



Monitoring Harbor seals at Point Reyes and Golden Gate 2016



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Photo Carlos Porrata

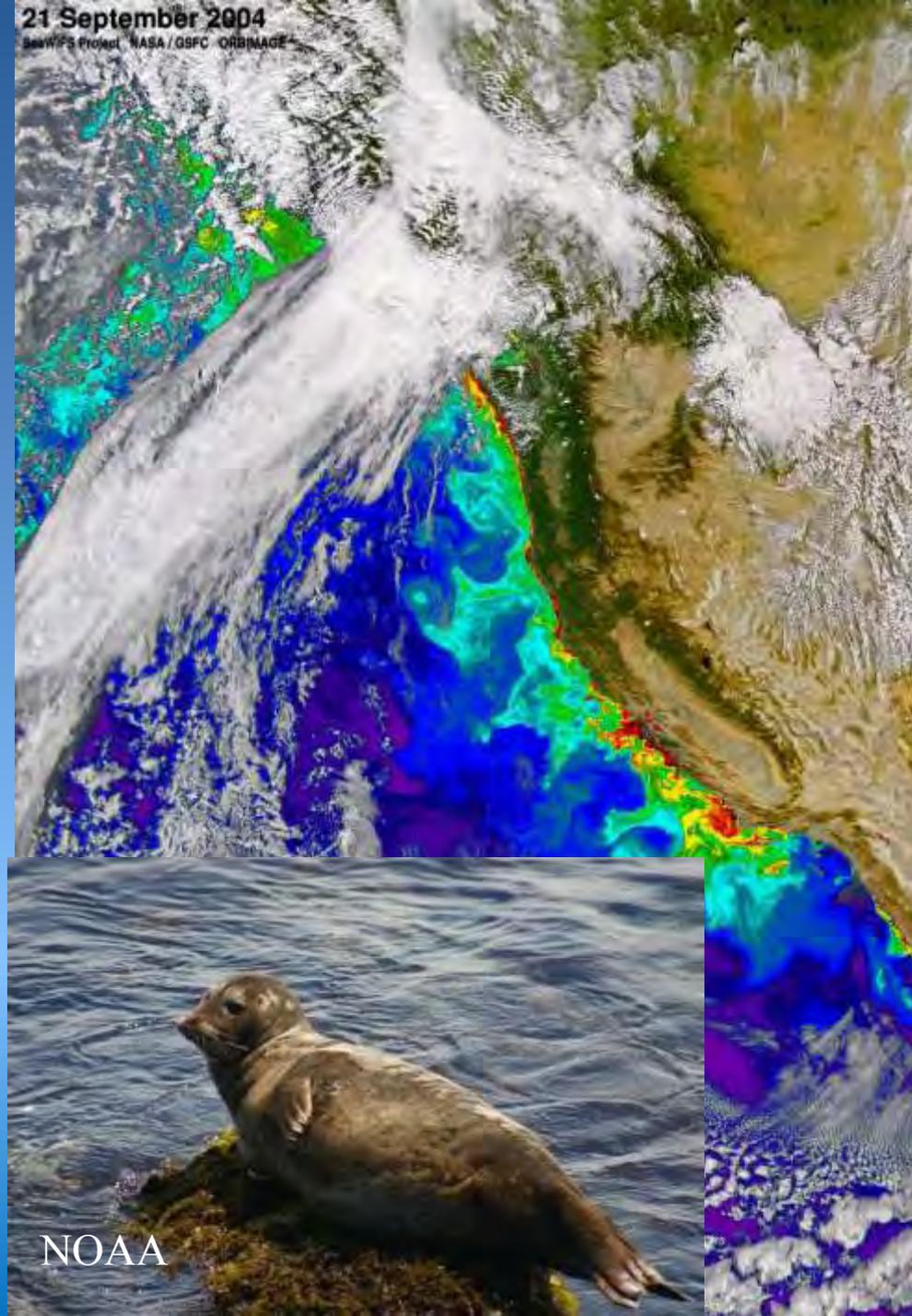
**Marine mammals are
sentinels of the sea (Moore
2008)**

Indicators of the condition of marine ecosystems

Harbor seals were selected as indicators of marine condition and potential effects of climate change at Point Reyes NS and Golden Gate NRA

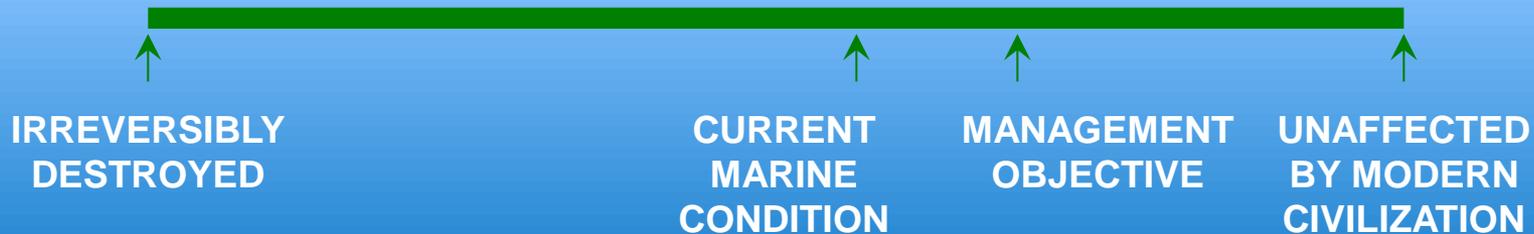
Pinniped Monitoring Protocol
available at

http://science.nature.nps.gov/im/units/sfan/vital_signs/pinnipeds/pinnipeds.cfm

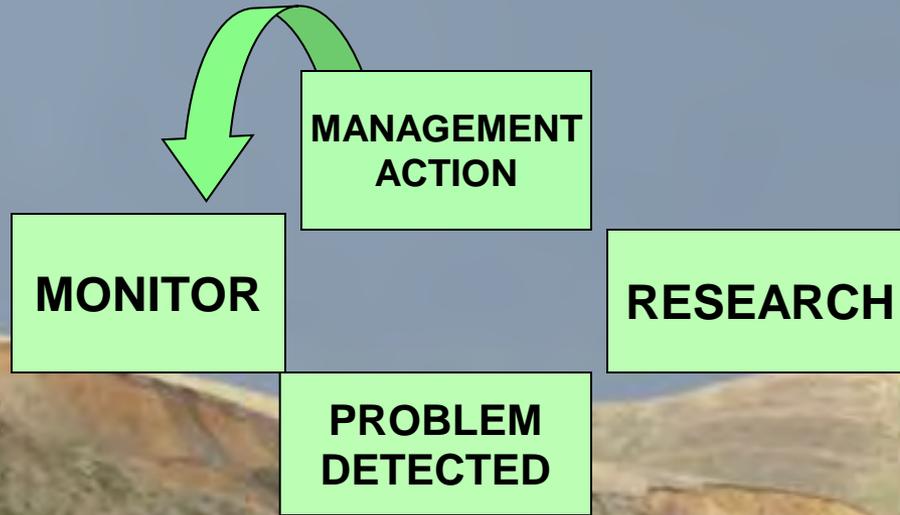




Indicator of Ecosystem Condition



Adaptive management



Management actions =

- More research
- Protect habitat/species
- Restoration
- Education
- Continue monitoring

Monitoring Objectives



- ❖ Determine population trends
- ❖ Determine natural range of variation
- ❖ Provide early detection of change
- ❖ Identify potential causes of abnormal change

What do we monitor?

