermined resource management objectives in specific geographic areas. In accordance with national federal wildfire policy, fire managers have the ability to implement a full range of strategic and tactical options in response to a wildfire. Naturally ignited wildfires are evaluated through deliberative risk analysis using the WFDSS process to determine the appropriate management response. The WFDSS analysis tool documents the decision to manage a naturally ignited wildfire, or part of a fire, for resource benefit and would depend on many factors including, but not limited to: firefighter and public safety, fire management unit objectives, fire cause, current and predicted weather, current and potential fire behavior and effects, proximity to private land and park infrastructure, resource availability, and cost effectiveness.

Depending on the anticipated consequences and management objectives for the area that is likely to burn, any one or a combination of the following strategic and tactical actions may be chosen: a) full suppression- a strategy developed to achieve control of a fire and prevent it from exceeding a defined perimeter; b) point/zone protection - suppression actions taken to protect a specific point or area from fire, usually by directing the fire movement away from identified values at risk; and c) monitor/confine/contain – a management strategy that periodically checks the fire to ensure objectives are being met. These strategies may change in time and space in response to given and anticipated conditions, and subsequent effect of fire.

An appropriate response could include aggressive suppression on one portion of the fire and monitoring another portion of the same fire. All actions related to managing wildfire for multiple objectives would be monitored to protect human life, property, and natural and cultural resources. Some wildfires would only be monitored due to the wildfire's location and risk. In these cases, no on-the-ground operations would occur. If a wildfire managed for multiple objectives no longer meets the desired objectives or if external concerns (e.g., multiple new starts in the area) make it inadvisable to continue the action, the fire would be considered an unwanted fire and the WFDSS decision would be updated to incorporate changes in strategy.

Managing wildfires for multiple objectives would be used to allow fire to function in its natural ecological role; maintain natural fire regimes; and protect, maintain, and enhance resources. This strategy requires continuous monitoring, implementing Minimum Impact Strategies and Tactics (MIST), and use of resource advisors to ensure that impacts to critical natural and cultural resources are minimized. Wildfires managed for multiple objectives would not be allowed to cross the park boundary without agreement from the adjacent jurisdictional agency.

Managing wildfire for multiple objectives, including resource benefit, under the proposed action would provide fire managers with the flexibility to adapt to changes in the environment and updates in wildfire management policy. In response to data collected on ONP wilderness wildfires and changes in fire behavior and fire size in recent years, an average of 1,200 acres per year of naturally ignited wildfire may be managed for resource benefit within the Wilderness FMU under the proposed action (Figure 1). This strategy allows for the natural process of wildland fire in the Olympic Range to be managed across the NPS and US Forest Service boundaries, creating increased heterogeneity of forest stand structure, in order to promote a more resilient landscape and reduce the spatial extent of high-intensity stand replacement wildfire that could severely alter the habitat of federally listed species.

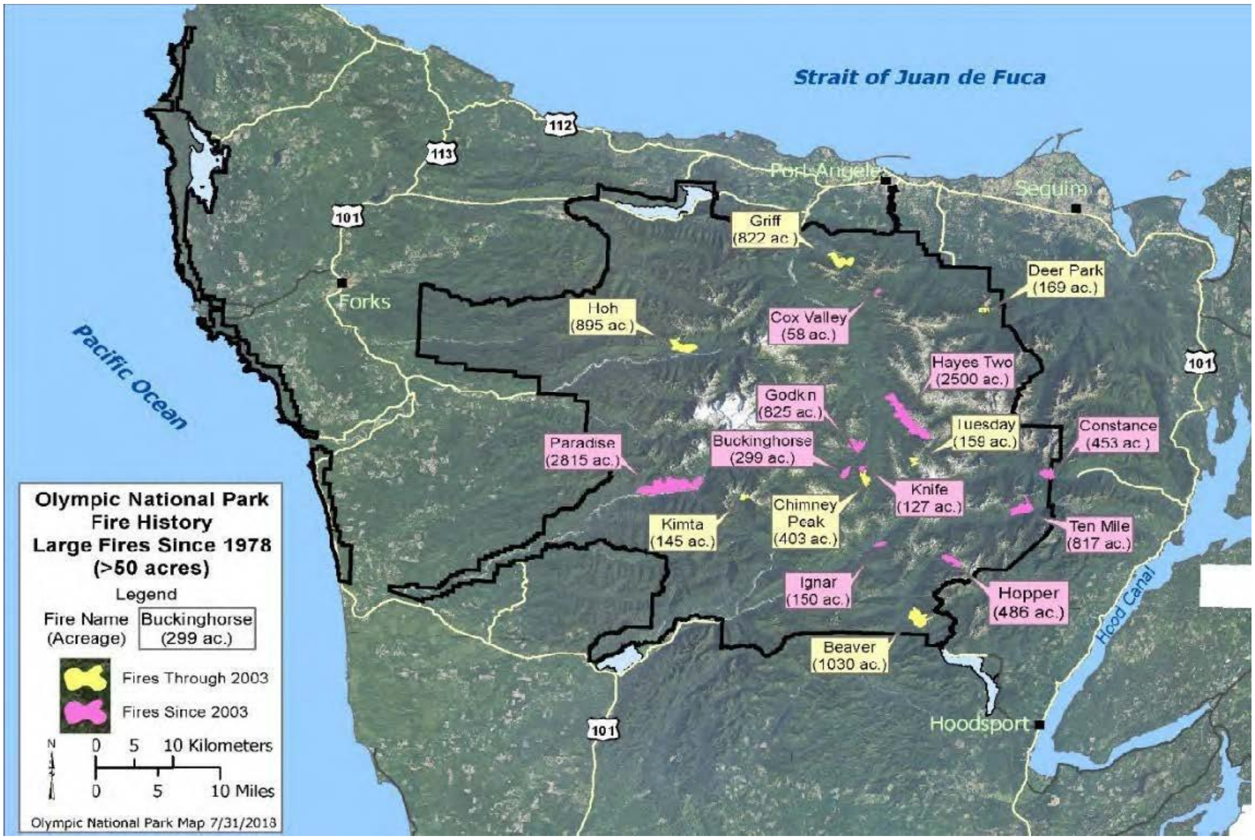

Figure 1. Large wildfires within the park between 1938 to present

(3) <u>Manual and Mechanical Treatments</u>
Manual and mechanical treatments include the use of hand-operated power tools and hand tools and specialized equipment to cut, clear, or prune herbaceous and woody species. In the park, manual and mechanical treatments have been used to remove excess woody debris from the ground; to remove "ladder" fuels, such as low limbs and brush which could carry fire from the forest floor into the crowns of trees; and to thin dense stands of trees in order to reduce the horizontal continuity of fuels. Occasionally, larger equipment (e.g., boom truck, front end loader) would be used to move large boles and build burn piles. Large equipment would be restricted from driving off road unless included in a work plan and approved by the superintendent. These actions are to be used as a preventative measure to reduce hazard fuels and provide defensible space around administrative sites, historic structures, wildland-urban interface communities, and roadways. Hazard fuel reduction around structures would reduce the likelihood of ignition, potentially reduce fire intensity and resistance to control, and lessen potential fire damage. The distance to be treated around each structure would vary from 0 to 250 feet and would depend on several factors including: size and value of the structure, historic significance, proximity to aquatic resources or important habitat, characteristics of local fuels (height, loading, flammability), wilderness character, visitor use of the area, and proximity to neighboring properties.

The park's interdisciplinary team would prioritize hazardous fuel reduction projects based on the following criteria: degree of hazard, proximity to values at risk, logical project sequence, coordination with adjacent efforts and land managers, environmental effects, and maintenance cycle. In the Wilderness FMU, manual or mechanical fuel treatments may be used in accordance with the PMRA when park infrastructure is in immediate risk from wildfires. The risk to individual structures outside wilderness would be rated using the International Code Council's International Urban-Wild/and Interface Code (2015), a standard adopted by the NPS. The code identifies defensible space and maintenance requirements for wildland-urban interface areas.

At each site, the area closest to the structure, also known as defensible space, would receive the most intense fuel reduction, with subsequent grading to lighter treatments further from the structure. Due to the rapid growth of some tree species in this environment, some trees next to park structures may have grown relatively large since the establishment of the structure. In some cases, these trees create a fuel hazard because their limbs impinge on the structure or create a closed canopy adjacent to the structure where fire could move easily from crown to crown or from crown to structure. To balance concern over hazard fuels with concern for protecting old-growth trees, an interdisciplinary team would evaluate individual large trees. According to Franklin and Spies (1991), the density of shade-tolerant individuals larger than 16-inches diameter at breast height (DBH) in groups of at least 10 distinguish old growth from younger stands. Therefore, for the purposes of this plan, trees larger than 16 inches DBH would be considered components of old-growth stands, and would not be cut without specific evaluation by an interdisciplinary team.

Manual and mechanical treatments would occur on a cyclic basis to maintain lower fuel loads within the developed areas in the park. There are a large number of private properties within the park boundary where private landowners may accomplish fuel maintenance on their own lands.

Thinned fuels would be used by the park for other projects, piled and burned in place, chipped on-site, or moved to another location such as a burn pit. The method of disposal depends on the logistics and character of the individual site. For example, material would be hauled away if there is no safe location to burn the thinned fuels or to avoid visual impacts from burned areas. After the initial treatment, most structures need regularly scheduled inspections to evaluate the need for vegetation retreatments to maintain defensible space. The maintenance treatments would primarily involve the use of hand tools such as loppers and D-ring brushers.

Under the proposed action, in the Non-Wilderness FMU, up to 100 acres per year of mechanical and manual treatment could be implemented as a preventative measure to reduce hazardous fuels and provide defensible space around developments and infrastructure. In the Wilderness FMU, manual or mechanical fuel treatments may be used in accordance with the PMRA when park infrastructure is in immediate risk from wildfires. In some cases, vegetation clearing may be required in addition to other structure protection activities, such as covering the structure with fire-resistant wrap or foam.

(4) <u>Prescribed Fire: Pile Burning and Debris Disposal</u>
Pile burning would be used to dispose of vegetative material that has been concentrated from manual and mechanical treatments for hazard fuel reduction or maintenance projects (i.e., cleaning up windfall debris from roads). Pile burning would occur in locations within the wildland environment and would follow the guidelines in NPSs' Reference Manual 18: Wildland

Fire Management (NPS 2014). A prescribed fire plan for each applicable pile burning activity would be prepared in advance, as described in the Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide (National Wildfire Coordinating Group 2017). Any material being burned for debris disposal must be classified as permissible to burn under applicable federal, state, and local regulations. Under the proposed action, a maximum of 20 acres per year of pile burning and debris disposal by fire that would occur within the Non-Wilderness FMU.

(5) Prescribed Fire: Broadcast Burning

The potential for prescribed fire in the Wilderness FMU is dependent on the decisions made in the park's forthcoming Wilderness Stewardship Plan. This Opinion does not provide coverage for this action and further compliance and consultation would be required to implement broadcast burns in either FMU. Therefore, this action is not described further.

(6) Activities in Wilderness

A PMRA has been developed to guide fire management activities in wilderness. Any fire management activities not listed in the PMRA require a separate MRA, approved by the superintendent prior to implementation. The Olympic National Park will reinitiate consultation with NOAA when a separate MRA is developed. Programs or activities requiring a separate MRA include proposed pre-wildfire fuels treatment, post-wildfire programs/activities (i.e., emergency stabilization, rehabilitation, restoration), prescribed fire, and fire activities (including long duration fire activities) within wilderness that are outside the scope of the PMRA. Though unlikely, if debris pile burning is proposed within the wilderness, a separate MRA is also required. Methods and tools outside the parameters of this PMRA require a separate MRA, including fireline explosives, remote satellite internet communications (e.g., satellite dish, WiFi), generators (including those for powering communications), safety zone clearing, and the use of markers for fire ecological monitoring other than wood or buried metal (e.g., small metal bars and magnets), or any markers for long-term monitoring (>2 years). Though only to be considered under extreme and rare circumstances in wilderness, a separate MRA would be required for use of heavy earth-moving equipment such as graders, bulldozers, or other tracked vehicles.

The majority of proposed long-duration fire activities within wilderness would likely fit within the scope of this PMRA. Any long-duration fire activities not approved within the PMRA, however, would require an incident-specific MRA to evaluate those tools and/or strategies. This may be triggered when there is an increase in operational activities as management action points are reached and an increase in personnel, equipment, and fireline construction is proposed that would go beyond the parameters within the PMRA. Prior approval by the park superintendent would be required in the form of a signed MRA specific to the event. Post-fire programs or activities (i.e., BAER, BAR) would also require separate MRAs.

(7) Minimum Impact Strategies and Tactics (MIST)

MIST (referred to as mitigation measures below) are incorporated into the planning and implementation phases of the proposed action. The objective of using MIST is to reduce resource damage from fire management actions, while minimizing costs and providing for firefighter and public safety. MIST is a framework for conducting fire management actions by selecting strategies that cause the least impact on resources while allowing for the management of the fire's existing or potential behavior. Like the philosophy behind the MRA, which is required to assess an appropriate tool for use in wilderness, MIST directs firefighters to use the minimum tool in terms of resource impact to safely and effectively accomplish a task.

Prevention and Education
Fire information would continue to be communicated to the public through interpretive programs, NPS brochures, park films, press releases, social media, and the park website. This includes, but is not limited to, educational information, the dissemination of information regarding fire prevention and fire management projects, and the role of fire in the ecosystem.

(8) Resource Advisors
The NPS would assign resource advisor(s) to an incident as dictated by values at risk, the Resource Advisor guides, and WFDSS. Resource advisors would provide input in the development and implementation of fire strategies and tactics to minimize or mitigate the expected impacts of fire and fire suppression actions on natural and cultural resources. A resource advisor would be consulted and/or assigned to each wildfire in wilderness or likely to burn into wilderness. The resource advisor's duties during the incident would include comparing proposed management strategies and tactics with the limits established for each element/action of the assigned wilderness wildfire strategies (i.e. the wilderness minimum requirement guidelines for methods and tools in the PMRA).

