AN UPDATE OF INTERTIDAL FISHING STRUCTURES IN SOUTHEAST ALASKA

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ABSTRACT

Forest Service and other archaeologists have gathered a wealth of information on intertidal fishing structures located in the bays and estuaries of the Tongass National Forest. A total of 369 fish trap and weir sites have been reported in Southeast Alaska's Alexander Archipelago and 182 wood stakes have undergone radiocarbon analysis. A review of this information reveals a complex array of trap and weir sites widely distributed across the region. This technological innovation, evident in the archaeological record as early as 5500 cal ^{14}C years BP, continued to provide the mainstay of life to the traditional inhabitants of Southeast Alaska to near modern times.

KEYWORDS: fish traps and weirs, Tlingit Indians, radiocarbon dates

INTRODUCTION

Intertidal fish trap and weir sites in Alaska, British Columbia, Washington, and Oregon suggest the importance of fish to prehistoric Northwest Coast societies. Over 1,200 wood stake and stone traps and weirs have been identified and evidence of fishing is found in most Northwest Coast archaeological sites (Moss 2011a:35). In Southeast Alaska's Alexander Archipelago hundreds of ancient fishing structures are preserved (Langdon n.d., 2006; Mobley and McCallum 2001; Moss 1989, 2011; Moss and Erlandson 1998; Moss et al. 1990; Smith 2006). Found from Yakutat Bay south to Dixon Entrance (Fig. 1), these sites are situated in the intertidal zone and occur in both island and mainland environments. They are made of piled stones or sharpened wood stakes and vary between elaborate traps to simple weirs. Geological processes such as erosion, sedimentation, marine transgression, isostasy, and other post-depositional processes have affected site integrity. Data minimally suggest the diverse and complex nature of the technology and the immense labor that went into salmon and other fin fish harvest. Remnants from fishing structures have provided us with evidence of over 5000 years of fish trap and weir use in the region.

Early ethnographers and visitors to Southeast Alaska invariably mentioned the importance of fish to the traditional inhabitants, mainly the Tlingit Indians. Niblack (1970:276) said that fish formed the staff of life amongst the Indians of the region. Krause (1956:118) pointedly stated "the Tlingit directs his attention primarily toward fishing; through this he gains the main part of his livelihood and to it he devotes the greatest part of his working hours." Emmons (1991:102, 103) described the Tlingit as primarily a fisherman whose most valuable natural product was the salmon. In his work on Tlingit traditional knowledge and the harvesting of salmon, Langdon (2006:1) stated that salmon was the mainstay of Tlingit diet and the resource most critical to the rich and complex cultural forms practiced today and in the past. The success of intertidal fishing influenced the social organization and societal welfare of the northern Northwest Coast people (Langdon n.d.:4; Moss 2011a:34). The archaeological record reported in this paper supports these observations and further defines the importance of fish and fishing by establishing a millennia-long temporal range.

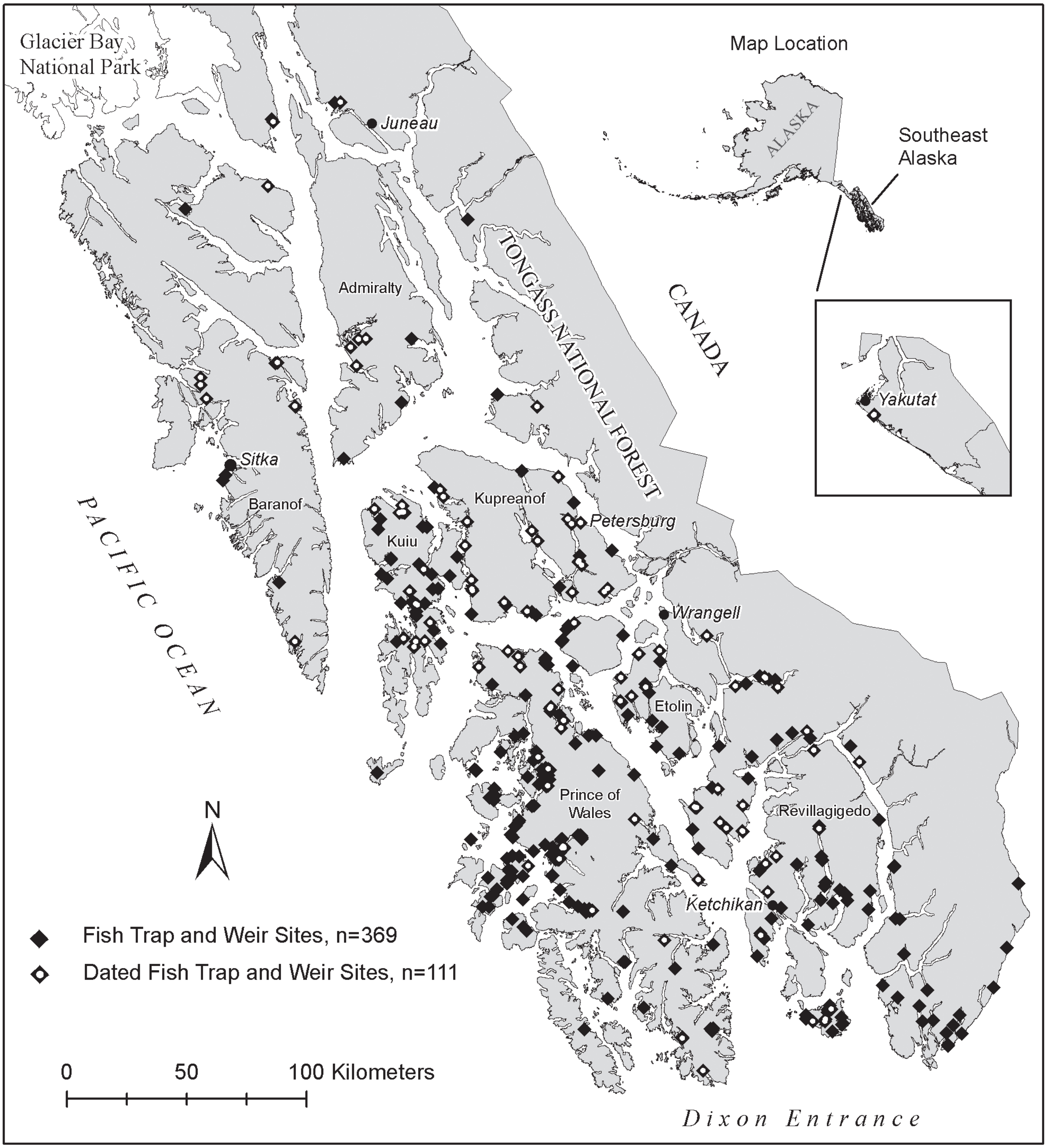


Figure 1: Fish trap and weir locations in Southeast Alaska.

ENVIRONMENT AND CULTURAL PAST

Understanding the Holocene environment is important in interpreting the archaeological record. The availability of coastal terrain for settlement, sea level and climate histories, and vegetation colonization influenced the development of fish trap and weir sites. Glacial activity and erosion created bays and inlets well suited for intertidal fishing. Southeast Alaska was deglaciated sometime around 16,000 ^{14}C yrs BP (Mann 1986:260). Retreat was rapid with iceberg calving causing glacier termini to withdraw to their modern positions by about 13,500 ^{14}C yrs BP. The retreat was followed by marine transgression difficult to generalize because of variable tectonism and local glacio-isostatic rebound (Mann and Hamilton 1995:460). Radiocarbon-dated raised marine deposits have been analyzed to formulate a marine transgression model for establishing paleo-shoreline elevations and predicting the locations of early archaeological sites (Baichtal and Carlson 2010:64–67; Carlson and Baichtal 2009). Preliminary results suggest sea level in southern Southeast Alaska reached its maximum transgression at about 8,500 ^{14}C yrs BP (Carlson and Baichtal 2009). By documenting the elevation of ancient *Saxidomus giganteus* (butter clam) specimens within the paleo intertidal zone, a paleo-shoreline was inferred (Baichtal and Carlson 2010:65–66). The Carlson-Baichtal model has been successful in identifying early archaeological sites (Baichtal and Carlson 2010:66; Smith 2010).

Sea levels may have influenced the position of fishing structures in the intertidal zone and our current ability to find them. It appears modern levels were reached over much of the region by about 4,000 ^{14}C yrs BP during the Neoglacial interval, a time characterized by fluctuating temperatures and precipitation (Mann et al. 1998:112, 119, 120). Sea level is, however, rarely constant and variations have been documented across the region (Mobley 1988:265). Isostatic rebound on the northern Northwest Coast is ongoing and changing shorelines may have affected trap and weir positions in the intertidal zone (Moss 2011a:83; Moss and Erlandson 1998:190–191; Putnam and Greiser 1993:9).

During the mid- to late Holocene, when intertidal fishing structures were abundant, cool and wet periods probably affected salmon production. A study in Kodiak measuring the amount of ^{15}N isotope released from dying salmon incorporated into lake sediments suggested that fluctuating salmon abundance is possibly associated with the size and intensity of the Aleutian Low (Mann et al. 1998:118–119). Whether trap construction and use correlate with climate change and its effect on salmon abundance in Southeast Alaska remains an interesting question.

