Marine Invasive Species and Biodiversity of South Central Alaska

Anson H. Hines & Gregory M. Ruiz, Editors

Smithsonian Environmental Research Center
PO Box 28, 647 Contees Wharf Road
Edgewater, Maryland 21037-0028
USA
Telephone: 443. 482.2208
Fax: 443.482-2295
Email: hines@serc.si.edu, ruiz@serc.si.edu

Submitted to:

Regional Citizens' Advisory Council of Prince William Sound
3709 Spenard Road
Anchorage, AK 99503
USA
Telephone: 907.277-7222
Fax: 907.227.4523

154 Fairbanks Drive, PO Box 3089
Valdez, AK 99686
USA
Telephone: 907835
Fax: 907.835.5926

U.S. Fish & Wildlife Service
43655 Kalifornski Beach Road, PO Box 167-0
Soldatna, AK 99661
Telephone: 907.262.9863
Fax: 907.262.7145

TABLE OF CONTENTS

Executive Summary

This report summarizes research on nonindigenous species (NIS) in marine ecosystems of Alaska during the year 2000 by the Smithsonian Environmental Research Center. The project is an extension of three years of research on NIS in Prince William Sound, which is presented in a major report (Hines and Ruiz, 2000) that is on line at the website of the Regional Citizens' Advisory Council: www.pwsrcac.org. The earlier report serves as important background for the current work.

The European green crab (*Carcinus maenas*) has invaded coastal ecosystems at several locations around the world, including the northwest coast of North America, where it spread rapidly during the 1990s from San Francisco Bay, CA to Vancouver Island, BC. Research was conducted to assess the potential spread of this ecologially destructive NIS:

- To assess the potential for spread northward by larval transport via currents or ballast water, laboratory experiments tested the larval tolerance for various combinations of temperature X salinity. Mortality was 100% at 20ppt regardless of temperature and at 5^{o}C regardless of salinity. However, this tolerance would potentially accommodate spread of the green crab into most of southeast and southcentral Alaska.
- A green crab monitoring program has been established from California to Alaska to track the spread of this species. To document potential arrival in Alask, crab traps were deployed in Juneau,, Cordova, Port Valdez and Homer. No green crabs were collected at any of these sites.

Previous surveys of NIS in southcentral Alaska indicated that while the overall number of invasive species in marine ecosystems was low compared to lower latitude sites along the West Coast of North America, Homer Boat Harbor appeared to have a greater number of NIS that other sites in the region. This finding elevated concern about risk of invasive species, because of the history of recently increased shipping activity for wood products at Homer and tankers at Nikiski, as well as the long history of fishing vessels at Homer and Seldovia. Sites of successful invasions could allow NIS to spread readily to neighboring areas. To assess the prevalence of invasive species, a team of about 20 taxonomic and ecological experts conducted intensive field surveys in Kachemak Bay on a low tide series during August 2000.

To assess geographic patterns and temporal variation in the levels of invasive species in marine ecosystems of North America, standard surveys are being conducted along the West Coast, East Coast and Gulf Coast at 16 bays, including Kachemak Bay during 2000. These surveys use arrays of 220 standardized pvc and wooden fouling plates at each site for a soak period of 3 months. In addition, fouling plates were deployed in Port Valdez during 2000 for a third year to monitor the potential for new invasions in the viscinity of the Valdez Marine Terminal. Much of the detailed quantitative analysis of the fouling plates is being completed during 2001; however a species list of species on the fouling plates is growing and forms part of the inventory of biodiversity for the region.

Major findings of the field and fouling plate surveys are:

- Surveys in Kachemak Bay and Cook Inlet, Alaska found 13 NIS in diverse taxonomic groups, including 3 NIS of hydroids, 1 bryozoan, 2 bivalve molluscs (one species – the cultured oyster – is not reproductive), and 7 species of vascular plants.
- Additionally, 4 other NIS have been reported as present in Kachemak Bay but not confirmed by taxonomic experts, including a salt marsh grass, a boring sponge, a polychaete worm and a clam.
- Taxonomic experts confirmed 4 "cryptogenic species" (species of unknown, but suspicious, origin), in Kachemak Bay, including a new species of ascidean, a seastar, and 2 species of hydroid.

- Field and fouling plate surveys in Kachemak Bay provided new documentation of the biodiverisity of the region, and help develop species list for the National Estuarine Research Reserve, including 359 species of marine invertebrates of many taxonomic groups and 68 species of wetland vascular plants.
- Taxonomic experts recorded 4 species of molluscs in Kachemak Bay that document biogeographic range extensions.
- No new NIS, cryptogenic or species ranges extensions were found in Port Valdez.

This report describes a significant increment of progress in documenting NIS and biodiversity of southcentral Alaska.

1. Introduction and Background

Anson Hines & Gregory Ruiz
Smithsonian Environmental Research Center

This report summarizes activities and products for research on nonindigenous species (NIS) in marine ecosystems of Alaska during the year 2000. The project is an extension of three years of research on NIS in Prince William Sound, which is presented in a major report (Hines and Ruiz, 2000) that is on line at the website of the Regional Citizens' Advisory Council: www.pwsrcac.org. The earlier report serves as important background for the current work. The work plan, progress and interpretation of this research have been developed in consultation with the Nonindigenous Species Work Group that is CoChaired by Gary Sonnevil (USFWS, Kenai, AK) and Robert Benda (Prince William Sound Community College, Valdez, AK) and coordinated by the Prince William Sound Regional Citizens' Advisory Council. The NIS Work Group includes representatives from Federal and Alaska State agencies, university and Smithsonian scientists, the oil shipping industry, and citizens groups associated with RCAC.

The project has 3 main elements:

- Green Crab Research, including Larval Tolerance Experiments and Field Trapping
- Fouling Plate Studies
- Taxonomic Field Surveys

Progress in each of the main elements during the year 2000 is summarized in the following sections.

During the year 2000, we presented aspects of the Alaska NIS work in several scientific meetings, workshops and public talks including:

- ANSTE, Ballast Water & Shipping Committee
- Invasive Species & Ballast Water Workshop, Anchorage, AK
- Gulf of Mexico Symposium, Mobile, AL
- Homer Museum, AK
- National Public Radio interview, Homer, AK
- Global Invasive Species Program meeting in South Africa
- Mid-Atlantic federal agency review of invasive species, MD
- Jug Bay National Estuarine Research Reserve, MD

Recent project publications include:

- Hines, A.H., G.M. Ruiz and LS. Godwin. 2000. Assessing the risk of nonindigenous species invasion in a high-latitude ecosystem: Ballast water treatment facility in Port Valdez, Alaska. Pp. 81-93 in J. Pederson (ed.), Proceedings of the Marine Bioinvasions Conference, MIT Sea Grant publication.
- Ruiz, G.M., P.W. Fofonoff, J.T. Carlton, A.H. Hines, and M.Wonham. 2000. Invasion of coastal Marine communities of North America: patterns and processes. Annual Reviews in Ecology and Systematics. 31:481-531.
- Goddard, J. and N. Foster. (in press). Nudibranchs of Prince William Sound, Alaska. Veliger.
- Lambert, G. and K. Sanamyan. (in press) Distaplia alaskensis sp. nov. (Ascidiacea, Aplousobranchia) and other new ascidian records from south-cnetral Alaska, with a redescription of Ascidia columbiana (Huntsman, 1912). Candian Journal of Zoology 79.

In addition, Nora Foster finalized her analysis and report of the biodiversity inventory for Prince William Sound, which was presented to Alaska Sea Grant. The biodiversity inventory is also available on line at the RCAC website (www.pwsrcac.org) as a chapter of Hines and Ruiz (2000).

2. Green Crab (*Carcinus maenas*) Research

Gregory M. Ruiz, Anson H. Hines, & Danielle Lipski
Smithsonian Environmental Research Center

The northward spread of green crabs from central California remains a serious potenial threat to Alaska. Important aspects of the ecological impacts of the West Coast green crab invasion are presented in Grosholz et al. 2000. At this date green crabs on the West Coast have spread from San Francisco Bay north to Washington state and Vancouver Island, British Columbia; however, it is not clear whether these northern subpopulations are established and sustaining or just the result of an unusual larval transport event during an El Niño period. Based on their distribution in the crab's native range (northern Europe) and invasive ranges (eastern North America, Australia, South Africa) elsewhere in the world, green crabs have a high potential for expanding their range to Alaska.

2.A. Larval tolerance experiments

Both native and introduced populations of green crabs occur over wide ranges of latitude. As green crabs become established at different latitudes along the West Coast, they may become acclimated to more extreme conditions. The further spread of green crabs may occur via larval transport by coastal currents or by ballast water. The survival of introduced larvae may depend on whether they spread progressively from the periphery of their range (where they have been acclimated) or through disjunct introductions to distant sites (where they may encounter conditions beyond their acclimation). We wish to know if larval tolerances for temperature and salinity depend on source of the population and acclimation temperature.

We planned to use laboratory Salinity X Temperature tolerance experiments to test the interactive effects of:

- Source Population: Low Latitude (central California, New Jersey) versus High Latitude (Northeast US, Sweden)
- Acclimation Temperature: 8°C and 15°C (based on spring water temperatures for Port Valdez and San Francisco Bay.
- Test Temperature
- Test Salinity

Green crabs brood eggs from late winter through spring, with timing adjusted according to latitude. Because of a late start on research in 2000, ovigerous green crabs (10-20 individuals) were collected from a single region (central California) and we were not able to other sites. Crabs were sent from Sweden but did not survive the transit. Ovigerous green crabs shipped to SERC for initial laboratory acclimation. Crabs are divided between two acclimation temperatures (8 and 15 ° C). Larvae hatch and are collected and placed into treatments.

Treatments were 4 Temperatures (5, 7.5, 10, 12.5 ° C) and 2 Salinities (20, 30ppt). Ten zoea were place in each culture dish of 80 ml of filtered, autoclaved Rhode River water. Larvae were fed in excesss with artemia, rotifers, and algae. Survivorship was monitored daily. Water was changed and crabs are fed every 2 days, and antibiotic, antifungal solution was added to each culture dish at the time of water changes. Crabs were reared in culture through complete larval development and several juvenile instars.

We have run green crab Salinity X Temperature tolerance experiments for two years: one was a study by a SERC Intern on SERC funds; and the other one during the late spring/early summer of 2000 on RCAC funds. The experiment worked very well the first year, when we were able to begin promptly in the early season (in late winter). During April/May 2000 ovigerous female green crabs were collected from Bodega Bay, California. Thirteen crabs altogether hatched eggs and provided larvae that were placed into treatments. Preliminary analysis of results shows that mortality was 100% at 20ppt regardless of temperature and at 5 degrees Celsius regardless of salinity. Survivorship at other temperature/salinity combinations was variable and did not reveal a clear pattern, due to low survival overall, although some test groups had larvae develop to the post -larval megalopal and juvenile crab stages.

Due to the low overall survival in 2000, we are repeating the experiments in the present year (2001).

2.B. Green Crab Trapping Network

Green crab field research in Alaska has two goals:

- To establish a network of sites to detect the arrival and spread of green crabs in Alaskan waters and
- To measure the abundance of native crabs and benthic invertebrates, which may be impacted by the arrival of green crabs.

The Alaska green crab trapping program was initiated in July-August 2000 at four locations: Valdez, Cordova, Homer, and Juneau. At each location we worked with local researchers and educators to implement a uniform trapping program that will be continue throughout the year. Small baited traps were placed out for a 24 hour period to determine the species composition and size structure of crabs and other organisms caught. Also, a series of benthic core samples were taken at the trapping sites to examine the native benthic community. At each site 20 cores and 8 traps were taken. Trapping is to continue monthly and benthic sampling will be taken once a year.

We are now working to expand this network and link the trapping sites formally with collaborating researchers from California to Alaska.

At this time, three of the four AK sites have continued the trapping program. No green crabs were collected at any site, and only a few other species were trapped and all organisms were released alive and unharmed (Table 2.B.1.). At SERC, we are beginning to analyze the benthic samples that were taken over the summer (Table 2.B.2). Bivalves in the samples were mainly *Macoma balthica*, with some *Mya* sp. and *Mytilus* spp.. High numbers of polychaetes in Juneau were mainly *Pectinaria granulata* and Oweniidae, while polychaetes at homer were mainly Oweniidae..

Table 2.B.1 Alaska Green Crab Research Program -2000
Trapping Results

Site	Individuals/Taxa							
	Hemi-grapsus sp.	*Telmessus cheira-gonus*	dunge ness	hermit crab	shrimp	fish	gastro pod	poly-chaete
Cordova, Orca Inlet	1	0	0	0	0	2	0	0
Cordova, Science Center	26	0	0	4	0	0	0	0
Cordova, Hippy Cove	1	0	0	1	0	1	0	0
Juneau, Echo Cove	0	0	0	0	0	0	0	0
Juneau, Cowee Creek	0	0	1	0	0	0	0	0
Juneau, Cascade Point	0	0	0	0	0	2	0	0
Homer, Clam Digger	0	3	0	0	0	2	1	1
Homer, Fishing Hole	0	0	0	0	1	1	0	0
Homer, Ferry Pier	0	0	0	0	0	0	0	0
Valdez, Hatchery	0	0	0	0	0	0	0	0
Valdez, Container	0	0	0	0	0	1	0	0
Valdez, Terminal	0	0	0	0	0	0	0	0

Table 2.B.2 2001 Alaska Green Crab Research Program - Benthic Core Analysis Results

site	# individuals/taxa									
	bivalve	poly-chaete	bar-nacles	gastro-pod	amphi-pod	iso-pod	echino-derm	cnida-rian	deca-pod	algae
Cordova, Orca Inlet	112	1	87	11	0	0	0	0	7	P
Cordova, Science Center	66	4	85	0	5	0	0	0	0	P
Cordova, Hippy Cove	421	36	5	2	1	0	0	0	0	P
Juneau, Echo Cove	143	265	8	3	13	0	13	0	0	0
Juneau, Cowee Creek	1	0	7	0	0	0	0	0	0	0
Juneau, Cascade Point	120	420	182	69	1	14	6	3	0	P
Homer, Clam Digger	1133	18	0	0	1	0	0	0	0	P
Homer, Fishing Hole	97	103	1	12	0	0	0	1	0	P
Homer, Ferry Pier	0	0	0	0	0	0	0	0	0	0
Valdez, Hatchery	488	2	51	22	7	6	0	0	0	P
Valdez, Container	303	3	2	16	3	4	0	0	0	0
Valdez, Terminal	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

P = present   ND = no data

3. Fouling Community Studies

Gregory Ruiz, Anson Hines, Linda McCann, Kimberly Philips, George Smith
Smithsonian Environmental Research Center

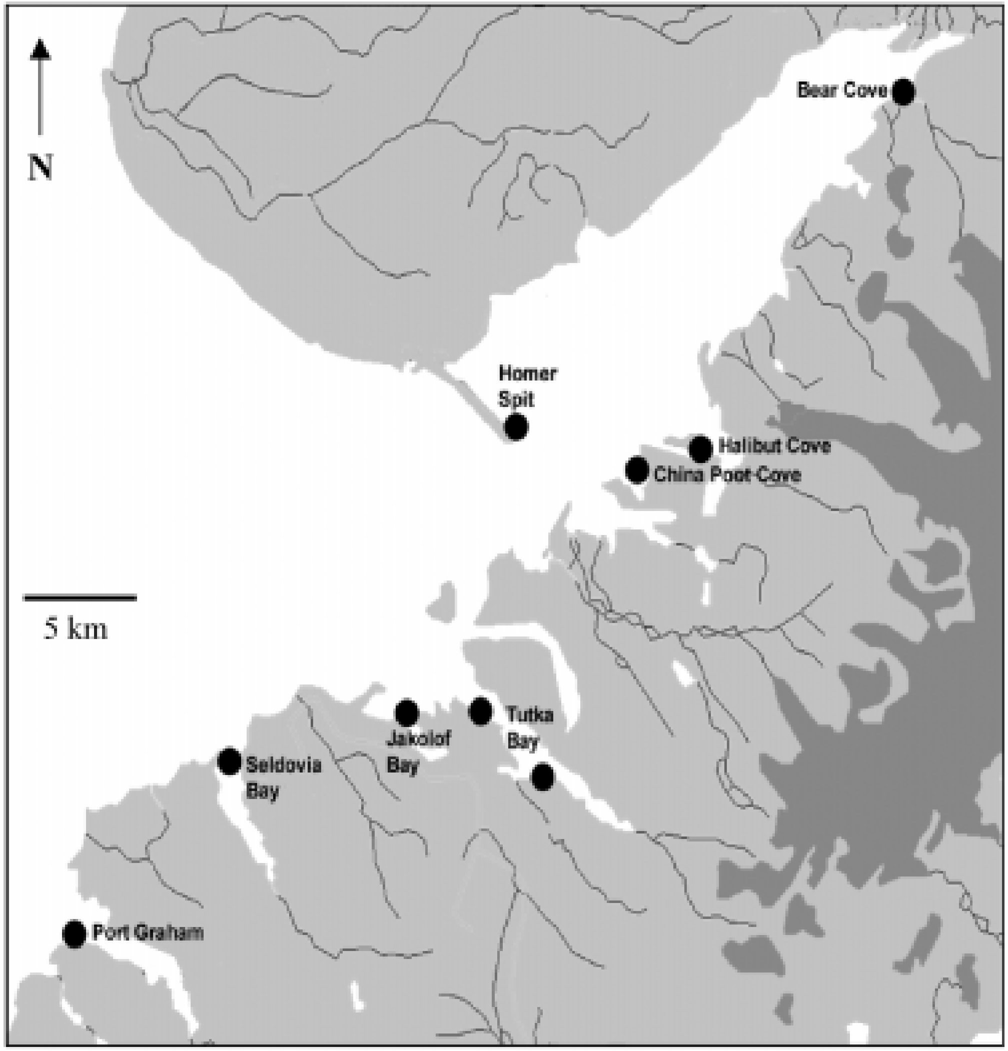
Fouling communities are often heavily invaded, because of their association with shipping (i.e., hull fouling, ballast water, disturbed areas of port facilities), as well as oyster/mussel/algal culture activities. Importantly, these communities are easily sampled with standardized fouling plates, which avoid certain problems with sampling various natural substrates. We use fouling communities to quantify patterns and rates of invasion, providing important baseline information that is now lacking in Alaska and elsewhere. We are conducting a global scale analysis of spatial and temporal pattens of invasion in fouling communities with support from RCAC/USF&WS, US Department of Defense, US National Sea Grant, and the Australian Centre for Invasive Marine Pests. Over a 3-year period of study, the project uses standardized fouling plates to compare the invasions of port systems along the three coasts of North America during the boreal summer and two coasts of Australia during the austral summer. During 2000 we deployed fouling plates in Kachemak Bay AK, Puget Sound WA, Coos Bay OR, San Francisco Bay, and San Diego Bay CA. During winter 2000-2001 (austral summer), we began parallel work in Australia with fouling plates deployed in Syndney Harbor and Swan River (Perth region). During 2001, we are sampling 4 sites on east coast; and the following year 4 sites on the Gulf coast. We hope to conduct identical surveys in Juneau/Sitka and Kodiak in 2001, and in 2002 we also hope to sample Dutch Harbor, AK, providing good latitidunal comparison along the West Coast.

