



# Steller Sea Lions: Status, Trends, Vital Rates and Terrestrial Sites

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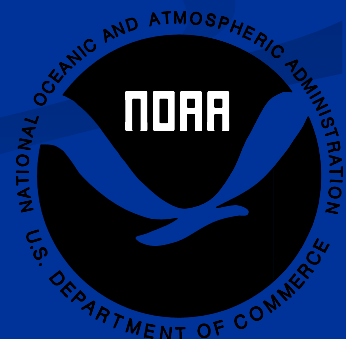
Seattle, WA

With considerable help from:

**Rod Towell, Tom Gelatt and Jeff Laake, NMML**

**Vladimir Burkanov, Natural Resources Consultants, Inc.**

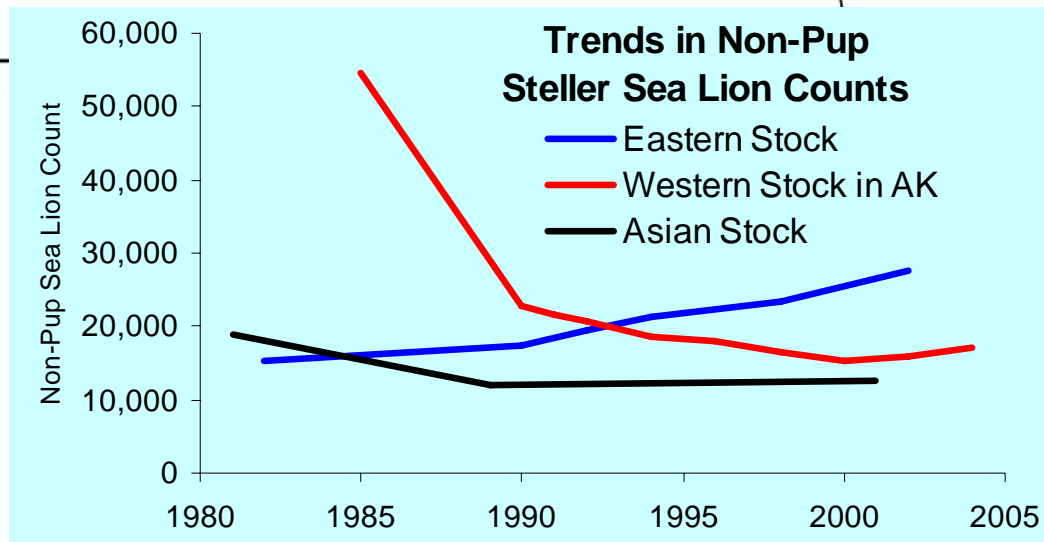
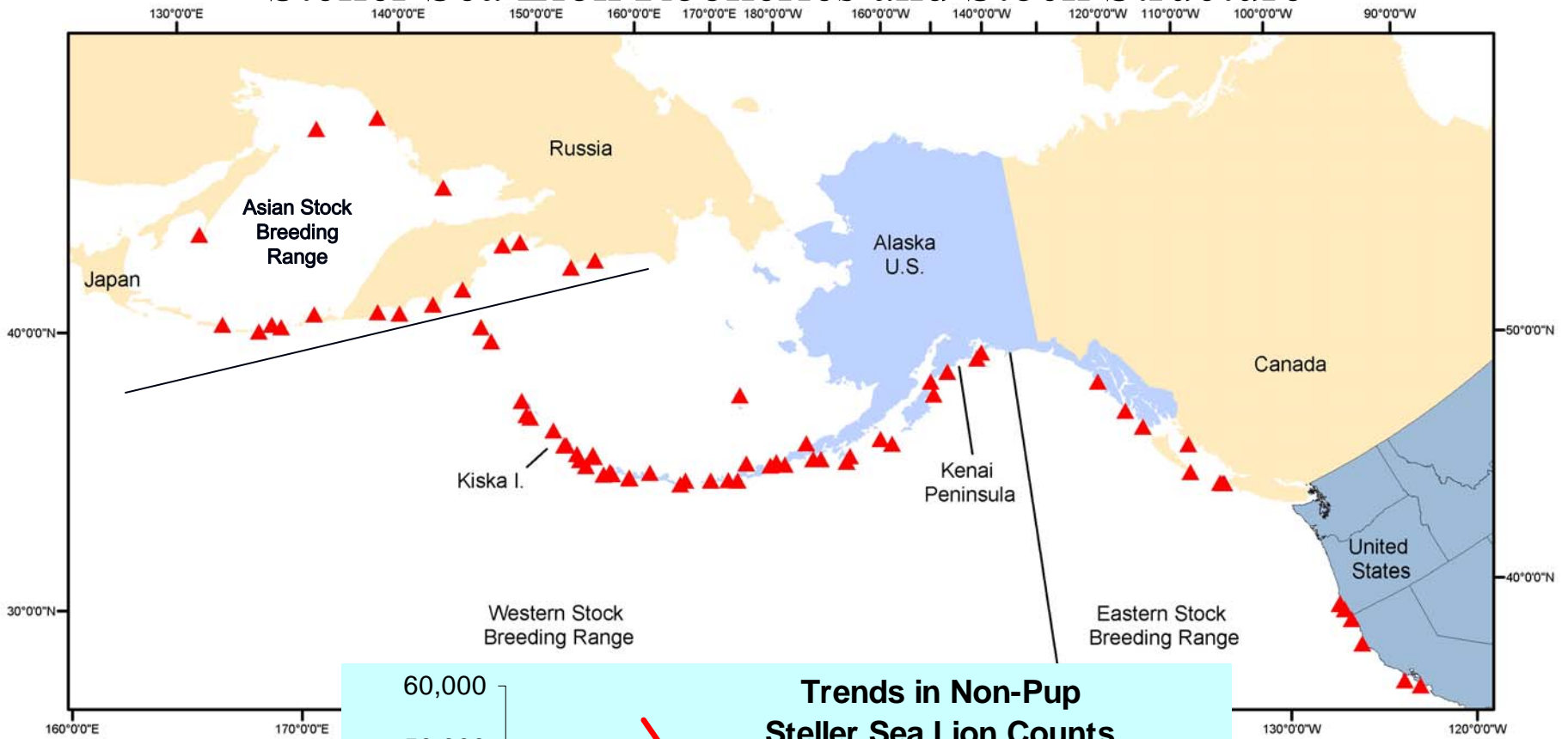
**Ken Pitcher, Grey Pendleton, and Lorrie Rea, Alaska Department of  
Fish and Game**



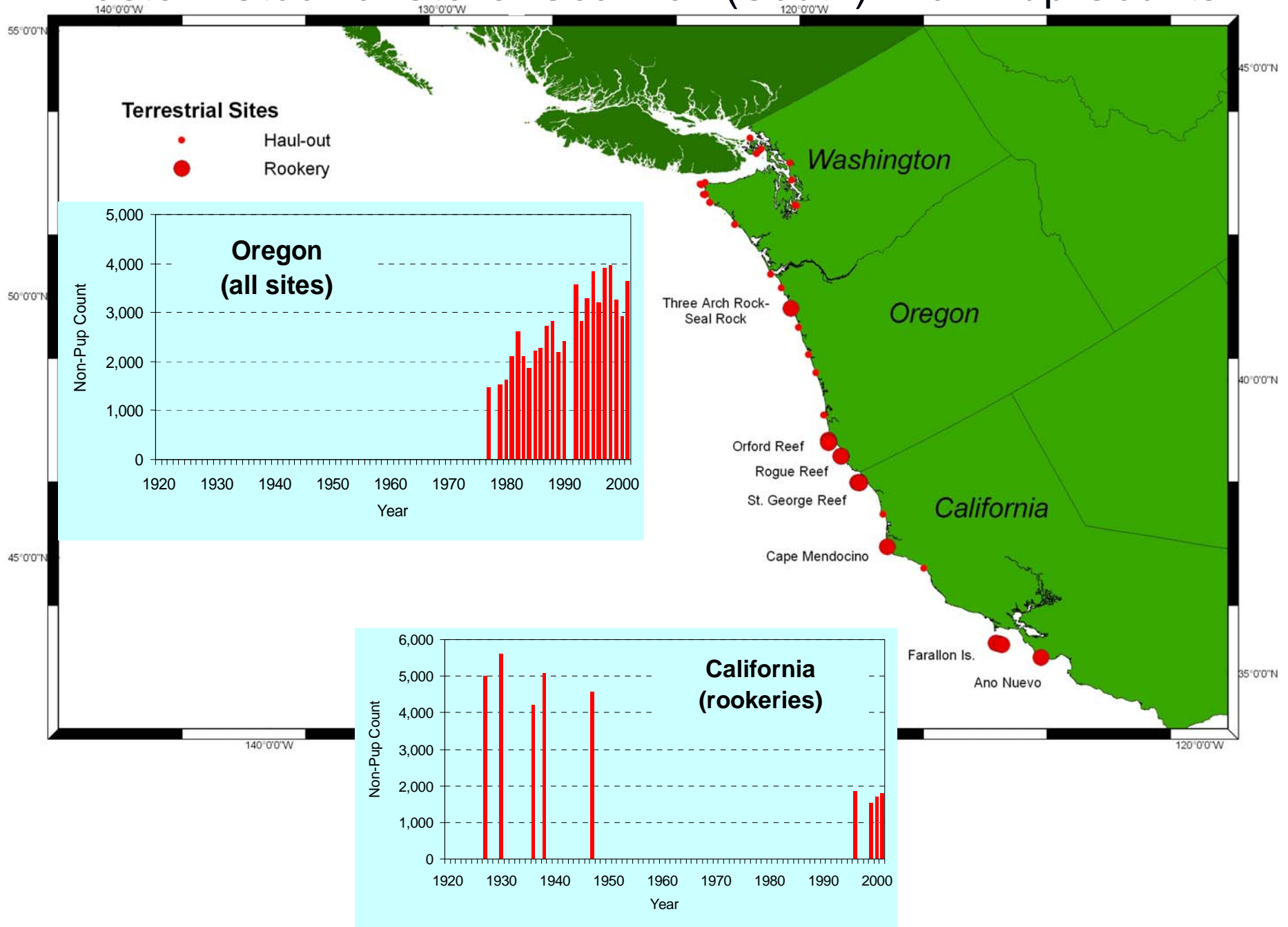
# Outline

- **Stock Structure, Population Status and Trends**
  - Pup and Non-Pup Counts
  - Annual rates of change
- **Vital Rates**
  - Mark-recapture analysis for survivorship (branding)
  - Population modeling (E. Holmes)
- **Terrestrial Sites**
  - Update list of rookeries
  - Seasonal importance of major haul-outs

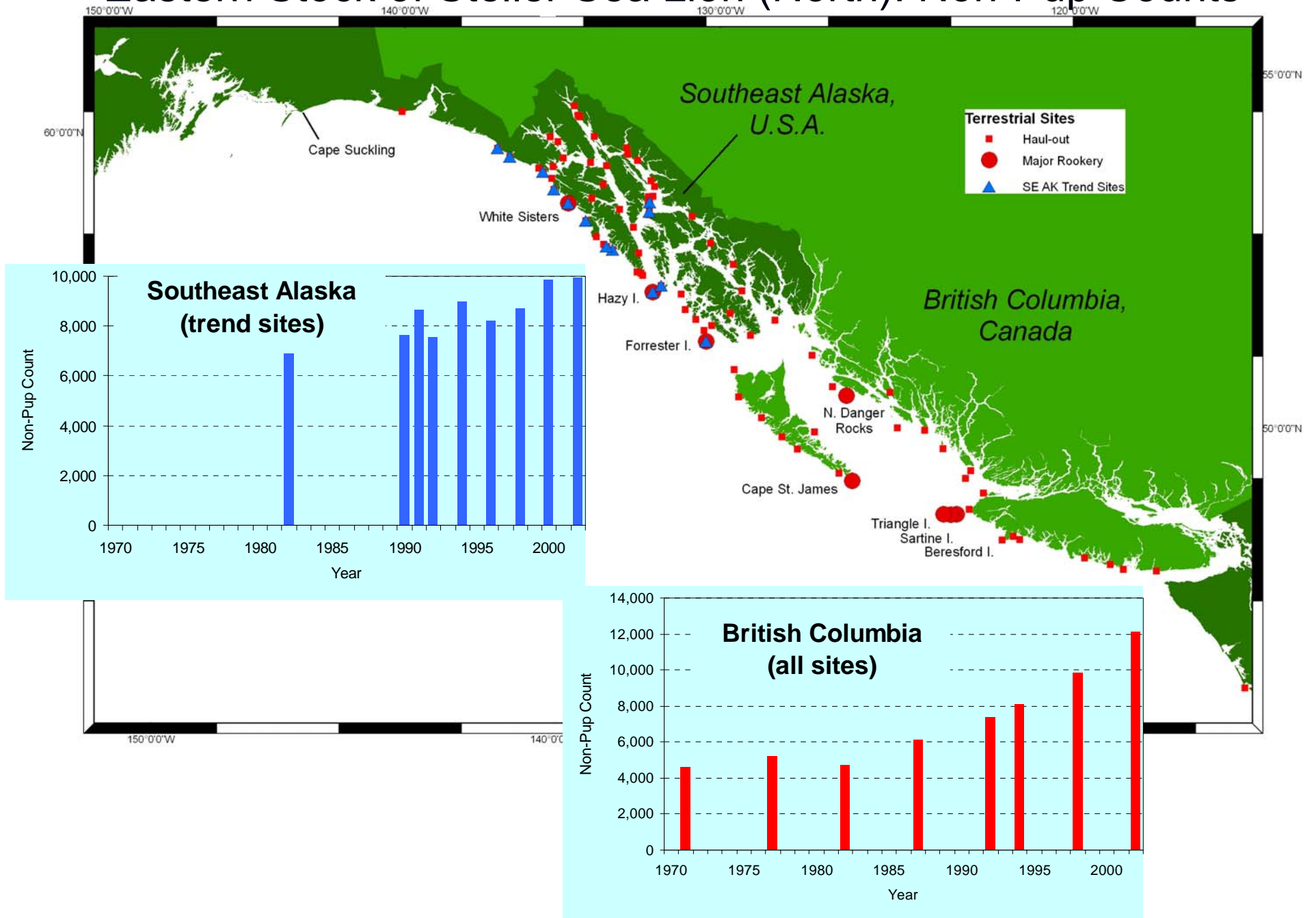
# Steller Sea Lion Rookeries and Stock Structure



