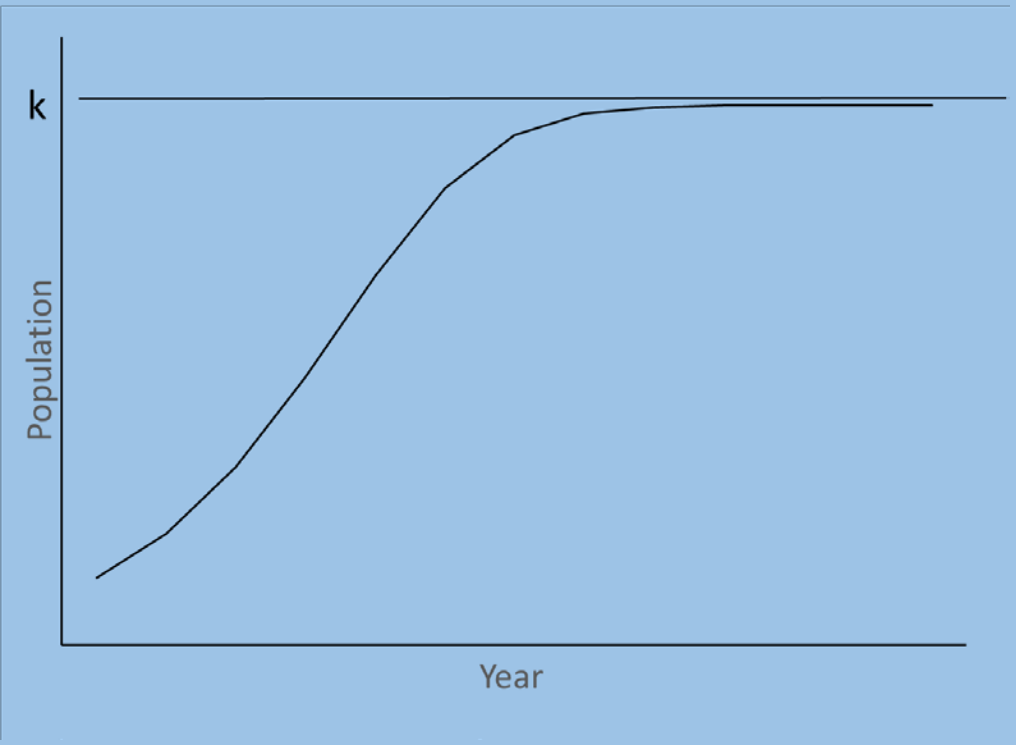
Seashore

Jim Fraser

With contributions by

Dan Catlin, Kelsi Hunt, Sarah Karpanty, Jonathan Cohen, Chelsea Weithman,

Eunbi Kwon, Shannon Ritter, Katie Walker



Virginia Tech Shorebird Program

Key Points

- Most breeding populations are habitat limited
- Populations can be below carrying capacity
  - After poor reproduction (or survival)
  - After sudden habitat increases
- Adequate reproduction is needed to get/keep populations at carrying capacity

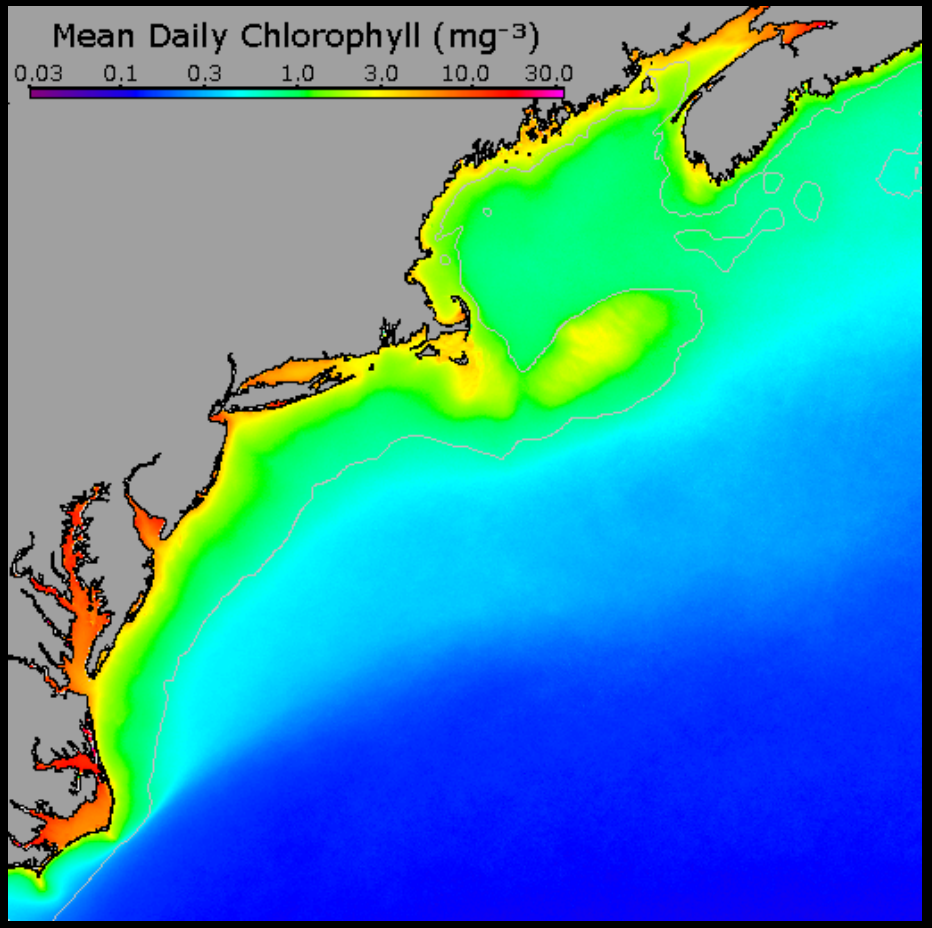
Outline

- What is good habitat
- Evidence for habitat limitation
- Population Regulation
- Implications for Cape Hatteras National Seashore

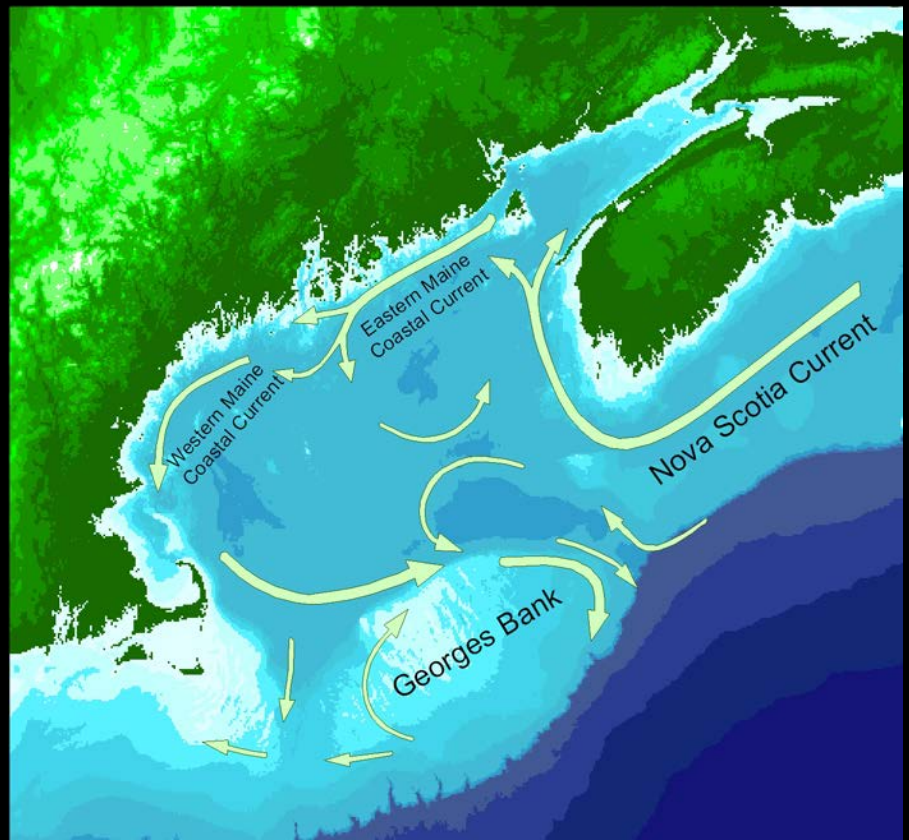
Mostly from areas outside of CAHA

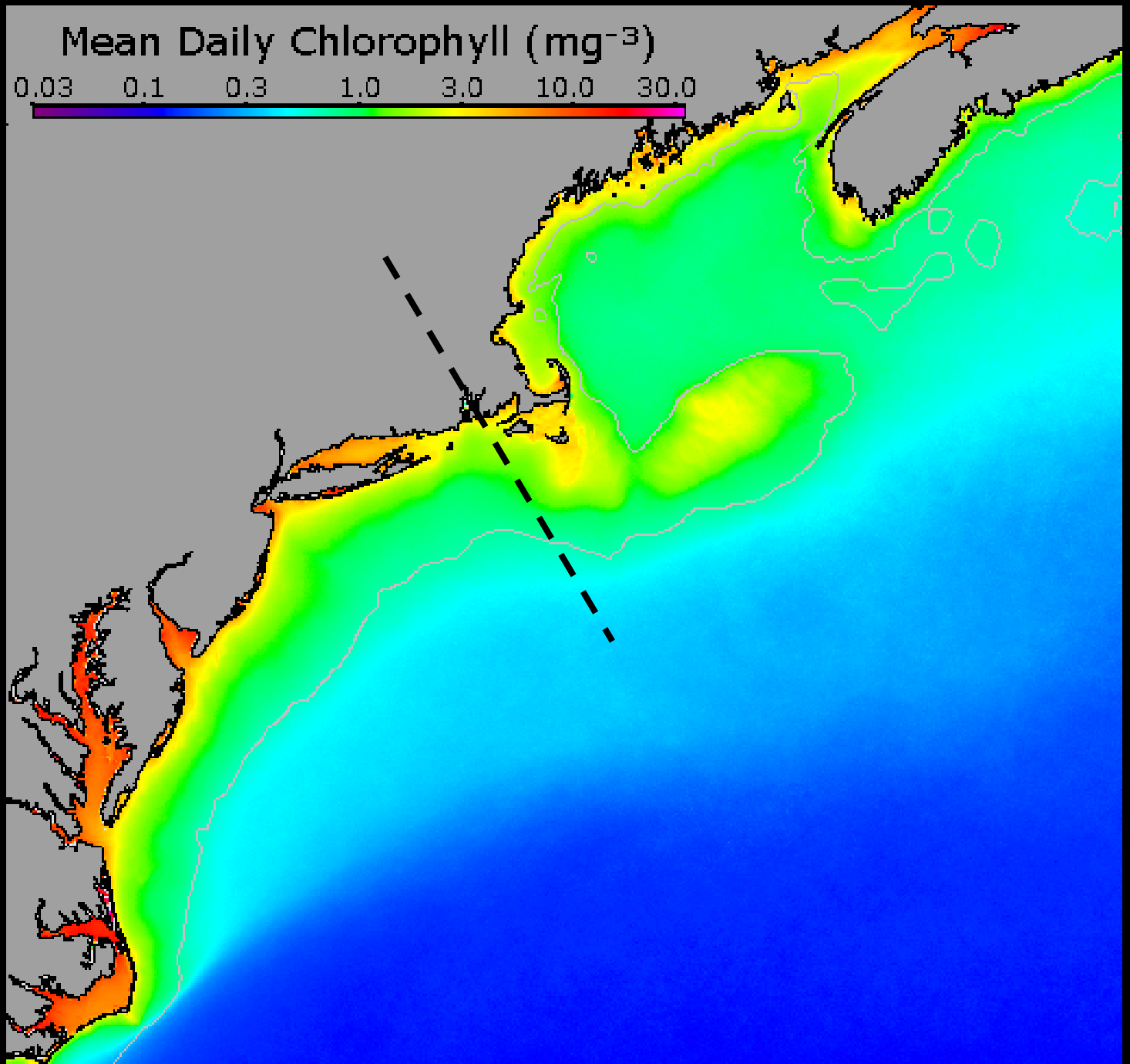
Outline

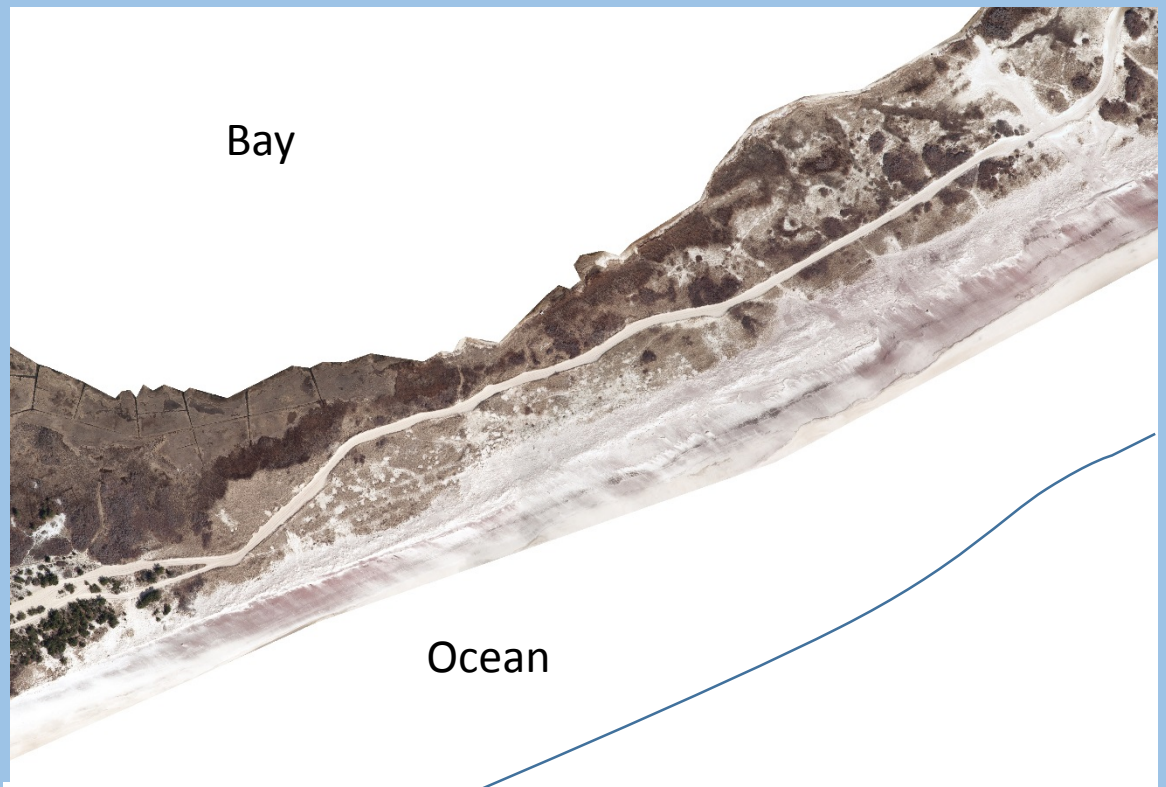
- What is good habitat?
- Evidence for habitat limitation
- Carrying capacity and density independent factors



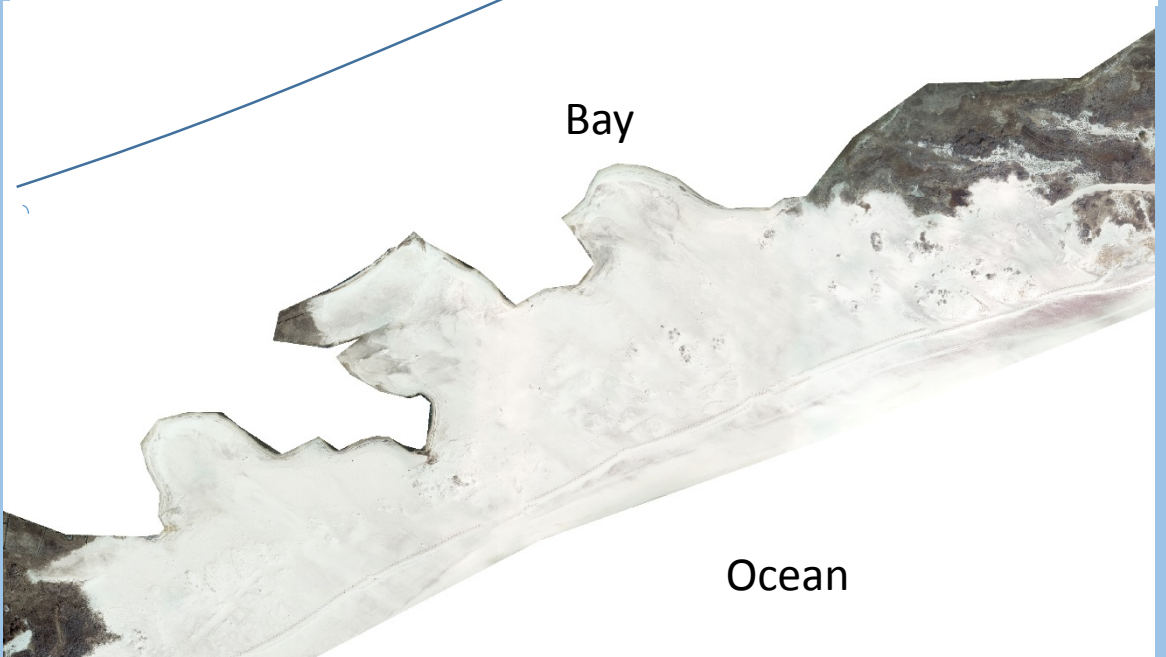
← Chlorophyll ~ phytoplankton




Mean Daily Chlorophyll (mg⁻³)
0.03
0.1
0.3
1.0
3.0
10.0
30.0



Pattersquash Area 2010
(Before Hurricane Sandy,
raw imagery)



Pattersquash Area 2013
(After Hurricane Sandy,
raw imagery)

