Biological Cruises of the R/V *Acona* in Prince William Sound, Alaska (1970-1973)

By Howard M. Feder
and A. J. Paul

Sea Grant Report No. 77-14
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Cover photo:
Silhouetted against snowy Chugach mountains,
the oceanographic research vessel
R/V **Acona** *rests at anchor in Blue Fjord*
on western Prince William Sound.
(Photo courtesy of Dr. Charles Hoskin,
Institute of Marine Science, University of Alaska

BIOLOGICAL CRUISES OF THE R/V *ACONA* IN PRINCE WILLIAM SOUND, ALASKA FROM 1970-1973

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INTRODUCTION

This report is a compilation of biological data collected in Prince William Sound on cruises of the R/V *Acona* in the years 1970-1973. Ship-time was made available during projects supported by the University of Alaska Sea Grant Program, Alyeska Pipeline Company, and the National Science Foundation. The primary purpose of this report is to provide qualitative information on benthic invertebrates and fishes from various locations in Prince William Sound (Fig. 1). Abundance, distribution, feeding, and reproductive data are presented in tabular form (Tables I-XLIII; Appendices I-V), but not discussed. A selected bibliography on the biology of some of the species examined is included. The results of a survey of the amounts of aliphatic hydrocarbons in selected inter-tidal bivalve mollusks are also reported as Appendix VI.

METHODS

This survey was conducted as an adjunct to other projects, and all areas trawled were determined by the requirements of the primary projects involved. Some of the stations occupied in Port Valdez were initially established as part of an Alyeska survey (Hood *et al.*, 1973). Intertidal collections of selected species of clams were made on beaches whenever time permitted (see bibliography included in this report). Subtidal collections were made with a small otter trawl with a 12' ft (4 m) mouth opening and a mesh size of 6.0 mm^2. Trawling time varied from 10 to 30 minutes. The following abbreviations appear in the tables presented in this report: SL=standard length, A=abundant (more than 25 animals), C=common (10-25 animals), F=few (less than 10 animals), M=male, F=female, we=with eggs, U=unsexed, 0 we=none with eggs. Numbers included in the abundance column

of each table refer to actual counts of a particular species. The following measurements are included in the comments column of the tables: carapace width for snow (*Chionoecetes bairdi*) and dungeness (*Cancer magister*) crabs, carapace (shell) length (shrimps: Pandalidae, and king crab: *Paralithodes camtschatica*) and standard length (fishes). All measurements are in millimeters. A list of species referred to in this report is included (Table 1).

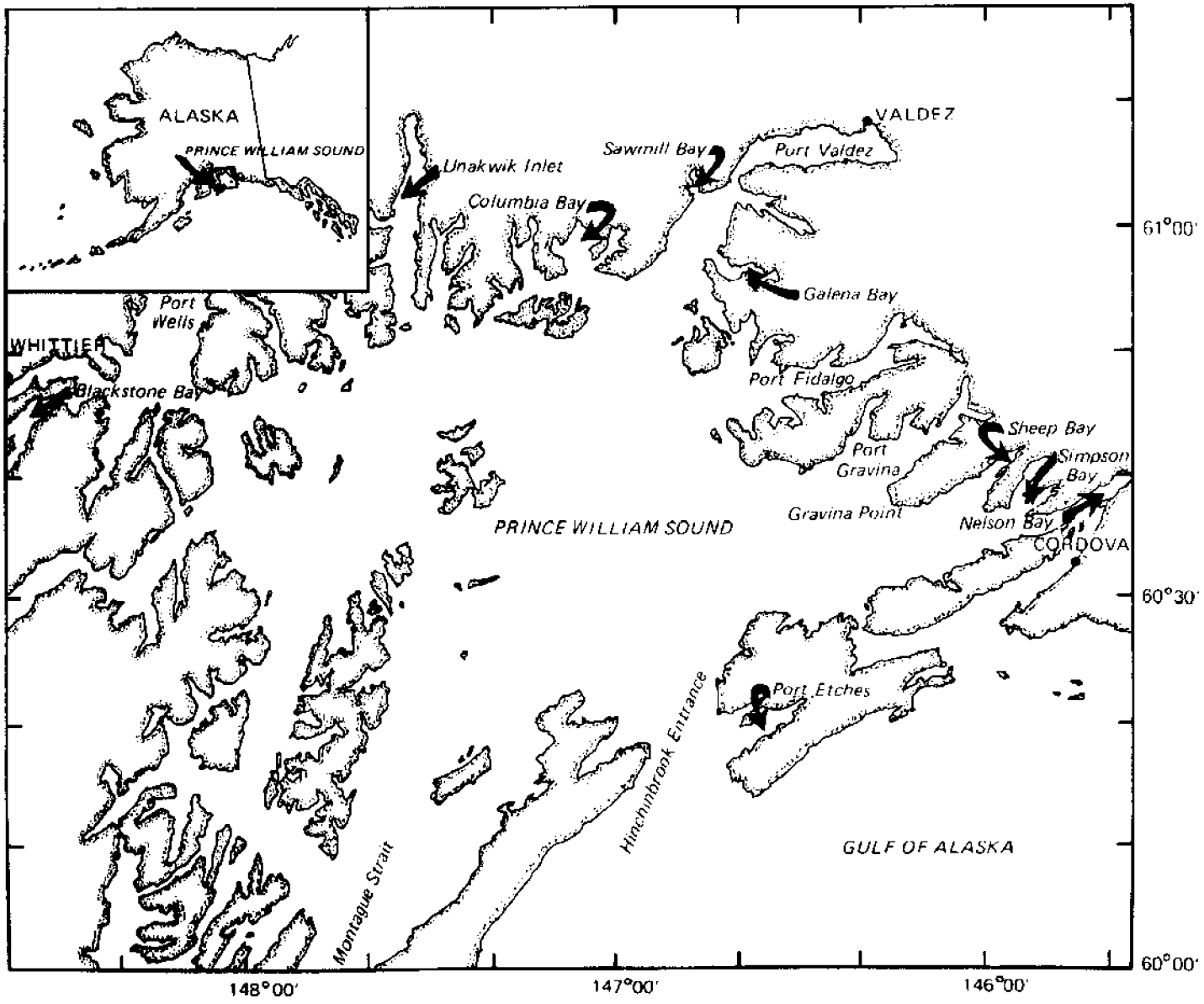

Figure 1. Bays investigated on cruises of the R/V *Acona* in Prince William Sound 1970-1973.

TABLE I. List of selected intertidal and subtidal species collected in Prince William Sound, Alaska on cruises of the R/V *Acona*.

Taxon	Common names
CNIDARIA	
Actiniaria	Sea anemone
Ptilosarcus sp.	Sea pen
ANNELIDA	
Arenicola claparedii	Lugworm
ECHIUROIDEA	
Echiurus echiurus alaskensis	Spoon worm
MOLLUSCA	
Nuculana sp.	Nut shell
Yoldia spp.	No common name
Hiatella arctica	Nestler clam
Macoma balthica	Baltic *Macoma*
Macoma nasuta	Bent-nosed *Macoma*
Clinocardium ciliatum	Iceland cockle
Clinocardium nuttallii	Nuttall's cockle
Serripes groenlandicus	Greenland cockle
Mya arenaria	Soft shell clam
Mytilus edulis	Blue mussel
Protothaca staminea	Littleneck clam
Saxidomus gigantea	Butter clam
Buccinum sp.	Whelk
Littorina sitkana	Sitka periwinkle
Littorina scutulata	Checkered periwinkle
Natica clausa	Moon snail
Polinices sp.	Moon snail
Colus sp.	Snail
Neptunea sp.	Whelk
Fusitriton oregonensis	Oregon triton
Melibe leonina	Lion nudibranch
ARTHROPODA (Crustacea)	
Balanus glandula	Acorn barnacle
Hyperid amphipod (*Parathemisto* sp.)	No common name
Crangonidae	Gray shrimp
Crangon dalli	Gray shrimp
Argis dentata	No common name
Argis sp.	No common name
Sclerocrangon boreas	No common name
Pandalus borealis	Pink shrimp
P. hypsinotus	Coonstripe shrimp
P. goniurus	Humpy shrimp
Pandalopsis dispar	Sidestripe shrimp
Cancer magister	Dungeness crab
Cancer gracilis	No common name
Hyas lyratus	Crab

TABLE I. Continued

Taxon	Common names
ARTHROPODA (cont'd)	
Chionoecetes bairdi	Snow crab
Telmessus cheiragonus	Horse crab
Hemigrapsus oregonensis	Crab
Labidochirus (=Pagurus) splendescens	Hermit crab
Upogebia pugettensis	Blue mud shrimp
Paralithodes camtschatica	Red king crab
BRACHIOPODA	
Laqueus sp.	Lamp shell
ECHINODERMATA	
Ophiura sarsi	Brittle star
Gorgonocephalus caryi	Basket star
Dermasterias imbricata	Leather star
Henricia sp.	Sea star
Evasterias troschelii	No common name
Pisaster ochraceus	Ochre sea star
Crossaster papposus	Rose star
Pycnopodia helianthoides	Sunflower star
Ctenodiscus crispatus	Mud star
Strongylocentrotus droebachiensis	Green urchin
Brisaster townsendi	Heart urchin
Stichopus sp.	Sea cucumber
Antedon sp.	Feather star
CHORDATA	
Raja spp.	Skate
Thaleichthys pacificus	Eulachon
Theragra chalcogramma	Pollock
Microgadus proximus	Pacific tomcod
Gadus macrocephalus[1]	Pacific cod
Sebastes ruberrimus	Red snapper
Hexagrammos decagrammus	Kelp greenling
Myoxocephalus spp.	Sculpin
Anaplopoma fimbria	Black cod or sablefish
Agonus acipenserinus	Sturgeon poacher
Liparis sp.	No common name
Eumicrotremus orbis	Pacific spiny lumpsucker
Lycodes brevipes	Shortfin eelpout
Hippoglossoides elassodon	Flathead sole

[1]Common in Prince William Sound, but not taken by the small trawl used in this field study.

TABLE I. Continued

Taxon	Common names
CHORDATA (cont'd)	
Pleuronichthys decurrens	Curlfin sole
Limanda aspera	Yellowfin sole
Glyptocephalus zachirus	Rex sole
Platichthys stellatus	Starry flounder
Microstomus pacificus	Dover sole
Isopsetta isolepis	Butter sole

TABLE II. Nelson Bay - Composite of four drags.

