



USING DNA-BASED STOCK IDENTIFICATION TO ELUCIDATE COASTAL MIGRATION OF JUVENILE SCKEYE SALMON

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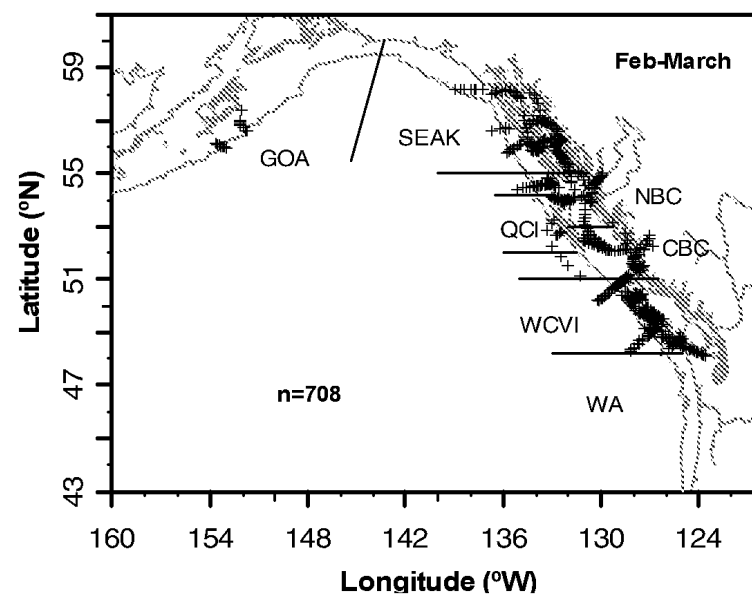
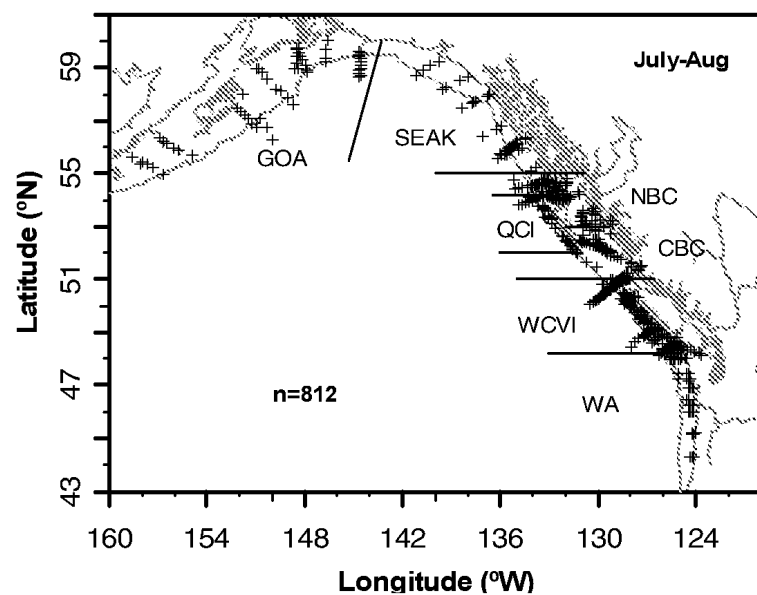
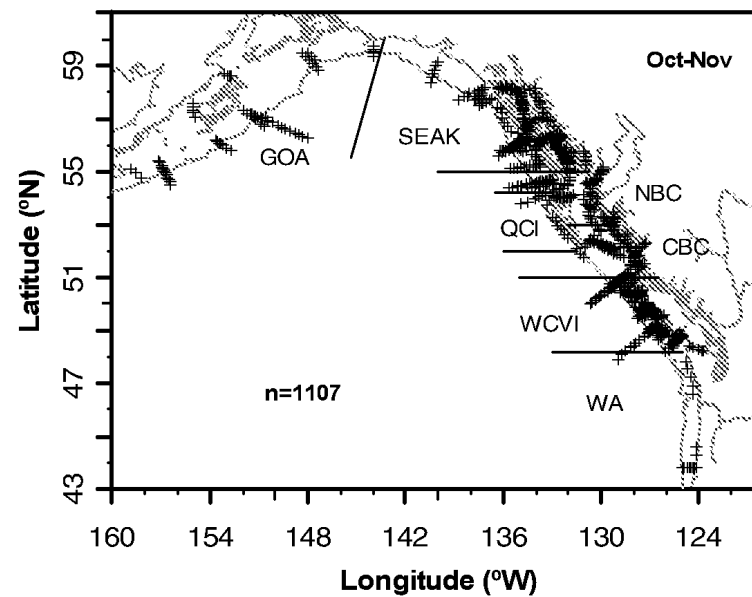
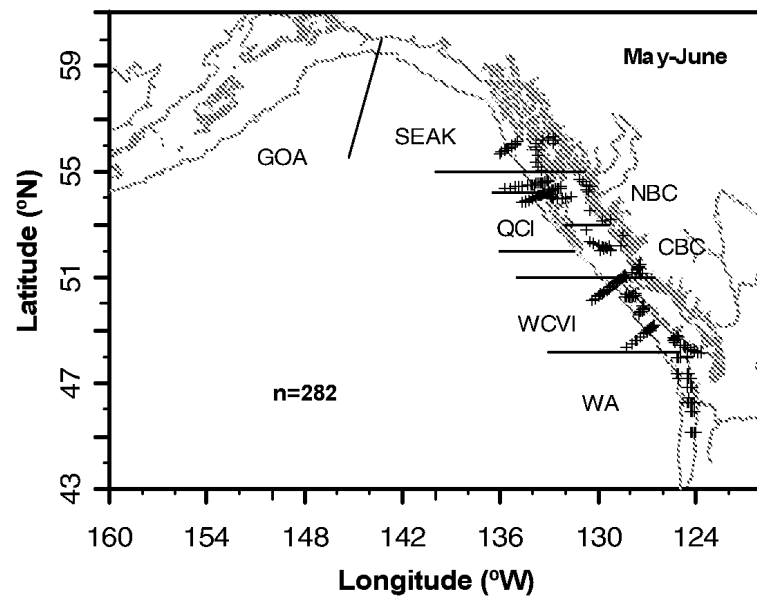
³Institute of Ocean Sciences, Fisheries and Oceans Canada, Sidney BC

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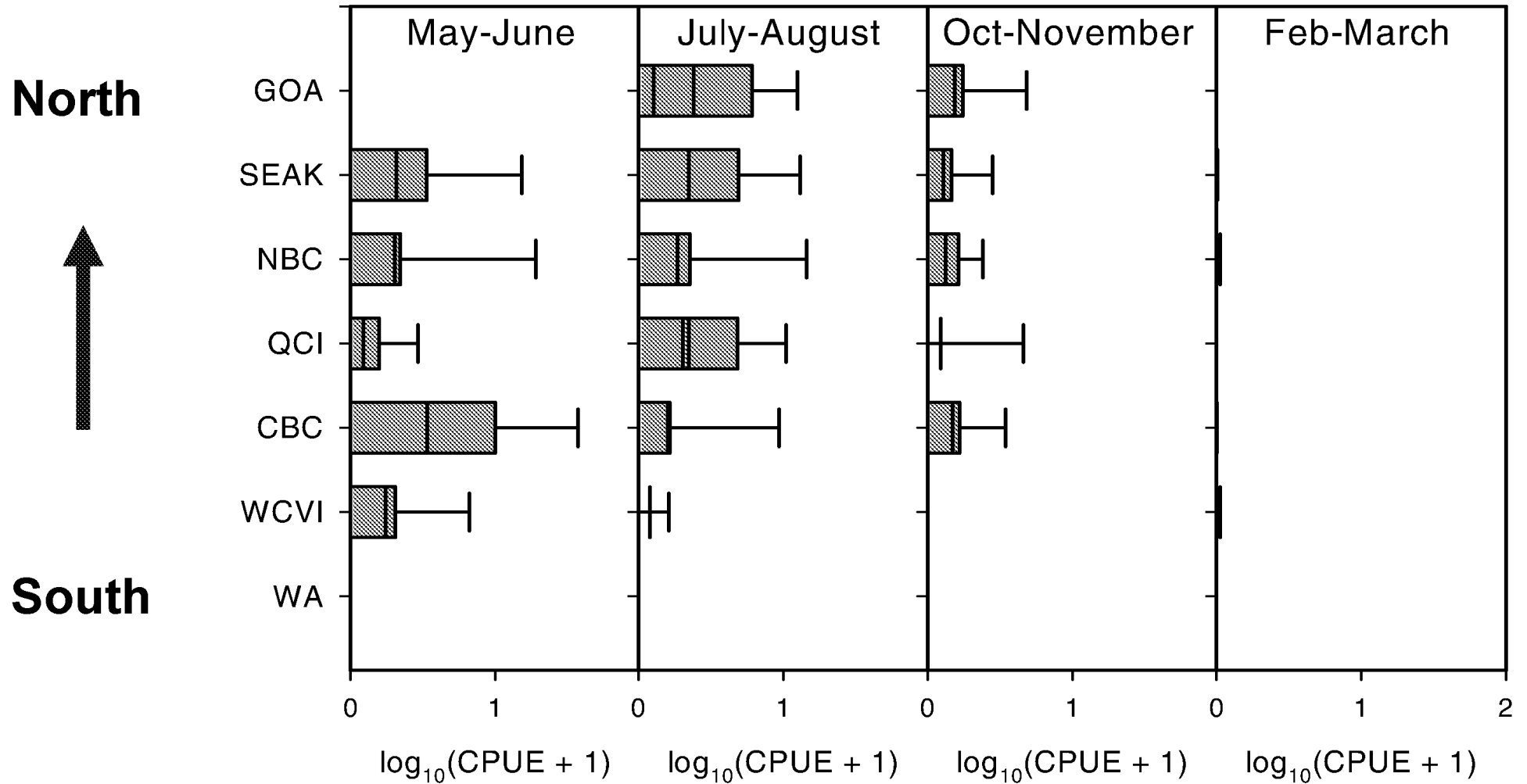
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Canada

Sampling Effort 1996-2007



Mean Catch per Unit Effort



DNA-Based Allocations to Regional Populations

Juvenile sockeye surveyed for 14 microsatellite loci (MSL)
and for 1 major histocompatibility complex (MHC) locus

359 Population Baseline:

Japan, Russia, Alaska to Columbia
River; 60 000 individuals (Beacham et
al. 2005)



cBAYES

Pella and Masuda (2001)

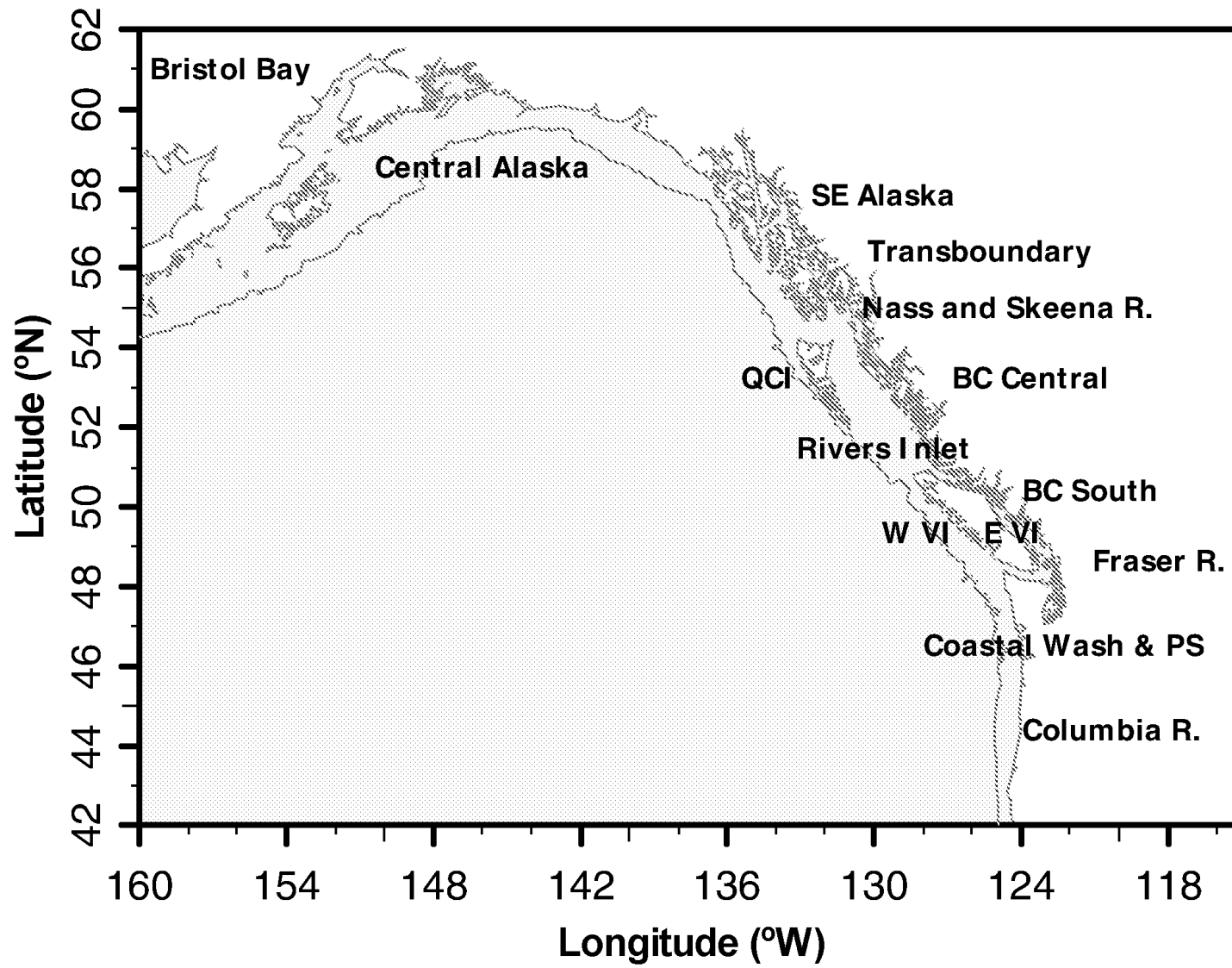
Individuals allocated to 14 regional populations

