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Inventory of Eelgrass (*Zostera marina*) and Seaweeds at the End of The Lower Alaska Peninsula, August–September 2012

Open-File Report 2021–1034

U.S. Department of the Interior
U.S. Geological Survey

Cover. The U.S. Fish and Wildlife Service vessel, *R/V Arlluk*, used to conduct the survey. Photograph by David Ward, U.S. Geological Survey (public domain).

Inventory of Eelgrass (*Zostera marina*) and Seaweeds at the End of the Alaska Peninsula, August–September 2012

By David H. Ward, Kyle R. Hogrefe, Tyronne F. Donnelly, Neils C. Dau, Orville Lind, Kevin J. Payne, and Sandra C. Lindstrom

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Conversion Factors

U.S. customary units to International System of Units

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)

International System of Units to U.S. customary units

Multiply	By	To obtain
	Length	
meter (m)	3.281	foot (ft)
meter (m)	1.094	yard (yd)
kilometer (km)	0.6214	mile (mi)
kilometer (km)	0.5400	mile, nautical (nmi)
	Area	
square kilometer (km^2)	0.3861	square mile (mi^2)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32$$

Datum

Horizontal coordinate information is referenced to World Geodetic System 1984 (WGS 84), unless otherwise stated.

Inventory of Eelgrass (*Zostera marina*) and Seaweeds at the End of the Alaska Peninsula, August–September 2012

By David H. Ward[1], Kyle R. Hogrefe[1], Tyronne F. Donnelly[1], Neils Dau[2], Orville Lind[3], Kevin Payne[3], and Sandra C. Lindstrom[4]

Abstract

Coastal communities in Alaska are undergoing rapid environmental change from increasing temperatures and baseline data are needed to monitor potential impacts. We conducted the first surveys of the abundance and distribution of eelgrass (*Zostera marina*) and seaweeds in the western part of Izembek National Wildlife Refuge at the end of the Alaska Peninsula. Six embayments and two offshore islands were surveyed in August–September of 2012. Biotic (percent cover of eelgrass/seaweeds, presence/absences of five sessile invertebrates), and abiotic (water temperature, salinity, and depth) data were recorded at 257 survey points (range =9–74 points per site) across all sites. Twenty-two genera/species of seaweeds were identified at the six embayments. New seaweed species for the offshore islands of Sanak and Caton were added to an existing seaweed collection accessioned at the University of British Columbia Herbarium. We also collected samples of eelgrass to be accessioned at U.S. Geological Survey, Alaska Science Center-Molecular Ecology Laboratory, for future genetic analyses. Fifty-three species of birds and 13 species of mammals were observed and recorded during the survey period.

Introduction

Increasing temperature and precipitation patterns are changing environmental conditions for the plants and animals of southwest Alaska (Stafford and others, 2000). These changes have been associated with declines in the extent and duration of winter sea ice and shifts in winter ranges of avian species (Ward and others, 2009; Petrich and others, 2014). We conducted baseline surveys to characterize the abundance, distribution, and health of eelgrass (*Zostera marina*) adjacent to Izembek National Wildlife Refuge (INWR). Eelgrass is a dominant marine macrophyte of shallow water embayments of this region, providing critical ecosystem services, food, and shelter to a wide variety of marine and terrestrial animals (McRoy, 1966, 1968, 1970; Barsdate and others, 1974; Ward and others, 2022a, 2022b). Previously, eelgrass surveys have

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been conducted in the eastern part of the refuge in Izembek and Kinzarof lagoons and Cold Bay (Ward and others, 2022b). No eelgrass surveys have occurred in the western part of INWR because of accessibility and logistical constraints. In August–September of 2012, we conducted a one-time boat survey in six embayments adjacent to INWR and along two offshore islands at the end of the Alaska Peninsula. The goal was to assess the abundance and distribution of eelgrass and seaweeds. We also recorded the presence and absence of five relatively sessile invertebrates: mussels (*Mytilus* spp.), sponges, sea stars (*Pisaster* and *Evasterias* spp.), gastropods, and *Telmessus* sp. crabs (fig. 1; see Ward and others, 2022a for details on methods). The primary interest was surveying Big Lagoon, Middle Lagoon, Hook Lagoon and Sanak/Caton islands because these sites were key stopover, staging and wintering sites for a variety of waterfowl and shorebird species and preliminary analysis of satellite imagery indicated that they also contain extensive beds of intertidal eelgrass. The boat survey was part of a more comprehensive project that aimed to inventory and monitor eelgrass in southwest Alaska (Ward and others, 2022a, 2022b). Here we present the accomplishments relative to the objectives of the boat survey.