At each site we deployed 198-220 plates in a stratified array for soaking period of approximately a 3-months. Plates were retrieved and processed initially in the field and a of plates with live organisms were worked up in the laboratoryat the time of collection to collect voucher specimens of every “morpho-species” on each plate to identify fouling species with the involvement of taxonomic experts. Remaining plates were fixed and transferred back to the laboratory at SERC for work-up and collection of voucher specimens. The voucher samples are being processed in the lab for further taxonomic identification by appropriate taxonomic experts. However, formal identification by taxonomic experts is a long process that is still in progress, and statistical summaries are not yet available. The data are quantitative for “presence/absence” of native and invasive species and percent cover of individual plates.

Fouling plates were deployed in Kachemak Bay during 24-27 April 2000 in a stratified random design for 9 strata (see map Fig. 3.1). Latitude/Longitude coordinates for each of the strata were:

Site name	Latitude	Longitude
Bear Cove	59°43.552N	151°03.575W
Halibut Cove	59°35.766N	151°14.524W
China Poot/Peterson Cove	59°34.252N	151°16.536W
Jackaloff Bay	59°27.969N	151°32.201W
Tutka Bay Lodge	59°28.398N	151°28.817W
Tutka Bay Hatchery	59°26.434N	151°25.697W
Port Grahm Hatchery	59°35.788N	151°14.628W
Seldovia Harbor	59°26.200N	151°42.898W
Homer Spit (harbor)	59°36.198N	151°25.399W

Figure 3.1 Map of Kachemak Bay showing sites for deployment of fouling plates and field survey collections.



At each of the 9 sites 20 PVC plates and 2 wooden plates were deployed. PVC plates consisted of 7mm grey PVC sheet stock cut into 14 cm X 14 cm squares, with one surface lightly sanded. The plates were attached horizontally to bricks serving as weights and hung from 7mm nylon lines attached to piers, floating docks and pilings to maintain a depth of 1 m below MLLW and at least 1 m above the bottom. Wooden plates 14 cm X 7 cm in area consisted of 18 mm thick soft pine wood block sandwiched between two 18mm thick oak blocks. The "sandwich" was held together with eyebolts and attached to a brick for weight and suspended as the PVC plates.

During 25 July-4 August 2000 a team of technicians and senior scientists retrieved the plates after a soak time of nearly 3 months. Utilizing the Kasitsna Bay Laboratory as a base of operations, plates were returned to the laboratory for examination under dissecting microscopes. Only the horizontal under-surface of the PVC plates were scored for percent cover and species presence, and wooden plate "sandwiches" were disassembled and examined for boring organisms. Small scraped voucher specimens of every species found on every plate were collected and preserved in either 70% EtOH or 10% formaldehyde for future verification by taxonomic experts. Vouchers were individually coded and are stored at SERC.

During May-August 2000, we also deployed 30 PVC fouling plates in Port Valdez at the Marine Terminal and sites near Valdez. These plates were similar to the standard PVC plates used in Kachemak Bay and in our previous fouling plate studies of Prince William Sound. These data also provide comparisons with the fouling plates that we deployed in past years throughout Prince William Sound. The plates from Port Valdez were processed with the same methods as the plates from Kachemak Bay.

On average, about 20 voucher samples of species were collected per plate, yielding nearly 4,000 voucher samples for the 198 plates deployed in Kachemak Bay and about 600 voucher samples from the 30 plates from Port Valdez . Final, formal identification of these vouchers is underway with assistance from taxonomic experts and should be completed during 2002 for the Kachemak Bay and Port Valdez fouling plates. Many of the key fouling groups (e.g., bryozoans, hydroids, ascidiaceans) have been reviewed by taxonomic experts, and these are reflected in the species lists of the following chapters in the earlier (Hines and Ruiz 2000) and present reports.

4. Field Surveys

During 25 July- 4 August 2000 we conducted surveys of the species diversity of Kachemak Bay in conjunction with the new Kachemak Bay National Estuarine Research Reserve, and in coordination with fouling plate retrieval (see above). We utilized the NOAA/University of Alaska Kasitsna Bay Laboratory as a base of operations during a low tide series and sampled numerous sites throughout the bay. In addition to the SERC team of 8 people working on fouling communities, the group included the following taxonomic experts:

- Judy Winston, Virginia Natural History Museum (Bryozoans)
- Lea-Ann Henry, Dalhousie University, Halifax, NS, Canada (Hydroids)
- Sarah Cohen, Harvard University (Tunicates)
- Nora Foster, University of Alaska Museum (Molluscs)
- Jerry Kudenov, University of Alaska at Anchorage (Polychaetes)
- Claudia Mills, Friday Harbor Laboratories, University of Washington (Medusae & Ctenophores)
- Jeff Cordell, University of Washington (Copepode and Peracarid Crustaceans)
- Jon Norenburg & Sveta Karzov, National Museum of Natural History (Nemertean Worms)
- Dennis Whigham, SERC (wetland plants)
- John Hall, Alaska Fish & Wildlife Service (wetland plants)

We were assisted by Mike Geagle (Kasitsna Bay Lab), Carmen Field & Cooie Moss (NERR), and John Pahutski (Washington State Department of Fish & Game).

Collecting sites for Kachemak Bay are indicated on the Map Fig. 3.1.

Voucher specimens were collected for many of the marine invertebrate species, but no collections were necessary for the wetland plants and common, well-known marine species.

Based on the cumulative field work over the past 4 years, the NIS of Kachemak Bay & Cook Inlet, Alaska, include the following confirmed species:

- *Opercularella lacerata* – hydroid
- *Proboscidactila flavicirrata* - hydroid
- *Garvia franciscana* - hydroid
- *Schizoporella unicornis* - bryozoan
- *Crassostrea gigas* - cultured oyster; not reproductive in Kachemak Bay
- *Mya arenaria* – soft-shelled clam
- *Matricaria discoidea* – plant, Asteraceae – weed in uppermost intertidal zone
- *Taraxacum officnale* – plant, Asteraceae – weed in uppermost intertidal zone
- *Plantago major* – plant, Plantaginaceae – weed in uppermost intertidal zone
- *Poa pretensis* – plant, Poaceae – grass in uppermost intertidal zone
- *Trifolium repens* – plant, Poaceae – grass in uppermost intertidal zone
- *Polygonum aviculare* – plant, Polygonaceae – weed in uppermost intertidal zone
- *Potamogeton gramineus* – plant, Potamogetonaceae – weed in uppermost intertidal zone

Reported but not yet confirmed NIS include:

- *Spartina alterniflora* – eastern salt marsh grass, small patch observed by John Hall (Wetland Botanist, US Fish& Wildlife Service, Anchorage, AK)
- *Cliona thosina* - Boring sponge in oyster shell, reported by several oyster growers in Kachemak Bay.
- *Polydora websteri* – polychaete, blister worm in cultured oyster shell, reported by several oyster growers in Kachemak Bay.
- *Venerupis philippinarum* - Japanese littleneck clam (Manila clam), reported by residents of Kachemak Bay to Robert Pierkowski (AK Dept of Fish & Game).

Cryptogenic species confirmed for Kachemak Bay:

- *Distaplia alaskensis* sp. novum - ascidiacean
- *Asterias amurensis* – sea star
- *Bougainvilla sp. 1* - hydroid
- *Bougainvilla sp. 2* - hydroid

The following summarizes the numbers of species in major taxonomic groups recorded for Kachemak Bay:

- Anthozoa – 5 species
- Hydoids – 22 species
- Hydromedusae – 18 species
- Siphonophore – 1 species
- Scyphomedusae – 4 species (3 semaeostome, 1 stauromedusa)
- Ctenophora – 3 species
- Bryozoa – 68 species
- Nemertea – 21 species
- Harpacticoid Copepoda – 59 species
- Amphipoda – 9 species (8 gammarideans, 3 caprellids)
- Isopoda – 2 species
- Cumacea – 1 species
- Brachyura – 5 species
- Mollusca – 120 species (53 bivalves, 48 prosobranch gastropods, 11 opisthobranch gastropods, 8 chitons)
- Echinodermata – 8 species
- Ascidiacea - 12 species
- Hemichordata – 1 species
- Wetland plants – 66 species

Biogeographic range extensions were noted for the following species:

- *Polycera zosterae* – mollusk
- *Doridella steinbergi* – mollusk
- *Eubranchus olivaceous* – mollusk
- *Aglaja ocelligera* - mollusk

4.A. Motile Crustacea on Fouling Plates

Jeffery R. Cordell
Wetland Ecosytem Team, Fishery Sciences
University of Washington, Seattle

Methods

Four to seven plates from each block were selected randomly, and mobile epifauna was removed by washing the plates with 5% formaldehyde solution. In the laboratory, each sample was examined under a dissecting microscope. For each taxon that could not be reliably identified during routine scanning, representatives were removed and further examined, usually under a compound microscope. Identification was made to the highest resolution possible without full dissection of individuals (with the exception of occasional removal of the abdomen of harpacticoid copepods to facilitate viewing the fifth leg). Individual taxa were ranked for abundance, with taxa occurring in the multiple 100s being ranked as abundant, those occurring in numbers from 10s to 100s as common, and those whose numbers were less than 10 as uncommon. When one taxon could be unambiguously identified as dominant in a sample, this was noted.

Results and Discussion

I identified 59 species of harpacticoid copepods, eight gammarid amphipods, three caprellid amphipods, three decapods, two isopods, and one cumacean from the settling plate samples (Table 4.A.1). In addition, a number of other taxa were identified at a lower level of resolution, including cyclopoid and poecilostomatoid copepods, decapod and barnacle larvae, halacarid mites, and chironomid fly larvae. Of these, none are confirmed introduced species. A number of mobile crustacean taxa appeared to be typical of settling plate assemblages in general, occurring in every or nearly every sample. These included the gammarid amphipod *Ischyrocerus* sp. and the harpacticoid copepods *Dactylopusia vulgaris* and *Tisbe* cf. furcata.

For harpacticoids, some taxa were found that were not recorded in our 1999 surveys of Prince William Sound. These included *Danielssenia quadriseta*, *Amonardia arctica*, *Stenhelia* sp., *Paramphiascella* sp., *Paralaophonte macera*, *Parastenhelia spinosa*, *Dactylopodella* sp., *Pseudonychocamptus koreni*, *Normanella* sp., *Eupelte* sp., *Porcellidum* sp., and *Parathalestris californica*.

Several blocks stood out from others. First, mean taxa richness (range 12.0-26.7) was markedly low at block 45 (12.0); at two other blocks, 41 and 43, mean richness was particularly high (26.6, 26.76). Second, at four of the blocks, a single taxon dominated at a majority of the settling plates examined for each block: (1) *Harpacticus* cf. *obscurus* at block 41 (5 of 5); (2) *Parastenhelia spinosa* at block 44 (5 of 5); *Tisbe* sp. 1 at block 47 (4 of 5); and *Dacylopusia vulgaris* at block 48 (3 of 5).

Table 4.A.1

Block Number	41	41	41	41	41	42	42	42	42	42	43	43	43	43	43	43	43	44	44	44	44	44	45	45	45	45	45	46	46	46	46	47	47	47	47	47	48	48	48	48	48	48	49	49	49	49	49
Plate Number	2	6	24	60	62	21	25	33	42	45	48	66	67	75	77	85	95	28	72	74	68	94	34	110	111	115	130	36	37	86	104	122	135	138	144	161	147	162	146	151	156	153	170	172	185	188	223
Order Harpacticoida																																															
Fam. Ameiridae																																															
Ameira longipes	c		c	c	c	u	u	c	u	u	c	c	c		c	c	c	u		c	c	u		c	c	c	c	c	c	c		c	u	c	u	c	u	c	u	c	c	c		c	u	c	
Ameira sp.	u	u																																	u			u		u			u				
Family Ancorabolidae																																															
Arthropsyllus serratus	u																																														
Fam. Canthocamptidae																																															
Mesochra pygmaea	u		u	u		u	u		u	u	c	c	c	u		c	u	c	c	c	c	c						u	u		u	c										u					
Mesochra sp.											u								u														u														
Fam. Cletodidae																																															
Acrenhydrosoma sp.	u																											u																			
Fam. Danielsseniidae																																															
Danielssenia typica	u	u												u	u																												u	u			
Danielssenia quadriseta	u		u																																												
Fam Diosaccidae																																															
Amphiascopsis cinctus	u	u	u	u	u			u					u	u	u		u	c		u							u	c	c	**c**	c	c			u		u	c		c		c	u		u		
Amphiascus minutus	u		u	c	u	u	u	u	u	u	u	u	u	c		u	u	u	u	u	u	u	u	u	c		u	c						u			c			c	c	c	u	c	u	u	c
Amphiascus sp., unidentified	u								u													u			u	u													u	u	u	u		u	u	u	
Amphiascoides sp. 1		u		u				u				u	u	u			u			u	u			u	u		u	c		u	u	c	c	u			u				c	c	c	u	u	u	
Amphiascoides sp., unidentified			u					u				u		u	u		u		u			u	u												u					u				u			
Amonardia arctica											u	c	u	u	u	u	u				u												c	c	c	u	u	u		u	u	c				u	
Amonardia normani	u	u	u	c	**c**		u	c	u		u	u		c		u	u	u	u		c	u		u	u		u	c	**a**	u	u	c		u				u	c	u	u	u	c	**c**	c	c	
Diosaccus spinatus	u		u	u		u	c	c	c	c									u			u		u				c	u	u	c	u	u		u	c	u	u		u	u	u	u			u	u
Haloschizopera sp.	c																																														
Robertsonia sp.	u		c		u		u				u				u			u		u	u	u														u				u			u	u	u		
Paramphiascella sp.					u									u						u																											
Stenhelia peniculata	u	u		u		u																																					u				
Stenhelia sp., unidentified			u																	u																											
Fam. Ectinosomatidae																																															
Ectinosoma sp.	u	u	u		u		u	u		u	u	c	u	c	u	c	u	u	u		u		u		u	u	u	c	u		c		u		u			c		u	u	c		u		u	u
Halectinosoma sp.	c	u	u		u		u							u	u				u	u	u	u										u	u							u	c	u					
Fam. Harpacticidae																																															
Harpacticus uniremis			u		u	u	u				u				u	u					u	u		u		u	u	u		u	u	u	c	u	c	c	c	c		c	c	c				u	
Harpacticus septentrionalis																						u											u		c	u		u				u					
Harpacticus compressus																															u	u	c		c	u					u						
Harpacticus unidentified sp.																																	u														
Harpacticus sp. 1- uniremis group																		u														u															
Harpacticus sp.- obscurus group	c	u	**c**	u	u	**a**	**a**	**a**	**a**	**a**	c	c	c	c	**a**	**c**	c	c	c	c	c	c			u		u	u	c	u	u		u	u	u		u						u				
Zaus sp.						u									u																																
Fam. Laophontidae																																															
Unidentified sp.																		u				u																u	u		u		u				
Echinolaophonte sp.	u		u							u	u	u		u	c	u		u												u	u		u	u	u			c		u	u	u	u				
Heterolaophonte discophora	u																																		u												
Heterolaophonte longisetigera	u	u						u	u	u			u		u		u	u		u	u	u		u				c	u	u	c	c		u	u		u	u		u		u	u		u	u	
Heterlaophonte sp.																u								u							u		u		u			u	u				u				
Laophonte elongata				u									u								u																	u									
Paralaophonte macera	u		u								u		u		u		u		u	u	u										u		u	u	u												
Paralaophonte pacifica														u																														u			
Paralaophonte perplexa	u		u	u	u		u	u	u	u	u	u	u		c	c	u	u	u	u	c	u					u	u	u	u	u	u	u	u			u	u		u	u	u	u			u	u
Paralaophonte sp. 1									u					u					u																			u	u	u							
Pseudonychocamptus spinifer																						u						u				u						u	u	u		u					
Pseudonychocamptus koreni																														u																	
Family Normanellidae																																															
Normanella sp.	u																																														

Table 4.A.1, continued.