Plant colonization reflects climate change and characterizes the development of the Holocene environment. Pollen analysis from a study near Petersburg on northern Mitkof Island indicated that pine woodland with abundant alders, sedges, sphagnum mosses and ferns colonized the island by circa 12,900 cal yrs BP (Ager et al. 2010:263–267). By circa 11,460 cal yrs BP, Sitka spruce and mountain hemlock replaced pines over much of the landscape and displaced some of the alder thickets that were previously well established. Sometime around 10,200 cal yrs BP western hemlock arrived and expanded to become a dominant species, forming a coastal forest composed primarily of Sitka spruce and western hemlock. After about 7,200 cal yr BP, muskeg vegetation with sedges and sphagnum mosses increased with a regional climate shift to cooler and wetter conditions. During the late Holocene, by circa 2,200 cal yr BP, cedar (*Chamaecyparis nootkatensis*, *Thuja plicata*) was well established and the modern coastal rainforest of western hemlock, Sitka spruce, mountain hemlock, pine, and cedar was in place.

The human history of Southeast Alaska is part of the northernmost segment of the Northwest Coast culture area, a region associated with the traditional territory of the Tlingit and to a lesser extent, the Haida and Tsimshian (Goldschmidt and Haas 1998 [1946]:4). The area's prehistoric culture has been subdivided to classify patterns in the greater context of a Northwest Coast sequence. Seen as a continuum, the cultural history has been roughly divided into stages or periods (Ames and Maschner 1999:18; Davis 1990a:197–202; Moss 1998:88; 2004:181–182, 2011:47). Most of the proposed divisions are consistent but with some time-sequence variations (Moss 2004:181, 2011a:49). Recent work by Moss (2011a:50) has associated cultural stages with geological time periods. For comparative purposes I use periods defined as the Early Period (10,000–5000 BP), the Middle Period (5000–1500 BP), and the Late Period (1500 BP–AD 1741) (Moss 1998:92–102, 2004:181–182). Recognizing the sequence was based on a relatively small data set, the divisions were coarsely formulated. Briefly, the Early Period is associated with chipped stone assemblages, often taking the form of a microblade tool tradition. The Middle Period is defined by an increase in the number and size of archaeological sites, more diversified bone tool assemblages and wood stake fish traps and weirs. A continuation of these site types, an increase in fort sites, and written history accounts help define the Late Period.

Southeast Alaska was occupied by about 11,000 years ago and is represented by a small number of Early Period sites. Most early sites have stone tool assemblages with few associated faunal remains. The earliest human remains date to 10,300 cal ^{14}C yrs BP and exhibit evidence of a marine-based diet that probably included fish (Dixon et al. 1997:703; Kemp et al. 2007:2; Moss 2011a:35). The Chuck Lake site, dated to ca. 8200 BP, has the oldest vertebrate assemblage in Southeast and includes fish bones (Ackerman 1992:22; Moss et al. 2011:287). Fish trap and weir sites appear during the later part of the Early Period.

The Middle Period has many sites, including numerous shell middens, fish traps, and weirs. Faunal assemblages are common in shell middens and many contain fish bones (Moss et al. 2011:286). Of the twenty-six fish assemblages from Southeast Alaska with more than one hundred identified specimens (NISP) identified to family, twenty-four have *Oncorhynchus* spp. (salmonid) bones as well as *Clupea harengus pallasi* (Pacific herring), *Gadus macrocephalus* (Pacific cod), *Hippoglossus stenolepis* (Pacific halibut), *Sebastes* spp. (scorpaenid), and *Squalus acanthias* (spiny dogfish) among others (Moss 2011b:161). Those assemblages with salmon bones date to between circa 8200 BP and 300 to 100 cal ^{14}C yrs BP with most dating within a range of about 2000 to 500 cal ^{14}C yrs BP (Moss 2011b:160). Fish trap and weir sites span the entire Middle Period with most dating between 2250 to 1500 cal ^{14}C yrs BP.

Shell midden and fish trap and weir sites continue into the Late Period along with specialized site types such as forts (Moss and Erlandson 1992:81) and gardens. Villages with house depressions are associated with the Late Period and artifacts resemble those documented ethnographically (Ames and Maschner 1999:99–100).

PAST WORK AND METHODS

In the early 1970s, the Tongass National Forest hired archaeologists to assess the cultural resources of the region resulting in the accumulation of substantial information about the technologies associated with mass fish harvest. Several papers about Southeast Alaska fishing sites and associated radiocarbon dates have been published over the last few decades (Betts 1998; Langdon n.d., 2006; Mobley and McCallum 2001; Moss and Erlandson 1998; Moss et al. 1990). Papers and posters presented at professional meetings add to the available literature (e.g., Smith 2006). The bulk of trap and weir information, however, is recorded in the gray literature. These reports most often document archaeological discoveries associated with National Historic Preservation Act Section 106 compliance requirements and Section 110 inventories. Much of this work is conducted by Forest Service or contracted archaeologists and the records are stored both at the Office of History and Archaeology in Anchorage and in various Forest Service databases, namely the Tongass Sites Database and, more recently, a National Heritage Database. This paper uses information from both gray and published literature to offer an overview of the resource and some current statistics on fish traps and weirs located on the tidal lands of Southeast Alaska.

Site recording methods have varied widely for many reasons. Preservation, time, funding, and technological advances such as digital imagery and mobile satellite mapping devices have resulted in a data set populated to different degrees of completeness and accuracy. Minimally, the sites addressed in this paper have been verified archaeologically. Survey intensity has varied in the region and is tied to compliance work, personal interest and public awareness. Forest Service archaeologists are stationed across the region and surveys for fish traps and weirs have occurred on each ranger district and national monument. Digitized survey data for the region are not currently available to quantify survey intensities.

The terms “trap” and “weir” have been described differently over the decades. Stewart (1977:99) defined traps as either removable basketry or as structures that were built into a river bed. Stone traps were rock walls that either trapped fish or funneled them to the mouth of a trap. Weirs were fences built across a shallow river or angled to guide fish into traps. Moss and Erlandson (1998:180) described a trap as a series of stakes or stones positioned to form an enclosure. Some traps might have portable or removable elements such as basketry or lattice work. A weir was defined as a fence-like alignment that guided fish to a trap or crossed a stream or tidal channel to block the movement of fish. More recently, Moss and Cannon (2011:2–3) defined a weir as a fence-like structure set across a river or stream or in an estuarine tidal channel and a trap as an arrangement of wood stakes or stones or other elements left in place as an enclosure. Often the two terms are used interchangeably and can be difficult to distinguish archaeologically. Many recorded sites incorporate the words “trap” or “weir” as part of their names, but these assignments can be erroneous. For this paper, traps and weirs are generally lumped to refer to all intertidal fishing structures.

Table 1 is a compilation of dates from Forest Service, contract, and independent researchers. Forest Service archaeologists account for the majority of the dates; these are often difficult to access and hidden in gray literature. While many have been published (e.g., Mobley and McCallum 2001:45; Moss et al. 1990:150; Moss and Erlandson 1998:184, 185), most have not. The citations associated with the radiocarbon ages include cultural resource reports, unpublished field notes and site records, journal articles, conference papers, and dissertations. Radiocarbon dates reflect both conventional and measured radiocarbon ages, the latter used if conventional ages were not available. I used the IntCal09 radiocarbon age calibration curve (Ramsey 2009:337–360; Reimer et al. 2009:1111–1150) to produce calendar year equivalents (cal BC/AD) and calibrated radiocarbon years before present (cal ^{14}C yrs BP). Dates in the text are rounded to the nearest ten years.

RESULTS

The Forest Service manages most of the land base across the Alexander Archipelago and is responsible for federal activities that have the potential to affect archaeological sites on or adjacent to National Forest System Lands. Although most intertidal fishing structures occur on state land, the Forest Service has documented the majority of these sites in Southeast Alaska. A review of Forest Service and the Alaska Heritage Resource Survey (AHRS) records indicate a total of 369 fish trap and weir sites have been recorded in the study area (Table 2). Most of these sites are situated on the tide flats near the mouths of anadromous streams or in areas where migrating fish school before their upstream journey. A few sites are located in stream beds, within tidal reach, but not necessarily on the tide flats. The technology used the ebb and flood of the tides to entrap fish that were then accessible at low tide (Langdon n.d.:3). Wood stake sites represent the majority (48%) with stone structures nearly as prevalent (46%). Many sites exhibit both wood and stone components (5%) and a few basket traps (1%) have been discovered buried and preserved in anaerobic stream or tide flat sediments.

WOOD STAKE FISHING STRUCTURES

Wood stake traps and weirs are the most abundant fishing sites in Southeast Alaska and vary in size, configuration, and age. Stakes were carefully sharpened (Fig. 2) and driven into the tidal sediments where anaerobic conditions have preserved the buried portions. The stakes were long and would have extended close to the mean high-water mark. Long stakes have been documented at several sites; at Favorite Bay Fish Weir (SIT-033), ten long (210 cm) stakes were found lying horizontally in the mud flats and

Figure 2: An adz-sharpened wood stake freshly pulled from anaerobic tidal sediments. The sharpened end at the top of the photograph exhibits remarkable preservation. Photo by author.

Table 1: Radiocarbon-dated fish trap, weir, and basket traps in Southeast Alaska.

