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DOWNEAST COASTAL SALMON HABITAT RECOVERY UNIT GENERAL CONSERVATION PLAN

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EXECUTIVE SUMMARY

Atlantic salmon (*Salmo salar*) are migratory fish that spend most of their adult life in the ocean but return to the Downeast Coastal Salmon Habitat Recovery Unit (SHRU) and adjacent coastal rivers to reproduce. Atlantic salmon need unobstructed upstream access to their spawning grounds and unobstructed downstream access back to the ocean. However, in the Downeast Coastal SHRU, numerous dams partially or completely block fish migrations. Barriers to migration and many other factors have resulted in the Gulf of Maine Distinct Population Segment of Atlantic salmon (GOM DPS) being listed as endangered under the Endangered Species Act (ESA). Accordingly, dam owners are responsible for any effects from their dam on GOM DPS Atlantic salmon. To provide Atlantic salmon with unobstructed access to habitat, dam owners are encouraged to remove dams or install fish passage devices (fishways) to comply with the ESA.

NOAA's National Marine Fisheries Service (NMFS) has initiated this step to involve willing dam owners and assist in compliance with the ESA. This General Conservation Plan (GCP) is a resource that private dam owners can use to facilitate dam removal or install fish passage to benefit endangered Atlantic salmon. The conservation strategies identified in this GCP describe how dam owners can avoid, minimize, and mitigate impacts to Atlantic salmon; thus, helping in the recovery of GOM DPS of Atlantic salmon and complying with ESA laws.

The federal government is responsible for working towards the recovery of endangered Atlantic salmon and needs the help of private dam owners to achieve this goal. This GCP describes how dam owners can avoid, minimize and mitigate impacts to Atlantic salmon, furthering the goals of the ESA. Complying with the ESA can be a lengthy and potentially expensive process, but by utilizing the process in this GCP, dam owners can take advantage of a streamlined regulatory process and technical support for their participation. By following the process in this GCP, dam owners can save time and enjoy greater certainty, because the GCP lays out a streamlined approach that describes what dam owners can do in order to benefit fish and comply with the ESA. Dam owners who participate in the GCP process may choose to either remove their dam or install a fishway that would provide upstream and downstream passage for Atlantic salmon. Dam removal is the ecologically preferable option but a fishway can also substantially improve Atlantic salmon passage, even though there would likely be some ongoing impact to the fish and their habitat and required ongoing maintenance of the fishway.

Dam removals in the Downeast Coastal SHRU will benefit Atlantic salmon and many other native diadromous fish species, including Atlantic sturgeon, shortnose sturgeon, alewives, blueback herring, American shad, sea lamprey, rainbow smelt, and American eel. By restoring natural stream processes, dam removal will also benefit many native resident fish species including brook trout and landlocked Atlantic salmon. Overall ecological functions of the watershed are expected to improve as many of these species could then freely move in the stream system, which should also contribute to improving conditions for Atlantic salmon. Furthermore, as dams are removed, the river system will return to more natural habitat conditions (flowing rather than impounded water) that are beneficial to native aquatic species. Dam owners have an opportunity to assist in the recovery of Atlantic salmon populations in the Downeast Coastal SHRU, and to save time, energy, and money by participating in the GCP process.

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1 INTRODUCTION

1.1 Purpose/Overview

Numerous dams in the Downeast Coastal Salmon Habitat Recovery Unit (SHRU) are delaying or blocking passage of Atlantic salmon and other diadromous fish such as alewife, herring, and shad. Dams impact these species by delaying or blocking access to habitats necessary to complete important life history events such as spawning and juvenile rearing. There are many dams in Maine that impact the native fish community and are no longer functional or serve a specific purpose such as supporting a functioning mill. However, there have only been a small number of dams in Maine that have either been removed or modified to improve habitat connectivity. These have ranged from small, abandoned mill dams to larger, active hydroelectric generating dams. Solutions have included full dam removal, partial breaching, or modification so that the downstream dam face becomes a "nature like" slope resembling natural rapids. In each case, the solution was custom-designed based on the unique biological, physical and economic characteristics of the site. The primary goal of this General Conservation Plan (GCP) is to provide a mechanism to facilitate dam removal and installation of fish passage facilities in order to provide access to quality habitat for Atlantic salmon and other diadromous fish.

In the Downeast Coastal SHRU, [1]Atlantic salmon are listed as endangered under the Endangered Species Act (ESA) (74 FR 29344). Man-made barriers that prevent or delay passage of Atlantic salmon are considered a form of take. Unless federally authorized, take is prohibited under Section 9 of the ESA. Non-federal entities can receive take authorization through issuance of an Incidental Take Permit (ITP) under Section 10(a)(1)(B) of the ESA, if the take is incidental to, and not the purpose of, an otherwise lawful activity. For an ITP to be issued, the applicant must satisfy the statutory issuance criteria that specify the taking of the species will not jeopardize the continued existence of the listed entity. In addition, a conservation plan must be approved that specifies, among other things, that the impacts of activities likely to result in take are minimized and mitigated to the maximum extent practicable, and that the taking is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. To pursue an ITP, individual entities can develop a Habitat Conservation Plan (HCP); however, development of HCPs can be complicated, time consuming, and expensive. This GCP provides an alternative streamlined process for certain qualified dam owners to obtain ITPs. Specifically, dam owners that are not regulated by the Federal Energy Regulatory Commission (FERC) can obtain an ITP by conforming to specific measures in the GCP that minimize and mitigate impacts to Atlantic salmon. In general, dam owners will either remove their dam or install a fishway to provide fish passage for Atlantic salmon. Dam owners that choose to install a fishway would also be required to fund additional mitigation measures to offset continuing impacts of the dam to Atlantic salmon. In some circumstances, partial funding may be available to lower the cost of dam removal and help dam owners comply with the ESA. The GCP will be implemented cooperatively by participating dam

[1] Once a fish or wildlife species is listed as endangered under the ESA, the act prohibits anyone from taking the species. To "take" a species means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (§ 1532 (19)). Taking threatened species can be prohibited by regulation.

owners and the NMFS. Information gained through monitoring activities will be used to adapt management activities to ensure that ESA and GCP goals and objectives are met.

1.2 Goals and Objectives

Implementation of the GCP is expected increase collaboration between private land owners, local communities, stakeholders, non-governmental organizations (NGO) and federal and state resource agencies and ultimately improve conditions for Atlantic salmon in the Downeast Coastal SHRU. It is anticipated that dam owners wishing to obtain an ITP will benefit from the GCP's streamlined process. Atlantic salmon will directly benefit from the GCP's mitigation and minimization measures that will provide improved passage at existing dam sites and restore access to essential Atlantic salmon habitat in the Downeast Coastal SHRU. In addition, other resident and diadromous species described in this GCP will also benefit from increased access to important habitat for spawning and juvenile rearing. These ecologically significant species provide an influx of marine derived nutrients which support a wide array of organisms from the very small aquatic invertebrates which form the basis of the food web to larger more complex species that are the foundation of a healthy ecosystem. These important species can also serve as a prey buffer for migrating juvenile Atlantic salmon due to their significant overlap both spatially and temporally during peak migration periods (Saunders et al. 2006). A wide variety of native and non-native terrestrial and aquatic species may directly or indirectly benefit from the deposition of nutrients or increase in forage base; native species include striped bass, tuna, cod, haddock, halibut, American eel, brook trout, lake trout, landlocked salmon, crappie, white and yellow perch, seabirds, bald eagle, osprey, great blue heron, gulls, terns, cormorants, seals, whales, otter, mink, fox, raccoon, skunk, weasel, fisher, and turtles, and non-native species that may benefit include brown trout, rainbow trout, smallmouth bass, largemouth bass, chain pickerel, and northern pike (MDMR 2008).

The specific goals of this GCP are to:

1. Restore connectivity between the ocean and freshwater habitats and provide for proper ecological stream function to the extent necessary to support recovered populations of Atlantic salmon in the Downeast Coastal SHRU.
2. Develop a streamlined process for dam owners not regulated by FERC in the Downeast Coastal SHRU to receive authorization for limited take of Atlantic salmon for activities covered under this GCP.

The specific objectives to support these goals are to:

1. Provide for safe, timely, and effective passage for all relevant life stages of Atlantic salmon at each covered facility in the GCP to promote recovery of the species.
2. Provide full access to 10,000 habitat units2 with a habitat quality score of 2 or 3 (74 FR 29300) in the Downeast Coastal SHRU.

[2] Habitat units are "a measure of the quantity of habitat (expressed in units where 1 unit of habitat is equivalent to $100m^2$ of habitat) within a HUC 10 based on qualitative factors that limit survivorship of juvenile salmon utilizing habitat for spawning, rearing and migration." (NMFS 2009a)

3. Mitigate for authorized incidental take by providing additional funds to improve access to quality habitat within the Downeast Coastal SHRU.
4. Provide a regulatory and permitting process for qualified dam owners to receive take authorization that minimizes time requirements for the applicant.

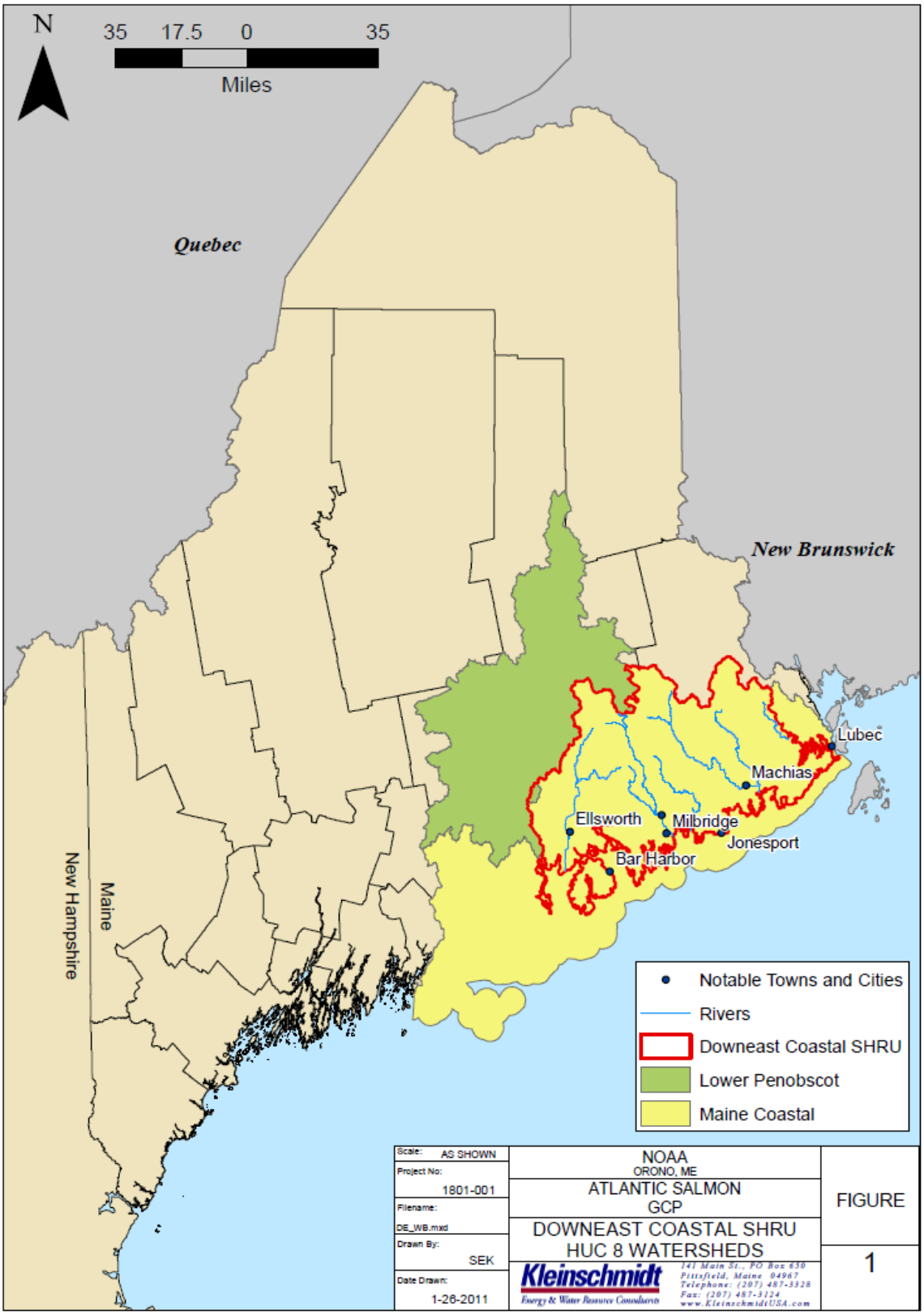
2 PLAN AREA: DOWNEAST COASTAL SALMON HABITAT RECOVERY UNIT

2.1 Existing Conditions

The Downeast Coastal SHRU drainage area encompasses approximately 2,790 square miles (mi^2) (Figure 1) and occupies sections of 3 counties, primarily Washington and Hancock, and a small portion of Penobscot County in the State of Maine. The Downeast Coastal SHRU is primarily undeveloped, with approximately 87% of the SHRU falling into either forested (deciduous, evergreen, and mixed) (1,758 mi^2), timber lands (290 mi^2), or wetland areas (369 mi^2) (Table 1). The remaining areas include development, open water, agricultural areas, meadow (including old pasture lands), and bare land. Development within the entire SHRU is limited (64 mi^2), occurring primarily in the Ellsworth and Bar Harbor areas and at the mouth of a number of the major rivers within the SHRU (i.e., Milbridge and Machias) (MEGIS 2004). The largest areas of development include Ellsworth along the Union River and Bar Harbor on Mount Desert Island. In addition to residential and commercial development, the Downeast Coastal SHRU includes a large number of active blueberry barrens. Of the 86 mi^2 identified as agricultural lands within the SHRU, approximately 72 mi^2 (primarily within Washington County) are identified as blueberry barrens (MEGIS 2004).