**4156 sockeye
analysed**



**98% identify to stock of origin
probability of > 80%**

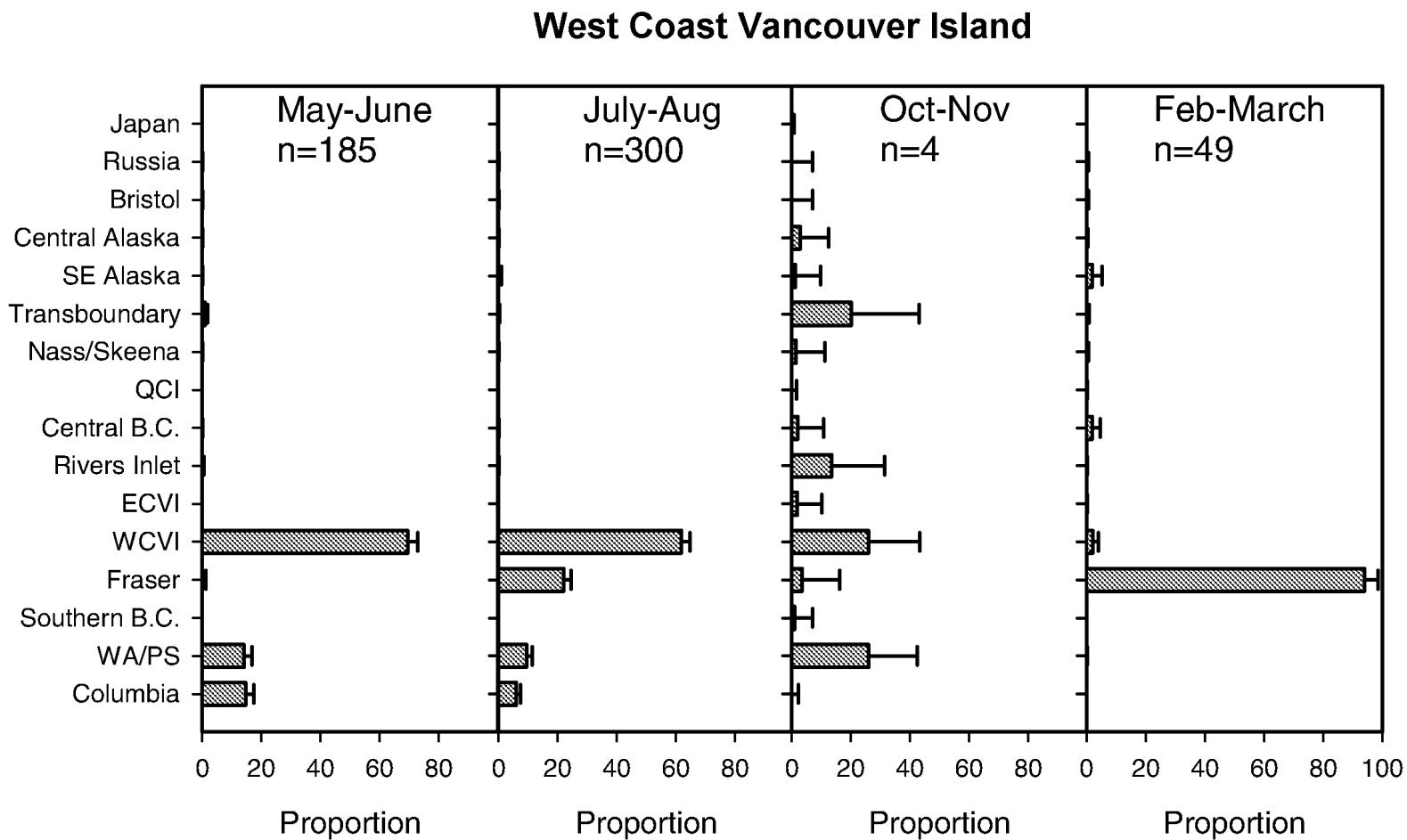
Pooled Regional Populations



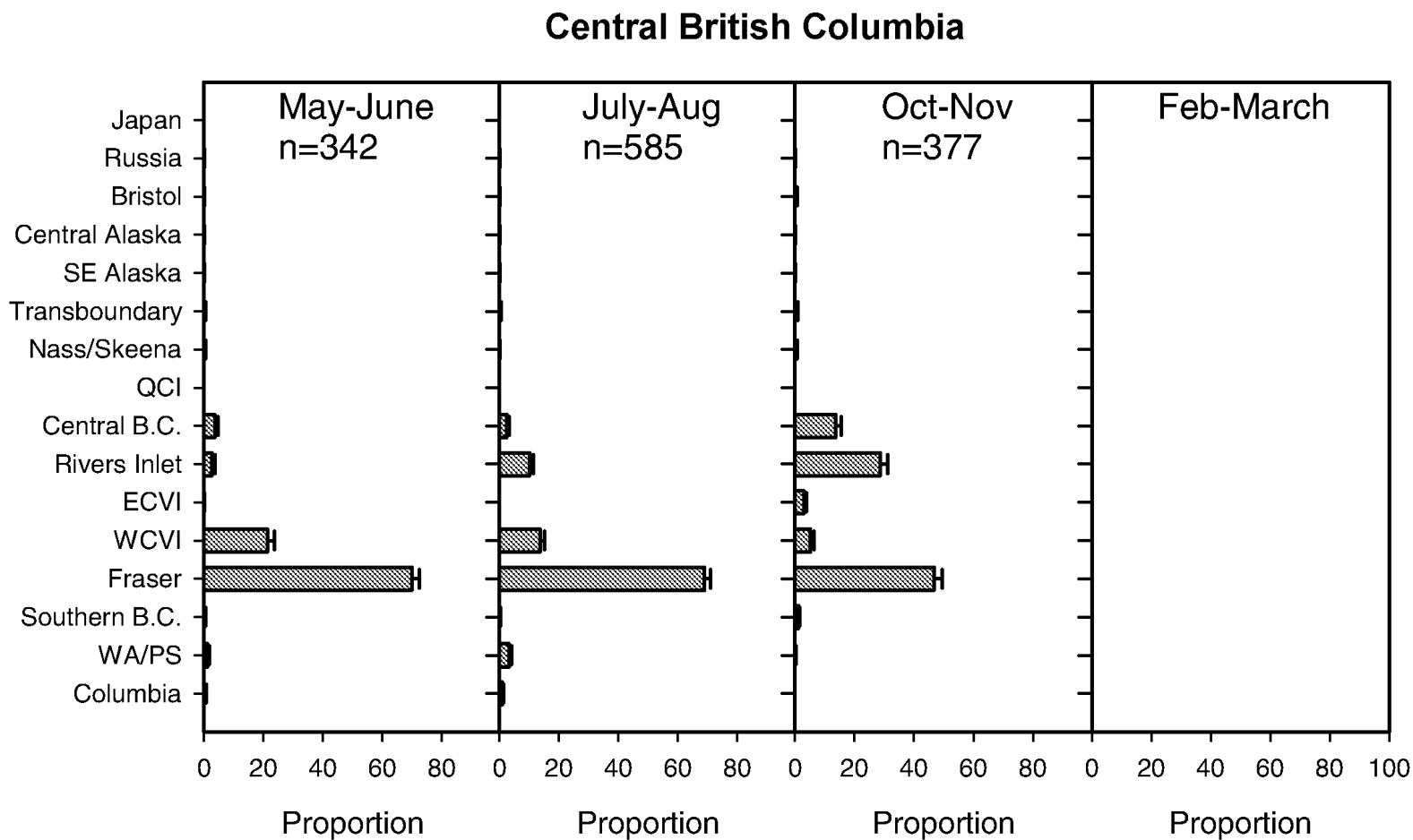
DNA-Based Allocations to Regional Populations

Region/Drainage	% Total
Columbia River	4.3
Coastal Washington/ Puget Sound	3.1
BC South Coast	0.2
Fraser River	42.0
West Vancouver Island	15.1
East Vancouver Island	0.5
BC Central Coast	5.0
Queen Charlotte Islands	0.6
Rivers Inlet	5.9
Nass and Skeena Rivers	14.4
Transboundary Rivers	3.8
South East Alaska	4.2
Central Alaska	0.5
Bristol Bay	0.2

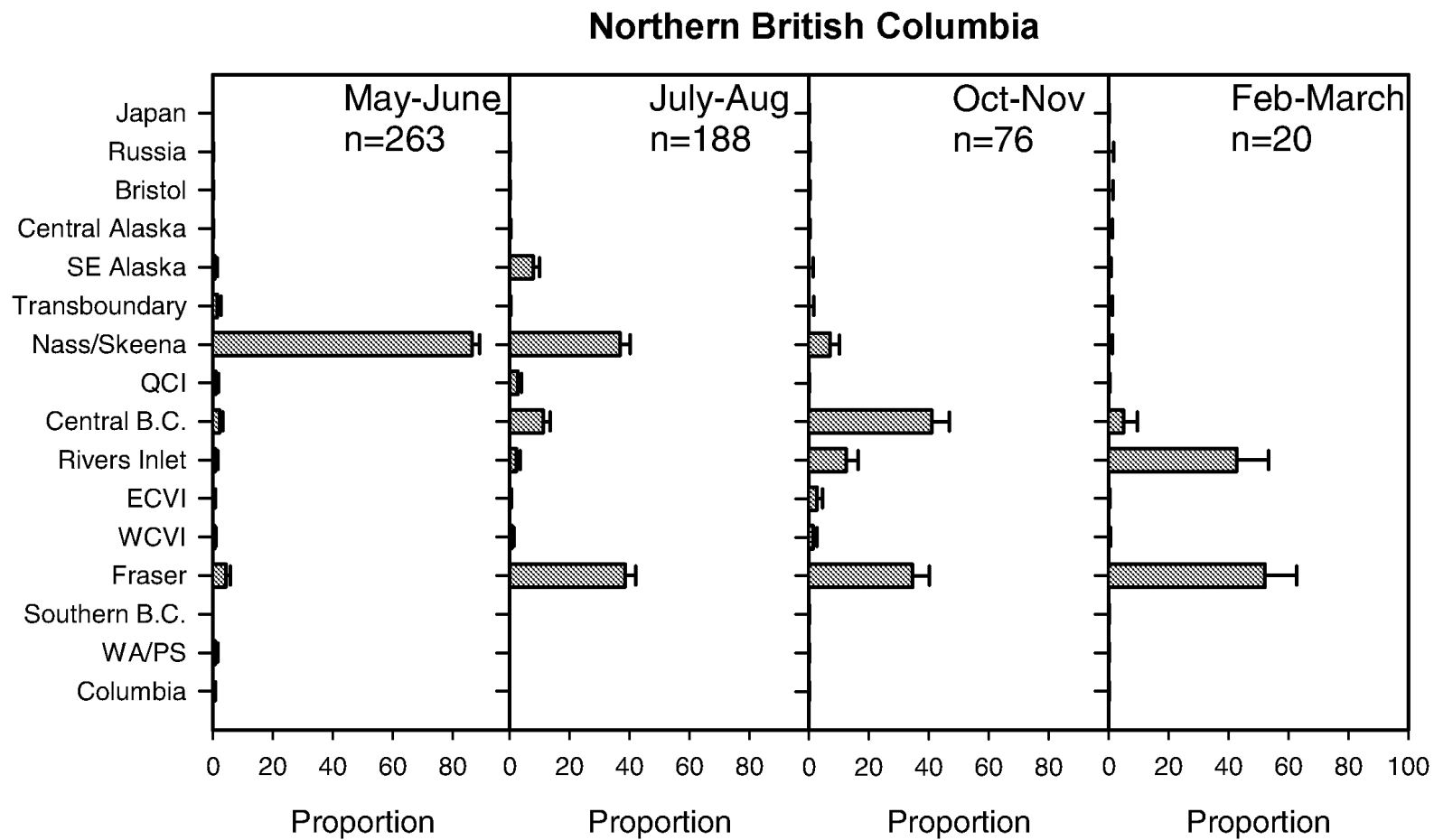
Stock Proportions in Specific Catch Regions



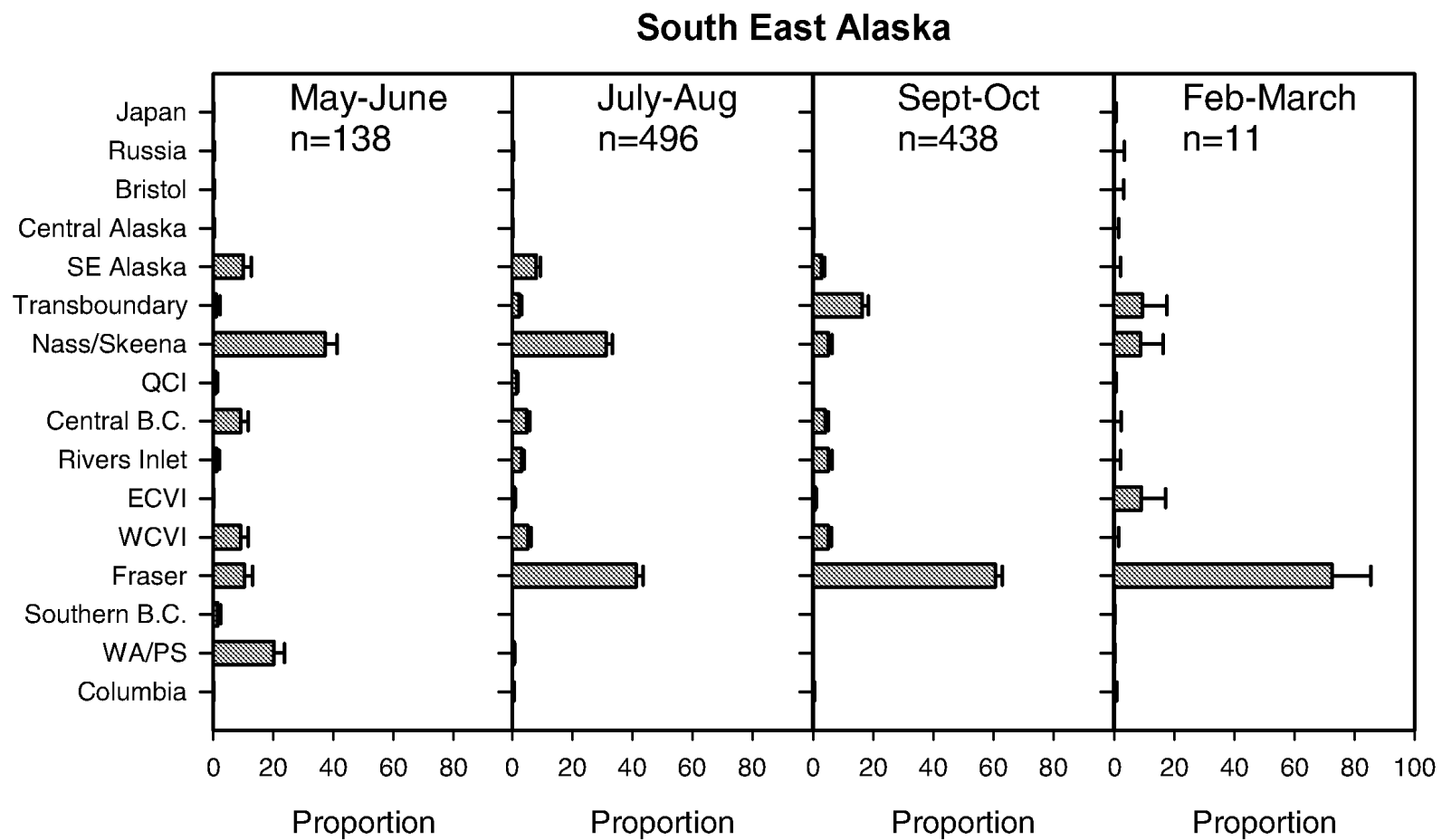
Stock Proportions in Specific Catch Regions



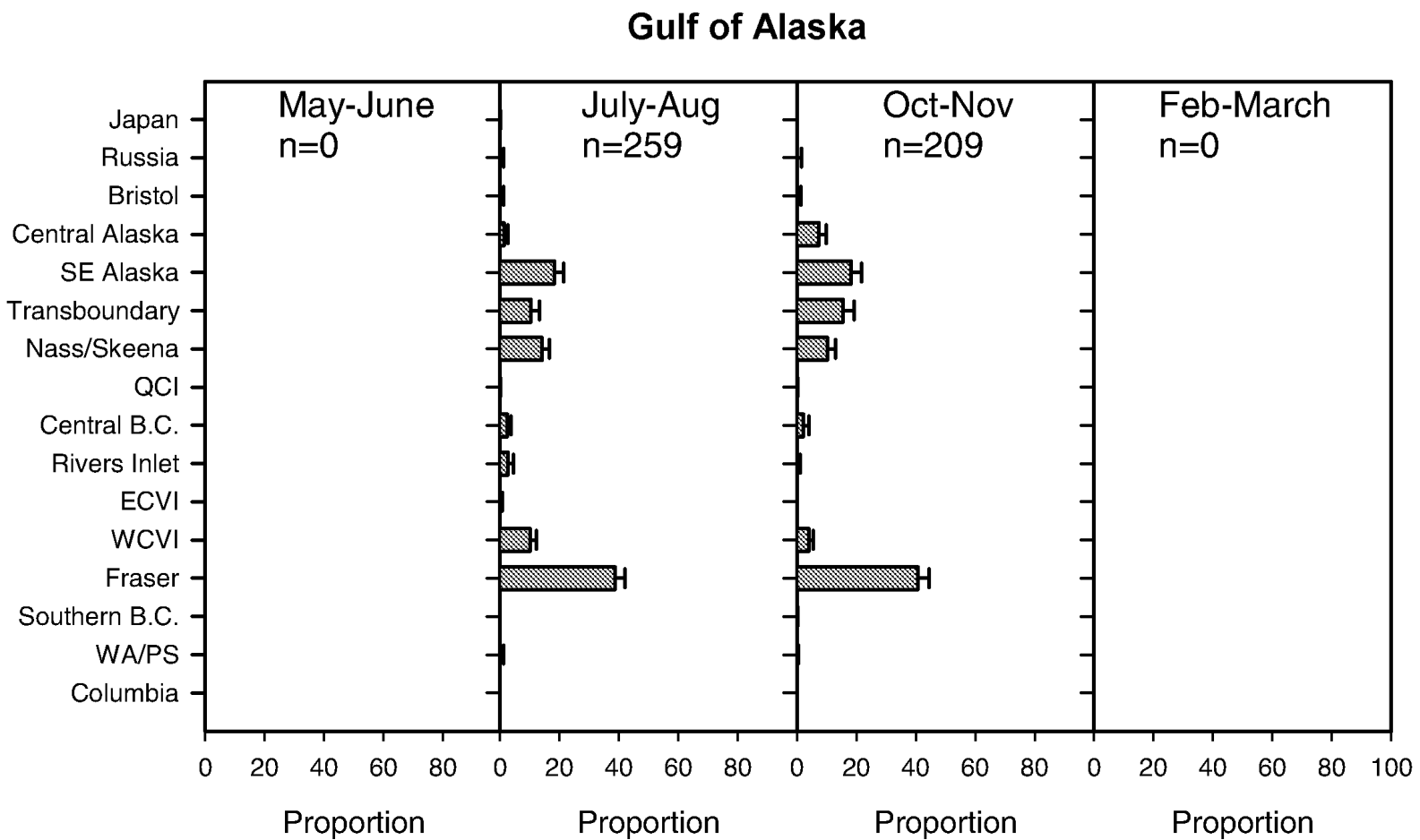
Stock Proportions in Specific Catch Regions



