##### SEAKFHP Freshwater Fish Habitat Conservation Strategy Revision

Background:

##### SEAKFHP’s FISH HABITAT CONSERVATION STRATEGY (2014-2016):

The **conservation strategy** originally embraced by the Southeast Alaska Fish Habitat Partnership (SEAKFHP) focuses on three broad conservation goals and includes objectives and action steps the partnership will support or directly engage in as funding and opportunities arise over the three-year period from 2014-2016. These **conservation goals** were outlined as follows:

* **Protect fish habitats in freshwater systems, estuaries and nearshore/marine areas in Southeast Alaska,**
* **Maintain water quality and quantity in those areas, and**
* **Restore and enhance fragmented and degraded fish habitats in impacted areas.**

SEAKFHP’s conservation strategy was developed with consideration of nationwide strategies developed through the National Fish Habitat Partnership (NFHP) and thorough review of existing strategies used by federal and state agencies and other entities working directly on fish habitat conservation in Southeast Alaska. Close attention was given to two specific regionally-based conservation strategies: 1) Chapter 10 of the *Coastal Forests and Mountains Ecoregion in Southeastern Alaska and the Tongass National Forest – titled: Southeastern Alaska Conservation Strategy: A Conceptual Approach*[[1]](#footnote-1), and 2) the *Sustainable Salmon Strategy for Southeast Alaska*[[2]](#footnote-2), developed as an interagency strategy to develop priorities for the Sustainable Salmon Fund.

In addition, the partnership’s conservation strategy was developed as a result of pre-work performed by members of the SEAKFHP Steering Committee and other interested regional stakeholders through the use of a SWOT (strengths, weaknesses, opportunities and threats) analysis and initial elements of a Conservation Action Planning (CAP) process. As part of these efforts a list of regional risks to fish habitat and associated stressors were identified and are included in Appendix 2 of the initial strategic plan.

In 2016, the SEAKFHP Steering Committee began to revise the partnership’s initial conservation strategy focusing on years 2017-2021 using two planning efforts, one focused on freshwater systems and the other on coastal areas. This document reflects the developing revision of **SEAKFHP’s Freshwater Fish Habitat Conservation Strategy** as it targets goals, objectives and associated actions SEAKFHP partners identified to address regional fish habitat needs in freshwater systems throughout Southeast Alaska. To date small group and individual review were used to develop this document, including new sections added to each of the objectives identified to provide greater context and desired outcomes partners hope to see over the next 5 years. Actions proposed in the document take two forms, broad actions partners may engage in and specific more time bound actions the partnership itself will engage in. Regional review is now underway and associated comments and edit suggestions will be included with similar outcomes from the **SEAKFHP’s Coastal Fish Habitat Conservation Strategy** review process and combined into one document titled**: SEAKFHP’s Strategic Conservation Action Plan for 2017-2021**.

**SEAKFHP’s Freshwater Fish Habitat Conservation Strategy 2017-2021**

For purposes of this document, the goals under the original review are revised to reflect focus on freshwater systems:

**Freshwater strategy conservation goals:**

* **Protect fish habitats in freshwater systems in Southeast Alaska,**
* **Maintain water quality and quantity in those areas, and**
* **Restore and enhance fragmented and degraded fish habitats in impacted areas.**
* **Foster and support research that informs fish habitat and restoration science.**

**GOAL C1:**  **Protect fish habitat in freshwater systems areas in Southeast Alaska.**

**Objective C1-1.** **Support progressive and consistent plans, policy, regulation and management practices necessary to maintain and protect aquatic habitats in watersheds throughout Southeast Alaska and the Tongass National Forest.**

**Current status:** Watershed protection within Southeast Alaska varies by scales, jurisdictions, and landownership. It is recognized that ecological integrity and the resilience of fish and their habitats in Southeast Alaska will depend in part on balancing urban and industrial development with sound conservation measures, including supporting existing management approaches and potentially expanding a watershed scale reserve network system for the region that preserves and maintains productive fish habitat (Schoen and Dovichin 20071, National Fish Habitat Action Plan 2010[[3]](#footnote-3), Ecological Atlas of Southeast Alaska 2016[[4]](#footnote-4)).

To achieve this goal Audubon and The Nature Conservancy teamed up to review existing resource information for Southeast Alaska and the Tongass National Forest. This included developing a process for ranking individual watersheds within 22 biogeographical provinces distributed across the region. A representative set of focal metrics were used for this conservation assessment including anadromous fish habitat. A Conservation Area Design for Southeast Alaska emerged from this effort which included identification of “Conservation Priority” watersheds with the highest concentrations of ecological values. The authors of the assessment outlined a selection of conservation measures including focal actions such as maintaining and expanding the existing conservation reserve network, applying best management practices as is included in the Tongass Land Management Plan administered by the US Forest Service, and extending additional critical habitat areas surrounding state lands and waters that include high value or sensitive fish habitats. An additional outcome from this assessment was the development of the Tongass 77 (T77), a proposal developed by Trout Unlimited (TU) and other stakeholders in the region, to designate key watersheds in Southeast Alaska for permanent protection to safeguard important salmon habitat across the Tongass National Forest. Maps of the watersheds comprising the conservation reserve network for Southeast Alaska including land use maps showing the legislatively protected areas currently set aside through federal designation, the conservation and restoration priority areas identified under the Conservation Area Design effort, and the T77 watersheds can be found in the Human Uses section of the [2016 Ecological Atlas of Southeast Alaska](http://ak.audubon.org/conservation/tongass-national-forest).

In 2016, the Tongass National Forest amended the [2008 Tongass Land and Resource Management Plan](https://www.fs.usda.gov/detail/tongass/landmanagement/?cid=STELPRD3801708), incorporating recommendations to cease old-growth timber harvest in TU’s T77 watersheds and conservation priority areas identified by The Nature Conservancy and Audubon Alaska. Under the new 2016 Plan[[5]](#footnote-5) young-growth timber harvest is allowed in these areas; the Forest Service would conduct an internal scientific review in collaboration with a forest collaborative and other stakeholders to determine likely impacts to fish and wildlife habitat from young-growth timber projects that intersect with the 19 “modified” Tongass 77 watersheds. Best Management Practices (BMPs) and other measures to protect water quality and fish habitat are incorporated into the Forest Plan and implemented during all ground-disturbing activities in the Tongass National Forest. An annual monitoring program evaluates the implementation and effectiveness of these measures.