Table 1. Land use within the Downeast Coastal Salmon Habitat Recovery Unit (MEGIS 2004)

Cover Class	Area (mi^2)	Percent of SHRU
Meadow	28	1.0%
Bare Land	39	1.4%
Developed Lands	64	2.3%
Agricultural Lands	86	3.1%
Open Water	156	5.6%
Active Timberlands	290	10.4%
Wetlands	369	13.2%
Forested	1,758	63.0%
Total	**2,790**	**100.0%**



Data Source: USDA, NRCS. National Cartography and Geospatial Center. 2009. HUC 8 Watershed Boundaries

Figure 1. Boundaries of the Downeast Coastal Salmon Habitat Recovery Unit

Unlike the Penobscot and Merrymeeting Bay SHRUs, which each have large main stem rivers, the Downeast Coastal SHRU includes significant rivers which are not direct tributaries to one large main stem. In the Downeast Coastal SHRU there are six primary rivers (Machias, East Machias, Narraguagus, Union, Dennys, and Pleasant). The greatest mean annual discharge of all the rivers noted above is 950 cfs on the Machias River (Table 1). Mean annual discharge for the Machias River reached a high of 2,390 cfs in April (USGS 2006[3]). The other rivers have lower mean annual discharges with the East Machias (509 cfs) and Narraguagus (502 cfs) being very similar, and the remaining rivers (Union, Dennys, and Pleasant) have mean annual discharges ranging from 148 cfs to 272 cfs (USGS 2006).

Table 2. Mean monthly discharge (cfs) for the primary watersheds (HUC 8) within the Downeast Coastal Salmon Habitat Recovery Unit

Month	Machias River (1905-2009)	East Machias River (1926-1958)	Narraguagus River (1948-2009)	West Branch Union River (1909-1979)	Dennys River (1955-2009)	Pleasant River (1980-2009)
Jan	817	564	509	243	190	122
Feb	719	444	472	211	189	150
Mar	1,220	630	740	352	265	207
Apr	2,390	1,270	1,220	814	444	310
May	1,700	859	678	459	272	197
Jun	863	423	359	209	171	131
Jul	449	220	196	111	103	66
Aug	312	137	139	59	78	64
Sep	333	141	166	72	81	58
Oct	565	253	294	141	121	102
Nov	966	506	597	278	211	177
Dec	1,060	660	657	316	235	190
Mean	950	509	502	272	197	148

The Gulf of Maine from Cape Cod, Massachusetts to the St. Croix River in Eastern Maine has an estimated 4,867 dams, 782 of which are within Maine (GMCME 2010)[4]. According to the National Inventory of Dams, there are 4 dams that are regulated by FERC within the Downeast Coastal SHRU (USACE 2005). These dams are all located on the Union River near Ellsworth. The Downeast SHRU also includes approximately 74 non-FERC regulated dams that are owned by state, federal, and private entities (NOAA 2010). These dams range in size from small mill dams to larger dams and include old dams, reservoir dams, and water level management structures constructed of stone, earth, timber and concrete or some combination of these materials (Kleinschmidt Associates 2010). Many of these dams do not have fish passage structures or fish passage may be in disrepair (Kleinschmidt Associates 2010). Non-FERC regulated dams within the SHRU occur on a variety of smaller tributaries and generally do not

[3] Data obtained from USGS data layer developed in 2006 which hyperlinks to gage data (including recent data).

[4] Maine's list of non-FERC dams was populated by a voluntary program which ran from 1983-1993. This registration required a minimum height and water capacity, therefore a much larger number of dams likely exists within the State (GMCME 2010).

occur on larger rivers. Dams are present within the SHRU as far east as Lubec and as far west as the Lower Patton Pond Dam in Surry.

2.2 Ecological Effects of Dams

2.2.1 Fish Passage

Dams can prevent or impair fish passage of Atlantic salmon and other diadramous fish species both upstream and downstream of the dam (Fay et al. 2006). Approximately 44-49% of all historical Atlantic salmon habitat is currently inaccessible due to barriers to fish passage. If a dam does not have a fishway, or the fishway is improperly designed or maintained, access to upstream spawning and rearing habitat can be restricted. (Fay et al. 2006). Installation of a fishway does not always ensure passage, as no fishway provides 100% fish passage. As a result, the more fishways encountered by migrating salmon, the less likely they are to achieve passage to spawning grounds or the ocean.

Hydroelectric dams can cause injury or mortality of salmon through entrainment or impingement. Entrainment occurs when downstream migrants are injured by passing through turbines, whereas, impingement occurs when fish are injured by coming into contact with a screen or trash rack at intake (Fay et al. 2006). Both entrainment and impingement can result in mortality as well as prevent fish passage.

Dams can also delay smolt migration to the ocean, which can lead to direct mortality through increased predation (Blackwell and Juanes 1998), and delayed mortality by affecting physiological health or preparedness for marine entry and migration (Budy et al. 2002). Delays in migration may cause salmon to lose physiological smolt characteristics due to high water temperatures during spring migration, and can result in progressive misalignment of physiological adaptations to seawater entry; thereby, reducing smolt survival (McCormick et al. 1999). Lastly, because Atlantic salmon often encounter multiple dams during their migratory life cycle, losses are cumulative and often biologically significant (Fay et al. 2006).

2.2.2 Physical Habitat

Dams can disrupt natural ecological processes as well as dramatically alter the river or stream habitat both up and downstream of the dam. Dams create pools or large impoundments and result in flooding of riparian habitat. Salmon are not adapted to live in the pools and reservoirs formed behind dams, and the inundation of once suitable habitat by a reservoir results in unsuitable habitat for spawning and juvenile rearing (NRC 2004).

2.2.3 Sediment Transport

The alteration in flow created by dams both upstream and downstream of the dam also alters natural sedimentation and erosion processes. Dams prevent the downstream movement of large woody debris, gravel, and sediment within rivers, lakes, and streams. Reduced stream flows may cause sediments to accumulate in downstream reaches or in the pool or reservoir (Spence et al. 1996). Many species of algae, phytoplankton, zooplankton, benthos, aquatic insects, and fish are adversely affected by suspended and shifting sediments (Iwamoto et al. 1978), which may result in reduced food availability for salmon.

2.2.4 Water Temperature

The slowing of free-flowing water by dams can alter stream temperature both upstream and downstream of the structure. Pools and impoundments that are formed behind dams increase water residence times and water depth, and decreases daily temperature fluctuations. Deep reservoirs tend to become thermally stratified into a warm, well-mixed upper layer (epilimnion), a cold, dense bottom layer (hypolimnion) and an intermediate layer (metalimnion) with a strong temperature gradient (thermocline) (Berkamp et al. 2000). If water is released from the epilimnion, downstream water temperatures may increase, while release of water from the hypolimnion layer can decrease downstream temperatures (Spence et al. 1996). Seasonal temperature regimes of the river may also be altered as water is released throughout the year. Alterations in stream temperatures can affect salmon development (Spence et al. 1996).

2.2.5 Stream Flow and Water Levels

Dams and river impoundments affect both the total volume of water available to fish and the seasonal distribution of flow (Spence et al. 1996). Flows in some reaches of river have been entirely bypassed as a result of dam construction resulting in dewatered or minimum flows in Atlantic salmon habitat. Changes in the quantity and timing of stream-flow alter the velocity of streams, which affects the ecology and biota of the river. Fluctuating water levels may delay migration of salmon and other diadromous fish species and reduce or expose spawning, incubation, and rearing habitat (Beiningen 1976). Lower water levels may also concentrate fish and increase predation and competition (Spence et al. 1996). In addition, the distribution, abundance and composition of many benthic invertebrate and fish communities are determined by water velocity.

2.2.6 Disease

Salmon inhabiting lakes and reservoirs experience more disease than fish in free-flowing water (Bell 1986). Dams can increase a salmon's susceptibility to disease by causing stress from delays, physical injury, altered temperature regimes, decreased flow and changing water levels. Further, by concentrating animals and creating habitat for intermediate hosts dams can facilitate the transmission of specific pathogens.

2.2.7 Water Chemistry

Many chemical and biological changes occur in deep, thermally stratified reservoirs. Dissolved oxygen is often high in the surface layers where phytoplankton are abundant, while lack of sunlight and mixing often causes anoxic conditions in the bottom layer (Berkamp et al. 2000). When water is released over the top of a dam it can become supersaturated with nitrogen, oxygen and other dissolved gases, which can cause gas bubble disease in salmonids downstream of the impoundment (Spence et al. 1996). The creation of impoundments through dam construction can also result in eutrophication. Eutrophication occurs as large influxes of organic material enter a reservoir. Eutrophication can cause algal blooms that may lead to oxygen depletion within the reservoir during decomposition of this excess organic matter. Water quality and prey available to salmon change in these areas, as do predation and competition threats (NRC 2003).

3 COVERED SPECIES: ATLANTIC SALMON

This GCP addresses the incidental take and conservation needs of the federally listed GOM DPS of Atlantic salmon (*Salmo salar*). The GCP does not provide for take authorization of other federally listed species not under NMFS jurisdiction unless otherwise specified. Other processes, such as developing a Habitat Conservation Plan, can be followed to pursue incidental take of other federally listed species.

The Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon is listed as endangered under the ESA (74 FR 29344). The GOM DPS includes all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River. Included are all associated conservation hatchery populations used to supplement these natural populations. Currently, such conservation hatchery populations are maintained at Green Lake National Fish Hatchery and Craig Brook National Fish Hatchery.

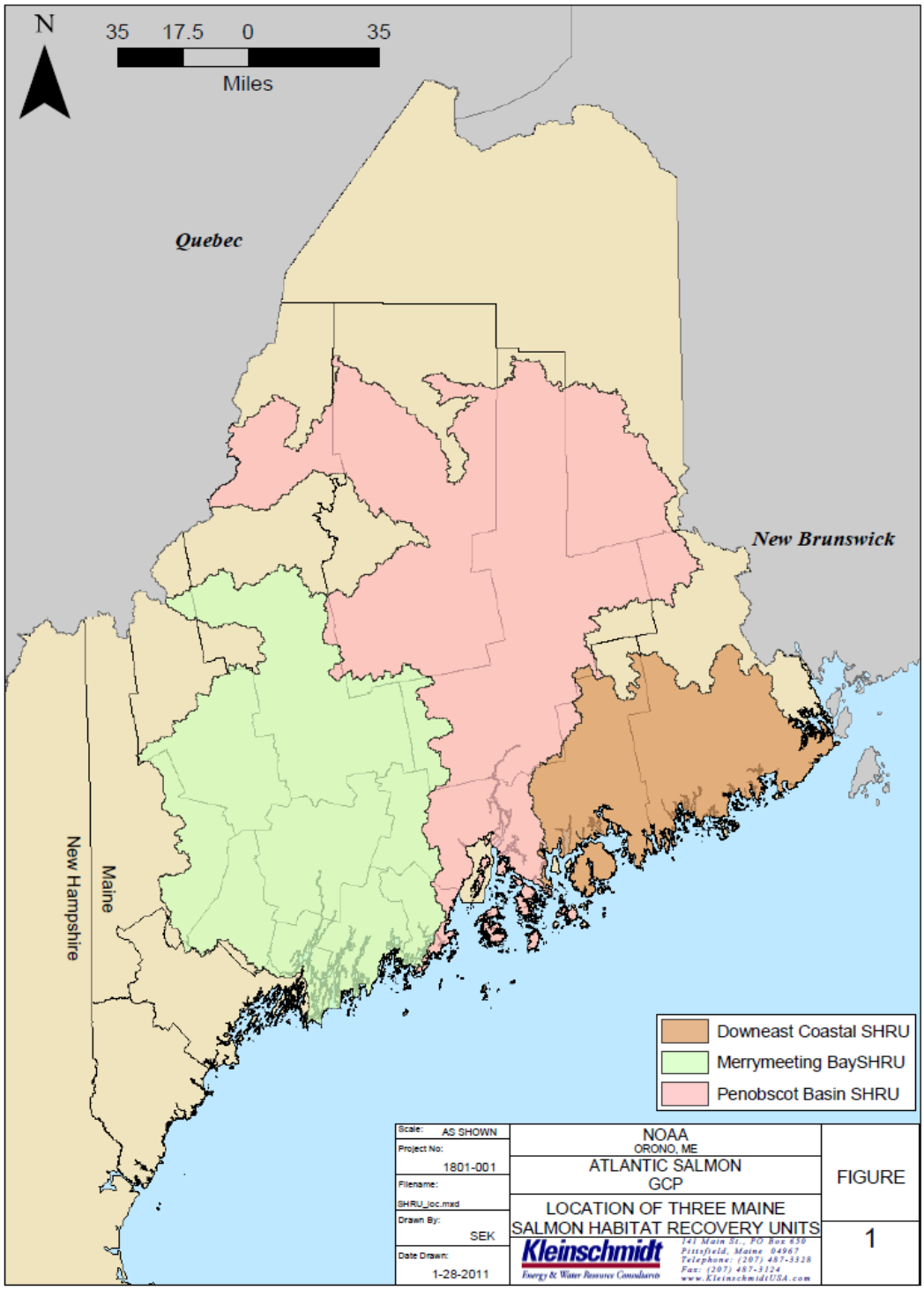
Critical habitat has been designated for the Atlantic salmon GOM DPS pursuant to section 4(b)(2) of the ESA (74 FR 29300). The critical habitat designation includes 45 specific areas occupied by Atlantic salmon at the time of listing, and includes approximately 12,160 miles of perennial river, stream, and estuary habitat and 308 mi^2 of lake habitat within the range of the GOM DPS in the State of Maine. The GOM DPS supports those physical and biological features essential to the conservation of the species.

