Table 1.1. Characteristics and measurement of seabird numerical and functional response parameters.

Measurable Parameters	Hypothesized Relationship to Prey Density				Measurement Time		Methods
	Direction	Form	Threshold	Buffer	Parameter	Response	
Numerical Response							
Adult survivorship	positive	-exponential	low	no	2 year	15-20 years	Banding/re-sighting
Juvenile survivorship	positive	-exponential	moderate	no	2-5 year	15-20 years	Banding/re-sighting
Clutch size	positive	-exponential	moderate	maybe	1 year	15-20 years	Visual observations (VO)
Brood size	positive	-exponential	moderate	maybe	1 year	15-20 years	VO, Remote camera observation
Hatching success	positive	sigmoidal	moderate	yes	1 year	15-20 years	Visual observation
Fledging success	positive	sigmoidal	moderate	yes	1 year	15-20 years	VO, Remote camera observation
Breeding success	positive	sigmoidal	moderate	yes	1 year	15-20 years	VO, Remote camera observation
Chick growth rate	positive	sigmoidal	moderate	yes	1 year	15-20 years	Direct measurement
Chick fledging weight	positive	sigmoidal	moderate	yes	1 year	15-20 years	Direct measurement
Functional Response							
Adult foraging time activity	negative	logarithmic	low	no	days	3-5 years	VO, Radio telemetry, TDR's
Adult free time activity	positive	-exponential	moderate	no	days	3-5 years	VO, Radio telemetry
Adult meal size	positive	sigmoidal	moderate	yes	days	3-5 years	Adult collections
Adult body mass	positive	-exponential	low	no	days	3-5 years	Adult collection/capture
Dive time, frequency, depth	negative	logarithmic	moderate	no	days	1-2 years	TDR's, Radio telemetry
Prey capture rate	positive	-exponential	moderate	yes	hours	1-2 years	Aquarium observations
Aggregative response (tracking) surveys	positive	sigmoidal	moderate	no	hours	1-2 years	At-sea bird/hydroacoustic
Aggregation index (group size)	positive	-exponential	low	no	hours	1-2 years	At-sea bird surveys
Foraging range	negative	logarithmic	moderate	no	days	3-5 years	At sea surveys, Radio telemetry
Adult diet diversity	negative	logarithmic	low	no	days	3-5 years	Collections, Stable isotopes
Chick diet diversity	negative	logarithmic	low	no	days	3-5 years	Collections, Stable isotopes
Chick feeding rate	positive	sigmoidal	moderate	yes	days	3-5 years	VO, Remote camera observations
Chick meal size	positive	-exponential	low	yes	days	3-5 years	Chick meal collections

Table 4.1. Mean catch-per-unit-effort (CPUE and standard error) of all fishes, and major fish species, captured per mid-water trawl (n=159) near the Barren Islands, Kachemak Bay and Chisik Island in 1996-1999.

Area	Year	No.	All fish species		P. sand lance		Herring		Walleye pollock		Capelin	
		trawls	mean	stderr	mean	stderr	mean	stderr	mean	stderr	mean	stderr
Barrens	1996	19	481.5	228.1	5.3	3.3	0.0	0.0	458.1	227.3	17.7	16.6
Barrens	1997	17	1748.6	877.5	1503.8	875.8	39.8	19.1	201.9	103.2	2.6	2.5
Barrens	1998	8	12595.9	5532.1	7108.8	3659.0	5280.3	3586.8	185.4	151.5	18.5	18.4
Barrens	1999	11	3626.8	1532.8	3415.3	1554.2	32.9	21.5	28.2	24.2	147.6	115.9
Kachemak	1996	16	206.5	90.7	153.3	90.8	0.0	0.0	14.9	4.6	13.7	9.9
Kachemak	1997	20	465.2	161.2	149.8	62.6	30.8	28.0	254.9	144.7	4.9	4.6
Kachemak	1998	18	971.6	221.5	746.7	210.1	118.7	46.4	103.0	45.1	0.9	0.7
Kachemak	1999	12	3981.6	1842.8	3724.4	1867.5	85.3	83.5	41.5	38.3	0.9	0.5
Chisik	1996	6	56.2	17.8	13.4	10.4	0.1	0.1	8.6	5.4	15.8	9.8
Chisik	1997	11	313.6	176.5	236.3	180.8	3.9	1.4	11.4	8.9	0.3	0.2
Chisik	1998	7	236.5	138.2	231.3	139.0	0.2	0.2	0.0	0.0	0.2	0.2
Chisik	1999	14	256.6	147.5	78.9	58.3	2.0	0.7	0.7	0.6	147.3	142.5

Table 4.2. Species composition of mid-water trawl catches at the Barren Islands, Kachemak Bay, and near Chisik Island, 1996-1999. Species that comprised at least 1% of the catch are listed. For a complete list of species see appendices 4.2-4.4. Species richness and species diversity (Shannon-Wiener Diversity Index) are listed for each area and year. See methods for details.

Common name	Scientific name	Barrens					Kachemak					Chisik				
		1996	1997	1998	1999	96-99	1996	1997	1998	1999	96-99	1996	1997	1998	1999	96-99
Pacific sandlance	*Ammodytes hexapterus*	1	86	56	94	67	74	32	77	96	83	24	75	98	31	60
Pacific herring	*Clupea pallasi*	0	2	42	1	24	0	7	12	2	5	0	1	0	1	1
Walleye pollock	*Theragra chalcogramma*	95	12	1	1	8	7	55	11	1	10	15	4	0	0	2
Capelin	*Mallotus villosus*	4	0	0	4	1	7	1	0	0	0	28	0	0	58	24
Pink salmon	*Oncorhynchus gorbuscha*	0	0	0	0	0	7	0	0	0	0	10	2	0	1	2
Pacific sandfish	*Trichodon trichodon*	0	0	0	0	0	0	0	0	0	0	12	1	1	1	1
Longfin smelt	*Spirinchus thaleichthys*	0	0	0	0	0	0	0	0	0	0	0	9	1	2	4
Pacific Cod	*Gadus macrocephalus*	0	0	0	0	0	5	5	0	0	1	1	2	0	0	1
King (chinook) salmon	*Oncorhynchus tshawytscha*	0	0	0	0	0	0	0	0	0	0	4	1	0	2	1
Lumpenus spp.	*Lumpenus spp.*	0	0	0	0	0	0	0	0	1	0	0	3	0	0	1
Eulachon	*Thaleichthys pacificus*	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Lingcod	*Ophiodon elongatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Lumpsuckers and snailfishes	Cyclopteridae	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Snake prickleback	*Lumpenus sagitta*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Arrowtooth flounder	*Atherestes stomias*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Red (sockeye) salmon	*Oncorhynchus nerka*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Armorhead sculpin	*Gymnocanthus galeatus*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Species richness		7	10	7	8	16	13	21	7	11	29	19	22	9	26	39
Species diversity		0.2	0.5	0.8	0.3	0.9	1.0	1.1	0.7	0.2	0.6	1.9	1.1	0.1	1.2	1.3

Table 5.1. Sampling time periods and number of beach seine sets conducted at the Barren Islands, Chisik Island and Kachemak Bay during 1995-1999. In parentheses are the number of sets conducted during the June-August window that we used for comparison of results among years and areas. Specifications of seine nets "P", "A", "K" and "C" are provided in Methods.

Year	Barren Islands			Chisik Island			Kachemak Bay		
	Sampling period	Net used	No. Sets	Sampling period	Net used	No. Sets	Sampling period	Net used	No. Sets
1995	No Samples	"P"	0 (0)	15 June	"K"	1 (1)	16 Jun - 26 Jul	"K"	60 (60)
1996	2 Jul - 8 Sep	"A"	36 (32)	3 Jul - 17 Aug	"A"	30 (30)	8 Feb - 11 Dec	"K"	283 (202)
1997	19 Jun - 2 Sep	"A"	28 (24)	4 Jul - 16 Aug	"A"	18 (18)	6 Feb - 16 Oct	"K"	228 (161)
1998	16 Jun - 8 Sep	"A"	30 (26)	23 Jun - 9 Aug	"C"	21 (21)	29 May - 7 Sep	"K"	190 (149)
1999	21 Jun - 8 Sep	"A"	26 (24)	21 May - 26 Aug	"C"	29 (24)	15 May - 26 Aug	"K"	117 (99)
TOTAL			120 (106)			99 (94)			878 (671)

Table 5.2. Numbers of fish collected for morphometric measurements. Length data were collected on all these specimens; a subset (particularly sand lance) were also weighed and assessed for sex, fecundity and age.

Kachemak Bay		Chisik Island		Barren Islands	
Species	No. Fish	Species	No. Fish	Species	No. Fish
Alaska Plaice	1	Capelin	5	Capelin	13
Arctic Shanny	1	Chinook Salmon	1	Pacific Sand Lance	3839
Armorhead Sculpin	8	Chum Salmon	5	Total	3852
Brown Irish Lord	1	Cottidae Spp.	34		
Buffalo Sculpin	26	Crescent Gunnel	1		
Butter Sole	40	Dolly Varden	74		
Capelin	296	Eulachon	10		
Chinook Salmon	78	Flathead Sole	3		
Chum Salmon	59	Great Sculpin	4		
Coho Salmon	1	Humpy Shrimp	2		
Crescent Gunnel	101	Lingcod	3		
Cuttlefish	1	Longfin Smelt	9		
Dolly Varden	481	Lumpenus Spp.	7		
Dover Sole	2	Myoxocephalus Spp.	4		
English Sole	9	Oncorhynchus Spp.	154		
Eulachon	1	Osmeridae	17		
Flathead Sole	5	Osmeridae Larvae	1		
Gadidae	45	Pacific Cod	34		
Great Sculpin	224	Pacific Herring	62		
Hexagrammidae	15	Pacific Sand Lance	924		
High Cockscomb	7	Pacific Sandfish	2		
Kelp Greenling	2	Pacific Staghorn Sculpin	55		
Lemon Sole	2	Rock Greenling	1		
Lingcod	69	Rock Sole	1		
Liparidae	7	Sand Shrimp	3		
Lobefin Snailfish	6	Silverspotted Sculpin	1		
Longfin Smelt	4	Smooth Aligatorfish	3		
Masked Greenling	23	Snake Prickleback	15		
Myoxocephalus Spp.	73	Sockeye Salmon	2		
Northern Ronquil	6	Starry Flounder	23		
Northern Sculpin	3	Sturgeon Poacher	1		
Oncorhynchus Spp.	691	Surf Smelt	9		
Pacific Cod	379	Three-Spined Stickleback	10		
Pacific Halibut	1	Unidentified Larval Fish	65		
Pacific Herring	1319	Walleye Pollock	2		
Pacific Sand Lance	22650	Whitespotted Greenling	8		
Pacific Sandfish	15	Total	1555		
Pacific Staghorn Sculpin	9				
Pacific Tomcod	135				
Padded Sculpin	2				
Painted Greenling	1				
Petrale Sole	12				
Pholidae	3				
Pink Salmon	409				
Pleuronectidae	10				
Prowfish	3				
Red Irish Lord	2				
Rock Greenling	41				
Rock Sole	166				
Sablefish	31				
Saddleback Gunnel	1				
Saffron Cod	377				
Sand Shrimp	2				
Sand Sole	1				
Sawback Poacher	1				
Sebastes Spp.	2				
Silverspotted Sculpin	43				
Slender Eelblenny	286				
Snake Prickleback	261				
Sockeye Salmon	58				
Soft Sculpin	2				
Starry Flounder	13				
Sturgeon Poacher	2				
Surf Smelt	130				
Three-Spined Stickleback	13				
Tidepool Sculpin	1				
Tubenose Poacher	71				
Unidentified Larval Fish	1				
Walleye Pollock	299				
Whitespotted Greenling	127				
Yellowfin Sole	24				
Total	29191				

Table 5.3. Total beach seine catches at the Barren Islands, Chisik Island and Kachemak Bay during June - August, 1995-1999.

Fish species	Barren Islands					Chisik Island					Kachemak Bay				
	1995	1996	1997	1998	1999	1995	1996	1997	1998	1999	1995	1996	1997	1998	1999
Total fish	No Data	129033	45821	19533	2580	31	1044	1153	473	1409	27944	110150	100055	279954	128272
Pacific Herring	No Data	0	0	0	0	0	18	220	39	6	4504	15241	7152	61862	219
Pink Salmon	No Data	412	0	36	229	0	21	0	0	0	838	7237	1608	14	175
Chum Salmon	No Data	0	0	0	0	0	0	0	5	0	260	526	31	107	0
Coho Salmon	No Data	0	0	0	0	0	1	0	0	0	1	3	0	0	6
Sockeye Salmon	No Data	0	0	0	0	0	1	0	0	0	80	350	173	212	11
Chinook Salmon	No Data	0	0	0	0	0	0	0	1	0	26	43	511	48	53
Dolly Varden	No Data	5	0	0	0	2	297	9	6	12	509	969	1160	1444	481
Unidentified Salmonid	No Data	0	0	0	0	0	0	109	96	1081	0	0	0	2925	7612
Surf Smelt	No Data	22	6	62	1	0	0	1	5	4	9	22	87	50	19
Capelin	No Data	12	0	1	0	4	13	0	1	0	1	0	5060	5	0
Eulachon	No Data	0	0	0	0	0	3	2	0	0	0	0	0	1	0
Longfin Smelt	No Data	0	0	0	0	0	5	0	9	0	0	0	0	52	0
Unidentified Larval Smelt	No Data	0	0	0	0	0	0	0	1	0	0	0	0	0	2
Unidentified Smelt	No Data	0	0	1	0	0	0	0	0	2	0	0	0	0	0
Pacific Cod	No Data	480	3317	28	0	21	74	0	5	0	2066	2334	1656	111	37
Pacific Tomcod	No Data	0	0	0	0	0	2	0	0	0	220	440	79	25	3
Saffron Cod	No Data	0	0	0	0	0	0	0	0	0	54	437	1450	2126	840
Walleye Pollock	No Data	0	5471	371	61	0	0	0	0	0	4	1406	0	19	14
Unidentified Juvenile Gadid	No Data	0	498	26	2	0	0	0	0	0	0	98	18	1072	300
Pacific Sandfish	No Data	0	265	1	0	0	0	0	0	0	9	36	9	2	6
Arctic Shanny	No Data	0	0	0	0	0	0	0	0	0	0	1	3	1	1
Pacific Snake Prickleback	No Data	0	0	0	0	1	119	23	6	7	163	14	300	132	268
Daubed Shanny	No Data	0	0	0	0	0	0	0	0	0	0	7	0	0	0
Slender Eelblenny	No Data	0	0	0	0	0	0	0	0	0	0	268	8	1367	0
Unidentified Lumpenus Spp.	No Data	0	0	0	0	0	0	0	2	0	0	0	0	1242	1403
High Cockscomb	No Data	0	0	0	0	0	0	0	0	0	0	0	1	1	2
Saddleback Gunnel	No Data	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Crescent Gunnel	No Data	0	0	0	0	0	11	0	0	0	14	43	112	104	97
Unidentified Gunnel	No Data	0	0	2	0	0	0	0	0	0	0	0	0	0	1
Sand Lance	No Data	127830	26516	15261	8	0	233	95	231	5	18612	78069	78847	205104	114587
Prowfish	No Data	0	0	0	1	0	0	0	0	0	0	1	0	1	2
Rock Greenling	No Data	1	2	1	0	1	1	0	0	0	25	22	18	50	60
Kelp Greenling	No Data	4	0	11	2	0	0	0	0	0	0	44	130	0	0
Masked Greenling	No Data	0	0	0	0	0	0	0	0	0	3	0	3	35	31
Whitespotted Greenling	No Data	0	0	0	0	0	22	0	0	2	51	118	335	102	236
Painted Greenling	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unidentified Greenling	No Data	2	76	8	5	0	0	0	0	0	0	0	0	43	55
Lingcod	No Data	13	127	570	45	0	0	0	1	2	0	5	190	160	131
Sablefish	No Data	0	0	0	0	0	0	0	0	0	46	6	0	0	0
Silverspotted Sculpin	No Data	15	0	0	0	0	2	0	0	0	45	70	81	35	128
Crested Sculpin	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tidepool Sculpin	No Data	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Eyeshade Sculpin	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Warty Sculpin	No Data	0	0	0	0	0	0	0	0	0	0	13	0	0	0
Northern Sculpin	No Data	227	13	0	0	0	0	0	0	0	0	0	2	23	4
Buffalo Sculpin	No Data	0	0	0	0	0	0	0	0	0	21	4	2	3	53

Table 5.3. Total beach seine catches at the Barren Islands, Chisik Island and Kachemak Bay during June - August, 1995-1999.

Fish species	Barren Islands					Chisik Island					Kachemak Bay				
	1995	1996	1997	1998	1999	1995	1996	1997	1998	1999	1995	1996	1997	1998	1999
Armorhead Sculpin	No Data	0	0	0	0	0	0	0	0	0	0	0	10	6	48
Soft Sculpin	No Data	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Pacific Staghorn Sculpin	No Data	0	0	0	0	0	2	0	22	33	7	4	8	0	5
Great Sculpin	No Data	0	0	10	3	2	32	9	2	83	194	240	280	583	263
Padded Sculpin	No Data	0	0	0	0	0	2	0	0	0	0	1	1	0	24
Sharpnose Sculpin	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Red Irish Lord	No Data	0	0	0	0	0	0	0	0	0	0	0	0	1	4
Yellow Irish Lord	No Data	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Brown Irish Lord	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Roughspine Sculpin	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ribbed Sculpin	No Data	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Scalyhead Sculpin	No Data	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Unidentified Sculpin	No Data	0	7970	267	873	0	0	0	22	0	0	0	0	0	96
Unidentified Larval Sculpins	No Data	0	0	0	0	0	0	0	0	0	0	1665	98	168	120
Threespine Stickleback	No Data	0	0	0	0	0	10	3	1	6	6	27	3	18	30
Sebastes spp.	No Data	0	0	0	0	0	0	0	0	0	0	0	0	3	166
Northern Rockfish	No Data	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Pipefish	No Data	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Wolf-Eel	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kelp Clingfish (Remicola)	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0	32
Unidentified Eelpout Spp.	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smooth Aligatorfish	No Data	0	1	2	0	0	0	0	0	0	0	1	1	0	0
Tubenose Poacher	No Data	0	0	0	1	0	0	0	0	0	80	48	24	20	74
Sawback Poacher	No Data	0	0	0	0	0	5	0	0	0	1	0	0	0	2
Sturgeon Poacher	No Data	0	0	0	0	0	0	0	1	0	0	0	1	3	3
Unidentified Poacher	No Data	0	0	1	23	0	0	0	0	0	0	0	0	1	1
Smooth Lumpsucker	No Data	0	0	0	0	0	0	0	0	0	0	1	0	3	0
Snailfish Spp	No Data	0	0	0	0	0	0	0	0	0	1	6	2	2	1
Ribbon Snailfish	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrale Sole	No Data	0	0	0	0	0	0	0	0	0	12	0	0	0	0
Flathead Sole	No Data	0	0	0	0	0	0	0	0	0	4	2	0	4	0
Pacific Halibut	No Data	0	0	0	0	0	1	0	0	0	1	3	20	15	24
Butter Sole	No Data	7	3	1	1	0	0	0	0	0	2	2	0	50	0
Dover Sole	No Data	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Sand Sole	No Data	0	0	0	0	0	0	0	0	0	0	0	0	6	13
Alaska Plaice	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hybrid Sole	No Data	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Rock Sole	No Data	0	13	0	0	0	62	0	1	0	58	288	549	496	375
Yellowfin Sole	No Data	0	0	0	0	0	0	0	0	0	0	0	1	43	51
EnglishSole	No Data	0	0	0	0	0	0	0	0	0	2	0	0	14	14
Starry Flounder	No Data	0	0	0	1	0	51	10	14	5	13	31	29	9	10
Unidentified Flatfish	No Data	1	19	0	19	0	0	0	0	0	0	0	0	17	66
Unid Juv/Larval Fish	No Data	0	0	0	1	0	56	672	2	161	0	0	0	8	0
Unidentified Fish	No Data	2	1220	0	20	0	0	0	0	0	0	0	0	0	0
Unidentified Larval Fish	No Data	0	304	2873	1283	0	0	0	0	0	0	0	0	0	0

Table 5.4. Beach seine catch composition by actual numbers (A) and by proportions (B) of major taxonomic groups at the Barren Islands, Chisik Island, and Kachemak Bay, during June-Aug, 1995-1999.

A. Total Fish

Island	Year	Herring	Salmonids	Osmerids	Gadids	Sand lance	Sculpins	Flatfish	Other	Total
Barren Islands	1995	0	0	0	0	0	0	0	0	0
Barren Islands	1996	0	417	34	480	127830	242	8	22	129033
Barren Islands	1997	0	0	6	9286	26516	7983	35	1995	45821
Barren Islands	1998	0	36	64	425	15261	277	1	3469	19533
Barren Islands	1999	0	229	1	63	8	876	22	1381	2580
Chisik Island	1995	0	2	4	21	0	2	0	2	31
Chisik Island	1996	18	320	21	76	233	38	114	224	1044
Chisik Island	1997	220	118	3	0	95	9	10	698	1153
Chisik Island	1998	39	108	16	5	231	46	15	13	473
Chisik Island	1999	6	1093	6	0	5	116	5	178	1409
Kachemak Bay	1995	4504	1714	10	2344	18612	269	92	399	27944
Kachemak Bay	1996	15241	9128	22	4715	78069	1999	326	650	110150
Kachemak Bay	1997	7152	3483	5147	3203	78847	484	599	1140	100055
Kachemak Bay	1998	61862	4750	108	3353	205104	821	656	3300	279954
Kachemak Bay	1999	219	8338	21	1194	114587	752	556	2605	128272
Total -Barren Islands		0	682	105	10254	169615	9378	66	6867	196967
Total -Chisik Island		283	1641	50	102	564	211	144	1115	4110
Total -Kachemak Bay		88978	27413	5308	14809	495219	4325	2229	8094	646375
Total -All Sites		89261	29736	5463	25165	665398	13914	2439	16076	847452

B. Proportion (%)

Island	Year	Herring	Salmonids	Osmerids	Gadids	Sand lance	Sculpins	Flatfish	Other
Barren Islands	1995	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Barren Islands	1996	0.00	0.32	0.03	0.37	99.07	0.19	0.01	0.02
Barren Islands	1997	0.00	0.00	0.01	20.27	57.87	17.42	0.08	4.35
Barren Islands	1998	0.00	0.18	0.33	2.18	78.13	1.42	0.01	17.76
Barren Islands	1999	0.00	8.88	0.04	2.44	0.31	33.95	0.85	53.53
Chisik Island	1995	0.00	6.45	12.90	67.74	0.00	6.45	0.00	6.45
Chisik Island	1996	1.72	30.65	2.01	7.28	22.32	3.64	10.92	21.46
Chisik Island	1997	19.08	10.23	0.26	0.00	8.24	0.78	0.87	60.54
Chisik Island	1998	8.25	22.83	3.38	1.06	48.84	9.73	3.17	2.75
Chisik Island	1999	0.43	77.57	0.43	0.00	0.35	8.23	0.35	12.63
Kachemak Bay	1995	16.12	6.13	0.04	8.39	66.60	0.96	0.33	1.43
Kachemak Bay	1996	13.84	8.29	0.02	4.28	70.88	1.81	0.30	0.59
Kachemak Bay	1997	7.15	3.48	5.14	3.20	78.80	0.48	0.60	1.14
Kachemak Bay	1998	22.10	1.70	0.04	1.20	73.26	0.29	0.23	1.18
Kachemak Bay	1999	0.17	6.50	0.02	0.93	89.33	0.59	0.43	2.03
Total -Barren Islands		0.00	0.35	0.05	5.21	86.11	4.76	0.03	3.49
Total -Chisik Island		6.89	39.93	1.22	2.48	13.72	5.13	3.50	27.13
Total -Kachemak Bay		13.77	4.24	0.82	2.29	76.61	0.67	0.34	1.25
Total -All Sites		10.53	3.51	0.64	2.97	78.52	1.64	0.29	1.90

Table 5.5. Catch-per-unit-effort (CPUE), standard error, and median catches in beach seine sets during June-August, 1995-1999, at the Barren Islands, Chisik Island and Kachemak Bay.

Island	Year	Total fish	No. sets	CPUE	Std Err	Median
Barren Islands	1995	No Data	0	No Data	No Data	No Data
	1996	129033	32	4032	2588	467
	1997	45821	24	1909	712	433
	1998	19533	26	751	234	97
	1999	2580	24	108	32	55
	TOTAL	196967	106	1858	805	190
Chisik Island	1995	31	1	31	---	---
	1996	1044	30	35	6	22
	1997	1153	18	64	27	22
	1998	473	21	23	5	22
	1999	1409	24	59	23	20
	TOTAL	4110	94	44	8	23
Kachemak Bay	1995	27944	60	466	146	104
	1996	110150	202	545	162	65
	1997	100055	161	621	173	116
	1998	279954	149	1879	555	122
	1999	128272	99	1258	643	131
	TOTAL	646375	671	963	170	103

Table 5.6. Frequency of occurrence of different fish species in beach seines at the Barren Islands, Chisik Island, and Kachemak Bay, June-August, 1995-1999. N = number of seine sets conducted.

Species	Barren Islands					Chisik Island					Kachemak Bay				
	1995	1996	1997	1998	1999	1995	1996	1997	1998	1999	1995	1996	1997	1998	1999
N=	0	32	24	26	24	1	30	18	21	24	60	202	161	149	99
Pacific Herring	No Data	0.0	0.0	0.0	0.0	0.0	6.7	22.2	23.8	12.5	30.0	12.4	28.0	38.3	18.2
Pink Salmon	No Data	34.4	0.0	3.8	8.3	0.0	13.3	0.0	0.0	0.0	51.7	36.1	37.9	2.7	12.1
Chum Salmon	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	16.7	6.4	3.7	1.3	0.0
Coho Salmon	No Data	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	1.7	0.5	0.0	0.0	1.0
Sockeye Salmon	No Data	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	16.7	5.9	6.8	6.0	2.0
Chinook Salmon	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	11.7	4.5	24.8	8.7	9.1
Dolly Varden	No Data	3.1	0.0	0.0	0.0	100.0	63.3	11.1	19.0	16.7	68.3	43.1	47.2	44.3	57.6
Unidentified Salmonid	No Data	0.0	0.0	0.0	0.0	0.0	0.0	55.6	28.6	58.3	0.0	0.0	0.0	34.2	71.7
Surf Smelt	No Data	6.3	4.2	11.5	4.2	0.0	0.0	5.6	9.5	4.2	1.7	5.0	9.3	12.8	7.1
Capelin	No Data	6.3	0.0	3.8	0.0	100.0	10.0	0.0	4.8	0.0	1.7	0.0	14.9	2.0	0.0
Eulachon	No Data	0.0	0.0	0.0	0.0	0.0	6.7	5.6	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Longfin Smelt	No Data	0.0	0.0	0.0	0.0	0.0	3.3	0.0	19.0	0.0	0.0	0.0	0.0	1.3	0.0
Unidentified Larval Smelt	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	2.0
Unidentified Smelt	No Data	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0
Pacific Cod	No Data	56.3	33.3	19.2	0.0	100.0	16.7	0.0	9.5	0.0	41.7	26.7	29.8	1.3	4.0
Pacific Tomcod	No Data	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	21.7	7.4	4.3	4.0	2.0
Saffron Cod	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	7.9	18.6	29.5	22.2
Walleye Pollock	No Data	0.0	29.2	26.9	50.0	0.0	0.0	0.0	0.0	0.0	3.3	3.0	0.0	6.7	1.0
Unidentified Juvenile Gadid	No Data	0.0	16.7	7.7	4.2	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.2	22.8	26.3
Pacific Sandfish	No Data	0.0	16.7	3.8	0.0	0.0	0.0	0.0	0.0	0.0	10.0	6.4	2.5	1.3	4.0
Arctic Shanny	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.9	0.7	1.0
Pacific Snake Prickleback	No Data	0.0	0.0	0.0	0.0	100.0	33.3	16.7	9.5	12.5	20.0	2.5	16.8	11.4	14.1
Daubed Shanny	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Slender Eelblenny	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.6	10.7	0.0
Unidentified Lumpenus Spp.	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	0.0	0.0	0.0	0.0	9.4	11.1
High Cockscomb	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	2.0
Saddleback Gunnel	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	3.0
Crescent Gunnel	No Data	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	13.3	7.4	15.5	18.8	31.3
Unidentified Gunnel	No Data	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Sand Lance	No Data	90.6	66.7	69.2	20.8	0.0	33.3	11.1	61.9	16.7	75.0	67.3	68.9	61.7	71.7
Prowfish	No Data	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.7	1.0
Rock Greenling	No Data	3.1	4.2	3.8	0.0	100.0	3.3	0.0	0.0	0.0	10.0	2.5	3.7	9.4	16.2
Kelp Greenling	No Data	6.3	0.0	11.5	8.3	0.0	0.0	0.0	0.0	0.0	0.0	5.9	13.0	0.0	0.0
Masked Greenling	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	1.2	11.4	11.1
Whitespotted Greenling	No Data	0.0	0.0	0.0	0.0	0.0	13.3	0.0	0.0	8.3	20.0	18.8	31.7	20.8	45.5
Painted Greenling	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unidentified Greenling	No Data	6.3	25.0	15.4	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.4	19.2
Lingcod	No Data	18.8	33.3	30.8	25.0	0.0	0.0	0.0	4.8	8.3	0.0	2.0	19.9	23.5	40.4
Sablefish	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	2.0	0.0	0.0	0.0
Silverspotted Sculpin	No Data	15.6	0.0	0.0	0.0	0.0	6.7	0.0	0.0	0.0	20.0	12.9	11.8	10.7	32.3
Crested Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tidepool Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Eyeshade Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Warty Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0
Northern Sculpin	No Data	43.8	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	2.7	3.0
Buffalo Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.3	1.5	1.2	2.0	23.2
Armorhead Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	3.4	22.2
Soft Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0
Pacific Staghorn Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	6.7	0.0	28.6	20.8	6.7	2.0	3.7	0.0	3.0
Great Sculpin	No Data	0.0	0.0	11.5	8.3	100.0	50.0	27.8	4.8	8.3	68.3	55.0	54.7	59.7	57.6
Padded Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0	0.0	0.0	0.5	0.6	0.0	15.2
Sharpnose Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
Red Irish Lord	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	4.0
Yellow Irish Lord	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.6	0.7	1.0
Brown Irish Lord	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Roughspine Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ribbed Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Scalyhead Sculpin	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Unidentified Sculpin	No Data	0.0	79.2	50.0	100.0	0.0	0.0	0.0	28.6	0.0	0.0	0.0	0.0	0.0	19.2
Unidentified Larval Sculpins	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	3.7	8.7	4.0
Threespine Stickleback	No Data	0.0	0.0	0.0	0.0	0.0	23.3	5.6	4.8	16.7	10.0	5.0	1.9	6.7	14.1
Sebastes spp.	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	7.1
Northern Rockfish	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0

Table 5.6. Frequency of occurrence of different fish species in beach seines at the Barren Islands, Chisik Island, and Kachemak Bay, June-August, 1995-1999. N = number of seine sets conducted.

Species	Barren Islands					Chisik Island					Kachemak Bay				
	1995	1996	1997	1998	1999	1995	1996	1997	1998	1999	1995	1996	1997	1998	1999
N=	0	32	24	26	24	1	30	18	21	24	60	202	161	149	99
Pipefish	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Wolf-Eel	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kelp Clingfish (Remicola)	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1
Unidentified Eelpout Spp.	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smooth Aligatorfish	No Data	0.0	4.2	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.6	0.0	0.0
Tubenose Poacher	No Data	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	31.7	14.4	6.2	5.4	15.2
Sawback Poacher	No Data	0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0	0.0	1.7	0.0	0.0	0.0	2.0
Sturgeon Poacher	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.6	1.3	2.0
Unidentified Poacher	No Data	0.0	0.0	3.8	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.0
Smooth Lumpsucker	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.7	0.0
Snailfish Spp	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	3.0	1.2	0.7	1.0
Ribbon Snailfish	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Petrale Sole	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0
Flathead Sole	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.5	0.0	1.3	0.0
Pacific Halibut	No Data	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	1.7	0.5	5.0	6.0	10.1
Butter Sole	No Data	15.6	8.3	3.8	4.2	0.0	0.0	0.0	0.0	0.0	3.3	1.0	0.0	2.0	0.0
Dover Sole	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.0
Sand Sole	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0
Alaska Plaice	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Hybrid Sole	No Data	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Sole	No Data	0.0	4.2	0.0	0.0	0.0	16.7	0.0	4.8	0.0	33.3	31.2	44.7	35.6	41.4
Yellowfin Sole	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	5.4	6.1
EnglishSole	No Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	2.0	5.1
Starry Flounder	No Data	0.0	0.0	0.0	4.2	0.0	46.7	27.8	33.3	12.5	11.7	6.9	5.0	4.0	6.1
Unidentified Flatfish	No Data	3.1	37.5	0.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	8.1
Unid Juv/Larval Fish	No Data	0.0	0.0	0.0	4.2	0.0	13.3	27.8	9.5	29.2	0.0	0.0	0.0	2.0	0.0
Unidentified Fish	No Data	6.3	50.0	0.0	29.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unidentified Larval Fish	No Data	0.0	20.8	46.2	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6.1. Relative abundance of demersal fishes captured in bottom trawls in Outer and Inner Kachemak Bay, 1996-1999. Average CPUE, standard deviation, and the number of trawls are listed for forage size (8-15 cm) and smaller than forage size (< 8 cm) fish.

Fish size	Year	Outer Bay			Inner Bay		
		mean	stdev	n	mean	stdev	n
Forage	1996	13.7	8.3	4	19.7	10.0	7
Forage	1997	19.8	17.1	12	17.9	14.1	20
Forage	1998	10.1	9.1	17	16.1	15.3	22
Forage	1999	9.5	15.9	5	35.9	33.6	8
Forage	1996-1999	13.5	13.3	38	20.0	18.7	57
Small	1996	18.5	20.3	4	94.5	152.7	7
Small	1997	26.2	31.5	12	65.7	114.4	20
Small	1998	23.1	35.9	17	35.6	39.7	22
Small	1999	46.4	47.7	5	59.9	42.4	8
Small	1996-1999	26.7	34.6	38	56.8	90.2	57

Table 6.2. Seasonal variation in relative abundance of demersal fishes captured in Kachemak Bay, 1996-1999. Data from all stations in Kachemak Bay are combined. Average CPUE, standard deviation, and the number of trawls are listed for forage size (8-15 cm) and smaller than forage size (< 8 cm) fish. Early and Late July were not sampled (ns) in 1996 or 1999.

Fish size	Year	Early July			Late July			August		
		mean	stdev	n	mean	stdev	n	mean	stdev	n
Forage	1996	ns	ns	ns	ns	ns	ns	17.5	9.5	11
Forage	1997	12.3	7.7	10	21.9	18.3	9	21.2	16.4	13
Forage	1998	7.8	5.4	11	10.9	8.3	14	20.6	18.0	14
Forage	1999	ns	ns	ns	ns	ns	ns	25.8	30.4	13
Small	1996	ns	ns	ns	ns	ns	ns	66.9	124.8	11
Small	1997	17.7	21.0	10	35.0	35.4	9	87.4	137.4	13
Small	1998	12.4	10.1	11	24.0	30.2	14	50.4	50.1	14
Small	1999	ns	ns	ns	ns	ns	ns	54.7	43.1	13

Table 6.3. Species composition (% total number) of demersal fishes in bottom trawls, 1996-1999, and SCUBA transects, 1997-1998, in Kachemak Bay. Data for small (< 8 cm) and forage (8 -15 cm) size fishes are combined. Data are presented for all of Kachemak Bay (bay wide), Outer Kachemak Bay, and Inner Kachemak Bay. For a complete species list, see Appendices 6.2 and 6.4.

Fish group	Trawls 1996-1999			SCUBA 1997-1998		
	Bay wide	Outer Bay	Inner Bay	Bay wide	Outer Bay	Inner Bay
Flatfish (Pleuronectidae)	41.0%	43.3%	40.2%	9.2%	3.9%	23.6%
Cod (Gadidae)	21.0%	12.8%	23.8%	10.4%	8.6%	15.4%
Sculpins (Cottidae)	14.8%	19.8%	13.0%	39.0%	50.5%	7.7%
Pricklebacks (Stichaeidae)	7.3%	4.2%	8.3%	23.2%	28.6%	8.5%
Ronquils (Bathymasteridae)	5.4%	4.9%	5.6%	0.9%	0.0%	3.2%
Greenlings (Hexagrammidae)	3.7%	3.1%	3.9%	6.3%	3.2%	14.6%
Rockfish *(Sebastes* spp.)	4.0%	9.2%	2.2%	0.3%	0.2%	0.5%
Poachers (Agonidae)	1.0%	0.9%	1.0%	0.6%	0.8%	0.0%
Snailfish *(Liparis* spp.)	0.9%	0.3%	1.1%	0.0%	0.0%	0.0%
Gunnels (Pholidae)	0.9%	1.4%	0.7%	9.1%	3.7%	23.9%
Other	0.1%	0.0%	0.1%	1.1%	0.6%	2.7%

Table 6.4. Demersal fish abundance on SCUBA transects in Outer and Inner Kachemak Bay, 1997-1998. Average CPUE, standard deviation, and the number of dives are listed for both forage (8-15 cm) and smaller than forage size (< 8 cm) fish.

Fish size	Year	Outer Bay			Inner Bay		
		mean	stdev.	n	mean	stdev.	n
Forage	1997	6.5	13.7	10	5.4	7.9	10
Forage	1998	6.2	15.1	27	1.5	4.1	25
Small	1997	5.6	4.5	10	3.9	7.7	10
Small	1998	7.7	15.9	27	1.9	4.7	25

Table 6.5. All fishes and hermit crabs counted on good SCUBA transects in 1999. Size is either small (< 8 cm), forage (8-15 cm), or big (> 15 cm).