Watershed condition on non-federal lands of Southeast Alaska are managed through a variety of municipal ordinances and comprehensive plans, Alaska Department of Natural Resources (ADNR) Area Management Plans, Alaska Department Fish and Game (ADFG) Special Area Plans, and specific State statutory authorities granted to ADFG, ADNR and Alaska Department of Environmental Conservation (ADEC). BMPs as prescribed under the State of Alaska Forest Resources Practices Act[[6]](#footnote-6) are designed to protect fish habitat and water quality on non-federal lands. In addition, ADFG has the statutory responsibility for protecting freshwater anadromous fish habitat and providing free passage for anadromous and resident fish in fresh water bodies ([AS 16.05.841-871](http://www.adfg.alaska.gov/index.cfm?adfg=habitatregulations.prohibited)). Any activity or project that is conducted below the ordinary high-water mark of an anadromous stream requires a Fish Habitat Permit, which is the tool used to safeguard freshwater anadromous fish habitat. Municipal waterbody protections exist in the form of anadromous stream setbacks in Juneau and Haines, and most other communities have localized watershed management plans for drinking water protection.

Mechanisms for additional habitat protection beyond local, state, or federal management are more limited. Non-governmental organizations, such as the Southeast Alaska Land Trust (SEAL Trust), The Conservation Fund (TCF), and The Nature Conservancy have protected portions of watersheds, shorelines, wetlands, and riparian corridors in limited areas of Southeast Alaska through fee simple acquisition and conservation easements. In addition, SEAL Trust and TCF are wetland mitigation sponsors under agreements with the U.S. Army Corps of Engineers governed by Section 404 of the Clean Water Act. Through SEAL Trust and TCF’s In-Lieu Fee Programs, the organizations receive mitigation funds from private and public developers who are required to pay a “fee in-lieu” of mitigation under the Corps permitting program. All mitigation funds are used for preservation of wetlands, other aquatic resources, and important adjacent upland buffers. SEAL Trust uses all of its mitigation funds in Southeast Alaska, while TCF is statewide. These tools are largely applied at the parcel scale, and in aggregate have protected roughly 6,000 acres over the past 20+ years. Additional In-Lieu Fee Programs are currently under consideration by the Army Corps of Engineers including a program proposal from the Southeast Alaska Watershed Coalition (SAWC), an additional SEAKFHP partner.

**Desired Future Condition/Outcomes:**

SEAKFHP recognizes habitat protection processes are legislative, regulatory, or attained in other means beyond the scope of the partnership. However, maintaining and preserving intact habitat is critical to maintaining sustainable fish populations across the region. On federal lands, the Tongass Forest Plan includes goals to “maintain ecosystems capable of supporting the full range of native and desired non-native species and ecological processes” and to “maintain or restore the natural range and frequency of aquatic habitat conditions on the Tongass National Forest to sustain the diversity and production of fish and other freshwater organisms.” The State of Alaska, through a legislative process can nominate Conservation Areas on state lands, which collectively includes Critical Habitat Areas (CHAs), State Game Areas, State Game Refuges, and Wildlife Sanctuaries, and has designated 32 of these around the state to protect particularly rich fish and wildlife habitats that possess significant fish and wildlife recreational opportunities. The legislature has the ability to expand and refine the Conservation Area system on an annual basis. Currently at play in Southeast Alaska is possible transfer of lands both from the Federal Government to the State of Alaska and also to Tribal entities in the region. As such, SEAKFHP Partners support collaborative planning strategies among all land owners that can afford continued habitat protections and associated Best Management Practices to conserve fish habitat across the region.

On private lands, SEAKFHP will support habitat protection opportunities through non-governmental organizations to permanently protect wetlands and productive fish habitat throughout Southeast Alaska, with a goal of increasing protected acreage up to 10,000 acres over the next five years.

**Actions:**

* **Action C1-1.1.** Elevate assessment work and conservation strategy recommendations completed as part of *The Coastal Forests and Mountains Ecoregion in Southeastern Alaska and the Tongass National Forest*, edited by J. Schoen and E. Dovichin.
* **Action C1-1.2.** Support regional discussions that consider establishing additional Special Areas/Conservation Areas (such as Critical Habitat Areas) surrounding state lands and waters that include high-value fish habitats.
* **Action C1-1.3.** Raise awareness and understanding of current habitat protection initiatives such as the Tongass 77 initiative developed by Trout Unlimited.
* **Action C1-1.4.** Support awareness of and participation in the Tongass National Forest Best Management Plan monitoring program.
* **Action C1-1.5.** Support evaluations ofthe habitat permitting process overseen by the State of Alaska that maintain the statutory responsibility to protect freshwater anadromous fish habitat.
* **Action C1-1.6.** Support awareness and information sharing about impacts of climate change on fish habitats. Participate in the development of vulnerability assessments and adaptation measures to protect and maintain resilient freshwater habitats.
* **Action C1-1.7.** Support efforts to more fully characterize the economic contribution of intact fish and wildlife habitat, pristine areas for recreation and ecosystem services provided to adjacent communities by undeveloped lands.
* **Action C1-1.8.** Support creation and implementation of financial mechanisms to support habitat protection opportunities through non-governmental organizations (such as land trusts) as part of a larger watershed restoration/protection strategy, including the development and implementation of high quality compensatory mitigation strategies for aquatic habitat restoration and protection (i.e. Mitigation banks, In-Lieu Fee programs, and carbon market credits).

**Objective C1-2. Foster regional support necessary to ensure that additional anadromous fish habitat in Southeast Alaska is included in the Anadromous Waters Catalog (AWC), and thus is eligible for basic protections afforded under state law.**

**Current status:** The Southeast Alaska landscape is home to an incredible amount of freshwater habitat that supports millions of anadromous fish. The habitat comes in the form of streams, rivers, and lakes and the numerous other finer distinctions inherent therein. Estimates of known anadromous habitat as identified from the Anadromous Waters Catalog (2017) include over 6,300 streams and rivers encompassing approximately 12,500 km. Over 1,200 lakes covering 35,000 ha also provide habitat to anadromous fish. Most of this stream, river, and lake anadromous habitat that is known to host anadromous fish is in good to pristine condition, due in part to protections afforded through Alaska Statute. Other protection measures are similarly afforded through Tongass National Forest and state of Alaska provisions.