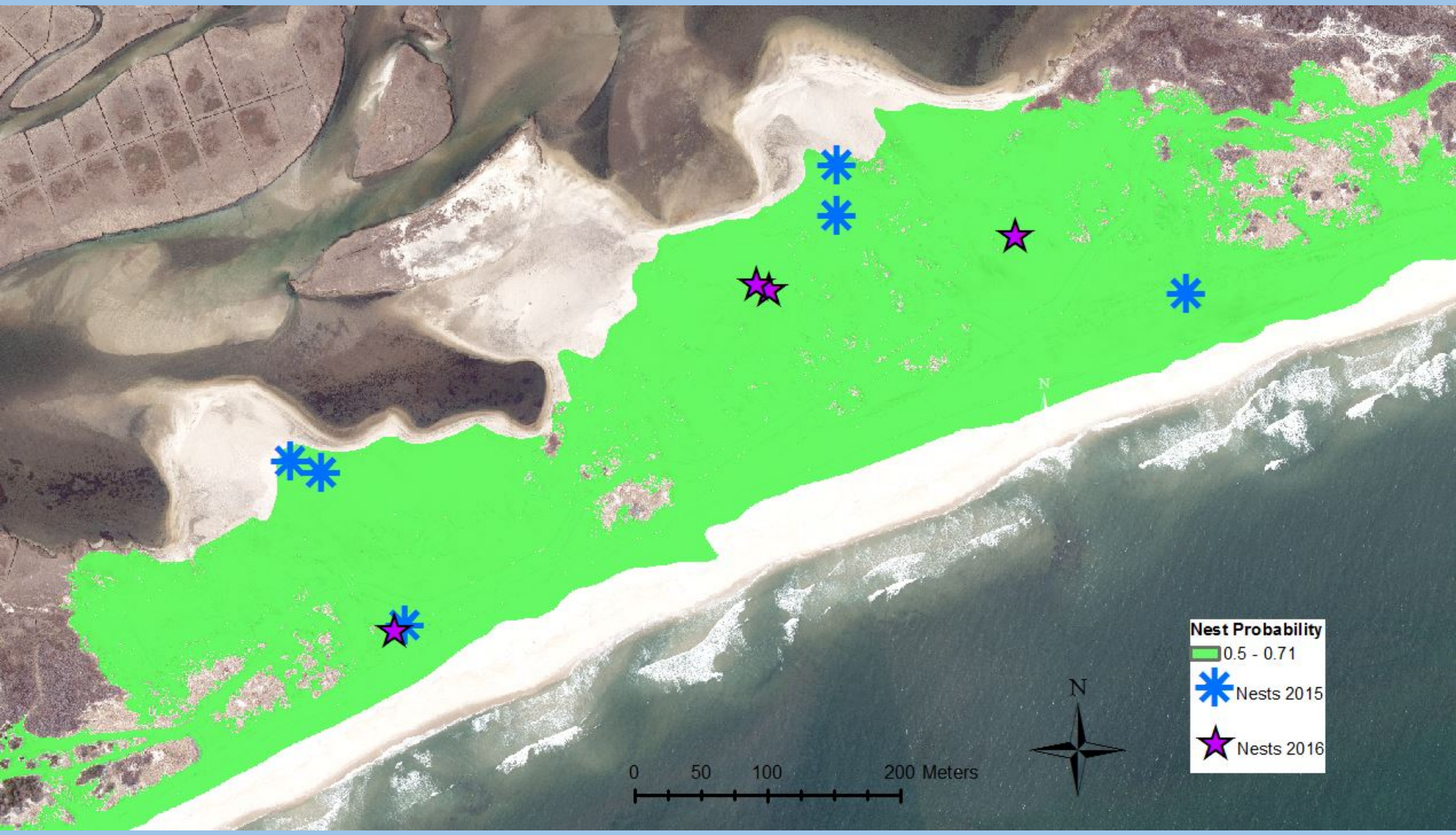
Importance of Bay-Side Habitat

- Patterson, M.E.*, J.D. Fraser, and J.W. Roggenbuck. Factors affecting piping plover productivity on Assateague Island. 1991. Journal of Wildlife Management 55: 526-531.
- Loegering, J.P.* and J.D. Fraser. 1995. Piping plover survival in different brood-rearing habitats. Journal of Wildlife Management 59: 646-655.
- Goldin, M.R. and J.V. Regosin. 1998. Chick behavior, habitat use, and reproductive success of piping plovers at Goosewing Beach, Rhode Island. J. field Ornithology 69 228-234.
- Elias, S.P.*, J.D. Fraser and P.A. Buckley. 2000. Piping plover brood foraging ecology on New York barrier Islands. Journal of Wildlife Management 64: 346-354.
- Fraser, J.D., S.H. Keane,* and P. A. Buckley. 2005. Prenesting use of intertidal habitats by piping plovers on South Monomoy Island. Journal of Wildlife Management 69: 1731-1736.
- Cohen, J.B.*, L.M. Houghton, and J.D. Fraser. 2009. Nesting density and reproductive success of piping plovers in response to storm and human-created habitat changes. Wildlife Monographs. 173: 1-24.
- Cohen, J.B.*, J.D. Fraser. 2010. Piping Plover foraging distribution and prey abundance in the pre-laying period. Wilson Journal of Ornithology. 122: 578-582.

Logistic Regression Model

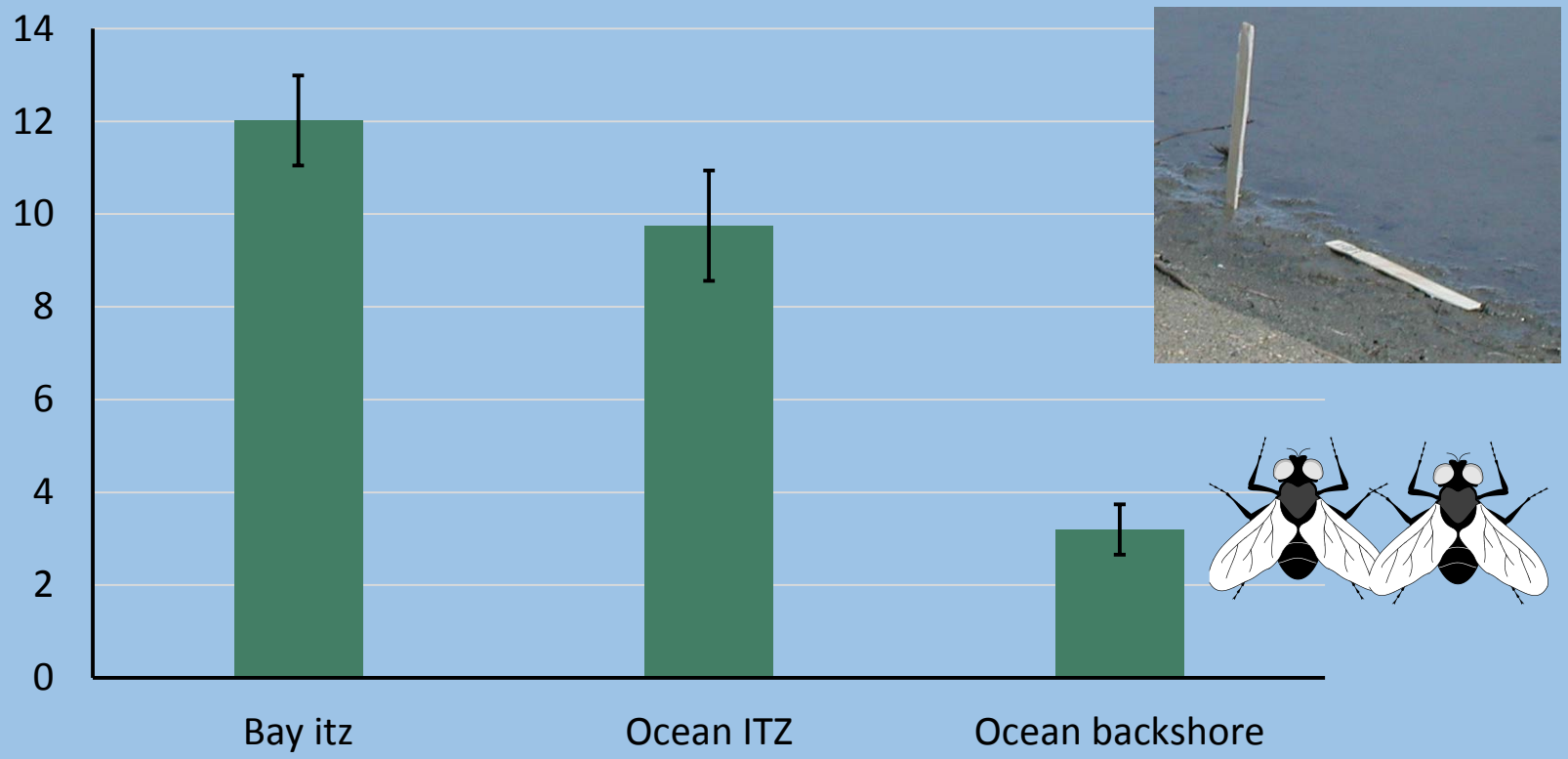
- 4 Models, using the following 3 variables:
  - Least cost distance to bay
  - Least cost distance to ocean
  - Ha of open sand within 500 meters

Pattersquash Area 2010
Classified Imagery
P of Nesting < 0.5



Pattersquash Area 2015
Classified Imagery
P of Nesting > 0.5

Invertebrates Caught in 3 hours
West Hampton Dunes, NY



Cohen, Houghton and Fraser 2009 Wildlife Monograph 173

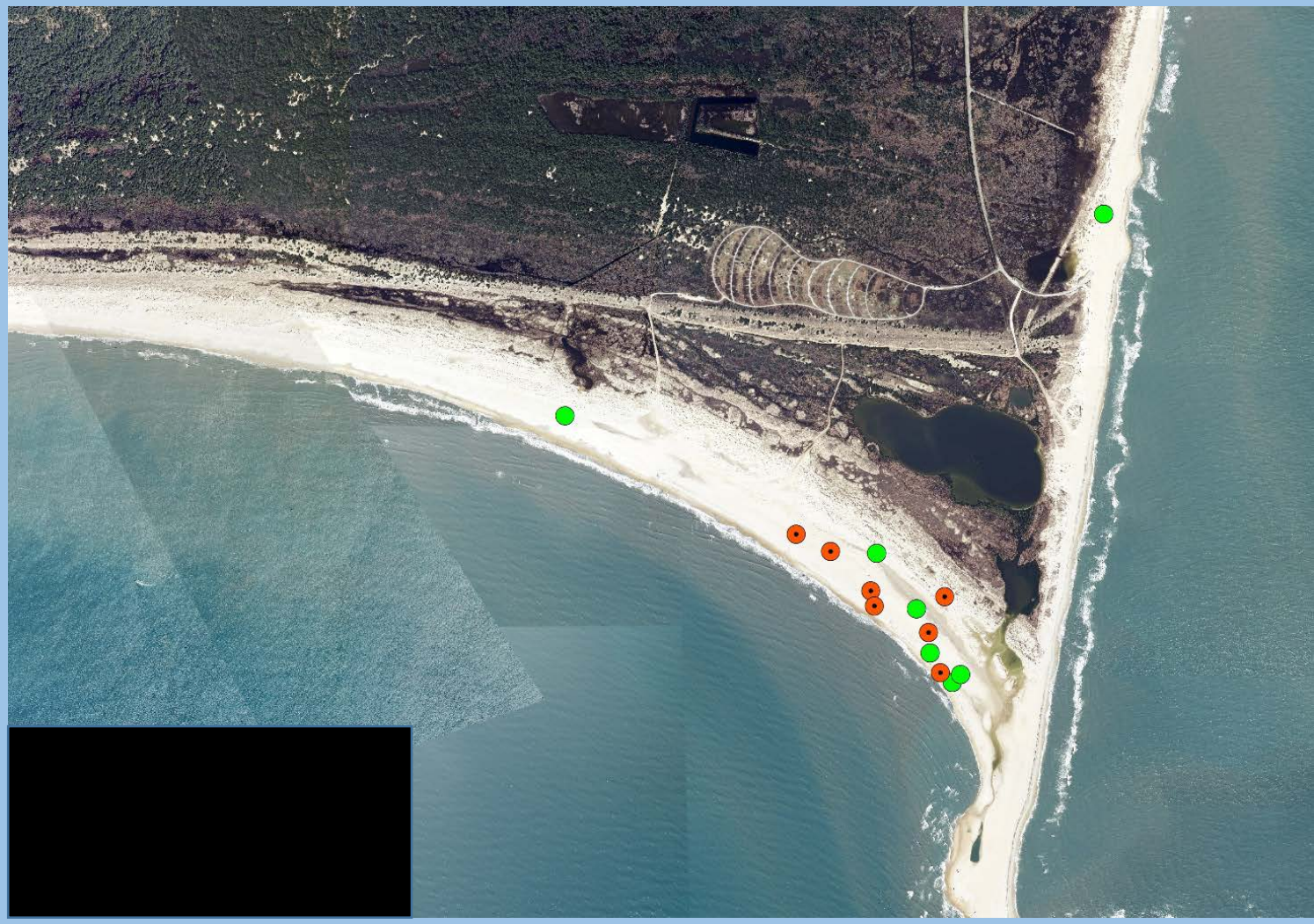
Animals Caught in Core Samples Pattersquash Bay ITZ, April 2015

Phylum	Category	Taxonomist Classification	PSO
Annelida	oligochaete	Enchytraeidae	0.36
		Tubificidae	12.79
	polychaete		
		Capitellidae	0.7
		Chaetopteridae	0.03
		Cirratulidae	0.61
		Glyceridae	0.06
		Lumbrineridae	2.73
		Nereididae	1.91
		Orbiniidae	0.58
		Phyllodocidae	0.61
		Spionidae	0.12
		Syllidae	2.55
Arthropoda	amphipod	Ampeliscidae	0.03
		Aoridae	0.52
		Corophiidae	9.36
		Lysianassidae	0.03
		Phoxocephalidae	0.79
	insect	Insecta	0.03
	isopod	Idoteidae	0.58
		Sphaeromatidae	10.58
	ostracod (seed shrimp)	Ostracoda	0.7
	pycnogonid (sea spider)	Phoxichilidiidae	0.42
	tanaid	Leptocheliidae	4.45
		Tanaidacea	0.03
Cnidaria	cnidarian	Actiniaria	0.36
Mollusca	bivalve	Cyrenidae	59.94
		Mytilidae	0.06
		Hydrobiidae	0.03
		Nassariidae	0.21
Nemertea	nemertean worm	Nemertea	0.12
Platyhelminthes	flatworm	Platyhelminthes	0
		Total Abundance:	111.3

Cape Point

2015 nest
2016 nest

2014 imagery



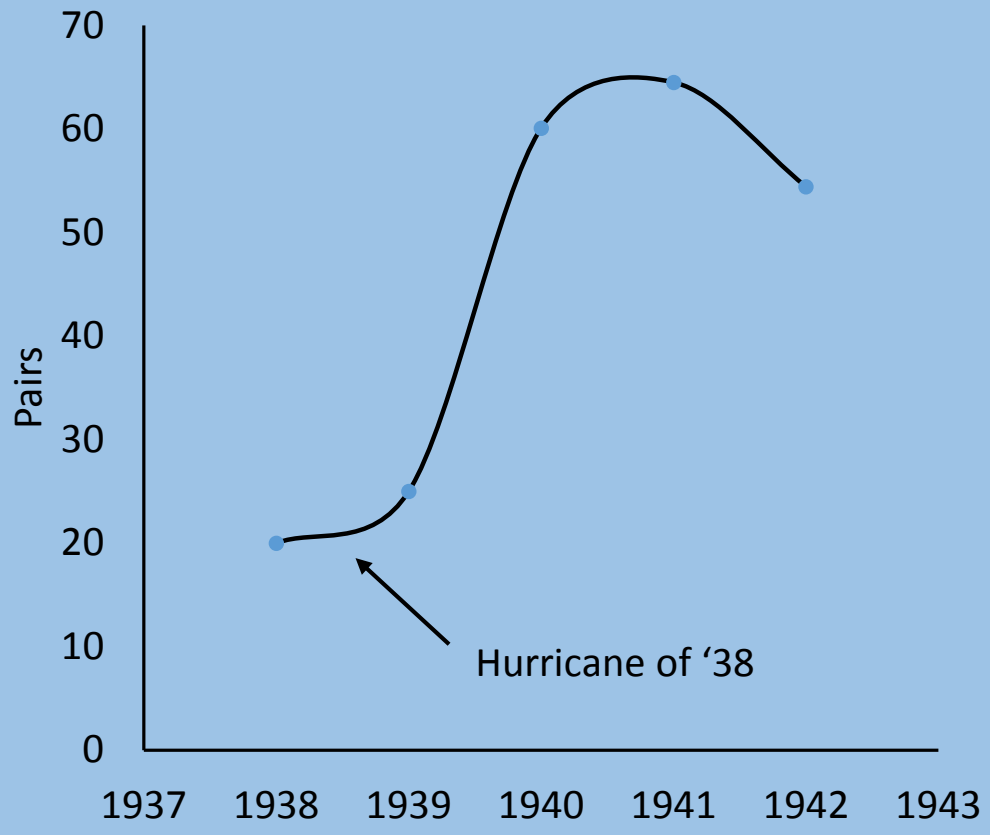
- Evidence for habitat limitation
  - Population irruptions
  - Low reproductive output

Photograph by Fairchild Aerial Surveys

EVEN THE COASTLINE WAS CHANGED BY THE HURRICANE'S ASSAULT

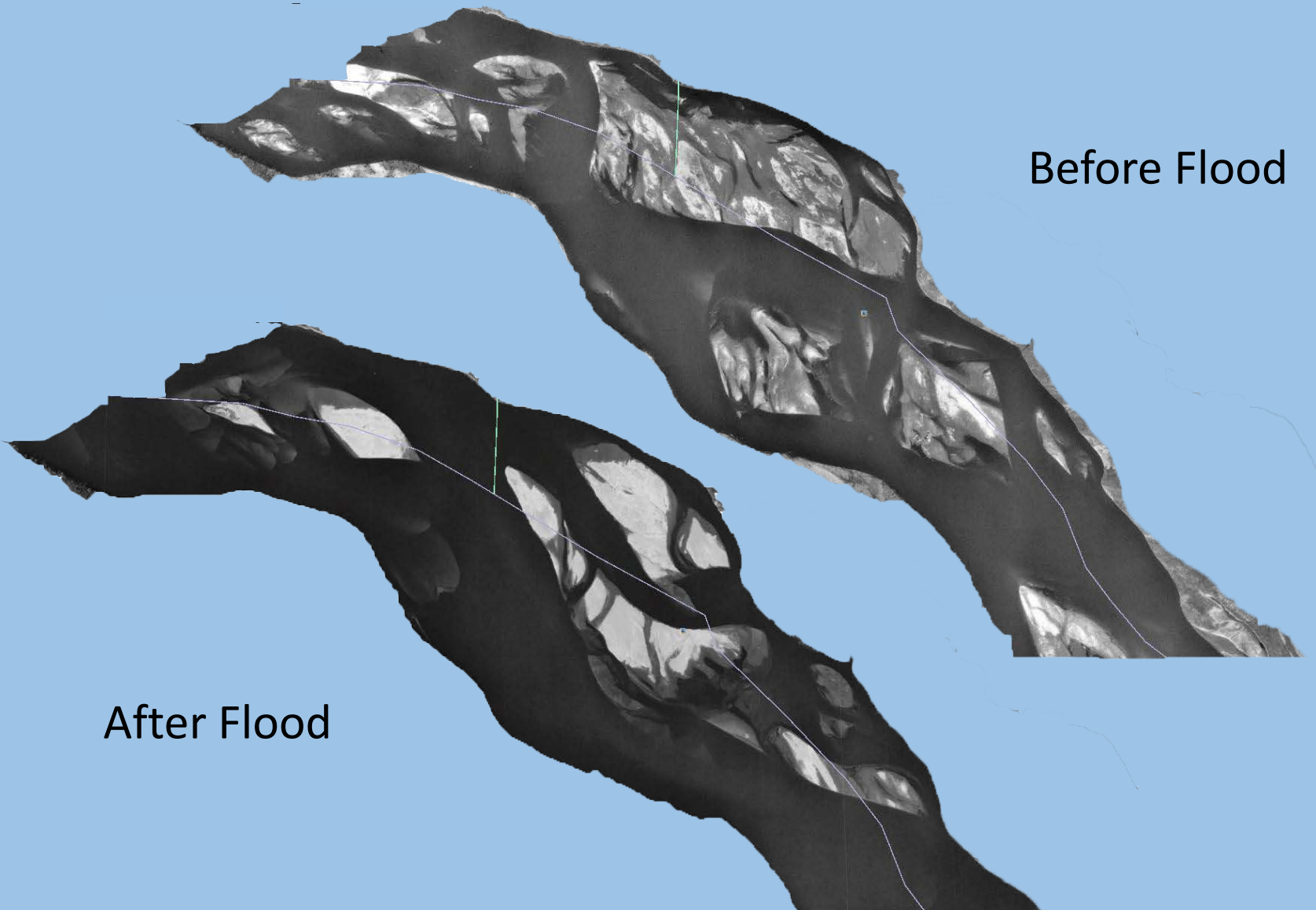
Where summer cottages once lined the beach, storm waves have cut two new inlets (nearest the camera) into Moriches Bay (left), on Long Island. The third inlet (background) existed previously but was considerably deepened. Just beyond the horizon is Westhampton Beach, where severe damage occurred.