Population trends

Distribution

Habitat

Health

Disturbance



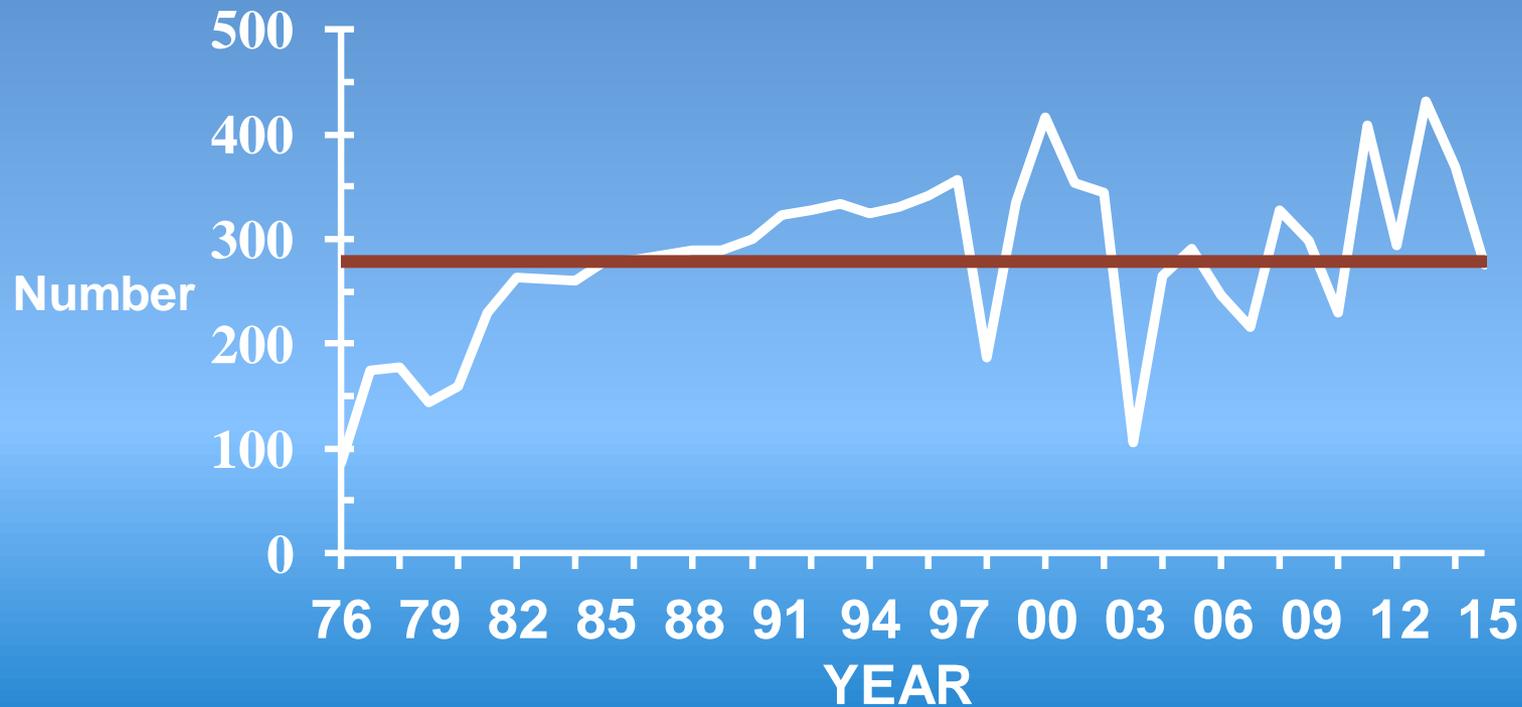
Population trend measures



- ❖ Total adult/immature count
- ❖ Total pup count
- ❖ Mortality



Pups born over 40 yrs at one site



Colonies at Point Reyes

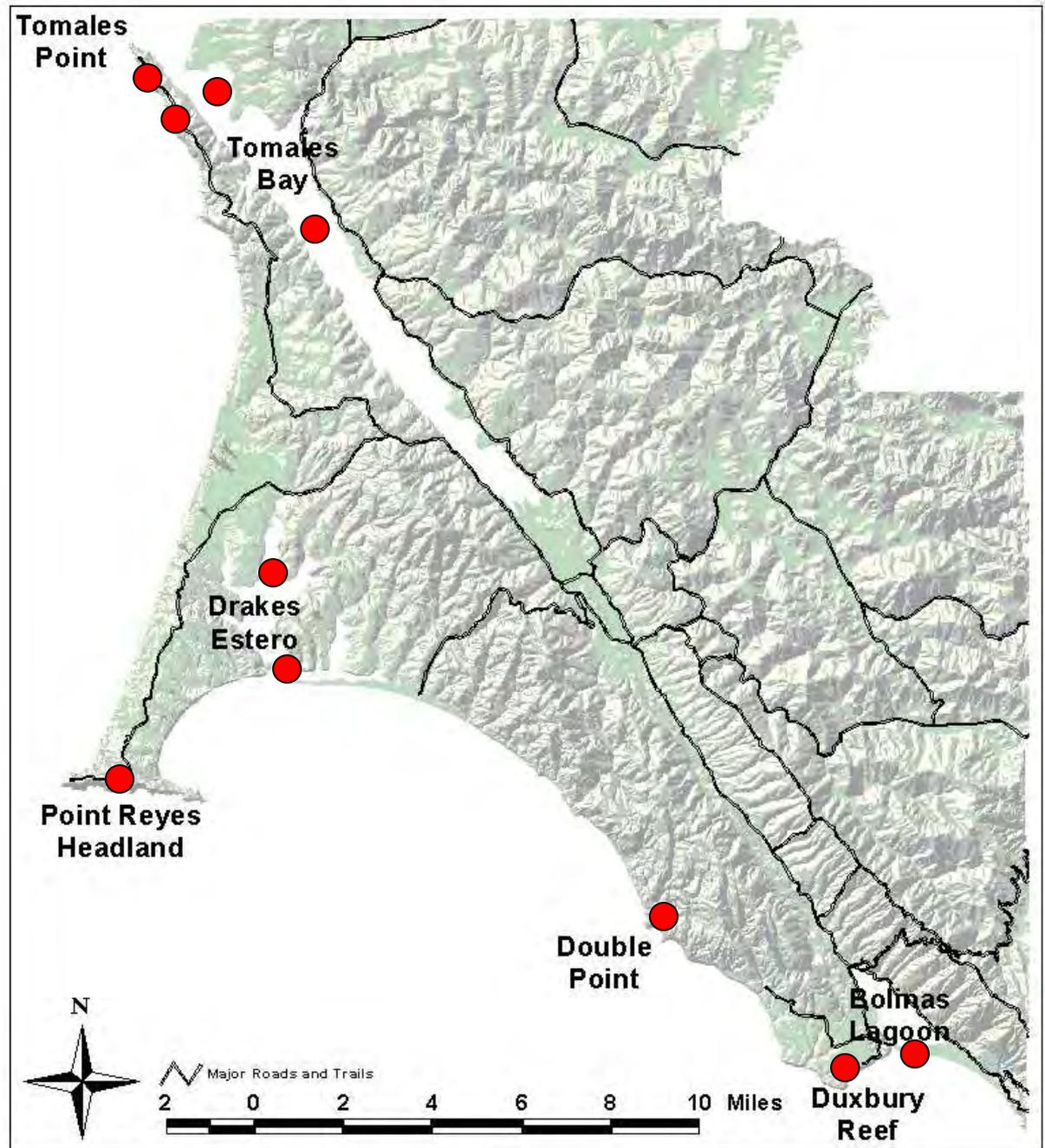
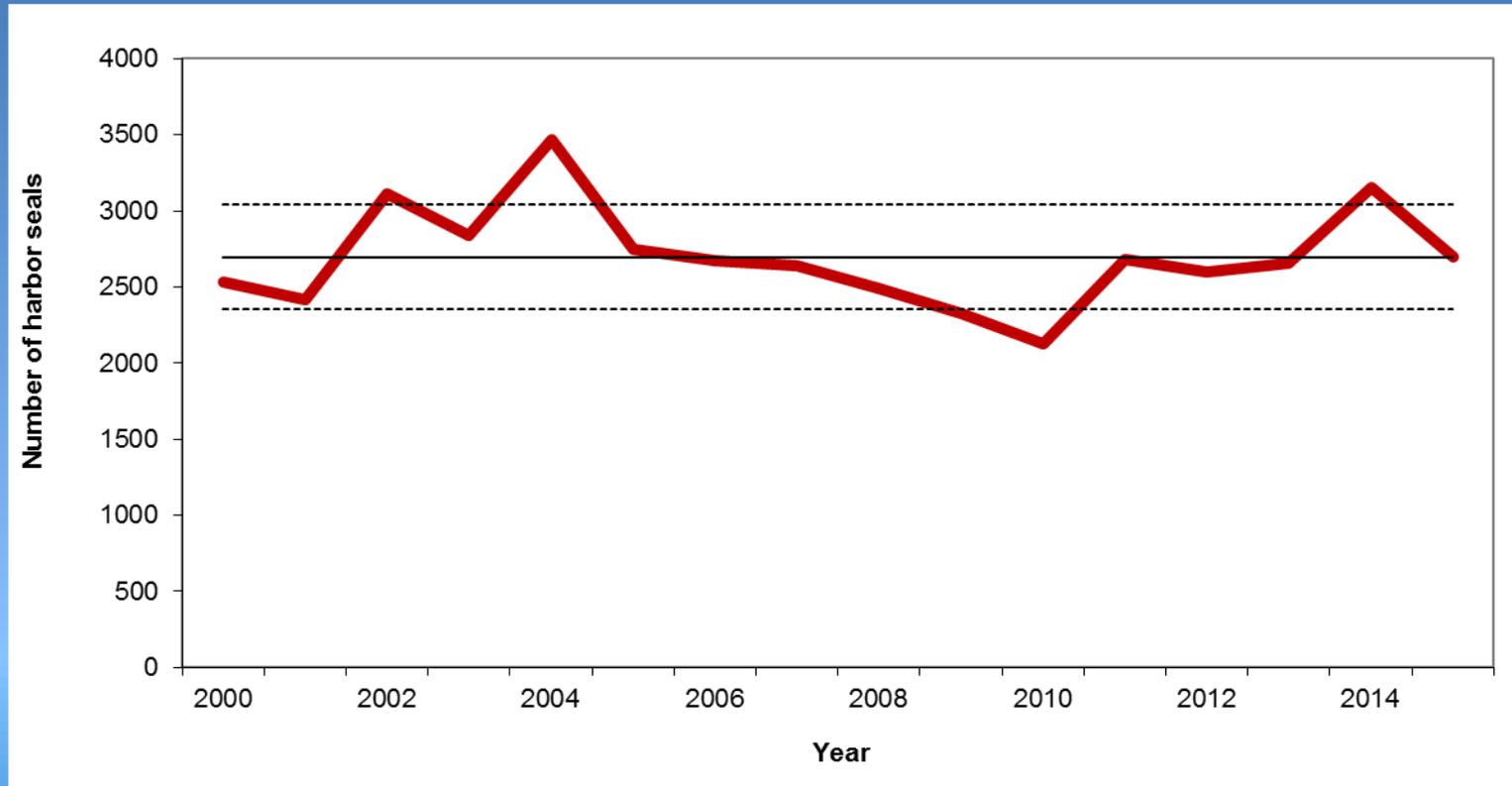


Figure 1: Map of harbor seal haul out sites at Point Reyes.

Population trends combining sites Point Reyes

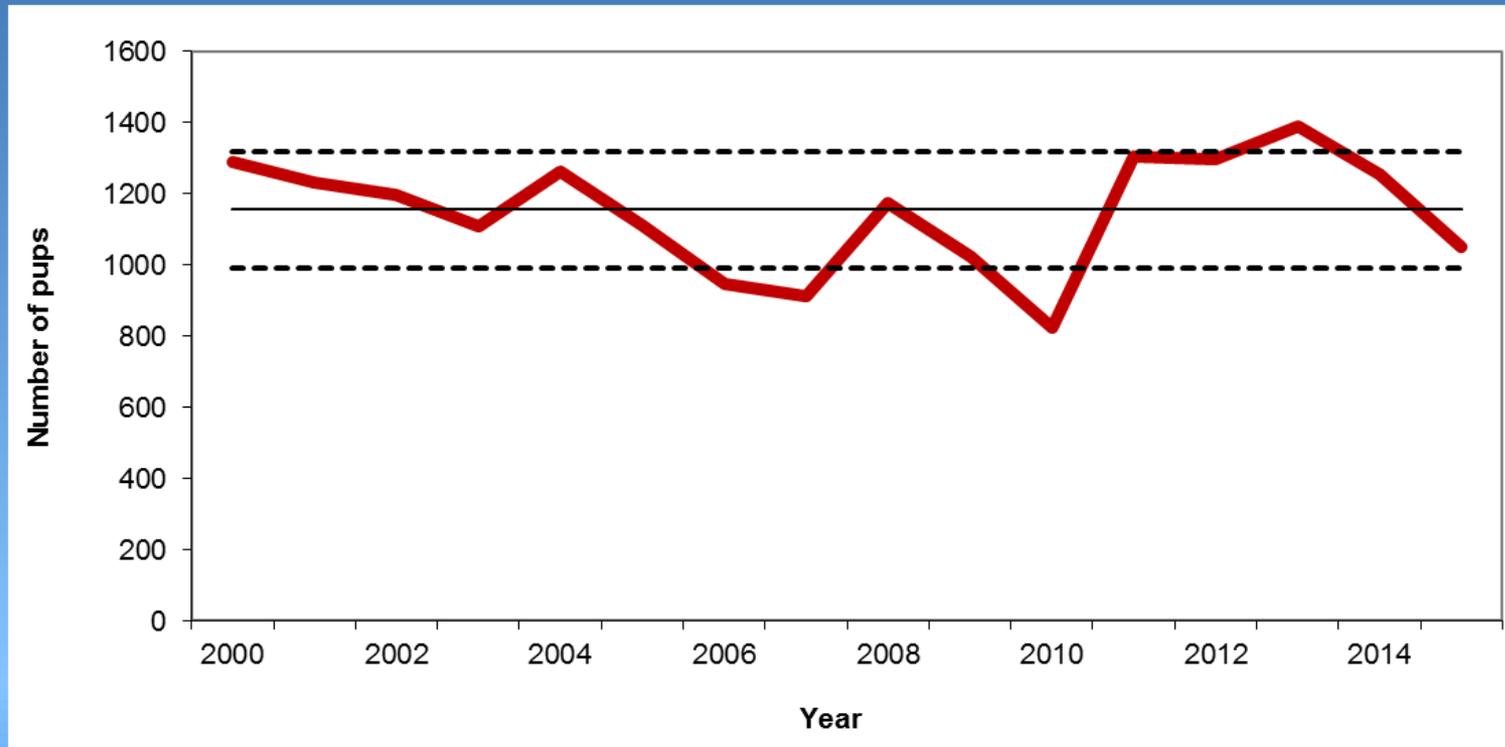
Adults - 2000 -2015



Maximum counts of harbor seal adults during the breeding season (March-May) for 2000-2015 at Marin County locations

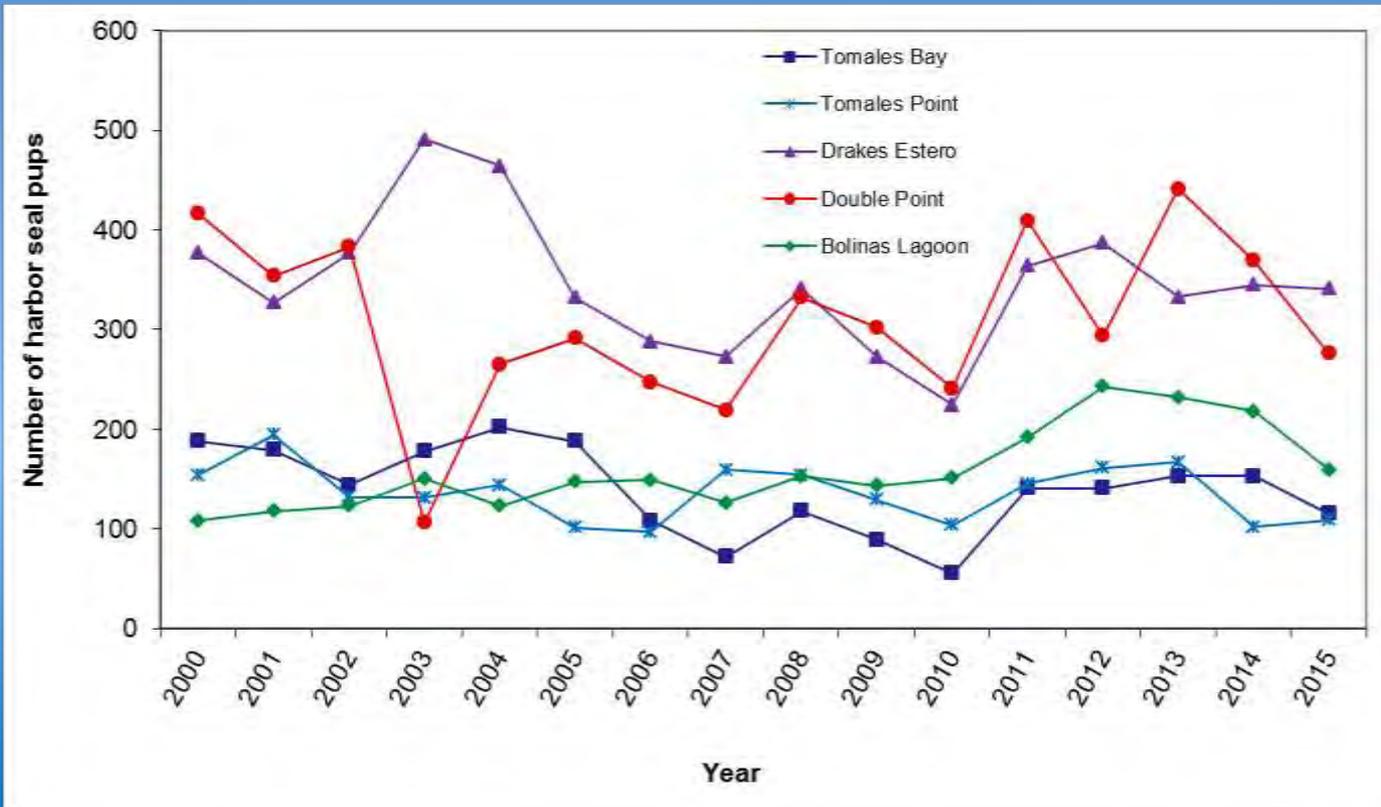
Population trends combining sites Point Reyes

