

Regional Distribution of Environmental Contaminants in Alaskan Fishes





Population 640,000

586,400 square miles (375,296,000 acres)

3 million lakes

12,000 rivers

33,000 miles of coastline

Spanning 3 different seas: Arctic Ocean, Pacific Ocean, Bering Sea

Fish Monitoring Program:

Determine if Alaska's seafood and freshwater fishes have been negatively impacted by environmental contaminants and monitor data trends

- General Survey of Alaskan Fishes:
 - Commercial , Subsistence, Recreational species
 - Opportunistic sampling-
 - Samples collected at commercial, recreational and subsistence fish harvest sites
 - Sampling Plan developed for Halibut with guidance from the IPHC biometricians

Fish Collection Procedures

- Basic technique:

- -Whole fish are collected (trawls, seine nets, hook and line)
- -Fish are killed and placed in a food grade plastic bag (fish sleeve)
- -Fish are placed on ice and shipped immediately; or frozen and shipped later

- Modified technique for Halibut:

- -Halibut are caught on longline
- -Length measurements are used to calculate weight, otoliths are removed for aging
- -3 to 5 pound section of fillet will be removed from directly behind the gill plate and processed as skinless fillet

- Dockside or Creel Survey:

- -Portion of the fillet is collected in a food grade plastic bag
- - Analyzed for total mercury and trace metals

Target Analytes

- **Heavy Metals:**

- Mercury: Total Mercury, Methyl-Mercury
- Arsenic, Cadmium, Chromium,
Nickel, Lead, Selenium

- **Organochlorine Compounds:**

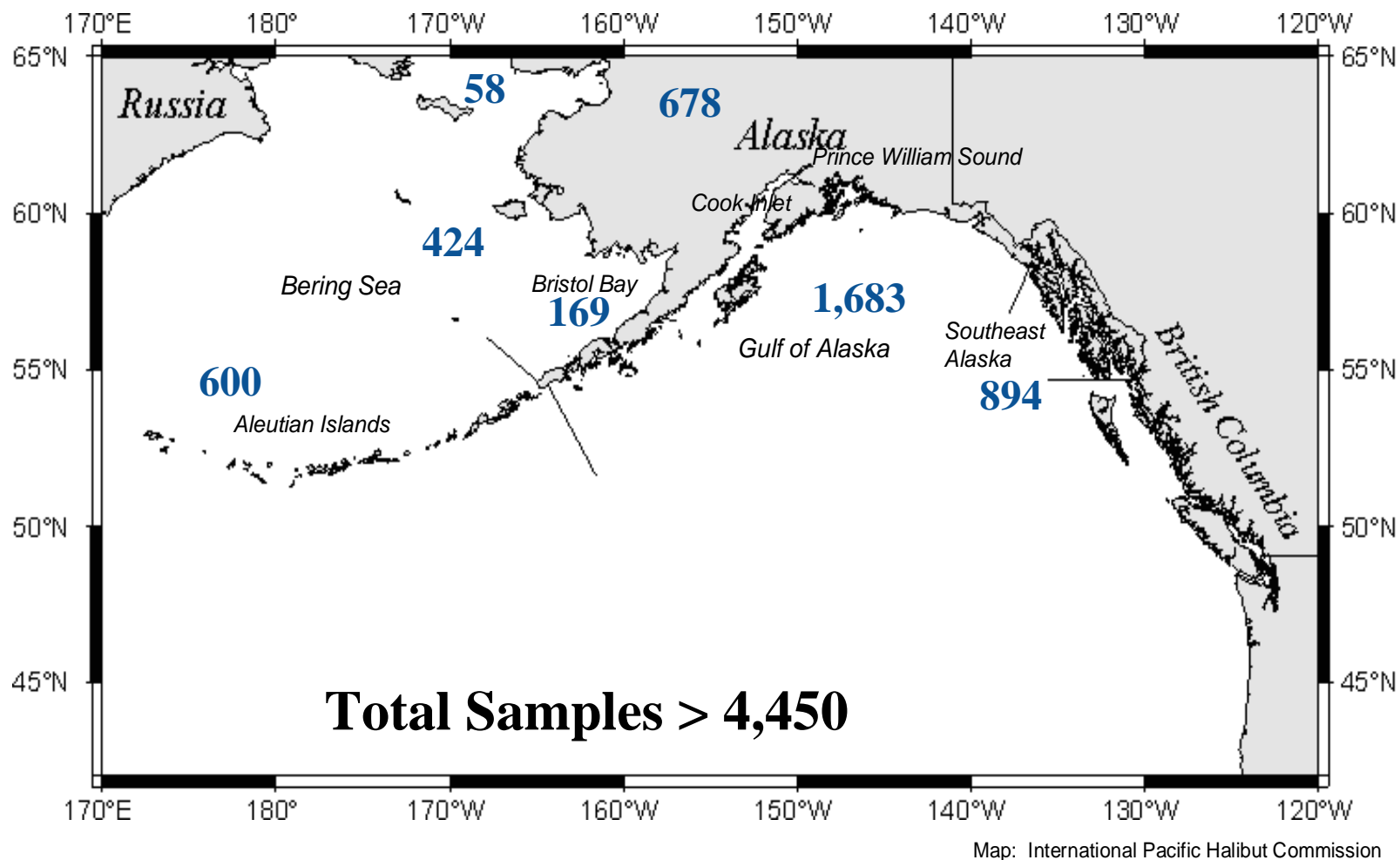
- PCBs
- Dioxins and Furans
- Pesticides

- **Emerging Contaminants:**

- Brominated Fire Retardants (PBDE)

