Inventory of marine and estuarine fishes in Southeast Alaska National Parks during summer, 2001

Annual Report

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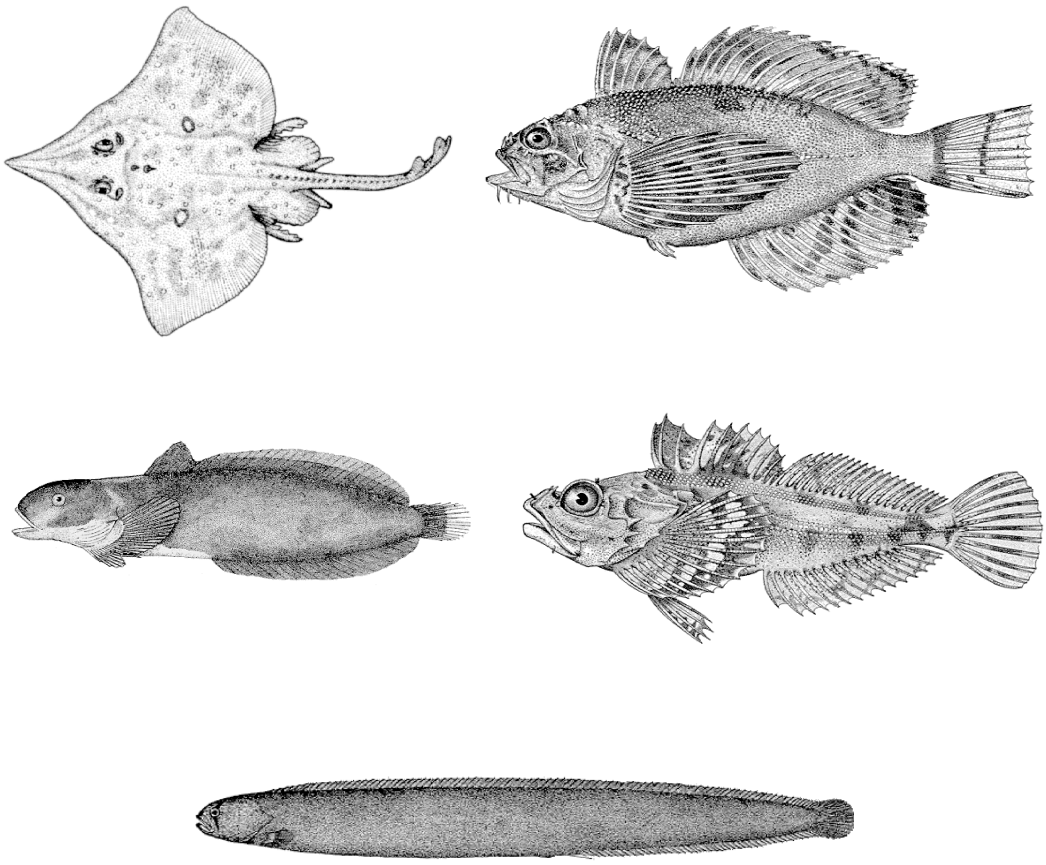

March 2002

INTRODUCTION

This report summarizes results obtained during the first year of a two-year survey of marine and estuarine fishes in three National Parks in Southeast Alaska: Glacier Bay National Park and Preserve, Klondike Goldrush National Historical Park and Sitka National Historical Park. This survey is part of a nationwide effort to inventory vertebrates and vascular plants in U.S. National Parks. During the planning stage for inventory studies, administrators and biologists from the Southeast Alaska network of parks determined that a marine fish inventory in Glacier Bay was one of their highest priorities. In Glacier Bay, the National Park Service has jurisdiction over 1,200 miles of marine shoreline and 600,000 acres of marine waters. Although Klondike Goldrush and Sitka National Historical Parks are considerably smaller coastal parks with limited jurisdiction over marine waters, inventory of near-shore estuarine (mainly intertidal) fishes was also a high priority. Southeast parks face a variety of pressing marine-related management issues, including the protection of important marine resources from rapidly growing visitation by large cruise ships and other vessels, human uses and development of the marine shoreline (both inside and outside the parks), and commercial and sport fishing.

Inventory information for marine fishes in southeast parks is of particular importance for several reasons. First, there is very little baseline information on marine fish in the three Southeast Alaska parks. Indeed, the realization that much less than 90% of fish species had been identified in these parks was one of the main criteria for prioritizing this inventory. Basic information on species occurrence and distribution is poorly known, and this lack of knowledge hampers management decisions regarding fish populations themselves, as well as decisions about the predators that rely on fish populations. Even simple presence/absence information obtained from inventory assessments can be used to detect long-term changes in marine fish communities (e.g., Robards *et al.* 1999). Inventory information will provide some basis for park managers to identify and understand such changes.

