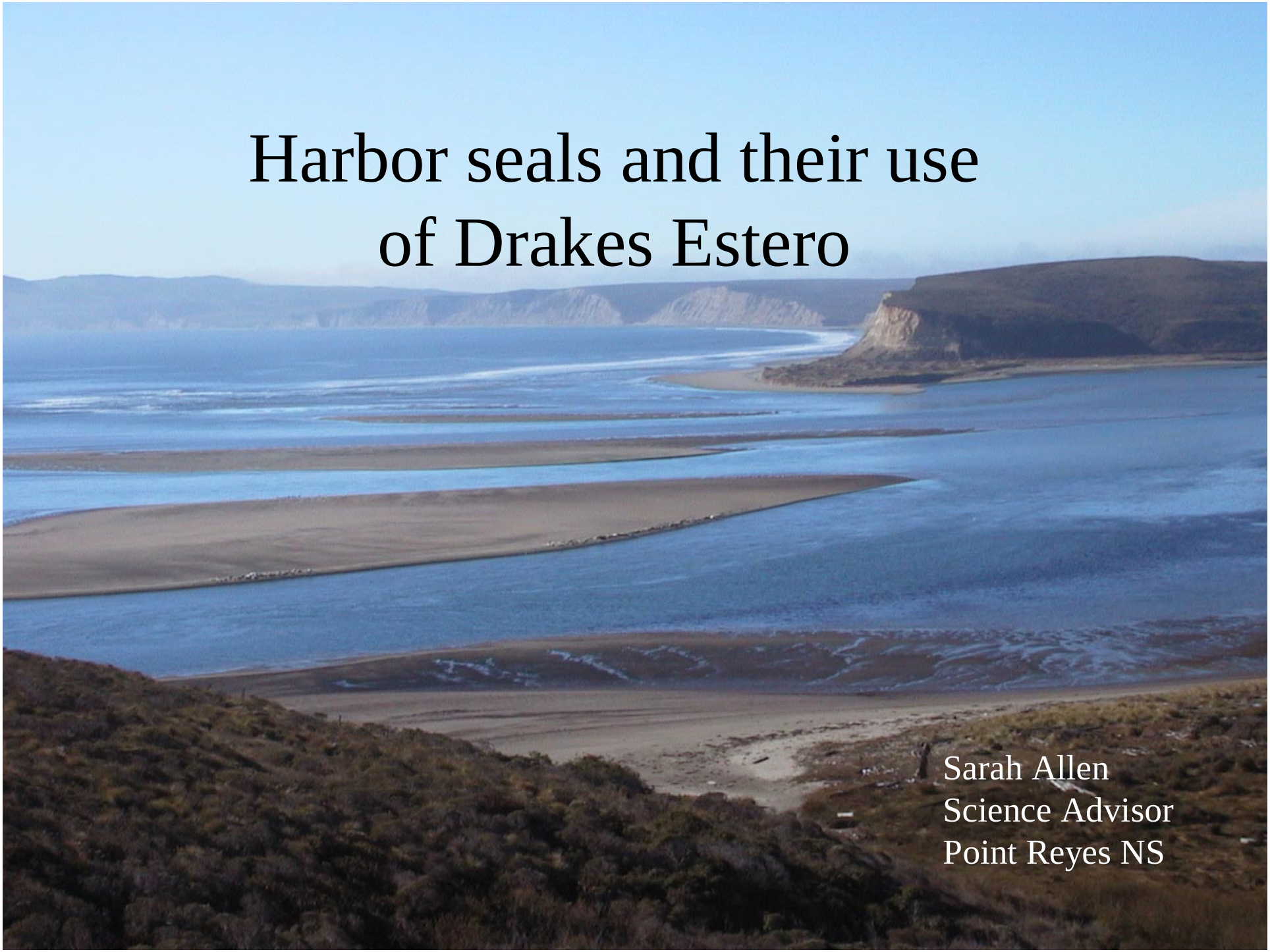
Harbor seals and their use of Drakes Estero



Sarah Allen
Science Advisor
Point Reyes NS

Outline

- Regional significance
- Daily activity patterns
- Seasonal patterns
- Spatial use
- Population trend
- Disturbance

Sources of information on Drakes Estero

- Baseline study of all haul outs in Point Reyes

  Allen and Huber 1982-83 and 1983-84

- Human interactions

  Allen and Huber 1983-84

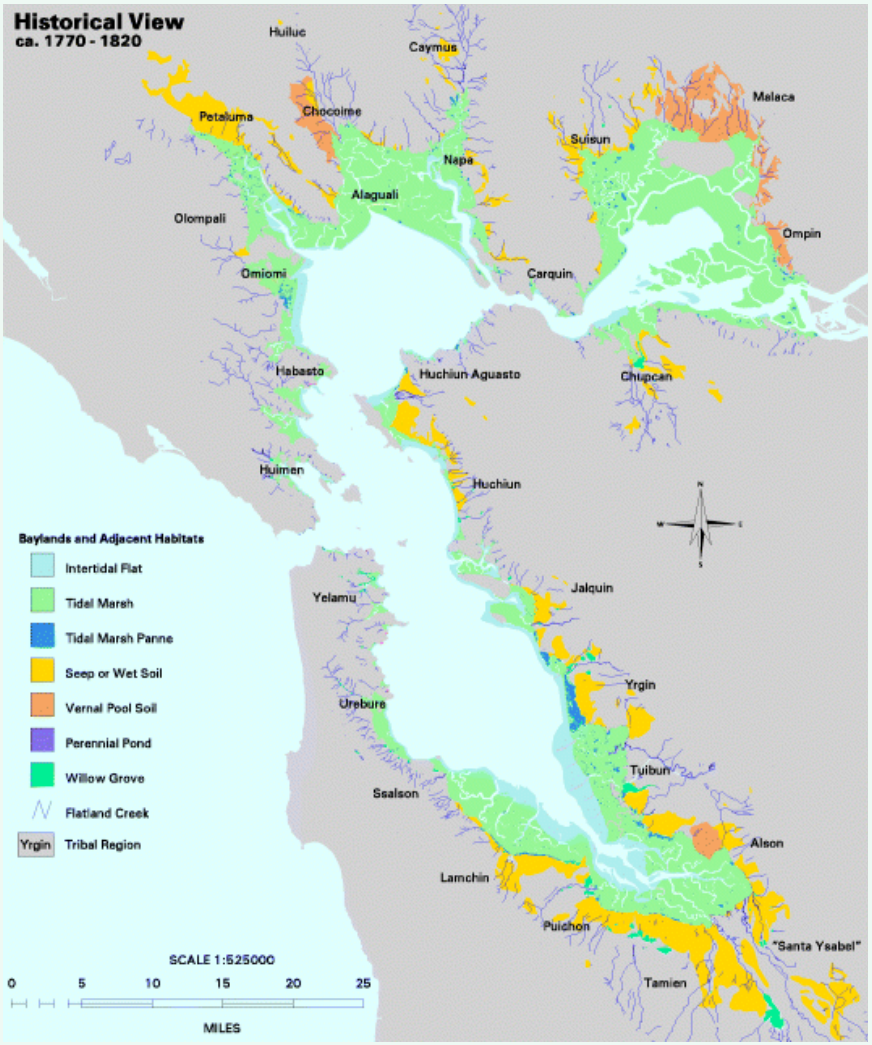
- Movement and activity pattern study 1985-88