# Eastern Stock of Steller Sea Lion (South): Non-Pup Counts

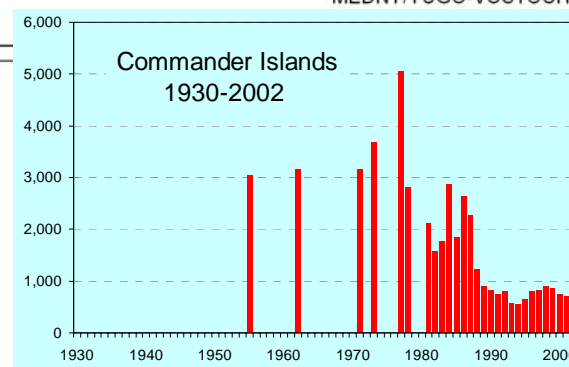
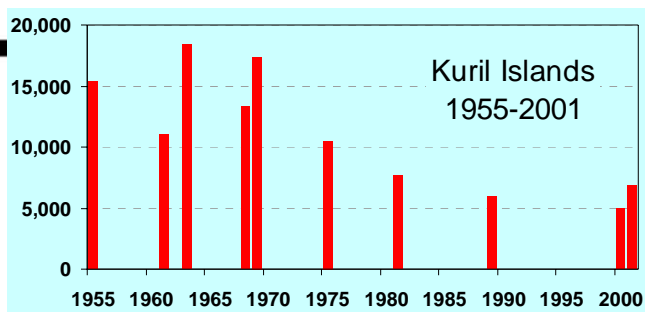
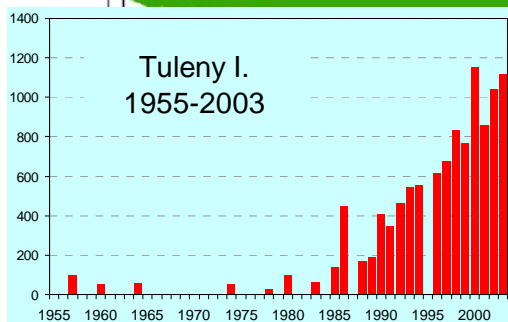
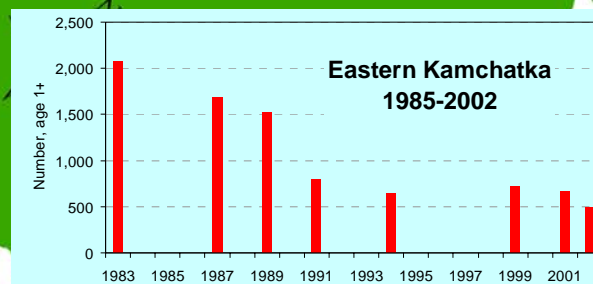
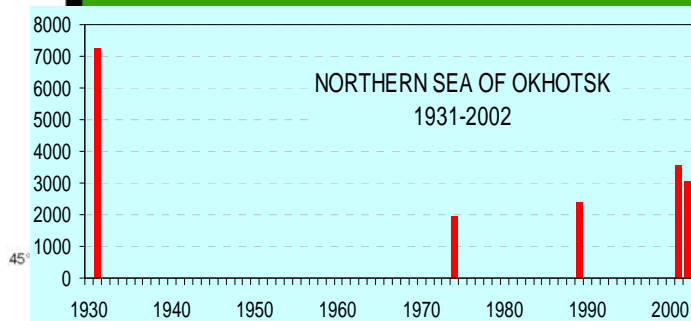


# Eastern Stock of Steller Sea Lion (North): Non-Pup Counts

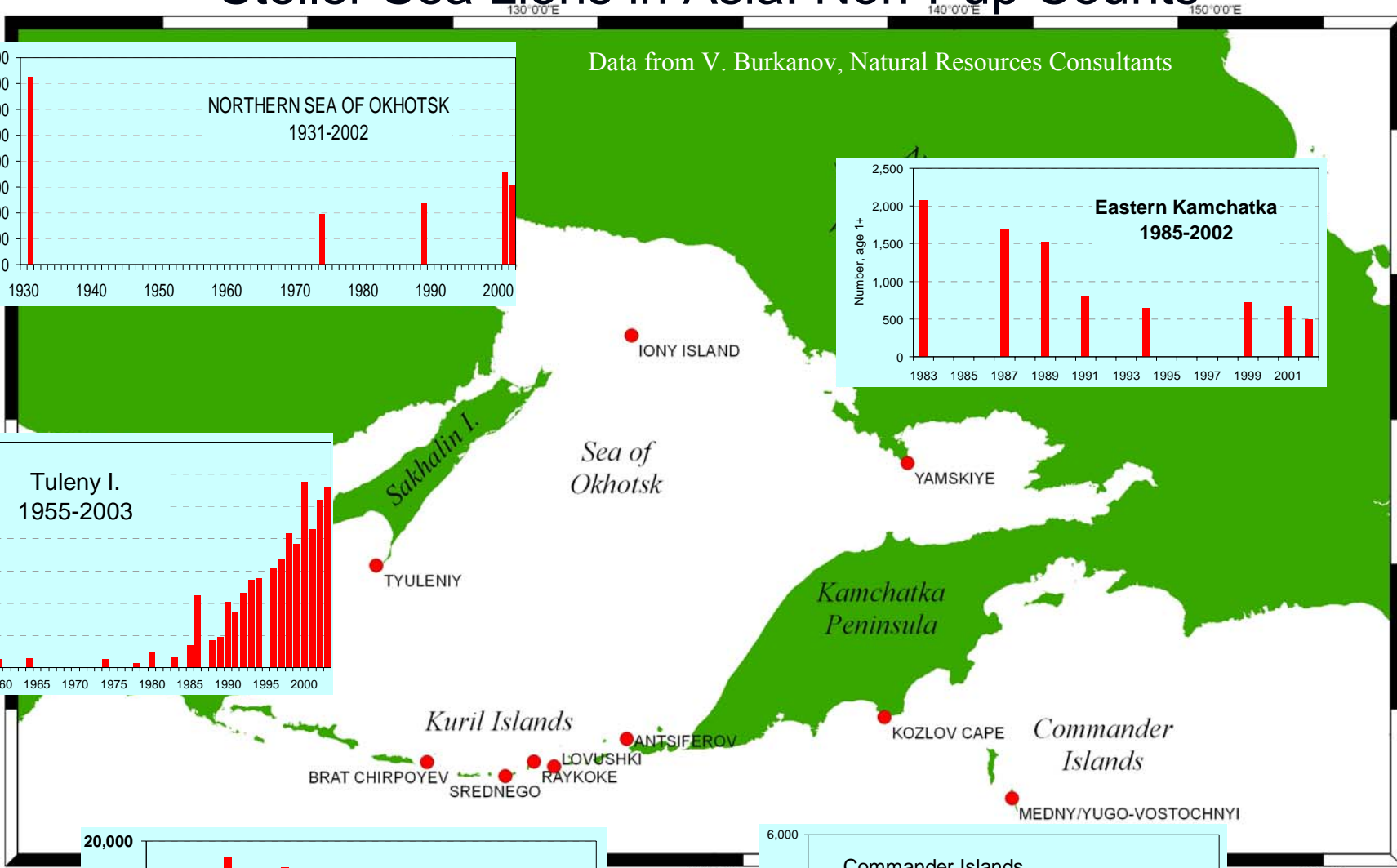


# Steller Sea Lions in Asia: Non-Pup Counts

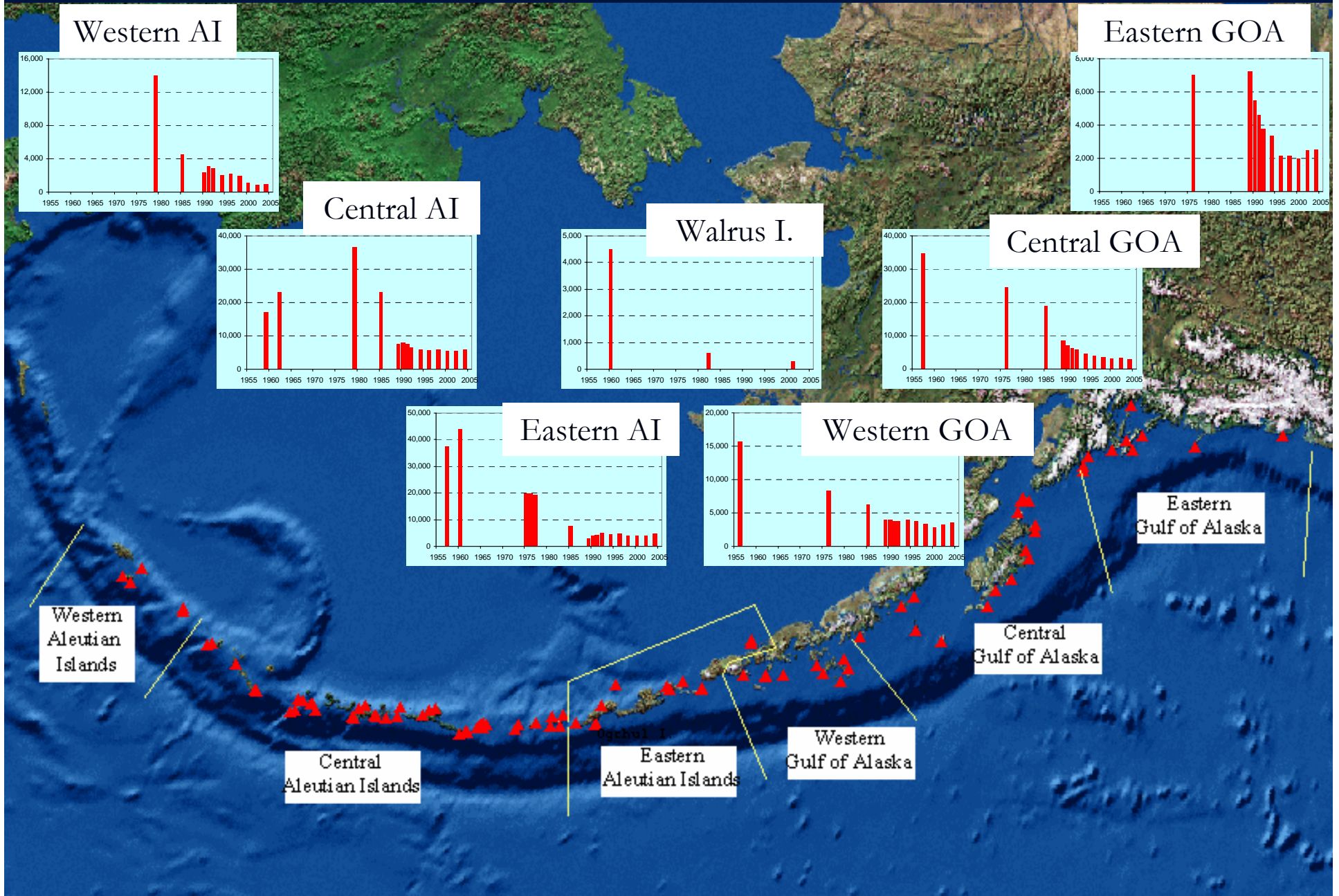
Data from V. Burkanov, Natural Resources Consultants