AHRS No.	Site Name	Lab No.	Conventional RCYBP	Cal RCYBP (IntCal09)	Reference
CRG-123	Naukati Creek Weir	not available	2240 ± 60*	2353–2115 BP	Rabich Campbell 1988
CRG-178	Black Bear Creek Weir 1	Beta-232426	1440 ± 40	1399–1291 BP	Stanford 2007a
CRG-243	Little Shakan Stone Weir	not available	1030 ± 60	1061–795 BP	Moss et al. 1990
CRG-280	Staney Creek Weir	Beta-19472	2470 ± 80	2731–2355 BP	Rabich Campbell 1988
CRG-334	Little Salt Lake Stone Weir	Beta-75716	310 ± 30*	466–301 BP	Moss and Erlandson 1998
		Beta-20072	580 ± 60*	661–518 BP	Rabich Campbell 1988
		Beta-75715	1140 ± 40	1172–963 BP	Putnam and Fifield 1995
		Beta-75714	2000 ± 40	2101–1867 BP	Putnam and Fifield 1995
CRG-335		Beta-72332	1200 ± 50*	1264–985 BP	Moss and Erlandson 1998
		Beta-72334	1340 ± 50*	1346–1172 BP	Moss and Erlandson 1998
		Beta-72333	1380 ± 60*	1393–1178 BP	Moss and Erlandson 1998
CRG-364	Klawock River Weir 3	Beta-26596	1150 ± 50	1228–956 BP	Putnam and Fifield 1995
CRG-376	Big Creek Fish Trap	Beta-54635	1640 ± 50	1691–1410 BP	Putnam and Fifield 1995
CRG-433	Thorne River (Silver Hole)	Beta-75619	2100 ± 60	2306–1925 BP	Putnam and Fifield 1995
		Beta-75470	3580 ± 60	4080–3700 BP	Putnam and Fifield 1995
		Beta-75618	3680 ± 60	4223–3845 BP	Putnam and Fifield 1995
CRG-434	Cable Creek Weir	Beta-75617	1440 ± 60	1515–1269 BP	Putnam and Fifield 1995
		Beta-74864	1670 ± 60	1707–1415 BP	Putnam and Fifield 1995
		Beta-75626	4470 ± 60*	5304–4883 BP	USDA Forest Service n.d.
CRG-437	Little Salt North Weir	Beta-72335	980 ± 50*	978–771 BP	Moss and Erlandson 1998
		Beta-75717	1060 ± 40*	1057–924 BP	Moss and Erlandson 1998
CRG-439	Little Salt Creek Weir	Beta-75712	1720 ± 50	1808–1523 BP	Putnam and Fifield 1995
		Beta-75713	2280 ± 40	2353–2156 BP	Putnam and Fifield 1995
CRG-466	Grass Creek Fish Weir	Beta-97682	2260 ± 70	2458–2062 BP	Lively 1997
CRG-469	Vixen Inlet Stake Weir Complex	Beta-109557	1780 ± 50	1824–1565 BP	Lively and Stanford 1997
		Beta-109555	2020 ± 60	2140–1832 BP	Lively and Stanford 1997
		Beta-109556	2080 ± 60	2301–1896 BP	Lively and Stanford 1997
CRG-556	Black Bear Creek Stake Weir 2	Beta-232427	1010 ± 60	1056–789 BP	Stanford 2007a
CRG-557	Black Bear Creek Stake Weir 3	Beta-232428	3240 ± 60	3615–3358 BP	Stanford 2007a
CRG-565	Harris River Fish Weir	Beta-251263	2360 ± 60	2702–2183 BP	Carlson 2008
CRG-584	Clam Creek Wooden Stake Weir	not available	2610 ± 60	2858–2490 BP	Carlson 2009
DIX-026	Nichols Creek Wooden Weir	Beta-145672	2340 ± 60	2698–2156 BP	Rabich 1980
DIX-058	Hunter Bay River Site and Weir	Beta-145671	2560 ± 60	2780–2367 BP	USDA Forest Service n.d.
JUN-453	Montana Creek Basket Trap	WSU-4140	550 ± 70*	665–500 BP	Loring 1992
		WSU-4141	700 ± 60*	733–552 BP	Loring 1992
JUN-695	Suntaheen Fish Weir	Beta-85553	2790 ± 60	3063–2766 BP	Iwamoto 1995
JUN-996	Howard Bay Fish Trap	Beta-195686	2830 ± 60	3142–2785 BP	Gilliam and Lantz 2004
		Beta-195687	2940 ± 60	3322–2928 BP	Gilliam and Lantz 2004
KET-063	Cow Creek Weirs	Beta-125846	2300 ± 50	2457–2152 BP	Autrey 1998
KET-290	Port Stewart Fish Weir	Beta-28354	1830 ± 70	1922–1569 BP	Mobley 1989
KET-351	Settlers Cove Fish Weir	Beta-158149	1210 ± 50*	1272–1000 BP	Carlson and Lively 1993
		Beta-75439	2440 ± 60*	2711–2352 BP	Autrey 1993
KET-448	Carroll Creek Fish Weir 2	Beta-85152	2630 ± 70*	2922–2489 BP	Greiser 1996
KET-504	Helm Creek Fish Weir	Beta-97681	2080 ± 60	2301–1896 BP	Lively 1997
KET-505	Raymond Cove Fish Weir	Beta-97680	2600 ± 60	2850–2488 BP	Lively 1997
KET-506	Granite Creek Fish Weir	Beta-97679	2850 ± 60	3200–2797 BP	Lively 1997

AHRS No.	Site Name	Lab No.	Conventional RCYBP	Cal RCYBP (IntCal09)	Reference
KET-565	Bostwick Inlet Stake Weir #1	Beta-125848	2850 ± 60	3200–2797 BP	Autrey and Stanford 1998
KET-986	Ward Creek Stake Weir	Beta-220261	2780 ± 40	2968–2778 BP	Stanford 2006a
KET-996	Robinson Creek Traps	Beta-220263	2870 ± 50	3162–2861 BP	Stanford 2006b
KET-1023	Moser Bay Stake Weirs	Beta-233634	1120 ± 50	1170–934 BP	Stanford 2007b
PET-027	Sandy Beach Fish Traps	Beta-60931	1860 ± 90	1991–1569 BP	McCallum 1993
		Beta-60930	1910 ± 70	2035–1635 BP	McCallum 1993
		Beta-192627	2000 ± 60	2116–1825 BP	Esposito and Smith 2004b
		Beta-60929	2090 ± 60	2304–1900 BP	McCallum 1993
PET-107	Whale Pass Fish Trap	not available	2910 ± 70	3316–2865 BP	Putnam and Fifield 1995
PET-187	Red Creek Fish Trap Complex	Beta-56458	1880 ± 50	1931–1705 BP	Greiser et al. 1993
		Beta-75624	2050 ± 50	2141–1896 BP	Greiser et al. 1993
		Beta-56451	2870 ± 50	3162–2861 BP	Greiser et al. 1993
PET-203	Goose Creek Fish Weir	Beta-56456	1630 ± 50	1691–1403 BP	Greiser et al. 1993
PET-205	Strait Creek Fish Weirs	Beta-56445	2130 ± 60	2315–1951 BP	Greiser et al. 1993
		Beta-56444	3770 ± 80	4411–3928 BP	Greiser et al. 1993
PET-206	Windsock Fish Weir Complex	Beta-75623	2340 ± 50	2685–2160 BP	Putnam and Fifield 1995
		Beta-75625	2870 ± 60	3209–2850 BP	Putnam and Fifield 1995
		Beta-75621	3240 ± 60	3615–3358 BP	Putnam and Fifield 1995
		Beta-75622	3470 ± 70	3922–3565 BP	Putnam and Fifield 1995
PET-208	MB-1	Beta-56453	40 ± 50	268–15 BP	Moss and Erlandson 1998
PET-212	Alvin Bay Fish Weir	UGAMS-03679	1640 ± 30*	1614–1416 BP	Smith 2008
PET-215	Duckbill Creek Fish Weirs	Beta-194880	1870 ± 60	1948–1628 BP	Smith and Esposito 2004a
		Beta-194881	2450 ± 50	2710–2356 BP	Smith and Esposito 2004a
PET-219	Mable Creek Fish Weir	Beta-55698	710 ± 50*	732–558 BP	Loring 1995
PET-319	Exchange Cove Weir Complex	Beta-56459	2810 ± 60	3078–2772 BP	Putnam and Fifield 1995
		Beta-20709	3220 ± 60	3608–3337 BP	Ream and Saleeby 1987
PET-329	Hole in the Wall (EO 2)	Beta-56460	2500 ± 60	2741–2365 BP	Putnam and Fifield 1995
PET-347	Honeymoon Creek Fish Trap	Beta-75700	1550 ± 50	1542–1341 BP	Hanks et al. 1995
		Beta-75699	1720 ± 60	1817–1519 BP	Hanks et al. 1995
PET-353	Lovelace Creek Fish Traps	Beta-208344	2120 ± 60	2309–1949 BP	Smith and Esposito 2005
PET-364	Douglas Bay Fish Trap	Beta-83518	2090 ± 60	2304–1900 BP	Smith et al. 1996
PET-393	McDonald Arm Fish Trap	Beta-73416	1690 ± 50	1718–1419 BP	Mobley 1995
		Beta-73414	1720 ± 60	1817–1519 BP	Mobley 1995
		Beta-73415	1780 ± 50	1824–1565 BP	Mobley 1995
PET-394	Island Point Fish Trap	Beta-73417	1690 ± 60	1729–1415 BP	Mobley 1995
PET-395	Woody Island Fish Trap	Beta-73418	1310 ± 60	1315–1075 BP	Mobley 1995
		Beta-73419	2180 ± 50	2333–2051 BP	Mobley 1995
PET-396	Mitchell Slough Fish Weir	Beta-73420	2000 ± 60	2116–1825 BP	Mobley 1995
PET-399	Paul's Fish Trap	Beta-74635	1480 ± 60	1518–1295 BP	Hanks et al. 1995
		Beta-74634	1620 ± 60	1692–1382 BP	Hanks et al. 1995
PET-455	Ohmer Creek Fish Weir	Beta-158139	2360 ± 60	2702–2183 BP	Smith and Esposito 2001
PET-456	Sumner Creek Fish Traps	Beta-158140	1330 ± 50	1343–1145 BP	Smith and Esposito 2001
		UGAMS-03680	1520 ± 30	1518–1341 BP	Smith 2009
		Beta-171510	1800 ± 50	1865–1605 BP	Smith and Esposito 2004b
		Beta-192626	4470 ± 70	5306–4878 BP	Smith and Esposito 2004b
		Beta-158141	4530 ± 60	5443–4973 BP	Smith and Esposito 2001
		Beta-132762	4760 ± 70	5605–5320 BP	Smith, Esposito, Wallesz 1999
		Beta-131029	4900 ± 50	5742–5488 BP	Smith, Esposito, Wallesz 1999