NMFS divided the GOM DPS into three geographic regions known as Salmon Habitat Recovery Units or SHRUs as a management tool for establishing recovery goals for the purpose of designating critical habitat (NMFS 2009b). The three SHRUs include: 1) the Merrymeeting Bay SHRU, which includes, the Androscoggin and Kennebec basins, and extends east as far as, and includes the St. George watershed; 2) the Penobscot Bay SHRU, which includes the Penobscot basin and extends west as far as, and includes the Ducktrap watershed, and east as far as, and includes the Bagaduce watershed; and 3) the Downeast Coastal SHRU, which includes all the small to medium size coastal watersheds extending east of the Penobscot Bay SHRU, including the Dennys River watershed (Figure 2).

Atlantic salmon have a complex life history that ranges from spawning and rearing in freshwater streams and rivers, to feeding and growing to maturity at sea (Fay et al. 2006). The Atlantic salmon is an anadromous species, i.e., it relies on both freshwater and marine environments to complete its life cycle. Each phase of the life cycle is marked by distinct behavioral and physiological changes, and habitat requirements. Atlantic salmon exploit a variety of habitat types and have developed specific survival strategies including behavioral, dietary and defensive strategies (Kircheis and Liebich 2007). The ability to utilize varying resources has led to the evolution of a highly variable life history in which some Atlantic salmon will spend their entire lives in fresh water, whereas others will undertake long sea migrations (Klemetsen et al. 2003). For more information about the life history and population demographics of Atlantic salmon, refer to the Atlantic Salmon Status Review (Fay et al. 2006).

Despite the Atlantic salmon's ability to adapt and survive, numerous populations are declining worldwide (Klemetsen et al. 2003), including those in the Gulf of Maine. A combination of

factors contribute to the decline, including habitat alteration, stress, delay and injury related to dam passage, low marine survival, land development and use, fishery management practices and alterations in predator prey interactions (Fay et al. 2006; NMFS and USFWS 2005).



Data Source: NOAA. 2007. Gulf of Maine DPS by SHRU. NOAA Fisheries Maine Field Station.

Figure 2. The geographic delineation of the three Salmon Habitat Recovery Units of the Gulf of Maine DPS

4 SPECIES NOT COVERED BY THE GCP

The Downeast Coastal SHRU supports a variety of sensitive aquatic species that are expected to benefit from implementation of this GCP. Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and shortnose sturgeon (*Acipenser brevirostrum*) are of special importance to the NMFS and this GCP because they are trust resources under the jurisdiction of NMFS. Shortnose sturgeon are currently listed as an endangered species under the ESA and Atlantic sturgeon are proposed for listing. Furthermore, because of their sensitivity to management actions in the Downeast Coastal SHRU, freshwater mussels and fish species such as rainbow smelt (*Osmerus mordax*), American eel (*Anguilla rostrata*) and river herring (*Alosa pseudoharengus* and *Alosa aestivalis*) will benefit from implementation of the activities authorized in the GCP. These species are an integral component of the overall riverine ecosystem and are described in more detail below. Section 9 describes potential impacts and benefits of the GCP on these species. These species are not covered by the GCP because incidental take is not expected to occur as a result of GCP-related activities.

4.1 Atlantic Sturgeon

The Atlantic sturgeon is an anadromous fish species that occurs in large rivers, estuaries and coastal waters along the northwest Atlantic Coast from Labrador south to northern Florida (Murawski and Pacheko 1977; Smith and Clugston 1997). In 2010, the Gulf of Maine DPS of Atlantic sturgeon was proposed to be listed as threatened, and four DPS's (New York Bight, Chesapeake Bay, Carolina, and South Atlantic) were proposed to be listed as endangered (75 FR 61872; 75 FR 61904). Atlantic sturgeon from different DPSs are known to mix in marine/coastal waters (75 FR 61872). The decision is pending (as of September 2011) as to whether Atlantic sturgeon that occur in the Downeast Coastal SHRU will be listed. Atlantic sturgeon populations underwent significant range-wide declines due to overfishing following development of a caviar fishery for the species in 1870 (Smith and Clugston 1997). Landings collapsed in 1901, but the fishery for both flesh and caviar continued in many rivers at much lower levels until the late 1990's. Threats to the Atlantic sturgeon include habitat degradation and loss from dams, dredging, water withdrawals, and reduced water quality from industrial pollution (e.g., mercury hot spots, coal tar deposits, wood processing byproducts) (ASSRT 2007; Fernandes 2008).

Atlantic sturgeon require large rivers with spawning areas that are not blocked by dams (Gilbert 1989). The Kennebec River is currently the only known spawning river for Atlantic sturgeon in Maine (ASSRT 2007). Other Maine rivers with possible, but unconfirmed, spawning include the Penobscot, Androscoggin, and Saco rivers (ASSRT 2007). Abundance of Atlantic sturgeon is not well understood across its entire range. Fernandes et al. (2010) found that Atlantic sturgeon inhabit a very narrow section of the Penobscot River estuary, with little upstream and downstream movements outside of summer immigration and fall emigration. Juvenile Atlantic sturgeon reside in the natal river estuary for months to years before emigrating to open ocean as subadults (Dadswell 2006; Dovel and Berggen 1983; Holland and Yelverton 1973; Waldman et al. 1996). For more information about the life history of the Atlantic sturgeon, refer to the status review for the species (ASSRT 2007).

4.2 Short-nosed Sturgeon

The shortnose sturgeon was listed as federally endangered throughout its range in 1967 (32 FR 4001). Shortnose sturgeon occur along the Atlantic coast of North America from the St. John River in southern Canada to the St. John's River in Florida (Dadswell et al. 1984; NMFS 1998). Threats to shortnose sturgeon include incidental take by commercial fishing operations, dams, habitat alteration and water quality degradation from discharges, and dredging or disposal of material into rivers (Fernandes 2008; NMFS 1998).

Shortnose sturgeon habitat includes rivers, estuaries, and the ocean. Previously, it was believed that populations were mostly confined to natal rivers and estuaries (NMFS 1998) and were not known to participate in coastal migrations (Dadswell et al. 1984). However, Fernandes et al. (2010) documented coastal movement between the Penobscot and the Kennebec rivers and found that as many as 50% of the fish studied moved in and out of the Penobscot River and 87% were subsequently detected in the Kennebec River, 150 km away. Further monitoring confirmed that as many as 70% of the tagged fish exhibited coastal migration and have been documented in 5 other rivers including; the Damariscotta, Medomak, and St. George rivers, as well as in the Union and Narraguagus rivers to the east of the Penobscot River (Dionne 2010). In the northern rivers, spawning begins in mid to late spring, and the adults typically migrate downstream soon after spawning (Dadswell et al. 1984). Juvenile shortnose sturgeon generally move upstream in spring and summer and back downstream in fall and winter. These movements usually occur above the saltwater/freshwater interface (Dadswell et al. 1984; Hall et al. 1991). Adults are generally in freshwater or freshwater tidal reaches of rivers in summer and in winter often occupy only a few short reaches of the total river (Buckley and Kynard 1985). These movements are consistent with movements of shortnose sturgeon in other river systems, including the Delaware and Kennebec Rivers. For more information about the life history of the shortnose sturgeon, refer to the shortnose sturgeon recovery plan (NMFS 1998).

4.3 Freshwater Mussels

Freshwater mussels are the most endangered group of animals in North America with approximately 75% of known species listed as endangered, threatened, extinct or possibly warranting listing status (MDIFW 2010). There are no federally listed mussels species in Maine, however, the State of Maine designated three species of freshwater mussels as threatened; tidewater mucket (*Leptodea ochracea*), yellow lampmussel (*Lampsilis cariosa*) and the brook floater (*Alasmidonta varicose*) (MDIFW 2010). These mussel populations are in decline and are found in low numbers in most populations. In Maine, the tidewater mucket and the yellow lampmussel are often found together and are known only from Merrymeeting Bay, and the Penobscot, St. George, lower Kennebec, and lower Androscoggin River watersheds (MDIFW 2010). Mussels are found on a variety of substrates including silt, sand, gravel and cobble. The tidewater mucket and the yellow lampmussel prefer coastal lakes, ponds and slow moving portions of rivers and can tolerate impoundments. The brook floater is only found in consistently flowing waters, from small brooks to large rivers. All three species rely upon a fish host to complete their life cycle (MDIFW 2010). Females release larvae called glochidia (MDIFW 2010), which attach to the gills of a host fish and remain there until developed. Host fish provide an essential sanctuary for developing glochidia and also help disperse mussel progeny to new areas.

4.4 Rainbow Smelt

Rainbow smelt are a pelagic anadromous species that inhabit coastal waters of the GOM (Collette and Klein-MacPhee 2002). They are widely distributed in estuaries. However, abundance varies greatly from place to place depending on the amount of available spawning habitat (Collette and Klein-MacPhee 2002). Like salmon and river herring, smelt grow in the marine environment and migrate up streams and rivers to spawn. Large schools of smelt gather in estuaries prior to upstream migration, which is generally confined to coastal streams and rivers above the head of tide (Collette and Klein-MacPhee 2002). Spawning occurs in late spring when the water temperature reaches 4°C (Collette and Klein-MacPhee 2002). The spawning period is short, lasting only a few weeks. Females release eggs that are demersal and sticky. Males fertilize the eggs as they are released. The eggs clump together and attach to gravel and woody debris (Collette and Klein-MacPhee 2002). Water chemistry, velocity, substrate and egg density play a role in egg survival (Collette and Klein-MacPhee 2002). After spawning, the adults return to coastal bays, harbors and estuaries where many stay year round, especially in Penobscot Bay and points east where surface water temperatures remain cool (<18°C) in the summer months (Collette and Klein-MacPhee 2002). Rainbow smelt are voracious predators commonly feeding upon amphipods, marine worms, shrimp and euphausiids (Collette and Klein-MacPhee 2002). Larger adults will feed on any small fish including young of year herring, mummichog and silverside (Collette and Klein-MacPhee 2002). Smelt are an important food source for a wide variety of marine and freshwater fauna including various bird species (birds of prey, water fowl, gulls, and cormorants), marine and aquatic mammals (seals and mink) as well as other species of fish (cod, haddock, landlocked and anadromous salmon, lake trout, burbot and walleye).

4.5 American Eel

The American eel is a panmictic species (i.e. a single global population) that matures in freshwater and migrates to the Sargasso Sea to spawn. Larval eels drift from the Sargasso Sea to coastlines from Mexico to Canada but do not have an affinity to a “home” river. The juveniles enter and gradually ascend the nearest river or stream mouth encountered along the coast. The distance eels move upriver varies from river to river. Eels spend most of their life in freshwater (5-40 years) before becoming sexually mature in the late summer and fall. American eels undergo a morphological change preparing them for their long migration to the Sargasso Sea, where they will spawn and die (Collette and Klein-MacPhee 2002). In recent years, eel populations have declined. Eels are harvested at the juvenile (glass eel, and yellow eel) life stage as well as adult for both food and fishing bait. In 2007, the USFWS completed a status review of the American eel and determined that listing under the ESA was not warranted (70 FR 38849). The USFWS determined that while over-fishing and fish passage at hydroelectric projects continue to impact American eel, the overall population was resilient and not in danger of becoming extinct. The USFWS is currently reviewing a new petition to list American eel.

4.6 River Herring

Blueback herring and alewife are collectively known as river herring; both species are listed as Species of Concern by NMFS. They are anadromous, schooling, pelagic species that spend the majority of their lives at sea, entering freshwater streams and rivers in the spring to spawn (Collette and Klein-MacPhee 2002). The historic range of river herring extends from Florida to

Newfoundland. In Maine, alewives are more common than blueback herring which are most numerous at points south of the Chesapeake Bay (MDMR 2008). Alewives begin their spawning migration and enter freshwater when temperatures reach 5-10°C. The exact time of the spawning migration varies with latitude. In Maine the run begins in late April or early May and continues into mid June (Collette and Klein-MacPhee 2002). The preferred spawning habitat of the alewife includes ponds and coves or in deep pools and eddies, whereas blueback herring prefer free flowing water with sand and gravel bottoms (Collette and Klein-MacPhee 2002). Post-spawned adults migrate back downstream immediately after spawning. Juveniles reside in freshwater during the spring and summer. Juvenile outmigration begins as early as late July, but most occurs in September and October (Collette and Klein-MacPhee 2002).