Although Alaska Statute provides protection to known anadromous waterbodies (as reflected by inclusion in the AWC), it is widely assumed that a significant amount of anadromous habitat in Southeast Alaska is not yet officially recognized and afforded the same protection. Estimates of the remaining anadromous habitat in the region are significant. Numerous evaluations suggest at least 50% more anadromous habitat exists on the landscape. This could amount to another 6,000 streams and rivers and over 1,000 lakes. Based on these numbers the total estimated anadromous habitat in Southeast Alaska likely encompasses over 12,000 streams and rivers and > 2,000 lakes.

Every year there are significant efforts put forth to document and inventory additional anadromous habitats for inclusion into the AWC. These efforts are absolutely critical if additional anadromous habitat is to be afforded basic protection under state law.

**Anadromous Waters Catalog (AWC):**

According to the most recent Anadromous Waters Catalog ([AWC, 2016](https://www.adfg.alaska.gov/sf/SARR/AWC/index.cfm?ADFG=main.interactive)), there are 6,334 individual waterbodies in Southeast Alaska which are known to support habitat for 10 species of anadromous fish present in the region. These waterbodies include a total of approximately 12,530 km of flowing water. Information from historic and recent field surveys as well as GIS-based evaluations suggest the AWC does not accurately identify and delineate the complete extent of anadromous habitat in the region. Estimates of the true amount of anadromous waterbodies in the AWC vary by island or area or even watershed, as well as by which type of data is referenced (e.g, field data or GIS-based evaluations) and range from 25% - 50%. Therefore it is recognized that a significant number of streams and rivers supporting anadromous fish are potentially not officially listed in the AWC and thus afforded the same protection under Alaska Statute (AS 16.05.871). Several other ways in which the AWC is known to be lacking involve species- and lifestage-specific accounting; although a waterbody in the AWC might accurately identify the upper extent of anadromous habitat for one species, other species extents might be truncated (or extended too far). Another example is related to identifying the entire spawning or rearing habitat extent for individual species, as opposed to just a species being noted as present.

**AWC Survey Prioritization:**

There is no single, all-encompassing and agreed upon prioritization strategy or final listing of watersheds in which AWC surveys could be implemented resulting in the most efficient and effective use of resources and ultimately, inclusion into the AWC. However, a number of strategies using similar data sources have been used for the same end desire for different areas across Southeast Alaska.

**AWC Survey Protocols:**

Similar to the lack of a single, all-encompassing prioritization strategy, there is no standard reference for how to conduct an AWC survey, although one [Division of Habitat Technical Report](http://www.sf.adfg.state.ak.us/FedAidPDFs/SP14-08) is published and readily available and contains valuable information and methodology which could assist future efforts.

**Desired Future Condition/Outcomes:** SEAKFHP supports development of prioritization strategies and utilization of consistent survey methodologies to update and expand the AWC, which represents the diversity and extent of anadromous fish habitats across the region.

**Actions:**

* **Action C1-2.1.** Annually facilitate communication among SEAKFHP partners to develop AWC prioritization strategies that considers current and future development or land management activities placing anadromous waters at risk.
* **Action C1-2.2.** By 2019 facilitate a review of watersheds in Southeast Alaska where AWC surveys would provide the most significant expansion (or correction) of the AWC.
* **Action C1-2.3.** By 2021 facilitate implementation of AWC surveys in the specific areas or streams WITHIN the 5 highest priority watersheds (identified via Action C1-2.2) associated with individual communities or areas where AWC surveys would be conducted.
* **Action C1-2.4.** Archive ADF&G AWC survey protocols on SEAKFHP website and support funding to ADF&G to host training opportunities and share methods necessary for producing AWC nominations.
* **Action C1-2.5.** Support and/or assist collaborating partners for conducting AWC surveys in at least 5 watersheds annually across Southeast Alaska.
* **Action C1-2.6.** Support and/or assist collaborating partners for submitting AWC nominations associated with surveys in the same year they were conducted.

Note: Efforts to catalog anadromous fish habitat should also identify and document non-anadromous fish habitat and distribution patterns with a focus on rainbow trout, cutthroat trout, and Dolly Varden. Such information should be used to populate ADF&G’s Alaska Freshwater Fish Inventory (AFFI) database and associated mapping interface (Fish Resource Monitor).

**Objective C1-3. Support coordination and collaboration efforts directed at the prevention, early detection, response, and control of aquatic invasive species (AIS) in Southeast Alaska.**

**Current Status:** An invasive species is defined as a species that is non-native to a particular ecosystem and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Presidential Executive Order 13112). The annual cost of invasive species to the U.S. economy is estimated at $120 billion. Invasive species represent an increasing threat to Alaska’s economy and environment as nonnative plants, animals, and pathogens invade aquatic and terrestrial ecosystems, either through accidental or intentional introductions.

Pathways for invasive species introductions to Southeast Alaska have not been studied, but likely mirror those common in other parts of the world. Typical pathways include transportation (e.g. goods, equipment, ballast water) and the accidental or intentional release of nonnative species (e.g. pets, aquatic farm biota, nursery plants). Nonnative invasive species that live in water or the riparian zone have the greatest potential for impacting fish and fish habitat.

Although few freshwater aquatic invasive species are known to occur in Southeast Alaska, these species, as well as those that may invade or get introduced in the future, pose a serious threat to fish and fish habitat. Invasive plants, animals, and other organisms can harm fish-dependent economies and ecosystems by outcompeting and displacing native fish and their prey, or by altering or degrading native riparian and aquatic habitats that sustain fish populations. Reed canarygrass (*Phalaris arundinacea*) and Bohemian knotweed (*Fallopia x bohemica*) are highly invasive plants intentionally introduced to Southeast Alaska. These plants are widely distributed in the region and thrive in both aquatic and riparian habitat. Infestations can alter stream flow and sediment transport, and dense monocultures in riparian zones can impact ecological functions that support fish and fish habitat.

The red-legged frog (*Rana draytonii*), the only freshwater aquatic invasive animal known from the region, was intentionally released on Chichagof Island in the early 1980s. Adult red-legged frogs are known to prey on three-spine stickleback and the herbivorous tadpoles can potentially alter aquatic food webs that support fish.