*** Analysis is performed on a skinless fillet

Areas Where Fish Were Collected in the DEC Fish Monitoring Program



Number of Fish Samples per Region

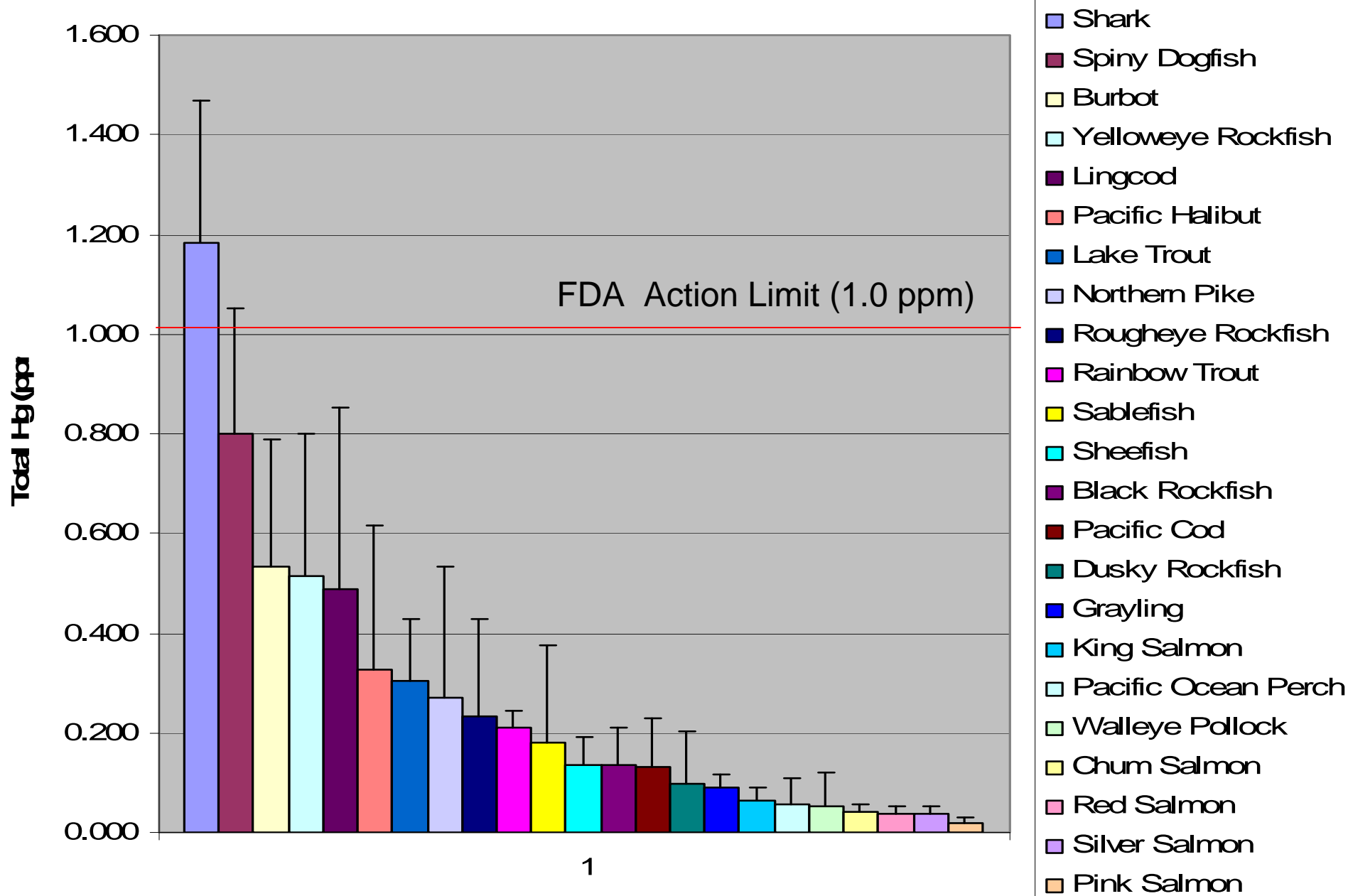
Fish Tissue Monitoring Program

Halibut	1,431
Pacific Cod	135
Pollock	185
Lingcod	136
Sablefish	230
Black Rockfish	71
Rougheye Rockfish	38
Pacific Ocean Perch	78
Chinook Salmon	140
Coho salmon	253
Sockeye Salmon	230
Chum Salmon	257
Pink Salmon	172
Northern Pike	483
Grayling	33
Dolly Varden	16
Sheefish	8
Burbot	21
Rainbow Trout	34
Lake Trout	16

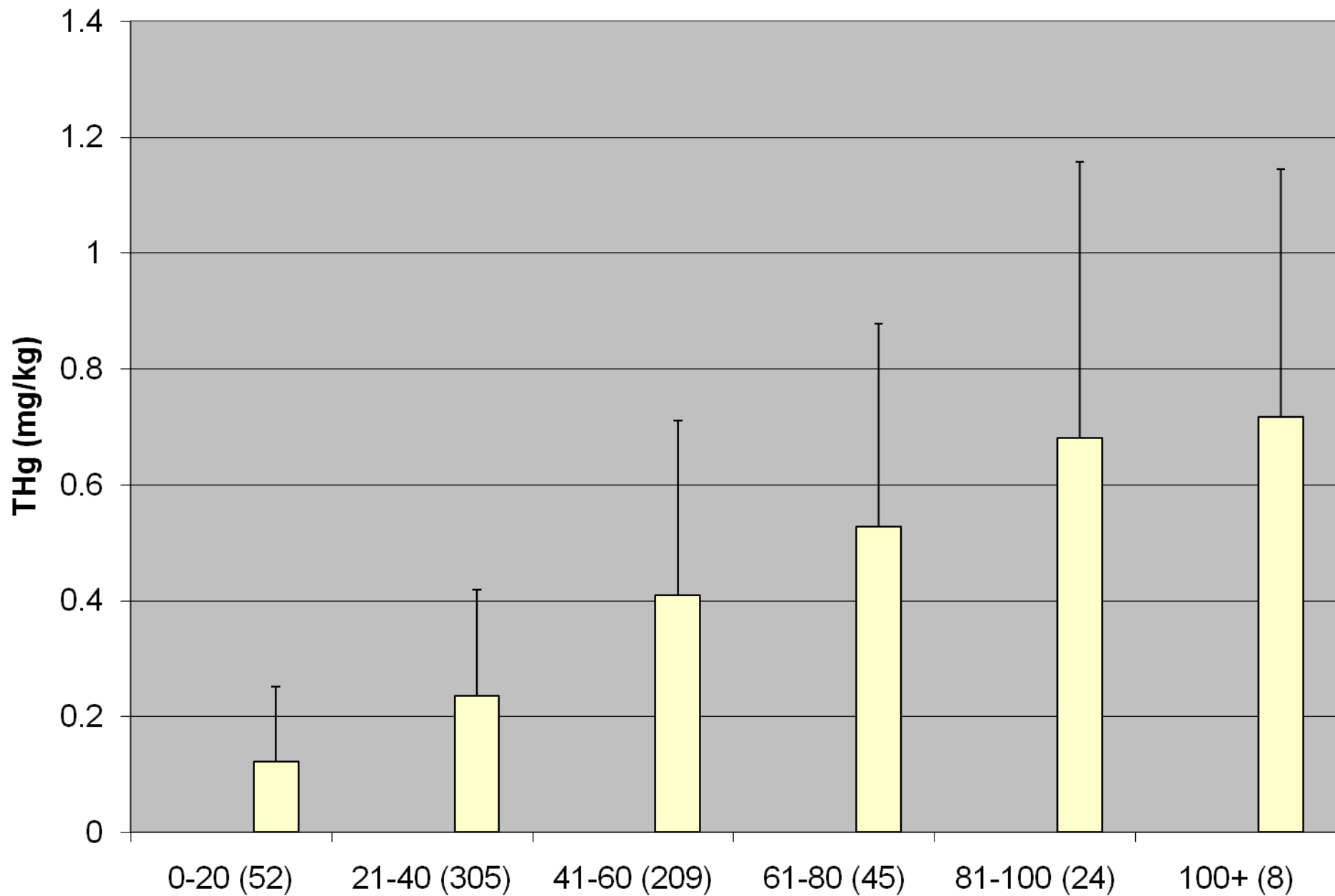
Dockside Creel Survey

Halibut	198
Pacific Cod	4
Lingcod	114
Sablefish	6
Black Rockfish	53
Rockfish- Silvergray	4
Rockfish-Dusky	55
Rockfish-Quillback	6
Rockfish-Yelloweye	53
Shark	86
Shark-Spiny Dogfish	49

Mean Total Mercury: mg/kg (ppm)



Halibut Mean THg per Wt Class



Sources of Environmental Contaminants

- Local
 - Natural Geologic sources, forest fires
 - Industrial production
 - Military Sites
 - Resource Extraction- mines, oil exploration
- Long Range Transport
 - Atmospheric
 - Ocean Currents
 - Animal migration
 - Commercial transport

Long Range Transport vs Local Sources

- Survey Work by USFWS – current and historic data
- Western Airborne Contaminants Study – National Parks Service
- Research Work by University of Fairbanks
- Historic Fisheries surveys NOAA