4.7 American Shad

American shad are an anadromous species that enter the rivers of the GOM in the spring on their annual spawning migration. They are the largest anadromous clupeid species in the GOM reaching lengths in excess of 50 cm and typically weigh 0.9-1.8 kg (Collette and Klein-MacPhee 2002). Shad are pelagic and highly migratory, inhabiting coastal areas, and spending the majority of their life at sea. In the spring (May and June), when water temperatures reach 10-12°C, American shad enter their natal GOM coastal rivers to spawn (Collette and Klein-MacPhee 2002). Although they are known to ascend considerable distances up river during their spawning migration (in the Saint John River the migration ends at Grand Falls 320 km from the sea (Collette and Klein-MacPhee 2002)), they do not necessarily have a home reach or tributary within the watershed that they return to. Currently a small relict run of American shad returns annually to the Penobscot River. Historically the migration ascended 145 km upstream in the Penobscot River (Collette and Klein-MacPhee 2002). Spawning occurs in broad flats with relatively shallow water (1-6 m depth) with moderate current (0.3-1.0 m/s) (Collette and Klein-MacPhee 2002). In Maine, viable eggs are found over a variety of substrates ranging from fine sands to coarse rubble and ledge, but are never found on silty or muddy bottom (Collette and Klein-MacPhee 2002). Young of year shad spend the summer months in freshwater, outmigrating in the fall. American shad as well as other diadromous species provide a vital influx of marine nutrients into the freshwater ecosystem.

5 REGULATORY BACKGROUND

Initially passed in 1973, the ESA (16 U.S.C. § 1531-1544, 87 Stat. 884, as amended), provides for the special designation and protection of invertebrates, wildlife, fish and plant species that are in danger of becoming extinct. A fundamental purpose of the ESA is to protect and recover endangered and threatened species and to provide a means to conserve the ecosystems on which they depend. The ESA defines an endangered species as any species that is in danger of becoming extinct throughout all or a significant portion of its range (16 U.S.C. § 1532(6)). The U.S. Fish and Wildlife Service (USFWS), within the Department of the Interior, and NMFS, within the Department of Commerce, share responsibility in administering the ESA.

Section 9 of the ESA makes it unlawful to “take” a species that is listed as endangered under the ESA. The term take under the ESA is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct” (16 U.S.C. § 1532 (19)). By federal regulation, the take prohibitions can be extended to species listed as threatened as

well (16 U.S.C. § 1538(a)). Section 10 of the ESA provides an exception to the Section 9 take prohibition. It states that the Secretary of the Interior or the Secretary of Commerce (depending on the species involved) may permit any taking otherwise prohibited by Section 9, if such taking is incidental to, and not the purpose of, carrying out an otherwise lawful activity (16 U.S.C. § 1539(a). Non-federal entities can obtain an ITP under this provision if they submit a conservation plan that meets certain requirements.

This GCP approach was developed to streamline the process associated with issuance of ITPs under Section 10(a)(1)(B) of the ESA and to promote recovery of Atlantic salmon in the Downeast Coastal SHRU. The GCP provides NMFS an opportunity to work with private dam owners and local communities to achieve a greater conservation benefit to Atlantic salmon through the development of a broader scope conservation plan. This process allows NMFS to complete the regulatory requirements for complying with the ESA and Nation Environmental Policy Act (NEPA), which includes a formal Section 7 consultation and preparation of an environmental assessment or environmental impact statement. The GCP creates a framework for NMFS to issue ITPs to individual dam owners who submit a completed application and can demonstrate compliance with the terms and conditions of the GCP. Therefore, the GCP will promote regulatory efficiency by avoiding the need to develop individual Habitat Conservation Plans (HCP) which can be very time consuming and costly to the applicant (USFWS 2007).

For the NMFS to issue ITPs under a GCP, the following issuance criteria must be met:

1. The taking will be incidental to otherwise legal activities.
2. Each applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking.
3. Each applicant will ensure there is adequate funding to implement their portion of the GCP and include procedures to deal with unforeseen circumstances.
4. The taking will not appreciably reduce the likelihood of survival and recovery of the covered species in the wild.
5. Each applicant will ensure that other measures required by NMFS as being necessary and appropriate will be adhered to.

Additionally, the GCP must comply with the requirements of the HCP Handbook addendum's 5-point policy (65 FR 35242):

1. The biological goals and objectives of the GCP must be defined.
2. Monitoring and reporting requirements must be established.
3. An adaptive management plan must be developed to address uncertainty.
4. The duration of the permit must be defined.
5. The public will be given the opportunity to provide input on the GCP.

Other state and federal laws and regulations relevant to the GCP are described in Table 3.

Table 3. State and Federal regulations that apply to the GCP

Legislation	Primary Responsible Agency	Permit or Approval
National Environmental Policy Act (NEPA)	NMFS is the "Lead agency"	Lead federal agency must complete an Environmental Assessment or Environmental Impact Statement.
Magnuson-Stevens Fishery Conservation and Management Act	NMFS	Lead federal agency must consult with NMFS regarding any action that may adversely affect Essential Fish Habitat.
Clean Water Act	Army Corps of Engineers (ACOE)	Lead federal agency must consult with ACOE and obtain Section 404 Permit prior to dam removal or other specific activities.
Rivers and Harbors Act	ACOE	Lead federal agency must consult with ACOE and obtain Section 10 Permit prior to dam removal.
Migratory Bird Treaty Act	USFWS	Lead federal agency may need to consult with USFWS regarding any action that may adversely affect migratory birds.
Bald and Golden Eagle Protection Act	USFWS	Lead federal agency may need to consult with USFWS regarding any action that may adversely affect bald or golden eagles.
Clean Water Act	State of Maine Department of Environmental Protection (MDEP)	The state must grant or waive a water quality certification stating that the proposed activity will not violate state water quality standards.
Coastal Zone Management Act	State of Maine Planning Office	If the project would take place in, or potentially affect, the coastal zone, the state must issue a certificate stating that the proposed activity is consistent with the state's approved coastal zone management program.
Municipal Regulation of Water Levels and Minimum Flows	State of Maine DEP	Upon petition, DEP will hold a public hearing and issue an order establishing a water level regime and minimum flow requirement.
Natural Resources Protection Act	State of Maine DEP	A permit is required if an activity will be located in or adjacent to protected natural resources, which includes coastal sand dune systems, coastal wetlands, significant wildlife habitat, fragile mountain areas, freshwater wetlands, great ponds and rivers, streams or brooks.
Maine Endangered Species Act	Department of Inland Fisheries and Wildlife (MDIFW)	DIFW has the responsibility for protecting species listed under the Maine Endangered Species Act.
National Historic Preservation Act	Maine Historic Preservation Commission	Lead federal agency must consult with Maine Historic Preservation Commission to evaluate impact on properties included in the National Register of Historic Places.

5.1 ESA Section 7 Consultation and Critical Habitat

Critical habitat is defined as specific areas within the geographic area occupied by a species in which are found physical or biological features that: 1) are essential to the conservation of the species; and 2) may require special management considerations or protection. Known physical and biological features for Atlantic salmon include sites for spawning and rearing and sites for migration. As described below, the GCP strives to open migratory corridors, by improving fish passage through dam removal and installation of fishways, to increase access to quality habitat for spawning, incubation and rearing. The GCP may also result in temporary impacts to these

features during dam removal and fishway construction and maintenance activities and will seek to offset the impact from these activities through a GCP adaptive management fund.

Under Section 7 of the ESA, federal agencies must consult with NMFS or USFWS when any federal action is carried out, funded, or authorized that may affect an endangered or threatened species or its designated critical habitat. During GCP implementation, certain measures implemented by ITP applicants, such as dam removal or fishway construction, will require authorization by the U.S. Army Corps of Engineers or another federal agency. Additionally, federal funding may be used for projects associated with the GCP. In these cases, an ESA Section 7 consultation would generally be required. However, it is expected that a Section 7 consultation will be conducted for this GCP and that in most cases this consultation will eliminate the need for individual project level Section 7 consultations.

6 SCOPE OF GCP COVERAGE

6.1 Eligible Projects and Applicants

Under the GCP, a dam is defined as a man-made barrier altering the flow of water or passage of fish, built across a watercourse for impounding or diverting water. The eligibility criteria for participation in this GCP are as follows:

1. Applicant must own or possess the right to remove, alter and maintain the existing dam structure or else be able to obtain such rights.
2. Applicant must demonstrate the ability to fund and carry out one of the recommended minimization options and associated mitigation measures identified in this GCP including compliance and effectiveness monitoring.
3. The dam structure cannot be licensed by the FERC to operate as a hydroelectric facility or otherwise generate electricity.
4. The dam structure and operations cannot cause additional take of listed Atlantic salmon not authorized in an ITP issued by NMFS as part of this GCP.
5. The dam structure must belong to a non-federal entity and cannot be tied to any federal action or activity that would otherwise preclude the removal, alteration or operation and maintenance necessary in order to fully comply with one of the recommended conservation strategies described in Section 7 below.
6. The dam structure must be located within the identified geographic range covered in this GCP.

ITP authorization may be revoked at the discretion of NMFS if any terms and conditions are not satisfied or authorized take of Atlantic salmon has been exceeded.

6.2 Covered Activities

Under the GCP, ITPs can be issued to cover otherwise legal activities necessary to maintain or improve Atlantic salmon passage. Such activities include, but are not limited to: demolishing and

removing a dam, rehabilitating riparian vegetation after dam removal, sediment removal upstream of the dam prior to removal and reconstructing the river channel after dam removal, and constructing and maintaining upstream or downstream fishways. The GCP does not provide coverage of activities that are not specifically related to maintaining or improving Atlantic salmon passage.

6.2.1 Dam Modification or Reconstruction

A dam that has been authorized to take through the GCP may require extensive modifications or reconstruction. If such modifications or reconstruction will result in a dam design that differs from the design approved by NMFS, then the dam owner must submit a revised fish passage plan (see Section 7 below) for review by NMFS. Continued take authorization for the dam will be contingent upon NMFS approval of the revised fish passage plan.

7 CONSERVATION STRATEGY

The operation and maintenance of existing dams can cause take of Atlantic salmon and the conservation strategies identified in this GCP provide measures to avoid (dam removal) and/or minimize (fishways) incidental take from these activities. If a dam owner chooses to minimize incidental take by providing fish passage, ongoing impacts to Atlantic salmon migration (take) are likely to continue to occur; and the dam owner will need to mitigate for the ongoing take and monitor and maintain the fishway.

Conservation measures undertaken as part of the GCP will substantially increase Atlantic salmon passage throughout the Downeast Coastal SHRU, thus promoting the recovery of Atlantic salmon in the GOM. The conservation strategy consists of specific minimization and mitigation measures that will be implemented by participating dam owners, and an adaptive management and monitoring program that will be cooperatively implemented by dam owners and NMFS. Figure 3 outlines the general structure of the conservation strategy. Under the GCP, participating dam owners have two options to address take, either Minimization Option 1 (Remove Dam), or Minimization Option 2 (Achieve Fish Passage Criteria).

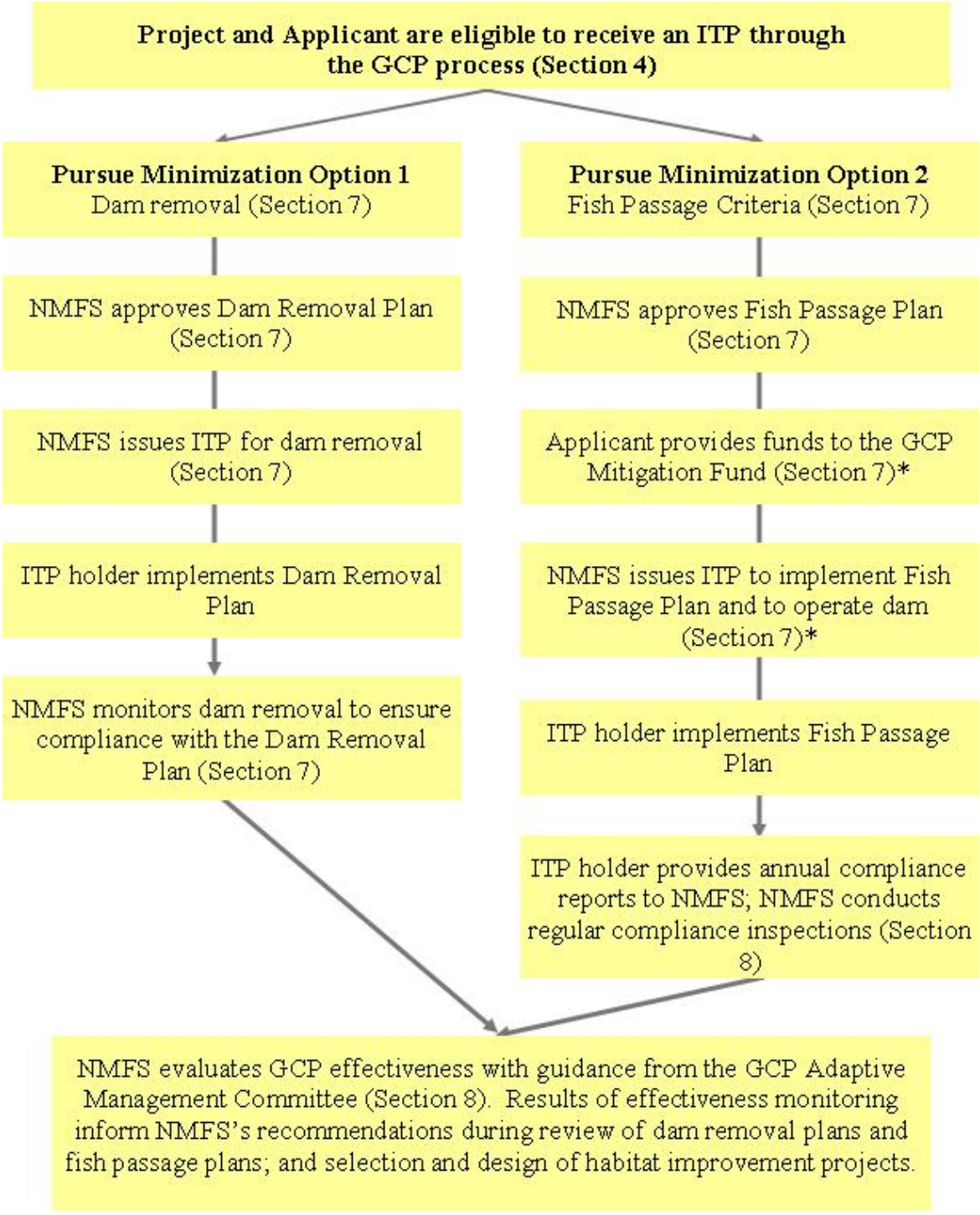


Figure 3. Structure of the Downeast Coastal Salmon Habitat Recovery Unit General Conservation Plan's minimization, mitigation, monitoring and adaptive management program

7.1 Minimization Option 1: Remove Dam

A dam may be completely removed, thus eliminating the Atlantic salmon passage barrier. Elimination of passage barriers will substantially promote the recovery of Atlantic salmon by restoring access to habitats that support adult spawning activities and juvenile rearing.