Furthermore, marine and anadromous fishes in Glacier Bay and elsewhere are important to regional marine, and, to some extent, terrestrial ecosystems (through

transport of marine production to the newly de-glaciated freshwater areas by salmon). The health of many marine predator populations in the parks depends on the abundance and distribution of forage fish species. Declines in seabird and marine mammal populations in the Gulf of Alaska have been linked to shifts in abundance and composition of forage fish stocks over the past 45 years (Piatt and Anderson 1996, Anderson and Piatt 1999). Glacier Bay hosts a variety of abundant marine predators during summer, including significant populations of humpback whales (*Megaptera novaeangliae*), harbor seals (*Phoca vitulina*) and *Brachyramphus* murrelets, among many other predators. Not only are these species important ecologically, they are also important aesthetically to the thousands of people who visit these parks.

By establishing a 90% baseline of fishes present in the Southeast Alaska Network parks and subsequently monitoring the abundance of key species, it will then be possible to identify long-term trends and changes in populations of fishes and their vertebrate predators. Furthermore, this information will facilitate discrimination between long-term natural changes in the marine environment and changes caused by pollution or other human disturbance.

Goals and Objectives

The following goals were identified during the planning phase of this project. In all cases, the proportion of work that we report as having been completed in 2001 represents progress towards completion of our goals for the entire two-year study.

Data Review and Compilation

Review all historical marine fish data compiled under the Alaska Natural Heritage Program project, identifying outstanding data sources (e.g., recent studies by U.S. Geological Survey or National Marine Fisheries Service, and identify any other species that would be expected to occur.

Progress: Relevant literature has been collected and compilation efforts are ongoing.

New Fishery Data Collection

The following primary objectives were identified in conjunction with the National Park Service:

1. Document the presence/absence (≥90% of expected species) of near-shore estuarine fish species at Klondike Goldrush and Sitka; secondarily, estimate relative abundances (for the areas/strata sampled).

   Progress: Sampling was completed in 2001, and preliminary findings are presented in this report.

2. Document and delineate critical marine fish habitats within Glacier Bay proper.

   Progress: Critical marine fish habitat will be identified after data collection is completed in summer 2002.

3. Document the presence/absence (≥90% of expected species) of marine benthic fish species within Glacier Bay proper; secondarily, estimate relative abundances (for the areas/strata sampled).

   Progress: About 50% of sampling was completed in 2001. Preliminary findings are presented in this report.

4. Document the presence/absence (≥90% of expected species) of marine pelagic fish species at depths below 50m within Glacier Bay proper; secondary, estimate relative abundances (for the areas/strata sampled).

   Progress: Sampling was completed in 2001, and preliminary findings are presented in this report.

5. Document marine fish assemblages (presence/absence ≥90% of expected species) in Glacier Bay outer waters (along the Icy Strait, Cross Sound, and exposed Gulf of Alaska coasts).

   Progress: The majority of this sampling remains to be completed in 2002. Preliminary results from three days of effort in Icy Strait are presented in this report.

6. Data management: ensuring that Park Service databases NPSpecies, NRBib, ANCS+, Dataset Catalog, and GIS Themes Manager are appropriately populated on an annual basis.

   Progress: Data are currently being transferred from Excel databases to Park Service databases in collaboration with Park Service personnel.

METHODS

Fishing methods

Fishing in 2001 was conducted with beach seines, bottom trawls and two kinds of midwater trawls. Trawling in Glacier Bay National Park was conducted from the M/V *Steller,* a 21-m stern trawler, and beach seines were conducted from a skiff launched from the *Steller*. Beach seining in Klondike Goldrush and Sitka parks was conducted from small skiffs. Minnow traps were also used in Klondike Goldrush and Sitka to sample areas unsuitable for beach seining. Fishing methods are briefly reviewed below.

Isaacs-Kidd mid-water trawl: This small trawl net (2 m mouth) was fished at depths of 300-360 m. This net can capture a wide range of pelagic species, although it is generally most effective for larval and juvenile fishes or small forage species (5-500 mm).

Modified herring trawl: A medium-sized (10 m mouth) trawl net was deployed from the M/V *Steller* using a dual winch and cable system, and fished at depths of 45-255 m.

Efficient and safe deployment requires considerable experience, but this method is highly effective for catching a wide range of pelagic fishes ranging in size from 10-1000 mm.

Bottom trawl: A small plumbstaff beam trawl (ca. 3 m mouth) was dragged across the ocean floor, capturing juvenile and adult fishes. This method was highly effective for benthic and demersal species of fishes and invertebrates ranging in size from 10 to 1500 mm. We bottom trawled at depths of 49-314 m.

Beach seine: A seine net (36.6 m long and 2.4 m deep at mid-point) was deployed by small boat a short distance from shore and pulled in to the beach by 3-4 persons. This method is highly effective for sampling the near-shore and intertidal zones that typically support the highest diversity of fishes in coastal marine areas.