AHRS No.	Site Name	Lab No.	Conventional RCYBP	Cal RCYBP (IntCal09)	Reference
PET-462	Moose Creek Fish Trap	Beta-157328	1380 ± 50	1382–1181 BP	Smith 2001
		Beta-157332	1430 ± 60	1514–1190 BP	Smith 2001
		Beta-123692	1490 ± 60	1518–1299 BP	Greiser 1999
		Beta-157331	1540 ± 60	1542–1312 BP	Smith 2001
		Beta-157329	1670 ± 60	1707–1415 BP	Smith 2001
		Beta-157330	1710 ± 60	1814–1422 BP	Smith 2001
		Beta-157333	1760 ± 60	1822–1541 BP	Smith 2001
PET-474	Blind Slough Fish Trap	Beta-132093	2060 ± 60	2295–1881 BP	Smith, Esposito, McCallum 1999
		Beta-132094	2110 ± 60	2308–1933 BP	Smith, Esposito, McCallum 1999
PET-486	Totem Creek Fish Weir	Beta-155979	2010 ± 60	2123–1827 BP	Smith and Esposito 2000
PET-490	Twelvemile Stake Fish Trap	Beta-158917	1740 ± 60	1816 -1535 BP	Smith and Esposito 2002a
PET-498	St. John Wood Stake Fish Trap	Beta-158920	2120 ± 60	2309–1949 BP	Esposito and Smith 2004a
PET-501	Hamilton Island Fish Trap	Beta-171511	1170 ± 40	1225–975 BP	Smith and Esposito 2002b
		Beta-171512	1300 ± 50	1304–1085 BP	Smith and Esposito 2002b
PET-502	Kake Portage Fish Trap	Beta-171513	1790 ± 50	1860–1569 BP	Smith and Esposito 2002b
		Beta-171515	2220 ± 50	2341–2125 BP	Smith and Esposito 2002b
		Beta-171514	3900 ± 60	4515–4152 BP	Smith and Esposito 2002b
PET-503	Hummingbird Point Fish Trap	Beta-171516	3510 ± 60	3964–3637 BP	Smith and Esposito 2002c
PET-513	Turn Point Fish Trap	Beta-186143	1990 ± 60	2115–1821 BP	Esposito and Smith 2003a
PET-514	Tunehean Creek Fish Traps	Beta-181790	1830 ± 60	1896–1608 BP	Esposito 2003
PET-516	Steamer Fish Trap	Beta-181791	1740 ± 40	1776–1541 BP	Esposito and Smith 2003b
PET-533	Petersburg Creek Fish Traps	Beta-194883	1180 ± 40	1234–979 BP	Smith 2004
		Beta-194882	1370 ± 40	1352–1183 BP	Smith 2004
PET-559	North Lovelace Fish Trap	Beta-208345	2420 ± 60	2708–2346 BP	Smith and Esposito 2005
PET-560	Big John Creek Fish Weir	Beta-208346	1650 ± 60	1695–1410 BP	Smith and Esposito 2005
PET-573	Quiet Harbor Fish Weir	Beta-223888	2580 ± 60	2843–2462 BP	Esposito and Smith 2007
PET-574	Mosman Fish Weir	Beta-223889	310 ± 60	503–153 BP	Esposito and Smith 2007
PET-578	Port Beauclerc Fish Traps	Beta-220318	2930 ± 60	3319–2888 BP	Smith and Esposito 2006
PET-645	Port Camden Fish Traps	Beta-262553	1810 ± 50	1869–1612 BP	Smith and Esposito 2009
PET-719	High Island Fish Trap	Beta-303731	1690 ± 40	1701–1524 BP	Smith 2011a
SIT-033	Favorite Bay Fish Weir	SI-6994	2190 ± 45*	2335–2064 BP	Moss et al. 1989
		PITT-07	2685 ± 40*	2860–2746 BP	Moss et al. 1989
		SI-6993	3015 ± 65*	3365–3004 BP	Moss et al. 1989
SIT-086	Cosmos Cove Weirs	Beta-32110	3460 ± 60	3877–3575 BP	Autrey 1989
SIT-311	Kanalku Bay Fish Weir	PITT-132	125 ± 35*	275–9 BP	Moss et al. 1989
		PITT-131	955 ± 35*	932–790 BP	Moss et al. 1989
		PITT-133	1700 ± 30*	1695–1537 BP	Moss et al. 1989
SIT-329	Kanalku Weir	Beta-46336	550 ± 50*	652–509 BP	Moss and Erlandson 1998
		Beta-46337	1690 ± 50*	1718–1419 BP	Moss and Erlandson 1998
		Beta-46338	1720 ± 50*	1808–1523 BP	Moss and Erlandson 1998
SIT-330	Chaik Bay	Beta-46341	1610 ± 60*	1690–1368 BP	Moss 1991
		Beta-46339	2070 ± 50*	2288–1899 BP	Moss 1991
		Beta-46340	2310 ± 60*	2671–2150 BP	Moss 1991
SIT-341	Portage Arm Fish Weir	Beta-56337	1730 ± 80	1861–1418 BP	Iwamoto 1992
SIT-398	S'aw Gee Y'ee, Nakwasina Weir	Beta-65325	126 ± 10	269–20 BP	Moss and Erlandson 1998
SIT-530	Waterfall Cove Fish Weir	Beta-97692	2170 ± 60	2331–2005 BP	Myron 1996
SIT-531	Ford Arm Fish Weir	Beta-97693	2120 ± 60	2309–1949 BP	Myron 1996

AHRS No.	Site Name	Lab No.	Conventional RCYBP	Cal RCYBP (IntCal09)	Reference
SUM-055	Sandborn Canal Fish Weir	Beta-76053	110 ± 40	273–10 BP	Bowers et al. 1995
		Beta-208347	1720 ± 60	1817–1519 BP	Esposito and Smith 2005
XBC-012	Tom Creek Fish Traps	Beta-232261	1850 ± 60	1925–1619 BP	Smith 2007
XBC-021	Bradfield Fish Traps	Beta-232262	1800 ± 50	1865–1605 BP	Smith 2007
		Beta-232264	1850 ± 60	1925–1619 BP	Smith 2007
		Beta-232265	2490 ± 70	2736–2363 BP	Smith 2007
		Beta-232266	2570 ± 80	2842–2363 BP	Smith 2007
		Beta-232263	2630 ± 40	2845–2624 BP	Smith 2007
XBC-030	Eagle River Fish Weir	Beta-75702	2430 ± 60	2710–2349 BP	Battino et al. 1993
		Beta-85147	2660 ± 70	2951–2515 BP	Greiser 1996
		Beta-85146	2800 ± 70	3138–2759 BP	Greiser 1996
		Beta-85144	2870 ± 60	3209–2850 BP	Greiser 1996
		Beta-75701	3030 ± 60	3380–3040 BP	Battino et al. 1993
XBC-044	Anchor Pass/Bell Arm Fish Weirs	Beta-85149	100 ± 60*	281–6 BP	Greiser 1996
		Beta-85151	1160 ± 60*	1257–956 BP	Greiser 1996
		Beta-85150	1220 ± 50*	1277–1010 BP	Greiser 1996
XBC-045	Anan Creek Fish Trap	Beta-232267	1560 ± 80	1684–1303 BP	Smith 2007
		Beta-232268	1620 ± 40	1607–1408 BP	Smith 2007
XPA-078	Lanaak (Redfish Bay Fish Weir)	Beta-38760	1950 ± 50	2034–1739 BP	Davis 1990b
		Beta-86169	2010 ± 50	2115–1869 BP	Myron 1995
		Beta-86170	4410 ± 40	5274–4863 BP	Myron 1995
XPA-119	Big Creek Weir	Beta-37128	200 ± 60	426–(-4) BP	Maschner 1992
XPA-130	Aleck's Creek Weir	Beta-37129	540 ± 50	651–505 BP	Maschner 1992
		Beta-303730	2110 ± 40	2300 – 1953 BP	Smith 2011b
XPA-132	Secluded Cove Weir 2	Beta-37130	1730 ± 60	1815–1527 BP	Maschner 1992
XPA-164	McCallum's Fish Weir	Beta-37131	2450 ± 60	2712–2355 BP	Maschner 1992
XPA-205	Yi's Fish Weir	Beta-37132	2110 ± 60	2308–1933 BP	Maschner 1992
XPA-217	XPA-217	Beta-37133	1140 ± 60	1228–932 BP	Maschner 1992
XPA-256	XPA-256	Beta-76741	1930 ± 70	2046–1707 BP	Maschner 1994
		Beta-76742	2070 ± 60	2299–1886 BP	Maschner 1994
		Beta-76743	2120 ± 70	2315–1946 BP	Maschner 1994
XPA-257	XPA-257	Beta-76745	1580 ± 50	1566–1353 BP	Maschner 1994
		Beta-76744	1600 ± 50	1609–1379 BP	Maschner 1994
XPA-267	XPA-267	Beta-76755	1480 ± 60	1518–1295 BP	Maschner 1994
XPA-271	XPA-271	Beta-76756	1970 ± 60	2112–1741 BP	Maschner 1994
XPA-283	XPA-283	Beta-76760	1870 ± 70	1986–1621 BP	Maschner 1994
XPA-284	XPA-284	Beta-76761	330 ± 50	497–302 BP	Maschner 1994
XPA-327	Retaliation Point Fish Trap	Beta-194885	2160 ± 60	2324–2002 BP	Esposito et al. 2004
XPR-049	Head of Hall Cove Weir	Beta-207947	2760 ± 60	2998–2754 BP	Stanford 2005
XPR-053	Hall Cove Estuary Weir	Beta-207949	2670 ± 60	2925–2622 BP	Stanford 2005
XPR-067	Goose Lake Stake Weir	Beta-208395	2340 ± 60	2698–2156 BP	Stanford 2005
XPR-096	Outside Fort Fish Traps/Weirs	Beta-265448	1470 ± 40	1484–1295 BP	Stanford 2009
YAK-019	Diyaguna 'Et	Beta-33024	160 ± 50*	290–(-2) BP	Moss et al. 1990
YAK-079	Lost River Basket Trap	Beta-105451	340 ± 40	489–308 BP	Davis 1997
		Beta-105612	410 ± 30	536–471 BP	Davis 1997
YAK-098	Basket Trap	Beta-195685	300 ± 40	476–288 BP	Gilliam 2004

*Represents measured, or raw, radiocarbon age. No $^{13}C/^{12}C$ correction factor has been applied.