Date: 2/16/73

Latitude: 60°39.0'

Longitude: 145°39.1'

Depth: 65 m

Trawl time: 30 minutes for each drag

Taxon or Common Name	Abundance	Comments
ARTHROPODA (Crustacea)		
Pandalus hypsinotus	C	
Crangonidae (unidentified)	C	
Shrimps (unidentified)	F	
Paralithodes camtschatica	1	M 175 mm[1]; soft shell
Chionoecetes bairdi	13	M 11-20 mm[2]
	29	M 21-30 mm
	1	M 31-40 mm
	25	M 41-50 mm
	29	M 51-60 mm
	13	M 61-70 mm
	3	M 71-80 mm
	2	M 80-90 mm; one soft shell
	8	F 10-20 mm
	18	F 21-30 mm
	3	F 31-40 mm
	17	F 41-50 mm
	17	F 51-60 mm
	17	F 61-70 mm
	3	F 71-80 mm
	6	F 81-90 mm; 2 soft shell
ECHINODERMATA		
Echinoidea (unidentified)	1	
CHORDATA (Fishes)		
Thaleichthys pacificus	C	
Limanda aspera	F	

Accessory Data

2/16/73
Chionocetes bairdi: fishing with Japanese snow crab pots, 8 hr soak, 1.5 crabs = mean catch for 8 pots, 6 males, 6 females - one female with

[1]shell length
[2]shell width

Accessory Data (cont'd)

eggs, carapace width=117 mm. Also, 1 *Cancer magister* taken in pot.

2/17/73

Cancer magister: fishing with 7 commercial Dungeness crab pots, 8 hr soak, 1.8 crabs=mean catch per pot; 3 male dungeness crabs 174-185 mm, 1 female 160 mm. Also, 4 male *Chionoecetes bairdi* 66-84 mm, 5 female 62-77 mm.

11/28/73

Mudflat at head of Nelson Bay examined. *Mya arenaria* densities of 13, 21, 32, 15, 10, 12, 22, 24, and 49 individuals per 0.25 m^2. Approximately 153,257 sq.m of the mud flat inhabited by *M. arenaria*. *Macoma balthica* and *Echiurus echiurus alaskensis* also abundant.

TABLE III. Simpson Bay - Trawl 1

Date: 2/17/73

Latitude: 60°38.0'

Longitude: 145°51.5'

Depth: 65 m

Trawl time: 30 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Pennatulacea (sea pen)	1	
MOLLUSCA		
Nudibranchiata	C	
Cephalopoda (small octopus)	1	
ARTHROPODA (Crustaceans)		
Pandalus borealis	2	
Pandalus hypsinotus	3	
Chionoecetes bairdi	2	M 13, 15 mm[1]
	2	F 26, 44 mm
	3	F, 2 we[2], 101-110 mm
Cancer magister	1	F, we, 170 mm
CHORDATA (Fishes)		
Thaleichthys pacificus	3	
Theragra chalcogramma	3	358, 308, 170 mm[3]
Hexagrammos decagrammus	2	
Cottidae	1	small
Agonus acipenserinus	1	
Eumicrotremus orbis	1	
Glyptocephalus zachirus	2	
Hippoglossoides elassodon	4	
Isopsetta isolepis	4	
Limanda aspera	50	
Platichthys stellatus	1	
Pleuronichthys decurrens	10	

[1]carapace width
[2]with eggs
[3]standard length

TABLE IV. Simpson Bay - Trawl 2.

Date: 2/17/73

Latitude: 60°38.0'

Longitude: 145°51.5'

Depth: 65 m

Trawl time: 30 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Pennatulacea (sea pen)	1	
Actiniaria (Anemone)	3	
MOLLUSCA		
Fusitriton oregonensis	1	
Gastropoda (unidentified)	1	small
Opisthobranchiata - 1 species	1	few
Cephalopoda (small octopus)	1	
ARTHROPODA (Crustacea)		
Pandalus hypsinotus	C	F,we, 27.3-32.3 mm[1]
Crangonidae (unidentified)	C	
Labidochirus splendescens	1	
Chionoecetes bairdi	1	M 5-10 mm
	3	M 11-20 mm
	1	M 31-40 mm
	1	M 81-90 mm
	1	M 101-110 mm
	1	M 121-130 mm
	1	M 141-150 mm
	1	F 5-10 mm
	1	F 31-40 mm
	2	F 41-50 mm
	2	F, 1 we, 101-110 mm
ECHINODERMATA		
Echinoidea (unidentified)	1	
Ophiuroidea (unidentified)	3	
CHORDATA (Fishes)		
Theragra chalcogramma	3	340, 180, 180 mm
Hexagrammos decagrammus	4	
Myoxocephalus (spp.)	3	
Agonus acipenserinus	3	
Pleuronectidae	-	Species composition and ratio, similar to trawl 1

[1]carapace length; same for all Pandalidae

TABLE V. Simpson Bay - Trawl 3.

Date: 2/17/73
Latitude: 60°38.0'
Longitude: 145°51.5'
Depth: 65 m
Trawl time: 30 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Pennatulacea	1	
MOLLUSCA		
Gastropoda (unidentified)	3	small
ARTHROPODA (Crustacea)		
Pandalus borealis	104	U 14-32 mm
	120	F, we, 19-27 mm
Pandalus hypsinotus	149	U 14-32 mm
	20	F, we, 22-31 mm
Shrimp (unidentified)	13	F 14-23 mm
Chionoecetes bairdi	5	M 10-21 mm
	4	M 21-30 mm
	1	M 31-40 mm
	5	F 11-20 mm
	2	F 21-30 mm
	3	F 31-40 mm
	2	F 61-70 mm
	1	F, we, 100 mm
	2	F, 1 we, 101-110 mm
Cancer magister	1	F 170 mm
ECHINODERMATA		
Gorgonocephalus sp.	3	
BRACHIOPODA		
Laqueus sp.	3	
CHORDATA (Fishes)		
Lycodes sp.	1	
Myoxocephalus sp.	1	
	3	
Pleuronectidae	Species composition and ratio similar to trawl 1	
Fishes (unidentified)	Fishes, uncounted	

Accessory Data

2/18/73

Cancer magister: fishing with 7 commercial dungeness pots, 8 hr soak, 8 crabs=mean catch per pot. 1 male dungeness crab 180 mm.[1] Also, 1 female *Paralithodes camtschatica* 130 mm; *Chionoecetes bairdi* 25 females, 90-110 mm, 22 with eggs, all old shell with attached barnacles. 37 *C. bairdi* males, 106-170 mm, 34 old shell with barnacles, one collected with Tag No. 04518. Examined 30 *C. bairdi* stomachs; all empty except for mud and a few shell fragments of small bivalves. Pots also contained several *Fusitriton oregonensis* and *Hyas lyratus*.

3/5/73

Beach survey of west side of bay indicates several beaches with good populations of *Protothaca staminea*. *Saxidomus gigantea* also present but in lesser numbers.

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[1]Carapace width

TABLE VI. Simpson Bay - Trawl 1.

Date: 9/27/73

Latitude: 60°38.3'

Longitude: 145°50.4'

Depth: 65 m

Trawl time: 10 minutes

Taxon or Common Name	Abundance	Comments
ARTHROPODA (Crustacea)		
Pandalus borealis	215	U
	2	F, we, 20, 21 mm
Pandalus hypsinotus	55	U
	5	F, we, 26-32 mm
Hippolytidae	4	
Crangonidae (unidentified)	5	
Argis spp.	4	F, 3 we
Chionoecetes bairdi	1	M 71-80 mm
	1	M 101-110 mm
	1	M 121-130 mm
	2	M 151-160 mm
	1	F 81-90 mm
	1	F 101-111 mm
CHORDATA (Fishes)		
Microgadus proximus	5	
Lycodes brevipes	5	
Elongate fishes (unidentified)	4	
Agonus acipenserinus	1	
Cottidae	1	small
Cyclopteridae	6	
Hippoglossoides elassodon	2	240, 505 mm
Limanda aspera	1	230 mm
Pleuronichthys decurrens	4	210-265 mm

TABLE VII. Simpson Bay - Trawl 2.

Date: 9/27/73

Latitude: 60°38.3'

Longitude: 145°50.4'

Depth: 65 m

Trawl time: 10 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Gastropod eggs	F	
Clinocardium ciliatum	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	35	0 we[1]
Pandalus goniurus	34	0 we
Pandalus hypsinotus	90	F, 11 we, 22-32 mm
Argis sp.	4	
Crangonidae (unidentified)	4	
Pagurus sp.	1	
Chionoecetes bairdi	1	F 97 mm[2]
BRACHIOPODA		
Laqueus sp.	7	
CHORDATA (Fishes)		
Microgadus proximus	1	
Lycodes brevipes	6	
Elongate fish (unidentified)	2	
Cottidae	2	
Agonus acipenserinus	1	
Pleuronectidae (unidentified)	3	
Limanda aspera	6	200-230 mm
Pleuronichthys decurrens	2	212, 296 mm

Accessory Data

9/26/73
At head of bay found large bed of *Mya arenaria*. Dug six 50 x 50 cm plots at approximately +0.3 meter tide height. Average yield=32 clams per plot; average shell length=46 mm.
9/27/73
Survey in same area as above, dug eighteen 50 x 50 cm plots. Average yield=15 *M. arenaria* clams per plot, average shell length=43 mm. Also see Feder and Paul (1973) and Paul and Feder (1975, 1976a).

[1]0 we=no egg bearing females collected.
[2]Carapace width.