Mitigation Measures (referenced as MIST in the request for consultation)

The NPS intends to implement the following mitigation measures:

- Avoid or minimize sediment disturbance when removing water from any drainage and/or when working in or around drainages or natural surface water.
- Not draw water for fire suppression from streams, ponds, and other open water bodies unless human life and safety are under immediate threat.
- Have containment pads in position during all refueling of equipment.
- Ensure equipment is free of any fluid leaks (fuel, oil, hydraulic fluid, etc.) upon arrival to the work site and will be inspected at the beginning of each shift for leaks. Leaking equipment will be removed for necessary repairs before the commencement of work.
- Minimize or avoid stream course disturbance, sedimentation, and actions that will result in increased water temperature.
- Maintain a riparian buffer as determined necessary by a resource adviser to meet the site prescription requirements during an incident. Management requirements and/or incident requirements would be included in the WFDSS decision to mitigate impacts to the identified riparian zones.
- Use fire retardant only if human life and safety are under imminent threat. Furthermore, fire chemical use within floodplains, wetlands, and other sensitive areas would adhere to the Interagency Policy for Aerial and Ground Delivery of Wildland Fire Chemicals Near Waterways and Other Avoidance Areas, as described in Chapter 12 of the Interagency Standards for Fire and Fire Aviation Operations (USDOI and USDA 2018) or future revised version. Use of chemicals will be avoided when there is a potential for contamination of waterways (based on proximity, wind direction, wind speed, size and

frequency of loads, etc.), unless conditions create immediate risk to life or property. Retardant or foam will not be used within 300 feet of streams or within designated critical habitat unless human life and safety are under imminent threat. Use of retardant would also be avoided in areas with oligotrophic lakes, bogs, or swamps as effects on aquatic biota may be prolonged. If a condition requires an intrusion within this buffer ONP will consult with resource advisors. ONP will not pump directly from streams if chemical products are going to be injected into the pump or pumping system; if chemicals are needed, they will use a fold-a-tank from which to pump water.

- To the extent possible, limit the number of locations where water would be removed from salmon bearing streams for helicopter buckets and water pump operations. ONP biologists could provide a list of these waterways. Firefighter and public safety will always take precedence, and if helicopter drops are needed, they will be utilized.
- Ensure that intakes for pumps are screened following the most recent guidance from the NMFS Northwest Region "Anadromous Salmonid Passage Facility Design" guidance.[1]

NMFS notes here that the annual extent vegetation/fuel reduction efforts via controlled burn or hand or mechanical removal may vary but that the average annual reduction from both methods is expected to be 5 acres of riparian habitat, with 600 linear feet of stream-adjacent habitat affected.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and/or an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of" a listed species, which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

[1] https://www.westcoast.fisheries.noaa.gov/publications/hydropower/fish_passage_design_criteria.pdf

This biological opinion also relies on the regulatory definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designations of critical habitat for Puget Sound Chinook salmon, Puget Sound steelhead, and Ozette Lake sockeye uses the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and in this Opinion, we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the range wide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest an RPA to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. Major ecological realignments are already occurring in response to climate change (IPCC WGII, 2022). Long-term trends in warming have continued at global, national and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 (IPCC WGI, 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI, 2021). Globally, 2014-2018 were the 5 warmest years on record both on land and in the ocean (2018 was the 4th warmest) (NOAA NCEI 2022). Events such as the 2013-2016 marine heatwave (Jacox et al. 2018) have been attributed directly to anthropogenic warming in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC WGII 2022). These two factors are often examined in isolation, but likely have interacting effects on ecosystem function.

Updated projections of climate change are similar to or greater than previous projections (IPCC WGI, 2021). NMFS is increasingly confident in our projections of changes to freshwater and marine systems because every year brings stronger validation of previous predictions in both physical and biological realms. Retaining and restoring habitat complexity, access to climate refuges (both flow and temperature) and improving growth opportunity in both freshwater and marine environments are strongly advocated in the recent literature (Siegel and Crozier 2020).

Climate change is systemic, influencing freshwater, estuarine, and marine conditions. Other systems are also being influenced by changing climatic conditions. Literature reviews on the impacts of climate change on Pacific salmon (Crozier 2015, 2016, 2017, Crozier and Siegel 2018, Siegel and Crozier 2019, 2020) have collected hundreds of papers documenting the major themes relevant for salmon. Here we describe habitat changes relevant to Pacific salmon and steelhead, prior to describing how these changes result in the varied specific mechanisms impacting these species in subsequent sections.

Forests

Climate change will impact forests of the western U.S., which dominate the landscape of many watersheds in the region. Forests are already showing evidence of increased drought severity, forest fire, and insect outbreak (Halofsky et al. 2020). Additionally, climate change will affect tree reproduction, growth, and phenology, which will lead to spatial shifts in vegetation. Halofsky et al. (2018) projected that the largest changes will occur at low- and high-elevation forests, with expansion of low-elevation dry forests and diminishing high-elevation cold forests and subalpine habitats.

Forest fires affect salmon streams by altering sediment load, channel structure, and stream temperature through the removal of canopy. Holden et al. (2018) examined environmental factors contributing to observed increases in the extent of forest fires throughout the western U.S. They found strong correlations between the number of dry-season rainy days and the annual extent of forest fires, as well as a significant decline in the number of dry-season rainy days over the study period (1984-2015). Consequently, predicted decreases in dry-season precipitation, combined with increases in air temperature, will likely contribute to the existing trend toward more extensive and severe forest fires and the continued expansion of fires into higher elevation and wetter forests (Alizedeh 2021).

Agne et al. (2018) reviewed literature on insect outbreaks and other pathogens affecting coastal Douglas-fir forests in the Pacific Northwest and examined how future climate change may influence disturbance ecology. They suggest that Douglas-fir beetle and black stain root disease could become more prevalent with climate change, while other pathogens will be more affected by management practices. Agne et al. (2018) also suggested that due to complex interacting effects of disturbance and disease, climate impacts will differ by region and forest type.

Freshwater Environments

The following is excerpted from Siegel and Crozier (2019), who present a review of recent scientific literature evaluating effects of climate change, describing the projected impacts of climate change on instream flows:

Cooper et al. (2018) examined whether the magnitude of low river flows in the western U.S., which generally occur in September or October, are driven more by summer conditions or the prior winter's precipitation. They found that while low flows were more sensitive to summer evaporative demand than to winter precipitation, interannual variability in winter precipitation was greater. Malek et al. (2018), predicted that summer evapotranspiration is likely to increase in conjunction with declines in snowpack and increased variability in winter precipitation. Their results suggest that low summer flows are likely to become lower, more variable, and less predictable.

The effect of climate change on ground water availability is likely to be uneven. Sridhar et al. (2018) coupled a surface-flow model with a ground-flow model to improve predictions of surface water availability with climate change in the Snake River Basin. Projections using RCP 4.5 and 8.5 emission scenarios suggested an increase in water table heights in downstream areas of the basin and a decrease in upstream areas.

As cited in Siegel and Crozier (2019), Isaak et al. (2018), examined recent trends in stream temperature across the Western U.S. using a large regional dataset. Stream warming trends paralleled changes in air temperature and were pervasive during the low-water warm seasons of 1996-2015 (0.18-0.35°C/decade) and 1976-2015 (0.14-0.27°C/decade). Their results show how continued warming will likely affect the cumulative temperature exposure of migrating sockeye salmon *O. nerka* and the availability of suitable habitat for brown trout *Salmo trutta* and rainbow trout *O. mykiss*. Isaak et al. (2018) concluded that most stream habitats will likely remain suitable for salmonids in the near future, with some becoming too warm. However, in cases where habitat access is currently restricted by dams and other barriers salmon and steelhead will be confined to downstream reaches typically most at risk of rising temperatures unless passage is restored (FitzGerald et al. 2020, Myers et al. 2018).

Streams with intact riparian corridors and that lie in mountainous terrain are likely to be more resilient to changes in air temperature. These areas may provide refuge from climate change for a number of species, including Pacific salmon. Krosby et al. (2018), identified potential stream refugia throughout the Pacific Northwest based on a suite of features thought to reflect the ability of streams to serve as such refuges. Analyzed features include large temperature gradients, high canopy cover, large relative stream width, low exposure to solar radiation, and low levels of human modification. They created an index of refuge potential for all streams in the region, with mountain area streams scoring highest. Flat lowland areas, which commonly contain migration corridors, were generally scored lowest, and thus were prioritized for conservation and restoration. However, forest fires can increase stream temperatures dramatically in short time-spans by removing riparian cover (Koontz et al. 2018), and streams that lose their snowpack with climate change may see the largest increases in stream temperature due to the removal of temperature buffering (Yan et al. 2021). These processes may threaten some habitats that are currently considered refugia.

Marine and Estuarine Environments

Along with warming stream temperatures and concerns about sufficient groundwater to recharge streams, a recent study projects nearly complete loss of existing tidal wetlands along the U.S. West Coast, due to sea level rise (Thorne et al. 2018). California and Oregon showed the greatest threat to tidal wetlands (100%), while 68% of Washington tidal wetlands are expected to be submerged. Coastal development and steep topography prevent horizontal migration of most wetlands, causing the net contraction of this crucial habitat.

Rising ocean temperatures, stratification, ocean acidity, hypoxia, algal toxins, and other oceanographic processes will alter the composition and abundance of a vast array of oceanic species. In particular, there will be dramatic changes in both predators and prey of Pacific salmon, salmon life history traits and relative abundance. Siegel and Crozier (2019) observe that changes in marine temperature are likely to have a number of physiological consequences on fishes themselves. For example, in a study of small planktivorous fish, Gliwicz et al. (2018) found that higher ambient temperatures increased the distance at which fish reacted to prey. Numerous fish species (including many tuna and sharks) demonstrate regional endothermy, which in many cases augments eyesight by warming the retinas. However, Gliwicz et al. (2018) suggest that ambient temperatures can have a similar effect on fish that do not demonstrate this trait. Climate change is likely to reduce the availability of biologically essential omega-3 fatty acids produced by phytoplankton in marine ecosystems. Loss of these lipids may induce cascading trophic effects, with distinct impacts on different species depending on compensatory mechanisms (Gourtay et al. 2018). Reproduction rates of many marine fish species are also likely to be altered with temperature (Veilleux et al. 2018). The ecological consequences of these effects and their interactions add complexity to predictions of climate change impacts in marine ecosystems.

Perhaps the most dramatic change in physical ocean conditions will occur through ocean acidification and deoxygenation. It is unclear how sensitive salmon and steelhead might be to the direct effects of ocean acidification because of their tolerance of a wide pH range in freshwater (although see Ou et al. 2015 and Williams et al. 2019), however, impacts of ocean acidification and hypoxia on sensitive species (e.g., plankton, crabs, rockfish, groundfish) will likely affect salmon indirectly through their interactions as predators and prey. Similarly, increasing frequency and duration of harmful algal blooms may affect salmon directly, depending on the toxin (e.g., saxitoxin vs domoic acid), but will also affect their predators (seabirds and mammals). The full effects of these ecosystem dynamics are not known but will be complex. Within the historical range of climate variability, less suitable conditions for salmonids (e.g., warmer temperatures, lower streamflows) have been associated with detectable declines in many of these listed units, highlighting how sensitive they are to climate drivers (Ford 2022, Lindley et al. 2009, Williams et al. 2016, Ward et al. 2015). In some cases, the combined and potentially additive effects of poorer climate conditions for fish and intense anthropogenic impacts caused the population declines that led to these population groups being listed under the ESA (Crozier et al. 2019).

Climate change effects on salmon and steelhead

In freshwater, year-round increases in stream temperature and changes in flow will affect physiological, behavioral, and demographic processes in salmon, and change the species with which they interact. For example, as stream temperatures increase, many native salmonids face increased competition with more warm-water tolerant invasive species. Changing freshwater temperatures are likely to affect incubation and emergence timing for eggs, and in locations where the greatest warming occurs may affect egg survival, although several factors impact intergravel temperature and oxygen (e.g., groundwater influence) as well as sensitivity of eggs to thermal stress (Crozier et al. 2020). Changes in temperature and flow regimes may alter the amount of habitat and food available for juvenile rearing, and this in turn could lead to a restriction in the distribution of juveniles, further decreasing productivity through density dependence. For migrating adults, predicted changes in freshwater flows and temperatures will likely increase exposure to stressful temperatures for many salmon and steelhead populations, and alter migration travel times and increase thermal stress accumulation for ESUs or DPSs with early-returning (i.e. spring- and summer-run) phenotypes associated with longer freshwater holding times (Crozier et al. 2020, FitzGerald et al. 2020). Rising river temperatures increase the energetic cost of migration and the risk of *en route* or pre-spawning mortality of adults with long freshwater migrations, although populations of some ESA-listed salmon and steelhead may be able to make use of cool-water refuges and run-timing plasticity to reduce thermal exposure (Keefer et al. 2018, Barnett et al. 2020).

Marine survival of salmonids is affected by a complex array of factors including prey abundance, predator interactions, the physical condition of salmon within the marine environment, and carryover effects from the freshwater experience (Holsman et al. 2012, Burke et al. 2013). It is generally accepted that salmon marine survival is size-dependent, and thus larger and faster growing fish are more likely to survive (Gosselin et al. 2021). Furthermore, early arrival timing in the marine environment is generally considered advantageous for populations migrating through the Columbia River. However, the optimal day of arrival varies across years, depending on the seasonal development of productivity in the California Current, which affects prey available to salmon and the risk of predation (Chasco et al. 2021). Siegel and Crozier (2019) point out the concern that for some salmon populations, climate change may drive mismatches between juvenile arrival timing and prey availability in the marine environment. However, phenological diversity can contribute to metapopulation-level resilience by reducing the risk of a complete mismatch. Carr-Harris et al. (2018), explored phenological diversity of marine migration timing in relation to zooplankton prey for sockeye salmon *O. nerka* from the Skeena River of Canada. They found that sockeye migrated over a period of more than 50 days, and populations from higher elevation and further inland streams arrived in the estuary later, with different populations encountering distinct prey fields. Carr-Harris et al. (2018) recommended that managers maintain and augment such life-history diversity.