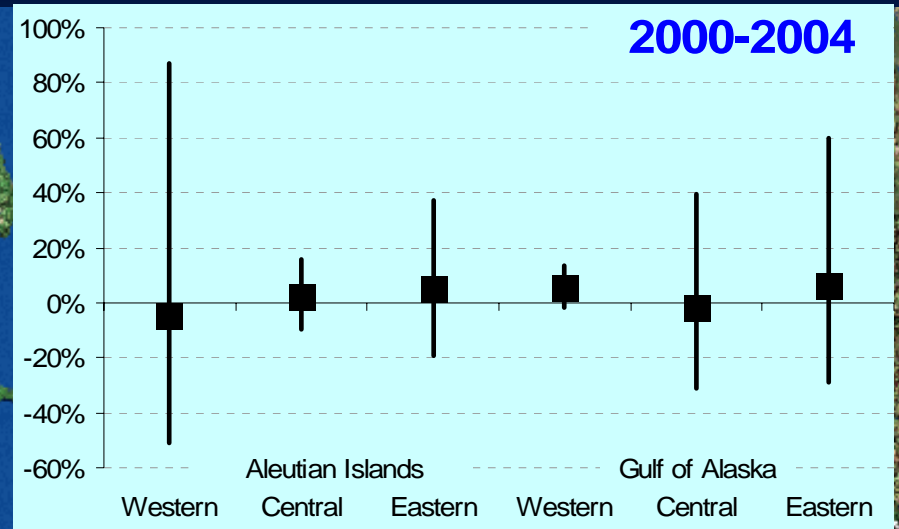
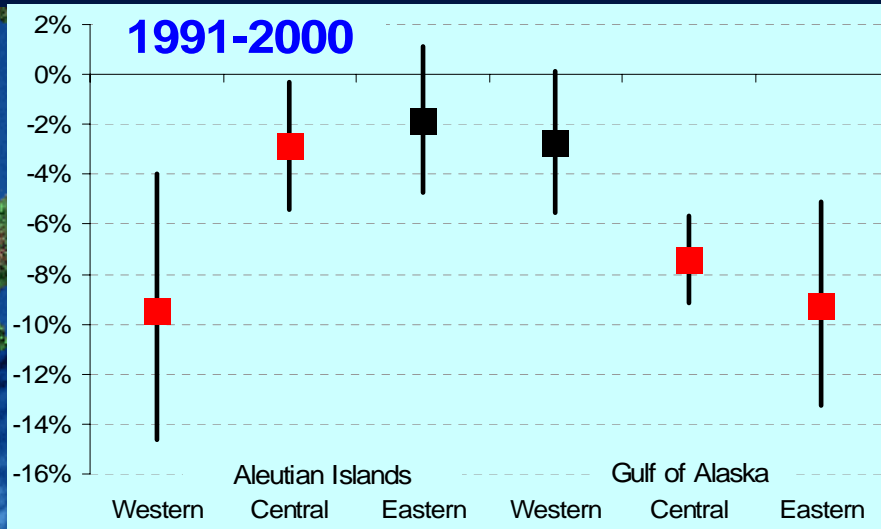
Genetically more similar to AK Western stock



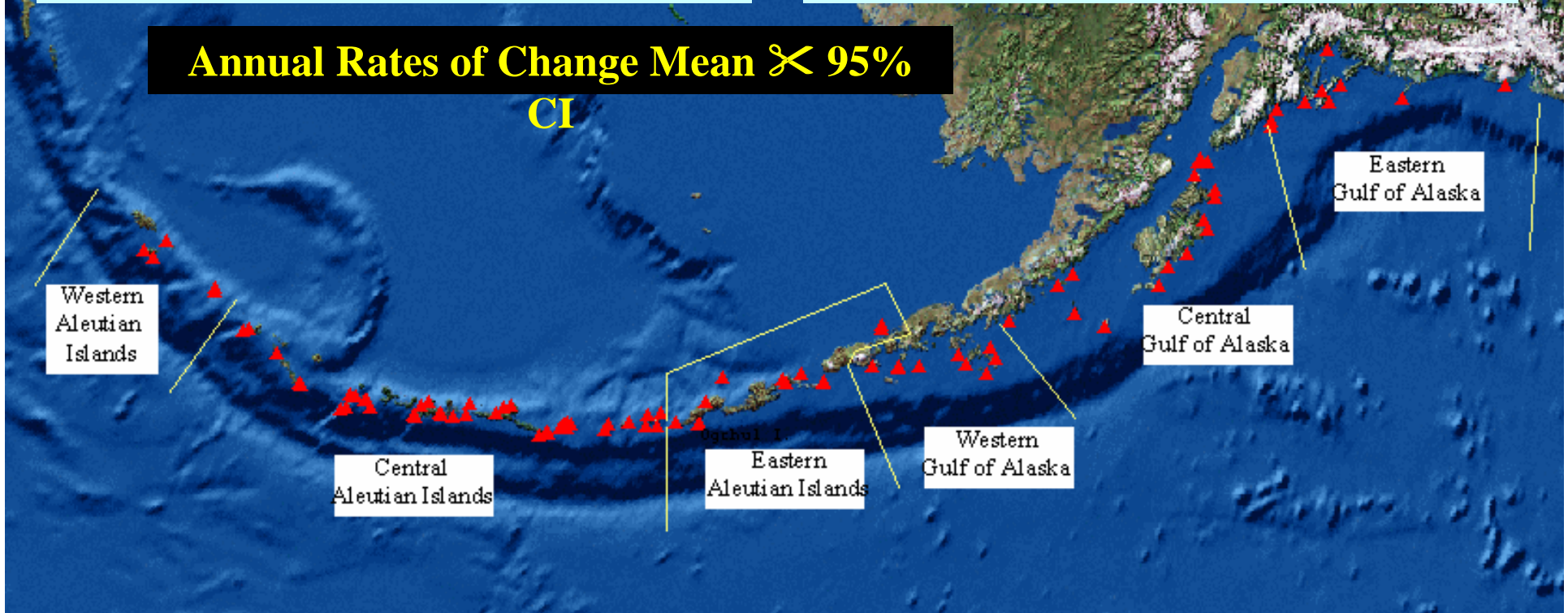
# Western Steller Sea Lion Non-Pup Counts in Alaska 1955-2004



# Western Steller Sea Lion **Non-Pup** Counts in Alaska

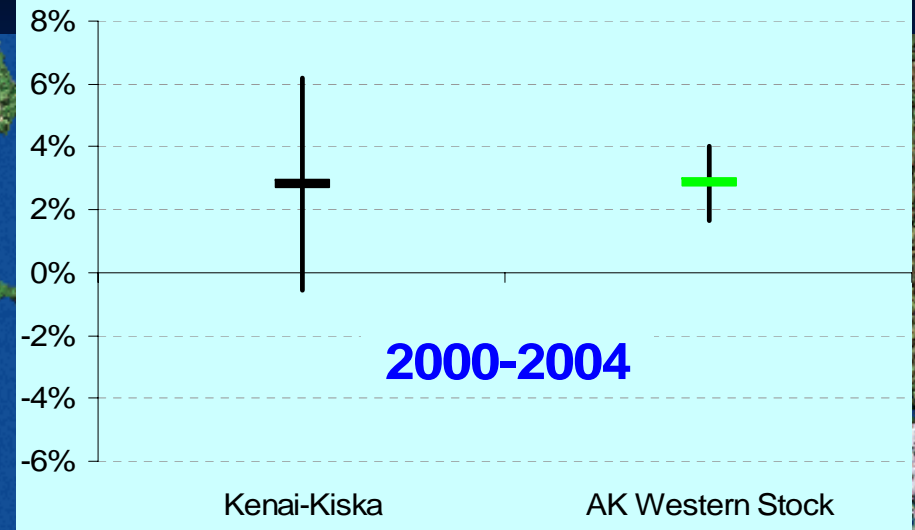
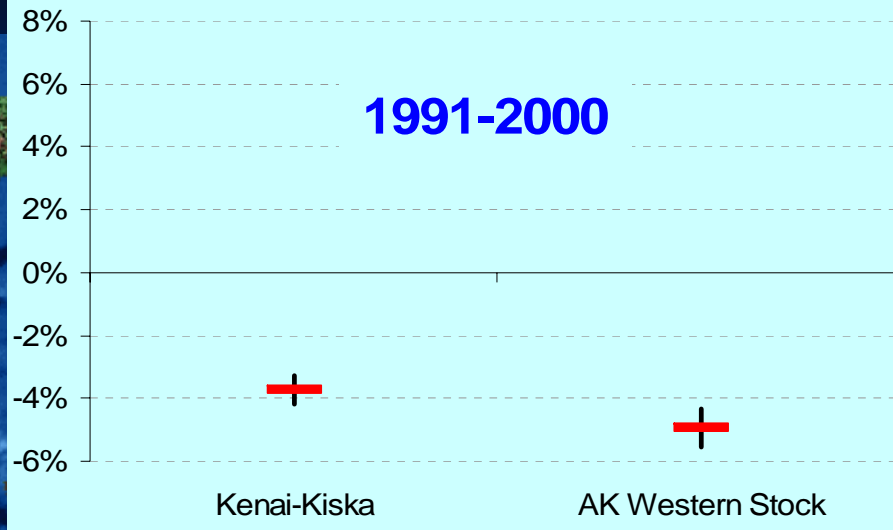