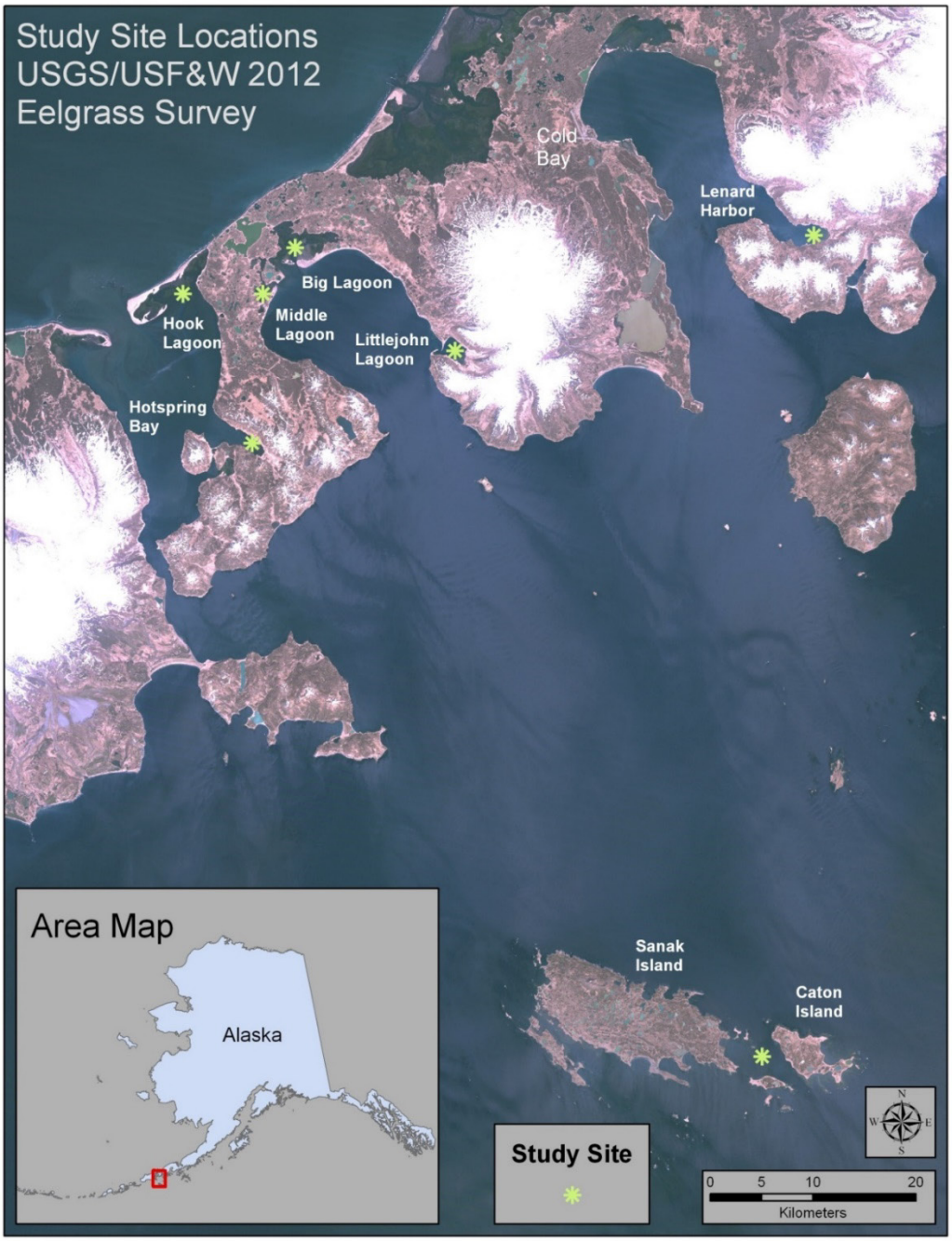

Figure 1. Locations of the six embayments and two offshore islands surveyed to assess the abundance and distribution of eelgrass (*Zostera marina*), seaweeds and five sessile invertebrates, at the end of the Alaska Peninsula, Alaska, 2012.

Objectives

There were six main objectives during the boat survey and they were to:

1. Conduct initial baseline surveys to estimate abundance and distribution of eelgrass in six embayments and along two islands at the end of the Alaska Peninsula.
2. Obtain spatial data on eelgrass abundance that can be used to ground-truth preliminary maps of eelgrass spatial extent derived from satellite imagery.
3. Collect eelgrass samples to characterize the genetic variability and population structure within and between eelgrass populations of the Alaska Peninsula.
4. Identify and assess abundance and distribution of macroalgae (henceforth, seaweeds) and five sessile macroinvertebrates associated with eelgrass beds.
5. Collect baseline environmental information, such as substrate type, and water temperature, salinity, clarity, and depth that are known to influence eelgrass abundance and distribution.
6. Identify and record observations of birds and mammals during the survey.

Accomplishments

1. The abundance and distribution of eelgrass were examined at the four high-interest eelgrass sites (Big, Middle, and Hook Lagoons, and Sanak/Caton Islands) and three additional sites (Littlejohn Lagoon, Hotspring Bay, and Lenard Harbor) during the 20-day survey (19 August–7 September 2012). We collected biotic and abiotic data at 257 survey points (range =9–74 points per site) across the seven sites (figs. 2 and 3). Strong winds cut short our sampling time at four sites: Hook Lagoon, Sanak/Caton Islands, Middle Lagoon, and Hotspring Bay. Nevertheless, we were able to acquire an adequate baseline dataset to assess the status and health of the eelgrass canopy in these four under-surveyed embayments (see Hogrefe and others, 2014).