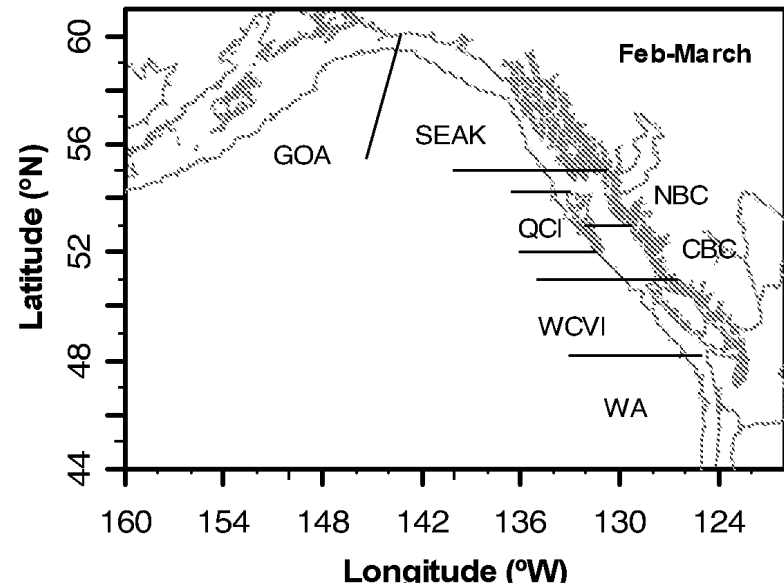
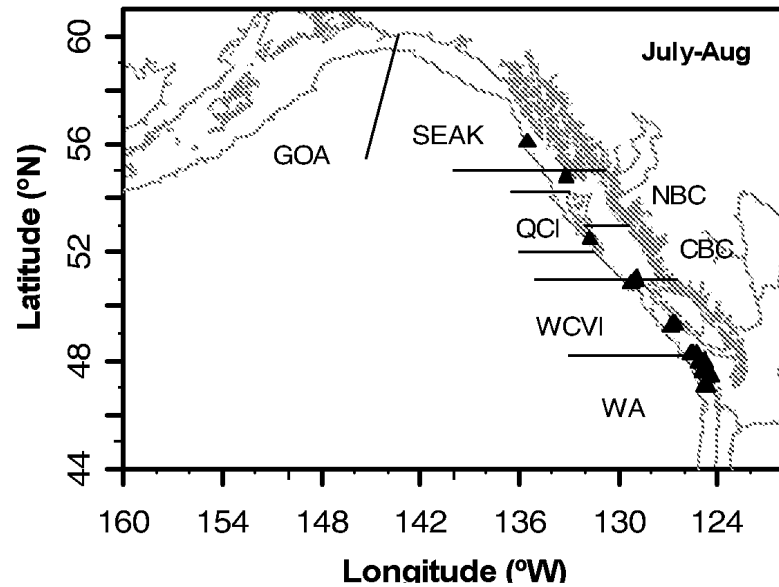
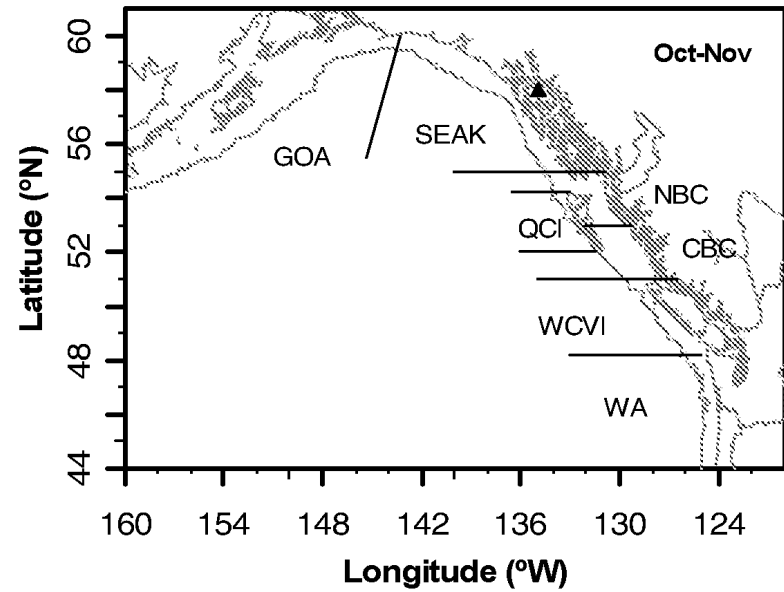
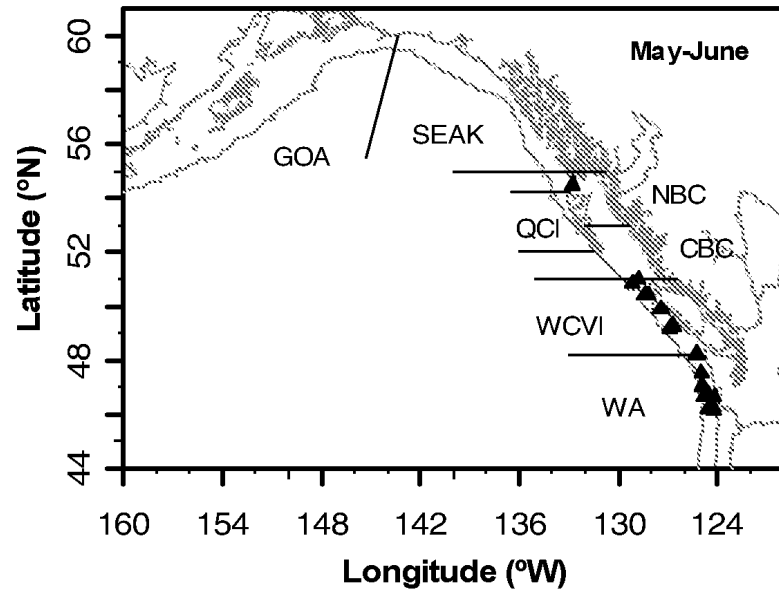
Stock Proportions in Specific Catch Regions



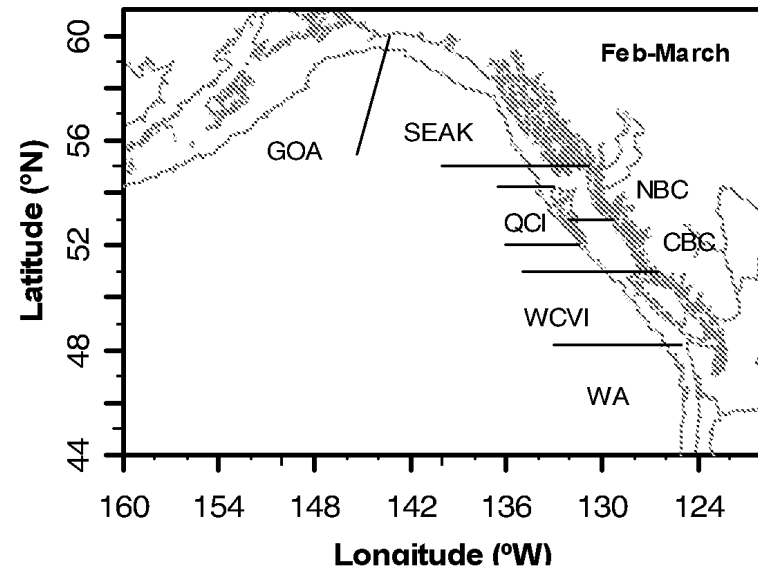
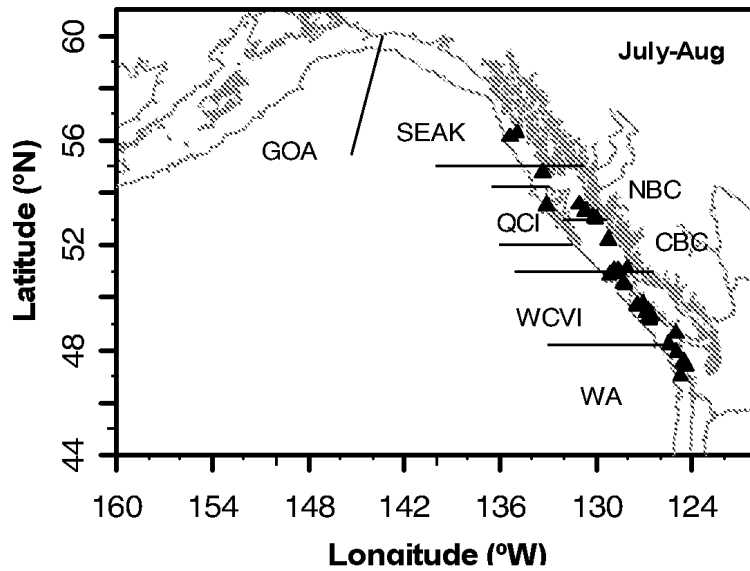
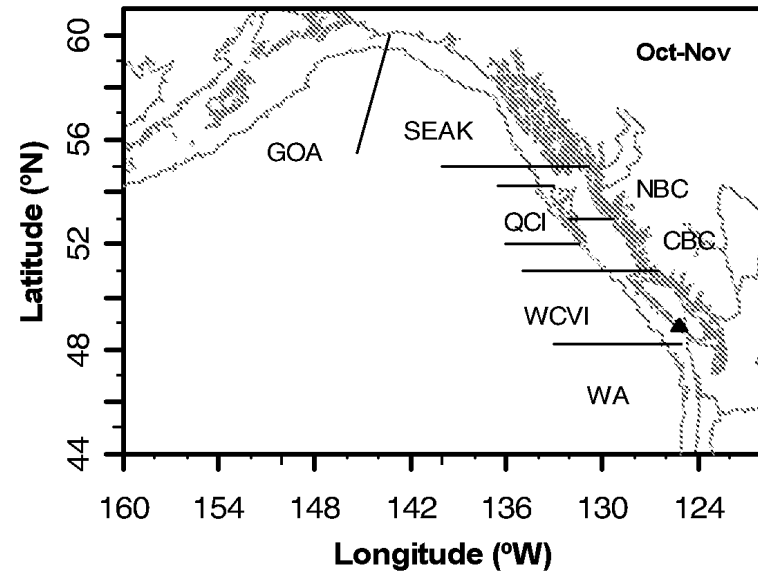
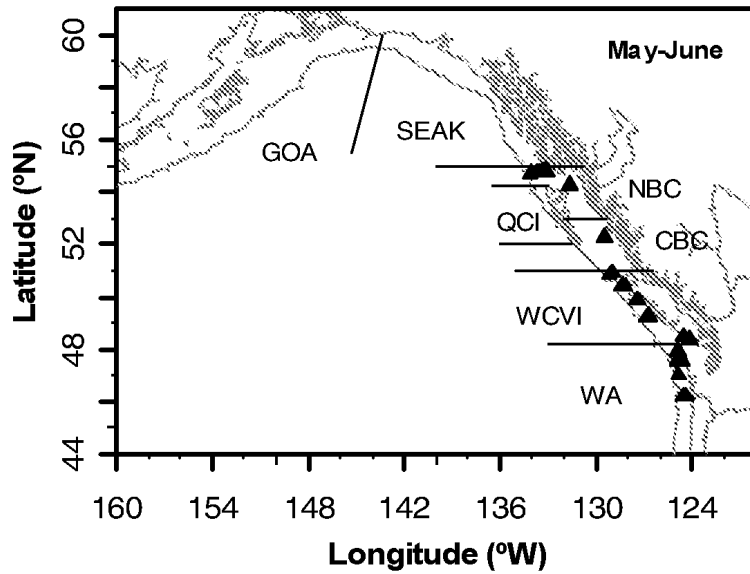
Stock Proportions in Specific Catch Regions



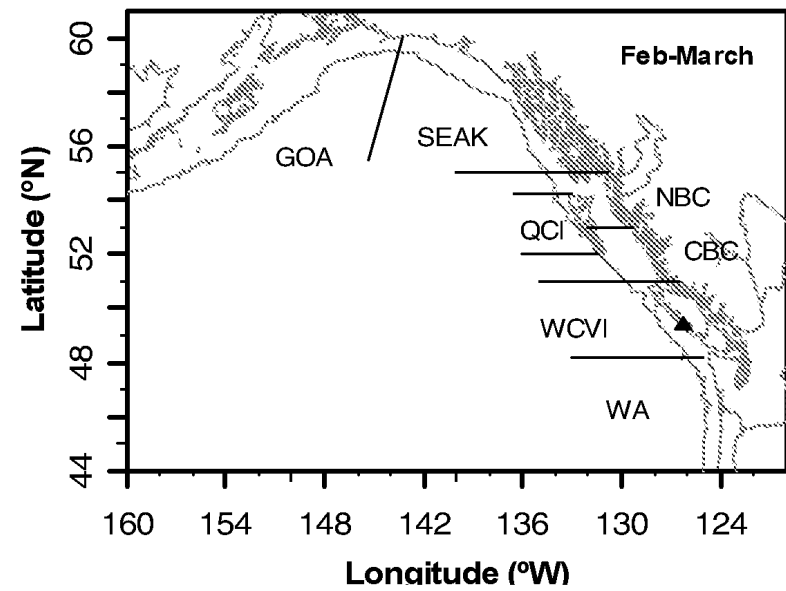
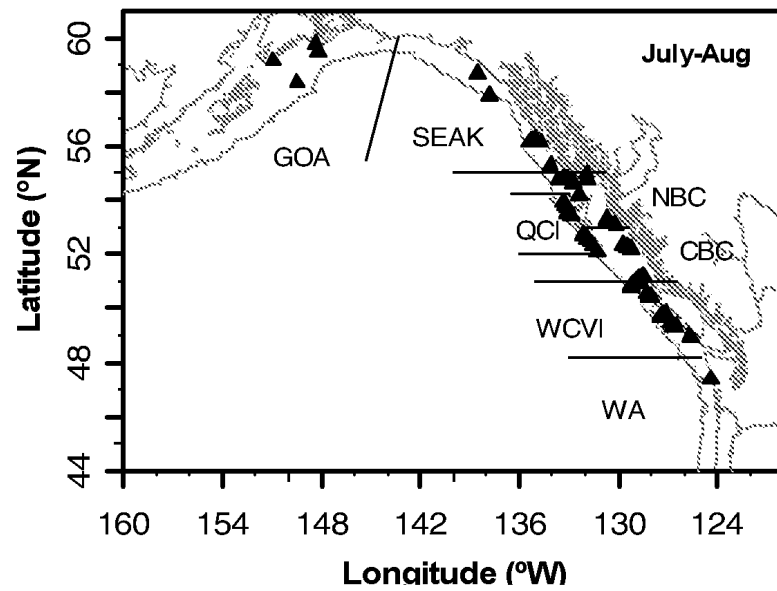
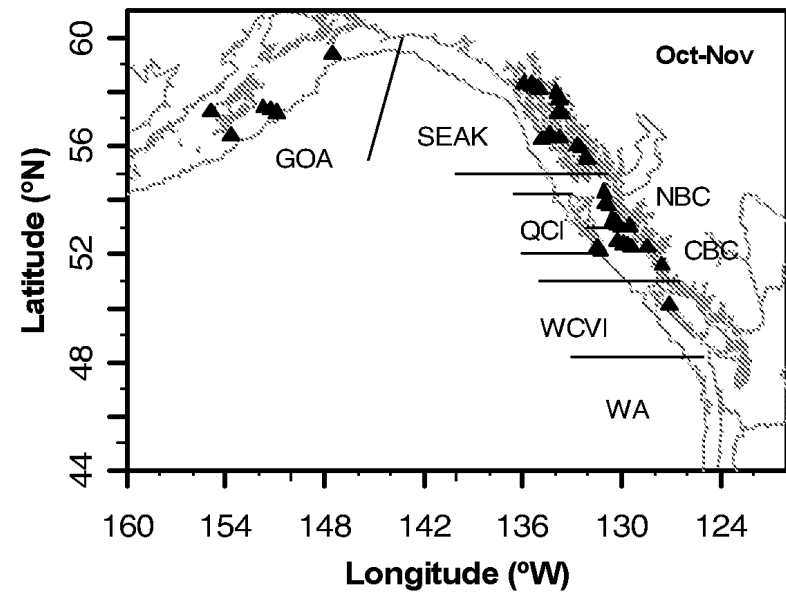
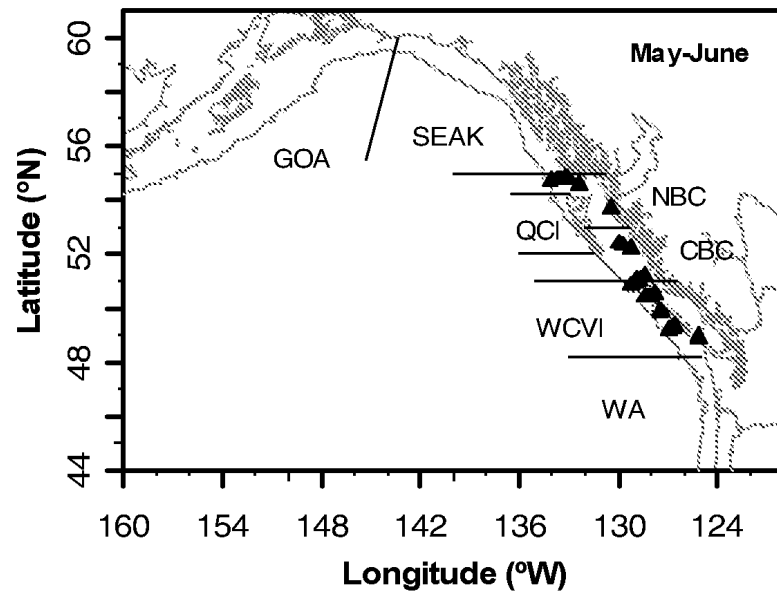
Columbia River



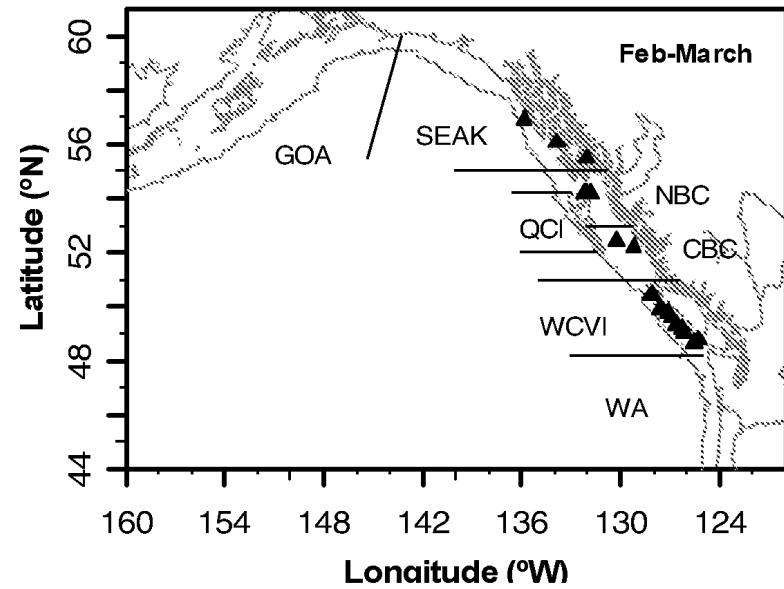
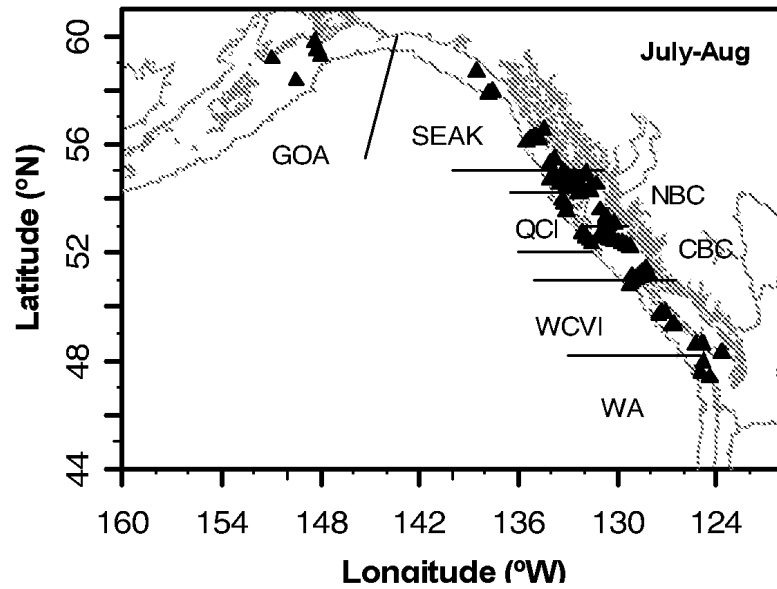
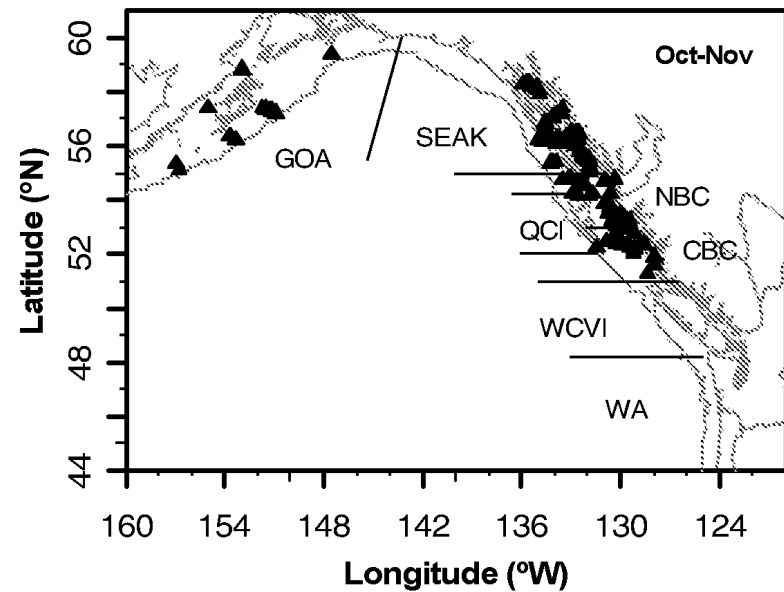
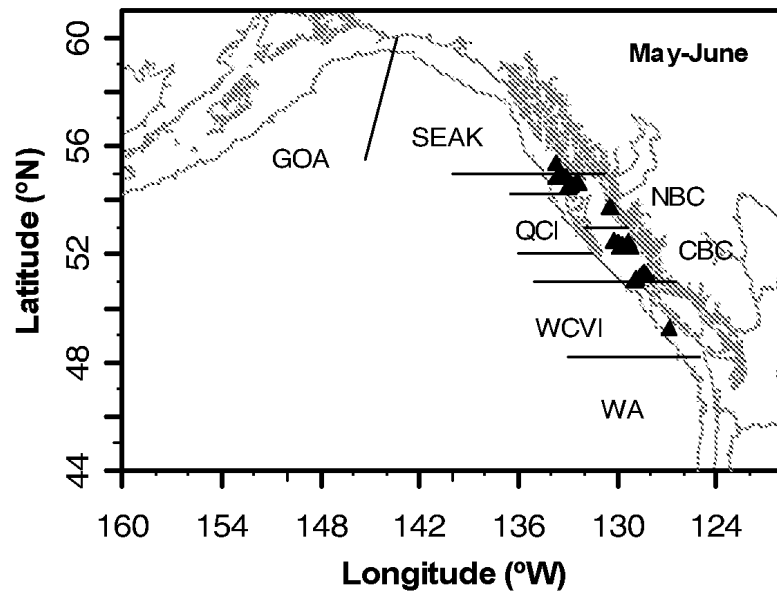
Washington