**Annual Rates of Change Mean  $\times$  95% CI**





# Western Steller Sea Lion **Non-Pup** Counts in Alaska

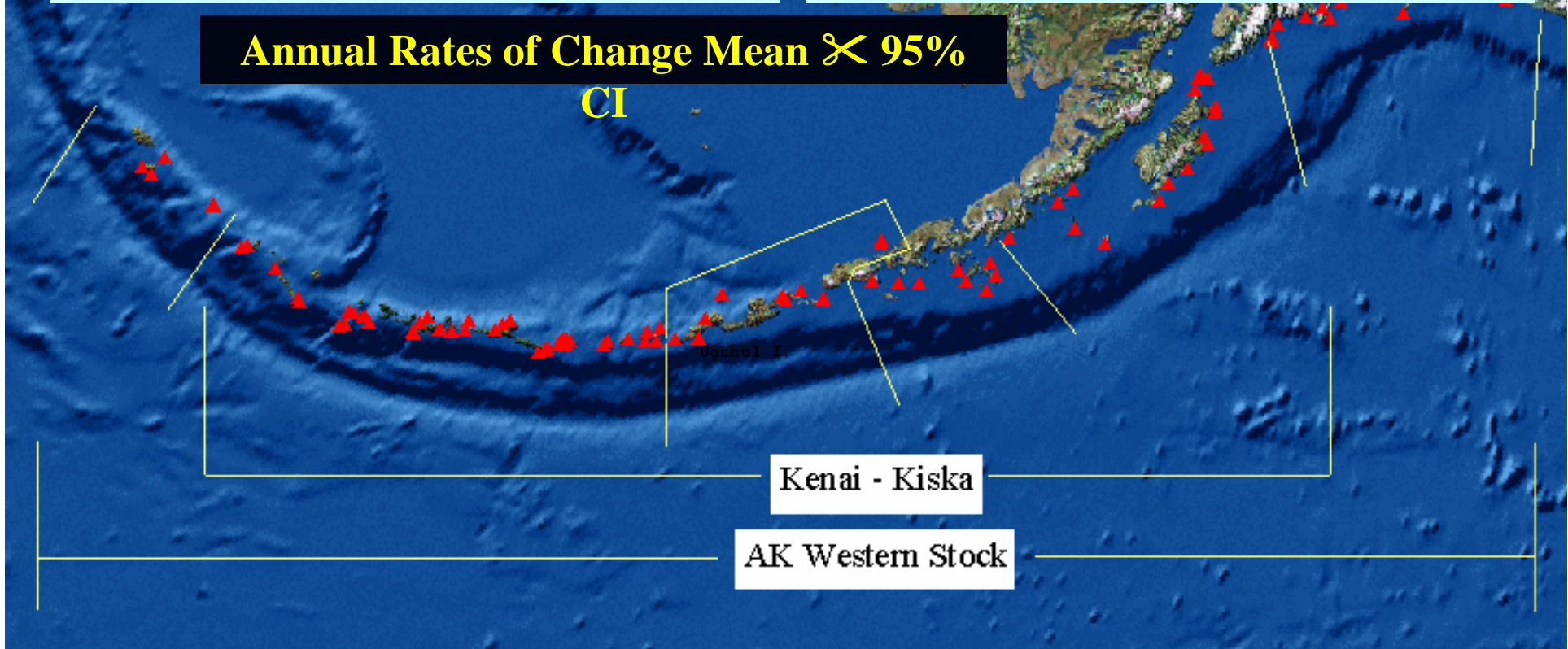


**Annual Rates of Change Mean  $\times$  95%**

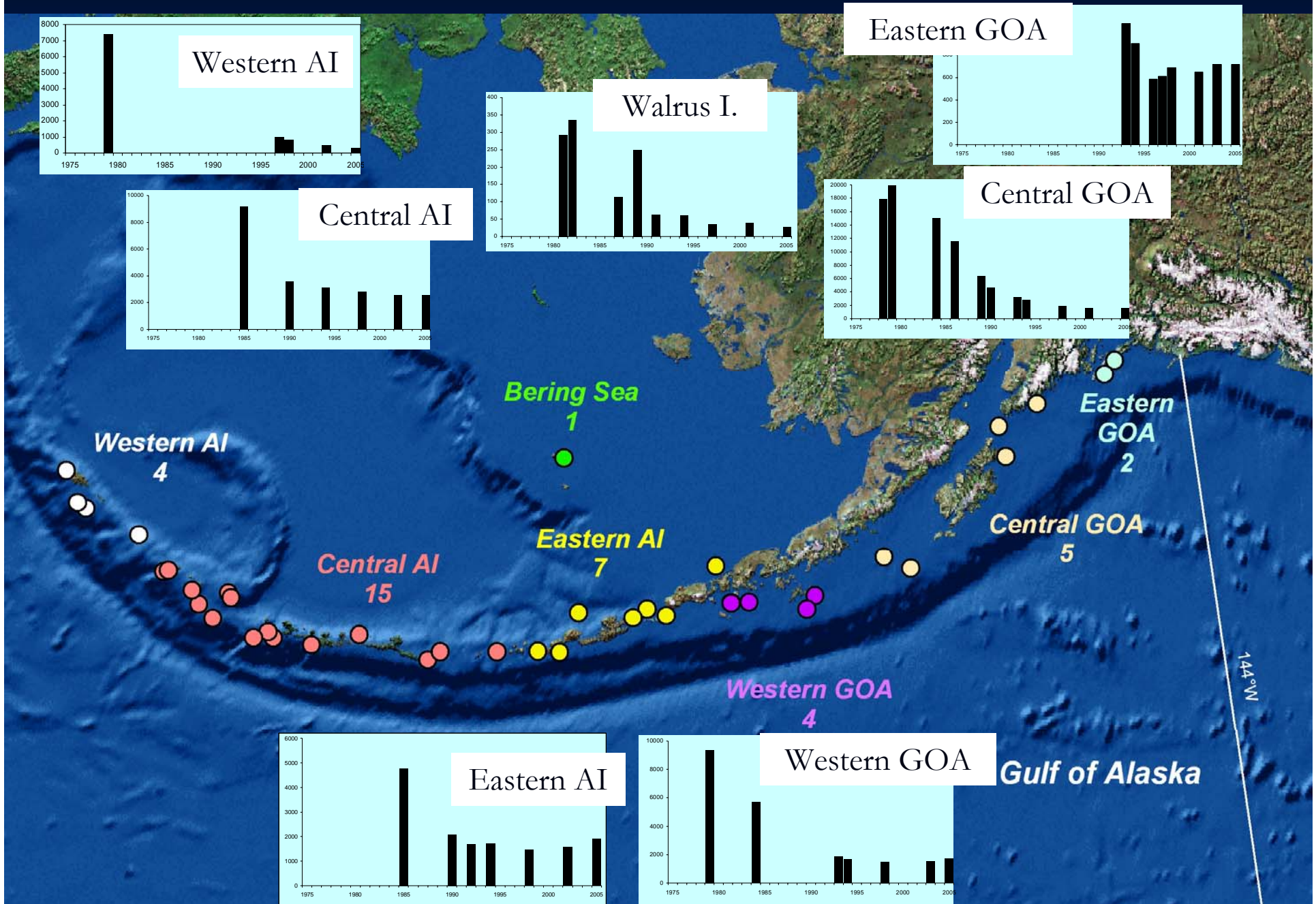
**CI**

Kenai - Kiska

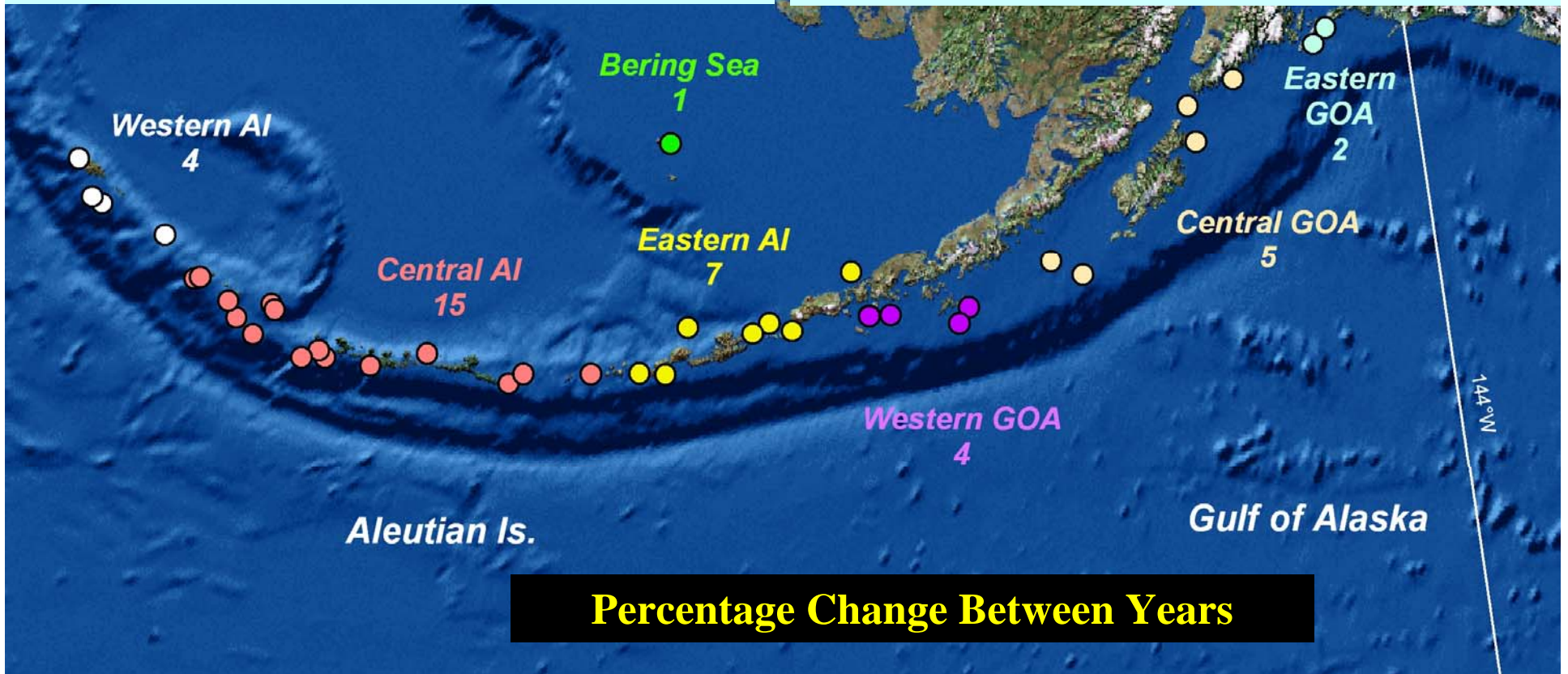
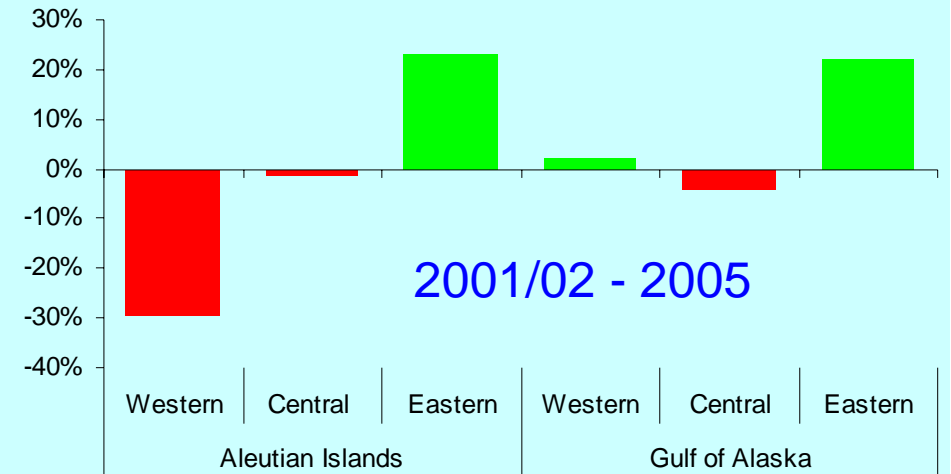
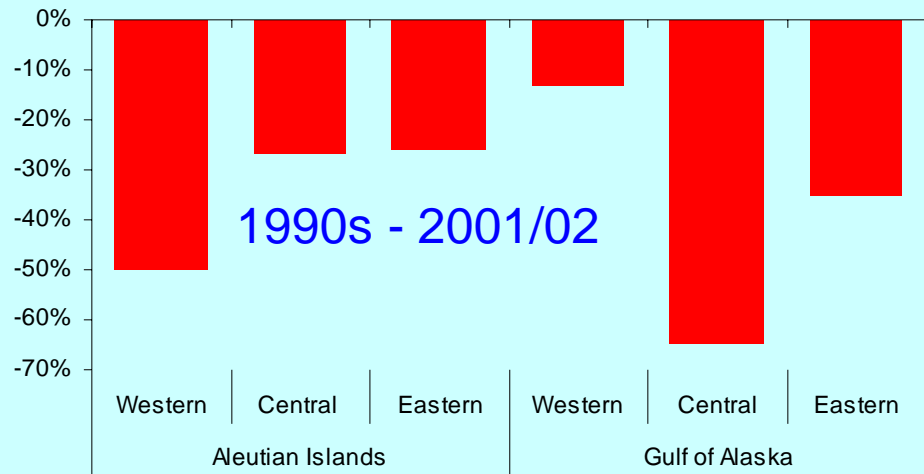
AK Western Stock



# Western Steller Sea Lion Pup Counts in Alaska 1975-2005



# Western Steller Sea Lion Pup Counts in Alaska



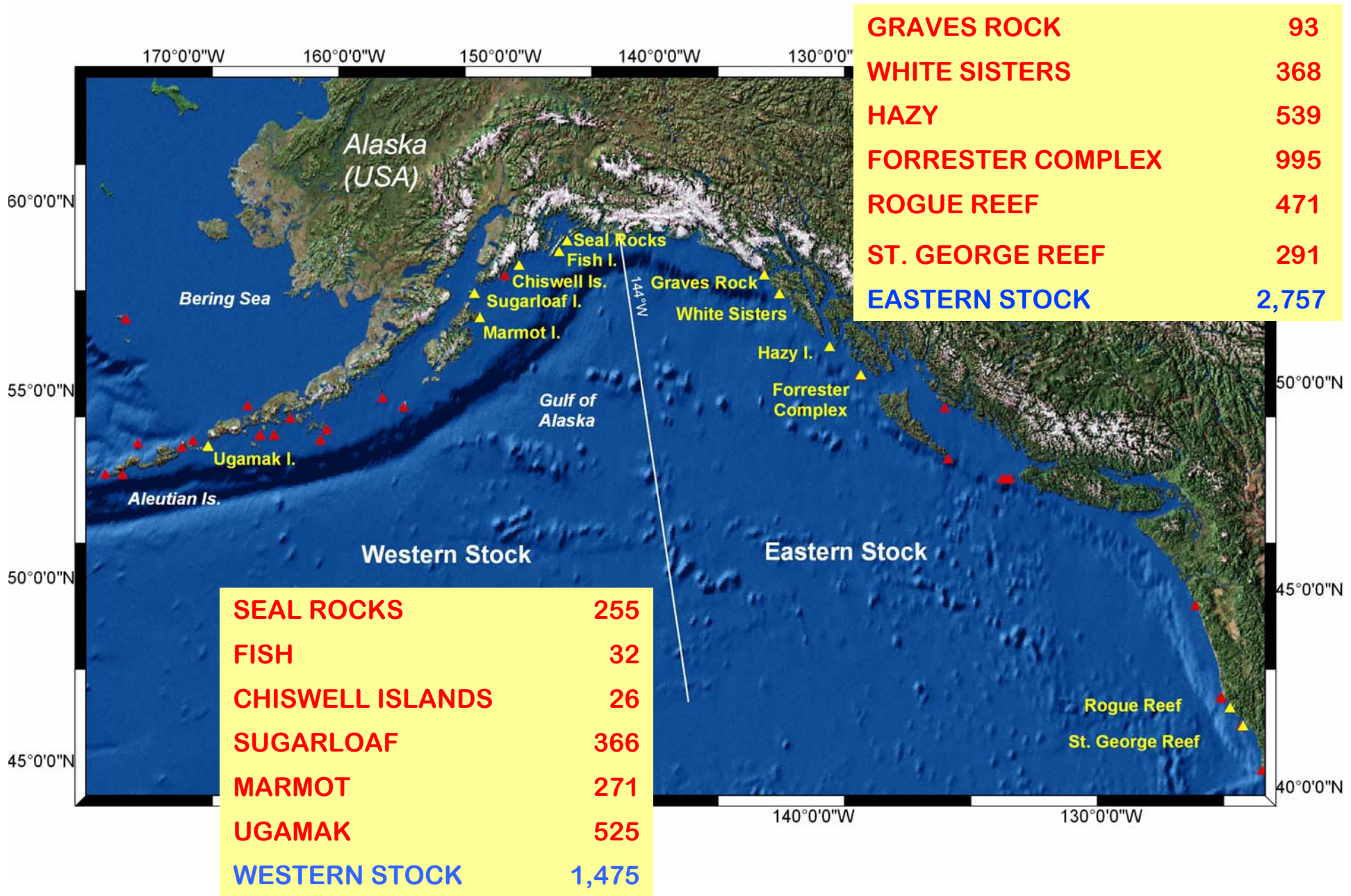
# Vital Rates Estimation

## Pup Branding Program

### ■ Objectives

- Survival and reproductive rates by age and area
- Marmot Island (Western Stock)
  - 1987-88: 751 pups
- Forrester Island (Eastern Stock)
  - 1994-95: 799 pups
- Since 2000, almost 6,000 pups have been branded
  - Eastern ~ 2,750
  - Western ~ 1,500
  - Asian ~ 1,700

A179 Resighted 17 May 2004  
At Ugamak, ~ 1 year old



**2000-2005 Pup Branding on Steller Sea Lion Rookeries in the US**

# Survival Estimation

Release Year	Resight Year		
	2	3	4
1	$r_{12}$ $p_{12} \quad \varphi_{12}$	$r_{13}$ $p_{13} \quad \varphi_{13}$	$r_{14}$ $p_{14} \quad \varphi_{14}$

Probabilities

$p$  = resight

$\varphi$  = survival

1100

1101

1110

1111

1010

1011

1110

1111

1001

1011

1101

1111

1000

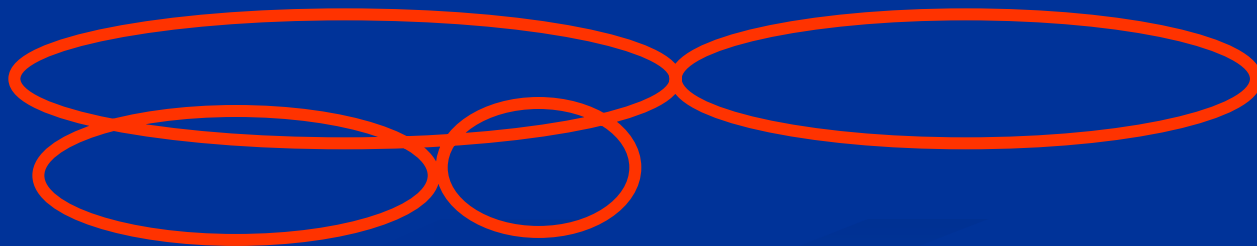
# Cormack-Jolly-Seber Models

$$1 \xrightarrow[1-p_{12}]{\varphi_{12}} 0 \xrightarrow[1-p_{13}]{\varphi_{13}} 0 \xrightarrow[1-p_{14}]{\varphi_{14}} 0$$