TABLE VIII. Sheep Bay

Date: 5/6/74

Latitude: 60°38.2'

Longitude: 146°06.7'

Depth: 73 m

Trawl time: 10 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Gastropoda (unidentified)	5	
Serripes groenlandicus	2	220, 330 mm[1]
Polinices sp.	1	
Colus spp.	3	
ARTHROPODA (Crustacea)		
Shrimps (unidentified)	2	
Pandalus borealis	65	
Crangonidae (unidentified)	12	106-230 mm
Pagurus spp.	11	
Chionoecetes bairdi	1	F, we, 94 mm
ECHINODERMATA		
Ctenodiscus crispatus	8	
Ophiuroidea (unidentified)	1	
CHORDATA (Fishes)		
Theragra chalcogramma	2	197-200 mm
Lycodes brevipes	12	212-290 mm
Sebastes ruberrimus	1	154 mm
Cottidae (unidentified)	4	120-440 mm
Glyptocephalus zachirus	1	148 mm
Limanda aspera	2	270, 272 mm
Microstomus pacificus	5	112-172 mm
Platichthys stellatus	1	244 mm

[1]Shell length

TABLE IX. Gravina Point

Date: 5/7/74

Trawl directly off Gravina Point

Depth: 120 m

Trawl time: 10 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Gastropoda (unidentified)	12	small
Cephalopoda (small octopus)	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	150	0 we
Crangonidae	18	
Pagurus spp.	4	
Chionoecetes bairdi	4	M 436-955 mm
	4	F, 3 we, 905, 905, 991 mm
ECHINODERMATA		
Ctenodiscus crispatus	814	Stomachs filled with mud
CHORDATA (Fishes)		
Theragra chalcogramma	3	22-42 mm
Lycodes brevipes	6	180-280 mm
Sebastes ruberrimus	2	132, 155 mm
Glyptocephalus zachirus	2	132, 155 mm

TABLE X. Port Gravina

Date: 3/5/73
Latitude: 60°40.5'
Longitude: 146°19.0'
Depth: 128 m
Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Gastropoda (unidentified)	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	110	F, 110 we
	115	U
Pandalus hypsinotus	3	U
Argis sp.	33	U 33
Crangonidae (unidentified)	3	F, 3 we
Labidochirus splendescens	20	
Chionoecetes bairdi	6	F
	7	
ECHINODERMATA		
Ctenodiscus crispatus	C	
CHORDATA (Fishes)		
Theragra chalcogramma	28	174-274 mm stomachs empty
Lycodes brevipes	2	
Sebastes ruberrimus	1	
Cottidae (unidentified)	4	
Myoxocephalus sp.	1	2 small pollock in gut
Pleuronectidae (unidentified)	10	
Glyptocephalus zachirus	2	
Hippoglossoides elassodon	1	
Microstomus pacificus	1	

Accessory Data

This trawl was made along north shore just before Olson Bay.

TABLE XI. Galena Bay

Date: 11/10/73

Station location: Alyeska station[1]

Depth: 95 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Clinocardium ciliatum	1	small
Gastropoda (unidentified)	1	small
ARTHROPODA (Crustacea)		
Pandalus borealis	32	F, we, 18-23 mm
	42	U
Pandalus goniurus	7	F, we
	12	U
Pandalus hypsinotus	1	F, we, 29 mm
	20	U
Argis sp.	3	F, 1 we
Pagurus sp.	1	
Chionoecetes bairdi	2	F, we, 105, 105 mm
Crinoidea	2	M 85, 90 mm
Antedon sp.	8	
CHORDATA (Fishes)		
Theragra chalcogramma	21	20 with empty gut; 1 feeding on shrimp
Lycodes brevipes	1	
Hippoglossoides elassodon	3	
Limanda aspera	1	

Accessory Data

Good beds of *Protothaca staminea* found in North and West beaches of the inner bay see Feder and Paul (1973); Paul and Feder (1973, 1975, 1976a). Observed dense aggregations of exposed *Evasterias troschelii* on Millard Creek mud flat during low tide 11/9/73; a water temperature of 6.5°C and a sediment surface temperature + 0.5°C was measured. Several of these aggregations were visible. They contained 200-250 individuals per m^2. Most of the sea stars had opened mussel or cockle shells in the oral area. Gonads did not appear to be mature. Hundreds of *Melibe leonina* on eelgrass; a similar observation of *M. leonina* was made on the west side of Prince William Sound at Eaglek Bay during this month.

[1]See Hood *et al* (1973a,b) for location of station.

TABLE XII. Port Valdez - Alyeska Stations 28-36[1].

Date: 3/7/73
Latitude: 60°06.75'
Longitude: 146°25.0'
Depth: 127 m
Trawl time: 30 minutes

Taxon or Common Name	Abundance	Comments
ANNELIDA		
Polynoidae	10	
ARTHROPODA (Crustacea)		
Mysidacea	F	
Crangonidae	23	F, 10 we
Pandalus borealis	12	F, 12 we, 20-24 mm
Pandalopsis dispar	39	F, 39 we, 29-32 mm
Chionoecetes bairdi	13	M 9-20 mm
	3	M 21-30 mm
	2	M 31-40 mm
	1	M 140 mm; old shell
	8	F 9-20 mm
	2	F 21-30 mm
	8	F 31-40 mm; 1 soft shell
ECHINODERMATA		
Ctenodiscus crispatus	F	
CHORDATA (Fishes)		
Raja sp.	1	
Theragra chalcogramma	2	125 mm - feeding on mysids; 189 mm, 1 amphipod in gut
Sebastes ruberrimus	1	
Cottidae	2	

[1]see Hood *et al.* (1973a,b) for additional trawl data.

TABLE XIII. Port Valdez - Alyeska Stations 27-32[1].

Date: 3/6/73

Latitude: 61°06.3'

Longitude: 146°23.4'

Depth: 237 m

Trawl time: 30 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Anemone	3	
ARTHROPODA (Crustacea)		
Pandalus borealis	59	U
	5	F, we
Pandalopsis dispar	19	O we
Labidochirus splendescens	2	
Chionoecetes bairdi	23	M 9-20 mm
	5	M 21-30 mm
	4	M 31-40 mm
	1	M 64 mm
	8	F 9-20 mm
	4	F 21-30 mm
	6	F 31-40 mm
	1	F 42 mm
CHORDATA (Fishes)		
Theragra chalcogramma	1	211 mm
		several *Parathemisto* sp.
Cottidae	3	in gut
		small

[1] see Hood *et al.* (1973a,b)

TABLE XIV. Port Valdez - Alyeska Station 40[1]

Date: 3/6/73
Latitude: 61°06.3'
Longitude: 146°28.7'
Depth: 238 m
Trawl time: 10 minutes

Taxon or Common Name	Abundance	Comments
PORIFERA		
Sponge	5	
CNIDARIA		
Anemone	2	
ANNELIDA		
Polynoidae	1	
MOLLUSCA		
Nudibranchiata	3	
ARTHROPODA (Crustacea)		
Pandalus borealis	70	U
	4	F, we
Pandalopsis dispar	22	O we
Labidochirus splendescens	2	
Chionoecetes bairdi	1	M 10-20 mm
	2	M 21-30 mm
	2	M 31-40 mm
	1	M 131-covered with fungus
	2	F 21-30 mm
	1	F, we, 78 mm, amphipods in egg mass
	1	F, we, 105 mm, amphipods in egg mass
ECHINODERMATA		
Ctenodiscus crispatus	F	
Ophiura sarsi	1	
CHORDATA (Fishes)		
Theragra chalcogramma	1	288 mm, *Parathemisto* sp. in gut
Cottidae	1	

[1]see Hood *et al.* (1973a,b)

TABLE XV. PORT VALDEZ - Alyeska Station 42[1]

Date: 3/6/73

Latitude: 61°05.9'

Longitude: 146°30.5'

Depth: 237 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
PORIFERA		
Sponge	1	
ANNELIDA		
Polynoidae	4	
ARTHROPODA (Crustacea)		
Pandalus sp.	4	F, 4 we
Pandalus borealis	100	U
	8	F, we
Pandalopsis dispar	33	O we
Shrimp (unidentified)	4	F, 4 we
Crangonidae	16	U
	20	F, 20 we
Labidochirus splendescens	1	
Chionoecetes bairdi	14	M 9-20 mm
	2	M 21-30 mm
	6	M 31-40 mm
	2	F 10-20 mm
	2	F 21-30 mm
	8	F 31-40 mm
	1	F 42 mm
ECHINODERMATA		
Ophiura sarsi	1	
Ctenodiscus crispatus	1	
CHORDATA (Fishes)		
Theragra chalcogramma	2	
Hippoglossoides elassodon	1	

[1]see Hood *et al.* (1973a,b)

TABLE XVI. Port Valdez - Alyeska Station 40[1]

Date: 12/8/73

Latitude: 61°06.35'

Longitude: 146°28.7'

Depth: 235 m

Trawl time: 30 minutes

Taxon or Common Name	Abundance	Comments
PORIFERA		
Sponges	2	
ARTHROPODA (Crustacea)		
Pandalus borealis	32	U
	30	F, we, 17-25 mm
Pandalopsis dispar	19	F, 3 we, 29-32 mm
Argis dentata	10	F, 3 we, 81-90 mm
Labidochirus splendescens	3	
Chionoecetes bairdi	1	M 140 mm
	2	M 181-190 mm
	1	F 20-30 mm
	2	F 41-50 mm
	1	F 71-80 mm
	3	F, 3 we, 81-90 mm
CHORDATA (Fishes)		
Theragra chalcogramma	7	large
Cottidae	1	

[1]see Hood *et al.* (1973a,b). In Hood *et al.* (1973a,b) and the present survey the majority of *Chionoecetes bairdi* in Port Valdez were generally less than 30 mm in width. This suggests that Port Valdez might be a nursery area for snow crabs. Additional trawl data from 1977 also demonstrated a preponderance of small crabs (Feder and Mueller, unpub.).

TABLE XVII. Columbia Bay

Date: 5/17/73

Latitude: 60°57.3'

Longitude: 147°02.6'

Depth: 91 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Anemone	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	62	0 we
Pandalus sp.	1	
Argis sp.	1	
Crangonidae	17	
Chionoecetes bairdi	1	M 76 mm, all new hard carapace
	1	M 96 mm
	1	M 115 mm
	2	M 131-140 mm
	2	F 15-20 mm
	1	F 76 mm
	1	F, we, 100 mm
ECHINODERMATA		
Ctenodiscus crispatus	1	
CHORDATA (Fishes)		
Theragra chalcogramma	6	
Myoxocephalus sp.	1	feeding on fish
Agonus acipenserinus	6	
Glyptocephalus zachirus	2	see Accessory Data for food contents
Hippoglossoides elassodon	7	

Accessory Data

Both *G. zachirus* contained polychaetes, amphipods, cumaceans, and fecal pellets in their stomachs.

TABLE XVIII. Columbia Bay

Date: 5/17/73
Latitude: 60°58.2'
Longitude: 147°01.2'
Depth: 54 m
Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Ptilosarcus sp.	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	39	
P. hypsinotus	24	
Argis dentata	2	
Chionoecetes bairdi	3	M 11-20 mm, all new hard carapace
	1	M 21-25 mm
	1	M 101-110 mm
	3	M 115-125 mm
Cancer magister	1	M 190 mm
CHORDATA (Fishes)		
Lycodes spp.	1	
Sebastes ruberrimus	2	SL=145, 148 mm fish in 1 gut
Cottidae	5	
Agonus acipenserinus	2	
Hippoglossoides elassodon	15	
Limanda aspera	1	228 mm, 1 *Yoldia* in gut

TABLE XIX. Columbia Bay

Date: 5/17/73

Latitude: 60°58.7'

Longitude: 147°00.6'

Depth: 109 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Ptilosarcus sp.	2	
ARTHROPODA (Crustacea)		
Pandalus borealis	41	0 we
P. hypsinotus	6	0 we
Crangonidae	4	
Chionoecetes bairdi	5	U
	2	F, we, 98-106 mm
	7	F 91-100 mm
ECHINODERMATA		
Ctenodiscus crispatus	1	
CHORDATA (Fishes)		
Theragra chalcogramma	5	
Agonus acipenserinus	2	
Glyptocephalus zachirus	3	see Accessory data
Hippoglossoides elassodon	8	see Accessory data

Accessory Data

Glyptocephalus zachirus: SL=120-143, stomachs contained amphipods, cumaceans, and fecal pellets. *H. elassodon*: SL 204, 1 *Pandalus borealis* in stomach; SL 210, 1 *Yoldia* sp. in stomach; SL 234, 1 *P. borealis* in stomach; SL 180, 1 fish in stomach; SL 230, 1 *Yoldia* sp. in stomach; SL 234, gut empty.