Synchrony between terrestrial and marine environmental conditions (e.g., coastal upwelling, precipitation and river discharge) has increased in spatial scale causing the highest levels of synchrony in the last 250 years (Black et al. 2018). A more synchronized climate combined with simplified habitats and reduced genetic diversity may be leading to more synchrony in the productivity of populations across the range of salmon (Braun et al. 2016). For example, salmon productivity (recruits/spawner) has also become more synchronized across Chinook populations from Oregon to the Yukon (Dorner et al. 2018, Kilduff et al. 2014). In addition, Chinook salmon have become smaller and younger at maturation across their range (Ohlberger 2018). Other Pacific salmon species (Stachura el al. 2014) and Atlantic salmon (Olmos et al. 2020) also have demonstrated synchrony in productivity across a broad latitudinal range.

At the individual scale, climate impacts on salmon in one life stage generally affect body size or timing in the next life stage and negative impacts can accumulate across multiple life stages (Healey 2011; Wainwright and Weitkamp 2013, Gosselin et al. 2021). Changes in winter precipitation will likely affect incubation and/or rearing stages of most populations. Changes in the intensity of cool season precipitation, snow accumulation, and runoff could influence migration cues for fall, winter and spring adult migrants, such as coho and steelhead. Egg survival rates may suffer from more intense flooding that scours or buries redds. Changes in hydrological regime, such as a shift from mostly snow to more rain, could drive changes in life history, potentially threatening diversity within an ESU (Beechie et al. 2006). Changes in summer temperature and flow will affect both juvenile and adult stages in some populations, especially those with yearling life histories and summer migration patterns (Crozier and Zabel 2006; Crozier et al. 2010, Crozier et al. 2019).

At the population level, the ability of organisms to genetically adapt to climate change depends on how much genetic variation currently exists within salmon populations, as well as how selection on multiple traits interact, and whether those traits are linked genetically. While genetic diversity may help populations respond to climate change, the remaining genetic diversity of many populations is highly reduced compared to historic levels. For example, Johnson et al. (2018), compared genetic variation in Chinook salmon from the Columbia River Basin between contemporary and ancient samples. A total of 84 samples determined to be Chinook salmon were collected from vertebrae found in ancient middens and compared to 379 contemporary samples. Results suggest a decline in genetic diversity, as demonstrated by a loss of mitochondrial haplotypes as well as reductions in haplotype and nucleotide diversity. Genetic losses in this comparison appeared larger for Chinook from the mid-Columbia than those from the Snake River Basin. In addition to other stressors, modified habitats and flow regimes may create unnatural selection pressures that reduce the diversity of functional behaviors (Sturrock et al. 2020). Managing to conserve and augment existing genetic diversity may be increasingly important with more extreme environmental change (Anderson et al. 2015), though the low levels of remaining diversity present challenges to this effort (Freshwater 2019). Salmon historically maintained relatively consistent returns across variation in annual weather through the portfolio effect (Schindler et al. 2015), in which different populations are sensitive to different climate drivers. Applying this concept to climate change, Anderson et al (2015) emphasized the additional need for populations with different physiological tolerances. Loss of the portfolio increases volatility in fisheries, as well as ecological systems, as demonstrated for Fraser River and Sacramento River stock complexes (Freshwater et al. 2019, Munsch et al. 2022).

2.2.1 Status of the Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging).

For most salmon, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

A summary (NOAA 2005) of the status of critical habitats, considered in this opinion, is provided in Table 2.

Table 2. Critical habitat, designation date, federal register citation and status summary for critical habitat

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Puget Sound Chinook salmon	9/02/05 70 FR 52630	Critical habitat for Puget Sound Chinook salmon includes 1,683 miles of streams, 41 square mile of lakes, and 2,182 miles of nearshore marine habitat in Puget Sounds. The Puget Sound Chinook salmon evolutionarily significant unit (ESU) has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and eight received a medium rating. Of the marine areas, all 19 are ranked with high conservation value.
Puget Sound steelhead	2/24/16 81 FR 9252	Critical habitat for Puget Sound steelhead includes 2,031 stream miles. Nearshore and offshore marine waters were not designated for this species. There are 66 watersheds within the range of this DPS. Nine watersheds received a low conservation value rating, 16 received a medium rating, and 41 received a high rating to the DPS.
Lake Ozette sockeye salmon	9/02/05 70 FR 52630	Critical habitat is comprised of a single subbasin containing a single watershed, Ozette Lake Subbasin located in Clallam County, Washington. It encompasses approximately 101 mi2 and approximately 317 miles of streams; Ozette Lake, the dominant feature of the watershed, is entirely located within the Olympic National Park. This single watershed is rated high conservation value.

2.2.2 Status of the Species

Table 3 provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. These documents are available on the NMFS West Coast Region website (http://www.westcoast.fisheries.noaa.gov/), and are incorporated into this Opinion. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), TRT (Technical Recovery Team), and VSP (Viable Salmonid Population).

Table 3. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Puget Sound Chinook salmon	Threatened 6/28/05 (70 FR 37159)	Shared Strategy for Puget Sound 2007 NMFS 2006	NMFS 2016; Ford 2022	This ESU comprises 22 populations distributed over five geographic areas. All Puget Sound Chinook salmon populations continue to remain well below the TRT planning ranges for recovery escapement levels. Most populations also remain consistently below the spawner–recruit levels identified by the TRT as necessary for recovery. Across the ESU, most populations have increased somewhat in abundance since the last status review in 2016, but have small negative trends over the past 15 years. Productivity remains low in most populations. Overall, the Puget Sound Chinook salmon ESU remains at “moderate” risk of extinction.	• Degraded floodplain and in-river channel structure • Degraded estuarine conditions and loss of estuarine habitat • Degraded riparian areas and loss of in-river large woody debris • Excessive fine-grained sediment in spawning gravel • Degraded water quality and temperature • Degraded nearshore conditions • Impaired passage for migrating fish • Severely altered flow regime
Puget Sound Steelhead	Threatened 5/11/07	NMFS 2019	NMFS 2016; Ford 2022	This DPS comprises 32 populations. Viability of has improved somewhat since the PSTRT concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 DIPs (Hard et al. 2015). Increases in spawner abundance were observed in a number of populations over the last five years within the Central & South Puget Sound and the Hood Canal & Strait of Juan de Fuca MPGs, primarily among smaller populations. There were also declines for summer- and winter-run populations in the Snohomish River basin. In fact, all summer-run steelhead populations in the Northern Cascades MPG are likely at a very high demographic risk.	• Continued destruction and modification of habitat • Widespread declines in adult abundance despite significant reductions in harvest • Threats to diversity posed by use of two hatchery steelhead stocks • Declining diversity in the DPS, including the uncertain but weak status of summer-run fish • A reduction in spatial structure • Reduced habitat quality • Urbanization Dikes, hardening of banks with riprap, and channelization

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lake Ozette sockeye salmon	Threatened 6/28/05	NMFS 2009a	NMFS 2022; Ford 2022	There are sufficient data to determine that the total Ozette Lake abundance is well below the desired lower bound, although the population has increased since the last review and over the past 15 years. Over the last few decades, productivity for the total Ozette Lake population has exhibited a 10–20-year cyclical pattern alternating between negative and positive values. Average rates over the last five- and 15-year periods have been slightly positive, although we may be entering a negative phase. Overall, the Ozette Lake sockeye salmon ESU therefore has mixed viability trends, and is likely at "moderate-to-high" risk of extinction.	• Predation by harbor seals, river otters, and predaceous non-native and native species of fish • Reduced quality and quantity of beach spawning habitat in Lake Ozette • Increased competition for beach spawning sites due to reduced habitat availability • Stream channel simplification and increased sediment in tributary spawning areas

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The action area affected by the proposed project is all lands that occur within the ONP and adjacent areas potentially affected by the proposed work (outlined in red, Figure 2). Here, we expect that adjacent areas would include a buffer for potential downwind drift of dropped fire retardants, which we assume for the purposes of this analysis to be 100 feet beyond park boundaries. ONP is a national park located on the Olympic Peninsula covering over 900,000 acres. The park has four regions: the Pacific coastline, alpine areas, the west side temperate rainforest and the forests of the drier east side. The majority of the park lies in the center of the peninsula but an additional sliver lies along the Pacific Coast from just south of Kalaloch to just north of the town of Ozette.

For ESA listed anadromous fish species affected by the proposed action, the action area includes all waterways within the park and extends two miles downstream from the park boundary in the Elwha, Greywolf, Dosewallips, Duckabush, Hamma, and North Fork Skokomish rivers. The action area occurs in Clallam, Jefferson, Grays Harbor, and Mason Counties on the Olympic Peninsula in Washington State. This area serves as spawning, rearing, and migration habitat for PS Chinook, PS steelhead, and Lake Ozette sockeye salmon. A broader area of the entire park is analyzed for EFH for Chinook, coho, and Puget Sound pink salmon.

Figure 2. Action area (red outline) depicting ONP wilderness in light green, and ONP Non-wilderness in bright yellow

2.4 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

The rivers in the action area are subject to a myriad of anthropogenic factors that influence baseline conditions in watersheds throughout. The following information provides background on general watershed basin conditions in the action area. Figure 3 shows land ownership patterns and watersheds.

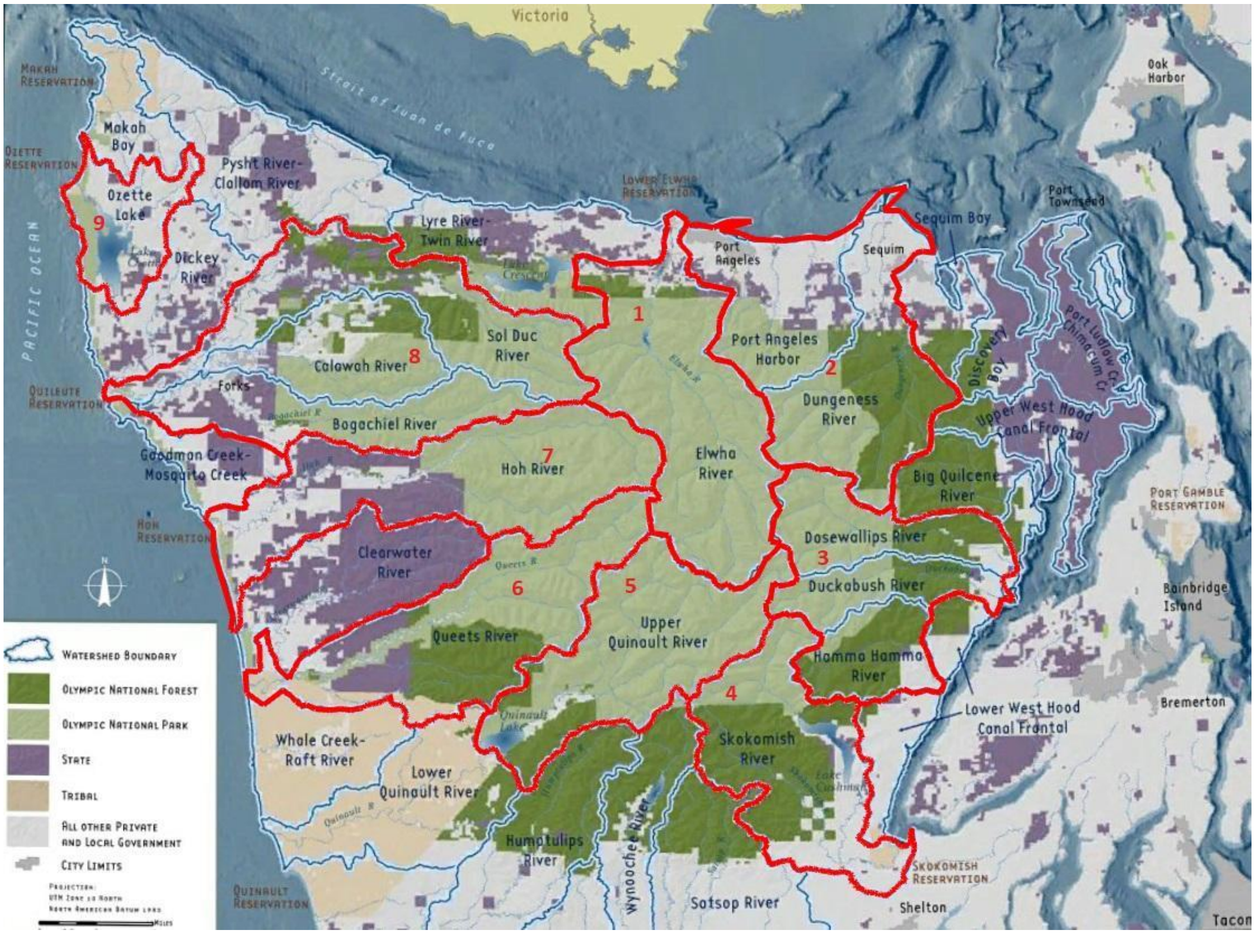

Figure 3. Land ownership and watershed boundaries in the action area (Note: the Action Area is limited to Olympic National Park and adjacent areas affected)

(1) Elwha River Basin – Elwha River

The Elwha River is located within the boundaries of the action area. Habitat conditions in the upper river are excellent. Construction of the Elwha Dam in 1910, and subsequent construction of Glines Canyon Dam upstream, excluded anadromous salmonids from approximately 70 miles of mainstem habitat and all tributary habitat. However, the Elwha Dam was completely dismantled in March 2012. The removal of the Glines Canyon Dam was completed in August 2014. Salmon will naturally recolonize the 70 miles of habitat previously inaccessible in the Elwha River. The area once under the reservoirs is being revegetated to prevent erosion and speed up ecological restoration of the area. Because almost all of the Elwha's watershed is in a national park, the river is relatively pristine, with few of the issues of agricultural runoff and water heating that affect other salmon river habitat in the Pacific Northwest. Model projections by the Park Service show that up to 392,000 fish will fill 70 miles of habitat, theoretically matching the "pre-dam peak" (Yardley 2011).