State and federal agencies, along with non-profit and other organizations are actively involved in efforts to document and manage invasive species in Southeast Alaska. ADFG produced the *Alaska Aquatic Invasive Species Management Plan* to address the threat of invasive species on aquatic ecosystems in the state. The plan identifies actions to prevent the introduction and spread of these species. Invasive plant management plans have been developed for several communities in Southeast Alaska and the USFS is currently developing an invasive plant management plan for the northern Tongass National Forest. Individual USFS ranger districts in the southern part of the Forest have developed invasive plant management plans. The Takshanuk Watershed Council leads a cooperative weed management area for the north Lynn Canal area. The National Park Service conducts invasive plant surveys and actively manages priority infestations on their park lands and properties in Southeast Alaska. The Sitka Tribe of Alaska is developing an invasive plant program. USFWS and its partners have conducted invasive plant surveys in the City and Borough of Juneau and are actively managing priority species in selected wetland and upland habitats.

**Desired Future Condition/Outcomes:** Preventing new introductions and managing existing infestations in a strategic manner is key to protecting fish and fish habitat from aquatic invasive species. Prevention is most likely to succeed by proactively identifying those species most likely to be introduced and the potential pathways for their introduction. Once identified, invasion pathways can be eliminated or managed through outreach and education to increase awareness and change practices or through existing or new regulations/policies. Monitoring efforts are necessary to detect aquatic invasive species as early as possible followed by rapid control efforts if warranted to ensure eradication. Some of the species that could invade freshwater aquatic habitats in Southeast Alaska include Atlantic salmon, Eurasian watermilfoil, purple loosestrife, and Elodea. Finally, understanding the current distribution and abundance of aquatic invasive species relative to the most vulnerable and productive fish habitat is necessary to develop management plans that use limited resources most effectively.

**Actions:**

* **Action C1-3.1.** Foster activities that complement invasive species programs administered by ADF&G, USFWS, NOAA-NMFS, and implemented on smaller scales by local and tribal government or non-government entities.
* **Action C1-3.2.** Encourage and assist with current and future pathway analyses that identify vectors contributing to the introduction and spread of AIS in Southeast.
* **Action C1-3.3.** Support activities that identify target audiences and increase public awareness about the species and pathways of concern, and impacts imposed by AIS through education and outreach efforts with objective to change human behaviors and increase reportage of AIS sightings.

**Objective C1-4. Facilitate regional support and funding for evaluation of potential effects to fish and their habitats from development projects in transboundary watersheds.**

**Current status:** Southeast Alaska shares the Taku, Stikine, Unuk and several smaller rivers with British Columbia; these are commonly referred to as transboundary rivers. Within these watersheds, at their Canadian headwaters, more than 10 large-scale mining projects are in various phases of operation and development. These types of operations have the potential to harm fish and fish habitat in these systems through direct and indirect impacts. Protecting productive and intact habitats throughout these transboundary river systems is necessary to ensure healthy salmon and other resident populations of fish are maintained. Current efforts are underway at various levels to work collaboratively with British Columbia and Canadian governments to ensure the necessary regulatory and policy frameworks are in place to protect Southeast Alaska from downstream impacts:

* Memorandum of Understanding and Statement of Cooperation between the State of Alaska and the Province of British Columbia which convenes the Bilateral Transboundary Working Group and the Transboundary Technical Working Group[[7]](#footnote-7)
* Formation of the United Tribal Transboundary Mining Working Group – a consortium of 15 federally recognized Indian Tribes that reside in Southeast Alaska and live along theses rivers
* Salmon Beyond Borders a campaign driven by sport and commercial fishermen, community leaders, tourism and recreation business owners and concerned citizens, in collaboration with Tribes and First Nations, united across the Alaska/British Columbia border to defend and sustain transboundary rivers, jobs and way of life).

In addition, numerous SEAKFHP partners are involved in habitat assessment and water quality monitoring efforts of these river systems, these include Central Council Tlingit Haida Indian Tribes of Alaska water quality monitoring on the Taku, Stikine and Unuk; Alaska Department of Environmental Conservation’s (ADEC) AKMAP sampling planned for 2017-2020 in Southeast Alaska lakes, rivers and coast including transboundary river systems and ADEC/SEACC Inside Passage Waterkeeper joint project to inventory and aggregate water quality data across Southeast Alaska. Additionally, support from the Alaska Congressional Delegation may include interior appropriations funding for baseline data collection in the near future. Support for these efforts can be seen through a recent study by the McDowell Group[[8]](#footnote-8) completed in 2016 highlighting the economic impact to Southeast Alaska as a result of the productivity provided to the region by transboundary rivers and by 2017 Alaska State Legislature – House Joint Resolution No. 9 (HJR9) addressing these concerns through the state legislature resolution process[[9]](#footnote-9).

**Desired Future Condition/Outcomes:** To maintain habitat quality for transboundary rivers entering into Southeast Alaska a transboundary land use framework is needed that ensures equal representation across the international boundary, amongst governing entities, including Tribes and First Nations, provincial, state and federal jurisdictions. To be effective, this framework must include a scientific assessment of impact and risk with respect to water quality and fish production and include land use protection mechanisms to ensure fish habitat quality is maintained, connectivity from headwaters to marine waters are maintained and water quality standards are developed and maintained.

**Actions:**

* **Action C1-4.1.** Continue to foster awareness of transboundary river development projects proposed adjacent to Southeast Alaska and support cross boarder collaboration and regional discussions on potential impacts to fish habitats. Encourage land use protection mechanism opportunities as part of these dialogs, for reference see the land use plan created for the Atlin Taku region of northwestern British Columbia, Canada.

<http://trtfn.com/wp-content/uploads/2012/09/press-release-lup-g2g.pdf> .

* **Action C1-4.2.** Encourage cross border participation and financial support for the State of Alaska Technical Transboundary Working Group and others to collaboratively assess and develop baseline fish habitat and water quality parameters for transboundary rivers.
* **Action C1-4.3.** Support funding opportunities for baseline evaluation of potential effects for transboundary development projects.
* **Action C1-**4.4. By 2018 produce fish habitat distribution maps for the Taku, Stikine, Unuk and other transboundary rivers in Southeast Alaska and British Columbia.
* **Action C1-**4.5. By 2018 produce a summary of reservations of water adjudications for Southeast Alaska transboundary river systems and associated tributaries.