TABLE XX. Columbia Bay

Date: 5/17/73

Latitude: 60°57.0'

Longitude: 147°03.5'

Depth: 100 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
ARTHROPODA (Crustacea)		
Pandalus borealis	44	
P. hypsinotus	1	
Pandalopsis dispar	2	
Crangonidae	10	
Chionoecetes bairdi	2	M 61-70 mm
	1	M 85 mm
	2	M 125-130 mm
	1	F, 87 mm, 0 we
ECHINODERMATA		
Ctenodiscus crispatus	13	
CHORDATA (Fishes)		
Theragra chalcogramma	6	
Anoplopoma fimbria	1	236 mm, gut empty
Cottidae	2	
Myoxocephalus sp.	1	
Agonus acipenserinus	3	
Hippoglossoides elassodon	3	

TABLE XXI. Columbia Bay

Date: 5/17/73

Latitude: 60°57.4'

Longitude: 147°03.2'

Depth: 108 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Cephalopoda	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	31	O we
Crangonidae	2	
Chionoecetes bairdi	6	M
	1	F 44 mm
ECHINODERMATA		
Ctenodiscus crispatus	11	
CHORDATA (Fishes)		
Microgadus proximus	2	see Accessory data
Theragra chalcogramma	10	see Accessory data
Lycodes sp.	2	
Anoplopoma fimbria	2	SL 275, 275 mm
Agonus acipenserinus	4	
Glyptocephalus zachirus	3	see Accessory data
Hippoglossoides elassodon	7	

Accessory Data

G. zachirus stomachs contained amphipods, cumaceans, and a small clam. 1 *M. proximus* had many hyperid amphipods in stomach. *T. chalcogramma*, 8 stomachs contained 1 *P. borealis*, 3 had hyperid amphipods.

TABLE XXII. Columbia Bay

Date: 5/17/73

Latitude: 60°58.8'

Longitude: 147°01.7'

Depth: 82 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Pennatulacea	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	112	
Pandalus hypsinotus	49	
Chionoecetes bairdi	1	M 95 mm
Crangonidae	29	
Pagurus sp.	1	
CHORDATA (Fishes)		
Theragra chalcogramma	8	see Accessory data
Lycodes sp.	2	
Cottidae	1	
Agonus acipenserinus	3	
Hippoglossoides elassodon	9	

Accessory Data

Theragra chalcogramma: 198 mm, full of hyperid and gammarid amphipods, *P. borealis*; 144 mm, full of hyperids; 144 mm, full of hyperids; 129 mm, full of hyperids; 115 mm, full of hyperids; 129 mm, 115 mm, 98 mm, all empty.

TABLE XXIII. Columbia Bay

Date: 5/17/73

Latitude: 60°58.6'

Longitude: 147°10.0'

Depth: 82 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Ptilosarcus sp.	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	62	
P. goniurus	2	
P. hypsinotus	36	
Crangonidae	16	
Chionoecetes bairdi	2	M 144, 92 mm
CHORDATA (Fishes)		
Theragra chalcogramma	1	155 mm, gut full *Parathemisto* sp.
Lycodes sp.	2	
Cottidae	2	
Hippoglossoides elassodon	4	

TABLE XXIV. Columbia Bay - Trawl #1.

Date: 12/10/73

Latitude: 60°58.6'

Longitude: 147°10.6'

Depth: 80 m

Trawl time: 30 min

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Pennatulacea	1	
MOLLUSCA		
Cephalopoda (small octopus)	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	192	U 65, see Accessory data
P. hypsinotus	15	F, 12 we, 31-38 mm
Pandalopsis dispar	3	0 we
Argis dentata	5	
Chionoecetes bairdi	1	M 71-80 mm
	3	M 91-100 mm
	2	M 101-110 mm
	3	M 119, 127, 155 mm
	1	F 83 mm
	1	F, we, 97 mm
	1	F, we, 101 mm
ECHINODERMATA		
Ctenodiscus crispatus	3	
CHORDATA (Fishes)		
Microgadus proximus	6	192-234 mm
Theragra chalcogramma	68	see Accessory data, 95-282 m
Cottidae	4	
Agonus acipenserinus	7	
Glyptocephalus zachirus	4	
Limanda aspera	4	
Microstomus pacificus	1	
Platichthys stellatus	9	281-394 mm

Accessory Data

Theragra chalcogramma: 25 had *P. borealis* in gut, 6 small fish, 1 *Argis* sp. One hundred twenty-one *P. borealis* females had blue green eggs. Carapace length of females bearing eggs ranged from 19-26 mm. Six *P. borealis* were carrying dead eggs.

TABLE XXV. Columbia Bay - Trawl #2.

Date: 12/10/73

Latitude: 60°58.4'

Longitude: 147°10.3'

Depth: 75 m

Trawl time: 30 min

Taxon or Common Name	Abundance	Comments
ARTHROPODA (Crustacea)		
Pandalus borealis	780	
P. platyceros	1	43 mm
P. hypsinotus	10	U 21-32 mm
	69	F, we, 23-39 mm
Argis sp.	23	
Chionoecetes bairdi	1	M 137 mm
	9	F, 6 we, 92-102 mm
CHORDATA (Fishes)		
Theragra chalcogramma	3	
Limanda aspera	2	
Platichthys stellatus	1	138 mm

TABLE XXVI. Unakwik Inlet - Trawl #1.

Date: 3/4/73

Latitude: 60°55.5'

Longitude: 147°34.0'

Depth: 300 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
ANNELIDA		
Polynoidae	1	
MOLLUSCA		
Opisthobranch (large white)	2	
ARTHROPODA (Crustacea)		
Mysidacea	C	
Pandalus borealis	F	
Pandalopsis dispar	F	
Crangonidae	F	
Labidochirus splendescens	3	
BRYOZOA		
Encrusting Bryozoa on algae	F	
ECHINODERMATA		
Ctenodiscus crispatus	C	
CHORDATA (Fishes)		
Fish (unidentified)	1	

Accessory Data

No snow crab collected.

TABLE XXVII. Unakwik Inlet - Trawl #2.

Date: 3/4/73

Latitude: 60°55.5'

Longitude: 147°34.0'

Depth: 300 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
ANNELIDA		
Polynoidae	5	
MOLLUSCA		
Opisthobranch	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	66	
Pandalopsis dispar	402	U
	10	F, 10 we, 29-37 mm
Crangonidae	9	
Labidochirus splendescens	10	
ECHINODERMATA		
Ctenodiscus crispatus	A	
CHORDATA (Fishes)		
Cottidae	6	
Agonus acipenserinus	3	

Accessory Data

No snow crab collected. *Protothaca staminea*, abundant at mouth of Cedar Bay. Observed 300 ft. beach where sea otters had eaten most sexually mature *Saxidomus gigantea*. *Stichopus* sp. common.

TABLE XXVIII. Unakwik Inlet - Trawl #3.

Date: 3/4/73

Latitude: 60°55.5'

Longitude: 147°34.0'

Depth: 300 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Anemone	10	
ANNELIDA		
Polynoidae	F	
ARTHROPODA (Crustacea)		
Pandalus borealis	77	U
	2	F, 2 we, 22, 23 mm
Pandalopsis dispar	394	U
	17	F, 17 we, 26-36 mm
Crangonidae	4	
Hyperid amphipod	2	
Labidochirus splendescens	8	
Chionoecetes bairdi	1	M 375 mm
	1	F 18 mm
	3	F 35-40 mm
	1	F, 100 we
ECHINODERMATA		
Ctenodiscus crispatus	A	
CHORDATA (Fishes)		
Cottidae	11	
Fish (unidentified)	6	

TABLE XXIX. Unakwik Inlet

Date: 10/3/73

Latitude: 60°55.5'

Longitude: 147°34.0'

Depth: 300 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Anemone	1	
ANNELIDA		
Polynoidae	1	
MOLLUSCA		
Nuculana sp.	5	
Yoldia spp.	42	
Natica clausa	3	
Natica egg collar	1	
Neptunea spp.	4	86-107 mm
Nudibranch	1	
Cephalopoda (small octopus)	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	168	U
	10	F, 10 we, 20-25 mm
Pandalopsis dispar	74	U
	34	F, 34 we, 28-35 mm
Crangonidae	47	0 we
Labidochirus splendescens	4	
Chionoecetes bairdi	1	M 145 mm
ECHINODERMATA		
Ctenodiscus crispatus	640	
Brisaster townsendi	1	
CHORDATA (Fishes)		
Liparis sp.	1	
Cottidae	2	
Agonus sp.	1	
Fish (unidentified)	6	

TABLE XXX. Port Wells - Trawl #1.

Date: 3/3/73

Trawl off Esther Passage

Depth: 365 to 402 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Anemone	F	
MOLLUSCA		
Yoldia spp.	6	
Chlamys spp.	2	
Neptunea sp.	1	large
ARTHROPODA (Crustacea)		
Pandalus borealis	F	F, 4 we, 21-24 mm
Pandalopsis dispar	C	F, 2 we, 33, 35 mm
Chionoecetes bairdi	2	M 80, 35 mm
	4	F 72-77 mm
BRACHIOPODA		
Laqueus sp.	C	
ECHINODERMATA		
Ctenodiscus crispatus	A	
Brisaster townsendi	1	
Synaptidae	A	
CHORDATA (Tunicata)		
Ascidiacea (unidentified)	3	
CHORDATA (Fishes)		
Cottidae	F	
Liparis spp.	1	

TABLE XXXI. Port Wells - Trawl #2.

Date: 3/3/73

Latitude: 60°54.0'

Longitude: 148°10.0'

Depth: 420 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
ARTHROPODA (Crustacea)		
Hyperid amphipod	1	
Pandalus borealis	F	
Pandalopsis dispar	290	U
	18	F, 18 we, 30-37 mm
Crangonidae	F	
Chionoecetes bairdi	1	F, we, 108 mm
ECHINODERMATA		
Ctenodiscus crispatus	A	
Synaptidae	F	
CHORDATA (Fishes)		
Cottidae	F	
Glyptocephalus zachirus	1	
Fish (unidentified)	F	

TABLE XXXII. Port Wells - Trawl #3.