Nine runs of migratory fish species, to include Chinook and steelhead, were documented upstream of the Elwha Dam within 31 months of removal (Duda et al., 2021). Within 60 months these species were documented upstream of the Glines Canyon Dam location.

By late December 2012, about 10 percent of the estimated 25,000,000 cubic yards of sediment that had been caught behind the river's two dams had collected at the Elwha's mouth, forming sandbars. With the Elwha Dam removed, the sediment had been pushed downstream as heavy rainfall produced faster-moving flows in the free-running river. By November 2014, 30 percent of the stored sediment had been carried to the mouth of the river, creating 70 acres of new estuary habitat for a wide variety of shellfish, kelp, fishes and other species (Leach 2014, Rubin et al., 2023).

(2) Dungeness River Basin/Port Angeles Harbor Basin - Grey Wolf River
The Grey Wolf River is a tributary of the Dungeness River. The Dungeness basin is located in a rain shadow of the Olympic Mountains and receives little annual precipitation (less than 20 inches). Water flow in this basin is dependent primarily upon snow melt. Human activities associated with agriculture, urban development and forest practices have caused gravel aggradation and river channelization in the middle and lower Dungeness basin. Low water flows through braided channels create barriers to migrating adult salmonids, increase the water temperature to marginal levels and reduce available spawning habitat. Diking for flood control in the developed areas has exacerbated impacts from high-water events by confining the energy of the river. Shifting bedloads kill incubating salmonid eggs and alevins during high-flow events in the fall and winter.

(3) Dosewallips Basin/Duckabush Basin/Hamma Hamma Bain
Habitat conditions in the upper half of the watersheds, located within the park, are very good. Logging and road-building on steep, unstable slopes further down the watershed have led to culvert blow-outs and debris torrents which have increased sediment loads in the streams and scoured streambeds. The most significant habitat impacts have come from the conversion of the once-forested flood plain along the lower river to agricultural land near the turn of the 1900’s. At that time, the land was cleared and the river was diked to channel the flow to the south side of the river valley. This activity led to loss of side channels which provide spawning habitat and to the loss of large wood in the lower river. More recently, residential development near the mouth of the river has resulted in further destruction or channelization of formerly productive side channels.

(4) Skokomish River Basin
Lake Cushman is located on the southwest border of Olympic National Park, and thus would fall within the assumed buffer area that describes this action area. The Cushman dams operated by Tacoma City Light prevent upstream and downstream passage of migratory fish between Hood Canal and the river. The river is diverted through a tunnel, at Lower Cushman Dam, to supply a power plant in Potlatch on Hood Canal. It is unknown as to whether the falls downstream of the Cushman dams served as a barrier to the migration of bull trout and other salmonids (prior to the construction of the dams). Historic accounts indicate native char were present in the original Lake Cushman prior to its impoundment. It is believed that a series of cascades (termed Staircase Rapids) prevents upstream passage of some fish species.

As part of the operation of the dams, the entire flow of the North Fork of the Skokomish River downstream of Cushman Dam number 2 was diverted to a power station near

Potlatch, Washington from 1930 to 1988. Since 1988, 3 cubic feet per second of water has been released into the river, an amount equal to 4 percent of the rivers average natural flow. Full–pool retention time for the reservoir is 307 days each year, and water is withdrawn at a maximum rate of 71 cubic feet per second for power generation. Presently, the reservoir inundates 12.6 miles of river including areas of the original Lake Cushman. There also is a small hydropower dam in lower Elk Creek that likely impedes movements of fish in that creek.

The eastern and western shorelines of the reservoir have been developed for residential and recreational uses. A road parallels the river immediately upstream from Lake Cushman. Riprap was installed to protect the road throughout approximately 200 yards of river in ONP near the boundary.

(5) Upper Quinault River Basin

Current land uses within the basin include timber harvest, fishing and tourism, with a major portion of the land managed by the NPS. The Quinault Indian Nation owns 32 percent of the basin, comprising most of the area downstream of Lake Quinault. The U.S. Forest Service manages 13 percent of the watershed, including the eastern part of the Cook Creek watershed and the southwest half of the Lake Quinault watershed between Quinault Ridge and the upper Quinault River. Private landholdings comprise only 4 percent of the lands in the basin, and Rayonier Timberlands Company is the largest private landholder, managing 14,030 acres in the Cook Creek area. Logging occurs in the basin on tribal and private lands downstream of Lake Quinault.

(6) Queets River Basin

Present land uses within the Queets Basin include timber harvest, agriculture, agriculture, fishing, recreation, and tourism. Settlements include the small communities of Queets and Clearwater. The ONP ownership includes 20.8 miles of the Queets River and 34 tributary streams. The Queets Basin upstream of the Sams River confluence (RM 23.5), including the Tshletshy Creek watershed, is part of the ONP, with the lower five miles of the Sams River as the boundary between the park and Olympic National Forest. The Queets Corridor is also under park ownership and includes the mainstem Queets and its valley between river mile (RM) 8 and RM 23.5 and the lower reaches of many tributary streams, including the Sams River (6,044 acres), Matheny Creek (387 acres), and the Salmon River (408 acres). ONP lands along the coastal strip include the lower mile of Kalaloch Creek. It is expected that timber harvest on these lands will be virtually non-existent.

The Forest Service administers 84 percent of the Matheny Creek watershed, 73 percent of the Sams River watershed, and 30 percent of the Salmon River watershed, as well as some acreage north of the Queets River near the town of Queets at RM 23. All of these watersheds have established Riparian Reserves, while lands outside of the riparian reserves are managed as Late Successional Reserves or Adaptive Management areas. Washington Department of Natural Resources (DNR) lands comprise 79 percent of the Clearwater sub-basin. All DNR lands in the Queets and Clearwater systems are managed as part of the Olympic Experimental Forest, which has a management objective of melding habitat conservation and timber production across the landscape, rather than separating each into designated areas. The riparian conservation strategy calls for interior riparian buffer zones and exterior riparian wind buffer zones. Monitoring and research components are also incorporated into the Olympic Experimental Forest Plan, which is part of the Habitat Conservation Plan approved in 1997 and updated in 2016.

In the Clearwater sub-basin, privately owned lands comprise approximately 20 percent of the total acreage. Most of the privately-owned lands are in the lower Clearwater subbasin. Lands in the Quinault Indian Reservation include the lower eight miles of the Queets River and the estuary and 54 percent of the Salmon River drainage (South Fork, Middle Fork, and lower mainstem Salmon rivers).

(7) Hoh River Basin

Most of the Hoh basin lies within the park, but downstream of the park, considerable habitat problems exist. Debris flows in hillside tributaries are common and devastating, resulting in scoured, incised channels with few spawning gravels and large woody debris (LWD). Channel incision has exposed clay layers that contribute fines into the streams, further degrading salmonid habitat. The sources of sediment loads are primarily mass wasting (eg, landslides) and road erosion. Downstream of the park boundaries, there are many areas deficient of LWD and dysfunctional riparian conditions. Fish passage problems from culverts and cedar spalts are numerous within the Hoh Basin and are a major limiting factor for fish that inhabit tributaries. The spalts have degraded water quality, riparian, and channel conditions as well. Floodplain complexes are vital habitats within the Hoh basin, providing excellent rearing and winter refuge habitat. The loss and degradation of these floodplain complexes are significant impacts. Riparian roads are another extensive floodplain problem in the Hoh basin. Reductions in hydrologic maturity have occurred in areas of the middle Hoh basin, and contribute to degraded floodplain habitat as well as a potentially altered flow regime. The loss of fog drip is a major concern pertaining to low summer flows in the Hoh.

(8) Quillayute River Basin- Sol Duc, Calawah and Bogachiel rivers

This part of the coastal region is a temperate rainforest with abundant waterfall and an annual rainfall that can reach 140 inches. The Quillayute River flows westerly from the confluence of the Sol Duc and Bogachiel rivers, and enters the Pacific Ocean at La Push, the ancestral home of the Quileute Tribe. The area supports Chinook, coho, sockeye, chum, and pink salmon, as well as steelhead and cutthroat trout.

The area is heavily forested with relatively infrequent impervious cover caused by development and small population centers. A part of the Quillayute basin lies in ONP, which has been protected from timber harvest and other major human impacts. Those lands outside the park include Olympic National Forest, state forests and private timberland and city of Forks.

(9) Ozette River Basin

Land ownership in the Ozette Basin is comprised of 1 percent tribal, 16 percent National Park, 75 percent private, and 9 percent state or local. In the Ozette Basin, numerous “poor” habitat conditions are found and appear to be linked to one another. The upper few hundred yards of Ozette River, which drains the lake to the ocean, has been cleared of LWD. Invasive plants have begun to displace native vegetation along the lakeshores. Sediment is believed to be a major habitat limiting factor, resulting in degraded spawning habitat for lake spawning sockeye, but the cause of the high levels of fines is uncertain. Some of the larger tributaries draining into Lake

Ozette (Umbrella Creek, Big River, Siwash Creek) are incised with banks hardened by Reed canary grass. Fine sediment levels are high in these streams as well. Road densities are high in this basin, likely contributing to the sediment loads. Throughout the area, low quantity LWD and dysfunctional riparian conditions are found. Other problems include naturally warm water temperatures, altered hydrologic conditions, and a lack of marine derived nutrients.

Listed fish in the Action Area:

PS Chinook salmon

The PS Chinook salmon ESU was listed as threatened on May 24, 1999[2]. The ESU encompasses all naturally spawned runs of Chinook salmon that occur below impassable natural barriers in the Puget Sound region from the North Fork Nooksack River in northeastern Puget Sound to the Elwha River on the Olympic Peninsula. This ESU includes Chinook in the Elwha, Dosewallips, NF Skokomish, and Gray Wolf River Basins in the park. Hatchery Chinook in the Dungeness River and Elwha River also are considered part of the ESU.

The majority of Chinook spawn in the fall, and can be found in all of the action areas coastal rivers. There are also small spring runs in the Hoh, Queets, and Quinault Rivers, and summer runs in the Hoh, Queets, and Quillayute Rivers. The spring and summer Chinook runs tend to remain in the rivers throughout summer.

Though Chinook runs in west coast valley rivers are stable, the PS Chinook are listed as threatened under the Endangered Species Act. Prior to dam construction in the Elwha River, the Chinook runs were legendary for their size and numbers. In the fall, they can still be spotted, returning to the base of the Elwha dam in an effort to return to the upper reaches of the river to spawn.

PS steelhead

The PS steelhead was listed as threatened on May 11, 2007[3]. The listing covers naturally spawned steelhead from river basins in the Puget Sound, Hood Canal, and the eastern half of the Strait of Juan de Fuca from the Elwha River east. They are found in the Elwha River and Graywolf River within the action area.

Lake Ozette Sockeye

Lake Ozette sockeye salmon were listed as threatened on March 25, 1999[4]. There are two significant sockeye runs within ONP. In the Quinault River, sockeye can be observed spawning in November and December in tributaries and in the river. A great place to see the run is in in the Quinault Valley at Big Creek, off of the North Fork road. Another small run enters Lake Ozette in summer and spawns along the edges and tributaries of the lake in winter. The Lake Ozette sockeye are listed as threatened under the Endangered Species Act.

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[2] https://www.westcoast.fisheries.noaa.gov/publications/frn/2005/70fr37160.pdf

[3] https://www.westcoast.fisheries.noaa.gov/publications/frn/2007/72fr26722.pdf

[4] https://www.westcoast.fisheries.noaa.gov/publications/frn/2005/70fr37160.pdf

Summary of Baseline habitat and species in the action area:

The action area contains some of the last remaining undisturbed, contiguous aquatic habitat throughout the range of several west coast fish species. The park protects 12 major river basins, more than 3,500 miles of rivers and streams, more than 300 high mountain lakes, and 2 large lowland lakes. As a consequence, the park is entrusted with the stewardship of numerous unique stocks of Pacific salmonids and other native freshwater fish species. Salmon are a keystone species of the park's forest and aquatic ecosystems and are deeply woven into the cultural fabric of the Pacific Northwest. Lake Ozette Sockeye occur only at Lake Ozette and three of its tributaries. Puget Sound Steelhead and Puget Sound Chinook occur within the several rivers and tributaries within the action area.

2.5 Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action (see 50 CFR 402.02). A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

The effects of the proposed actions on federally listed fish and critical habitat will vary depending on the condition of existing habitat, soil types, timing of the fires, steepness of slopes in burned areas, and proximity of fire to habitat.

The assessment below considers the intensity of expected effects of fire management measures in terms of the change they would cause on habitat features from their baseline conditions, and the severity of each effect, considered in terms of the time required to recover from the effect. Ephemeral effects are those that are likely to last for hours or days, short-term effects would likely to last for weeks, and long-term effects are likely to last for months, years or decades.

Effects include (1) reduction of wildfire adverse effects; (2) effects of controlled burn for fuel reduction; (3) vegetation removal; (4) use of fire retardant and foam chemicals; and, (5) withdrawing water.

(1) Reduction of wildfire adverse effects

While fire is not an effect of the action (prescribed pile burning is only allowed in Non-Wilderness FMU and prescribed burns will be part of a future consultation), implementing a FMP is intended to inhibit large wildfire, and thus an effect of the proposed action is expected to be less fire, and reduced adverse effects from wildfires. The proposed FMP anticipates an average of 1,200 acres of wildfire per year, which is an increase from the previous plan due to increased emphasis on Managing Wildfire for Multiple Objectives. While more wildfire events would be allowed to burn naturally, they would be managed to allow fire to function in its natural ecological role to maintain and enhance habitat conditions. Despite the increase in acreage allowed to burn within the park, it is anticipated that only 600 linear feet of steam habitat and 5 acres of adjacent riparian habitat will be affected annually, on average, by implementation of plan.