**GOAL C2: Maintain water quality and quantity in freshwater systems in Southeast Alaska.**

**Objective C2-1. Support water quality monitoring programs to track and manage changes occurring in freshwater aquatic systems across Southeast Alaska.**

**Current status:** The Alaska Department of Environmental Conservation Division of Water has the responsibility to report and identify causes and sources of water quality impairment by "characterizing all the waters in Alaska". One way the division carries out this task is to monitor and report on water quality. The Alaska Monitoring & Assessment Program (AKMAP) fulfills this responsibility. The Environmental Protection Agency (EPA) created the Environmental Monitoring and Assessment Program (EMAP) in the mid-1990s to survey the environmental condition of the Nation's water resources. AKMAP is part of this nationwide effort and is responsible for surveying Alaska's water resources. This effort is now part of EPA national Aquatic Resource Surveys. AKMAP surveys report on the status of Alaska's water resources with a known statistical confidence, allowing resource managers, elected officials, and the public to understand the "big picture" of Alaska's water resources. No similar probabilistic sampling surveys are currently providing regional, ecological information on such a large scale within Alaska. The EMAP implementation strategy is DEC's plan to sample and report monitoring data for large regions of Alaska in the near future.

The AKMAP has sampled coastal and fresh waters since 2002. Additional information and links to interactive maps can be found here: <http://dec.alaska.gov/water/wqsar/monitoring/AKMAP.htm>.

AKMAP is planning to conduct aquatic resource surveys in Southeast Alaska over the course of the next 4 to 5 years. AKMAP partners with the Environmental Protection Agency’s National Aquatic Resource Surveys (NARS) to complete this work. NARS are statistical surveys designed to assess the status of and changes in quality of the nation’s coastal waters, lakes, rivers, streams, and wetlands. Using survey sites selected at random, they provide a snapshot of overall condition of the nation’s waters. AKMAP applies NARS methodology, adapting methods to fit Alaska’s large size and often remote nature. AKMAP will be conducting these surveys in Southeast Alaska, beginning with a lakes survey in 2017, a rivers and streams survey in 2018 or 2019, and a coastal survey in 2020. A similar coastal survey was completed for Southeast in 2004, details can be found here: <http://dec.alaska.gov/water/wqsar/monitoring/2004Southeast.htm>.

Additionally, local municipalities, tribes and non-profit groups have become increasingly engaged in water quality monitoring in the region. A few examples include the Southeast Alaska Stream Temperature Monitoring Network; the Inside Passage Waterkeeper a small, grassroots group who care for, protect, and restore their local bodies of water who in partnership with the Southeast Alaska Conservation Council are compiling and archiving regional water quality data and monitoring information for the region; and Central Council Tlingit and Haida Indian Tribes of Alaska who are collecting baseline water quality information in transboundary watersheds as part of a three-year study funded by the Bureau of Indian Affairs.

**Desired Future condition:** SEAKFHP desires robust water quality monitoring across the region to maintain aquatic habitat necessary for sustainable fish populations across the region.

**Actions:**

* **Action C2-1.1.** Work proactively with ADEC partners to encourage partner participation and engagement with the Alaska Monitoring & Assessment Program (AKMAP) to leverage resources for water quality sampling in lakes, rivers and coastal areas of Southeast Alaska. By 2020 support a regional workshop to elevate the findings from the Southeast assessment.
* **Action C2-1.2.** Work with the Alaska Department of Environmental Conservation (DEC) through the Alaska Clean Water Actions program and with other SEAKFHP partners to promote development of a long-term water quality monitoring and tracking program for Southeast Alaska.
* **Action C2-1.3.** Facilitate regional support for the Southeast Alaska Stream Temperature Monitoring Network to leverage resources needed for monitoring stream temperatures at key locations across Southeast Alaska. By 2021 support a regional workshop to elevate awareness of successes of the network.
* **Action C2-1.4.** Working with SEACC partners, support data archive for regional water quality information available across Southeast Alaska.
* **Action C2-1.5.** Elevate awareness of CCTHITA water quality sampling work in transboundary areas in the region and support leveraging partner resources for this work to connect to long-term monitoring in the region.

**Objective C2-2. Secure Reservations of Water (ROW) on important salmon, trout, and steelhead-producing systems.**

**Current status:** According to ADF&G’s anadromous waters catalog, over 19,000 stream rivers or lakes have been specified as supporting anadromous fish populations in Alaska (Johnson and Litchfield 2016)[[10]](#footnote-10). These waterbodies are all potentially subject to water withdrawals and modification of their natural streamflows. Most waterbodies in the state are currently not subject to withdrawals, diversions, or impoundments of water and remain free flowing at this time. It is important to protect these unallocated streamflows before competition over the water arises.

An appropriation of water that remains within its waterbody is legally defined under Alaska law (AS 46.15.145) and regulations (11 AAC 93.970) as a reservation of water (ROW). To reserve water, an application with supporting data and analyses must be submitted to the Alaska Department of Natural Resources (DNR). A minimum of 5 years of mean daily streamflow data is recommended by DNR to quantify instream flow requirements within an application. Priority dates for ROW applications are based on the date they are accepted by DNR. Alaska water law is based on the doctrine of prior appropriation, also known as “first in time first in right.” The legal process of determining the validity and amount of a water right is called an adjudication.

In 2001, ADF&G started a project supported by the Alaska Sustainable Salmon Fund to collect the data necessary and to file ROWs on priority waterbodies in Southeast Alaska. Since that time ADF&G has filed ROWs on 110 reaches, three lakes, adjudicated 52 reaches, and collected streamflow data at 60 stations. Currently ADF&G is operating stream gages at Peterson Creek out the road Juneau, Windfall Creek, multiple sites in the Thorne River drainage, and Eva Creek. Klein 2016[[11]](#footnote-11), provides a full list of ROWs that ADF&G has filed and adjudicated.

**Desired Future condition:** A lack of streamflow data on Southeast Alaska waterbodies will severely limit the future filing of additional ROWs and potentially leaves thousands of stream reaches without adequate protection of instream flows. In Southeast Alaska there remains only 15 stream reaches with sufficient streamflow data to file an ROW. ADF&G will continue to file ROWs on these waterbodies, including: Thorne River, Blossom River, Alsek River (downstream of Alsek Lake), Chilkat River (near Klukwan), Salmon River (Gustavus), Eva Creek, Hatchery Creek (POW), and Ahrnklin River (Yakutat).