After Hurricane of 1938

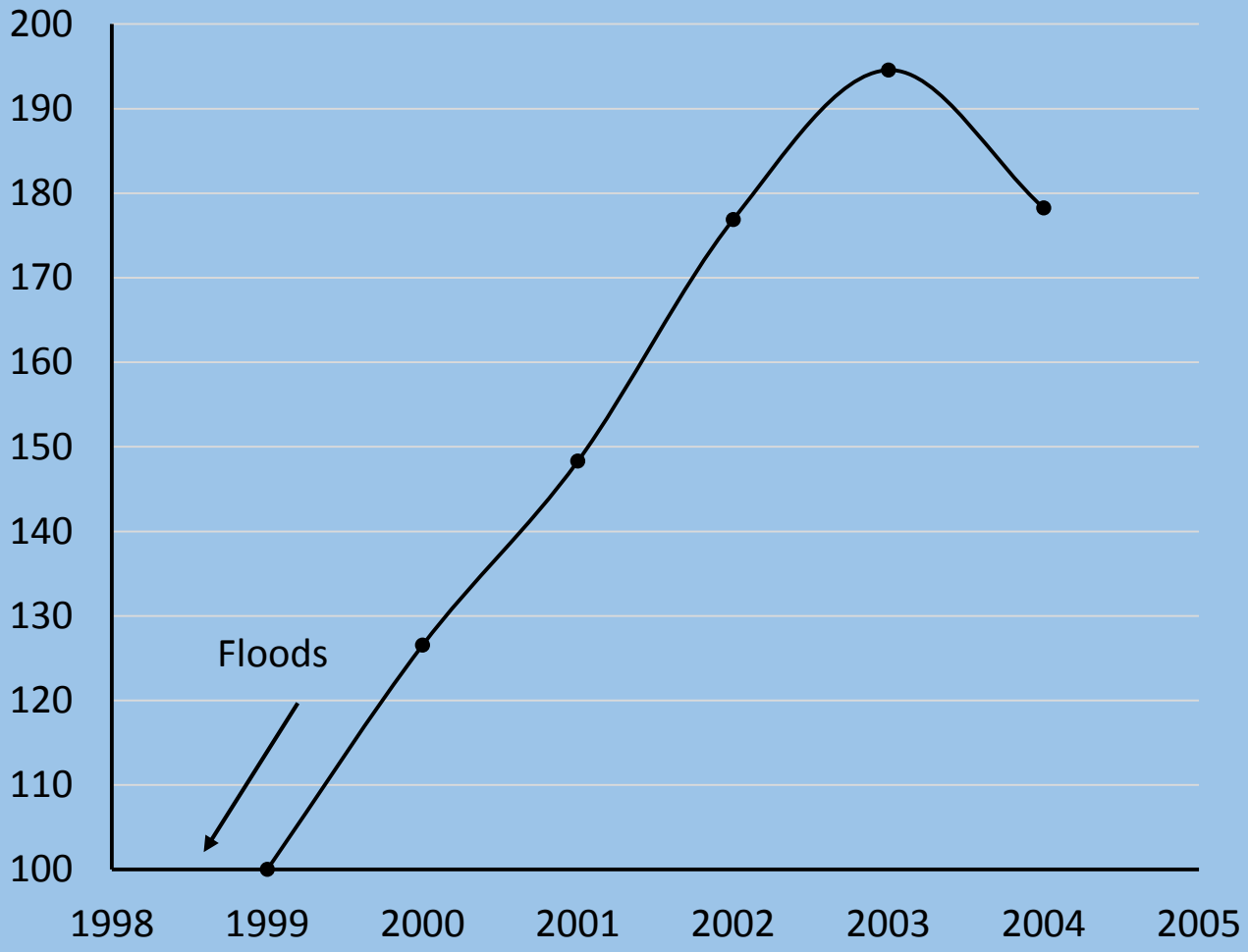


Tripled in 2 years after hurricane, from 20 to 60 pairs
Wilcox 1959

Missouri River 1990's



Missouri River, Gavins Reach 1990'S

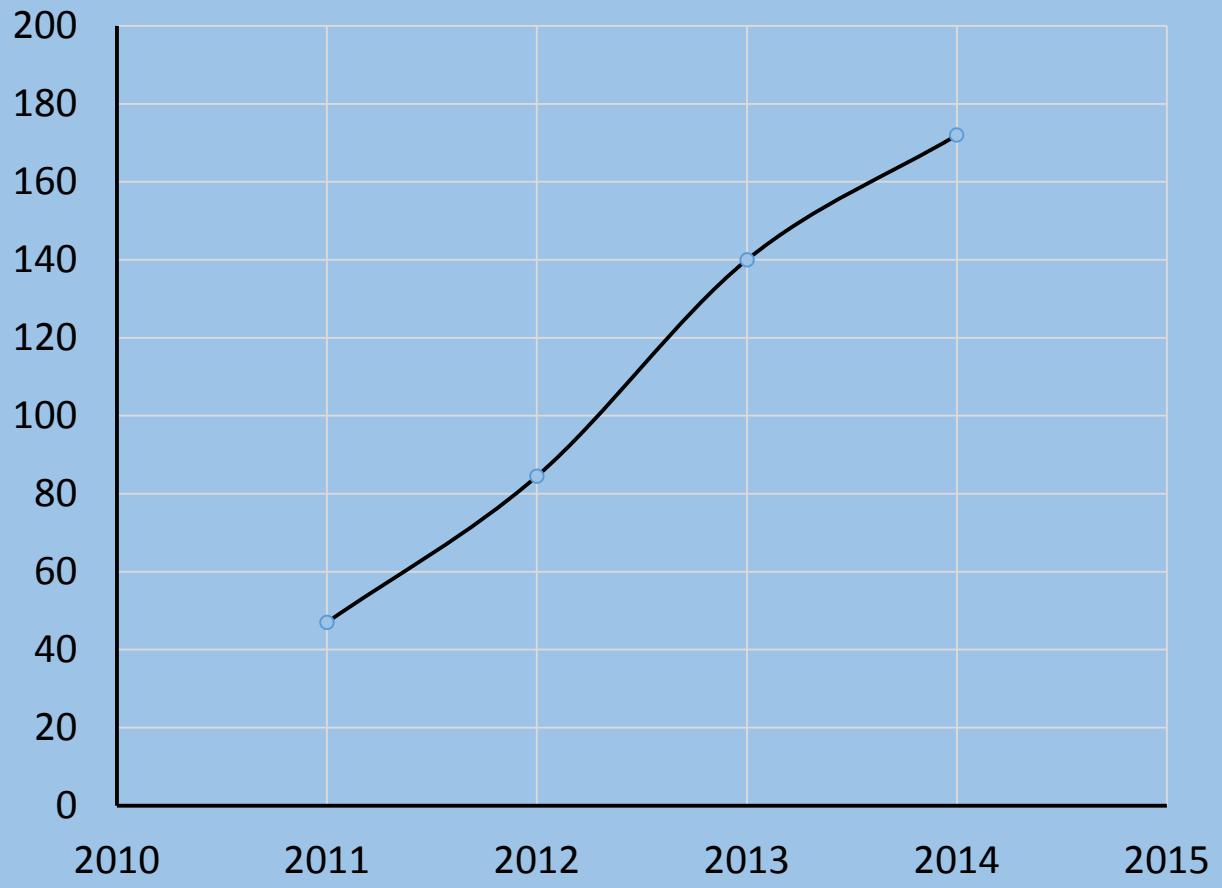


~ 500 ha new habitat

~ population doubled in 4 years

From USACE unpublished

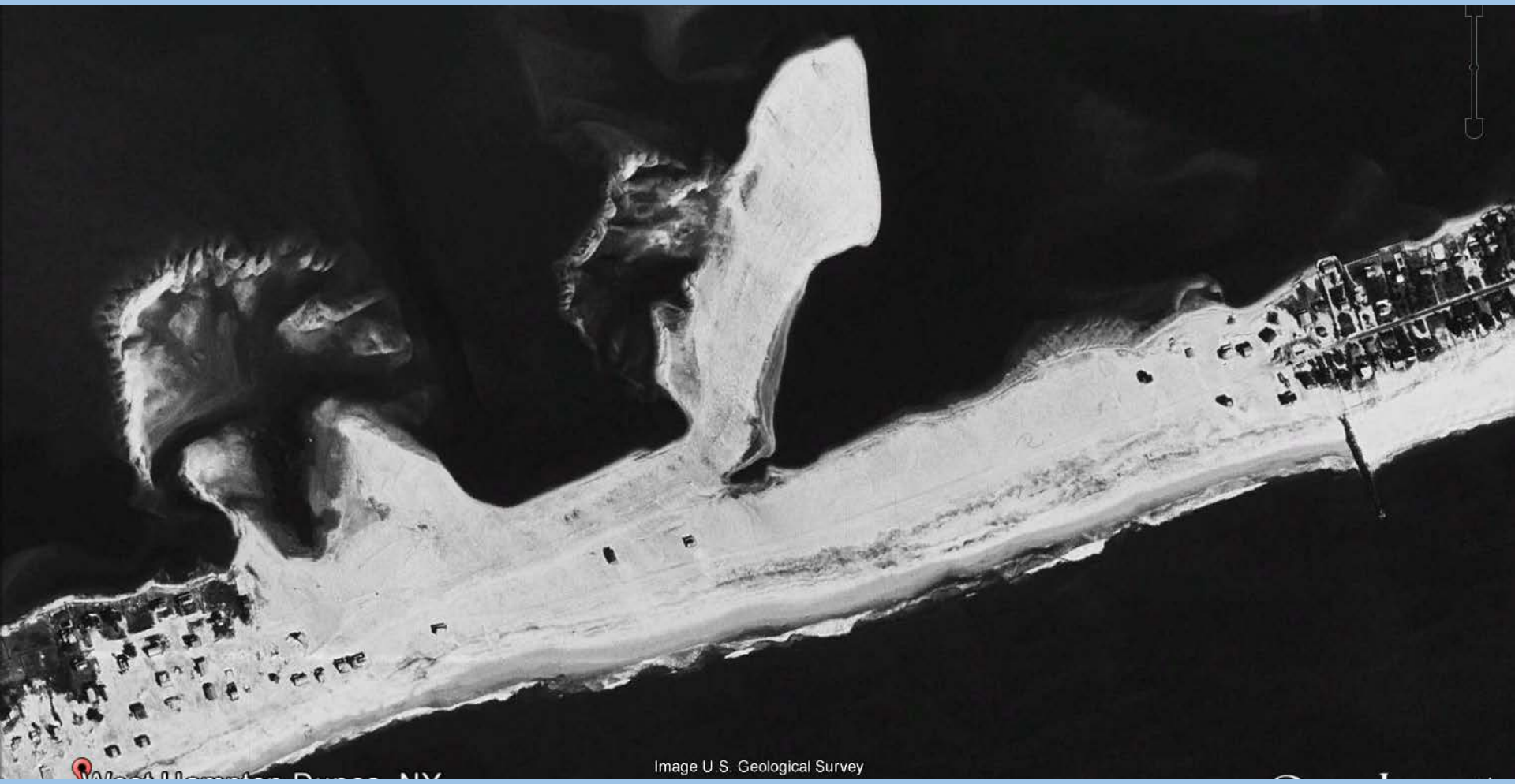
Missouri River, Gavins Reach, 2010's



More than tripled in 3 years

Hunt thesis, Hunt, Catlin and Fraser in prep.

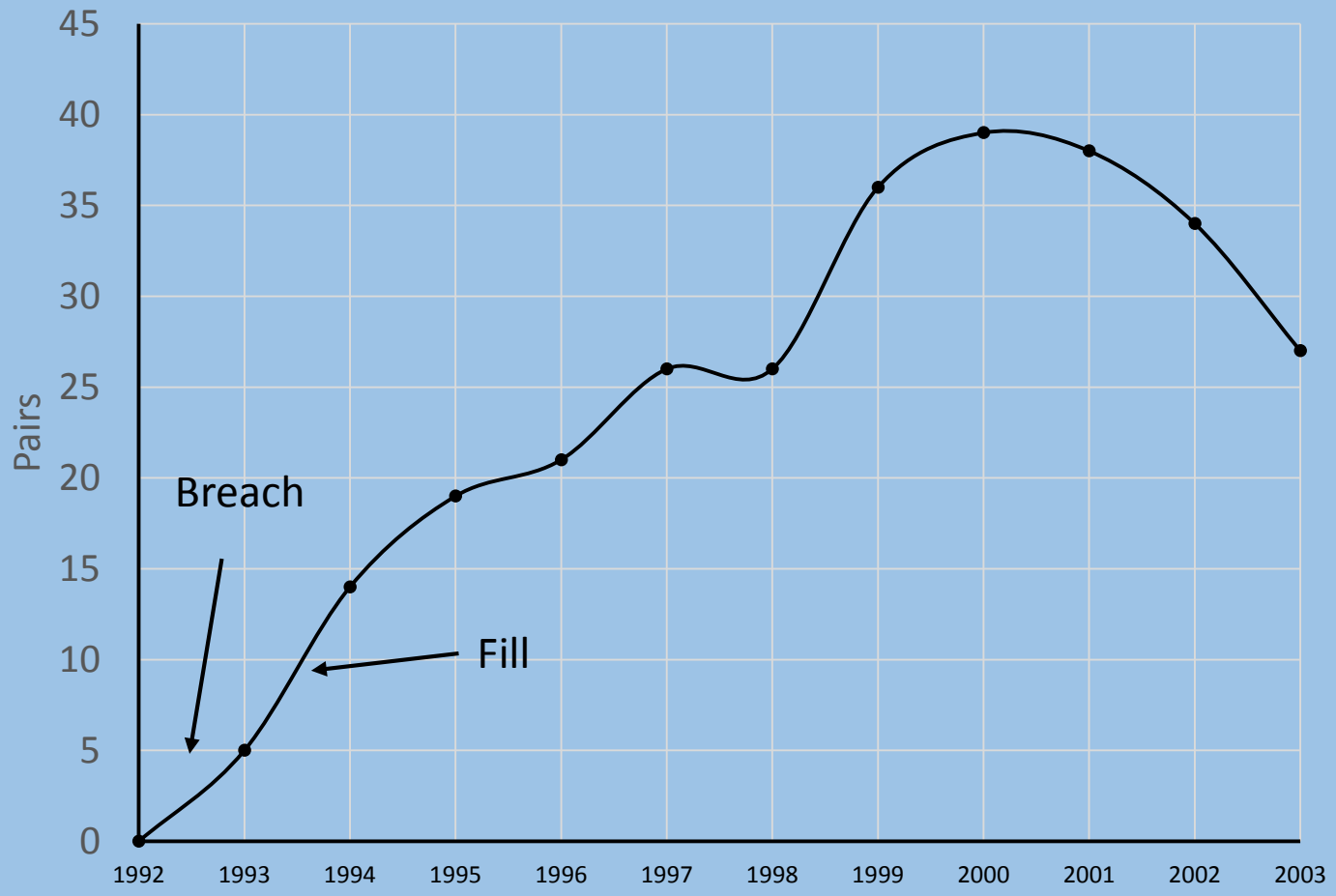
After Northeaster of 92-93, breach, and Corps repair