Table 2: Wood and stone fishing structures documented in Southeast Alaska.

Site Type	Quantity	Percent
Basket	3	0.8%
Stone	168	45.5%
Wood Stake	177	48.0%
Basket and Stake	1	0.3%
Stone and Stake	20	5.4%
Total	369	100%

are thought to indicate the original length of the stakes (Moss et al. 1990:147). At the Sumner Creek Fish Traps (PET-456), a 350-cm-long stake, sharpened at one end, was found partially buried in the mud. It appears to be an entire sapling, tapering from the sharpened stump to the tip, with small branches still intact (Smith and Wallesz 1999:27, 35, 36). The Eagle River Fish Weir (XBC-030) has long stakes still in situ that are exposed in the eroding bank of the river (Battino et al. 1993:69–72).

The majority of wood fishing structures consist of stake remnants flush with or protruding slightly above the ground surface. Most traps were configured to form fence-like barriers; some might look like a picket fence while others are wide swathes of densely packed stakes (Figs. 3 and 4). Branches were left on some stakes, others were stripped; small boughs may have been woven among the stakes to help form barriers. Densely packing stakes in lieu of weaving among them may have been preferable and sturdier. Wide swathes or pavements might be remnants of a catwalk or platform leading to or above an enclosure (Mobley and McCallum 2001:42; Moss and Erlandson 1998:193). Replacement stakes were evidently used since multiple radiocarbon dates from a single configuration sometimes reflect repairs that occurred hundreds of years apart (Table 1). Errors inherent in radiocarbon dating do not explain all of the date inconsistencies (e.g., CRG-334, KET-351, PET-206).

Stakes vary from about 4 cm to over 10 cm in diameter and probably reflect the resources at hand. A few stakes have been analyzed for species identification; analysis of a cross section of a 5610 to 5320 cal ^{14}C yrs BP (3660 to 3370 cal BC) (Beta-132762) stake from the Sumner Creek Fish Traps (PET-456) revealed it to be a hemlock (*Tsuga*) branch (Loring 1999).

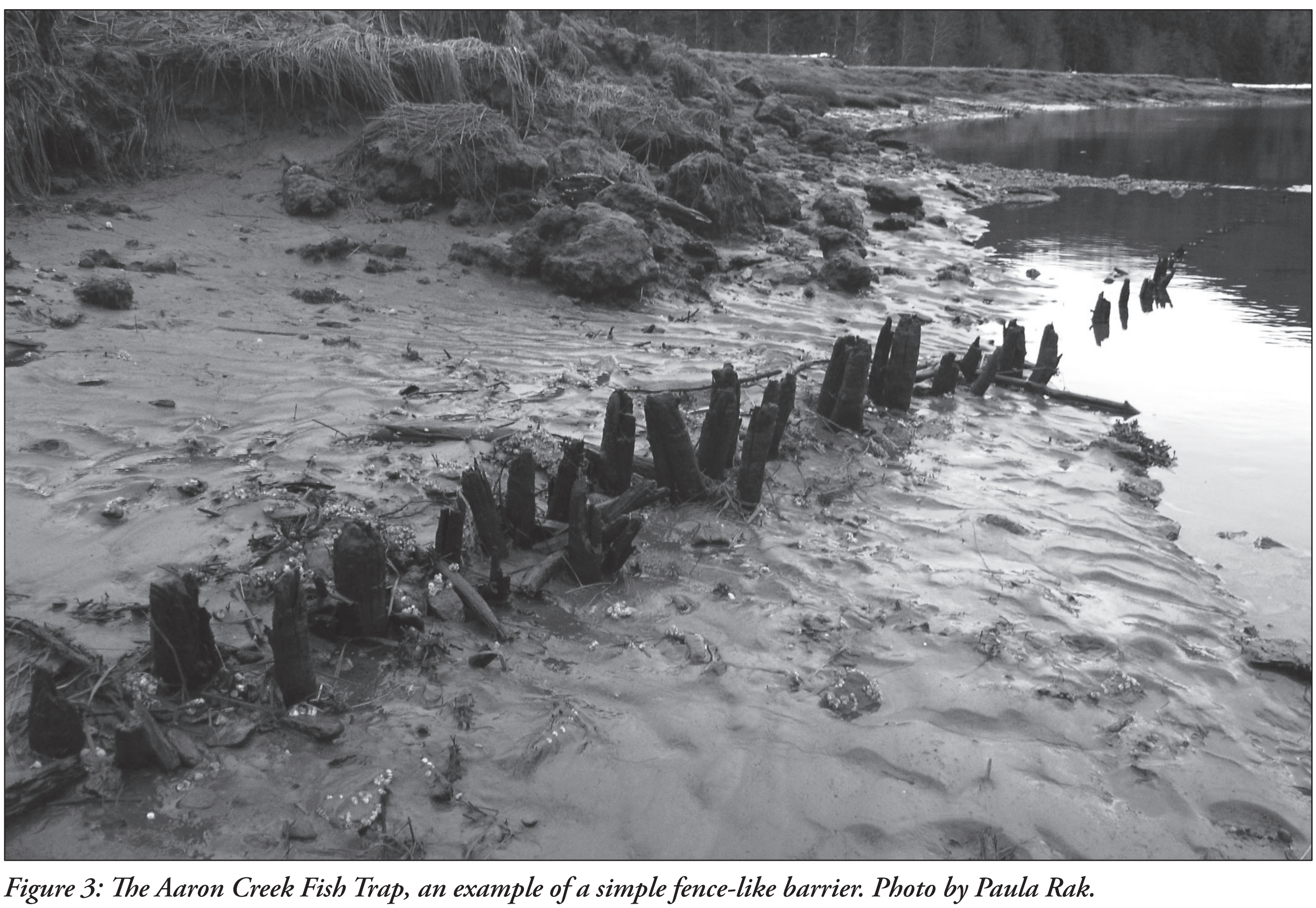


Figure 3: The Aaron Creek Fish Trap, an example of a simple fence-like barrier. Photo by Paula Rak.

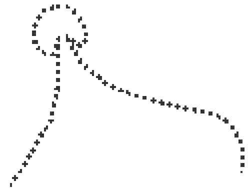
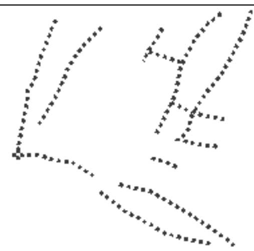
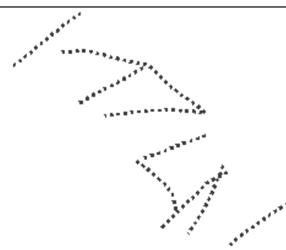
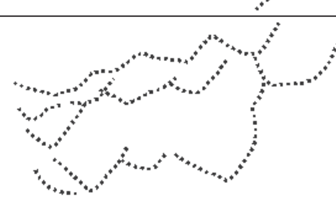
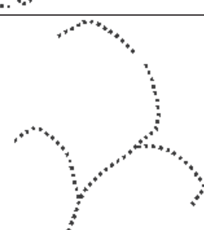
Figure 4: The Port Camden Fish Trap is made of wide swathes of densely packed stakes. Photo by Gina S. Esposito.

Erosion, sedimentation, exposure, and weathering have greatly affected the preservation of archaeological materials. Most traps appear incomplete; portions have washed away or sections are buried. Partial remains might resemble stakes with no discernible pattern or alignments with no identifiable function or terminus. Traps with recognizable features can differ greatly from site to site (Table 3). Some are simple linear configurations positioned in small bays while others are massive complexes that stretch across vast flats. The Bradfield (XBC-21) and Tom Creek (XBC-12) fish traps, which are temporally and spatially associated, consist of thousands of stakes that reach across a 1.4-km-long tide flat (Battino et al. 1993:35–48; Smith 2007). In 2007 a team of Forest Service archaeologists recorded 33 separate features that extended from near the high tide line to a –2 foot low tide. Langdon (2001:17–19) reported on the extensive remains of the Little Salt Lake (CRG-334) site with pavements of densely packed stakes and features as long as 100 meters.