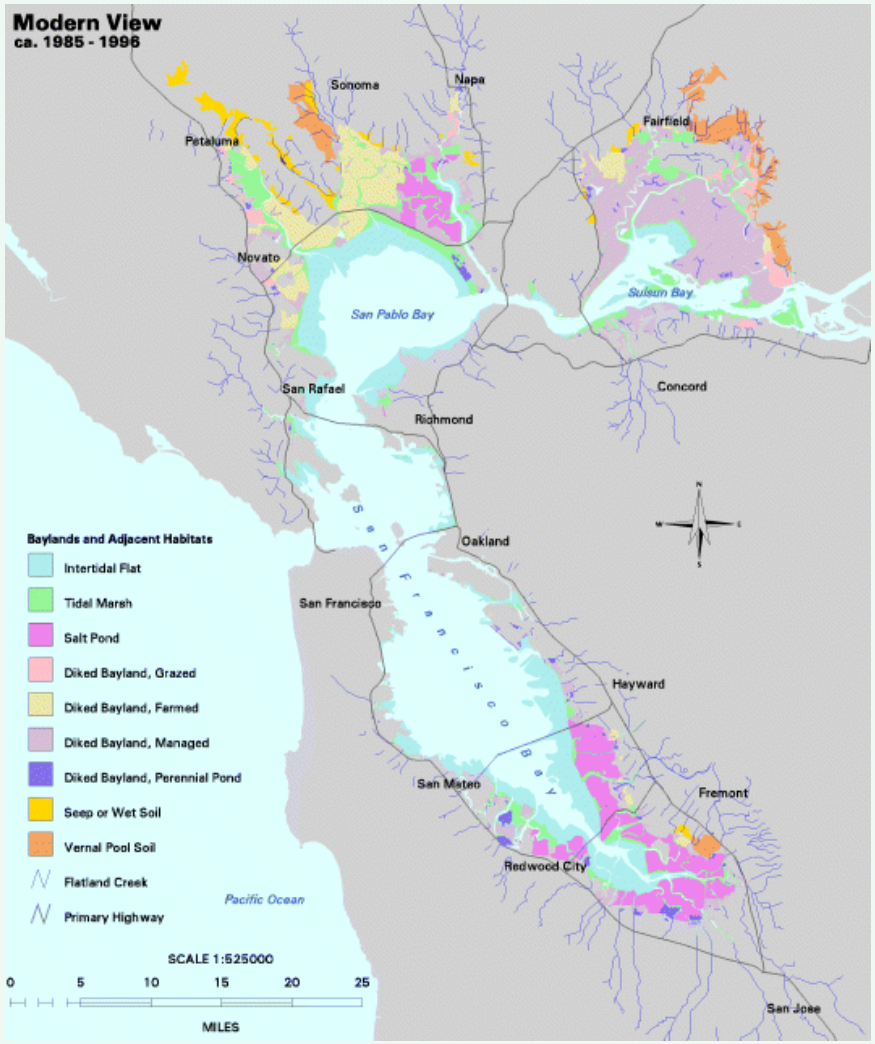
  Allen Miller 1988

- Monitoring 1996-2009

  NPS pinniped monitoring database

Urbanization of San Francisco Bay

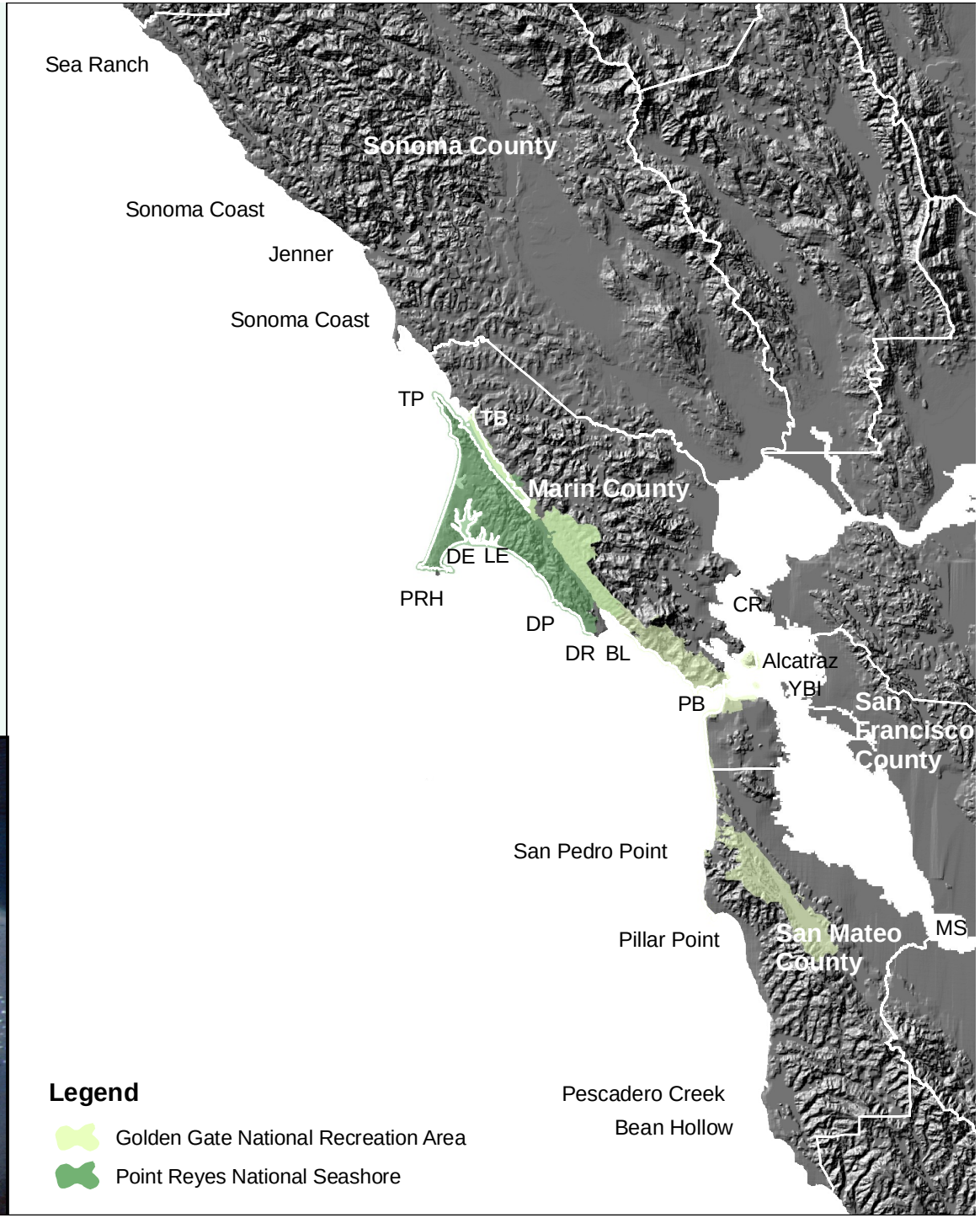




Maps from the San Francisco Estuary Institute

Regional harbor seal haul out sites

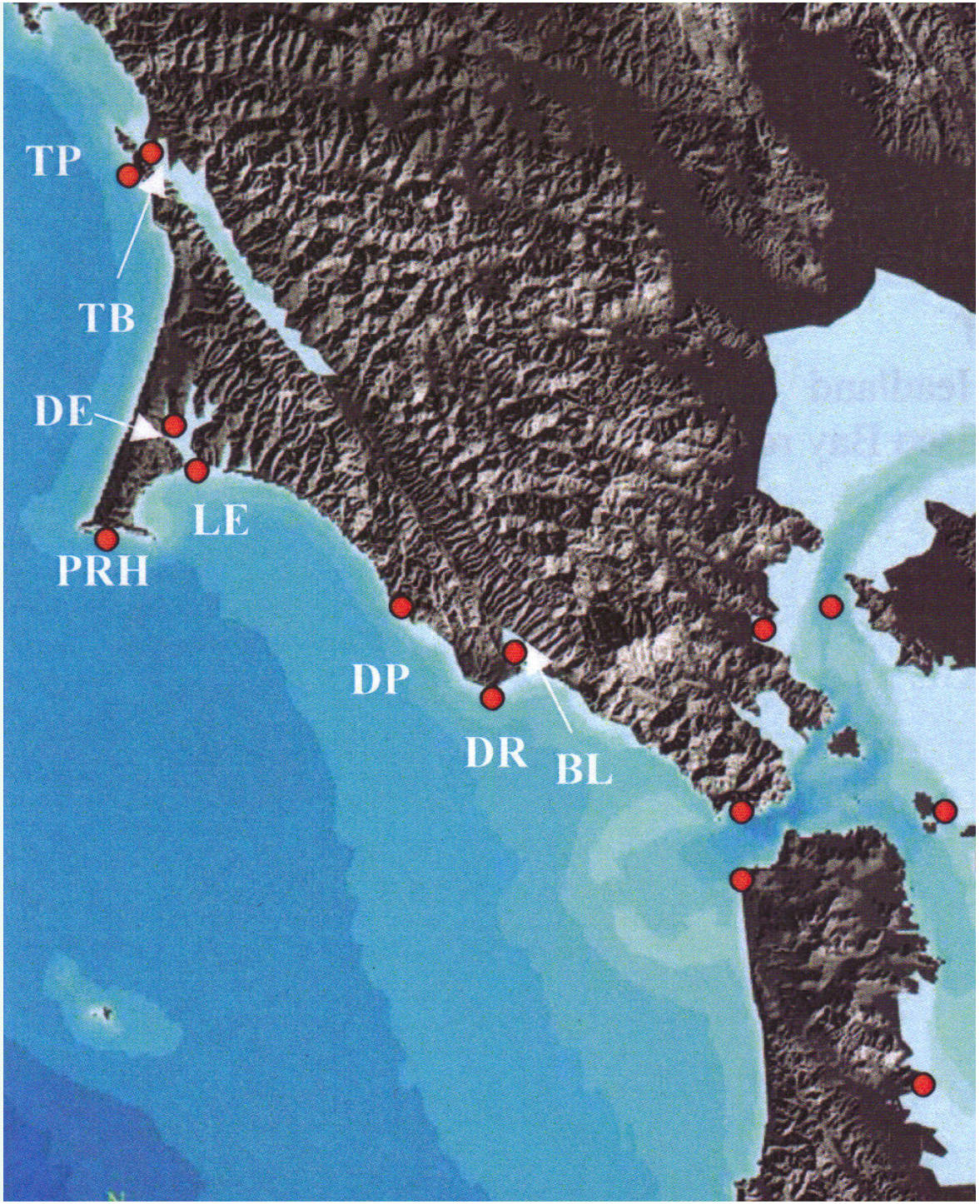
Marin County colonies = @ 20% of California mainland population (Lowry et al. 2005)



Marin County Colonies

DE accounts for
24-30% of total seals
29-33% of total pups

(from NPS annual reports)