From 22 ha with no bay access to 50 ha with bay access

West Hampton Dunes N.Y. 1990's

From Cohen, Houghton and Fraser 2009



From 22 ha with no bay access to 50 ha with bay access

From 0 to 39 pairs in 7 years 6.8-fold increase in 6 years

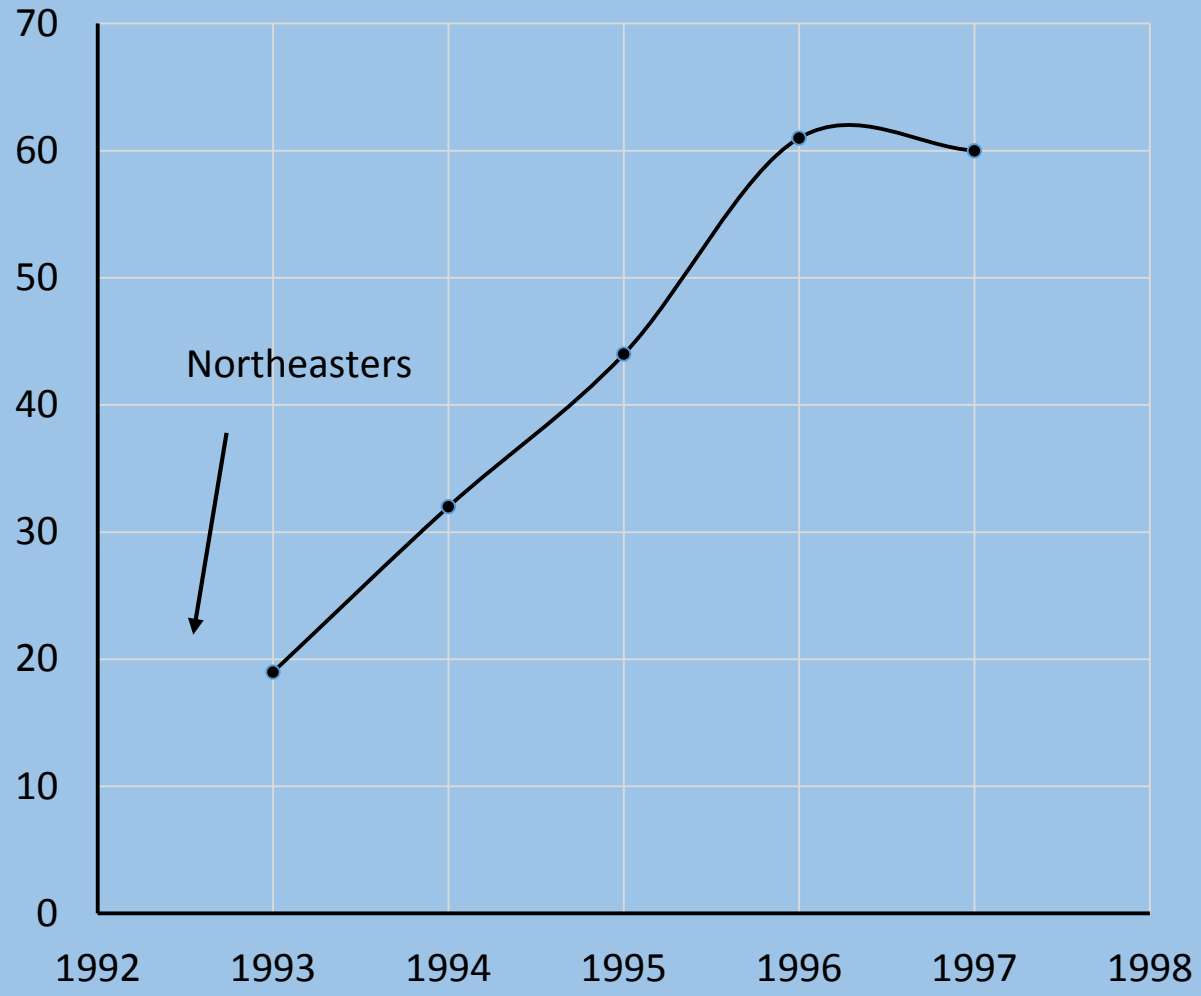
North end of Assateague Island, MD

Northeasters
1992-1993

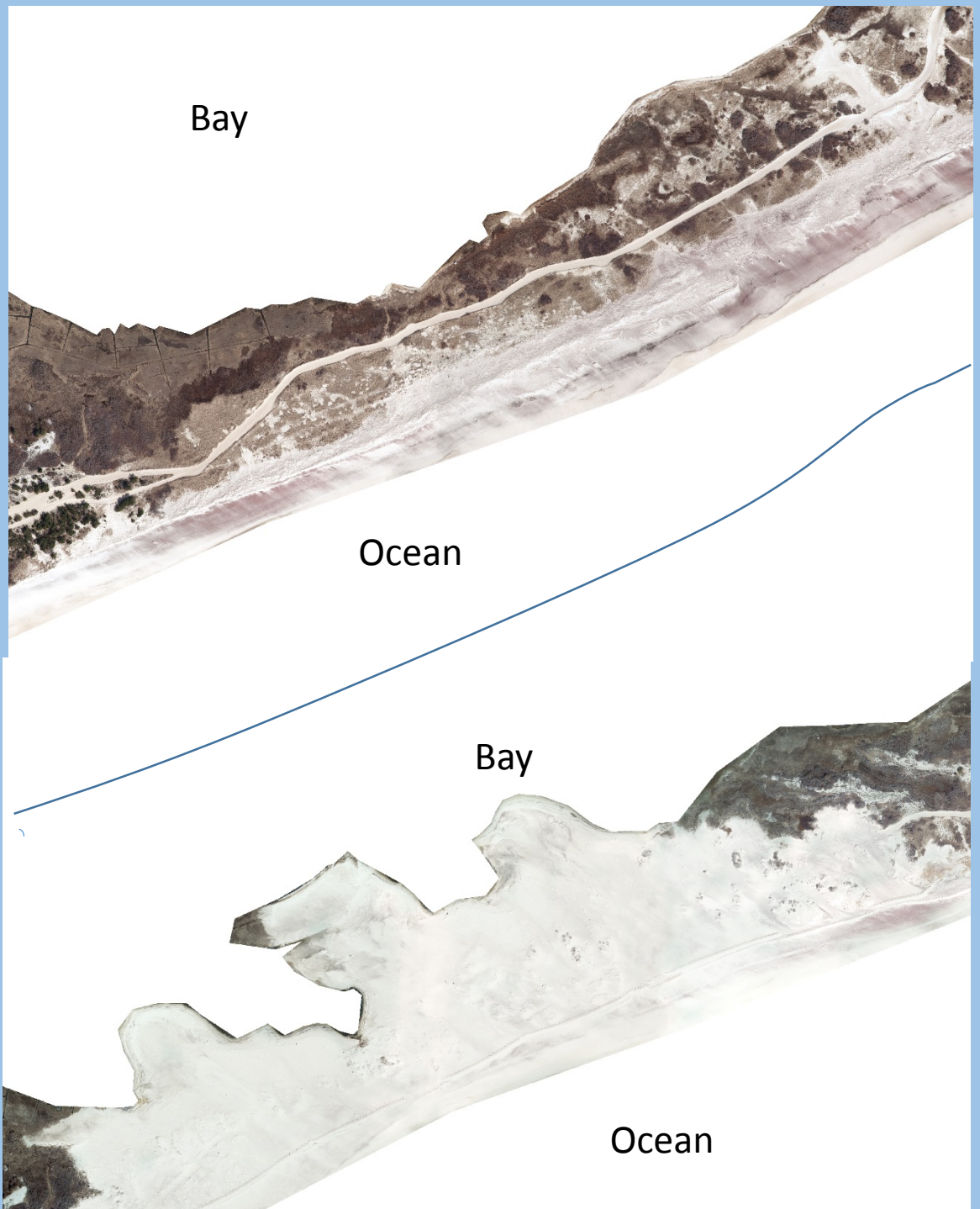
1989

1998

North End of Assateague Island MD After Northeasters of ‘92 – ‘93



Population tripled in 3 years
NPS unpublished data

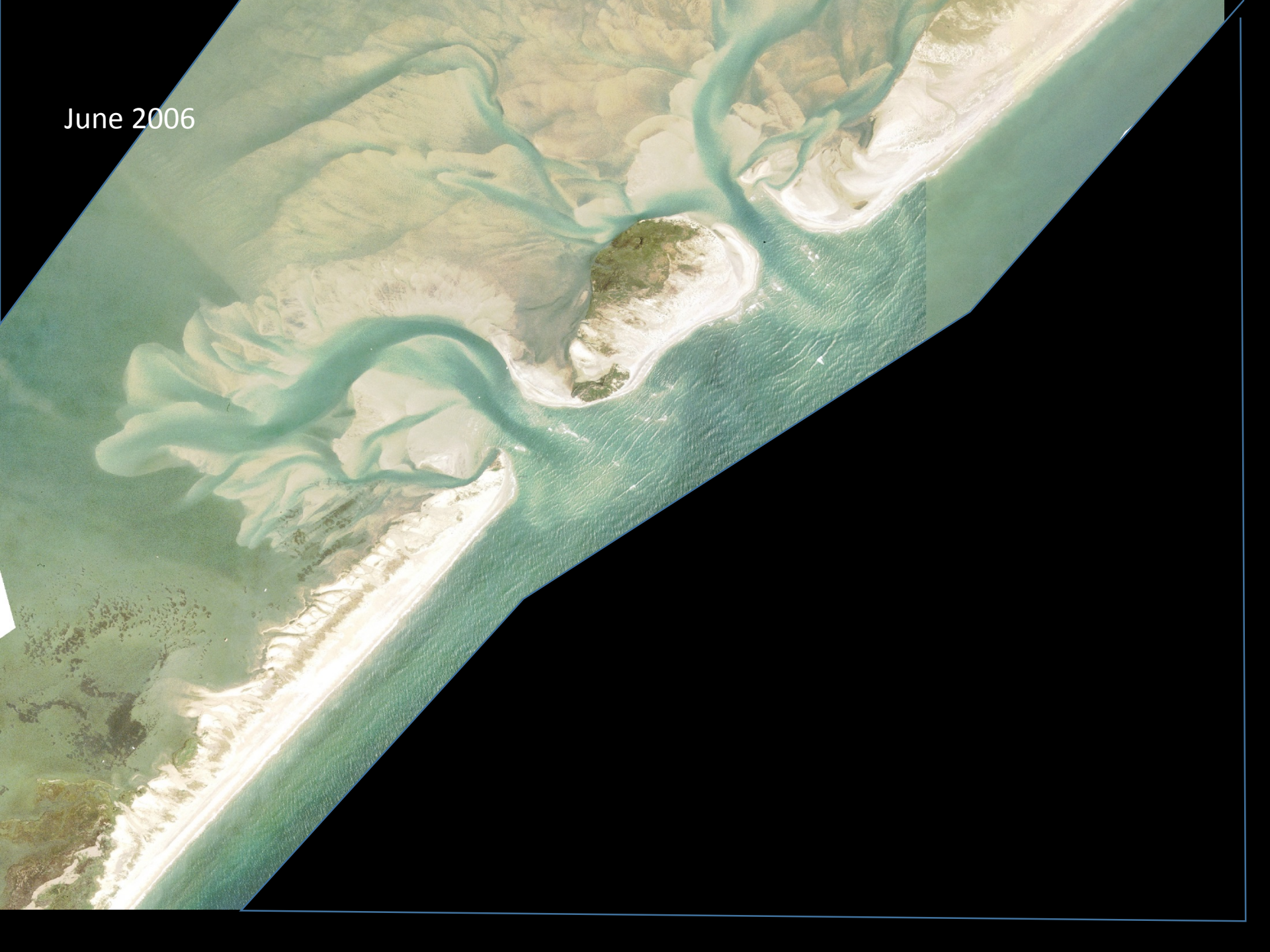


Fire Island New York

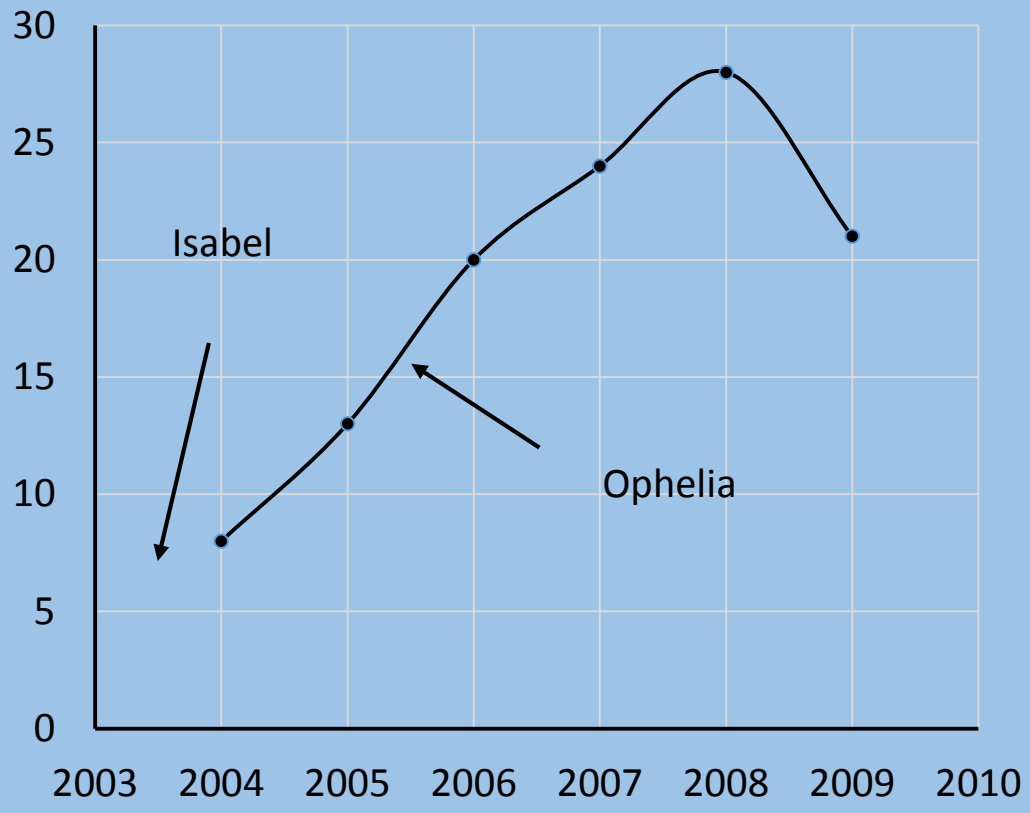
~ Tripled in 3 years

13 – 39 Pairs

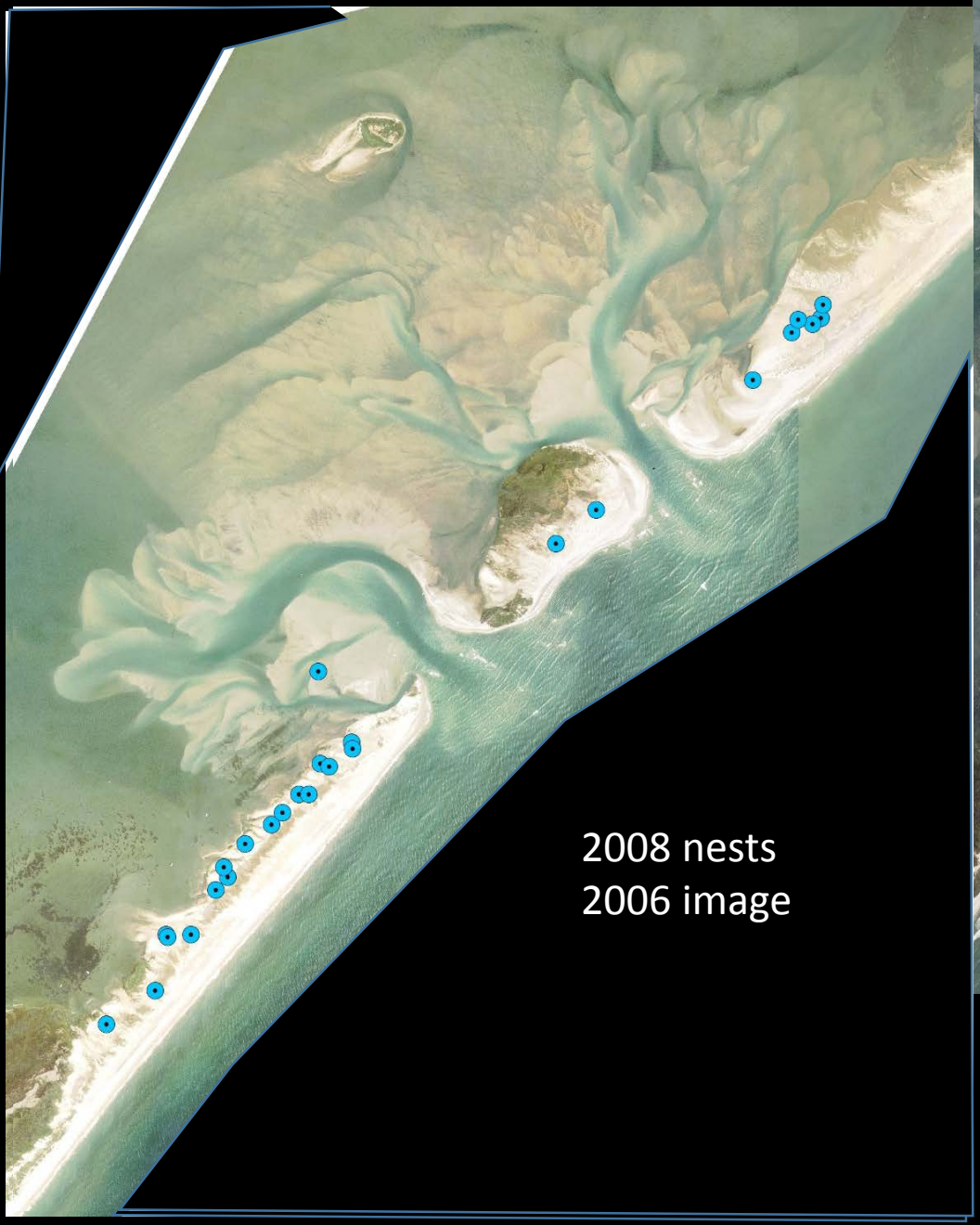

Core Sound
Feb 2003
Ophelia Inlet
Image © 2016 DigitalGlobe
Image U.S. Geological Survey
1153 m
Google earth
Tour Guide
1993
Imagery Date: 2/10/2003 lat 34.857079° lon -76.354364° elev -2 m eye alt 4.98 km


June 2006

Ophelia and Old Drum Inlets, NC, after Isabel and Ophelia

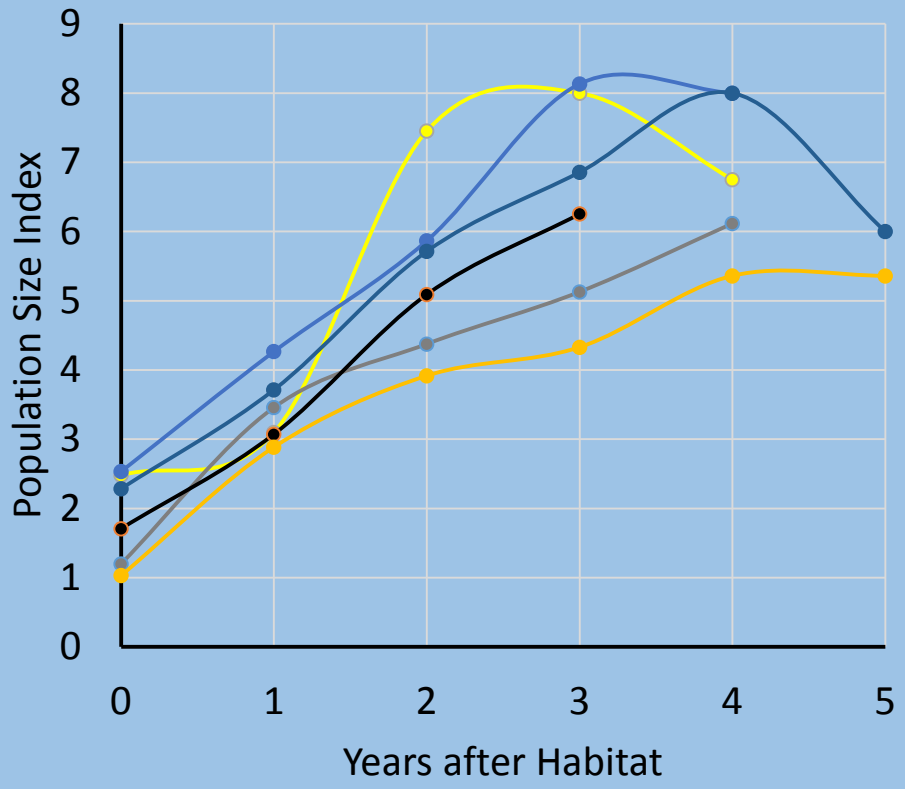


More than tripled in 3 years
(Thanks to Jon Altman, CALO)


2008 nests
2006 image

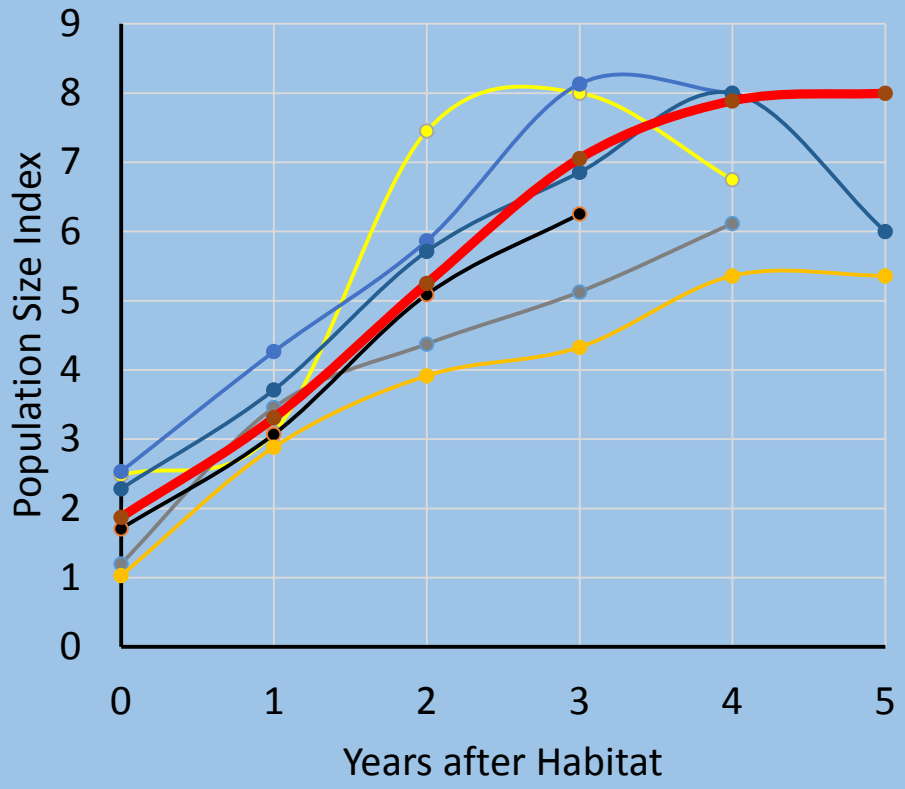

2008 nests
2009 image

All Irruptions
(scaled to K = 8)



Tripling time usually ~ 3 years

All Irruptions
(scaled to K = 8)