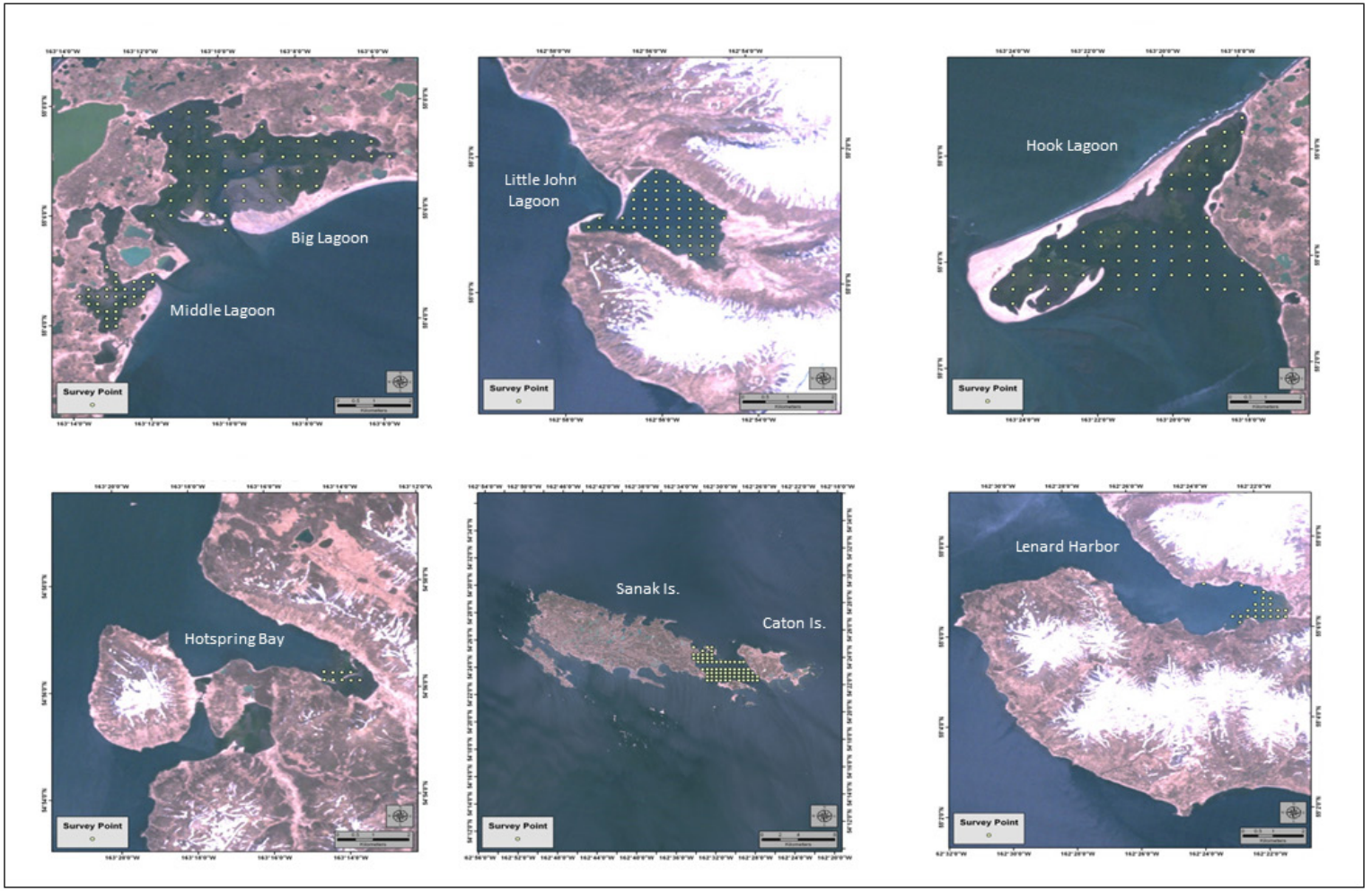

Figure 2. The distribution of surveyed points at six embayments and two offshore islands at the end of the Alaska Peninsula, Alaska, August–September 2012.

Figure 3. The 0.25 square meter sampling quadrat (left) in a dense bed of eelgrass. Eelgrass (*Zostera marina*) beds were assessed by snorkeling in dry suits at high tide. Shoot densities were high in some eelgrass beds; for example, in Hook Lagoon (right), Alaska.

2. We determined eelgrass/seaweed cover within a 20-m diameter circle around 345 points (range =9–78 points per site) and along seven additional transects in Lenard Harbor that can be used to ground-truth existing maps of eelgrass extent in Big, Middle and Hook lagoons (fig. 4; Ward, 2022). This newly acquired data can also be used to assist in the creation of new maps of eelgrass extent in Littlejohn Lagoon, Lenard Harbor and along Sanak/Caton Islands. Field survey data indicated that eelgrass extended farther into Middle Lagoon, and lower into the subtidal zone of Hook Lagoon and Sanak/Caton Islands than previous aerial views had suggested, thereby expanding preliminary estimates of eelgrass spatial extent at these sites.