Block Number	41	41	41	41	41	42	42	42	42	42	43	43	43	43	43	43	43	44	44	44	44	44	45	45	45	45	45	46	46	46	46	47	47	47	47	47	48	48	48	48	48	48	49	49	49	49	49
Plate Number	2	6	24	60	62	21	25	33	42	45	48	66	67	75	77	85	95	28	72	74	68	94	34	110	111	115	130	36	37	86	104	122	135	138	144	161	147	162	146	151	156	153	170	172	185	188	223
Family Parastenheliidae																																															
Parastenhelia spinosa			u	u			c	c	u	u	c	u	c	u	c	u	c	**a**	**c**	**c**	**c**	**a**		u			u	u	u		u	u		u	u	u	c			u	u			u			
Family Peltidiidae																																															
Eupelte sp.																																		u							u						
Family Porcellidiidae																																															
Porcellidium sp.			u																																												
Fam. Tegastidae																																															
Tegastes sp. 1			u	u					u		u	c		u	c	u		u				u						u					c	u	u	u	u					u		u		u	
Tegastes sp. 2	u	u	u								u	u	u		c		u		u															u				u		u	u	u	u		u		
Fam. Thalestriade																																															
Diarthrodes sp. 1	u	u	u								u			u	c						u												u					u			u	u		u			
Diarthrodes sp. 2		u			u			c	u			u	u	u	c	c	u	u	c	c	c	c												u	u						u	u	u	u	u		
Parathalestris californica																			u			u											u		c	c											
Parathalestris sp. 1			u			c	c	u	c	c							u		u		u	u						u					u		u	u	u	u					u				
Dactylopusia vulgaris	c	u	c	c	c	a	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	**c**	**c**	c	c	c	**c**	c	u	c	c	c	u	u		**c**	**c**	c	**c**	c	c	**c**	c	c	**c**	
Dactylopodella sp.		u		u	u			u				u	u	u		u	u																											u		u	u
Paradactylopodia sp.				u						u			u	u	u	u								u	u				u	u											u	u					
Fam. Tisbidae																																															
Tisbe cf. furcata	c		u	c	c	c	c	c	u	c	c	u	u	c	u	c	u	c	u	u	c		u	c	**c**	u	**c**	c	c	c	u	c	c	u		c	u	c	u	c	c	c	c	c	c	u	
Tisbe sp. 1	c	u	c	u	c	a	u	c	u	c	c	c	c	c	u		u			u	u		c	c		c	u						**c**	**a**	**c**	**a**					u		c	u		c	c
Tisbe sp., unidentified													u																u											c	u			u		u	u
Scutellidium sp.																u																															
Order Cyclopoida	u	u	u	u	c	u		c			u	u	u		u		u		u		u	u		u	u	u	u							u			c	c		u	u	c	u	c		c	**c**
Order Poecilostomatoida			u			c		u	u	u		u																				u	u	u	u	u	u	u		u	u	u			u		
Order Siphonostomatoida															u																						u										
Ostracoda Podocopida	c	u	u	c	c	u	u	c	u	u			u	u	u	u	u	u	u	c	u	u		u	u	**c**	u	c	u	u		u					c	c	u	c	u	c	u		c		
Cumacea																																															
Cumella vulgaris																															u				u												
Isopoda																																															
Gnorimosphaeroma oregonense																														u	u	u															
Munna sp.	u		u	u	u							u		u						u												u															
Amphipoda Gammaridea																																															
Calliopiidae, unidentified																																	u														
Corophium carlottensis	u			u	u																u																	u				u					
Dexamonica reducans					u										u																																
Ischyrocerus sp.	c	u	u	c	c	c	c	c	u	c	c	**c**	**c**	c	c	c	**c**	c	c	c	c	c	u	u		u		u	u	c	**c**	c	c	c	c	c	u	c		u	u	c			**c**		u
Jassa staudei																																			u												
Paraeurystheus dentata													u																						u												
Stenothoidae, unidentified						u	u																										u	u				u									
Thorlaksonius sp.																					u																										
Amphipoda Caprellidea																																															
Caprella alaskana																u																															
Caprella laeviuscula							u	u	u	u			u	u	u				u	u																		u								u	
Metacaprella kennerlyi																																			u	c											
Decapoda Brachyura																																															
Majidae, unidentified																																						u	u								
Oregonia gracilis														u																																	
Telmessus cheiragonus								u	u	u			u	u																																u	
Decapoda Caridea																																															
Heptacarpus brevirostris							u								u					u													u	u											u		
Fam. Hippolytidae, juveniles											u			u																																	
Acarina, Halacaridae	u	u		u								u	u	u	u																		u				u	u		u							
Diptera, Chironomidae															u			u	u									u					u	u				u									
Cirripedia, cyprid larvae					u									u																																	
Total Number of Taxa	35	20	31	24	23	17	21	23	22	20	23	24	28	33	33	22	24	21	24	23	25	25	7	16	12	10	15	22	16	17	20	21	30	25	29	16	21	32	11	28	28	29	23	20	16	20	9
Mean Number of Taxa for Block	26.6					20.6					26.7							23.6					12.0					18.8				24.2					24.8						17.6				

4.B. Shallow-Water Hydroids in southern Alaska

Lea-Anne Henry
Department of Fisheries and Oceans
Bedford Institute of Oceanography, Science Branch
P.O. Box 1006
Dartmouth, Nova Scotia
Canada
B2Y 4A2
(902)-426-7477 (phone)
(902)-426-1862 (fax)
HenryL@mar.dfo-mpo.gc.ca

Historical records of hydroid distribution from Alaska were examined from Fraser (1937) and his reports on material from the Harriman Alaska expedition, the *Catalyst* and the *Albatross*. Biogeographical data were collated from several ecological and taxonomic studies on hydroids from adjacent "provinces" in the Arctic, Commander (Sheiko and Stepanyants, 1997), Russia (Naumov, 1960 or 1969?), the Japanese Archipelago and China (Uchida and Okuda, 1941; Yamada, 1959), and the Pacific Northeast (British Columbia including Vancouver Island, San Juan Archipelago, Puget Sound) (Brinckmann-Voss, 1983, 1985, 1988; Brinckmann-Voss *et al*., 1993; Brinckmann-Voss, 1996). Ecological data (e.g. latitude, depth, habitat), when available, were collected from descriptions reported in the distribution records from each biogeographical province and worldwide when necessary.

A species was considered "native" if Fraser included it in distribution tables for the entire Alaskan region, "non-native" if no records exist of it in Alaska or adjacent areas, or "cryptogenic" if no records exist of the species in Alaska but in adjacent areas.

Historical data were then considered in context with hydroid biogeography and ecology to ascribe a status to species not determined "native" using historical data. "Non-native" species were those that occurred in few biogeographical provinces, while "cryptogenic" species were those that occurred in many. "Non-native" species were those with ecological records from the other biogeographical provinces that were discordant from observations made during collections, and "cryptogenic" species were those with little ecological data. Species recorded "non-native" 3 times were identified as potentially invasive fauna.

Results

Collecting sites in Kachemak Bay during the Year 2000 are listed in Table 4.B.1.

Table 4.B.1: Summary of field collection sites for August 2000

Site	Location	Latitude	Longitude
1. Kachemak Bay	small boat harbour		
2. Kachemak Bay	low intertidal		
3. Halibut Cove	low intertidal		
4. Peterson's Bay	low intertidal		
5. Homer	Homer spit		
6. Seldovia	small boat harbour		

Historical
(Numbers denote the location detailed in Table 1.)

Species	Notes	Status
Bougainvillia sp.1 and 2		cryptogenic
Sarsia eximia [1,2]	(as *Syncoryne eximia*)	native
Sarsia tubulosa [1,2]	(as *Syncoryne tubulosa*)	native
Garveia annulata [plate 00303]		native
Proboscidactila flavicirrata [1,6]	only medusae historically recorded on Pacific U.S. coast (Rees, 1979)	cryptogenic
Gonothyraea clarki [1-6, most plates]		native
Obelia dichotoma [2]		native
Obelia longissima [1,2,4,5,6, most plates]		native
Cytia kincaidi [3]		native
Clytia hemisphaerica [1,2,3,5,6]	(as *Clytia johnstoni*)	native
Orthopyxis caliculata [2]	(as *Eucopella caliculata*)	native
Calycella syringa [1-6, many plates]		native
Opercularella lacerata [1-6, most plates]	not recorded any more north than Puget Sound and Vancouver Island	non-native
Cuspidella grandis [many plates]	in British Columbia, but not Alaska	cryptogenic
Abietinaria amphora [2]		native
Abietinaria annulata [2]		native
Abietinaria turgida [2]		native
Sertularella elegans [2]		native
Sertularella rugosa [2]		native
Sertularia robusta [2]	(as *Thuiaria robusta*)	native
Thuiaria dalli [2]		native

Biogeography

Commander Islands: *Proboscidactyla flavicirrata*, *Opercularella lacerata*, *Cuspidella grandis*
Russia: *Bougainvillia* sp. 1 and 2, *Proboscidactyla flavicirrata, Opercularella lacerata*
Japanese Archipelago: *Bougainvillia* sp.1 and sp. 2, *Proboscidactyla flavicirrata*, *Cuspidella grandis*, *Opercularella lacerata*
Pacific Northeast: *Opercularella lacerata*

Ecology

Proboscidactyla flavicirrata: Obligate commensal association with sabellids around the tube rims (Hirai and Kakinuma, 1973; Rees, 1978). Presently collected on sabellid worm attached to dock at low tide in Seldovia small boat harbour. Temperature suitable at 10°C (Rees, 1979).

Opercularella lacerata: 0-20m, Puget Sound to Vancouver Island. Epizoic on *Gonothyraea clarki* (Fraser, 1914) and other invertebrates (Cornelius, 1995). Presently collected off most plates and on *Gonothyraea clarki* intertidally.
Cuspidella grandis (= the medusae *Cosmetira pilosella*, from Rees, 1941). 40-140m, Puget Sound to British Columbia. Typically found on hard, inert substrates (Cornelius, 1995). Found here on settling plates and other hydroids on the plates.

Summary Listing of All Hydroids from Kachemak Bay, Alaska

Species	Historical	Biogeographical	Ecological
Bougainvillia spp.	cryptogenic	cryptogenic	cryptogenic
Sarsia eximia	native	-	-
Sarsia tubulosa	native	-	-
Garveia annulata	native	-	-
Proboscidactila flavicirrata	non-native	non-native	native
Gonothyraea clarki	native	-	-
Obelia dichotoma	native	-	-
Obelia longissima	native	-	-
Cytia kincaidi	native	-	-
Clytia hemisphaerica	native	-	-
Orthopyxis caliculata	native	-	-
Calycella syringa	native	-	-
Opercularella lacerata	non-native	non-native	native
Cuspidella grandis	cryptogenic	cryptogenic	cryptogenic
Abietinaria amphora	native	-	-
Abietinaria annulata	native	-	-
Abietinaria turgida	native	-	-
Sertularia robusta	native	-	-
Sertularella elegans	native	-	-
Sertularella rugosa	native	-	-
Thuiaria dalli	native	-	-

Discussion

Five species have been identified as potentially invasive organisms to southern Alaska, based on historical, biogeographical and ecological data. These include 3 athecate hydroids (*Bougainvillia* sp. 1 and 2, *Proboscidatila flavicirrata*) and 2 species of thecate hydroids (*Opercularella lacerata* and *Cuspidella grandis*).

Only 2 species, the athecate hydroid *Proboscidactila flavicirrata* and the thecate hydroid *Opercularella lacerata*, were recorded as non-native three times. I conclude with the most confidence that these species have been introduced, and most likely from the northeast Pacific states. Their distributions are highly disjunct across Pacific North America, and are found in few other surrounding biogeographical provinces.

References

Brinckmann-Voss, A. 1983. British Columbia marine faunistic report on the Hydrozoa. Part II. Hydroids. Canadian Technical Report of Fisheries and Aquatic Sciences No. 1185. 20pp.

Brinckmann-Voss, A. 1985. Hydroids and medusae of *Sarsia apicula* (Murbach and Shearer, 1902) and *Sarsia princeps* (Haeckel, 1879) from British Columbia and Puget Sound with an evaluation of their systematic characters. Canadian Journal of Zoology 63: 673-681.

Brinckmann-Voss, A. 1988. *Sarsia cliffordi* n. sp. (Cnidaria, Hydrozoa, Anthomedusae) from British Columbia with distribution records and evaluation of related species. Canadian Journal of Zoology 67: 685-691.

Brinkmann-Voss, A., Lickey, D.M. and Mills, C.E. 1993. *Rhysia fletcheri* (Cnidaria, Hydrozoa, Rhysiidae), a new species of colonial hydroid from Vancouver Island (British Columbia, Canada) and the San Juan Archipelago (Washington, U.S.A.). Canadian Journal of Zoology 71: 401-406.

Brinckmann-Voss, A. 1996. Seasonality of hydroids (Hydrozoa, Cnidaria) from an intertidal pool and adjacent subtidal habitats at Race Rocks, off Vancouver Island, Canada. Scientia Marina 60 (1): 89-97.

Cornelius, P.F.S. 1995. North-West European thecate hydroids and their medusae. Part 1. In: Synopses of British Fauna (New Series). Barnes, R.S.K. and Crothers, J.H. (eds). Field Studies Council, Shrewsbury. pp. 173-176.

Fraser, C.M. 1937. Hydroids of the Pacific Coast of Canada and the United States. University of Toronto Press, Toronto. 207pp.

Hirai, E. and Kakinuma, Y. 1973. Differentiation and symbiosis in two hydrozoans. In: The Proceedings of the Second International Symposium on Cnidaria. Tokioka, T. and Nishimura, S (eds). Seto Marine Biological Laboratory, Kushimoto, Japan. pp. 257-273.

Naumov, D.V. 1969. Hydroids and hydromedusae of the U.S.S.R. Israel Program for Scientific Translations, Jerusalem. 660pp.

Rees, J.T. 1941. The hydroid of the medusae *Cosmetira pilosella* Forbes. Proceedings of the Royal Society of Edinburgh (Section B, Biology) 61 (1): 55-58.

Rees, J.T. 1979. Growth stages of the medusa of *Proboscidactyla flavicirrata* Brandt, 1835 (Hydrozoa; Limnomedusae). Canadian Journal of Zoology 57: 551-557.

Uchida, T. and Okuda, S. 1941. The hydroid *Lar* and the medusa *Proboscidactyla*. J. Fac. Sci. Hokkaido Univ. Ser. 6, 7: 431-440.

4.C. Pelagic Cnidaria and Ctenophora

Claudia E. Mills, Ph.D.
Friday Harbor Laboratories, University of Washington
620 University Road
Friday Harbor, WA 98250
e-mail: cemills@u.washington.edu

Summary

No recognized nonindigenous species of pelagic Cnidaria or Ctenophora were collected in Kachemak Bay, Cook Inlet, by the Smithsonian-hosted scientific team in mid-summer 2000. In that summer 2000 expedition, 16 species of Hydromedusae were collected (with an additional 2 species found in Kachemak Bay during the 1999 Prince William Sound Expedition, totaling 18 species), as well as one siphonophore, three species of semaeostome scyphomedusae, one (attached=benthic) stauromedusa, and three species of ctenophores, bringing the total of known medusae, siphonophores and ctenophores to 27 for Kachemak Bay (also for Cook Inlet). In general, the planktonic medusae and ctenophores of Alaska have been little-documented.

Introduction

Medusae and ctenophores have proven themselves to be among the "important" marine invaders, capable of creating effects that alter entire ecosystems, as in the case of the American ctenophore *Mnemiopsis leidyi*, accidentally introduced to the Black Sea in the mid-1980s and which has subsequently altered fisheries as well as the entire planktonic food chain in that basin. Blooms of nonindigenous medusae are having negative effects in such far-reaching areas as the eastern Mediterranean Sea, the northern Gulf of Mexico, the Chesapeake Bay and San Francisco Bay (Mills, 2001).

Native jellyfishes also have "bloom" aspects to their life cycles, either in the short- or long-term. It has only recently been recognized that in the past decade, the large native scyphomedusa *Chrysaora melanaster* in the Bering Sea has become 10 times as abundant as in the previous 20 years (Brodeur *et al*., 1999), although the ecosystem-level effects of such a large change remain unclear.

The pelagic Cnidaria and Ctenophora of Kachemak Bay, Cook Inlet, Alaska, were inventoried over 7 days in July–August 2000 for the first time, with an eye to the presence of both native and nonindigenous species.

Methods

Pelagic Cnidaria and Ctenophora were collected at several sites in Kachemak Bay, from July 28–August 4, 2000, primarily by hand-dipping animals seen at the surface either from docks or small boats, using a plastic beaker attached to a 5' pole. Most of the effort was from docks. A few plankton tows were taken, using a 225 μm mesh 1/4 m diameter plankton net, when the seas were too rough to see well at the surface. Sites in Kachemak Bay sampled by hand-dipping or plankton net included Jakolof Bay at the dock, Kasitsna Bay in front of the marine lab, Halibut Cove, the Seldovia Boat Harbor, and the Homer Marina (see Table 1).

Intertidal searches for attached stauromedusae at low water (about -3' to -6') were conducted in several locations; in Kasitsna Bay in front of the marine lab, at three fairly exposed sites in the Herring Islands, and at Halibut Cove on the east side of Ismailof Island. One species of stauromedusa, in the genus *Haliclystus*, was found (4 specimens), only at the Halibut Cove site.

The intertidal eelgrass in pools and on the tidal flats at the head of Jakolof Bay was searched twice for the eelgrass-inhabiting jellyfish *Gonionemus vertens*. No *Gonionemus* medusae were found in this or any other location in Kachemak Bay [although this species is known from Tatitlek, Prince William Sound (Mills, 1999), and from a "salt lake" in Unalaska (Murbach and Shearer, 1903)].

Most specimens were identified to species by C. E. Mills, from living material, at the Kasitsna Bay Laboratory. Carmen and Conrad Field were both helpful in spotting material for this report, Carmen having found 3 of the 4 stauromedusae and Conrad spotting several interesting medusae from the Jakolof dock. Dr. Yayoi Hirano of the Kominato Marine Laboratory, Japan, verified the stauromedusa identification; Dr. Philip Pugh of the Southampton Oceanography Centre, United Kingdom, verified the siphonophore identification.

Results and Discussion

All pelagic Hydrozoa, Scyphozoa, and Ctenophora collected are listed by site in Table 1. A comprehensive taxonomic species list for all species in these groups known to be present in Cook Inlet is given in Table 2. An annotated species list follows here. To my knowledge, no previous collections of medusae or ctenophores from Cook Inlet have been published; I did not search for unpublished data or specimens from Cook Inlet at the University of Alaska.

