

***False Pass Marine and Aquatic Surveys  
September 2005 – July 2006  
False Pass, Alaska***

***DRAFT***



**PENTEC ENVIRONMENTAL**

*Delivering smarter solutions*

***Prepared for  
DOWL Engineers***

***October 23, 2006  
12634-01***





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## **False Pass Marine and Aquatic Surveys September 2005 – July 2006 False Pass, Alaska**

Anchorage

**DRAFT**

Denver

**Prepared for  
DOWL Engineers**

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**October 23, 2006  
12634-01**

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FALSE PASS MARINE AND AQUATIC SURVEYS  
SEPTEMBER 2005 – JULY 2006  
FALSE PASS, ALASKA**

## **1.0 INTRODUCTION**

### **1.1 Background**

The Village of False Pass is located on Unimak Island, the easternmost major island of the Aleutian Chain, along Isanotski Strait (Figure 1). The village is now served by a gravel runway approximately 2,100 feet in length that has approaches constrained by the proximity of hillsides (Figure 1, Photo 1). To provide for safer airport operations, especially during the frequent periods of poor weather, several alternatives are under evaluation to provide an extended active runway area and to improve the runway safety area (RSA) beyond, and alongside that runway.

The present runway is bounded on either end by streams known or suspected of supporting coho, chum, and/or pink salmon (*Oncorhynchus kisutch*, *O. keta*, and *O. gorbuscha*) as well as Dolly Varden char (*Salvelinus malma*). Several ponded wetlands and the marine shoreline of False Pass lie immediately to the east side of the runway and a large wetland/complex borders the runway to the west (Figure 1, Photo 1). All alternatives to expand the existing active surface and RSA would encroach on one or more of these significant habitats.

Pentec Environmental was contracted by DOWL Engineers, Inc. to conduct fish surveys of nearshore marine areas and streams in the vicinity of the runway and marine habitat surveys in areas of the proposed runway expansion. Fish surveys were conducted in May, July, and September to collect data on fish use during those periods readily accessible in this remote region of Alaska. Marine habitat surveys were conducted in July near peak growing periods of the marine macrovegetation community within the nearshore.

### **1.2 Study Objectives**

The objective of this work was to investigate freshwater, intertidal, and subtidal environments in areas that would be affected by alternative alignments under consideration for the extension of the runway and expansion of the RSA around the False Pass airport. The project area was defined as those aquatic and riparian habitats that would be directly impacted by one or more of the planned alternatives. Specifically, the project area included marine waters and riparian

areas between the upland limit of riparian vegetation types and approximately – 70 feet mean lower low water (MLLW) as well as freshwater streams flowing past both ends of the runway. Surveys were designed to describe the distribution and abundance of important marine benthic habitats and resources, including fish using the streams and nearshore waters of the project area.

## **2.0 METHODS**

### ***2.1 Sample Locations and Sampling Periods***

The False Pass sampling effort employed a beach seine to capture fish in the marine nearshore, minnow traps to capture fish in vicinity streams, intertidal habitat surveys conducted at extreme low tides, and subtidal habitat surveys conducted by divers. Beach seining was conducted in the spring, summer, and fall to determine the seasonal composition of the fish community in the marine nearshore. Minnow traps were set during the spring and summer to determine the presence and composition of juvenile and resident salmonids in area streams. Intertidal and subtidal habitat surveys were conducted in the summer during peak periods of macrovegetation growth. Incidental observations of bird and mammal presence were recorded during all surveys.

### ***2.2 Shoreline Fish Surveys***

An important function of the littoral zone is its role as a nursery for juvenile salmonids and other forage fish as well as several important invertebrates. While primary littoral use by juvenile salmonids occurs during the spring time, recent work in Knik Arm (Pentec 2005) and elsewhere in the Aleutians (Akutan, Pentec 2004) has shown a substantial presence of these fish in shallow waters along shorelines of embayments and estuaries. Thus, beach seining was conducted using a standard 37-m, fine-mesh seine (Photo 2) at four locations along low gradient, finer sediment beaches (cobble, pebble, or sand) along the shoreline adjacent to the runway and on the deltas of streams at each end (Figure 2). Sampling occurred during the following periods:

- September 24, 2005
- May 24, 2006
- July 19 – 21, 2006

Beach seine Stations BS 1 and BS 2 (Photo 3) were located adjacent to the southern portion of the runway where proposed runway expansion activities are planned. Station BS 3 (Photo 4) was located about mid-runway, 800 feet north

of BS 2. Station BS 4 was located north of the runway in the vicinity of the mouth of Roundtop Creek (Figure 2).

Beach seine methods were similar to those used in juvenile salmon studies within many estuaries in the northeast Pacific. Field personnel anchored one end of a 100-foot towline while the skiff deployed the net, parallel to the beach in the direction of the current. After net deployment, the boat returned to the beach while releasing the second 100-foot towline. The seine was then hauled to the beach by hand (Photo 2) where samples were processed (Photo 5).

Upon retrieval of the seine, fish and invertebrates were removed from the net and placed in a bucket of ambient water. Fish were sorted by species in the field. Selected fish were preserved in 10 percent formalin and retained for confirmation of species identification.

Lengths of most fish were measured and recorded in the field (Photo 5); however, when large numbers of the same species were captured, a representative subsample (usually at least 20 fish) was measured. Fork lengths were measured on species with homocercal (notched) caudal fins (tails) and total length was taken for all other species. Fish were retained in the bucket until after the second set, after which fish were released back into the nearshore. Basic water quality data (temperature and salinity) were measured with a YSI Model 85 temperature and salinity meter during the fish surveys.

Two sets were made at each station in each sample period, usually on both a flooding and ebbing (or flat) tide. Beach seining occurred at mid to higher tidal elevations because of presence of larger cobbles and boulders at lower tidal elevations.

### **2.3 Stream Fish Surveys**

On May 24, 25 and July 20, 2006, baited minnow traps were fished at 12 locations in four streams that traverse the north and south ends of the airport runway (Figure 2). Two trap stations were located in estuarine portions of South Creek, at the south end of the airport. Six trap stations were located in braided portions of Roundtop Creek from just upstream of the bridge to the mouth. Two trap stations were also located in Per Creek, a tributary of Roundtop Creek (Photo 6). In addition, two reference trap stations were located in Peter Pan (PP) Creek, located north of the airport runway.