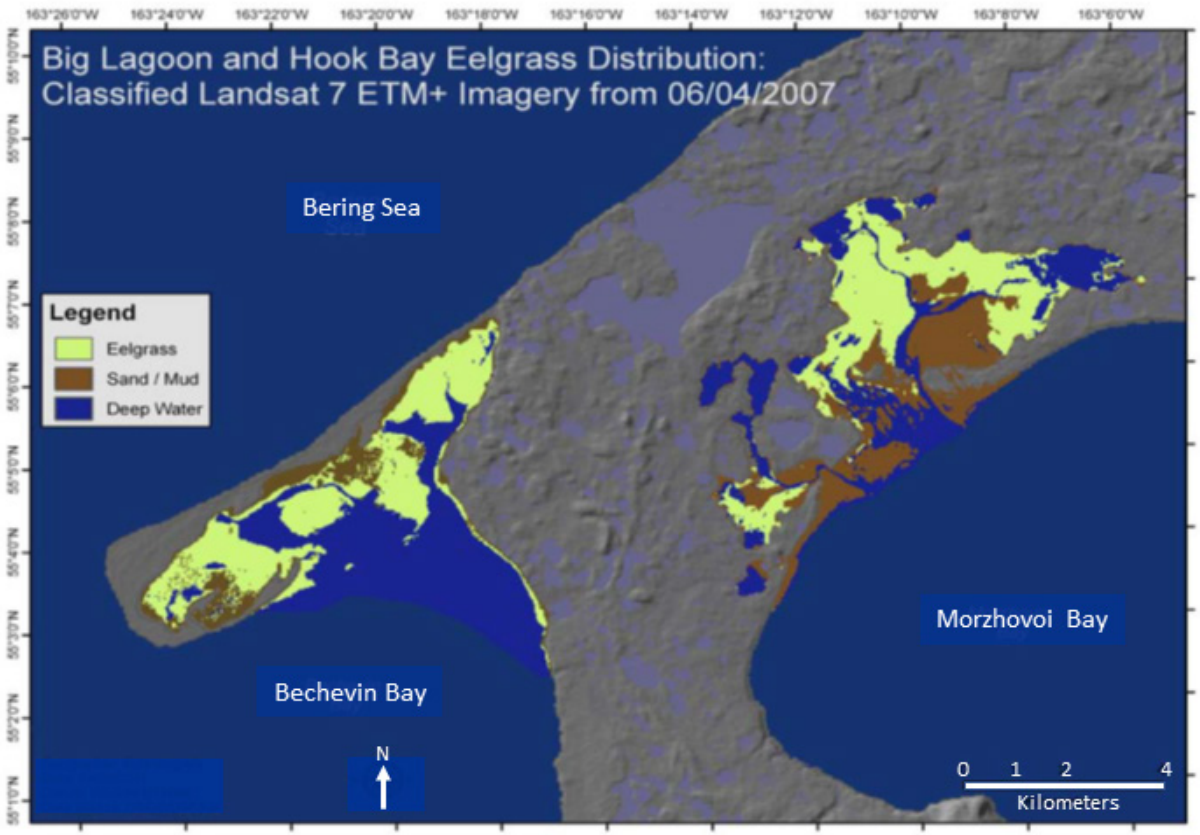

Figure 4. Eelgrass (*Zostera marina*) spatial extent in Big and Middle Lagoons in Morzhovo Bay (see fig. 1) and Hook Lagoon in Bechevin Lagoon, Alaska. Image based on Landsat imagery and field data from boat survey.

3. We collected samples of eelgrass for genetic analyses at three embayments: Big Lagoon along four transects, Hook Lagoon along three transects, and Sanak Island along one transect (Ward, 2022). These samples were accessioned to an existing library of genetic information held at the U.S. Geological Survey, Alaska Science Center-Molecular Ecology Laboratory, for future analyses of eelgrass population structure and genetic variability among and within coastal communities in Alaska. Previous genetic sampling of eelgrass on the Alaska Peninsula occurred at Izembek Lagoon, Kinzarof Lagoon, St. Catherine Cove, Chignik Lagoon, Wide Bay, and Sand Point (Talbot and others, 2016).
4. The abundance and distribution of seaweeds were assessed at the seven surveyed sites (see Hogrefe and others, 2014, for details on methods and a summary of results). We also identified seaweeds to genera, and when possible, to species at the six embayments (table 1.1). A more detailed assessment of macroalgae was made along the rocky coastline of Sanak/Caton islands, expanding the University of British Columbia Herbarium collection of seaweeds found on these islands during past expeditions (fig. 5; table 1.2).
5. We recorded animals observed at each site and during travel between sites (table 1.3). The list included 53 species of birds and 13 species of mammals.

Figure 5. Rack line of drift *Ahnfeltia fastigiata*.seaweed along the rocky shoreline of Sanak Island, Alaska.

References Cited

Barsdate, R.J., Nebert, M., and McRoy, C.P., 1974, Lagoon contributions to sediment and water of the Bering Sea, *in*, Hodd, D.W., and Kelly, E.J., eds., Oceanography of the Bering Sea: Fairbanks, Alaska, Institute of Marine Science Occasional Publication No. 3, University of Alaska, p. 553–576.

Guiry, M.D., and Guiry, G.M., 2020, AlgaeBase—World-wide electronic publication: Galway, National University of Ireland, accessed March 23, 2020, at https://www.algaebase.org.