Tripling time usually ~ 3 years

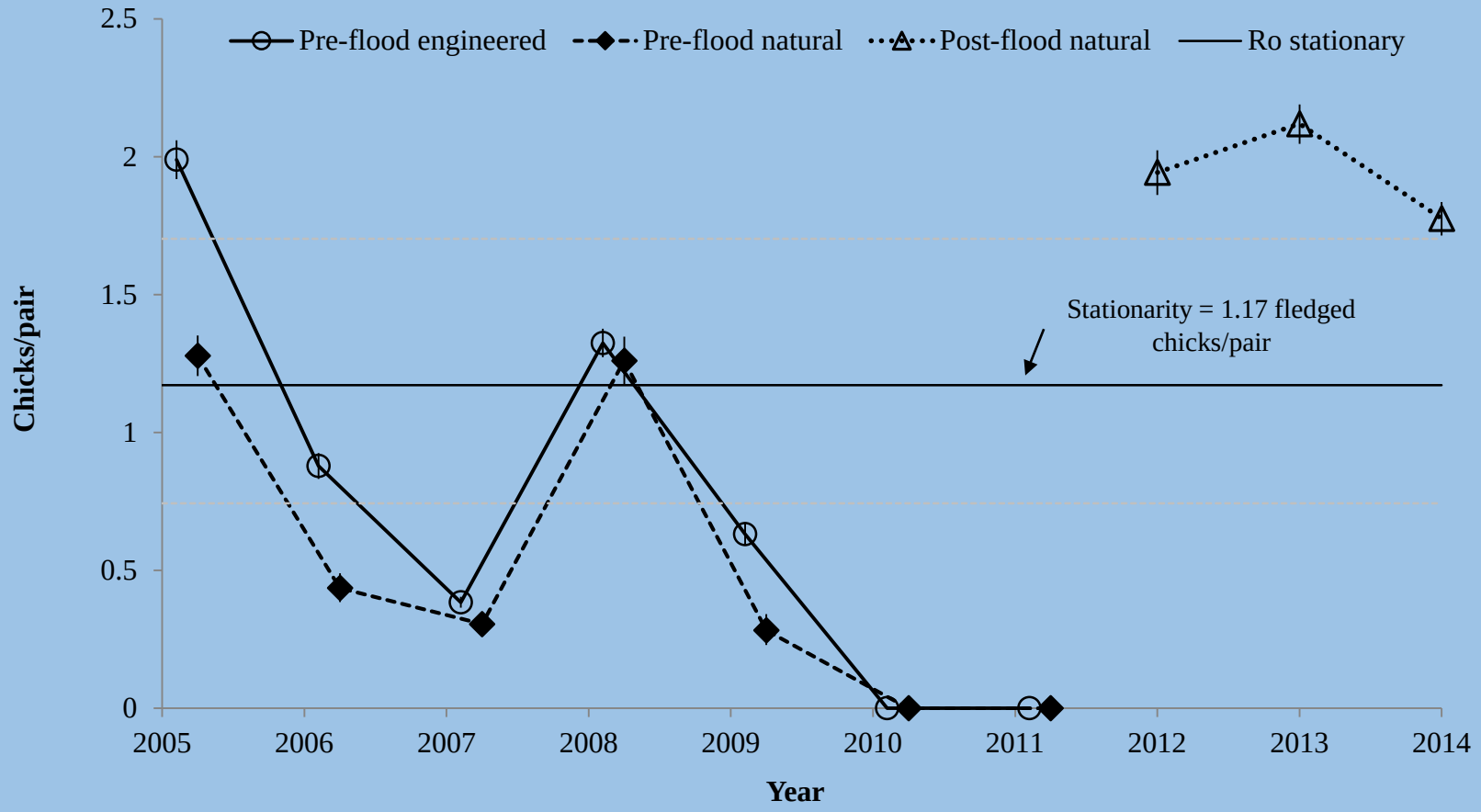
Remember, Only You Can Prevent Overwash

1922 – 2003 > 6050 km of beach “nourished”

(Peterson and Bishop 2005)

- Evidence for habitat limitation
  - Population irruptions
  - Low reproductive output

Reproductive Output, Gavins Point Reach

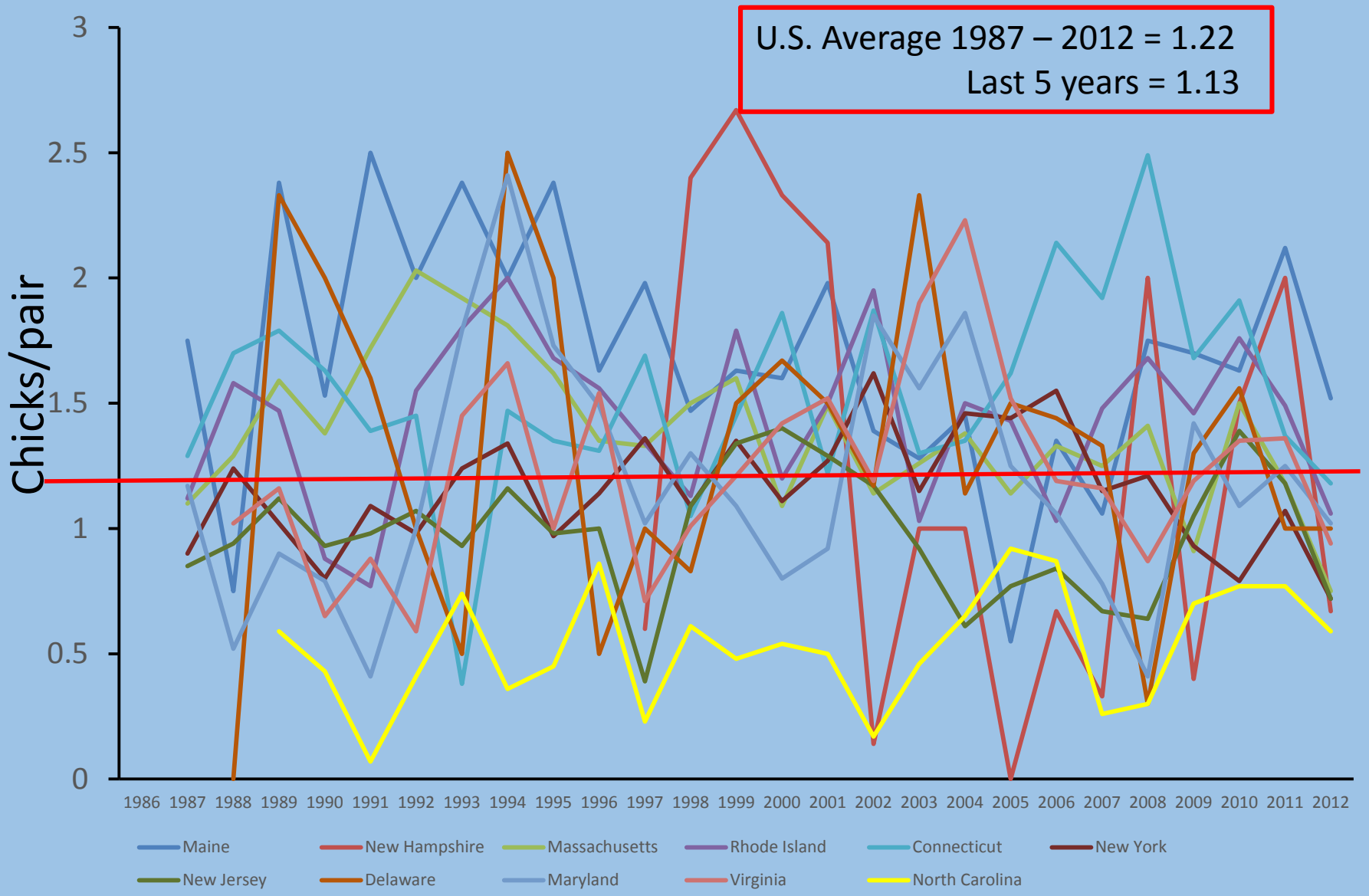


_____Predator Management_____ ___No Predator Management__

Floods created habitat: 1900 ha in 2012

Catlin et al. 2015, Wildlife Monograph, Hunt 2016 thesis, Hunt , Catlin, and Fraser, in prep.

Chicks/Pair by State



Chicks/Pair Required for a Stationary Population

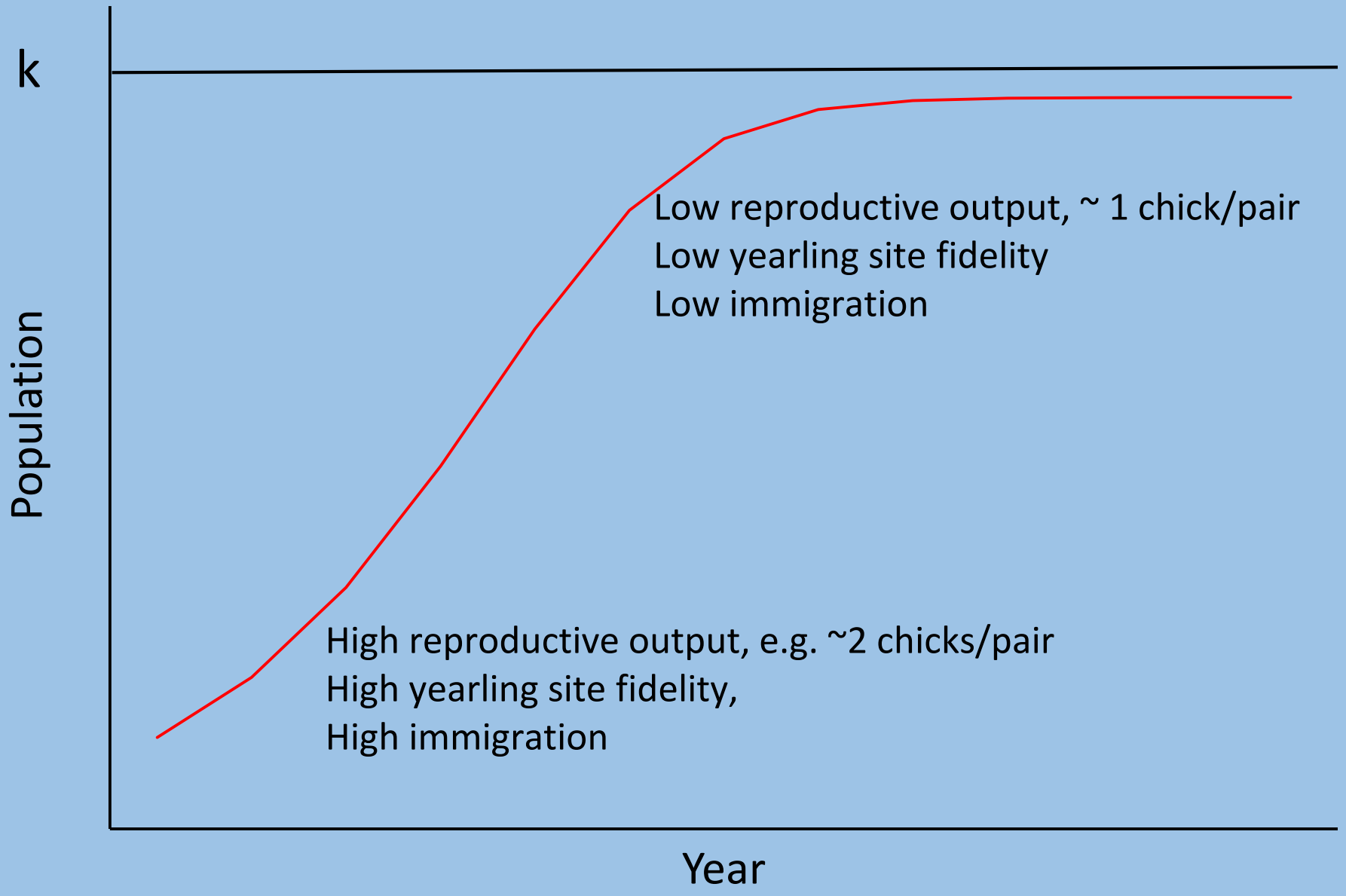
	Survival Adult, Juv	Ro Needed	
Massachusetts	0.74, 0.48	1.245	Melvin and Gibbs 1996
Westhampton Dunes, NY	0.75, ?	>1.24	Cohen et al. 2006
Prairie Canada	0.80, 0.57	0.86	Cohen and Gratto Trevor 2011
Missouri River	0.76, 0.44	1.25	Catlin et al. 2015
Southern Recovery Unit		0.93	Hecht and Melvin 2009

Outline

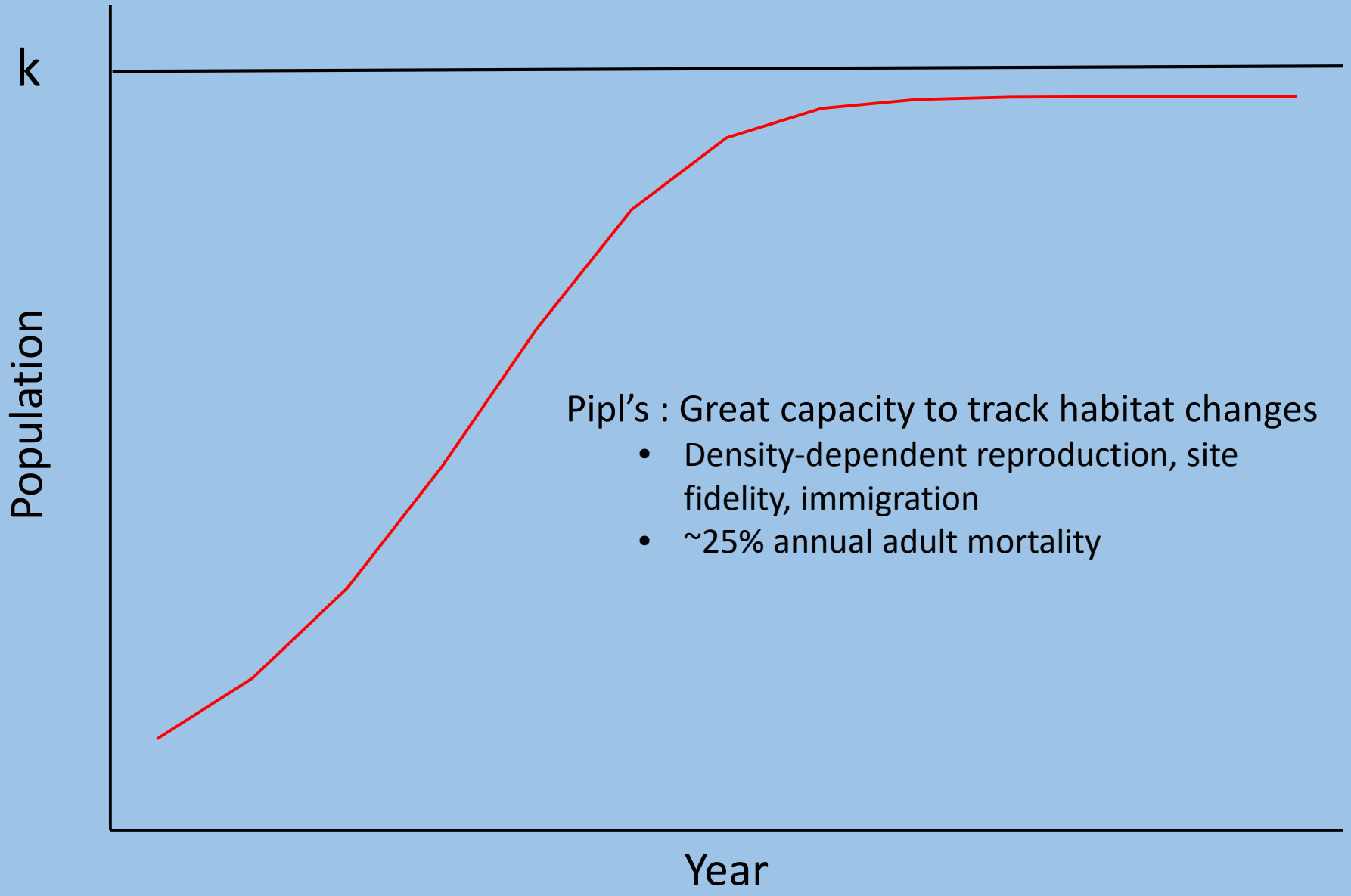
- What is good habitat
- Evidence for habitat limitation
- Regulation
- Implications for Cape Hatteras National Seashore

So, Piping Plovers are habitat limited

- How does that work?

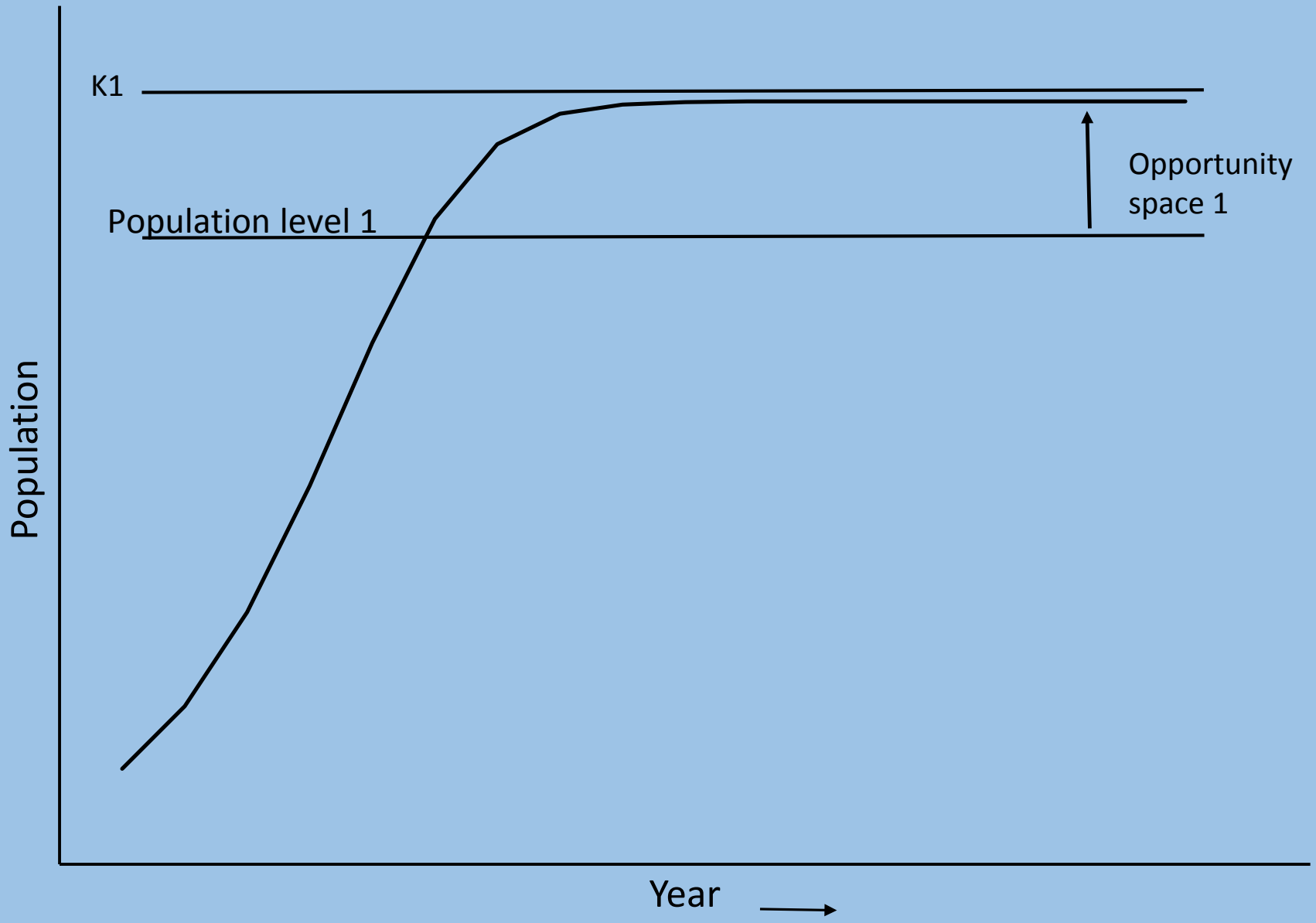


Catlin et al. 2015 Wildlife Monograph, Hunt et al in prep.