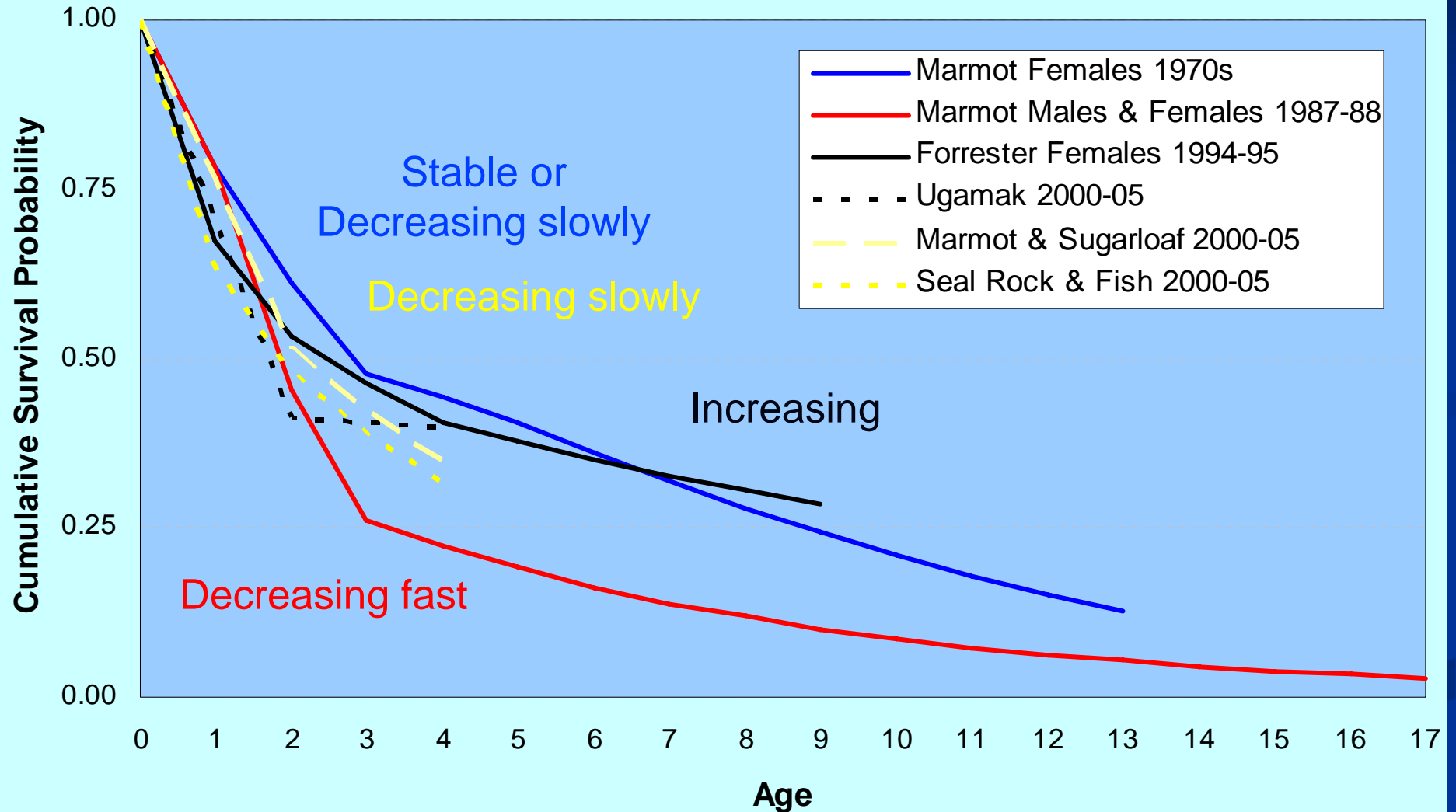
$$1 \xrightarrow[1-p_{12}]{\varphi_{12}} 0 \xrightarrow[1-p_{13}]{\varphi_{13}} 0 \xrightarrow{1-\varphi_{14}} 0$$

$$1 \xrightarrow[1-p_{12}]{\varphi_{12}} 0 \xrightarrow{1-\varphi_{13}} 0 \longrightarrow 0$$

$$1 \xrightarrow{1-\varphi_{12}} 0 \longrightarrow 0 \longrightarrow 0$$



# Comparison Steller Sea Lion Survival: East and West in 1970s-2000s





# Implications of Changes in Western Steller Sea Lion Vital Rates

- **Factors currently affecting population are different from those that caused decline**
  - Survivorship likely has improved
  - Reproductive Rate may have declined (Holmes et al)
- **Direct threats decreased relative to late 1980s**
  - Predation, shooting, hunting, or incidental take
- **Potential Indirect factor affecting birth rates**
  - Such as environmental variability, fishing, possible disease or contaminant

# Rookery and Haulout Sites

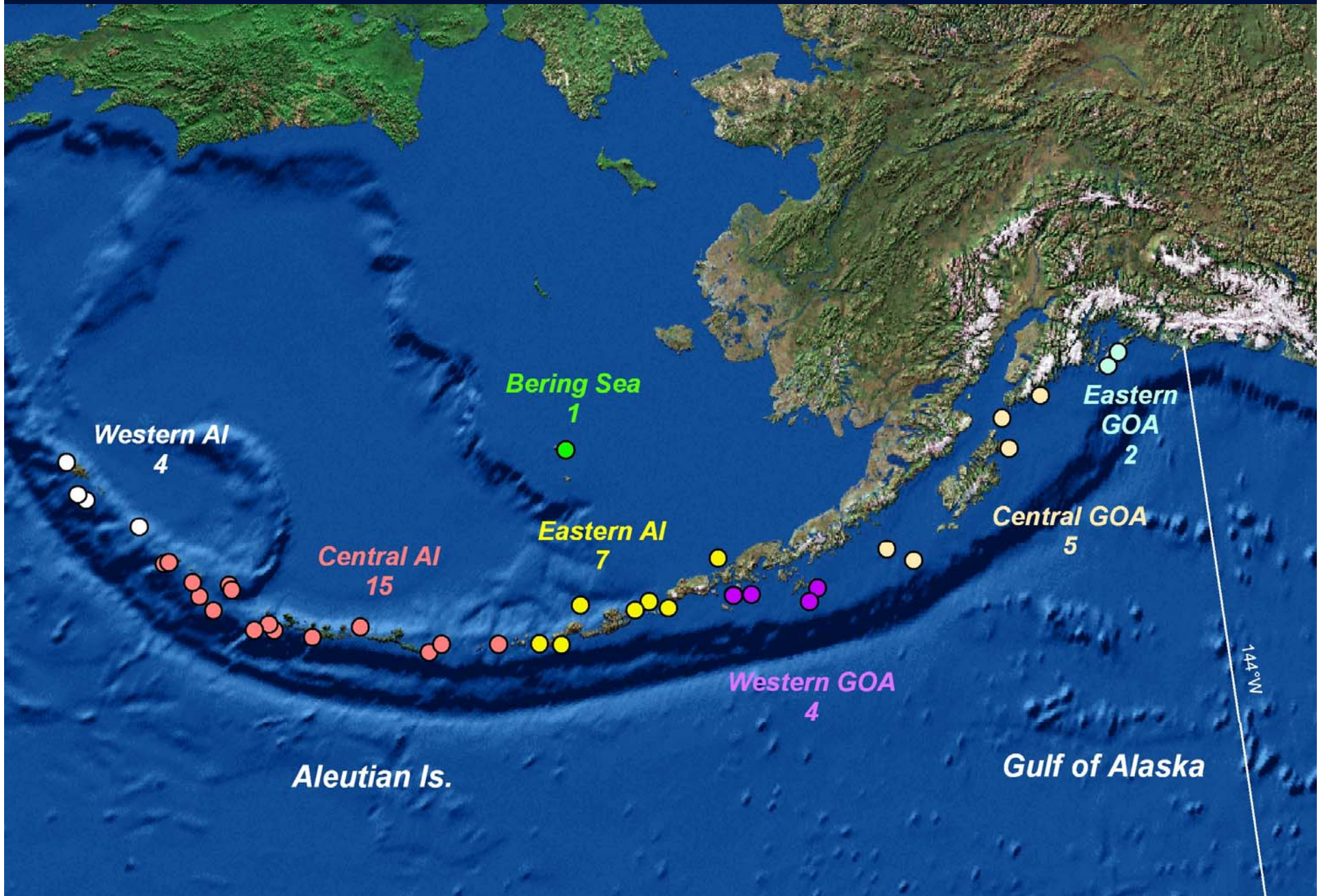
## ■ Rookeries

- ESA list
- New list based on > 50 pups counted since 1975

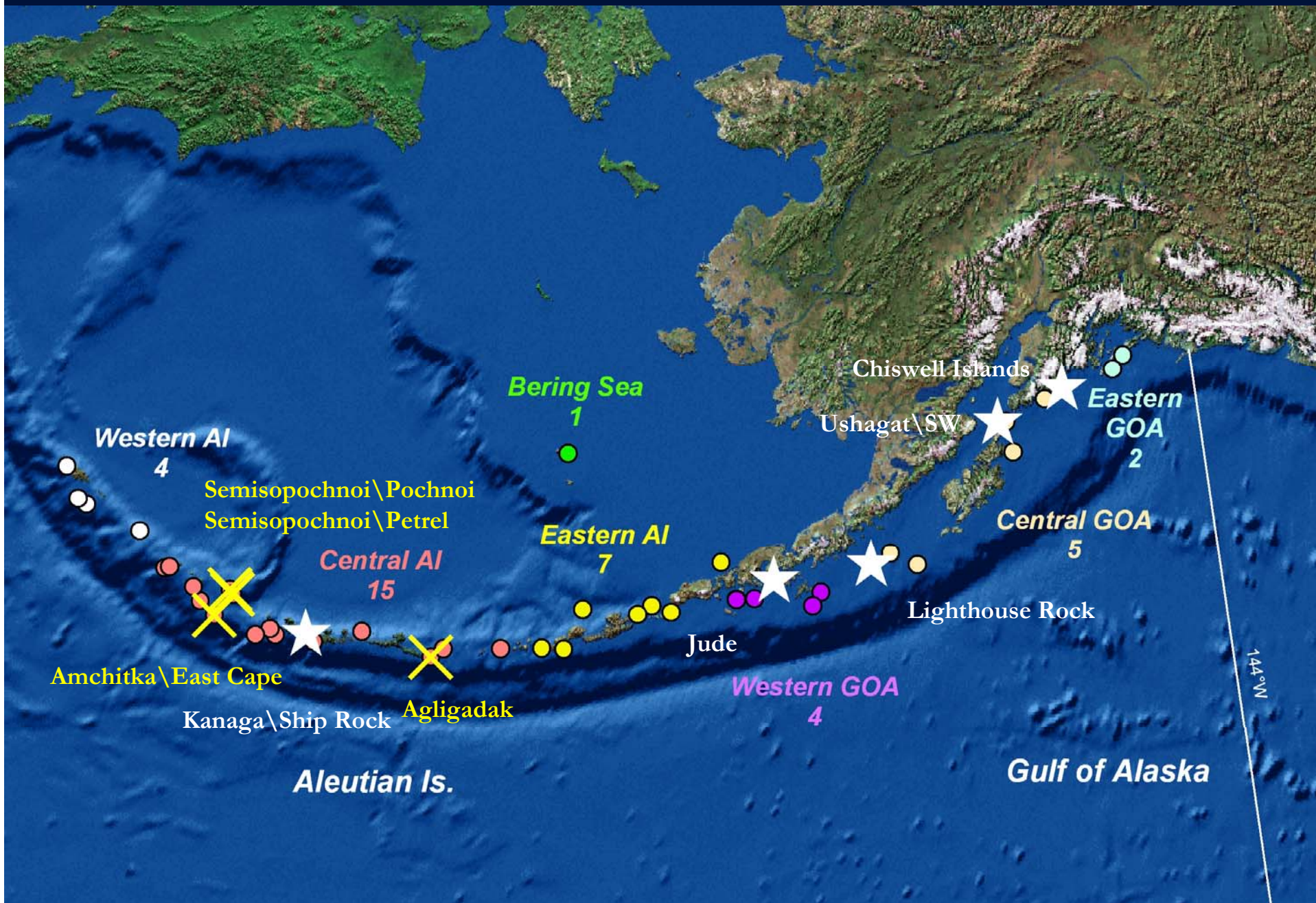
## ■ Haul-outs

- ESA list (> 200 non-pups)
- RFRPA list based on seasonal usage
  - > 200 in summer or > 75 in winter (additional 19 sites)
- New list based on seasonal usage
  - > 200 in summer or > 100 in winter since 1990