Hogrefe, K.R., Ward, D.H., Donnelly, T.F., and Dau, N., 2014, Establishing a baseline for regional scale monitoring of eelgrass (*Zostera marina*) habitat on the lower Alaska Peninsula: Remote Sensing, v. 6, no. 12, p. 12447–1277.

McRoy, C.P, 1966, Standing stocks and ecology of eelgrass (*Zostera marina*) at Izembek Lagoon, Alaska: Seattle, University of Washington, Master's thesis, 138 p.

McRoy, C.P, 1968, The distribution and biogeography of *Zostera marina* (eelgrass) in Alaska: Pacific Science, v. 22, p. 507–513.

McRoy, C.P, 1970, On the biology of eelgrass, *Zostera marina*, Izembek Lagoon, Alaska: University of Alaska, Fairbanks, Ph.D. dissertation, 156 p.

Petrich, C., Tivy, A.C., and Ward, D.H., 2014, Reconstruction of historic sea ice conditions in a sub-Arctic lagoon: Cold Regions Science and Technology, v. 98, p. 55–62.

Stafford, J. M., Wendler, G. and Curtis, J., 2000, Temperature and precipitation of Alaska—50 year trend analysis: Theoretical Applied Climatology, v. 67, p. 33–44.

Talbot, S.L., Sage, G.K., Rearick, J.R., Fowler, M.C., Muñiz-Salazar, R., Baibak, B., Wyllie-Echeverria, S., Cabello-Pasini, A., and Ward, D.H., 2016, The structure of genetic diversity in eelgrass (*Zostera marina L.*) along the North Pacific and Bering Sea Coasts of Alaska: PLoS ONE, v. 11, no. 4, 31 p., https://doi.org/10.1371/journal.pone.0152701.

Ward, D.H. 2022, Point sampling data from eelgrass (*Zostera marina*), seaweeds and selected invertebrates at six embayments and two islands at the end of the Alaska Peninsula: U.S. Geological Survey data release, https://doi.org/10.5066/P9K1ZOMY.

Ward, D.H., Dau, C.P., Tibbitts, T.L., Sedinger, J.S., Anderson, B.A., and Hines, J.E., 2009, Change in abundance of Pacific brant wintering in Alaska: evidence of a climate warming effect? Arctic, v. 62, no. 3, p. 301–311.

Ward, D.H., Hogrefe, K.R., Donnelly, T.F., Fairchild, L., and Britton, R., 2022a, Eelgrass (*Zostera marina*) and seaweed assessments at Alaska Peninsula-Becharof National Wildlife Refuge, 2010: U.S. Geological Survey Open-File Report 2020–1144, 14 p., https://doi.org/10.3133/ofr20201144.

Ward, D.H., Hogrefe, K.R., Donnelly,T.F., Fairchild, L.L., Sowl, K.M., and Lindstrom, S.C., 2022b, Abundance and distribution of eelgrass (*Zostera marina*) and seaweeds at Izembek National Wildlife Refuge, Alaska, 2007–10: U.S. Geological Survey Open-File Report 2020–1035, 30 p., https://doi.org/10.3133/ofr20201035.

Appendix 1. Species Lists

Table 1.1. Seaweed genera and species identified on sample points at the six embayments surveyed, August–September 2012, end of the Alaska Peninsula, Alaska. Seaweed taxonomy is based on Guiry and Guiry (2020).

[Phylum: C, Chlorophyta; O, Ochrophyta; R, Rhodophyta. Embayments: —, not present; X, present]

No.	Phylum	Genus	Species	Embayments					
				Big Lagoon	Middle Lagoon	Little John Lagoon	Hook Bay	Hotspring Bay	Lenard Harbor
1	R	*Ahnfeltia*	*fastigiata*	X	—	—	X	X	—
2	O	*Alaria*	*marginata*	X	X	X	—	—	—
3	C	*Acrosiphonia*	sp.	X	—	X	X	—	X
4	R	*Ceramium*	*pacificum*	X	—	—	—	—	—
5	C	*Chaetomorpha*	spp.	X	X	X	X	X	—
6	O	*Chorda*	*borealis*	X	X	X	X	—	—
7	O	*Chordaria*	*flagelliformis*	X	X	X	X	—	X
8	C	*Cladophora*	*sericea*	X	X	X	X	X	X
9	O	*Desmarestia*	*viridis*	X	X	X	—	—	—
10	O	*Devaleraea*	*firma*	—	X	—	—	—	—
11	O	*Dictyosiphon*	*tenuis*	X	—	X	—	—	—
12	O	*Eudesme*	*borealis*	X	X	X	X	X	X
13	O	*Fucus*	*distichus*	X	X	X	X	X	X
14	O	*Hildenbrandia*	sp.	X	—	—	—	—	—
15	O	*Leathesia*	*marina*	—	—	X	X	—	—
16	R	*Melanothamnus*	*akkeshiensis*	X	—	—	—	—	—
17	R	*Neorhodomela*	spp.	X	X	X	—	X	X
18	R	*Petalonia*	*fascia*	—	—	—	—	—	X
19	R	*Pylaiella*	sp.	—	—	—	—	—	X
20	R	*Saccharina*	*latissima*	X	—	X	—	—	—
21	R	*Soranthera*	*ulvoidea*	—	X	—	—	—	—
22	R	Savoiea	bipinnata	X	—	—	—	—	—
23	O	*Sphaerotrichia*	*divaricata*	X	—	—	—	—	—
24	C	*Ulva*	*fenestrata*	X	—	X	X	—	—

Table 1.2. Seaweed genera/species recorded at Sanak/Caton islands during the 2012 survey and collected in prior years (1966, 2004, 2006, and 2007), end of the Alaska Peninsula, Alaska. All collections are accessioned at the University of British Columbia herbarium.