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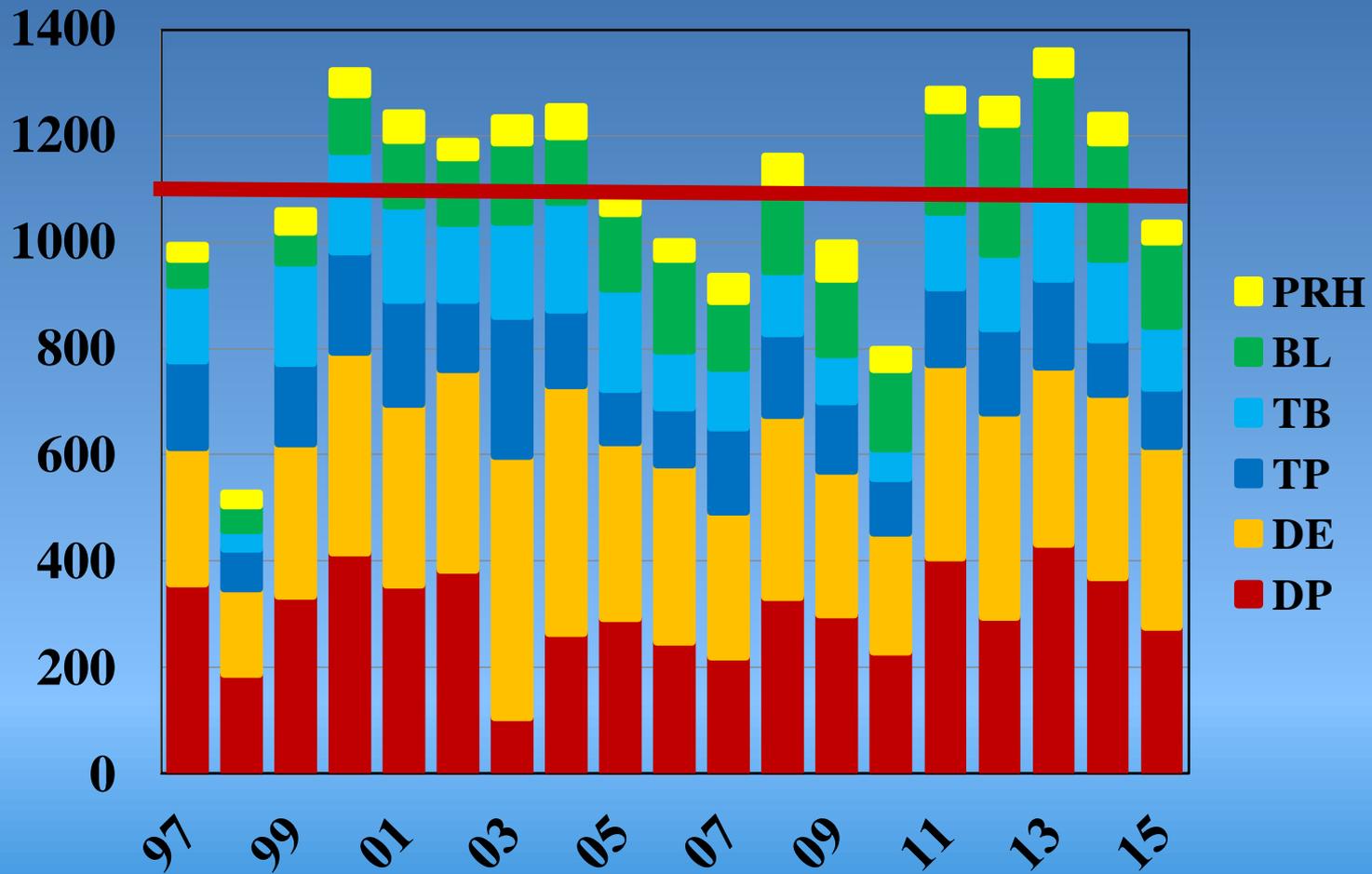


Maximum counts of harbor seal pups during the breeding season (March-May) for 2000-2015 at Marin County locations

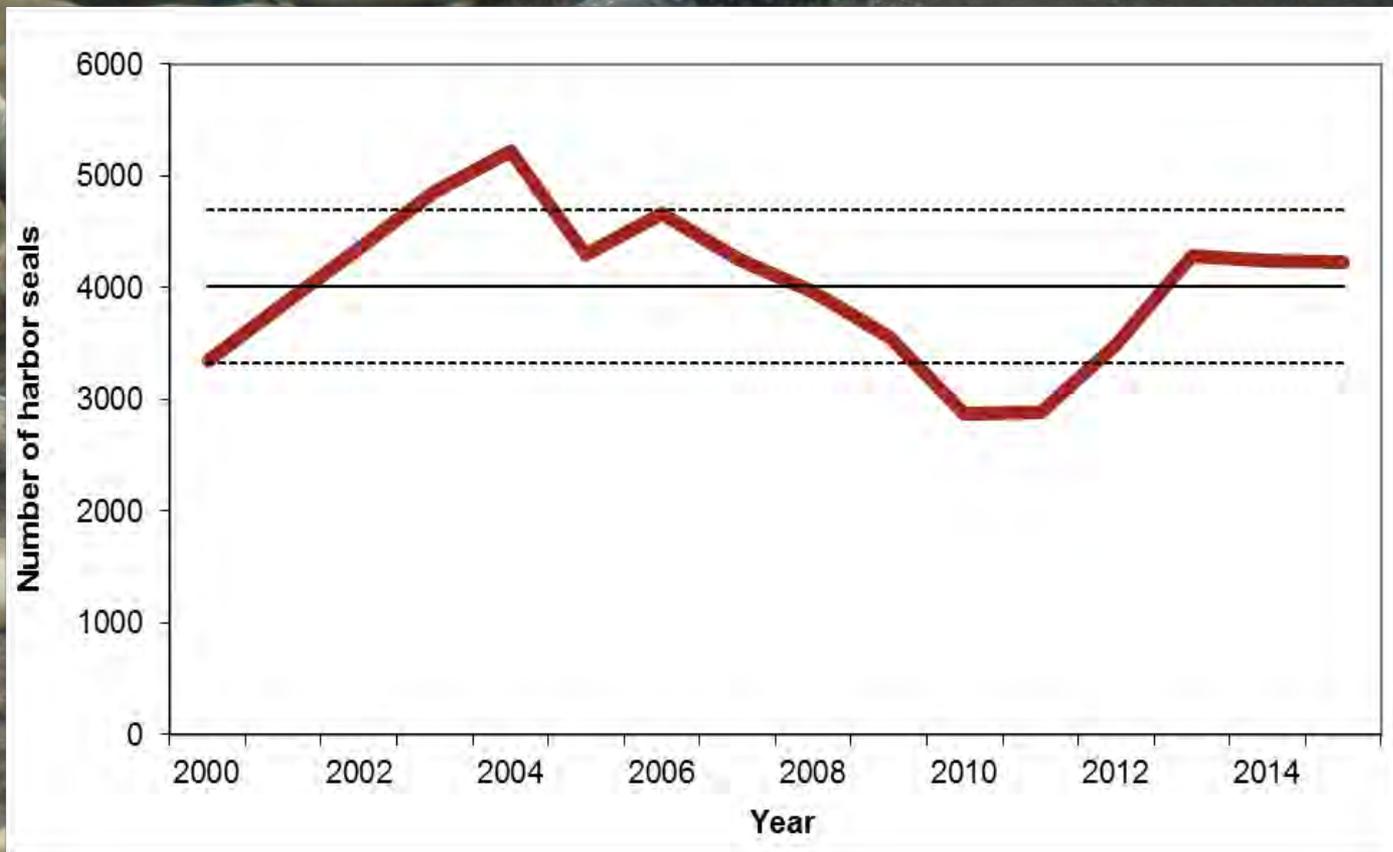
Maximum pup count by colony



Maximum pup count by colony



All sites maximum molt season



Tomales Bay



- Observation Point
- SI Seal Island
- CI Clam Island
- HI Hog Island

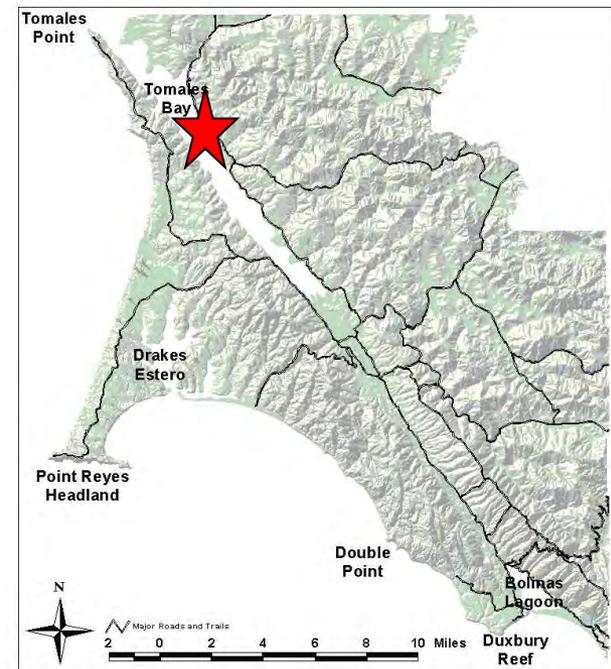


Figure 1: Map of harbor seal haul out sites at Point Reyes.

Tomales Bay – 3 sites



Seal Island and Clam Island
sand bars

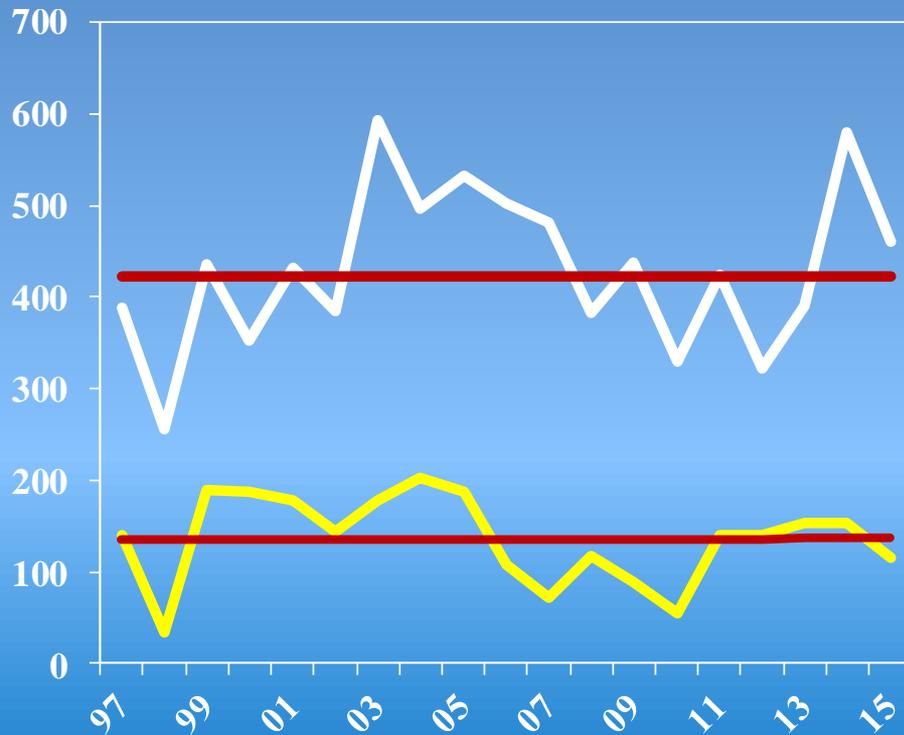


Hog Island

Tomales Bay colony



Survey data 1997 - 2015



Adults

Maximum count
2015

Pups

Adults = 460
Pups = 115

Tomales Point



● Observation Site

— Observation Area

TRB Two Rocks Beach

RB Rope Beach



Figure 1. Map of Tomales Point and local waters at Point Reyes.