Date: 3/3/73

Latitude: 60°50.5'

Longitude: 148°11.8'

Depth: 430 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
CNIDARIA		
Anemone	1	
MOLLUSCA		
Buccinum spp.	3	
ARTHROPODA (Crustacea)		
Pandalus borealis	38	
Pandalus sp.	11	Black eggs
Pandalopsis dispar	75	U
	5	F, 5 we, 31-39 mm
Crangonidae	6	
Chionoecetes bairdi	3	M 25, 77, 125 mm
ECHINODERMATA		
Holothuroidea	F	Large
Synaptidae	A	
Ctenodiscus crispatus	A	
CHORDATA (Fishes)		
Cottidae	8	
Thaleichthys pacificus	1	

Accessory Data

In Esther Passage *Strongylocentrotus droebachiensis* (sea urchins) abundant in low intertidal to deeper waters; *Stichopus* sp. also abundant, *Pycnopodia helianthoides* and *Evasterias* (see Paul and Feder, 1975) abundant intertidally; large nereid polychaetes, *Protothaca staminea*, *Saxidomus gigantea*, *Hiatella arctica* and *Hyas lyratus*, common intertidally. Urchins apparently eating low lying brown algal cover.

TABLE XXXIII. Blackstone Bay

Date: 5/15/73

Latitude: 60°44.5'

Longitude: 148°36.0'

Depth: 354 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
PORIFERA		
Sponge	A	
CNIDARIA		
Anemone	A	
ARTHROPODA (Crustacea)		
Pandalus borealis	34	
P. goniurus	20	
P. hypsinotus	1	
Pandalopsis dispar	16	
Crangonidae	3	
Chionoecetes bairdi	3	M 30-45 mm
(see Accessory Data)	1	M 95 mm
	1	M 125 mm
	3	F 31-60 mm; 1 soft shell
	1	F, we, 91.5 mm
CHORDATA (Tunicata)		
Ascidiacea	11	
CHORDATA (Fishes)		
Cottidae	49	
Liparis sp.	1	

Accessory Data

Examined 3 *C. bairdi* stomachs: F, 46 mm with stomach full of mud and algae; F, 61 mm with stomach full of mud, 2 flatworms, 3 nematodes; M, 43 mm, stomach empty, intestine full of mud. Examined beaches in Culross Passage - no clams encountered.

TABLE XXXIV. Port Etches - Trawl #1.

Date: 5/13/73

Latitude: 60°20.2'

Longitude: 146°35.0'

Depth: 73 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Nuculana sp.	50	
Clinocardium ciliatum	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	931	U
	2	F, 2 we
P. goniurus	31	F, 2 we
P. hypsinotus	40	
Pandalus sp.	5	
Pandalopsis dispar	10	
Crangonidae	27	
Labidochirus splendescens	1	
Hyas lyratus	3	
Chionoecetes bairdi	16	M 15-25 mm
	8	M 26-35 mm; 1 soft shell
	14	M 36-45 mm; 3 soft shell
	5	M 46-56; 1 soft shell
	15	F 15-25; 3 soft shell
	2	F 26-35
	6	F 40-50; 2 soft shell
	4	F 51-60; 2 soft shell
	1	F 61-70
ECHINODERMATA		
Pycnopodia helianthoides	16	see Paul and Feder, 1975
Strongylocentrotus droebachiensis	1	
CHORDATA (Fishes)		
Thaleichthys pacificus	1	
Theragra chalcogramma	1	55 mm
Lycodes brevipes	1	
Hippoglossoides elassodon	2	
Platichthys stellatus	1	4 cockles in stomach

TABLE XXXV. Port Etches - Trawl #2.

Date: 5/13/73

Latitude: 60°20.2'

Longitude: 146°35.0'

Depth: 69 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
ARTHROPODA (Crustacea)		
Pandalus borealis	131	F, 1 we
P. goniurus	7	
P. hypsinotus	5	
Argis sp.	3	
Crangonidae	18	F, 1 we
Hyas lyratus	1	F, 1 we
Chionoecetes bairdi	8	M 25-50 mm
(see Accessory Data)	11	M 51-75 mm; 1 soft shell
	1	M 139 mm
	4	F 20-40 mm
	5	F 41-60 mm; 2 soft shell
	1	F 70 mm; soft shell
ECHINODERMATA		
Pycnopodia helianthoides	6	see Paul and Feder, 1975

Accessory Data

C. bairdi stomachs examined: M 75 mm, stomach full of mud and algal material; F 47 mm, stomach full of mud and algal material, also mud-filled shell of gastropod.

TABLE XXXVI. Port Etches - Trawl #3.

Date: 5/13/73

Latitude: 60°20.2'

Longitude: 146°35.0'

Depth: 67 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Nuculana sp.	A	
ARTHROPODA (Crustacea)		
Pandalus borealis	220	0 we
P. goniurus	7	F, 1 we
P. hypsinotus	2	
Crangonidae	20	
Labidochirus splendescens	2	
Hyas lyratus	4	F, 4 we
Cancer magister	1	F 120 mm
Chionoecetes bairdi	14	M 21-30 mm; 1 soft shell
	10	M 31-40 mm
	8	M 41-50 mm; 2 soft shell
	4	M 51-60; 1 soft shell
	11	F 21-30 mm
	6	F 31-40 mm
	11	F 41-50 mm; 2 soft shell
	2	F 51-60 mm
	2	F 61-65 mm
ECHINODERMATA		
Pycnopodia helianthoides	3	see Paul and Feder, 1975
CHORDATA (Fishes)		
Theragra chalcogramma	1	
Lycodes brevipes	3	
Liparis sp.	1	
Hippoglossoides elassodon	1	

TABLE XXXVII. Port Etches - Trawl #4.

Date: 5/13/73

Latitude: 60°20.0'

Longitude: 146°35.1'

Depth: 55 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Nuculana sp.	C	
ARTHROPODA (Crustacea)		
Pandalus borealis	92	F, O we
P. hypsinotus	5	
Hyas lyratus	2	M
Chionoecetes bairdi	7	M 21-30 mm
	4	M 41-50 mm
	1	M 57; 1 soft shell
	1	F 23 mm
	5	F 40-50 mm; 1 soft shell
ECHINODERMATA		
Pycnopodia helianthodes	25	see Paul and Feder, 1975
CHORDATA (Fishes)		
Lycodes brevipes	1	

Accessory Data

Examined Constantine Harbor for intertidal clams, found only young *Protothaca staminea* and *Saxidomus gigantea*. Very few large clams. At least 50 sea otters in area. Several females with young pups observed. Thousands of empty *S. gigantea* and *P. staminea* shells along beaches.

TABLE XXXVIII. Port Etches - Trawl #1.

Date: 10/3/73
Latitude: 60°19.8'
Longitude: 146°35.2'
Depth: 64 m
Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Nuculana sp.	A	
Clinocardium ciliatum	1	
Cephalopoda (small octopus)	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	1,254	F, 14 we, 18-23 mm
P. goniurus	2	
P. hypsinotus	125	F, 4 we, 27-30 mm
Crangonidae	120	F, few we
Hyas lyratus	1	
Cancer magister	2	M 85, 110 mm
	3	F, 0 we, 85-100 mm
Chionoecetes bairdi	10	M 31-40 mm
	7	M 41-50 mm
	7	M 51-60 mm
	3	M 61-70
	1	M 75 mm
	3	F 31-40 mm
	5	F 41-50 mm
	2	F 51-60 mm
	2	F 61-70 mm
ECHINODERMATA		
Ophiura sp.	1	
CHORDATA (Fishes)		
Theragra chalcogramma	7	see Accessory data
Lycodes brevipes	46	see Accessory data
Sebastes ruberrimus	1	96 mm
Cottidae	1	128
Glyptocephalus zachirus	1	
Hippoglossoides elassodon	43	
Limanda aspera	2	see Accessory data

Accessory Data

Limanda aspera: SL 275 mm with 1 *C. bairdi* in gut; SL 247 mm, small fish in gut. *Lycodes brevipes*: SL 155-222 mm, 37 of 46 (80%) specimens examined had 1 to 20 *Nuculana* in their stomachs, others were empty. *T. chalcogramma*: SL 145-155 mm, 5 empty, 2 with *P. borealis* in gut.

TABLE XXXIX. Port Etches - Trawl #2.

Date: 10/3/73

Latitude: 60°19.8'

Longitude: 146°35.2'

Depth: 64 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Nuculana sp.	170	Average length=15.5 mm
Cephalopoda (small octopus)	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	542	F, 4 we, 18-21 mm
P. goniurus	24	
P. hypsinotus	25	F, 6 we, 28-32 mm
Pandalopsis dispar	1	
Crangonidae	44	
Cancer magister	3	M 94-98 mm
	3	F 88-97 mm
Chionoecetes bairdi	3	M 31-40
	7	M 41-50
	14	M 51-60 mm
	6	M 61-70
	1	M 83 mm
	2	F 41, 44 mm
	7	F 58-68 mm; 1 soft shell
	1	F 80 mm
CHORDATA (Fishes)		
Theragra chalcogramma	1	165 mm, Accessory data
Lycodes brevipes	38	see Accessory data
Hippoglossoides elassodon	19	132-165 mm; see Accessory
Limanda aspera	1	250 mm, gut empty

Accessory Data

Gut contents of 7 *H. elassodon* examined, 3 had 1 *P. borealis* in gut, 4 empty. *T. chalcogramma* had 1 *P. borealis* in its gut.

TABLE XL. Port Etches - Trawl #1.

Date: 11/8/73

Latitude: 60°20.5'

Longitude: 146°33.6'

Depth: 54.0 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Nuculana sp.	A	
Macoma nasuta	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	A	
P. hypsinotus	F	
Pandalopsis dispar	F	
Crangonidae	F	
Chionoecetes bairdi	1	M 43 mm
	2	F 46, 47 mm
ECHINODERMATA		
Pycnopodia helianthoides	2	see Paul and Feder, 1975
ARTHROPODA (Fishes)		
Theragra chalcogrammus	7	
Cottidae	1	
Glyptocephalus zachirus	8	small
Limanda aspera	1	

TABLE XLI. Port Etches - Trawl #2.