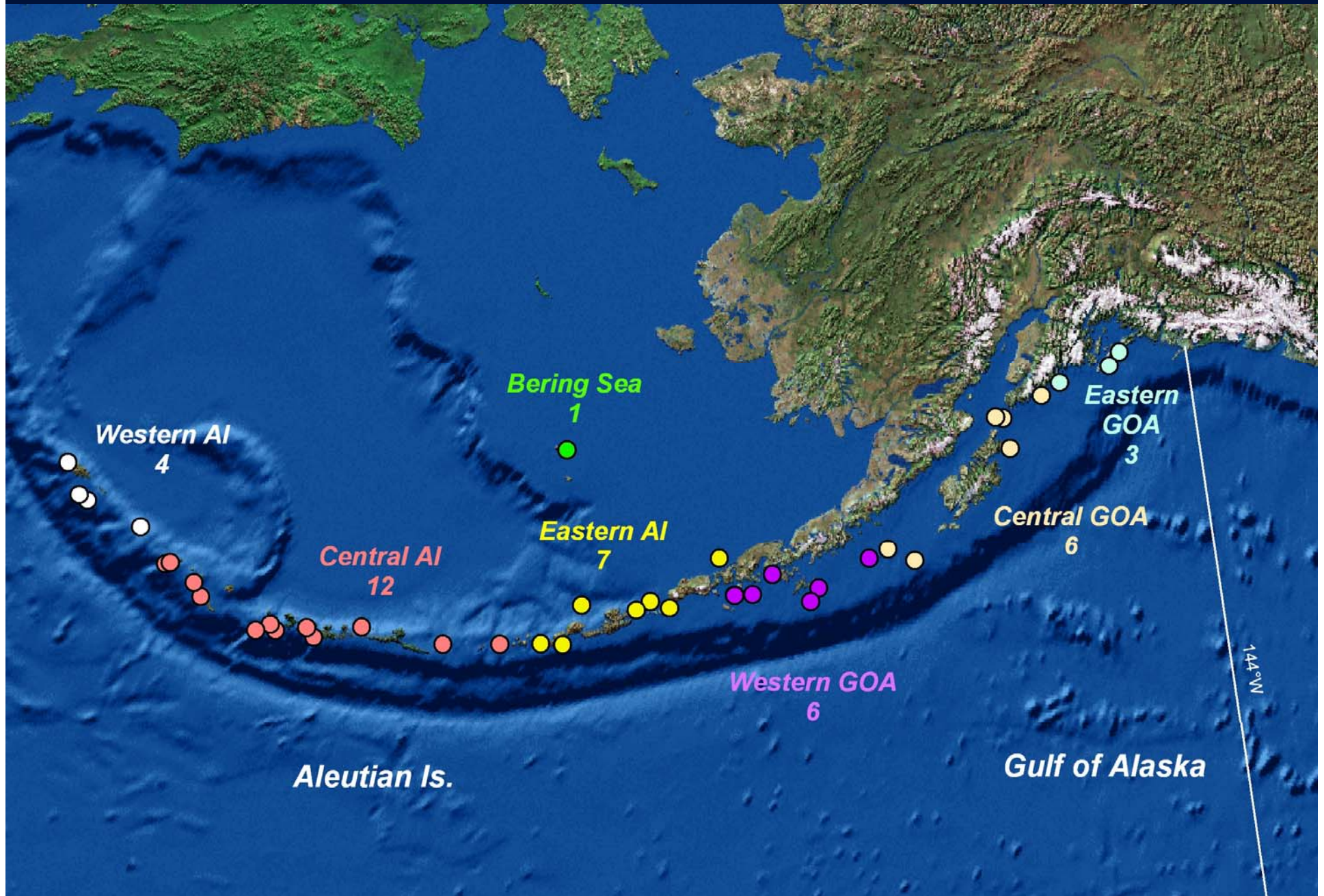
# Steller Sea Lion Rookeries – ESA List (N = 38)



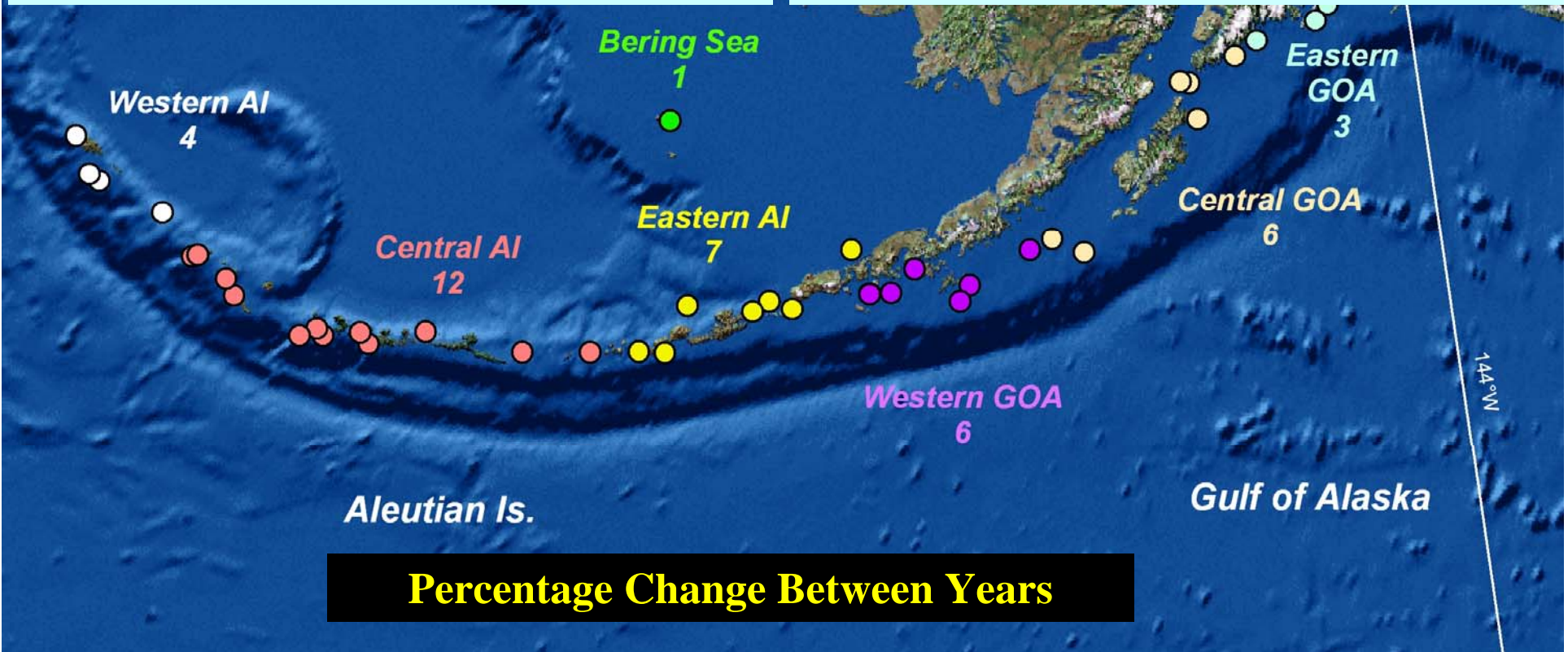
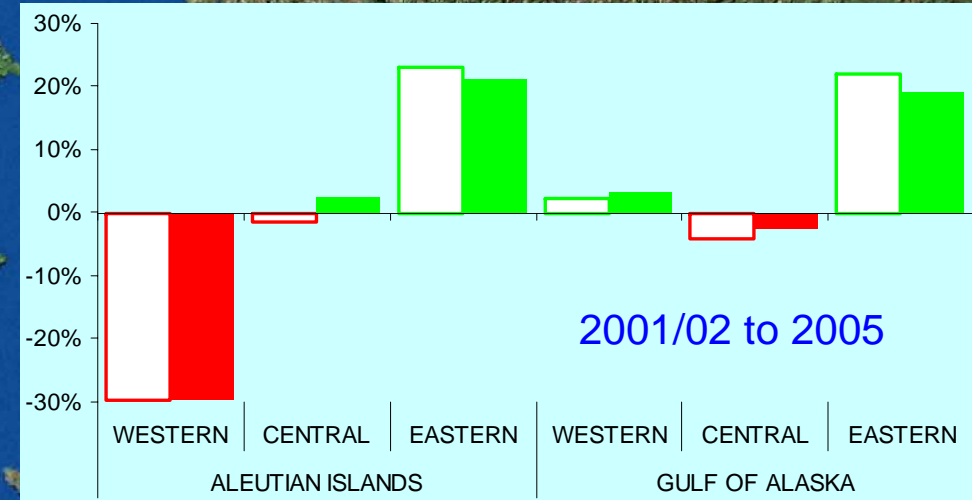
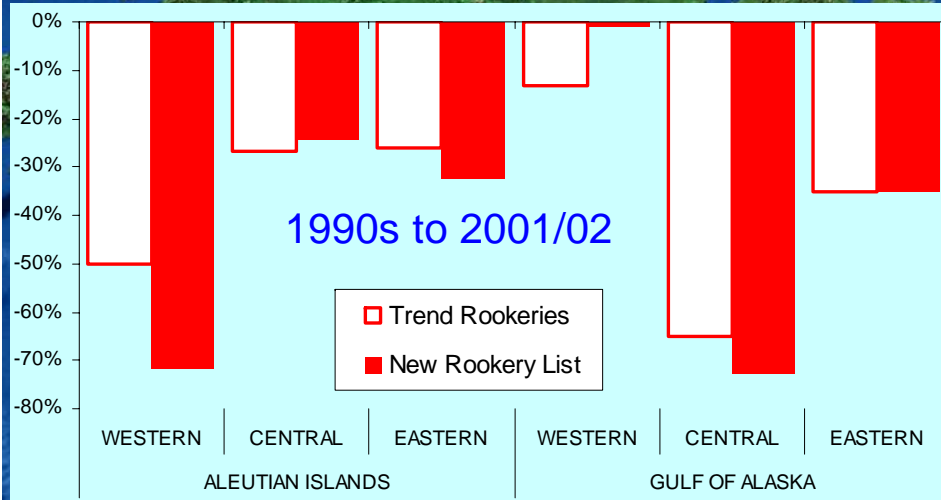
# Steller Sea Lion Rookeries – Changes (-4 X, +5 ★)