Sampling design

Midwater trawl stations in Glacier Bay were randomly selected from a grid of 2.5 km^2 cells overlaid on the Bay, and effort was evenly divided among four depth strata (50-100 m, 100-200 m, 200-300 m, >300 m). Midwater stations were also randomly selected in Icy Strait and Cross Sound. We used different depth strata in these areas (0-50 m, 50-100 m, >100 m) because data on fish communities at 0-50 m in these areas have not been previously collected, and because these areas are shallower than Glacier Bay. Each selected cell was searched for acoustic backscattering layers with the *Steller's* depth sounder, and fish sign at each depth stratum was fished. When suitable sign could not be discovered in a particular depth stratum, we fished in a haphazardly selected location within that stratum in the predetermined grid area. We use the word "haphazardly" in the statistical sense, that is, sampling that is neither systematic nor random. Average vessel speed over the bottom during tows was 4.4 km hr^{-1}. Average tow duration at depth was 57 min, almost double our planned tow duration of 30 min. This increase represented a significant increase in the boat time required to accomplish our midwater goals, but was necessary because fish density was typically low, and long tows were needed to adequately sample the community.

Incidental to our main inventory project, we also conducted a 10-day pilot study of humpback whale feeding ecology in Glacier Bay and Icy Strait during summer 2001. We used the midwater herring trawl to sample whale prey, adding to the total number of trawl samples within the inventory study area. We report the catch of these trawls here. Whereas these trawls can be used to assess species occurrence and distribution for inventory purposes, average catch-per-unit-effort (CPUE) in whale trawls were about an order of magnitude greater than CPUE of inventory trawls because we were targeting dense prey concentrations used by whales.

Bottom trawl stations were randomly selected from a grid of 1 km^2 cells overlaid on Glacier Bay. When bottom trawling is completed in 2002, effort will be evenly allocated among five depth strata (0-20 m, 20-70 m, 70-120 m, 120-170 m, and >170 m) and four strata of glacial history (< 3 km from current tidewater glacier, < 3 km from the heads of recently deglaciated fjords, other areas deglaciated <140 yr, and areas deglaciated >140 yr.). Ponar grabs were made at the beginning and end of each trawl so that sediment types could be characterized for each station. These samples will be analyzed after bottom trawling is completed in 2002.

Beach seine stations were haphazardly located in suitable sites (i.e., beaches free from obstructions and steep enough for a skiff to drive to shore). Within these constraints we attempted to sample as many habitat types as possible. Minnow traps were used in Sitka and Klondike National Historical Parks in habitats that were not suitable for seining.

Specimen identification

Most fish were identified in the field, and, after the field season was completed, identifications were confirmed at the Auke Bay Laboratory (National Marine Fisheries Service) in Auke Bay, Alaska. Ten specimens of each species from each park were archived in a voucher collection that is currently stored in Glacier Bay park headquarters. Species that were difficult to identify or poorly described were identified with the assistance of experts in the taxonomy of Southeast Alaskan fishes (Bruce Wing, Kitty Mecklenburg). A small number of specimens came from taxa that are poorly described in Alaska (e.g., eelpouts, snailfish) and could not be positively identified to the species

level. These specimens were also archived with the voucher collection. The 2001 voucher collection from all three parks currently consists of 563 specimens, and is in the possession of National Park Service staff.

Some of our herring trawls caught thousands of larval fishes, which were typically comprised of one or two species. In these situations we identified every fish in a subsample of the catch. We sorted through the remainder of the catch to find any uncommon species, and used volumetric methods to estimate catch size.

RESULTS

Glacier Bay

We caught 28,840 fish and identified 63 species in Glacier Bay National Park during 2001. Twenty nine of these species (46% of total) were previously undocumented in the Park (Lenz *et al.* 2002). One of these previously undocumented species was not listed as "expected" by the Alaska Natural Heritage Program review (Lenz *et al. 2002).* Nine of these previously undocumented species were fairly common (total catch of tens or hundreds of individuals), underscoring the current paucity of information on marine fish populations in the park.

Midwater trawling

We fished 36 midwater stations in Glacier Bay and 22 stations in Icy Strait / Cross Sound (Fig. 1). These totals include 17 stations fished during the whale study. We accomplished 100% of our inventory sampling goal for Glacier Bay and 110% of our goal for Cross Sound / Icy Strait. We caught 27,782 fish in midwater trawls, and documented the presence of 31 species (Table 1). We did not identify approximately 8,800 specimens from midwater trawls. A large majority of these (96%) were larval fishes that were discarded in the field after they had been sorted to detect rare species and catch size had been estimated. In these situations a subsample was retained for identification in the lab. The remaining 4% were comprised of poorly described eelpouts and snailfish, as well as a few specimens that were damaged during capture and could not be identified. The cumulative number of new species detected with midwater trawls in Glacier Bay is presented in Fig. 2.