Wood stake traps are located across the flats, from the high tide mark to below the 0 tidewater mark. Many have components with fairly straight or curvilinear configurations that do not clearly form an entrapment or weir. Structures like this are often exposed by meandering channels and erosion and are parts of more complex configurations that are not visible above ground. The Favorite Bay Fish Weir (SIT-33) site is represented by a linear configuration located along the bank of a tidal channel (Moss et al. 1990:145–148). The stakes are concentrated in an area 50 meters long by 8 meters wide with several linear spurs off to the side that could have functioned as leads. Moss et al. (1990:145) thought that some stakes in the channel may have been lost to erosion while stakes beyond the channel probably are hidden beneath the surface. The Sumner Creek Traps (PET-456) have several alignments exposed along a tide channel (Smith and Wallesz 1999:27–30; Fig. 5). Widely dispersed trap components are visible along different portions of the channel but no stakes are evident across the rest of the flats. Four trap sections have been identified; all are linear, exposed in the bank, and do not have sections on the opposite side of the channel. Additional stakes may be revealed as the channels erode higher ground.

Many sites in the study area have V-shaped leads that funneled fish. Mobley and McCallum (2001:28–39) described several fish trap sites in central Southeast Alaska with lead technology. The traps are made of stone and/or wood stakes arranged to make two leads that converge to form a narrow chute that penetrates either circular or heart-shaped enclosures (Table 3a; Fig. 6). The Port

Table 3: Examples of fish trap configurations found in Southeast Alaska.

AHRS No.	Shape	Configuration (not to scale)	Conventional Age RCYBP	
Sandy Beach PET-027	(**a**) V-shaped lead converging to heart enclosure		Beta-60931 Beta-60930 Beta-192627 Beta-60929	1860 ± 90 BP 1910 ± 70 BP 2000 ± 60 BP 2090 ± 60 BP
Port Camden PET-645	(**b**) V-shaped with loops		Beta-262553	1810 ± 50 BP
Douglas Bay PET-364	(**c**) grid-like or rectangular		Beta-83518	2090 ± 60 BP
Moose Creek PET-462	(**d**) linear with semi-perpendicular extensions, funnel-shaped		Beta-157328 Beta-157332 Beta-123692 Beta-157331 Beta-157329 Beta-157330 Beta-157333	1380 ± 50 BP 1430 ± 60 BP 1490 ± 60 BP 1540 ± 60 BP 1670 ± 60 BP 1710 ± 60 BP 1760 ± 60 BP
Island Point PET-394	(**e**) V-shaped and random linear		Beta-73417	1690 ± 60 BP
Kunk Creek PET-512	(**f**) adjacent arcs		stone trap; not dated	
Twelvemile Creek PET-491	(**g**) modified bi-lobed		stone trap; not dated	

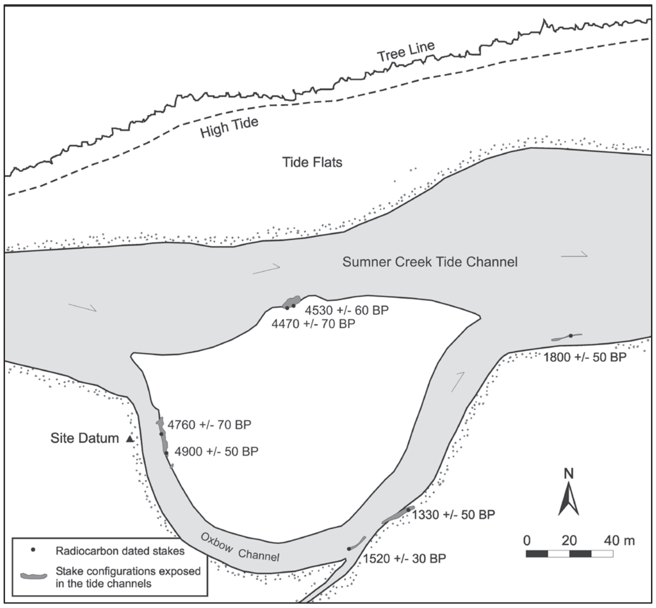


Figure 5: The Sumner Creek Fish Trap site shows where wood stakes have been exposed along tide channels. No other stakes were located on the tide flats.

Camden Fish Traps (PET-645) are massive traps made of thousands of stakes packed tightly together to form wide sweeping linear configurations (Smith and Esposito 2009). The long configurations form adjacent V-shaped structures with additional leads and loop-shaped enclosures (Table 3b, Figs. 4 and 7).

In addition to V-shaped leads, the Douglas Bay Traps (PET-364) have parallel linear configurations that are one to two meters wide. Perpendicular configurations cross the parallel rows to form rectangular or box-like features (Table 3c; Smith et al. 1996:151–153). The Moose Creek Fish Trap (PET-462) has funnel leads and straight alignments that extend at angles from a main alignment (Table 3d; Greiser 1999:28–30). Straight alignments that converge at seemingly haphazard angles form open-ended triangular and rectangular features at the Island Point Fish Trap (PET-394) (Table 3e; Mobley 1995:43–45). Mobley (1995:44) suspected these alignments served as leads to funnel fish into enclosures that were not apparent when he recorded the site.

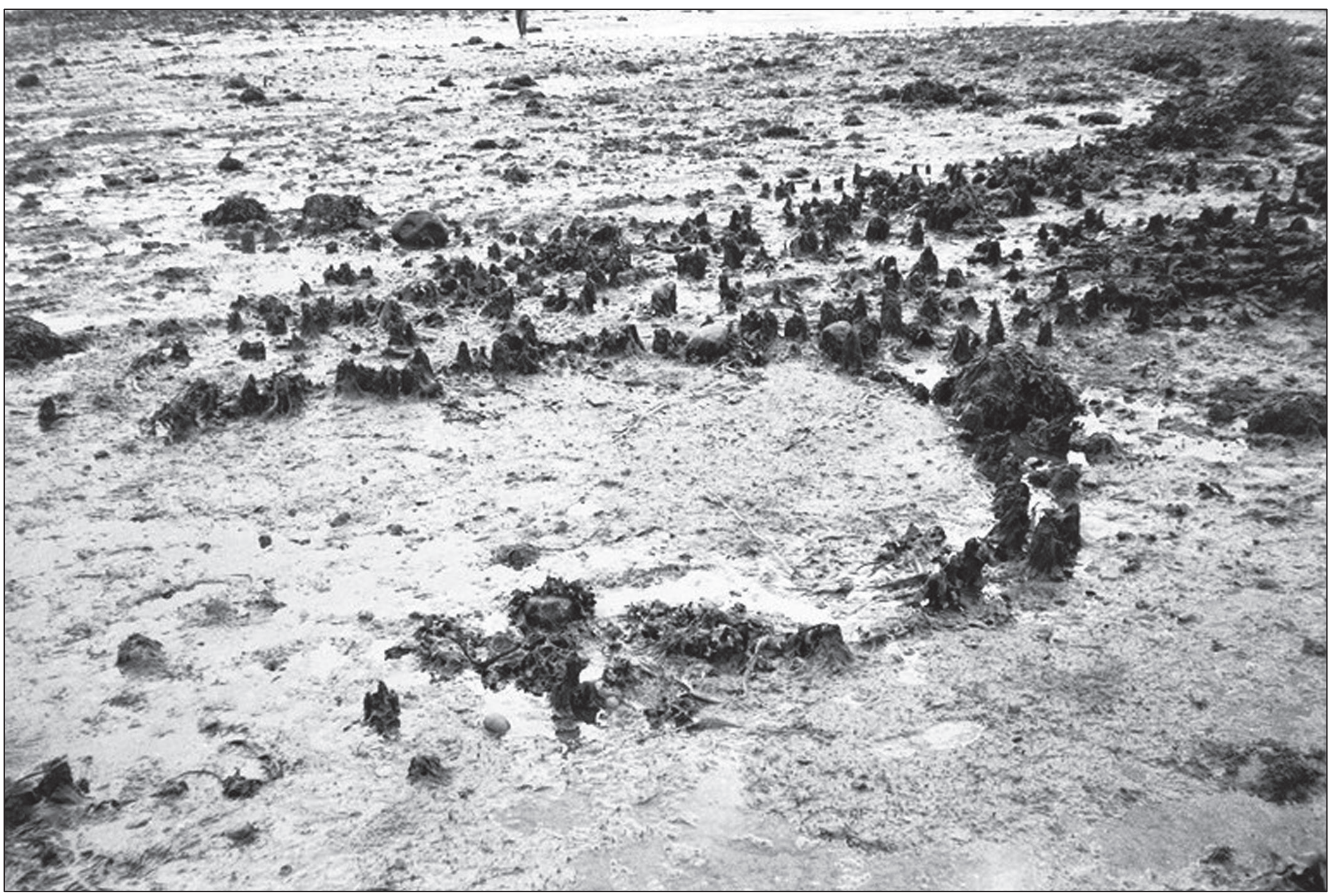


Figure 6: The Blind Slough Fish Trap has a heart-shaped enclosure penetrated by funnel leads. One of the lobes and the apex of the leads are shown here. Photo by author.