Latin name	Common name	Size	Cohen			Seldovia	
			Dive 1	Dive 2	Dive 3	Dive 3	Dive 4
Sitchaeus punctatus	Arctic shanny	small	1	0	0	0	0
Sitchaeus punctatus	Arctic shanny	forage	2	0	0	0	0
Pleuronectidae	Flatfish	small	0	0	0	1	0
Pleuronectidae	Flatfish	forage	0	0	0	1	0
Pleuronectidae	Flatfish	big	0	0	0	0	1
Pholidae	Gunnel	small	1	0	0	0	1
Pholidae	Gunnel	forage	0	2	0	0	0
Lumpenus spp.	Lumpenus spp.	small	0	0	0	4	4
Lumpenus spp.	Lumpenus spp.	forage	0	0	0	43	54
Lumpenus spp.	Lumpenus spp.	big	0	0	0	0	6
Sebastes spp.	Rockfish	forage	0	0	0	1	0
Bathymasteridae	Ronquil/Searcher	forage	1	0	0	0	0
Cottidae	Sculpin	small	3	0	1	49	66
Cottidae	Sculpin	forage	0	0	0	13	7
Cottidae	Sculpin	big	0	0	0	2	3
Anarrhichthys ocellatus	Wolf-eel	big	0	0	0	1	0
Unidentified fish	Unidentified fish	forage	0	0	0	0	1
Unidentified fish	Unidentified fish	big	1	0	0	0	0
Hermit Crab	Hermit Crab	small	0	0	0	45	43
Hermit Crab	Hermit Crab	forage	0	2	2	11	14
Grand total			9	4	3	171	200

Table 7.1. Total number of linear kilometers surveyed in Lower Cook Inlet during hydroacoustic surveys, 1995-1999.

Survey Year	Survey Dates	Nearshore km	Offshore km	Total Surveyed km
1995	10-23 August	115	705	820
1996	14-31 July	561	1462	2023
1997	19 July-08 August	459	581	1040
1998	21 July-12 August	482	649	1130
1999	25 July-16 August	481	656	1137

Table 7.2. Number of ten-minute transects used for analysis of hydroacoustic surveys in Cook Inlet.

Year	Chisik			Kachemak			Barrens		
	Total	Insh	Offsh	Total	Insh	Offsh	Total	Insh	Offsh
1995	103	*	103	124	*	124	129	*	129
1996	131	42	89	203	120	83	154	43	111
1997	159	45	114	186	117	69	107	40	67
1998	156	59	97	204	118	86	158	50	108
1999	139	58	81	173	106	67	139	41	98

* Inshore area surveyed was too small to use in this analysis

Table 7.3. Hydroacoustic biomass (g/m^3) of forage fish in waters near Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island					Gull Island					Barren Islands				
	n	mean	stdev	stderr	90th pctle	n	mean	stdev	stderr	90th pctle	n	mean	stdev	stderr	90th pctle
1995	488	0.0120	0.0228	0.0010	0.0356	640	0.0691	0.1261	0.0047	0.1919	1076	0.0164	0.0444	0.0013	0.0461
1996	938	0.0089	0.0564	0.0018	0.0120	1793	0.0446	0.1832	0.0040	0.0793	2139	0.0197	0.1025	0.0021	0.0280
1997	1271	0.0122	0.0396	0.0011	0.0254	1598	0.0588	0.1702	0.0039	0.1475	1433	0.0248	0.0728	0.0019	0.0573
1998	1169	0.0082	0.0378	0.0011	0.0112	1720	0.0360	0.1345	0.0030	0.0736	2288	0.0191	0.0814	0.0016	0.0346
1999	1045	0.0034	0.0214	0.0007	0.0049	1542	0.0147	0.1139	0.0028	0.0177	2067	0.0154	0.0588	0.0013	0.0334

Table 7.4. Hydroacoustic biomass (g/m^3) of forage fish in surface (<30m) waters near Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island					Gull Island					Barren Islands				
	n	mean	stdev	stderr	90th pctle	n	mean	stdev	stderr	90th pctle	n	mean	stdev	stderr	90th pctle
1995	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	540	0.0131	0.0742	0.0031	0.0160	902	0.0707	0.2477	0.0074	0.1630	765	0.0261	0.1129	0.0039	0.0380
1997	697	0.0151	0.0488	0.0018	0.0323	841	0.0793	0.2202	0.0069	0.2066	533	0.0371	0.0930	0.0039	0.1004
1998	665	0.0113	0.0495	0.0019	0.0200	910	0.0519	0.1731	0.0053	0.1114	800	0.0462	0.1323	0.0044	0.1185
1999	592	0.0050	0.0280	0.0011	0.0099	792	0.0249	0.1611	0.0053	0.0350	705	0.0252	0.0781	0.0028	0.0584

Table 7.5. Hydroacoustic biomass (g/m^3) of forage fish in inshore transect waters near Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island					Gull Island					Barren Islands				
	n	mean	stdev	stderr	90th pctle	n	mean	stdev	stderr	90th pctle	n	mean	stdev	stderr	90th pctle
1995	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	143	0.0357	0.1410	0.0111	0.0464	957	0.0642	0.2296	0.0067	0.1499	353	0.0474	0.1801	0.0089	0.0837
1997	176	0.0148	0.0413	0.0031	0.0313	840	0.0798	0.2158	0.0068	0.2066	369	0.0468	0.1071	0.0053	0.1499
1998	214	0.0118	0.0275	0.0019	0.0381	827	0.0609	0.1879	0.0060	0.1398	432	0.0433	0.1234	0.0056	0.1184
1999	213	0.0103	0.0454	0.0030	0.0226	780	0.0230	0.1756	0.0058	0.0309	372	0.0263	0.0710	0.0036	0.0635

Table 7.6. Hydroacoustic biomass (g/m^3) of forage fish in offshore transect waters near Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island					Gull Island					Barren Islands				
	n	mean	stdev	stderr	90th pctle	n	mean	stdev	stderr	90th pctle	n	mean	stdev	stderr	90th pctle
1995	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	797	0.0045	0.0218	0.0008	0.0094	836	0.0227	0.1103	0.0036	0.0289	1786	0.0143	0.0794	0.0018	0.0205
1997	1104	0.0120	0.0401	0.0012	0.0247	747	0.0399	0.1658	0.0056	0.0853	1068	0.0173	0.0549	0.0016	0.0408
1998	969	0.0075	0.0396	0.0013	0.0100	907	0.0144	0.0563	0.0018	0.0319	1862	0.0136	0.0674	0.0015	0.0229
1999	851	0.0017	0.0069	0.0002	0.0036	808	0.0085	0.0545	0.0019	0.0111	1741	0.0129	0.0549	0.0013	0.0225

Table 8.1. Total number of linear and square kilometers surveyed in Lower Cook Inlet during 5 years of surveys for marine birds and mammals, 1995-1999. Nearshore transects followed the contours of mainland or island shorelines, while offshore transects cut across open water from one shore to another. The transects immediately around the Barren Islands were considered offshore.

Survey Year	Survey Dates	Transect Width	Nearshore		Offshore		Total Surveyed	
		m	km	km^2	km	km^2	km	km^2
1995	10-23 August	300	74	22	689	207	763	229
1996	14-31 July	200 nearshore 300 offshore	561	126	1491	447	2052	574
1997	19 July-08 August	300	459	138	651	195	1110	333
1998	21 July-12 August	300	482	145	649	195	1130	339
1999	25 July-16 August	300	481	144	656	197	1137	341

Table 8.2. Species composition and numbers of seabirds and marine mammals observed during 5 years of surveys in Lower Cook Inlet during July and August, 1995-1999.

Species	Scientific Name	1995		1996		1997		1998		1999		Total	
		Number	% Total	Number	% Total	Number	% Total	Number	% Total	Number	% Total	Number	% Total
All marine birds total		16241		67461		17690		15964		18041		135397	
All Loons	*Gavia* spp. total	2	<0.1	12	<0.1	27	0.2	8	0.1	6	<0.1	55	<0.1
Common Loon	*Gavia immer*			5	<0.1	10	0.1	5	<0.1	5	<0.1	25	<0.1
Yellow-billed Loon	*Gavia adamsii*			1	<0.1					1	<0.1	2	<0.1
Pacific Loon	*Gavia pacifica*			1	<0.1	15	0.1	3	<0.1			19	<0.1
Red-throated Loon	*Gavia stellata*			5	<0.1							5	<0.1
Red-necked Grebe	*Podiceps grisegena*			4	<0.1			5	<0.1	2	<0.1	11	<0.1
Horned Grebe	*Podiceps auritus*									1	<0.1	1	<0.1
Laysan Albatross*	*Phoebastria immutabilis*					1	<0.1					1	<0.1
Northern Fulmar	*Fulmarus glacialis*	2151	13.2	429	0.6	157	0.9	72	0.5	261	1.4	3070	2.3
All Shearwaters	*Puffinus* spp. total	3155	19.4	45550	67.5	4823	27.3	3733	23.4	8015	44.4	65276	48.2
Sooty Shearwater	*Puffinus griseus*	9	0.1	1	<0.1	70	0.4	1377	8.6	209	1.2	1666	1.2
Short-tailed Shearwater	*Puffinus tenuirostris*	80	0.5	189	0.3	2	<0.1	10	0.1	4	<0.1	285	0.2
Buller's Shearwater	*Puffinus bulleri*									1	<0.1	1	<0.1
Fork-tailed Storm-Petrel	*Oceanodroma furcata*	748	4.6	2172	3.2	357	2.0	49	0.3	265	1.5	3591	2.7
Leach's Storm-Petrel	*Oceanodroma leucorhoa*			2	<0.1							2	<0.1
All Cormorants	*Phalacrocorax* spp. total	34	0.2	72	0.1	112	0.6	56	0.4	41	0.2	315	0.2
Pelagic Cormorant	*Phalacrocorax pelagicus*	33	0.2	42	0.1	53	0.3	40	0.3	24	0.1	192	0.1
Red-faced Cormorant	*Phalacrocorax urile*	1	<0.1	12	<0.1	3	<0.1	9	0.1	4	<0.1	29	<0.1
Double-crested Cormorant	*Phalacrocorax auritus*			1	<0.1	11	0.1	1	<0.1	8	<0.1	21	<0.1
Red-breasted Merganser	*Mergus serrator*					6	<0.1					6	<0.1
Unidentified Merganser	*Mergus* spp.			1	<0.1							1	<0.1
White-winged Scoter	*Melanitta fusca*	6	<0.1	40	0.1	22	0.1	8	0.1	225	1.2	301	0.2
Surf Scoter	*Melanitta perspicillata*			63	0.1	5	<0.1	56	0.4	25	0.1	149	0.1
Harlequin Duck	*Histrionicus histrionicus*	3	<0.1	5	<0.1	7	<0.1	13	0.1			28	<0.1

Table 8.2. (cont'd) Species composition and numbers of seabirds and marine mammals observed during 5 years of surveys in Lower Cook Inlet during July and August, 1995-1999.

Species	Scientific Name	1995		1996		1997		1998		1999		Total	
		Number	% Total	Number	% Total	Number	% Total	Number	% Total	Number	% Total	Number	% Total
All Phalaropes	*Phalaropus* spp.	409	2.5	2545	3.8	371	2.1	647	4.1	138	0.8	4110	3.0
Red-necked Phalarope	*Phalaropus lobatus*	278	1.7	2483	3.7	176	1.0	562	3.5	127	0.7	3626	2.7
Red Phalarope	*Phalaropus fulicaria*	34	0.2	1	<0.1			1	<0.1			36	<0.1
All Jaegars	*Stercorarius* spp.	46	0.3	11	<0.1	2	<0.1	5	<0.1	11	0.1	75	0.1
Pomarine Jaeger	*Stercorarius pomarinus*	31	0.2	5	<0.1	1	<0.1	2	<0.1	7	<0.1	46	<0.1
Parasitic Jaeger	*Stercorarius parasiticus*	8	<0.1	5	<0.1	1	<0.1			2	<0.1	16	<0.1
Long-tailed Jaeger	*Stercorarius longicaudus*	7	<0.1	1	<0.1			1	<0.1			9	<0.1
All Gulls	Laridae	3684	22.7	4019	6.0	2452	13.9	3201	20.1	1663	9.2	15019	11.1
Mew Gull	*Larus canus*	1	<0.1	73	0.1	1	<0.1	7	<0.1	18	0.1	100	0.1
Glaucous-winged Gull	*Larus glaucescens*	674	4.1	783	1.2	359	2.0	250	1.6	307	1.7	2373	1.8
Herring Gull	*Larus argentatus*			4	<0.1	1	<0.1	1	<0.1			6	<0.1
Bonaparte's Gull	*Larus philadelphia*							2	<0.1	1	<0.1	3	<0.1
Black-legged Kittiwake	*Rissa tridactyla*	3008	18.5	3157	4.7	2091	11.8	2941	18.4	1337	7.4	12534	9.3
Sabine's Gull	*Xema sabini*			1	<0.1							1	<0.1
All Terns	*Sterna* spp.	188	1.2	169	0.3	484	2.7	133	0.8	393	2.2	1367	1.0
Arctic Tern	*Sterna paradisaea*	63	0.4	135	0.2	468	2.6	108	0.7	276	1.5	1050	0.8
Aleutian Tern	*Sterna aleutica*	119	0.7	28	<0.1	5	<0.1	1	<0.1	23	0.1	176	0.1
All Alcids	Alcidae	5815	35.8	12367	18.3	8864	50.1	7978	50.0	6995	38.8	42019	31.0
All Murres	*Uria* spp.	1204	7.4	2955	4.4	2455	13.9	2207	13.8	2016	11.2	10837	8.0
Common Murre	*Uria aalge*	1201	7.4	2916	4.3	2455	13.9	2193	13.7	2012	11.2	10777	8.0
Thick-billed Murre	*Uria lomvia*	3	<0.1	22	<0.1			1	<0.1	2	<0.1	28	<0.1
Pigeon Guillemot	*Cepphus columba*	90	0.6	360	0.5	341	1.9	373	2.3	321	1.8	1485	1.1
All *Brachyramphus*	*Brachyramphus* spp.	472	2.9	1571	2.3	2336	13.2	2380	14.9	1661	9.2	8420	6.2
Marbled Murrelet	*Brachyramphus marmoratus*	371	2.3	904	1.3	1585	9.0	1844	11.6	1357	7.5	6061	4.5
Kittlitz's Murrelet	*Brachyramphus brevirostris*	6	<0.1	114	0.2	122	0.7	208	1.3	56	0.3	506	0.4
Ancient Murrelet	*Synthliboramphus antiquus*	31	0.2	615	0.9	53	0.3	17	0.1	17	0.1	733	0.5
Cassin's Auklet	*Ptychoramphus aleuticus*	1	<0.1			4	<0.1			1	<0.1	6	<0.1
Parakeet Auklet	*Aethia psittacula*	39	0.2	114	0.2	11	0.1	15	0.1	51	0.3	230	0.2
Rhinoceros Auklet	*Cerorhinca monocerata*	10	0.1	12	<0.1	14	0.1	25	0.2	4	<0.1	65	<0.1
Tufted Puffin	*Fratercula cirrhata*	3489	21.5	6254	9.3	3349	18.9	2681	16.8	2675	14.8	18448	13.6
Horned Puffin	*Fratercula corniculata*	476	2.9	485	0.7	298	1.7	279	1.7	248	1.4	1786	1.3
Least Auklet	*Aethia pusilla*	1	<0.1									1	<0.1

Table 8.2. (cont'd) Species composition and numbers of seabirds and marine mammals observed during 5 years of surveys in Lower Cook Inlet during July and August, 1995-1999.

Species	Scientific Name	1995		1996		1997		1998		1999		Total	
		Number	% Total	Number	% Total	Number	% Total	Number	% Total	Number	% Total	Number	% Total
All marine mammals total*		27		219		97		123		365		831	
Sea Otter	*Enhydra lutris*	9	33.3	73	33.3	70	72.2	65	52.8	103	28.2	320	38.5
Northern Fur Seal	*Callorhinus ursinus*			6	2.7							6	0.7
Steller's Sea Lion	*Eumetopias jubatus*			1	0.5	1	1.0	1	0.8	25	6.8	28	3.4
Harbor Seal	*Phoca vitulina*	1	3.7	4	1.8	4	4.1	7	5.7	160	43.8	176	21.2
Harbor Porpoise	*Phocoena phocoena*			1	0.5	9	9.3	7	5.7	12	3.3	29	3.5
Dall's Porpoise	*Phocoenoides dalli*			78	35.6	10	10.3	14	11.4	4	1.1	106	12.8
Killer Whale	*Orcinus orca*	8	29.6	6	2.7			3	2.4	4	1.1	21	2.5
Humpback Whale	*Megaptera novaeangliae*	1	3.7	36	16.4	1	1.0	11	8.9	45	12.3	94	11.3
Fin Whale	*Balaenoptera physalus*	4	14.8	8	3.7			2	1.6	4	1.1	18	2.2
Minke Whale	*Balaenoptera acutorostrata*	2	7.4	3	1.4	2	2.1	1	0.8			8	1.0
Unidentified baleen whale	*Balaenoptera* spp.	2	7.4	3	1.4			12	9.8	8	2.2	25	3.0

*All birds were observed within transect boundaries (see Table 8.1 for transect widths) except for the Laysan Albatross, which was off-transect. Marine mammal observations include all sighted marine mammals, regardless of distance from the survey vessel.

Table 8.3. Number observed (N) and density (D) per kilometer squared of predominant marine bird species and species groups by study area in Lower Cook Inlet, 1995-1999. In 1996-1999, Chisik, Kachemak, and the Barrens surveys covered comparable areas with similar (1996) or identical (1997-1999) transect layouts (Figures 7.2-7.3). In 1995, transects covered a smaller portion of each study area and included minimal nearshore habitat (Table 8.1, Fig. 7.1).

Species		1995			1996					1997			1998			1999		
		Chisik	Kach	Barrens	Chisik	Kach	Barrens	Central	Shuyak	Chisik	Kach	Barrens	Chisik	Kach	Barrens	Chisik	Kach	Barrens
All marine birds	N	2661	3400	10180	2098	4892	18273	3746	38452	1131	7723	8829	1764	6952	7248	925	3804	13312
	D	34.36	53.03	116.47	20.42	39.16	165.94	31.92	324.77	11.37	58.92	86.17	16.63	53.12	70.94	8.65	28.76	130.76
All Shearwaters	N	518	1401	1236	565	496	10090	1897	32502	308	2341	2174	577	1533	1623	98	1090	6826
	D	6.69	21.85	14.14	5.50	3.97	91.63	16.17	274.51	3.10	17.86	21.22	5.44	11.71	15.89	0.92	8.24	67.05
All Cormorants	N	11	0	23	0	26	41	0	5	0	36	70	0	25	31	1	14	26
	D	0.14	0.00	0.26	0	0.21	0.37	0	0.04	0	0.27	0.68	0	0.19	0.30	0.01	0.11	0.26
Black-legged	N	805	807	1396	383	1393	1265	42	74	167	987	937	356	1476	1109	252	280	805
Kittiwake	D	10.39	12.59	15.97	3.73	11.15	11.49	0.36	0.63	1.68	7.53	9.14	3.36	11.28	10.85	2.36	2.12	7.91
Glaucous-winged	N	317	36	321	28	352	282	37	84	60	129	170	79	50	121	33	78	196
Gull	D	4.09	0.56	3.67	0.27	2.82	2.56	0.32	0.71	0.60	0.98	1.66	0.74	0.38	1.18	0.31	0.59	1.93
All Murres	N	409	280	515	190	860	813	272	819	154	972	1329	250	1001	956	157	400	1459
	D	5.28	4.37	5.89	1.85	6.88	7.38	2.32	6.92	1.55	7.42	12.97	2.36	7.65	9.36	1.47	3.02	14.33
Pigeon Guillemot	N	0	25	65	1	209	142	0	8	3	193	145	0	194	179	0	150	171
	D	0.00	0.39	0.74	0.01	1.67	1.29	0	0.07	0.03	1.47	1.42	0	1.48	1.75	0	1.13	1.68
Marbled Murrelet/	N	67	285	114	198	428	361	266	204	262	1650	302	257	1443	472	157	986	462
Brachyramphus	D	0.87	4.45	1.30	1.93	3.43	3.28	2.27	1.72	2.63	12.59	2.95	2.42	11.03	4.62	1.47	7.46	4.54
Kittlitz's Murrelet	N	2	3	1	23	47	15	21	8	2	117	3	22	185	1	4	32	20
	D	0.03	0.05	0.01	0.22	0.38	0.14	0.18	0.07	0.02	0.89	0.03	0.21	1.41	0.01	0.04	0.24	0.20
Tufted Puffin	N	30	20	3439	124	212	4402	198	1318	7	444	2898	19	274	2388	15	122	2538
	D	0.39	0.31	39.35	1.21	1.70	39.98	1.69	11.13	0.07	3.39	28.28	0.18	2.09	23.37	0.14	0.92	24.93
Horned Puffin	N	386	38	53	241	125	90	12	17	98	99	101	165	23	91	153	17	78
	D	4.98	0.59	0.61	2.35	1.00	0.82	0.10	0.14	0.99	0.76	0.99	1.56	0.18	0.89	1.43	0.13	0.77

Table 9.1. Numbers of Common Murres in population plots at Chisik Island (includes Duck Island), 1995 - 1999. Of the original 7 plots (1 - 7) historically monitored by AMNWR personnel, Common Murres were present in plots 4 & 7 only from 1995 - 1999, therefore totals from plots 4 & 7 are comparable to plots 1- 7 from the historical data. Additional population plots for Common Murres were established in 1997. Plot 9 is a Chisik Island plot that was created in 1997 and Duck Island plots are productivity plots that were counted starting in 1997.

Year	Plot 7			Plots 4 & 7			Plot 9			Duck Island plots		
	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	5	64	11.80	1*	169	-	-	-	-	-	-	-
1996	4	91	17.15	4	153	11.95	-	-	-	-	-	-
1997	7	76	36.34	7	138	45.23	8	60	34.18	8	219	13.02
1998	3	0	0.00	3	69	7.00	3	0	0	2	249	31.82
1999	5	67	12.74	5	187	57.81	5	88	14.83	3	227	27.07

* There was only 1 count for plot 4 in 1995 and it was added to the counts for plot 7 to generate a mean for plots 4 & 7, therefore there is not a standard deviation for this count.

Table 9.2. Numbers of Common Murres in population plots at Gull Island, 1995-1999.

Year	Plots 1-3			Plots 1-8			Plots 1-10		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	3	223	7.55	3	377	8.39	3	384	7.51
1996	5	197	26.80	5	329	44.35	5	340	46.79
1997	10	223	20.94	10	336	22.52	10	344	20.60
1998	5	221	18.99	5	321	28.97	5	334	30.70
1999	6	254	18.29	6	381	41.82	6	407	49.03

Table 9.3. Numbers of Common Murres in population plots at the Barren Islands*, 1995-1999.

Year	Plots 1-8		
	n	mean	stdev
1995	5	5225	854
1996	7	5648	396
1997	7	7139	795
1998	3	7275	402
1999	6	6245	242

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.4. Common Murre hatching success (chicks hatched per egg laid) at Chisik, Gull and Barren Islands, 1995-1999.

Year	Chisik Island			Gull Island			Barren Islands*		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	4	0.39	0.43				10	0.84	0.08
1996	8	0.81	0.13	12	0.84	0.21	10	0.84	0.09
1997	11	0.77	0.14	12	0.81	0.13	10	0.90	0.09
1998	11	0.52	0.32	5	0.84	0.11	10	0.72	0.24
1999	8	0.83	0.15	5	0.52	0.17	10	0.86	0.09
All	8	0.66	0.20	9	0.75	0.16	10	0.83	0.07

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.5. Common Murre fledging success (chicks fledged per chick hatched) at Chisik, Gull and Barren Islands, 1995-1999.

Year	Chisik Island			Gull Island			Barren Islands*		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995							10	0.88	0.06
1996	8	0.92	0.08	12	0.69	0.34	10	0.88	0.08
1997	11	0.87	0.10	12	0.64	0.34	10	0.92	0.07
1998	11	0.21	0.32	5	0.78	0.05	10	0.71	0.35
1999	8	0.70	0.34	5	0.45	0.35	10	0.84	0.09
All	10	0.68	0.32	9	0.64	0.14	10	0.85	0.08

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.6. Common Murre breeding success (chicks fledged per egg laid) at Chisik, Gull and Barren Islands, 1995-1999.

Year	Chisik Island			Gull Island			Barren Islands*		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995				5	0.61	0.18	10	0.74	0.11
1996	8	0.74	0.12	12	0.64	0.35	10	0.74	0.11
1997	11	0.67	0.16	12	0.53	0.29	10	0.82	0.09
1998	11	0.18	0.30	5	0.65	0.07	10	0.58	0.30
1999	8	0.63	0.34	5	0.28	0.29	10	0.75	0.12
All	10	0.56	0.25	8	0.54	0.15	10	0.73	0.09

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.7. Timing of Common Murre egg laying at Chisik, Gull and Barren Islands, 1995-1999.

Year	Chisik Island			Gull Island			Barren Islands*		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	4	20-Jul	11.52				10	7-Jul	2.81
1996	8	10-Jul	2.66	11	12-Jul	5.55	10	3-Jul	4.65
1997	11	6-Jul	3.62	12	10-Jul	4.92	10	1-Jul	1.17
1998	11	26-Jul	6.81	5	9-Jul	2.80	10	8-Jul	2.37
1999	8	16-Jul	6.34	5	13-Jul	7.03	10	3-Jul	4.98
All	8	15-Jul	7.92	8	11-Jul	1.83	10	4-Jul	2.97

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.8. Timing of Common Murre hatching at Chisik, Gull and Barren Islands, 1995-1999.

Year	Chisik Island			Gull Island			Barren Islands*		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	2	11-Aug	1.77				10	7-Aug	2.04
1996	8	9-Aug	2.29	10	13-Aug	5.22	10	4-Aug	4.57
1997	11	7-Aug	5.09	12	9-Aug	4.63	10	2-Aug	1.42
1998	10	25-Aug	6.44	5	10-Aug	3.15	6	6-Aug	2.64
1999	8	16-Aug	6.17	5	12-Aug	11.63	10	3-Aug	5.01
All	8	13-Aug	7.20	8	11-Aug	1.83	9	4-Aug	2.07

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.9. Summary of Common Murre chick diet composition (% number) at Chisik, Gull and Barren Island, 1995-1999.

Prey	Chisik Island						Gull Island						Barren Islands*					
	1995	1996	1997	1998	1999	Total	1995	1996	1997	1998	1999	Total	1995	1996	1997	1998	1999	Total
No. meals	n.d.	553	783	203	307	1846	35	132	326	552	130	1175	389	236	421	408	186	1640
Osmerids		48.8	46.7	47.8	53.1	49.1	5.7	20.5	30.4	37.0	56.2	29.9	79.9	90.7	91.2	93.4	91.4	87.3
Sand lance		21.2	11.9	27.6	35.5	24.0	60.0	12.9	29.1	20.1	23.8	29.2	0.8	2.1	4.3	2.0	2.2	2.4
Gadids		5.2	0.9	0.0	0.0	1.5	5.7	22.7	13.8	4.2	0.0	9.3	6.9	2.5	1.2	1.7	1.1	3.6
Other		17.4	13.8	23.2	10.7	16.3	22.9	11.4	13.8	32.1	17.7	19.6	6.4	0.4	0.2	2.0	2.2	2.4
Unidentified		7.4	26.7	1.5	0.7	9.1	5.7	32.6	12.9	6.7	2.3	12.0	5.9	4.2	3.1	1.0	3.2	4.4

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.10. Summary of adult Common Murre diet composition (% mass) at Chisik, Gull and Barren Islands, 1995-1999.

Prey	Chisik Island						Gull Island						Barren Islands*					
	1995	1996	1997	1998	1999	Total	1995	1996	1997	1998	1999	Total	1995	1996	1997	1998	1999	Total
No. stomachs	13	10	10	8	10	51	11	16	8	10	10	55	10	9	10	10	5	44
Total biomass (g)	186	342	360	164	364	1416	965	1351	331	103	484	3234	52	231	73	263	295	913
Mean g/stomach	14	34	36	21	36	25	88	84	47	10	48	47	5	26	7	26	59	22
Osmerids	0.3	35.5	0.5	0.0	55.8	18.4	0.0	0.3	0.6	62.1	7.3	14.1	34.6	26.0	35.7	92.0	13.4	40.3
Sand lance	37.6	34.8	66.5	86.6	36.5	52.4	95.8	98.4	62.9	13.7	89.9	72.1	0.0	2.8	0.8	0.0	72.8	15.3
Gadids	39.3	10.6	14.6	0.0	0.6	13.0	4.2	1.3	32.8	0.0	1.0	7.9	65.4	59.8	59.3	0.0	10.4	39.0
Other	0.3	19.1	18.4	13.4	4.3	11.1	0.0	0.1	3.7	24.2	1.7	5.9	0.0	11.4	4.3	8.0	0.0	4.7
Unidentified	22.5	0.1	0.0	0.1	2.7	5.1	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.0	3.4	0.7

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.11. Common Murre attendance expressed as "bird-minutes" or the combined minutes both parents spent at the nest site per hour during incubation at Chisik, Gull, and Barren Islands, 1995-1999 (n = nest sites) .

Year	Chisik Island			Gull Island			Barren Islands*		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	10	66.82	4.30	11	74.29	8.94	n.d.		
1996	13	65.71	5.33	12	71.17	5.84	16	78.87	13.98
1997	13	68.04	4.85	11	70.16	5.85	9	87.56	12.45
1998	24	64.55	7.05	17	72.70	9.25	11	74.15	6.23
1999	12	68.21	11.30	14	75.98	8.42	10	75.51	4.44

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.12. Common Murre attendance expressed as "bird-minutes" or the combined minutes both parents spent at the nest site per hour during chick-rearing at Chisik, Gull, and Barren Islands, 1995-1999 (n = nest sites) .

Year	Chisik Island			Gull Island			Barren Islands*		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	7	63.09	2.17	9	70.82	6.04	12	65.79	4.41
1996	22	60.34	4.14	12	64.65	2.22	10	69.03	4.64
1997	19	64.93	3.32	7	73.50	6.56	9	73.25	6.41
1998	9	59.93	4.72	14	75.47	9.62	9	69.20	4.08
1999	12	62.84	5.23	11	66.59	4.16	9	75.54	4.10

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.13. Common Murre chick-feeding rates (feeds per hour) at Chisik, Gull, and Barren Islands, 1995-1999 (n = nest sites) .

Year	Chisik Island			Gull Island			Barren Islands*		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	7	0.28	0.07	9	0.32	0.12	12	0.29	0.11
1996	22	0.19	0.06	12	0.36	0.11	10	0.26	0.04
1997	19	0.25	0.09	7	0.30	0.13	9	0.25	0.07
1998	9	0.16	0.05	14	0.24	0.09	9	0.25	0.05
1999	12	0.26	0.06	11	0.27	0.12	9	0.23	0.03

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.14. Common Murre foraging trip durations (minutes) when chick provisioning (resulted in chick feeding) at Chisik, Gull, and Barren Islands, 1995-1999 (n = nest sites).

Year	Chisik Island			Gull Island			Barren Islands*		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	7	172.36	147.91	9	123.80	36.40	12	185.02	89.33
1996	23	241.74	92.74	12	147.27	59.96	10	174.54	31.71
1997	19	193.65	96.21	7	113.67	42.28	8	156.44	32.31
1998	12	187.18	121.94	14	120.14	38.97	9	166.10	38.48
1999	12	163.65	43.20	12	119.94	40.90	9	160.78	27.53

* Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.15. Pooled growth rate* (g /mm wing growth) of Common Murre chicks at Chisik and Gull Islands, 1995-1999.

Year	Chisik Island			Gull Island		
	n	slope	stdev	n	slope	stdev
1995	31	5.68	4.42	15	6.11	3.59
1996	45	7.83	3.76	24	9.30	2.70
1997	32	8.26	5.00	3	n.d.	n.d.
1998	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
1999	24	6.31	2.38	n.d.	n.d.	n.d.
All	4	7.02	1.22	2	7.71	0.63

*Slope of linear regression of mass on wing length for chicks with wings >= 25mm and <= 45 mm (linear growth phase). N represents number of chicks; each chick was measured once, thus growth rates shown here are composites per colony-year.

Table 9.16. Size, condition, and estimated age of common murre fledglings at Chisik Island, 1997-1999, summarised by capture bout date.

Year		Headbill (mm)			Tarsus (mm)			Wing (mm)			Mass (g)			Wing/mass			Estimated age (d)*		
	bout date	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
1997	19-Aug	0			0			2	74.5	7.78	2	231.0	16.97	2	3.11	0.10	2	21.9	3.02
	23-Aug	0			0			10	75.7	4.06	10	233.4	22.34	10	3.08	0.24	10	22.4	1.57
	24-Aug	0			0			51	73.5	7.26	51	233.1	26.96	51	3.18	0.28	51	21.5	2.82
	26-Aug	0			0			21	73.7	5.81	21	234.0	28.13	21	3.18	0.32	21	21.6	2.25
	27-Aug	0			0			7	66.0	3.96	7	200.9	24.53	7	3.04	0.29	7	18.6	1.54
	28-Aug	0			0			22	67.8	5.88	22	222.6	23.86	22	3.29	0.28	22	19.3	2.28
	29-Aug	0			0			4	66.3	12.97	4	220.8	46.21	4	3.34	0.33	4	18.7	5.03
	31-Aug	0			0			6	71.8	5.38	6	236.3	52.43	6	3.30	0.73	6	20.9	2.09
	1997 Total	0			0			123	72.0	7.06	123	229.3	28.81	123	3.19	0.32	123	20.9	2.74
1998	29-Aug	0			0			2	77.5	4.95	2	205.0	28.28	2	2.64	0.20	2	23.1	1.92
	3-Sep	0			0			9	68.0	9.87	9	198.2	34.57	9	2.92	0.34	9	19.4	3.83
	4-Sep	0			0			9	69.4	9.08	9	198.7	35.01	9	2.86	0.29	9	19.9	3.52
	1998 Total	0			0			20	69.6	9.21	20	199.1	32.64	20	2.86	0.30	20	20.0	3.57
1999	27-Aug	2	66.5	0.49	2	35.3	0.42	2	77.5	0.71	2	237.5	24.75	2	3.07	0.35	2	23.1	0.27
	28-Aug	4	64.5	4.21	4	35.0	2.58	4	72.0	9.56	4	211.0	34.55	4	2.92	0.13	4	20.9	3.71
	30-Aug	2	65.6	1.27	2	34.3	0.49	2	74.5	2.12	2	220.0	14.14	2	2.95	0.11	2	21.9	0.82
	31-Aug	6	66.2	3.09	6	34.6	0.97	6	73.0	7.10	6	224.8	19.15	6	3.10	0.34	6	21.3	2.75
	4-Sep	5	62.9	2.76	5	34.1	0.36	8	76.1	6.64	8	215.4	30.16	8	2.83	0.32	8	22.5	2.58
	6-Sep	4	62.6	3.80	4	32.2	1.62	21	70.4	8.11	21	203.0	32.93	21	2.88	0.29	21	20.3	3.15
	7-Sep	0			0			28	69.7	9.65	28	203.4	32.30	28	2.92	0.21	28	20.0	3.75
	8-Sep	0			0			17	65.7	7.74	17	198.5	30.55	17	3.03	0.31	17	18.5	3.00
	11-Sep	0			0			4	66.3	9.18	4	211.8	49.61	4	3.16	0.35	4	18.7	3.56
	1999 Total	23	64.5	3.25	23	34.2	1.59	92	70.1	8.63	92	206.6	31.71	92	2.95	0.28	92	20.2	3.35
	Grand Total	23	64.5	3.25	23	34.2	1.59	235	71.0	7.92	235	217.9	32.54	235	3.07	0.33	235	20.6	3.07

* age is estimated by regression from wing length, using relationship [age(d) = -7.01 + 0.388*wing(mm)] from known-age chicks (see Methods).

Table 9.17. Size, condition, and estimated age of common murre fledglings at Gull Island, 1997-1999, summarized by capture bout date.

Year		Headbill (mm)			Tarsus (mm)			Wing (mm)			Mass (g)			Wing/mass			Estimated age (d)*		
	bout date	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
1997	28-Aug	0			0			16	78.9	4.74	16	245.3	28.55	16	3.10	0.27	16	23.6	1.84
	29-Aug	0			0			21	80.8	5.50	21	247.9	23.79	21	3.07	0.19	21	24.3	2.13
	1997 Total	0			0			37	80.0	5.20	37	246.8	25.61	37	3.08	0.22	37	24.0	2.02
1998	10-Sep	0			0			17	70.7	5.45	17	223.5	22.27	17	3.16	0.22	17	20.4	2.12
	12-Sep	0			0			20	64.1	5.97	20	212.3	26.75	20	3.32	0.33	20	17.8	2.32
	13-Sep	0			0			26	64.9	8.67	24	197.7	33.91	24	3.01	0.29	26	18.2	3.36
	1998 Total	0			0			63	66.2	7.53	61	209.7	30.23	61	3.15	0.31	63	18.7	2.92
1999	11-Sep	7	65.1	1.92	7	34.4	1.66	22	70.6	7.46	19	237.2	23.93	19	3.30	0.32	22	20.4	2.89
	13-Sep	3	63.9	3.21	3	34.0	1.90	41	66.3	8.23	40	214.3	21.61	40	3.25	0.29	41	18.7	3.19
	1999 Total	10	64.7	2.26	10	34.3	1.64	63	67.8	8.18	59	221.7	24.65	59	3.27	0.30	63	19.3	3.17
	Grand Total	10	64.7	2.26	10	34.3	1.64	163	70.0	9.14	157	222.9	30.54	157	3.18	0.29	163	20.1	3.55

* age is estimated by regression from wing length, using relationship [age(d) = -7.01 + 0.388*wing(mm)] from known-age chicks (see Methods).

Table 9.18. Size and condition of Common Murre fledglings at the Barren Islands*
1996 - 1999, summarized by capture bout date.