Habitat Effects: Fewer fires or less extensive burned areas within the riparian zone is expected to minimize:

- loss of riparian vegetation and corollary streambank destabilization,
- reduced water quality from landslide potential,
- aggravated flood risk associated with devegetated areas.

If the proposed action is successful in reducing the frequency or extent of fire, we expect that intact riparian vegetation currently present as a baseline condition will persist more fully throughout the watershed, keeping sediments in place, absorbing pollutants and controlling rain runoff inputs that would enter waterways. This would work to more fully retain cool clear water for spawning and rearing areas, migration areas unobstructed by burn debris and slope failure, and retain other valuable PBFs such as natural cover/shade, detrital prey, and floodplain connectivity.

Species Effects: Fire can result in fish mortality, though few studies have documented such direct effects (Rinne and Jacoby 2005). Severe fire and heavy fuel and slash buildup in riparian areas are predisposing factors for direct fish kills resulting from fire (Rinne and Jacoby 2005). Key factors in immediate mortality to fish and other aquatic species include size of the riparian area, fuel load present in the riparian area, severity of fire, and size of aquatic habitat (e.g., stream) (Rinne and Jacoby 2005). For example, a small stream with neighboring high fuel loads and high-severity fire is most likely to experience immediate aquatic species mortality primarily due to an increase in water temperature. Where such conditions exist in the park, if fire were not be effectively contained, such impacts have potential to occur. Furthermore, physical (water yield, sediments and temperature) and chemical (nutrients, ions, organic chemicals, and metals) water quality degradation can negatively impact biological assemblages (Paul et al, 2022). The loss of riparian habitat can exacerbate and prolong these effects. These short-term degradations can result in impaired biological processes, reduced feeding success, failed reproduction, abandonment of the affected area for local refugia (Preston et al., 2023). The implementation of the proposed plan is intended to result in a reduction of these adverse effects.

(2) Effects of controlled burn for fuel reduction

Habitat Effects: Where controlled burn is used to reduce fuel base, these areas will subsequently have less vegetative cover and more exposed soil. Soils can become hydrophobic post burn. If these areas include slopes it is likely that increased suspended sediment loads from rain events over areas covered in ash, or exposed soils/hydrophobic soils would degrade the water quality of habitat for listed fish and their prey communities. Rain run-off exposed to ash can result increases of organic chemicals and metals in streams. The loss of riparian habitat can also result in changes in stream flow that can disrupt sediment inputs and loads. Much of this variance can occur the first few years after a wildfire, though in some cases, sediment transport disruptions may take decades or even longer to recover to pre-fire conditions. Individual rain events can result in pulses of ash affected waters and sediments inputs. Although much of the proposed action is intended to manage wildfires to protect listed species' habitat, the proposed action could result in increased sediment. In some locations this effect would be temporary, but in others the loss of habitat, degradation of spawning and rearing habitat, and damage to habitat structure could be long term.

There can also be a dramatic increase in in-stream nutrient levels the first year after a burn. Excess amounts of nutrients can cause algae blooms, which, when alive, decrease light penetration and, when dead and decomposing, decrease amounts of dissolved oxygen available in aquatic habitats. However, one beneficial habitat effect can be an increase in large woody debris as a result of fire management actions. While an initial slope failure contributing wood and sediment would likely have several short-term adverse effects on water and sediment quality, this would also have long-term beneficial impacts by developing complex aquatic habitat features, including establishing cover and additional prey sources.

Species Effects: Increased turbidity and suspended sediment, and changes in stream habitat can result in behavior changes such as avoidance, migration, distribution, homing, and delays in spawning migration. The recovery of aquatic communities is often dependent on the presence of intact communities upstream and downstream from the burned areas, and a majority of the fires would burn themselves out in moist streamside areas, providing a natural buffer strip that would filter out products of erosion before they entered the stream. Live fish can rapidly reoccupy fire-affected areas when their movements are not limited by barriers. However, short-term adverse impacts could include an excess of fine sediment which can fill in pore spaces between cobbles where fish lay their eggs and, in some cases, clog and abrade fish gills and suffocate eggs and aquatic larvae living on the bottom. If large wood enters stream areas, this could eventually benefit fish by providing habitat complexity, additional cover, and additional prey base as the wood becomes occupied by insects.

(3) Effects of vegetation removal for fuel reduction
Habitat Effects: Removal of vegetative cover from fire suppression activities (e.g. fireline construction) and managing wildfire for multiple objectives may cause a decrease in habitat quality due to increased water temperatures, increased suspended sediment, decreased dissolved oxygen, and reduced detrital prey base. Manual and mechanical treatment can result in disturbance of 100 acres per year; however, this is only allowed in the non-wilderness FMU which is typically upland of aquatic habitat. It is anticipated that implementing the proposed FMP will result in an annual average of 5 acres of riparian zone being degraded per year. Vegetation removal is expected to ameliorate over a period of several years.

Species Effects: Diminished habitat conditions could result in displacement of individuals to sections of stream in unburned areas. This could create increased competition for prey and rearing/refuge areas, and may mean decreased growth or fitness in some individuals. However, displacement of individuals is expected to be temporary as water quality degradations stabilize (Luce et al. 2012). Furthermore, because MIST-related actions designed to mitigate impacts to water quality and post-fire BAER/BAR treatments will be implemented, these effects would be minimized, and improve over a period of several years.

(4) Use of fire retardant and foam chemicals for fire suppression
Habitat Effects: As described above, fire chemical use within floodplains, wetlands, and other sensitive areas would adhere to the Interagency Policy for Aerial and Ground Delivery of Wildland Fire Chemicals Near Waterways and Other Avoidance Areas, as described in Chapter 12 of the Interagency Standards for Fire and Fire Aviation Operations (US DOI 2018) or future revised version. These policies mandate that the use of fire retardant is only to be used when human life and safety are under imminent threat. Historically, given these restrictions, fire retardants are rarely used and have not been used in the park since 2003. Foam is occasionally used in the park; however, its usage is still rare and requires superintendent approval. While foam may be applied via helicopter bucket drops, it is much more likely that it will be applied via fire engines and ground crews. Foam intrusion into buffers are rare because they are more precisely applied with smaller quantities and usually with ground resources. However, if these chemicals need to be applied, certain circumstances such as surrounding terrain and fire location could increase the potential for fire suppression chemicals to reach waterways and adversely affect aquatic species. Fire retardants typically contain large amounts of nitrogen and phosphates, which could adversely impact aquatic habitats when fire-suppressing chemicals enter streams. Chemical exposure has temporary effects. When an intrusion occurs, the chemical concentrations spikes at the intrusion site and then decreases as the chemicals are diluted as they are washed downstream (Rehmann et al., 2021). For analytical purposes, NMFS assumes that at any location when chemical retardants are being applied, drift may carry some of these chemicals up to 100 feet beyond the target application area.

Species Effects: The surfactant action of foam fire suppressants can cause fish to suffocate by interfering with the ability of the gills to absorb oxygen from the water. Depending on time and location of fire, all life stages of fish could be adversely affected due to the toxicity of the chemicals from accidental direct application or chemicals in the soil that could impact fish from contaminated run-off. Exposure to fire retardant and foam chemicals could result in immediate or delayed mortality to listed fish. Additionally, if stream conditions are impaired by pulses of nitrogen and phosphates, fish may experience disruption of the aquatic food chain, and/or temporary displacement of fish that results in slowed growth and maturation.

(5) Withdrawing water for fire suppression
During suppression activities, water is typically taken from lakes, ponds, and larger rivers via bucket drips in areas with five feet of water or greater. Water collection from listed species' habitat will be avoided, unless human life and safety are under imminent threat. The use of fire suppression and wildfire for multiple objectives (which may include fire suppression activities) would have short-term adverse effects on water quantity and quality, and impact other aquatic species such as prey communities, and their habitat.

Species Effects: Withdrawing water during bucket drops or pumping from lakes, ponds, streams, and rivers could result in potential mortality, injury, or disturbance to fish. Removing water from small streams and creeks may reduce flow and increases the risk of entraining young fish in pumps. These impacts would be minimized with implementation of MIST-related actions designed to mitigate impacts to special-status fish species.

2.5.1 Effects on Critical Habitat

As mentioned in Section 2.2.1, critical habitat for PS Chinook, PS steelhead and Lake Ozette sockeye occur within the action area. The physical and biological features of critical habitat for each of these species for spawning, rearing, and migration in freshwater environments are identical. The NMFS reviews the habitat effects described above, in terms of their effect on the conservation value of critical habitat, by examining how the PBFs of critical habitat will be altered, and the duration of such changes.

The NMFS reviews the effects on critical habitat affected by the proposed action by examining changes of the project to the condition and trends of physical and biological features identified as essential to the conservation of the listed species. The salmonid PBFs present in the action area are presented below, with the affected features in bold:

1. Freshwater spawning sites with **water quantity and quality conditions** and substrate supporting spawning, incubation and larval development.

2. Freshwater rearing sites with **water quantity** and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; **water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood**, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

3. Freshwater migration corridors free of obstruction and excessive predation with **water quantity and quality conditions and natural cover such as submerged and overhanging large wood**, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

PBFs of the critical habitats can be affected by the proposed action through the habitat effects described above. When habitat elements are affected, the conservation value of the proposed critical habitat can be proportionally affected, although the proportion might not indicate a direct relationship in change of conservation value.

Water quality effects from turbidity, sedimentation, temperature increases, and chemical contamination described above will impact conservation values of spawning, rearing, and migration habitats to varying degrees. The duration of the effect depends on future landscape conditions and stochastic events, both anthropogenic and natural in origin. The longer the project's effects endure, the greater the diminution of conservation value.

The program activity that could have a significant adverse effect on PBFs of proposed freshwater critical habitat is the use of fire retardants and foams. These materials reach streams through application that is accidentally too close to streams, and through precipitation falling after application, erosion of soils containing these materials, or from mass wasting events. Such chemical contamination may impair egg to emergence survival in spawning habitats, and juvenile growth, development, or survival in rearing habitats, depending on the size and location of the wildfire and the degree and character of the water quality impact. However, since the application of these chemicals is heavily restricted (retardants haven't been used on the park since 2003) and that most applications of these chemicals will be outside the riparian corridor the amount of contamination is expected to be low in most circumstances, and areas of contamination are not expected to occur in multiple streams at the same time.

Wildfire suppression and manual and mechanical treatment can also affect PBFs of proposed freshwater critical habitat. These program activities are similar in that they both will use hand-operated power tools and hand tools and specialized equipment to cut, clear, or prune herbaceous and woody species. The difference is that wildfire suppression occurs during an active fire and manual and mechanical treatment occurs to manage future wildfires. In either activity, vegetation removal and associated activity within a riparian zone can result in increases of sediment inputs, degradation of water quality, and increase in stream temperatures through loss of shading. For wildfire suppression, the activity (to include post-burn repair) may be required within riparian zones. On the other hand, manual and mechanical treatments are to be used as a preventative measure reduce fuel around administrative sites, historic structures, wildland-urban interface communities and roadways. These assets are not typically in riparian habitat. Since this is a preventative action, activity will be designed to protect riparian habitat. It is anticipated that implementing the proposed FMP will result in an annual average of 600 linear feet of stream and 5 acres of adjacent riparian zone being affected per year by these activities to suppress wildfire.

When all the habitat effects are considered, it is likely that some streams will have PBFs diminished, but it is not likely that the intensity of any one effect will be extreme across multiple streams, or that multiple effects will combine at any given time. Relative to the proposed action, which is managing fire, the most impactful effect (albeit rare) would be impacts to water quality from retardants entering the stream, but this effect is temporary. The most enduring effect would be from riparian vegetation removal, which would take several years to return to baseline conditions. Historically for the park, only about 5 acres of riparian vegetation is disturbed annually under the current FMP. While this is relatively small area, it will take several years for the vegetation to reach full functionality. Succession will begin with fast growing plants that survived the fire or is recruited from adjacent undisturbed areas. This will begin to control sediment and water quality degradation. Followed by the slow growth of woody stemmed shrubs and trees several years later.

Since it is unlikely that multiple watersheds/streams would be impacted simultaneously, we expect that diminished PBFs would be localized and conditions would begin to improve within the following year because water chemistry and stream conditions will quickly stabilize and the gradual natural restoration of the riparian zone will occur. Therefore, we believe the effects, while adverse, would be insufficient to reduce the conservation value of the critical habitat of the action area.

2.5.2 Effects on Species

Effects of the proposed action on species are based, in part, on exposure of species to the effects to features of habitat, as described above. In addition to the intended beneficial effect of exposing fewer fish bearing streams to wildfire, we expect that PS Chinook, PS steelhead, and Lake Ozette sockeye will be exposed to the following adverse effects:

1. Temporary diminishment of water quality from elevated suspended sediment and discharge of fire retardant and foam chemicals into waters
2. Temperature and prey reductions from riparian vegetation removal and
3. Water withdrawal during fire activities might also occur.

Species effects are briefly outlined above. No permanent pathways of fish exposure to effects are expected as a result of the proposed action.

2.5.2.1 Species Presence and Exposure

Each of the following species uses the action area with variable presence. In order to determine whether the effects on species briefly described above will occur, we must evaluate when species will be present and the nature (duration and intensity) of their exposure to those effects of the action in their habitat, which were described above. It should be noted; an effect exists even if only one individual or habitat segment may be affected (Fish and Wildlife Service and the National Marine Fisheries Service 1998). Though most fires do occur during the warmer, drier, summer months, fire activities in ONP could occur any time of the year. Because of the uncertain timing of when fire management activities occurring, NMFS conducts this analysis as if all life stages (larval, juvenile, and adult) could be present. The following populations of the ESUs and DPS have natal, rearing, or migration streams within the ONP's boundaries, and therefore are likely to be affected at some time by fire management activities.