Date: 11/8/73

Latitude: 60°25.5'

Longitude: 146°33.6'

Depth: 36.0 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Clinocardium ciliatum	1	small
Nuculana sp.	A	
ARTHROPODA (Crustacea)		
Pandalus borealis	40	F, 9 we
P. hypsinotus	6	F, 1 we
Chionoecetes bairdi	1	M 13 mm
	10	M 31-40 mm
	3	M 41-50 mm; 1 soft shell
	8	F 31-40 mm
	5	F 41-50 mm
CHORDATA (Fishes)		
Theragra chalcogramma	28	
Lycodes brevipes	4	guts empty
Cottidae	1	gut empty
Pleuronectidae (unidentified)	2	
Hippoglossoides elassodon	3	
Limanda aspera	3	

TABLE XLII. Port Etches

Date: 11/15/73

Latitude: 60°20.8'

Longitude: 146°33.7'

Depth: 73 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
ARTHROPODA (Crustacea)		
Pandalus borealis	1,057	F, 314 we
P. goniurus	5	
P. platyceros	11	
P. hypsinotus	119	F, 38 we
Pandalopsis dispar	8	
Hippolytidae	243	F, 96 we
Argis spp.	32	F, 2 we
Crangonidae	22	
Hyas lyratus	1	F, we
Chionoecetes bairdi	4	M 35-50 mm; 1 soft shell
	3	F 31-46 mm; 1 soft shell
ECHINODERMATA		
Pycnopodia helianthoides	7	see Paul and Feder, 1975
CHORDATA (Fishes)		
Theragra chalcogramma	27	
Hexagrammos sp.	1	
Cottidae	1	
Pleuronectidae	2	
Glyptocephalus zachirus	19	small
Hippoglossoides elassodon	16	small
Limanda aspera	1	see Accessory data

Accessory Data

L. aspera 255 mm, stomach contained 2 *P. borealis*

TABLE XLIII. Port Etches

Date: 12/12/73

Latitude: 60°19.4'

Longitude: 146°35.9'

Depth: 64 m

Trawl time: 15 minutes

Taxon or Common Name	Abundance	Comments
MOLLUSCA		
Clinocardium ciliatum	1	
Macoma sp.	1	
Serripes groenlandicus	1	
ARTHROPODA (Crustacea)		
Pandalus borealis	2,000	Not examined for eggs
P. goniurus	8	Not examined for eggs
P. hypsinotus	55	F, 12 we, 29-34 mm
Pandalopsis dispar	5	
Crangonidae	42	
Chionoecetes bairdi	12	M 35-45 mm
	12	M 46-55 mm
	6	M 56-65 mm
	3	M 70-75 mm
	11	F 41-50; 2 soft shell
	6	F 51-60 mm
	1	F 62 mm
	1	F 76 mm; soft shell
ECHINODERMATA		
Pycnopodia helianthoides	3	see Paul and Feder, 1975
ARTHROPODA (Fishes)		
Theragra chalcogramma	185	small
Lycodes brevipes	4	
Glyptocephalus zachirus	2	
Hippoglossoides elassodon	27	
Limanda aspera	20	

Accessory Data

Observed about 50 sea otters in Port Etches and Constantine Harbor. One was eating a crab. Two had large white clams, probably *Saxidomus*.

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APPENDIX I. OBSERVATIONS ON PARASITISM AND MARINE LEECHES

Bopyroid isopods were observed parasitizing 2 *Pandalopsis dispar* in Port Wells and 2 crangonid shrimp in Port Etches. The egg clutches of *Chionoecetes bairdi* in Port Valdez frequently contained amphipods.

A curlfin sole, *Pleuronichthys decurrens*, caught with a hook and line had 14 leeches attached to its body. These leeches were similar in appearance to *Notostomobdella* sp. which lays its eggs on *C. bairdi* carapaces. This observation was made 18 May 1973 in Nelson Bay.

APPENDIX II. Relative abundance of selected, common intertidal and subtidal species observed in 12 localities in Prince William Sound on cruises of the R/V *Acona*. A=abundant; C=common; F=few. See Fig. 1 for location of the 12 study areas.

Species	Nelson Bay	Simpson Bay	Sheep Bay	Gravina Point	Port Gravina	Galena Bay	Port Valdez	Columbia Bay	Unakwik Inlet	Port Wells	Blackstone Bay	Port Etches
ANTHOZOA												
Anemone, several species	F	-	-	-	-	-	-	-	-	-	A	-
Ptilosarcus	-	-	-	-	-	-	-	F	-	-	-	-
MOLLUSCA												
Nuculana sp.	-	-	-	-	-	-	-	-	F	-	-	A
Yoldia spp.	-	-	-	-	-	-	-	-	C	F	-	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	F
Clinocardium ciliatum	-	-	-	-	-	F	-	-	-	-	-	F
Serripes groenlandicus	-	-	F	-	-	-	-	-	-	-	-	F
Mya arenaria	A	A	-	-	C	C	A	-	-	-	-	-
Protothaca staminea	C	A	-	-	A	A	F	-	A	-	-	F
Saxidomus gigantea	F	C	-	-	A	C	-	-	F	-	-	F
Natica clausa	-	-	-	-	-	C	-	-	F	-	-	-
Polinices sp.	-	-	F	-	-	-	-	-	-	-	-	-
Colus sp.	-	-	F	-	-	-	-	-	-	-	-	-
Neptunea sp.	-	-	-	-	-	-	-	-	F	F	-	-
Fusitriton oregonensis	-	F	-	-	-	F	-	-	-	-	-	-
Melibe leonina	-	-	-	-	-	C	-	-	C	-	-	-
ARTHROPODS (Crustacea)												
Pandalus borealis	-	A	A	A	A	A	A	A	A	F	C	A
P. hypsinotus	C	C	-	-	F	C	-	C	-	-	-	C
P. goniurus	-	F	-	-	-	C	-	-	-	-	C	C
Pandalopsis dispar	-	-	-	-	-	-	F	F	A	A	C	F
Argis spp.	-	F	-	-	-	-	-	F	-	-	-	-
Labidochirus splendescens	-	-	-	-	F	-	F	-	F	-	-	F
Cancer magister	F	-	-	-	-	C	C	F	-	-	-	F
Hyas lyratus	-	-	-	-	-	F	-	-	-	-	-	F
Chionoecetes bairdi	A	A	F	F	C	F	C	F	F	F	F	C
ECHINODERMATA												
Ophiura sarsi	-	-	-	-	-	-	F	-	-	-	-	-
Gorgonocephalus eucnemis	-	F	-	-	-	-	-	-	-	-	-	-
Pyenopodia helianthoides	F	A	-	-	-	A	F	-	F	-	-	C
Ctenodiscus crispatus	-	-	F	A	C	-	C	F	A	A	-	-
Strongylocentrotus droebachiensis	-	-	-	-	-	-	-	-	-	A	-	F
Brisaster townsendi	-	-	-	-	-	-	-	-	F	F	-	-

APPENDIX II. Continued

Species	Nelson Bay	Simpson Bay	Sheep Bay	Gravina Point	Port Gravina	Galena Bay	Port Valdez	Columbia Bay	Unakwik Inlet	Port Wells	Blackstone Bay	Port Etches
CHORDATA (Fishes)												
Raja spp.	-	-	-	-	-	-	F	-	-	-	-	-
Theragra chalcogramma	-	F	F	F	C	C	F	F	-	F	-	C
Sebastes ruberrimus	-	-	F	F	-	-	F	F	-	-	-	F
Hexagrammos decagrammus	-	F	-	-	-	-	-	-	-	-	-	-
Myoxocephalus spp.	-	F	-	-	-	-	-	F	-	-	-	-
Anoplopoma fimbria	-	-	-	-	-	-	-	F	-	-	-	-
Agonus acipenserinus	-	F	-	-	-	-	-	F	F	-	-	-
Liparis sp.	-	-	-	-	-	-	-	-	F	F	F	F
Lycodes brevipes	-	F	C	F	-	-	-	-	-	-	-	C
Hippoglossoides elassodon	-	F	-	-	F	F	F	C	-	-	-	C
Pleuronichthys decurrens	-	F	-	-	-	-	-	-	-	-	-	-
Limanda aspera	C	F	F	-	-	F	-	F	-	-	-	F
Glyptocephalus zachirus	-	F	F	F	F	-	-	F	-	F	-	C
Platichthys stellatus	-	F	F	-	-	-	-	F	-	-	-	F
Microstomus pacificus	-	-	F	-	F	-	-	-	-	-	-	-
Isopsetta isolepis	-	F	-	-	-	-	-	-	-	-	-	-

APPENDIX III. Reproductive data for selected species of crabs and shrimps. Sampling localities were determined by the needs of the primary projects, and collections were ones of opportunity only. N=Number of individuals. A dash indicates no data.

Single numbers in male/female column imply undetermined sex.

Species and Location	N (males/females)	N (w/eggs)	%	Egg color	Size (mm) female w/eggs
16-17 February 1973					
Chionoecetes bairdi					
Nelson Bay	115/89	0	-	-	-
Simpson Bay	21/28	0	-	-	-
Pandalus borealis					
Simpson Bay	233	123	52.8	dark green	-
Pandalus hypsinotus					
Simpson Bay	228	19	8.3	green	-
3-7 March 1973					
Chionoecetes bairdi					
Port Gravina	7/0	-	-	-	-
Port Valdez	88/54	2	3.7	brown	78-108
Unakwik Inlet	1/5	1	20	dark brown	100
Port Wells	5/5	1	20	orange	100
Pandalus borealis					
Port Gravina	225	110	48.9	steel blue	-
Port Valdez	250	29	11.6	steel blue	20-24
Unakwik Inlet	140	2	1.4	steel blue	
Port Wells	F	4	-	steel blue	21-24
Pandalus hypsinotus					
Port Gravina	3	0	-	-	-
Pandalopsis dispar					
Port Valdez	113	4	3.5	brown	29-32
Unakwik Inlet	823	27	3.3	brown	29-37
Port Wells	385	23	6.0	brown	30-39
13-17 May 1973					
Chionoecetes bairdi					
Columbia Bay	41/15	3	20	bright orange;	98-106

APPENDIX III. Continued

Species and Location	N (males/females)	N (w/eggs)	%	Egg color	Size (mm) female w/eggs
		13-17 May 1973 (cont'd)			
Blackstone Bay	5/2	1	50	dark brown	91.5
Port Etches	183/76	0	-	-	-
Pandalus borealis					
Columbia Bay	279	0	-	-	-
Blackstone Bay	34	0	-	-	-
Port Etches	1378	3	0.2	gray w/eye spots	-
Pandalus hypsinotus					
Columbia Bay	116	0	-	-	-
Blackstone Bay	1	0	-	-	-
Port Etches	52	0	-	-	-
Pandalopsis dispar					
Columbia Bay	2	0	-	-	-
Blackstone Bay	16	0	-	-	-
Port Etches	10	-	-	-	-
Pandalus goniurus					
Blackstone Bay	20	0	-	-	-
Port Etches	45	3	6.7	green	-
		27 September 1973			
Chionoecetes bairdi					
Simpson Bay	8	0	-	-	-
Pandalus borealis					
Simpson Bay	250	2	1.0	dark green	20-21
Pandalus hypsinotus					
Simpson Bay	150	16	10.7	green	22-32
		3 October 1973			
Chionoecetes bairdi					
Port Etches	59/27	0	-	-	-