Year		Wing (mm)			Mass (g)			Wing/mass		
	bout date	n	mean	stdev	n	mean	stdev	n	mean	stdev
1996	26-Aug	18	74.27	4.25	18	235.94	22.37	18	3.18	0.23
	27-Aug	14	79.43	4.13	14	251.77	23.20	14	3.17	0.88
	31-Aug	13	77.62	6.53	13	237.85	26.23	13	3.06	0.27
	3-Sep	2	68.00	2.83	2	216.00	19.80	2	3.18	0.16
	1996 Total	47	74.83	5.03	47	235.4	14.73	47	3.15	0.06
1997	19-Aug	13	72.23	13.89	13	246.92	30.87	13	3.42	1.52
	20-Aug	7	74.57	4.50	7	238.57	13.59	7	3.20	0.10
	24-Aug	43	79.05	5.86	43	254.53	20.64	43	3.22	0.30
	26-Aug	17	78.47	5.27	17	254.29	17.78	17	3.24	0.35
	28-Aug	16	77.69	3.20	16	256.13	20.03	16	3.30	0.22
	1997 Total	96	76.40	2.90	96	250.1	7.36	96	3.28	0.09
1998	26-Aug	3	85.33	8.74	3	269.00	16.82	3	3.15	0.18
	1998 Total	3	85.33	-	3	269.00	-	3	3.15	-
1999	16-Aug	4	79.00	4.55	4	235.25	42.05	4	2.98	0.50
	17-Aug	5	79.40	3.78	5	250.00	19.20	5	3.15	0.26
	24-Aug	38	80.63	4.68	38	261.08	21.46	38	3.24	0.28
	25-Aug	6	76.83	7.14	6	254.17	30.59	6	3.31	0.17
	26-Aug	24	76.21	7.13	24	244.46	25.02	24	3.21	0.27
	1999 Total	77	78.41	1.84	77	249.0	9.79	77	3.18	0.12
	Grand Total	223	77.56	3.99	223	247.1	12.93	223	3.17	0.10

*Data from: Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 9.19. Common Murre fledging age (days) at Chisik and Gull Islands, 1995 - 1999 (n = fledglings).

Year	Chisik Island			Gull Island		
	n	mean	stdev	n	mean	stdev
1995	n.d.			n.d.		
1996	78	19.96	3.25	46	19.72	3.18
1997	104	21.65	3.53	49	18.71	2.81
1998	8	19.50	3.66	49	20.61	3.56
1999	55	21.23	4.16	20	20.60	3.78
All	61	20.59	1.02	41	19.91	0.90

Table 9.20. Common murre adult size and condition, Chisik Island 1997-1999, summarized by capture bout date.

Year		Culmen (mm)			Headbill (mm)			Tarsus (mm)			Wing (mm)			Mass (g)			Mass/wing		
	bout date	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
1997	12-Jun	4	45.8	1.01	0			4	41.1	1.87	4	213.0	4.76	4	1048.8	67.00	4	4.92	0.25
	24-Jun	10	47.4	2.00	0			10	39.5	1.46	10	218.0	3.56	10	1064.5	76.72	10	4.88	0.35
	31-Jul	96	46.7	2.20	96	116.2	2.97	96	39.6	1.56	96	218.1	4.71	96	1081.3	67.07	96	4.96	0.29
	10-Aug	9	46.8	2.28	9	116.9	4.06	9	40.8	1.22	9	223.3	3.74	9	1043.6	31.69	9	4.67	0.11
	17-Aug	27	47.1	2.31	15	117.0	3.30	27	40.7	1.95	27	216.8	5.94	27	1017.1	81.23	27	4.69	0.36
	1997 Total	146	46.8	2.18	120	116.3	3.09	146	39.9	1.69	146	218.1	5.06	146	1065.1	72.69	146	4.88	0.32
1998	28-Jun	4	49.5	1.42	4	118.3	2.10	4	40.6	0.61	4	223.3	3.30	4	1060.0	21.60	4	4.75	0.14
	12-Jul	5	47.0	3.04	5	116.4	2.43	5	40.9	1.12	5	223.0	4.64	5	998.0	43.24	5	4.48	0.19
	23-Jul	11	45.8	2.36	11	115.7	3.65	11	40.6	1.20	11	221.5	6.83	11	1044.5	64.82	11	4.72	0.28
	13-Aug	15	45.7	2.38	15	115.7	3.70	15	40.6	1.21	15	222.9	3.99	15	1055.7	56.50	15	4.74	0.25
	31-Aug	21	46.9	2.41	21	115.0	3.29	21	39.5	1.76	21	219.0	5.32	21	959.0	46.17	21	4.38	0.21
	1998 Total	56	46.5	2.52	56	115.7	3.34	56	40.2	1.48	56	221.2	5.33	56	1012.4	67.09	56	4.58	0.28
1999	29-Jun	10	46.8	2.19	10	116.0	2.59	10	40.3	1.16	10	224.6	3.66	10	1030.8	58.38	10	4.59	0.22
	6-Jul	24	46.9	2.22	24	116.1	3.32	24	40.8	1.19	24	220.5	3.87	24	1026.9	59.91	24	4.66	0.25
	13-Jul	10	46.7	2.90	10	115.9	3.26	10	41.3	1.00	10	224.7	5.27	10	1037.0	92.95	10	4.61	0.38
	19-Jul	12	46.5	1.91	12	117.2	3.31	12	39.8	1.18	12	216.4	5.53	12	1031.7	69.59	12	4.77	0.28
	26-Jul	5	46.8	1.85	5	116.6	1.07	5	38.1	1.48	5	219.6	5.86	5	1062.0	27.97	5	4.84	0.13
	12-Aug	7	47.4	0.81	7	117.4	3.17	7	40.2	1.76	7	222.9	3.80	7	1090.3	95.48	7	4.89	0.40
	28-Aug	6	47.7	2.88	6	116.8	3.12	6	41.4	1.01	6	222.5	4.28	6	1010.8	70.95	6	4.54	0.25
	1999 Total	74	46.9	2.15	74	116.5	3.01	74	40.4	1.44	74	221.3	5.14	74	1036.6	69.98	74	4.68	0.29
Grand Total		276	46.8	2.24	250	116.2	3.13	276	40.1	1.60	276	219.6	5.36	276	1046.8	73.70	276	4.77	0.33

Table 9.21. Common murre adult size and condition, Gull Island 1997-1999, summarized by capture bout date.

Year		Culmen length (mm)			Headbill length (mm)			Tarsus length (mm)			Wing length (mm)			Mass (g)			Mass/wing		
	bout date	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
1997	20-Jun	11	47.6	2.31	0			11	40.0	1.56	11	220.8	4.58	11	1018.2	126.00	11	4.61	0.59
	30-Jul	14	47.4	2.54	12	115.0	3.02	14	40.4	1.51	14	215.3	4.12	14	1008.6	51.19	14	4.68	0.22
	8-Aug	25	45.3	2.40	0			25	41.4	1.36	25	218.8	5.04	25	988.4	52.76	25	4.52	0.24
	26-Aug	28	47.2	2.72	19	116.9	4.07	28	40.3	1.78	28	215.5	6.26	28	1005.9	67.95	28	4.67	0.37
	1997 Total	78	46.7	2.67	31	116.1	3.76	78	40.6	1.63	78	217.3	5.62	78	1002.5	71.42	78	4.62	0.35
1998	4-Jun	18	47.6	3.39	18	118.3	3.64	18	40.3	1.61	18	218.4	5.25	18	1032.8	45.40	18	4.73	0.19
	14-Jun	6	48.2	2.04	6	116.4	3.97	6	40.0	1.76	6	215.5	6.28	6	1046.3	116.81	6	4.85	0.46
	21-Jun	5	49.8	2.20	5	119.0	2.52	5	39.1	0.88	5	218.6	4.34	5	1041.2	55.68	5	4.77	0.29
	10-Jul	14	46.5	4.13	14	116.2	2.73	14	40.1	3.43	14	216.8	5.38	14	1057.1	74.89	14	4.88	0.33
	23-Jul	6	47.5	2.56	6	115.9	4.42	6	40.6	0.97	6	215.5	4.72	6	1100.5	58.90	6	5.11	0.28
	1-Aug	23	47.0	2.11	23	116.4	3.28	23	39.7	1.84	23	214.7	4.11	23	1085.9	55.55	23	5.06	0.27
	12-Aug	10	47.2	3.55	10	117.6	4.57	10	41.1	1.77	10	213.9	3.45	10	1101.7	92.87	10	5.15	0.38
	19-Aug	10	46.2	2.52	10	115.0	3.57	10	39.4	1.54	10	212.8	3.88	10	1036.4	66.86	10	4.87	0.31
	27-Aug	10	46.7	1.88	10	116.7	2.40	10	39.5	1.19	10	213.5	5.21	10	1009.8	51.71	10	4.73	0.26
	6-Sep	10	47.5	2.27	10	116.8	3.14	10	38.7	2.26	10	213.9	7.55	10	962.1	81.57	10	4.49	0.29
	1998 Total	112	47.2	2.85	112	116.8	3.45	112	39.9	2.00	112	215.4	5.20	112	1049.6	76.46	112	4.87	0.34
1999	12-Jun	15	47.3	1.85	15	118.0	2.91	15	41.4	1.10	15	213.7	3.56	15	1062.5	67.46	15	4.97	0.27
	24-Jun	10	49.2	1.74	10	116.6	3.17	10	40.4	1.27	10	218.2	6.60	10	1011.4	74.79	10	4.63	0.28
	7-Jul	7	47.0	2.27	7	116.7	3.69	7	39.7	1.72	7	215.7	3.73	7	1085.7	84.75	7	5.03	0.35
	19-Jul	7	47.3	1.62	7	116.7	2.37	7	40.7	1.26	7	215.3	3.45	7	1088.1	140.25	7	5.05	0.63
	3-Aug	10	47.1	2.03	10	115.4	3.83	10	40.1	1.24	10	217.7	7.02	10	1101.1	56.38	10	5.06	0.22
	16-Aug	9	46.6	2.48	9	115.1	3.37	9	40.6	1.20	9	213.0	5.17	9	963.8	70.81	9	4.53	0.33
	23-Aug	10	47.9	2.15	10	116.4	3.36	10	40.8	1.34	10	213.1	6.15	10	1004.5	45.09	10	4.72	0.25
	1999 Total	68	47.5	2.09	68	116.5	3.27	68	40.6	1.33	68	215.1	5.46	68	1044.1	87.24	68	4.85	0.38
Grand Total		258	47.1	2.62	211	116.6	3.43	258	40.3	1.77	258	215.9	5.46	258	1033.9	80.44	258	4.79	0.37

Table 9.22. Baseline concentrations of corticosterone (ng/ml) in Common Murres at Gull and Chisik Islands, 1997-1999.

Year	Breeding stage	Gull Island			Chisik Island		
		n	mean	stdev	n	mean	stdev
1997	Pre-egg-laying	11	7.55	4.72	14	6.20	2.87
	Incubation	12	6.20	3.16	12	7.71	2.76
	Early chick-rearing	8	10.20	2.49	11	11.69	5.36
	Late chick-rearing	12	34.77	19.89	6	25.78	3.29
	Total	43	15.26	16.28	43	10.76	7.40
1998	Pre-egg-laying	28	6.56	5.30	5	19.45	9.77
	Incubation	47	6.80	8.34	31	19.41	9.66
	Early chick-rearing	15	4.22	1.81	11	19.69	9.68
	Late chick-rearing	20	9.59	8.98	15	19.56	6.69
	Total	110	6.90	7.29	62	19.50	8.82
1999	Pre-egg-laying	21	9.61	9.33	21	7.31	7.44
	Incubation	29	9.47	9.14	30	13.65	10.45
	Early chick-rearing	11	3.96	2.45	23	9.86	10.81
	Late chick-rearing	10	7.99	15.79	8	3.72	1.36
	Total	71	8.45	9.76	82	10.00	9.77

Table 10.1. Number of adult Black-legged Kittiwakes counted in plots from middle incubation to the start of fledging at Chisik (plots 1-7), Gull (plots 1-10) and Barren islands (plots 1-4), 1995-1999.

Year	Chisik Island			Gull Island			Barren Island*		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	8	878.88	269.11	7	1340.86	96.30	15	201.40	8.70
1996	5	890.00	313.50	5	1109.40	82.17	12	182.80	8.20
1997	9	555.30	136.93	7	1195.86	66.53	12	196.30	11.20
1998	5	583.60	173.30	7	1203.00	117.96	8	180.40	27.40
1999	3	687.67	25.11	6	1094.00	60.55	10	205.00	18.50

* Data from : Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Reostoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 10.2. Black-legged Kittiwake productivity (chicks fledged per nest site) at Chisik, Gull and Barren island, 1995-1999.

Year	Chisik Island			Gull Island			*Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	12	0.02	0.06	6	0.34	0.35	11	0.62	0.25
1996	7	0.04	0.06	10	0.50	0.31	11	0.72	0.20
1997	10	0.02	0.04	11	0.60	0.36	11	0.31	0.13
1998	9	0.00	0.00	10	0.32	0.22	11	0.04	0.06
1999	9	0.00	0.00	10	0.65	0.11	11	0.45	0.14
All	5	0.02	0.02	5	0.48	0.15	5	0.43	0.07

Table 10.3. Black-legged Kittiwake laying success (number of nest structures with >=1egg, per nest structure) at Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island			Gull Island			*Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	12	0.38	0.19	6	0.58	0.23	11	0.92	0.06
1996	7	0.87	0.11	10	0.80	0.31	10	0.91	0.07
1997	10	0.61	0.28	11	0.85	0.12	11	0.67	0.13
1998	9	0.80	0.13	10	0.65	0.13	11	0.24	0.13
1999	9	0.70	0.18	10	0.81	0.09	11	0.72	0.09
All	5	0.67	0.19	5	0.74	0.12	5	0.69	0.28

Table 10.4. Black-legged Kittwake clutch size (eggs laid per nest with eggs) at Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island			Gull Island			*Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	12	1.39	0.46	6	1.59	0.28	11	1.83	0.13
1996	7	1.65	0.21	10	1.74	0.57	10	1.78	0.13
1997	10	1.38	0.21	11	1.65	0.37	11	1.40	0.11
1998	9	1.41	0.33	10	1.58	0.16	7	1.08	0.11
1999	9	1.42	0.38	10	1.62	0.13	11	1.34	0.10
All	5	1.45	0.11	5	1.64	0.06	5	1.49	0.32

* Data from : Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Reostoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 10.5. Black-legged Kittiwake hatching success (chicks hatched per egg laid) at Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island			Gull Island			Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	12	0.29	0.37	6	0.50	0.31	11	0.91	0.16
1996	7	0.80	0.12	10	0.75	0.10	n.d.	n.d.	n.d.
1997	10	0.57	0.24	11	0.53	0.22	11	0.65	0.15
1998	9	0.21	0.12	10	0.44	0.25	8	0.56	0.33
1999	9	0.12	0.12	10	0.70	0.10	11	0.74	0.12
All	5	0.40	0.28	5	0.58	0.13	5	0.72	0.15

Table 10.6. Black-legged Kittwake brood size at hatching (chicks hatched per nest with chicks) at Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island			Gull Island			*Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	12	1.39	0.46	6	1.30	0.15	11	1.71	0.23
1996	7	1.65	0.21	10	1.51	0.15	9	0.00	0.00
1997	10	1.38	0.21	11	1.40	0.22	10	1.32	0.15
1998	9	1.41	0.33	10	1.32	0.18	4	1.07	0.08
1999	9	1.42	0.38	10	1.45	0.10	11	1.23	0.13
All	5	1.45	0.11	5	1.40	0.09	5	1.07	0.64

Table 10.7. Black-legged Kittiwake fledging success (chicks fledged per chick hatched) at Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island			Gull Island			*Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	12	0.06	0.17	n.d.			11	0.45	0.17
1996	7	0.04	0.05	10	0.52	0.15	n.d.	n.d.	n.d.
1997	10	0.03	0.06	11	0.69	0.30	10	0.54	0.15
1998	9	0.00	0.00	10	0.66	0.31	4	0.39	0.31
1999	9	0.00	0.00	10	0.76	0.13	11	0.65	0.12
All	5	0.03	0.03	5	0.66	0.10	5	0.51	0.11

* Data from : Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Reostoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 10.8. Black-legged Kittiwake brood size at fledging (chicks fledged per nest with chicks) at Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island			Gull Island			*Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	1	1.00		4	1.32	0.32	11	1.37	0.15
1996	3	1.00	0.00	10	1.24	0.14	0	no chicks	no chicks
1997	2	1.00	0.00	11	1.31	0.16	9	1.05	0.84
1998	0	n.d.		10	1.37	0.28	1	0.00	0.00
1999	0	n.d.		10	1.35	0.14	10	1.11	0.10
All	3	1.00	0	5	1.32	0.05	4	1.18	0.17

Table 10.9. Black-legged Kittiwake egg laying chronology at Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island			Gull Island			*Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	12	20-Jun	7.77	6	19-Jun	6.41	11	10-Jun	1.78
1996	7	5-Jun	1.12	10	12-Jun	6.30	11	11-Jun	7.22
1997	10	13-Jun	2.37	11	8-Jun	1.58	11	20-Jun	2.88
1998	9	9-Jun	4.19	10	16-Jun	1.84	10	29-Jun	5.34
1999	9	15-Jun	2.67	10	13-Jun	1.90	11	22-Jun	0.90
All	5	12-Jun	5.73	5	13-Jun	4.16	5	18-Jun	7.96

Table 10.10. Black-legged Kittiwake chick hatching chronology at Chisik, Gull and Barren islands, 1995-1999.

Year	Chisik Island			Gull Island			*Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	12	8-Jul	3.89	6	14-Jul	5.66	12	7-Jul	1.83
1996	7	2-Jul	1.12	10	9-Jul	6.22	11	7-Jul	6.74
1997	10	9-Jul	2.74	11	7-Jul	3.73	11	17-Jul	2.84
1998	9	4-Jul	1.37	10	15-Jul	3.96	6	28-Jul	5.69
1999	9	10-Jul	3.58	10	10-Jul	2.07	11	19-Jul	1.27
All	5	6-Jul	3.65	5	11-Jul	3.39	5	15-Jul	8.88

* Data from : Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Reostoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 10.11. Black-legged Kittiwake productivity index at Gull and Chisik Islands, 1995-1999. This index is the proportion of large chicks counted late in the season to the number of nests counted during middle incubation, for the whole colony.

Year	Chisik Island					Gull Island				
	nests	fledglings	prod. Index	first count	2nd count	nests	fledglings	prod. Index	first count	2nd count
1995	n.d.					5719	2288	0.40	13-Jul	9-Aug
1996	n.d.					5152	2885	0.56	29-Jun	4-Aug
1997	13,341	67	0.01	19-Jun	7-Aug	4435	2040	0.46	26-27 Jun	3-4 Aug
1998	n.d.					4800	1344	0.28	17-18 Jun	12-Aug
1999	11,063	1041	0.09	21-Jun	22-Aug	5809	3427	0.59	23-24 Jun	10-Aug

Table 10.12. Black-legged Kittiwake attendance expressed as "bird-minutes" or the combined minutes both parents spent at the nest site per hour during chick-rearing at Chisik, Gull and Barren islands, 1995-1999 (n = nest sites).

Year	Chisik Island			Gull Island			**Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	*			*			11	57.72	4.30
1996	14	57.69	5.05	18	58.26	8.10	8	56.42	6.34
1997	5	57.61	4.05	31	60.66	2.55	19	48.32	17.58
1998	*			31	60.63	3.93	23	58.93	5.50
1999	*			24	59.54	6.69	29	50.20	15.19
All	2	57.65	0.71	4	59.77	2.53	5	54.32	6.13

Table 10.13. Black-legged Kittwake chick-feeding rates (feeds per hour) at Chisik, Gull and Barren islands, 1995-1999 (n = nest site).

Year	Chisik Island			Gull Island			**Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	*			*			11	0.19	0.08
1996	14	0.10	0.06	18	0.19	0.10	8	0.23	0.07
1997	5	0.16	0.07	31	0.21	0.09	19	0.11	0.06
1998	*			31	0.26	0.12	23	0.20	0.11
1999	*			24	0.23	0.12	29	0.15	0.08
All	2	0.13	0.01	4	0.22	0.02	5	0.18	0.02

Table 10.14. Black-legged Kittiwake foraging trip durations (minutes) when chick provisioning (resulted in chick feeding) at Chisik, Gull and Barren islands, 1995-1999 (n = nest sites).

Year	Chisik Island			Gull Island			**Barren Islands		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	*			*			10	235.01	59.63
1996	17	304.13	145.57	11	167.32	45.78	7	335.66	37.88
1997	5	312.47	102.53	27	190.25	62.07	13	381.10	130.01
1998	*			32	191.54	107.32	22	283.87	102.06
1999	*			23	236.42	115.30	24	338.66	164.20
All	2	308.30	30.43	4	196.38	33.95	5	314.86	56.40

* Breeding failure limited observations to less than 2 nest sites.

** Data from : Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Reostoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 10.15. Growth rates (g/d*) of Black-legged Kittiwake chicks by rank at Gull and the Barren islands, 1995-1999.

Rank	Year	Chisik			Gull			**Barrens		
		n	mean	stdev	n	mean	stdev	n	mean	stdev
Alpha / Singleton	1995	n.d.			16	15.5	8.9	8	19.1	3.4
	1996	10	11.0	6.2	2	17.2	4.3	32	17.5	6.1
	1997	8	14.5	4.4	36	15.4	3.7	35	16.2	4.8
	1998	n.d.			46	16.1	2.7	13	17.3	2.6
	1999	n.d.			30	16.2	2.2	36	17.8	3.4
Beta	1995	n.d.			2	13.8	6.5	5	19.8	4.5
	1996	1	12.0		1	17.4		3	18.4	6.1
	1997	n.d.			9	12.6	3.1	6	6.9	5.0
	1998	n.d.			18	15.5	1.7	1	21.7	--
	1999	n.d.			17	15.6	3.2	6	14.2	3.0

*Slope of linear regression of mass on age for chicks age 6-22 d.

**Data from : Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Reostoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer, Alaska.

Table 10.16. Baseline concentrations of corticosterone (ng/ml) in Black-legged Kittwakes at Gull and Chisik islands, 1997-1999.

Year	Breeding stage	Gull Island			Chisik Island		
		n	mean	stdev	n	mean	stdev
1997	Pre-egg-laying	10	4.14	1.22	7	4.47	1.21
	Incubation	8	6.09	2.81	10	8.30	3.54
	Early chick-rearing	11	7.20	3.57			
	Late chick-rearing	8	8.53	3.89	7	14.59	4.53
	Total	37	6.42	3.32	24	9.02	5.16
1998	Pre-egg-laying	22	11.24	7.46	11	6.39	4.35
	Incubation	32	11.85	11.61	14	6.78	4.63
	Early chick-rearing	35	10.27	8.42	14	9.46	5.31
	Late chick-rearing	10	10.32	3.35			
	Total	99	11.00	8.98	39	7.63	4.89
1999	Pre-egg-laying	10	7.97	7.01	10	5.05	3.03
	Incubation	25	6.18	3.51	10	7.14	2.48
	Early chick-rearing	10	7.79	3.86	9	12.45	6.16
	Late chick-rearing	20	5.45	2.96			
	Total	65	6.48	4.15	29	8.07	5.05
All	Grand Total	3	7.97	2.63	3	8.24	0.71

Table 10.17. Summary of Black-legged Kittiwake chick diet composition (% mass) at Chisik, and Gull islands, 1995-1999.

Prey	Chisik Island						Gull Island						Barren Islands					
	1995	1996	1997	1998	1999	Total	1995	1996	1997	1998	1999	Total	1995	1996	1997	1998	1999	Total
No. regurgitations	0	19	27	17	3	66	40	74	100	101	68	383	40	74	100	101	68	383
Total biomass (g)	--	266	520	241	24	1051	228	825	1727	1776	1406	5961	228	825	1727	1776	1406	5961
Mean g/sample	--	14	19	14	8	16	6	11	17	18	21	16	6	11	17	18	21	16
Osmerids	--	18.0	0.0	16.3	0.0	8.3	10.7	2.0	0.6	5.7	1.8	3.0	10.7	2.0	0.6	5.7	1.8	3.0
Herring	--	0.0	11.7	0.0	0.0	5.8	0.0	7.5	20.1	22.3	11.5	16.2	0.0	7.5	20.1	22.3	11.5	16.2
Sand lance	--	69.8	72.9	74.8	100.0	73.2	86.0	80.0	73.5	70.5	85.5	76.8	86.0	80.0	73.5	70.5	85.5	76.8
Gadids	--	0.0	3.7	0.0	0.0	1.8	1.4	0.0	3.2	1.3	0.5	1.5	1.4	0.0	3.2	1.3	0.5	1.5
Other	--	9.4	6.2	8.7	0.0	7.5	0.0	0.0	0.4	0.3	0.7	0.4	0.0	0.0	0.4	0.3	0.7	0.4
Unidentified fish	--	0.1	3.6	0.0	0.0	1.8	1.9	6.5	0.2	0.0	0.0	1.0	1.9	6.5	0.2	0.0	0.0	1.0
Invertebrates	--	2.7	1.9	0.2	0.0	1.6	0.0	4.0	2.0	0.0	0.0	1.1	0.0	4.0	2.0	0.0	0.0	1.1

Table 10.18. Average feeding frequency, meal size, energy density, and energy provisioning rates to Black-legged Kittiwake broods at Gull, Chisik, and Barren islands, Cook Inlet, Alaska 1995 - 1999. Data from Dan Roby and Patrick Jodice of the Cooperative Fish and Wildlife Unit at Oregon State University, Corvalis, Oregon.

Location / Year	Feeding frequency (meals/nest/day)*	Meal size (g)	Energy density (kJ / g wet mass)	Energy provisioning rate (kj / nest day)
Barren Islands				
1996	3.7	23.5	4	348
1997	2.2	38.8	4.2	358
1998	3.6	25.5	4.1	376
1999	2.3	17	5.1	200
Gull Island				
1996	3.6	15.7	4.5	254
1997	3.6	29.6	4.7	501
1998	4.5	22.4	4.7	474
1999	4	22.4	4.7	421
Chisik Island				
1996	2	n=3	n=3	
1997	2.5	15.9	5	198
1998	Failed			
1999	Failed			

* Based on feeds / hour and an 18 hour day.

Table 10.19. Summary of adult Black-legged Kittwake diet composition (% mass) at Chisik, Gull and Barren islands, 1995-1999.

Prey	Chisik Island						Gull Island						Barren Islands					
	1995	1996	1997	1998	1999	Total	1995	1996	1997	1998	1999	Total	1995	1996	1997	1998	1999	Total
No. stomachs	11	10	13	0	9	43	10	14	11	0	12	47	10	10	10	9	10	49
Total biomass (g)	40	27	89	--	71	226	145	126	55	--	113	439	137	129	125	190	44	625
Mean g/stomach	4	3	7	--	8	5	15	9	5	--	9	9	14	13	13	21	4	13
Osmerids	0.0	5.2	21.1	--	25.4	12.9	0.0	0.0	13.0	--	56.5	17.4	84.4	9.8	3.8	16.7	0.0	22.9
Sand lance	81.3	50.2	17.6	--	70.4	54.9	92.4	92.1	61.1	--	37.3	70.7	7.3	14.1	10.8	23.7	84.2	28.0
Gadids	16.3	0.0	7.6	--	0.0	6.0	7.6	0.0	0.2	--	0.0	1.9	8.3	74.9	85.1	1.4	7.8	35.5
Other	2.5	26.0	0.6	--	0.0	7.3	0.0	0.0	20.0	--	4.4	6.1	0.0	1.2	0.4	52.7	0.0	10.9
Unidentified fish	0.0	0.0	2.2	--	4.2	1.6	0.0	7.9	0.0	--	1.8	2.4	0.0	0.0	0.0	5.5	3.4	1.8
Invertebrates	0.0	18.6	50.8	--	0.0	17.3	0.0	0.0	5.8	--	0.0	1.4	0.0	0.1	0.0	0.0	4.6	0.9

Table 10.20. Black-legged Kittiwake adult size and condition, Chisik Island 1997-1999, summarized by capture bout

Year		Culmen (mm)			Headbill (mm)			Tarsus (mm)			Wing (mm)			Mass (g)			Mass/wing		
	bout date	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
1997	11-Jun	7	38.5	2.90	0			7	35.2	1.46	7	316.9	7.69	7	422.9	32.64	7	1.33	0.10
	23-Jun	61	37.7	1.61	61	93.0	2.86	61	35.0	1.29	61	319.4	7.37	61	394.9	42.28	61	1.24	0.13
	1-Jul	2	35.0	4.17	2	88.8	5.37	2	33.4	3.32	2	317.5	4.95	2	363.5	33.23	2	1.15	0.12
	31-Jul	6	37.6	1.16	4	93.6	3.92	6	35.0	1.40	6	307.5	12.44	6	354.2	32.47	6	1.15	0.10
	1997 Total	76	37.7	1.83	67	92.9	3.02	76	35.0	1.36	76	318.2	8.33	76	393.4	42.78	76	1.24	0.13
1998	10-Jun	24	38.4	1.52	24	93.2	2.94	24	35.4	1.26	24	321.7	5.85	24	436.8	33.06	24	1.36	0.09
	19-Jun	23	37.9	1.99	22	93.1	3.41	23	35.1	1.37	23	324.5	9.32	23	412.2	39.31	23	1.27	0.10
	28-Jun	9	38.6	2.01	9	93.7	4.16	9	35.3	1.83	9	321.8	5.54	9	391.1	48.85	9	1.21	0.14
	5-Jul	15	38.9	1.60	15	94.1	2.63	15	35.0	0.86	15	324.9	9.60	15	396.3	29.67	15	1.22	0.08
	1998 Total	71	38.4	1.76	70	93.4	3.16	71	35.2	1.29	71	323.3	7.92	71	414.5	40.09	71	1.28	0.11
1999	13-Jun	8	37.3	1.59	8	92.2	3.40	8	34.8	1.55	8	323.0	8.43	8	451.9	31.50	8	1.40	0.11
	24-Jun	9	38.7	1.65	9	95.0	2.13	9	36.4	1.30	9	323.8	7.64	9	424.3	32.02	9	1.31	0.08
	3-Jul	12	36.8	1.52	12	93.3	2.91	12	35.5	1.46	12	325.6	11.60	12	404.1	36.17	12	1.24	0.08
	1999 Total	29	37.5	1.73	29	93.5	2.96	29	35.5	1.52	29	324.3	9.41	29	423.6	38.04	29	1.31	0.11
Grand Total		176	37.9	1.81	166	93.2	3.07	176	35.2	1.37	176	321.3	8.73	176	406.9	42.51	176	1.27	0.12

Table 10.21. Black-legged Kittiwake adult size and condition, Gull Island 1997-1999, summarized by capture bout date.

Year		Culmen (mm)			Headbill (mm)			Tarsus (mm)			Wing (mm)			Mass (g)			Mass/wing		
	bout date	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
1997	16-Jun	14	38.5	1.48	0			13	35.7	0.94	14	319.4	5.98	14	388.0	37.23	14	1.21	0.11
	27-Jun	15	39.3	2.51	15	94.6	4.61	15	35.5	1.23	15	325.3	9.25	15	409.2	44.17	15	1.26	0.11
	2-Jul	15	39.6	1.77	15	94.9	3.46	15	35.8	0.89	15	321.6	7.46	15	417.7	33.00	15	1.30	0.09
	11-Jul	7	37.5	1.44	7	90.8	2.77	7	34.6	1.08	7	316.9	5.84	7	397.1	33.52	7	1.25	0.09
	22-Jul	10	39.8	1.56	5	95.9	3.26	10	35.7	1.20	10	317.1	7.42	10	400.8	38.08	10	1.26	0.11
	4-Aug	8	40.5	4.56	8	94.8	3.31	8	34.9	1.01	8	320.6	6.78	8	374.4	24.85	8	1.17	0.07
	1997 Total	69	39.2	2.39	50	94.3	3.88	68	35.5	1.10	69	320.7	7.72	69	400.3	37.96	69	1.25	0.10
1998	13-Jun	21	38.8	1.62	21	94.2	2.77	21	35.8	1.14	21	324.7	9.94	21	438.6	44.51	21	1.35	0.13
	22-Jun	21	39.1	1.58	21	95.4	3.29	21	36.0	1.21	21	322.3	7.42	21	421.3	39.02	21	1.31	0.12
	30-Jun	7	37.6	3.12	7	94.6	3.49	7	35.5	1.53	7	324.6	6.02	7	404.3	24.57	7	1.25	0.06
	7-Jul	7	39.9	3.07	7	95.6	3.76	7	35.5	1.23	7	326.0	11.00	7	409.6	37.79	7	1.26	0.11
	15-Jul	15	38.7	1.93	15	94.3	3.71	15	35.4	1.50	15	323.8	8.45	15	426.2	38.28	15	1.32	0.11
	22-Jul	11	39.1	2.09	12	94.0	3.71	12	35.6	1.14	12	316.6	10.77	12	411.1	41.28	12	1.30	0.10
	1-Aug	11	40.1	1.67	11	96.1	3.44	11	35.3	1.51	11	322.4	8.96	11	428.8	32.66	11	1.33	0.09
	12-Aug	10	39.7	1.92	10	95.6	3.79	10	34.7	1.09	10	325.6	7.88	10	380.5	44.66	10	1.17	0.11
	1998 Total	103	39.1	2.01	104	94.9	3.38	104	35.5	1.29	104	323.1	9.02	104	419.3	41.55	104	1.30	0.12
1999	13-Jun	10	38.5	1.57	10	94.0	3.30	10	35.6	1.59	10	322.1	10.27	10	422.9	36.54	10	1.31	0.09
	25-Jun	14	39.2	1.45	14	94.8	2.96	14	36.4	1.35	14	325.1	9.28	14	408.1	24.77	14	1.26	0.07
	6-Jul	8	39.4	1.23	8	95.3	2.22	8	36.3	0.85	8	326.3	10.35	8	423.9	34.01	8	1.30	0.09
	20-Jul	9	39.5	1.60	9	94.3	3.03	9	36.0	1.20	9	325.9	6.43	9	394.4	32.48	9	1.21	0.09
	3-Aug	9	38.9	1.39	9	94.7	2.04	9	36.1	1.24	9	322.4	9.14	9	358.9	20.42	9	1.11	0.08
	15-Aug	12	39.1	2.16	12	95.2	3.22	12	36.3	1.23	12	320.3	6.79	12	395.1	39.44	12	1.23	0.11
	1999 Total	62	39.1	1.59	62	94.7	2.80	62	36.1	1.25	62	323.6	8.71	62	400.9	36.99	62	1.24	0.10
Grand Total		239	39.2	2.02	221	94.7	3.31	239	35.7	1.25	240	322.4	8.62	240	408.1	40.51	240	1.27	0.11

Table 10.22. Black-legged Kittiwake adult mass, Barren Island* 1997-1999, summarized by capture bout date.

Year		Wing (mm)			Mass (g)			Mass / wing		
	bout date	n	mean	stdev	n	mean	stdev	n	mean	stdev
1997	24-Jun	1	320.00	-	1	385.00	-	1	1.20	-
	28-Jun	9	316.89	9.29	9	403.34	25.78	9	1.27	0.08
	29-Jun	5	315.20	7.50	5	399.47	10.76	5	1.27	0.04
	30-Jun	9	309.11	8.59	9	405.05	33.46	9	1.31	0.09
	3-Jul	6	311.00	6.42	6	403.33	30.27	6	1.30	0.10
	14-Aug	7	321.00	10.50	7	405.64	33.11	7	1.26	0.09
	1-Aug	1	316.00	-	1	389.00	-	1	1.23	-
	2-Aug	1	306.00	-	1	339.00	-	1	1.11	-
	3-Aug	6	321.00	12.73	6	380.94	38.51	6	1.19	0.12
	6-Aug	3	322.67	10.69	3	375.67	13.20	3	1.17	0.06
	7-Aug	2	320.00	7.07	2	335.49	7.76	2	1.05	0.05
	15-Aug	14	322.14	9.29	14	373.57	39.40	14	1.16	0.11
	1997 Total	64	316.75	5.49	64	382.96	24.27	64	1.21	0.08
1998	26-Jun	3	317.00	5.29	3	399.41	24.95	3	1.26	0.07
	28-Jun	3	311.33	10.02	3	429.88	17.58	3	1.38	0.06
	29-Jun	2	314.50	0.71	2	402.50	17.68	2	1.28	0.05
	6-Jul	5	316.80	7.05	5	403.00	34.21	5	1.27	0.09
	10-Jul	2	313.50	0.71	2	406.00	1.41	2	1.30	0.01
	12-Jul	6	319.83	7.78	6	424.52	24.19	6	1.33	0.06
	14-Jul	4	319.00	3.37	4	440.16	35.69	4	1.38	0.10
	27-Jul	11	310.91	7.85	11	413.65	41.53	11	1.33	0.11
	2-Aug	2	313.50	3.54	2	385.27	2.71	2	1.23	0.01
	10-Aug	6	316.83	5.78	6	398.03	44.78	6	1.26	0.13
	11-Aug	7	320.14	6.39	7	397.46	27.88	7	1.24	0.07
	12-Aug	2	331.50	16.26	2	415.00	21.21	2	1.25	0.00
	21-Aug	8	324.38	8.11	8	402.96	25.18	8	1.24	0.10
	1998 Total	61	317.63	5.64	61	409.06	15.11	61	1.29	0.05
1999	26-Jul	3	323.33	6.66	3	433.00	21.79	3	1.34	0.05
	11-Aug	3	319.67	8.96	3	422.20	22.38	3	1.32	0.09
	16-Jul	3	314.67	12.50	3	423.33	28.43	3	1.35	0.12
	23-Jul	10	315.50	8.10	10	399.52	39.50	10	1.27	0.11
	2-Aug	6	317.00	4.94	6	360.17	34.07	6	1.14	0.10
	8-Aug	10	313.60	7.83	10	371.40	35.10	10	1.18	0.10
	9-Aug	4	317.75	10.59	4	390.91	43.35	4	1.23	0.10
	15-Jul	6	320.00	9.36	6	416.65	26.09	6	1.30	0.07
	1-Jul	5	323.80	10.73	5	442.32	43.06	5	1.37	0.13
	7-Jul	6	321.33	6.02	6	431.39	44.59	6	1.34	0.12
	8-Jul	9	323.11	7.91	9	425.67	29.35	9	1.32	0.09
	17-Jul	5	316.20	14.74	5	420.80	29.08	5	1.33	0.10
	1999 Total	70	318.83	3.55	70	411.45	25.56	70	1.29	0.07
Grand Total		195	317.74	1.04	195	401.37	24.98	195	1.26	0.05

* Data from : Kettle, A., D.G. Roseneau, G.V. Byrd. 2000. Barren Islands seabird studies, 2000, Exxon Valdez Oil Spill Restoration Project Final Report (Reostoration Project 00163J), U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Service, Homer,

Table 11.1. Duration of counts made at Pigeon Guillemot colony sites in Kachemak Bay.