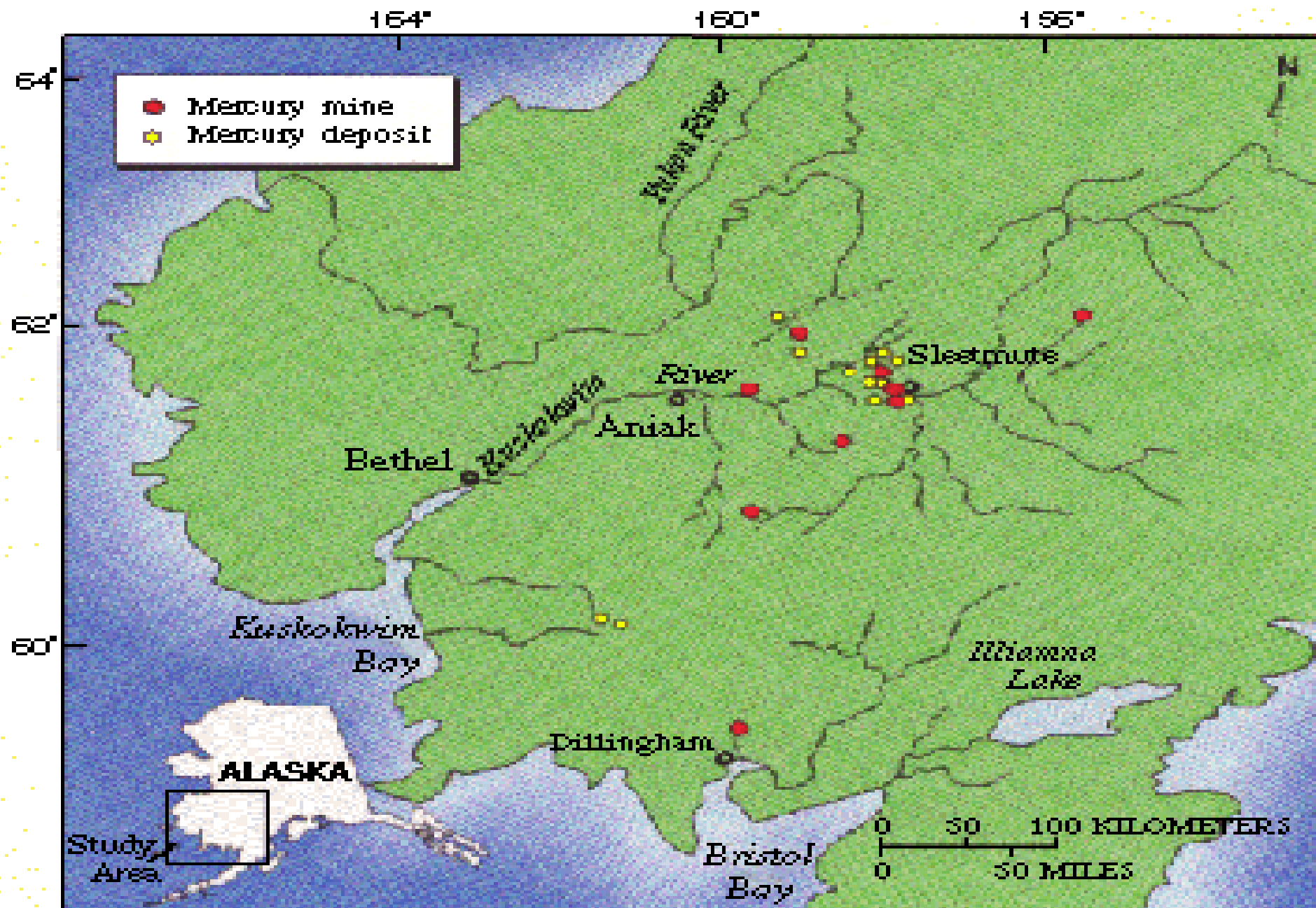
Volcanic Activity

Historically Active Alaskan Volcanoes

★ Volcanoes monitored by the Alaska Volcano Observatory





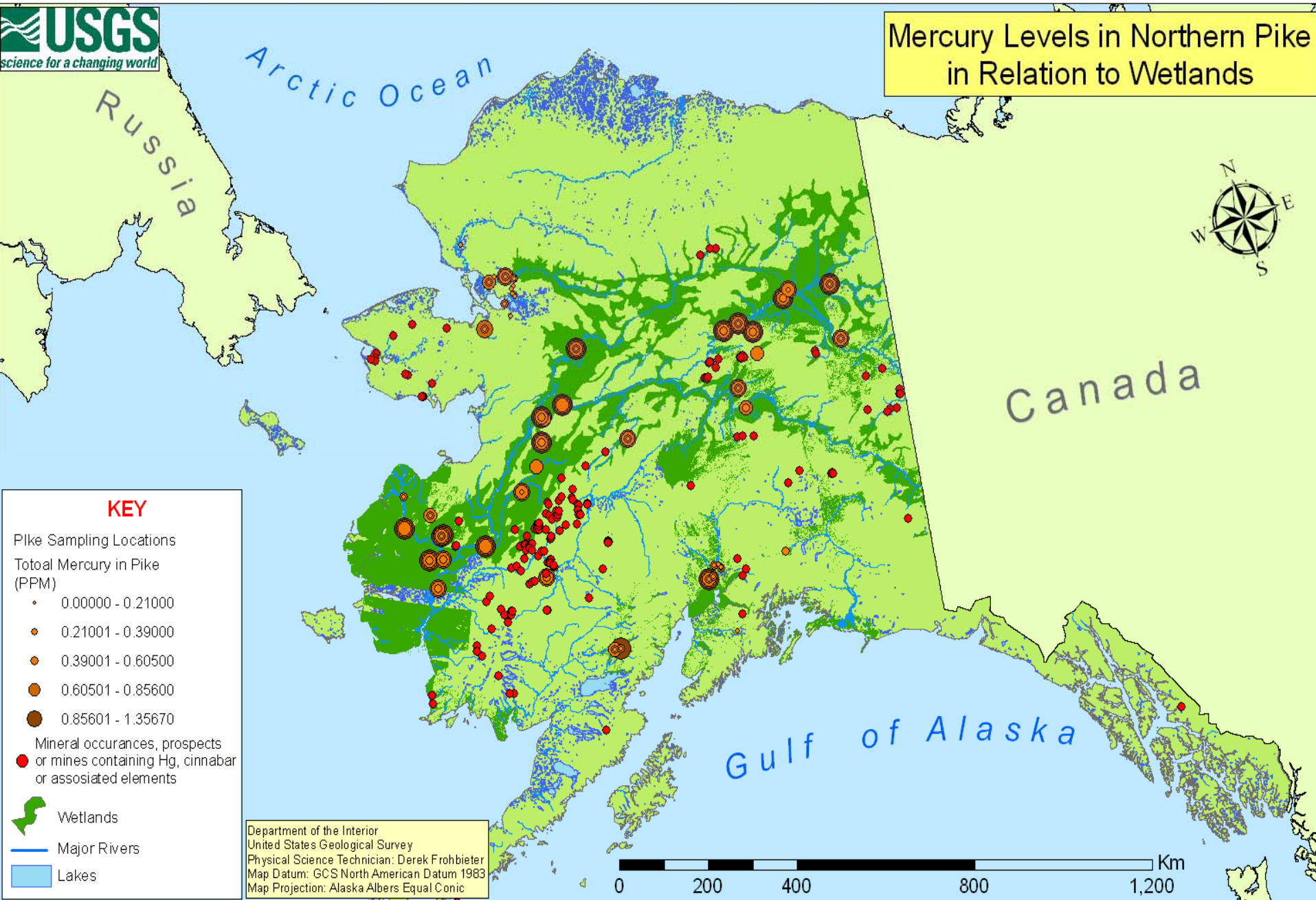