Tomales Point – 3 subsites



Bird Rock

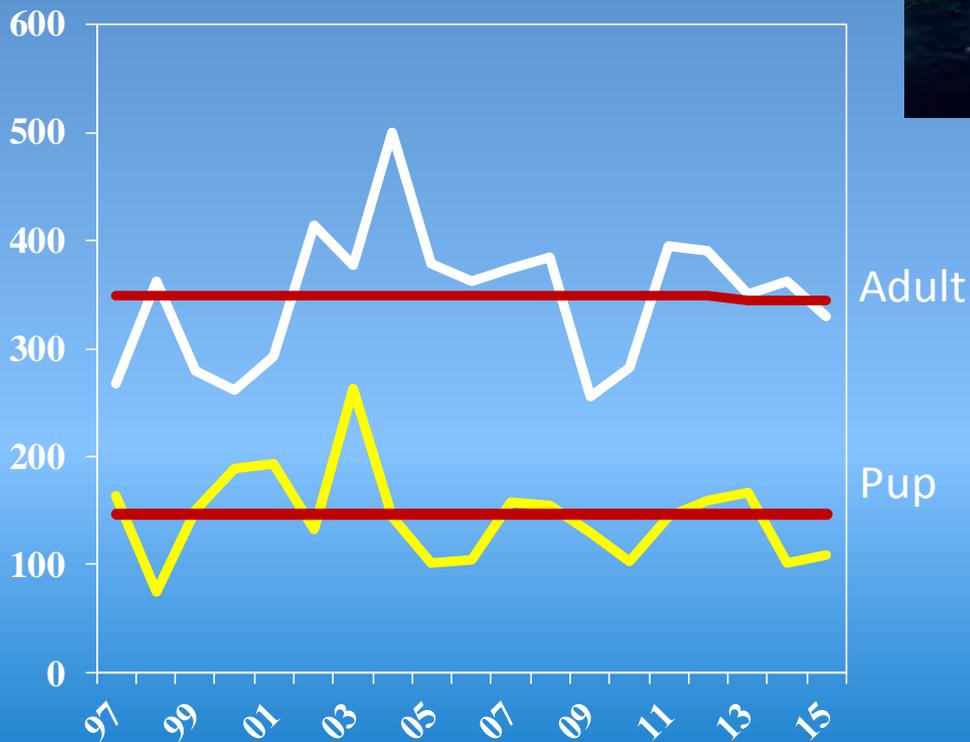


2 intertidal sites on
mainland

Tomales Point colony



Survey data
1997 - 2015



Maximum count
2015

Adults = 330

Pups = 109

Point Reyes Headland – 4 sites

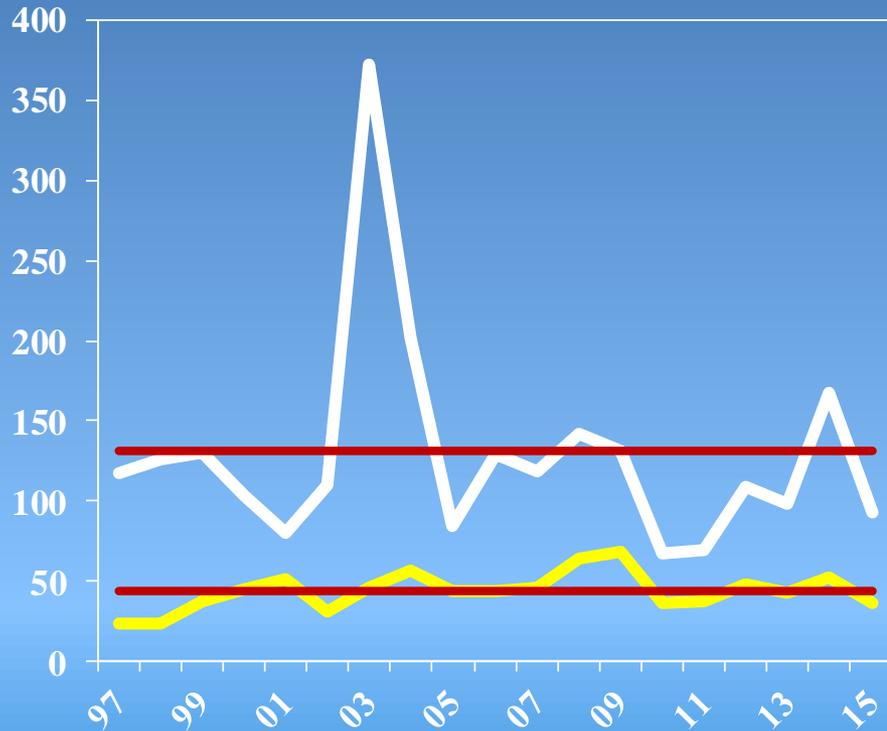




Point Reyes Headland



Point Reyes colony



Adult

Maximum count

Pup

2015

Adults = 93

Pups = 36

Drakes Estero Seal Haulout Subsites

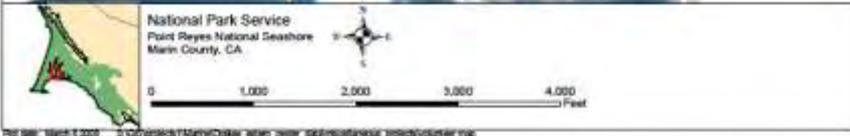
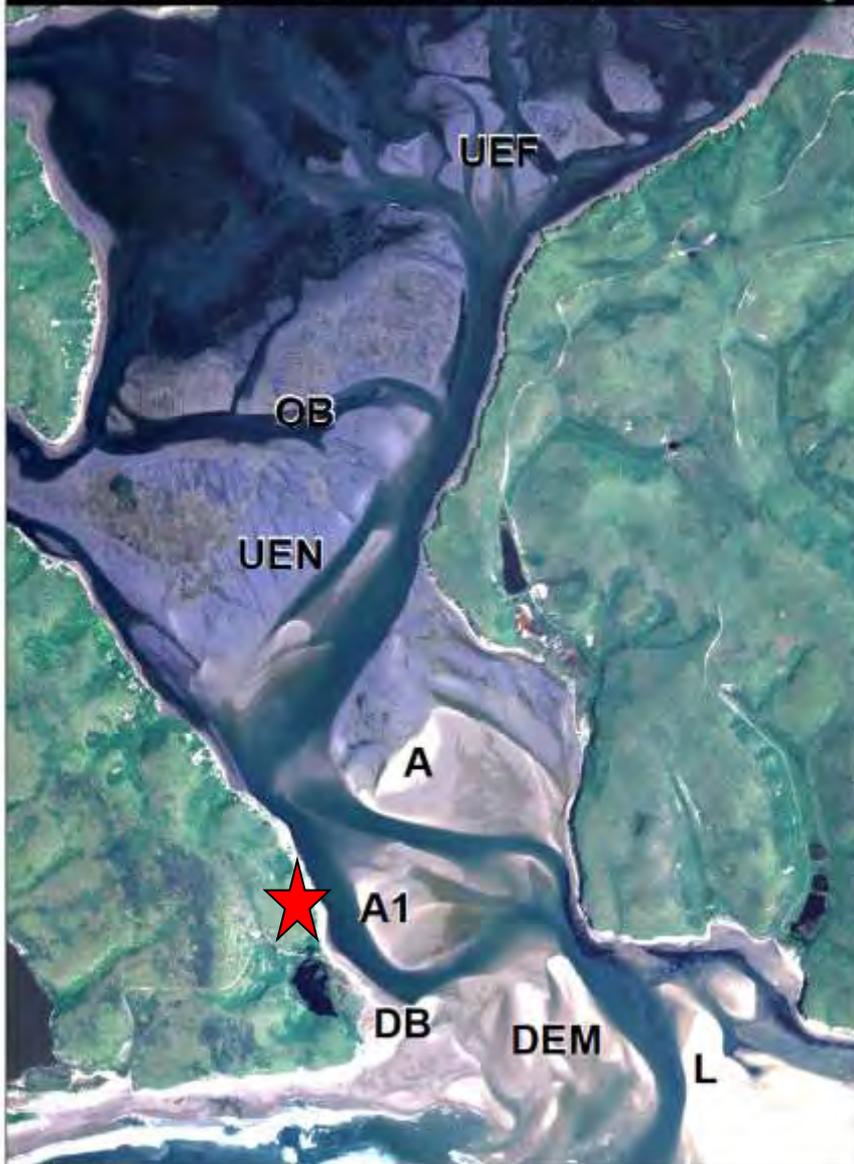


Figure 1. Map of northern and central coast sites at Point Reyes.

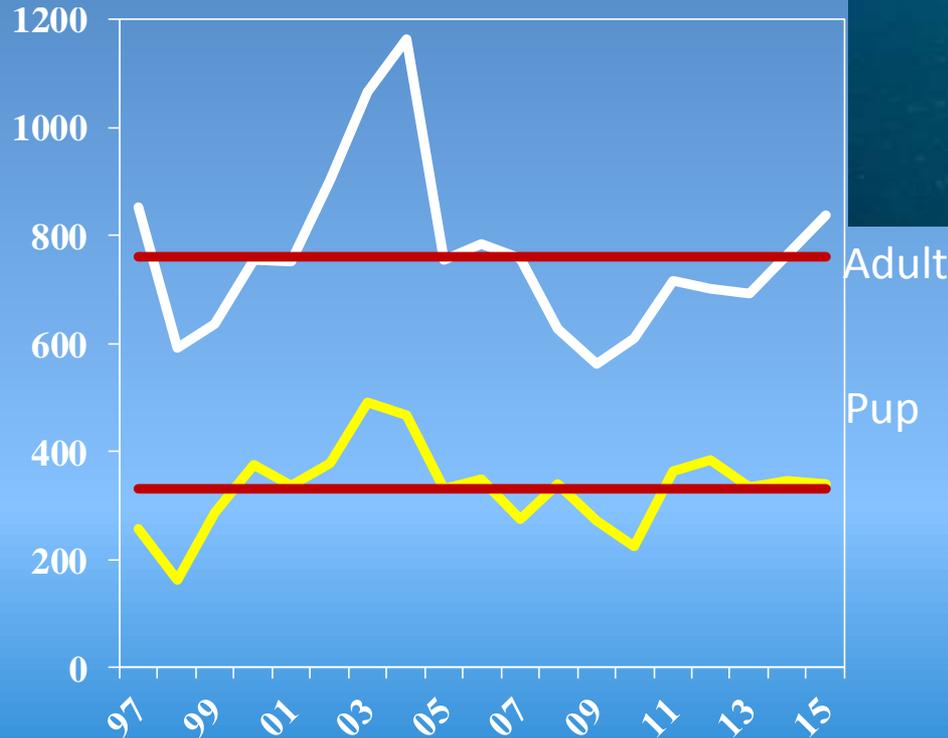
Drakes Estero

8 sites





Drakes Estero colony



Maximum count
2015

Adults = 839

Pups = 341

DOUBLE POINT

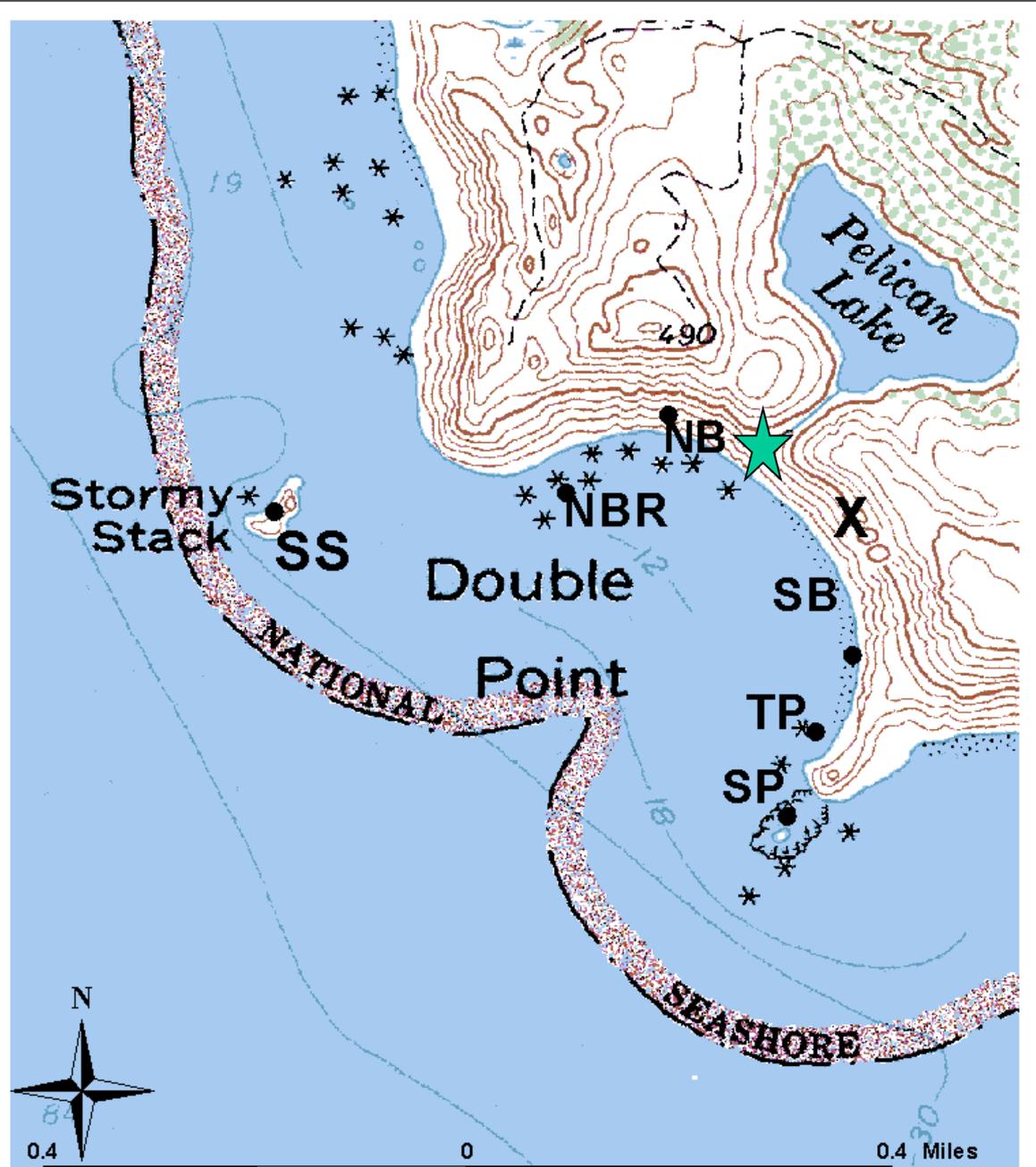


Figure 1. Map of bathymetry and land use near Point Reyes.