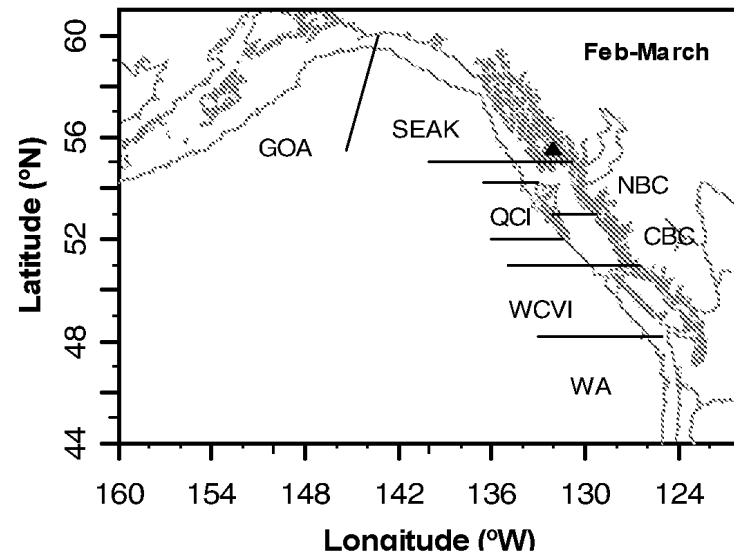
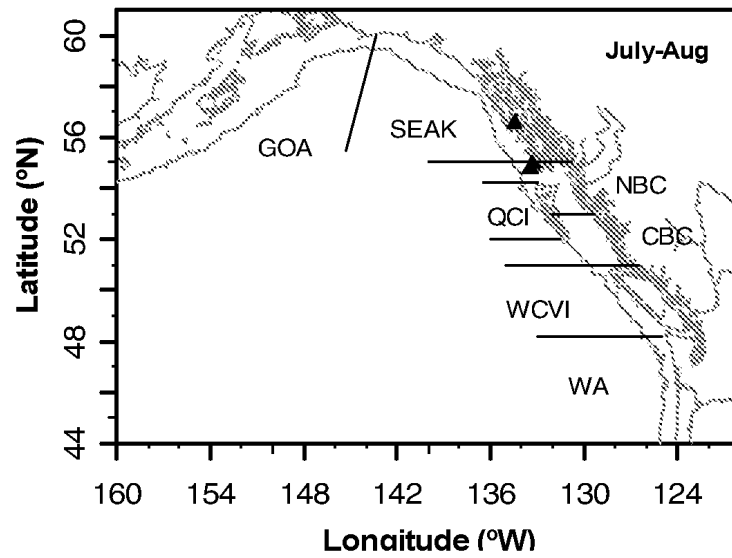
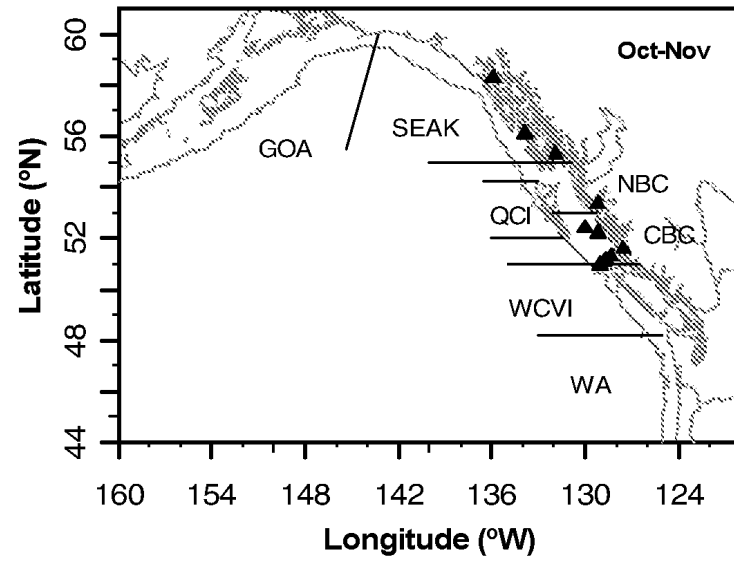
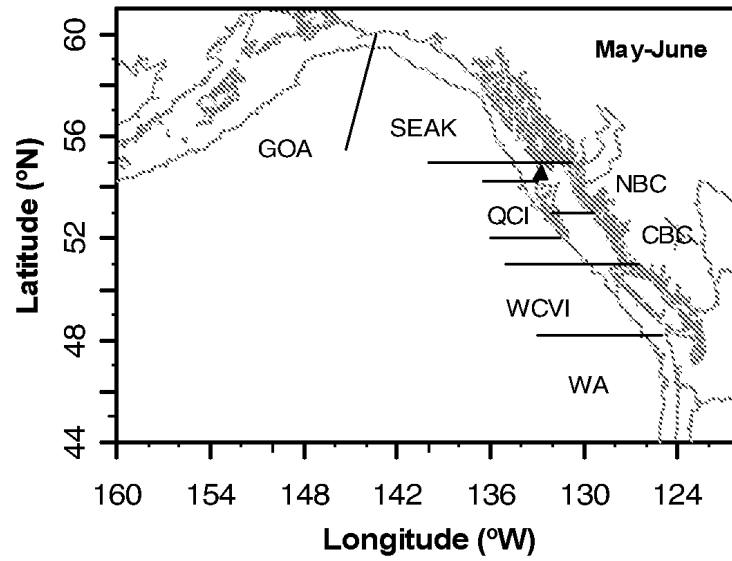
WCVI



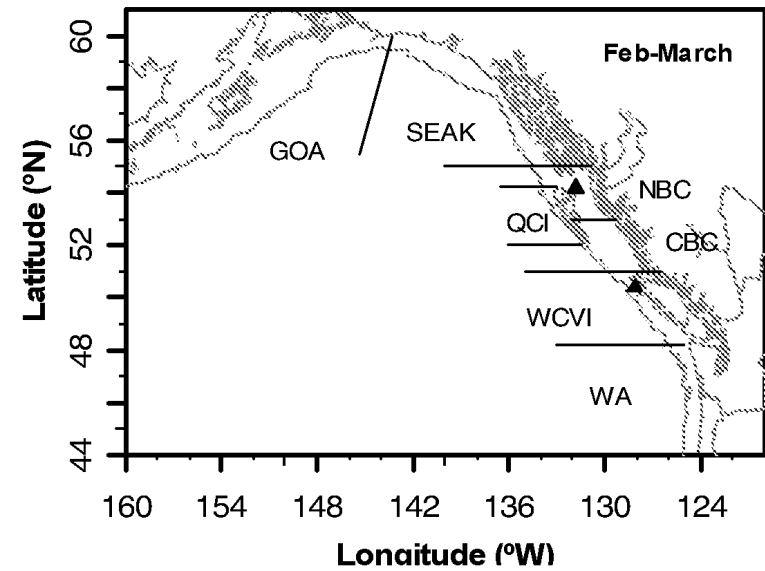
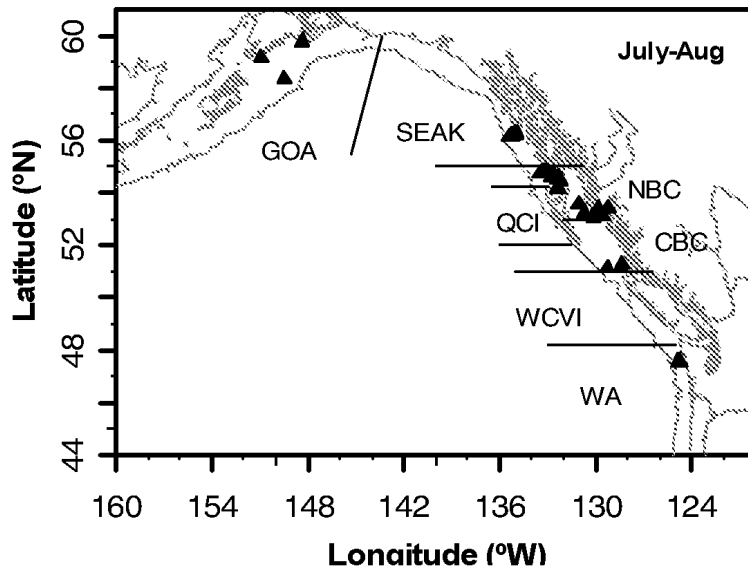
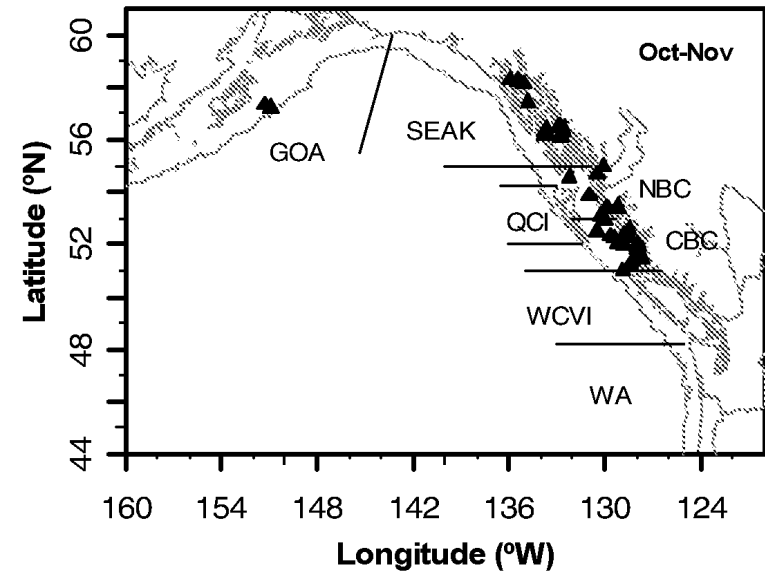
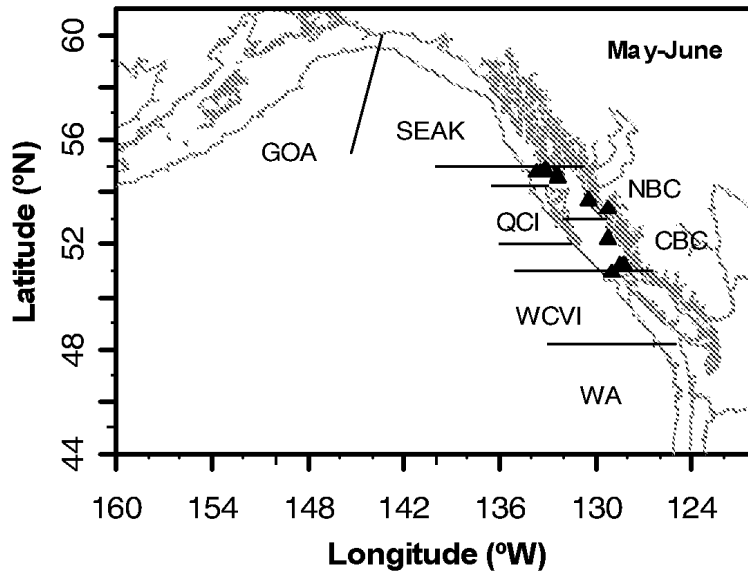
Fraser River



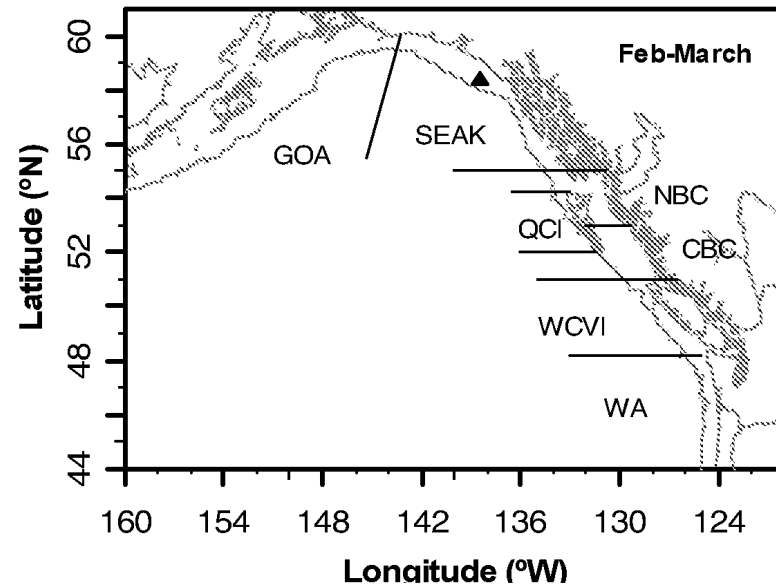
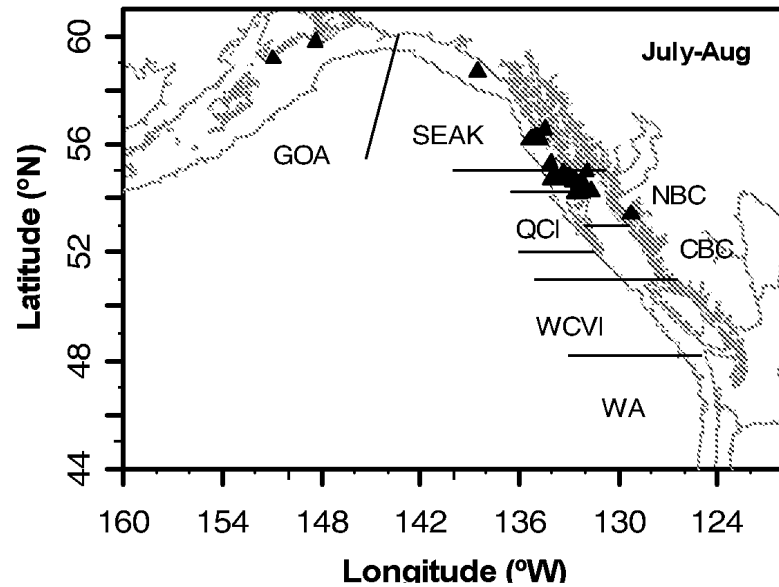
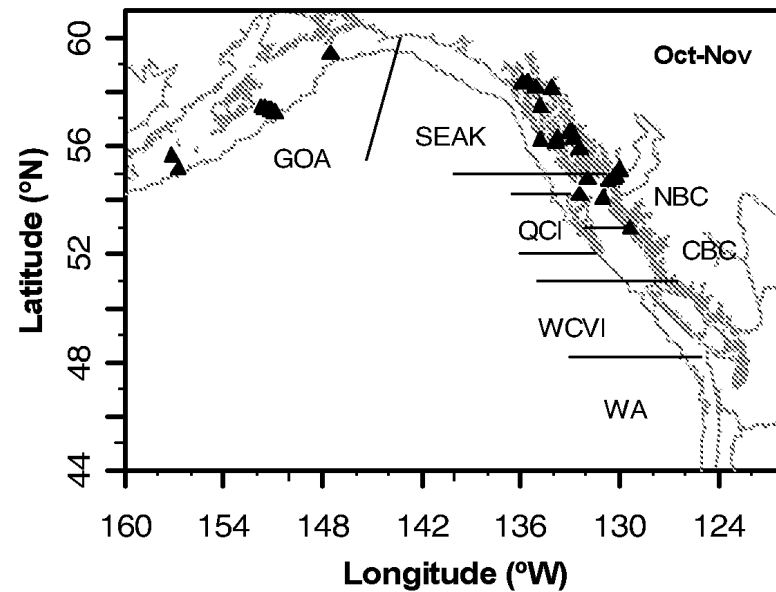
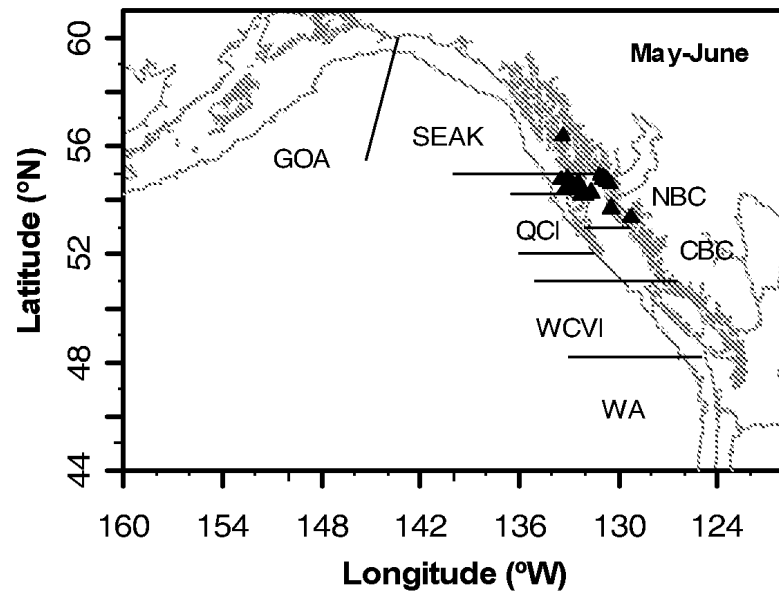
ECVI