Location of mercury mines and deposits in southwestern Alaska

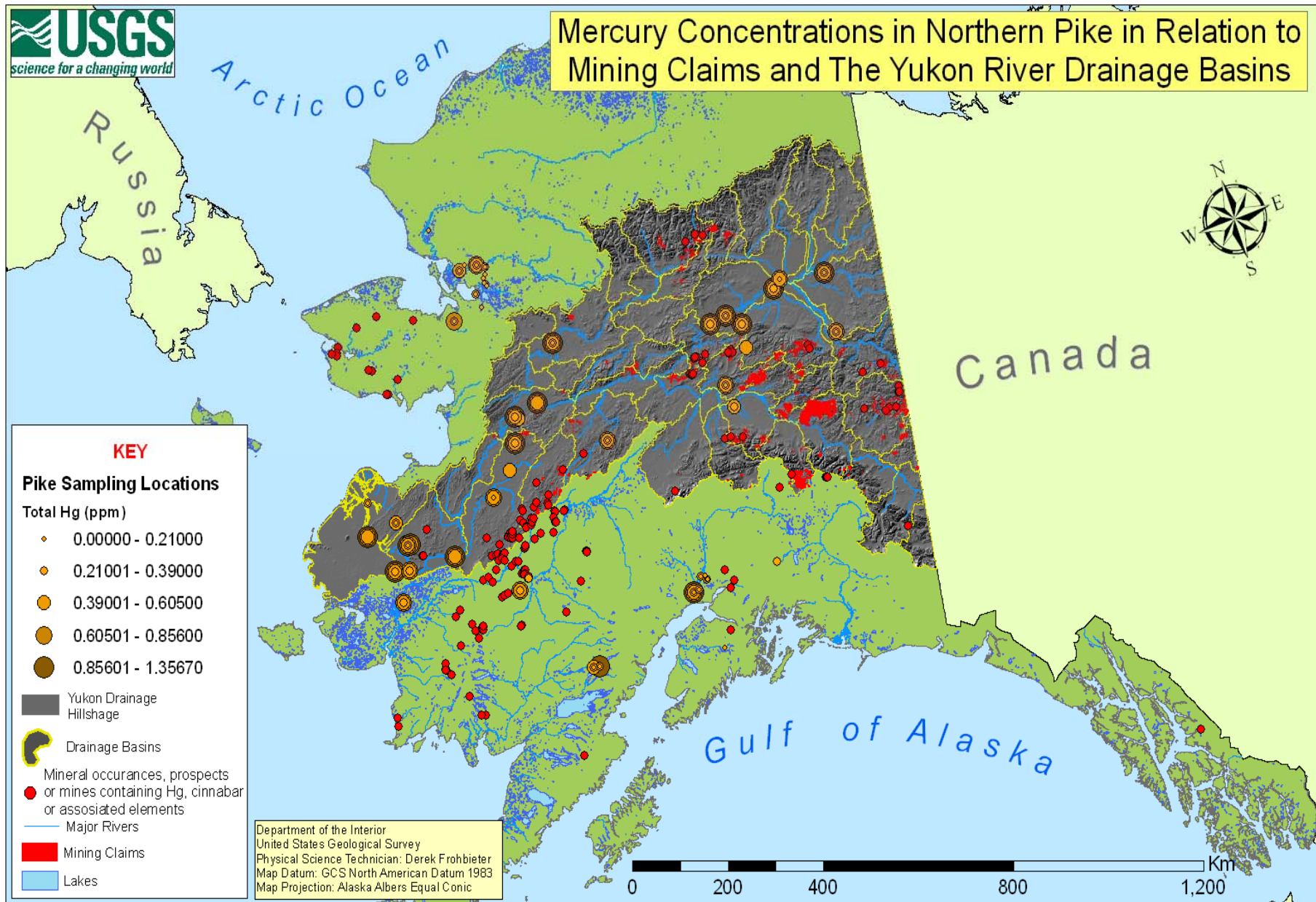


Sample of cinnabar (red mineral)

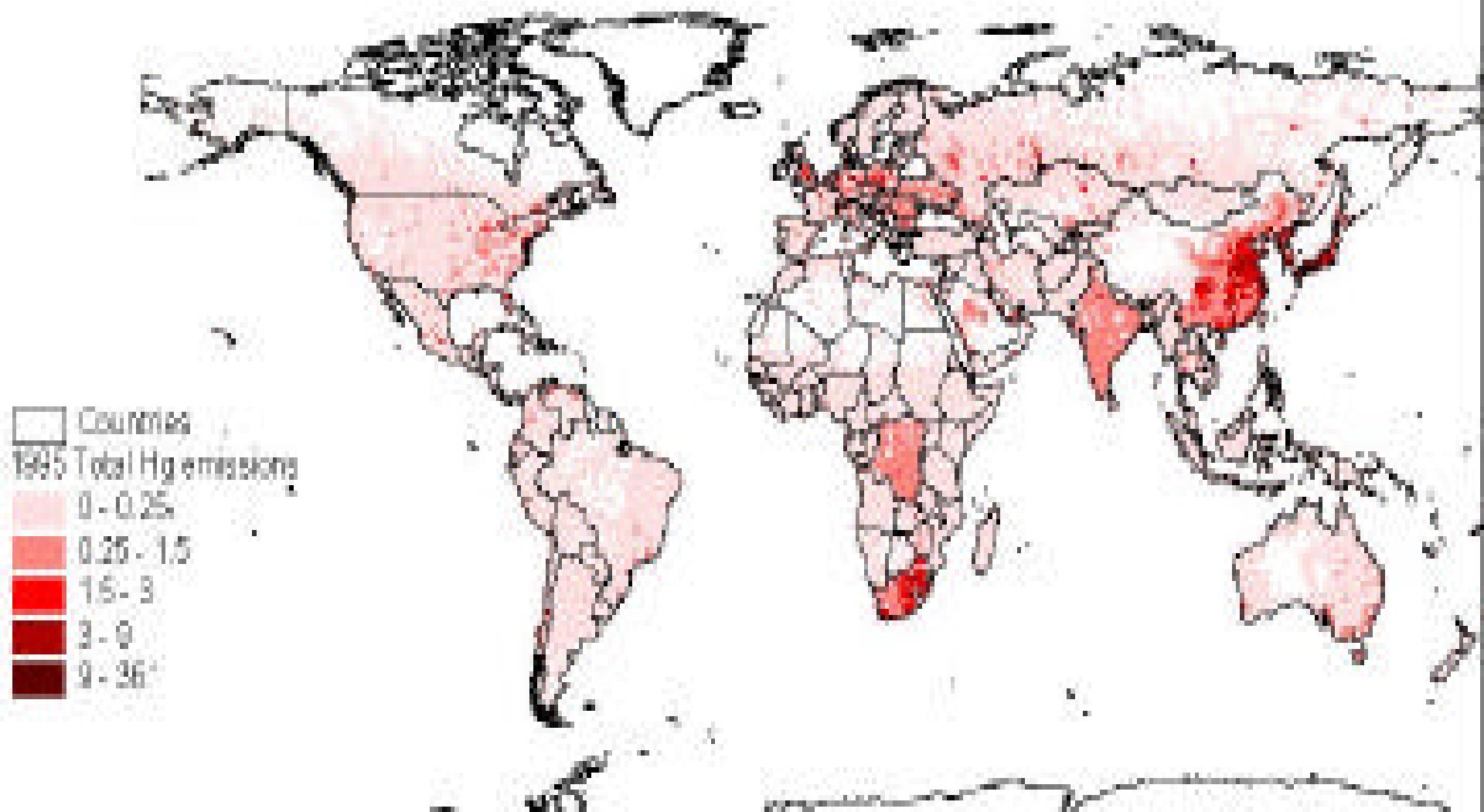
Mercury Levels in Northern Pike in Relation to Wetlands