Bottom trawling

We successfully fished 46 bottom stations in Glacier Bay proper (Fig. 3). We met 100% of our sampling goals for 121-170 m and > 170 m strata, and 80% of our goals for stations 71-120 m deep. Fishing these 46 stations required 65 sets. This was hard on gear: all four of our nets required extensive repair after the field season. We averaged 3.2 successful sets per day of fishing effort, about half of the rate for which we had planned. We fished at this slower rate partly because we fished our deepest (most time-consuming) stations in 2001, and partly because of the learning curve required for fishing on a new boat. We caught 864 fish in bottom trawls, and identified 42 species (Table 2). Twenty three of these species were previously undocumented within the Park, including the most common fish in bottom trawls, shortfin eelpout (*Lycodes brevipes*). We did not identify 53 specimens from bottom trawls. Sixteen (30%) of these were snailfish species (*Liparis* sp.) that have not been well described by taxonomists. The remainder were small and/or damaged specimens that could not be identified by us or the experts that we consulted. Undamaged specimens that could not be positively identified were retained as part of the voucher collection. Cumulative numbers of species detected in well-sampled strata (i.e., waters deeper than 70 m) during 2001 are presented in Fig. 4.

Beach seines

We set beach seines at six sites in Dundas Bay, which represents 20% of our goal for outer waters in Glacier Bay National Park and Preserve. We caught 248 fish in seines, and identified 12 species (Table 3). One of these species was previously undocumented in the Park.

Klondike Goldrush and Sitka Historical Parks

Proposed sampling goals were exceeded for both parks in 2001. Beach seines were conducted at four sites (n = 34 sets) in Klondike Goldrush and two sites (n = 12 sets) in Sitka Park. Data on relative abundance of fishes in these seines are currently being compiled. We identified 25 species in Sitka Park (Table 4). Twenty one of these (84%) were previously undocumented in the park. Ten species were documented in

Klondike Goldrush, and eight of these were previously undocumented (Table 5). Such high proportions of previously undocumented taxa underscore the extreme paucity of current knowledge about fish populations in these parks.

RECOMMENDATIONS FOR 2002

Bottom trawling

Bottom habitat in waters less than 70 m deep is generally found in small, obstructed areas at the sides of deep fiords of Glacier Bay. We found that the M/V *Steller* was too large to make sets in this habitat. We therefore plan to trawl from a 9.5 m boat in Glacier Bay proper during 2002. Most nearshore demersal fishes in Alaska migrate to shallow habitats during early summer (Abookire *et al*. 2000), and we recommend that bottom trawling in Glacier Bay start no earlier than 1 July so that sampling will coincide with the seasonal peak in fish abundance.

Fyke nets, gill nets and longlines

These gear types were identified as potential sampling tools in the original proposal for this inventory. In one case (longlines), considerable sampling has already been conducted in Glacier Bay by other U.S. Geological Survey researchers, and we intend to compile records from their studies in our review of existing information. We recommend that fyke nets and gill nets not be used in 2002. Application of new methods will require a significant amount of time and effort that could be better expended on completing the survey with proven methods that continue to collect new and undocumented species (right up to our final trawls in 2001).

ACKNOWLEDGEMENTS

We are grateful to Mary Beth Moss for help in planning this project, supplemental funding, and logistic support while in the park. Our thanks also go to captain Dan Foley of the M/V *Steller* and crew John Rock and Denali Foley, to Lewis Sharman for planning assistance and support, to Gary Drew for map making assistance, to Eric Knudsen for comments on an earlier draft of this report, to Amber Bethe, Elaine Furbish, Jon Piatt, and Tim Piazza for help with field work, to Bruce Wing and Kitti Mecklenburg for assistance with fish identification, and to Elizabeth Hooge, Philip Hooge, Chad Soiseth and Jim Taggart for their assistance and logistical support in Juneau and Glacier Bay. Our thanks to Eric Knudsen, Chad Soiseth and Sara Persselin for helpful criticism of earlier drafts of this report.

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Table 1. Fishes caught in midwater trawls in Glacier Bay, Cross Sound and Icy Strait during summer 2001. Species in bold are previously undocumented in the park, but listed as "expected" in Alaska Natural Heritage Program review (Lenz *et al.* 2002). Species underlined and in bold was undocumented and not listed as "expected".