PS Chinook Salmon
Chinook salmon in the Puget Sound ESU all exhibit an ocean-type life history (Myers et al. 1998). The ocean-type migrate to the sea during their first year of life, usually within 3 months of emergence (heaviest migration is March-May), spend most of their life in coastal waters, then return to their natal streams in the fall only a few days to weeks prior to spawning (NPS 2003). Critical habitat for Chinook salmon is designated to include all marine, estuarine, and river reaches accessible to listed Chinook salmon in the Puget Sound. PS Chinook are found in the northern and eastern watersheds in the park (watersheds 1-4 on Figure 3, above), with the exception of the Elwha River upstream of the former Elwha Dam. Although the Elwha River upstream of the former dam is not designated, it is now accessible to and utilized by Chinook salmon, appears to have the characteristics associated with Puget Sound Chinook critical habitat, and would be managed in the same manner as designated critical habitat.

Puget Sound Steelhead
Within the park boundaries, Puget Sound steelhead spawn primarily in the spring from February to late May. They may rear for up to 2 years prior to going to the ocean, covering 1-2 seasons of exposure to fire management effects. They live in the ocean for 2 to 4 years before returning to spawn. They may spawn several times, though most only spawn once. Similar to the PS Chinook, PS steelhead are found in the northern and eastern watersheds in the park (watersheds 1-4 on Figure 3, above).

Lake Ozette Sockeye Salmon
The ESU is a single population that includes all naturally spawned sockeye salmon in Lake Ozette, Ozette River, Coal Creek, and other tributaries flowing into Lake Ozette. Within the

park, critical habitat was designated for the Lake Ozette sockeye salmon in the Hoh/Quillayute Sub basin, in the Ozette River, and Lake Ozette and several of its tributaries including Umbrella Creek, Big River, Crooked Creek, North Fork Crooked Creek, and South Fork Crooked Creek.

Spawning in Lake Ozette generally occurs from mid-November through early February. The Lake Ozette sockeye population is comprised of two spawning aggregates: a beach spawning component (restricted to submerged beaches of Lake Ozette where upwelling occurs along the shore) and a tributary spawning component. Beach spawning in the lake is distributed from the seasonally inundated upper littoral zone, down to a depth of 10 meters or more. The entire beach spawning habitat for the population lies within the park. At this time, just two beach spawning locations are utilized at a fraction of their historic extent, although a number of other locations around the lake are likely to have been important historically. Tributary spawning of sockeye occurs outside of the ONP boundary, primarily in the Umbrella Creek and Big River watersheds. The tributary population is supplemented through a hatchery program originally developed from the beach spawning component.

2.5.2.2 Species Response at the Individual Scale

Generally, the effects of fire and fire response on the different listed fish species will be the same because they all have similar life histories; therefore, this discussion will refer to all species unless clarified. The effects of the proposed action vary widely, based on the proximity of the fire to fish bearing streams, severity of the burn, steepness of slopes in burned areas, soil types, seasonal timing of the activity, condition of existing habitat, and relative abundance and extent of distribution of each population and the specific fire management practices utilized. Implementing the proposed fire management actions in the action area may cause effects to individual listed fish through four categories of activities: (1) reduction of wildfire adverse effects (2) water quality and stream condition, (3) vegetation removal, (4) use of fire retardant and foam chemicals, and, (5) withdrawing water. As indicated above, because activities to reduce fire risk can occur at any time of year, exposure could affect any lifestage of the listed fish species. Response will vary by lifestage.

(1) Reduction of Wildfire

To the degree that the implementation of the FMP reduces the number of fires, or the amount of area burned, the effects on species is is greater retention of baseline levels of habitat function, which we would interpret to be neutral in the short term and beneficial in the long term to all freshwater lifestages of the three listed salmonids.

Wildfire can result in fish mortality through substantial increase in stream temperature and alteration of stream chemistry (addition of nutrients; reduction of dissolved oxygen; and addition of harmful ions, organic chemicals, and metals). Sublethal effects of these degradations can result in impaired biological processes, reduced feeding success, failed reproduction, and abandonment of the affected area for local refugia. Destruction of adjacent riparian habitat exacerbate and prolong these harmful effects. The implementation of the proposed plan will result in a reduction of these adverse effects, and we anticipate that overall, egg and alevin survival, juvenile fitness, and productivity levels will be retained in the short term, and be beneficial in the long term by inhibiting extensive areas where wildfire would otherwise impair fish survival.

(2) Controlled Burn

Controlled burn for fire suppression activities may cause short-term increases in turbidity and sediment inputs that would likely exceed natural background levels, because reductions in vegetation (caused by fire or due to thinning to reduce fuel loads) is likely to expose soils and increase the likelihood of mass erosion. This could result in the deposition of fine sediment in streams that may degrade salmonid spawning habitat by occluding spawning gravels, and reducing available dissolved oxygen, both of which can reduce survival from egg to emergence. If redds are in an area when high turbidity occurs, redds can be buried or smothered.

Quantifying turbidity levels and their effect on juvenile and adult fish of the listed species is complicated by several factors. First, turbidity from an activity will typically decrease as distance from the activity increases. How quickly turbidity levels attenuate depends on the quantity of materials in suspension (e.g., mass or volume), the particle size of suspended sediments, the amount and velocity of ambient water (dilution factor), and the physical/chemical properties of the sediments. Second, the impact of turbidity on fish is not only related to the turbidity levels, but also the particle size of the suspended sediments, the temperature of the water, and the life stage of the fish. As mentioned earlier in this document, we assume any life stage could be affected by turbid conditions in a post fire circumstances, or related to vegetation removal to reduce fuel load for fire.

For salmonids, turbidity has been linked to a number of behavioral and physiological responses (i.e., gill flaring, coughing, avoidance, increase in blood sugar levels) which indicate some level of stress (Bisson and Bilby 1982; Sigler et. al. 1984; Berg and Northcote 1985; Servizi and Martens 1987; Gregory and Northcote 1993). Although turbidity may cause stress, Gregory and Northcote (1993) have shown that moderate levels of turbidity (35-150 Nephelometric Turbidity Units [NTUs]) accelerate foraging rates among juvenile Chinook salmon, perhaps because of reduced vulnerability to predators (camouflaging effect). Moderate turbidity levels (11 to 49 NTU's) may also cause juvenile steelhead and coho to leave rearing areas (Sigler et al.1984). Sustained high levels of turbidity can clog gills and smother fish.

Adult fish are less susceptible to turbidity because they have better detection and avoidance of areas with high suspended sediment, and because it takes more intense or prolonged exposure for their gills to become occluded. It is anticipated that implementing the proposed FMP will result in an annual average of 600 linear feet of stream and 5 acres of adjacent riparian zone being affected per year (in combination with vegetation removal activities). We assume that this may occur on multiple streams, but no more than 600 cumulative feet in any given year's FMP practice, and that the 600-foot length could receive sediment load via rain fall in the subsequent rainy season. Such suspended sediment would likely be transported downstream a few hundred feet, the turbidity level attenuating with distance. As described above within this annual area of impact, effects can range from death of eggs and alevin in redds to avoidance response of subadult and adult fish, depending on timing and intensity of post-burn storm events.

(3) Vegetation Removal

Riparian vegetation links terrestrial and aquatic ecosystems, influences channel processes, contributes organic debris to streams, stabilizes streambanks, and modifies water temperatures (Gregory et al. 1991). Removal of riparian vegetation may increase water temperature (solar radiation) that would further degrade already impaired water temperatures in some action areas. Similar to fuel reduction through controlled burn, it is anticipated that implementing the proposed FMP will result in an annual average of 600 linear feet of stream and 5 acres of adjacent riparian zone being affected by other vegetation removal efforts per year (in combination with controlled burning activities). We anticipate the full 600 feet could have warmer temperatures and less detrital prey, and that these effects can extend downstream until mixing occurs with cooler and more prey rich water associated with a fully intact riparian zone.

Elevated water temperatures based on thermal inputs is associated with reduction in streamside vegetation. In a literature review, Gresswell (1999) reported that maximum daily water temperatures in small streams increased 3.3 to 10 degrees Celsius in intensively burned sites one year later. Maximum daily water temperatures were 5.6 degrees Celsius above the temperatures predicted for unburned areas. Elevated water temperatures may persist for as long as it takes for vegetation to restore to the extent of function it provided when initially removed. Elevated water temperatures may influence the physiology, growth and development, life history patterns, disease, and competitive predator-prey interactions (Spence et al. 1996).

Because all life stages of fish could be exposed, we can expect that adult fish avoid certain spawning areas because stream temperatures are too warm to attract them, that egg survival will decline in areas where post spawning water temperatures become too warm, and the juvenile fish will vacate some streams sooner than would otherwise occur because temperatures warm to the point that they must seek cooler, suitable rearing habitats. Displaced rearing fish may experience greater competition for prey and rearing space that could result in some individuals having reduced growth or fitness relative to others in the cohort. These responses to reduced riparian condition could occur among several successive cohorts until the residual trees re-establish pre-thinning levels of canopy and shade.

Microclimates in riparian areas tend to be cooler, resulting in moist soils and high fuel moisture, especially in floodplain woodlands (Spence et al. 1996). Because of these attributes, riparian areas typically do not burn, or they burn at lower intensity than forests in upland areas. This pattern of less burning is presumed to buffer aquatic communities from some of the effects of wildfire. (Spence et al. 1996). However, if riparian areas burn, or riparian vegetation is removed to reduce fuel load, then, in addition to warming stream temperatures described above, there will also be a reduction in detrital prey base to the adjacent stream. This would affect only rearing juveniles that would have less available forage and potentially reduced growth, maturation, or fitness.

Loss of vegetation also may reduce allochthonous inputs to the stream (e.g. vegetation debris and insects). Additionally, the removal of vegetation decreases streambank stability and resistance to erosion. There may be localized impacts that include compaction of soils and loss of vegetation associated with fire crew camps located in floodplain or riparian habitats. MIST principles will be utilized tailored to make sure effects are localized. The indirect effects to fish (reduced prey base, reduced shade, reduced cover, increased temperature, and increased turbidity) associated with the removal of riparian vegetation are however, expected to be localized and not to affect multiple populations of fishes in a manner that would significantly alter population abundance or distribution.

(4) Use of fire retardant and foam chemicals

The program restricts application of retardants and foams within 300 feet of lakes or streams where ESA listed fish range. The use of these chemicals is only to occur when human life and safety are under imminent threat. Historically, given these restrictions, fire retardants have not been used in the park since 2003. Foam is used more frequently, but its application is typically with ground crews and is more precisely applied. These measures are incorporated to minimize the likelihood that these chemicals will affect salmonids, and thus, the proposed action would not appreciably increase chemical inputs into aquatic environments. However, these chemicals could enter such environments through accidental applications within the buffer, wind drift, rain runoff and soil erosion after application. Chemicals entering the waterways may adversely affect incubating eggs, juveniles, and pre-spawning adults. The program includes monitoring and periodic reporting that is expected to include information on any such occurrences. Therefore, we evaluate exposure on the assumption that despite best management practices, some exposure will occur.

The risk of toxicological effects of chemicals on salmonids is greatest when chemicals are applied directly to surface waters or reach surface waters by wind drift (Spence et al. 1996). All life stages (eggs to adults) of listed fish may be affected. Fire-fighting chemicals are toxic to early life history stages of fish. Early life stages of rainbow trout (*Oncorhynchus mykiss*) and Chinook salmon were examined for acute toxicity to three fire retardants, Phos-Chek D75-F, Fire-Trol GTS-R and Fire-Trol LCGR, and two foams, Phos-Chek WD-881 and Silv-Ex (Gaikowski et al. 1996a; 1996b). The two foams were 10 times more toxic for rainbow trout and Chinook salmon than the fire retardants tested. The life stage of the exposed salmonids had a significant influence on the toxicity of the formulation. Eggs and eyed-eggs were almost always more resilient than later life stages. Fry which were actively swimming in search of food were the most sensitive (Gaikowski et al. 1996a; 1996b).

Gaikowski et al. (1996) evaluated acute toxicities on fish species. Laboratory studies of five early life stages of rainbow trout were conducted to determine the acute toxicities of five fire-fighting chemical formulations in standardized soft and hard water. Eyed-egg, embryo-larvae, swim-up fry, 60- and 90-day post-hatch juveniles were exposed to three fire retardants (Fire-Trol LCG, Fire-Trol GTS-R, and Phos-Chek D75-F), and two fire suppressant foams (Phos-Chek WD-881 and Silv-Ex). Swim-up fry of rainbow trout were generally the most sensitive life stage, whereas the eyed-egg life stage was the least sensitive. Toxicity of fire-fighting formulations was greater in hard water than soft water for all life stages tested with Fire-Trol GTS-R and Silv-Ex, and 90-day old juveniles tested with Fire-Trol LCG-R. Fire suppressant foams were more toxic than the fire retardants. The 96-h LC50s were rank ordered from the most toxic to the least toxic formulation as follows: Phos-Chek WD-881 (11 - 44 mg/L) > Silv-Ex (11 – 78 mg/L) > Phos-Chek D75-F (218 - >3,6000 mg/L) > Fire-Trol GTS-R (207 - >6,000 mg/L) > Fire-Trol LCG-R

(872 - >10,000 mg/L); (ranges are the lowest and highest 96-h LC50 calculated for each formulation). However, studies have shown that there was no evidence that retardant increased the levels of chemical constituents above those from the wildfire itself (Crouch et al. 2006).

Similarly, Dietrich et al. in 2014, reviewed the toxicity of, and found that LC-95A is lethal to 50% of Chinook salmon at 0.23% of the applied concentration; 259F is lethal to 50% of Chinook salmon at 0.09% of the applied concentration; and delayed mortality occurred in seawater after PHOS-CHEK exposure at smolt stage.