Double Point

6 sites



South Beach

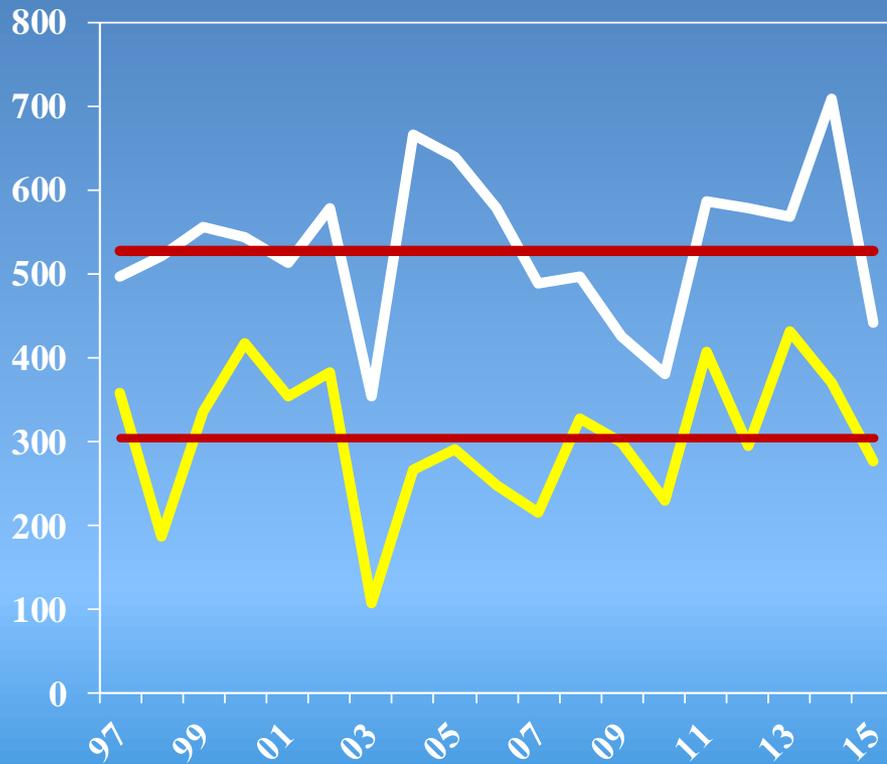


Entire cove



North Beach

Double Point colony



Adult

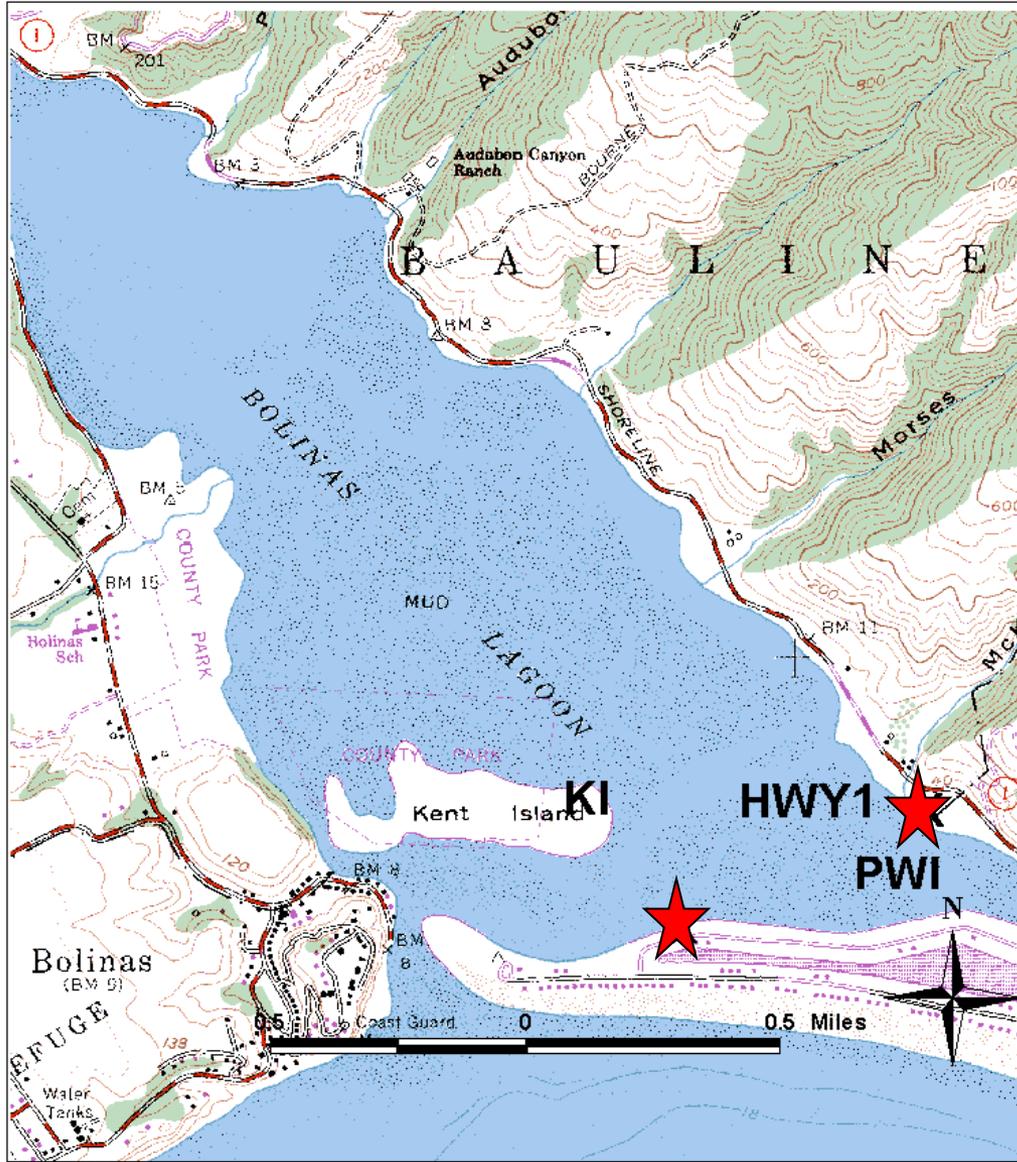
Pup

Maximum count
2015

Adults = 442

Pups = 276

BOLINAS LAGOON



Map of Bolinas Lagoon haul out sites. Sub-sites include: KI = Kent Island, HWY1 = Highway 1 sand bars, PWI = Pickle Weed Island. X = Observation Points



Figure 1. Map of Bolinas Lagoon and sites at Point Reyes.

Bolinas Lagoon

3 sites



Kent Island sand bar

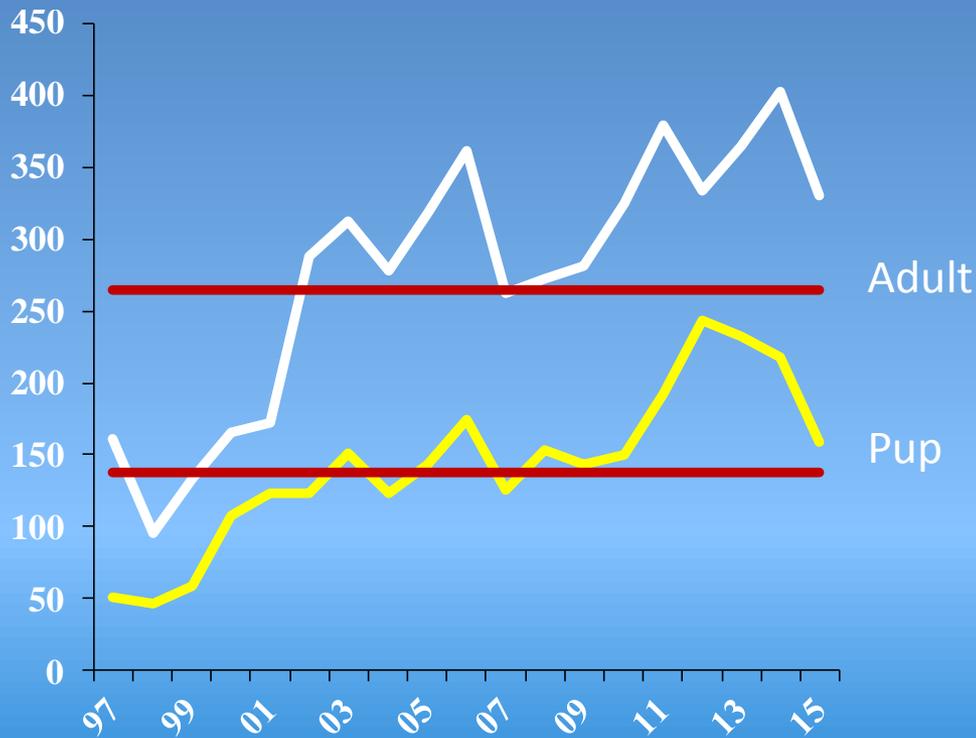


Pickleweed Island



Highway One sand bar

Bolinas Lagoon colony



3 subsites
Maximum count
2015
Adults = 330
Pups = 159

POINT BONITA

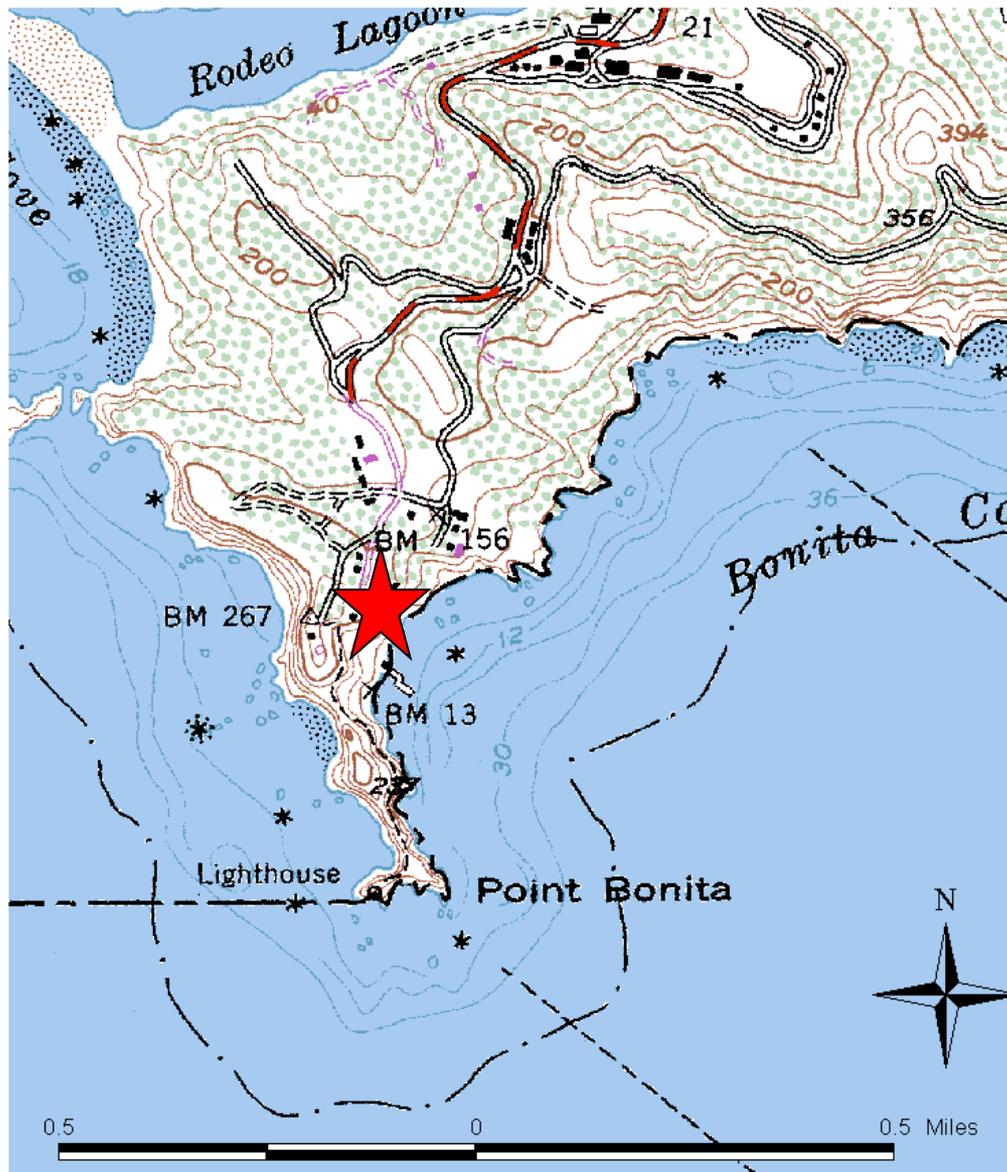
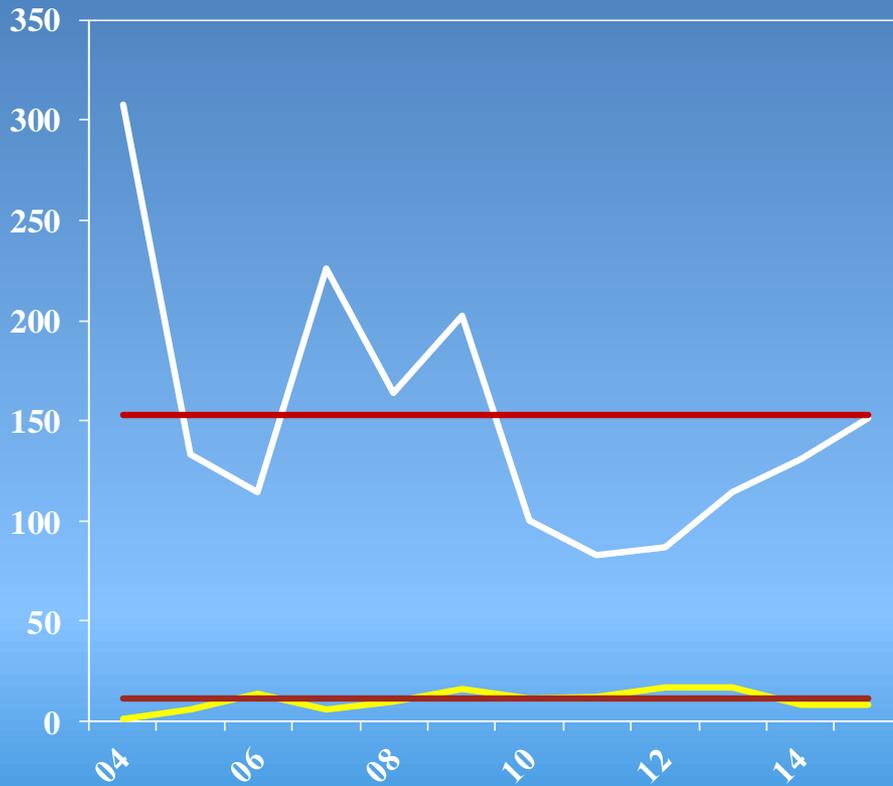


Figure _ Map of Point Bonita haul out sites.