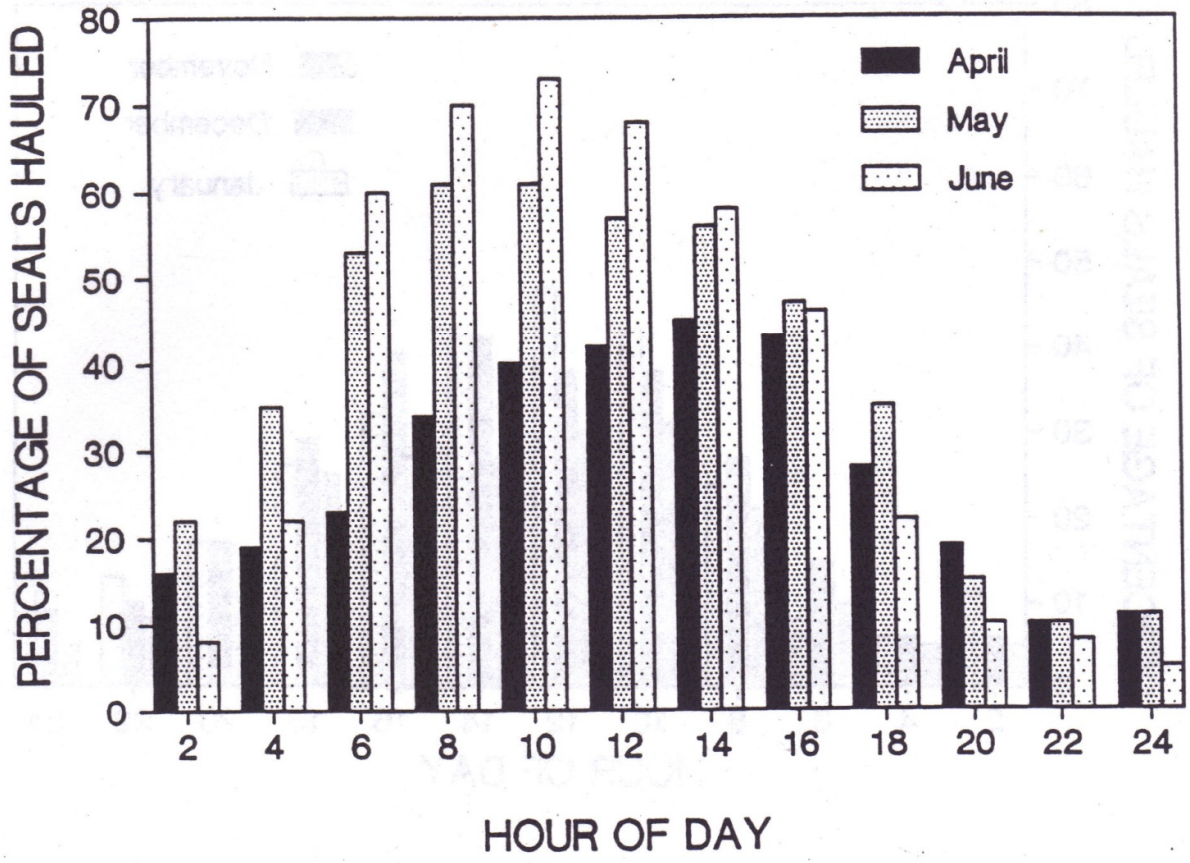
Harbor seal activity patterns in Drakes Estero

Many factors influence seal haul out patterns elsewhere: Loughlin 1978, Newby 1973, Slater and Markowitz 1983, Yochem et al. 1987, Jeffries 1986, Harvey 1987, Watts 1996, Thompson et al. 1997, Grigg et al. 2002, Lowry et al. 2005.

Daily Pattern
- Time of day
- Tide
- Hours per day

Seasonal Pattern
- Breeding (March-June)
- Molt (July-August)
- Non-breeding (Sept-Feb)

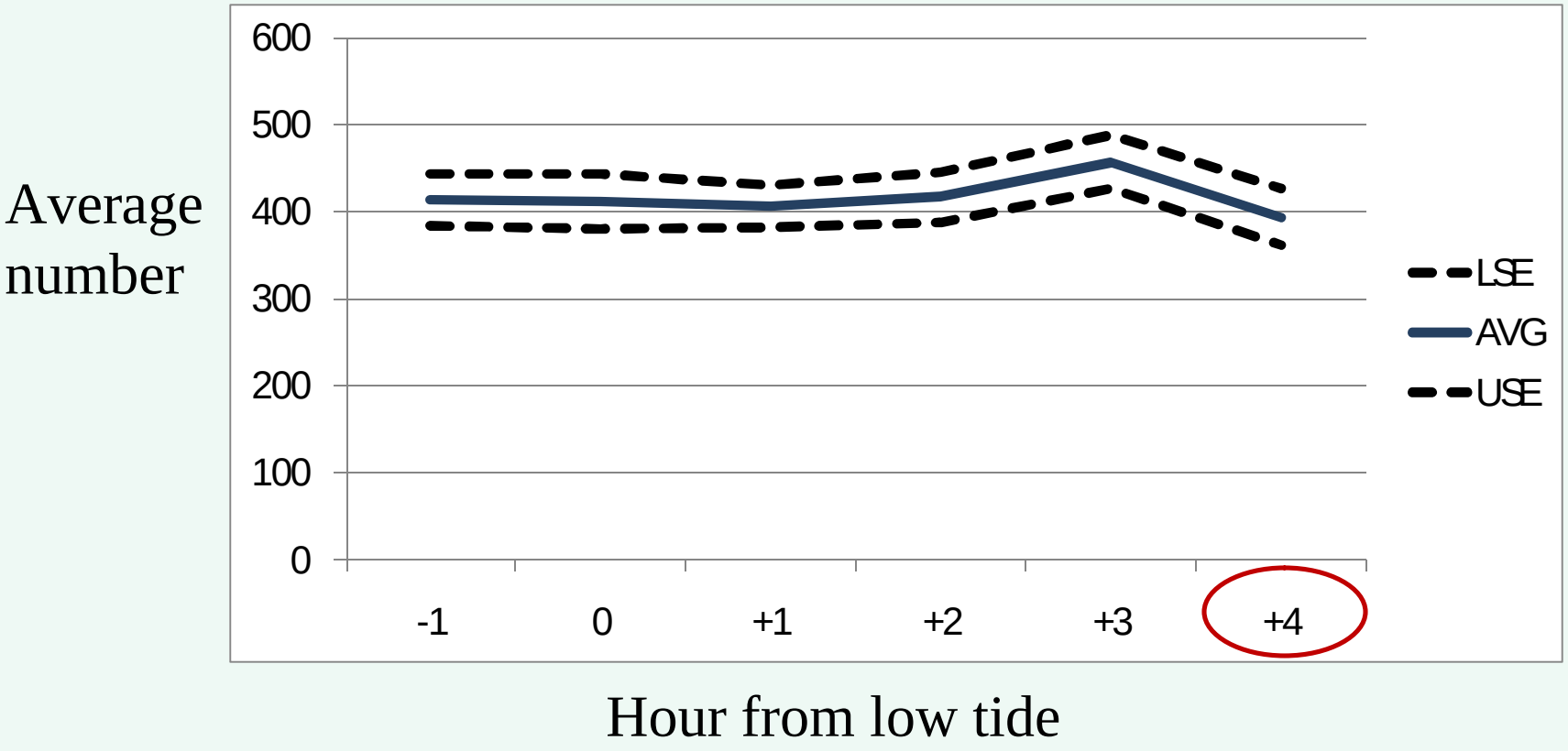
Daily patterns



Percentage of radio-tagged seals hauled out by hour of day for the months April –June. Regardless of season, the largest number of seals hauled out from 0500-1600 hr. Similar patterns seen by Yochem et al 1987, Harvey 1987.