Minnow traps were cylindrical, 16 inches in length, 8 inches in diameter, and equipped with funnel shaped fykes in either end that prevent fish that enter the trap from exiting. Traps were baited with uncured salmon roe and fished

overnight. Captured fish were processed in the same manner as described for beach seining.

## **2.4 Intertidal Surveys**

Intertidal habitat types were described by walking the shore along the existing airport and off each end of the airport during extreme low tides during each site visit. During the intertidal field investigations, the following site data were collected:

- Dominant vegetation and animal species and relative abundance;
- Substrate/habitat types;
- Potential functions (e.g., fish spawning, nursery, bird nesting, etc.);
- Potential values (e.g., "tide pooling", fishing, claming, etc.); and
- Presence and relative abundance of marine birds and mammals.

## **2.5 Subtidal Dive Surveys**

Subtidal areas off the south end of the existing runway were surveyed and documented using divers and a hand-held underwater video (UTV) system. The general nature of the bottom substrata and habitats was documented with the UTV coverage. This information was supplemented by divers who compiled a detailed list of benthic and demersal species and characterized benthic assemblages in key habitat types identified in the UTV surveys. As expected, marine areas offshore of the existing airport have strong currents, which limited the extent of survey time and data recovery safely possible from the UTV and divers.

Subtidal information gathered included species relative abundance and diversity, and features of the seafloor. The extent of kelp and eelgrass beds and other subtidal habitats within the project area were mapped using a hand held GPS.

## **2.6 Personnel**

The September 2005 survey was conducted by J. Houghton, marine biologist, and J. Starkes, fishery biologist, of Pentec Environmental. These two biologists were accompanied by D. Ormerod, wetland ecologist, of Pentec for the May 2006 survey and by marine biologist D. Lees (Lees Environmental and Ecological Services) and by marine technician, E. Parker (Research Support Services) for the July 2006 survey.

## 3.0 RESULTS

### 3.1 Location and Hydrology

As noted above, the False Pass village and airport lie along Isanotski Strait on the east side of Unimak Island (Photo 1). The Strait opens to the north into Bechevin Bay and the Bering Sea, and to the south into Ikatan Bay and the Pacific Ocean. The strait near the village is relatively confined (less than a mile wide) and experiences strong tidal currents despite relatively low tidal range.

Freshwater habitats in the vicinity of the airport are shaped by the geology and hydrology of the Roundtop Creek valley, as well as, to some degree, by past construction activity. The glacially carved valley around the major stream, and under the village is comprised of relatively coarse pebbles and sands that are highly permeable.

A single, highly braided surface drainage (Roundtop Creek) drains the majority of the valley but surface flow in this system is intermittent in the lower valley (right side of Photo 1). The majority of the middle reach of this stream, from at least a mile above the bridge, down to the bridge, is a “losing” reach; during periods of low rainfall and low snowmelt, more water is lost into the stream bed than is delivered to the upper reaches of the stream, and the stream bed goes dry. This was the condition during the first part of our May 2006 visit: On May 23 and 24 the stream was dry at the bridge (Photo 7), yet it was actively flowing approximately a mile above the bridge (Photo 8). Below the bridge, beginning in line with the northern end of the runway, flow surfaced in at least three areas forming three separate channels in the broad and braided streambed (Photo 9). Flow in these channels continued to increase downstream to and across the stream delta. On May 25, a substantial surface flow, approximating the volume seen upstream on May 24, was present under the bridge. Roundtop Creek also had continuous surface flow in July 2006 and in September 2005.

As a result of the permeability of the lower valley gravel soils, a number of smaller streams originate along the eastern margin of the valley, flowing only from a few hundred yards to as much as a half a mile into the Strait. These small streams, including one called “Peter Pan Creek” and one called “Per Creek” in this report (Figure 1) gather flow from several smaller streams (Photo 10) before building up enough hydraulic pressure to breach the pebble/cobble storm berm along the marine shoreline. The largest of these streams, “South Creek,” originates in wetlands along the southeastern valley wall and flows through a substantial slough (Photo 11) into Isanotski Strait at the south end of the runway. Each of these streams had flow during all three of our site visits and, based on the fish fauna present in each, all appear to be perennial.

The final aquatic habitat type in the study area is represented by the large borrow ponds along the east side of the runway (Photo 12). These ponds are fed by the shallow groundwater table and are very clear. Because they are physically isolated from other aquatic habitats they support only threespine sticklebacks (*Gasterosteus aculeatus*) and were not sampled in this study.

### **3.2 Intertidal Ecology**

Shorelines along Isanotski Strait adjacent to the False Pass airport are dominated by unconsolidated cobbles and pebbles with lesser amounts of sand in certain areas (e.g., Photos 2 – 5). Beach gradients are generally moderate to low and wave exposure is moderate to high. A storm berm, built during major storm events from pebble to cobble sized beach materials, extends along the majority of the shoreline from north of the village to the rocky shoreline south of the runway (e.g., left side of Photo 4). Tidal range is very limited as is typical of the Aleutians: Mean higher high water (MHHW) is about +4.1 feet relative to MLLW and extreme low waters likely do not extend below –2 feet MLLW. As a result intertidal areas tend to be relatively narrow except where beach gradient is low (e.g., on creek deltas).

#### **3.2.1 Peter Pan Docks to Roundtop Creek Mouth**

The reach of shoreline from the southernmost portion of the village near the Peter Pan docks, south to the spit east of the mouth of Roundtop Creek (Figure 1) was surveyed in detail on May 25, 2006. This reach was typical of much of the study area shoreline. The top of the storm berm and backshore was dominated by dune grass (*Elymus mollis*) while the face of the storm berm down to approximately MHHW supported a dense band of seabeach sandwort, *Honckenya peploides* (Photo 13). Below this vegetation there was a band of coarse sand and pebbles that was relatively unstable and supported little apparent life. Lower on the beach the slope was flatter and the substrate coarser (sand and pebbles with abundant cobble sized materials) and apparently more stable. Rockweed (*Fucus distichus* subsp. *evanescens*) was common on larger rocks (cobbles) at mid and lower intertidal elevations (e.g., down to mean lower low water, MLLW) along with sea lettuce (*Ulva/Ulvaria* spp.) and the tubular green *Blidingia minima*.