[Species in **bold** type indicate a new record. Category: Seaweed taxonomy is based on Guiry and Guiry (2020). /, seen but not collected in 2012; *, specimen collected and accessioned; C, Chlorophyta; O, Ochrophyta; R, Rhodophyta. See Ward, 2022]

No.	Category	Phylum	Genus	Species	No.	Category	Phylum	Genus	Species
1	/	O	*Agarum*	*clathratum*	71	*	R	*Bossiella*	*frondescens*
2		O	*Alaria*	*marginata*	**72**	*	**R**	***Bossiella***	***manzae***
3	*	O	*Analipus*	*japonicus*	**73**	*	**R**	***Callithamnion***	***pikeanum***
4	/	O	*Chorda*	*borealis*	74	*	R	*Ceramium*	*pacificum*
5	*	O	*Chordaria*	*flagelliformis*	75	*	R	*Clathromorphum*	*circumscriptum*
6	*	O	*Chordaria*	*gracilis*	**76**	*	**R**	***Clathromorphum***	**undescribed**
7		O	*Coilodesme*	*bulligera*	77		R	*Constantinea*	*rosa-marina*
8		O	*Coilodesme*	*californica*	78	/	R	*Constantinea*	*subulifera*
9		O	*Coilodesme*	*fucicola*	**79**	*	**R**	***Corallina***	***arbuscula***
10		O	*Colpomenia*	*peregrina*	80	*	R	*Corallina*	*officinalis*
11	*	**O**	***Compsonema***	***serpens?***	81	*	R	*Corallina*	*vancouveriensis*
12		O	*Costaria*	*costata*	82	/	R	*Cryptosiphonia*	*woodii*
13		**O**	*Dactylosiphon*	*bullosus*	83	*	R	*Devaleraea*	*callophylloides*
14	/	O	*Desmarestia*	*aculeata*	84	*	R	*Devaleraea*	*mollis*
15		O	*Desmarestia*	*viridis*	85		R	*Dilsea*	*californica*?
16	*	O	*Dictyosiphon*	*tenuis*	86	*	R	*Dumontia*	*alaskana*
17	*	**O**	***Ectocarpus***	***siliculosus***	87	*	R	*Endocladia*	*muricata*
18	*	**O**	***Elachista***	***fucicola***	88	/	R	*Gloiopeltis*	*furcata*
19	/	O	*Eualaria*	*fistulosa*	89	*	R	*Halosaccion*	*glandiforme*
20	/	O	*Eudesme*	*borealis*	**90**	*	**R**	***Halosaccion***	**undescribed**
21	*	O	*Fucus*	*distichus*	**91**	*	**R**	***Hildenbrandia***	***rubra***
22	/	O	*Hedophyllum*	*nigripes*	92	*	R	*Holmesia*	sp.
23	*	O	*Hedophyllum*	*sessile*	**93**	*	**R**	**Hymenena**	***ruthenica***
24	*	O	*Laminaria*	*longipes*	94		R	Lithothamnion	*pacificum*
25		O	*Laminaria*	*yezoensis*	**95**	*	**R**	**Lithothamnion**	**sp.**
26	*	O	*Leathesia*	*marina* [as *L. difformis*]	96	*	R	Mastocarpus	*alaskensis*
27	/	O	*Melanosiphon*	*intestinalis*	97	*	R	*Mastocarpus*	*pacificus*
28	/	O	*Nereocystis*	*luetkeana*	98	*	R	*Mazzaella*	*parksii*
29	*	O	*Petalonia*	*fascia*	99	*	R	*Mazzaella*	*phyllocarpa*
30	*	**O**	***Pleurophycus***	***gardneri***	100	*	R	*Mazzaella*	*parvula*
31		O	*Punctaria*	*latifolia*	**101**	*	**R**	***Membranoptera***	***spinulosa***
32		O	*Punctaria*	*lobata*	102		R	*Mesophyllum*	*conchatum*