Daily patterns

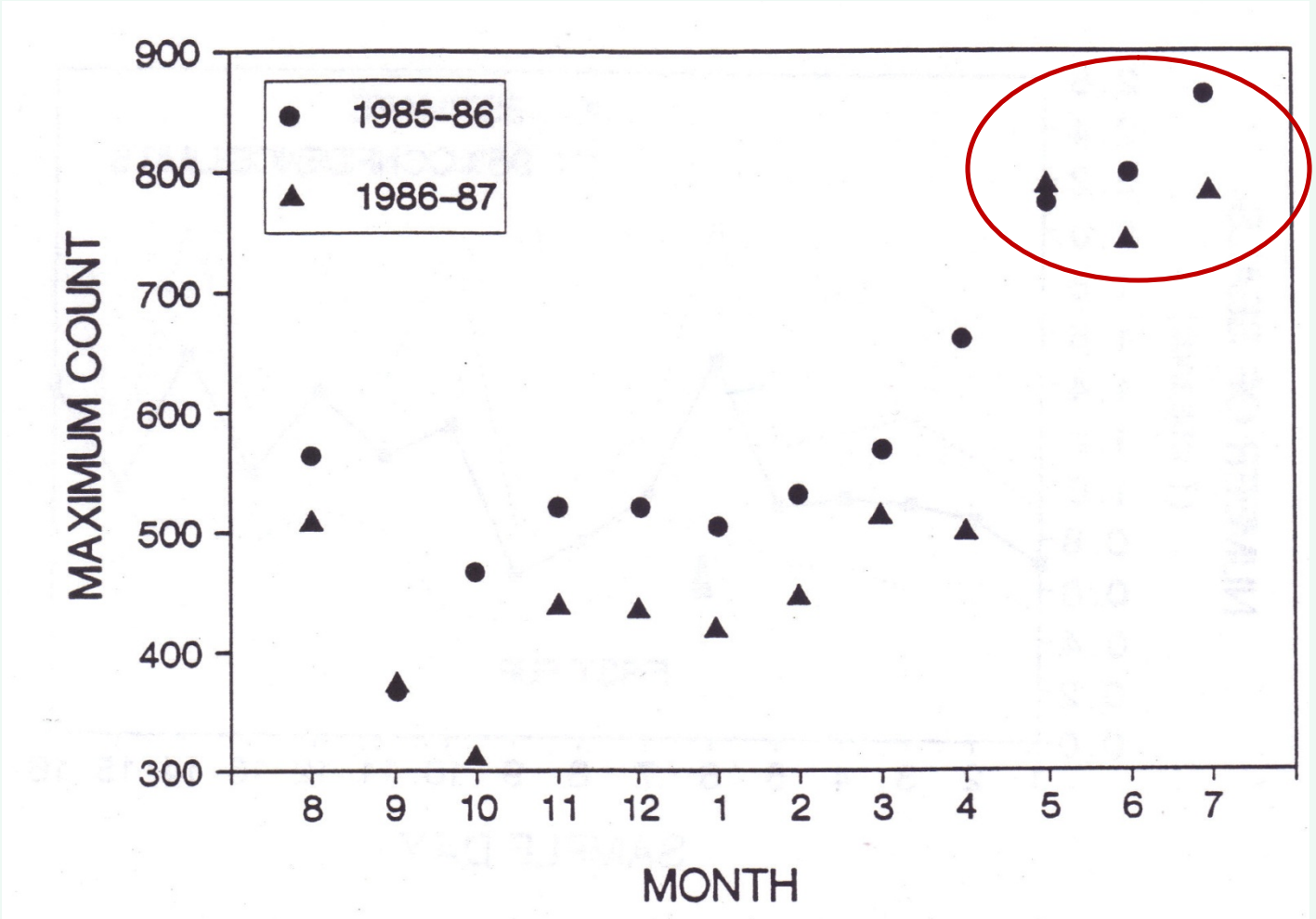
More seals hauled out relative to tide from -1 hr before to +4 hours after low tide. After +4 hours, numbers drop off. Similar pattern seen by Stein 1989, Harvey 1987.




Harbor seal use of site on rising tide in DE

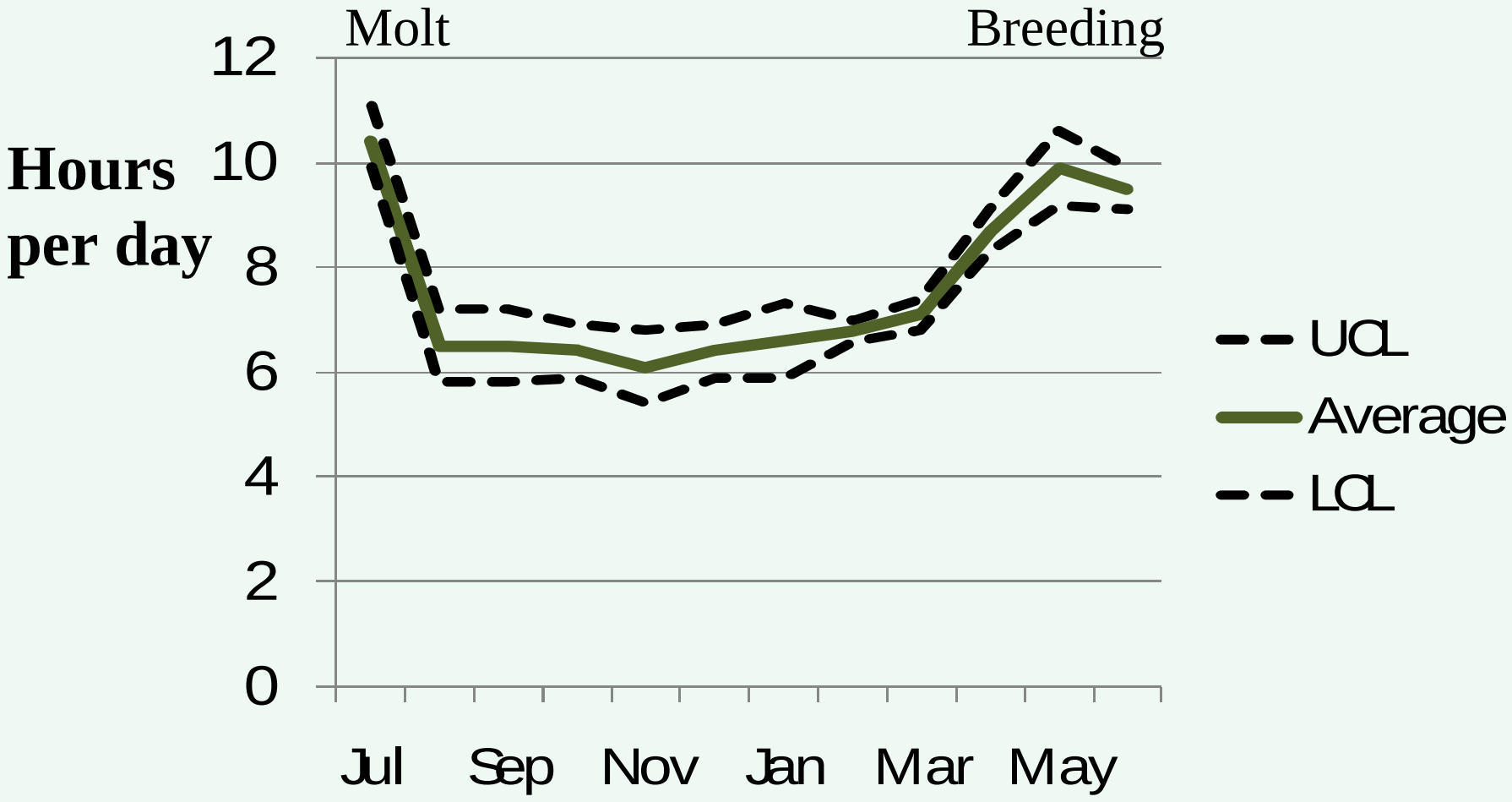
Seasonal Patterns

Monthly maximum number of seals counted between August 1985 and July 1987. Similar to Yochem et al. 1987, Harvey 1987, Suryan and Harvey 1999)



Seasonal Patterns

Average hours per day that radio-tagged female seals hauled out at Drakes Estero. Similar results to Stein 1989, Harvey 1987, Huber et al 2001.