Pipl's : Great capacity to track habitat changes

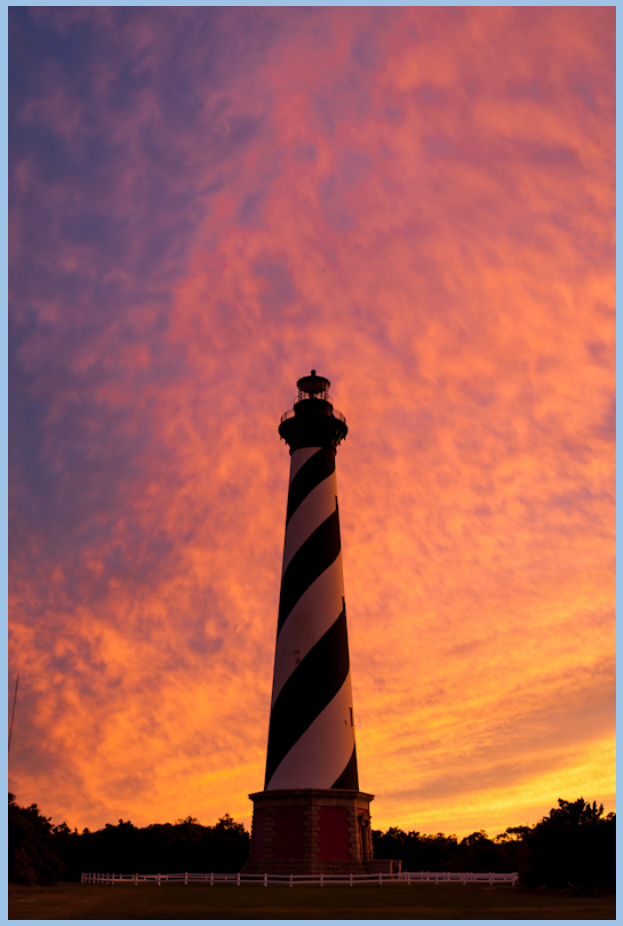
- Density-dependent reproduction, site fidelity, immigration
- ~25% annual adult mortality