KACHEMAK BAY, COOK INLET, ANNOTATED SPECIES LIST
(alphabetical by class or subclass, see Table 2)

HYDROZOA

HYDROMEDUSAE

Aequorea aequorea var. aequorea (= ?Aequorea victoria)

Distribution. Common in Jakolof Bay, Kasitsna Bay and the Seldovia Boat Harbor. This is the "small" species of *Aequorea* found throughout coastal Alaska, which is probably the same as the species known as *Aequorea victoria* from British Columbia to California (Wrobel and Mills, 1998).

Remarks. Specimens in Kachemak Bay in July–August 2000 were mostly 6–10 cm in diameter and closely resemble *Aequorea* medusae in Friday Harbor. *Aequorea* taxonomy on the west coast is confused and for the purposes of this report, I am calling the "small" morph specimens by the name applied by Bigelow (1913), who made a careful comparison of medusae including material from Friday Harbor and Dutch Harbor. This is very likely the same species that is known as

Aequorea victoria in British Columbia and Washington State (see Arai and Brinckmann-Voss, 1980b), but no one has done the life cycle or genetic work that would be useful in finally sorting out *Aequorea* taxonomy. For further comments, see my *Aequorea* web page (Mills, 1999–2000).

Aequorea aequorea var. albida

Distribution. Common in Jakolof Bay, Kasitsna Bay and the Seldovia Boat Harbor; one also seen in Halibut Cove (and in the Homer Marina in 1999). This is the "large" species of *Aequorea* (salad plate to dinner plate size) found throughout coastal Alaska and the Bering Sea. It is also common in the Queen Charlotte Islands (J. Blinks, personal communication) and has appeared rarely (1990, 1998) in Friday Harbor (Mills, unpublished).

Remarks. This name was applied by Bigelow (1913) to *Aequorea* specimens measuring 120 mm and 165 mm bell diameter, collected in Dutch Harbor. Such very-large *Aequorea* occur throughout southern Alaska, where they are easily recognized by their large size, large numbers of radial canals, and large central disk. They are often accompanied by the smaller *Aequorea* mentioned above. Whether they are different sizes of the same species or 2 different species has still not been resolved, but there seemed not to be a size overlap between these two morphs in Kachemak Bay in July–August 2000, where all of the largest specimens also had large numbers of radial canals.

Aglantha digitale

Distribution. Many *Aglantha digitale* medusae were observed or collected at the head of Sadie Cove, Katchemak Bay, on August 8, 1999 (Mills, 1999). We saw none of this species during the Kachemak Bay 2000 Expedition.

Remarks. This circumpolar species is well known in the North Pacific, North Atlantic and Arctic Oceans, including the Bering Sea.

Bougainvillia principis / B. ?superciliaris

Distribution. *Bougainvillia principis* medusae were common in both Jakolof Bay and the Seldovia Boat Harbor. This species is also known from elsewhere in the North Pacific and in the North Atlantic.
Arai and Brinckmann-Voss (1980b) chose to call this species *B. multitentaculata* in British Columbia; the species identification is still controversial in the Pacific Northwest.

Remarks. Although they were quite similar to the *Bougainvillia* medusae collected in August 1999 in Sadie Cove and identified at that time as *B. ?superciliaris* (Mills, 1999), the medusae collected in August 2000 lacked one important morphological feature, the peduncle, of the 1999 specimens and this year my best match for species identification is to call them *Bougainvillia principis*. It is very likely that material from both years are the same species, but they are not quite a perfect match for either species description. There was a distinct difference in the peduncle morphology of the 1999 and 2000 specimens, yet we don't yet know the possible range of morphological variation for either species. L. A. Henry identified a common bushy hydroid that was producing medusa buds from the year 2000 settling plates as *Bougainvillia* sp., and it is likely that it is the hydroid of these common *Bougainvillia* medusae collected in the water column. Although the medusa of *B. principis/multitentaculata* is fairly common in the Victoria/Friday Harbor region, its hydroid has not been identified in the field or grown in the laboratory – this fact makes identification of the Alaskan *Bougainvillia* hydroid as the same species less certain.

Clytia gregaria (=Phialidium gregarium)

Distribution. This species was common at the Jakolof dock and at the Seldovia Boat Harbor and a single specimen was seen at the Homer Marina. In 1999 it was also collected in Sadie Cove. *C. gregaria* is known from San Diego (Kramp, 1961) to Alaska (Mills, 1999). *C. hemisphaerica* (see below) is known primarily from both coasts of the North Atlantic and the Mediterranean Sea (Kramp, 1961).

Remarks. The genus name *Clytia* has typically been applied primarily to the hydroid form of this species, but it is an older genus name than *Phialidium* - the name typically used for medusae of this species, and should be applied to both phases of the life cycle of this hydrozoan. L. A. Henry (this report) found *Clytia* polyps to be common in Kachemak Bay and she identified all to be *C. hemisphaerica*. There is little doubt in my mind that the *C. gregaria* medusae were produced by these *C. hemisphaerica* polyps. This confusion is most likely the result of insufficient life cycle knowledge about the species of *Clytia/Phialidium* and more life cycle work should be done on this genus on the west coast before anyone attempts to draw conclusions about what is indigenous or nonindigenous. Hydroids cultured from the eggs of the *P. gregarium* medusae have been described as both *Clytia inconspicua* and *C. osterudi* (Strong, 1925), although only the former species was listed by Fraser (1937). One *Clytia gregaria* medusa from the Seldovia Boat Harbor had a parasitic sea anemone larva attached to one gonad – the larva looked superficially like the species that is known as *Peachia quinquecapitata* in Friday Harbor.

Dipleurosoma typicum

Distribution. Three of these small medusae were collected at the Jakolof dock, on July 29 and 31, 2000. This species has been infrequently collected, but is known from both sides of the North Atlantic (Kramp, 1961), Friday Harbor (Mills, 1981; Mills and Wrobel, 1998) and Sitka (Mills, unpublished).

Remarks. In addition to typical sexual reproduction, this species reproduces asexually by fission of the medusa (Mills, unpublished). Without microscopic inspection, this medusa is easily mistaken for a *Clytia gregaria*.

Eperetmus typus

Distribution. A few immature *Eperetmus typus* medusa were collected at the Jakolof dock and at the Seldovia Boat Harbor. They were previously collected at the head of Sadie Cove during the 1999 Expedition and at the Homer Marina in September 1998 (J. T. Carlton collected the specimens) as well as on this trip (one specimen only)

Remarks. Mills (1999) speculated that this infrequently-collected species might be typical of protected coves and associated with the bottom in the same way as the hydromedusae *Gonionemus* and *Polyorchis*. Collections during the year 2000 Expedition provided little additional information to support or disprove this hypothesis.

Eutonina indicans

Distribution. Small numbers of *Eutonina indicans* medusae were collected in Jakolof Bay and at the Seldovia Boat Harbor. In 1999, it was also collected at the Homer Marina. This species is well known from many locations in the North Pacific and North Atlantic, including other Alaskan locations.

Remarks. A very common species on the west coast from California to Alaska.

Leuckartiara ?foersteri

Distribution. Collected in Jakolof Bay and Halibut Cove on this Expedition and in Sadie Cove in 1999 (Mills, 1999). *Leuckartiara forsteri* was previously known only from locations on Vancouver Island (Arai and Brinckmann-Voss, 1980a, b) and Friday Harbor (Mills, 1981).

Remarks. These approximately 15 mm-tall medusae corresponded fairly well to the recently-described *Leuckartiara foersteri* of Arai and Brinckmann-Voss (1980a, b), but they were 50% larger than specimens described from British Columbia, with more tentacles. These 15 mm-tall specimens were characterized by 8 large and 24 small marginal tentacles, with no additional rudimentary marginal bulbs, and highly-crenulated lips. Identification is pending confirmation by Dr. Anita Brinckmann-Voss of Sooke, British Columbia.

Melicertum octocostatum

Distribution. This species was common in Jakolof Bay and in the Seldovia Boat Harbor; in 1999 it was also collected at the Homer Marina. It is well known elsewhere in Alaska, as well as in the North Pacific and North Atlantic (Wrobel and Mills, 1998).

Remarks. This is a colorful and unusual-looking medusa, with 8 tan, wavy radial canals covered with gonads. It is commonly found in the late spring to mid-summer, at least from Seattle to Alaska.

Mitrocoma cellularia

Distribution. Several of these medusae were collected only at the Jakolof dock; in 1999 they were also found at the Homer Marina. This species has been collected from Monterey Bay to Point Barrow (Kramp, 1961; Wrobel and Mills, 1998).

Remarks. Individuals ranged in size from immature specimens about 20 mm in diameter to sexually mature medusae of 60–70 mm bell diameter.

Polyorchis penicillatus

Distribution. This was a very common medusa in Jakolof Bay, Kasitsna Bay and the Seldovia Boat Harbor. A student once reported to me that this species is also in Sadie Cove, but that has not been verified. It is known to occur from southern California to Dutch Harbor (Kramp, 1961; Wrobel and Mills, 1998).

Remarks. On one occasion as many as 50 *P. penicillatus* medusae were visible in the Seldovia Boat Harbor over about 45 minutes. The hydroid of this species is unknown (Mills, unpublished and A. Brinckmann-Voss, personal communication).

Proboscidactyla flavicirrata

Distribution. These small medusae were very common in both Jakolof Bay and the Seldovia Boat Harbor. A single *P. flavicirrata* medusa was also seen in the Homer Marina (where its hydroid was collected in 1999). This species is well-known throughout the boreal North Pacific (Kramp, 1961 and Mills, unpublished).

Remarks. The hydroid of *P. flavicirrata* was found at the distal tips of most of the sabellid worm tubes in the Seldovia Boat Harbor and was actively producing medusa buds at the time of collection.

Sarsia sp. A *"tubulosa"*

Distribution. These medusae were sporadically abundant in both Jakolof Bay and at the Seldovia Boat Harbor. The same species was collected in 1999 in Sadie Cove and the Homer Marina.

Remarks. These medusae were about 10 mm in bell height and had a long, bluish manubrium that hung down more than twice as long as the bell height. They were of the *Sarsia tubulosa /Sarsia apicula* type (Brinckmann-Voss, 1985); identification is pending confirmation by Dr. Anita Brinckmann-Voss. *Sarsia* is a typical north-boreal hydrozoan genus. Many sympatric *Sarsia*s are known from the Puget Sound / Strait of Georgia region and the entire life cycle - both hydroid and mature medusa - is usually needed for identification to species. *Sarsia* hydroids were collected on some of the settling plates.

Sarsia sp. B *"cliffordi"*

Distribution. These small *Sarsia* medusae were collected only in the Seldovia Boat Harbor.

Remarks. This species is distinguished both by its small size (8 mm bell height) and by the short red manubrium that hangs only 3/4 of the height of the subumbrella. They were of the *Sarsia cliffordi /Sarsia producta* type (Brinckmann-Voss, 1989); identification is pending confirmation by Dr. Anita Brinckmann-Voss.

Staurophora mertensii

Distribution. This species was seen at the Jakolof dock on several occasions; a single medusa of this species was also seen in Halibut Cove. It is a well-known boreal species throughout the North Pacific and North Atlantic (Kramp, 1961).

Remarks. This species is perhaps the largest known hydromedusa, the transparent bell typically exceeding25 cm in diameter. It is easily recognized by its 4 prominent, white, cross-shaped radial canals, each of which is highlighted by numerous cross-hatches of digestive diverticula.

Stomotoca atra

Distribution. This medusa was collected several times from the Jakolof dock and the Seldovia Boat Harbor. It is otherwise known from Puget Sound and British Columbia (Arai and Brinckmann-Voss, 1980b) to Dutch Harbor (Mills, unpublished) and the Bering Sea (Hamner *et al*., 1982).

Remarks. This species name has also been applied recently to a subtropical medusa in Papua New Guinea (Bouillon et al., 1988), but because of temperature differences, I find it difficult to believe that they are the same species.

SIPHONOPHORA

Agalma elegans

Distribution. About 8 specimens were seen from the Jakolof dock and offshore in Kasitsna Bay on July 29, 31 and August 1, 2000. This species is said to be cosmopolitan in the world's ocean, but infrequently collected (Kirkpatrick and Pugh, 1984); I have also collected it in southeast Alaska at Sitka, Elfin Cove and Cross Sound (Mills, unpublished). It is mostly associated with deeper oceanic water (Kirkpatrick and Pugh, 1984) and was probably advected inshore with some oceanic water.

Remarks. Identification verified by Dr. Philip Pugh of the Southampton Oceanography Centre, England, with whom the specimens now reside.

SCYPHOZOA

STAUROMEDUSAE

Haliclystus salpinx or *H. monstrosus*

Distribution. Four of these attached medusae were found on the east side of Ismailof Island, on kelp. *H. salpinx* has not previously been reported from Alaska; it has a disjunct distribution, being known from New England and eastern Canada (Kramp, 1961), the Russian shore of the Sea of Japan (Sheiko and Stepanyants, 1990), the San Juan Islands, and now southern Alaska. Before finding these Kachemak Bay specimens, I was tempted to consider the (rare) San Juan Island *H. salpinx* as possibly introduced, but now I suspect that the species is more widely distributed, but rarely collected. *H. monstrosus* is known from the Kurile Islands (Sheiko and Stepanyants, 1990).

Remarks. The four specimens were given to Dr. Yayoi Hirano of Japan to study and add to her worldwide collection of stauromedusae. She verifies their identification as either *H. salpinx* or *H. monstrosus* and states that there is some possibility that these two species are conspecific, but not yet sufficiently known to make this designation; otherwise, there has probably been some confusion in assigning species names. She notes that the Alaskan specimens look the same as specimens identified as *H. salpinx* from the San Juan Islands, Washington, but also are like specimens called *H. monstrosus* from the Kurile Islands; specimens identified as *H. salpinx* from other locations look slightly different (Sheiko and Stepanyants, 1990; Y. Hirano, personal communication). This species seemed to be very uncommon in the Kachemak Bay area. Lower intertidal algae and rocks were searched in several places (see Methods) for a total of several hours, but we found only 4 specimens, all on the east side of Ismailof Island, on the brown algae *Agarum clathratum* and *Laminaria bongardiana*, near the water line at about -5.5'. All were pale brown and very cryptic on the algae. Dr. Hirano is continuing her study of the species of *Haliclystus* in the North Pacific and will eventually to determine the best species designation for these specimens.

Aurelia labiata

Distribution. *Aurelia labiata* medusae were common in the Seldovia Boat Harbor and a few were also seen from the Jakolof dock. These medusae were known as "*Aurelia aurita*" in Alaska until the species *A. labiata* was resurrected recently (see Wrobel and Mills, 1998). *Aurelia labiata* seems to be restricted to the west coast of North America, but genetic studies are presently underway to establish its range (M. Dawson, UCLA, personal communication).

Remarks. Specimens identified as *A. labiata* had whitish or colorless bells, with no tan pigment on the bell tissue; the gonads were pinkish-red or yellowish. All had a substantial, central, conical gelatinous manubrium (see Wrobel and Mills, 1998, for further description); the largest were around 20 cm in bell diameter.

Aurelia ?limbata

Distribution. Medusae identified by color (see below) as *Aurelia ?limbata* were collected only in the Seldovia Boat Harbor, where they were as common as the "white" *A. labiata* form. The brown-rimmed *A. limbata* is known from boreal regions in both the North Pacific and the North Atlantic, including several locations in Alaska (Kramp, 1961).

Remarks. Specimens identified as *A. ?limbata* had yellowish or tan-colored bells, with light-brown pigment forming a distinctive, narrow rim at the bell margin. Their gonads were a deep brick-red. All had the same substantial, central, conical gelatinous manubrium as specimens called *A. labiata*, and they may simply be color variants of the same species. I did not make a thorough morphological comparison between the two color morphs. Most of the *A. ?limbata* medusae were around 15–20 cm in bell diameter. Previously-identified specimens of *Aurelia limbata* have had a much darker chocolate-brown marginal rim.

Chrysaora melanaster

Distribution. This species is well-known from the Bering Sea and the Gulf of Alaska, although the southern end of its range is not well-defined (Wrobel and Mills, 1998; Brodeur *et al.*, 1999).

Remarks. This species was not collected during the Kachemak Bay 2000 Expedition and has not previously been reported from Cook Inlet. Carmen and Conrad Field state that small numbers of these large medusae are usually beached in the autumn in Kachemak Bay. Since the Prince William Sound Expedition of 1999 (Mills, 1999), I have received photographs of *C. melanaster* beached near Seward in late January, 2000 (Carol Griswold, personal communication).

Cyanea capillata

Distribution. *Cyanea capillata* was common throughout Kachemak Bay in August 2000. This species is common in the North Atlantic, North Pacific, and Arctic Oceans; it is also reported from Australia and Africa (Kramp, 1961).

Remarks. As in Prince William Sound, this species comes in a range of colors in Kachemak Bay, from red to pink or lilac, to yellowish, to a colorless "white" or beige. Most individuals were about 10-30 cm in bell diameter.

Unidentified scyphistomae (probably *Aurelia* spp.)

Distribution. These white scyphozoan polyps were collected below the water line in the Seldovia Boat Harbor in August 2000, and in the Homer Marina in August 1999.

Remarks. Most scyphistomae (polyps) from floating docks along the west coast that have been identified to genus prove to be *Aurelia* (see above). It is likely that scyphistomae seen in the Homer and Seldovia marinas also belong to *Aurelia*, but this identification has not been verified either microscopically by checking nematocysts or by growing the medusae produced. The scyphistomae in the Seldovia Boat Harbor were not strobilating (producing medusae) at the time of collection.

CTENOPHORA

Beroe cucumis

Distribution. Four very large *Beroe cucumis* were observed in the adjacent Kasitsna and Jakolof Bays; I received a description by a kayak guide of something that must have been the same thing earlier in the week in China Poot Bay. This species is known from the North Pacific, North Atlantic and the Southern Ocean (Mayer, 1910, Arai, 1988).