Mercury Concentrations in Northern Pike in Relation to Mining Claims and The Yukon River Drainage Basins



Anthropogenic Mercury Emissions



Atmospheric Mercury (Hg)

Sources : Anthropogenic (80%)
Natural (20%)

Forms of Mercury and Residence Time

Gaseous Elemental Hg (Hg^0): ~ 1 year

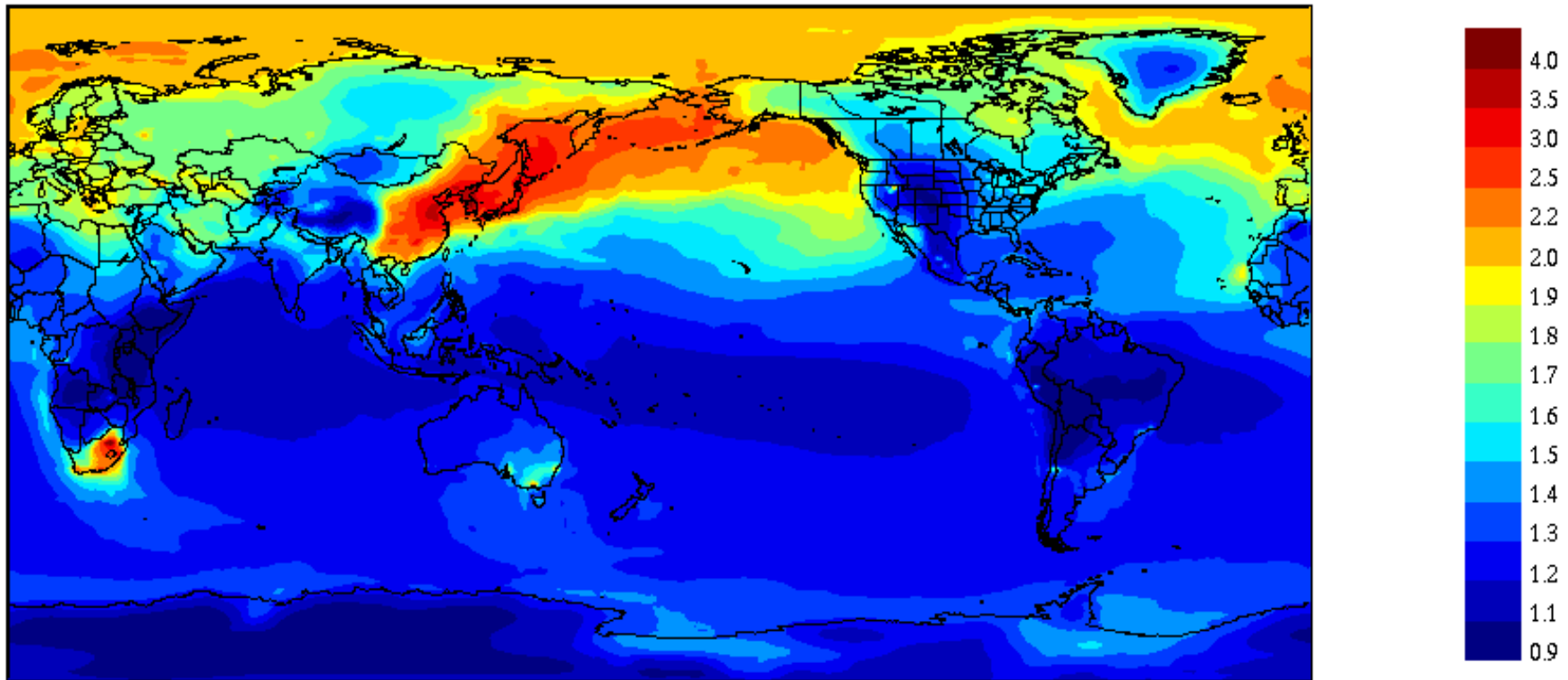
Reactive Gaseous Hg (RGM): minutes-weeks

Particulate Hg (Hg_p): minutes-weeks



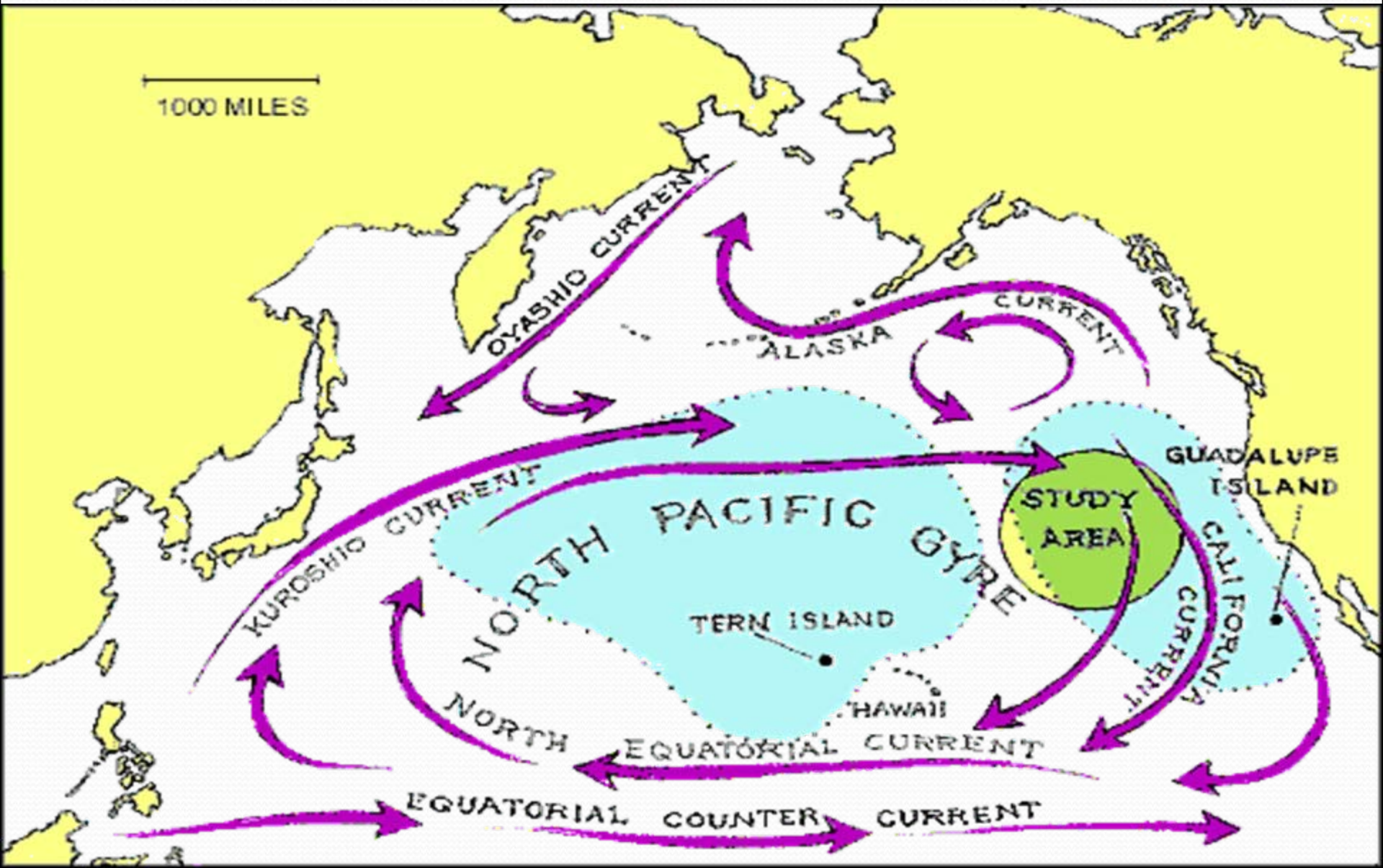
Global transport modelling

Average elemental mercury surface concentrations for July 2001 (ng/m³)