K1
Population level 1
Opportunity space 1
Population
Year

To Increase a Population

- Unoccupied habitat
- Recruitment
  - Local recruitment
  - Immigration

Cape Hatteras National Seashore

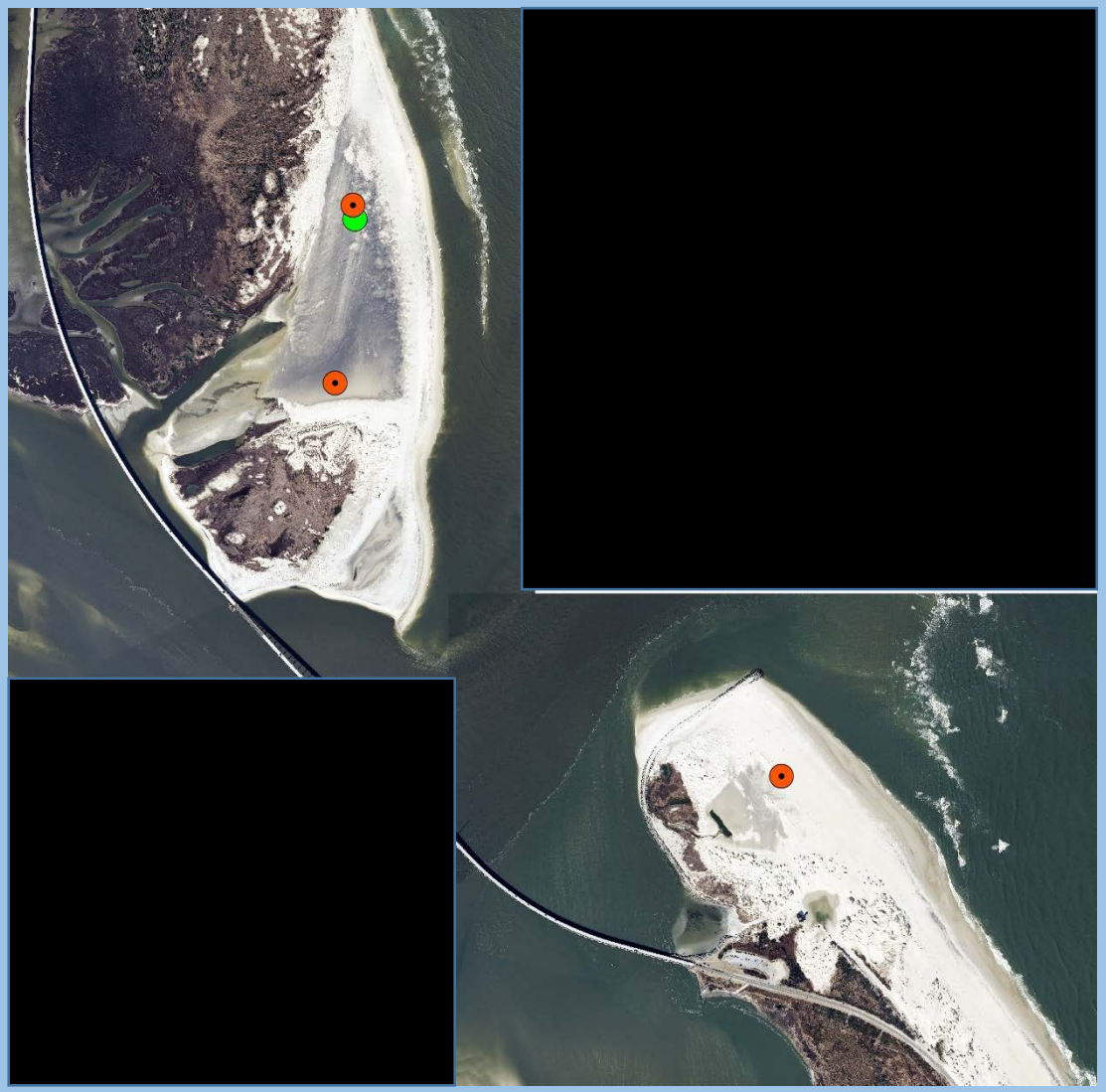


Oregon Inlet

2015 nest 1 pr Bodie

2016 nest 2 prs Bodie

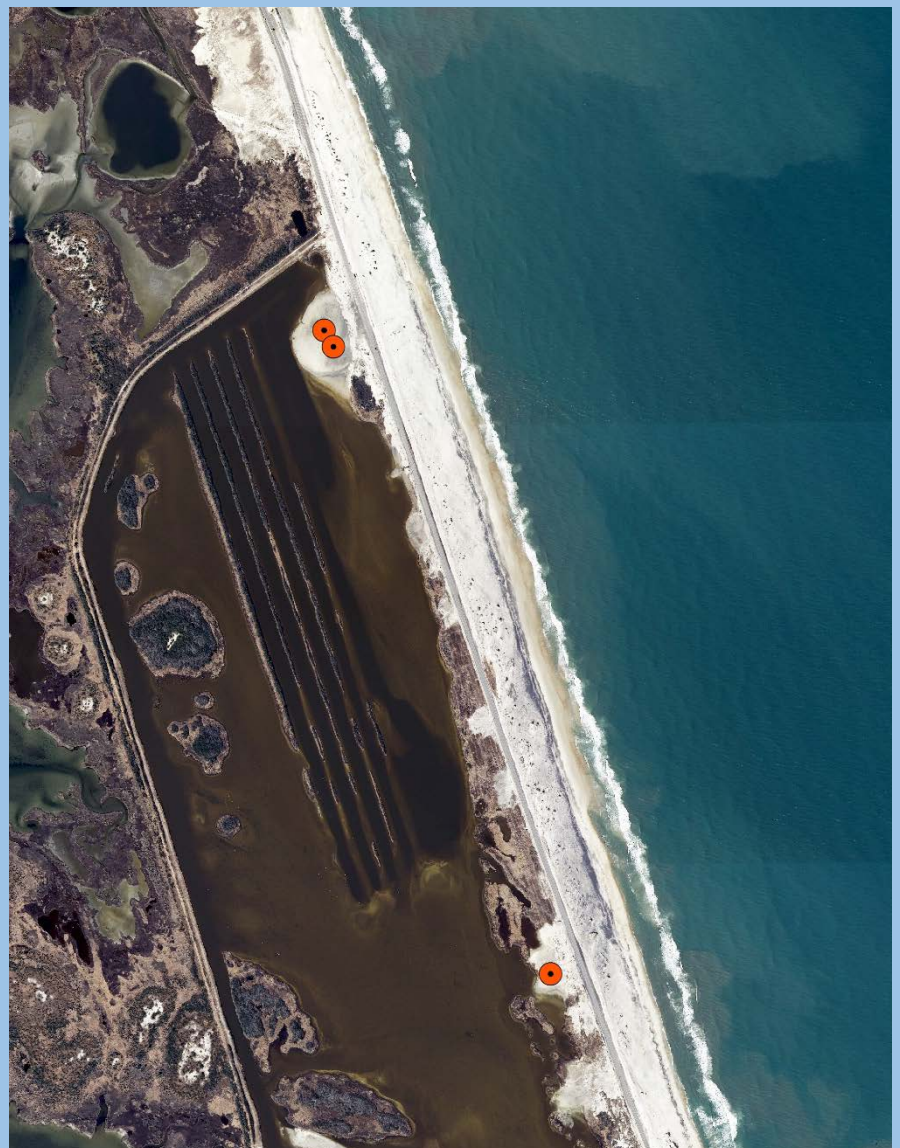
2014 imagery



Pea Island South

2015 nest
2016 nest

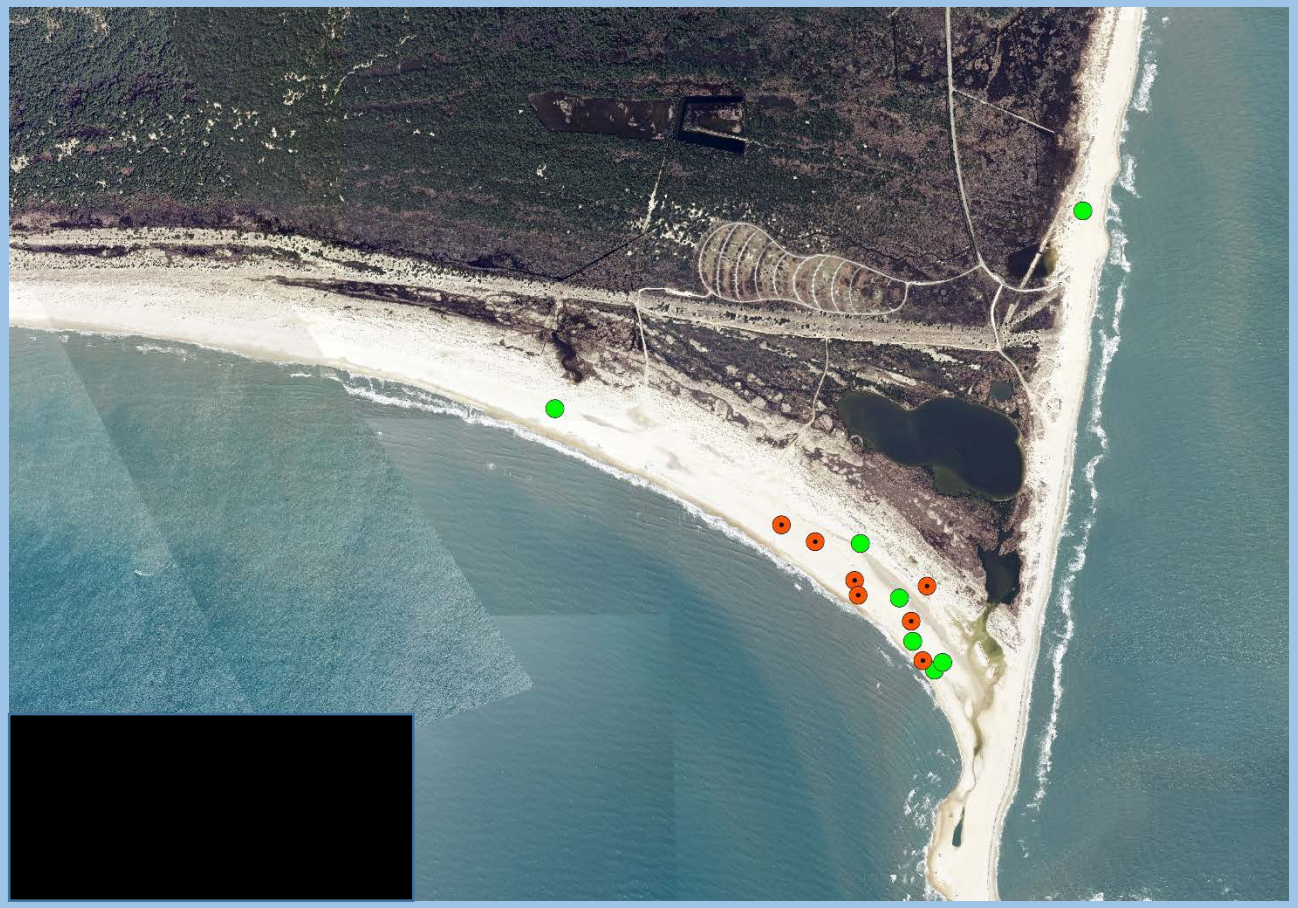
2014 imagery



Cape Point

2015 nest 5 prs
2016 nest 5 prs

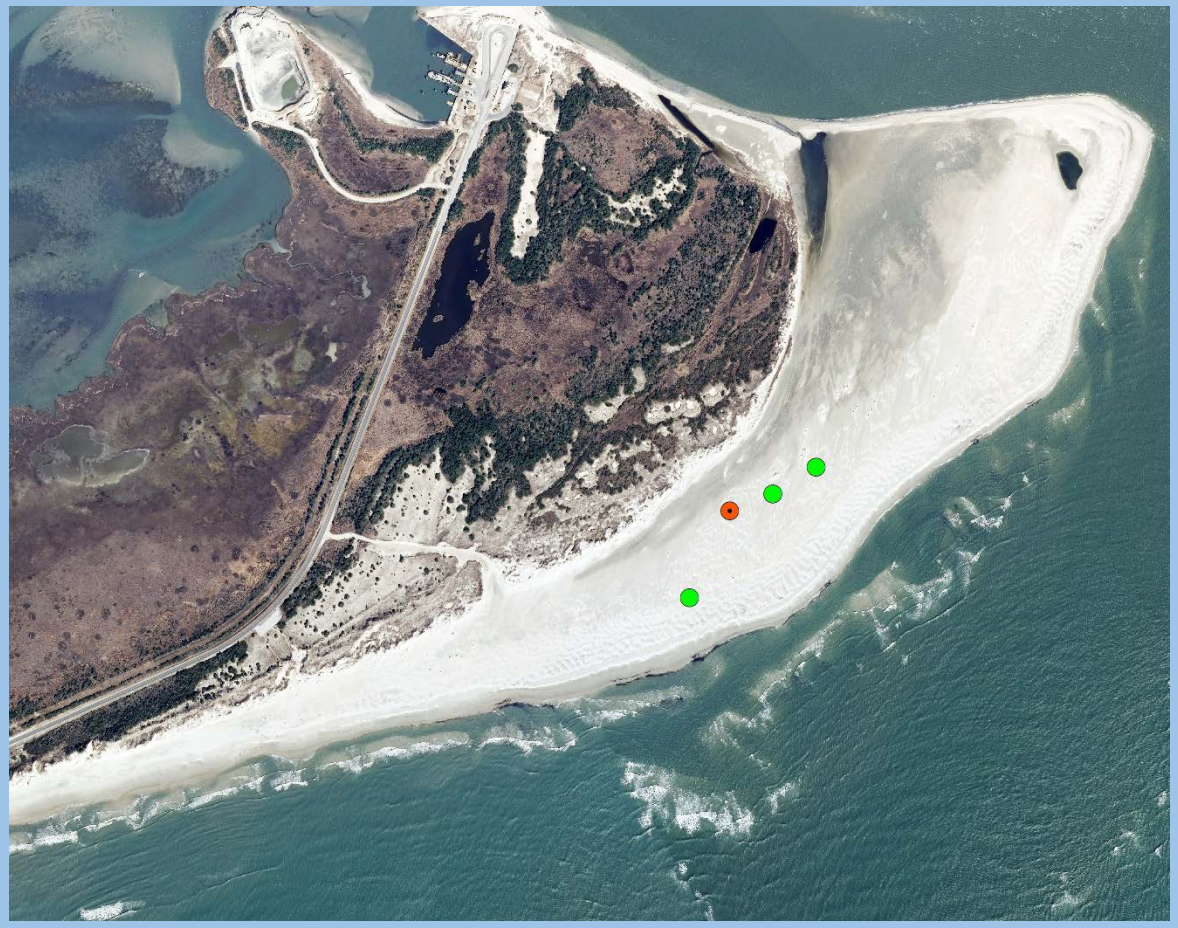
2014 imagery



Ocracoke North

2015 nest 2 prs
2016 nest 1 pr

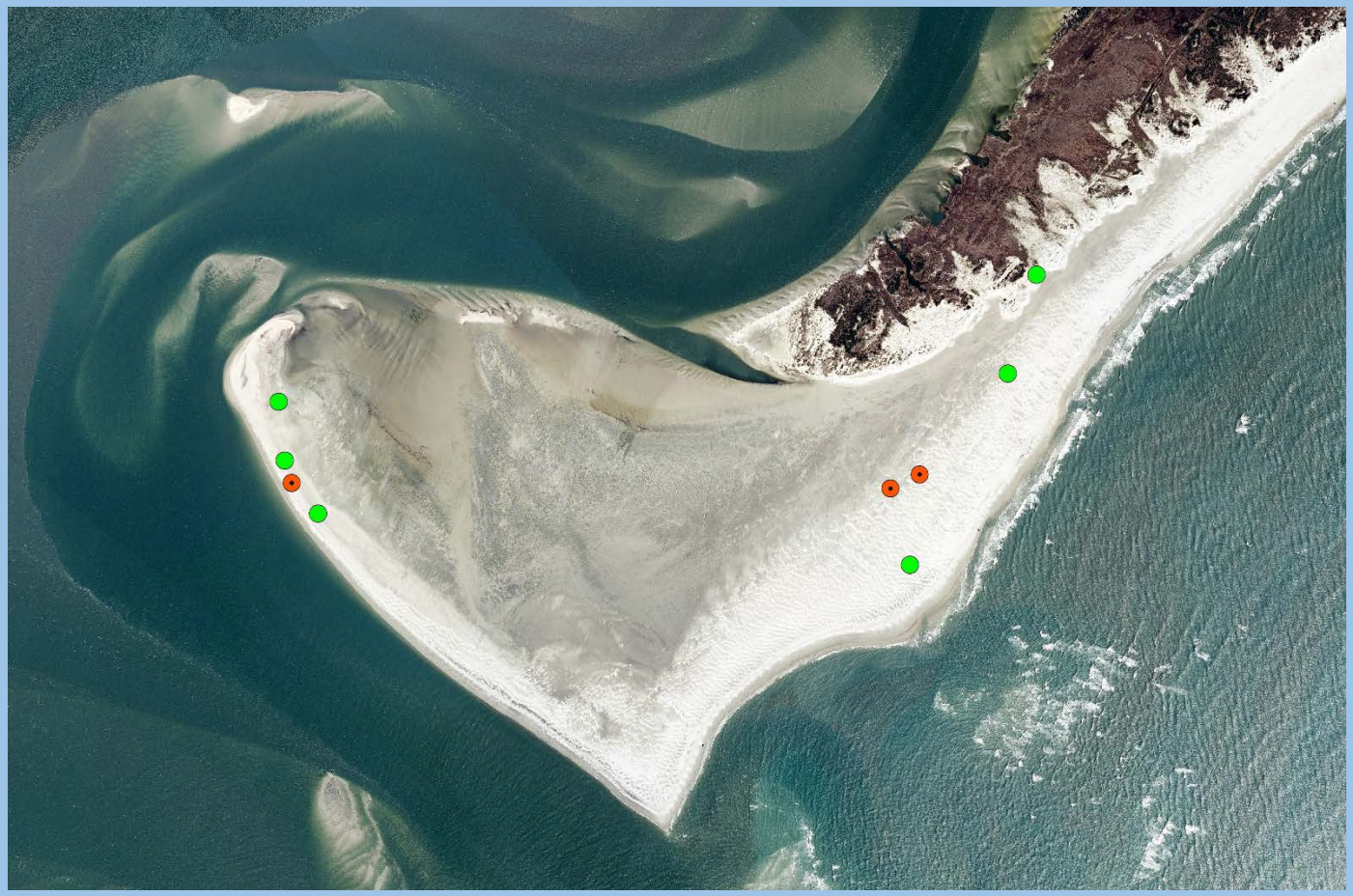
2014 imagery



Ocracoke South

2015 nest 6 prs
2016 nest 2 prs

2014 imagery



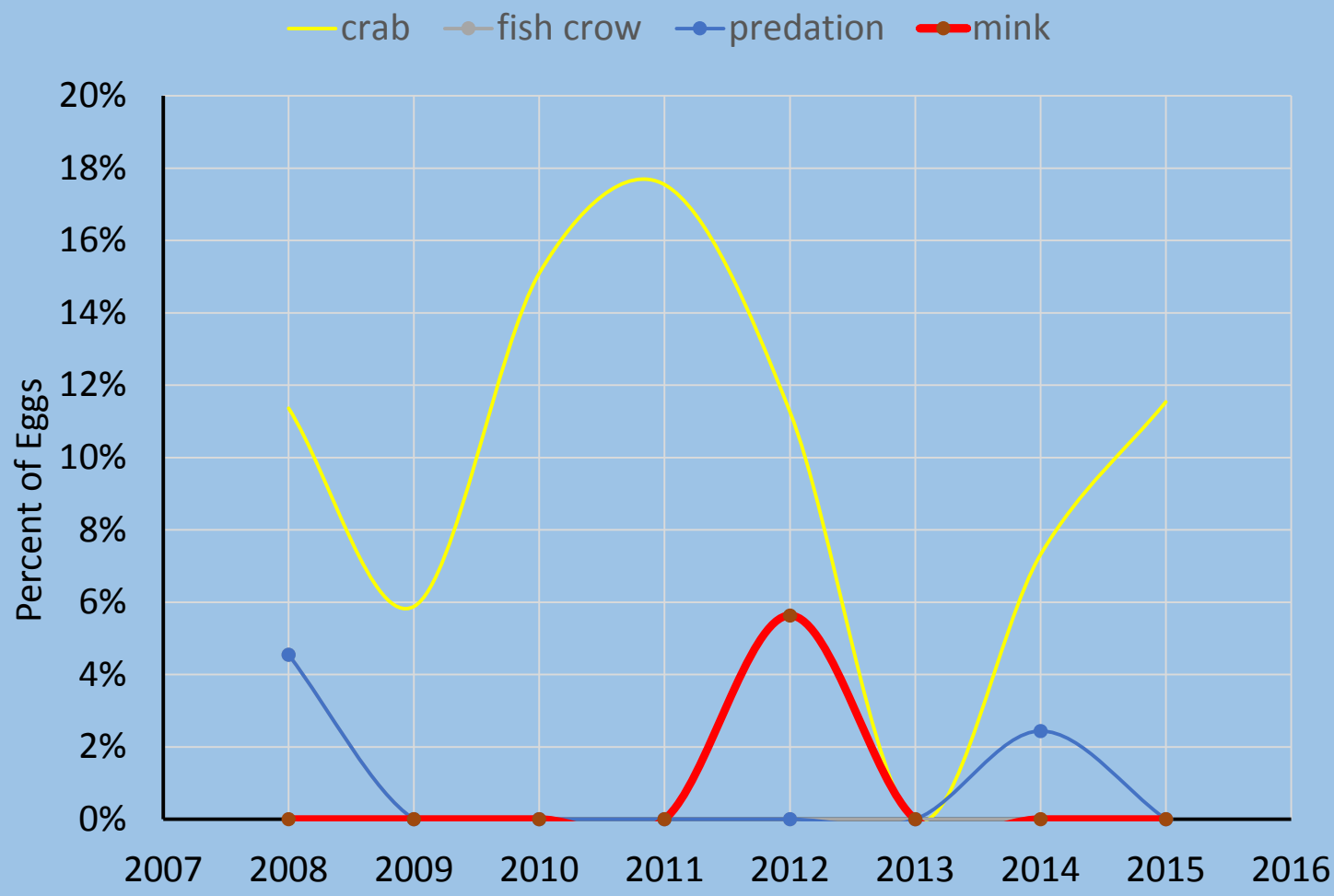
Desired Future Conditions

TABLE 1. DESIRED FUTURE CONDITIONS FOR PIPING PLOVERS

Variable	Short-Term Target	Long-Term Target	Source
Number of breeding pairs	15	30	Short-term target from highest number of pairs recorded at Cape Hatteras National Seashore (1989) and the Biological Opinion (USFWS 2006a)[a]; Long-term target from the Piping Plover Recovery Plan (USFWS 1996a, appendix B)
Fledge rate	5-year average of 1.0 chick per pair	5-year average of 1.5 chicks per pair[b]	Short-term target from the Biological Opinion (USFWS 2006a); long-term target from the Piping Plover Recovery Plan (USFWS 1996a)
Depredation rate	5-year average rate of mammalian depredation of eggs is <10%	Same as short-term target	Adapted from the Piping Plover Recovery Plan (USFWS 1996a)[c]

From Final EIS, Cape Hatteras National Seashore.
Off-Road Vehicle Management Plan

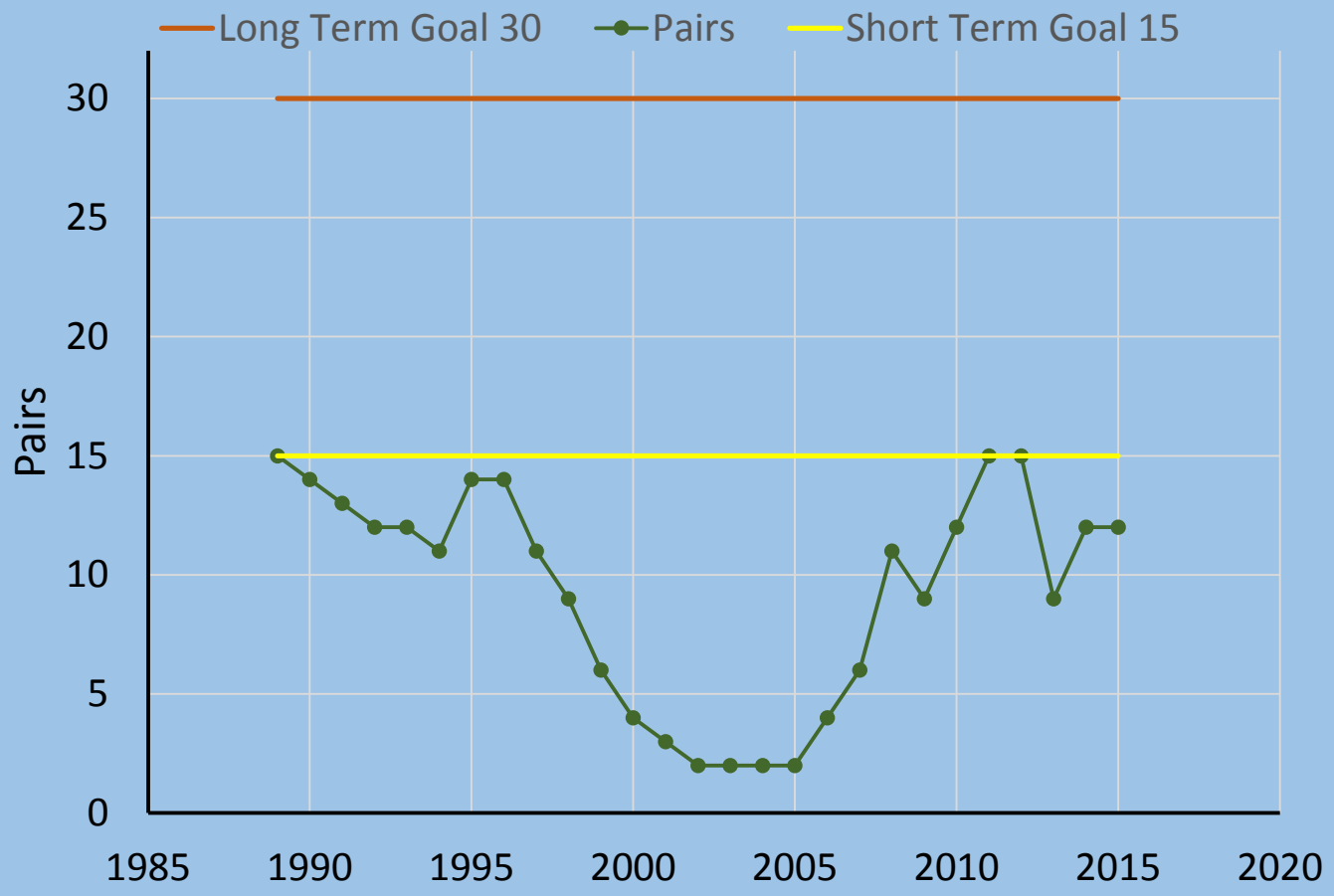
Desired Mammalian Depredation Rate <10% of Eggs