Remarks. On August 1, 2000, 2 *Beroe* were collected, in Kasitsna Bay and off the Jakolof dock, measuring 240 mm long and 160 mm long, respectively. Two more *B. cucumis* of similar size were seen at the Jakolof dock on August 4 as we were preparing to depart and were not measured. All had rose-pink pigment along the comb rows, a lighter pink body wall, and were similarly rounded at both the oral and aboral ends; the body was translucent, not transparent. All were characterized by 8 comb rows of equal length, running nearly the entire length of the animal, and unbranched pharyngeal canals (observed by dissection of two specimens). These are among the largest reported specimens of *Beroe cucumis*. *Beroe* feeds on other ctenophores and these were presumably feeding on the abundant *Bolinopsis* (see below), although no feeding interactions were observed.

Bolinopsis infundibulum

Distribution. *Bolinopsis infundibulum* was abundant in Kachemak Bay on this trip. Individuals were seen almost everywhere I looked in the upper meter of water (which could be easily searched from the surface). This is a common north boreal species in the Pacific, Atlantic and Arctic Ocean; I have also collected *B. infundibulum* in Prince William Sound (Mills, 1999) and at Dutch Harbor (Mills, unpublished).

Remarks. The Kachemak Bay specimens agreed well with the *B. infundibulum* description in Mayer (1912). All.were colorless, lacking the fairly-characteristic black line or row of spots near the edge of the lobes seen on specimens in Friday Harbor and Dutch Harbor (Mills, unpublished) and some arctic locations (M. Ospovat, personal communication). The average size of individuals seemed to increase substantially during our week-long visit. When we arrived, there were many individuals in the 10–20 mm-long size class, whereas most were 30–50 mm long when we left, with some individuals by that time approaching 100 mm in length. The *Bolinopsis* had copepods as well as appendicularians in their guts. At least one *Bolinopsis* carried an *Oodinium*-type ectoparasitic dinoflagellate on a comb row (see Mills and McLean, 1991).

Pleurobrachia bachei

Distribution. Only one *Pleurobrachia* specimen was seen on the Kachemak Bay 2000 trip. It was observed on July 28, 2000, at the Jakolof Bay dock, amongst about 50 small *Bolinopsis infundibum* at the surface.

Remarks. This specimen was not collected or closely examined because it was seen just as the party arrived at the Jakolof dock, in the rain. It was assumed that *Pleurobrachia* would prove to be a common species, but it was not. This species name is applied here because I have also collected *P. bachei* in Prince William Sound (Mills, 1999) and at Sitka (Mills, unpublished).

References

Arai, M. N. 1988. *Beroe abyssicola* Mortensen, 1927: a redescription. Contributions to Natural Science, Royal British Columbia Museum, 9: 1-7.

Arai, M. N. and A. Brinckmann-Voss, 1980a. A new species of *Leuckartiara* (Pandeidae, Hydrozoa) from the east coast of Vancouver Island. Can. J. Zool., 58: 1491-1493.

Arai, M. N. and A. Brinckmann-Voss, 1980b. Hydromedusae of British Columbia and Puget Sound. Canadian Bulletin of Fisheries and Aquatic Sciences, Bulletin 204: 1-192.

Bigelow, H. B. 1913. Medusae and siphonophorae collected by the U. S. Fisheries steamer “Albatross” in the Northwestern Pacific, 1906. Proc. U. S. Nat. Museum, 44: 1-119, 6 pls.

Bouillon, J., G. Seghers and F. Boero, 1988. Notes additionnelles sur les méduses de Papouasie Nouvelle-Guinée (Hydrozoa, Cnidaria III. Indo-Malayan Zool., 5: 225-253.

Brinckmann-Voss, A. 1985. Hydroids and medusae of *Sarsia apicula* (Murbach and Shearer, 1902) and *Sarsia princeps* (Haeckel, 1879) from British Columbia and Puget Sound with an evaluation of their systematic characters. Can. J. Zool., 63: 673-681.

Brinckmann-Voss, A. 1989. *Sarsia cliffordi* n. sp. (Cnidaria, Hydrozoa, Anthomedusae) from British Columbia, with distribution records and evaluation of related species. Can. J. Zool., 67: 685-691.

Brodeur, R. D., C. E. Mills, J. E. Overland, G. E. Walters and J. D. Schumacher, 1999. Evidence for a substantial increase in gelatinous zooplankton in the Bering Sea, with possible links to climate change. Fish. Oceanogr. 8: 296-306.

Fraser, C. M. 1937. Hydroids of the Pacific Coast of Canada and the United States. University of Toronto Press, Toronto, 207 pages and 44 plates.

Hamner, W., P. Hamner, J. Morin and M. Shulman, 1982. Unpublished cruise report of the Bering Sea PROBES cruise on the “Alpha Helix”, July-August, 1982.

Kirkpatrick, P. A. and P. R. Pugh, 1984. Siphonophores and Velellids. For the Linnean Society of London by E. J. Brill / Dr. W. Backhuys, London, 154 pp.

Kramp, P. L. 1961. Synopsis of the medusae of the world. J. Mar. Biol. Assoc. U.K., 40: 1–469.

Mayer, A. G. 1912. Ctenophores of the Atlantic Coast of North America. Carnegie Institution of Washington Publication No. 162: 1-58.

Mills, C. E. 1981. Seasonal occurrence of planktonic medusae and ctenophores in the San Juan Archipelago (NE Pacific). Wasmann J. Biol., 39: 6-29.

Mills, C. E. 1999-2000. Web Site: http://faculty.washington.edu/cemills/Aequorea.html.

Mills, C. E. 1999. Planktonic Cnidaria, Ctenophora, and pelagic Mollusca. pp. 9C2-15 *In* A. H. Hines and G. M. Ruiz, Biological Invasions of Cold-water Coastal Ecosystems: Ballast-mediated Introductions in Port Valdez / Prince William Sound, Alaska. Final Project Report, 15 December 1999, presented to the Regional Citizens' Advisory Council of Prince William Sound, Valdez, Alaska.

Mills, C. E., 2001. Jellyfish blooms: are populations increasing globally in response to changing ocean conditions? Hydrobiologia: accepted.

Mills, C. E. and N. McLean, 1991. Ectoparasitism by a dinoflagellate (Dinoflagellata: Oodinidae) on 5 ctenophores (Ctenophora) and a hydromedusa (Cnidaria). Dis. Aquat. Org., 10: 211-216.

Murbach, L. and C. Shearer, 1903. On medusae from the coast of British Columbia and Alaska. Proc. Zool. Soc. London, 2: 164-192, pls. 17-22.

Sheiko, O. and S. Stepanyants, 1990. Far East representatives of stauromedusae of the family Eleutherocarpidae. pp. 30-43 *In* Systematics and Ecology of the Hydrobionts of the Far-East Marine Reserve (V. Gulbin, ed.). Academy of Sciences, Far East Department, Institute of Marine Biology, Vladivostok, 137 pp. (In Russian).

Strong, L. H., 1925. Development of certain Puget Sound hydroids and medusae. Publ. Puget Sound Biol. Station, 3: 383-399.

Wrobel, D. and C. Mills, 1998. Pacific Coast Pelagic Invertebrates: a Guide to the Common Gelatinous Animals. Sea Challengers and the Monterey Bay Aquarium, Monterey, California, 108 pp.

Table 1. Pelagic (and attached) Medusae and Ctenophora collected in Kachemak Bay, Alaska, July 28 – August 4, 2000, listed by site (continued on following page).

YEAR 2000 EXPEDITION TO KACHEMAK BAY, C.E. MILLS REPORT	Homer Marina	Sadie Cove (1999)	Halibut Cove	Jakolof Bay	Kasitsna Bay	Seldovia Boat Harbor
HYDROMEDUSAE						
Aequorea aequorea v. aequorea				x	x	x
Aequorea aequorea v. albida	(1999)		x	x	x	x
Aglantha digitale		(1999)				
Bougainvillia principis				x		x
Bougainvillia ?superciliaris		(1999)				
Clytia gregaria (=Phialidium gregarium)	x	(1999)		x		x
Dipleurosoma typicum				x		
Eperetmus typus	x (1998)	(1999)		x		x
Eutonina indicans	(1999)			x		x
Leuckartiara ?foersteri		(1999)	x	x		
Melicertum octocostatum	(1999)			x		x
Mitrocoma cellularia	(1999)			x		
Polyorchis penicillatus		rumor		x	x	x
Proboscidactyla flavicirrata	x (1999)			x		x
Sarsia sp. A *"tubulosa"* - with long blue stomach	(1999)	(1999)		x		x
Sarsia sp. B *"cliffordi"* - with short red stomach						x
Staurophora mertensii			x	x		
Stomotoca atra				x		x

Table 1, continued.

YEAR 2000 EXPEDITION TO KACHEMAK BAY, C.E. MILLS REPORT	Homer Marina	Sadie Cove (1999)	Halibut Cove	Jakolof Bay	Kasitsna Bay	Seldovia Boat Harbor
SIPHONOPHORA						
Agalma elegans				x	x	
SCYPHOZOA						
Haliclystus salpinx/monstrosus			x			
Aurelia labiata				x		x
Aurelia ?limbata (tan margin)						x
Cyanea capillata	(1999)	(1999)		x	x	x
unidentified scyphistomae (probably *Aurelia* sp.)	(1999)					x
CTENOPHORA						
Beroe cucumis				x	x	
Bolinopsis infundibulum				x	x	x
Pleurobrachia bachei				x?		
ANTHOZOA						
"*Peachia*" larva attached to *Clytia gregaria* medusa						x

Table 2. List of all Medusae and Ctenophora known from Kachemak Bay, Alaska.
PHYLUM CNIDARIA

CLASS HYDROZOA
SUBCLASS HYDROIDOMEDUSAE (=HYDROMEDUSAE)
ORDER ANTHOMEDUSAE
Bougainvillia principis (Steenstrup, 1850)
Bougainvillia ?superciliaris (L. Agassiz, 1849)
Leuckartiara ?foersteri Arai & Brickmann-Voss, 1980
Polyorchis penicillatus (Eschscholtz, 1829)
Proboscidactyla flavicirrata Brandt, 1835
Sarsia sp. A *"tubulosa"* (confer *Sarsia tubulosa* (M. Sars, 1835))
Sarsia sp. B *"cliffordi"* (confer *Sarsia cliffordi* Brinckmann-Voss, 1989)
Stomotoca atra A. Agassiz, 1862

ORDER LEPTOMEDUSAE
Aequorea aequorea var. aequorea (Forskål, 1775)
Aequorea aequorea var. albida A. Agassiz, 1862
Clytia gregaria (A. Agassiz, 1862) *(=Phialidium gregarium)*
Dipleurosoma typicum Boeck, 1866
Eutonina indicans (Romanes, 1876)
Melicertum octocostatum (M. Sars, 1835)
Mitrocomella cellularia (A. Agassiz, 1865)
Staurophora mertensii Brandt, 1835

ORDER LIMNOMEDUSAE
Eperetmus typus Bigelow, 1915

ORDER TRACHYMEDUSAE
Aglantha digitale (O. F. Müller, 1776)

SUBCLASS SIPHONOPHORA
ORDER PHYSONECTA
Agalma elegans (Sars, 1846) Fewkes, 1880

CLASS SCYPHOZOA / SCYPHOMEDUSAE
ORDER STAUROMEDUSAE (attached to kelp, low intertidal)
Haliclystus salpinx Clark, 1863 or *H. monstrosus* (Naumov, 1961)

ORDER SEMAEOSTOMEAE
Aurelia labiata Chamisso & Eysenhardt, 1821
Aurelia ?limbata Brandt, 1835
Chrysaora melanaster Brandt, 1835
Cyanea capillata (Linnaeus, 1758)

PHYLUM CTENOPHORA

ORDER CYDIPPIDA
Pleurobrachia bachei A. Agassiz, 1860
ORDER LOBATA
Bolinopsis infundibulum (O. F. Müller, 1776)
ORDER BEROIDA
Beroe cucumis Fabricius, 1780

4.D. Anthozoa

Anson H. Hines
Smithsonian Environmental Research Center
PO Box 28
Edgewater, MD 210037
USA

Nora Foster
University of Alaska Museum
Fairbanks, AK
USA

Five species of sea anemones were recorded during field surveys in Kachemak Bay using keys in Kozloff (1987). These are all common and well known from previous work, so no specimens were collected.

Species List of Anthozoans Observed at Kachemak Bay, Alaska, during July-August 2000.

Metridium senile
Anthopleura elegantissima
Anthopleura xanthogrammica
Urticina (Tealia) crassicornis
Urticina (Tealia) columbiana

Kozloff, E.N. 1987. Marine invertebrates of the Pacific Northwest. University of Washington Press, Seattle. 511 p.

4.E. Bryozoans

Judith E. Winston
Director of Research
ph. 540-666-8600, fax 540 632-6487
e-mail, jwinston@vmnh.org

J. E. Winston, VMNH, 18 October 2000
Alaskan bryozoan species list – all stations, summer 2000, 68 species.

SPECIES AUTHOR & DATE FAMILY

Ctenostomata

1. Alcyonidium sp. 1
(polyoum-like)
2. Alcyonidium sp. 2
(transparent, on kelp)
3. Alcyonidium sp. 3
(bubble kenozooids)
4. Alcyonidium sp. 4
(thick, orange colored)
5. Alcyonidium sp. 5
(grayish-tan, barnacles,
high intertidal)
6. Alcyonidium irregulare Kluge 1962 Alcyonidiidae
7. Bowerbankia aggregata (O'D&O'D)* 1926 Vesiculariidae
8. Flustrellidra cervicornis (Robertson) 1900 Flustrellidridae
9. Flustrellidra gigantea (Silén) 1947 Flustrellidridae

Cyclostomata

1. Crisia arctica (?) (M. Sars) 1863 Crisiidae
2. Crisia sp. (juv.) Crisiidae
3. Berenicea arctica Kluge 1946 Diastoporidae
4. Diplosolen obelia (Johnston) 1838 Diastoporidae
5. Disporella alaskensis Osburn 1953 Lichenoporidae
6. Heteropora alaskensis (Borg) 1933 Heteroporidae
7. Plagioecia ambigua Osburn 1953 Diastoporidae
8. Tubulipora penicillata (Fabricius) 1780 Tubuliporidae
9. Tubulipora tuba (Gabb &.Horn) 1862 Tubuliporidae
10. Tubulipora sp. Tubuliporidae

Cheilostomata

1. Alderina brevispina (O'D & O'D) 1926 Calloporidae
2. Bugula pacifica Robertson 1905 Bugulidae
3. Callopora armata (O'D & O'D) 1926 Calloporidae
4. Callopora decidua Dick & Ross 1988 Calloporidae
5. Callopora sedovi (Kluge) 1962 Calloporidae
6. Cauloramphus magnus Dick & Ross 1988 Calloporidae
7. Cauloramphus pseudospinifer Androsova 1958 Calloporidae
8. Cauloramphus spinifer (Johnston) 1832 Calloporidae
9. Celleporella hyalina (Linnaeus) 1767 Hippothoidae
10. Celleporella reflexa Dick & Ross 1988 Hippothoidae
11. Celleporella sp. Hippothoidae
12. Cribrilina corbicula (O'D & O'D) 1923 Cribrilinidae
13. Cryptosula okadai Dick & Ross 1988 Cryptosulidae
14. Cylindroporella tubulosa (Norman) 1868 Tessaradomidae
15. Dendrobeania exilis (Hincks) 1882 Bugulidae
16. Dendrobeania lichenoides (Robertson) 1900 Bugulidae
17. Desmacystis sandalia (Robertson) 1900 Desmacystidae
18. Electra arctica (Osburn) 1950 Electridae
19. Electra crustulenta (Pallas) 1766 Electridae
20. Ellisina levata (Hincks) 1882 Calloporidae
21. Escharella peristomata (Kluge) 1962 Escharellidae
22. Fenestruloides eopacifica S, S & C** 1995 Microporellidae
23. Harmeria scutulata (Busk) 1855 Cryptosulidae
24. Hippoporidra truculenta Dick & Ross 1988 Hippoporidridae
25. Hippoporina apertura (Osburn) 1952 Hippoporinidae
26. Hippoporina vulgaris Dick & Ross 1988 Hippoporinidae
27. Hippothoa mawatarii Dick & Ross 1988 Hippothoidae
28. Lagenicella neosocialis Dick & Ross 1988 Teuchoporidae
29. Membranipora membranacea (Linnaeus) 1767 Membraniporidae
30. Microporella alaskana Dick & Ross 1988 Microporellidae
31. Microporella californica (Busk) 1856 Microporellidae
32. Microporella neocribroides Dick & Ross 1988 Microporellidae
33. Microporina articulata (Fabricius) 1821 Microporidae
34. Myriozoella plana (Dawson) 1958 Myriozoidae
35. Parasmittina alaskensis Osburn 1952 Smittinidae
36. Porella acutirostris Smitt 1868 Smittinidae
37. Porella alba Nordgaard 1906 Smittinidae
38. Porella columbiana O'D & O'D 1923 Smittinidae
39. Porella immersa Mawatari 1956 Smittinidae
40. Rhynchozoon tumulosum (Hincks) 1882 Reteporidae
41. Scrupocellaria arctica Kluge 1962 Scrupocellariidae
42. Smittina majuscula (Smitt) 1868 Smittinidae
43. Stomachetosella cruenta Osburn 1952 Stomachetosellidae
44. Tegella arctica (D'Orbigny) 1851 Calloporidae
45. Tegella armifera (Hincks) 1880 Calloporidae
46. Tegella aquilirostris O'D & O'D 1923 Calloporidae

47. Tegella horrida (Hincks) 1880 Calloporidae
48. Terminoflustra membranaceotruncata (Smitt) 1867 Flustridae
49. Tricellaria occidentalis (Trask) 1857 Scrupocellariidae