	Common name	Scientific name	Number caught
Identified specimens	Capelin	*Mallotus villosus*	7896
	Walleye pollock	*Theragra chalcogramma*	4350
	Pacific herring	*Clupea pallasii*	2586
	Northern lampfish	*Stenobrachius leucopsarus*	2328
	Northern smoothtongue	*Leuroglossus stilbius*	1209
	Pacific sandfish	*Trichodon trichodon*	456
	Longsnout prickleback	*Lumpenella longirostris*	40
	Prickly snailfish	*Paraliparis deani*	23
	Smalldisk snailfish	*Careproctus gilberti*	15
	Eulachon	*Thaleicthys pacificus*	14
	Darkfin sculpin	*Malacocottus zonurus*	12
	Soft sculpin	*Psychrolutes sigalutes*	5
	Pink salmon	*Oncorhynchus gorbuscha*	5
	Arrowtooth flounder	*Reinhardtius stomias*	4
	Pacific sand lance	*Ammodytes hexapterus*	4
	Rex sole	*Glyptocephalus zachirus*	4
	Spinyhead sculpin	*Dasycottus setiger*	4
	Daubed shanny	*Leptoclinus maculatus*	3
	Flathead sole	*Hippoglossoides elassodon*	3
	Rougheye rockfish	*Sebastes aleutianus*	3
	Stout eelblenny	*Anisarchus medius*	3
	California headlightfish	*Diaphus theta*	2
	Gray starsnout	*Bathyagonus alascanus*	2
	Pacific spiny lumpsucker	*Eumicrotremus orbis*	2
	Snake prickleback	*Lumpenus sagitta*	2
	Crested sculpin	*Blepsias bilobus*	1
	English sole	*Parophrys vetulus*	1
	Pacific hake	*Merluccius productus*	1
	Tadpole sculpin	*Psychrolutes paradoxus*	1
	Vermillion rockfish	*Sebastes miniatus*	1
	Wattled eelpout	*Lycodes palearis*	1
Unidentified specimens	Unid larval fish	Osmeridae, Clupeidae, Stichaeidae	8435
	Unid eelpout	*Lycodapus* sp.	326
	Unid snailfish	Cyclopteridae	16
	Unid prickleback	*Lumpenus* sp.	9
	Unid larval poacher	Agonidae	9
	Unid round fish		3
	Unid flatfish	Pleuronectiformes	2
	Unid larval sculpin	Cottidae	1
	Total catch		27782

Table 2. Fishes caught in bottom trawls in Glacier Bay, summer 2001. Species listed in bold were previously undocumented in the park (Lenz *et al.* 2002).

Identified specimens			Unidentified specimens		
Common name	Scientific name	Number caught	Common name	Scientific name	Number caught
Shortfin eelpout	*Lycodes brevipes*	127	Unid snailfish	*Liparis* sp.	16
Rex sole	*Glyptocephalus zachirus*	110	Unid round fish		12
Spinyhead sculpin	*Dasycottus setiger*	96	Unid eelpouts	Zoarcidae	7
Longsnout prickleback	*Lumpenella longirostris*	90	Unid poacher	Agonidae	6
Gray starsnout	*Bathyagonus alascanus*	62	Unid larval fish		3
Stout eelblenny	*Anisarchus medius*	48	Unid larval smelts	Osmeridae	3
Flathead sole	*Hippoglossoides elassodon*	30	Unid skates	*Bathyraja* sp.	3
Capelin	*Mallotus villosus*	29	Unid flatfish	Pleuronectiformes	2
Rock sole	*Lepidopsetta bilineata*	24	Unid rockfish	*Sebastes* sp.	1
Prickly snailfish	*Paraliparis deani*	22			
Walleye pollock	*Theragra chalcogramma*	20	Total catch		864
Slender sole	*Lyopsetta exilis*	17			
Dover sole	*Microstomus pacificus*	15			
Sturgeon poacher	*Podothecus acipenserinus*	13			
Wattled eelpout	*Lycodes palearis*	10			
Northern lampfish	*Stenobrachius leucopsarus*	10			
Pacific spiny lumpsucker	*Eumicrotremus orbis*	9			
Thorny sculpin	*Icelus spiniger*	9			
Blackmouth eelpout	*Lycodapus fierasfer*	8			
Blackfin poacher	*Bathyagonus nigripinnis*	7			
Northern smoothtongue	*Leuroglossus stilbius*	7			
Sandpaper skate	*Bathyraja interrupta*	6			
Smalldisk snailfish	*Careproctus gilberti*	5			
Northern sculpin	*Icelinus borealis*	5			
Arrowtooth flounder	*Reinhardtius stomias*	5			
Armorhead sculpin	*Gymnocanthus galeatus*	4			
Daubed shanny	*Leptoclinus maculatus*	2			
Yellowfin sole	*Limanda aspera*	2			
Marbled snailfish	*Liparis dennyi*	2			
Blackfin sculpin	*Malacocottus kincaidi*	2			
Whitebarred prickleback	*Poroclinus rothrocki*	2			
Northern ronquil	*Ronquilus jordani*	2			
Ribbed sculpin	*Triglops pingelii*	2			
Smooth alligatorfish	*Anoplagonus inermis*	1			
Bigeye poacher	*Bathyagonus pentacanthus*	1			
Searcher	*Bathymaster signatus*	1			
Decorated warbonnet	*Chirolophis decoratus*	1			
Showy snailfish	*Liparis pulchellus*	1			
Snake prickleback	*Lumpenus sagitta*	1			
Longnose skate	*Raja rhina*	1			
Sawback poacher	*Sarritor frenatus*	1			
Eulachon	*Thaleicthys pacificus*	1			

Table 3. Fishes caught in beach seines in Dundas Bay, summer 2001. Species in bold is previously undocumented in the Park (Lenz *et al.* 2002).