At somewhat lower elevations, the red algae *Palmaria mollis*, the branched tubular red alga *Devaleraea ramentacea*, and the filamentous green alga *Acrosiphonia* sp. were abundant (Photos 14 and 15) along with the greens *Ulva* spp. and *Monostroma grevillei*. The red *Mazzaella* sp. and the tubular brown *Dumontia alaskana* were also common. In subtidal waters (e.g., below –1 feet MLLW) the kelps *Alaria taeniata* (ribbon kelp, Photo 16) and *Saccharina*

*subsimplex* (Photo 17) also were present along with the tubular red *Halosaccion glandiforme*, sheets of the red *Porphyra* spp., and the acid kelp *Desmarestia aculeate*. Under cobbles the red *Mastocarpus papillatus* was often present along with an encrusting coralline alga. Still farther offshore was a narrow band of the floating ribbon kelp *Alaria fistulosa*. In areas where freshwater seeps emerged and flowed down the beach, the tubular green alga *Ulva intestinalis* and the red alga *Devaleraea ramentacea*, were present.

Animals at the upper intertidal zone were limited to a few acorn barnacles (*Semibalanus balanoides*) on larger cobbles along with the grazing littorine snail *Littorina sitkana*. The isopod, *Idotea wosnesenskii*, was also seen in association with rockweed fronds. At lower elevations, larger boulders supported isolated patches of large mussels (*Mytilus trossulus*), the thatched barnacle (*S. cariosus*), and limpets (Lottiidae). Under cobbles, gunnels (Pholidae), the typically subtidal barnacle *Balanus rostratus*, and gammarid amphipods were common.

### 3.2.2 Roundtop Creek Delta to BS 3

Roundtop Creek enters Isanotski Strait over a broad delta that is well protected by a gravel spit from northerly and easterly seas (Figure 1). The delta consists mostly of coarse sand and pebbles and at low tide, the stream fans out into several channels (Photo 18). The eastern most channel carries primarily water from "Per Creek"; this flow reaches the delta from the area of the Peter Pan facility by flowing south along the backside of the storm berm and shoreline described above.

When surveyed, the channels supported a considerable growth of diatoms and algae tolerant of both fresh and salt water including *U. intestinalis*, the filamentous brown *Pilayella littoralis*, and a species of the red *Porphyra*. The lower portion of the delta, e.g., below about -1 foot MLLW had patches of relatively pure sand with ripple marks. Occasional cobbles at this elevation supported kelps including *Cymathere triplicata*, *Alaria taeniata*, and *Saccharina latissima* as well as the red *P. mollis*.

South of the Roundtop Creek delta, the beach remained relatively broad but narrows gradually to the south. Between the delta and beach seine station BS 3, the upper beach was as described above but the lower beach had somewhat larger cobbles than seen north of the delta (Photo 4). A great deal of freshwater was seeping out along the beach face (May 2006) such that the undersides of cobbles were bathed in fresh water during low tide. As a result, algae were largely the freshwater tolerant species listed above and under cobble fauna was limited to gammarids and spawning *Littorina sitkana*. On cobble tops, removed from the direct freshwater flow, rockweed was common along with large and

dense mussels and thatched barnacles Photo 19). This dense mussel bed extended about half way from the delta to BS 3.

Offshore of this reach of beach and continuous with the lower Roundtop Creek delta (visible offshore in Figure 1) a shallow bench extended out for several hundred feet, narrowing to the south. Subtidal vegetation on this bench, visible at low tide, included *Alaria* sp., *Saccharina* spp., and *Desmarestia* sp.

### **3.2.3 BS 3 to BS 1**

South of BS 3, the amount of fresh water seepage out onto the beach diminishes and the beach type, fauna, and vegetation was generally similar to that described north of the Roundtop Creek delta. On the middle intertidal rocks another acorn barnacle, *Balanus glandula*, shared space with *S. balanoides*.

A large boulder at about MLLW, just south of BS 2 had a dense growth of large mussels and the drill, *Nucella* sp., was present, preying on barnacles and mussels. Under the lower margin of boulder, the green sponge *Halichondria panacea* was also present. Offshore and south of this boulder, lay a bed of floating bladder kelp, *A. fistulosa*.

South of this boulder, the beach and subtidal bench is at its most narrow point along the study area shoreline.

Around the curve in the beach line, between BS 2 and BS 1 the mid and upper beach was composed of relatively uniform sized pebbles and cobbles up to 4 inches in maximum dimension (Photo 3). The beach was very sterile down to about -1 foot MLLW where a few algae (e.g., *P. mollis*, *Acrosiphonia* sp.) were present. No barnacles or mussels were present suggesting that wave energy is sufficient to move the beach materials making the area unsuitable for attached biota.

### **3.2.4 BS 1 and South Creek Delta**

The beach in the vicinity of the mouth of South Creek is composed of relatively fine-grained pebbles and sand. Wave energy here is sufficient to move the beach materials frequently so that the middle and upper intertidal is relatively devoid of biota. The stream itself is slowed to form a quiescent lagoon (Photo 11) that ultimately creates the hydraulic head to break through the storm berm in a dynamic and often sinuous path (Photo 20).

Off the mouth of the creek beginning at about MLLW, there is a relatively low gradient bench that continues subtidally. This bench has relatively clean, hard

packed sand and pebbles with little epibiota. A limited number of excavations in these sands and pebbles in July 2006 failed to reveal any infauna.

South of an abandoned cabin behind the beach, the lower intertidal and subtidal zone have increasing amounts of cobbles supporting rockweed, sea lettuce, the red alga *P. mollis*, the tubular brown alga *Scytosiphon lomentaria* in shallow areas, and small *Alaria* sp. and *Saccharina* spp. on deeper cobbles and boulders. On wet sand and pebbles around the cobbles the green algae *Ulva* sp. and *U. intestinalis* and the filamentous brown *Pilayella littoralis*, were common.