GRAHM (Global/Regional Atmospheric Heavy Metals Model)
simulation – Ashu Dastoor, Meteorological Service of
Canada, Environment Canada

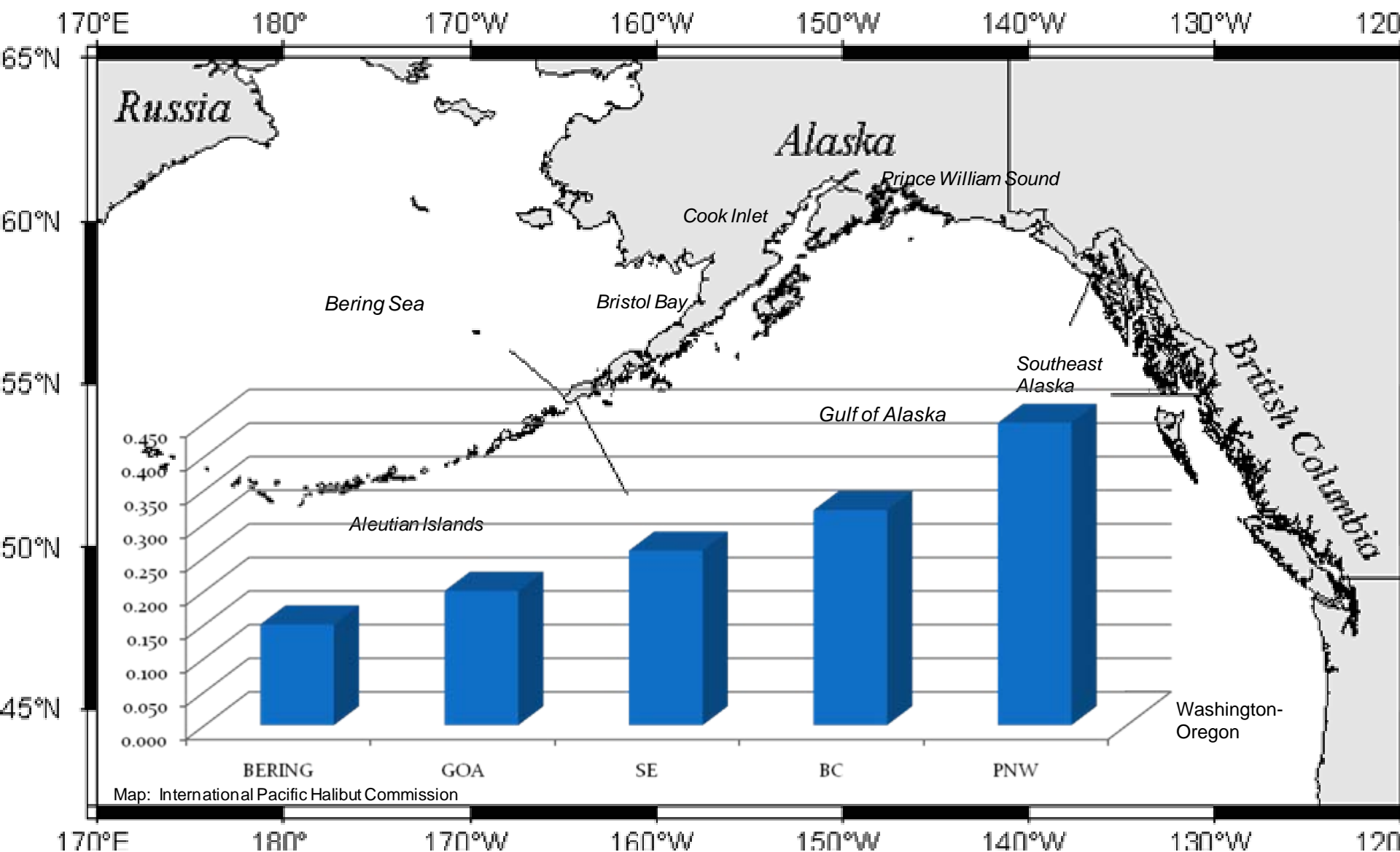
North Pacific Gyre



Regional Differences in Mercury concentration in fish tissue

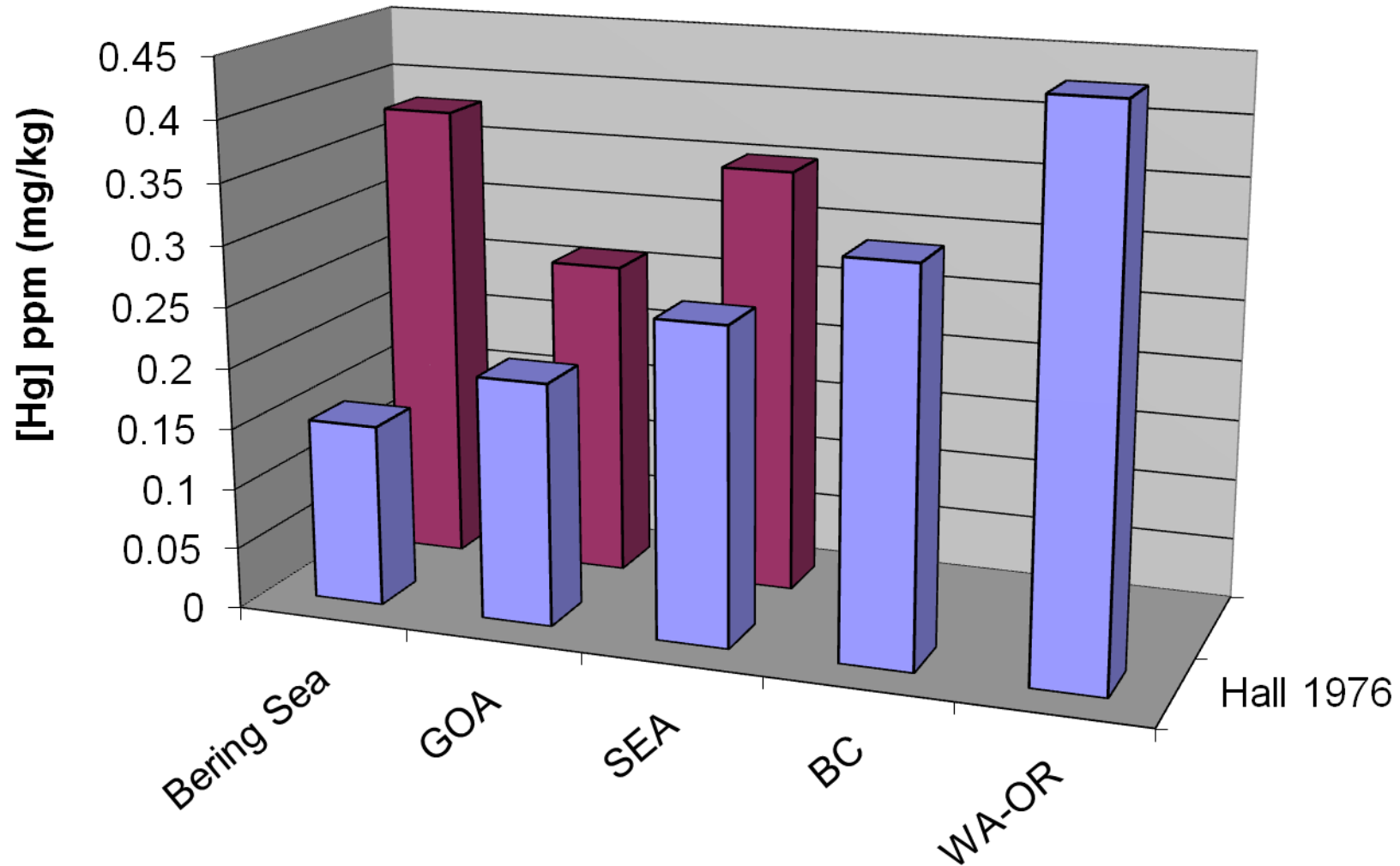
- NOAA study (Hall, et.al. 1976)
 - Total Mercury Concentration
 - Skinless Fillet
 - Regional comparison:
 - Bering Sea
 - Gulf of Alaska
 - South East Alaska
 - British Columbia
 - Washington-Oregon