Common name	Scientific name	Number caught
Capelin	*Mallotus villosus*	195
Red salmon	*Oncorhynchus nerka*	18
Pink salmon	*Oncorhynchus gorbushca*	8
Pacific herring	*Clupea pallasi*	6
Great sculpin	*Myoxocephalus polyacanthocephalus*	6
Rock greenling	*Hexagrammos lagocephalus*	5
Crescent gunnel	*Pholis laeta*	2
Rock sole	*Pleuronectes bilineatus*	2
Unid larval fish		2
Pacific staghorn sculpin	*Leptocottus armatus*	1
Starry flounder	*Platichthys stellatus*	1
Tubenose poacher	*Pallasina barbata*	1
Dolly varden	*Salvelinus malma*	1
Total catch		248

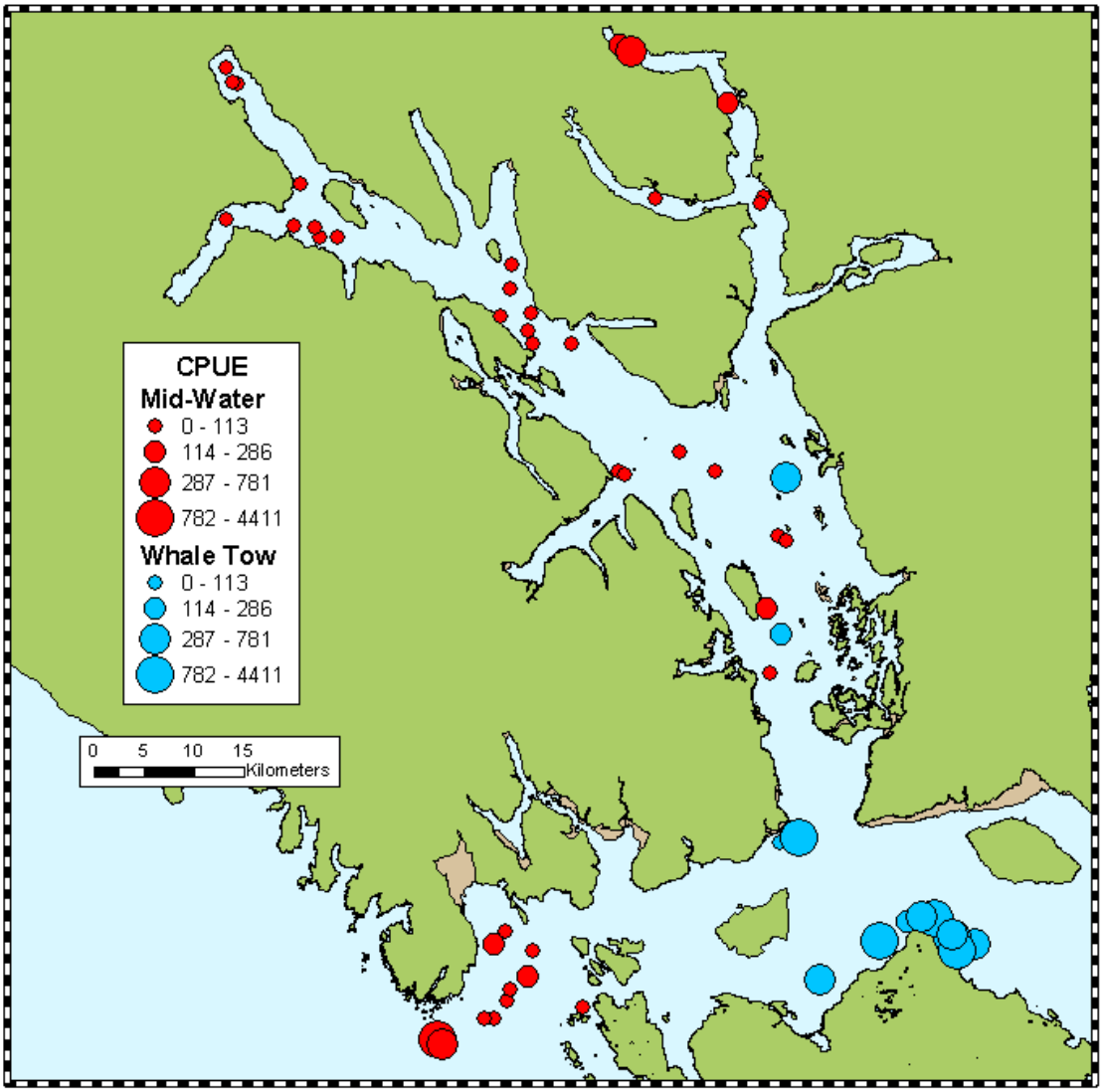
Table 4. Fishes caught in beach seines and minnow traps in Sitka National Historical Park. Species in bold are previously undocumented in the park, but listed as "expected" in Alaska Natural Heritage Program review (Lenz *et al.* 2002). Species underlined and in bold were undocumented and not listed as "expected".