### 3.2.5 South Reef

A low rocky bench south of the South Creek beach provides a stark contrast to the unconsolidated beaches to the north. This rock habitat was rich in an abundance of species common on lower intertidal rock in the Eastern Aleutian Islands (Photo 21). The tops of this reef at elevations of about +2 feet MLLW supported dense growths of thatched barnacles, acorn barnacles (*S. balanoides*), and mussels along with the predatory drill *Nucella lima* and scattered limpets. Rockweed and the red alga *Halosaccion glandiforme* were also common along with the filamentous green *Acrosiphonia* sp. The black chiton, *Katharina tunicata* was common among the thatched barnacles (*Semibalanus cariosus*), here and at lower elevations.

Below these upper elevations, the dominant feature of the reef is the dense cover of kelp, primarily *Alaria* sp. at the middle elevations and shifting to *A. fistulosa* at lower elevations (Photo 21). Under this kelp layer, lower tide pools and rock crevices supported a variety of life including the large anemones *Urticina crassicornis* and *Anthopleura xanthogrammica* along with *A. artemisia*, partially buried in sediments. Pools also had an abundance of the lined chiton *Tonicella lineata*, the small pink snail *Margarites pupillus*, the hermit crab *Elassochirus gilli*, calcareous tube polychaetes (Spirorbidae and *Crucigera* sp.), articulating and encrusting coralline algae, and tufts of the red algae *Neorhodomela* sp. Green urchins, *Strongylocentrotus droebachiensis*, were common but not abundant. The spiral sieve kelp, *Thalassiophyllum clathrus* and the cabbage like kelp *Saccharina sessile* were also seen in lower pools and rock surfaces below about -1 foot MLLW indicating (along with the *A. fistulosa*) a high wave exposure at this reef.

South of the reef the bottom remains a mix of boulders, cobbles, and bedrock. There were relatively few algae on the boulders but some rockweed was present on larger boulder tops along with acorn barnacles (both spp.), limpets, mussels and drills and an abundance of *Littorina sitkana*. Under intertidal boulders, were gammarid amphipods and egg masses of *L. sitkana*. A narrow bed of large

mussels was present on lower intertidal boulders from the beach shoreward of the reef described above to the south.

### **3.3 Offshore Kelp Bed Distribution**

Two types of kelp beds occurred along the shoreline adjacent to the runway and to the south off the end of the runway. The first of these was comprised primarily of low-growing species that may reach a maximum of several feet in height. These beds occupied areas of cobble to small boulders below about -1 feet MLLW and are dominated by laminarians (*S. subsimplex*, Photo 17, and *S. latissima*). Lesser numbers of *Alaria taeniata* (Photo 16), *Cymathere triplicata*, *Thalassiophyllum clathrus* (Photo 22), and the acid kelp, *Desmarestia aculeata* were also present.

In areas of larger boulders or bedrock outcrops, the dominant overstory kelp was the floating *Alaria fistulosa* (floating on surface in Photo 19). These floating kelp beds typically had an understory of several of the species mentioned above and were often surrounded by areas with the low-growing kelp species. Distribution of the kelp beds in July 2006 is shown on Figure 3, which includes some areas of the lower growing but visible kelp beds.

### **3.4 Subtidal Ecology**

As noted above, the lower intertidal zone along much of the airport shoreline continues subtidally into a generally low gradient bench. This bench is generally broad (100 feet or more) and extends to about -10 to -12 feet MLLW before the slope steepens sharply to the deeper waters of Isanotski Strait (Figures 1 and 3). Between FP BS 2 and FP BS 1, however, this shallow subtidal bench is relatively narrow (< 50 feet), broadening again to the south in the delta of South Creek and the rocky benches farther to the south.

A marine biologist (D. Lees) and a videographer (E. Parker) conducted three dive surveys during our July field period to characterize the nature of subtidal habitats and biota off the south end of the runway alignment in areas that would be affected by some project alternatives. Dive tracks are shown on Figure 3 and each is described in the following paragraphs.

For the first dive, divers began at the beach at the south end of the runway, swam out approximately perpendicular to the shore, and then swam and were carried by the current parallel to the shoreline to the south. Nearshore, from about +3 to -1 feet MLLW the substrate consisted of pebbles and small cobbles with little biota. Beginning about -2 feet MLLW limited amounts of sea lettuce (*Ulva* sp.) and the brown alga, *Scytosiphon lomentaria* were present. The

substrate became increasingly sandy and the bottom sloped gradually out to a slope break at about -7 feet MLLW. On this gently sloping area, a flat fish (possibly a starry flounder, *Platichthys stellatus*) and scattered plants of acid kelp and the broad rib kelp, *Pleurophycus gardneri* were seen.

Beginning at -7 feet MLLW the slope steepened down to about -15 feet; scattered cobbles on this slope supported a forest of *Saccharina latissima* with a few *A. fistulosa*. Among these kelps, the small snails *Margarites pupillus* and *Lacuna* sp., and the anemone *Metridium senile* were common. To the south along the dive transect, the slope came up to -3 feet MLLW on an outer lobe of the South Creek delta. Back at this elevation, occasional cobbles in the sand and pebble substrate supported the kelps *Alaria taeniata*, *Cymathere triplicata*, *L. saccharina*, and a variety of red algae.

The slope then dropped again and the bottom became more rocky with the first of two rock reefs encountered on the transect. These reefs supported abundant floating kelp *A. fistulosa* along with *Saccharina subsimplex* (Photo 17) and a highly diverse biota. Much of the rocky substrate was covered with encrusting coralline algae and articulated corallines were also common. The large green and red anemone, *Urticina crassicornis*, was abundant and green urchins (*Strongylocentrotus droebachiensis*) were common and large, both on the rock and on the kelp. The diversity of other plants and animals typical of these reefs in the -5 to -20 feet MLLW range is shown on Table 1 and included many taxa described above on the nearby intertidal reef. Sandy areas adjacent to the reefs at about -5 feet MLLW had abundant unidentified juvenile flatfish, an unidentified cottid, and shells of the clams *Serripes groenlandicus* and *Protothaca staminea*.