APPENDIX III. Continued

Species and Location	N (males/females)	N (w/eggs)	%	Egg color	Size (mm) female w/eggs
		3 October 1973 (cont'd)			
Pandalus borealis					
Unakwik Inlet	178	10	5.6	turquoise	20-25
Port Etches	1796	18	1.0	-	18-23
Pandalus hypsinotus					
Port Etches	150	10	6.7	-	27-32
Pandalopsis dispar					
Unakwik Inlet	108	34	31.5	olive-green	28-35
Port Etches	1	0	-	-	-
Pandalus goniurus					
Port Etches	26	0	-	-	-
		8-15 November 1973			
Chionoecetes bairdi					
Galena Bay	4	2	100	orange	105
Port Valdez	10	3	30	-	-
Port Etches	11/13	0	-	-	-
Pandalus borealis					
Galena Bay	74	32	42.7	-	18-23
Port Etches	1097	323	29.4	steel blue	-
Pandalus hypsinotus					
Galena Bay	21	1	4.8	-	29
Port Etches	125	39	31.2	-	-
Pandalus goniurus					
Galena Bay	19	7	36.8	-	-
Port Etches	5	0	-	-	-
Pandalopsis dispar					
Port Etches	8	0	-	-	-

APPENDIX III. Continued

Species and Location	N (males/females)	N (w/eggs)	%	Egg color	Size (mm) female w/eggs
		8-12 December 1973			
Chionoecetes bairdi					
Port Valdez	3/7	3	42.9	bright orange	85-90
Columbia Bay	10/12	8	66	-	97-101
Port Etches	33/19	0	-	-	-
Resurrection Bay	13/13	9	69.2	orange	-
Pandalus borealis					
Port Valdez	62	30	48.4	blue-green	171-24.5
Columbia Bay	-	-	-	blue-green	19-26
Pandalus hypsinotus					
Columbia Bay	94	81	86.2	blue-green	31-38
Port Etches	55	12	21.8	blue-green	29.34
Pandalopsis dispar					
Port Valdez	22	3	-	olive-green	29-32
Columbia Bay	3	0	-	-	-
Port Etches	5	0	-	-	-

APPENDIX IV. Food of the Alaska Pollock, *Theragra chalcogramma*, in Prince William Sound in 1973-1974.

A. The percent frequency of feeding fish, as a percent of total number of fish feeding and percent of total number of fish examined, from all areas combined (Port Valdez, Galena Bay, Port Gravina, Sheep Bay, Simpson Bay, Port Etches, Columbia Bay).

Food items	Number times observed feeding on item	% freq. of total number feeding animals	% freq. as % of total fish examined
MOLLUSCA			
Pelecypoda			
clam fragments	1	1.1	0.5
ARTHROPODA			
Crustacea			
unidentified crustacean	14	14.7	6.5
Malacostraca			
Mysidacea	1	1.1	0.5
Amphipoda			
Gammaridae	4	4.2	1.9
Hyperiidae			
Parathemisto libellula	35	36.8	16.4
unidentified amphipod	2	2.1	0.9
Decapoda			
Pandalidae			
Pandalus borealis	27	28.4	12.6
pandalid shrimp	4	4.2	1.9
Crangonidae			
Argis sp.	1	1.1	0.5
unidentified shrimp	5	5.3	2.3
CHORDATA			
Vertebrata			
Osteichthyes			
Osmeridae			
Thaleichthys pacificus	3	3.2	1.4
unidentified fish	5	5.3	2.3
unidentified soft material	3	3.2	1.4
empty stomach	119	-	55.6

TOTAL NO. EXAMINED=214
TOTAL NO. FEEDING = 95

APPENDIX IV. Continued

B. % frequency of feeding fish, as a percent of total number of fish feeding and percent of number of fish examined per bay.

Food items	Number times observed feeding on item	% freq. of total number feeding animals	% freq. as % of total fish examined
Columbia Bay - 10 December 1973 and 17 June 1973			
ARTHROPODA			
Crustacea			
crustacean fragments	1	2.3	1.2
Malacostroca			
Amphipoda			
Gammaridae	3	7.0	3.6
Hyperidae			
Parathemisto libellula	11	25.6	13.3
Decapoda			
Pandalidae			
Pandalus borealis	22	51.2	26.5
pandalid shrimp	1	2.3	1.2
unidentified shrimp	5	11.6	6.0
Crangonidae			
Argis sp.	1	2.3	1.2
CHORDATA			
Vertebrata			
Osteichthys			
unidentified fish	5	11.6	6.0
empty stomach	40	-	48.2
TOTAL NO. EXAMINED=83			
TOTAL NO. FEEDING =43			
Simpson Bay - 17 February 1973			
ARTHROPODA			
Crustacea			
Malacostraca			
Decapoda			
Pandalidae			
Pandalus borealis	1	25.0	25.0
CHORDATA			
Vertebrata			
Osteichthys			
Osmeridae			
Thaleichthys pacificus	3	75.0	75.0
empty stomachs	0	-	-
TOTAL NO. EXAMINED=4			
TOTAL NO. FEEDING =4			

APPENDIX IV. Continued

B. % frequency of feeding fish, as a percent of total number of fish feeding and percent of number of fish examined per bay.

Food items	Number times observed feeding on item	% freq. of total number feeding animals	% freq. as % of total fish examined
Port Valdez - 7 and 13 March 1973, 22 and 23 January 1973, 9 May 1974			
MOLLUSCA			
Pelecypoda	1	3.3	3.0
ARTHROPODA			
Crustacea			
Malacostraca			
Mysidacea			
Mysidae	1	3.3	3.0
Amphipoda			
Gammaridae	1	3.3	3.0
Hyperiidae			
Parathemisto libellula	22	73.3	66.7
unidentified amphipods	2	6.7	6.0
unidentified soft material	2	6.7	6.0
empty stomach	3	-	9.0
TOTAL NO. EXAMINED=33			
TOTAL NO. FEEDING =30			
Port Etches - 4 October 1973, 14 November 1973, 9 May 1974			
ARTHROPODA			
Crustacea			
crustacean fragments	11	73.3	42.3
Malacostraca			
Decapoda			
Pandalidae			
Pandalus borealis	3	20.0	11.5
pandalid shrimp	1	6.7	3.9
empty stomach	11	-	42.3
TOTAL NO. EXAMINED=26			
TOTAL NO. FEEDING =15			

APPENDIX IV. Continued

B. % frequency of feeding fish, as a percent of total number of fish feeding and percent of number of fish examined per bay.

Food items	Number times observed feeding on item	% freq. of total number feeding animals	% freq. as % of total fish examined
Port Gravina - 18 February 1973, 5 March 1973			
ARTHROPODA			
Crustacea			
Malacostraca			
Amphipoda			
Hyperiidae			
Parathemisto libellula	1	100.0	2.3
empty stomachs	43	-	97.7
TOTAL NO. EXAMINED=44			
TOTAL NO. FEEDING = 1			
Sheep Bay - 19 June 1974			
ARTHROPODA			
Crustacea			
unidentified crustacean parts	2	100.0	66.7
empty stomach	1	-	33.3
TOTAL NO. EXAMINED=3			
TOTAL NO. FEEDING =2			
Galena Bay - 10 November 1973, 13 March 1973			
ARTHROPODA			
Crustacea			
Malacostraca			
Decapoda			
Pandalidae			
pandalid shrimp	2	100.0	9.5
empty stomach	19	-	90.5
TOTAL NO. EXAMINED=21			
TOTAL NO. FEEDING = 2			

APPENDIX V. List of intertidal and shallow subtidal invertebrates collected in Prince William Sound, 1970, with a small trawl from a 16-foot Boston whaler and the M/V *Arctic Sea*. Crustacea were determined by Dr. Fenner A. Chace, Jr. of the Smithsonian Institution. Blank spaces in this table do not necessarily imply absence of species from the area.

ORGANISMS	COLLECTION AREAS						
Taxon	Port Valdez	Sawmill Bay		Galena Bay		Port Fidalgo	
	Intertidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal	Subtidal
Porifera							
Unidentified			+		+		+
Cnidaria							
Anthozoa							
Anthopleura sp.		+					
Hydrozoa							
hydrocoral							+
Unidentified hydroids		+					+
Nemertinea							
Paranemertes sp.		+					
Cerebratulus sp.		+					
Annelida							
Polychaeta							
Family Polynoidae (scale worm)		+					
F. Terebellidae		+					
F. Arenicolidae							
Arenicola claparedii (lugworm)	+						
F. Capitellidae		+					
F. Nephthyidae	+	+					
Nephthys sp.							
F. Glyceridae		+		+			
Hirudinea							
Unidentified leech							
Echiuroidea							+
Echiurus echiurus alaskensis (spoon worm)		+		+		+	

APPENDIX V. Continued.

ORGANISMS	COLLECTION AREAS						
	Port Valdez	Sawmill Bay		Galena Bay		Port Fidalgo	
Taxon	Intertidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal	Subtidal
Arthropoda							
Crustacea							
Unidentified amphipods	+	+	+	+	+		+
Unidentified shrimps			+	+			+
Argis dentata (rock shrimp)			+		+		
Crangon dalli (gray shrimp)			+				+
Sclerocrangon boreas			+				
Pandalus borealis (pink shrimp)							+
Pandalus hypsinotus (coon-stripe shrimp)					+		
Pandalus montagui					+		
Cancer gracilis				+			
Cancer magister (dungeness crab)	+ (subtidal)	+	+	+	+		+
Chionoecetes bairdi (snow crab)					+		+
Hemigrapsus oregonensis		+		+		+	
Hyas lyratus			+		+		
Telmessus cheiragonus (hairy crab)			+		+		
Pagurus sp. (hermit crab)					+		+
Upogebia pugettensis (mud shrimp)	+	+		+			
Balanus sp. (acorn barnacle)	+						
Balanus glandula		+		+			

APPENDIX V. Continued.