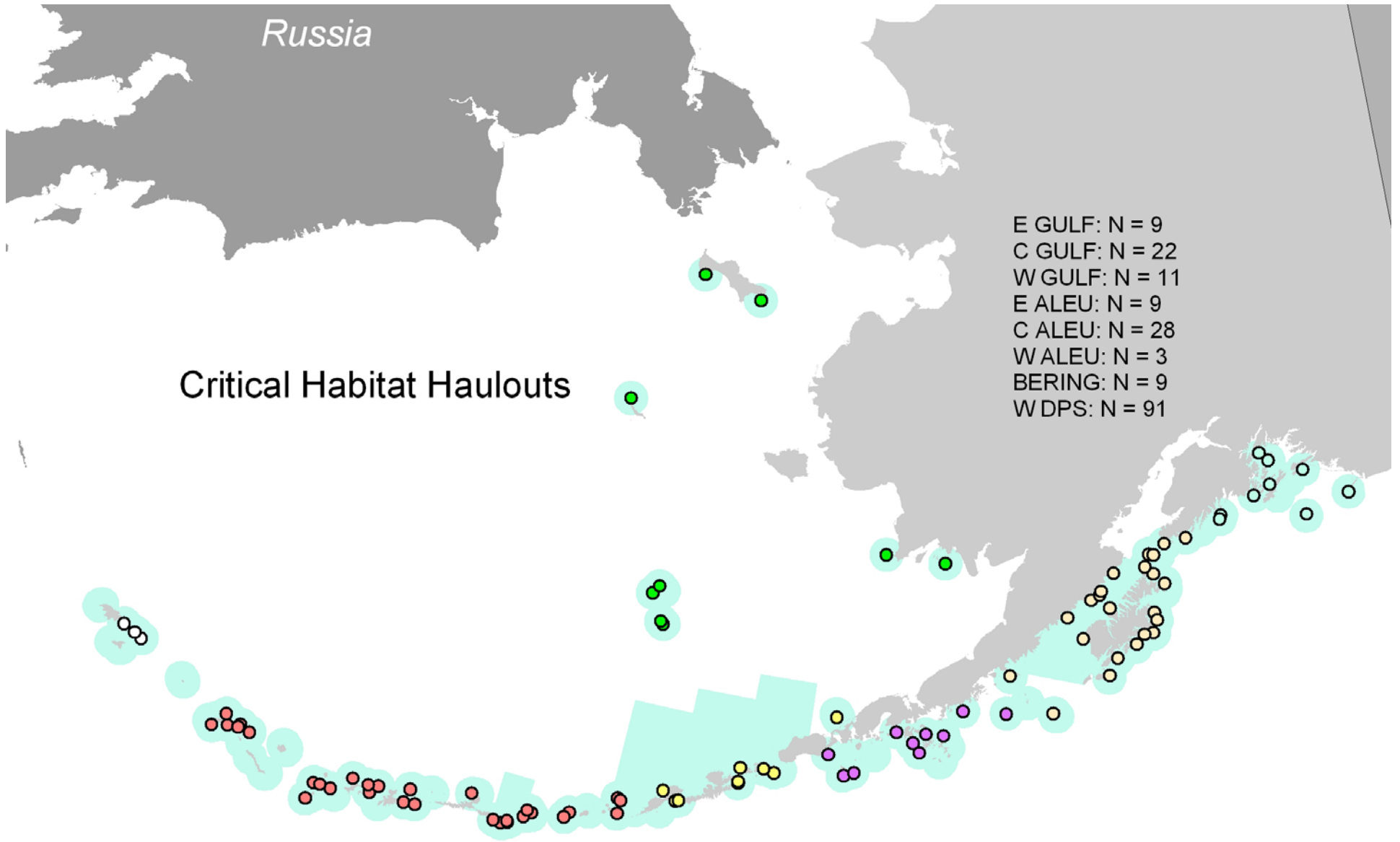


# Steller Sea Lion Rookeries – New List (N = 39)



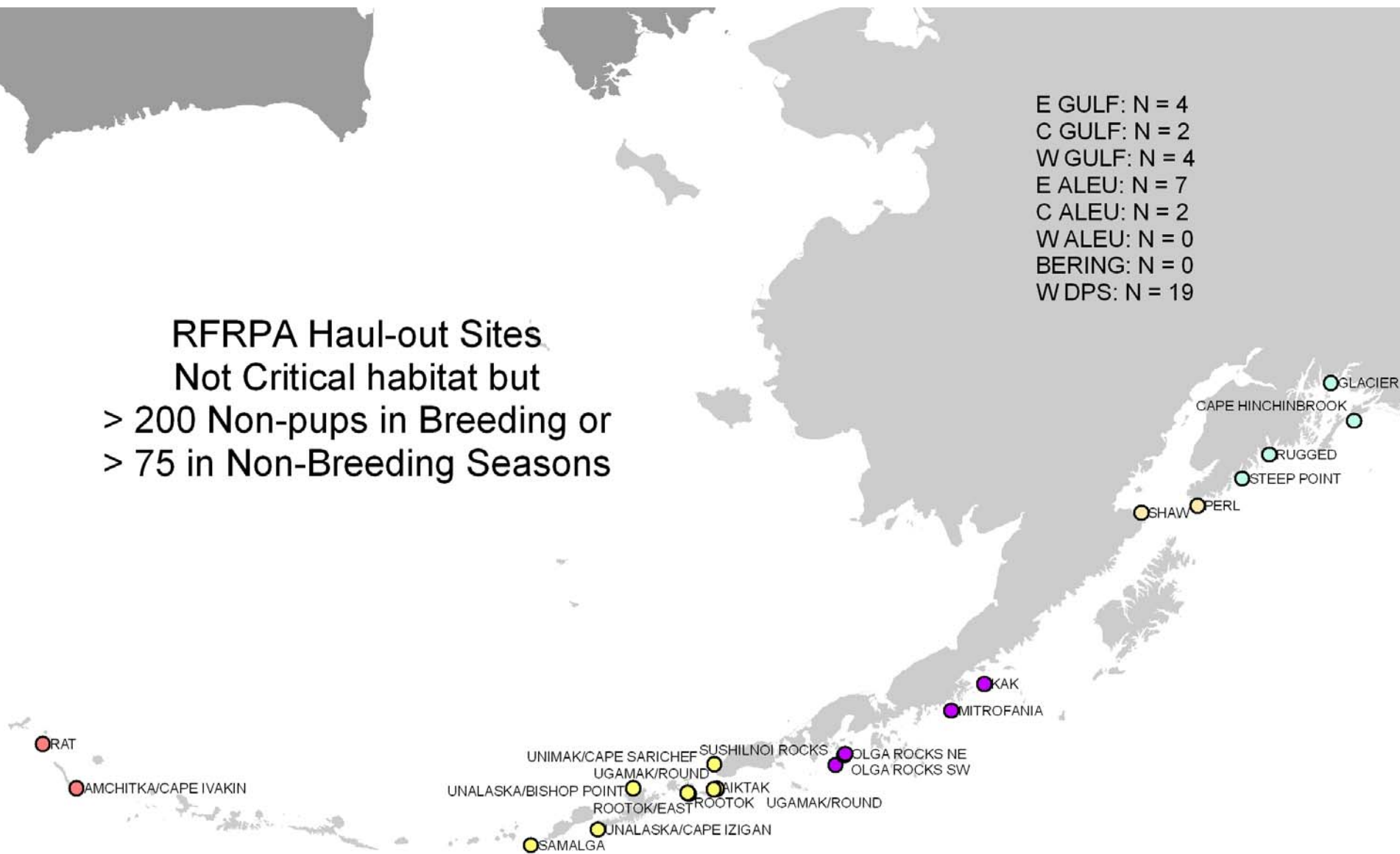
# Western Steller Sea Lion Pup Counts in Alaska: NEW Rookery List and Extrapolation for Missing Counts



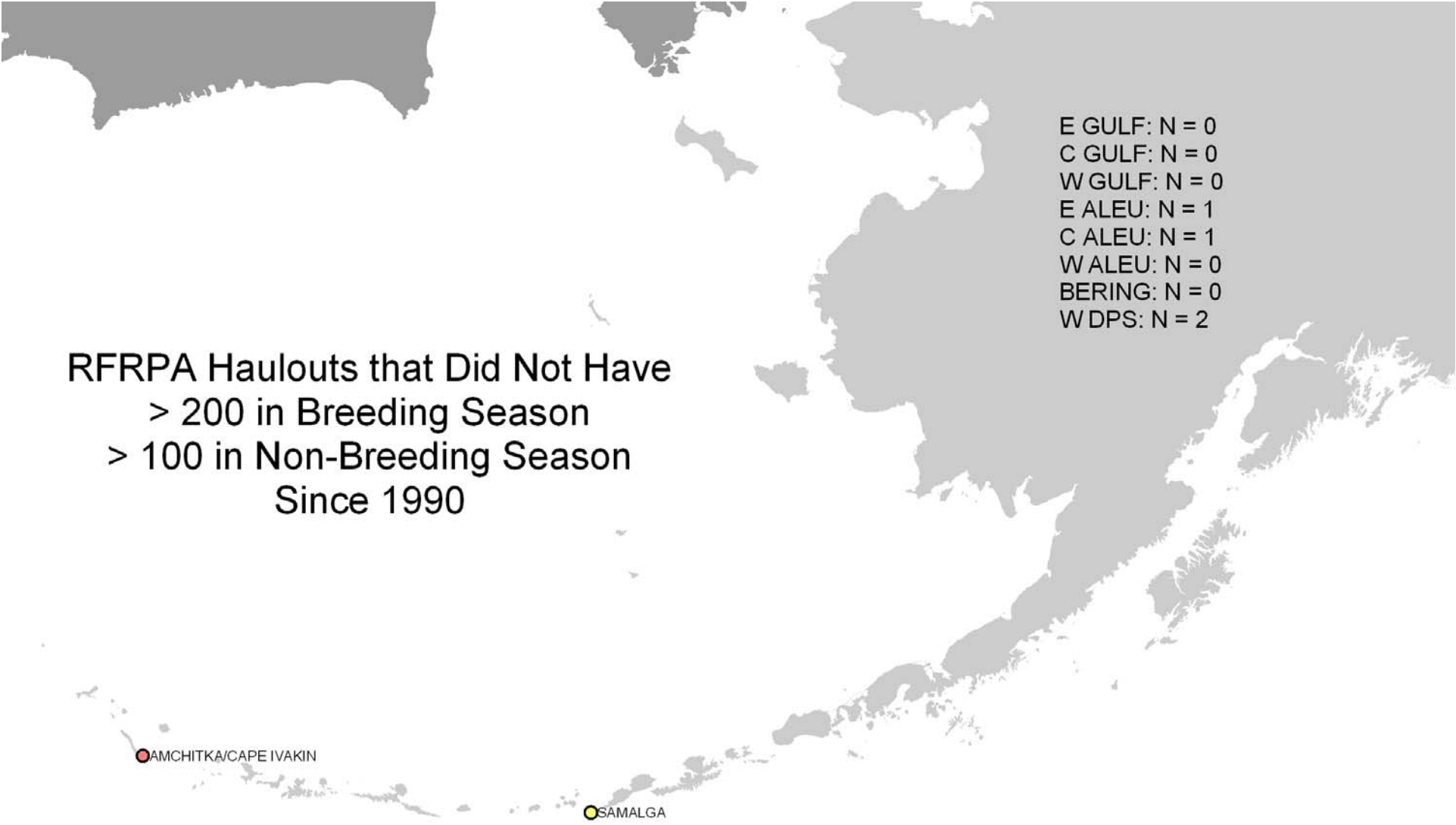


RFRPA Haul-out Sites  
Not Critical habitat but  
> 200 Non-pups in Breeding or  
> 75 in Non-Breeding Seasons

E GULF: N = 4  
C GULF: N = 2  
W GULF: N = 4  
E ALEU: N = 7  
C ALEU: N = 2  
W ALEU: N = 0  
BERING: N = 0  
W DPS: N = 19







RFRPA Haulouts that Did Not Have  
> 200 in Breeding Season  
> 100 in Non-Breeding Season  
Since 1990

● AMCHITKA/CAPE IVAKIN

● SAMALGA



Non-RFRPA or Critical Habitat Haulouts  
that Have Had  
> 200 in Breeding Season  
> 100 in Non-Breeding Season  
Since 1990

E GULF: N = 0  
C GULF: N = 2  
W GULF: N = 1  
E ALEU: N = 0  
C ALEU: N = 2  
W ALEU: N = 0  
BERING: N = 0  
WDPS: N = 5