---

* = O'Donoghue and O'Donoghue, **= Soule, Soule and Chaney

AK0100 Bear Cove, Kachemak Bay, Alaska 29 July 2000, JE Winston

---

Ctenostomata
Alcyonidium sp. (Alaskan sp. 1)
Bowerbankia aggregata

Cheilostomata
Cauloramphus spiniferum
Celleporella hyalina
Electra crustulenta

AK0200 Peterson Bay, Kachemak Bay, Alaska, 29 July 2000, JE Winston

---

Ctenostomata
Alcyonidium sp. 2 (transparent smooth encrusting on kelp)

Cheilostomata
Celleporella sp.
Membranipora membranacea

AK0300 Jakolof Bay, Kachemak Bay, beach by public boat landing, 30 July 2000
JE Winston

Ctenostomata
Alcyonidium sp. 3, hirsutum-like (bubble-like kenozooids)
Alcyonidium sp. 4 (thick, orange colored)
Alcyonidium sp. 5 (grayish-tan, on barnacles in high intertidal)
Alcyonidium irregulare

Cyclostomata
Disporella alaskensis
Heteropora alaskensis
Plagioecia ambigua
Tubulipora tuba

Cheilostomata
 Cauloramphus pseudospinifer
 Celleporella reflexa
 Celleporella hyalina
 Cribrilina corbicula
 Cylindroporella tubulosa
 Electra arctica
 Escharella peristomata
 Fenestruloides eopacifica
 Lagenicella neosocialis
 Membranipora membranacea
 Microporella alaskana
 Microporella neocribroides
 Myriozoella plana
 Parasmittina alaskensis
 Porella immersa
 Porella alba
 Porella columbiana
 Rhynchozoon tumulosum
 Smittina majuscula
 Stomachetosella cruenta
 Tegella arctica
 Tegella armifera
 Terminoflustra membranaceotruncata

AK0400 Floating docks at Public Boat Dock, Seldovia, Alaska 30 July 2000
JE Winston

Ctenostomata
 Alcyonidium sp. 2

Cheilostomata
 Celleporella hyalina
 Bugula pacifica
 Terminoflustra membranaceotruncata

AK0500 Buoy on boat pulled out at public boat landing, Jakolof Bay, Alaska
30 July 2000, JE Winston

Cheilostomata
 Bugula pacifica
 Celleporella hyalina

AK0600, Outer beach of Ismailof Island, Halibut Cove, Kachemak Bay, Alaska
31 July 2000,JE Winston

Cyclostomata
 Crisia sp. (juv.)
 Disporella alaskensis
 Heteropora alaskensis
 Tubulipora sp. (very grazed)

Cheilostomata
 Callopora armata
 Callopora sedovi
 Callopora decidua
 Celleporella reflexa
 Celleporella hyalina
 Cribrilina corbicula
 Cryptosula okadai
 Cylindroporella tubulosa
 Dendrobeania lichenoides
 Parasmittina alaskensis
 Porella acutirostris

AK0700 Kasitsna Bay Marine Lab, beach on left side of lab, 30 July
JE Winston

Cyclostomata
 Berenicea arctica

Cheilostomata
 Hippothoa mawatarii
 Alderina brevispina
 Celleporella reflexa

AK0800 Kasitsna Bay Marine Lab, beach on point to right of lab buildings,
1 August 2000, JE Winston

Ctenostomata
 Alcyonidium sp. 1
 Bowerbankia aggregata

Cheilostomata

Celleporella reflexa
Cryptosula okadai
Harmeria scutulata
Hippoporina vulgaris

AK0900 Outer part of Tutka Bay, Kachemak Bay, Alaska, 1 August 200, JE Winston

---

Ctenostomata
Alcyonidium sp. (dried)

Cyclostomata
Berenicea arctica
Disporella alaskensis
Heteropora alaskensis
Tubulipora sp.

Cheilostomata
Callopora sedovi
Cauloramphus spinifer
Cauloramphus pseudospinifer
Celleporella hyalina
Cribrilina corbicula
Cylindroporella tubulosa
Dendrobeania exilis
Dendrobeania lichenoides
Desmacystis sandalia
Hippoporina apertura
Myriozoella plana
Parasmittina alaskensis
Porella acutirostris
Rhynchozoon tumulosum
Stomachetosella cruenta

AK1000 Mouth of Jakolof Bay, Kachemak Bay, Alaska (other side of bay from boat dock)
1 August 2000, JE Winston

Ctenostomata
Alcyonidium sp. 1
Alcyonidium sp. 3
Alcyonidium sp. 4
Alcyonidium irregulare

Flustrellidra cervicornis

Cyclostomata
Berenicea arctica
Disporella alaskensis

Cheilostomata
Alderina brevispina
Callopora sedovi
Cauloramphus pseudospinifer
Celleporella hyalina
Celleporella reflexa
Cribrilina corbicula
Crypotosula okadai
Cylindroporella tubulosa
Dendrobeania exilis
Harmeria scutulata
Hippoporina vulgaris
Hippothoa mawatarii
Lagenicella neosocialis
Myriozoella plana
Parasmittina alaskensis
Porella immersa
Rhynchozoon tumulosum
Terminoflustra membranaceotruncata

AK1100 English Bay, Cook Inlet, Alaska 1 August 2000, Jon Norenburg

---

Ctenostomata
Flustrellidra gigantea

Cyclostomata
Disporella alaskensis
Heteropora alaskensis
Tubulipora penicillata

Cheilostomata
Alderina brevispina
Cauloramphus magnus
Celleporella hyalina
Celleporella sp.
Dendrobeania exilis
Lagenicella neosocialis
Microporella californica
Microporina articulata

Porella alba
Scrupocellaria arctica
Tegella arctica
Tegella horrida
Tricellaria occidentalis

AK1200 Kasitsna Bay, 60' depth on rubber inner tube strip, collected while fishing
31 July 2000 Jerry Kudenof

Cyclostomata
Tubulipora tuba

Cheilostomata
Porella columbiana

AK 1300 Herring Islands, Kachemak Bay, Alaska , 1 August 2000, Claudia Mills and Sarah Cohen

---

Cyclostomata
Disporella alaskensis
Heteropora alaskensis
Tubulipora tuba

Cheilostomata
Celleporella hyalina
Hippoporina apertura
Lagenicella neosocialis
Porella acutirostris
Porella columbiana
Tegella aquilirostris

AK 1400 Kasitsna Bay Marine Lab, beach on point to right of lab buildings,
2 August 2000, JE Winston

Ctenostomata
Alcyonidium sp. 3
Alcyonidium sp. 4
Alcyonidium sp. 5

Cyclostomata

Berenicea arctica
Crisia arctica (?)
Diplosolen obelia
Disporella alaskensis
Tubulipora tuba

Cheilostomata
Celleporella reflexa
Celleporella hyalina
Cryptosula okadai
Cylindroporella tubulosa
Ellisina levata
Fenestruloides eopacifica
Harmeria scutulata
Hippoporidra truculenta
Hippoporina vulgaris
Hippothoa mawatarii
Porella immersa
Rhynchozoon tumulosum
AK1500 Kasitsna Spit, Kasitsna Bay, Alaska 2 August 2000 Sarah Cohen

---

Cheilostomata
Hippoporina vulgaris
Porella alba

On SERC Panel Labels from Homer Spit, Homer, AK

Cheilostomata
Bugula pacifica
Celleporella hyalina
Electra crustulenta

Voucher specimens from SERC panels, Identified by JE WINSTON

Plate # Location	Voucher # VMNH	Species
020	Bugula pacifica	X
	Celleporella hyalina	
	Tegella aquilirostris	

064 Disporella alaskensis X

---

066 Celleporella hyalina X

---

088 Celleporella hyalina X

---

099 Celleporella hyalina X

---

121 Electra crustulenta (2) X

---

158 2768 Tubulipora sp. Seldovia Hbr. X

---

165 Electra crustulenta X

---

169 2810 Cribrilina corbicula (2) X

---

185 2619 Porella columbiana X
2618 Tegella aquilirostris
2625 Callopora sedovi
2624 Parasmittina alaskensis (juv.)

---

191 Cribrilina corbicula (1) X
Celleporella hyalina (many)

? 1175 Electra crustulenta X

? 2636 Electra crustulenta X

? 1169 Cribrilina corbicula X

? 2849 Electra crustulenta X

? 2850 Cribrilina corbicula

? 2697 Bowerbankia aggregata wet specimen in vial, SERC

4.F. Nemertea

Jon Norenburg & Svetlana Maslakova
Department of Invertebrate Zoology
National Museum of Natural History
Smithsonian Institution

Single collecting trips were made to each site with exception of MacDonald Spit, where three collections were made on each side of the spit. Nemertea were collected by hand in the intertidal zone and shallow (<1 m) subtidal water on low tides.

Results

Twenty-one species were collected with as many as nine species found at any one site (Table 4.E.1). No unexpected species were encountered; all species recorded were previously known from southern Alaska locations.

Table 4.F.1. Nemertea collected from Kachemak Bay, Alaska, 25 July – 4 August, 2000.

Bear Cove
- *Procephalothrix spiralis?*
- *Micrura alaskensis*
- *Micrura verrilli*
- *Myoisophagos sanguineus*
- *Amphiporus angulatus*
- *Amphiporus imparispinosus*
- *Emplectonema gracile*
- *Paranemertes pallida?*
- *Paranemertes peregrina*

Oyster farm floats
- *Emplectonema buergeri*
- *Paranemertes peregrina*
- *Zygonemertes virescens*
- *Tetrastemma* spp

Jackaloff Bay
- *Tubulanus theeli?*

Kasitsna lab shore
- *Emplectonema gracile*

MacDonald Spit--inside flat
- *Carinoma mutabilis*
- *Carinomella lactea*
- *Micrura alaskensis*
- *Micrura verrilli*

MacDonald Spit—outside

Tubulanus sexlineatus
Cerebratulus latus
Cerebratulus marginatus?
Cerebratulus montgomeryi
Lineus torquatus
Micrura verrilli
Amphiporus angulatus
Amphiporus formidabilis

English Bay

Cerebratulus montgomeryi
Micrura verrilli
Amphiporus formidabilis
Paranemertes peregrina
Paranemertes sp.

4.G. Brachyura

Anson H. Hines
Smithsonian Environmental Research Center
PO Box 28
Edgewater, MD 21037
USA

Species List of Brachyuran Crabs Obseved at Kachemak Bay. No specimens collected.

Cancer magister
Cancer oregonensis
Oregonia gracilis
Scyra acutifrons
Telmessus cheiragonus

4.H. Molluscs

Nora R. Foster
2998 Gold Hill Road
Fairbanks, Alaska 99709

Methods

Marine mollusks were collected form seven sites along the south side of Kachemak Bay during the low tide series of July 29- August 3, 2000. The survey is intended as a search for nonindigenous species and to produce a general species inventory.

Bear Cove
July 29, 2000
Habitat: boulders and irregular cobbles with shell hash and mud

Peterson Bay
July 29, 2000
Habitat: oyster float buoys

MacDonald Spit, sheltered side
July 30, 2000
Habitat: sand and mud

MacDonald Spit, exposed side
July 31, 2000
Habitat: rounded boulders, with sand between

Tutka Bay entrance
August 1, 2000
Habitat: bedrock and boulders

Jakalof Bay dock floats
August 2, 2000

Jakolof Bay head
August 3, 2000
Habitat: gravel and mud with freshwater stream

Species determination was accomplished at the Kachemak Bay lab, using available literature on Alaskan marine mollusks: Foster (1985), Beherns (1991), Kozloff (1987), and Harbo (1997). Nomenclature updates follow Turgeon et al.(2000) and Coan et al. (2000).

Additional collecting records for Kachemak Bay mollusca are based on the Aquatic Collection, University of Alaska Museum. Collections were made by Rae Baxter and George Mueller around 1977 and by Nora Foster in 1984. Localities are: Jakalof Bay , rocky intertidal habitats, the outer side of MacDonlad Spit, Glacier Spit, Tutka Bay intertidal, Sadie Cove intertidal, subtidal samples collected by pipe dredge in Kachemak Bay, unspecified loacalities, Tutka Bay and Kasitsna Bay.

Results

One hundred twenty species were found in 15 localities (seven visited in July/August 2000, eight at other times) (Table 4.G.1) including 53 bivalve species, 48 prosobranch gastropod species, 11 opisthobranch gastropods species, and 8 chiton species. Habitats include eight rocky settings, 3 soft bottom subtidal, 2 fouling communities, two soft sediment intertidal settings. Species occurrences among the habitats are shown in Table 4.G.2.

The species list includes range extensions for the opisthobranchs *Polycera zostera*e, *Doridella steinbergi*, *Eubranchus olivaceous*, and *Aglaja ocelligera*.

Two nonindigenous species are preent: The north Atlantic soft shell clam, *Mya arenaria* is well established in the upper intertidal zone in sheltered soft sediments, and the introduced, but not established Pacific oyster, *Crassostraea gigas* .

Table 4.H.1. Species list: mollusks from the south side of Kachemak Bay

BIVALVIA

Anomiidae
Pododesmus macroschisma (Deshayes, 1839)
Astartidae
Astarte arctica (Gray, 1824)
Cardiidae
Clinocardium californiense (Deshayes, 1864)
Clinocardium nuttallii (Conrad, 1837)
Cinocardium sp.
Serripes sp.
Serripes cf.S laperousii (Deshayes, 1864)
Serripes groenlandicus (Mohr, 1786)
The small cardiids could not be determined below the generic level. *Clinocardium nutt*allii is the most common of the *Clinocardium* species in the intertidal zone. *Serripes laperousii* , *S. groenlandicum* and *Serripes notabilis* Sowerby, 1915 have been collected in Kachemak Bay.
Glycymerididae
Glycymeris septentrionalis (Middendorff, 1849)
Hiatellidae
Hiatella arctica (Linnaeus, 1767)
Kelliidae
Kellia suborbicularis (Montagu, 1803)
Lasaeidae
Rochefortia tumida (Carpenter, 1864)
Lyonsiidae
Entodesma navicula (Adams and Reeve, 1850)
Mactridae
Mactromeris polynyma (Stimpson, 1850)
Tresus nuttalli (Conrad, 1837)

<u>Mytilidae</u>
Mytilus trossulus (Gould, 1950)
Modiolus modiolus (Linnaeus, 1758)
Musculus discors (Linnaeus, 1767)
Musculus sp.
Valisina vernicosa (Middendorff, 1849)
<u>Myidae</u>
Mya arenaria (Linnaeus, 1758)
Mya arenaria is a large clam that inhabits upper intertidal soft sediments in protected bays. In Alaska, it is abundant on mud sediments in various locations in southeastern Alaska, Prince William Sound, Kodiak Island and bays in the Yukon-Kuskokwim Delta. The populations the soft shell clam on the west coast of North America are possibly the result of its accidental introduction along with Atlantic oysters, starting in San Francisco Bay in 1869, and Puget Sound in 1888 or 1889 (Bernard, 1979).
Mya pseudoareneria (Sclesch, 1931)
Mya sp. At small sizes (10 mm or less) it is difficult to distinguish to species of Mya
Mya truncata (Linnaeus, 1758)
<u>Nuculanidae</u>
Nuculana minuta (Muller, 1776)
Nuculana pernula (Muller, 1779)
<u>Nuculidae</u>
Enucula tenuis (Montagu, 1808)
<u>Ostreidae</u>
Crassostraea gigas (Thunberg, 1793)
Pacific oysters are grown in several localities- the species does not reproduce in Alaskan waters.
<u>Pandoridae</u>
Pandora wardiana Adams, 1859
Pandora sp.
At least three small species of *Pandora*, *P. bilirata* Conrad, 1855, *P. filosa* (Carpenter, 1864), and *P. glacialis* Adams, 1860, have been collected in Cook Inlet.
<u>Pectinidae</u>
Chlamys rubida (Hinds, 1845)
*Patinopecten caurin*us (Gould, 1850)
<u>Tellinidae</u>
Macoma balthica (Linnaeus, 1758)
Macoma brota Dall, 1916
Macoma expansa Carpenter, 1864
Macoma golikovi Scarlato and Kafanov,1988
Macoma inquinata (Deshayes, 1855)
Macoma lama Bartsch, 1929
Macoma nasuta (Conrad, 1837)
Tellina lutea Wood, 1828
Tellina modesta (Carpenter, 1864)
Tellina nuculoides (Reeve, 1854)

Thraciidae
Thracia myopsis Moller, 1824
Thracia trapzoides Conrad, 1848
Thyasiridae
Axinopsida serricata (Carpenter, 1864)
Turtoniidae
Turtonia sminuta (Fabricius, 1780)
Ungulinidae
Dipodonta impolita Berry, 1953
Veneridae
Humilaria kennerleyi (Reeve, 1863)
Liocyma fluctuosa (Gould, 1841)
Protothaca staminea (Conrad, 1837)
Saxidomus gigantea (Deshayes, 1839)

GASTROPODA: PORSOBRANCHIA

Acmaeidae
Acmaea mitra Rathke, 1833
Buccinidae
Buccinum baeri (Middendorff, 1848)
Buccinum glaciale Linnaeus, 1761
Lirabuccinum dirum (Reeve, 1846)
Neptunea lyrata (Gmelin, 1791)
Calyptraeidae
Crepidula nummaria Gould, 1846
Cancellarriidae
Neadmete modesta (Carpenter, 1864)
Capulidae
Trichotropis insignis Middendorff, 1849
Cerithiidae
Bittium sp.
Cerithiopsis ?
At small sizes the Cerithiidae are difficult to distinguish.
Columbellidae
Amphissa columbiana Dall, 1916
Conidae
*Curitoma inci*sula (Verrill, 1882)
Oenopota alaskensis (Dall, 1871)
Oenopota sp.
Propebela arctica (Adams, 1855)
Many species of *Oenopot*a and *Propebela* have been described from Alaksa waters, they are difficult to distinguish, much of their taxonomy needs to be resloved.
Eulimidae
Vitreolina columbiana (Bartsch, 1917)
Balcis ? sp.
Fissurellidae
Cranopsis cucullata (Gould, 1846)