Point Bonita many rocks



Point Bonita colony



Adult

Maximum count
2015

Adults = 151

Pups = 8

Pup

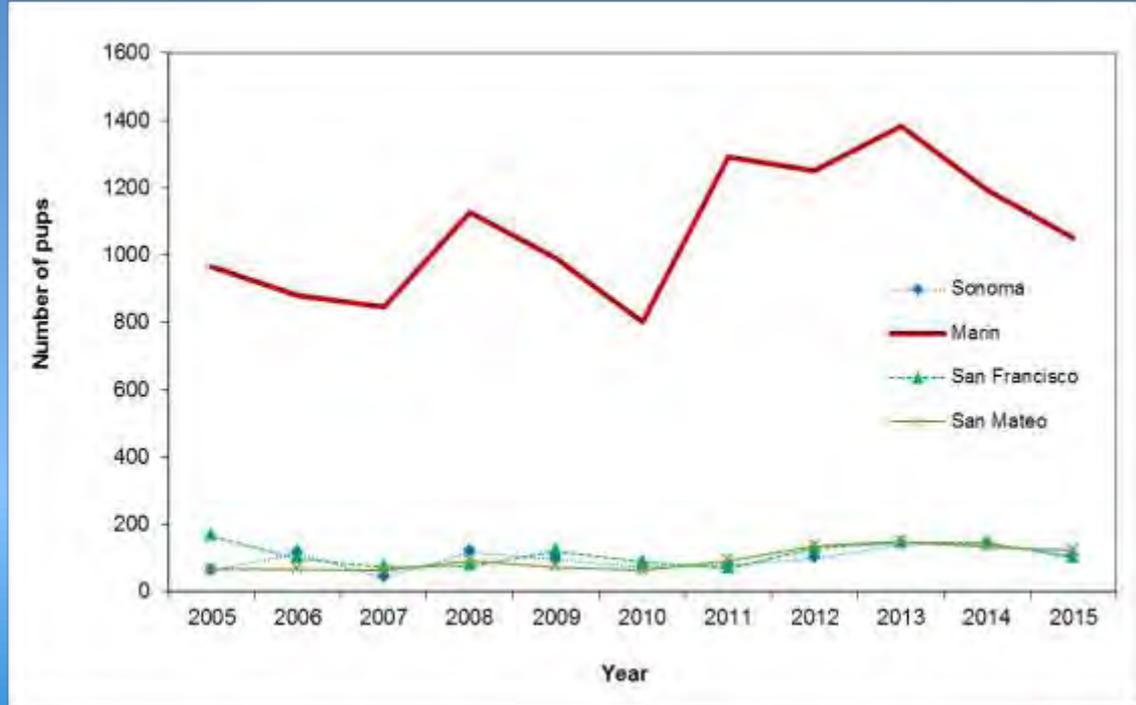
Colonies in Region



Regional surveys – 2005 -2015

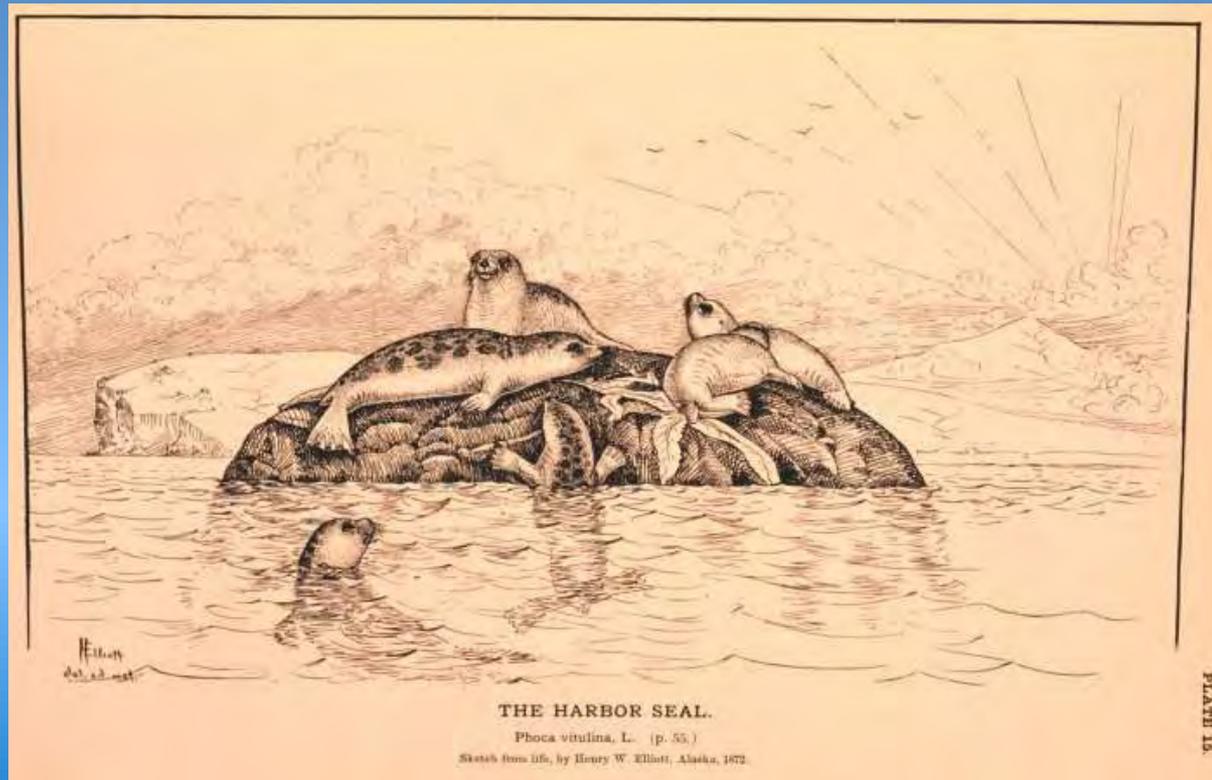


Marin - 62% adults; 76% pups
Population estimate = 8,760



Habitat monitoring

- ❖ Haul out sites
- ❖ El Niño and weather



Habitat changes



Drakes Estero

2002

Channel

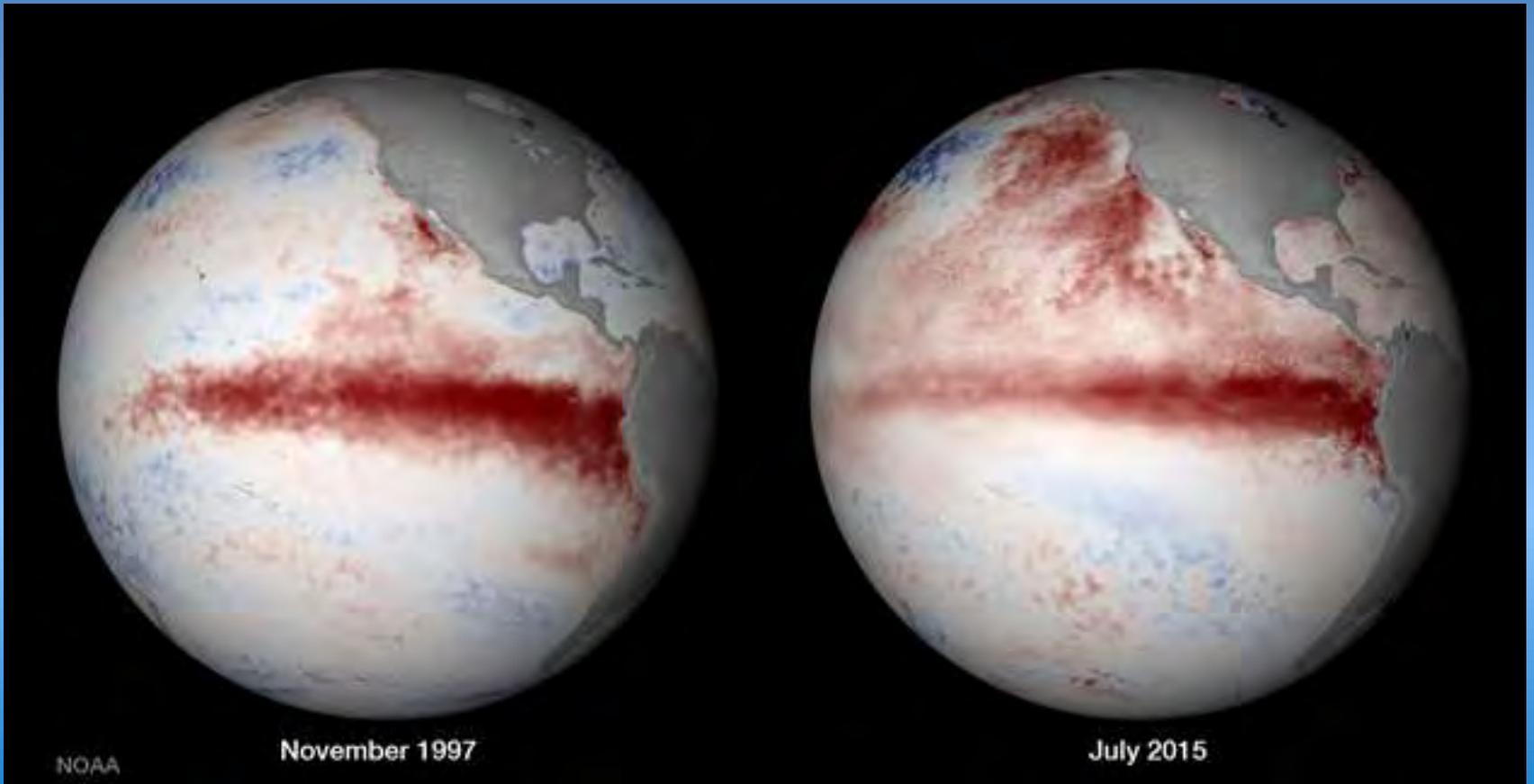


2009

No Channel



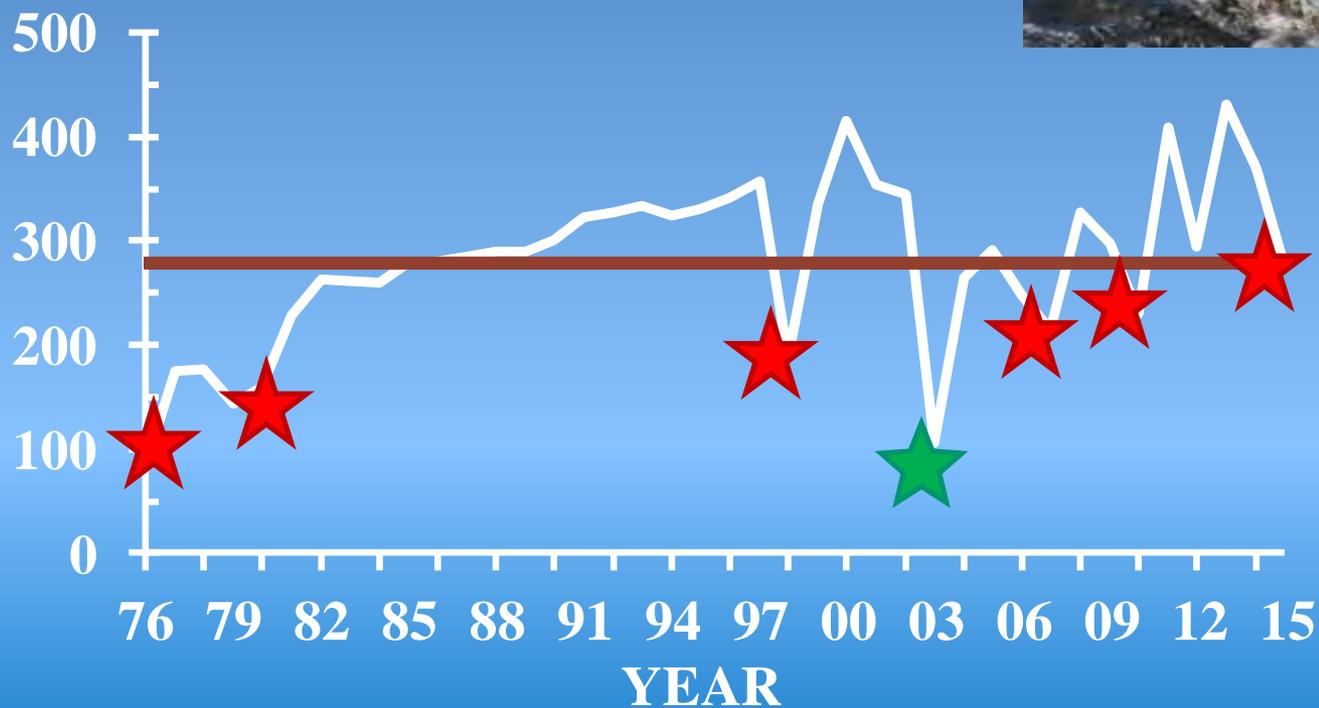
El Niño Events and the “Blob”