Colony site	Area*	Count duration (min.)
Guillemot Meadows		moving count
Naskowhak Pt.		5
Lemon Cliffs		5
Gray Cliffs	Seldovia Bay	5
Seldovia Bay	Seldovia Bay	moving count
Sub-Seldovia	Seldovia Bay	5
Seldovia Pt.	Seldovia Bay	moving count
Kasitsna Cliffs		5
Hesketh I.	Hesketh I.	moving count
S. W. Yukon		5
Yukon I.	Yukon I.	5
Sub-Yukon	Yukon I.	5
S. Neptune Bay		5
N. Neptune Bay	Neptune Bay	10
China Poot Bay		5
Motherlode	Moosehead Pt.	moving count
Moosehead N. Side	Moosehead Pt.	5
Moosehead Peterson Side	Moosehead Pt.	10
E. Peterson Bay		5
The Nose		5
Peterson Pt.		5
Ismailof I.		5
Sea Cliff Manor		5
Triangle Rock		5
Goshawk		5
Mallard Bay		moving count

*Indicates the individual colony sites that make up larger census areas.

Table 11.2. Age - wing length data used to age unknown-age Pigeon Guillemot chicks (from known-age chicks raised in captivity, G. Divoky, unpubl data.).

Age (d)	Mean wing length (mm)
1	20.4
2	21.5
3	22.0
4	24.4
5	25.8
6	27.8
7	30.1
8	32.0
9	36.0
10	40.2

Table 11.3. Results of replicated counts at individual Pigeon Guillemot colony sites in Kachemak Bay, 1996-1999.

Colony Site	1996			1997			1998			1999		
	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
Guillemot Meadows	2	33.5	4.9									
Naskowhak Pt.	2	14.0	2.8									
Lemon Cliffs	2	3.5	0.7									
Gray Cliffs	3	7.7	5.1	8	4.8	3.8	5	20.2	11.2	3	7.7	5.5
Seldovia Bay	2	28.0	0.0	7	30.6	9.0	5	28.8	7.9	3	26.7	2.3
Sub-Seldovia	2	13.5	3.5	7	6.0	3.3	5	7.4	3.6	3	3.0	3.0
Seldovia Point	3	34.7	9.0	7	35.6	16.5	6	22.3	7.4	3	17.7	5.0
Kasitsna Cliffs	3	10.0	5.0	8	9.3	4.7						
Hesketh	3	39.7	1.5	7	25.6	10.1	8	43.0	6.8	4	25.0	7.6
S.W. Yukon	3	2.3	4.0									
Yukon I.	4	16.3	8.8	6	11.5	8.3	8	13.5	4.9	3	3.7	3.2
Sub-Yukon	3	4.7	8.1	5	2.0	1.4	8	7.1	3.6	3	3.7	1.2
S. Neptune	3	9.3	2.3	9	15.9	3.1						
N. Neptune	3	29.3	0.6	9	29.0	4.7	7	25.4	4.2	3	15.0	2.6
China Poot Bay	3	7.3	3.8	9	8.8	2.7						
Motherlode	3	45.0	7.2	9	41.4	6.6	7	56.9	6.2	3	38.7	3.5
N. Moosehead Pt.	4	11.0	5.6	9	14.1	5.1	7	14.4	4.0	3	7.3	3.5
E. Moosehead Pt.	4	43.0	4.7	8	52.9	3.8	6	46.8	1.7	3	32.7	5.1
E. Peterson Bay	3	6.3	1.5									
The Nose	3	6.3	2.1									
Peterson Pt.	3	1.0	1.0									
Ismailof I.	2	5.0	1.4	7	3.3	0.8						
Sea Cliff	2	2.0	2.8									
Triangle Rock	4	8.5	4.4	6	12.7	2.8						
Goshawk	3	2.0	1.0									
Mallard Bay	2	15.0	1.4									

Table 11.4. Results of replicated counts of Pigeon Guillemots at different areas of Kachemak Bay, 1996-1999.

Area	1996			1997			1998			1999		
	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
Seldovia Bay	2	89.5	4.9	6	81.8	19.2	5	79.6	23.0	3	55.0	9.6
Hesketh I.	3	39.7	1.5	6	29.8	4.6	8	43.0	6.8	4	25.0	7.6
Yukon I.	3	20.0	5.6	5	14.6	8.4	7	23.6	9.3	3	7.3	2.1
Neptune Bay	3	29.3	0.6	9	29.0	4.7	7	25.4	4.2	3	15.0	2.6
Moosehead Pt.	3	100.0	10.0	8	110.3	9.1	6	119.0	11.0	3	78.7	6.7

Table 11.5. Results of annual surveys of Pigeon Guillemots along the south shore of Kachemak Bay, 1995-1999.

Year	Count
1995	557
1996	467
1997	634
1998	504
1999	563

Table 11.6. Median hatch date of Pigeon Guillemot eggs in Kachemak Bay, 1995-1999.

Area	Year	n (nests)	median hatch date*
Inner Bay	1995	24	7/4
	1996	15	6/28
	1997	20	7/4
	1998	12	7/1
	1999	9	6/30
Outer Bay	1995	25	7/2
	1996	15	6/29
	1997	23	7/1
	1998	17	7/2

* Date that first egg in a given nest hatched

Table 11.7. Percent composition (by number) of prey items in Pigeon Guillemot nestling diets at Kachemak Bay, Alaska, 1995-1999.

Taxon	Halibut Cove	Moosehead Point 1				Moosehead 2		Moose-head 3
	1995[a]	1995[a]	1996	1997	1999	1998	1999	1998
Total schooling fish	41.1	83.4	46.1	74.1	79.6	55.2	77.8	68.6
Sand lance[d]	39.1	83.4	44.2	67.7	79.6	55.2	76.6	68.6
Capelin[b,e]			1.9					
Salmonids[f]	2.0			0.4				
Unidentified schooling fish				6.0			1.2	
Total demersal fish	53.6	10.9	49.8	11.0	20.4	44.8	19.3	29.0
Gadids[b,g]				0.4				
Sculpins[h]	5.3		6.8	1.2			1.8	4.7
Blennies[i]								
Gunnels[j]	42.4	9.7	28.4	1.2	17.5	29.3	7.0	15.1
Pricklebacks, eelblennies[k]	5.3	1.1	10.4	4.8	2.9	8.6	6.4	6.9
Arctic shanny[b,l]						3.4		
Ronquils[b,m]			0.7	0.4				
Unidentified blennies			1.2	1.6				1.2
Total blennies	47.7	10.9	40.8	7.9	20.4	41.4	13.4	23.2
Flatfish[n]			0.7	0.7			4.1	
Rockfish[o]								
Greenlings[b,p]			0.2					
Unidentified demersal fish	0.7		1.2	0.4		3.4		1.2
Total invertebrates	2.0							
Hermit Crabs[q]								
Shrimp[r]	2.0							
Unidentified invertebrates								
Unidentified	3.3	5.7	4.1	3.2			2.9	2.3
n	151	175	412	249	103	58	171	86

[a]Observations made from boats. [b]These identifications were not used in 1995, and these groups could not be reliably distinguished during boat observations. [c] May have been present this year, but not identified. [d] Ammodytes hexapterus [e] Mallotus villosus [f] Salmonidae [g] Gadidae [h] Cottidae [i] Blenniodea [j] Pholidae [k] Lumpenus spp. [l] Stichaeus punctatus [m] Bathymaster signatus, Ronquilus jordani [n] Pleuronectiformes [o] Sebastes spp. [p] Hexagrammidae [q] Anomura [r] Decapoda

Table 11.7 (continued). Percent composition (by number) of prey items in Pigeon Guillemot nestling diets at Kachemak Bay, Alaska, 1995-1999.

Taxon	Neptune Bay	Yukon Island		Outer Seldovia 1		Outer Seld. 2	Inner Seldovia 1		Inner Seld. 2
	1995[a]	1996[a]	1997	1996[a]	1997	1998[a]	1997[a]	1998[a]	1998[a]
Total schooling fish	20.0	2.9	1.9	21.1	14.8	11.1		0.8	9.6
Sand lance[d]	19.3		1.0	21.1	14.4	11.1			3.8
Capelin[b,e]					0.4			0.8	
Salmonids[f]	0.7	2.9	1.0						1.0
Unidentified schooling fish									4.8
Total demersal fish	53.3	94.1	87.6	66.8	66.8	66.7	92.3	90.0	91.3
Gadids[b,g]		1.5		1.4	1.2				
Sculpins[h]	6.7	4.4	3.8	7.0	12.4	22.2	29.0	9.2	4.8
Blennies[i]									
Gunnels[j]	29.6	26.5	8.6	5.6	6.4	11.1	15.4	16.2	34.6
Pricklebacks, eelblennies[k]	12.6	7.4	18.1		1.2	1.0	30.1	50.0	30.8
Arctic shanny[b,l]			4.8		1.6	2.0			1.0
Ronquils[b,m]		8.8	3.8		2.0				
Unidentified blennies		1.5	30.5		3.2	3.0	13.3	9.2	5.8
Total blennies	42.2	44.1	65.7	5.6	14.4	17.2	58.7	75.4	72.1
Flatfish[n]	4.4	4.4	9.5	32.4	32.4	18.2	2.4	6.2	2.9
Rockfish[o]			1.9						
Greenlings[b,p]		2.9							
Unidentified demersal fish		36.8	6.7	16.9	6.4	9.1	2.1	5.4	11.5
Total invertebrates					8.8		1.4		1.0
Hermit Crabs[q]				[c]	8.4	2.0	1.4		1.0
Shrimp[r]									
Unidentified invertebrates					0.4	5.1			
Unidentified	26.7	2.9	10.5	15.5	9.6	15.2	6.3	3.1	2.9
n	135	68	105	71	250	99	286	130	104

[a]Observations made from boats. [b]These identifications were not used in 1995, and these groups could not be reliably distinguished during boat observations. [c] May have been present this year, but not identified. [d] Ammodytes hexapterus [e] Mallotus villosus [f] Salmonidae [g] Gadidae [h] Cottidae [i] Blenniodea [j] Pholidae [k] Lumpenus spp. [l] Stichaeus punctatus [m] Bathymaster signatus, Ronquilus jordani [n] Pleuronectiformes [o] Sebastes spp. [p] Hexagrammidae [q] Anomura [r] Decapoda

Table 11.8. Growth parameters of alpha and singleton Pigeon Guillemot chicks in Kachemak Bay, 1995-1999.

Area	Year	Age 8-18 rate (g / day)[a]			Age 5-20 rate (g / day)[a]			Mass at age 30 ± 2 d			Fledge mass[b]		
		n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
Inner Bay	1995	16	20.4	4.5	15	19.8	2.6	13	467	44			
	1996	7	17.5	4.9	8	17.2	3.6	9	423	85			
	1997	9	18.1	5.9	14	17.1	5.8	7	434	77	6	447	32
	1998	7	19.4	5.9	9	16.9	4.8	4	411	49	2	448	39
	1999	5	19.8	2.2	7	20.6	2.2	1	500				
Outer Bay	1995	14	19.6	6.5	16	19.1	4.1	13	423	94			
	1996	8	17.1	4.8	9	18.4	4.3	6	429	29			
	1997	11	18.0	4.4	11	18.5	2.9	10	415	54	13	441	34
	1998	7	19.8	2.3	10	16.8	4.7	10	412	32	9	430	39

[a] Slope of linear regression of mass on age

[b] Mass within 1 day of fledging

Table 11.9. Growth parameters of beta Pigeon Guillemot chicks in Kachemak Bay, 1995-1999.

Area	Year	Age 8-18 rate (g / day)[a]			Age 5-20 rate (g / day)[a]			Mass at age 30 ± 2 d			Fledge mass[b]		
		n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
Inner Bay	1995	9	21.0	1.9	10	20.2	1.9	9	462	25			
	1996	7	16.0	5.8	7	16.1	4.1	9	414	75			
	1997	6	18.4	2.5	10	18.3	1.5	6	413	82	7	451	44
	1998	2	20.6	2.3	2	20.6	2.3	2	436	47	2	459	36
	1999	4	21.7	5.5	5	20.9	5.1	2	455	28			
Outer Bay	1995	9	12.1	9.6	10	11.0	8.0	7	403	50			
	1996	4	14.9	4.3	4	15.7	4.8	3	360	135			
	1997	6	16.3	6.9	7	14.6	8.2	6	383	95	7	445	39
	1998	1	21.8		6	16.4	5.9	4	403	46	4	471	34

[a] Slope of linear regression of mass on age

[b] Mass within 1 day of fledging

Table 11.10. Mayfield parameters and estimates of reproductive success for Pigeon Guillemots in Kachemak Bay, 1995-1999.

Area	Year	n (nests)	mean clutch size	Egg DSR	Proportion Hatching	Age 1-15 DSR	Age 16-30 DSR	chicks fledged / nesting pair*	Brood at fledge		
									n	mean	stdev
Inner Bay	1995	45	1.78	0.984	0.63	0.973	0.997	0.44			
	1996	33	1.81	0.987	0.71	1.000	0.988	0.71	10	1.90	0.32
	1997	29	1.77	0.983	0.89	0.983	0.971	0.47	9	1.78	0.44
	1998	19	1.64	0.961	0.78	0.982	0.957	0.15	4	1.50	0.58
	1999	15						0.67	6	1.67	0.52
	1995-1998	141	1.78	0.983	0.74	0.984	0.983	0.47	29	1.76	0.44
Outer Bay	1995	39	1.80	0.981	0.79	0.962	0.991	0.38			
	1996	30	1.83	0.988	0.63	0.969	0.974	0.34	4	1.75	0.50
	1997	36	1.72	0.979	0.74	0.964	0.992	0.34	18	1.56	0.51
	1998	34	1.70	0.976	0.63	0.928	0.967	0.10	12	1.33	0.49
	1999	14						0.29	3	1.33	0.58
	1995-1998	153	1.76	0.982	0.70	0.959	0.983	0.29	37	1.49	0.51

*Productivity estimates for 1999 are not directly comparable with estimates from other years - see Methods for details.

Table 11.11. Fledging age of Pigeon Guillemot chicks in Kachemak Bay, 1996-1998.

		Fledging age (d)		
Area	Year	n	mean	stdev
Inner Bay	1996	10	34.9	3.2
	1997	17	34.9	3.0
	1998	6	36.3	3.3
Outer Bay	1996	6	36.7	2.6
	1997	14	37.9	3.2
	1998	13	37.8	3.5

Table 11.12. Age-dependant observed mortality rate of Pigeon Guillemot chicks in Kachemak Bay, 1995-1999.

Chick age (d)	# of obs*	# of deaths	Mortality rate (deaths / obs)
2	26	2	0.08
3	46	9	0.20
4	32	3	0.09
5	36	8	0.22
6	37	5	0.14
7	33	0	0.00
8	36	3	0.08
9	43	8	0.19
10	24	4	0.17
11	35	5	0.14
12	45	2	0.04
13	31	3	0.10
14	35	4	0.11
15	30	6	0.20
16	30	5	0.17
17	36	2	0.06
18	22	4	0.18
19	40	3	0.08
20	40	2	0.05
21	35	0	0.00
22	28	1	0.04
23	28	4	0.14
24	36	5	0.14
25	47	2	0.04
26	24	1	0.04
27	30	5	0.17
28	30	1	0.03
29	33	1	0.03
30	48	0	0.00

*number of chicks observed alive at given age

Table 11.13. Measurements of adult Pigeon Guillemots in Kachemak Bay, 1995-1999.

Area	Mass			Wing*			Culmen		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
Inner Bay	8	472	22	7	181	12	4	33.4	2.0
Outer Bay	16	481	28	8	187	3	6	34.0	0.6
Both areas	24	478	26	15	184	9	10	33.7	1.3

Area	Headbill			Tarsus			10th Primary		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
Inner Bay	4	82.9	0.7	4	34.1	3.0	5	105	5
Outer Bay	6	84.3	2.3	6	33.5	2.4	4	106	4
Both areas	10	83.7	1.9	10	33.7	2.5	9	105	4

* Flattened wing length

Table 12.1. Horned Puffin breeding success on Duck (Chisik) Island.

Year	1999	1998	1997	1996	1995	chi square	df	p
Total no. egg-sites	47	61	48	51	21			
Total no. chicks	36	42	32	43	15			
Total no. fledglings	33	34	26	35	12			
Hatching Success	0.77	0.69	0.67	0.84	0.71	5.186	4	>0.5
(Chicks/egg-site)								
stdev	0.43	0.47	0.48	0.37	0.46			
Fledging Success	0.97	0.89	0.96	0.83	0.92	4.71	4	>0.5
(Fledglings/chicks)								
stdev	0.17	0.31	0.19	0.38	0.28			
Breeding Success	0.70	0.62	0.64	0.70	0.66	5.186	4	>0.5
(Fledglings/egg-sites)								
stdev	0.46	0.50	0.50	0.47	0.51			
Median chick hatch date	26-Jul	29-Jul	25-Jul	19-Jul	21-Jul			
no.chicks used for phenology	33	27	28	35	13			
stdev	5.58	5.49	5.43	5.96	4.48			

Notes: Nest-site is sample unit. Hatching, fledging and reproductive success are compared between years using a chi-square contigency table. All tests were non-significant, with four degrees of freedom. Median chick hatch dates are limited to chicks with precise hatch dates.

Table 12.2. Diet composition (% number) of Horned Puffin chicks at Duck (Chisik) Island in 1995-1999.

Prey Items	1995		1996		1997		1998		1999	
	N	%	N	%	N	%	N	%	N	%
Pacific sandlance *Ammodytes hexapterus*	91	98	825	94	465	95	1174	95	103	99
Rockfish species *Sabastes* sp.	0	0	0	0	0	0	1	0.1	0	0
Gadidae	0	0	0	0	2	0.4	0	0	0	0
Capelin *Mallotus villosus*	2	2	27	3	9	2	13	1	0	0
unidentified squid	0	0	0	0	0	0	2	0.2	0	0
Salmon sp. *Onchorhynchus* sp.	0	0	16	2	7	1	34	3	1	1
Euphasiid	0	0	0	0	6	1	1	0.1	0	0
Sculpin sp. *Cottidae sp.*	0	0	0	0	1	0.2	0	0	0	0
Pacific Lamprey *Lampetra tridentatus*	0	0	4	0.5	0	0	4	0.3	0	0
Sandfish *Trichodon trichodon*	0	0	1	0.1	0	0	0	0	0	0
unidentified Smelt Osmeridae	0	0	0	0	0	0	2	0.2	0	0
Unidentified fish species	0	0	0	0	0	1	0.2	2	0	0
Total prey items	93		875		491		1233		104	

Table 12.3. Mean size and energy value of sandlance in Horned Puffin chick diet.

Year	Length (mm)	N	SD	Mass (g)	N	SD	kJ	N	SD
1995	92.7	93	24.7	2.9	93	2.6	16.1	93	15.2
1996	85.2	542	31.5	2.1	560	1.8	13.8	293	10.1
1997	86.0	143	19.1	2.5	142	2.3	13.1	142	13.7
1998	95.4	1170	16.5	3.1	1011	2.0	16.6	1111	10.7
1999	100.2	101	8.5	3.3	104	1.0	18.7	101	6.2
	F	P	df	F	P	df	F	P	df
year	26.51	<0.001	4	28.76	<0.001	4	7.86	<0.001	4
error			2049			2022			1735

Note: Length was measured fork length, mass is mean fresh mass and kJ is mean food energy in kJ. There was a significant difference in sandlance length, mass and energy value between years (one-way ANOVA results presented).

Table 12.4. Characteristics of meal loads delivered by Horned Puffins to their chicks.

YEAR	Mass/load (g)			No. prey items/load		
	mean	n	SE	mean	n	SE
1995	15.2	3.0	2.4	7.7	3.0	2.2
1996	17.4	15.0	2.1	6.9	16.0	0.7
1997	16.0	16.0	1.8	6.3	67.0	0.4
1998	16.5	8.0	2.5	6.0	24.0	0.7
1999	15.7	22.0	1.3	4.9	21.0	0.4
1995-1999	16.4	63.0	0.8	6.2	132.0	0.3

Table 12.5. Horned Puffin daily food delivery rates at Duck Island.

Year	Date	Time		Deliveries			
		Start	Finish	Mean	N*	SD	Phenology
1996	23-Aug-96	630	2200	5.4	5	2.0	late chick-rearing
1996	24-Aug-96	630	2200	6.8	5	2.2	late chick-rearing
1997	26-Jul-97	500	2300	2.8	5	0.8	late incubation/early chick-rearing
1997	1-Aug-97	500	2300	3.4	5	1.1	early chick-rearing
1997	13-Aug-97	600	2200	2.6	7	1.0	mid chick-rearing

* N = number of nests observed

Table 12.6. Linear growth rates of Horned Puffin chicks on Duck Island in different years

Year	Body Mass (g/day)			Wing (mm/day)			Culmen length (mm/day)			Tarsus (mm/day)		
	Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD
1995	12.8 b	14	3.1	3.9	14	1.05	0.39	14	0.08	0.37	15	0.08
1996	9.4 b	18	2.6	3.5	18	0.91	0.28	11	0.16	0.39	12	0.21
1997	10.5 b	16	3.3	4.3	16	0.57	0.39	11	0.11	0.46	13	0.10
1998	3.7 a	22	6.9	3.4	22	1.08	0.27	10	0.13	0.30	12	0.16
1999	9.6 b	21	3.0	4.0	21	0.43	0.29	10	0.13	0.36	10	0.10
	F	df	*P*									
treatment	11.7	4	<.001									
error		86										

Means followed by different letters are significantly different as determined from Tukey multiple comparison tests.

Table 12.7. Horned Puffin chick fledging age on Duck Island. Fledging age (+/- 3 days) is calculated from productivity and growth data of known age chicks.

Year	Fledging age (days)		
	Mean	SD	N
1996	42.1	4.9	25
1998	34.7	5.7	23
1999	40.7	4.1	28

Table 12.8. Measurements of Horned Puffin fledglings caught en route to the ocean. All measurements in mm except mass, which is in grams.

Date	Wing	Tarsus	Headbill	Culmen	Mass
29-Aug-98	158				385
29-Aug-98	155				345
29-Aug-98	157				350
1-Sep-98	152	29.2		29.8	370
1-Sep-98	150	30.2		31.1	333
3-Sep-98	147	28.5		29.4	266
4-Sep-99	163	31.3	70.2	32.7	365
6-Sep-99	158	31.1	68.3	31.8	420
8-Sep-99	161	31.6	71.3	30.6	400

Table 12.9. Census counts of Horned Puffins on Duck Island.

Year	Date	Land	Water	Flying	Total	Stage of breeding
1995	24-Jul-95	483	984	290	1757	early chick-rearing
1995	8-Aug-95	811	761	235	1807	mid chick-rearing
1996	12-Jul-96	335	198	236	769	late incubation
1996	16-Jul-96	364	435	160	959	late incubation
1997	16-Jul-97	233	485	29	747	late incubation
1997	17-Jul-97	197	780	10	987	late incubation
1997	18-Jul-97	527	652	100	1293	late incubation
1997	14-Aug-97	1323	757	255	2335	mid/late chick-reaing
1997	15-Aug-97	631	230	25	886	mid/late chick-reaing
1997	17-Aug-97	985	410	225	1620	mid/late chick-reaing
1998	25-Jun-98	290	1017	0	1307	late incubation/early chick-reaing
1998	26-Jun-98	551	1342	300	2193	late incubation/early chick-reaing
1998	27-Jun-98	261	917	22	1200	late incubation/early chick-reaing
1998	25-Aug-98	1580	470	750	2800	late chick-rearing
1998	2-Sep-98	649	479	218	1346	late chick-rearing
1999	9-Aug-99	1472	690	435	2597	mid chick-rearing
1999	4-Sep-99	2380	1380	610	4370	late chick-rearing

"Land" = no. birds counted on shore (all individuals visible on rocks, vegetation and cliff). "Water" = no. birds counted in rafts or as individuals on the water within about 200m from shore. "Flying" = no. birds counted flying around colony. "Total" = total no. birds counted on land, water and flying.

Table 12.10. Whole island census counts of Tufted Puffin on Duck Island.

Year	Date	Total no.	Stage of breeding
1995	24-Jul-95	26	early chick-rearing
1995	8-Aug-95	54	mid chick-rearing
1996	12-Jul-96	12	late incubation
1996	16-Jul-96	6	late incubation
1997	16-Jul-97	3	late incubation
1997	17-Jul-97	9	late incubation
1997	18-Jul-97	14	late incubation
1997	14-Aug-97	20	mid/late chick-reaing
1997	15-Aug-97	5	mid/late chick-reaing
1997	17-Aug-97	11	mid/late chick-reaing
1998	25-Jun-98	28	late incubation/early chick-reaing
1998	26-Jun-98	29	late incubation/early chick-reaing
1998	27-Jun-98	63	late incubation/early chick-reaing
1999	10-Aug-99	20	mid chick-rearing
1999	4-Sep-99	34	late chick-rearing

"Total no." = sum of birds on land, water and in flight.

Table 13.1. Glaucous-winged Gull productivity and hatching chronology at Chisik and Gull Islands, 1995-1999.

Colony	Year	Clutch size			*Productivity			Hatching success			**Brood size at hatch			Hatch date		
		n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
Gull	1995	2	2.07	0.10	2	1.31	0.23	2	0.64	0.14	2	2.00	0.00	2	2-Jul	1.41
	1996	5	2.39	0.15	5	1.25	0.26	5	0.53	0.14	5	1.93	0.16	5	4-Jul	5.41
	1997	5	2.47	0.35	5	1.30	0.33	5	0.52	0.07	5	2.03	0.25	5	30-Jun	2.17
	1998	5	2.40	0.22	5	1.55	0.43	5	0.65	0.19	5	2.20	0.40	5	30-Jun	2.90
	1999	5	2.23	0.32	5	1.43	0.30	5	0.64	0.08	5	2.16	0.41	5	8-Jul	5.66
Chisik	1995	n.d.			n.d.			n.d.			n.d.			n.d.		
	***1996	12	2.42	0.75	30	1.73	0.96	9	0.53	0.35	27	1.93	0.74	2	27-Jun	---
	1997	2	2.41	0.06	2	1.23	0.32	2	0.51	0.12	2	2.33	0.47	2	26-Jun	0.71
	1998	2	2.88	0.18	2	1.50	0.71	2	0.53	0.28	2	2.45	0.07	2	24-Jun	1.06
	1999	3	2.07	0.32	3	1.07	0.57	3	0.50	0.18	3	2.05	0.33	3	5-Jul	2.90

*Productivity is defined as chicks hatched per nest with eggs.
**Brood size at hatch is defined as the number of chicks hatched per nest with chicks.
***Nest site used as sample unit.

Table 13.2. Number of adult Glaucous-winged Gulls counted in plots from middle incubation to the start of fledging at Chisik (plots 1-7)* and Gull Islands (plots 1-10), 1995-1999.

Year	Chisik Island						Gull Island		
	plots 1-7			North & Snug Harbor plots			plots 1-10		
	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	9	5	4.7	10	93	30.7	5	25	6.6
1996	6	11	5.3	6	121	35.9	4	11	3.8
1997	5	14	6.0	9	94	32.6	6	18	2.4
1998	7	15	3.8	7	132	44.9	8	21	3.7
1999	5	18	3.5	5	103	49.6	8	23	6.6

*data reported for Chisik 1995-1999 are for only those plots where gulls were present. However, plots 1-7 were checked periodically for the presence of gulls.

Table 13.3. Total numbers of individual Glaucous-winged Gulls seen at Chisik and Gull Islands 1995-1999.

Year	Chisik Island		Gull Island	
	individuals	count date	individuals	count date
1995	1884	7-22 Jul*	500	8-Jun
1996	n.d.		n.d.	
1997	81**	15-Jun	1222	17-Jun
1998	634	14-Jun	825	10-Jun
1999	n.d.		n.d.	

*single count
**Duck Island only

Table 13.4. Pelagic Cormorant productivity and hatching chronology at Gull Island, 1995-1999.

Year	Clutch size			Productivity			Hatching success			Brood size at hatch			Brood size at fledge			Hatch date		
	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	median	stdev
1995	31	2.17	1.17	31	0.29	0.46	31	0.78	0.39	31	1.80	0.77	31	0.42	0.51	31	28-Jul	6.33
1996	25	3.00	1.15	25	0.58	0.50	25	0.69	0.36	25	2.72	0.67	25	0.82	0.39	25	9-Jul	10.96
1997	19	2.69	1.27	19	0.63	1.07	19	0.47	0.38	19	2.40	0.70	19	1.09	1.22	19	22-Jul	13.59
1998	6	3.83	1.17	6	0.83	0.41	6	0.41	0.30	6	2.00	1.00	6	1.00	0.00	6	10-Jul	5.59
1999	9	3.00	0.50	9	0.78	0.44	9	0.57	0.40	9	2.29	1.11	9	1.00	0.00	9	17-Jul	3.06

Table 13.5. Pelagic and Red-faced Cormorant productivity index on Gull Island 1995-1999.

Cormorant spp.	Year	Count #1			Count #2				productivity
		count date	nest count	adult count	count date	nest count	adult count	chick count	
Pelagic	1995	8-Jun	92	194	21-Aug	68	217	105	1.14
	1996	5-Jul	87	138	23-Aug	68	n.d.	144	1.66
	1997	28-Jun	74	141	19-Aug	n.d.	n.d.	69	0.93
	1998	16-17-Jun	58	n.d.	26-Aug	n.d.	38	11	0.19
	1999	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Red-faced	1995	8-Jun	12	27	21-Aug	9	13	8	0.67
	1996	5-Jul	8	16	23-Aug	n.d	n.d.	14	1.75
	1997	28-Jun	6	16	19-Aug	n.d.	n.d.	4	0.67
	1998	16-17-Jun	9	n.d.	26-Aug	n.d.	n.d.	4	0.44
	1999	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

Table 13.6. Numbers of Pelagic Cormorant individuals and nests in population plots on Gull Island 1995-1999.

	plots 1-3						plots 1-8						plots 1-10					
	individuals			nests			individuals			nests			individuals			nests		
Year	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev	n	mean	stdev
1995	2	1	0.00	4	1	0.00	2	43	0.71	4	29	1.41	2	44	0.00	4	30	2.12
1996	5	1	1.95	4	0	0.00	5	31	3.91	4	20	0.50	5	31	3.91	4	20	0.50
1997	7	1	0.69	7	1	0.00	7	21	3.09	7	12	0.79	7	23	2.97	7	12	0.38
1998	8	1	0.35	8	1	0.00	8	18	3.07	8	10	2.56	8	20	3.38	8	10	2.64
1999	11	4	0.89	11	3	0.00	11	18	5.09	11	11	0.30	11	21	5.28	11	12	0.30

n = number of count days

Table 13.7. Numbers of Tufted Puffins in population plots at Gull Island 1997-1999 (n=count day).

Plots	Year	n	mean	stdev
1-3	1997	10	0.00	0.00
	1998	9	0.00	0.00
	1999	12	0.00	0.00
1-8	1997	10	5.70	3.71
	1998	9	4.22	6.68
	1999	12	6.00	4.22
1-10	1997	10	5.80	3.71
	1998	9	4.22	6.68
	1999	12	6.73	4.98

Table 13.8. Tufted Puffin chick growth rates at Gull Island 1997 for five individual chicks. Mass growth rate is expressed in terms of grams per day during the linear phase of growth. Wing, culmen and tarsus growth is millimeters of increase per day over the linear growth phase.

Chick	Mass	Wing	Culmen	Tarsus
A	20.81	4.29	0.40	0.12
B	14.36	4.30	0.29	0.20
C	13.21	3.37	0.50	0.30
D	15.94	4.04	0.30	0.25
E	14.44	3.67	0.26	0.14
Mean	15.75	3.93	0.35	0.20

Table 14.1. Ranked variability in seabird parameters among years (expressed as "m/m Ratio", the ratio of maximum to minimum values, and as C.V., the Coefficient of Variation) and functional relationship with prey density. BLKI= Black-legged Kittiwake; COMU= Common Murre; N= number of colony-years of data; Ranks are low (C.V.<20%), medium (20%<C.V.<40%) and high (C.V.>40%).

Parameter	n	Variability			Relationship with Fish Density				
		m/m Ratio	C.V.	RANK	linear r^2	model r^2	model p	best-fit model	Threshold
BLKI % Time Adult Present with Chick	11	1.2	6.6	Low	0.08	0.08	NS	none	
BLKI Adult Body Condition	15	1.3	7.5	Low	0.03	0.03	NS	none	
BLKI Clutch Size	15	1.7	12.3	Low	0.01	0.01	NS	none	
BLKI Alpha/Singleton Chick Growth Rate	12	1.7	12.6	Low	0.00	0.73	0.012	sigmoidal	0.012
BLKI Brood Size at Fledging	11	1.4	13.5	Low	0.30	0.59	0.084	sigmoidal	0.013
BLKI Beta Chick Growth Rate	9	2.8	25.6	Medium	0.00	0.00	NS	none	
BLKI Foraging Trip Duration	11	2.3	26.1	Medium	0.59	0.61	0.008	neg. exponential	
BLKI Chick Feeding Rate	11	2.3	26.1	Medium	0.21	0.71	0.045	sigmoidal	0.013
BLKI Laying Success	15	3.8	28.7	Medium	0.00	0.00	NS	none	
BLKI Hatching Success	14	4.3	37.2	Medium	0.01	0.53	0.049	sigmoidal	0.008
BLKI Density at Sea	12	20.1	72.3	High	0.41	0.80	<0.001	sigmoidal	0.013
Forage Fish Biomass	15	20.3	79.8	High	-----	-----	-----	-----	-----
BLKI Fledging Success	13	>27*	81.2	High	0.42	0.89	<0.001	sigmoidal	0.013
BLKI Breeding Success	15	>36*	87.0	High	0.20	0.64	0.009	sigmoidal	0.015
COMU % Time Adult Present with Chick	15	0	0.0	Low	0.00	0.00	NS	none	
COMU Adult Body Condition	13	1.1	3.8	Low	0.04	0.04	NS	none	
COMU Chick Body Condition	10	1.1	4.2	Low	0.05	0.71	0.044	sigmoidal	0.010
COMU Chick Age at Fledging	8	1.2	4.8	Low	0.37	0.44	0.073	neg. hyperbolic	
COMU Chick Feeding Rate	15	1.7	15.5	Low	0.41	0.41	0.011	linear	
COMU Hatching Success	14	2.3	20.9	Medium	0.11	0.11	NS	none	
COMU Foraging Trip Duration	15	2.1	21.1	Medium	0.45	0.49	0.005	neg. exponential	
COMU Fledging Success	13	4.4	28.3	Medium	0.00	0.00	NS	none	
COMU Breeding Success	14	4.5	29.2	Medium	0.00	0.02	NS	none	
COMU Discretionary Time at Incubation	14	6.7	44.3	High	0.06	0.54	0.040	sigmoidal	0.013
COMU Discretionary Time at Chick-rearing	15	>27*	65.8	High	0.28	0.65	0.008	sigmoidal	0.012
COMU Density at Sea	12	12.6	72.4	High	0.16	0.70	0.017	sigmoidal	0.015
Forage Fish Biomass	15	20.3	79.8	High	-----	-----	-----	-----	-----

* minimum m/m Ratio values obtained by rounding min values upward from zero.

Table 14.2. Variability in breeding success of Black-legged Kittiwakes and Common Murres in different geographic areas. See text for sources of data.

Species	Location	Breeding success			
		n	mean	CV (%)	s.d.
Kittiwakes	Cook Inlet	15	0.31	87	0.27
	Gulf of Alaska	113	0.24	110	0.26
	Aleutians	20	0.27	84	0.22
	Bering Sea	84	0.24	94	0.24
	Chukchi Sea	18	0.82	65	0.54
	Alaska	235	0.29	110	0.32
	Newfoundland	7	0.86	65	0.56
	Vedoy I., Norway	20	0.69	41	0.28
	Hornoya I., Norway	17	0.93	27	0.25
	Isle of May, UK	17	0.59	69	0.41
	North Sea 1986	15	1.09	29	0.32
	North Sea 1987	20	0.96	49	0.47
	North Sea 1988	21	0.61	85	0.52
	West Coast UK	31	0.62	56	0.35
	Atlantic Ocean	148	0.77	53	0.39
Murres	Cook Inlet	14	0.61	29	0.18
	Gulf of Alaska	34	0.54	34	0.18
	Aleutians	13	0.41	76	0.31
	Bering Sea	52	0.50	35	0.17
	Alaska	99	0.50	41	0.20
	California	29	0.74	29	0.22
	Newfoundland	14	0.76	9	0.07
	Isle of May	21	0.78	7	0.06
	Europe	19	0.70	20	0.14
	Atlantic Ocean	54	0.75	12	0.09

Table 14.3. Preliminary estimate of population parameters for seabirds at Chisik and Gull Islands.

Type	Parameter	Black-legged Kittiwake		Common Murre	
		Chisik	Gull	Chisik	Gull
Measured	Population change (prop. per annum)	-0.043	0.088	-0.089	0.091
Measured	Annual adult survival (p.p.a.)	0.930	0.820	0.920	0.960
Measured	Mean productivity (chicks/pair)	0.020	0.482	0.560	0.540
Literature	Juvenile survival to breeding	0.400	0.400	0.400	0.400
Estimated	Maximum recruitment (p.p.a.)	0.004	0.096	0.112	0.108
Estimated	Maximum (im/e)migration (p.p.a.)	0.023	0.171	-0.120	0.023

Note: recruitment and immigration must balance. For example, if no murre chicks at Chisik survived to breed, then recruitment would be zero, and emmigration would have to be -0.008 to account for population trends.