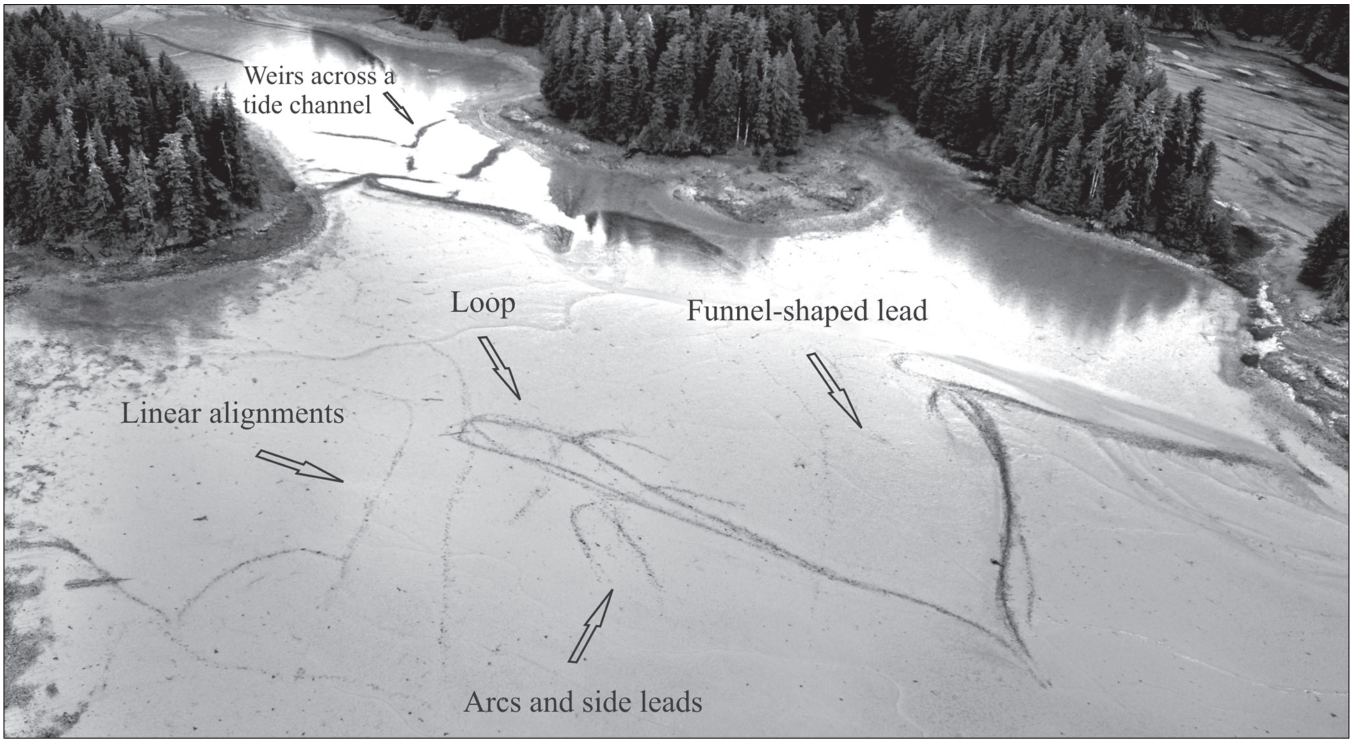


Figure 7: The Port Camden Fish Trap exhibits many configurations of densely packed stakes. Courtesy Alaska ShoreZone Imagery.

The illustrations shown in Table 3 are a small sample of linear and curved components that, when combined, formed complex structures. The technology, whether complex or simple, was ultimately developed to capture fish as they moved with the pulsing flood and ebb of the tide (Langdon n.d.:3). Most structures are located at or near the mouths of anadromous streams where the ebb harvest technique targeted fish awaiting upstream migration. Those traps not positioned near stream mouths may have targeted a different fin fish, such as herring or smelt, or been situated where fish schooled to feed or await suitable migration conditions. The Turn Point Fish Trap (PET-513) is on a narrow strip of intertidal ground across the Wrangell Narrows from the large tide flats at the mouth of the very productive Petersburg Creek (Esposito and Smith 2003a). Knowledge of currents and schooling patterns probably influenced the position of this trap.

STONE FISHING STRUCTURES

Nearly as abundant as wood stake structures are stone traps and weirs made of cobbles and small boulders piled atop one another to form low barricades. The piles tend to scatter with time but still seem to maintain their general design. They are frequently located high in the intertidal zone where stone building materials are more readily available than in lower intertidal reaches. Their position may also reflect effectiveness, in that low barricades located high in the intertidal zone might successfully capture fish without having to be as tall as lower intertidal structures.

Most stone structures are arced, whether a weir, an individual trap, or part of a more complex structure. The Outside Fort Fish Trap site (XPR-96) is a large complex with distinguishable weir and trap components (Fig. 8; Stanford 2009). The weirs at this site are slightly curved barriers that cross an intertidal creek and incorporate natural shoreline features as part of their design. Use of natural features is common in stone structures. The McHenry Anchorage Stone Traps (CRG-520) consist of a series of arcs positioned in the upper intertidal zone (Esposito and Smith 2010). Some of the arcs are extensions of a natural bedrock outcrop while others are tied into large boulders moveable only by great effort. The openings face upland, creating a pool at the apex when the tide is out.

Arcs are also interconnected to form large configurations. The Kunk Creek site (PET-512), has a series of eighteen to twenty interconnected arcs that stretch for 230 meters across a gently sloping cobble beach (Table 3f; Fig. 9; Hardin and Jesmain 1991). In August 2003, I observed pink salmon caught in one of the arcs at low tide (Fig. 10).

Figure 8: An arced stone component of the Outside Fort Fish Trap stretches from the rocky shore to an intertidal channel. Courtesy Alaska ShoreZone Imagery.

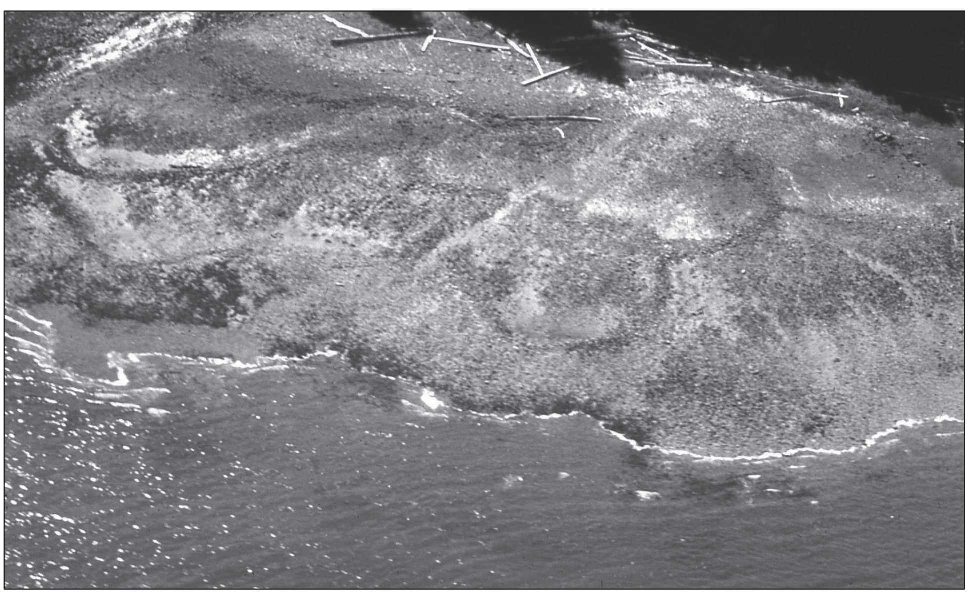


Figure 9: The Kunk Creek Fish Trap is constructed of interconnected stone arcs. Photo by USDA Forest Service personnel.

The Twelvemile Creek site (PET-491) is an arced bi-lobed stone trap with two lobes extending from a common side (Smith and Esposito 2002a:35–37; Table 3g). A third component extends off one of the bi-lobed features and has a gap midway along the arc. Langdon (2006:61–62) said gaps like this might have facilitated a removable circular basket trap.

Another type of stone trap is found in the grassy upper intertidal zone. These sites are stone alignments built to enhance natural kettle-like formations or the raised grassy edges of an estuary. Ponds are created by erecting stone barriers along the seaward edge of the landform while the remaining sides are bound by thick grasses. The resulting pools are usually free of rocks and many retain water after the tide has receded. Examples include the Fivemile Creek (PET-019; Smith and Esposito 2002a:48, 49) and the Mink Bay (KET-357) fish traps (Edmondson and Foskin 1993; Fig. 11). Both exhibit pools in the thick grasses near the stream mouth. The lower edge of the pool is created by an arcing rock barrier and the remainder is formed by the indented edge of the slightly elevated grassy meadow. The upper tidal features that retain water may also have held fish, either dead or alive, after harvest from lower structures (Langdon 2006:59).

RADIOCARBON DATING

Over the last few decades, archaeologists have submitted 182 wood stake samples for radiocarbon analysis from 108 sites and five fiber samples from three basket trap sites. A few of the specimens produced contemporary dates while the oldest was dated to 5740 to 5490 cal ^{14}C yrs BP (3790 to 3540 cal BC; Table 1). Fig. 12 shows the temporal distribution of dated wood stake sites in Southeast Alaska and the number of sites associated with each chronological increment. It appears trap construction increased during the mid-Middle Period, around 3250 to 3000 cal ^{14}C yrs BP (1530 to 1210 cal BC) and continued to grow until it peaked during the late Middle Period between about 2250 and 1500 cal ^{14}C yrs BP (390 cal BC to cal AD 600). Construction persisted but diminished during the Late Period (1500 cal ^{14}C yrs BP to present; cal AD 600 to present). Nearly 70% of the dates are clustered between 3000 and 1250 cal ^{14}C yrs BP (1300 cal BC to cal AD 780)

Figure 10: In 2003 we found pink salmon caught in one of the arcs of the Kunk Creek Fish Trap. Photo by author.

Figure 11: The Mink Bay Fish Traps have pools created by arcing rock barriers built to incorporate natural estuary features. Courtesy Alaska ShoreZone Imagery.