Weather-climate effects



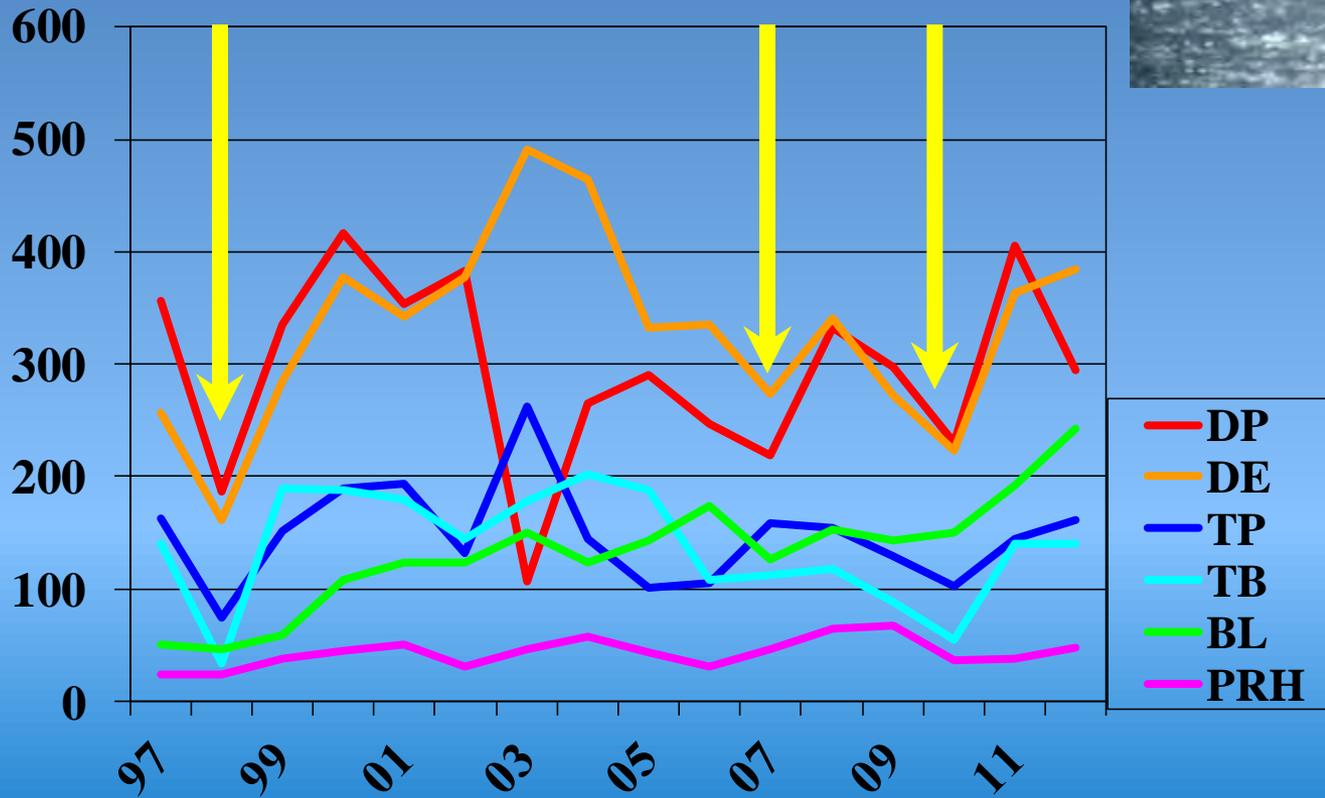
Double Point pups born





El Niño Effect

Maximum pup count by site



Health monitoring



Fresh shark bites



©2009 Richard James

Shark Bite - Double Point

12 June, 2009

Fresh dead



Health



3 die offs in past 20 years
@100 in 1997
@ 25 in 2000
@ 15 in 2009



©2009 Richard James

Double Point

12 June, 2009

Disturbance monitoring



Seal Response

Head alert

Flush to water

Flush into water

Measures

Source

No. disturbances/hour

No. Seals flush

No. Pups separated

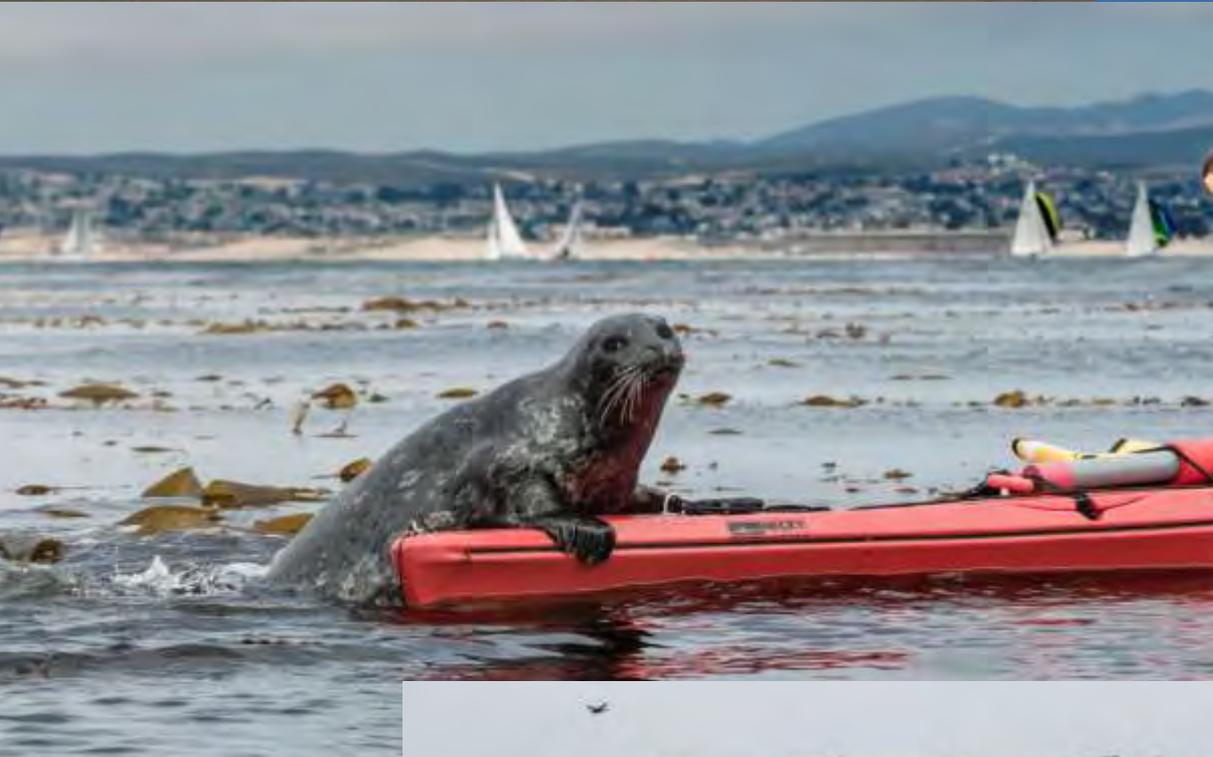


Disturbance monitoring



Seal Response

Hitch a ride.....

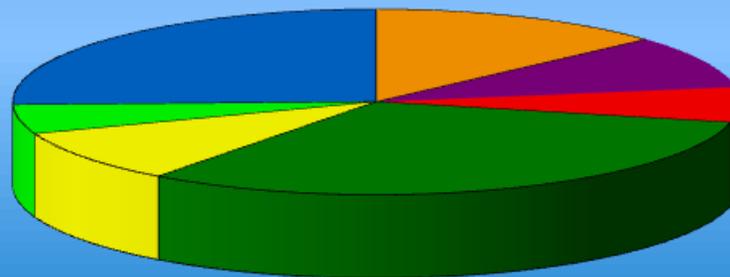


Barton Selby

Disturbances at all sites



Disturbance sources
Percent averaged over 15 years



- Motor boat
- non-motor
- Aircraft
- Human
- Birds
- Other
- Unknown

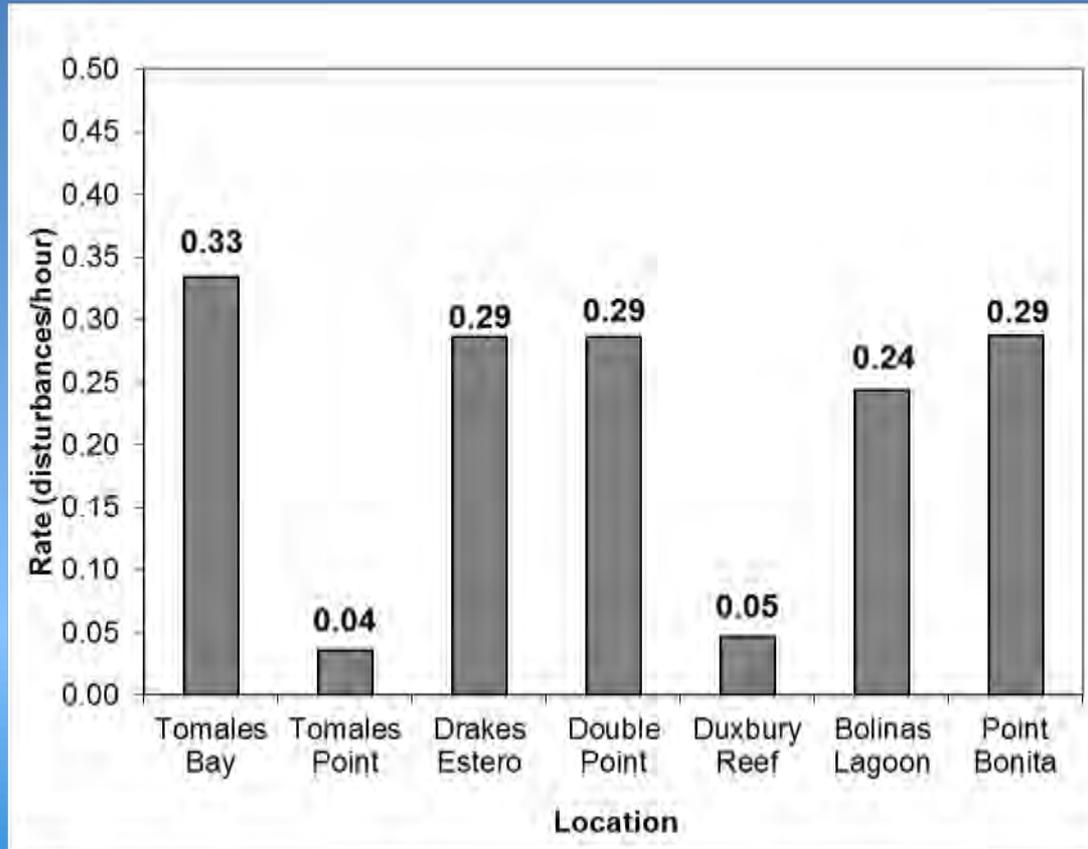
Disturbance type by year

Year	Motor boat	Non	Car	Air craft	Human	Bird	Unkno	Other
		motor boat			On foot		wn	
2002	19%	15%	6%	6%	31%	7%	21%	5%
2003	13%	20%	2%	8%	29%	8%	24%	5%
2004	2%	9%	8%	2%	38%	8%	25%	8%
2005	9%	14%	1%	8%	35%	8%	25%	2%
2006	14%	16%	3%	5%	36%	8%	22%	5%
2007	29%	21%	7%	7%	33%	7%	24%	1%
2008	11%	10%	5%	4%	47%	5%	21%	4%
2009	22%	11%	2%	3%	22%	6%	17%	4%
2010	27%	5%	3%	5%	31%	4%	28%	2%
2011	21%	9%	3%	5%	29%	12%	20%	6%
2012	13%	4%	2%	3%	27%	14%	28%	7%
2013	17%	6%	1%	6%	31%	9%	25%	5%
2014	13%	9%	2%	8%	27%	10%	28%	3%
2015	15%	8%	3%	15%	18%	12%	25%	4%

Disturbance measure



Disturbances per hour - 2015



Rates of disturbances per hour of actual disturbances (head alert, flush, flush water)

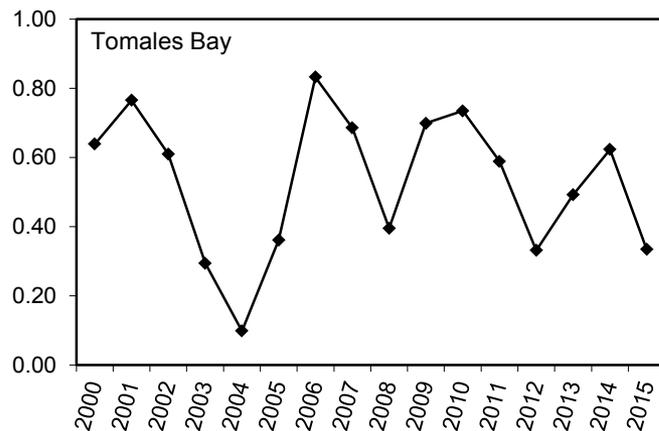
Disturbance measure



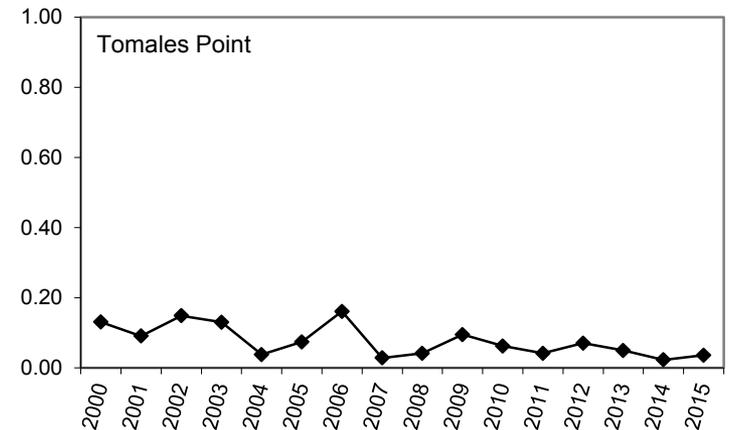
Disturbances
per hour
2000-2015



High disturbance rate



Low disturbance rate



Tomales Bay

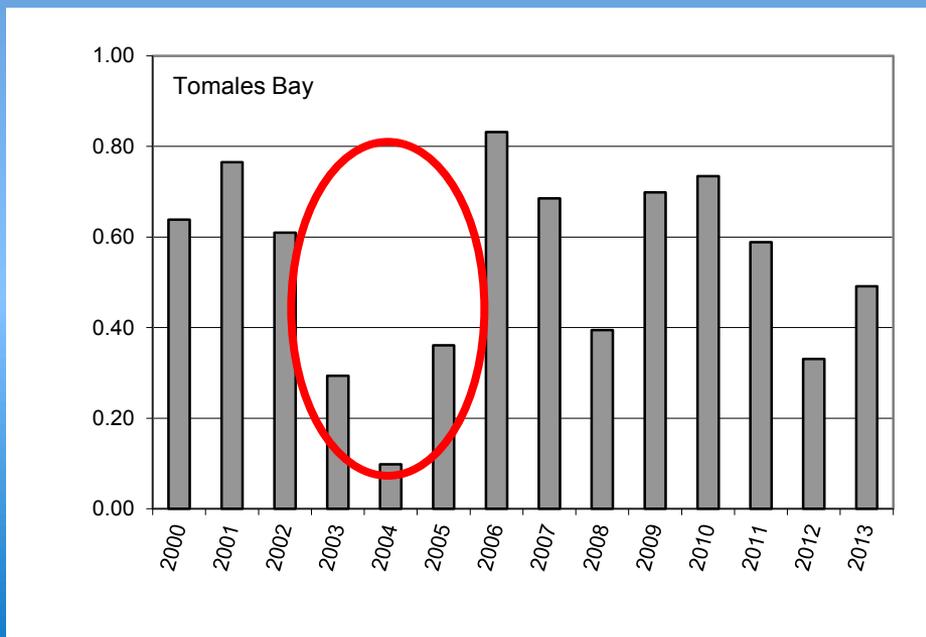


NOAA initiated SEALS Program that reduced rate of disturbance (see Tezak et al. 2004)