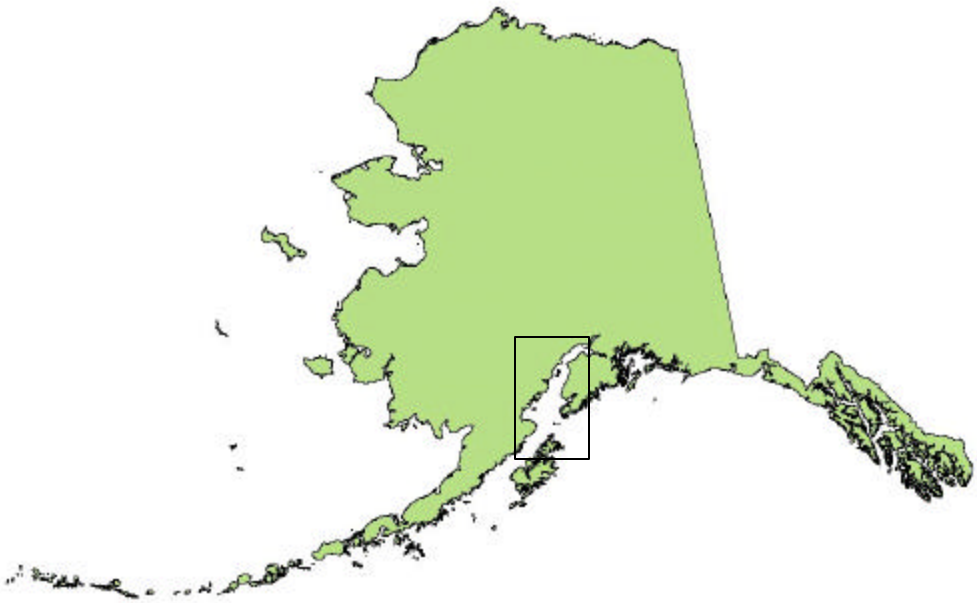

Fig. 2.1. Location of the Cook Inlet study area in south-central Alaska.

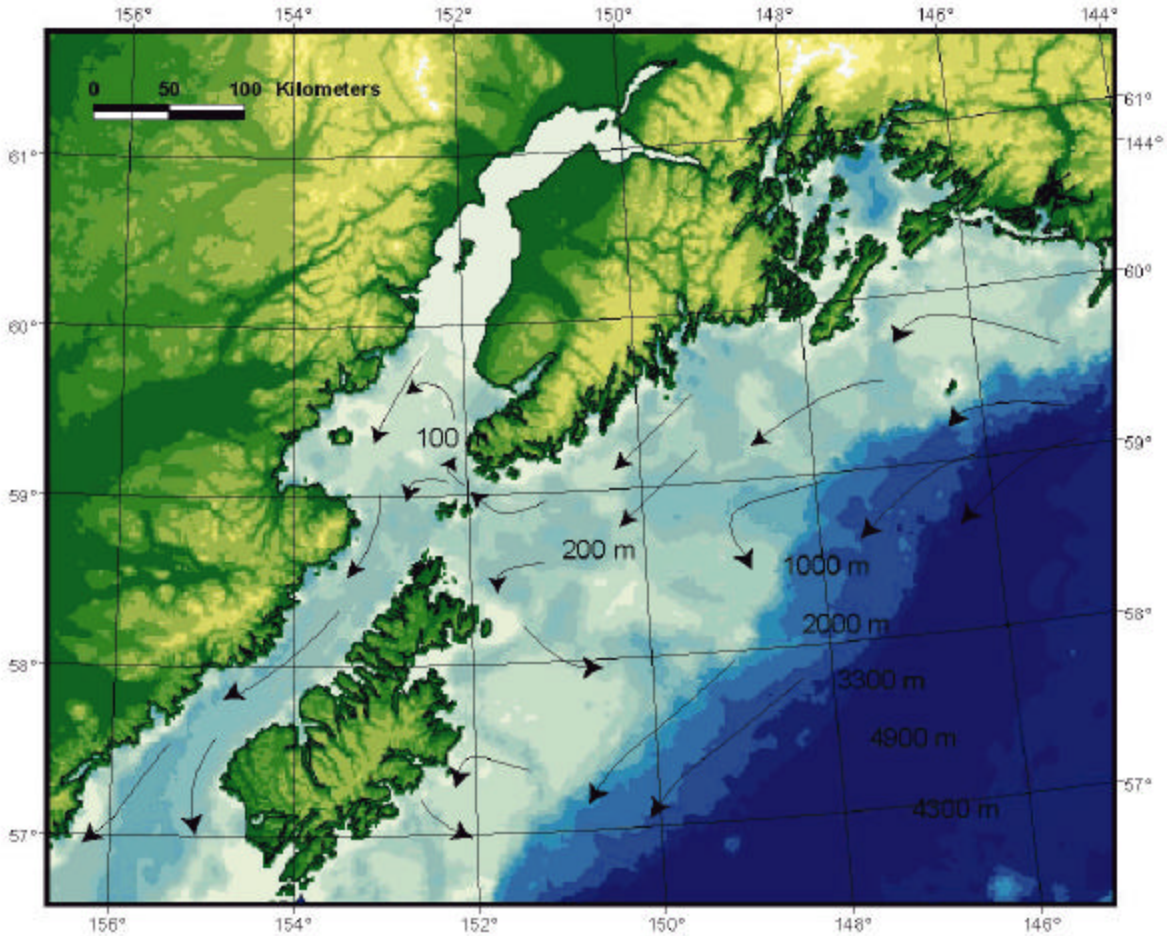

Fig. 2.2. Bathymetric map of the greater Cook Inlet area (adapted from Smith and Sandwell 1997). Arrows depict major currents (adapted from Reed and Schumacher 1986).

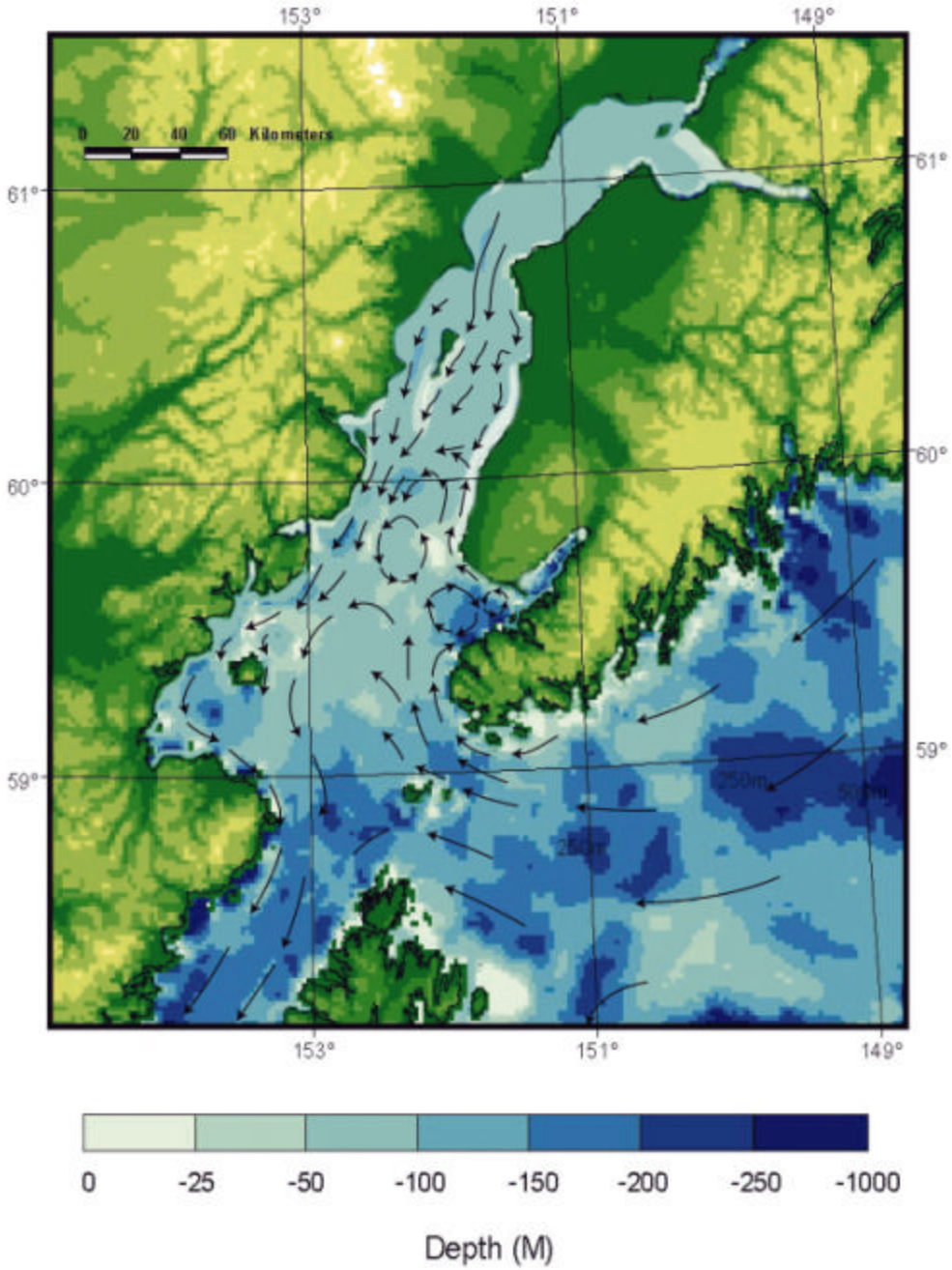

Fig. 2.3. Currents in Cook Inlet (adapted from Burbank 1977) overlayed upon bathymetry (adapted from Smith and Sandwell 1997).

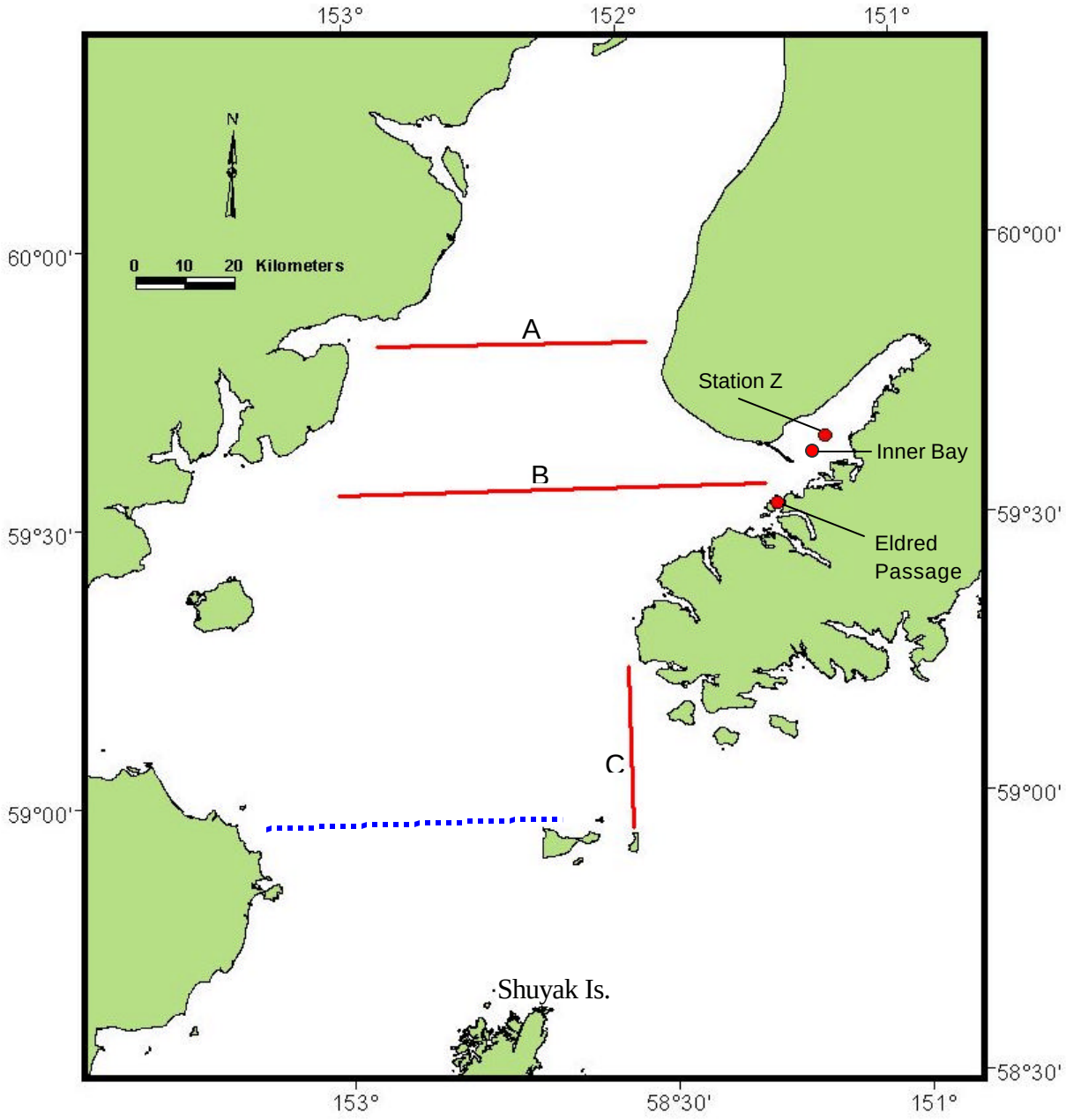

Fig. 2.4. Locations of CTD transects and long term monitoring stations in Cook Inlet. Red lines represent transects near seabird colonies that were sampled annually in 1995-1999. The blue dashed line represents the additional area of lower Cook Inlet sampled in 1996. Red dots represent stations that were monitored throughout the summers of 1995-1999.

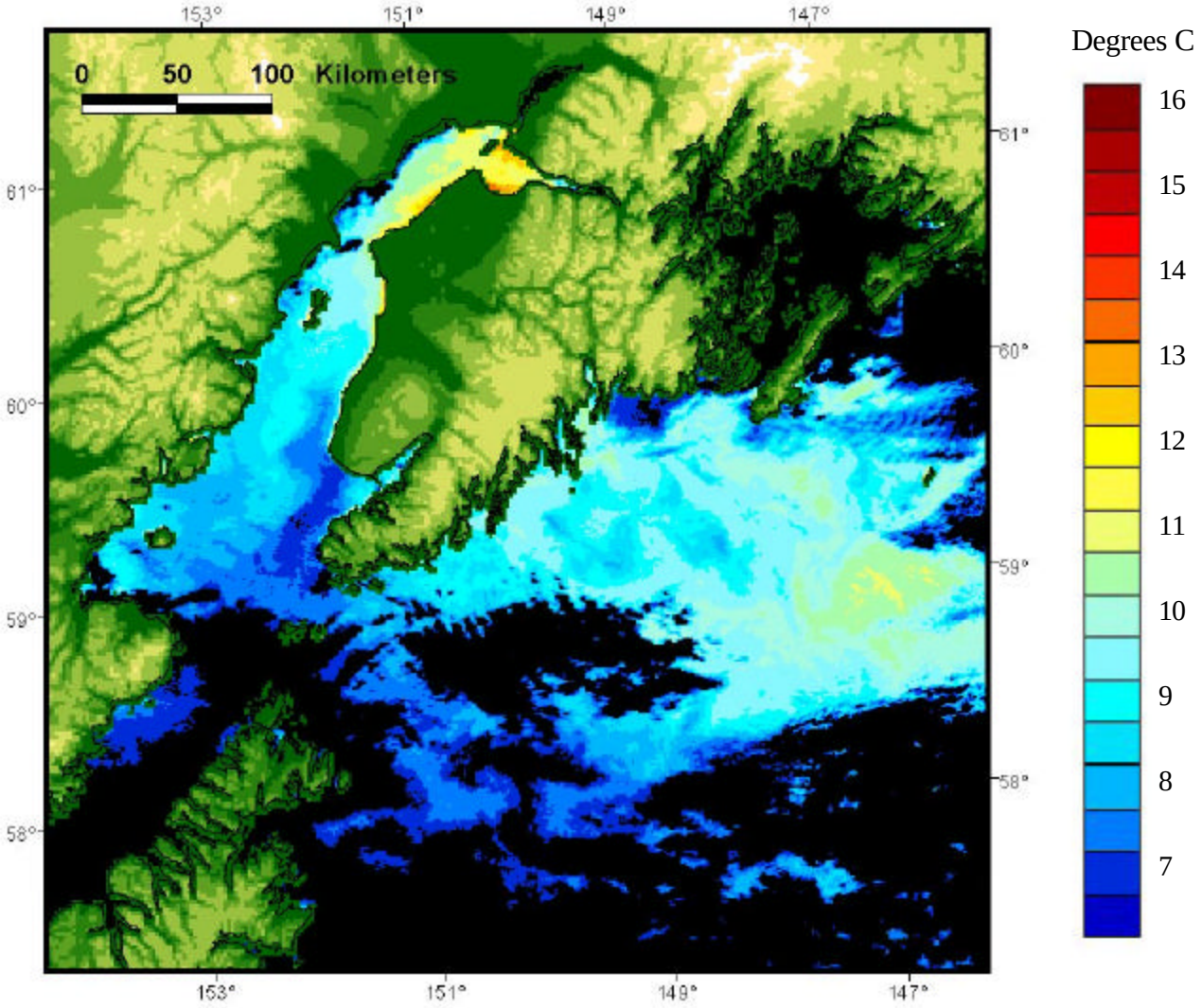

Fig. 2.5. NOAA 12 AVHRR Channel 4 sea surface temperature for Cook Inlet, July 22, 1995. Blacked out areas represent the presence of cloud cover. Topographic relief of the land illustrates drainages in the area (data is from Smith and Sandwell 1997).

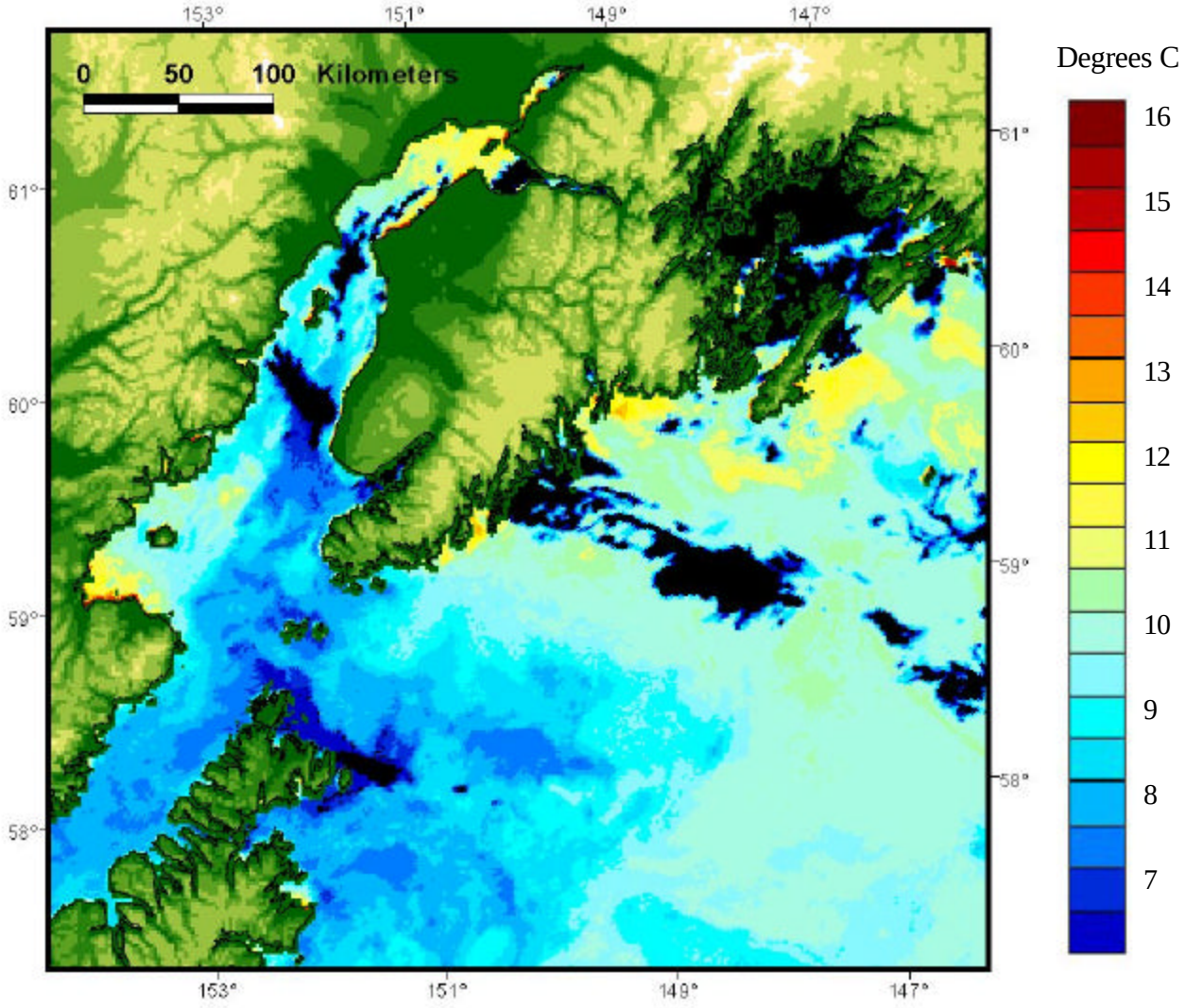

Fig. 2.6. NOAA 12 AVHRR Channel 4 sea surface temperature for Cook Inlet, July 16, 1996. Blacked out areas represent the presence of cloud cover. Topographic relief of the land illustrates drainages in the area (data is from Smith and Sandwell 1997).

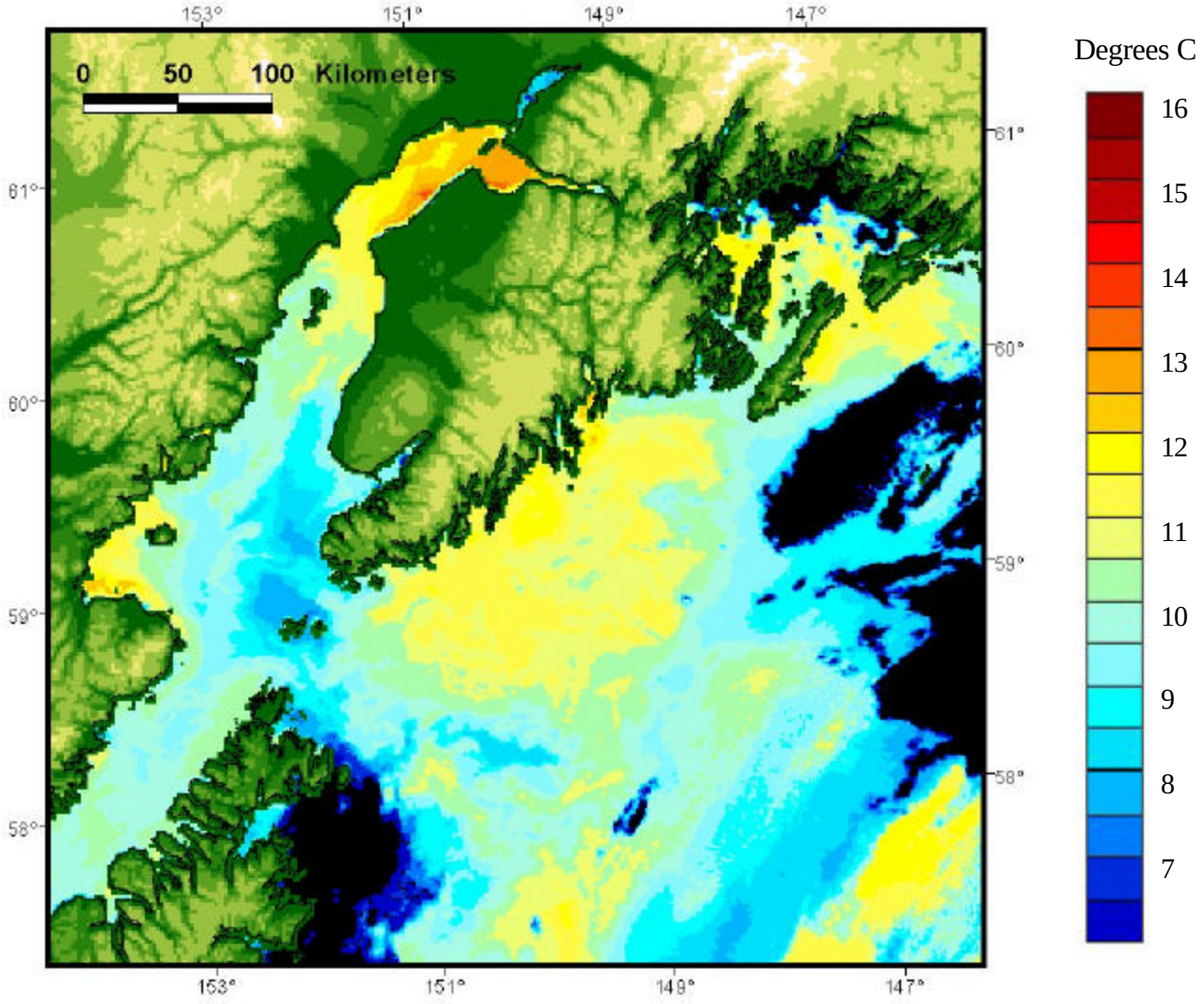

Fig. 2.7. NOAA 12 AVHRR Channel 4 sea surface temperature for Cook Inlet, July 27, 1997. Blacked out areas represent the presence of cloud cover. Topographic relief of the land illustrates drainages in the area (data is from Smith and Sandwell 1997).

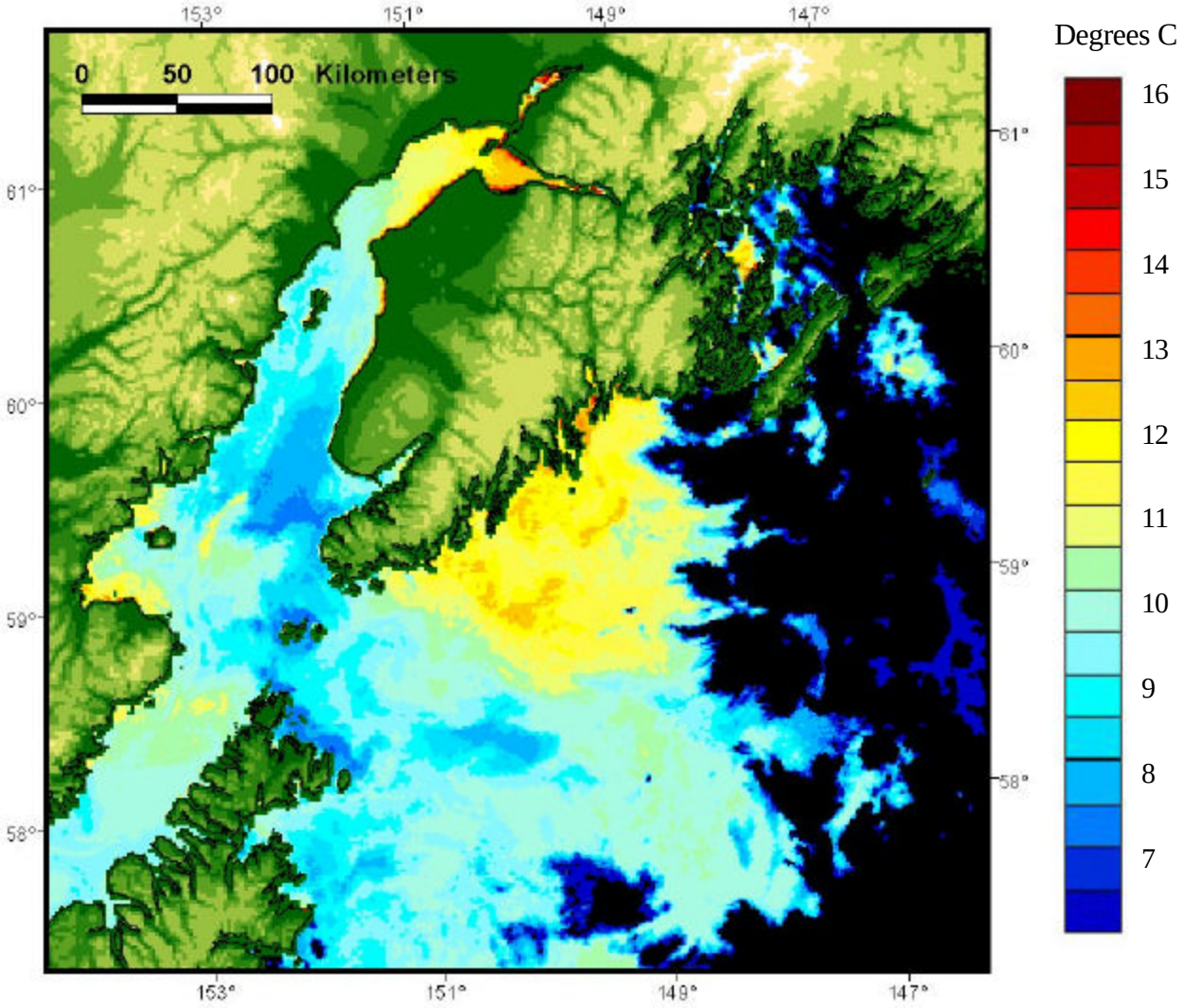

Fig. 2.8. NOAA 12 AVHRR Channel 4 sea surface temperature for Cook Inlet, July 14, 1998. Blacked out areas represent the presence of cloud cover. Topographic relief of the land illustrates drainages in the area (data is from Smith and Sandwell 1997).

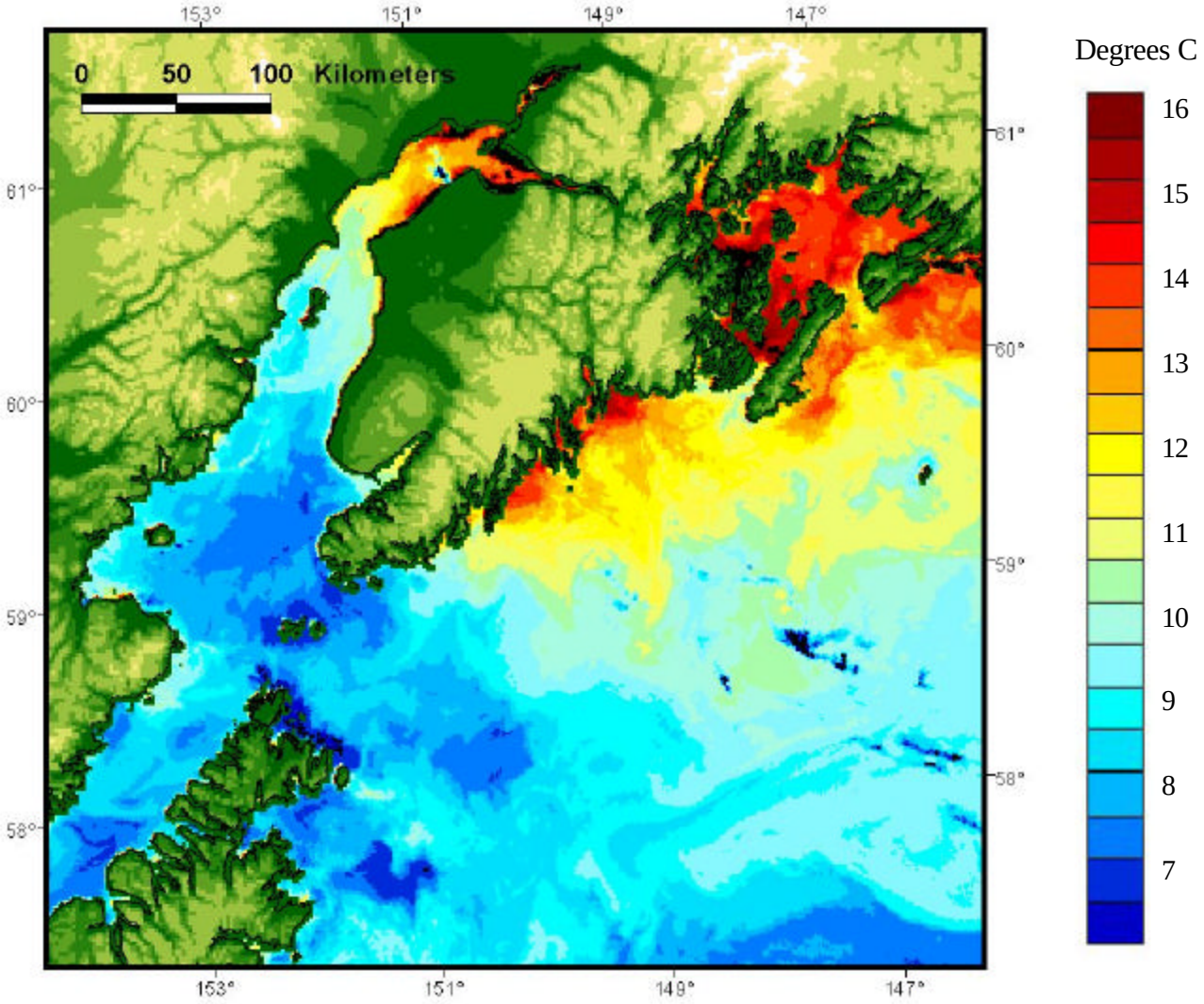

Fig. 2.9 NOAA 12 AVHRR Channel 4 sea surface temperature for Cook Inlet, July 3, 1999. Blacked out areas represent the presence of cloud cover. Topographic relief of the land illustrates drainages in the area (data is from Smith and Sandwell 1997).

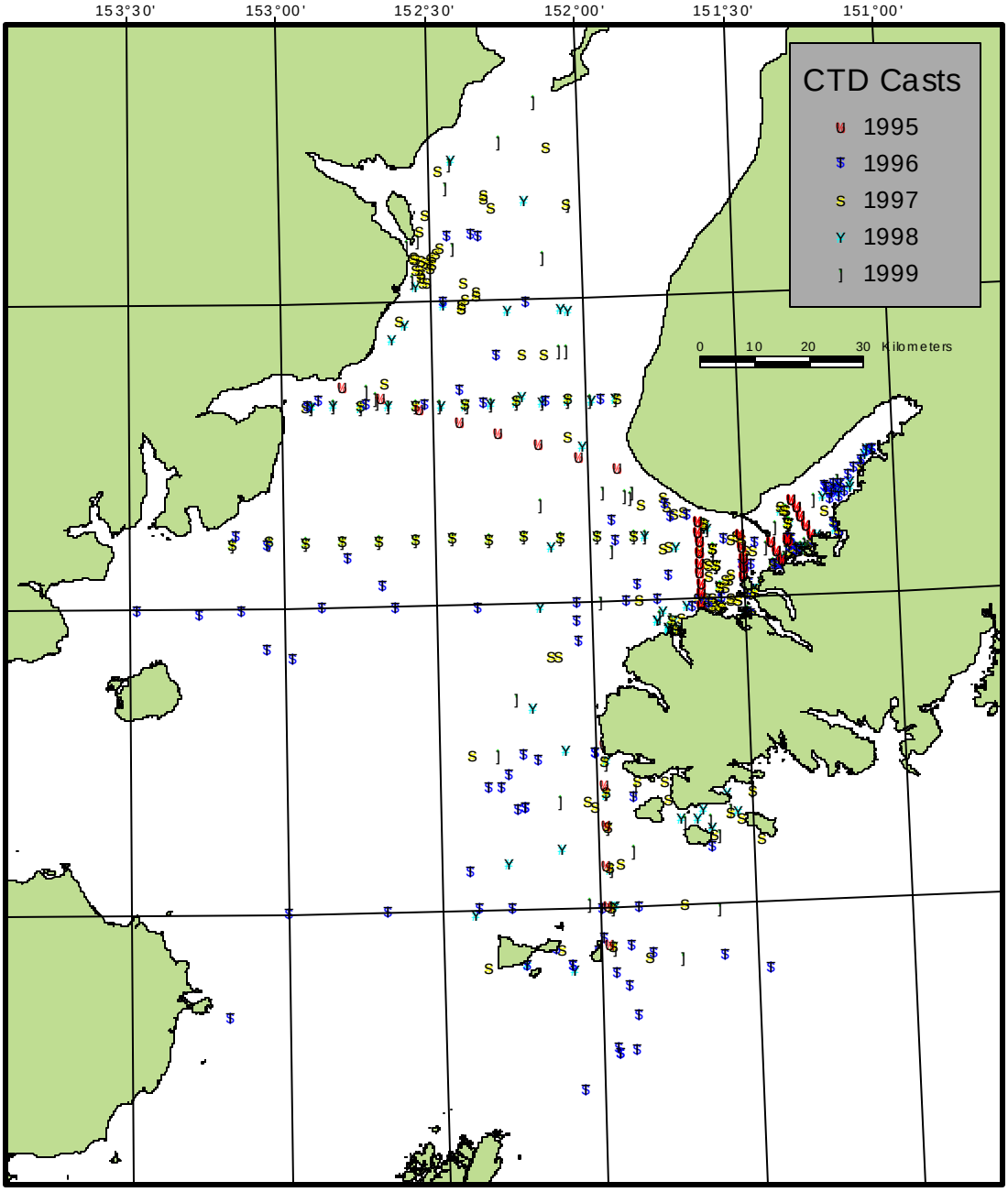

Fig. 2.10. All CTD casts conducted in Cook Inlet during 1995-1999. A total of 856 casts are represented, but some casts within and between years are obscured.