A deeper dive transect was begun at about -49 feet MLLW approximately 2,200 feet off the end of the runway with the intent of swimming towards shore. Strong tidal currents greatly limited the divers' effectiveness and carried them down the channel to the south, away from the runway (Figure 3). The bottom at the beginning of the dive was a mixed sand and pebbles with scattered cobbles and boulders and a moderate amount of shell debris. Algae were limited to a few species of small red algae, encrusting corallines, and an occasional acid kelp. Attached, filter-feeding animals were abundant on larger rocks with a variety of tunicates, bryozoans, hydroids, and sponges. Also, tightly adhering to the rocks were a filter feeding polychaete, *Serpula vermicularis* and clam, *Pododesmus macroschisma*, as well as the chiton *Tonicella lineata*, which grazes on encrusting corallines. The anemone *M. senile* was common and brittle stars (Ophiuroida) were abundant, as was the snail *Trichotropus cancellata*. A single octopus (probably *Octopus dolfeini*) was seen and crabs were common

including the orange hermit, *Elassocheirus tenuimanus*, and the Oregon cancer crab (*Cancer oregonensis*). Sea stars, *Henricia* spp. were present.

At somewhat shallower depths, approximately 2,400 feet from the end of the existing runway, the divers first encountered brown algae at about -37 feet MLLW in the form of the sieve kelp (*Agarum cribrosum*), the bull kelp (*Nereocystis luetkeana*), acid kelp, *S. latissima*, and *A. fistulosa*. Currents were very strong in this area and the maximum size of kelp appeared to be limited by the size of cobble or boulder to which the plant attached: if the drag of the algae gets too great as the plant grows, it can dislodge the boulder and remove it from the area. A few large butter clam *Saxidomus gigantea* shells were present along with a likely predator on them, the sun star *Pycnopodia helianthoides*.

### **3.5 Birds and Mammals**

A number of birds and mammals were documented along the marine shorelines, and using freshwater streams and wetlands within the False Pass study area. Ravens (*Corvus corax*), gulls (Laridae), and black-billed magpies (*Pica hudsonia*) were generally common around the village along with song and white-crowned sparrows (*Melospiza melodea* and *Zonotrichia leucophrys*, respectively).

#### **3.5.1 September 2005**

By far the most abundant birds present in September were gulls, especially black-legged kittiwakes (*Rissa tridactyla*) and glaucous-winged (*Larus glaucescens*). Large aggregations were present most of the time on the spit and sand flats at mouth of Roundtop Creek, some feeding on decaying pink salmon carcasses. Feeding flocks of gulls were seen several times out in the Isanotski Strait channel, probably preying on forage fish such as Pacific herring (*Clupea pallasii*) or sand lance (*Ammodytes hexapteris*). A merlin (*Falco comumbarius*) was seen in pursuit of a magpie. Marbled murrelets (*Brachyramphus marmoratus*) were occasionally seen within a few hundred yards of shore along with several groups of 5 to 10 harlequin ducks (*Histrionicus histrionicus*). Along the beach, especially near the Peter Pan docks, a large flock of rock sandpipers (*Calidris ptilocnemis*) remained for the duration of our field survey.

#### **3.5.2 May 2006**

Several semipalmated plovers (*Charadrius semipalmatus*, Photo 23) were consistently present along the freshwater streams and ponds and on the airport in May, and may have been nesting nearby. A pair of peeps (least or semipalmated sandpipers, *Calidris* sp.), were feeding along the low tide line near the mouth of Roundtop Creek. Flocks of ducks (pintail, *Anas acuta*; greater

scaup, *Aythya marila*) were also disturbed off of the sloughs around the airport. Also seen were a kingfisher (*Ceryle alcyon*) and several immature bald eagles (*Haliaeetus leucocephalus*). Gulls and magpies were still common around town; gulls remained common on the Roundtop Creek delta, but numbers were lower than they had been in September.

A single river otter (*Lutra canadensis*) was seen in a tidal pond behind the store at the north side of the village. At least one gray whale (*Eschrichtius robustus*) was seen off the City Dock on May 24.

### **3.5.3 July 2006**

In July, three species of shorebirds were repeatedly seen along the shoreline, especially near the Peter Pan docks. Black turnstones (*Arenaria melanocephala*) and dunlin (*Calidris alpina*) were most abundant with about 10 of each seen at various locations and times. Two to three small peeps (identified from photographs as least sandpipers, *Calidris minutilla*) were typically present near the other species.

Brown bears (*Ursus arctos*) were abundant around town in July; a single male was seen on several occasions near the Roundtop Creek delta and lower channel and crossing the runway (Photo 24). A sow with two cubs was exploring the beach in front of the abandoned cabin at the south end of the runway and moved off south along the shoreline when approached by our survey crew.

## **3.6 Fish Surveys**

Seasonal fish surveys in 2005 and 2006 captured over 20,000 fish by beach seine and minnow traps within the False Pass Runway study area. Twenty-three beach seine and 28 minnow trap sets were conducted during the three sampling periods. A summary of catch and catch per unit effort (CPUE) of fish sampling activities is presented in Tables 2 and 3. Water quality data collected during fish surveys is presented in Table 4.

### **3.6.1 Nearshore Beach Seine**

Nineteen species of fish were captured in beach seine sets over the spring through early fall period of sampling in 2005 and 2006. Despite the total number of species, the fish community was strongly dominated numerically by juvenile Pacific cod (*Gadus macrocephalus*), which comprised over 87 percent of all fish collected during the sampling period. Two other species, Pacific sand lance and juvenile pink salmon combined to comprise an additional

10.2 percent of total beach seine catch (Table 2). Moderate numbers of kelp greenling (*Hexagrammos decagrammus*, 264 individuals) were also captured, but comprised only 1.3 percent of total catch. Other species captured in notable numbers included juvenile sockeye and coho salmon, juvenile and adult great sculpin (*Myoxocephalus polyacanthocephalus*; Photo 25), crescent gunnel (*Pholis laeta*), juvenile walleye pollock (*Theragra chalcogramma*), adult rock sole (*Pleuronectes bilineatus*), silverspotted sculpin (*Blepsias cirrhosis*), and Pacific sandfish (*Trichodon trichodon*; Table 2). Most of the commonly found species showed no distinct preference for beach seine station.