To ensure that ROWs can continue be filed into the future, ADF&G will continue to operate existing stream gages and investigate installing new stations on priority waterbodies. Future potential ADF&G stream gage locations include streams on the Prince of Wales road system (Eagle Creek, Control Creek, Logjam Creek), Hoonah road system streams, Davies Creek (Cowee Creek near Juneau), and Steep Creek (near Juneau). The USGS has recently begun and will continue to operate new stream gages on Salmon Creek (Gustavus) and Hatchery Creek (POW). Alaska HydroScience, Inc. operates a stream gage on the Ahrnklin River and will have five years of streamflow data in November of 2018. Takshanuk Watershed Council in Haines maintains a gage at Sarah Creek, five years of data collection will conclude in 2018. Cooperative projects to collect streamflow data with the USGS, USFS, consultants, and local watershed councils will also continue to be explored.

In 2017, ADF&G anticipates beginning the adjudication process with DNR on the Lost River (5 reaches), Hamilton River, Kadashan River (4 reaches), and Maybeso Creek (5 reaches).

**Actions:**

* **Action C2-2.1** Support projects that prepare, file, and adjudicate Reservation of Water (ROW) for instream use applications including the collection of water quantity and quality data to obtain five years of record.
  + Create a regional list of priority waterbodies for ROWs
  + Identify waterbodies that have the five years of stream gage data necessary to file ROWs
  + Prepare and file ROWs on priority waterbodies that have five years of streamflow data
  + Adjudicate ROWs filed with DNR
  + Provide regional coordination support to partners interested in filing for ROWs
* **Action C2-2.2** Support projects that collect the streamflow data necessary to file ROWs
* Collect additional stream gage data on priority waterbodies that have less than 5 years of data
* Collect five years of streamflow data on priority water waterbodies with no data
* Support training, equipment purchases, and travel costs necessary to install and operate stream gages
* **Action C2-2.3** Increase awareness of the current status and the process used to prepare and file ROWs
* Provide training opportunities in the process and data requirements to file ROWs
* Support public meetings/partner updates on current state of ROWs in SEAK
* Increase awareness of ADF&G Instream Flow Protection Annual report and Interactive Mapper <http://dnr.alaska.gov/mlw/mapguide/wr_intro.cfm>

**Objective C2-3. Increase awareness of the adverse impacts of urban stormwater runoff on fish and fish habitat and support efforts to manage stormwater runoff to improve water quality and aquatic health.**

**Current status:** Stormwater runoff is rainwater or meltwater (from snow and ice) that flows off of impervious or partially impervious surfaces in developed landscapes like urban environments. Runoff rates from these areas are typically much higher due to lower infiltration and storage rates. Elevated runoff rates can physically alter fish habitat by scouring the streambed and eroding banks. Stormwater from urbanized landscapes frequently contains petroleum hydrocarbons, heavy metals, sediment, fecal coliforms, and other pollutants. Upon entering water bodies, these pollutants can impair fish habitat (i.e. elevated turbidity, sedimentation) and have chronic and acute effects on fish and other aquatic organisms.

Several urban anadromous streams in Southeast Alaska have been designated as impaired water bodies by the Alaska Department of Environmental Conservation (ADEC) because they do not meet one or more state water quality standards. For each impaired water body, ADEC establishes a total maximum daily load (TMDL) for each pollutant impacting water quality. The TMDL establishes a daily limit on the amount of the pollutant that can enter the stream to ensure compliance with state water quality standards. Most TMDLs for impaired streams in Southeast Alaska identify stormwater as the source of one or more pollutants. There are likely other urban fish streams in the region that should be evaluated for potential stormwater impacts to water and habitat quality.

Watershed restoration and action plans have been produced for several Southeast Alaska streams on the state list of impaired water bodies. These plans often recommend best management practices for specific sites that address stormwater. Regional watershed councils, ADEC, and USFWS are working with landowners and other partners to map stormwater systems and manage stormwater in several urban watersheds. The City and Borough of Juneau has produced a manual of stormwater best management practices.

**Future condition:** SEAKFHP partners envision a future where local communities have greater access to resources, including vetted Best Management Practices, to better protect aquatic communities from poor water quality conditions associated with urban settings.

**Actions:**

* **Action C2-3.1.** Work with ADEC, ADFG, and communities to identify and prioritize watersheds where stormwater is likely impacting fish and fish habitat.
* **Action C2-3.2.** Support efforts to map stormwater runoff, identify and prioritize stormwater management projects, and implement and monitor stormwater management Best Management Practices (BMPs).
* **Action C2-3.3.** Work with communities to develop stormwater management requirements for new development and redevelopment to maintain or improve water quality and fish habitat.
* **Action C2-**3.4. Support public outreach efforts that communicate the benefits of stormwater management practices and stream buffers.

**GOAL C3:** **Restore and enhance fragmented and degraded fish habitats in southeast Alaska.**

**Objective C3-1. Foster activities that maintain and restore fish habitat connectivity at road/stream crossings in Southeast Alaska**

**Current Status:** Interagency efforts in Southeast Alaska to inventory, assess, prioritize, develop design methods, and restore aquatic habitat connectivity at road/stream crossings have been ongoing with varying levels of intensity since 1997.

Early efforts by EPA, ADFG and USFS focused on inventory and assessment on USFS Tongass National Forest (TNF) system roads, culminating in the only regionally comprehensive publication *Tongass Road Condition Survey* (ADFG, 2000) to date. TNF staff continued an intensive assessment program through 2005 and concurrently developed a comprehensive GIS, an Upstream Habitat Assessment protocol, an estimate of barrier severity, a biological significance index, and various prioritization schemas to inform remediation efforts. Additional, although less intense assessment work continues, and includes capture of previously missed road segments, filling in of data gaps, and updates to previously identified road/stream crossings. As of 2016, the TNF has surveyed 3,668 fish stream road crossings along 5,000 miles of road. Of the 2,019 crossings that are culverts, approximately 34% of these crossings do not meet State of Alaska Passage Standards. Between 1998 and 2016, the TNF has reinstalled, retrofitted, or removed approximately 516 non-compliant crossings. Since 2013, approximately 10 crossings per year have been reconstructed to design standards and a total of 44 crossings were removed from roads (TNF, 2015 Monitoring and Evaluation Report). Efforts are currently underway to develop and apply a new fish passage restoration prioritization schema for the Staney Creek watershed on Prince of Wales Island.