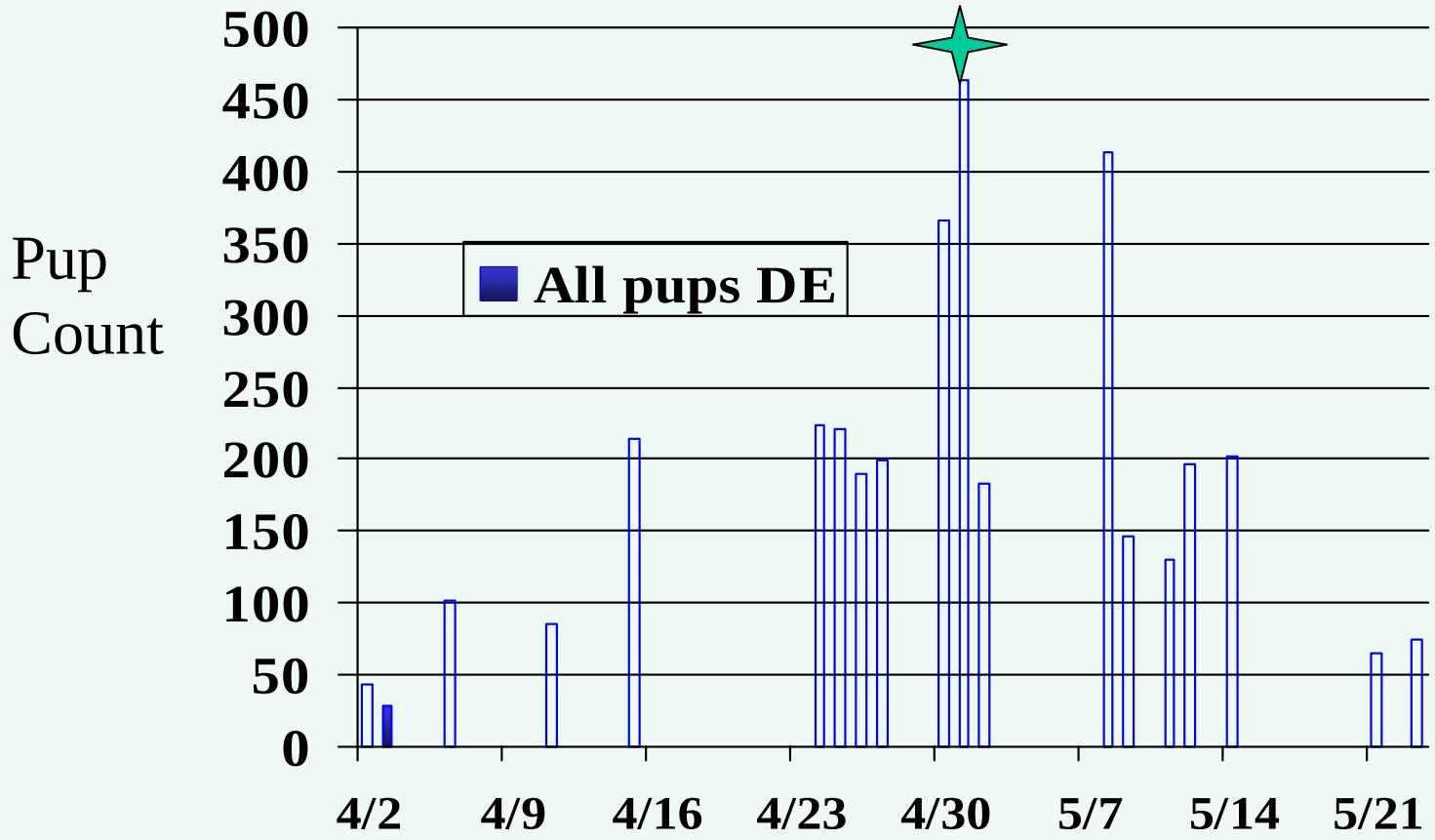
First Pups

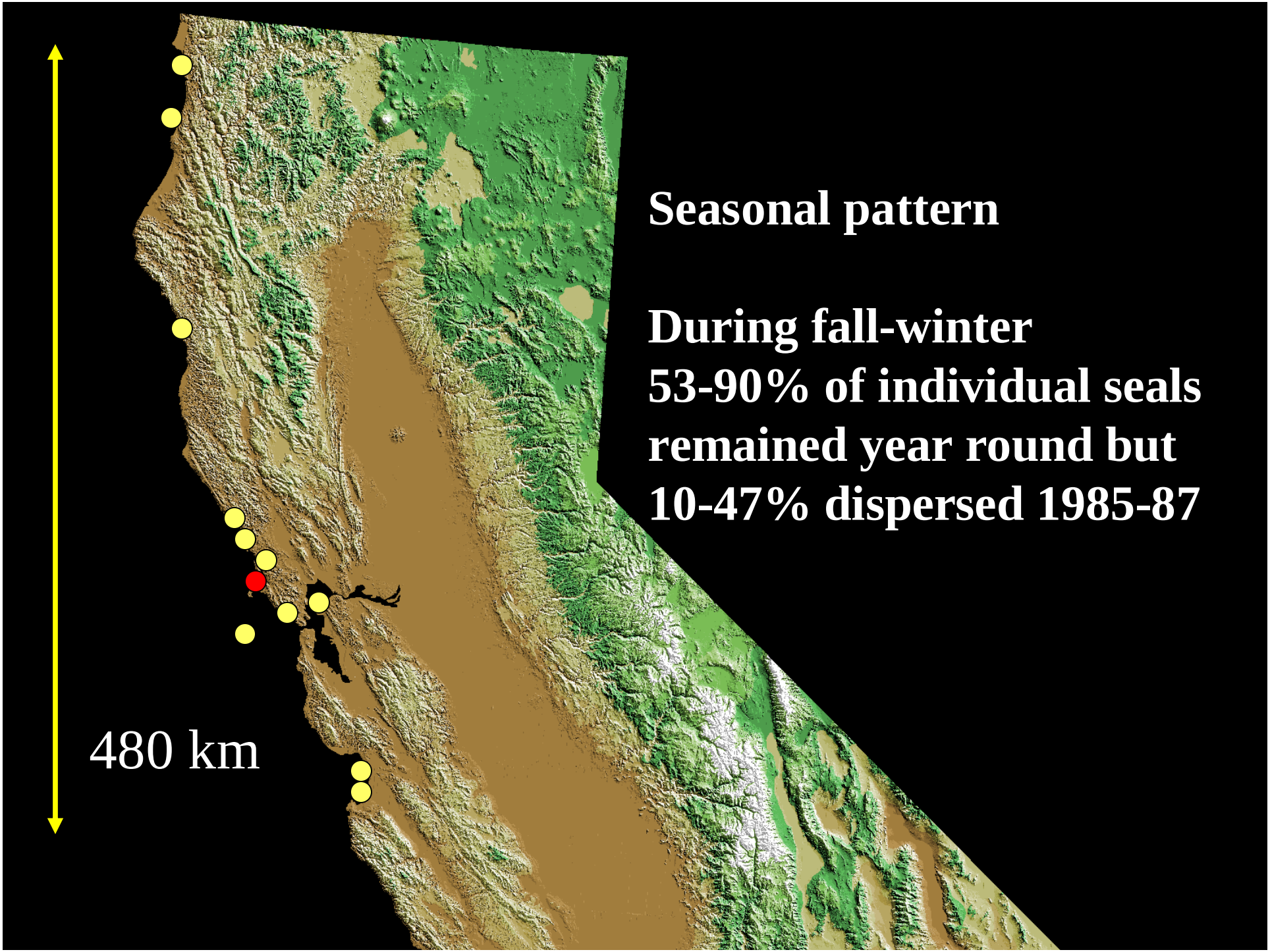
Date of first pup observed in the season by location, 2000–2008. (From NPS Annual Report 2009).

Year	Date	Location
2000	March 14	Point Reyes Headland
2001	March 16	Tomales Bay
2002	March 3	Drakes Estero
2003	March 27	Bolinas Lagoon
2004	March 20	Double Point
2005	March 6	Drakes Estero
2006	March 9	Double Point
2007	March 2	Double Point
2008	March 16	Bolinas Lagoon

Pupping Season

Regardless of year, peak pup count for DE and region is between last week of April and first week of May. Proportion of pups is @ 0.3 regardless of year. (Example from 2004 NPS database).



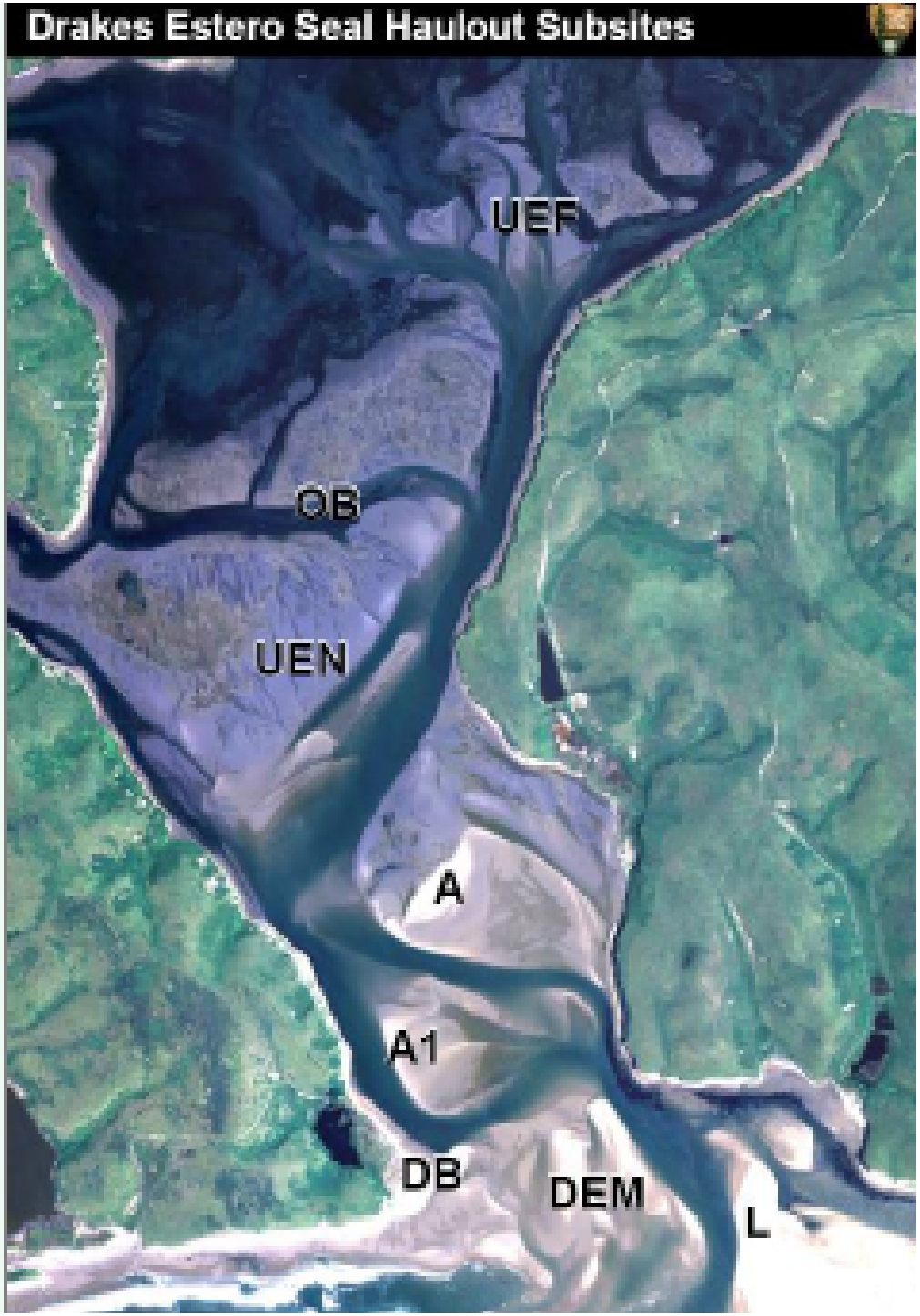

480 km
Seasonal pattern
During fall-winter
53-90% of individual seals
remained year round but
10-47% dispersed 1985-87

Spatial Patterns

Upper - UEN, OB, UEF
Middle -A, A1
Lower – DB, DEM, L

Isolated sandbars
A before 2003,
A1, UEN, OB, UEF, DEM

Attached to mainland
L, DB, A later after 2003



Spatial Patterns

Females preferred isolated sand bars (A, A1 and U (includes UEF, OB and UEN) significantly more than sites attached to mainland (L). Segregation of sexes only occurred during the breeding season. This pattern persists to the present. Segregation seen at other sites by Knudtson 1977, Stein 1989, Slater and Markowitz 1983.