While the historic level of fire in ONP has been relatively low (over the past 40 years, over 900 recorded fires (from all causes) burned over 4300 acres in Olympic National Park), climate change and fire management both have influenced the fire regime such that between 2003 and 2010 nearly 4,000 acres burned in and adjacent to Olympic National Park, i.e., more than half of the number of acres burned in the 64 year period of 1916-1980. [5] Furthermore, the park's recent fire history indicates that an average of 1,200 acres per year can be expected to burn. Accordingly, NMFS expects that chemical fire suppression will occur intermittently.

Chemical constituents in streams may result in degradation localized food webs where intrusions occur (Anderson and Prosser, 2023). The proposed fire suppression actions are intended to reduce the risk of high intensity fires in the riparian areas that would otherwise consume all vegetation and substantially alter chemical inputs to the aquatic environment. Generally, an individual bucket drop may affect 0.2 acre. Streams modified by fire suppression chemicals will likely reduce spawning suitability, egg to emergence survival, and juvenile to adult survival, in the short term. However, maximum exposure time rarely exceeds 5 hours (Rehmann et al 2021). Furthermore, given the restrictions associated with the usage of the chemicals, we expect this type of habitat effect to occur infrequently and affect very few populations of any particular species during any intrusion event.

(5) Withdrawing Water

The drafting (i.e., removal) of water from streams with listed fish to suppress fire is to be avoided unless human life and safety are under imminent threat. If this condition exists and water must be drafted from a salmonid bearing stream, then the action may kill or injure fish through removal or direct contact with the firefighting equipment. During drafting, water is typically taken from lakes, ponds, and larger rivers via bucket drops in areas with 5 feet of water or greater. The risk of take from bucket drops is presumed to be highest in large rivers, such as Lake Mills, and Lake Ozette. Any effects associated with bucket drops will be restricted to young-of-the-year or juvenile fish. Adult fish are expected to avoid contact with bucket drafting activities by the startle response being triggered when equipment is overhead or first contacting the water, which will result in adults swimming away from the area. This behavior has been observed in a field experiment were buckets were dipped into multiple water bodies (ponds and lakes) with abundant salmonids (primarily brook trout (*Salvelinus fortinalis*)) (Jimenez and Burton 2001). The helibuckets were dipped 18 times and then the water was released into a holding tank. None of the 18 helibuckets captured any fish, as fish were observed fleeing from the shadows, rotor wash, and bucket splashing on the water surface. River and stream habitats

[5] https://www.nps.gov/olym/learn/management/fire-history.htm accessed 10/20/23

may not be directly analogous, but we can assume similar avoidance behavior. Because of the restriction placed on this activity, number of fish trapped, injured or killed via water drafting is likely to be low, with only a fraction of the bucket drops capturing a fish (NMFS estimates only one in 10 bucket drops will incidentally capture a fish, and as only 10 water withdrawal events from fish bearing streams are anticipated in any given year we anticipate only one fish per year captured/killed in this manner).

Pumping water or construction of temporary check dams from salmon bearing streams is to be avoided unless human life and safety are under imminent threat. If this condition exists and these activities must occur from such waterbodies, then they may result in dewatering which can injure or kill fish. Any pumps used to draft water where listed fish may range will be screened. The use of temporary check dams to facilitate pumping of water will be conducted in areas with 3 feet depth of water or greater, to minimize the risk of dewatering pools that can injure or kill fish. Dewatering within a check dammed area would be most likely to kill eggs, alevin, or fry. Larger fish are expected to have adequate mobility and swimming speed to evacuate the area being disturbed as the check dam is being constructed.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The action area is almost exclusively within the control of a federal entity, the Olympic National Park. Adjacent to the action area, most of the property is in Federal, State, tribal, and local government holdings, or large private timber land holdings. Furthermore, the proposed plan is intended to provide the park with the flexibility to manage fire on a landscape scale and in coordination with the U.S. Forest Service. Non-federal activities in the action area are expected to be generally restricted to recreational uses that may intensify commensurate with human population growth in the region. To the degree that the action area includes lands adjacent to the park, other non-federal activities besides recreational uses could include land conversion to support homes or commerce.

Regional economic diversification has contributed to population growth and movement, and this trend is likely to continue (See Table 4). Such population trends will result in greater demands for electricity, water, and buildable land outside of the park, and will increase the need for transportation, communication, and other infrastructure. The result of these economic and population demands will probably affect habitat features as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect will likely be negative on aquatic resources, unless avoided or carefully planned for and mitigated.

Table 4. Excerpt from a table showing estimated Clallam County human population growth 2010-2018. (Figure source: https://www.ofm.wa.gov/sites/default/files/public/dataresearch/pop/april1/ofm_april1_poptrends.pdf accessed 6/25/19).

County Municipality	Census 2010	Estimate 2011	Estimate 2012	Estimate 2013	Estimate 2014	Estimate 2015	Estimate 2016	Estimate 2017	Estimate 2018
Clallam	**71,404**	**71,600**	**72,000**	**72,350**	**72,500**	**72,650**	**73,410**	**74,240**	**75,130**
Unincorporated	42,228	42,395	42,560	42,830	42,935	43,030	43,485	43,995	44,685
Incorporated	29,176	29,205	29,440	29,520	29,565	29,620	29,925	30,245	30,445
Forks	3,532	3,500	3,545	3,545	3,565	3,565	3,580	3,595	3,615
Port Angeles	19,038	19,080	19,100	19,120	19,090	19,140	19,270	19,370	19,370
Sequim	6,606	6,625	6,795	6,855	6,910	6,915	7,075	7,280	7,460

The state of Washington has various strategies and programs designed to improve the habitat of listed species and assist in recovery planning. Washington's Salmon Recovery Planning Act provided the framework for developing watershed restoration projects and established a funding mechanism for local habitat restoration projects. The Watershed Planning Act encourages voluntary planning by local governments, citizens, and Tribes for water supply and use, water quality, and habitat at the Water Resource Inventory Area or multi-Water Resource Inventory Area level. Washington's Department of Fish and Wildlife and tribal co-managers have been implementing the Wild Stock Recovery Initiative since 1992. The co-managers are completing comprehensive species management plans that examine limiting factors and identify needed habitat activities. Water quality improvements will be proposed through development of Total Maximum Daily Loads (TMDLs). The state of Washington is under a court order to develop TMDL management plans on each of its 303(d) water quality- listed streams. It has developed a schedule that is updated yearly; the schedule outlines the priority and timing of TMDL plan development. These efforts should help improve habitat for listed species.

The ONP is managed to protect, conserve, and promote natural resources within its boundaries while promoting non-consumptive resource and recreational uses. There are administrative, maintenance, and public use facilities and supporting infrastructure within the park's boundaries. There are numerous towns and privately-owned lands adjacent to the ONP, many with developed infrastructure. NMFS cannot conclude with certainty that any particular riparian habitat will be modified by changing land use practices to such an extent that measurable effects or take will occur. Riparian habitat is essential to salmonids by providing and maintaining various stream characteristics such as; channel stabilization and morphology, leaf litter, shade, and temperature. It is likely that continued growth and development outside the park's boundaries will result in the additional loss or degradation of riparian habitat (non-Federal activities), though as adjacent and outlying population grows, use of ONP amenities and resources will also increase.

Lastly, climate change is likely to intensify conditions that can modify habitat in a detrimental manner, including warmer stream temperatures, lower water conditions in spring, summer and early fall, drier riparian conditions, greater susceptibility to fire, and more stochastic flooding.

The occurrence of wildfire within and adjacent to the park will have an effect on important fish habitat. With warming climate trends, it is expected that the frequency and intensity of fires will increase. Fires will destroy forested area and introduce pollutants to the aquatic environment. The presence of chemical constituents in smoke and ash on the water may have profound effect on stream chemistry. Immediately after fire, waterways adjacent to burned areas may exhibit peak concentrations of nitrogen and phosphorus (Gresswell 1999). The stream condition may degrade as increased erosion (associated with deforestation) and increase of solar exposure affects streambed and water temperature. While fire is destructive, it is a natural process and will create forest opening and diverse habitats. These openings can create pathways for renewal of spawning gravel, short-term increases in stream productivity, and diversification of benthic invertebrates by increasing the stream's algae production. (Luce et al. 2012). All of these can detriment fish survival among returning spawners, redds, and rearing/migrating juvenile salmonids, making it more difficult to achieve recovery targets.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminishes the value of designated or proposed critical habitat for the conservation of the species.

The species considered in this opinion are listed as threatened with extinction because of declines in abundance, poor productivity, and reduced spatial structure and diminished diversity. Systemic anthropogenic detriments in fresh and marine habitats are limiting the productivity for PS Chinook, PS steelhead, and Lake Ozette sockeye salmon. Regarding sockeye, the contribution of conservation hatchery practices and stream supplementation, has improved spatial structure and age class diversity in freshwater areas. Beach spawning habitat continues to diminish, and beach spawning is in decline.

There are seven watersheds that are at least partially within the action area. Generally, the baseline condition of these watersheds' good conditions by virtue of low levels of development within the Olympic National Park. However, conditions can decline downstream of the Park's boundary where the rivers are subject to a myriad of anthropogenic factors that influence baseline conditions in these watersheds. Some of these factors have been beneficial to aquatic species, such as the dam removal projects in the Elwha River Basin. However, human activities associated with agriculture, urban development, logging, hydropower, and road/culvert development, have contributed to habitat stressors.

Cumulative effects within the action area are somewhat restricted, given that the action area is almost exclusively within the control of a federal entity, the Olympic National Park. Wildfires are expected to occur within the park and their frequency and intensity are expected to increase as warming climate trends continue. However, the action area does extend into adjacent property that is controlled by local governments and private interests. Implementation of their management decisions can have impacts on the aquatic environment. The state of Washington has programs and strategies in place to improve the habitat of listed species and assist in recovery planning.

Under the proposed action, the impact of managing wildfire for multiple objectives would result in short-medium term (weeks to several years) adverse impacts and substantial long-term (years to decades) beneficial impacts to listed species and their habitat (through reducing adverse effects of fires, creating forest openings and diversifying habitat). No broadcast burning would be allowed within the park under without additional environmental review and compliance.

Critical Habitat

Critical habitat for PS Chinook, PS steelhead, and Lake Ozette sockeye are located within the action area. Critical habitat for PS Chinook salmon include 1,683 miles of stream, 41 square miles of lakes and 2,182 miles of near shore marine habitat. PS Chinook ESU has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value and 8 received a medium rating. All 19 marine areas were rated with high conservation value. Critical habitat for PS steelhead includes 2,031 miles of stream. PS steelhead DPS has 66 watersheds within its range. Of these, 41 are rated high conservation value, 9 low conservation value and 16 received medium conservation value rating. Critical habitat for Lake Ozette sockeye salmon is comprised on a single subbasin containing a single watershed. It encompasses approximately 101 square miles and includes 317 miles of streams. This single watershed is rated high conservation value. Critical habitat can be high value despite having degraded habitat features or reduced habitat access, as is true of PS Chinook and PS steelhead designated critical habitat in multiple areas outside of the action area.

The effects of the proposed action on features of designated critical habitat for PS Chinook, PS steelhead, and Lake Ozette sockeye salmon will consist of water quality effects from turbidity/sedimentation, temperature increases, and chemical contamination, to varying degrees. Despite the increase in acreage allowed to burn within the park, it is anticipated that only 600 linear feet of steam habitat and 5 acres of adjacent riparian habitat will be affected annually, on average, by this plan. When these effects are added to the baseline, we expect that they will not occur across the entire action area at any given time, but be limited in geographic scale to subsets of individual watersheds. Next, we consider these effects within the context of climate change as a cumulative effect. With increasingly dry, hot, summers the chances of wildfires are rising. The fire management practices are likely to be employed more frequently, and in more areas in the foreseeable future. Because the proposed action is to constrain wildfire, rather than to let fire burn unchecked within the action area, the detrimental effects of fire management should be understood as preventing the significant effects of fire from modifying habitat features at a larger scale within these watersheds. While the water quality effects from firefighting techniques discussed above will impact conservation values to varying degrees, the duration of the effect depends on many factors that are difficult to fully predict. The longer the project’s effects endure, the greater the diminution of conservation value. However, based on implementation of the previous plan, the average annual number of days of work in riparian buffers and aquatic habitat was 2 days. Implementation of the new plan should not see significant variances from these metrics. Thinned riparian areas may take several years to re-establish the baseline level of canopy cover.

The implementation of this plan can also degrade critical habitat through intrusion of fire suppression chemicals. Fire management activities will be limited in geographic scale of impact. The anticipated annual average of effect is on 600 feet of stream habitat and 5 acres of riparian habitat. Furthermore, suppressions chemicals are only used when human life and safety are at imminent risk (fire retardant has not been used in the park since 2003). Any detrimental effects that do occur would begin to ameliorate within a year of the activity. However, the implementation of the plan will also have a beneficial effect in that there will be a reduction to the detriments of unchecked fire. When added to the baseline, and considered together with the anticipated cumulative impact of non-federal effects, the effects of the proposed action are both positive and negative, and are not likely to impair long term conservation values of critical habitat designated for PS Chinook, PS steelhead, or Lake Ozette sockeye. We have determined that the impairments will not reduce conservation values of the critical habitat to serve the recovery goals for the listed species.

Species

NMFS has estimated the median population growth rate (lambda) for each species affected by this project, and for each of the ESUs the overall lambda is below 1.0, which essentially means that the population is nonviable, because reproduction/ survival is insufficient to replace the existing population. Under the environmental baseline, population parameters of productivity, abundance, and life history diversity has been limited by the influence of hatchery fish, by physical barriers that prevent migration to historical spawning and rearing areas, and by habitat degradation actions that have impacted spawning, rearing, and migratory habitat.