Catch rates varied dramatically during the three time periods sampled. During the May (2006) sampling period, Pacific sand lance and juvenile pink salmon dominated catch with CPUEs of 104.4 and 55.8 fish/set, respectively. Kelp greenling were also caught in moderate numbers with a CPUE of 23.0 fish/set (Table 3).

In July (2006), catch rates increased by an order of magnitude with over 2,000 total fish/set captured, 98 percent of which were juvenile Pacific cod. During this period, catch rates for both juvenile pink salmon and sand lance decreased from levels seen in May. In contrast, all sockeye and coho salmon juveniles were captured during the July sampling event at modest catch rates of 6.9 and 2.1 fish/set, respectively (Table 3).

In September (2005), total catch rates were comparable to those seen in May. Juvenile cod and sand lance dominated catch, with catch rates of 79.6 and 77.4 fish/set, respectively. Kelp greenling were also present in modest numbers with a CPUE of 7.9 fish per set (Table 3).

Length frequency data show a single dominant cohort of juvenile Pacific cod in the 41 to 60 mm range, found first during the July (2006) sampling period. September (2005) data suggest substantial growth of this cohort with about 80 percent of fish in the 61 to 100 mm range (Figure 4).

In contrast, length frequency data for Pacific sand lance show the likelihood of more than one cohort in the nearshore. In May, the dominant cohort consisted of juveniles in the 61 to 100 mm range, with a few larger adults up to 180 mm. In July, the data suggest substantial growth of the juvenile cohort with most of these fish ranging from 101 to 120 mm. September 2005 data show cohorts of maturing and adult fish over 100 mm and another juvenile cohort in the 61 to 80 mm range (Figure 5).

Length frequency data for juvenile pink salmon show a single young-of-the-year cohort with typical growth patterns with time in the nearshore. Substantial

numbers were found in May with almost all between 21 and 40 mm. In July, the cohort had increased in size with about half in the 61 to 80 mm range and half between 81 to 100 mm. Very few juvenile pink salmon were captured during the September (2005) sampling event, but those that were found measured between 101 and 140 mm (Figure 6). Also in September, large numbers of pink salmon in this size range or larger were observed feeding actively around the Peter Pan docks.

A wide size range of juvenile sockeye salmon (41 to 140 mm) was observed in the nearshore (all captured in July 2006) indicating multiple cohorts, but length frequency data do not show distinct size groups (Figure 7). The largest group of fish was between 40 and 80 mm.

Multiple cohorts of juvenile coho salmon were also captured in beach seine sets in July 2006 (Figure 8). The coho were relatively large, with three distinct size groups—40 to 80 mm, 100 to 169 mm, and 180 to 220 mm, probably representing three different year classes of recent migrants to salt water. The smallest fish were within the size range of those remaining in study area streams in July (Figure 9) and were likely recent local outmigrants.

Multiple cohorts of kelp greenling also were evident in the nearshore study area. During the May 2006 sampling event, a large number of young-of-the-year fish under 20 mm were captured in beach seine sets (Figure 10). Another cohort of juvenile fish between 101 and 160 mm was also observed in May. By July 2006, the young-of-the-year cohort increased substantially in size, ranging from 21 and 60. Two distinct groups of maturing and adult greenling were also observed in July—fish in the 120 to 180 mm range and adults over 200 mm. In September 2005, the dominant cohort consisted of juveniles in the 61 to 120 mm range, which may represent growth of a juvenile cohort comparable to that observed in July (2006; Figure 9).

### **3.6.2 Stream Minnow Trap Sampling**

Minnow trap sampling conducted in May and July in the four study area streams resulted in the capture of 43 juvenile coho salmon and 19 Dolly Varden char (Table 5). Juvenile coho salmon were taken in all four streams, with the highest catch rates in lower South Creek (measured as number of fish per trap set; Table 6). CPUEs in South Creek were up to an order of magnitude greater than in Roundtop Creek and its tributary, Per Creek. Catch rates in Peter Pan Creek were also relatively high in May, but no fish were captured there in July. Total CPUE for coho at all stations in May was over twice that observed in July which would be expected as age 1+ coho migrated out of the freshwater environment.

Length frequency data show a dominant cohort of age 1+ juvenile coho in the 71 to 120 mm range during the May sampling period (Figure 9). A few smaller coho, perhaps young-of-the-year under 60 mm were also observed. In July, a much smaller number of coho were captured and most were young-of-the-year between 50 and 60 mm, confirming the outmigration of older fish between the two sampling periods.

Dolly Varden char were captured in South Creek, Roundtop Creek, and Per Creek during minnow trap sampling. Where found, CPUEs ranged from 0.25 to 2.5 fish per trap set with mean catch rates of 0.6 fish per set in May and 0.9 fish per set in July (Table 6). The highest catch rates were found in Roundtop Creek and its tributary, Per Creek. No Dolly Varden were found in Peter Pan Creek and only one specimen was captured in South Creek.

Length frequency data showed a wide range of sizes for Dolly Varden, ranging from 54 mm to 193 mm (Figure 11). This represents at least three cohorts in each sampling period, but with the small total catch, clear size distributions to distinguish separate cohorts would be speculative. A dominant cohort between 91 and 110 mm was observed in May. This cohort may have been present during the July sampling period as well, which had a dominant size group between 111 and 140 mm.

### **3.6.3 Literature Review and Comparison With Other Studies**

Very few aquatic studies have been identified from this remote area of Alaska. Schroeder (2000) conducted four beach seine sets in the vicinity of the False Pass Harbor located approximately a mile northeast of the runway. This sampling, on July 19, 1999, found over 275 young-of-the-year pink and chum salmon (the number of each species was not provided; total CPUE for juvenile salmon of 68.8 fish/set). In our study, we found somewhat fewer pink salmon (14.4 fish/set) and no chum salmon in July. In addition we found juvenile coho and sockeye salmon at CPUEs ranging from 2.1 and 6.8 fish/set in July. Schroeder (2000) also found few non-salmonid species (Pacific sand lance, greenling, rock sole, and stickleback at CPUEs of 1 or less) while we found significant numbers of Pacific cod, kelp greenling, Pacific sand lance, as well as eight other species of fish.