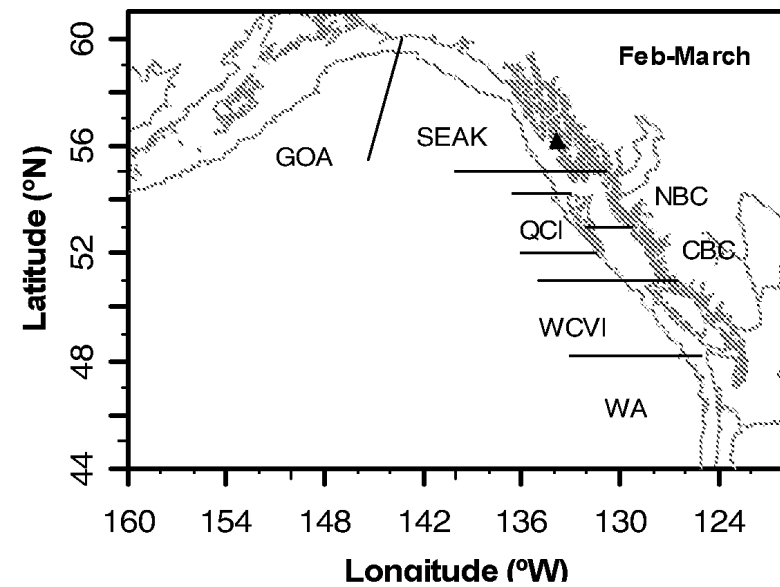
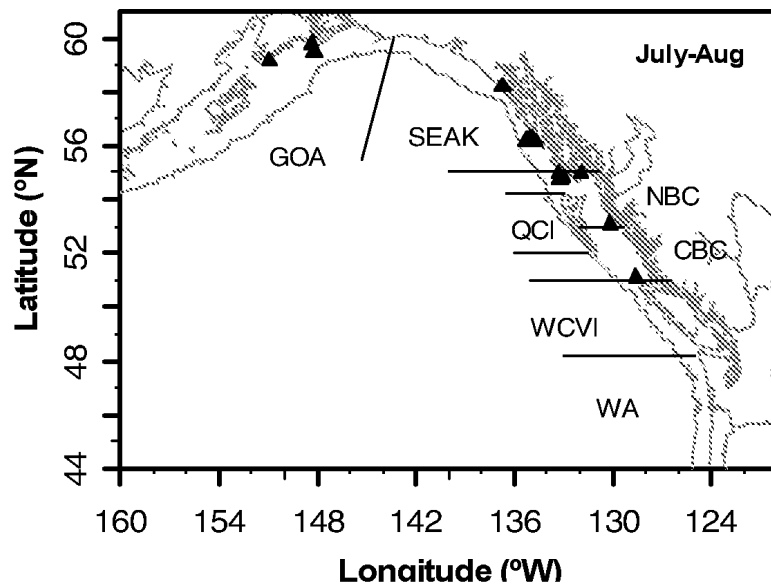
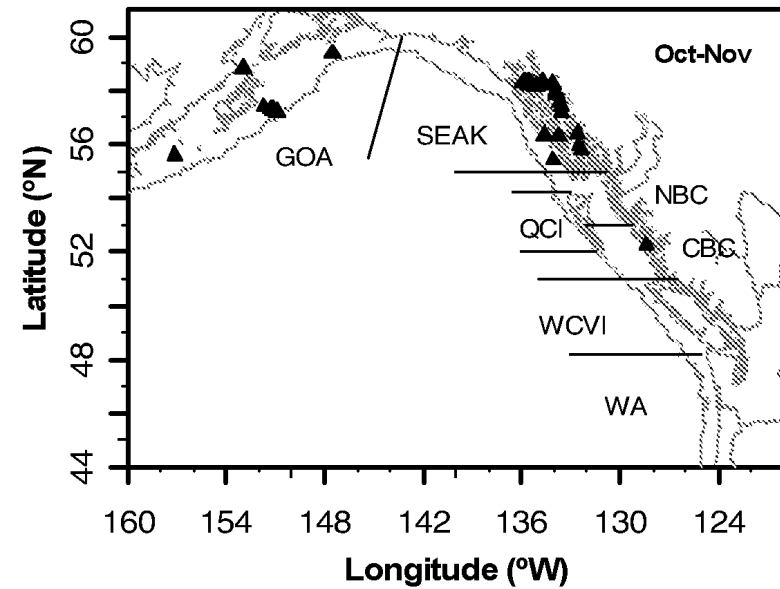
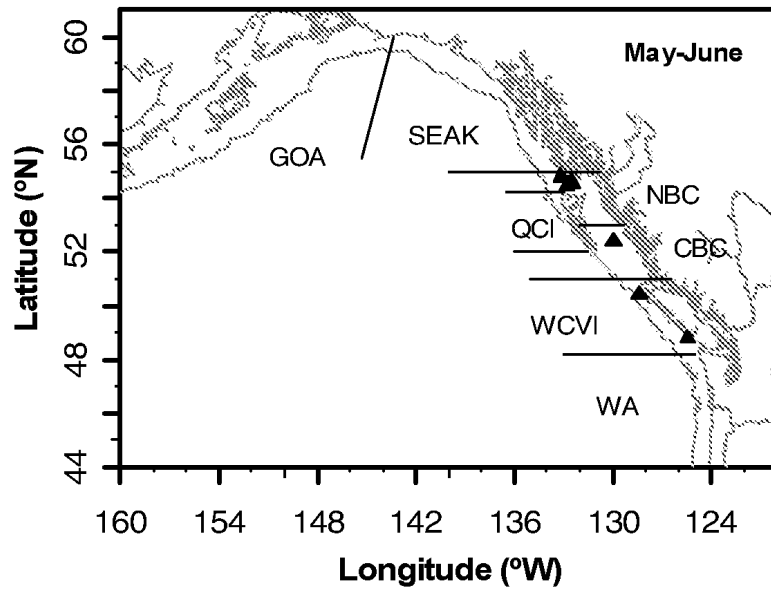
Central Coast



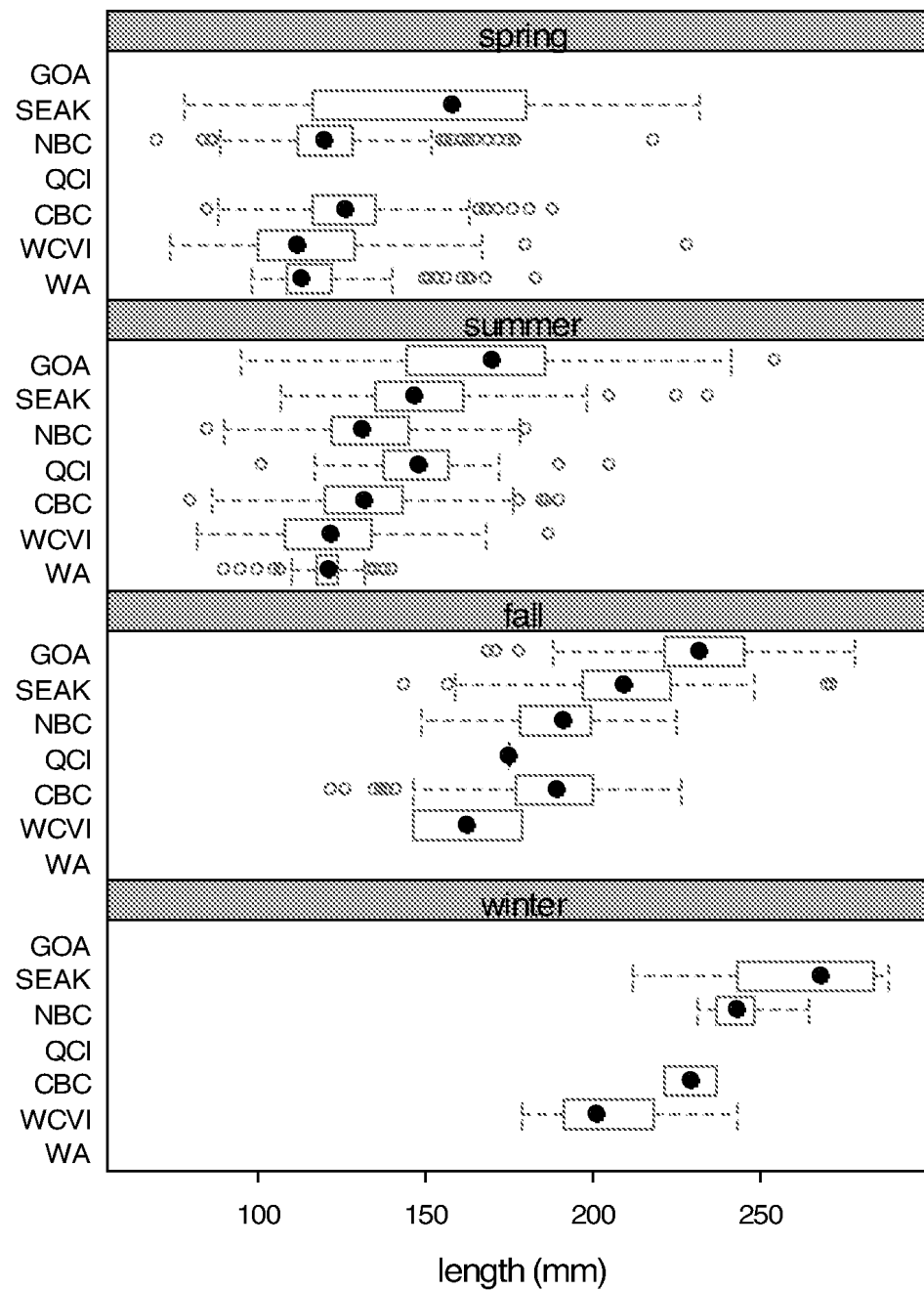
Nass and Skeena Rivers



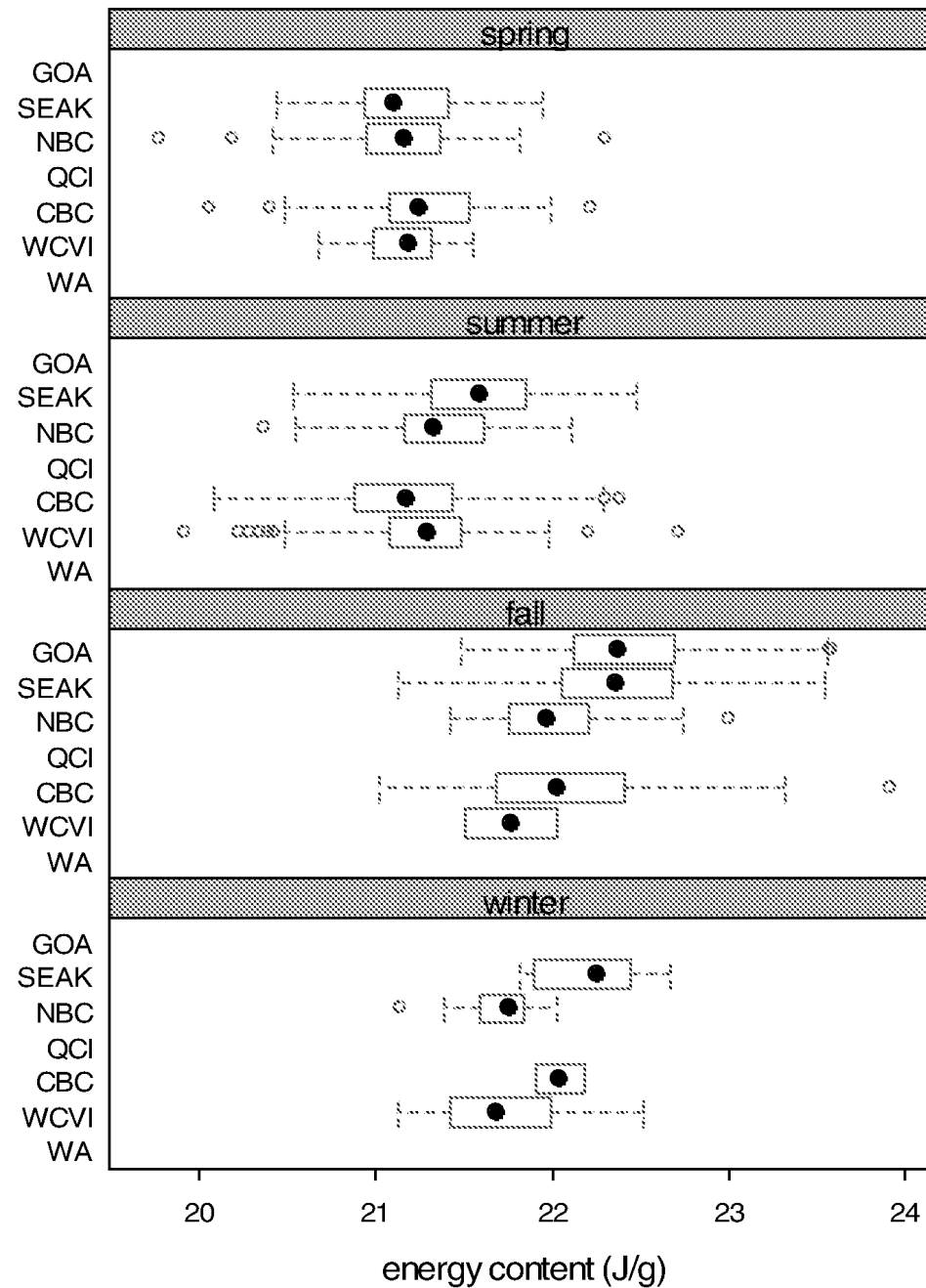
Trans-boundary



Latitudinal Trend in Body Size



Latitudinal Trend in Energy Density



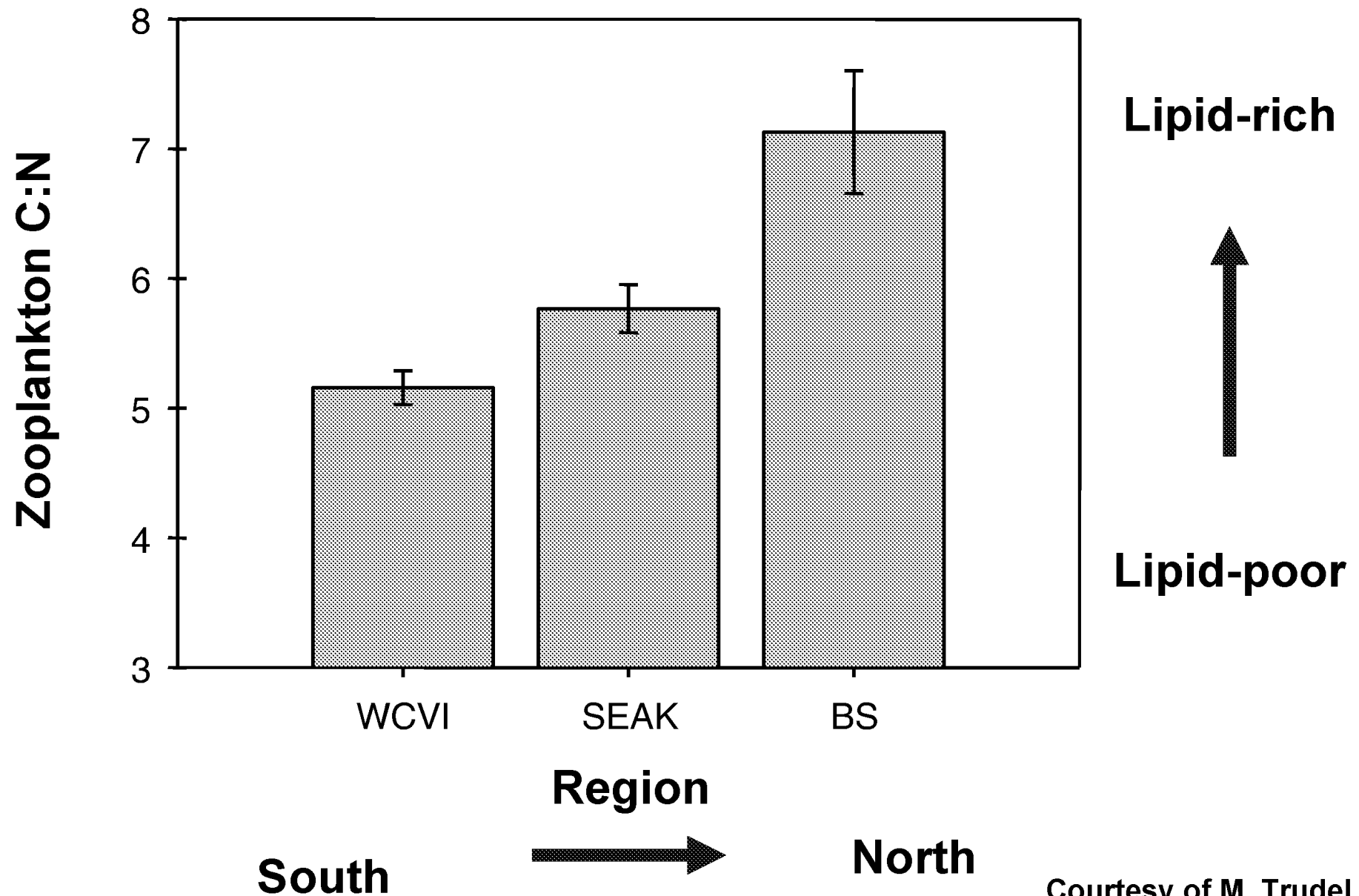
Latitudinal Trend in Body Size

1. there is variation in time and size of ocean entry
2. larger fish migrate faster
3. fish are encountering better growing conditions as they move north therefore are attaining larger size