Under this option, the dam owner will work with NMFS to develop a dam removal plan. In most instances, NMFS can provide assistance to the applicant when developing and implementing dam removal plans if requested. The dam removal plan will require that removal be conducted in accordance with the conditions listed below. NMFS has determined that these activities are likely to promote the conservation of the GOM DPS and recovery of Atlantic salmon, with relatively small risk of negative impacts. The dam removal plan should include the removal approach described sufficiently to estimate feasibility, costs, and work schedules, and allow review by NMFS and adjustment if necessary. For dam removal projects identified as important to Atlantic salmon conservation and recovery, NMFS may be able to provide technical and financial support for project management and implementation.

A dam removal plan shall be developed and submitted to NMFS at least 180 days prior to the proposed removal. The dam removal plan shall include the following conditions and information:

1. Work must be restricted to low flows or low tides during the work window July 15 through October 15. Work shall not be conducted during a significant rain event or when one is anticipated. Work outside the recommended work window may be allowed under certain circumstances, but must be approved by NMFS with at least 7 days notification prior to the start of proposed construction.
2. Erosion and sediment control measures shall be present at the site at all times and used when bare ground is exposed or soils that could mobilize during rains could enter watercourses. Erosion control can include mulching with hay or straw, seeding, fiber matrix, and temporary mats or blankets.
3. If temporary coffer dams are required to dewater areas for dam removal, salvage shall be conducted to move juvenile salmon and other fish species downstream before dewatering. Electrofishing, seining, or other methods should be described, and designed to minimize injury to fish. Salvage will be performed by qualified state or federal fishery biologists with scientific research permits for handling Atlantic salmon.
4. Streams, riparian zones, and wetlands must not be used as equipment staging or refueling areas. Equipment must be stored, serviced, and fueled in a contained area that is at least 150 ft away from aquatic habitats.
5. For projects involving natural stream channel restoration in the footprint that was previously occupied by the dam, a geomorphic approach, such as stream simulation or FishXing (for links, see http://www.streamcontinuity.org/index.htm), shall be used to design the restoration work.
6. Heavy equipment used below the ordinary high water mark will be cleaned (e.g., power washed, streamed, etc.) prior to use. Machinery will be inspected for fluid and fuel leaks

after cleaning and prior to entering sensitive areas. Use of heavy equipment in known rearing and spawning habitat will be minimized to the maximum extent practicable.

7. An analysis of sediment mobility may be required. A survey in the area upstream of the proposed dam removal (i.e., head pond) may be required to assess the extent of sediment mobility and to determine if sediment excavation is necessary prior to dam removal. Furthermore, an analysis of sediment transport, including deposition downstream of the dam may be needed (for information, see Pizzuto 2002).
8. All disturbed soils will be stabilized with appropriate materials, including planting of native vegetation, within 3 days of the end of construction unless otherwise approved by NMFS.
9. Where excess excavated material is generated, the material must be salvaged or disposed of properly to protect the stream or other aquatic habitats, like wetlands, from erosion and sedimentation.
10. Potential habitat changes due to channel aggradation or channel adjustments must be described. Creation of downstream "flood waves" (Pizzuto 2002) must be avoided.
11. Temporary increases in suspended sediment concentrations and turbidity must be minimized by controlling for erosion.
12. Other minimization measures must be implemented as determined necessary by NMFS.

If the dam removal plan is approved by NMFS and other requirements described in this GCP are met, then NMFS will authorize take to implement the dam removal plan. Removal of the dam is expected to eliminate the dam owner's impacts to Atlantic salmon and potentially other fish species that are listed or could be listed under the ESA. Therefore, if dam removal is pursued by the owner, then NMFS will not require any mitigation measures.

This GCP and associated ITPs are specifically related to ESA compliance for impacts to Atlantic salmon passage. The dam owner must comply with all relevant local, state and federal laws and receive appropriate permits for all activities.

7.2 Minimization Option 2: Meet Fish Passage Criteria

Take may be authorized for a facility that meets specific fish passage criteria. These criteria may be achieved by developing fish passage devices (fishways), examples of which are described in Appendix A. The fish passage criteria are:

1. The fishway allows for upstream migration of adult Atlantic salmon 100% of the time that such migration could otherwise occur if the dam were not present; and
2. The fishway allows for downstream migration of adult and juvenile Atlantic salmon 100% of the time that such migration could otherwise occur if the dam were not present.

The dam owner shall submit a fish passage plan to NMFS that describes any dam modifications (fishways, etc.). NMFS will issue an ITP authorizing a small amount of incidental take associated with construction activities to install a fishway, and will also cover ongoing

maintenance and operations to improve Atlantic salmon passage. NMFS can provide support for development and implementation of fish passage plans prior to commencing activities. The fish passage plan should ideally include 50% engineering designs, sufficient to estimate feasibility, costs, and work schedules, but allow review by NMFS and design adjustment if necessary.

Provided the measures below are used during the construction and installation of fish passage facilities, NMFS believes the activities are likely to promote the conservation of the GOM DPS and recovery of Atlantic salmon, with relatively small risk of negative impacts.

1. All passage plans shall be submitted to NMFS at least 180 days prior to implementation. If NMFS does not agree with a proposed approach, take will not be authorized and NMFS will notify the project proponent within 60 days of receiving the fish passage plan.
2. Work will be restricted to low flows or low tides during the work window July 15 through October 15. Work will not be conducted during a significant rain event or when one is anticipated. Work outside this window may be allowed under certain circumstances, but must be approved by NMFS with at least 7 days notification prior to the start of proposed construction.
3. Erosion and sediment control measures shall be present at the site at all times and used when bare ground is exposed or soils that could mobilize during rains could enter watercourses. Erosion control can include mulching with hay or straw, seeding, fiber matrix, and temporary mats or blankets.
4. If temporary coffer dams are required to dewater areas for fishway construction, salvage shall be conducted to move juvenile salmon and other fish species downstream before dewatering. Electrofishing, seining, or other methods should be described, and should minimize injury to fish. Salvage will be performed by qualified state or federal fishery biologists with scientific research permits for handling Atlantic salmon.
5. Streams, riparian zones, and wetlands must not be used as equipment staging or refueling areas. Equipment must be stored, serviced, and fueled in a contained area that is at least 150 ft away from aquatic habitats or other sensitive areas.
6. Heavy equipment used below the ordinary high water mark will be cleaned (e.g., power washed, streamed, etc.) prior to use. Machinery will be inspected for fluid and fuel leaks after cleaning and prior to entering sensitive areas. Use of heavy equipment in known rearing and spawning habitat will be minimized to the maximum extent practicable.
7. All disturbed soils will be stabilized with appropriate materials, including planting of native vegetation, within 3 days of the end of construction unless otherwise approved by NMFS.
8. Where excess excavated material is generated, the material must be salvaged or disposed of properly to protect the stream or other aquatic habitats, like wetlands, from erosion and sedimentation.

If NMFS determines that the fish passage plan is adequate and that other requirements described in this GCP are met (including mitigation requirements described in Section 7.2.1), then NMFS

will authorize take to implement the fish passage plan and for ongoing dam maintenance and operations as related to Atlantic salmon passage.

This GCP and associated ITPs are specifically related to ESA compliance for impacts to Atlantic salmon passage. The dam owner must comply with all relevant local, state and federal laws and receive appropriate permits for all activities.

7.2.1 Mitigation Requirements

Applicants choosing to install and maintain fish passage devices at their dam facility, rather than remove their dam, will be required to mitigate for impacts from inadequacies in fish passage which will result in effects to individual migrating adult and juvenile salmon and habitat in the project area as further described in this GCP. Some of the impacts associated with dams and fish passage may be minimized by properly operating and maintaining the fish passage facility and monitoring important environmental components of fish passage such as water levels and flow through the fishway. Regular maintenance of the dam and fishway includes replacing broken or worn out mechanical components, removal of debris, installation and removal of dam boards or lowering and raising gates to regulate water levels and spill. These are important to allow for a properly functioning fish passage facility.

The ability of a fish passage facility to effectively pass migratory fish is dependent on many factors, most of which are specific to the site. The specific fish passage design is also a function of site-specific features and the biological needs of the species being passed. Therefore, fishway passage effectiveness is difficult to determine and in many instances requires multiple studies, presence of abundant migratory fish species and sophisticated monitoring equipment which is costly. For this GCP, NMFS will require that installed fishways (upstream and downstream) be fully functional during 100% of Atlantic salmon passage seasons. Upstream passage season is defined as April 15 – November 15. Downstream passage season for smolts is defined as April 1 to June 30; and downstream passage season for kelt is defined as April 1 to June 30 and November 1 to December 15.

To monitor and maintain fishway effectiveness the applicant needs to:

- Provide dates of annual fishway operations (i.e., days fishway is opened and closed).
- Regularly monitor water levels by installing a staff gauge in the head pond and fishway entrance.
- Regularly monitor the absence or presence of migratory fish such as Atlantic salmon, alewives, shad and American eels.
- Regularly monitor water temperatures.
- Perform regular maintenance of the facility.
- Provide the estimated numbers of migratory fish passed through facility

7.2.1.1. *Mitigation Fee*

To mitigate for ongoing impacts to fish passage that will result from continued dam presence, dam owners will be assessed an annual mitigation fee which will be allocated to the GCP Adaptive Management Fund that will be used to improve fish passage at high priority locations in the Downeast Coastal SHRU. As described below, the annual fee will be calculated based on general information regarding the impacts of dams to Atlantic salmon passage and the quantity and quality of habitat upstream of the dam.

A small percentage of upstream migrating adults will likely be injured or killed. Based on an expert panel convened by NMFS in 2010 (NMFS 2011), it is expected that between 1-3% of fish attempting to use a fishway will be injured or killed due to a variety of factors. To mitigate for these impacts to Atlantic salmon, a mitigation fee will be applied to mitigate for a conservative 3% reduction in fish passage through each dam. Similarly, a small percentage of downstream migrating juvenile salmonids are likely to be injured or killed. Downstream passage through large dams has been well-studied, especially in the Columbia/Snake river system. Study results indicate that the least injurious passage routes on large dams on large rivers are usually associated with spill, with survival rates generally greater than 96% (Evans et al. 2010; Muir et al. 2001). It is likely that survival rates at small dams that fall under the GCP will be at least this high or potentially higher; therefore, we assume survival is approximately 98% (2% mortality) (Larinier 2000; NMFS 2003; S. Amaral, Alden Research Lab, pers. comm. 2011), and a mitigation fee will be applied to mitigate for a 2% reduction in downstream fish passage. Hence, the overall mitigation fee applied will mitigate for a 5% reduction in fish passage (3% reduction in upstream passage and 2% reduction in downstream passage).

To determine the overall annual mitigation fee cost, the total number of available salmon habitat units (1 unit = 100 m^2) with a habitat quality score of 2 or 3 above the project will be calculated based on information from a GIS model developed by the USFWS (NMFS et al. 2010). These habitat units and Atlantic salmon production estimates will be used to determine the number of juvenile Atlantic salmon smolts that could be produced in the habitat upstream of the dam if the dam were not present. The smolt production estimates will be based on the best available information the NMFS has for the Downeast Coastal SHRU, which are based on in stream population estimates from the Maine Department of Marine Resources annual population assessments and NMFS estimates of smolt migration from rotary screw trapping operations conducted in the Penobscot Bay watershed. The monetary cost of producing one smolt will be determined based on the current annual cost estimate provided by the USFWS Green Lake National Fish Hatchery at the time of the project construction. For example, the cost of producing one smolt in 2011 has been determined to be $2.50 based on a USFWS hatchery estimate provided to NOAA.

To calculate the annual mitigation fee amount, the total number of salmon habitat units (with a habitat quality score of 2 or 3) above the project is multiplied by 5% (expected impacts to upstream and downstream migration), multiplied by the number of smolts per unit of habitat, then multiplied by the cost to produce one smolt ((Total Annual Fee) = (Habitat Units) X (Number of Smolts per Habitat Unit) X (Cost of Production for one Smolt)). This mitigation fee will be an annual cost to the applicant because the impacts from the fishway will occur annually throughout the period of the GCP. If the applicant decides to remove their dam then no additional mitigation will be required.

8 MONITORING AND ADAPTIVE MANAGEMENT

8.1 Compliance Monitoring

The purpose of compliance monitoring is to ensure that ITP holders are complying with the terms of their ITP. Each ITP holder will allow NMFS, or persons designated by NMFS, to access the dam property at any time for the purpose of compliance inspections.