Puncturella galeata (Gould, 1846)
Puncturella noachina (Linnaeus, 1771)
Puncturella sp.
Lepetidae
Cryptobranchia alba Dall, 1869
Cryptobranchia concentrica (Middendorff, 1851)
Littorinidae
Littorina scutulata Gould, 1849
Littorina sitkana Phillipi, 1846
Lacuna vincta (Montagu, 1803)
Lottiidae
Lottia ochracea (Dall, 1871)
Lottia pelta (Rathke, 1833)
Tectura persona (Rathke, 1833)
Tectura scutum (Rathke, 1833)
Capulidae
Trichotropis cancellata Hinds, 1843
Muricidae
*Boreotrophon clat*hratus (Linnaeus, 1767)
Boreotrophon truncatus (Strom, 1768)
Nucella canaliculata (Duclos, 1832)
Nucella lamellosa (Gmelin, 1791)
Nucella lima (Gmelin, 1791)
Scabrotrophon maltzani (Kobelt and Kustler, 1878)
Nassariidae
Nassarius mendicus (Gould, 1850)
Naticidae
Cryptonatica affinis (Gmelin, 1791)
Olividae
Olivella beatica (Carpenter, 1864)
Ranellidae
Fusitriton oregonensis (Redfield, 1848)
Rissoidae
Boreocingula martyni (Dall, 1887)
Trochidae
Margarites beringensis (Smith, 1899)
Margarites pupillis (Gould, 1849)
Turbinidae
Moellaria costulata (Moller, 1842)
Spiromoellaria kachemakensis Baxter and McLean, 1984
*Spiromoellaria quad*rae (Dall, 1897)
Velutinidae
Velutina velutina (Muller, 1776)

GASTROPODA: OPISTHOBRANCHIA

Aeolidiidae
Aeolidia papillosa (Linnaeus, 1761)

Aglajidae
Aglaja ocelligera (Bergh, 1893)
Range extension west from Prince William Sound.
Archidorididae
Archidoris monteryensis (Cooper, 1883)
Corambidae
Doridella steinbergi Lance, 1862
Range extension west from Prince William Sound.
Dendronotidae
Dendronotus frondosus (Ascanius, 1774)
Eubranchidae
Eubranchus olivaceous (O'Donoghue, 1922)
Range extension west from Prince William Sound.
Facelinidae
Hermissenda crassicornis (Eschscholtz, 1831)
Onchidorididae
Onchidoris bilamellata (Linnaeus, 1767)
Onchidoris muricata? (Muller, 1776)
threee small white dorids are difficult to distinguish: *O. muricata*, *Adalaria jannae* (Millen,1987) and *A. proxima* (Alder and Hancock, 1854).
Polyceratidae
Polycera zosterae (O'Donoghue, 1924)
Range extension west from Prince William Sound.
Triophidae
Triopha catalinae (Cooper, 1863)

POLYPLACOPHORA

Lepidopleuridae
Leptochiton sp.
Mopaliidae
Katharina truncata (Wood, 1815)
Mopalia ciliata (Sowerby, 1829)
Mopalia lignosa (Gould, 1846)
Mopalia spectabilis Cowan and Cowan, 1977
Tonicellidae
Tonicella sp.
Tonicella insignis (Reeve, 1849)
Tonicella lineata (Wood, 1815)

TABLE 4.H.2

Molluscs of Katchemak Bay July/Aug. 2000	Rocky Intertidal Habitats								Subtidal sand/mud			Fouling community		Protected soft sediment intertidal habitats	
	Jakal. Bay unspecified	McD. outer	Bear Cove	Engl. Bay	Glac. Spit	Tutka Bay	Sadie Cove	Seldo. Point	K'mak Bay unspecified subtidal	Tutka Bay sub tidal	Kasit. Bay unspecified subtidal	Peter. Bay	Jakal. Bay dock	Jakal. Bay head	McD. Spit inner
BIVALVIA															
Pododesmus macroschisma	o														*
Astarte arctica														x	x
Clinocardium californiense														o	
Clinocardium nuttallii		x	x				o							x	x
Clinocardium sp.			x												x
Serripes sp.															x
Serripes cf.S laperousii			x												
Serripes groenlandicus							o								
Glycymeris septentrionalis															x
Hiatella arctica		x	x			x									
Kellia suborbicularis															o
Rochefortia tumida		x													
Entodesma navicula		x													
Mactromeris polynyma		x					o								x
Tresus nuttalli															x
Mytilus trossulus		x	x		o	x						x	x	x	x
Mya arenaria														x	x
Mya pseudoareneria															*
Mya sp			x												
Mya truncata															*
Modiolus modiolus	o					x			o					x	*
Musculus discors						o									
Musculus sp.				x											
Valisina vernicosa		x													
Nuculana minuta										o	o				
Nuculana pernula		o				o				o					
Enucula tenuis										o					
Crassostraea gigas												x			
Pandora wardiana										o					

TABLE 4.H.2, cont.

Molluscs of Katchemak Bay July/Aug. 2000	Rocky Intertidal Habitats								Subtidal sand/mud			Fouling community		Protected soft sediment intertidal habitats	
	Jakal. Bay unspecified	McD. outer	Bear Cove	Engl. Bay	Glac. Spit	Tutka Bay	Sadie Cove	Seldo. Point	K'mak Bay unspecified subtidal	Tutka Bay sub tidal	Kasit. Bay unspecified subtidal	Peter. Bay	Jakal. Bay dock	Jakal. Bay head	McD. Spit inner
Pandora sp.										o	o				
Chlamys rubida	o		*			o					o	x			
Patinopecten caurinus											o				
Macoma balthica			x											x	
Macoma brota											o				
Macoma expansa															o
Macoma golikovi						x									x
Macoma inquinata			x			x	o				o				
Macoma lama		x													x
Macoma nasuta														x	
Tellina lutea		x							o						x
Tellina modesta									o						
Tellina nuculoides									o						x
Thracia myopsis									o		o				
Thracia trapzoides															x
Axinopsida serricata		o							o	o					
Turtonia minuta															x
Dipodonta impolita															x
Humilaria kennerleyi		o													
Liocyma fluctuosa							o								
Protothaca staminea		x	x			x	o							x	
Saxidomus gigantea			x			x								x	x
GASTROPODA: PORSOBRANCHIA															
Acmaea mitra		x		x		x									*
Buccinum baeri			x			x									
Buccinum glaciale						o									
Lirabuccinum dira		o				o		o							
Neptunea lyrata			*												
Crepidula nummaria						x									

TABLE 4.H.2, cont.

Molluscs of Katchemak Bay July/Aug. 2000	Rocky Intertidal Habitats								Subtidal sand/mud			Fouling community		Protected soft sediment intertidal habitats	
	Jakal. Bay unspecified	McD. outer	Bear Cove	Engl. Bay	Glac. Spit	Tutka Bay	Sadie Cove	Seldo. Point	K'mak Bay unspecified subtidal	Tutka Bay sub tidal	Kasit. Bay unspecified subtidal	Peter. Bay	Jakal. Bay dock	Jakal. Bay head	McD. Spit inner
Neadmete modesta						x									*
Trichotropis insignis						x									
Bittium sp.						*									
Cerithiopsis ?								o							
Amphissa columbiana						x									
Oenopota alaskensis						o									
Curitoma incisula										o					
Oenopota sp.		x													*
Propebela arctica		o													
Balcis columbiana						o									
Balcis sp.						o									
Cranopsis cucullata						x									
Puncturella galeata										o					
Puncturella noachina										o					
Puncturella sp.										o					
Cryptobranchia alba		x	x			x		o							x
Cryptobranchia concentrica	o					x				o					x
Littorina scutulata									o						
Littorina sitkana			x		o	x								x	
Lacuna vincta		x				x						x	x		x
Lottia ochracea		x				x									
Lottia pelta		x	x			x								x	
Tectura persona		x	x			x									x
Tectura scutum		x	x		o	x		o							
Trichotropis cancellata		x				x									
Boreotrophon clathratus						x									
Boreotrophon truncatus						x									
Nucella canaliculata															*
Nucella lamellosa		x	*			x									

TABLE 4.H.2, cont.

Molluscs of Katchemak Bay July/Aug. 2000	Rocky Intertidal Habitats								Subtidal sand/mud			Fouling community		Protected soft sediment intertidal habitats	
	Jakal. Bay unspecified	McD. outer	Bear Cove	Engl. Bay	Glac. Spit	Tutka Bay	Sadie Cove	Seldo. Point	K'mak Bay unspecified subtidal	Tutka Bay sub tidal	Kasit. Bay unspecified subtidal	Peter. Bay	Jakal. Bay dock	Jakal. Bay head	McD. Spit inner
Nucella lima		x	x			x								x	x
Scabrotrophon maltzani		x				x									
Nassarius mendicus									o						x
Cryptonatica affinis		x	x			x									x
Olivella beatica															x
Fusitriton oregonensis		x													
Boreocingula martyni															x
Margarites beringensis			x	x		x							x		x
Margarites pupillis			x			x									x
Moellaria costulata															
Spiromoellaria kachemakensis	o					o									
Spiromoellaria quadrae		o						o							
Velutina velutina								o							
GASTROPODA: OPISTHOBRANCHIA															
Aeolidia papillosa						x									
Aglaja ocelligera		x													x
Archidoris monteryensis														x	
Doridella steinbergi															x
Dendronotus frondosus						x							x		
Eubranchus olivaceous													x		
Hermissenda crassicornis		x				x									x
Onchidoris bilamellata		x													
Onchidoris muricata?		x				x							x		
Polyceraalio zosterae		x													
Triopha catalinae				x											
POLYPLACOPHORA															
Leptochiton sp.						x									
Katharina truncata		x				x									
Mopalia ciliata						x									

TABLE 4.H.2, cont.

Molluscs of Katchemak Bay July/Aug. 2000	Rocky Intertidal Habitats								Subtidal sand/mud			Fouling community		Protected soft sediment intertidal habitats	
	Jakal. Bay unspecified	McD. outer	Bear Cove	Engl. Bay	Glac. Spit	Tutka Bay	Sadie Cove	Seldo. Point	K'mak Bay unspecified subtidal	Tutka Bay sub tidal	Kasit. Bay unspecified subtidal	Peter. Bay	Jakal. Bay dock	Jakal. Bay head	McD. Spit inner
Mopalia lignosa		x				x									
Mopalia spectabilis		x													
Tonicella sp.		x				x									
Tonicella insignis						x									
Tonicella lineata		x		x		x									

Literature cited

Baxter, R. 1987. Mollusks of Alaska. Shells and Sea Life. Bayside, California. 163p.

Behrens, 1991. Pacific coast nudibranchs; A guide to the Opisthobranchs Alaska to Baja California. Sea Challengers, Monterey California. 107p.

Bernard, F.R. 1979. Identification of living Mya (Bivalvia:Myoidea). Venus. 38(3):185-204.

Coan, E. V., P. V. Scott, F. R. Bernard. 2000. Bivalve seashells of western North America. Santa Barbara Museum of Natural History Mongraphs, Studies in Biodiversity: no. 2.

Foster, N. R. 1991. Intertidal Bivalves: A guide to the common marine bivalves of Alaska. University of Alaska Press. Fairbanks. 152 pp.

Goddard, H. J. 2000. Focal taxonomic collections: opisthobranch mollusks. Chapter 9C8 In Hines, A. H. et al. 2000. Biological invasion of cold-water ecosystems: ballast-mediated introductions in Port Valdez/Prince William Sound, Alaska Final Project Report.

Harbo, R. M. 1997. Shells and shellfish of the Pacific northwest. Harbour Publishing, Mariera Park BC Canada. 270 pp.

Kozloff, E.N. 1987. Marine invertebrates of the Pacific Northwest. University of Washington Press, Seattle. 511p.

4.I. Urochordates and Hemichordates

Sarah Cohen
Museum of Comparative Zoology
Harvard University

Twelve species of Acidiaceans (tunicates) and one species of Hemichordate were found. In addition to the cryptogenic species *Distaplia alaskensis*, which is newly described by Lambert (in press), 2 other cryptogenic species (*Botryllus* sp., *Molgula* sp.) require further morphological and/or molecular work-up for correct identification.

Species of Urochordata and Hemichodata found in Kachemak Bay during July-August 2000 are listed in Table 4.I.1 below.

Table 4.I.1. Urochordata and Hemichordata collected from Kachemak Bay, AK, 2000.

Urochordata, Ascidiacea						
Genus	**species**	**Family**	**Habitats**	**Collecting locations and dates**	**Notes**	**Invasion status**
Botryllus	?	Botryllidae	exposed rocky intertidal	Herring Isl., 8/1/00.	No sexual reproduction found. Lots of asex. Further ID requires molecular work.	Unknown, pending molecular systematics.
Trididemnum	?	Didemnidae	exposed rocky intertidal	Herring Isl., 8/1/00.		
Didemnum	?	Didemnidae	exposed rocky intertidal	English Harbor (collected by J. Norenberg), 8/1/00.		
Corella	inflata	Corellidae	marina fouling panels	plates		native
Corella	wilmeriana	Corellidae	marina fouling panels	plates		native
Distaplia	alaskensis	Holozoidae	Floating docks, marina	Homer Boat Harbor, Seldovia docks		cryptogenic
Distaplia	occidentalis	Holozoidae	docks, rocky intertidal	plates?, Seldovia Docks, Jakalof Inlet, 7/30/00.		native
Molgula	?	Molgulidae	marina	Seldovia docks	Specimens will be reexamined with MB Saffo.	Unknown, need further morphological, perhaps molecular comparison.
Styela		Styelidae	marina, rocky exposed intertidal	Herring Isl., 8/1/00. Kasitsna Bay lab rocky intertidal.		

Table 4.I.1, continued.

Urochordata, Ascidiacea						
Genus	**species**	**Family**	**Habitats**	**Collecting locations and dates**	**Notes**	**Invasion status**
Ascidia	callosa	Ascidiidae	marina, rocky exposed intertidal	Seldovia docks, Herring Isl. Intertidal, 8/1/00. Kasitsna Bay lab rocky intertidal.		native
Boltenia		Pyuridae	rocky intertidal	Herring Isl., 8/1/00., Halibut Cove area, 7/31/00, Jakalof Inlet, 7/30/00.		
Aplidium	californicum	Synoicidae	rocky intertidal	Jakalof Inlet, 7/30/00. Herring Isl., 8/1/00., Kasitsna Bay Lab rocky intertidal.		native
Halocynthia	aurantium	Pyuridae	rocky intertidal	Herring Isl., 8/1/00. Jalalof Inlet 7/30/00.		native
Hemichor-data	Collected from Jakalof Bay and MacDonald Spit.					

Species notes:

Botryllus sp.

Circular systems. No sexual reproduction found, no larval, reproductive characters available. Lots of asexual reproduction. Further ID requires molecular work as with most botryllids.

Blue/black color morph on large and small boulders in low to mid intertidal, Herring Islands, very exposed shoreline for this area. 8/1/00, 9:30 AM, -5.0 tide. Colonies crowded with many interaction areas.

Formalin and ethanol vouchers taken for further work.

Ascidia

A. callosa is definitively identified from two locations based on brooding embryos. *Ascidia* was found in many locations (dock and intertidal) and in cases where embryos were not found, the specimens need to be reexamined for other definitive characters that may reveal *A. columbiana* or possibly other species.

Ascidia callosa from Herring Isl.

Red dots (numbering 6-8) on atrial and branchial lobes, test without tubercles, laterally flattened, w/ renal vesciles, brooding, branchial sac brownish, matching nearby kelp, w/ longitudinal vessels, papillae at intersections only. Embryos brooded between mantle and branchial sac on both sides of sac. About 4 bars/stigmatal block, pretty regular, many stigmatal rows->25, 11-12 oral tentacles.

Hemichordata
With purple eggs in posterior, packed along intestine? 2 samples saved in ethanol.
Found in 2 locations:

- Head of Jakalof Bay, coll. by J. Kudenov in berm in oxic top 1 inch of soil.
- MacDonald Spit, coll. by J. Norenberg.

Collecting notes:

Intertidal in front of Kasitsna Bay Lab **(in front of living room window and working towards Homer)**

7/29/00 rocky intertidal, about 8 am, low. Surveyed fairly extensively on one tide, covering most tidal heights, turning over boulders, looking under cover, etc.; occasionally visited at additional times.
--*Aplidium californicum*. Orange compound on lg-med boulders, shared excurrent, post-abdomen long, brooding brown larvae, long white testis, paired, not obviously serially arranged, smooth outer surface, long languet on atrial aperture, flanked by two smaller languets, 11 rows stigmata, post-abdomen well connected to abdomen (not on narrow stalk), stomach wall striations longitudinal. Have ethanol and formalin vouchers.
--*Styela*, v. small, only on *Fusitriton* shells, eg 4 on 40 cm *Fusitriton*. Too small to ID (though one had testis). Not saved.
--*Ascidia*, from cobbles. Formalin vouchers only. 8 oral tentacles with red dots at ends.

Jakalof Bay-dock to mouth of inlet on dock side

7/30/00, AM tide, -5.0, collecting low in boulder area.
--Orange clumped tube colonial, same as specimen left by R. Highsmith. Not yet identified.
--*Aplidium californicum*
--*Boltenia*, stalked
--*Distaplia occidentalis*—reproductive, brood pouches with 2 early embryos, atrial siphon with 6 folds, smooth stomach, 4 stigmatal rows? (check this again). Vouchers in ethanol and formalin. Suggest molecular systematics to sort out *Distaplia* spp due to great morphological plasticity observed in other locations.
--*Halocynthia* (*aurantium*?)

Halibut Cove

7/31/00, examined dock where plates were hung, walked around boardwalks and across large berm to rocky intertidal on other side (not really Halibut Cove). Surveyed extensively along rock slab, boulder, and cobble areas.

Boltenia in rocky intertidal, also collected there by Carmen Field.

Herring Islands

Most exposed site where I collected. Surveyed 8/1/00 AM very low tide (-5.0) with Claudia Mills. Cruised islands in zodiac looking for most exposed rocky areas, surveyed three areas on foot, covering low to upper intertidal in swaths, checking under overhangs, boulders, heavy kelp cover. Much heavy kelp, large asteroids, *Katherina*. Large and small boulders.