South » North

↑ prey quality \approx lipid

Regional Variation in Prey Quality



Latitudinal Trend in Body Size

- 1. fish are encountering better growing conditions as they move north therefore are attaining larger size**
- 2. larger fish migrate faster**
- 3. there is variation in time and size of ocean entry**

South » North

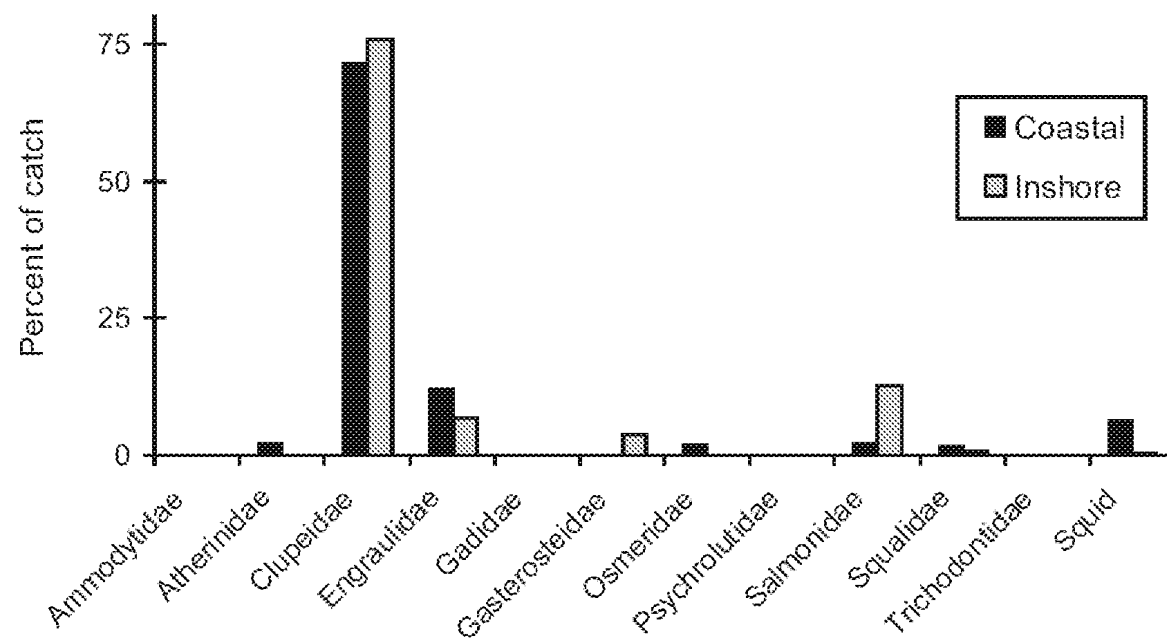


prey quality \approx lipid

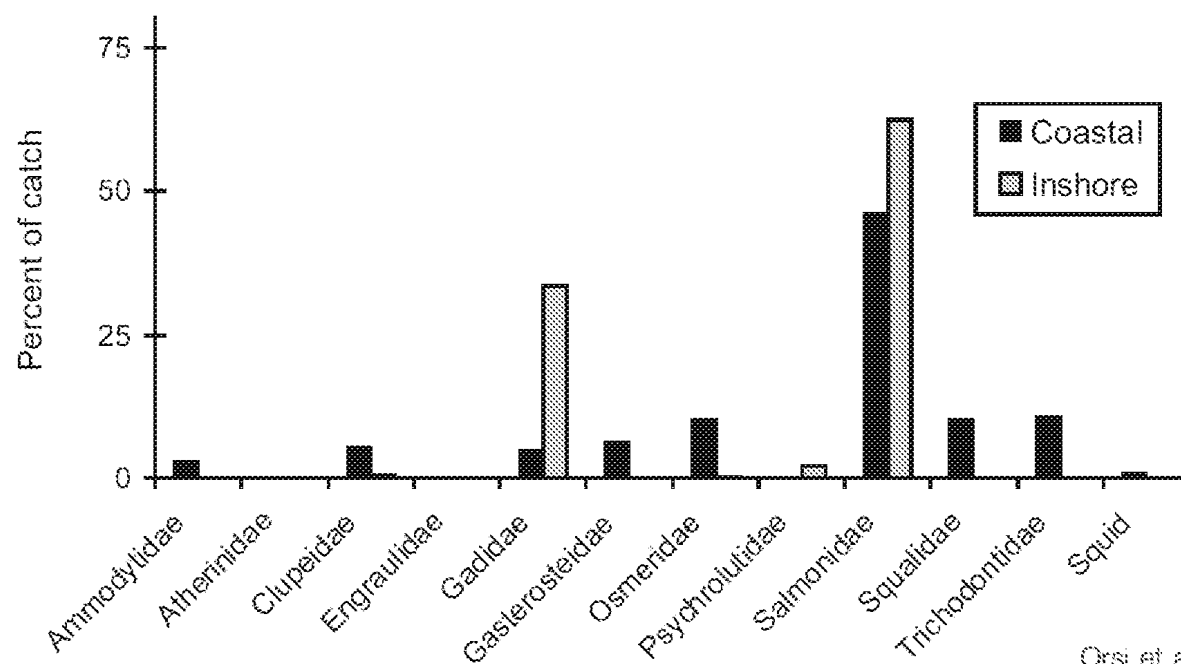


abundances of potential competitors

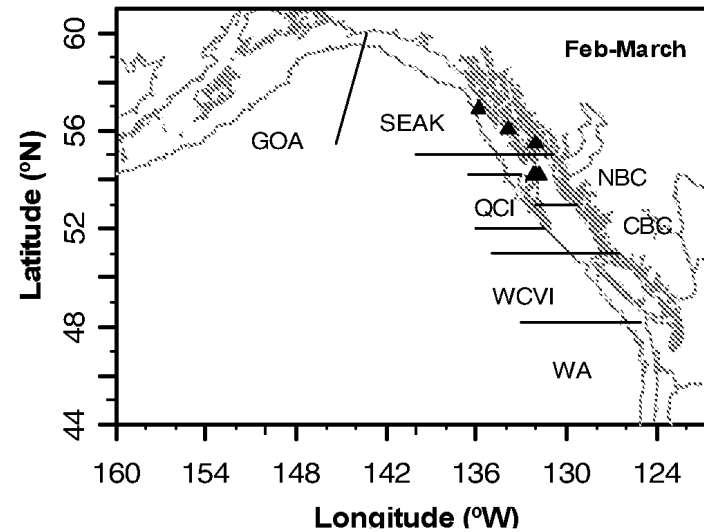
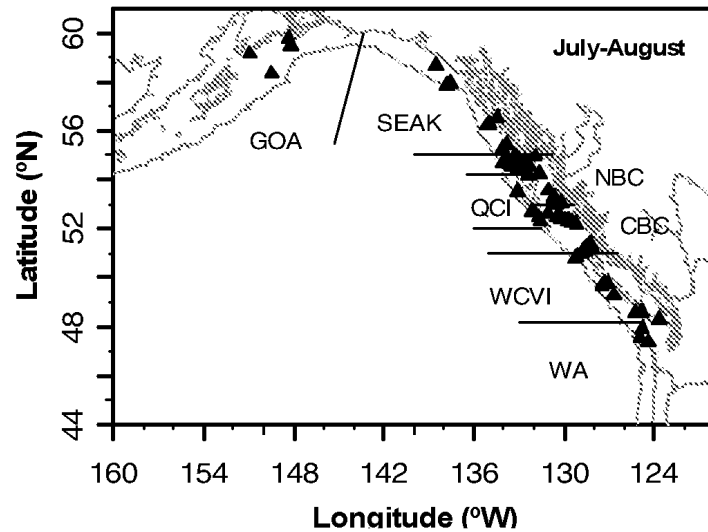
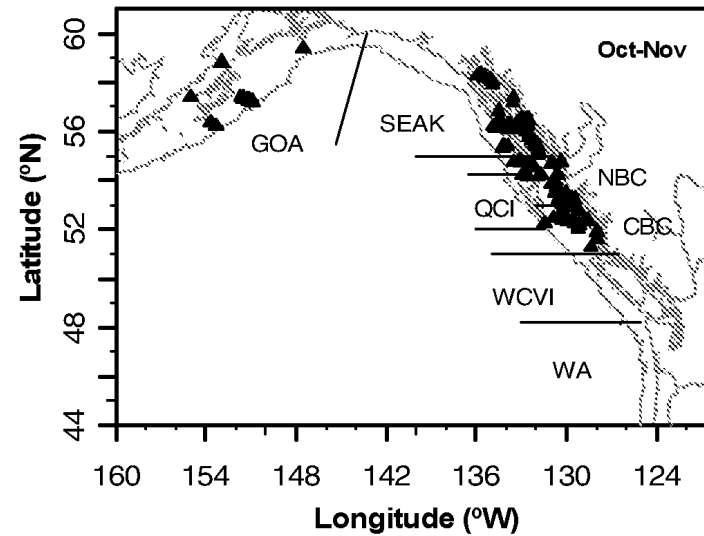
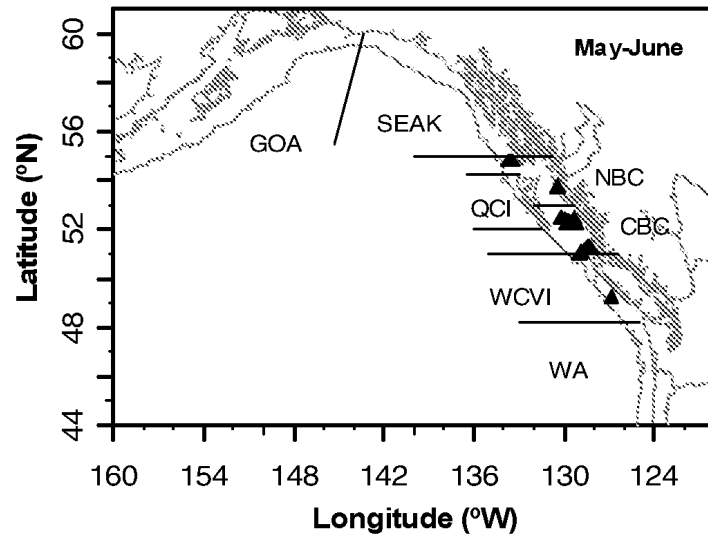
a) California Current ($N = 1,559,691$)



b) Alaska Current ($N = 124,352$)

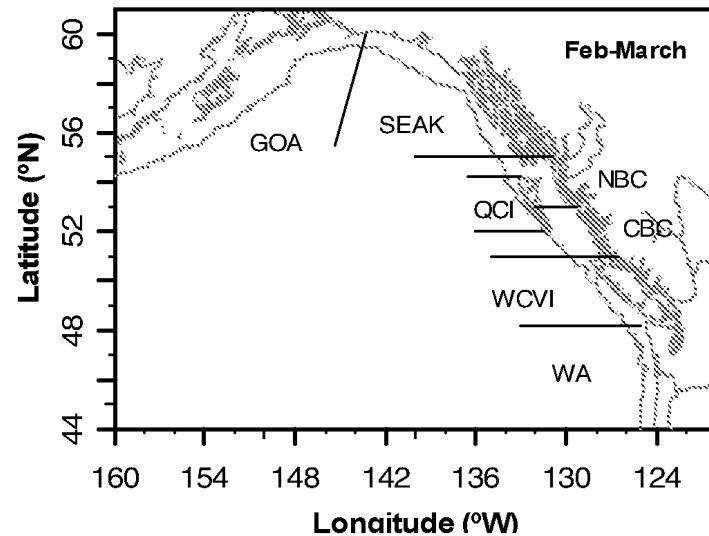
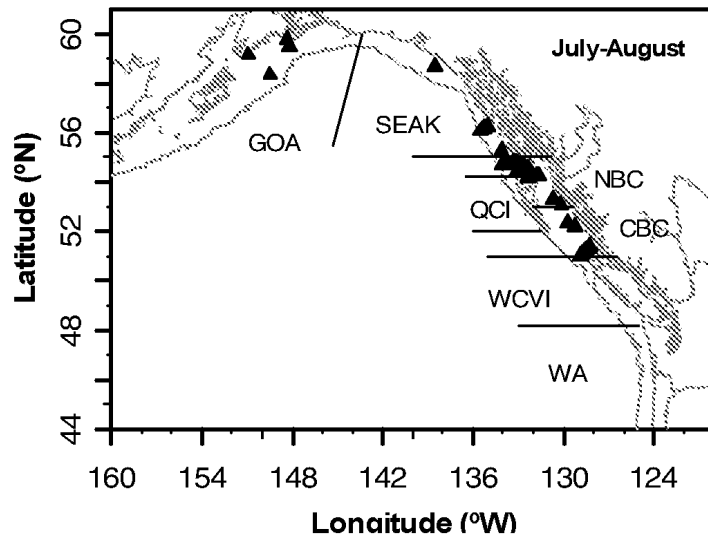
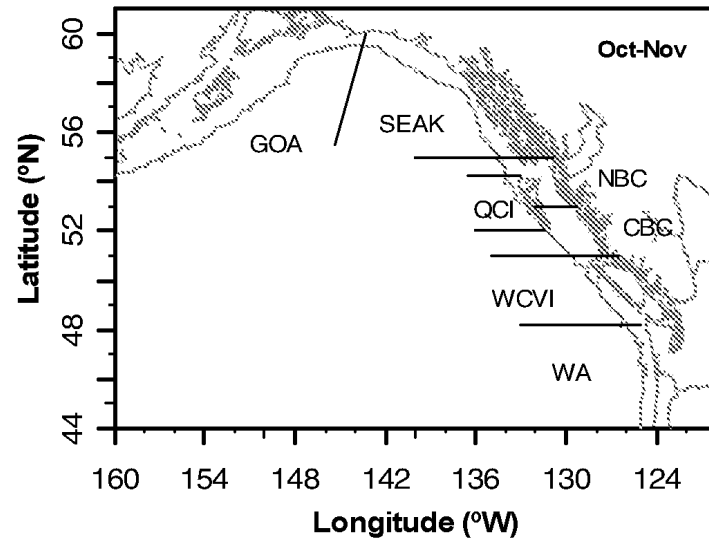
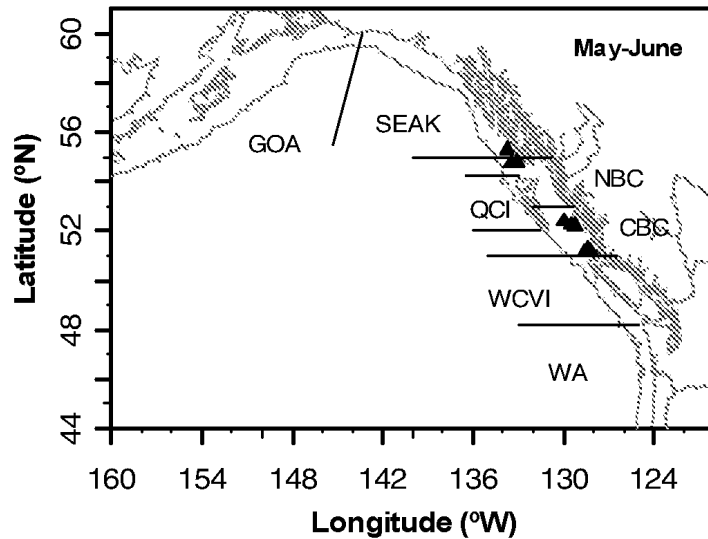