33	*	O	*Pylaiella*	*littoralis*	103	*	R	*Microcladia*	*borealis*
No.	**Category**	**Phylum**	**Genus**	**Species**	**No.**	**Category**	**Phylum**	**Genus**	**Species**
34	*	O	*Ralfsia*	*fungiformis*	104	*	R	*Neodilsea*	*borealis*
35		O	*Saccharina*	*latissima*	105		R	*Neohypophyllum*	*middendorfii*
36	*	**O**	***Saundersella***	***simplex***	106		R	*Neopolyporolithon*	*arcticum*
37		O	*Scytosiphon*	*dotyi*	107	*	R	*Neopolyporolithon*	*reclinatum*
38	*	O	*Soranthera*	*ulvoidea*	108		R	*Neoporphyra*	*perforata*
39	/	O	*Stephanocystis*	*geminata*	109	*	R	*Neorhodomela*	*aculeata*
40	/	O	*Thalassiophyllum*	*clathrus*	110	*	R	*Neorhodomela*	*larix*
41	*	C	*Acrosiphonia*	*arcta*	**111**	/	**R**	***Neorhodomela***	***oregona***
42		C	*Acrosiphonia*	*coalita*	112	*	R	*Odonthalia*	*floccosa*
43		C	*Acrosiphonia*	*duriuscula*	**113**	*	**R**	***Odonthalia***	***floccosa f. comosa***
44	*	**C**	***Acrosiphonia***	**sp. [undescribed]**	114	*	R	*Palmaria*	*hecatensis*
45		C	*Blidingia*	*chaudefaudii*	**115**	*	**R**	***Palmaria***	**undescribed**
46		C	*Blidingia*	*marginata*	116		R	*Pantoneura*	*juergensii*
47	/	C	*Blidingia*	*minima*	117		R	*Peyssonnelia*	*pacifica*
48	/	C	*Chaetomorpha*	*cannabina*	118	*	R	*Phycodrys*	*fimbriata*
49		C	*Chaetomorpha*	*melagonium*	**119**	*	**R**	***Polysiphonia***	***hendryi***
50	*	**C**	***Chaetomorpha***	***picquotiana***	120	*	R	*Polysiphonia*	*pacifica*
51	*	C	*Cladophora*	*sericea*	121		R	*Polysiphonia*	*senticulosa*
52		C	*Kornmannia*	*leptoderma*	122	/	R	*Ptilota*	*asplenioides*
53		C	*Monostroma*	*grevillei*	123		R	*Ptilota*	sp.
54	*	C	*Prasiola*	*borealis*	124		R	*Pyropia*	*abbottiae*
55	*	**C**	***Prasiola***	***meridionalis***	125		R	*Pyropia*	*nereocystis*
56		**C**	*Pseudothrix*	*borealis*	**126**	*	**R**	***Pyropia***	**undescribed**
57	*	**C**	***Rosenvingiella***	***polyrhiza***	**127**	*	**R**	***Pyropia***	***pseudolanceolata***
58	*	C	*Spongomorpha*	*aeruginosa*	128		R	*Rhodomela*	*tenuissima*
59	*	C	*Ulva*	*fenestrata*	129	*	R	*Savoiea*	*bipinnata*
60	*	C	*Ulva*	*intestinalis*	**130**	*	**R**	***Scagelia***	***occidentale***
61	*	C	*Ulva*	*prolifera*	131		R	*Schizymenia*	*pacifica*
62	*	**C**	***Ulva***	**undescribed**	132		R	*Smithora*	*naiadum*
63		C	*Ulvaria*	*obscura* var. *blyttii*	133	/	R	*Sparlingia*	*pertusa*
64		C	*Urospora*	sp.	134		R	*Stenogramma*	sp.
65	*	R	*Ahnfeltia*	*fastigiata*	135	*	R	*Tokidadendron*	*bullatum*
66	*	R	*Antithamnionella*	*pacifica*	136		R	*Turnerella*	*mertensiana*
67		R	*Bangia*	sp.	137	*	R	*Wildemania*	*norrisii*
68	*	R	*Boreophyllum* [as *Porphyra*)	*aestivalis*	138		R	*Wildemania*	*variegata*
69	*	**R**	***Boreophyllum***	***ambiguum***					
70		R	*Bossiella*	*chiloensis*					

Table 1.3. Avian and mammalian observations at each site and travel between sites, August–September 2012, end of the Alaska Peninsula, Alaska.

[Avian breeding codes (S, singing male; Y, downy or recently fledged young detected with breeding evidence; X, detected with no evidence of breeding); ?, not sure of the species; abundance code (A, abundant [>25 birds/day]; C; common [5–25 birds/day]; U, uncommon [0–4 birds/day]); Mammalian (V, visual; T, tracks; S, scat)]