ITP holders implementing Minimization Option 1 (Remove Dam) shall submit a written report to NMFS within 90 days after dam removal. The report must describe how dam removal complied with the approved dam removal plan and any problems encountered, and provide photo documentation of the removal process and resulting changes to the watercourse, both upstream and downstream of the removed dam.

ITP holder's implementing Minimization Option 2 (Meet Fish Passage Criteria) must submit a written report to NMFS annually by September 30. The report must describe compliance with the approved fish passage plan and any difficulties encountered, and provide photo documentation of the fishway construction process. NMFS will continually monitor compliance with the terms and conditions of the ITP. Any violation of ITP conditions will be reported to the ITP holder, with compliance actions and timelines indicated. Failure to bring a dam and dam operations into compliance within the specified time frame could result in enforcement actions and revocation of the ITP.

8.2 Effectiveness Monitoring

The focus of the GCP is to improve Atlantic salmon passage at dam sites where non-federal dam owners voluntarily agree to participate in the GCP program. The dam owners do not have control over conditions upstream or downstream of their dam, and have little influence as to whether Atlantic salmon will be present at their dam site. The dam owner's ultimate responsibility is to ensure that when Atlantic salmon are present, they can pass the site. Hence, effectiveness monitoring is designed to determine whether dam owners successfully create conditions that can effectively pass Atlantic salmon. This will be assessed based on conformance of each implemented project with the dam removal or fish passage plan that has been approved by NMFS. For dam removal projects (Minimization Option 1), NMFS (or entities identified by NMFS) will conduct a post dam removal inspection to ensure the dam has been removed as described in the approved dam removal plan. At sites where fishways have been constructed (Minimization Option 2), NMFS engineers (or entities identified by NMFS) will conduct site visits during various stream discharge rates to determine if the water velocities and depths of constructed fishways conform to what has been approved in the fish passage plan. NMFS will also monitor Atlantic salmon distribution throughout the Downeast Coastal SHRU by tracking monitoring and research efforts conducted by other entities and by conducting periodic "spot-checks" for the presence of Atlantic salmon adults, juveniles and redds.

8.3 Performance and Success Criteria

Overall performance and success of the GCP will be measured based on the level of dam owner participation and the effectiveness of the GCP in increasing habitat use by Atlantic salmon.

8.3.1 Dam Owner Participation Criteria and Habitat Connectivity

To increase Atlantic salmon habitat connectivity through the GCP program, there will need to be a high level of dam owner participation. Limited dam owner participation could be indicative of several circumstances including: 1) dam owners are unaware of their impacts on Atlantic salmon and that incidental take can be permitted through the GCP, 2) dam owners believe the requirements of the GCP are too arduous for them to participate, and/or 3) dam owners do not recognize the benefits of participating in the GCP. NMFS will annually assess the amount of habitat that has been increased through dam owner participation in the GCP. If progress is considered poor, then NMFS will evaluate possible strategies for increasing participation, for example, by conducting increased public outreach. Expected ITP issuance should result in increased access to habitat units as follows (habitat units are defined in the Atlantic salmon recovery framework (NMFS et al. 2010).

- By Year 5: 1,000 habitat units with a habitat quality score of 2 or 3 accessible
- By Year 10: 5,000 habitat units with a habitat quality score of 2 or 3 accessible
- By Year 20: 10,000 habitat units with a habitat quality score of 2 or 3 accessible

8.3.2 Atlantic Salmon Habitat Use Criteria

Implementation of the GCP is expected to improve Atlantic salmon passage, thus increasing the range of wild Atlantic salmon in the Downeast Coastal SHRU. NMFS will monitor Atlantic salmon distribution throughout the SHRU by tracking monitoring and research efforts conducted by other entities and by conducting periodic surveys to document the presence of Atlantic salmon. The purpose of this effort will be to determine if Atlantic salmon distribution is expanding into habitat that had been previously blocked by dams participating in the GCP program. Because the GCP is a voluntary program for dam owners, it is unknown where fish passage will be improved and the rate at which fish passage improvements will occur. However, as the GCP progresses, the GCP Adaptive Management Committee (See Section 8.4) will evaluate whether Atlantic salmon distribution is expanding, consistent with what should be expected given the distribution of dam removal and fish passage improvement projects taking place. If Atlantic salmon distribution is not improving as expected, then NMFS will work with the GCP Adaptive Management Committee to identify possible reasons and solutions that can be implemented within the existing GCP framework or through a GCP amendment (see Section 11.3 below).

8.4 Adaptive Management Committee and Fund

The GCP Adaptive Management Committee will be composed of individuals representing NMFS, the State of Maine, a conservation advocacy group and dam owners. NMFS will solicit nominations for the committee and select appropriate individuals to serve. The committee will convene annually to identify high priority habitat improvement projects that will be financed with the GCP mitigation fund. Appropriate projects may include, but are not limited to, fish passage improvement (dam/culvert removal, or installation of fishways), non-native species control, or aquatic habitat enhancements. The committee will attempt to reach consensus on habitat improvement priorities. However, if consensus can not be reached then NMFS will have

final authority regarding priority selection. The GCP Adaptive Management Committee will also advise NMFS on appropriate strategies to improve GCP implementation if success criteria are not being met (see Section 6.3) or changed/unforeseen circumstances occur (see Section 8), using adaptive management. Adaptive management allows for the use of different methods for achieving the biological objectives, rather than adhering to an inflexible list of prescriptions. Results are periodically assessed, and if shortcomings are evident, alternative strategies may be implemented. For example, the GCP Adaptive Management Committee may use the results of future studies to recommend alternative fish passage structures to better achieve fish passage or to improve salmon habitat. These recommendations could be used by existing or new ITP holders when planning future fish passage improvements.

9 ASSESSMENT OF POTENTIAL IMPACTS

9.1 Potential Impacts to Atlantic Salmon

Activities covered under this GCP will result in direct and indirect impacts, both adverse and beneficial, to Atlantic salmon. Ultimately, dam removals and installation of fish passage structures are expected to improve habitat conditions for Atlantic salmon.

9.1.1 Potential Impacts from Dam Removal (Minimization Option 1)

Removal of an existing dam may result in incidental take of Atlantic salmon as a result of clearing, excavating, grading, filling or other construction activities. These activities could temporarily degrade water quality by increasing turbidity, disturbance of substrates, and/or altering flows, affecting habitat quality for spawning and incubation, and potentially resulting in injury or mortality of Atlantic salmon. However, these impacts are expected to be temporary and will be limited to the area where the dam is located and the area immediately upstream and downstream of the dam. Potential impacts will be minimized by conducting instream activities during the summer months when stream flow is low and salmon migration, spawning, and incubation activities are minimal, and by adhering to other conditions described in Section 7.

Incidental take of Atlantic salmon is not expected to occur at a particular dam site after that dam is removed. Dam removal is expected to increase availability of spawning, feeding, sheltering, and resting habitat for Atlantic salmon within the Downeast Coastal SHRU by replacing impounded waters with fluvial habitat more suitable to Atlantic salmon life stages, and by removing barriers to migration. For salmon to survive and reproduce, habitat must exist within a watershed for: 1) spawning in late autumn; 2) feeding and sheltering during the growing period in the spring, summer, and autumn; and 3) overwintering. Unimpeded migration among these habitats and the sea is necessary for the species to complete its life cycle. Ultimately, dam removals are expected to increase the population size of Atlantic salmon in the Downeast Coastal SHRU and contribute to the recovery of the species.

Indirect effects of dam removals on Atlantic salmon may include improved connectivity for both co-evolved native, as well as non-native, aquatic species; improved water quality; changes in hydrology and ice damming; changes in predation and mortality from commercial and recreational fishing; and improved nutrient transport.

Improved Connectivity for Co-evolved Native, and Non-native Aquatic Species-- Dam removals will remove barriers to migration for river herring, American shad, rainbow smelt, sea lamprey, and American eel, all of which experienced dramatic population declines due to their inability to reach historic spawning habitat (Collins et al. 2007). Removals of fish passage barriers are expected to result in increased distribution of these fish species into upper reaches and increased reproductive success, ultimately increasing population sizes (Hart et al. 2002). Some of these co-evolved species provide important ecological functions for Atlantic salmon. For example, increased connectivity may increase the population size and distribution of sea lamprey. While spawning, lamprey burrow in and turn over gravel beds, which cleanses the gravel of residual sediments and makes them more suitable for subsequent use by salmon (Kircheis LLC 2004). Furthermore, emerging larval lamprey (ammocytes) provide valuable forage for juvenile salmon. Dam removals could also increase habitat connectivity for non-native species, such as smallmouth bass and northern pike that compete with and/or prey upon juvenile Atlantic salmon.

Improved Water Quality-- Dam removal is expected to result in improved water quality by reducing the volume of static water impounded behind each dam. Static water is subject to solar warming and reduced dissolved oxygen levels. In the summer, this may result in reduced ambient water quality in downstream reaches affected by outflow from the dam that may stress, limit or impair growth and survival of Atlantic salmon and other co-evolved, ecologically-linked native cold water aquatic fauna, such as brook trout and rainbow smelt. There may also be less sediment accumulation if a dam is removed, reducing sediment oxygen demand, which would free more dissolved oxygen for consumption by salmon.

Changes in Hydrology and Ice Damming-- Dam removal may also modify the rate of water storage and stream flow run-off which could affect stream hydrology. This effect will vary by site and by magnitude depending on stream slope, impoundment volume, and position in the watershed. Changes in the existing pattern of ice jamming and ice breakup have been identified by the USGS as a factor to consider in prior dam removals in Maine. Ice scour can alter shoreline geometry and vegetation, and recurring jams can result in temporary flooding that causes localized changes to stream geometry and habitat.

Changes in Predation and Mortality from Commercial and Recreational Fishing-- Dam removals are expected to reduce upstream and downstream migration delay for salmon and other diadromous fish species at each dam site. Fish delayed at the base of dams often concentrate and may be more vulnerable to predation or fishing exploitation. Such bottlenecks often attract predators, anglers and poaching. Dam tailwaters are often the focus of commercial fisheries for species such as alewives, and inefficient passage could result in salmon crowding and increased take due to bycatch if salmon cannot enter and exit a dam tailwater rapidly.

Improved Nutrient Transport-- Terrestrial-origin nutrients (e.g. leaf litter, organic matter, insects, soil particles, etc.) and aquatic nutrients (e.g. phytoplankton, zooplankton, aquatic insects, detritus, etc.) are the basis for trophic food webs in stream systems and are generated in tributaries and distributed downstream. Marine-derived nutrients, including the protein bound up in the biomass of diadromous fish species (including Atlantic salmon) that grow in the sea and then migrate to freshwater, also provide nutrients for aquatic, terrestrial and avian predators. Therefore, dam removals may reduce accumulation of nutrients at impoundments and increase watershed-scale distribution and availability of organic nutrients and other materials such as

woody debris within the Downeast Coastal SHRU. This is expected to increase food availability for Atlantic salmon.

9.1.1.1. *Potential Impacts on Critical Habitat*

Dam removals will result in direct and indirect impacts, both adverse and beneficial, to Atlantic salmon critical habitat. Ultimately, dam removals are expected to improve the physical and biological features within critical habitat in the Downeast Coastal SHRU, which includes habitat for spawning and incubation, juvenile rearing, and migration. These features are essential to the conservation of the species.

Removal of an existing dam may temporarily degrade Atlantic salmon critical habitat as a result of clearing, excavating, grading, filling or other construction activities. These activities could temporarily degrade water quality by increasing turbidity, siltation, and/or altering flows, potentially degrading spawning, incubation, rearing, and migration habitat. However, these impacts are expected to be temporary and will be limited to the area where the dam is located and the area immediately upstream and downstream of the dam. Potential impacts will be minimized by conducting instream activities during the summer months when stream flow is low and salmon migration, spawning, and incubation activities are minimal, and by adhering to the minimization measures described in Section 7.

Removals of existing dams are expected to significantly improve critical habitat for Atlantic salmon within the Downeast Coastal SHRU by improving habitat for spawning, incubation, rearing, and migration in the following ways:

Spawning and Incubation-- Spawning and incubation occurs in clean, unembedded gravel/cobble riffles between mid-fall through early spring. Restoration of natural seasonal flows after dam removal will promote flows suitable for scouring silt from gravel bars, maintaining appropriate depth and interstitial flow during egg incubation, promoting floodplain nutrient exchange, and avoiding stagnation and degraded water quality that may be detrimental to embryo survival. Thus, dam removals are expected to improve spawning and incubation habitat for Atlantic salmon.

Juvenile Rearing-- The fry life stage extends from spring emergence through mid to late summer, and then the parr occupy rearing habitat for two years prior to emigrating to marine waters as smolts. Newly emerged fry prefer shallow, low velocity, riffle habitat with a clean gravel substrate, and parr prefer riffle habitat associated with diverse rough gravel substrate. Habitat occupancy is a function of territoriality, and biotic and abiotic habitat features, including stream morphology, substrate, gradient, and cover; food availability; and the presence of predators and competitors. Cover is needed to buffer extreme temperatures and high flows, and provides protection from predators. Dam removal may improve habitat for juvenile rearing by changing formerly impounded upstream reaches into more productive riffle and run habitat with improved water quality, cover substrate and drift characteristics.