According to the Fish Distribution Database and Atlas, produced by the Alaska Department of Fish and Game, South Creek is designated in the catalog as stream 311-60-10400. The atlas lists that the stream and two tributaries are used for spawning and rearing by chum salmon and rearing by coho salmon. Minnow trap sets during our study also captured one Dolly Varden char in South

Creek. Roundtop Creek, Per Creek, and Peter Pan Creek have not been cataloged in the Fish Distribution Database.

## 4.0 DISCUSSION

Relatively little prior biological sampling had been conducted in the False Pass area. The surveys conducted in fall 2005, and spring and summer 2006 provide a reasonable characterization of the aquatic and marine environments that could be affected by various alternatives under consideration for expansion of the False Pass runway and RSA. While all areas examined were productive, the levels of productivity, abundance, and diversity of species appear to be comparable to those in many areas of the eastern Aleutian Islands and no unique habitats or species were found.

### 4.1 Marine Nearshore

#### 4.1.1 Primary and Secondary Productivity

The shoreline of Isanotski Strait adjacent to the runway and Village of False Pass is typical of semi-protected unconsolidated shorelines in the Aleutians. Productivity is low on mid and upper beaches where wave energy continually moves the pebbles and cobbles making up the beach and where desiccation and freezing limit attachment and survival of biota. Lower intertidal areas and shallow subtidal zones, however, are highly productive. It can be expected that nutrient levels are high in waters passing through the strait, water clarity is uniformly high, and water temperatures are moderate—all contributing to robust growths of algae from about +2 feet MLLW down to about -40 feet MLLW, wherever substrates are suitable.

Larger cobbles are well vegetated from about -1 feet MLLW down slope (e.g., Photo 14) and dense algae occupy rock surfaces beginning at about +2 feet MLLW (Photo 18). Below about MLLW, dominant algae are large kelps that can form dense, mixed-species, beds down to about -30 feet MLLW. Fringing beds of kelp, dominated by the floating *Alaria fistulosa*, but including a dense understory of a half dozen or more other species, occur along the flanks of the False Pass airport (Figure 3). Larger beds, indicating a broader area of boulders and bedrock outcrops, begin along shore just south of the runway and extend well to the south.

Associated with this high benthic primary productivity and the less visible but equally productive pelagic food web, is a diverse array of animals that is particularly evident on more stable boulder and rocky substrates. Many of these

animals, both intertidally and subtidally, are attached filter feeders that capture phytoplankton and zooplankton from the passing water. This group is dominated by barnacles and mussels in the intertidal zone and by anemones, bryozoans, tunicates, hydroids, and brittle stars in subtidal areas. The high currents in the study area equate to high rates of food delivery to these animals and growth rates are expected to be relatively high.

Another abundant group of species are grazers on algal films that grow on rock surfaces and on larger plants themselves. This group is represented in intertidal areas by limpets, littorine snails, and chitons and subtidally by different species of these same taxa. Predators in the intertidal zone include the drill *Nucella* and occasional sea stars that migrate upslope during high tides. Subtidally, sea stars are more abundant and effective predators along with fish (especially flatfish, greenling, and cottids), nudibranchs, and some larger snails. Scavengers and omnivores in both intertidal and subtidal areas include a variety of crustaceans (amphipods, hermit crabs, brachyuran crabs, pandalid and crangonid shrimp), as well as gulls and bears (intertidal only).

In summary, marine benthic and pelagic primary and secondary productivity is robust in Isanotski Strait and supports a substantial assemblage of demersal and pelagic fish.

#### **4.1.2 Fish Use**

Collectively, beach seine data gathered in 2005 and 2006 covered the spring through early fall period when fish use in the nearshore is highest and when the recruitment of juvenile species dependent upon the nearshore, including juvenile salmonids, can be characterized. Winter use of nearshore waters is typically less than that during other times of the year due in part to reduced light levels and high frequency of storms. Although it would be ideal to collect and interpret seasonal data collected over a single year, contractual timing precluded this. Despite sampling over two separate seasons, the data collected show seasonal patterns of use of the nearshore by marine resident and anadromous fish.

Beach seine sampling showed that the nearshore study area is used by a variety of marine resident and anadromous salmonids and that there is substantial use as a rearing area for juvenile fish. We found a substantial abundance of young-of-the-year Pacific cod that entered the nearshore study area during the summer (July) and became the overall numerically dominant species (Figure 12). Spring and summer sampling intervals were not sufficient to determine when these juvenile fish entered the nearshore, but data showed only one individual in mid-May, increasing to catch rates of over 2,000 fish/set in July. This is consistent

with most accounts of Pacific cod spawning within the Gulf of Alaska and Bering Sea, which indicate late-winter spawning periods between January and April (Hirshberger and Smith 1983; Brodeur, et al. 1995; DiCosimo and Kimball 2001). Larval cod are pelagic with early juvenile stages recruiting to intertidal and nearshore areas composed of sandy bottoms, eelgrass and kelp beds (Garrison and Miller 1982). The juvenile cod in the study area appear to occupy the nearshore in dominant numbers through the summer, declining from the extremely high abundances by September, while still remaining the most abundant fish species present. Brodeur et al. (1995) theorize that juveniles move into progressively deeper water with increasing size and age. The July 2006 and September 2005 length frequency data suggest that substantial growth of a single young-of-the-year cohort occurred during their nearshore residence period.

The nearshore study area is also used extensively by rearing juvenile salmon. Juvenile pink salmon were the second most abundant species observed in the nearshore during the May sampling period, before the arrival of the juvenile cod (Figure 13). The high abundances observed in May suggest an earlier arrival into the nearshore; most studies of juvenile salmon in southwest Alaska indicate that pinks outmigrate into the marine nearshore as early as mid-April (Heard 1991). In recent studies conducted by Pentec (2006) in lower Cook Inlet, very few juvenile pink salmon occupied the nearshore in late-April; pinks arrived in substantial numbers by mid-May and peaked by mid-July, declining sharply in August. False Pass data suggest that the residence period of juvenile pink salmon in the study area may be shorter, since substantial declines were observed by July and only a few were captured in September. However, Schroeder (1999) found high abundances of pink and chum salmon in July, although this sampling did not distinguish between the two species.