NOAA 1976 Hall et. al. Study

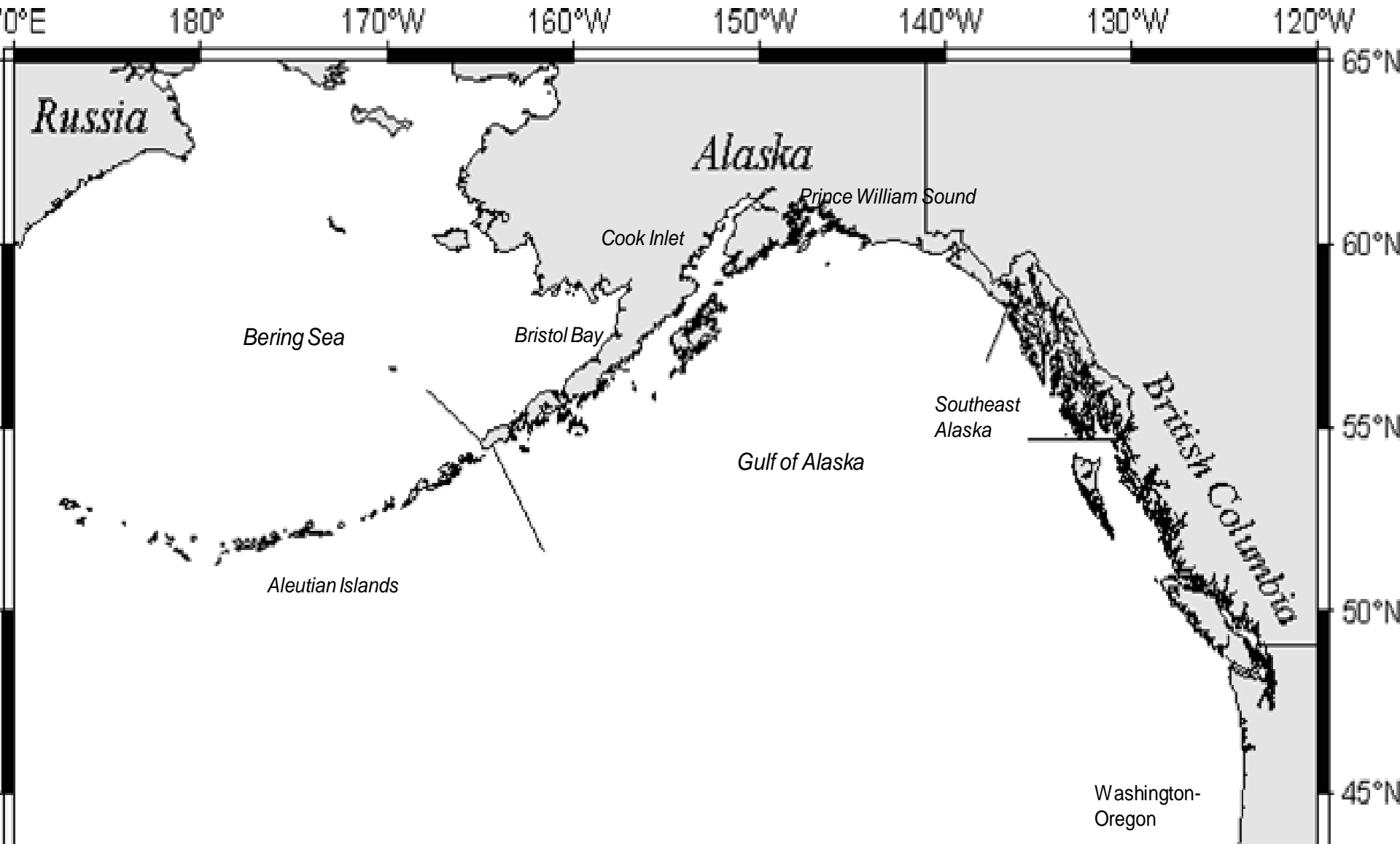


Regional Comparison

Total Mercury



Areas Where Fish Were Collected in the DEC Fish Monitoring Program vs. NOAA 1976 Hall et. al. Study



Comparison FMP to NOAA Study

(Hall, et. al. 1976)

	Number fish			Weight (kg)	
	Hall	FMP		Hall	FMP
Aleutian	0	336		0	17.7
Bering Sea	152	189		24.8	18.8
GOA	761	612		32.6	19.1
SE	70	284		30.7	18.9
Total samples	983	1,421			

Comparison FMP to NOAA Study

(Hall,et. al. 1976)