Formal fish passage assessment on ADOT and municipal roads trailed significantly behind the Tongass National Forest efforts. Localized assessments were conducted by ADFG Habitat Division in the Klawock watershed in 2002, by Takshanuk Watershed Council along the Haines Borough road system in 2010, and by ADNR Division of Forestry on State and private forest lands in 2009. Since 2011, the ADFG Sportfish Division Fish Passage Improvement Program has conducted formal inventories of ADOT and local municipal roads across Southeast. As of 2016, ADFG has assessed 625 culverts along these roads at fish streams; of these 254 were classified ‘red’, 151 ‘gray’, 187 ‘green’ and 33 ‘black’ (unclassified). ADFG will complete the remaining ADOT assessment in 2017 and also has a draft prioritization schema in development. ADFG maintains its data, photos, and mapping information on a publicly accessible [website/mapper](http://www.adfg.alaska.gov/index.cfm?adfg=fishpassage.main).

Fish passage barrier restoration on the non-federal ownerships in Southeast has largely been conducted by ADOT as part of road reconstruction projects and occasional maintenance or special projects. ADOT projects have occurred on almost all of their road systems, and 26 fish culvert replacements are in currently in planning and design as part of Haines Highway improvements. Various NGOs and watershed councils have collaborated on site-based fish passage restorations, and the USFWS Fish Passage Program has partnered with these entities as well as local governments on approximately 48 culvert replacements or removals since 2003.

Quantitative monitoring of the physical habitat metrics of replaced culverts has been part of the Tongass National Forest Monitoring and Evaluation Program, and is the only ongoing formal monitoring of its type in the region.

**Desired Future Condition/Outcomes:**As a regional partnership SEAKFHP partners desire no new barriers constructed on new development or as part of existing road re-construction. This will require increased awareness, training opportunities and consistent application of policy and regulation. We recognize the benefit in developing a regional fish passage mapper across land ownerships. We strive to leverage SEAKFHP partnerships to remove or restore 50fish passage barriers over the next five years and commit to annually archiving fish passage remediation accomplishments in the region.

**Actions:**

* **Action C3-1.1.** Annually support interagency cooperation and policy to improve fish habitat connectivity.
  + Support interagency cooperative agreements related to fish passage.
  + Encourage periodic review, updates and adoption of fish passage design guidelines among agencies.
  + Foster awareness to and within agencies and landowners of guidance and cooperation for fish friendly ORV road-stream crossing structure design and evaluation.
  + Support training and utilization of USFS upstream fish habitat assessment protocol on state and private land road-stream crossings to inform prioritizing crossings for remediation.
  + Support regional fish passage restoration prioritization efforts.
* **Action C3-1.2.** By 2018 support completion of fish passage barrier inventory on ADOT road/stream crossings.
* **Action C3-1.3.** By 2019 support development of unified interagency (USFS, ADFG, DNR) fish passage inventory mapper and database for Southeast Alaska ownerships.
* **Action C3-1.4.** By 2018, convene fish passage design workshop for Southeast Alaska.
* **Action C3-1.5**. By 2021 support SEAKFHP partners to remove or restore 50 fish passage barriers across all ownerships.
* **Action C3-1.6.** By 2021 foster interagency effectiveness monitoring at remediation sites.

**Objective C3-2. Restore and enhance fish habitat function and complexity and inform future restoration activities through adaptive management.**

**Current status:** The commercial, sport, and subsistence fisheries for salmon in Southeast Alaska are world renowned and, in addition to high-value economic returns to local communities the Tongass occupies a “failsafe” position for habitat and stocks. The USFS Tongass Watershed Condition Assessment (2015) found that most of the 900 watersheds within the Tongass are in near natural condition (Condition Class I). Less than 7% of these watersheds may be “at risk” for maintaining ecological function due to past management practices and likely have restoration needs. Degraded watershed condition in the Tongass primarily results from timber harvest and road building between 1950 and 1979. More restrictive measures to protect watershed condition and salmon habitat were included in the Tongass Timber Reform Act (1990) and subsequent Tongass Forest Plans (1997, 2008, 2016). Per the 2016 Tongass Forest Plan Amendment, old growth timber harvest is not allowed in Trout Unlimited’s “Tongass 77” watersheds.

In the Tongass National Forest, following a review by USFS staff and stakeholders, Priority Watersheds were established, creating focused restoration plans and activities. Restoration projects include road storage and decommissioning, removal and remediation of fish barriers at road-stream crossings, wildlife habitat improvements in young-growth forests, riparian young-growth forest treatments, and large wood placement to restore floodplain and stream functions that provide spawning and rearing habitat features critical to freshwater salmon life stages.

Large and small-scale stream restoration manipulations have been undertaken on a number of streams throughout the Tongass since the 1990’s. The Forest continues restoration work on the list of rated watersheds as determined by the National Watershed Condition Framework. The Fisheries and Watershed Programs on the Tongass have committed substantial funds toward continued identification, design, implementation, and monitoring of watershed restoration work across the Forest. Essential restoration has been completed in Harris River and Twelvemile Creek on Prince of Wales Island and Sitkoh River and Sitkoh Creek on Chichagof Island. The National Fish Habitat Partnership recognized Twelvemile Creek as one of ten “Waters to Watch” in 2014.

The Hoonah Native Forest Partnership, a Natural Resource Conservation Service-funded all-lands collaboration of private landowners, Tribes, state and federal agencies, and conservation organizations seeking to improve watershed condition to benefit the community of Hoonah.

**Desired Future condition:** Through a combination of natural recovery and active management, SEAKFHP partners work cooperatively to restore watersheds and aquatic habitat adversely affected by past management actions. As a result, diversity of fish stocks will be retained, benefitting all user groups. Partnerships increase our ability to provide these opportunities in a more efficient and cost-effective manner.

Ongoing partnerships support restoration that will soon be completed in the Tongass National Forest: Shelikof (Iris Meadows), Saginaw, Staney and Luck Creek watersheds. Additional Priority Watersheds will be identified to help focus strategic restoration plans in the next five years.

**Actions:**

* **Action C3-2.1.** Support further development and dissemination of reference watershed condition data that informs establishment of quantitative restoration and enhancement objectives.
* **Action C3-2-2.** Support utilization of the Forest Service Watershed Condition Framework, climate change projections and other analytical tools to identify long-term watershed restoration and resiliency opportunities and priorities.
  + Annually review and facilitate outreach of partner out-year restoration plans.
* **Action C3-2-3.** Review effectiveness of on-going mitigation and restoration projects to identify opportunities to employ adaptive management leading to improved implementation.
  + Support fish habitat utilization investigations in response to bank stabilization techniques (e.g. rip rap, large woody debris placements).
  + Support further development of physical / geomorphic response monitoring protocols for in-stream restoration/enhancement activities.
  + Evaluate efficacy of fish production response models/tools/protocols for in-stream restoration/enhancement activities.
  + By 2021 review draft U.S. Forest Service Tongass National Forest Watershed Restoration Effectiveness Monitoring (WREM) work products and reports
* **Action C3-2-4.** Support training and specialist development opportunities for conducting smaller scale hand-crew stream restoration work across all land ownerships that can be planned and implemented with minimal impact.