Length frequency data show a strong growth pattern of a single young-of-the-year cohort of pinks through the summer, suggesting valuable use of the nearshore as a nursery. Juvenile pink salmon were not taken in minnow trap samples from study area streams, nor have they been documented in the Fish Distribution Database. However, given the number of juveniles found in the nearshore in May, pinks most likely had already outmigrated at the time of sampling. This species has been documented in other streams within Isanotski Strait and Ikatan Bay and clear evidence of prior spawning by pinks was widespread in False Pass area streams in September 2005.

Moderate numbers of juvenile coho and sockeye salmon were also observed in the nearshore study area, all in July. Length frequency data show multiple cohorts of coho in the nearshore, including smaller fish < 60 mm that would likely be young-of-the-year, perhaps from area streams. Coho were the most

abundant species of salmonid observed in study area streams and fish remaining in the streams (Figure 9) in July had size ranges similar to the smallest cohort in the marine catches (Figure 8). The decline in abundance from May to July in minnow trap catches in area streams also suggests an outmigration into the nearshore. Juvenile sockeye salmon ranged widely in size without distinct size groups suggesting a mix of several cohorts outmigrating from widely distributed basins. None of the cataloged streams on Unimak Island within the Fish Distribution Database are known to have runs of sockeye salmon.

Juvenile chum salmon were notably absent in the study nearshore and streams, although they have been documented to use South Creek for spawning and rearing and were found by Schroeder (1999) in one time sampling in July. It is unknown why chum salmon were not observed, although their outmigration may have been missed with a sampling interval of two months. Pentec's studies in lower Cook Inlet found that chum salmon had the shortest and earliest nearshore residence period; they were present in high abundance when sampling began in April but were largely gone by June (Pentec 2006).

Pacific sand lance were abundant in the nearshore, found during all three sampling events from the spring to early fall. Unlike the salmonids and Pacific cod, it is likely that most sand lance were older juveniles and adults, rather than young-of-the-year. The temporal distribution of the species was also unusual having the highest CPUE in May (over 100 fish/set), the lowest in July (under 10 fish/set), and an increase in September (2005; nearly 70 fish/set). This pattern may result from the sand lance behavior of traveling in large, but well-defined schools. This patchy distribution was evident from our capture of hundreds of sand lance at one station while none to very few were captured at the next. For example, during the May sampling event, 486 sand lance were taken at Station BS 1 and 344 at Station BS 4, while none were caught at Station BS 2 and only 5 were caught at Station BS 3. Similarly in September, 536 sand lance were collected at Station BS 2 and only 6 individuals were captured at the remaining three stations combined. In July, no large schools of sand lance were captured, but small numbers were found at three of the four stations. It appears likely that the species was fairly abundant through the sampling period, but travels in dense schools creating a patchy distribution in nearshore catches.

Data show that the nearshore zone in the study area is used for all stages of development by kelp greenling. In May, notable numbers of very small larval greenling were present in the nearshore, and given their small size (<20mm), were still in the pelagic stage typical of young-of-the-year greenling during their first year (Gorbunova 1970). In July, substantial growth was evident in that most young-of-the-year kelp greenling were approaching 50 mm. This rapid growth rate is consistent with most observations of the species, including those in Alaska

waters. The species is known to spawn during the fall and winter in north Pacific waters; larval stages between 10.0 and 24.4 mm have been reported in Alaska (Fox Islands) from October to December. Larger juveniles ranging from 31.2 to 50.3 mm have been reported in the eastern Bering Sea in July and August (Gorbunova 1970). Multiple cohorts of maturing and adult fish were also commonly observed, particularly in July, indicating a degree of resident use.

Several other adult marine resident fish, typical of littoral areas in Alaska, were common in the nearshore. These include piscivorous species such as the great sculpin and several opportunistic and demersal invertebrate feeders such as rock sole, Pacific sandfish, red irish lord (*Hemilepidotus hemilepidotus*), and silverspotted sculpin.

In summary, fish use in the study area nearshore is to large extent a juvenile rearing area for Pacific cod, local and regional stocks of juvenile salmon, and local populations of kelp greenling. Abundances of these juvenile fish were seasonally very high and substantial growth of young-of-the-year cohorts was observed over time. The composition and abundance of marine resident species appears typical of protected littoral areas of western Alaska.

## **4.2 Study Area Streams**

The minnow trap data collected during the spring and summer provide a preliminary look at the composition of anadromous and resident salmonid use of streams that drain the study area. The length frequency data suggest that many of the coho salmon observed in area streams in May contributed to the population of coho found along the nearshore in July. The limited sampling period in the streams precluded confirmation of stream use by chum or pink salmon, both of which tend to outmigrate to the nearshore relatively early in the spring. Both of these species are fairly common in streams that drain Unimak Island (ADFG Fish Distribution Database), and there is evidence that the two species spawn in study area streams. Numerous adult pink salmon and a few chum salmon were observed in Per Creek in September 2005. In addition, adult chum salmon were observed in a community gill net set at the mouth of South Creek.

Minnow trap sampling determined that Dolly Varden char are present in all study area streams sampled. These findings have not been documented in Alaska Department of Fish and Game's (ADFG)'s Fish Distribution database. It was somewhat surprising that these Dolly Varden appeared to be residents; no char were captured in the marine nearshore during any of the beach seine sampling events. Previous sampling activities in lower Cook Inlet (Pentec 2006; Blackburn et al. 1981), Knik Arm (Pentec 2005), and Turnagain Arm (Pentec

unpublished) show that the anadromous variety of this species occupies the nearshore during the spring and summer and is readily captured by beach seine. Equally remarkable was that the highest catch rates for Dolly Varden were observed in the Roundtop Creek basin. As noted, surface flow in Roundtop Creek disappears during dry periods without snow melt and perhaps during much of the winter, except for the lowest portions, downstream of the runway. Several Dolly Varden were captured in this reach in May, when middle portions of the stream channel were dry (Photo 7). In July, when surface waters flowed through previously dry portions of stream channel, Dolly Varden were captured in this reach, as well. Per Creek is spring fed and flows continuously, but is a relatively short stream that parallels the marine shore, draining freshwater wetland and lowland areas. Seven Dolly Varden were captured in this stream.

In summary, the limited sampling conducted in study area streams indicates use by both resident and anadromous salmonids that is typical for small eastern Aleutian streams.

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