Common name	Scientific name
Penpoint gunnel	*Apodichthys flavidus*
Padded sculpin	*Artedius fenestralis*
Tube-snout	*Aulorhynchus flavidus*
Silverspotted sculpin	*Blepsias cirrhosus*
Shiner perch	*Cymatogaster aggregata*
Buffalo sculpin	*Enophrys bison*
Pacific cod	*Gadus macrocephalus*
Red Irish lord	*Hemilepidotus hemilepidotus*
Rock greenling	*Hexagrammos lagocephalus*
Masked greenling	*Hexagrammos octogrammus*
Whitespotted greenling	*Hexagrammos stelleri*
Pacific staghorn sculpin	*Leptocottus armatus*
Tidepool snailfish	*Liparis florae*
Great sculpin	*Myoxocephalus polyacanthocephalus*
Tidepool sculpin	*Oligocottus maculosus*
Pink salmon	*Oncorhynchus gorbuscha*
Chum salmon	*Oncorhynchus keta*
Coho salmon	*Oncorhynchus kisutch*
Chinook salmon	*Oncorhynchus tshawytscha*
Tubenose poacher	*Pallasina barbata*
Crescent gunnel	*Pholis laeta*
Starry flounder	*Platichthys stellatus*
Cabezon	*Scorpaenichthys marmoratus*
Redstipe rockfish	*Sebastes sp. (proriger?)*
Manacled sculpin	*Synchirus gilli*

Table 5. Fishes caught in beach seines and minnow traps in Klondike Goldrush National Historical Park. Species in bold are previously undocumented in the park, but listed as "expected" in Alaska Natural Heritage Program review (Lenz *et al.* 2002). Species underlined and in bold were undocumented and not listed as "expected".

Common name	Scientific name
High cockscomb	*Anoplarchus purpurescens*
Rock sole	*Lepidopsetta bilineata*
Pacific staghorn sculpin	*Leptocottus armatus*
Great sculpin	*Myoxocephalus polyacanthocephalus*
Chum salmon	*Oncorhynchus keta*
Crescent gunnel	*Pholis laeta*
Saddleback gunnel	*Pholis ornata*
Starry flounder	*Platichthys stellatus*
Dolly vardern	*Salvelinus malma*
Walleye pollock	*Theragra chalcogramma*

Figure 1. Midwater trawl stations in Glacier Bay, Icy Strait and Cross Sound, summer 2001. Catch per unit effort (CPUE) is in units of fish / km towed. "Mid-Water" refers to inventory tows, "Whale Tow" refers to humpback foraging study.