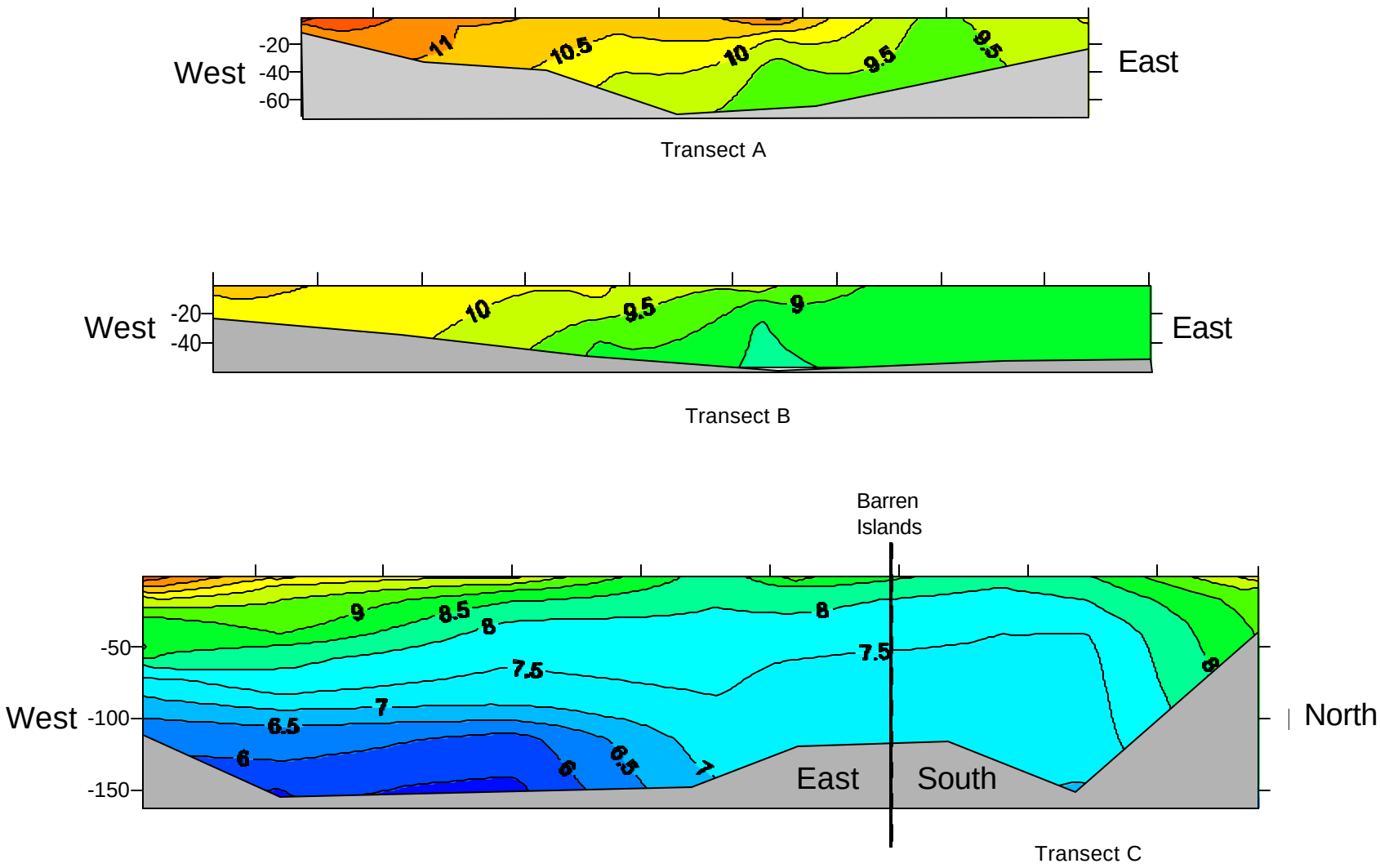

Fig. 2.11. Comparison of vertical temperature profiles on three different transects of Cook Inlet in 1996. Note that the Barren Islands transect was a dog-leg (see Fig. 2.4), being mostly an east-west transect westward of the Barren islands, and a north-south transect eastward of the Barrens (crossing Kennedy Entrance).

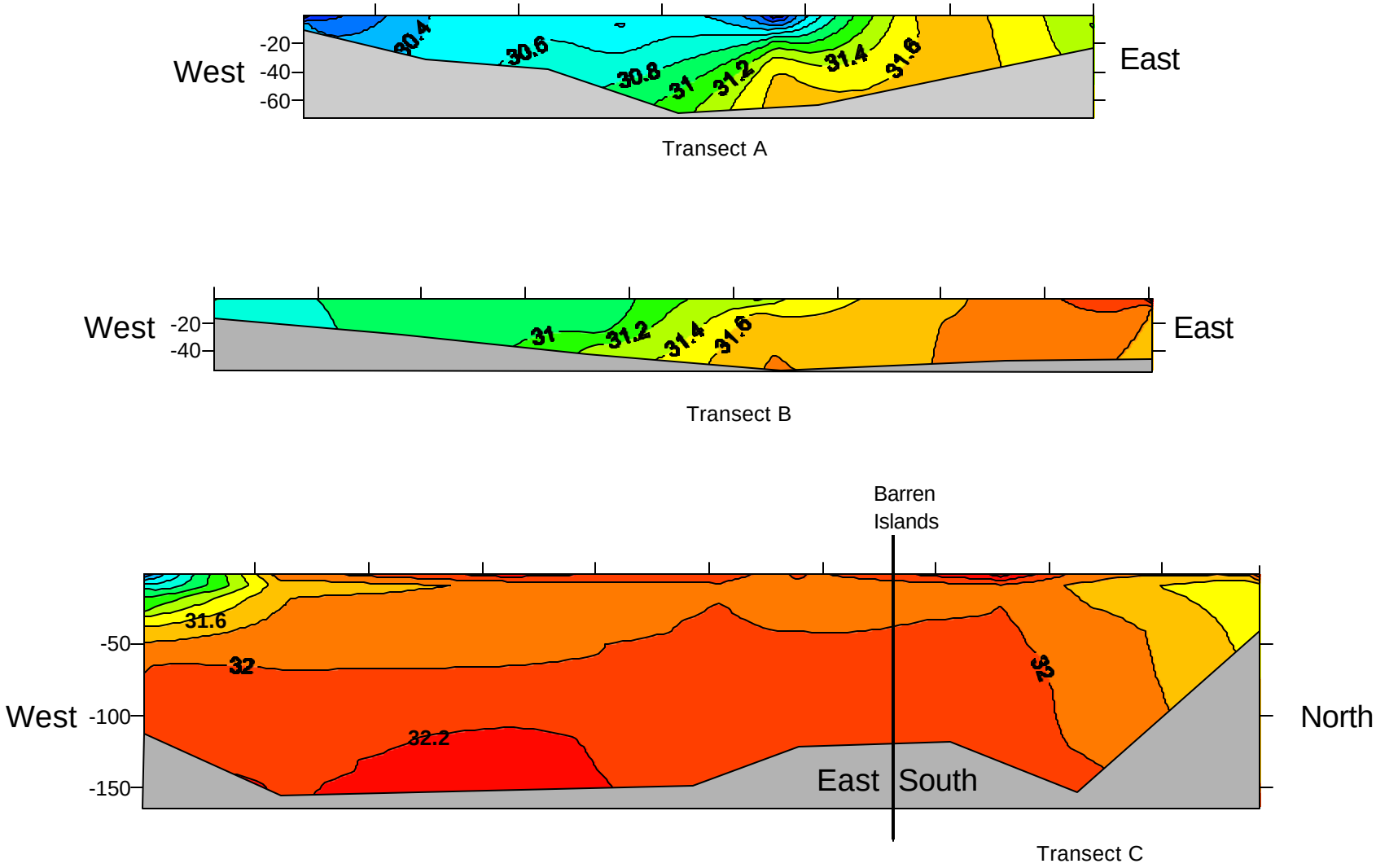

Fig. 2.12. Comparison of vertical salinity profiles on three different transects of Cook Inlet in 1996. Note that the Barren Islands transect was a dog-leg (see Fig. 2.4), being mostly an east-west transect westward of the Barren islands, and a north-south transect eastward of the Barrens (crossing Kennedy Entrance).

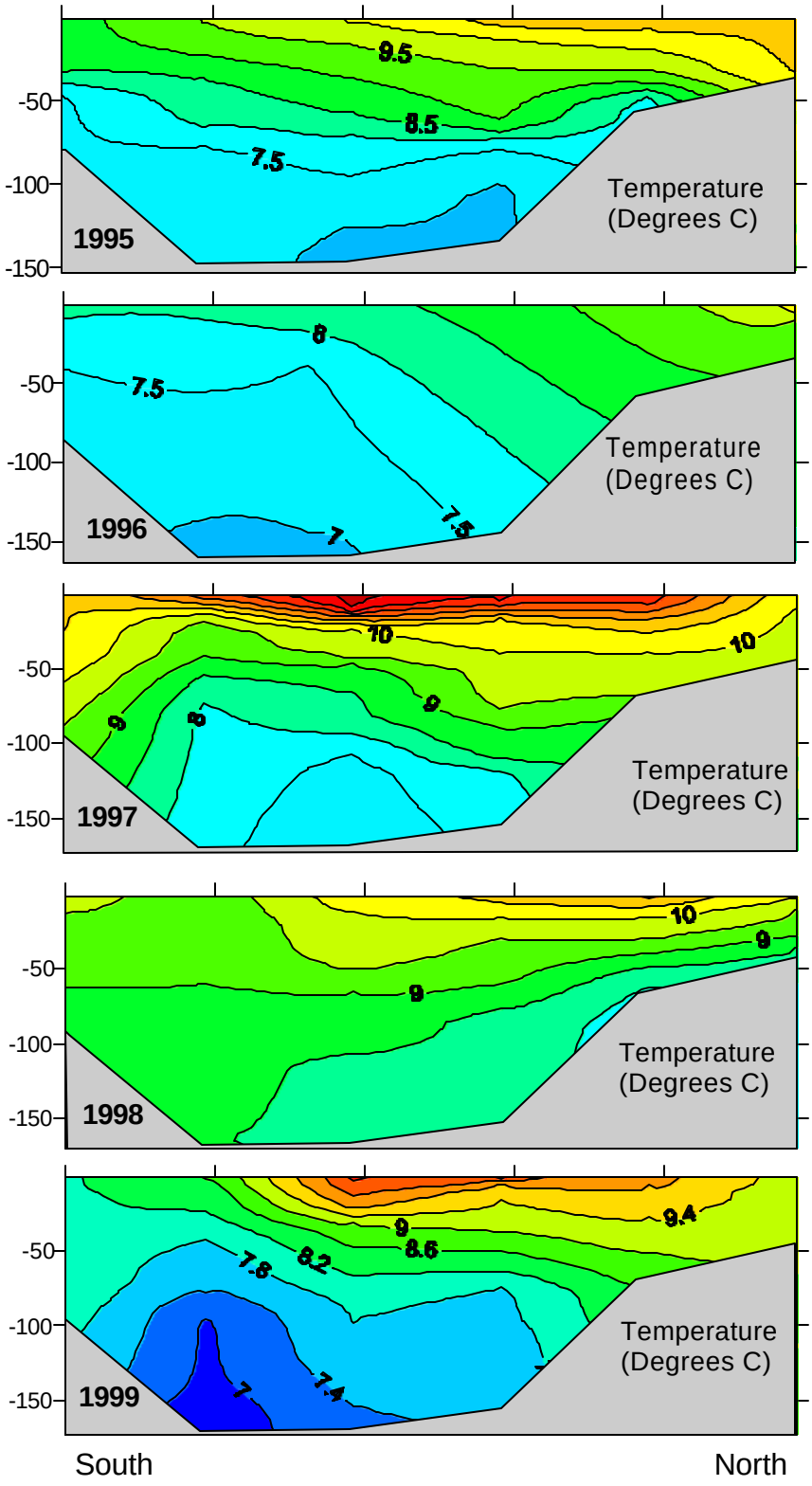

Fig. 2.13. Inter-annual variation in vertical temperature profiles of Kennedy Entrance in lower Cook Inlet (Transect C). This transect ran northward from the Barren Islands to the Kenai Peninsula (see Fig. 2.4). Data were collected in August during each year (1995-1999).

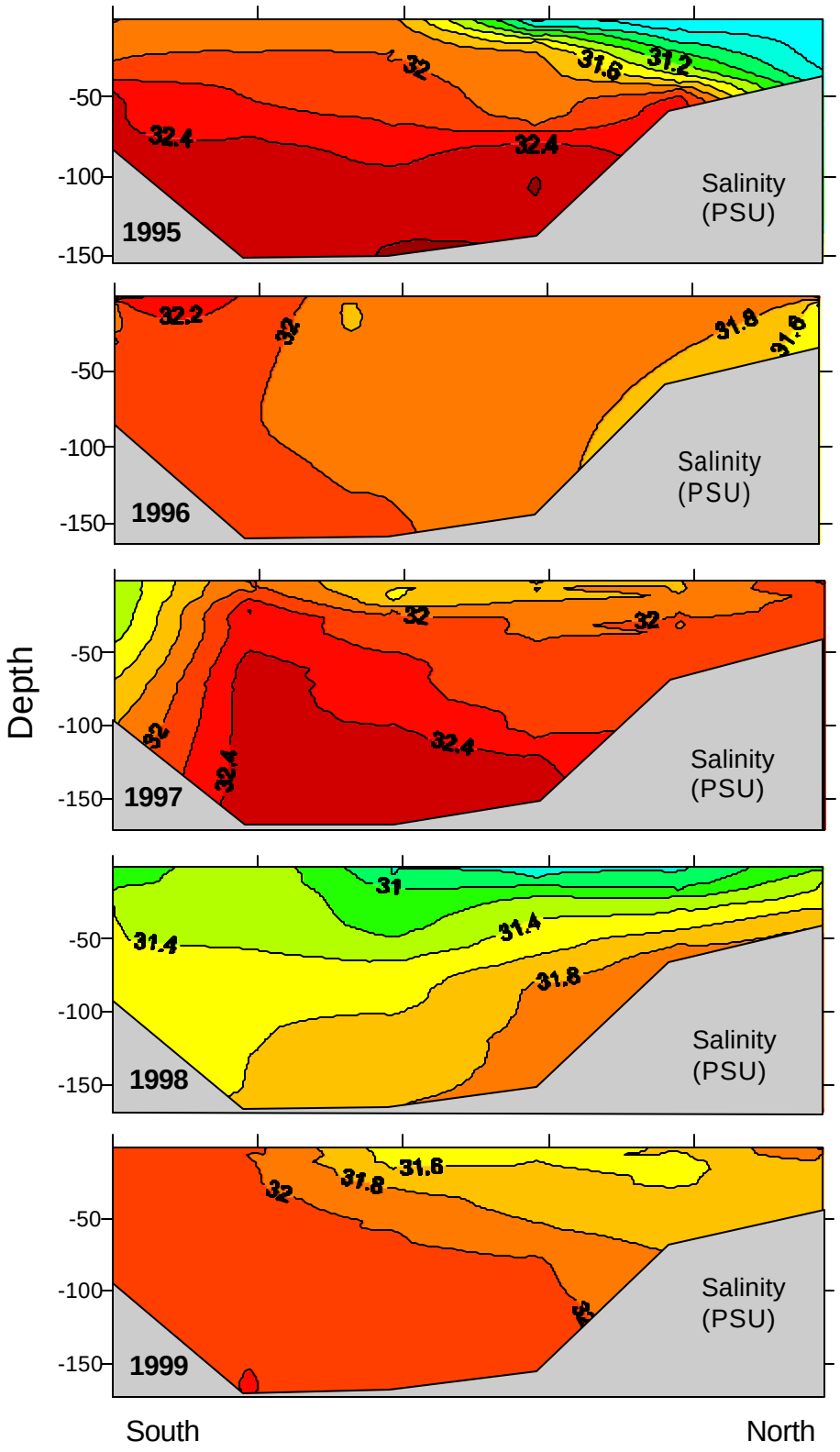

Fig. 2.14. Inter-annual variation in vertical salinity profiles of Kennedy Entrance in lower Cook Inlet (Transect C). This transect ran from northward from the Barren Islands to the Kenai Peninsula (see Fig. 2.4). Data were collected in August during each year (1995-1999).

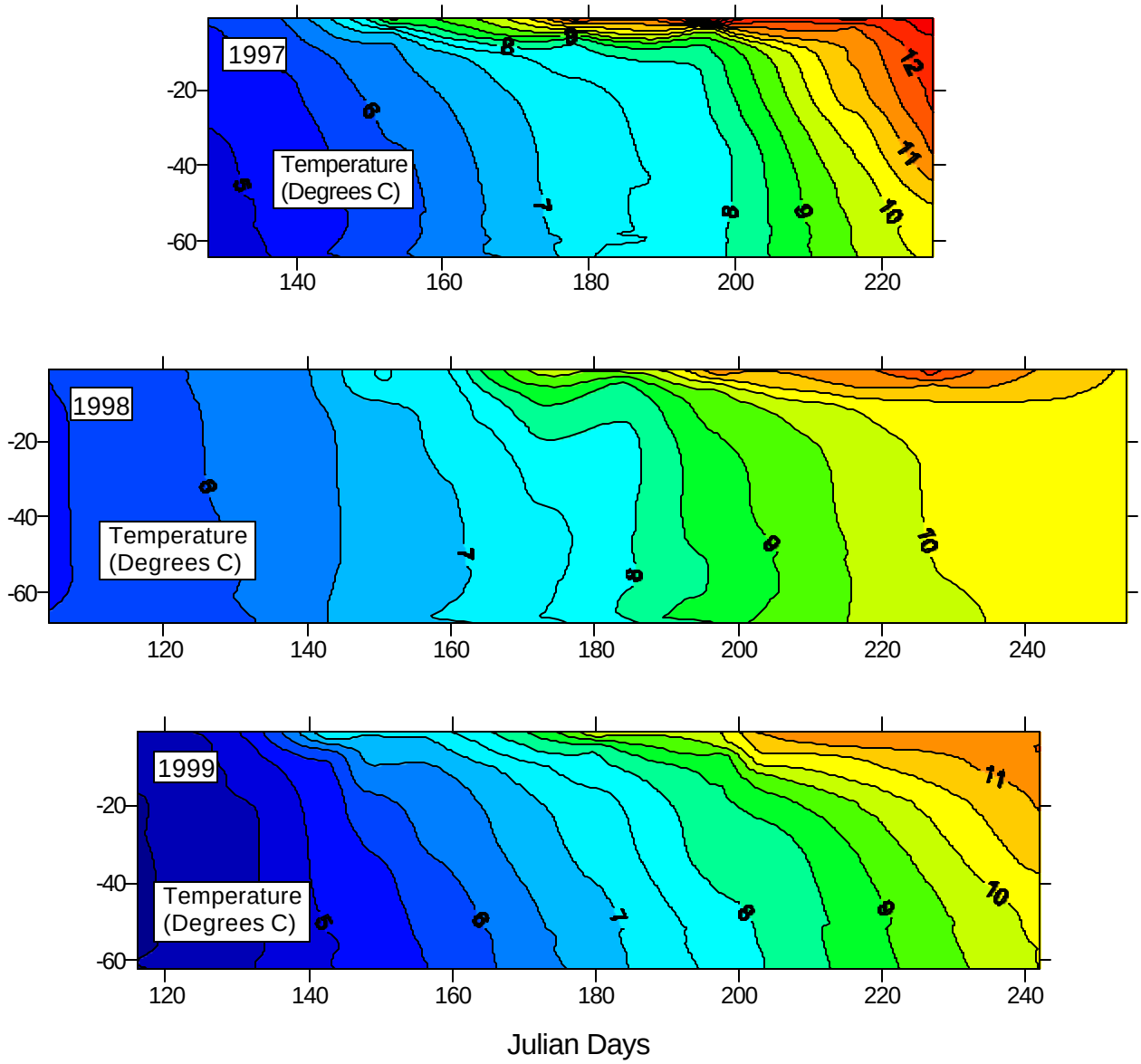

Fig. 2.15. Seasonal development of thermal stratification at the Eldred Passage station in Kachemak Bay, during 1997 to 1999.

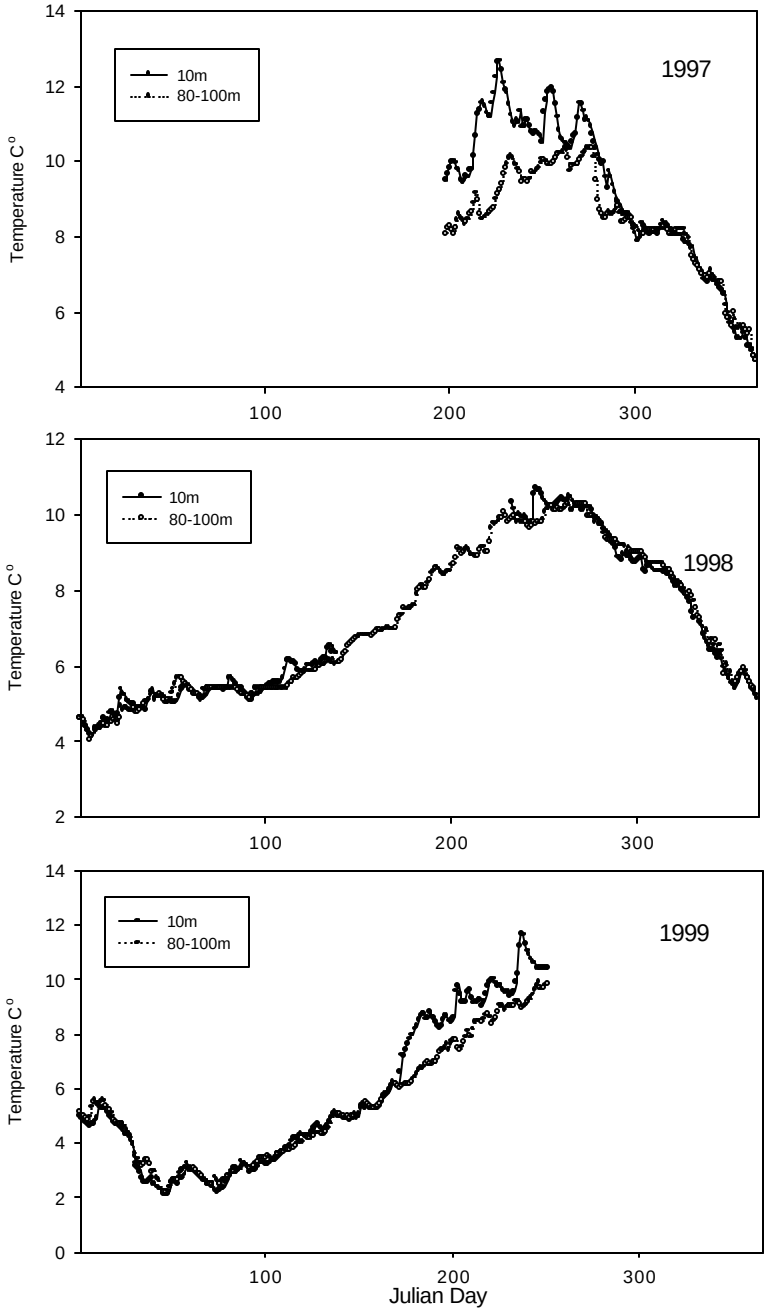

Fig. 2.16. Seasonal variability in surface and bottom temperatures near Hesketh Island, Kachemak Bay, during 1997 to 1999. When surface and bottom temperatures were the same, waters were completely mixed. When they differed, waters were thermally stratified.

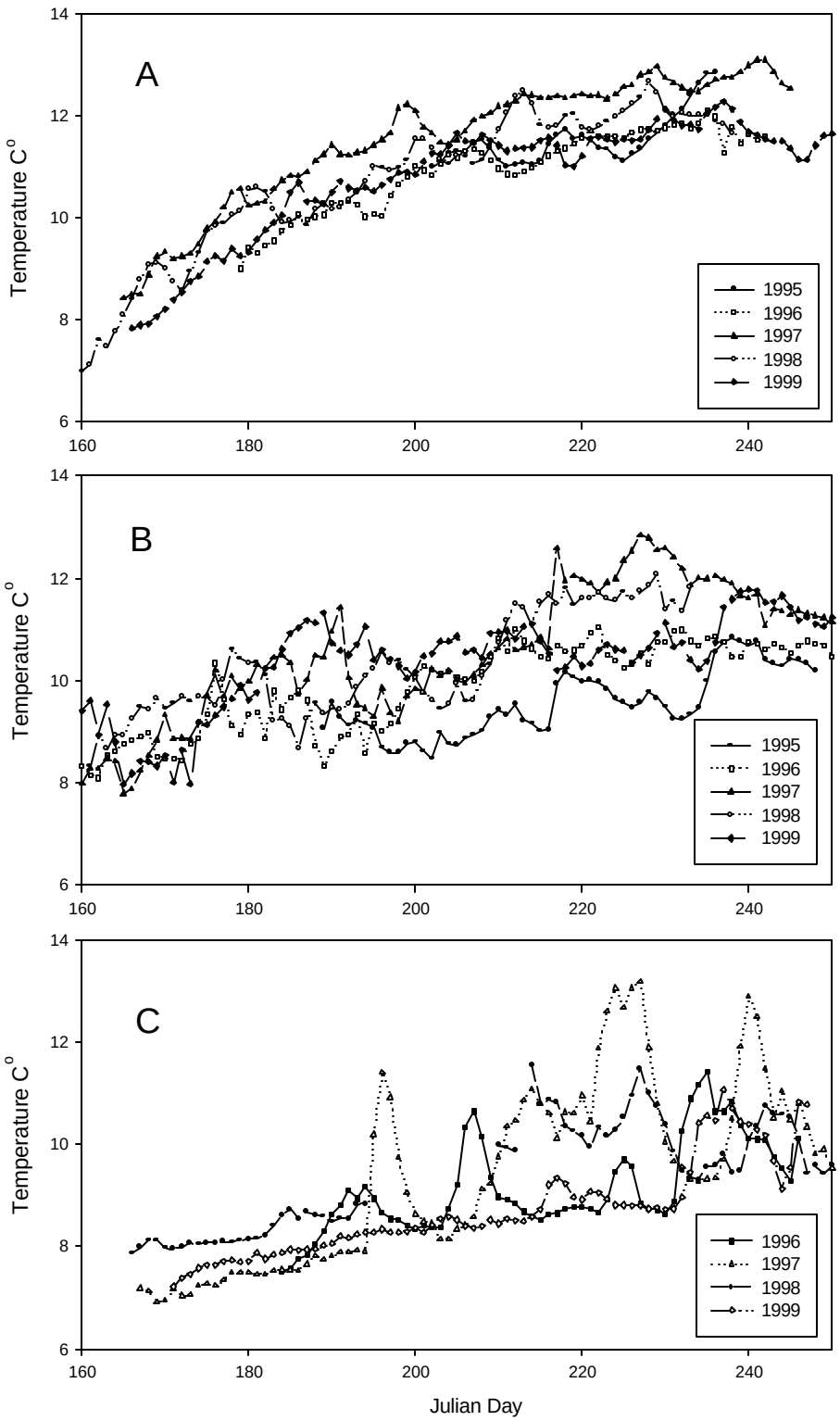

Fig. 2.17. Seasonal variability in sea surface temperatures at the three study sites during 1995 to 1999. Temperature loggers were placed 3-10m below the low tide line. Data plotted for each colony: A= Chisik Island, B= Gull Island, and, C= East Amatuli Island (Barrens).

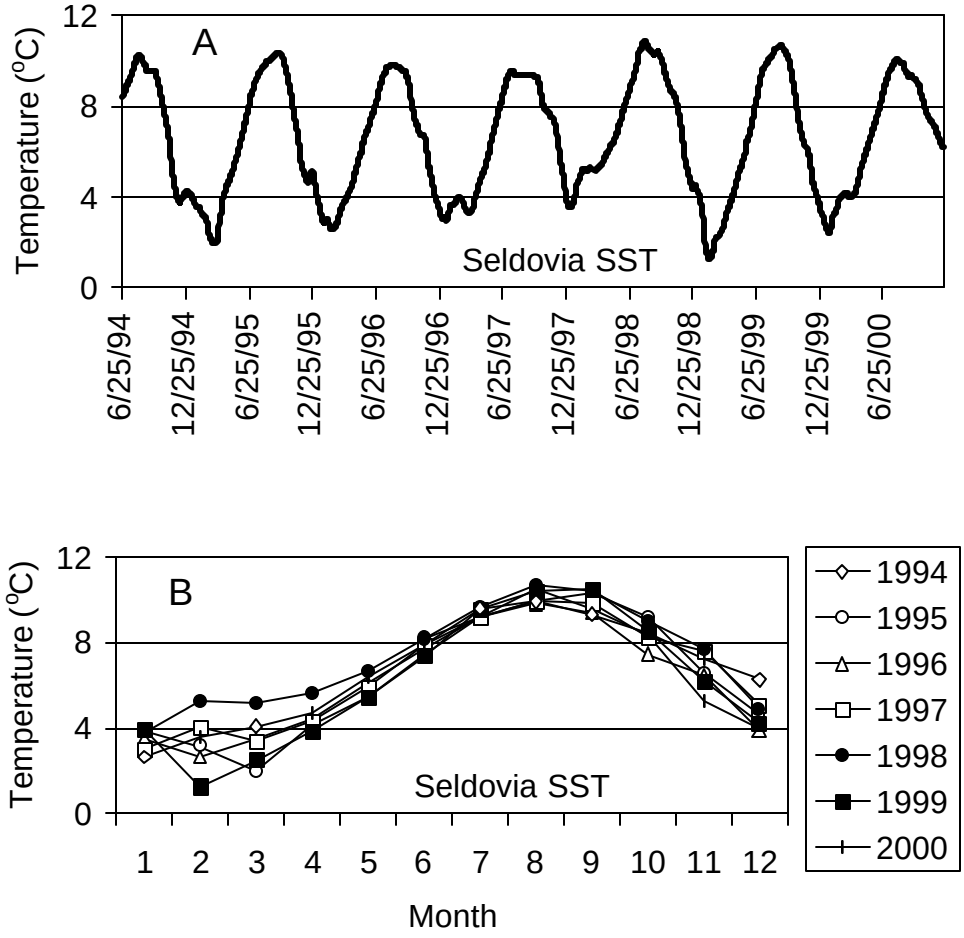

Fig. 2.18. Continuously recorded fluctuations in sea surface temperature at Seldovia Harbor, Kachemak Bay, from June 1994 to December 2000. Upper graph "A" shows continuous cycle in daily temperature for >6 years. Lower graph "B" shows mean monthly temperatures for each year of observation. Data from NOAA: http://co-ops.nos.noaa.gov .

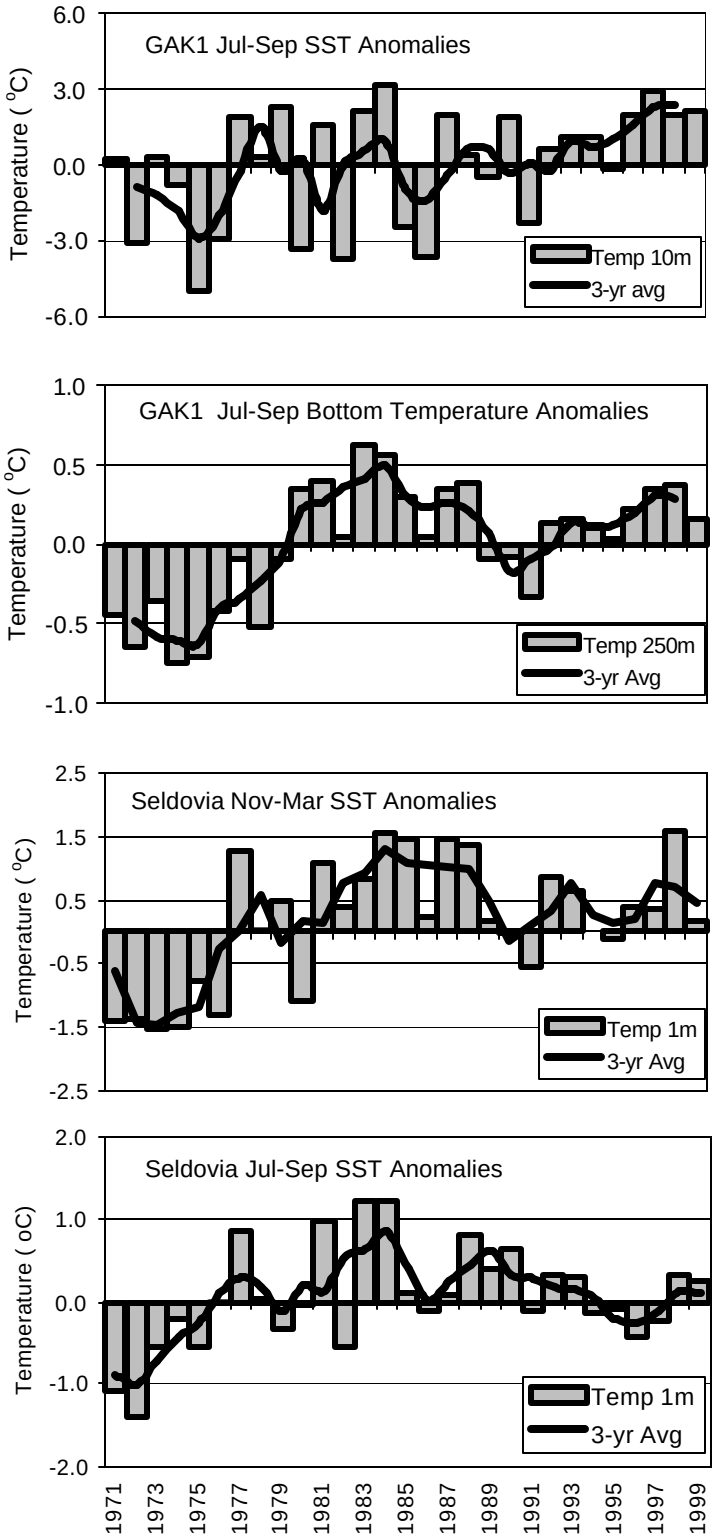

Fig. 2.19. Temperature anomalies in the Gulf of Alaska and Cook Inlet, 1971-1999. Top two graphs show anomalies at surface (10 m) and at 250 m depth. Bottom two graphs show anomalies in sea surface temperature (SST) at Seldovia during winter and summer. Three-year running averages are superimposed on each plot of mean annual temperature. Data from University of Alaska at Fairbanks: http://www.ims.uaf.edu:8000/gak1 .

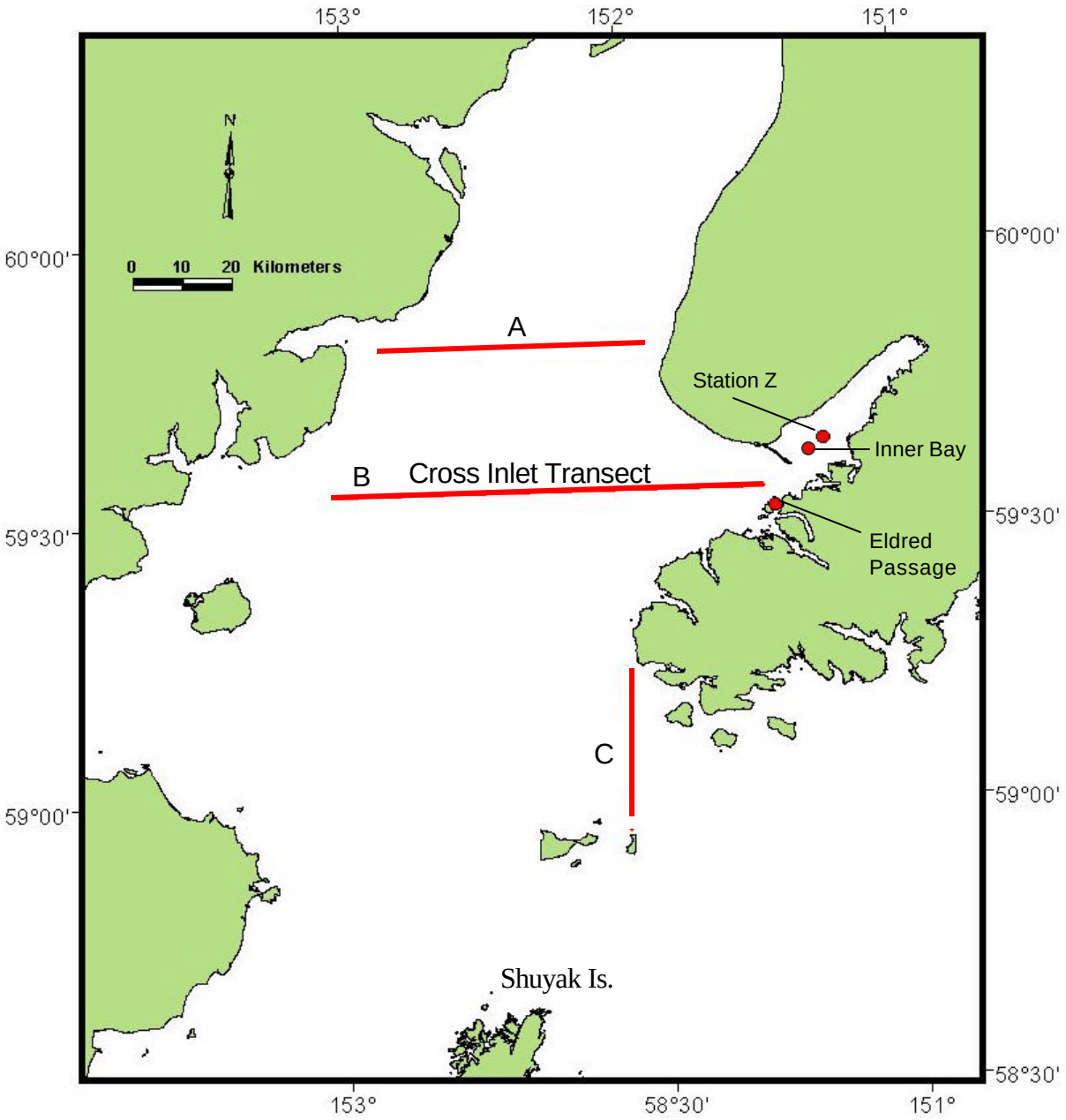

Fig. 3.1. Locations of transects (red lines) and monitoring stations (red dots) where phytoplankton biomass was measured in Cook Inlet, 1997-1999. Letter designations (A, B, and C) indicate which transects are illustrated in Figs. 3.2 and 3.3.