Pacific salmon populations are also substantially affected by variations in the freshwater and marine environments. Ocean conditions are a key factor in the productivity of Pacific salmon populations. Stochastic events in freshwater (floods, drought, snowpack conditions, volcanic eruptions, wildfire, etc.) can play an important role in a species' survival and recovery, but those effects tend to be localized compared to the effects associated with the ocean. The survival and recovery of these species depends on their ability to persist through periods of low natural survival due to ocean conditions, climatic conditions, and other conditions outside the action area. Freshwater survival is particularly important during these periods because enough smolts must be produced so that a sufficient number of adults can survive to complete their oceanic migration, return to spawn, and perpetuate the species.

In the action area, the controlled use of fire, implementing firefighting activities, and fuel reduction are expected to add temporary impacts (soil erosion, turbidity, retardant/foam application, bucket drops, water withdrawal by pumps) to the existing environmental baseline, and some smaller but longer term increases in sediment accretion, water temperature, and reduced allochthonous inputs to few affected streams. These effects are contemporaneous with the beneficial purpose of the proposed action, which is a reduction in the frequency and extent of wildfire within the Park. While some effects of the proposed action area adverse to fish and could range from behavioral responses to death, NMFS expects these would not have appreciable effects on PS Chinook, PS steelhead, and Lake Ozette sockeye populations. We expect that the occurrence of injury or death of individuals of the listed species will not occur at a large enough scale, or with a frequency over time that any multiple cohorts of any single population, would find their total abundance reduced in a manner that appreciably diminishes, productivity, or spatial structure, or diversity of any species.

Chinook: Overall, abundance of Chinook salmon in this ESU has declined substantially from historical levels, and spring Chinook populations are chronically low in abundance. These populations are heavily augmented by hatchery supplementation. Several anthropogenic factors such as habitat degradation, water diversions, harvest, and artificial hatchery supplementation along with various negative natural events (e.g., ocean conditions, weather patterns, and environmental variability) have served to adversely impact Chinook salmon populations. Abundance information, through 1997-1998, for 36 streams with available data in this ESU shows declines in estimated numbers. Of these streams, 10 showed positive trends; however, seven of these were heavily influenced by hatchery production (NPS 2003).

Steelhead: The principal factor for the decline of PS steelhead is the destruction, modification, or curtailment of its habitat or range. Barriers to fish passage and adverse effects on water quality and quantity resulting from dams, the loss of wetlands and riparian habitat, and agricultural and urban development activities have contributed and continue to contribute to the loss and degradation of steelhead habitat in Puget Sound (NMFS 2007). In addition, ocean and climate conditions can have a profound impact on the continued existence of steelhead populations.

Sockeye: Natural production from the tributary spawning component has been stable or increasing over time while the beach spawning component has been decreasing, but both the beach spawning component and the tributary spawning component are necessary for recovery. Declines in abundance have been attributed to a combination of introduced species, predation, loss of tributary populations, a decline in quality of beach-spawning habitat, temporarily unfavorable ocean conditions, habitat degradation, artificial supplementation, and excessive historical harvests (Haggerty et al. 2009).

To sum, we expect a relatively small number of fishes from the few affected populations would be killed or injured, either directly or indirectly - as an effect of the action. This is due to the small area and short duration of annual suppression activity within riparian habitat, the localized nature of these impacts, and the overall beneficial effects from fire suppression. Therefore, the effects on productivity, diversity, and spatial structure are not expected to be discernible, and therefore unlikely to bear on any aspect of PS Chinook salmon, PS steelhead, or Lake Ozette sockeye population viability. As such, we expect that the total effects of the proposed action on individual fish identified in this opinion would be indiscernible at the population level. Additionally, PS Chinook salmon, PS steelhead, and Lake Ozette sockeye, although currently well below historic levels, are distributed widely enough and are presently at high enough abundance levels that any adverse effects resulting from the project would not have an observable effect on the spatial structure, productivity, abundance and diversity of these species. Therefore, when considered in light of existing risk, baseline effects, and cumulative effects, the project itself does not increase risk to the affected populations to a level that would reduce appreciably the likelihood for survival and recovery of the species analyzed in the Biological Opinion.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook, PS steelhead, or Lake Ozette sockeye salmon, nor adversely modify their designated critical habitats.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

1) Take in the form of harm from water quality degradation (excess sediment, increased stream temperatures, decreased prey)

Habitat related incidental take cannot be accurately quantified as a number of ESA-listed fish as there is no practicable means to count or observe the number of fishes exposed to the water quality degradation because fish will move in and out of the affected area over the period of time during which these effects will occur and harm to these fish are not necessarily visible. Because NMFS cannot directly determine the amount of take, we instead use two separate indicators of the extent of take that will serve as surrogates for incidental take. Each of these surrogates is proportionally related to the numbers of fish expected to be taken, is quantifiable and measurable, and may be effectively monitored, and thus will served as a meaningful reinitiation trigger. For water quality and stream condition effects, take is anticipated from turbidity/sediment inputs from bank erosion or mass wasting subsequent to treatments to reduce ladder fuels and debris. Because we cannot estimate the number of fishes, or even the lifestage present at any specific incident from a sediment deposit and plume downstream, we will rely on a surrogate measure of take. *The extent of take is 5 acres of riparian habitat* ***or*** *1/3 stream mile affected by erosion or mass wasting per year (to accommodate 600 linear feet of modified streambank and any downstream area of elevated turbidity or temperature). Exceeding either metric represents an exceedance of the permitted extent of incidental take*. The greater the amount of riparian vegetation removed, the greater the likelihood of slope failure and debris entering the stream where it can smother fish and prevent up and downstream passage. The riparian area and/or stream miles disturbed as a result of this action shall be surveyed and documented in the annual report.

2) Take in the form of injury or death from exposure to chemical fire suppressants
Chemical fire suppressant related incidental take cannot be accurately quantified as a number of ESA-listed fish because the distribution and abundance of fish that occur within the action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic population, and environmental characteristics. Additionally, there is no practicable means to count or observe the number of fishes exposed to the chemical fire suppressants because fish will move in and out of the affected area over the period of time during which these effects will occur and harm to these fish are not necessarily visible. Because NMFS cannot directly determine the amount of take, we instead use an indicator of the extent of take that will serve as surrogates for incidental take. This surrogate is proportionally related to the numbers of fish expected to be taken, is quantifiable and measurable, and may be effectively monitored, and thus will served as a meaningful reinitiation trigger. For fire retardant and foam exposure, the surrogate take measure will be the number of intrusion events that occurs within the stream buffer for dispersal of fire suppression chemicals. *The extent of incidental take anticipated for fire suppression chemical activities in this incidental take statement is two intrusion events per year.* This is rationally connected to the extent of take because the more chemical contact with freshwater, the greater the likelihood of fish mortality. This can also be reliably measured and monitored and intrusion events shall be documented in the annual report.

3) Take in the form of injury or death from water withdrawal during firefight.
Water withdrawal related incidental take cannot be accurately quantified as a number of ESA-listed fish because the distribution and abundance of fish that occur within the action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic population, and environmental characteristics. Additionally, there is no practicable means to count or observe the number of fishes exposed to the water withdrawal events because fish will move in and out of the affected area over the period of time during which these effects will occur and harm to these fish are not necessarily visible. Because NMFS cannot directly determine the amount of take, we instead use an indicator of the extent of take that will serve as surrogates for incidental take. This surrogate is proportionally related to the numbers of fish expected to be taken, is quantifiable and measurable, and may be effectively monitored, and thus will served as a meaningful reinitiation trigger. Therefore, the surrogate take measure will be the number of water withdrawal events (i.e., bucket drops and pumping station establishments) that occur in salmonid bearing water bodies. *The extent of incidental for water withdrawal activities in this incidental take statement is 10 withdrawal events per year from salmon bearing water bodies* (“withdrawal” being inclusive of bucket draws, and pumping). The surrogate is rationally

connected to the extent of take because the greater the number of bucket drops or pumping stations, the greater the likelihood of fish entrainment, resulting in injury or death. Finally, the surrogate can be reliably measured and monitored and shall be documented in the annual report.

2.9.2 Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

RPM 1: The NPS shall reduce take from overdrift of fire suppressing chemicals.

RPM 2: The NPS shall ensure completion of a monitoring and reporting program to confirm this Opinion is meeting its objective of limiting the extent of take, and minimizing take, from permitted activities.

2.9.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the National Park Service must comply (or must ensure that any applicant complies) with the following terms and conditions. The Olympic National Park or any delegate has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following term and condition implements RPM 1:
    a) Make all reasonable effort to ensure a 300-foot buffer from the edge of waterbodies (i.e. 600 feet total when both sides of a stream or river are considered) when airdrops of fire suppression chemicals are made.

2. The following terms and conditions implement RPM 2:
    a) Submit monitoring reports to NMFS monthly during fire plan activities implementation, with a final monitoring report summarizing the monthly reports submitted no later than December 31 of the activity year. Monitoring shall include
        i. Location and area of riparian fuel reduction, and record of mass wasting or landslide into streams or rivers following upland fuels reduction.
        ii. the number of water withdrawals (bucket drops or pumping) from ESA-listed fish streams;
        iii. downstream observations after airdrop of chemical fire suppressants to determine if fish injury or mortality occurs;

iv. collection of all discovered salmonid carcasses resulting from fire suppression actions, i.e., applications of foams or retardants; and
v. Identification of all species type collected, size, and number, at the NPS expense.

b) Send reports to: projectreports.wcr@noaa.gov
Attn: WCRO-2022-00230

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02). The conservation measure listed below is consistent with these obligations, and therefore should be implemented by the NPS.

1. Apply Minimum Impact Strategies and Tactics (MIST) to all fire operations.
2. Assign resource advisors to wildfire in the park when dictated by the values at risk.
3. Implement resource-specific mitigation strategies.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects, or those that benefit listed species, NMFS requests notification of the achievement of any conservation recommendation when the NPS submits its monitoring report describing action under this Opinion or when the project is completed.

2.11 Reinitiation of Consultation

This concludes formal consultation for Olympic National Park Fire Management Plan.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect Essential Fish Habitat (EFH). The MSA (section 3) defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the NPS and descriptions of EFH for Pacific Coast salmon (PFMC 2014); contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of Federally-managed Pacific salmon: PS Chinook (*Oncorhynchus tshawytscha*); coho (*Oncorhynchus kisutch*); and PS pink salmon (*Oncorhynchus gorbuscha*) (PFMC 2014). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers, and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). Assessment of potential adverse effects to these species’ EFH from the proposed action is based, in part, on this information.

The proposed action and action area are detailed above. The action area includes habitats that have been designated as EFH for various life-history stages of chinook, coho, and Puget Sound pink salmon.

The proposed actions are the same as those described under the ESA portion of this document. ONP proposes to revise the Fire Management Plan. Information on Chinook salmon in the project area can also be found above in the ESA information. The PS/Strait of Georgia coho salmon is a federal species of concern with EFH. Coho salmon can be found in the Quinault, Queets, Quillayute, and Elwha River basins within the park. The ESU includes all naturally spawned populations of coho salmon from drainages of Puget Sound and Hood Canal and the eastern Olympic Peninsula (east of Salt Creek), and other areas outside of the Olympic Peninsula. In the park, adult fish enter the rivers from September through early January, with some arriving as late as February. Spawning takes place from October into January, primarily in side channel habitats. Juveniles live for about a year in the river systems before migrating to the ocean from late March through mid-June.

Populations of the PS pink salmon have been identified in the Dosewallips, Duckabush, and Elwha Rivers within ONP. Pink salmon have also been observed periodically in the Skokomish River on Hood Canal and the Bogachiel River. Pink salmon have a fixed two-year life cycle, the shortest life span among Pacific salmon. River entry for pink salmon occurs from July to October in Washington, and spawning generally occurs from August to October. Freshwater EHF for Puget Sound pink salmon consists of spawning and incubation, juvenile migration corridors, adult migration corridors, and holding habitat.

3.2 Adverse Effects on Essential Fish Habitat

As described in detail in the effects of the action section of this document, the proposed action may result in short- and long-term adverse effects to a variety of habitat parameters.

1. The proposed action is likely to cause contamination of waters through the accidental application of retardants/foam from aerial drops or ground units operating heavy equipment.

2. The proposed action is likely to result in short- and long-term degradation of water quality (turbidity, temperature) because of fire suppression activities, such as reduction of riparian vegetation

3. The proposed action is likely to result in temporary reduction prey because riparian vegetation removal reduces sources of detrital prey.

3.3 Essential Fish Habitat Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NMFS is required to provide EFH conservation recommendations to federal agencies regarding actions which may adversely affect EFH. NMFS understands that the conservation measures described in the BA will be implemented by the NPS, and believes these measures are sufficient to minimize, to the maximum extent practicable, the following EFH effects; contamination of waters, suspended sediment, sound, benthic habitat removal, and predation. However, these conservation measures are not sufficient to fully address the remaining adverse effects to EFH. Consequently, NMFS recommends that the NPS implement the following conservation measures to minimize the potential adverse effects on EFH for chinook, coho, and Puget Sound pink salmon:

To minimize EFH adverse effects, the NPS should:

1. Confine fire suppression impacts to the minimum area necessary to complete the action.

2. Prepare and carry out a pollution and erosion control plan to prevent pollution caused by fire suppression operations. The plan should be available for inspection on request by NPS or NMFS.

3. Prepare and carry out a site restoration plan as necessary to ensure that all streambanks and soils disturbed by the action are stabilized and make the written plan available for inspection on request by the NPS or NMFS.

3.4 Statutory Response Requirement

Pursuant to the MSA (section 305(b)(4)(B)) and 50 CFR 600.920(k), Federal agencies are required to provide a detailed written response to NMFS' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

3.5 Supplemental Consultation

The NPS must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion is the NPS. Individual copies of this opinion were provided to the NPS. The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.
Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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