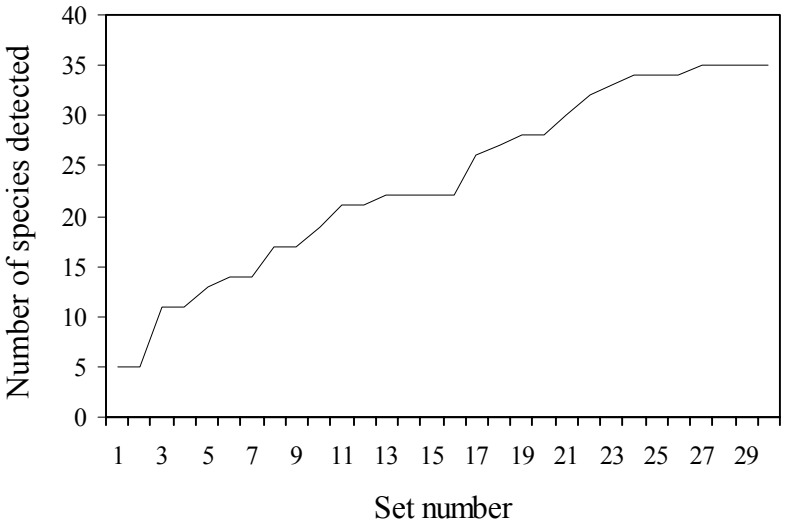
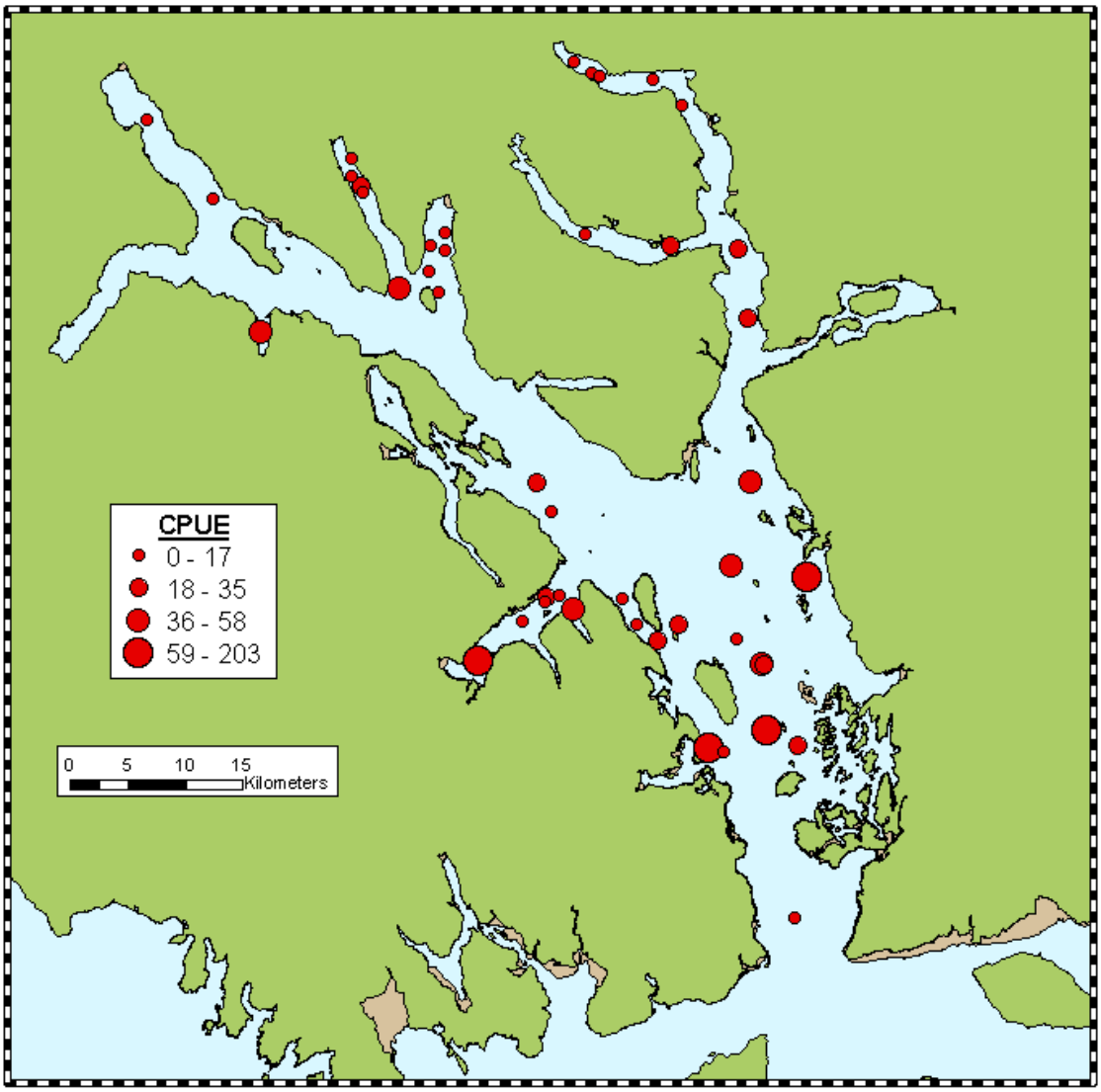


Figure 2. Cumulative number of species detected with midwater trawls set in Glacier Bay proper, summer 2001.

Figure 3. Location of bottom trawls conducted in Glacier Bay during summer 2001. CPUE is in units of fish 1000 m^{-2} towed.



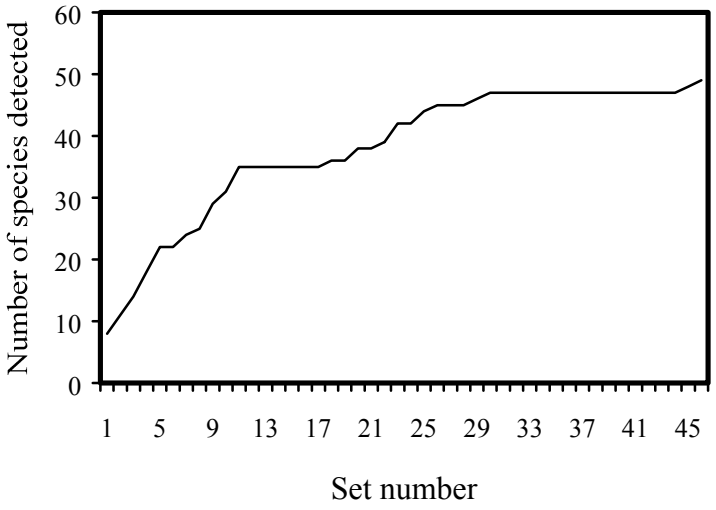


Figure 4. Cumulative number of species detected with bottom trawls in waters > 70m in Glacier Bay proper, summer 2001.