Herring Islands species list:

--*Botryllus* sp.-see description above.
--*Halocynthia aurantium*
--*Trididemnum* sp.-Interspersed with *Botryllus* on undersides of rocks. Grayish overall with brown/red pigment in branchial sac. 3 stigmatal rows.
--*Boltenia*, stalked
--*Ascidia callosa*- boulder overhang next to kelp blade attaching to rocks, tops dark like the color of kelp, sides clear.
--Orange, clumped stalked colony, same as Jakalof and R. Highsmith collections.
--*Aplidium californicum*
--Yellow colonial, small bits..too small to ID.
--Tannish, slightly puffy didemnid
--*Styela*, small on *Fusitriton* shells

<u>Seldovia docks</u>

Surveyed extensively 8/2/00 and sporadically on two other dates, same week. Extensive surveying consisted of walking all piers and 1) pulling all available hanging ropes, tires, buckets, etc. for examination and collecting, 2) leaning over sides of docks for visual examination and reaching under docks occasionally to sample areas not visible, 3) looking at occasional SERC plates and ropes as they were pulled.

Ascidia specimen #1

<u>**No embryos inside. Sperm duct to atrial siphon. Large flap over endostyle or dorsal lamina? Renal vesicles. Stomach with linear plications. Egg duct runs all the way up along sperm duct, packed with eggs, somewhat mishapen. Ovotestis up against renal sacs.**</u>

Eggs removed from top of oviduct, surrounded by scattered test cells within outer envelope. Took measurements of 5 eggs, but need calibration for Nikon Alphaphot YS (i.e., 17 units diameter at 100X). Compared to *prunum* (see Van Name, p. 179), look like *callosa* in stigmatal characters (rectangular, not square), also fewer oral tentacles. Dorsal lamina has straight edge, not fluted like callosa in Van Name, looks more like *obliqua* not having intermediate papillae, but *obliqua* has fewer stigmata per mesh. Oral tentacles different sizes. Esophagus enters branchial sac above bottom.

Ascidia callosa, specimen #2

Abundant, 7/30/00. All sizes on ropes, sides of docks, etc. Reddish siphons in variety of orientations, tunic clear or less so. Packed with eggs and larvae. Renal vesciles abundant and obvious, stigmata obvious as p. 179 in Van Name, as opposed to *prunum*. A. *callosa* (synon. with *columbiana* in Van Name). Siphons with about 6 branchial/atrial lobes.

Ascidia specimen #3

Pink embryos and larvae. Very convoluted branchial surface with many imperfect stigmatal bars. No renal vesciles. Oral tentacles, about 20, hard to count, long.

Molgula sp.

Siphons 4 and 6? Branchial folds 13 or more. Pink larvae. Stigmata not spiral, linear but irregular, about 17/row. Weak parastimatic vessel. Renal sac-1 side, hard object, whitish tissue around it on one side of body. Gonads both sides. *Retortiformis* in Ritter (1913), but with larvae brooded?!

--*Distaplia occidentalis*
--*Styela* sp?

Specimens left at Kasitsna Lab by Ray Highsmith

--Large white mounding colonial, opaque, translucent whitish mound with darker covering, sand grains throughout, v. long zooids (3-4 cm), clear abdomen, dense white at posterior-not sure if connected, thorax yellowish, esp. when contracted. 12-13 stigmatal rows.

--Orange tubular colonial—also found abundantly at head of Jakalof Bay, Herring Islands (ie more exposed rocky areas).

Shared cloacal apertures, 6 lobed branchial. Atrial languet with 3 short points. Many (13-15) stigmatal rows with simple bars. 1 row long papillae/tentacles closer to dorsal/endostyle side. 1 with visible sperm duct, runs along intestine to near atrial opening.

Very muscular zooids, heavily contracted, very difficult to relax for exam. Stomach striations not obvious but present, not plicated, more like aeroles. Entire zooid including post-abdomen is orange. White refractive wide line under stomach. No longitudinal vessels.

--*Boltenia*

--*Ascidia*

--didemnid

English Harbor (most exposed location, visited by J. Norenberg, 8/1/00)

Didemnum sp.

4 branchial rows. Thickish, puffy colonies around kelp holdfasts.

4.J. Echinoderms

Anson Hines
Smithsonian Environmental Research Center
PO Box 28
Edgewater, MD 20137
USA

Nora Foster
Univeristy of Alaska Museum
Fairbanks, AK

Eight species of Echinoderms were recorded, including 2 sea cucumber species, 5 sea stars, and 1 sea urchin (Table 4.J.1). Of these only Asterias amurensis is cryptogenic, as its range in Alaskan waters is the Berring Sea and it has not been recorded in Cook Inlet until recent years. This could be a natural range extension or an introduction. Records of the intertidal occurrence of *A. amurensis* have been assembled by Carmen Field (National Estuarine Research Reserve, Kachemak Bay, AK).

Table 4.J.1. Species List of Echinoderms Observed at Kachemak Bay, Alaska. No specimens collected.

Eupentacta pseudoquesemita
Cucumaria frondosa japonica
Pycnopodia helianthoides
Evasterias troschellii
Asterias amurensis
Leptasterias hexactis
Dermasterias imbricata
Strongylocentrotus droebachiensis

4.K. Wetland Plants

Dennis Whigham
Smithsonian Environmental Research Center
PO Box 28, 647 Contees Wharf Road
Edgewater, MD 21037
USA

Wetlands have often been invaded by introduced species of plants. The wetlands of Kachemak Bay were surveyed in July-August 2000, and 66 species were recorded. While these wetlands are rather pristine, the survey included 7 species of invasive weedy species in the uppermost intertidal zone that grades into the terrestrial ecosystem. The following is a description of the wetland sites visited in Kachemak Bay.

Team:

July 26: Wetlands around Homer Spit –Whigham, Jon Hall (USFWS), Carmen Field (K. Bay NEERS), Coowe Moss (K. Bay NEERS), Karen Noyes (NRCS), Mike Gracz (NRCS)

July 27: China Poot: Whigham, Jon Hall

July 28: Fox River flats: Whigham, Jon Hall, Coowe Moss, Conrad Field (K. Bay NEERS)

July 31: Jakilof : Whigham

Aug. 1: Seldovia: Whigham

Description of sites sampled:

Wetlands around Homer Spit:

There are several discrete wetlands around the city of Homer. The only wetlands that appear to be natural and not formed as a result of human activities are the wetlands associated with Beluga Slough. The road to the Homer Spit crosses the Beluga Lake and Slough area. Beluga Lake is no longer influenced by the tide. Intertidal wetlands occur downstream of the lake. All other wetlands in the Homer Spit area appear to have formed as a result of alterations of hydrologic patterns following the development of jetties and roads.

Four areas were sampled:

1. Mud Bay (1) The area known locally as Mud Bay occurs on the east side of the Homer Spit road. The wetland is nestled in the corner between the road and fast land. We sample the site at low tide and were able to examine all of the potential habitats from low intertidal to high intertdial, including the wetland-upland boundary. Most of the site is dominated by intertidal mud flats. The wetland is limited to a relatively narrow band (200 meters) between the mud flats and the upland.

2. Mud Bay (2): This wetland is west of the Homer Spit road, immediately across the road from Mud Bay (1). Intertidal wetlands have formed in this area because of a protective beach line that shelters the site from K. Bay. Water enters the site from K. Bay at high tide. The area is mostly intertidal mud flats but a distinct vegetated zone has developed at the upland boundary where there was also evidence of subsurface discharge of freshwater.
3. Louise's Lagoon: This site is associated within a lagoon on the east side of Homer Spit approximately ¼ of the way on the Homer Spit road. It appears to be a site in which wetland vegetation has developed following considerable physical disturbance. Local scientists did not know if the site was natural or not but it appears to have formed behind a breakwater that was made to protect the road. Wetland vegetation is poorly developed and most of the area is dominated by species that are characterized by low intertidal habitats.
4. Beluga Slough: This wetland occurs on the west side of the Homer Spit road and downstream of Beluga Lake. The seaward boundary is composed of a high beach line and there is one break in the beach through which tidal exchange occurs. The northern end of the site is dominated by an emergent wetland that seemed to be influenced by subsurface and surface runoff from adjacent uplands. At least one small freshwater stream enters the wetland from the area near Two Sisters. A boardwalk crosses a portion of the upper intertidal.
5. Fox River Flats: Two rivers drain into the upper part of K. Bay (Fox River and Sweet Rvier). We were able to access a large portion of the wetlands associated with Fox River. The area has a history of disturbance associated with summer grazing of cattle and horses. We were informed that at least three ranchers place their cattle herds on the site and we encountered one group of free ranging horses. The animals have access to the entire wetland and we found evidence of trampling in all areas from the upland boundary to the extensive mud flats. We examined low and high intertidal habitats and were able to reach the upper end of tide where there was a small area of tidal freshwater wetlands intermixed with brackish wetlands. All areas examined were grazed and this was the only site where we found any exotic species. The exotics are all species that have been in Alaska for a long time and they only accounted for very minor elements of the vegetation.

China Poot: This large wetland complex is located immediately across K. Bay from the Homer Spit. We received a copy of a previous vegetation study of the area. The China Poot wetlands are highly complex and have a range of habitats from intertidal mud flats to expansive high intertidal wetlands that grade into non-tidal freshwater wetlands. A number of small streams flow through the wetland and eventually connect with tidal streams. The vegetation ranged from very luxurious (i.e., very tall macrophytes in areas with a considerable litter layer) to vegetation in the low intertdial areas that seemed to have a very low productivity. The wetland was also internally complex with areas of low productivity found in the middle of areas with highly productive vegetation. Creek banks near the upland portion of the site were particularly productive. The upper (landward) portions of the wetland consisted of a sunken forest (1964 earthquake) over which wetlands had formed.

Jakilof: The upper end of Jakilof Bay consists of an expansive intertidal complex dominated by large beds of mussels and macroalgae. There are a large number of intertidal ponds dominated by *Zostera*. At the upper end, the wetland is strongly influenced by freshwater input and the wetlands have formed over a sunken forest (similar to China Poot). There is some evidence of human disturbance in the high intertidal and it appears to mostly be due to vehicles crossing the wetland to reach streams for purposes of fishing.

Soldovia: I attempted to reach the tidal flats areas of this system but there was no road access. Sampling was limited to a wetland complex associated with the airport. The landing strip was formed on fill placed into the lagoon. I sampled three areas that were all hydrologically connected. One wetland is found upstream of the culvert that is under the road to the airport. This area is dominated by robust emergent species and there appears to be a sharp boundary between this wetland and the freshwater stream the drains into it. At the time of my visit,the creek was filled with chum salmon. At one location there was evidence of vehicles driving to the edge of the stream, thus impacting a small fringe of intertidal wetlands. Downstream of the culvert was a wetland complex that ranged from low to high intertidal – all found over a relatively short distance. The third area sampled was on the west end of the lagoon beyond the airport runway. Vegetation in this area was also restricted to a narrow zone between the upland and the deeper intertidal which supported no higher plants.

Overall impression:

The wetland of K. Bay appear to be very pristine from the context of species composition. Few invasive species were found and when they were present, they only represented a very minor element of the vegetation. Even areas that have been grazed for decades have the same species that occur in undisturbed sites, however 7 invasive weedy species were recorded in the uppermost intertidal zone that grades into the terrestrial ecosystem. Overall, more than 60 species were encountered, however the wetlands are typically dominated by a few species (see Table 4.K.1): Going from low to high intertidal, the following zones are typically found.

A. Low intertidal: *Spergularia canadensis*, *Pucinellia phryganodes*, *Cochlearia officinalis*
B. Intermediate position within the intertidal zone: *Plantago maritima*, *Triglochin maritimum*, *Carex ramenski*
C. High intertdial: *Carex lyngbyaei* (where there is freshwater input), *Leymus mollis* (where there is little freshwater input)

Table 4.K1. Species of Wetland Plants of Kachemak Bay, AK. July-August 2000

Species	Family	Mud Bay (E)			Mud Bay (W)	Spit	Beluga Slough	China Poot								Fox River			Jakilof		Seldovia		
		Upper intertidal	Low intertidal	Wetland-upland ecotone	Low to upper intertidal	Upper intertidal	Low-Upper intertidal	Upper Intertidal	Swale in upper intertidal	Stream channel in high intertidal	Infrequently flooded intertidal	Tidal creek bank	Bar in tidal stream (mostly fresh)	High intertidal (next to bar)	Tidal creek and bank (mostly fresh)	Low intertidal	Stream bank - high marsh	Stream and bank - upper end of tide	High marsh in low intertidal	Upper intertidal to upland boundayr	Upstream of culvert - airport	Downstream from culvert	Lagoon opposite other two sites
Achillea millefolium var. borealis	Asteraceae														x		x						
Agrostis scabra	Poaceae																x						
Argentina anserina	Rosaceae	x					x				x		x	x	x					x	x	x	
Atriplex gmelinii	Chenopodiaceae				x		x	x											x	x		x	x
Atriplex alaskensis	Chenopodiaceae		x		x	x	x		x	x			x			x				x	x	x	x
Caltha palustris	Ranunculaceae																	x					
Carex lyngbyaei	Cyperaceae	x			x		x					x		x				x		x	x	x	
Carex mackenziei (?)	Cyperaceae		x																				
Carex raminskii	Cyperaceae	x			x		x				x					x				x		x	
Cicuta virosa	Apiaceae																	x			x		
Cochlearia officinalis	Brassicaceae												x						x	x	x	x	x
Conioselinum gmelinii	Apiaceae																	x		x			
Dendranthema arcticum	Asteraceae									x				x			x						
Deschampsia beringensis	Poaceae														x		x					x	
Eleocharis kamtecharctica	Cyperaceae	x																					
Epilobium angustifolium	Onagraceae																			x			
Equisetum fluviatile	Equisetaceae																	x					x
Equisteum palustris	Equisetaceae																	x					
Festuca altaica	Poaceae				x																		
Festuca rubra	Poaceae				x			x							x			x		x	x	x	x
Festuca sp.	Poaceae																			x			
Glaux maritima	Primulaceae																		x		x	x	
Hippuris tetraphylla	Hippuridaceae	x			x											x							
Hippuris vulgaris	Hippuridaceae																	x					
Honckenya peploides	Caryophyllaceae			x																			
Hordeum brachyantherum	Poaceae				x										x		x	x		x	x	x	x
Juncus alpinus	Juncaceae																x						
Juncus articus	Juncaceae																x						
Juncus bufonius	Juncaceae																	x					
Juncus sp.	Juncaceae																						x
Lathyrus japonicus	Fabaceae							x							x					x		x	
Leymus mollis	Poaceae			x	x			x		x	x	x		x	x				x	x	x	x	x
Ligustichum scoticum	Apiaceae				x			x		x			x	x						x	x	x	x
Luzula multiflora	Juncaceae						x											x					
Matricaria discoidea (I)	Asteraceae																x						
Parnassia palustris	Saxifragaceae																x	x					
Plantago major (I)	Plantaginaceae																x						
Plantago maritima	Plantaginaceae			x	x		x	x	x	x	x		x		x	x			x	x	x	x	x
Poa arctica	Poaceae																x						
Poa eminens	Poaceae				x												x						x
Poa glauca	Poaceae																x						
Poa praetensis (I)	Poaceae																x						
Poa sp.	Poaceae																				x		x
Polygonum aviculare (I)	Polygonaceae																x						
Polygonum viviparum	Polygonaceae																	x					
Potamogeton gramineus (*)	Potamogetonaceae																	x					
Potentilla egedii	Rosaceae															x				x			
Potentilla palustris	Rosaceae																	x					
Puccinellia hultenii	Poaceae					x																	
Puccinellia phryganodes	Poaceae	x	x	x	x	x	x			xx						x			x	x	x	x	x

I = Invasive weed found only in upper intertidal where it transitioned to upland habitat.
* = Native but not previously reported for Kachemak Bay
? = Postive identification not made

Table 4.K.1, continued.

Species	Family	Mud Bay (E)			Mud Bay (W)	Spit	Beluga Slough	China Poot								Fox River			Jakilof		Seldovia		
		Upper intertidal	Low intertidal	Wetland-upland ecotone	Low to upper intertidal	Upper intertidal	Low-Upper intertidal	Upper Intertidal	Swale in upper intertidal	Stream channel in high intertidal	Infrequently flooded intertidal	Tidal creek bank	Bar in tidal stream (mostly fresh)	High intertidal (next to bar)	Tidal creek and bank (mostly fresh)	Low intertidal	Stream bank - high marsh	Stream and bank - upper end of tide	High marsh in low intertidal	Upper intertidal to upland boundayr	Upstream of culvert - airport	Downstream from culvert	Lagoon opposite other two sites
Puccinellia nutkaensis	Poaceae		x	x	x	x	x	x	x	xx	x		x		x				x	x	x	x	x
Ranunculus cymbalaria	Ranunculaceae																x	x					
Ranunculus gmelini	Ranunculaceae																	x					
Rhinanthes minor var. groenlandica	Scrophulariaceae																x	x					
Rubus arcticus	Rosaceae												x										
Rumex arctica var fenestrata	Polygonaceae														x		x				x		
Salicornia maritima	Chenopodiaceae		x			x	x									x							
Sparganium angustifolium	Sparganiaceae																	x					
Spergularia canadensis	Caryophyllaceae			x	x		x	x	x										x	x		x	x
Stellaria humifusa	Caryophyllaceae	x			x						x		x						x	x	x		
Sueada calceoliformis	Chenopodiaceae			x		x								x									
Taraxacum officinale (I)	Asteraceae																x						
Trifolium repens (I)	Poaceae																x						
Triglochin maritimum	Juncaginaceae	x			x		x			x	x		x	x		x			x	x	x	x	x
Triglochin palustris	Juncaginaceae	x	x		x		x				x												
Zostera marina	Zosteraceae																		x			x	x

I = Invasive weed found only in upper intertidal where it transitioned to upland habitat.
* = Native but not previously reported for Kachemak Bay
? = Postive identification not made