	Breeding Location			
Sex	A	A1	L	U
Female	55	76	14	52
Male	20	9	21	14

$X^2 = 33.55$

$p < 0.0001$

Spatial Patterns

Individual seals, particularly females, displayed strong within-site fidelity during the breeding season and remained entirely within DE for the first 2 weeks after birth. Similar to other sites seen by Stein 1989, Thompson et al. 1994).

Photo Judy Bourke

Habitat change over time

Channel

Channel absent

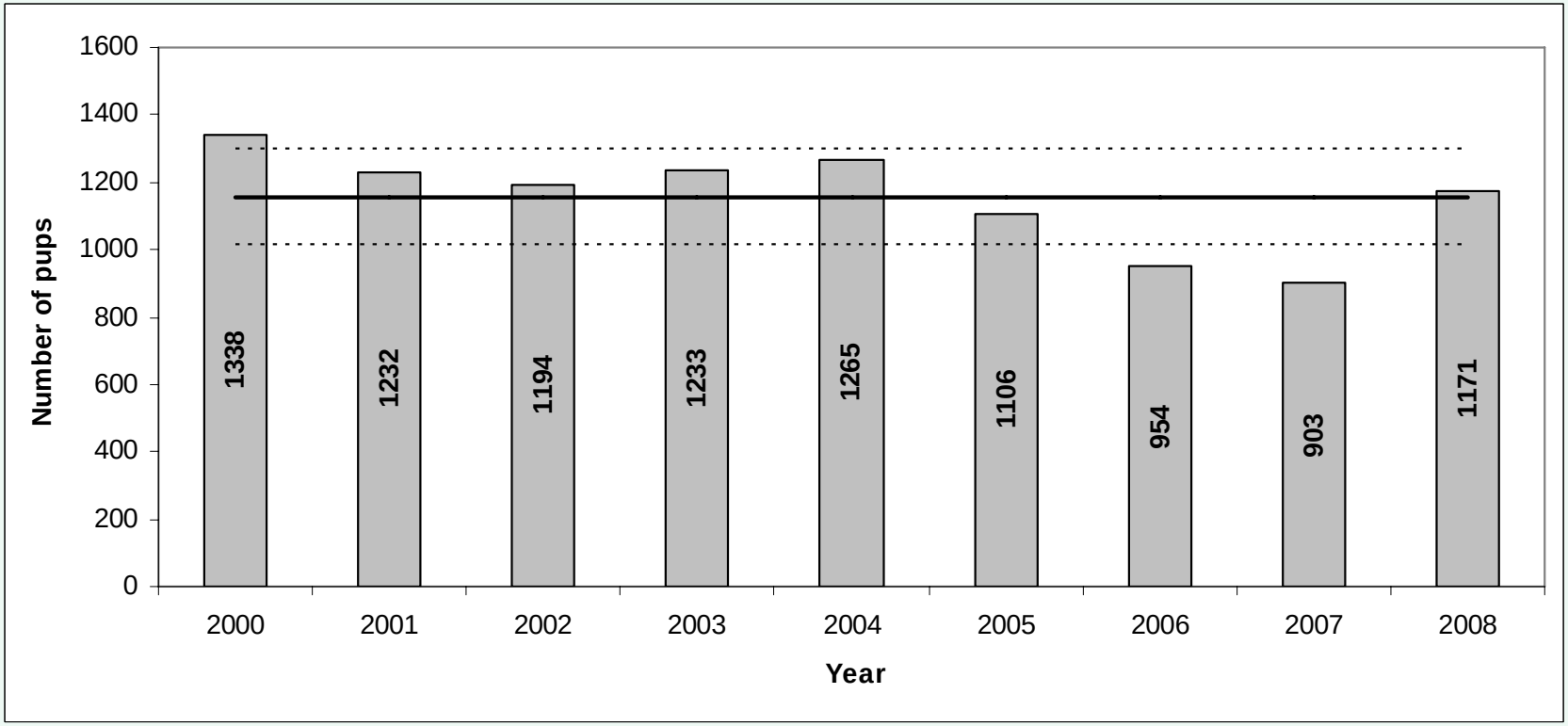
1986

2009

californiacoastline.org

Population Trend

Maximum harbor seal pup counts for 2000–2008 at Marin County locations. The solid line on the graph represents the mean of the maximum pup counts from 2000-08 (mean = 1,155.1) and dashed lines represent one standard deviation from the mean (SD = 143.9; from NPS annual report 2009).



Disturbance

Defined by MMPA

The term “ harassment” means any act of pursuit, torment, or annoyance which—

(i) has the potential to injure a marine mammal or marine mammal stock in the wild. Level A Harassment

(ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering. Level B Harassment

NMFS prohibits

The negligent or intentional operation of an aircraft or vessel, or the doing of any other negligent or intentional act which results in disturbing or molesting a marine mammal.

Disturbance potential effects on pinnipeds

Short-term – direct

•Disturb resting period by visual, sound or smell cues from human actions (Newby 1971, Johnson 1977, Allen et al. 1984, Suryan and Harvey 1999)

•Disrupt seals in water foraging or mating (NAS 2009)

•Pup separation and potential mortality (Johnson 1977, Kenyon 1972, Lawson&Renouf 1987, Jansen et al. 2003)

•Temporary displacement to subprime habitat (Ragen 1999, Stevens and Boness 2003)

Long-term – indirect

•Reduced usage/abandonment (Bartholomew 1949, Newby 1971, Kenyon 1972, Schulmeister 1981, Allen&King 1991, Richardson 1995)

•Shift to nocturnal haul out (Paulbitski 1975, Grigg et al. 2002)

•Lower pup production (Slater&Markowitz 1983, Allen&Huber 1984, Ragen 1999)

•Reduced fitness from displacement from foraging areas, chronic stress, reduced nursing or resting of pups

•Permanent shift to subprime habitat leading to changes in demography and reduced population (Gerrodette and Gilmartin 1990)

Seal responses to disturbance on land

- Head alert
- Flush to water
- Enter water

Pinniped Response to Disturbance

Head alerts – vigilance time in search of a predator

- Varies with sex, age, location (Sullivan 1979)
- Females with pups scan more often than other seals (Suryan & Harvey1999)
- Tomales Bay seals were disturbed more often and alerted significantly more times than other sites in Marin (Allen and Huber 1984)

Distances triggering response on land

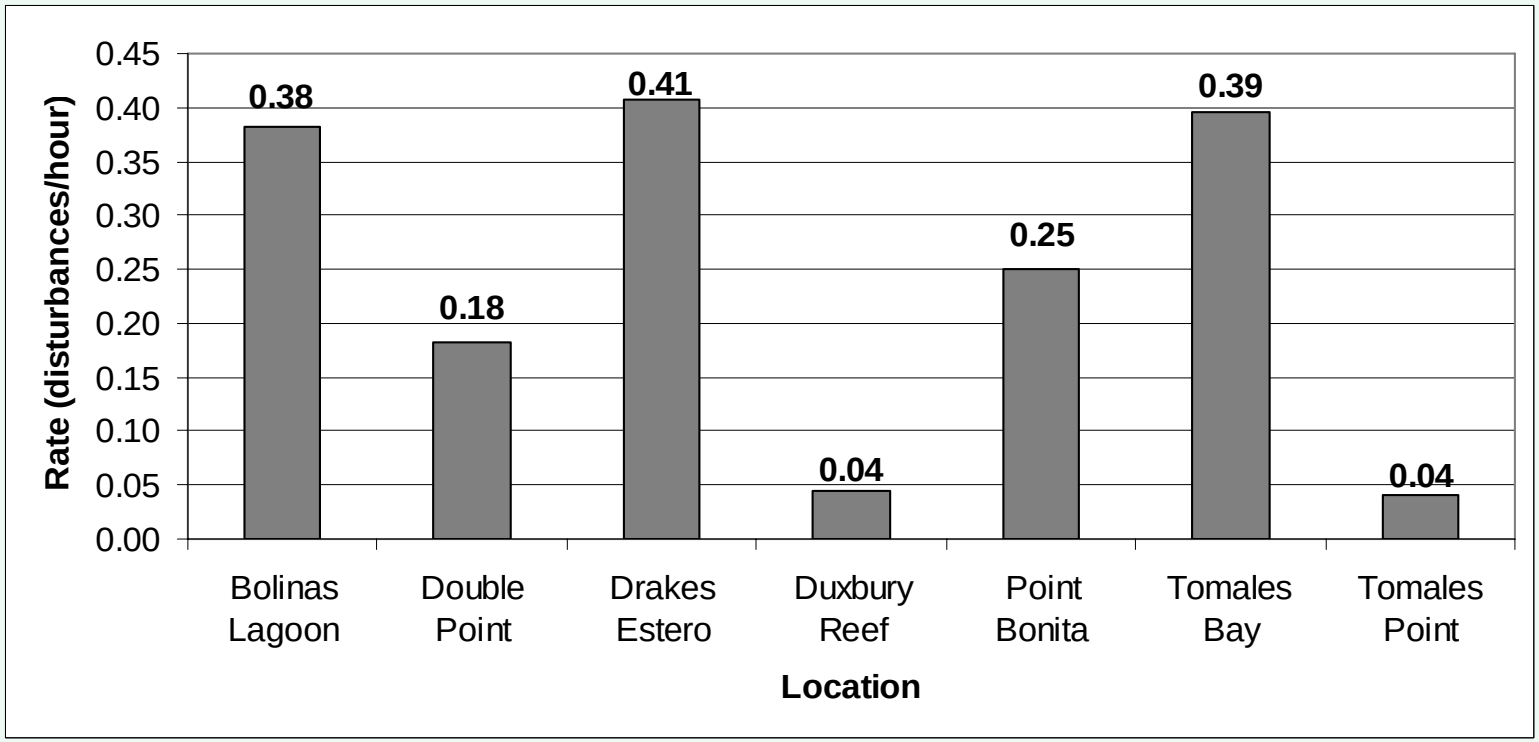
- Varies with species and population, and source
- NMFS guidelines = 300 ft (90 m)
- 50-600 ft (15-183 m) SF Bay (Alcorn and Fancher 1980)
- 80-500 m for small boats (Johnson and Acevedo-Gutierrez 2007)
- Within 200 m 75% of seals flushed (Jansen et al. 2003)
- 28-260 m seals flushed (Suryan and Harvey 1999)