Stock-specific migration: Fraser River



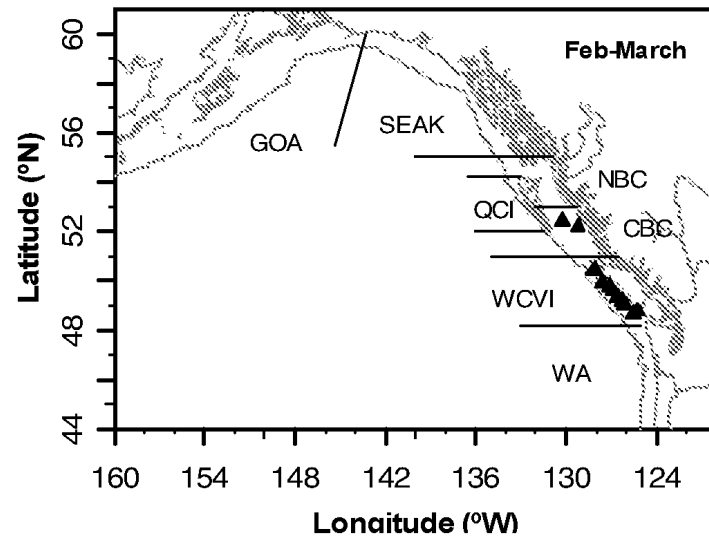
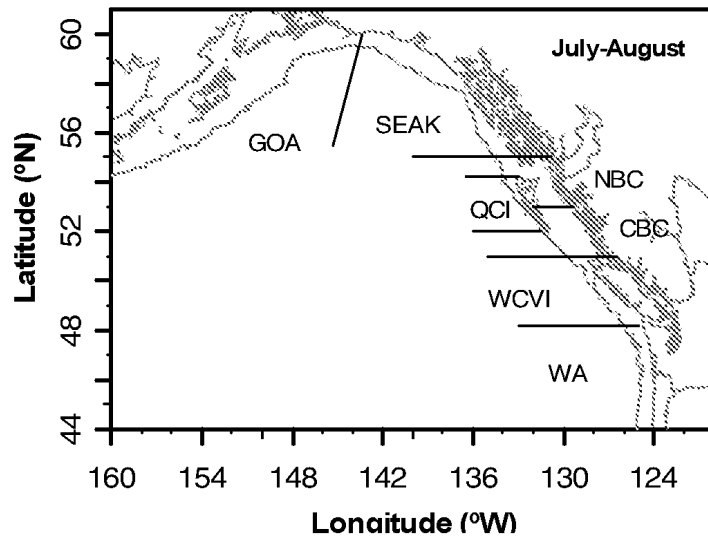
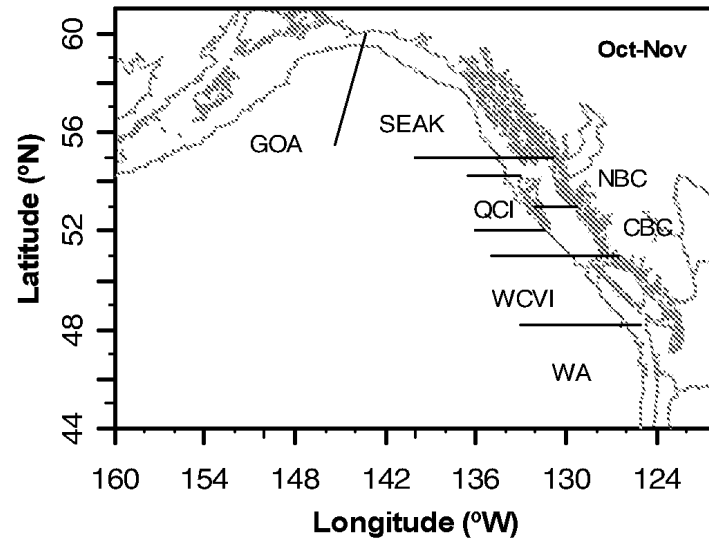
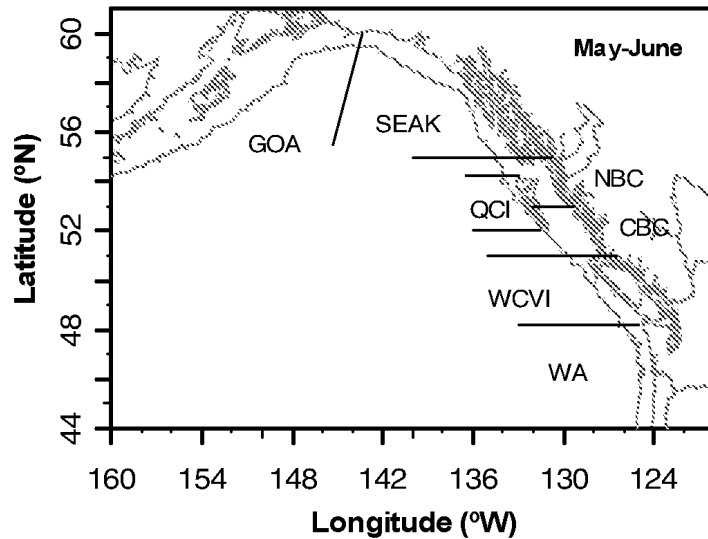
Majority Fraser River stocks

Stock-specific migration: Fraser River



Stuart and Stellako Rivers

Stock-specific migration: Fraser River



Harrison River

Stock-specific migration: Fraser River

Harrison River sockeye: atypical life-history

**smolt immediately following emergence; most stocks 1+ year
freshwater residence**

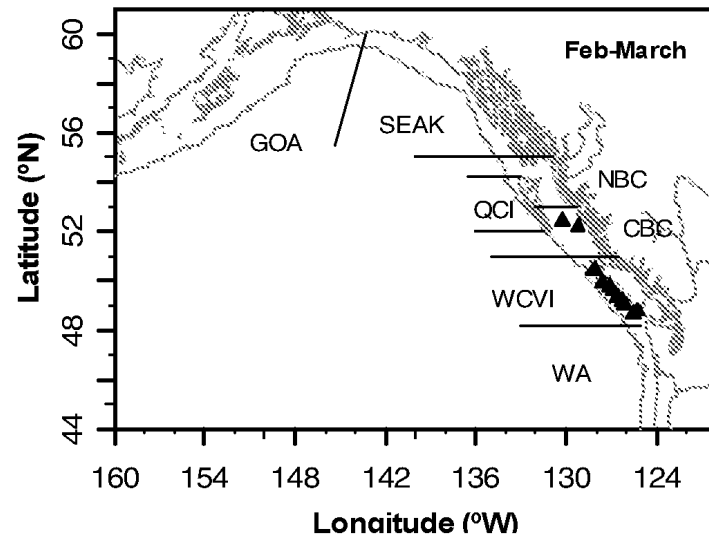
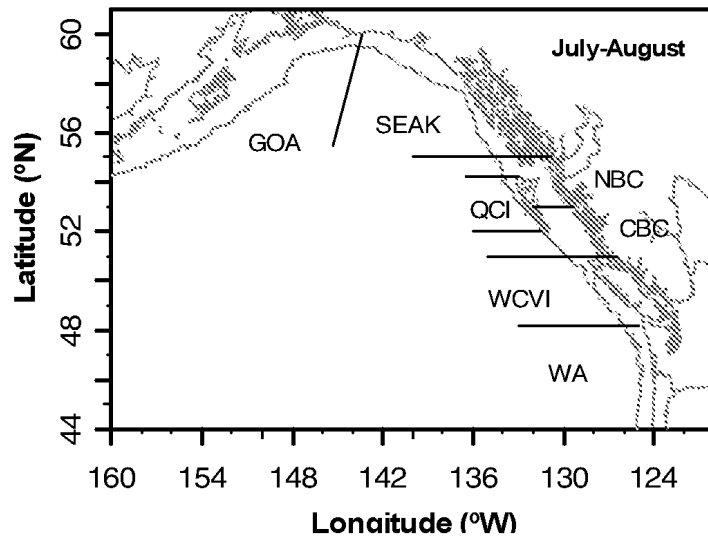
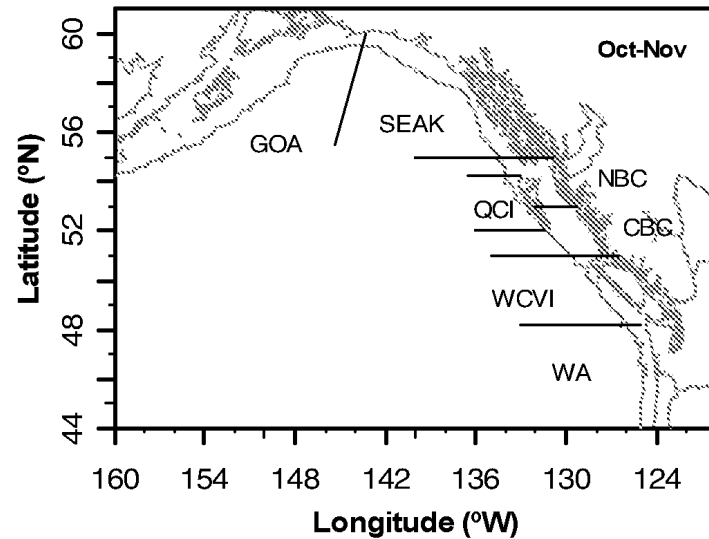
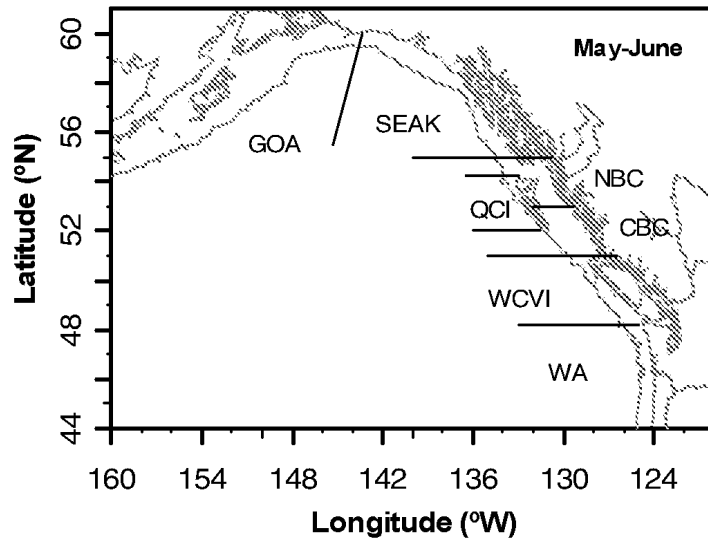
→ enter Strait of Georgia in spring; disappear by late fall

fate unknown till now!

highest consistent survival and returns of Fraser River sockeye

→ related migration pattern??

Stock-specific migration: Fraser River



Harrison River

Stock-specific migration: Rivers Inlet

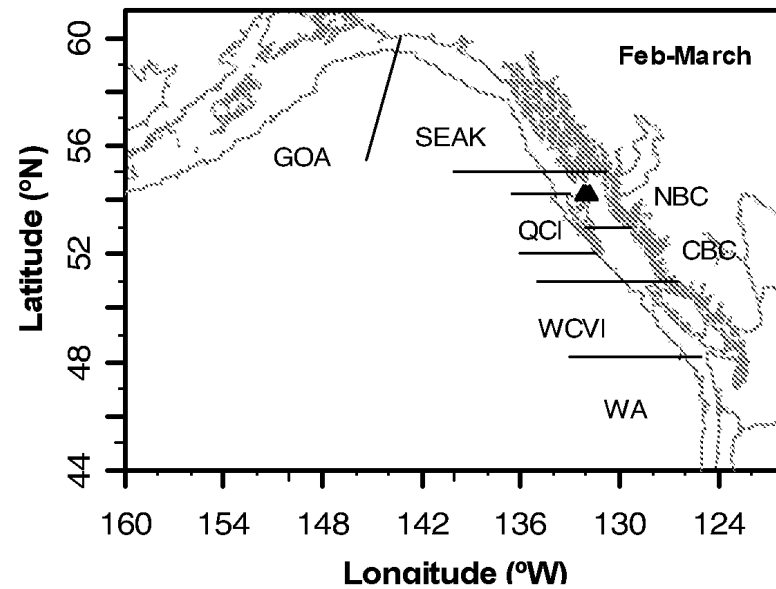
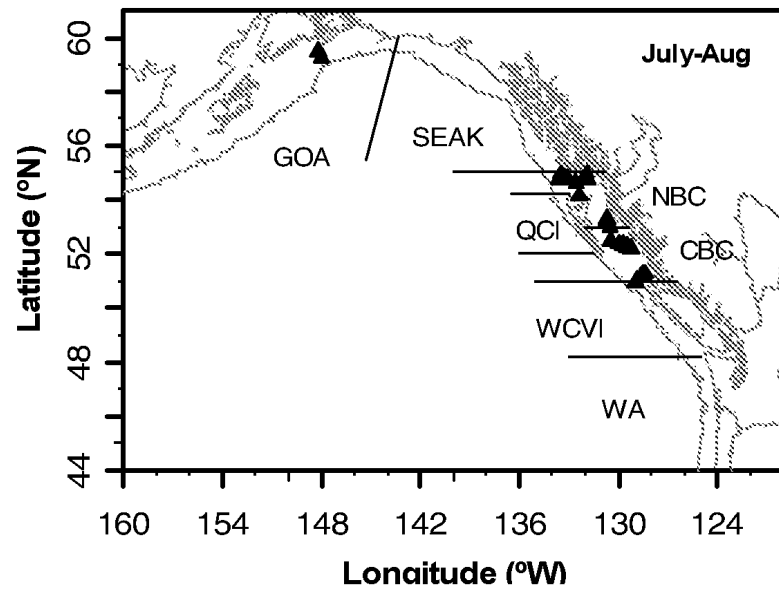
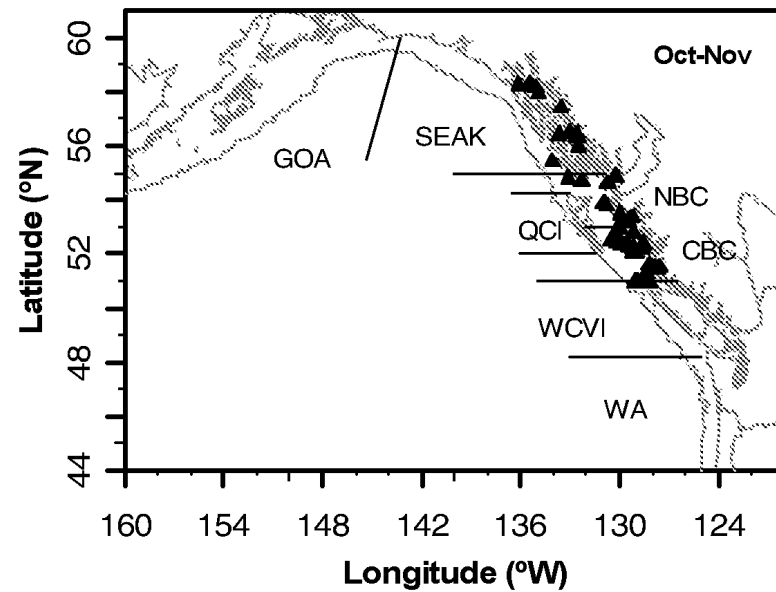
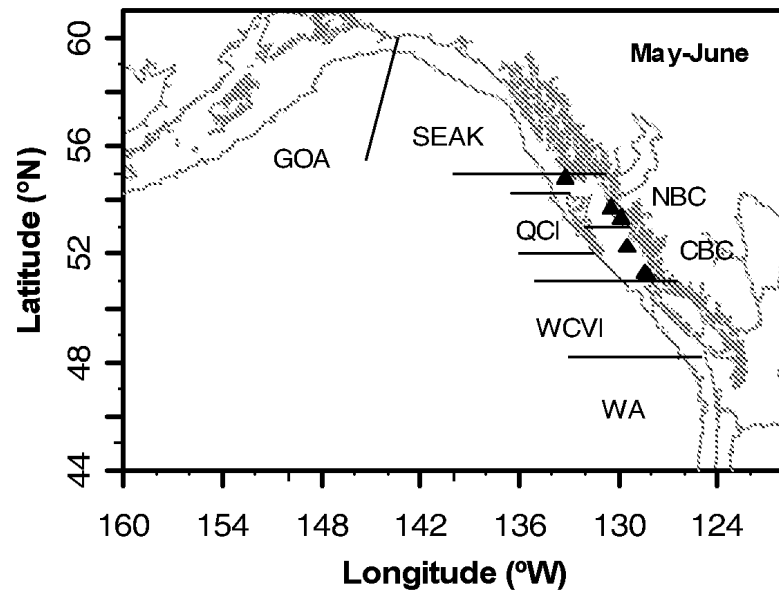
Rivers Inlet sockeye declined to ~ 0.1% of historical abundance

**→ extended period of low marine survival
(McKinnell et al. 2001)**

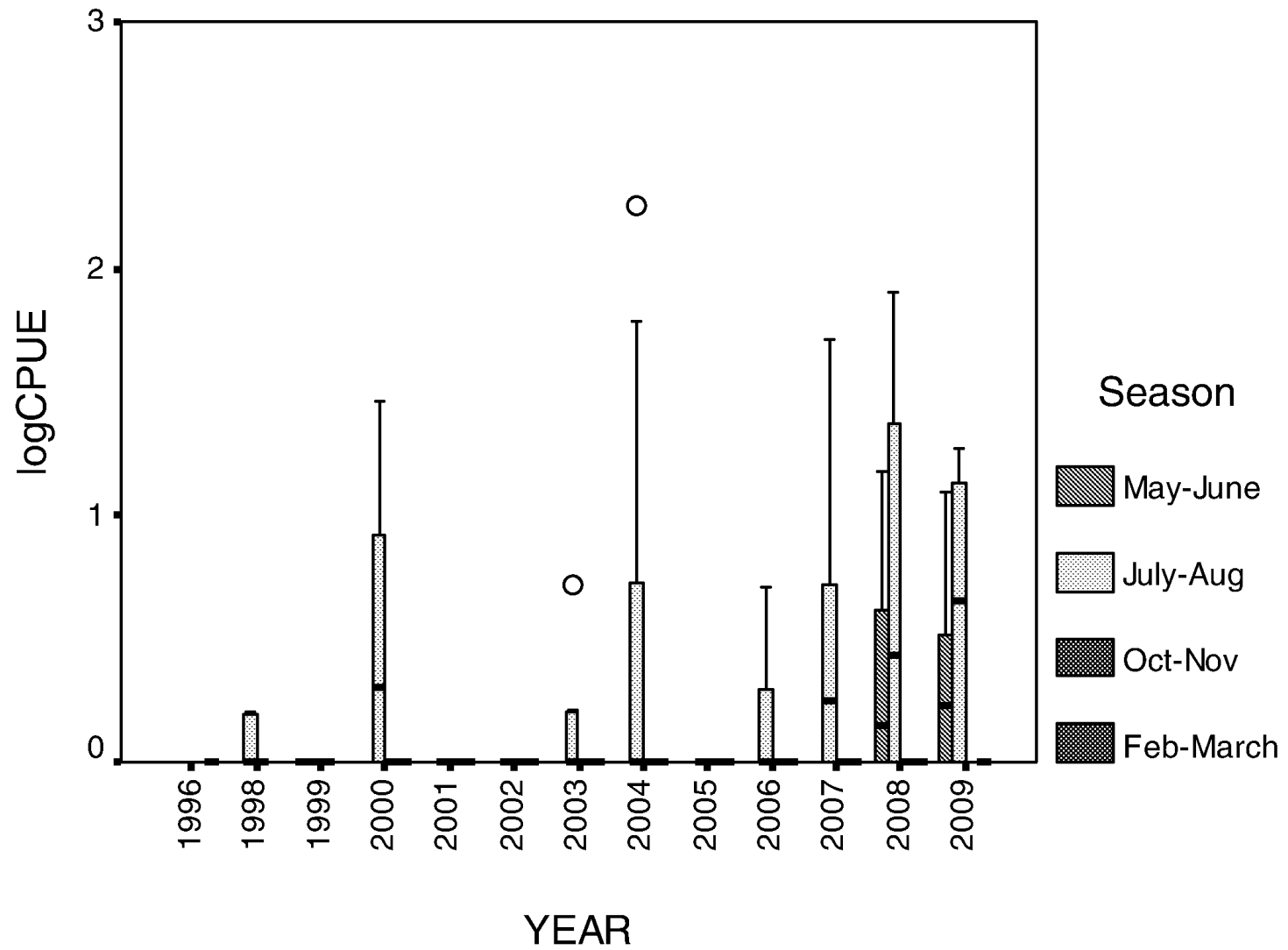
**drastic declines in marine survival not consistent among
other stocks**

→ related to migration pattern??