PADDLER'S Etiquette developed jointly by agencies and organizations

NOAA Program terminated in 2006

Rate of disturbance



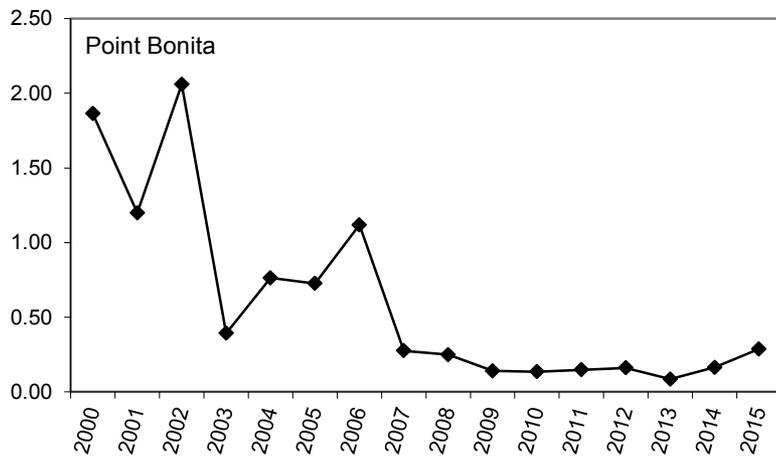
Point Bonita



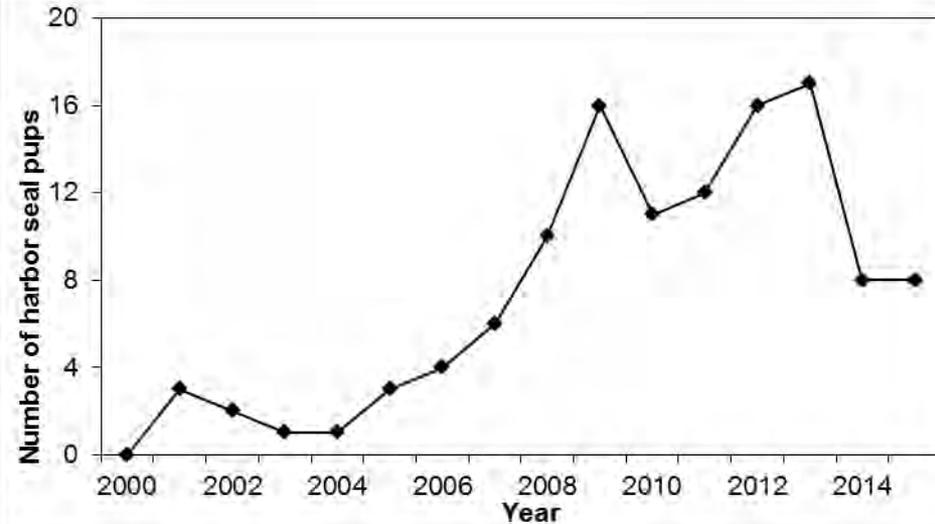
- ❖ GGNRA reduced access in 2006
- ❖ Disturbance rate down in 2007
- ❖ Pup numbers up in 2007



Disturbance Rate



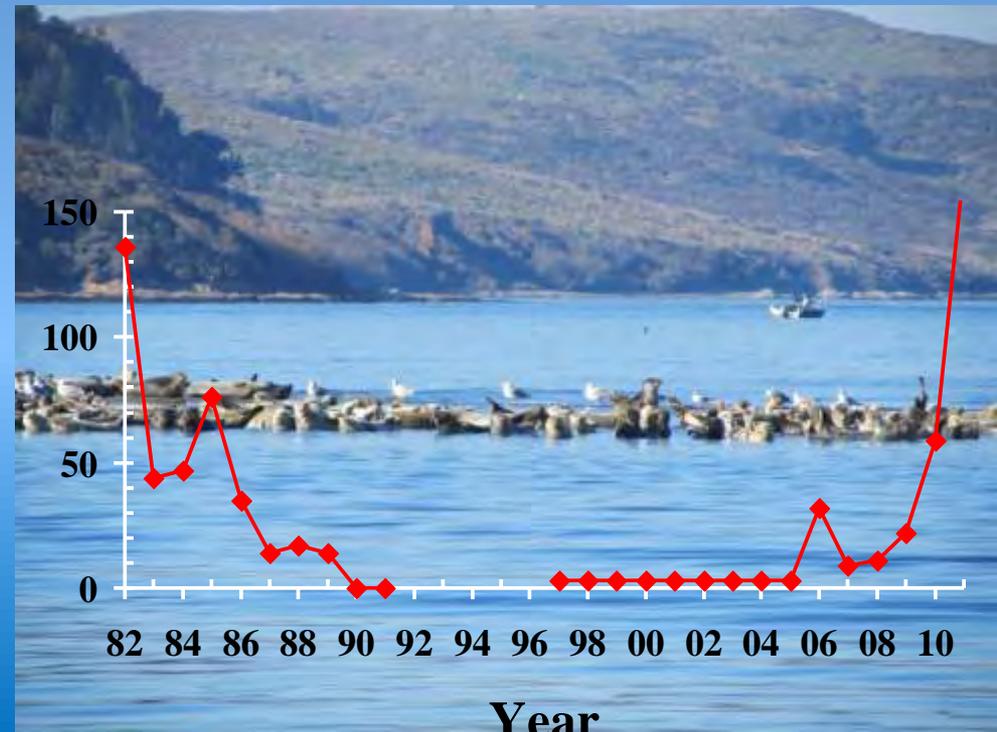
Pup counts



Hog Island – Tomales Bay



- Park limited access to island in @1998
- Seals increased use in 2006
- Now present all surveys
- Maximum > 117 adults in 2012
- Maximum 9 pups



Data various sources:
CDFG, NPS, Allen & King 1992

Return of terrestrial predator - Coyotes



Photos Jason Thompson

Emerging issue

Arrival of avian predators – Bald eagles in 2012
Now nesting in Tomales Bay near seal colony



Sue Van Der Wal



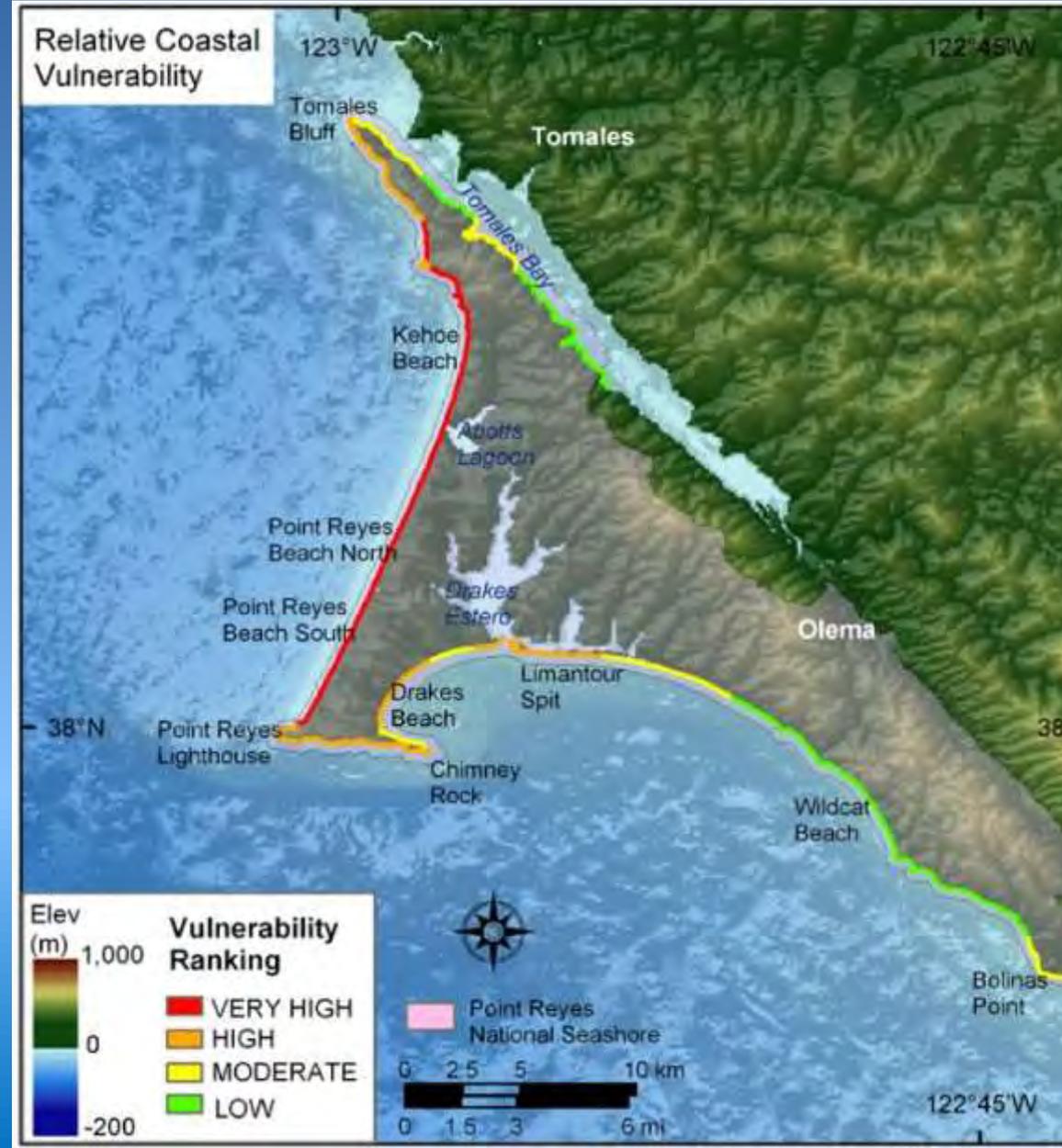
Sarah Codde



Emerging issue

Climate Change effects on marine ecosystems

- Sea Level Rise
 - Habitat loss
 - Potential new habitat
- Ocean condition
 - Change in upwelling
 - More frequent and more intense ENSOs



Potential climate effects



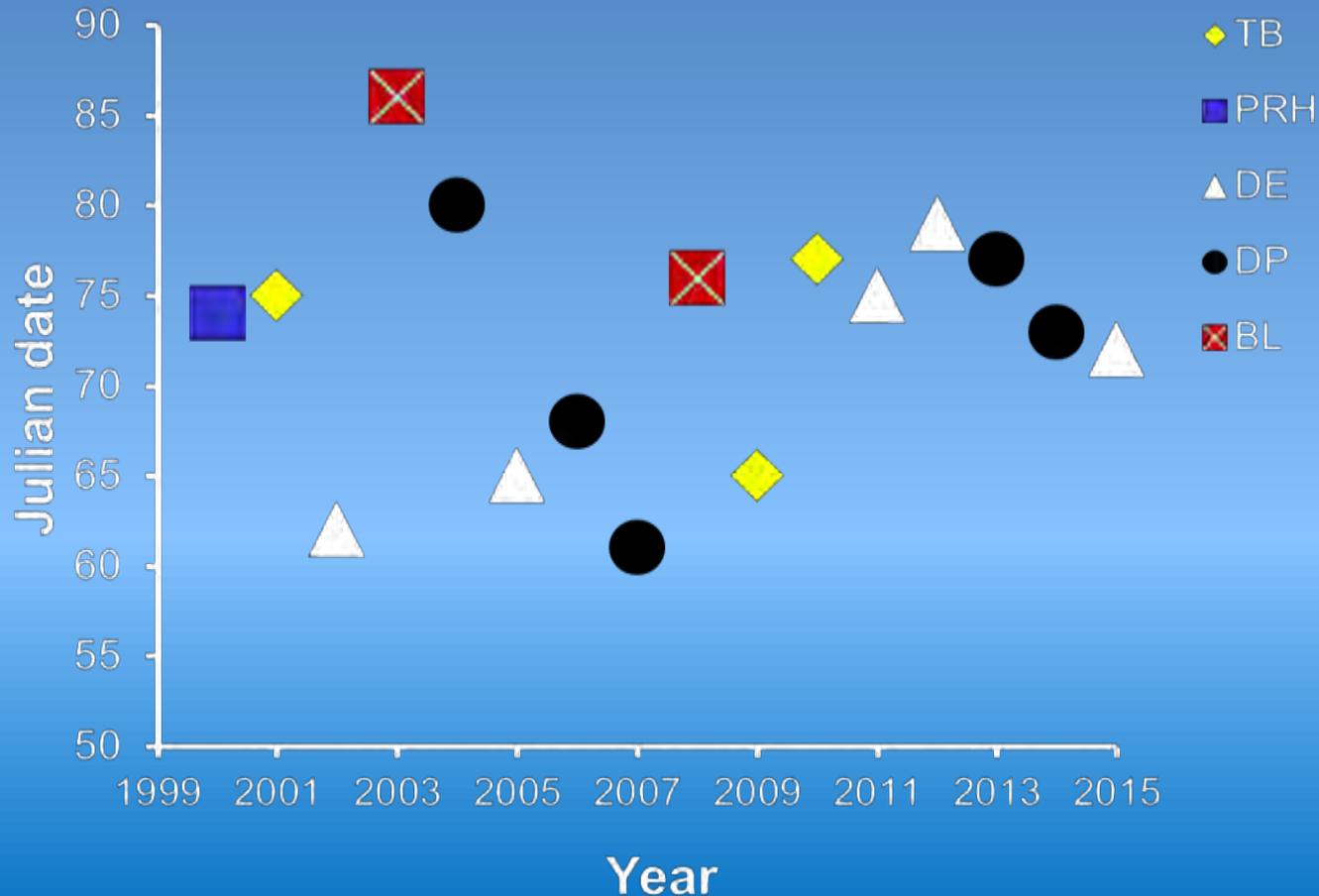
Sea Level Rise in transitional habitats

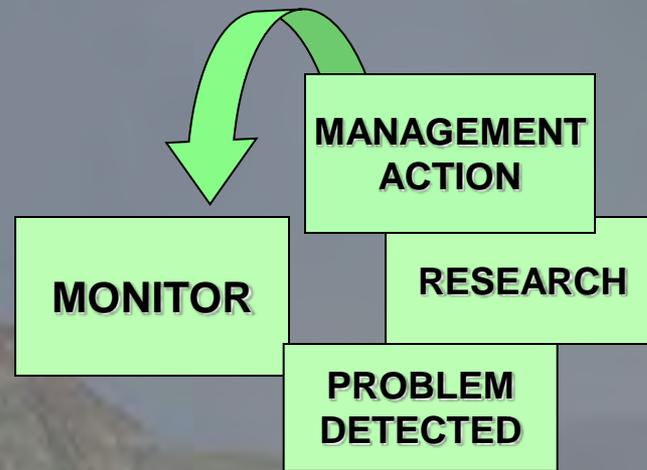


Changes in Phenology

Date of first live pup 2000-2015

Average date - March 13 – no trend





Management actions =
Research
Protect habitat/species
Restoration
Education
Continue monitoring*

Management actions in 2016

- Protection of pupping sites with seasonal closure
 - Hog Island
 - Limantour and Drakes Beach tip
 - Double Point
 - Drakes Estero to all boats (no power boats allowed)
March 1 - June 30
- Mariculture lease ended January 1, 2015
 - Park began removal of aquaculture equipment;
 - Rack removal will begin July 31
- Monitoring continues.....





THANKS TO ALL OF YOU!!!!!!