**Total-Hg
(ppm)**

Mean

Minimum

Maximum

Hall

FMP

%

Hall

FMP

Hall

FMP

Aleutian

	0.455	

	0.073			1.947

**Bering
Sea**

0.150	0.234	56%

0.020	0.037		1.000	0.926

GOA

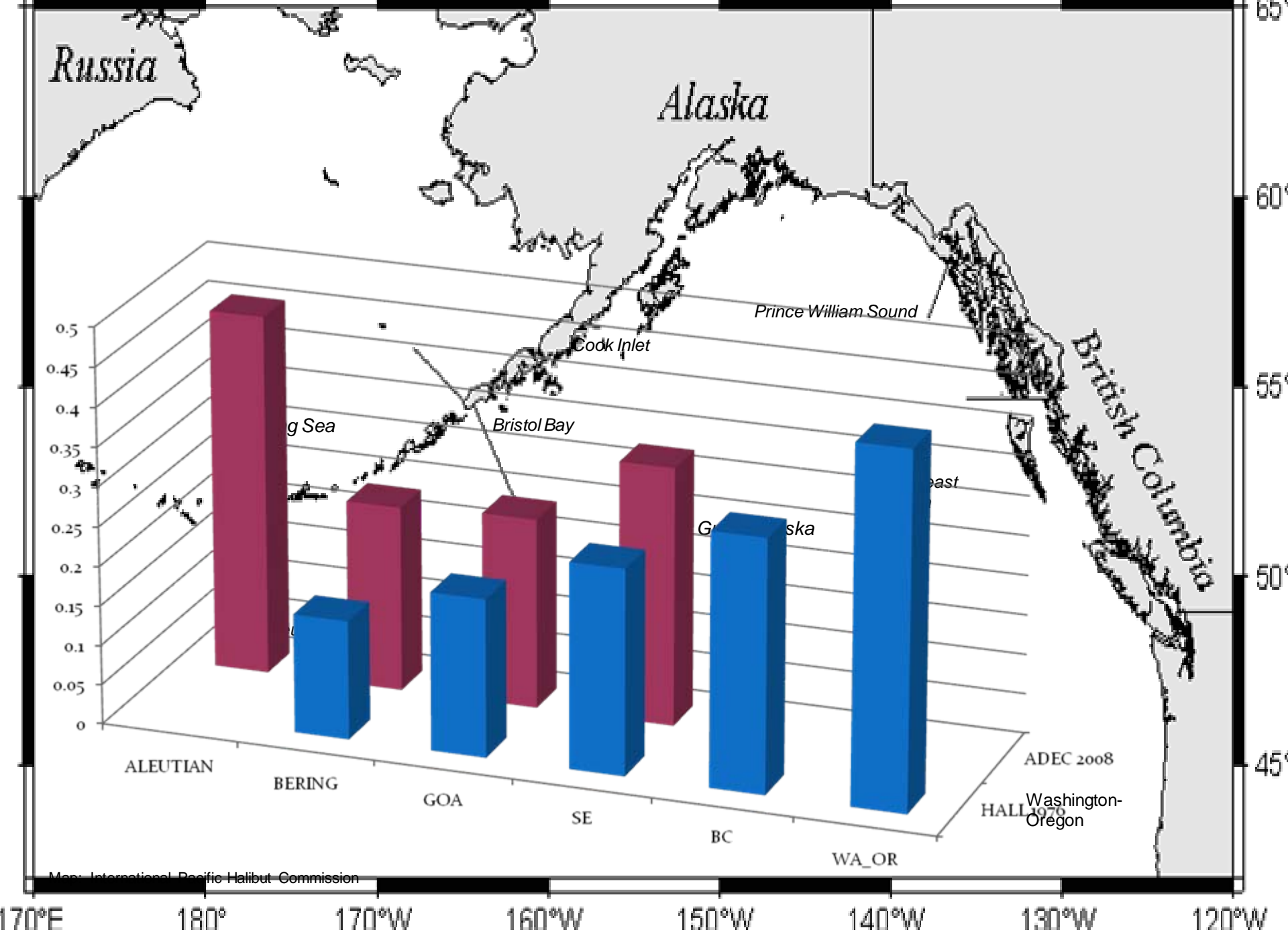
0.200	0.240	20%

0.010	0.013		1.280	1.578

SE

0.260	0.327	26%

0.040	0.040		1.300	1.512



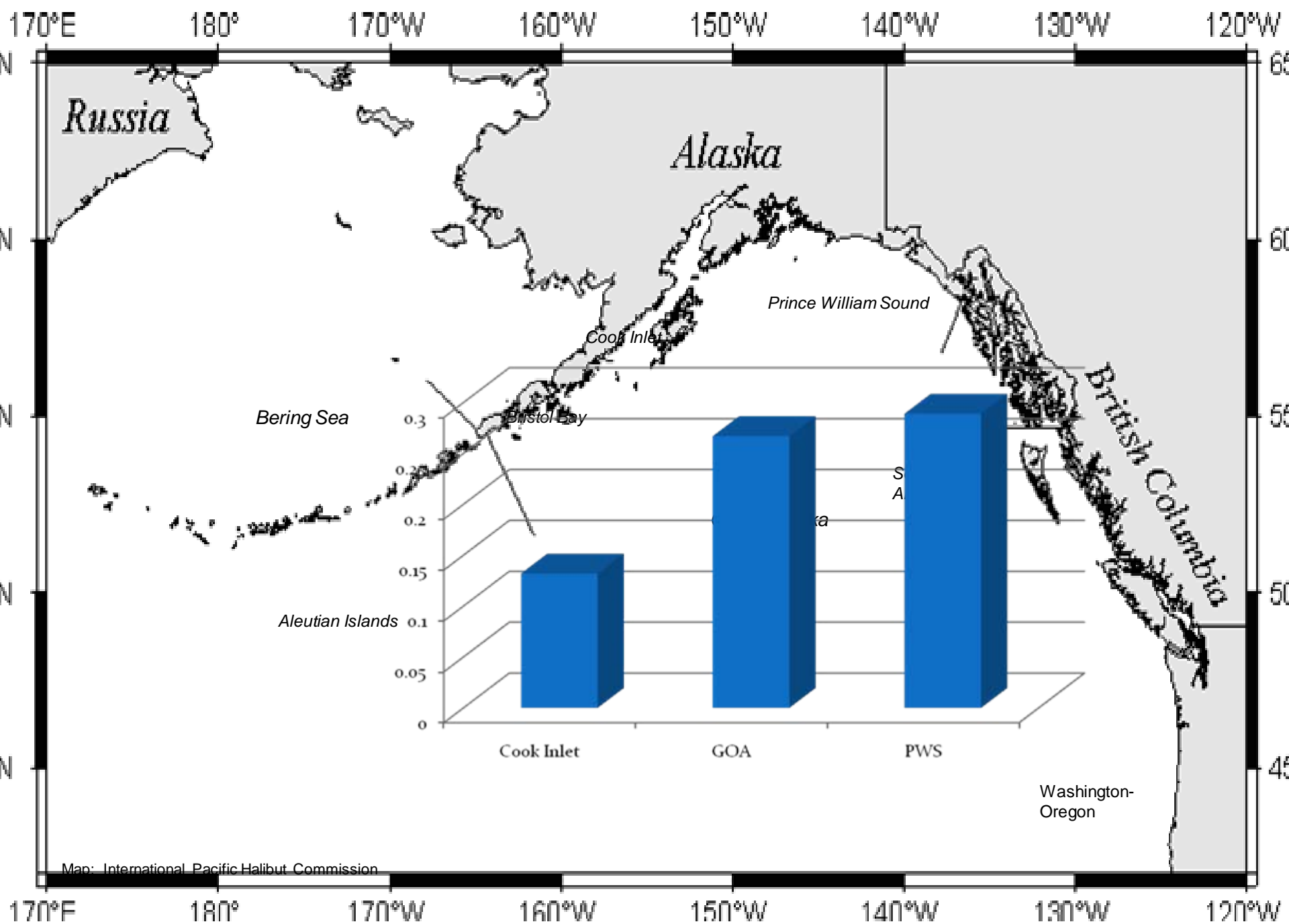
Comparison FMP to NOAA Study (Hall, et. al. 1976)

Percentage of samples exceeding
[Total Mercury] of 0.5 ppm

	Hall	FMP
Aleutian		32.2
Bering	4.6	12.6
GOA	5.0	10.8
SE	12.8	19.7

Regional Differences in Gulf of Alaska

Hg (ppm)		<u>Mean</u>			<u>Minimum</u>		<u>Maximum</u>	
	#	Hall	FMP	%	Hall	FMP	Hall	FMP
GOA	612	0.200	0.240	20%	0.010	0.013	1.280	1.578



Map: International Pacific Halibut Commission