Recovery time

- Varies with species and location
- @ 28 min +/-21 for seals to rehaul in Bolinas (Allen et al. 1984)
- Counts typically do not return to pre-disturbance levels within the same tidal cycle – (Suryan and Harvey 1999)

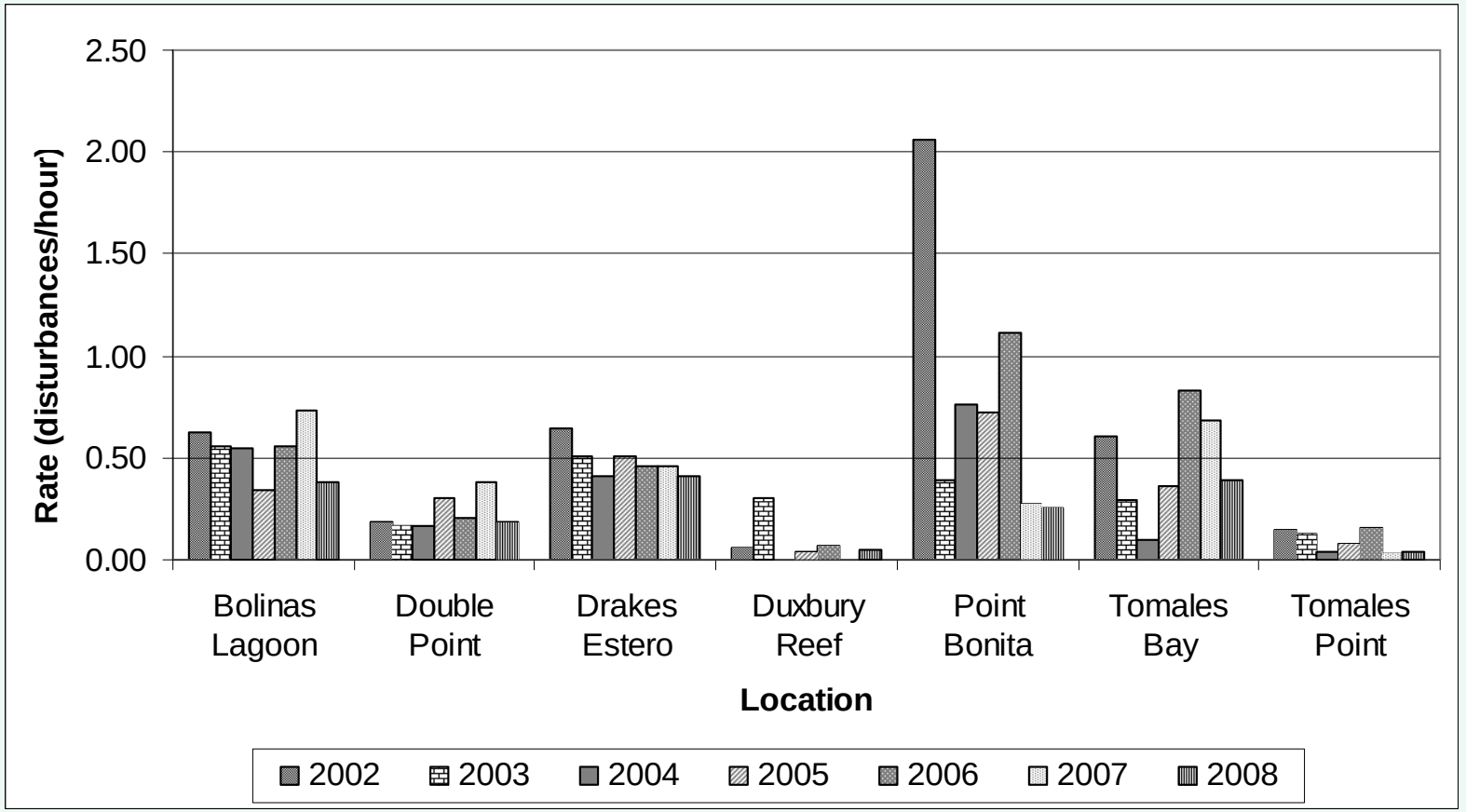
Disturbance Rate

Rates of disturbances per hour at Marin County locations from March through July 2008. Only actual disturbances (head alert, flush, flush water) were used and survey time was based on observation time for all complete surveys (with or without disturbances). (From NPS Annual Report 2008).



Disturbance Rate

Rates of disturbances per hour at Marin County locations 2002–2008. Only actual disturbances (head alert, flush, flush water) were used, and survey time was based on observation time for all complete surveys (with or without disturbances). (From NPS Annual Report 2008).