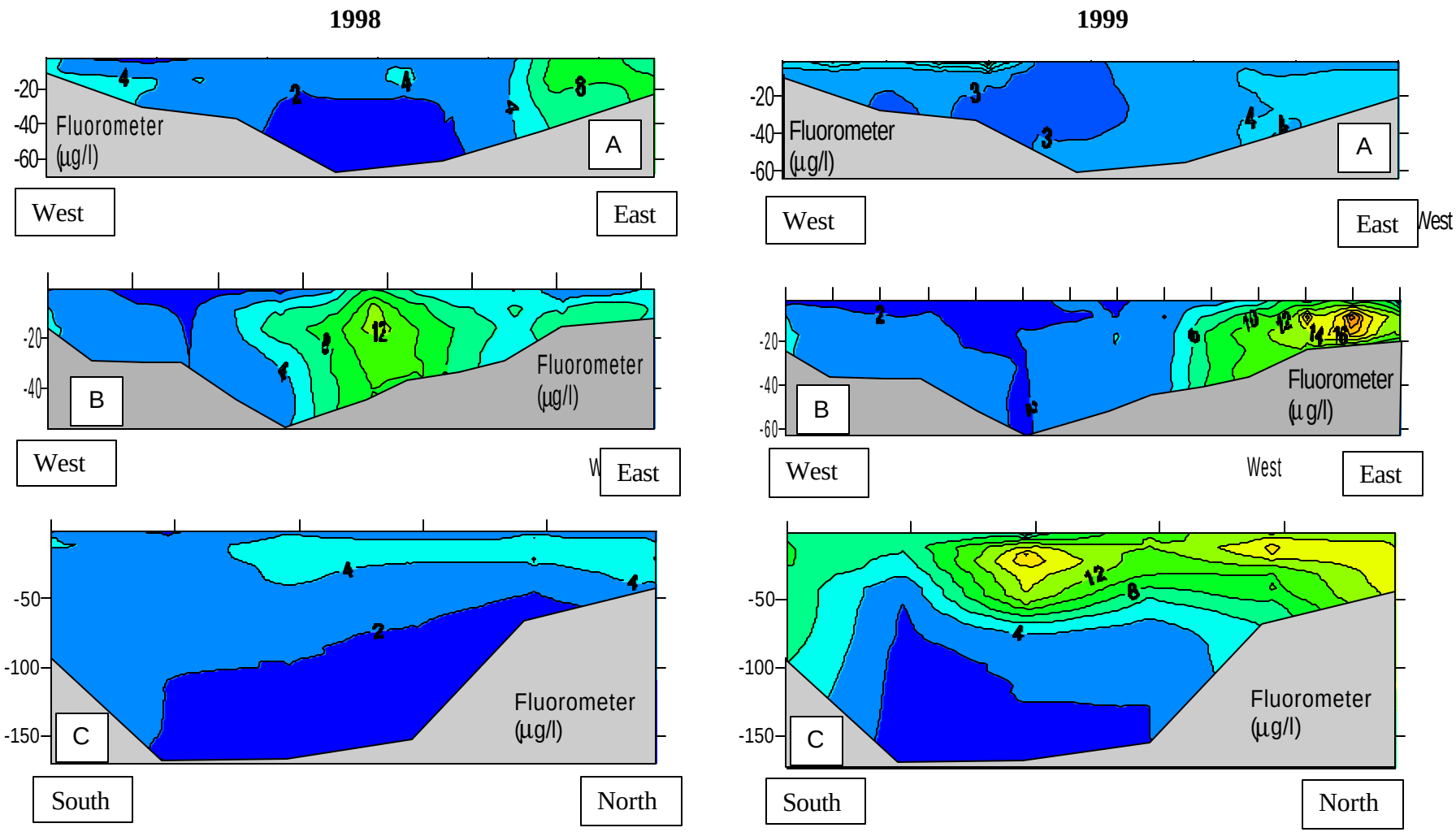

Fig. 3.2. Fluorometer measurements of chlorophyll concentrations on vertical profiles of transects A, B and C in Cook Inlet (see Fig. 3.1). Data were collected in late July - early August of 1998 and 1999.

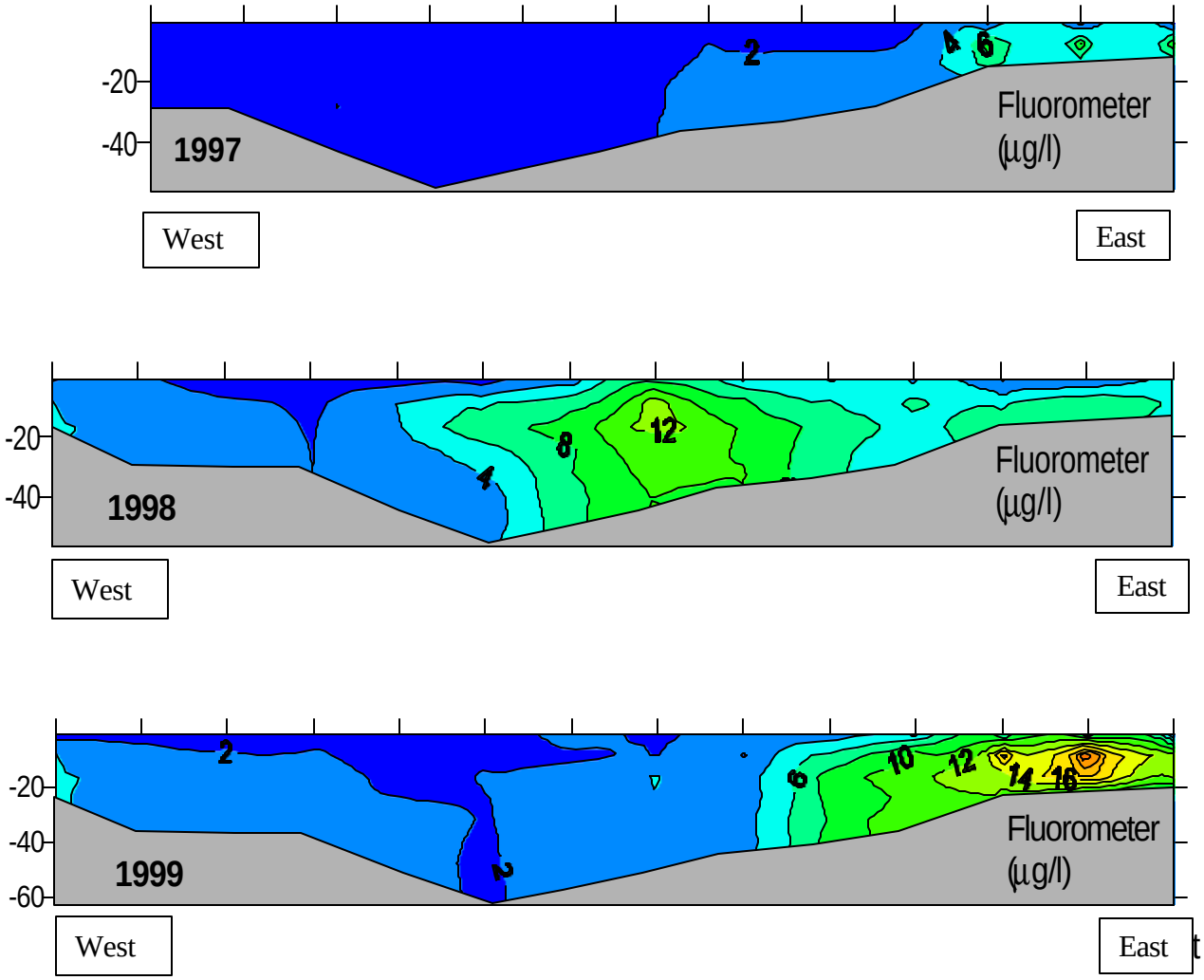

Fig. 3.3. Fluorometer measurements of chlorophyll concentrations on vertical profiles of transect B (see Fig. 3.1), collected during the summers of 1997, 1998, and 1999.

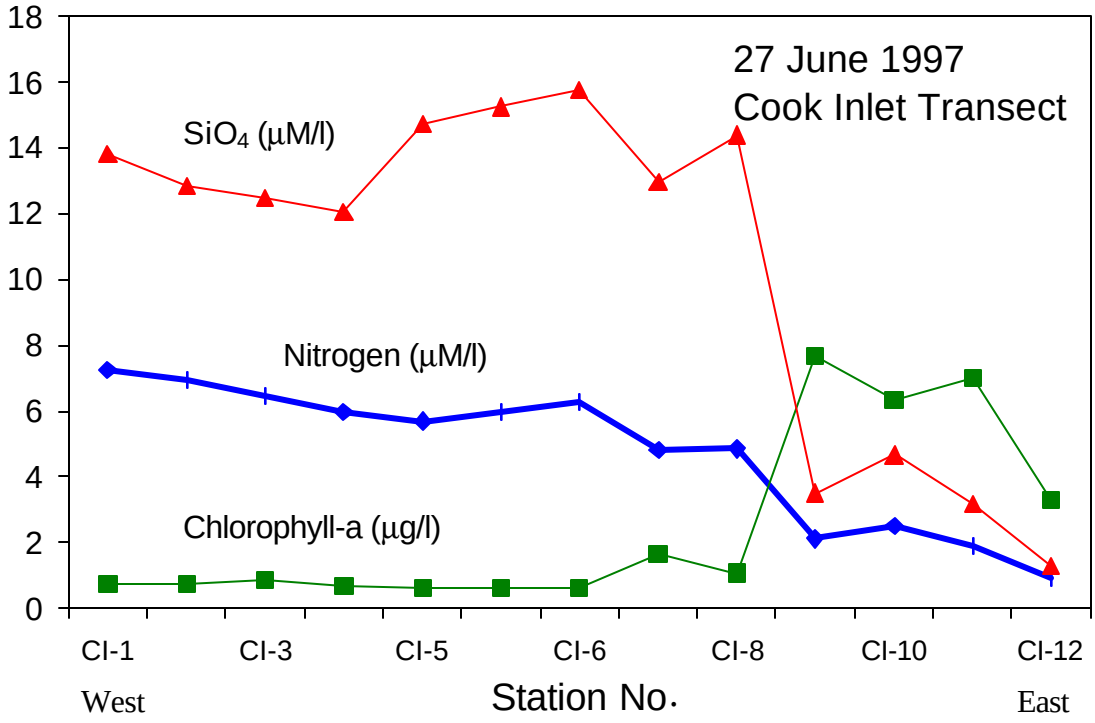

Fig. 3.4. Nutrient and chlorophyll concentrations across transect B in 1997. Compare with phytoplankton concentrations estimated with the fluorometer (Fig. 3.3) and zooplankton biomass (Fig. 3.8) on the same transect.

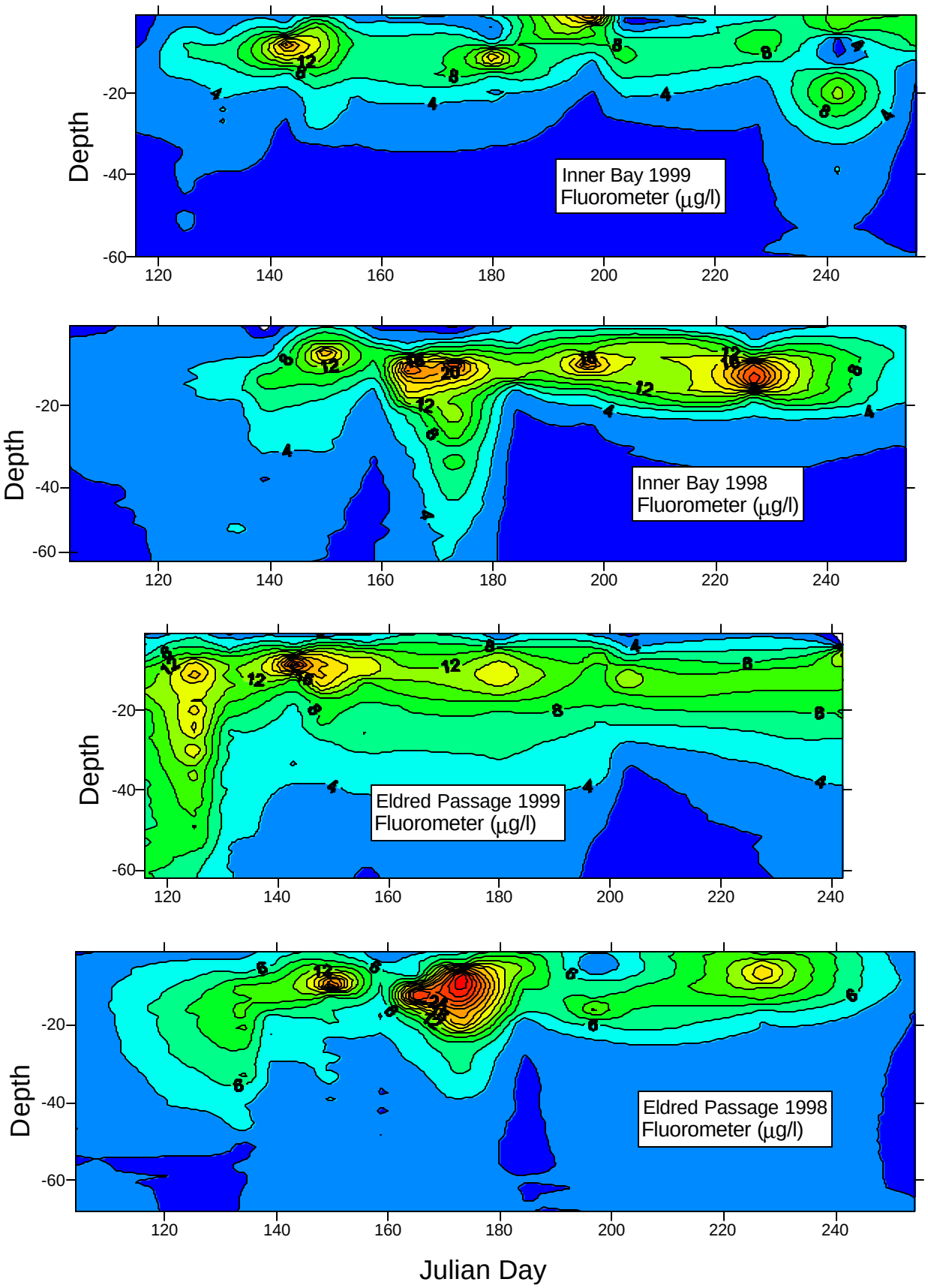

Fig. 3.5. Seasonal fluctuations in phytoplankton concentrations at Inner Bay and Eldred Passage monitoring sites in Kachemak Bay. Fluorometry profiles were collected throughout the summers of 1998 and 1999.

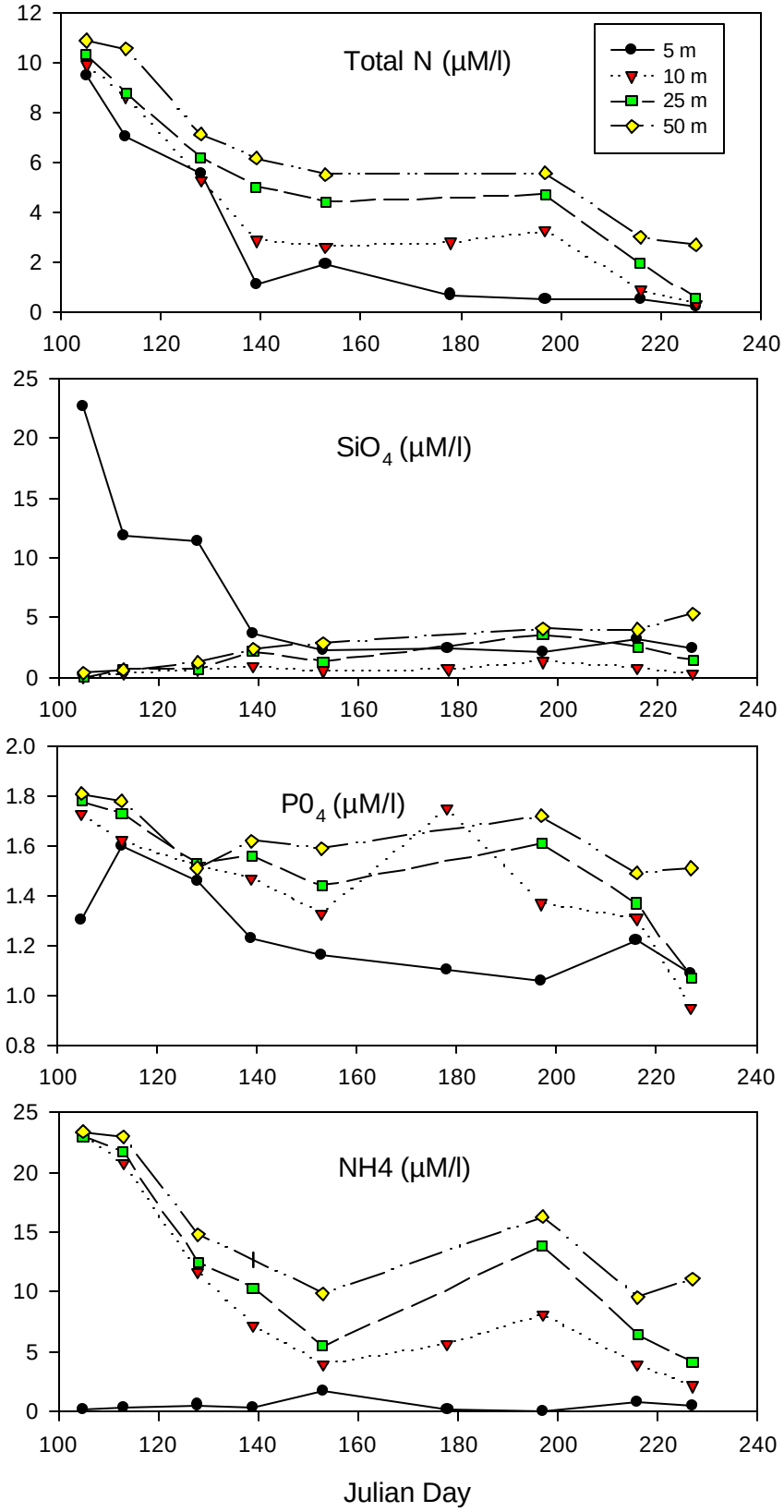

Fig. 3.6. Seasonal variability in nutrient concentrations at 5, 10, 25, and 50 meter depths at the Eldred Passage monitoring station. Data collected from April 15 to August 15, 1997.

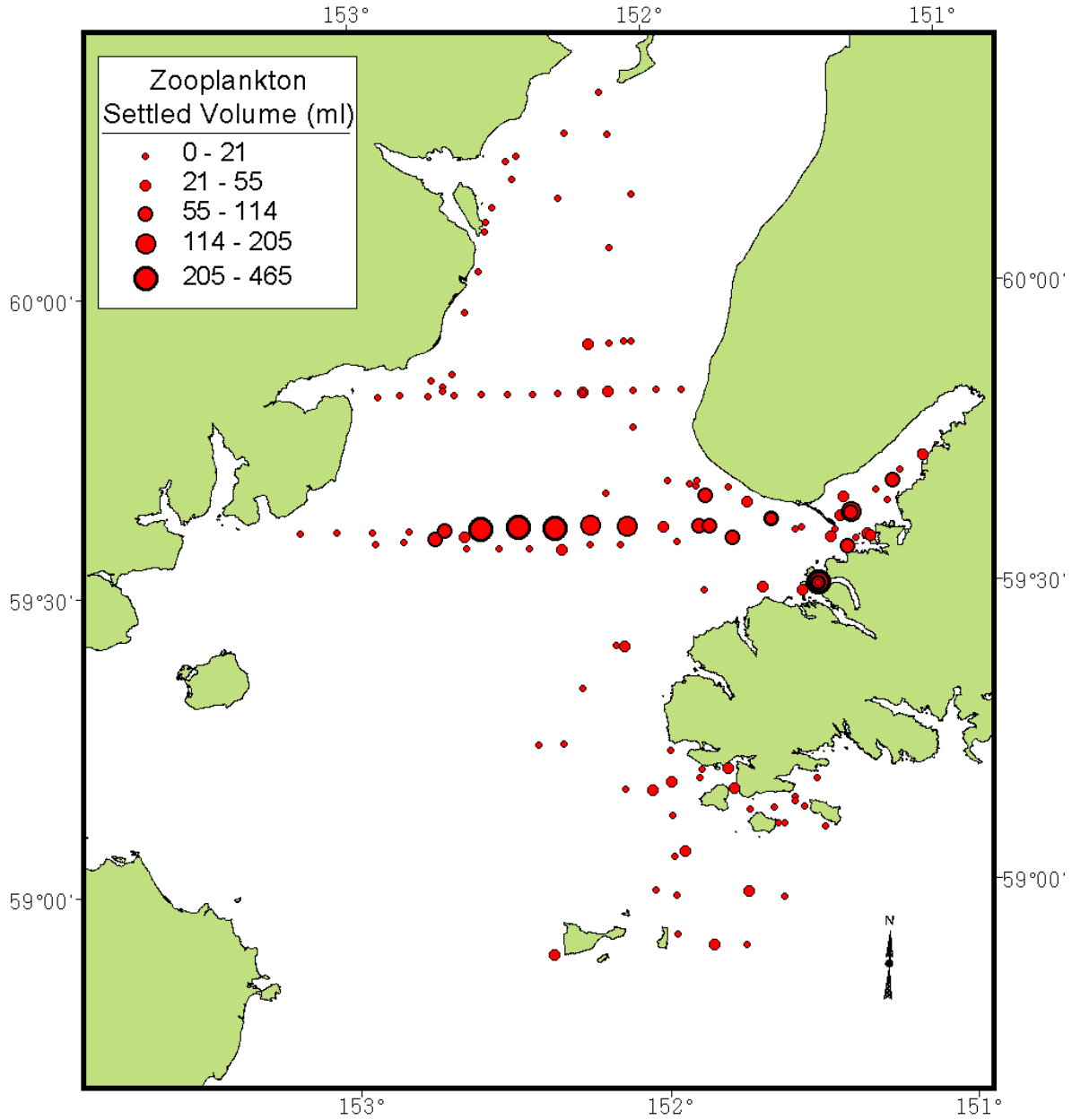

Fig. 3.7. Zooplankton biomass (settled volume) in samples collected in Cook Inlet at mid-water trawl stations, along CTD transects, and at monitoring stations in Kachemak Bay, during 1997-1999.

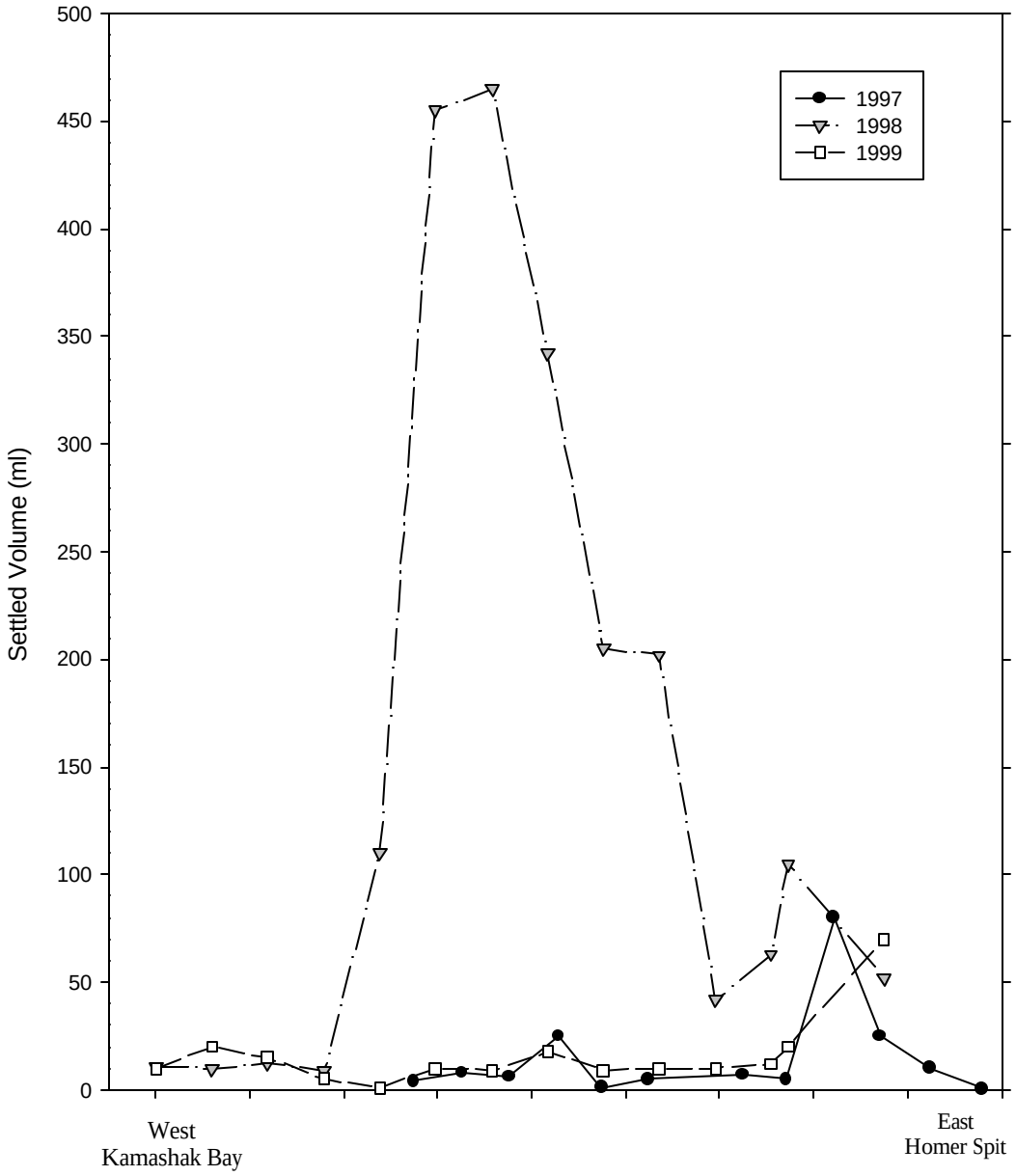

Fig. 3.8. Zooplankton biomass (settled volume) on transect B across lower Cook Inlet in 1997-1999. Compare with phytoplankton biomass on the same transects (Fig. 3.3).

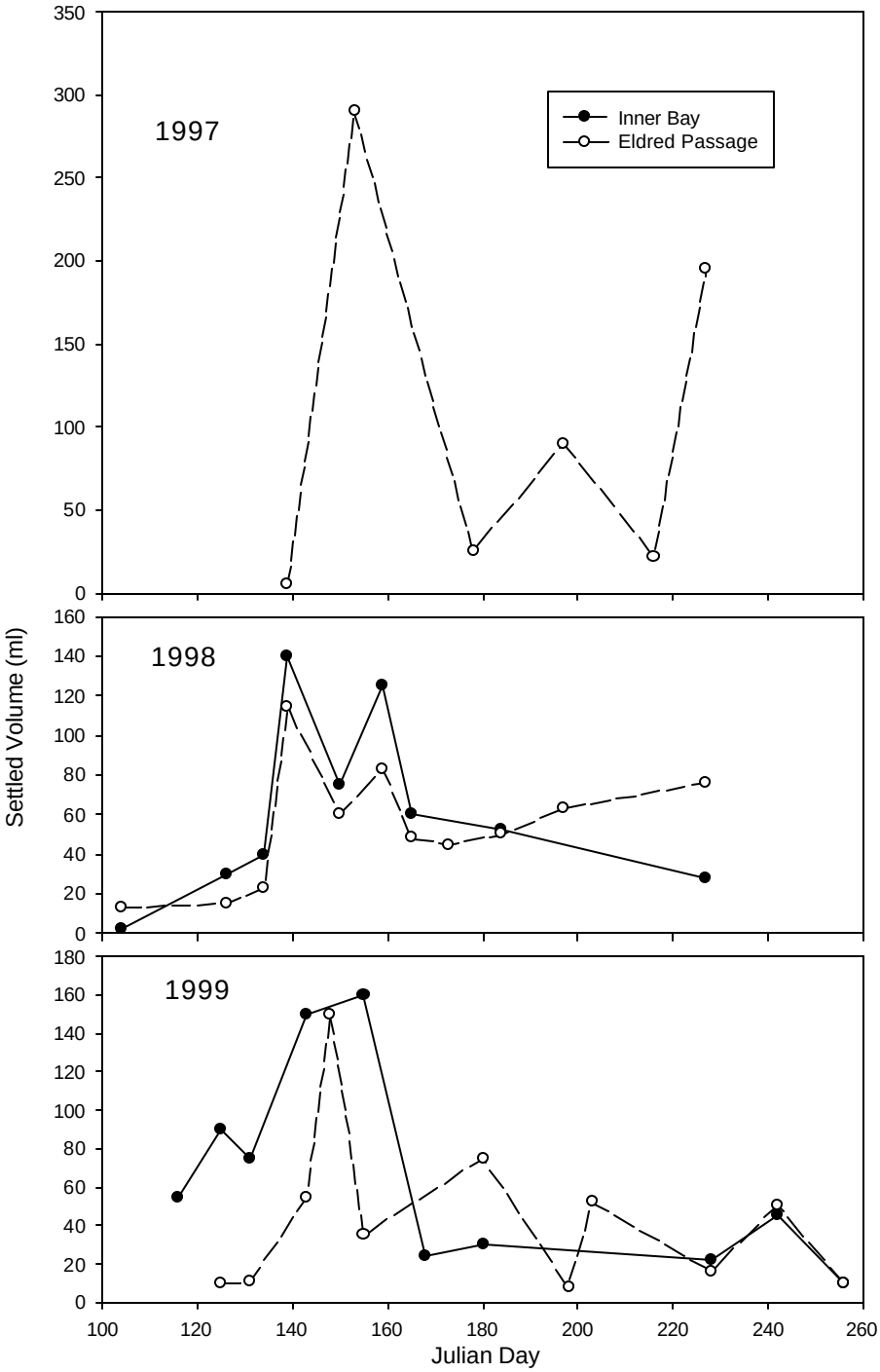

Fig. 3.9. Seasonal variation in zooplankton biomass (settled volume) at the Inner Bay and Eldred Passage monitoring sites in Kachemak Bay, 1997-1999.

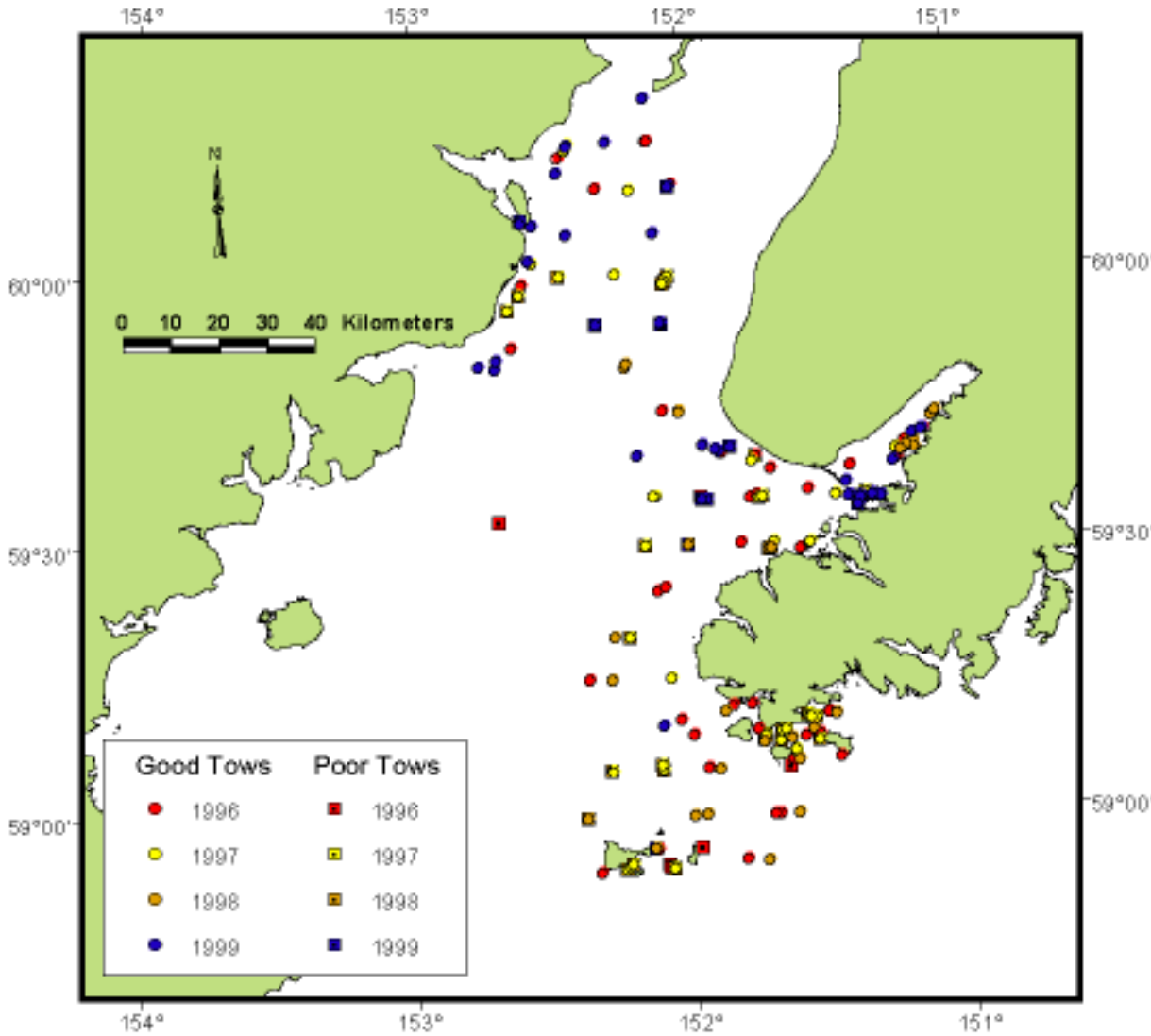

Figure 4.1. Stations sampled with mid-water trawl in lower Cook Inlet, 1996-1999. Shown are locations of "good tows" used in calculations of CPUE, and additional "poor tows" used for mapping distribution of species (Figs. 4.6-4.9). See Methods for details.

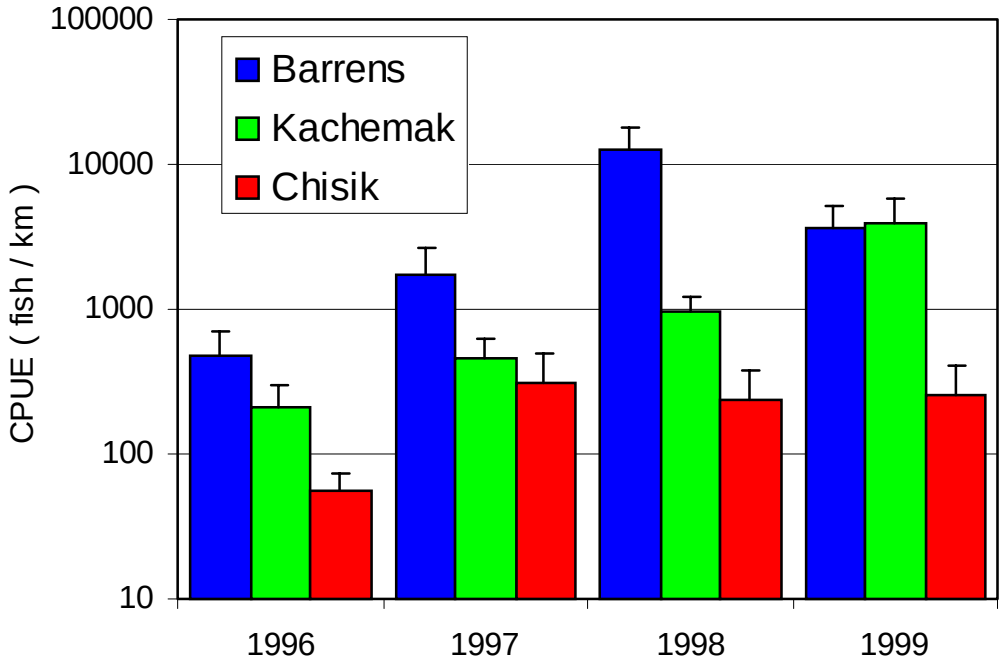

Figure 4.2. Mean catch-per-unit-effort (+ standard error) for all fishes captured from 1996 to 1999 at the Barren Islands, Kachemak Bay and near Chisik Island. Note logarithmic scale for CPUE.