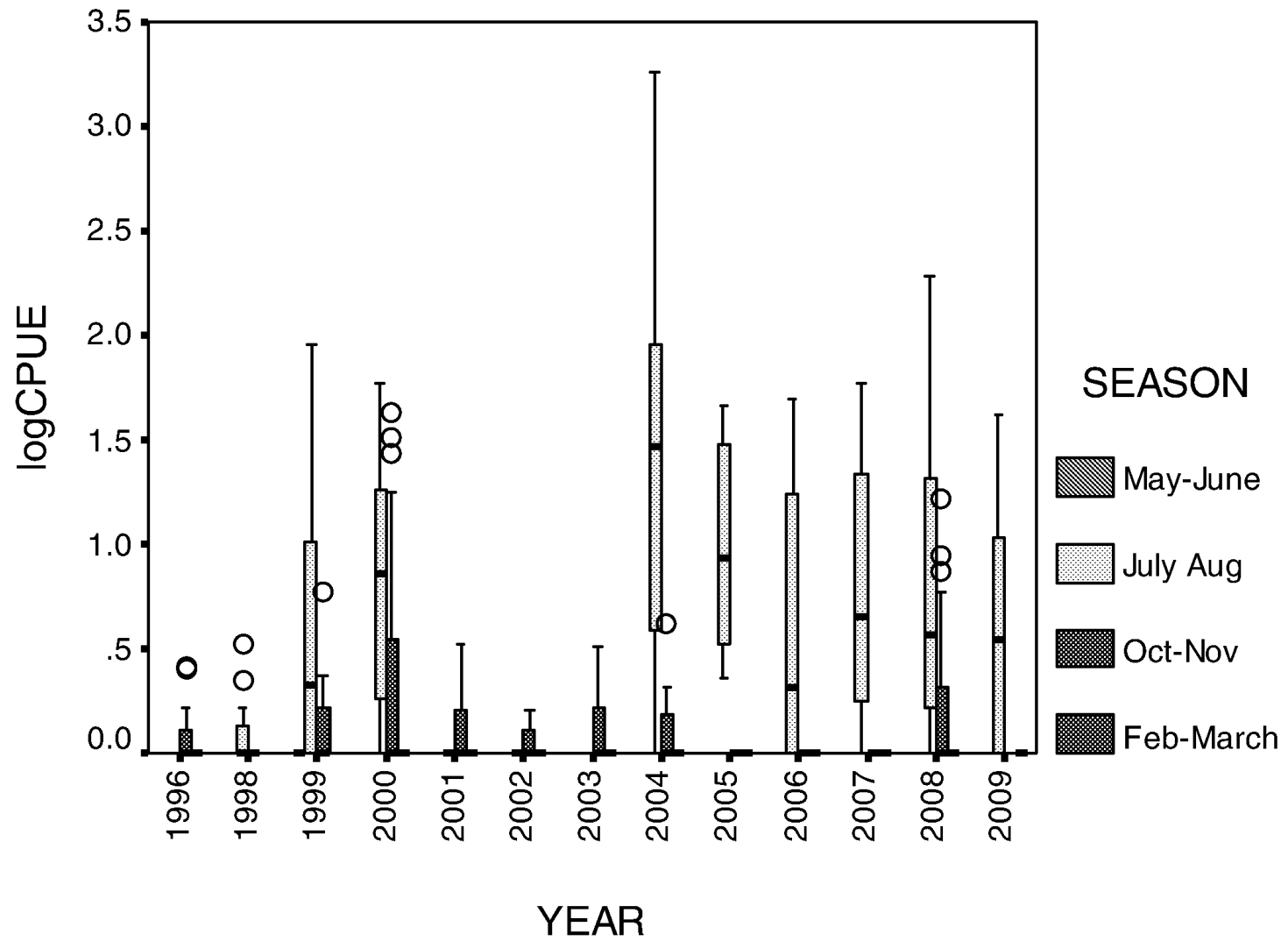
Rivers Inlet



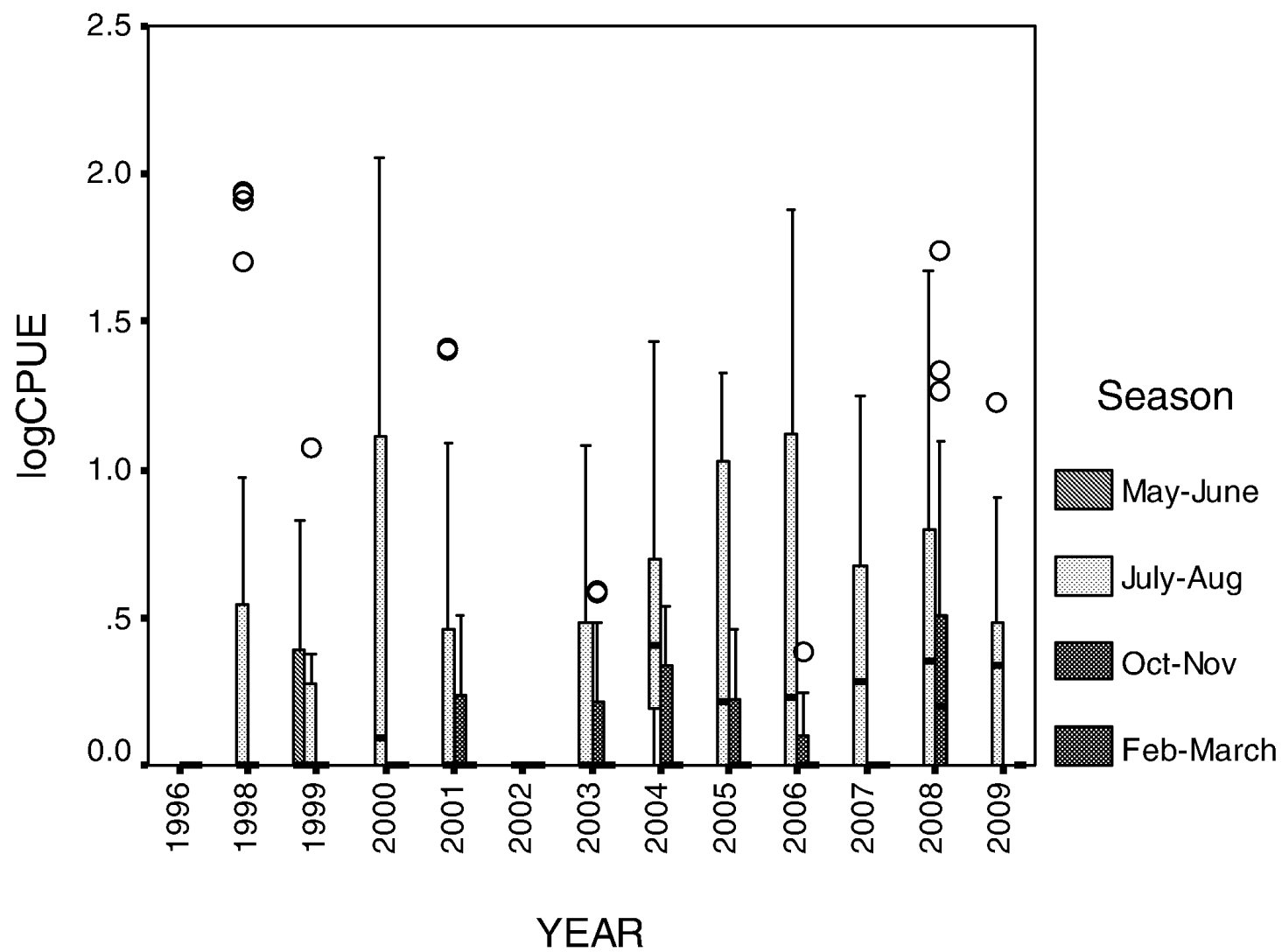
West Coast Vancouver Island



Central BC



Northern BC



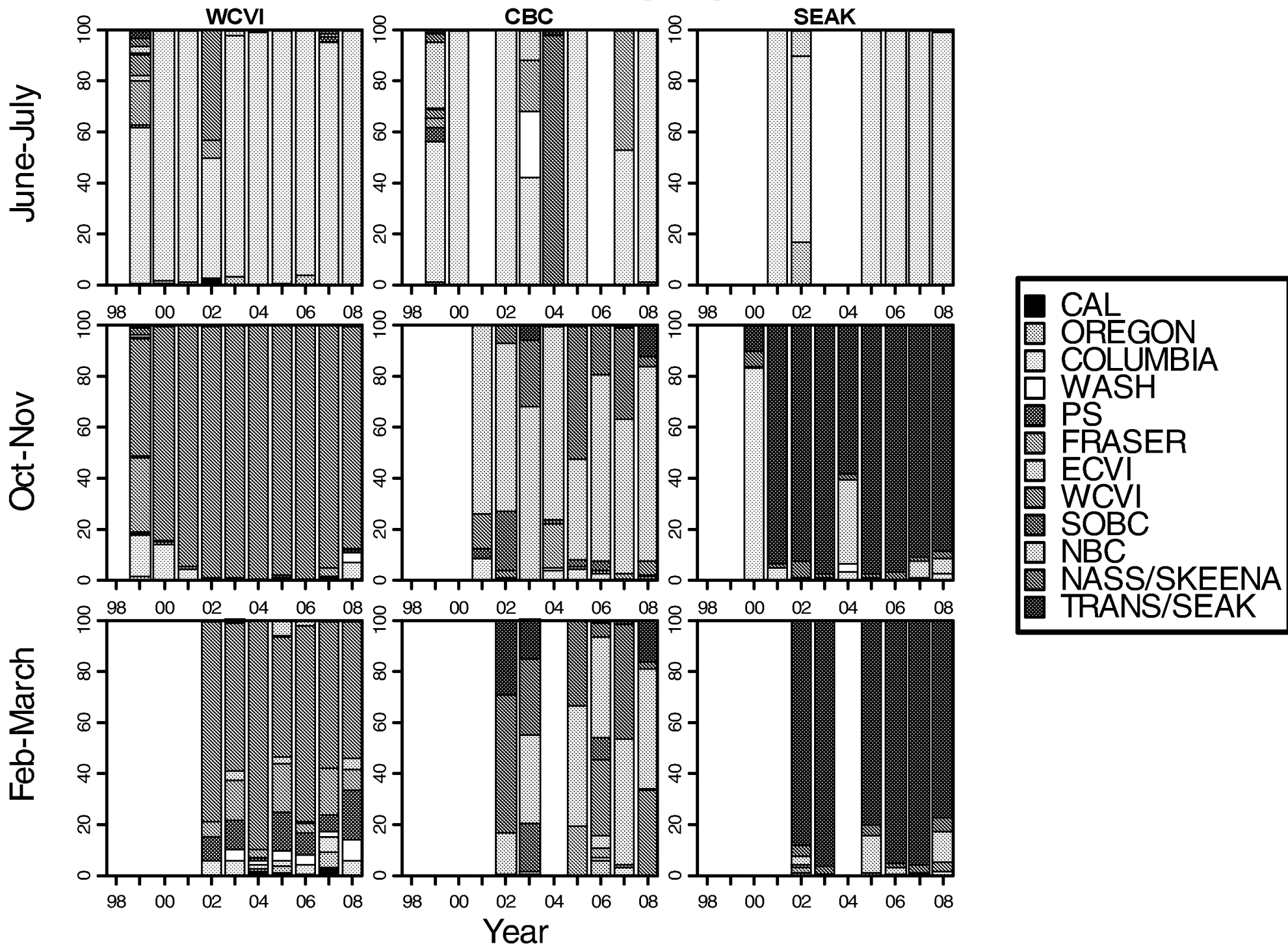
Potential future DNA analysis

Year	Month	Available samples
2007	June	631
	Oct	46
2008	February	38
	June	975
	Oct	379
2009	February	11
	June	606

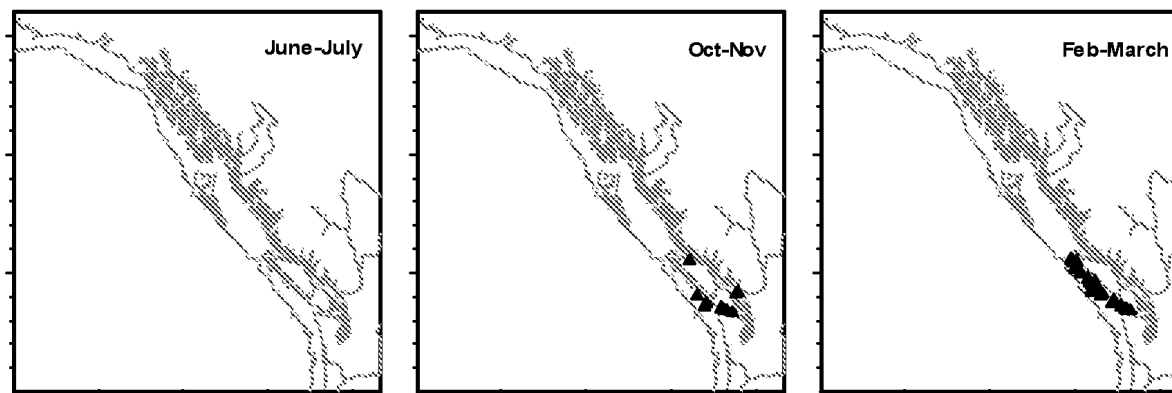
Regional Population	n	Specific Population	% Regional Population
Central Coast	145	Long Lake	24.8
		Kitlope	16.6
		Devon Lake	13.1
		Bella Coola	6.2
		Banks	5.5
		Kitkiata Lake	4.1
		Kimsquit	3.4
		Kingkown	3.4
		Canoona	2.8
		Deer Lake	2.8
		Kitimat	2.8
		Lowe	2.1
		Mikado Creek	2.1
		Shawatlan Lake	2.1
		West Arm Creek	2.1
		Tankeeah	1.4
		Tenas	1.4
Columbia	108	Okanagan River	76.9
		Rocky Reach	16.7
		Lake Wenatchee	6.5
ECVI	19	Nimpkish	52.6
		Woss Lake	26.3
		Vernon	15.8
		Nahwitti	5.3
Fraser	1622	Lower Adams	20.1
		Chilko	19.4
		Mitchell	5.2
		Lower Shuswap	4.3
		Stellako	4.3
		Upper Horsefly	4.0
		Birkenhead	3.8
		Little River	3.7
		Scotch	3.5
		QuesnelTrib#4	3.0
		Tachie	2.9
		Middle Shuswap	2.8
		Weaver	2.8
		Horsefly	2.4
		Nadina	2.2
		Chilkosouth	1.8
		Seymour	1.7
		Pinchi Creek	1.4
		Harrison	1.1
		Fennell	1.0

Regional Population	n	Specific Population	% Regional Population
NassSkeena	577	Fulton Late	37.6
		Meziadinweir	13.7
		Upper Babine	9.5
		Pierre	7.3
		Meziadin beach	5.0
		Morrison	4.3
		Tintina Creek	3.6
		Hanna Creek	3.1
		Salix Bear	2.3
		Gingit	2.1
		Nangeese Kispi	1.6
		Kispiox	1.2
		Kwinageese	1.2
		Bowser	1.0
		Kalum	1.0
		Stephens Kispox	1.0
		Alastair	0.5
		Schulbuckhand	0.5
		Sustut	0.5
		Bonney	0.3
SEAK	141	Damdochax	0.3
		FourMile	0.3
		Scud	0.3
		McDonald	38.3
		Chilkat River	19.9
		Hugh Smith	11.3
		Luck	11.3
		Kutlaku Lake	5.0
Trans-boundary	130	Kegan	4.3
		Hetta	2.8
		Karta	1.4
		Scud	28.5
		Iskut	20.0
		OConnor	17.7
		Craig River	10.8
		Yonakina	5.4
		Upper Stikine	4.6
		Shakes Creek	3.1
Washington	87	Tuya	2.3
		Stikinemain	1.5
		Tulsequah	1.5
		Lake Washington	97.7
WCVI	608	Baker Lake	2.3
		Great Central	29.1
		GCL North	11.8
		GCL McBride	10.7
		Sproat Antler	8.9
		Kennedy	8.1
		GCL Fawn	7.4
		Sproat	6.7
		Henderson	6.3
		Sproat Snow	6.1
		Sproat Gracie	2.0
		Hobiton	1.8
		GCL Forest2	1.2

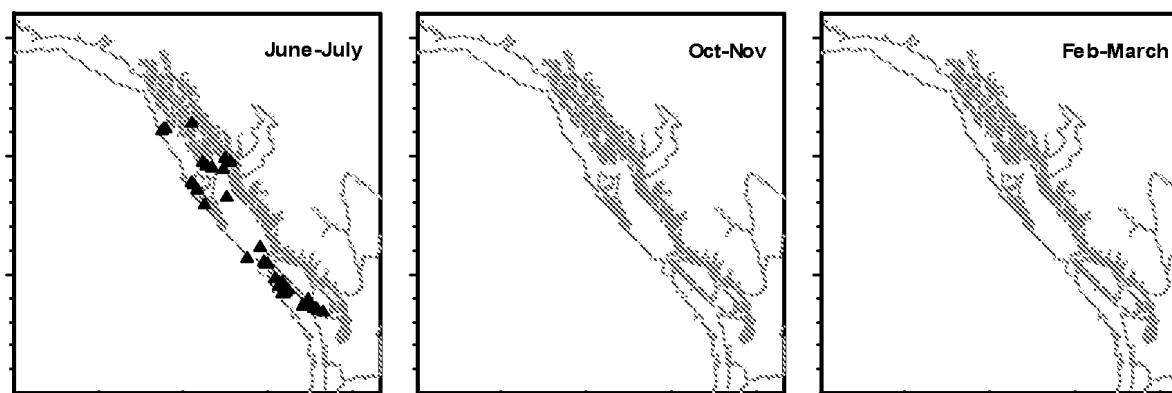
Annual stock proportions



F: Fraser River Chinook
sub-yearling:
0.0



0.1



South East Alaska