Migration-- While migrating upstream, adult Atlantic salmon must traverse a range of stream gradients, water qualities, and channel conditions between the estuary and headwaters where spawning occurs. Upstream migration commences in late April, peaks by July and may continue

sporadically through mid-fall. Barriers to migration can prevent access to spawning habitat, delay migration, or impair fish health. Atlantic salmon smolts emigrate downstream in late April-June. The emigration period is short, prompted by environmental conditions (water temperature, daylight length, increased flow, etc.), and metabolic changes in the smolt (production of enzymes necessary to adapt to saltwater). Smolts require a barrier-free corridor from rearing habitat to the marine environment so that they can emigrate before either environmental or metabolic conditions change. A delay in smolt migration can decrease their ability to osmoregulate in the marine environment, which is a necessary adaptation for survival. Delays at barriers can also result in increased predation on emigrating smolt by avian and aquatic predators. Therefore, dam removals will eliminate a source of delay, stress or mortality, resulting in improved habitat for adults migrating upstream and smolts emigrating downstream in the Downeast Coastal SHRU.

9.1.2 Potential Impacts from Fish Passage Installation (Minimization Option 2)

Installation of a fish passage structure may result in incidental take of Atlantic salmon as a result of clearing, excavating, grading, filling, or other construction activities to install fishway components. These activities could temporarily degrade water quality by increasing turbidity, disturbance of substrates, and/or altering flows, affecting habitat quality for spawning and incubation, and potentially resulting in injury or mortality of Atlantic salmon. However, these impacts are expected to be temporary and will be limited to the area where the dam is located and the area immediately upstream and downstream of the dam. Potential impacts will be minimized by conducting instream activities during the summer months when stream flow is low and salmon migration, spawning, and incubation activities are minimal, and by adhering to other conditions described in Section 7.

After installation of a fish passage structure at an existing dam, some incidental take of Atlantic salmon is expected to occur. Some juvenile or adult Atlantic salmon may be killed or injured during fishway installation and operation. However, the installation of fish passage structures are expected to reduce potential mortality or injury to migrating salmon relative to prior conditions existing at the dams. As discussed in Section 7.2.1, the GCP estimates a 5% cumulative impact to upstream and downstream migrating Atlantic salmon. The addition of fish passage structures are also expected to increase availability of spawning, feeding, sheltering, and resting habitat for Atlantic salmon within the Downeast Coastal SHRU by removing barriers to migration. Ultimately, installation of fish passage structures could increase the population size of Atlantic salmon in the Downeast Coastal SHRU and contribute to the recovery of the species.

9.2 Potential Impacts to Non-Covered Species

Non-covered species of interest in the Downeast Coastal SHRU, including shortnose sturgeon, Atlantic sturgeon, freshwater mussels, rainbow smelt, American eel, American shad and river herring are expected to benefit from the improved connectivity that will result through implementation of the GCP. Dam removals and installation of fish passage structures will likely have the most profound impact on those species that would benefit from access to the small tributaries, upper reaches and headwaters of the Downeast Coastal SHRU. Shortnose and Atlantic sturgeon typically inhabit the mainstem of large rivers in Maine, where dams are typically federally regulated and are not covered by this GCP. A return to more historic water

quality, hydrology and turbidity conditions will likely benefit sturgeon within the Downeast Coastal SHRU, but few direct impacts will result from the implementation the GCP.

The removal of anthropogenic barriers to migration will improve habitat quality and connectivity while restoring historically available habitat to all diadromous species. Dam removal activities will likely result in temporary localized degradation to the river habitat during deconstruction. However, impounded areas will revert to riverine habitat, restoring the natural function of the river ecosystem. The benefits of re-naturalization of impounded areas include improved water quality (temperature, chemistry and turbidity), habitat (substrate, embeddedness, structure and function) and hydrology. These factors will improve habitat for diadromous fish species.

Rainbow smelt enter streams and rivers in spring to spawn. Spawning occurs in both large and small bodies of water above the head of tide (Collette and Klein-MacPhee 2002). Obstructions to spawning migration including dams and other anthropogenic alterations are known to result in the overabundance of eggs below the obstruction leading to fungal infection and high egg mortality (Collette and Klein-MacPhee 2002). The removal of dams on coastal rivers will increase and redistribute spawning habitat area. River herring and American eel will benefit similarly from the restoration of historically available habitat.

Diadromous fish provide an influx of marine derived nutrients benefiting a wide variety of fauna including osprey, eagles, great blue heron, loons and other fish-eating birds and at the same time they provide a prey buffer for migrating juvenile and adult Atlantic salmon in estuaries and open ocean where they are captured by seals, ospreys, or other marine predators (MDMR 2008). River herring provide a vital link between the marine and freshwater environments, supplying nutrients and forage to a wide variety of fish and animals including; striped bass, bluefish, tuna, cod, haddock, halibut, American eel, brook trout, rainbow trout, brown trout, lake trout, landlocked salmon, smallmouth bass, largemouth bass, pickerel, pike, white and yellow perch, seabirds, bald eagle, osprey, great blue heron, gulls, terns, cormorants, seals, whales, otter, mink, fox, raccoon, skunk, weasel, fisher, and turtles (MDMR 2008).

Freshwater mussels are a predominantly sessile organism and are therefore highly susceptible to environmental degradation because they are unable to seek refuge from disturbance. Activities associated with dam removal will likely impact localized populations of freshwater mussels. However, restoring migratory corridors to resident fish species will promote the abundance of mussels within the Downeast Coastal SHRU, as mussels rely on fish hosts to disperse larvae and colonize new areas. Mussels are an important food item for some aquatic mammals, especially otters, muskrats, and raccoons, as evidenced by piles of shells (middens) often seen along shorelines (MDIFW 2010), and benefit water quality by filter feeding.

10 CHANGED AND UNFORESEEN CIRCUMSTANCES

10.1 Changed Circumstances

Changed circumstances are defined in 50 CFR 17.3 as changes in circumstances affecting the species or geographic area covered by the GCP that can reasonably be anticipated and for which contingency plans can be prepared. Anticipated changed circumstances for the GCP include the new ESA listing of species, fire, flood, drought, or other natural catastrophic events. If additional

conservation and mitigation measures are deemed necessary to respond to changed circumstances and these additional measures are already provided for in the plan's conservation program (e.g., the conservation management actions or mitigation measures agreed to in the GCP), then the permittee will implement those measures as specified in the plan. However, if additional conservation management and mitigation measures are deemed necessary to respond to changed circumstances and such measures are not provided for in the plan's conservation program, NMFS cannot require these additional measures absent the consent of the permittee, provided that the GCP is being "properly implemented" (properly implemented means the commitments and the provisions of the GCP have been or are being fully implemented).

10.1.1 Newly Listed Species

If a species that is not covered by the GCP, but that may be affected by activities covered by the GCP, is listed under the ESA by NMFS or USFWS during the term of the GCP, the GCP will be reevaluated by NMFS and the covered activities may be modified, as necessary, to ensure that the activities are not likely to result in the take of the newly listed species or result in adverse effects to any newly designated critical habitat. ITP holders shall implement the modifications to the GCP covered activities identified by NMFS as necessary to avoid the likelihood of jeopardy to or take of the newly listed species or adverse affects to newly designated critical habitat. The ITP holder shall continue to implement such modifications until such time as they have applied for and NMFS has approved an ITP amendment, in accordance with applicable statutory and regulatory requirements, to cover the newly listed species or until NMFS notifies the permit holder in writing that the modifications to the GCP covered activities are no longer required to avoid take of the newly listed species or result in adverse modification of newly designated critical habitat.

10.1.2 Fire, Flood and Drought

Significant changes to stream morphology and/or vegetation could result from a major fire, flood or drought. ITP holders that implement Minimization Option 1 (Remove Dam) have no responsibly to address this type of changed circumstance. However, if 1) the change results in a dam not meeting the fish passage criteria described in Section 7, and 2) the decrease in fishway function is likely to continue for a minimum of 2 consecutive years, then the ITP holder must develop and implement a plan to modify or reconstruct the fishway to meet the fish passage criteria. If required modifications are significantly different then what has been approved in the existing fish passage plan (Section 7), then the ITP holder must submit a revised fish passage plan for approval by NMFS. All terms and conditions described in this GCP will continue to apply.

10.2 Unforeseen Circumstances

Unforeseen circumstances are defined in 50 CFR 17.3 as changes in circumstances that affect a species or geographic area covered by the GCP that could not reasonably be anticipated by plan developers and NMFS at the time of the GCP's negotiation and development, and that result in a substantial and adverse change in the status of the covered species. The purpose of the No Surprises Rule is to provide assurances to non-federal landowners participating in the GCP that no additional land restrictions or financial compensation will be required for species adequately

covered by a properly implemented GCP, in light of unforeseen circumstances, without the consent of the permittee.

In case of an unforeseen event, the permittee shall immediately notify NMFS staff. In determining whether such an event constitutes an unforeseen circumstance, NMFS shall consider, but not be limited to, the following factors: size of the current range of the affected species, percentage of range adversely affected by the GCP, percentage of range conserved by the GCP, ecological significance of that portion of the range affected by the GCP, level of knowledge about the affected species and the degree of specificity of the species' conservation program under the GCP, and whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

The minimization and mitigation measures described in this GCP are generally considered adequate for an ITP recipient to address unforeseen circumstances, within the boundaries of "No Surprises" assurances. If NMFS determines that additional conservation and mitigation measures are necessary to respond to the unforeseen circumstances where the GCP is being properly implemented, the additional measures required of the permittee must be as close as possible to the terms of the original GCP. As such, additional conservation and mitigation measures which involve the commitment of additional financial compensation or restrictions on the use of land or other natural resources otherwise available for development or use under original terms of the GCP may be implemented with the consent of the permittee.

However, unforeseen circumstances may affect how NMFS continues to administer the GCP. If an unforeseen circumstance is identified, NMFS will convene a meeting of the GCP Adaptive Management Committee to evaluate potential biological effects and determine if any changes to the GCP are appropriate. As a result, NMFS and the GCP Adaptive Management Committee may determine it necessary to amend the GCP, which may constitute a "Major Amendment" (Section 11.3). Any major amendments as a result of unforeseen circumstances would not affect ITPs approved prior to the amendment.

11 FUNDING AND ASSURANCES

ITP applicants must demonstrate adequate funding sources to complete and maintain required minimization and mitigation measures, compliance and effectiveness monitoring; and to implement measures that may be required due to changed circumstances (Section 10.1). Mitigation fees collected into the GCP Adaptive Management fund will be used, as determined by the GCP Adaptive Management Committee, to fund projects that improve connectivity for Atlantic salmon in the Downeast Coastal SHRU. In order to maximize the value of these funds, funding from other sources such as matching grants, federal funds, state matching funds, and volunteer labor and support from non-profit organizations will be sought and may be used to offset the costs of these projects.

NOAA Restoration Center's Community-based Restoration Program invests funding and technical expertise in habitat restoration projects, leveraging funding and support from partner organizations (http://www.habitat.noaa.gov/restoration/programs/crp.html). USFWS's National Fish Passage Program aims to remove or bypass the barriers that impede movement of fish and wildlife, and to restore stream flows and dynamics; this program provides engineering, technical

assistance and funding to conserve aquatic species and their habitats. Other funding opportunities for dam removal and fish passage projects available from USFWS include the Partners for Fish and Wildlife Program, the Coastal Program, and the National Fish Habitat Action Partnerships.

11.1 Permit Duration

The GCP will be in effect for 50 years. For projects pursuing Minimization Option 1 (Remove Dam) individual ITPs will be valid for the duration of the GCP if necessary, though in most cases all take should be eliminated by dam removal and long-term coverage should not be needed. For projects pursuing Minimization Option 2 (Achieve Fish Passage Criteria) individual ITPs will be valid for 20 years and may be extended for an additional term (the duration will be dependent on the number of years that the GCP remains in effect) if NMFS determines that a dam has been, and remains, in compliance with the GCP's requirements. The relatively long GCP duration is necessary for GCP goals and objectives to be met and will also ensure a long-term commitment for maintenance of fishways.

11.2 Severability

Each ITP issued under the GCP is severable from all other ITPs. Additionally, the GCP is severable from all other GCPs and all HCPs.

11.3 GCP Amendments

Amendments to the GCP are not anticipated on a regular basis. However, clerical changes may be required to clarify the intent of the GCP. Furthermore, certain events may require significant GCP amendments (Major Amendments).

11.3.1 Clerical Changes

Clerical changes include corrections of typographical, grammatical, and similar editing errors that do not change the intended meaning of text or any exhibit. Clerical changes to the GCP shall be made by NMFS on its own initiative or in response to a written request, which includes documentation supporting the proposed clerical change. Clerical changes shall not result in any changes to issued ITPs and will not require any NEPA documentation or public process.

11.3.2 Major Amendments

Major amendments to the GCP may be warranted because new information regarding Atlantic salmon biology is available, new strategies for achieving GCP goals are identified, or other reasons. Amendments may include changes to minimization measures, mitigation measures, or monitoring methods. When a major amendment is warranted, the appropriate level of NEPA documentation will be prepared.

12 ALTERNATIVES TO GCP

As discussed above, the general purpose of the GCP is to provide a relatively efficient process for non-FERC regulated dams to receive authorization for incidental take of Atlantic salmon and to contribute towards Atlantic salmon recovery. In the absence of the GCP (the no project

alternative), the dams may remain in violation of the ESA. An alternative is for dam owners to individually pursue take authorization by developing individual HCPs. A third alternative is the development of regional HCPs by local entities (e.g., the State of Maine, or counties) through which individual dam owners could receive Atlantic salmon take authorization. Finally, safe harbor agreements may provide a mechanism for dam owners to address fish passage impediments and related ESA permitting needs.

12.1 No Project Alternative

If ITPs are not issued for dams in the Downeast Coastal SHRU, then certain dam owners may not be in compliance with the ESA until dams are removed. The rate and extent of dam removal that would occur is uncertain.