SEMISOPCHNOI/TUMAN POINT

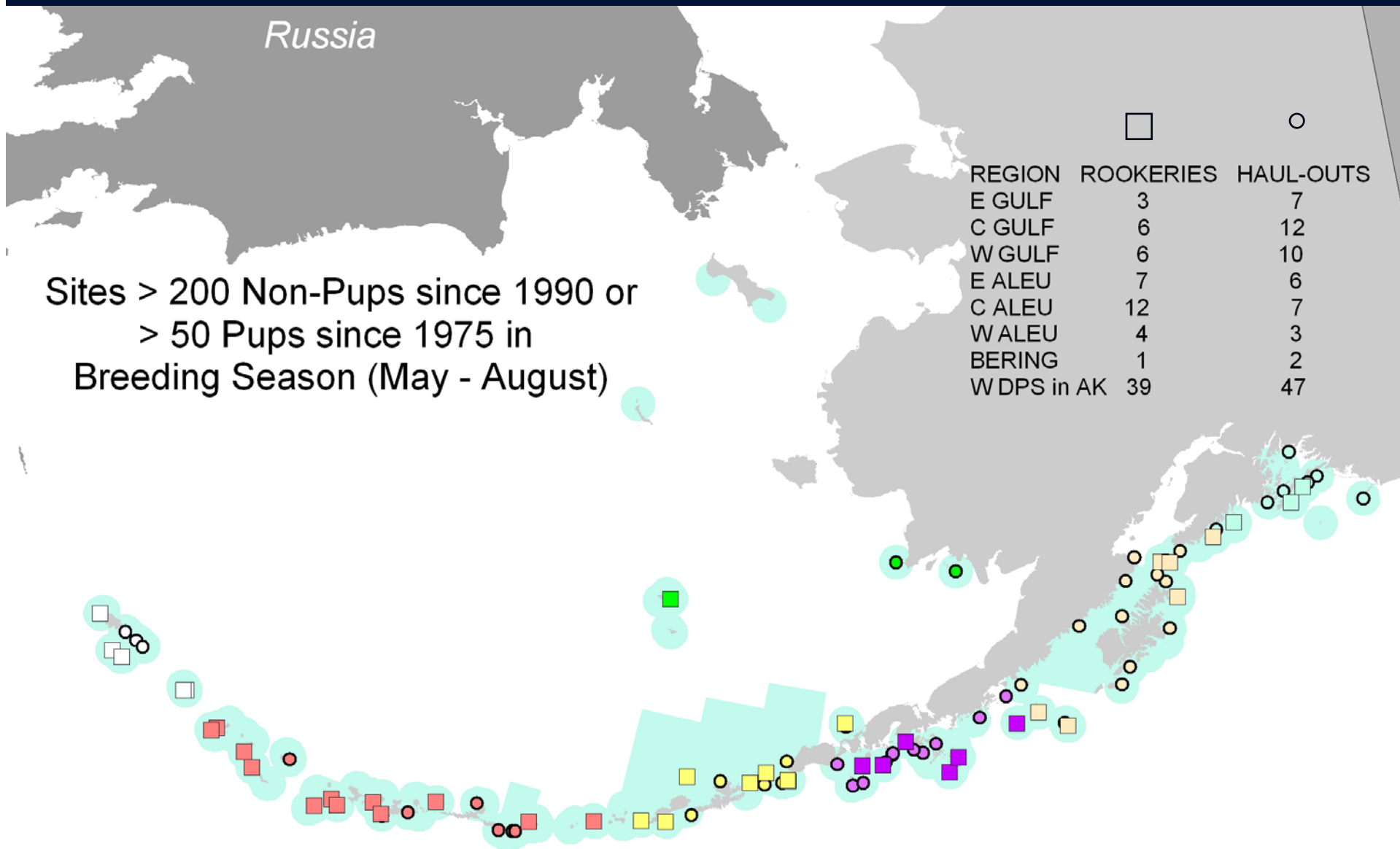
TAGALAK

UNGA/ACHEREDIN POINT

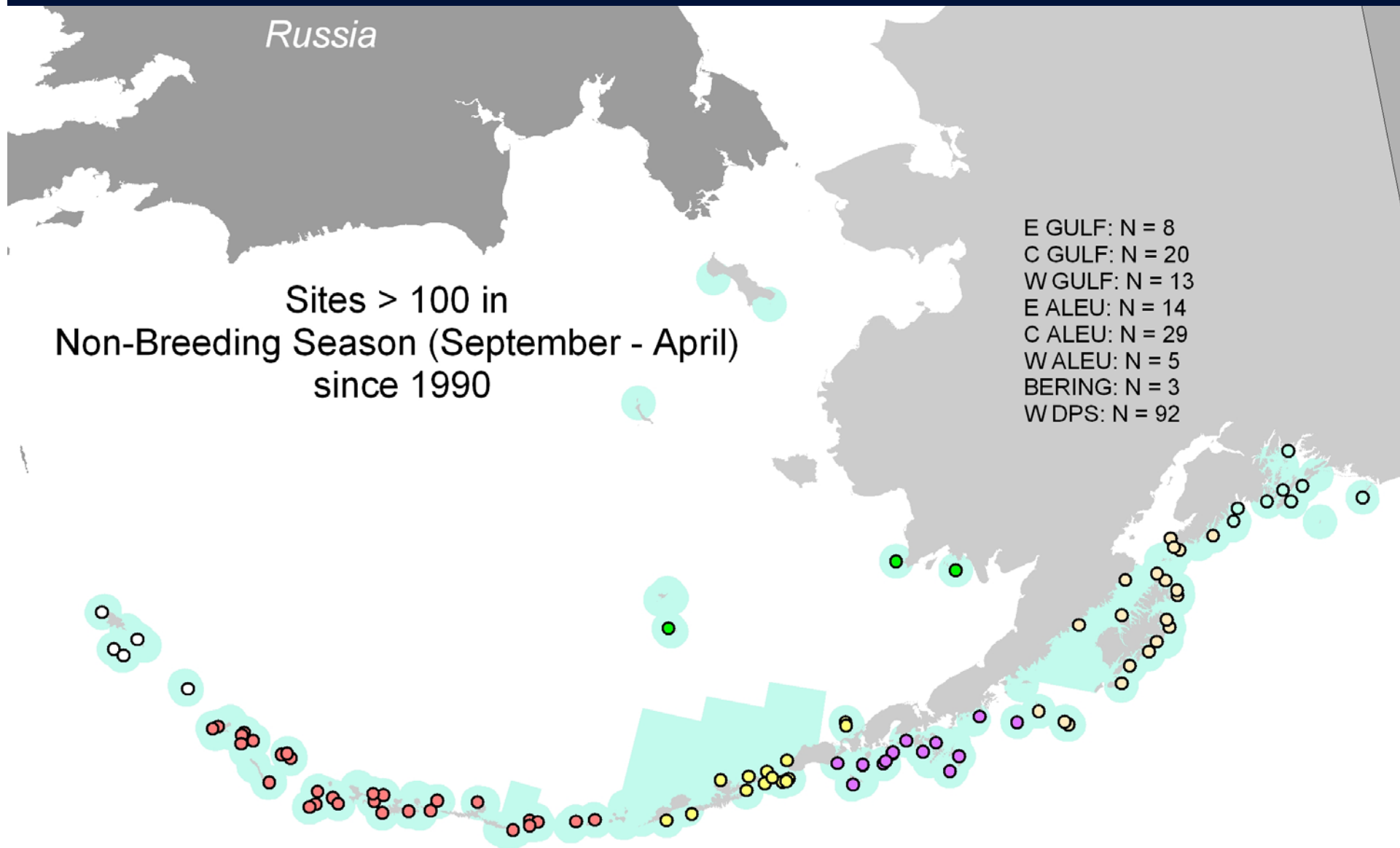
ELAT  
ELIZABETH/CAPE ELIZABETH



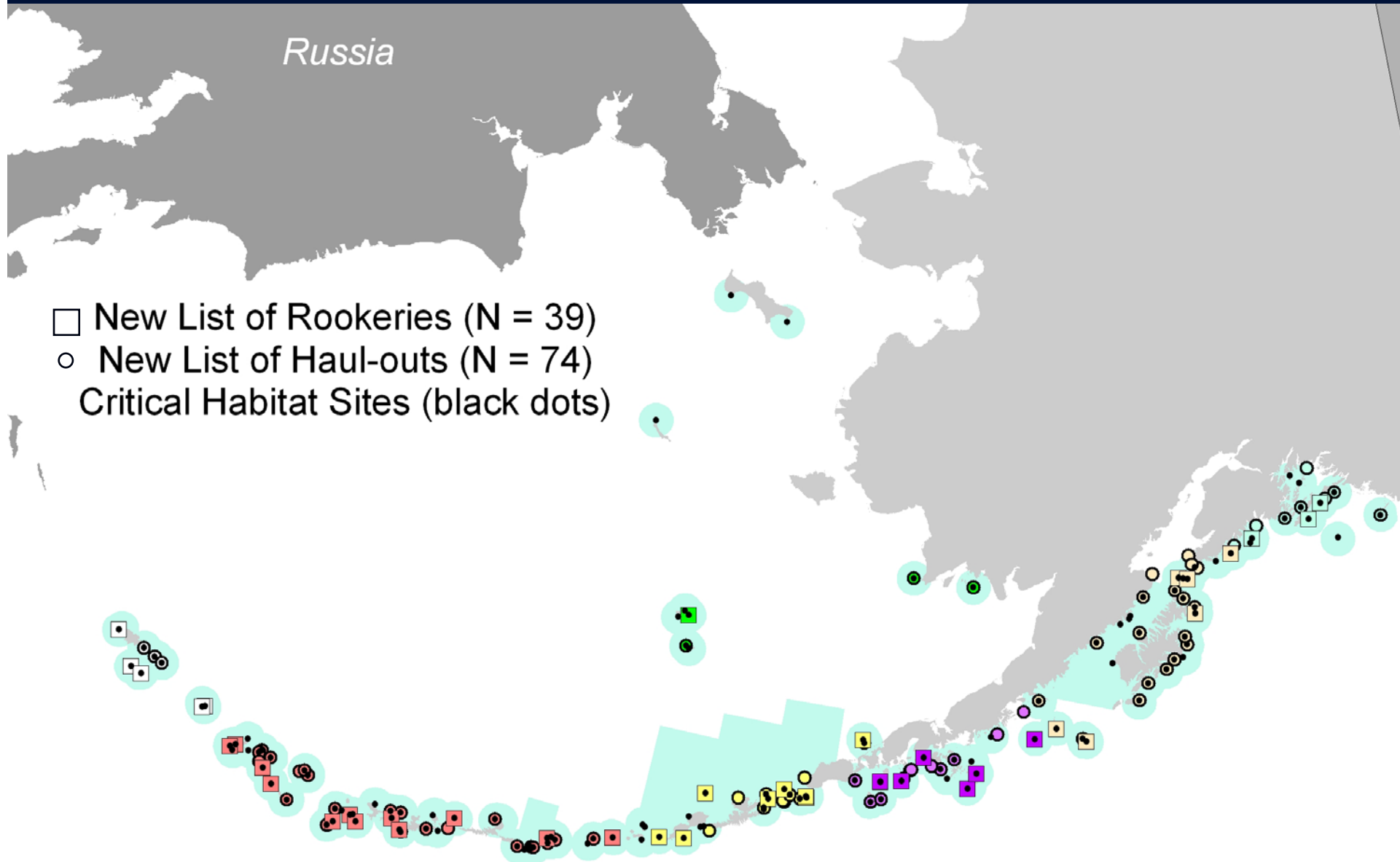
# May - August (Breeding Season)



# September - April (Non-Breeding Season)

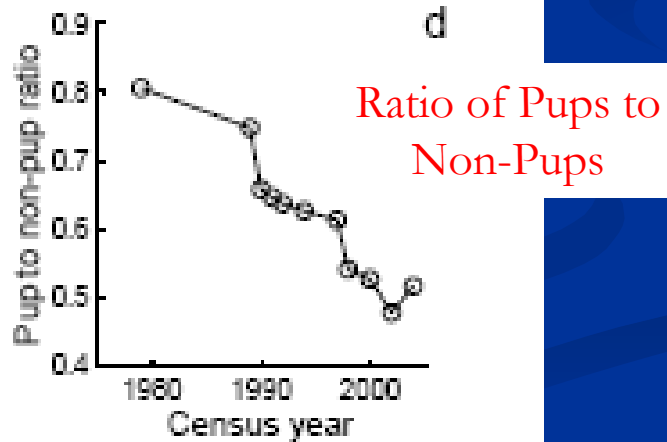
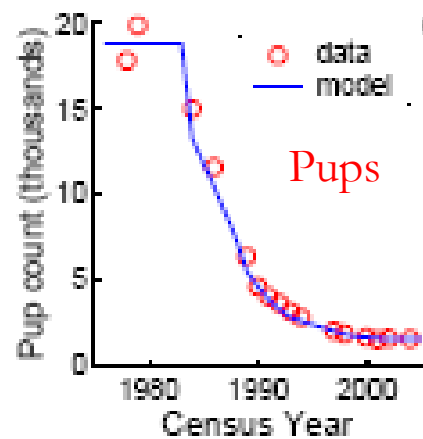
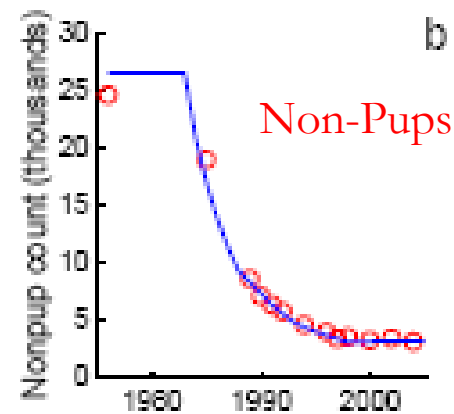
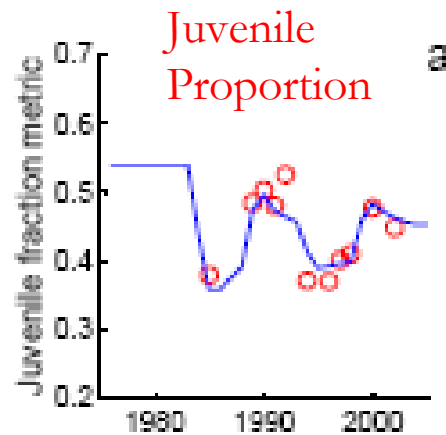


# All Rookery and Haul-out Sites



# Central Gulf of Alaska Survivorship and Fecundity Estimates

Model based on Pup/Non-pup Counts and Size Distribution



## Central Gulf of Alaska Survivorship and Fecundity Estimates

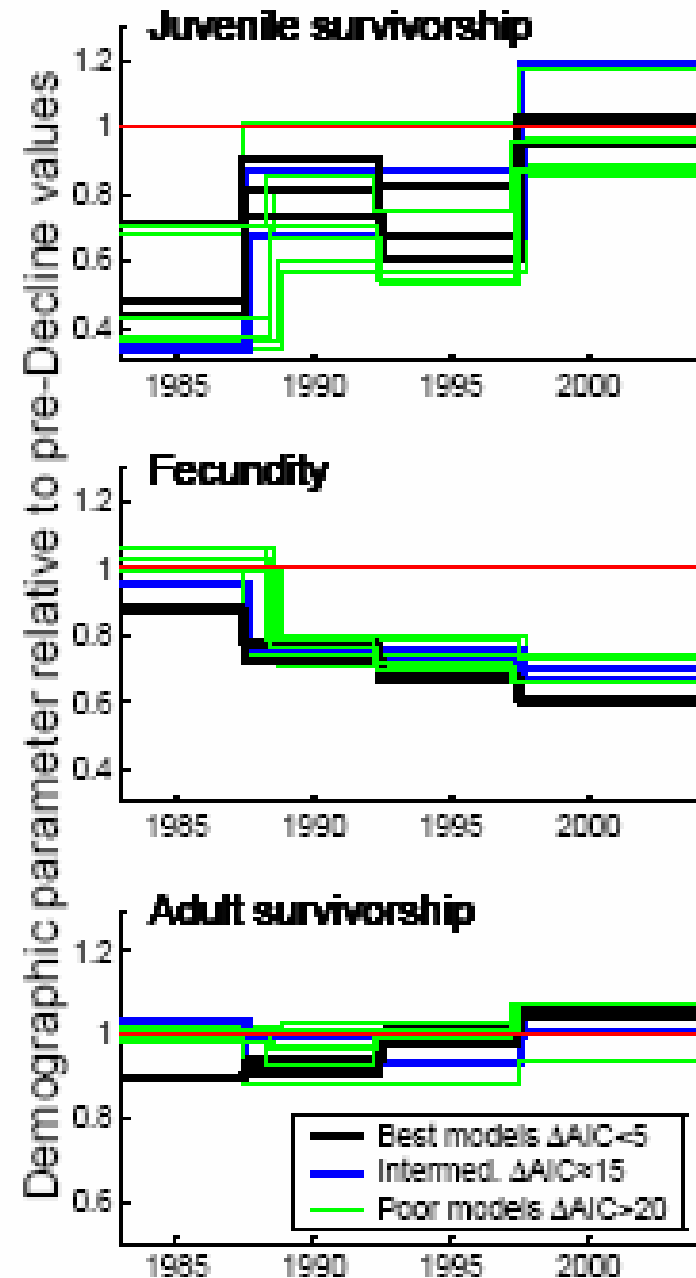
- 12 different models using various life tables and assumptions regarding environmental variability
- Relative to 1976 rates (= 1) when population was stable or declining slightly
- Estimates for other time periods [1983-87, 1988-92, 1993-97, and 1998-2004] relative to 1976

Juvenile survivorship increased after large initial decline

Fecundity has declined and currently may

only be 70% of 1970s

Adult survivorship increased



Critical Habitat Haulouts with  
 < 200 Non-pups in Breeding and  
 < 100 in Non-Breeding Seasons  
 Since 1990

E GULF: N = 4  
 C GULF: N = 8  
 W GULF: N = 3  
 E ALEU: N = 4  
 C ALEU: N = 15  
 W ALEU: N = 0  
 BERING: N = 6  
 W DPS: N = 40