Predators disturb seals

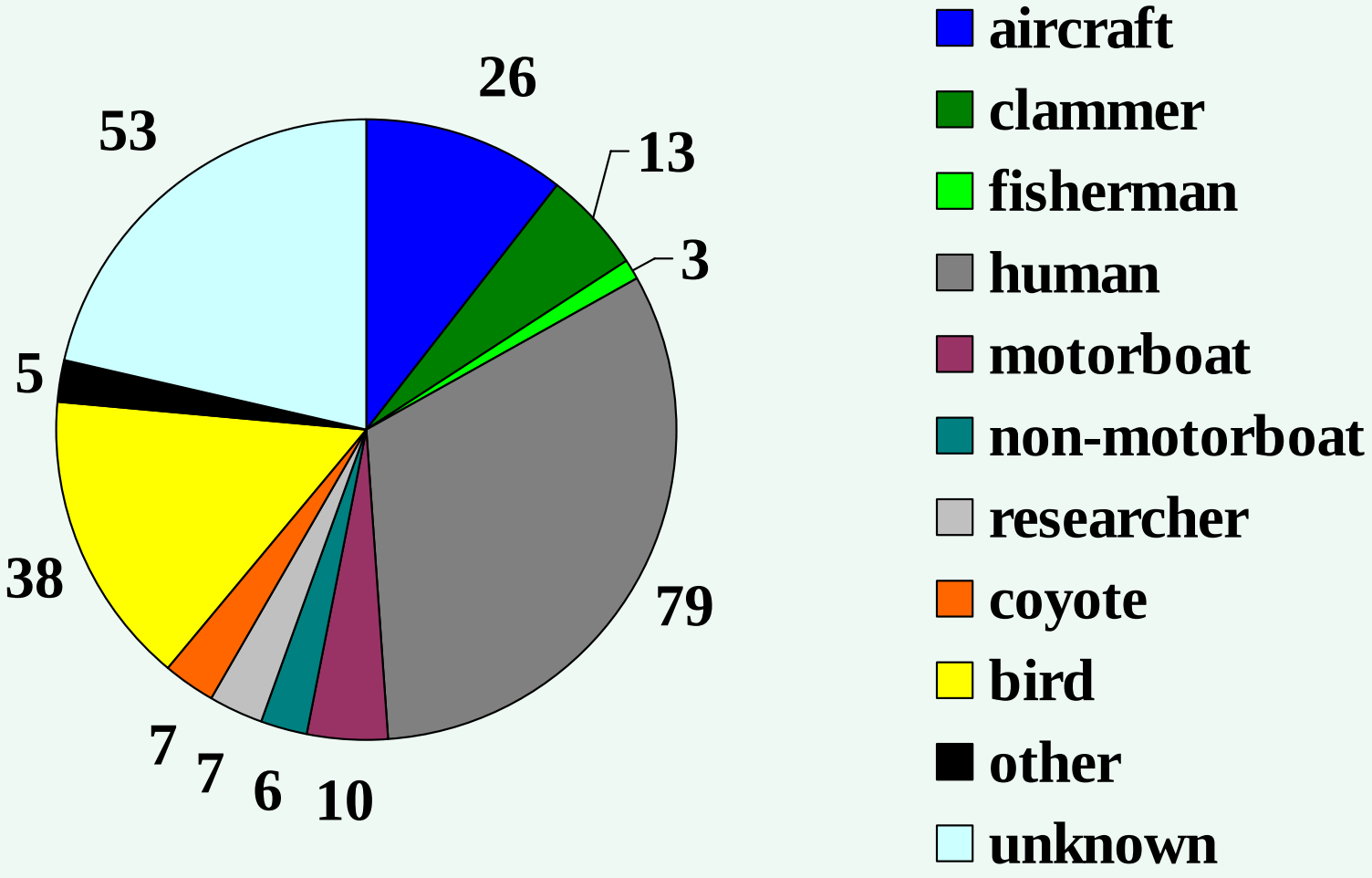
Photos NPS

Human activities at Point Reyes disturb seals

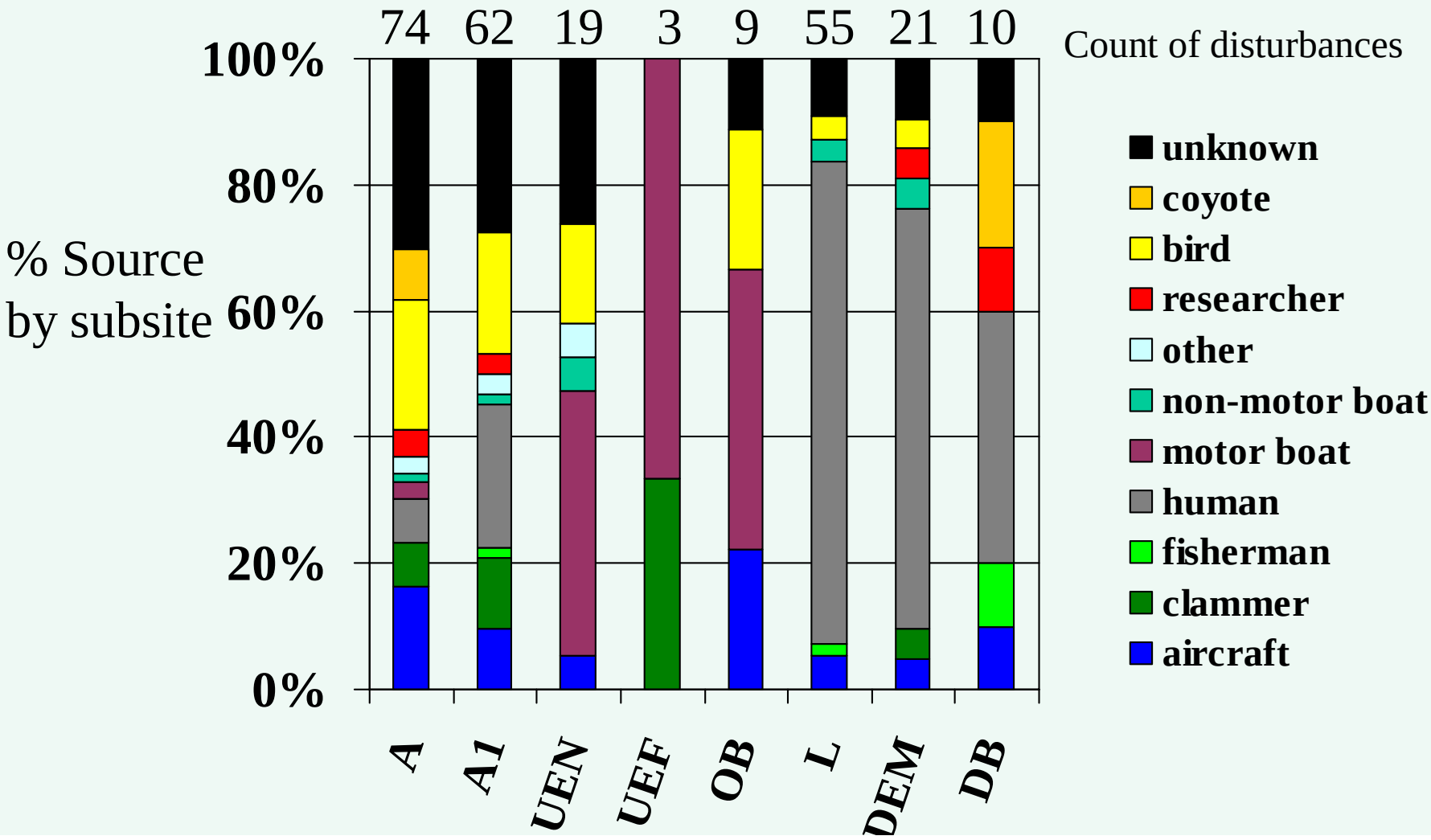
Mariculture activities that disturb seals in DE

- Bags/equipment on or adjacent to haul outs
- Boat traffic
- People adjacent to haul outs tending equipment for extended periods

Number of disturbances by source at Drakes Estero
Breeding seasons 2000-2009



Sources for disturbance by subsite for breeding seasons 2000-2009

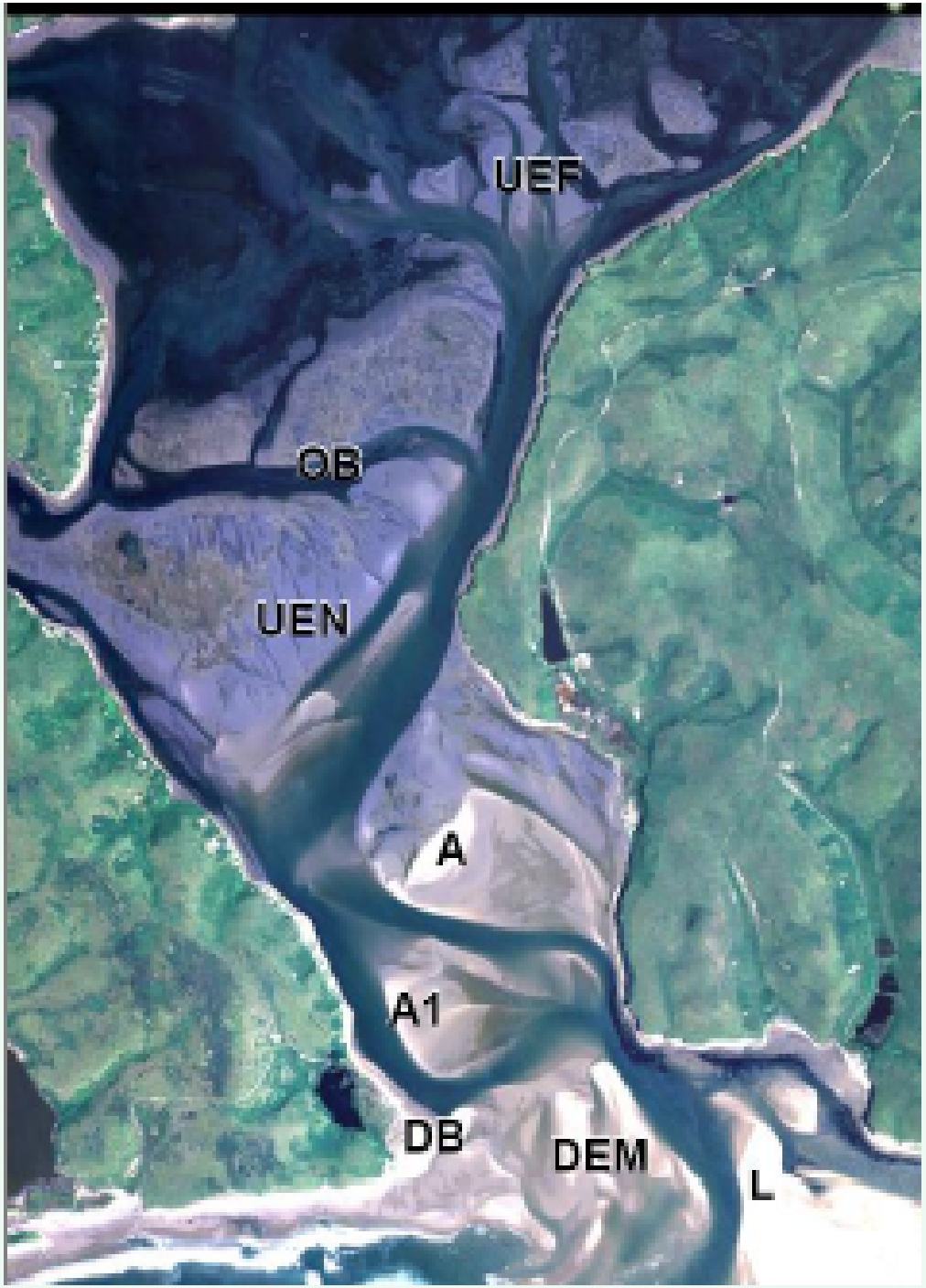


Summary

- DE is a significant colony in the state, largest in Marin County
- More seals are present during breeding season
- Seals haul out more hours per day during the breeding
- Peak pupping occurs the last week of April, first week of May
- Females prefer isolated sandbars for breeding
- Disturbance displaces seals
- More disturbances occur at Limantour – short duration
- Disturbances from mariculture at isolated sandbars – longer duration

Acknowledgments

Farallones Marine Sanctuary Association
NOAA Fisheries
Gulf of Farallones National Marine Sanctuary
San Francisco State University students
Stewards of Coast and Redwoods
The Marine Mammal Center
Volunteers of Point Reyes Pinniped Monitoring


UEF
QB
UEN
A
A1
DB
DEM
L