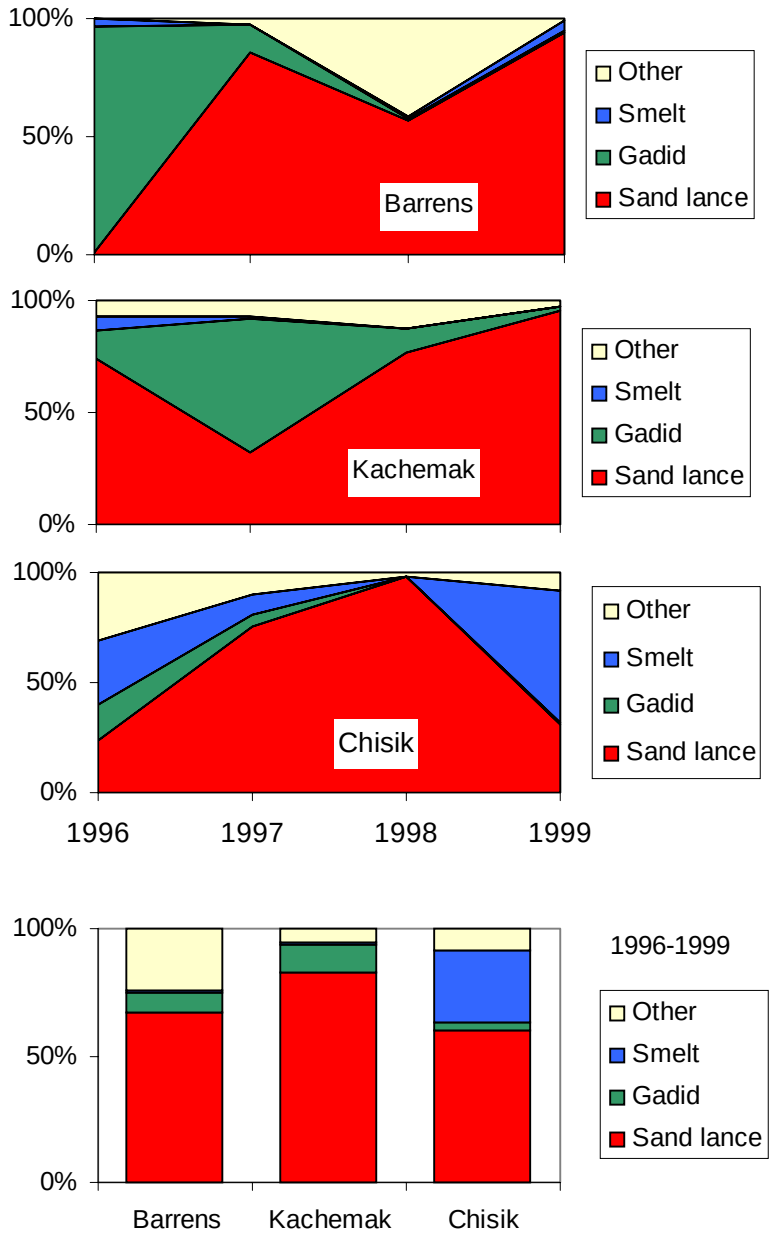

Figure 4.3. Species composition (% total numbers) of mid-water trawl catches near the Barren Islands, Kachemak Bay and Chisik Island in 1996-1999. "Gadids" include walleye pollock, Pacific cod, and saffron cod. "Smelt" include capelin, longfin smelt, eulachon and larval osmerids. For a complete list of 'other' species see appendices 4.2-4.4. The bottom graph shows the species composition in each area for all years combined.

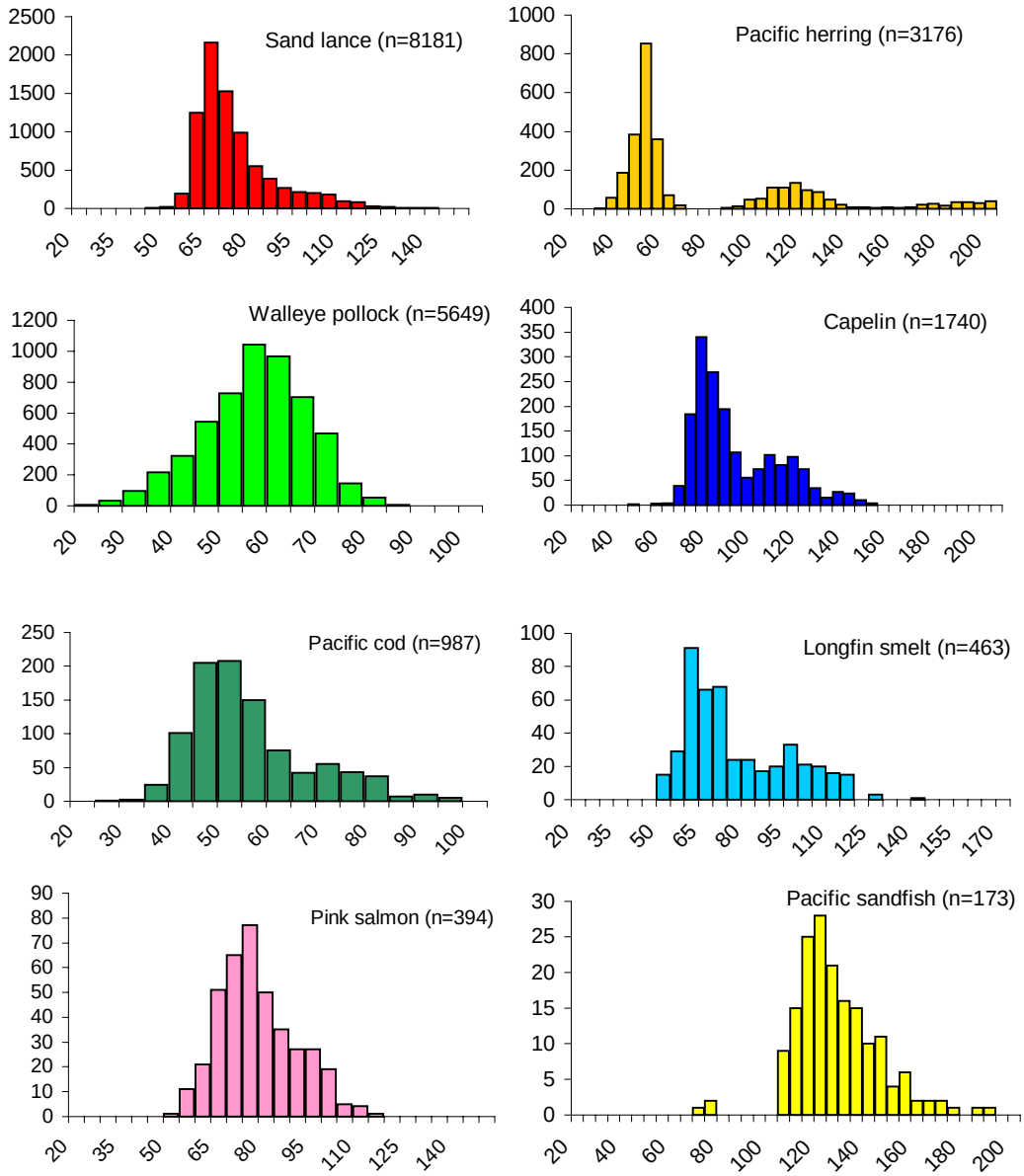

Figure 4.4. Length frequency histograms for the most common fish species caught in mid-water trawls in Cook Inlet, 1996-1999. Data are combined from all years and areas. In all graphs the y-axis is the frequency count (no. of fish) and the x-axis is fish fork length (in 5 mm bins). Numbers in parentheses are sample sizes.

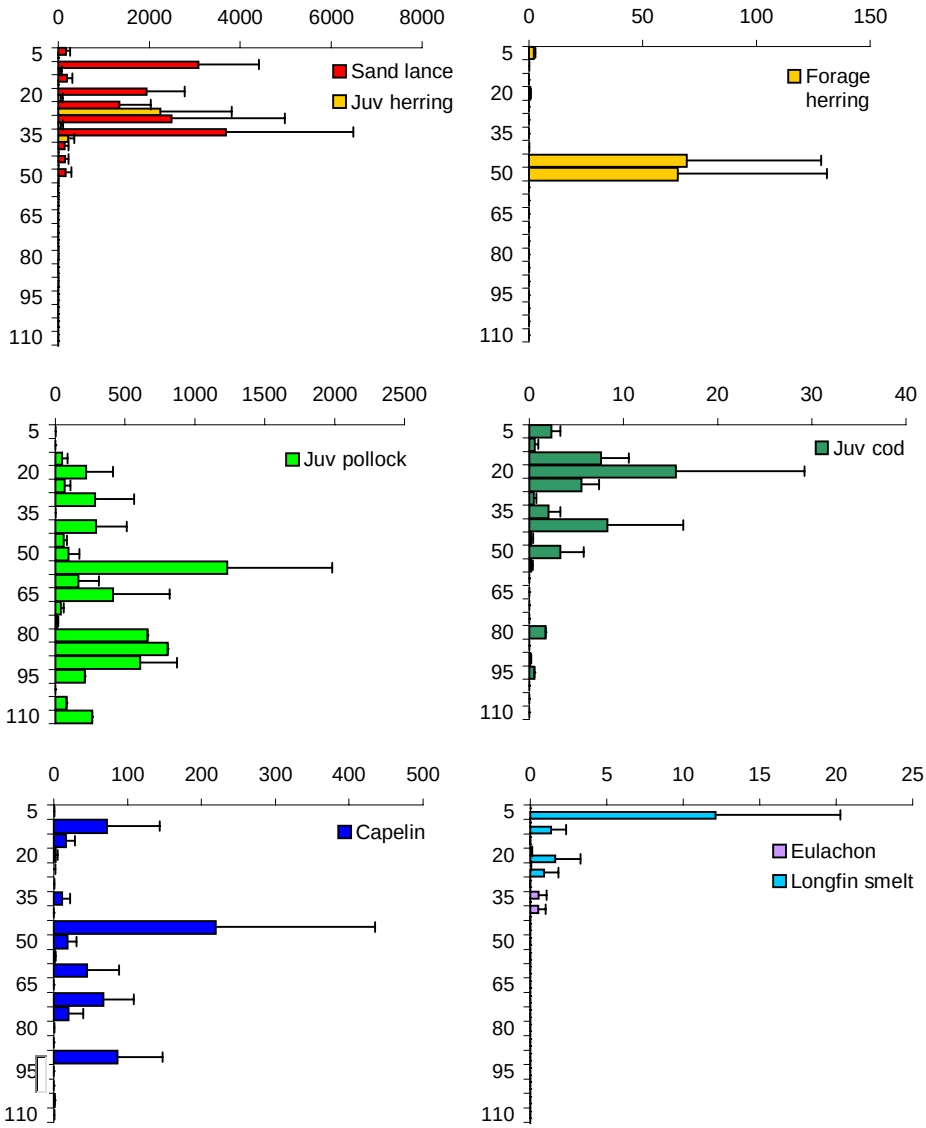

Figure 4.5. Depths at which sand lance, herring, gadids and osmerids were caught in mid-water trawls in Cook Inlet. Data were binned into 5 m depth intervals, and plotted as mean CPUE (+ standard error). For all graphs the y-axis is depth of capture (m) and the x-axis is CPUE (fish caught per km trawled). Data are combined from all years and areas.

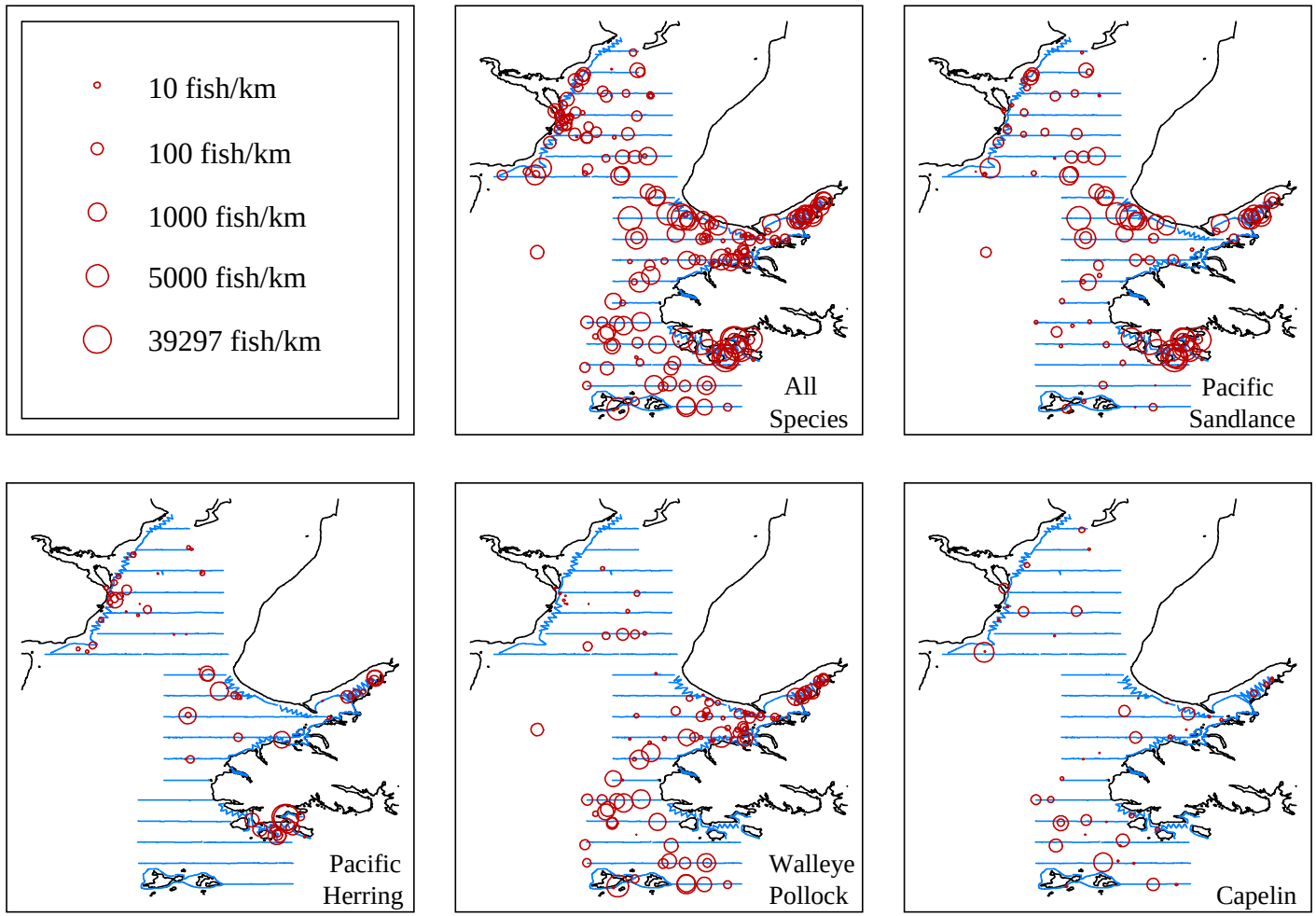

Figure 4.6. Geographic distribution of mid-water trawl catches of all species, sand lance, herring, pollock, and capelin in lower Cook Inlet, 1996-1999 (CPUE, fish per km trawled, data combined for all years).

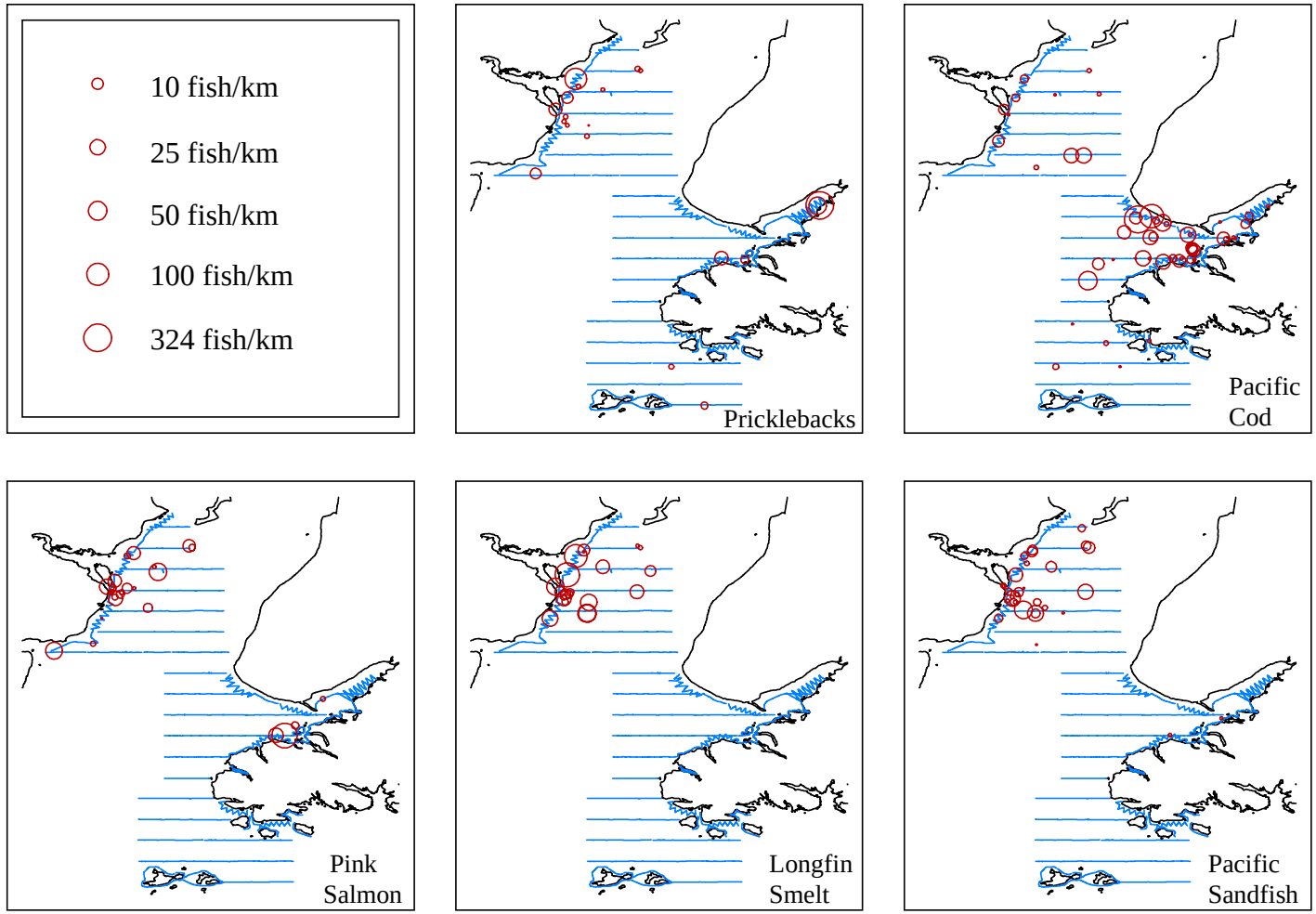

Figure 4.7. Geographic distribution of mid-water trawl catches of prickleback, cod, pink salmon, longfin smelt, and Pacific sandfish in lower Cook Inlet, 1996-1999 (CPUE, fish per km trawled, data combined for all years).

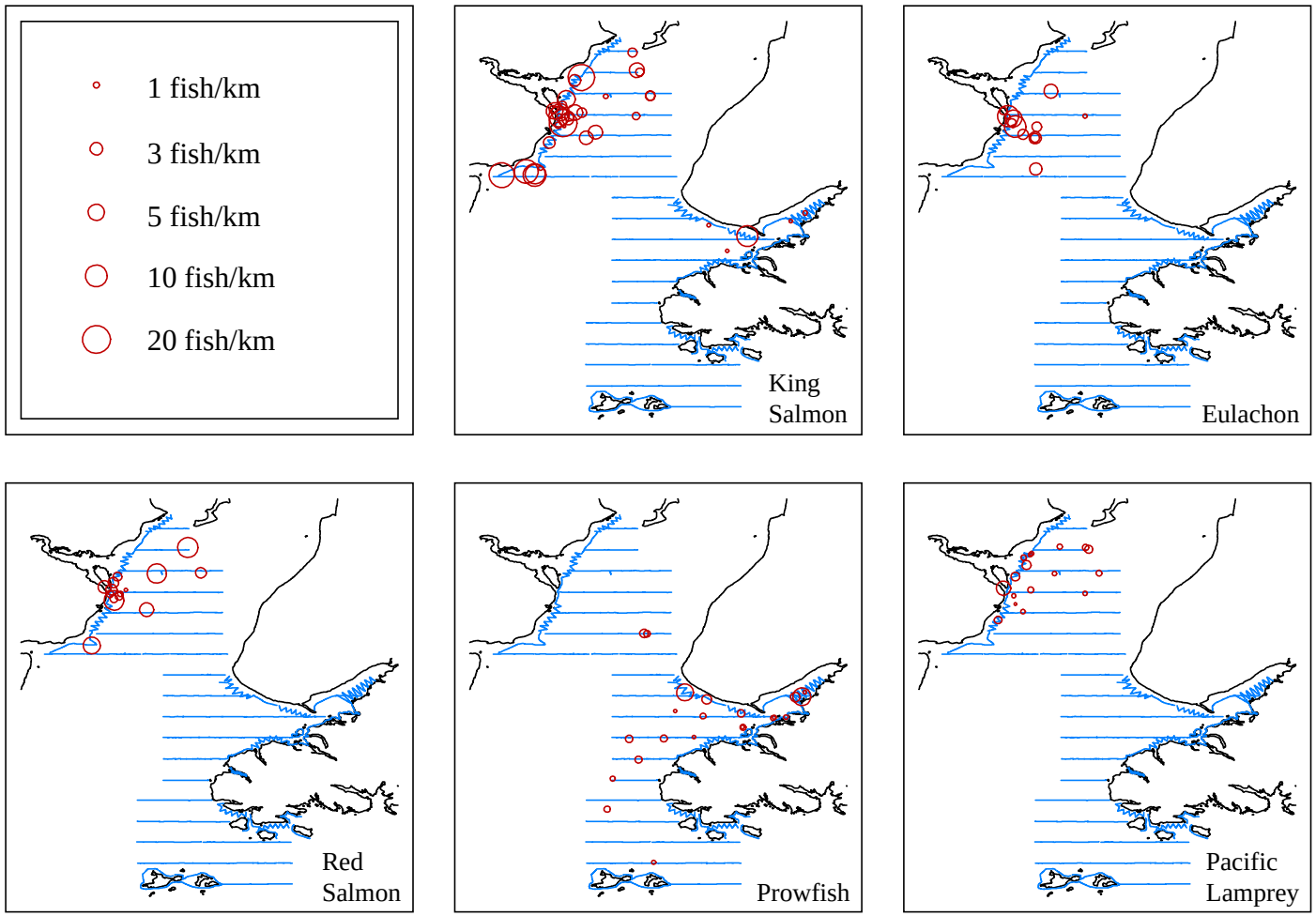

Figure 4.8. Geographic distribution of mid-water trawl catches of king salmon, eulachon, red salmon, prowfish, and Pacific lamprey in lower Cook Inlet, 1996-1999 (CPUE, fish per km trawled, data combined for all years).

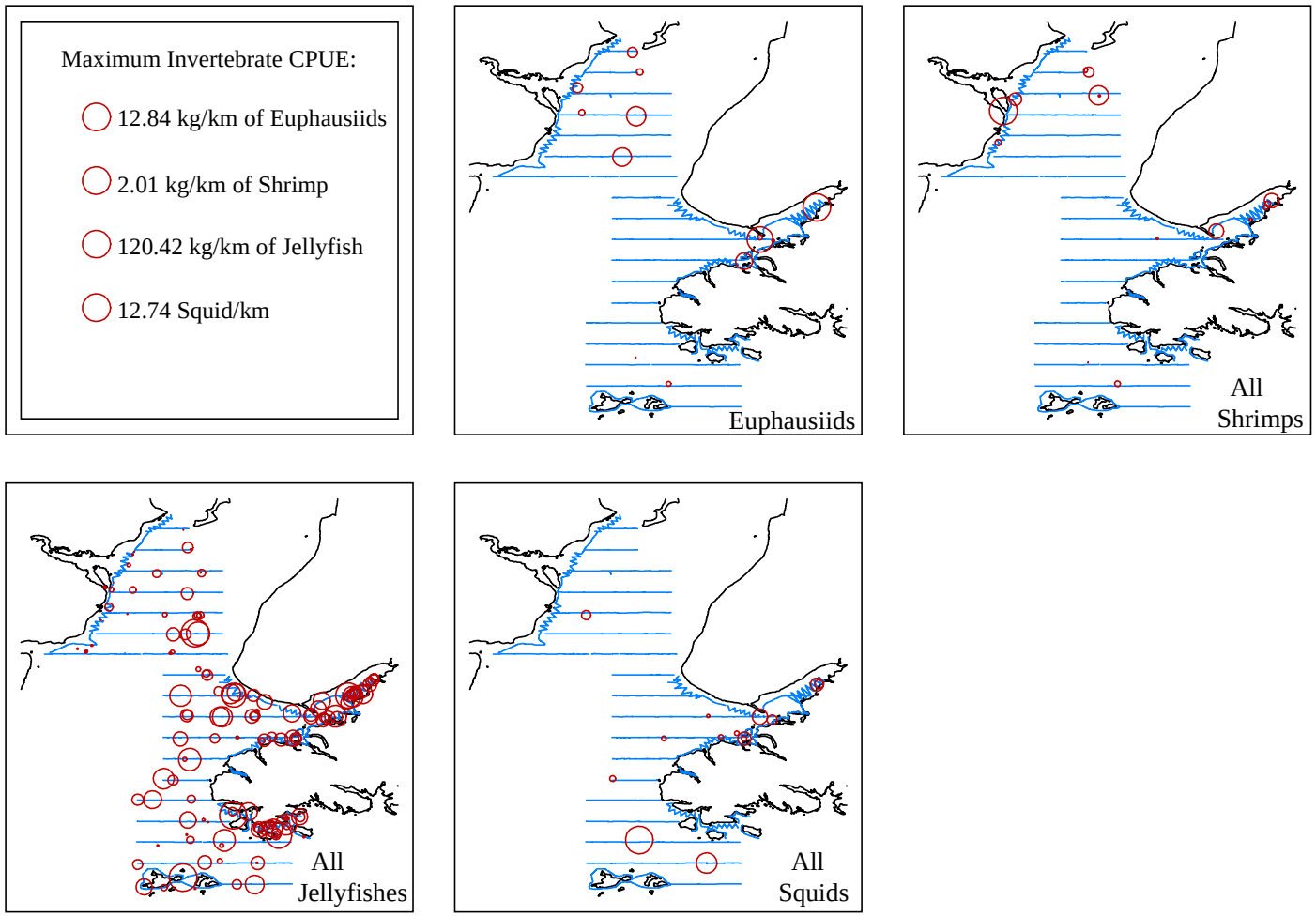

Figure 4.9. Geographic distribution of mid-water trawl catches of euphausiid, shrimp, jellyfish and squid in lower Cook Inlet, 1996-1999 (CPUE, fish per km trawled, data combined for all years).

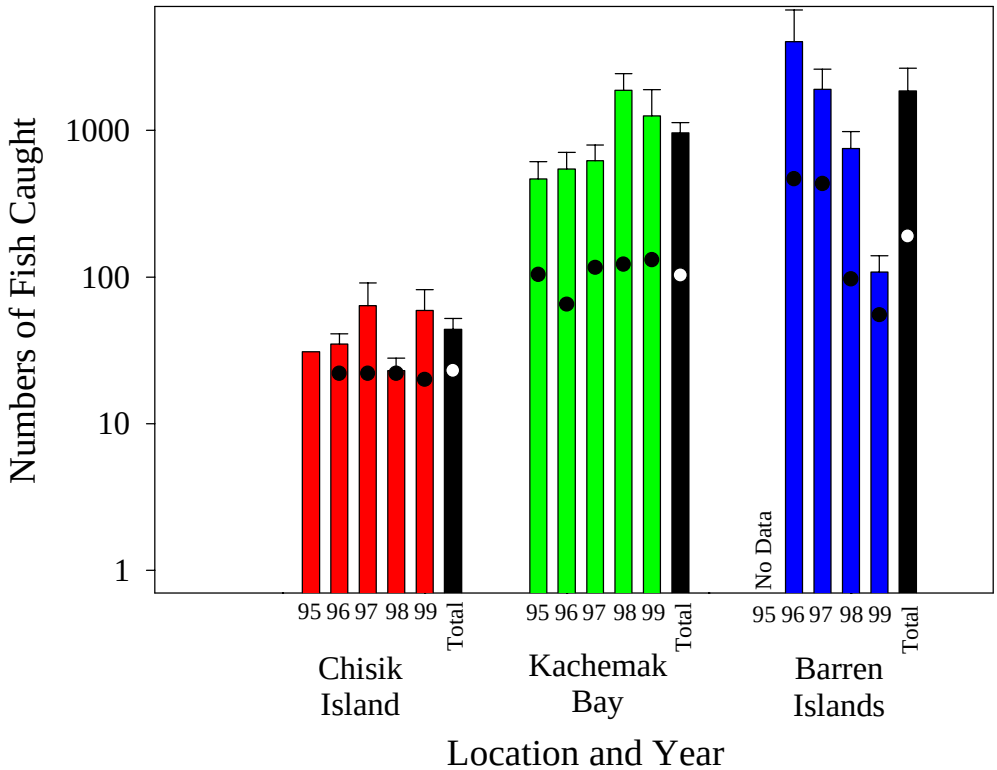

Figure 5.1. Mean (columns), standard error (error bars), and median (dots) seine catches at Chisik Island, Kachemak Bay and the Barren Islands.

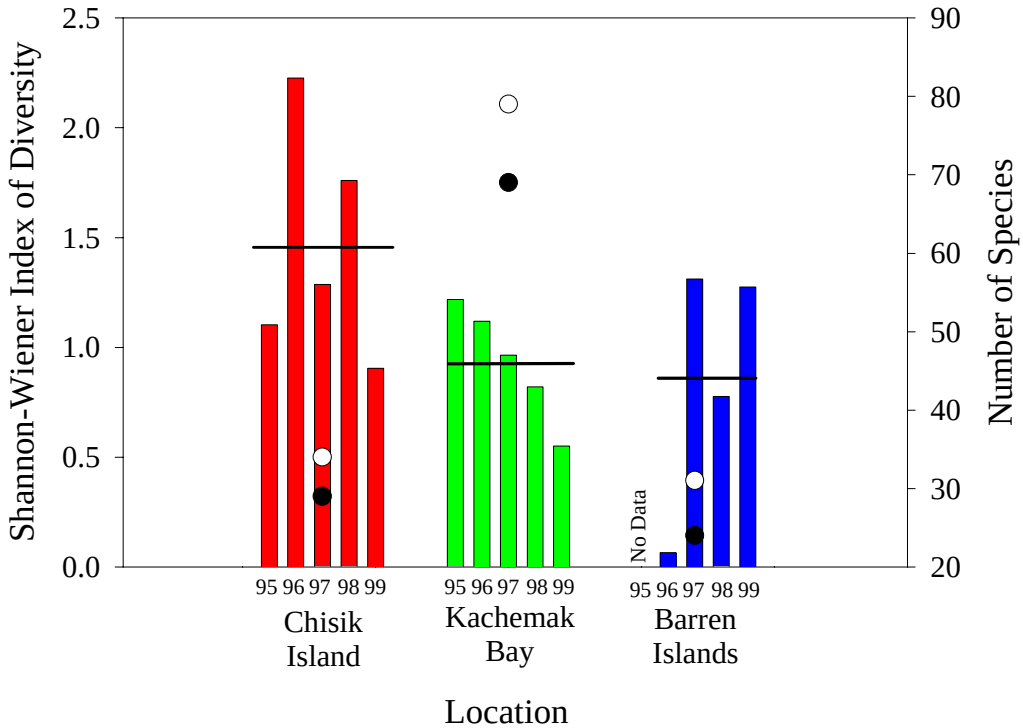

Figure 5.2. Shannon-Wiener index of diversity and species richness for Chisik Island, Kachemak Bay, and the Barren Islands. Black dots represent number of species identified at each site, and white dots include number of unidentified taxa. Horizontal lines indicate mean index for all years combined.

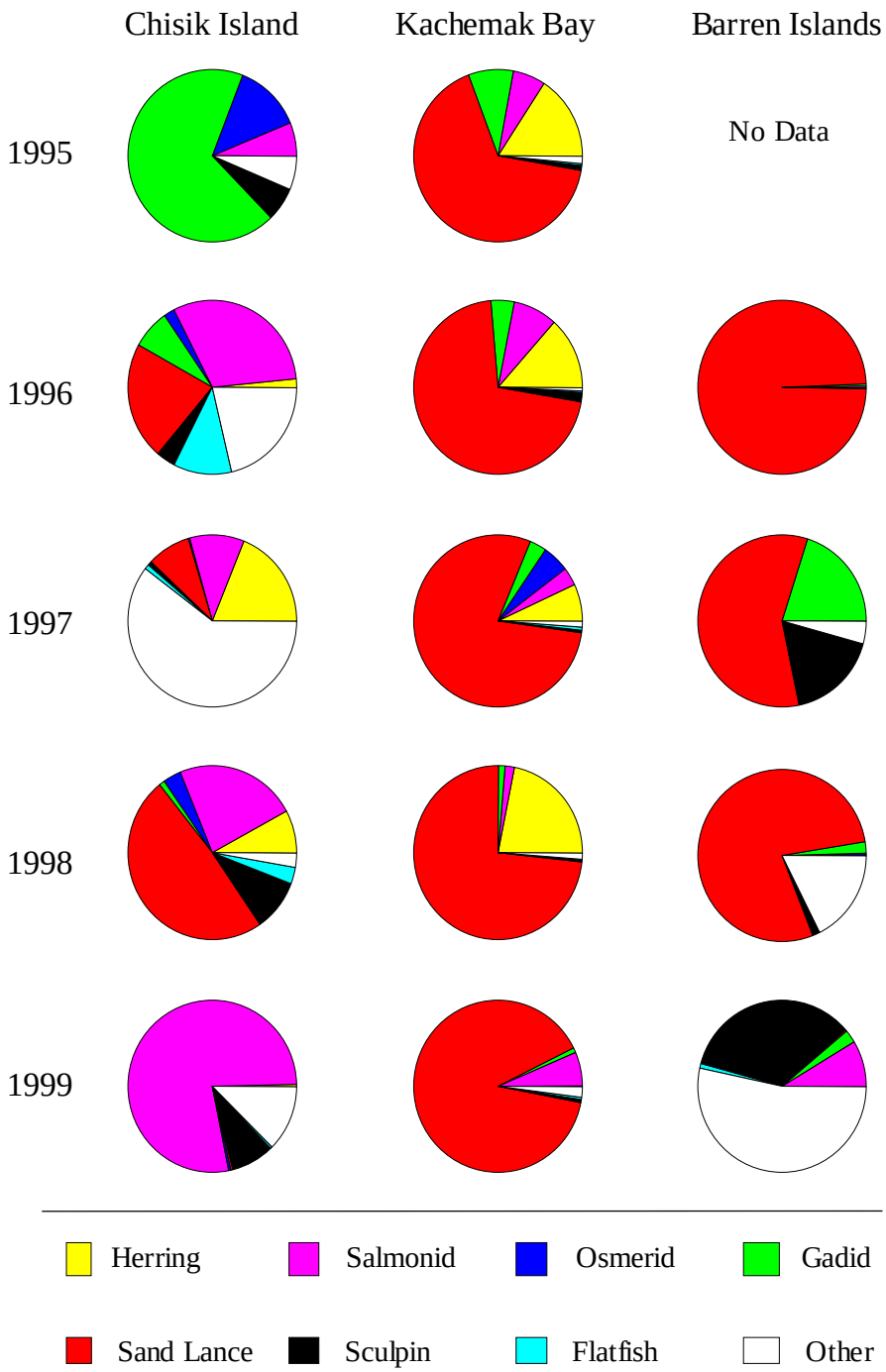

Figure 5.3. Species composition of beach seine catches at Chisik Island, Kachemak Bay, and the Barren Islands, 1995-1999.

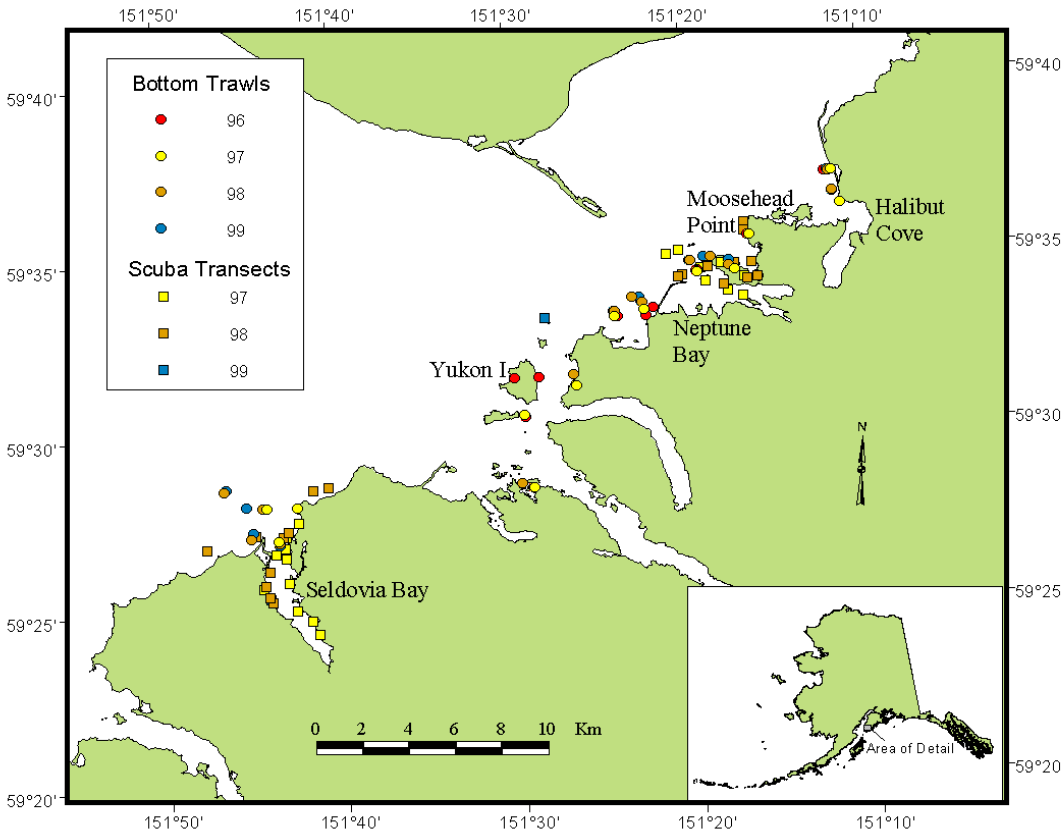

Figure 6.1. Stations sampled by bottom trawl and SCUBA in Kachemak Bay, 1996-1999.