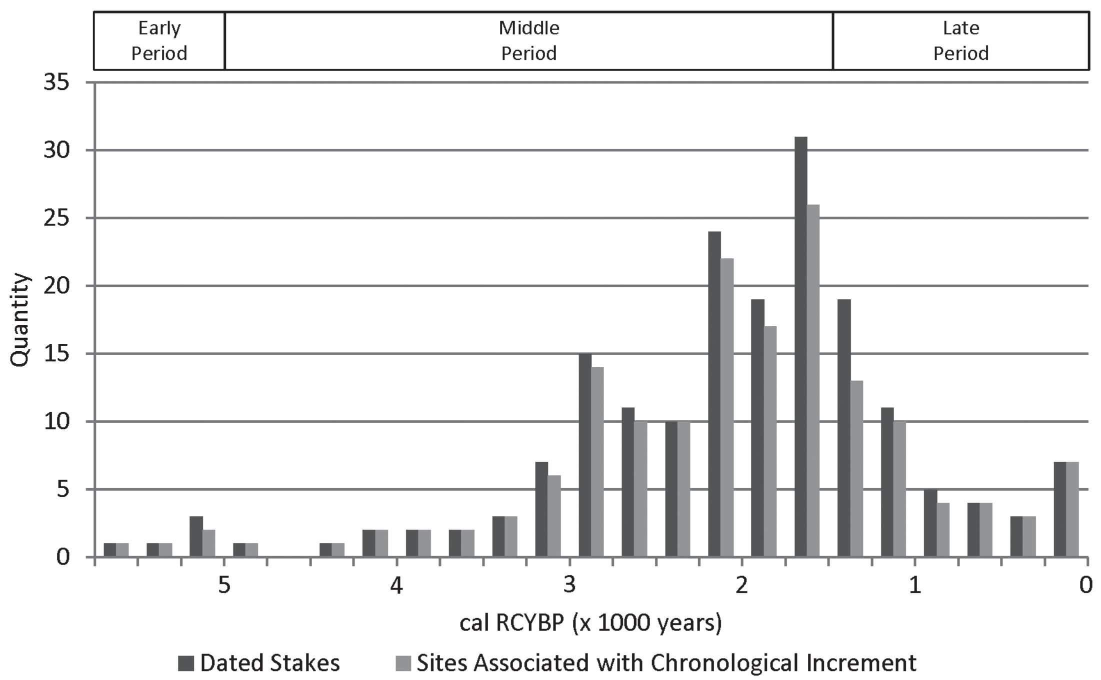


Figure 12: Temporal distribution of radiocarbon dated wood stake traps and weirs in Southeast Alaska.

with the greatest concentration (40%) between 2250 and 1500 cal ^{14}C years BP (cal 390 BC to cal AD 600). Moss and Erlandson (1998:189) found a similar date distribution with less than half (*n* = 71) the sample size. The five basket trap dates fall within the Late Period, between about 730 to 290 cal ^{14}C yrs BP (cal AD 1270 to 1650).

Numerous sites have both wood stakes and rock, of which several have been dated. Whether the stone and wood features were built simultaneously is unknown, but at some sites the two materials appear interrelated. Dates suggest construction as early as the mid-Middle Period, some 4000 to 3500 cal ^{14}C yrs BP (2570 to 1890 cal BC). Ethnographic information suggests stone trap use persisted through modern times (Langdon 2006:4, 55, 57).

SITE DISTRIBUTION

The distribution of fish trap and weir sites across the region reflects survey intensity and different levels of sampling. Even so, a few general inferences regarding distribution can be made. Fish trap and weir sites occur across the region with the vast majority located in the southern half of the archipelago (Fig. 1). Trap density is greatest along a swathe that stretches between northern Kuiu Island and mid Prince of Wales Island. Topographically, this area is characterized by smooth mountain slopes, broad U-shaped valleys, and long drainages. Conversely, areas with fewer traps tend to have steep mountainsides that drop abruptly to saltwater, short streams, and long and narrow bays. Anadromous streams are abundant throughout the region, but their reaches and rearing grounds have a tendency to be shorter in steep and rugged terrain (Alaska Department of Fish and Game 2011).

Sites associated with different time periods are distributed across the region. Table 4 provides the age of sites by geographic subdivision. Considering the uneven nature of survey and sampling, this information still suggests that wood stake structures were built simultaneously across the region during each time interval. Note the large number of sites from the Petersburg area that date between 2500 and 1500 cal ^{14}C yrs BP (Table 4). This may reflect survey and sampling intensity but also might indicate population or settlement patterns, technology preference, or resource availability. Future work may lead to more definitive statements regarding site locations and what they mean in the broader context of possessory rights and settlement of the northern Northwest Coast.

SUMMARY AND CONCLUSIONS

Numerous fish trap and weir sites in Southeast Alaska have been recorded in various ways over the last three decades. Although a great deal of effort has gone towards discovering, mapping, and dating these sites, much of the information remains unpublished or reported in gray literature. A review of fishing sites data for Southeast Alaska seems to confirm what early visitors to the region observed, that salmon was probably the most important resource to the Tlingit Indians (Emmons 1991:102, 103; Krause 1956 [1885]:120; Langdon 2006:1; Niblack 1970

Table 4: Temporal and general geographic distribution of sites represented by dated wood stakes.*

cal RCYBP	Yakutat	Sitka	Admiralty Juneau	Petersburg	Prince of Wales	Wrangell	Ketchikan
5800–5500				1			
5499–5000		1		1	1		
4999–4500				1			
4499–4000					2		
3999–3500		1		1	2		1
3499–3000		1	2	1	4	1	3
2999–2500			2	3	7	4	7
2499–2000		3	2	14	6	1	4
1999–1500		1	4	15	5	8	2
1499–1000				5	5	1	6
999–500			2	1	3	1	
499–0	1	1	1	3	2		1

* Some sites are represented by more than one date increment.

[1888]:276). The quantity, spatial and temporal range of intertidal traps and weirs suggest the importance of this procurement technique for salmon harvest. Bycatch and other targeted fin fish were likely caught (Byram 2002:2, 95, 149, 335), but perhaps salmon was the mainstay.

Made of wood stakes or stone, traps and weirs captured salmon moving with the ebb and flood of the tide. A great number of configurations were used, remnants of which are still present across the region. Some traps are complex alignments that funneled fish into entrapments, others are simple barricades that captured fish with the receding tide.

Over half (n = 108) of the 198 sites with a wood stake component have at least one radiocarbon date. The dates suggest this technology grew slowly from its early beginnings around 5500 cal ^{14}C yrs BP (4360 cal BC), began to increase by 3000 cal ^{14}C yrs BP (1310 cal BC), and boomed between 2250 to 1500 cal ^{14}C yrs BP (390 cal BC to cal AD 600). New construction decreased through European contact until the technology was curtailed by regulations imposed in the 1890s under federal fisheries protection legislation (Langdon 2006:62).

In terms of cultural sequence time divisions, fish traps and weirs began to be constructed at the very end of the Early Period and continued through the 1800s. A surge in building and use began during the mid-Middle Period, and peaked during the late Middle Period. Construction continued but diminished in the Late Period. The Middle Period is also characterized by many large shell midden sites (Ames and Maschner 1999:88, 89; Moss 1998:100, 2004:182). Whether shell midden size is correlated with an increase in fish trap construction remains an open question. Nearly all archaeological sites with excavations that produced a minimum of one hundred identified specimens of fish identified to family contain salmonid remains and are, overall, the most abundant (Moss 2011b:160). Sampling biases need to be addressed before a quantitative analysis can be conducted. Most of the salmonid remains from the excavations date to about 2000 to 500 cal ^{14}C yrs BP (40 cal BC to cal AD 1440).

The majority of fishing sites are in the southern half of the region, between Frederick Sound and Dixon Entrance (Fig. 1). Concentrations occur in the relatively gentle and eroded terrain of Kuiu Island and west Prince of Wales, an area characterized by convoluted shorelines, large bays, and long anadromous stream reaches. It is evidently a terrain well suited to the ebb tide harvest technique. Sites are well distributed east of this area, across larger islands and the mainland.

To refine this overview, a program of work is needed to facilitate further analysis. A systematic pedestrian survey of the shoreline during a 0 or minus tide would be ideal. Review of aerial photography could supplement field survey. The Alaska ShoreZone Coastal Mapping and Imagery project provides aerial views of the entire Southeast Alaska coastline (NOAA Fisheries 2011). I use this tool to view aerial images of known sites and to assess probable areas. Applying consistent mapping techniques helps compare trap technologies and intertidal position. Mobile GPS mapping units enable accurate position data that can be geo-referenced with aerial photographs or USGS base maps. Imagery files can be accessed on-line at Alaska Mapped (2011) and downloaded to Google Earth or ESRI ArcGIS. I use ESRI ArcPad loaded onto a mobile GPS unit to map trap features and then upload the data to ArcMap where it is geo-referenced on aerial imagery.

A completely recorded site should have basic site inventory information and a geo-referenced plan map. Several radiocarbon dates are preferable for each site. ArcPad software enables the collection of point, vector, and polygon data. Point data is useful for small sites that have few stakes and to indicate where a stake has been collected. Vector data is good for large sites with recognizable stone or stake configurations. Polygon data is helpful to delineate an area where stakes or stones are present but a decipherable pattern is not evident. A combination of data collection methods is sometimes warranted and photographs will supplement the descriptive details. Elevation data will address sea level change, regional isostasy, and whether intertidal position is a product of function and/or age.

Detailed plan maps of trap configurations will help track the evolution of the technology and address many questions. Were configurations based on technical knowledge, preference, or ownership? Did trap styles target different salmon species or another fin fish altogether? Does trap design reflect periods of lean or productive salmon runs? Are there temporal associations between a certain type of trap and salmon abundance? Are large complexes spatially associated with habitation centers or, conversely, are small traps associated with ephemeral sites? Many threads of future research could pursue the relationships between fishing, settlement, social hierarchy, and Holocene ecology.

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