**Action C3-2-5.** By 2019, convene regional restoration symposium to share projects, innovations, and outcomes.

**Goal 4. Foster and support research and data collection that informs fish habitat and restoration science.**

**Current status:** A tremendous amount of information and data resources are available for freshwater systems in Southeast Alaska; however, more research and continued data collection are needed to better understand the region’s anadromous and resident freshwater fish species and associated habitats that sustain them, especially as climate changes across the region. There are many archives and sources for these types of information, a few are highlighted here:

* Localized fisheries information for fish stocks in Southeast Alaska can be found on the [ADF&G website](http://www.adfg.alaska.gov/index.cfm?adfg=fishing.main) including life history information and annual fish stock assessment data,
* Federal, state and local land managers and other interested stakeholders periodically assess and monitor fish habitat conditions in the region; a summary for some of this information is located on the SEAKFHP website: <http://www.seakfhp.org/resources/>,
* The [National Fish Habitat Assessment](http://assessment.fishhabitat.org/) has localized habitat degradation information for Southeast Alaska,
* Resource agencies and the science community continue to conduct research in the region and produce a variety of informational resources important for understanding local fish species and their habitats; a few sources are include here:
  + US Forest Service, [Tongass National Forest](https://www.fs.fed.us/fs-tags/tongass)
  + US Forest Service, [Pacific Northwest Research Station](https://www.fs.fed.us/pnw/)
  + [NOAA’s Habitat Restoration Center](http://www.habitat.noaa.gov/restoration/index.html)
  + [ADF&G Habitat Division](http://www.adfg.alaska.gov/index.cfm?adfg=lands.main)
  + [Alaska Coastal Rainforest Center](http://acrc.alaska.edu/)
  + [UAS GIS Library](http://seakgis.alaska.edu/)
  + [Sitka Conservation Society](http://www.sitkawild.org/),
* In 2016, a regional climate workshop was held in Southeast Alaska that focused on impacts to local freshwater fisheries; numerous research projects were noted and resources provided, these can be found here:<http://www.seakfhp.org/2016-climate-change-workshop-resources-page/> **.**

**Future needs:** Southeast Alaska is often termed “Alaska’s Salmon Forest,” due to the complex make-up and interaction of the terrestrial and aquatic environments in this region and how coupled together they produce robust and abundant fish populations. Exactly how this all works is still a mystery, but advancements in soil science, better understanding of localized hydrology and food web dynamics are helping us to learn how the region’s landscapes and aquatic systems interact and transfer energy for the production of fish. More work in these and associated fields are needed and are supported by the partnership.

Climate change is also a huge unknown, but with a changing environment this region is sure to experience changes in precipitation, temperature, associated snow melt and impacts to flow regimes for freshwater systems. Recent work regarding increased freshwater temperatures and periods of hypoxia offer insights to potential changes to local aquatic systems. More work in these and associated areas will help managers better prepare for changing environmental conditions in the region.

In 2017, the State of Alaska will complete an index of fish passage on state managed roads in the region. These data, along with similar data for federally managed road systems in the region, will help agencies and associated stakeholders better prioritize and restore impaired fish passage areas across Southeast Alaska. SEAKFHP will actively work to leverage fiscal resources to help plan and implement needed fish passage projects in the region.

**Actions:**

* **Action C3-3.1.** By 2019, SEAKFHP will host a regional dialog to develop a collective list of information and research gaps in the region.
* **Action C3-3.2.** In general, the partnership is supportive of research studies and data collection efforts that support the following:
  + Refine baseline hydrology in the region and across the state,
  + Map fish-habitat communities and assemblages in the region,
  + Support comprehensive surface and groundwater studies, or other habitat changes associated with climate change or other forms of habitat alteration,
  + Examine effects of partial fish passage on salmon movements and populations,
  + Characterize salmon movement within watersheds to inform and improve fish passage models and structure design,
  + Provision other restoration needs in the region or target other salmonid species such as trout.

Appendix X. Recognized risks and associated stressors to fish habitat in Southeast Alaska identified as part of SEAKFHP’s strategic planning effort, this list will be refined and used in future efforts to refine the partnership’s conservation strategy.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Risks and associated stressors to fish habitat** | Addressed in Freshwater Plan |  | Addressed in Coastal Plan |  |
| **Changing Environmental Conditions** | | | | |
| global climate change | Yes |  | Yes |  |
| ocean acidification | No |  | Yes |  |
| catastrophic events | Yes |  | Yes |  |
| tsunami debris | No |  | Yes |  |
| **Habitat Loss** | | | | |
| urban/community development | Yes |  | Yes |  |
| shoreline dredge and fill | Yes |  | Yes |  |
| **Loss of Habitat Connectivity and Complexity** | | | | |
| timber harvest and logging practices | Yes |  | Yes |  |
| energy development via hydro/tidal projects | Yes |  | Yes |  |
| road/stream crossings | Yes |  | Yes |  |
| **Degraded Water Quality and/or Quantity** | | | | |
| mining development | Yes |  | Yes |  |
| contaminated sites | Yes |  | Yes |  |
| marine vessel transportation contaminates | No |  | Yes |  |
| mixing zone contaminates | No |  | No |  |
| alteration of hydrology | Yes |  | Yes |  |
| **Ecosystem Imbalance** | | | | |
| introduction and persistence of invasive species | Yes |  | Yes |  |
| algal blooms | No |  | Yes |  |
| **Fishing Pressure** | No |  | No |  |
| **Mariculture, Aquaculture & Hatcheries** | No |  | No |  |
|  | | | | |

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3. National Fish Habitat Action Plan (reference and link to be added in final plan) [↑](#footnote-ref-3)
4. Ecological Atlas of Southeast Alaska 2016 <http://ak.audubon.org/conservation/tongass-national-forest> [↑](#footnote-ref-4)
5. 2016 Tongass Land Management Plan (link to be added) [↑](#footnote-ref-5)
6. State of Alaska Forest Resources Practices Act (link to be added) [↑](#footnote-ref-6)
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