12.2 Individual HCPs

This alternative assumes that dam owners will develop individual HCPs and apply for ITPs to receive take authorization for Atlantic salmon. Under this alternative, dam owners may have more flexibility in negotiating minimization and mitigation measures than is provided through the GCP. However, the cost and time associated with developing an individual HCP are expected to be substantially higher than the cost of receiving an ITP through the GCP. The GCP would not prevent dam owners from developing individual HCPs and applying for ITPs. It is anticipated that few owners of small, non-FERC regulated dams would opt to pursue an individual HCP/ITP rather than receive an ITP under the GCP, resulting in fewer dams that provide for Atlantic salmon passage.

12.3 State or Local Agency HCPs

Under this alternative, NMFS would rely on the implementation of regional HCPs developed by the State of Maine or local agencies (e.g., counties) to provide opportunities for dam owners to receive take authorization. Under this type of program, the State of Maine or a county would develop a regional HCP and receive an ITP. Subsequently, certificates of inclusion that authorize take would be issued to third party beneficiaries (dam owners). This type of HCP program would be similar to the GCP, except the local entity would negotiate the HCP terms and conditions with NMFS and then assume the responsibility of issuing ITPs to dam owners and making any necessary findings. This process would take significant effort by the local entity. It is unknown whether the State of Maine or any local agency would be willing to assume this responsibility.

12.4 Safe Harbor Agreement

Under this alternative, dam owners would work with NMFS to develop safe harbor agreements. Under a safe harbor agreement, a dam owner would improve conditions for Atlantic salmon by improving fish passage through either dam removal or construction and maintenance of a fishway, similar to the program described in this GCP. Dam owners would also be required to implement monitoring and mitigation activities. Safe harbor agreements have provisions that allow for sites to be returned to baseline conditions at the end of the agreement. In the case of this GCP, returning the sites to baseline conditions would generally mean removing the mechanisms that allow for fish passage. However, in many circumstances, returning a dam to such a condition may significantly reduce the likelihood of Atlantic salmon recovery. Hence,

safe harbor agreements may not be a suitable mechanism to address Atlantic salmon passage in the Downeast Coastal SHRU.

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APPENDIX A.
UPSTREAM FISH PASSAGE TYPES

1 UPSTREAM FISH PASSAGE

The goal of an upstream fishway is to promote the movement of fish past a migration barrier in such a way as to minimize stress, injury, or delay in the most cost-effective manner possible (Rizzo 1992). There are numerous types of upstream fish passage facilities used for passing upstream migrating diadromous fish including Atlantic salmon at dams. These passages include fish elevators, pool and weir fishways, Denil fishways, Alaskan steeppass fishways, vertical slot fishways, rock ramp fishways, and others. The choice of a specific fish passage design is a function of site-specific physical and biological requirements. The following sections describe fishways that would most likely used by dam owners that decide to pursue Option #2 as part of this GCP, based on past experience in New England.

1.1 Denil Fishways

A Denil fishway is a type of chute fishway. Generally the slope of the fishway is between 1:8 to 1:5 or a 12% to 20% slope. The rectangular chute varies in dimension based upon the size, peak loading, and type of target species that the fishway is intended to pass. The available river flow and headwater to tailwater vertical distance are also factors in the design of the fishway. A typical cross section dimension of the rectangular chute is 4 foot wide by 7 foot high. Baffles are located within the chute in order to slow the velocity of the water and disturb the flow direction in order to make the passage easier on the migrating fish. Fish dart through the baffles as they ascend the chute. The baffles are typically inserted in slots in the chute walls, and orientated at a 45 degree vertical upstream incline from the floor of the chute.

Denil fishways can be constructed out of wood, metal, concrete, fiberglass, etc. Typically in the northeast, the chute is constructed out of concrete and the baffles out of wood. The cutes can be removed after the fish passage season to reduce maintenance, but typically must be periodically replaced. Resting pools need to be constructed every 6 to 9 ft of vertical rise. During the fish passage season, maintenance would consist of removing debris that could clog entrances, exits or other areas. The hydraulic effectiveness of a Denil is often hampered at locations that have relatively large fluctuations of headpond or tailwater elevations. Construction cost vary depending upon the kind of material used in the construction, the structure of construction contracts, the planning and design of the structure, the dimensions of the chute, exit gate requirements, total vertical passage requirements, the number of required resting pools, site location constraints, etc. Typical costs in 2011 range from $15,000 per foot of rise to $65,000 per foot of rise.

Photo 1. Browns Mills Hydroelectric Project Denil Fishway (*Courtesy of Maine Dept. of Marine Resources*)

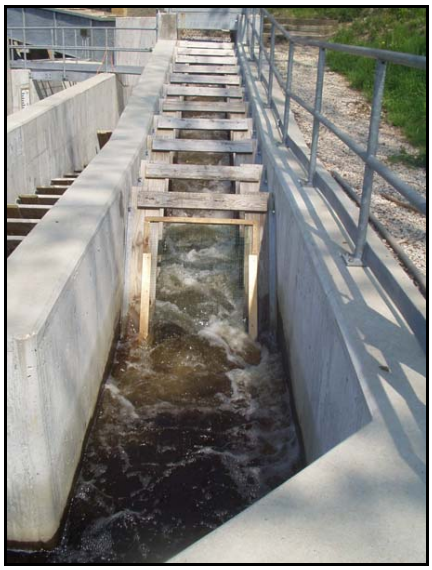


Photo 2. South Berwick Hydroelectric Project Denil Fishway (*Courtesy of Enel North America, Inc.*)

1.2 Alaskan Steeppass Fishways

The Alaskan Steeppass fishway is very similar in design to the Denil fishway. The major is difference is that in addition to being sloped upstream in the vertical direction, the baffles are also sloped upstream from the side walls of the structure. The baffles are more complex and efficient at controlling water velocities than the baffles in a Denil; therefore, the design slope of the structure is steeper.

The Steeppass is typically a pre-manufactured, modular fishway. Currently, in Maine, Sheepscot Machine of Woolwich manufactures the device. The Steeppass is lightweight, and is designed so that it can be removed and even relocated after fish passage at the site has ended. The hydraulic effectiveness of a Steeppass is often hampered at locations that have relatively large fluctuations of headpond or tailwater elevations. Construction costs are less variable than the Denil fishway because the typical design is the pre-manufactured one. Variances in construction costs from site to site will occur, however, due to limited access, supporting civil works requirements, height of the structure, number of required resting pools, and required dimensions of the structure to pass the target loading of fish. Typical installed costs in 2011 for the aluminum pre-manufactured version range from $3,000 per ft of rise to $5,000 per ft of rise. Installed costs for a field constructed ladder with concrete or wood would be more. There is additional savings with a Steeppass over a Denil in that the Steeppass has a significantly lower cross sectional area and a steeper slope for a specific flow than a Denil, thus require much less material.

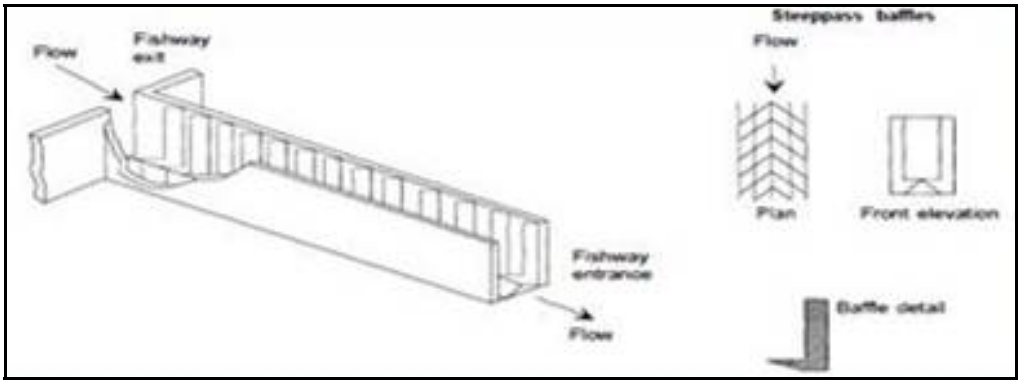


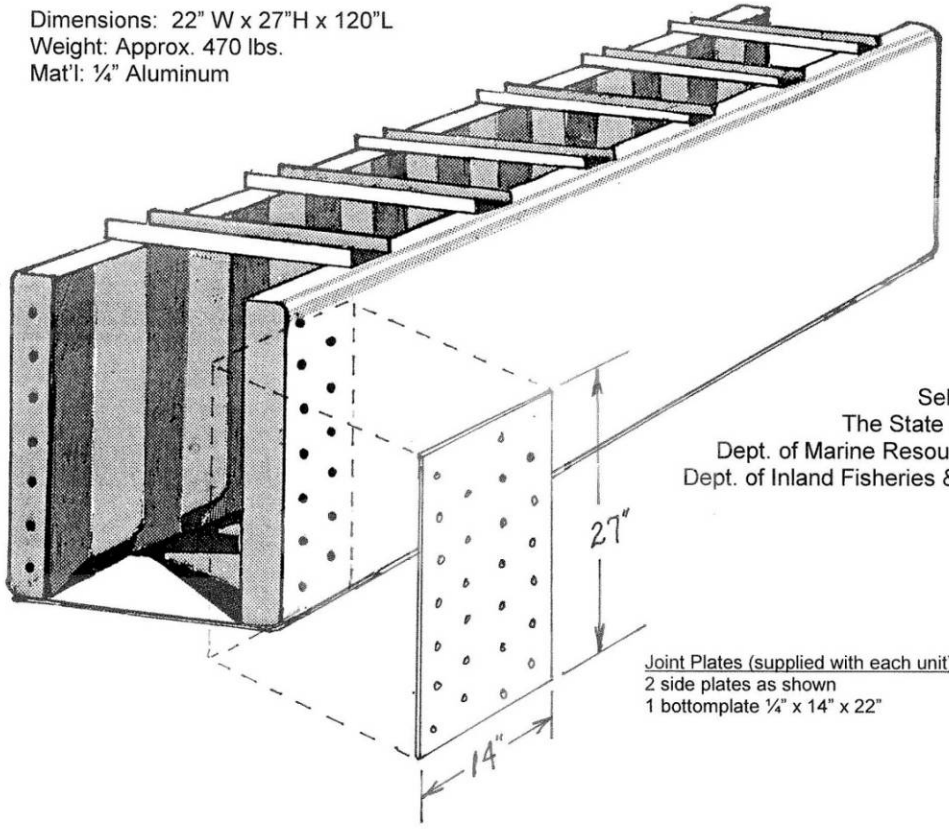
Photo 3. General layout of Alaskan Steeppass Fishway (*Source: Katopodis, C., "Introduction to Fishway Design," working document, Freshwater Institute, Department of Fisheries and Oceans, Winnipeg, Manitoba, Canada, 1992.*)

Photo 4. Unicorn Lake Alaskan Steeppass Fishway (*Courtesy of Maryland Department of Natural Resources*)

Sheepscot

ALUMINUM DENIL STEEPASS FISHWAY

Dimensions: 22" W x 27"H x 120"L
Weight: Approx. 470 lbs.
Mat'l: ¼" Aluminum



As
Selected by
The State of Maine
Dept. of Marine Resources and
Dept. of Inland Fisheries & Wildlife

Joint Plates (supplied with each unit):
2 side plates as shown
1 bottomplate ¼" x 14" x 22"

PROVEN ALASKAN DESIGN:

- Slows water passage, enabling more species of fish to pass more easily. Recommended by field biologists.
- Compact efficiency (Maine's first installed 2' x 10' unit replaced a 4' x 28' wooden denil fishway).
- Includes provision for four-man carry to remote locations.

MODULAR CONSTRUCTION OF ALUMINUM PLATE, SUPERIOR IN:

- Cost... estimated at 38-50% of the cost of wood and 17-19% the cost of concrete fishways.
- Ease of installation, saves time and labor.
- Long lasting durability.
- Maintenance free.

Sheepscot Machine Works 1130 US Rt 1 Newcastle, Maine 04553
Tel. 207-563-2299 Fax. 207-563-2619

1.3 Vertical Slot Fishways

A vertical slot fishway differs from the Denil and Steeppass. Rather than a chute, it is a pool and weir fishway that steps upward from pool to pool. The design consists of rectangular chambers or pools that have a vertical slot exit on the upstream wall and entrance on the downstream wall in order for the fish to enter and exit and controls the depth of water within each chamber. Fish can rest within each chamber.

Vertical slot fishways typically have a slope of 10 percent. The number of steps is determined by the maximum forebay to tailwater head differential. Each step is typically 0.75 to 1 ft in elevation. Due to the more gradual slope, a vertical slot fishway will require a larger footprint to rise to a given elevation than a comparable Denil or Steeppass. The vertical slot fishway hydraulics operate effectively over large ranges of headwater and tailwater elevations, thus giving it an advantage in such situations over the Denil or Steeppass.

Typically the vertical slot fishway is constructed of concrete and is often prohibitively expensive to construct when compared to either the Steeppass or Denil. As a result, it is rarely used on small dams. Due to the extensive civil design requirements, costs vary widely based on site-specific constraints. The variance can be caused by height of structure, material, location, size of the structure, etc. It would be unlikely that any vertical slot fishway could be constructed for a total cost less than $20,000 per foot of rise (based on 2011 costs).

Photo 5. West Enfield Hydroelectric Project Vertical Slot Fishway (*Courtesy of Maine Dept. of Marine Resources*)

Photo 6. West Enfield Hydroelectric Project Vertical Slot Fishway (*Courtesy of Maine Dept. of Marine Resources*)