ORGANISMS	COLLECTION AREAS					
	Port Valdez	Sawmill Bay		Galena Bay		Port Fidalgo	
Taxon	Intertidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal	Subtidal
Mollusca							
Pelecypoda							
Clinocardium nuttallii (cockle)		+		+		+	
Hiatella arctica				+			
Macoma balthica	+	+		+			
Macoma nasuta (bent nosed clam)				+			
Macoma spp.		+		+		+	
Mya arenaria (soft shell clam)	+	+		+		+	
Mytilus edulis (bay mussel)	+	+		+		+	
Protothaca staminea (little-neck clam)	+	+		+		+	
Saxidomus gigantea (butter clam)		+		+		+	
Unidentified scallops					+		+
Gastropoda							
Anisodoris sp. (nudibranch)		+		+			
Diaulula sp. (nudibranch)		+			+		
Two species of unidentified nudibranchs							
Melibe leonina (nudibranch)		+		+	+		
Fusitriton oregonensis (whelk)				+	+		
Haminoea sp.		+					
Unidentified opisthobranch				+			
Lacuna sp.		+		+			
Littorina sitkana (Sitka periwinkle)	+						
L. scutulata (checkered periwinkle)	+	+		+		+	
Natica sp. (moon snail)		+		+		+	

APPENDIX V. Continued.

ORGANISMS	COLLECTION AREAS					
	Port Valdez	Sawmill Bay		Galena Bay		Port Fidalgo	
Taxon	Intertidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal	Subtidal
Bryozoa							
Membranipora sp.			+		+		
Unidentified species			+		+		+
Brachiopoda							
Laqueus sp. (lamp shell)					+		
Echinodermata							
Asteroidea (sea stars)							
Crossaster papposus (rose star)					+		
Dermasterias imbricata (leather star)		+	+	+	+		
Evasterias troschelii		+	+	+	+		+
Leptasterias sp.			+	+			
Pisaster ochraceus (ochre star)				+	+		
Pycnopodia helianthoides (sunflower star)		+	+	+	+		+
Ophiuroidea							
Unidentified spp.					+		+
Gorgonocephalus caryi (basket star)							+
Echinoidea							
Strongylocentrotus droebachiensis (urchin)		+	+				
Holothuroidea (sea cucumber)							
Leptosynapta sp.		+		+			
Stichopus sp.			+		+		+
Crinoidea							
Antedon sp. (feather star)							+

APPENDIX VI. The results of a survey of the amounts of aliphatic hydrocarbons in selected intertidal bivalve mollusks from Prince William Sound, Alaska[1].

INTRODUCTION

The incorporation of petroleum hydrocarbons into the tissues of marine organisms can make those organisms unfit or undesirable for human consumption (Blumer *et al.*, 1970). Petroleum pollution can, over limited areas, also result in greatly reduced viabilities of marine species and communities (Sanders *et al.*, 1972). Yet biogenic hydrocarbons similar to petroleum are of widespread occurrence in marine organisms (Blumer, 1967; Clark and Blumer, 1967; Eglinton, 1969). The analytical problem of distinguishing between biogenic and petroleum hydrocarbons is by no means trivial, but by the use of carefully defined sample preparation procedures and gas chromatography (Wilson and Hunt, 1975), much information can be gained.

The biological resources of Prince William Sound may in the near future be subjected to petroleum contamination from oil transportation and production. Should a major petroleum spill occur, baseline data on the naturally occurring hydrocarbon levels is necessary in order to properly assess damage to the resource.

"The best method for detecting petroleum contamination is to have analyses available from specimens free of contamination with which comparisons can be made" (Farrington *et al.*, 1972). The work reported here is the result of an initial effort to develop data on the

[1]This section prepared by Dr. David Shaw, Institute of Marine Science University of Alaska.

ambient concentrations of hydrocarbons in selected bivalve mollusks from Prince William Sound.

A total of fifteen hydrocarbon analyses of seven species have been made. All organisms were collected in 1973 and 1974. Six of the species are of present or potential fisheries importance. The seventh, *Macoma balthica* is of interest as an indicator species (Shaw *et al.*, 1976).

METHODS

Lipid Extraction

All glassware used in the lipid extraction was washed, rinsed in distilled water twice, rinsed with acetone and redistilled hexane. The dissection implements were flamed before use. The Virtis homogenizer parts which came in contact with the example were washed in distilled water, rinsed with acetone and then rinsed at high speed with hexane and methanol for approximately 2 minutes each.

The Soxhlet extraction thimbles, double thickness Whatman, cellulose, were washed with a refluxing mixture of equal parts methanol and benzene for at least 48 hours before use. The solvent mixture was changed once during the 48 hours and the final 24 hour wash was concentrated to 1 ml and 5 µl of the concentrate was analysed by gas chromatography to check for the presence of any hydrocarbon contamination.

The frozen samples were allowed to thaw. After removing the mollusks from their shells, between 16 g and 60 g of mussel or clam tissue (wet weight) was placed in a 250 ml Virtis homogenizing flask with 100 ml of redistilled methanol and homogenized at medium speed until a thick slurry was formed. The tissue homogenate was poured into the

cellulose extraction thimble in the Soxhlet apparatus and rinsed with 50 ml of methanol and 150 ml of benzene. The sample was extracted for 48 hours.

After cooling, the lipid extract was washed three times with 100 ml volumes of hexane in a 1000 ml separatory funnel. The combined hexane washes were concentrated to approximately 0.5 ml on a rotary evaporator. This concentrated lipid extract was refluxed for two hours in a 50 ml solution of 1:1:0.5 KOH in methanol (0.5N), benzene, and distilled water. After saponification, the non-saponifiable lipids were partitioned into hexane using three 30 ml hexane washes in a 250 ml separatory funnel. The hexane fractions were combined and washed with 50 ml of saturated NaCl solution. Emulsions usually occurred at this stage. These emulsions were broken up by addition of more NaCl solution, powdered NaCl, or by pouring off as much of the top level as possible, drawing off the clear bottom layer and reshaking, which often had to be repeated several times. The non-saponifiable lipid extract in hexane was dried overnight with a small amount of $NaSO_4$.

Separation of Hydrocarbons from other Non-Saponifiable Lipids

For samples labeled V and VI (see Table I) the amount of lipid remaining after saponification was estimated by weighing an evaporated 100 ml aliquot of a 10 ml lipid solution in hexane. An aliquot of lipid extract having not more than 80 mg of lipid was placed on a column of 1:1 alumina (deactiviated with 5% water) silica gel (deactivated with 6% water) (wet packed) with a total of 4 g of absorbant. Column size was 18 cm x 6 mm. After a 2 ml null volume, a 10 ml first fraction and a 30 ml second fraction were collected as the column was eluted with hexane.

Samples labeled III and IV were not weighed before chromatographing and as a result an excess of lipid was placed on the column. These samples required rechromatographing. This was done by combining the first and second fractions, evaporating to approximately 1 ml under nitrogen and carrying out the procedure outlined above again.

For samples with a large amount of non-saponifiable lipid (> 160 mg) a larger column was used. Ten grams of absorbant in a ratio of 1:1 alumina over silica gel (each deactivated as specified above) were wet packed in a 25 ml buret. A 4 ml null volume, 20 ml first fraction, and 60 ml second fraction were collected as the column was eluted with hexane.

The size of the first and second fractions was determined by eluting standard alkane mixtures or Prudhoe Bay crude oil and checking successive 4 ml fractions by gas chromatography for presence or absence of the standard.

Gas Chromatography

The eluate fractions were concentrated to a volume near 1 ml using a rotary evaporator and nitrogen. A 100 ml aliquot of each fraction was evaporated and weighed on a Cahn gram balance to determine hydrocarbon weight. The actual volume of the sample in hexane was calculated by multiplying the weight of the solution by the density of hexane. Five ml of each fraction was injected onto a 1.5% OV101 on 80/100 chromosorb W column (1/8" x 6' stainless steel) in a Varian G. C. with FID, temperature programmed from 60°C to 280°C at 15°/min. Detector response was recorded on a Sargent recorder.

A blank was carried through the entire procedure to check on any contamination of the samples during analysis. The standard procedure was to run five samples and one blank at a time.

RESULTS AND DISCUSSION

Quantitative data for hydrocarbons isolated from bivalve mollusks are shown in Table 1. The concentrations of aliphatic hydrocarbons reported are from the first fraction of liquid chromatography. The second fraction contains any aromatic hydrocarbons that may be present and probably also contains some slightly polar, non-saponifiable oxygenated components. Because of our uncertainty about the composition of this second fraction, it is not reported. However, these second fractions were measured and gas chromatographed and did not show evidence of petroleum.

The gas chromatograms for each of the analyses (not shown) indicate the absence of petroleum and arrays of biogenic hydrocarbons typical of deposit and filter feeding marine invertebrates.

These results show a range of inter- and intra-species differences in the hydrocarbon composition of bivalve mollusks of Prince William Sound. Inter-species differences are certainly to be expected because of differences in metabolic pathways and food sources. Intra-species differences are likewise not unexpected because of differences in sex, age, and physical condition of individuals within a species.

It is clear from this work that the bivalve mollusks of Prince William Sound are generally free of contamination by petroleum hydrocarbon in amounts that could be of concern to public health.

TABLE 1. Hydrocarbons in Mollusks of Prince William Sound

Sample Number	Animal	Source	Wet tissue analysed (g)	Non-saponifiable lipid (mg)	Aliphatic-hydrocarbons (mg/kg) based on wet tissue
IV- 5	Mussel *Mytilus edulis*	Simpson Bay	26	--	3.8
IV- 4	Mussel *Mytilus edulis*	Simpson Bay	25	--	3.4
V- 1	Butter clam *Saxidomus gigantea*	Simpson Bay	62	235	1.5
IV- 2	Butter clam *Saxidomus gigantea*	Simpson Bay	52	--	3.7
IV- 3	Butter clam *Saxidomus gigantea*	Simpson Bay	50	--	3.5
IV- 1	Littleneck clam *Protothaca staminea*	Simpson Bay	29	--	5.8
V- 5	Littleneck clam *Protothaca staminea*	Simpson Bay	45	165	4.5
V- 3	Soft shell clam *Mya arenaria*	Hartney Bay	36	63	5.3
V- 4	Soft shell clam *Mya arenaria*	Hartney Bay	54	169	20
VI- 2	Soft shell clam (gut only) *Mya arenaria*	Hartney Bay	16	105	29
III-2	Razor clam *Siliqua patula*	Hartney Bay	65	350	8.9
VI- 1	Pinkneck clam *Spisula polynyma*	Hartney Bay	78	123	2.6
VII-1	*Macoma balthica*	Valdez	60	--	8.1
	Macoma balthica plus 2mg/kg alkane spike	Valdez	61	--	11.0

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