Type	Common name	Genus	Species	Morzhovoii Bay (August 19–23)	Bechevin Bay (August 25–28)	Sanak-Caton Islands (August 31–September 3)	Lenard Harbor (Sepember 7)
A	Brant	*Branta*	*bernicla nigricans*	—	X-C	—	—
A	Tundra Swan	*Cygnus*	*columbianus*	—	—	Y	—
A	Northern Pintail	*Anus*	*acuta*	X-U	—	X-C	—
A	Harlequin Duck	*Histrionicus*	*histrionicus*	—	—	X-C	—
A	Black Scoter	*Melanitta*	*nigra*	—	—	—	X
A	Red-breasted Merganser	*Mergus*	*serrator*	X-A	—	X-U	—
A	Rock Ptarmigan	*Lagopus*	*muta*	—	—	X-C	—
A	Common Loon	*Gavia*	*immer*	X-U	—	X-C	—
A	Pacific/Common Loon	*Gavia*	*pacifica/immer*	—	—	—	—
A	Northern Fulmar	*Fulmaris*	*glacialis*	—	—	?	—
A	Sooty/Short-tailed Shearwater	*Puffinus*	*griseus/tenuirostris*	—	—	X	—
A	Fork-tailed Storm Petrel	*Oceanodroma*	*furcata*	—	—	X	—
A	Leach's Storm Petrel	*Oceanodroma*	*leucorhoa*	—	—	X	—
A	Double Crested Cormorant	*Phalacrocorax*	*auritus*	X-U	—	X	—
A	Red-faced Cormorant	*Phalacrocorax*	*urile*	X-U	—	X	—
A	Pelagic Cormorant	*Phalacrocorax*	*pelagicus*	X-U	—	—	—
A	Red-faced/Pelagic Cormorant	*Phalacrocorax*	*urile/pelagicus*	—	—	—	—
A	Rough-legged Hawk	*Buteo*	*lagopus*	X-U	—	?	—
A	Bald Eagle	*Hailiaeetus*	*lecucocephalus*	—	—	X-U	—
A	Peregrine Falcon	*Falco*	*peregrinus*	—	—	X-U	—
A	Sandhill Crane	*Grus*	*canadensis*	—	—	Y-U	—
A	Black Oystercatcher	*Haematopus*	*bachmani*	—	—	X-U	—
A	Semipalmated Plover	*Calidris*	*mauri*	X-U	—	X-C	—
A	Greater Yellowlegs	*Tringa*	*melanoleuca*	X-U	—	—	—
A	Whimbrel	*Neumenius*	*phaeopus*	—	—	—	—
A	Black Turnstone	*Arenaria*	*melancephala*	X-U	—	X-U	—
A	Ruddy Turnstone	*Arenaria*	*interpres*	—	—	—	—
A	Rock Sandpiper	*Calidris*	*ptilocnemis*	X-A	X-U	X-U	—
A	Dunlin	*Calidris*	*alpina*	X-U	—	X-U	—
A	Sharp-tailed Sandpiper	*Calidris*	*acuminata*	—	—	—	—
A	Black-legged Kittiwake	*Rissa*	*tridactyla*	X-U	X-A	X-U	—
A	Glaucous-winged Gull	*Larus*	*glaucescens*	X-A	—	X-C	—

Type	Common name	Genus	Species	Morzhovoii Bay (August 19–23)	Bechevin Bay (August 25–28)	Sanak-Caton Islands (August 31–September 3)	Lenard Harbor (Sepember 7)
A	Arctic Tern	*Sterna*	*paradisaea*	—	—	X-A	—
A	Parasitic Jaeger	*Stercorarius*	*parasiticus*	—	—	X-U	—
A	Marbled Murrelet	*Brachyramphus*	*marmoratus*	—	—	X-U	—
A	Parakeet Auklet	*Aethia*	*psittacula*	—	—	X-U	—
A	Common/Thick-billed Murre	*Uria*	*aalge/lomvia*	—	X-U	X-U	—
A	Pigeon Guillemot	*Cepphus*	*columba*	—	X-C	X	—
A	Horned Puffin	*Fratercula*	*corniculata*	X-C	X-C	—	—
A	Tufted Puffin	*Fratercula*	*cirrhata*	X-U	X-A	X-C	—
A	Short-eared Owl	*Asio*	*flammeus*	—	—	X-A	—
A	Black-billed Magpie	*Pica*	*hudsonia*	—	X-U	X-U	—
A	Common Raven	*Corvus*	*corax*	X-U	X-U	—	—
A	American Pipit	*Anthus*	*rubescens*	X-U	X-U	X-U	—
A	Orange-crowned Warbler	*Oreothlypis*	*celata*	—	X-U	X-U	—
A	Yellow Warbler	*Setophaga*	*petechia*	—	S-U	—	—
A	Wilson's Warbler	*Cardelina*	*pusillla*	—	X-U	—	—
A	Savannah Sparrow	*Passerculus*	*sanwichensis*	—	X-U	—	—
A	Fox Sparrow	*Passerella*	*iliaca*	—	X-U	X-C	—
A	Song Sparrow	*Melospiza*	*melodia*	—	—	X-C	—
A	Golden-crowned Sparrow	*Zonotrichia*	*atricapilla*	—	X-C	X-C	—
A	Lapland Longspur	*Calcarius*	*lapponicus*	—	X-U	—	—
A	Common Redpoll	*Acanthis*	*flammea*	—	X-U	X-C	—
M	Brown Bear	*Urus*	*arctos*	V	V	—	—
M	Caribou	*Rangifer*	*tarandus*	—	V	—	—
M	Gray Wolf	*Canis*	*lupus*	—	T	—	—
M	Red Fox	*Vulpes*	*vulpes*	V	—	—	—
M	Arctic Ground Squirrel	*Urocitellus*	*parryii*	V	—	—	—
M	Northern River Otter	*Lontra*	*canadensis*	V	—	—	—
M	Tundra Vole	*Microtus*	*oeconomus*	—	—	S	—
M	Horse	*Equus*	*ferus caballus*	—	—	V-C	—
M	Cow	*Bos*	*taurus*	—	—	V-C	—
M	Humpback Whale	*Megaptera*	*novaeangliae*	V	V	—	—
M	Killer Whale	*Orcinus*	*orca*	—	—	V	—
M	Harbor Seal	*Phoca*	*vitulina*	—	V	—	—
M	Steller Sea Lion	*Eumetopias*	*jubatus*	—	V	?	—

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