CAHA UNPUBLISHED DATA

Desired Number of Breeding Pairs

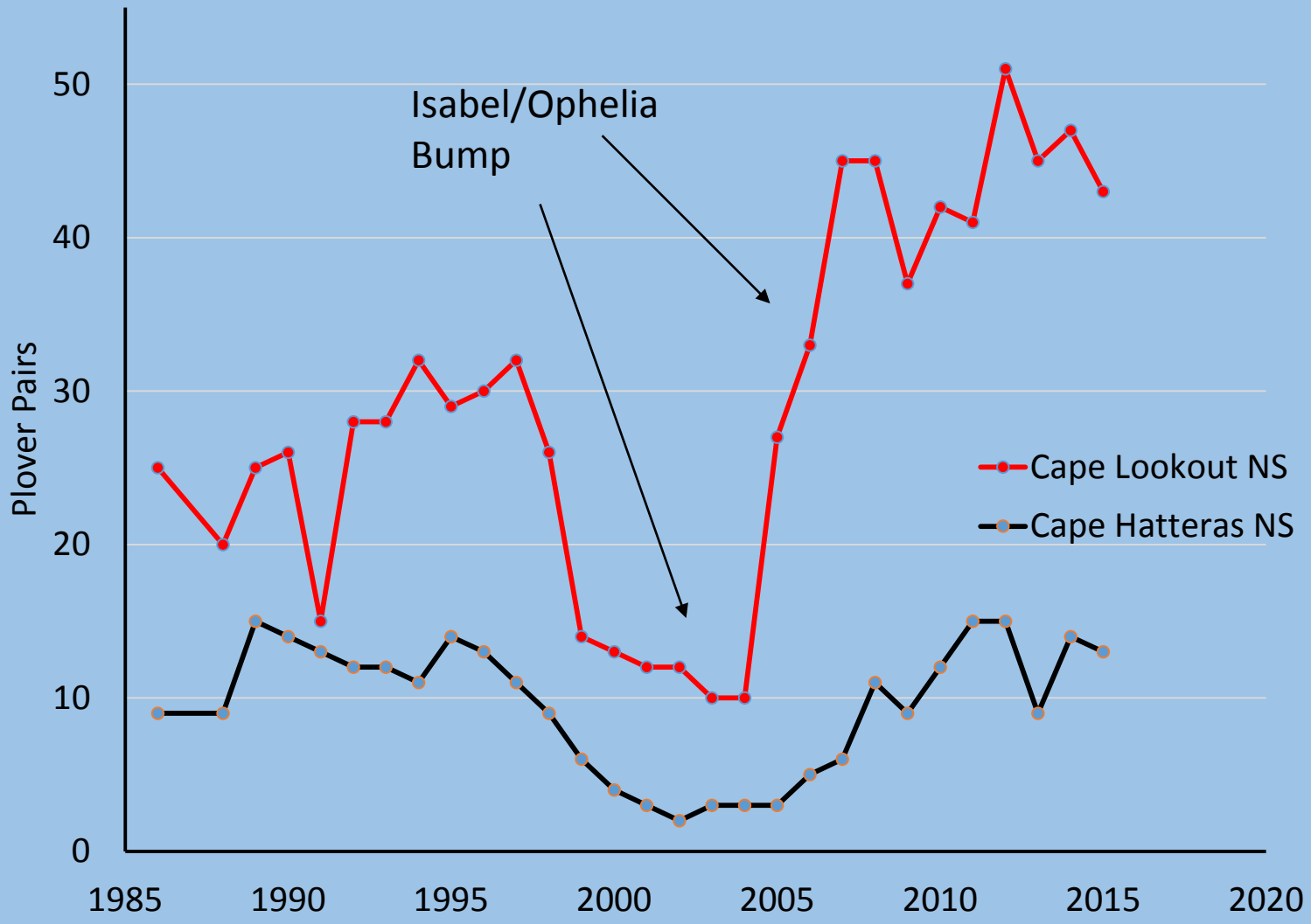
15 short term, 30 long term



CAHA UNPUBLISHED DATA


DEERE

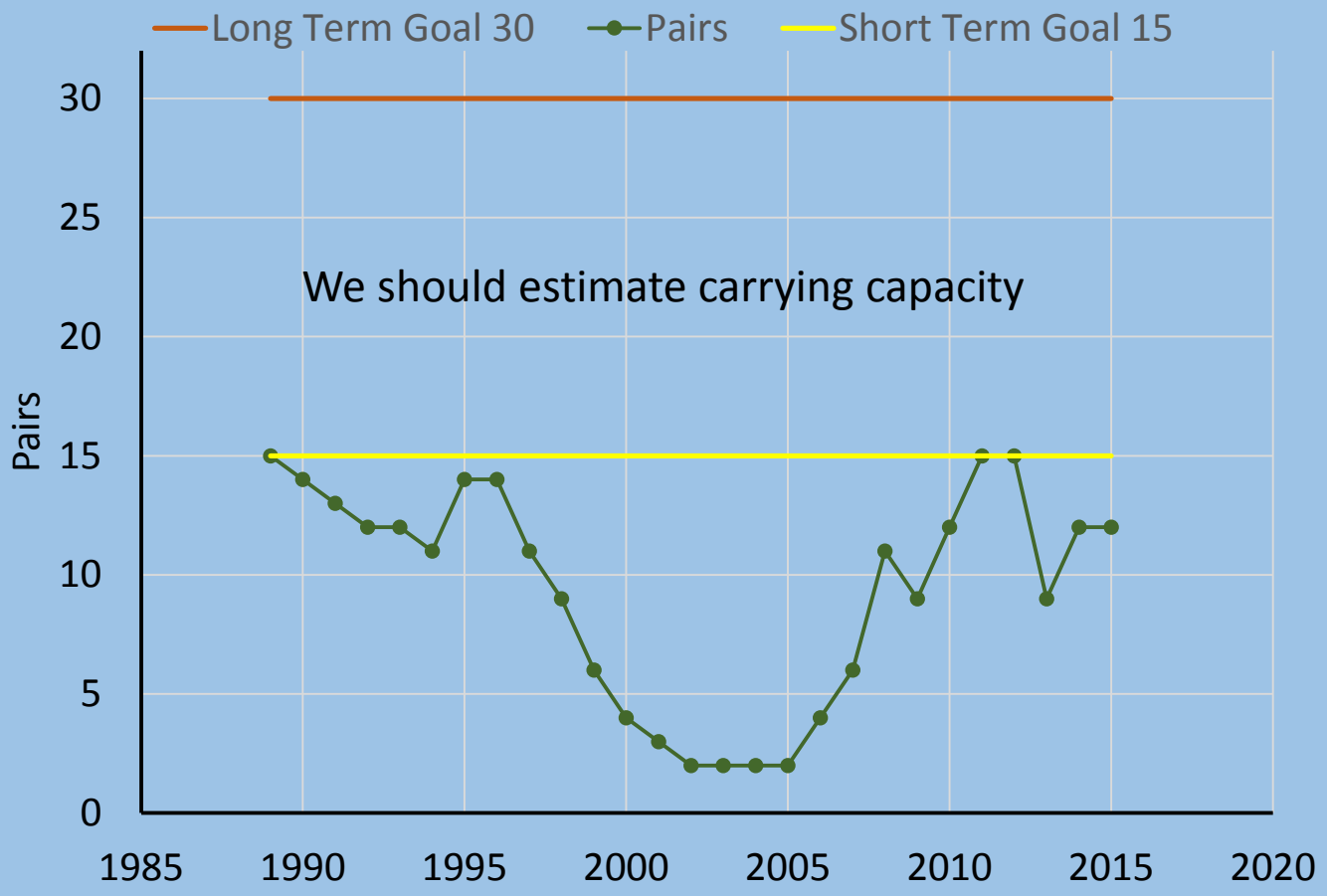
Piping Plover Pairs CALO, CAHA



CAHA, CALO UNPUBLISHED DATA

Desired Number of Breeding Pairs

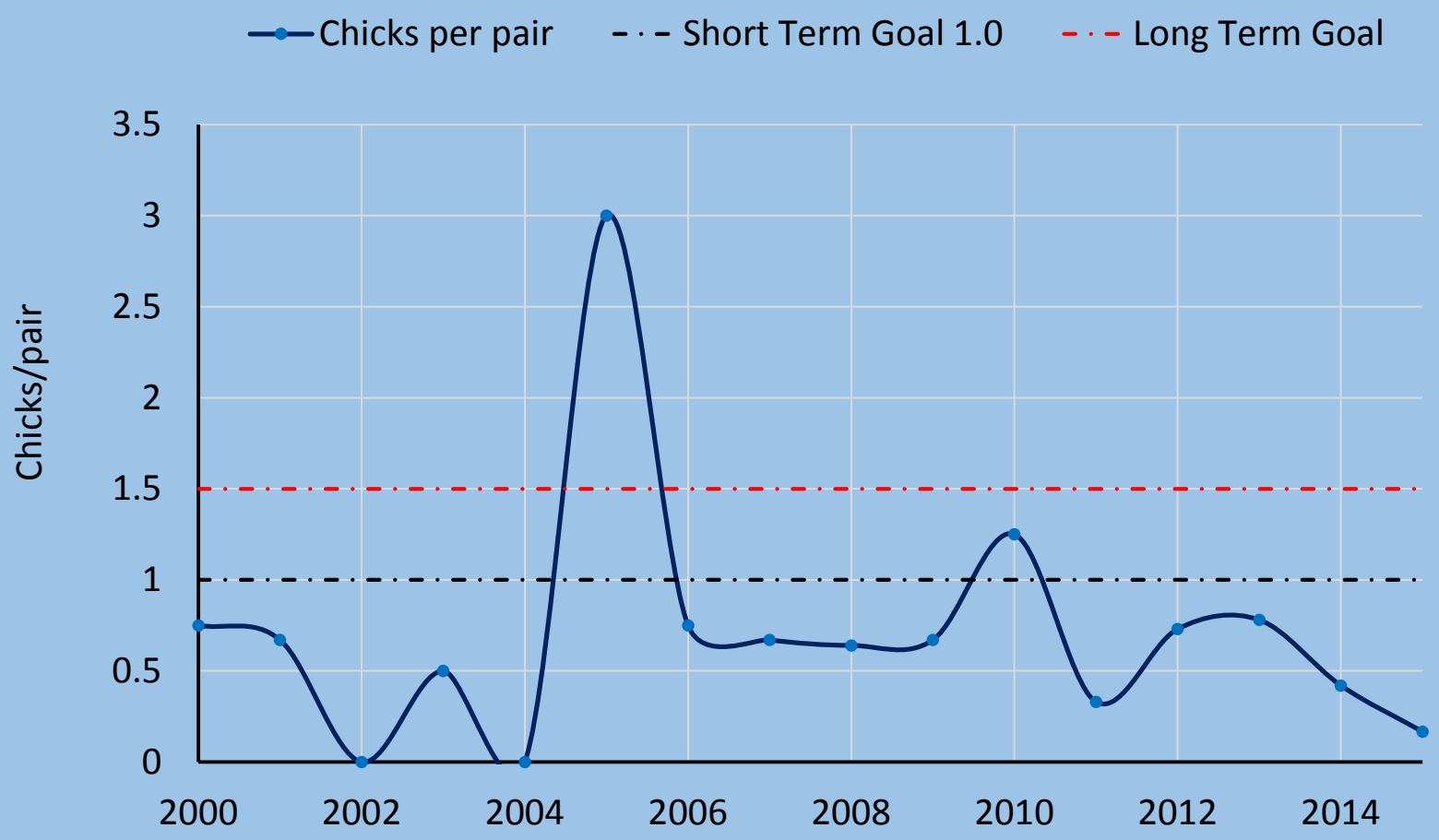
15 short term, 30 long term



CAHA UNPUBLISHED DATA

Desired Fledge Rate

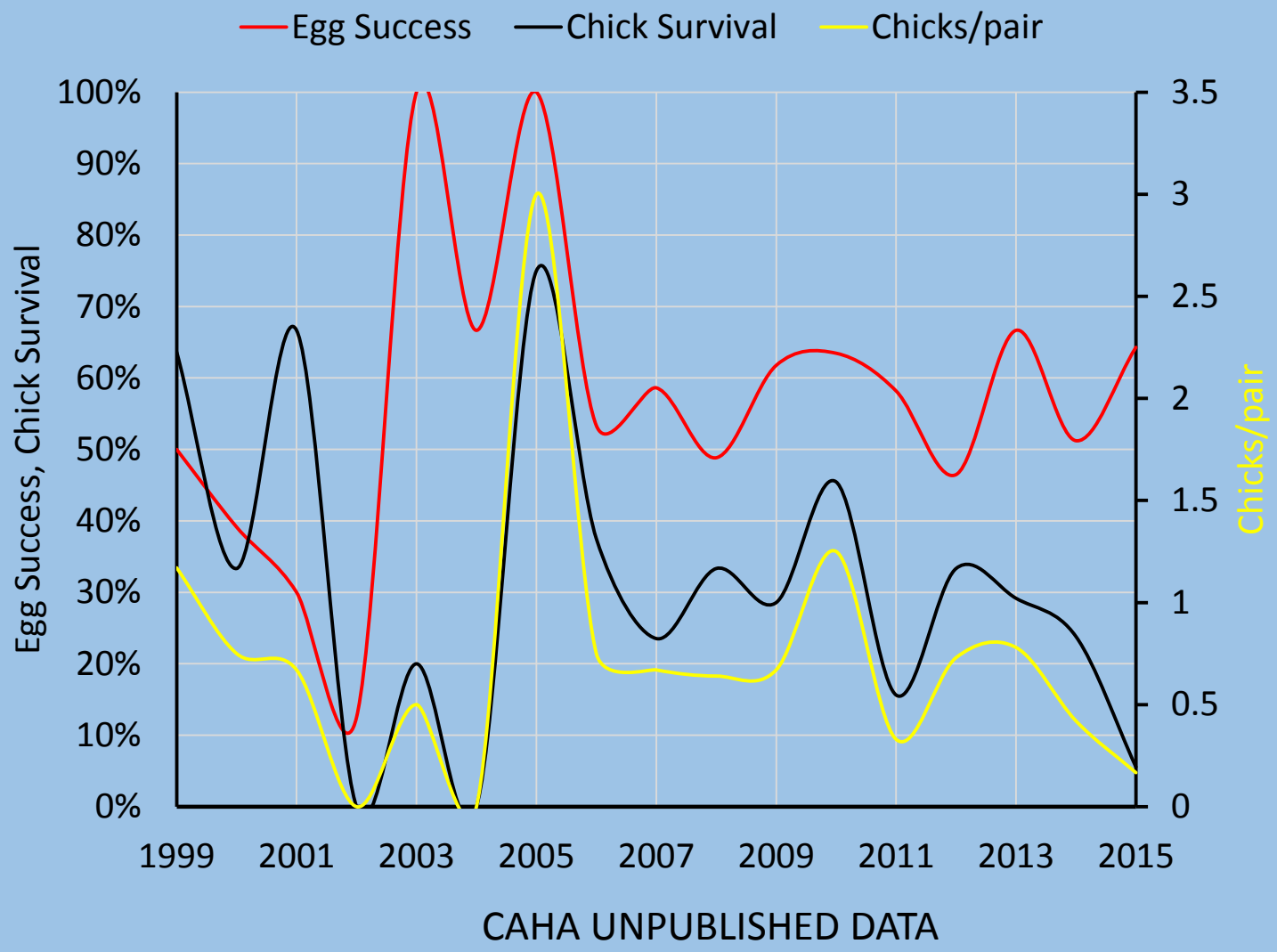
Short term 1.0 chicks/pair, long term 1.5



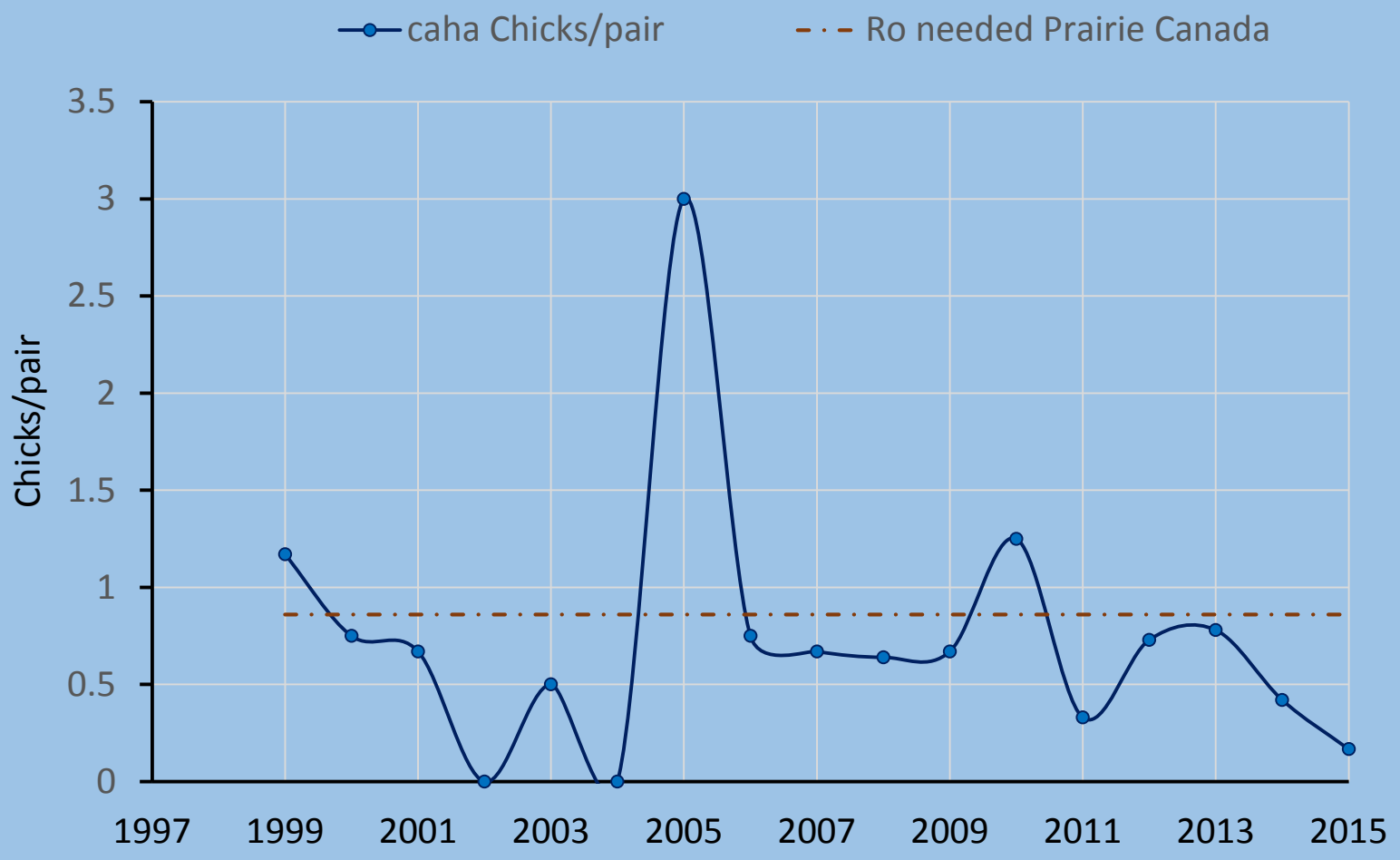
CAHA UNPUBLISHED DATA

U.S. State Average last 5 years = 1.13

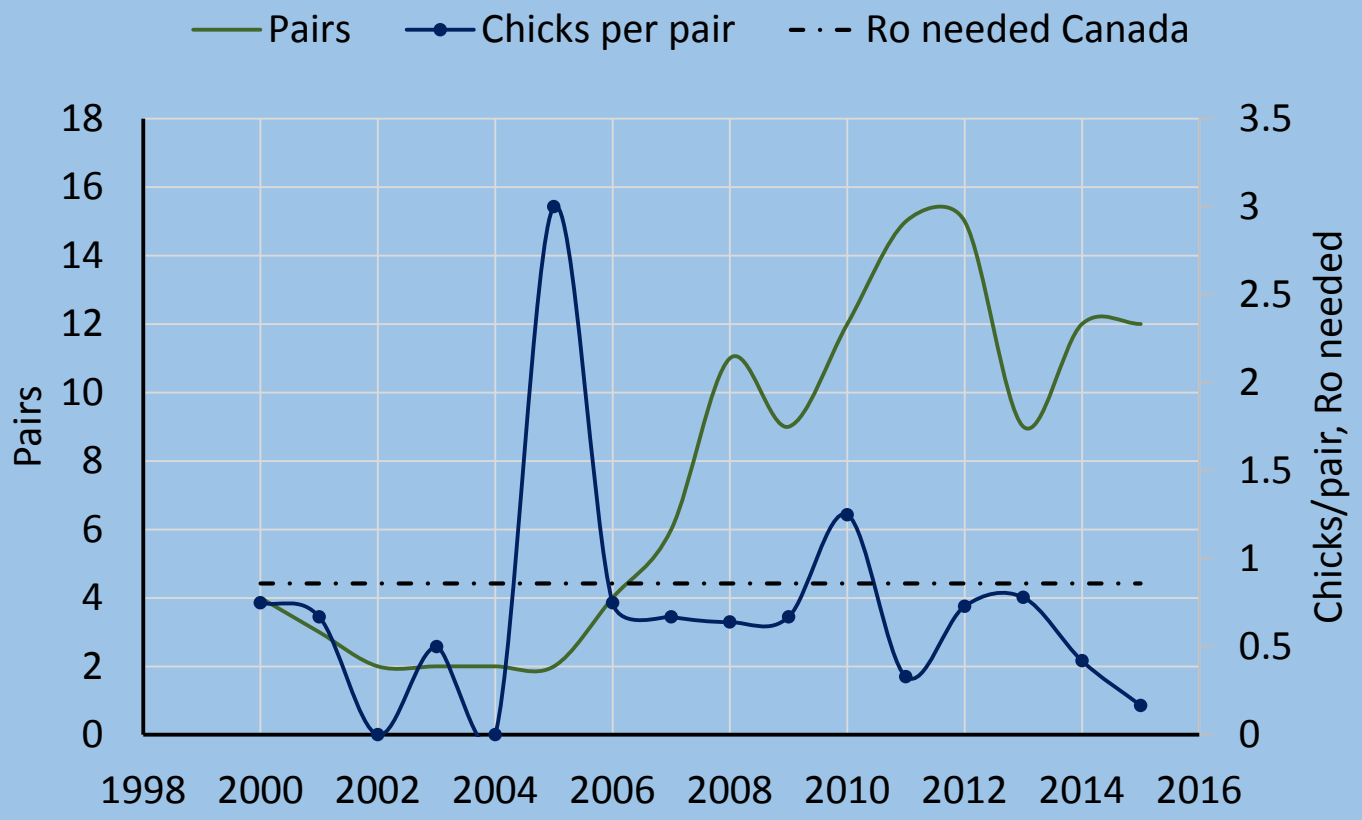
Egg Success, Chick Survival and Chicks/Pair



CAHA Reproduction and Reproductive Output Needed for a Stationary Population from other Places

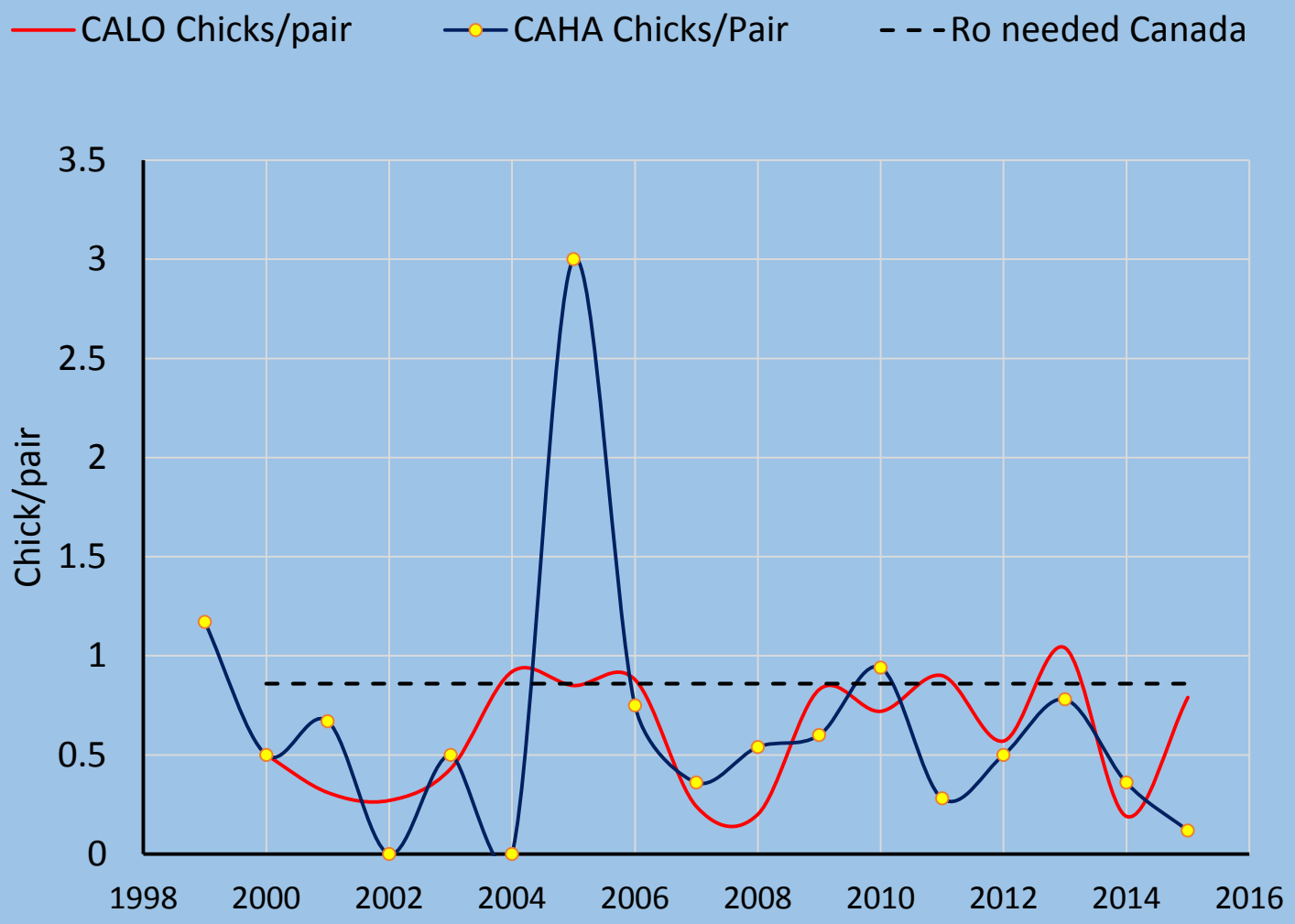


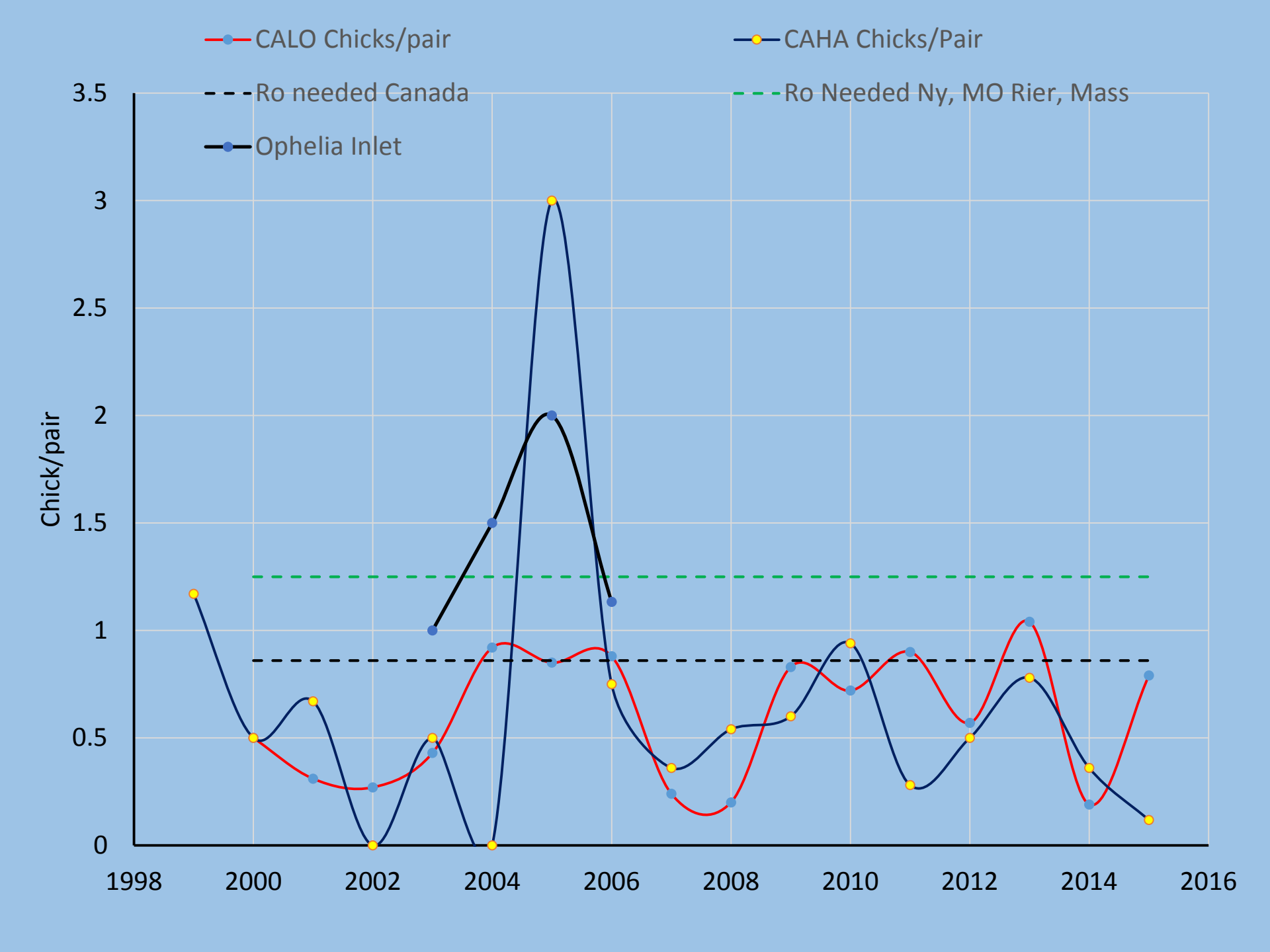
CAHA Reproduction and Growth



We should estimate Ro needed for Stationarity for CAHA (and CALO) and use that as a basis for revising reproductive goal

CAHA and CALO Reproductive Output




CALO Chicks/pair
CAHA Chicks/Pair
Ro needed Canada
Ro Needed Ny, MO Rier, Mass
Ophelia Inlet
Chick/pair
3.5
3
2.5
2
1.5
1
0.5
0
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016

Chicks/Pair Required for a Stationary Population

	Survival Adult, Juv	Ro Needed	
Massachusetts	0.74, 0.48	1.245	Melvin and Gibbs 1996
Westhampton Dunes, NY	0.75, ?	>1.24	Cohen et al. 2006
Prairie Canada	0.80, 0.57	0.86	Cohen and Gratto Trevor 2011
Missouri River	0.76, 0.44	1.25	Catlin et al. 2015
Southern Recovery Unit	-	0.93	Hecht and Melvin 2009
Cape Hatteras National Seashore	0.38 (return rate)	?	Weithman et al. 2016

What Reproduction is Needed for a Stationary Population?

- Is CAHA a sink, dependent upon immigration from elsewhere?
- Or, is the Ro needed for stationarity lower than all previous estimates?
- What is the demographic relationship between CALO and CAHA?

Research Needs

- Ro needed for stationary population CAHA, CALO (ongoing for CAHA, should add CALO)
- Carrying Capacity CAHA
- Factors affecting Ro (ongoing)
- Brood movements (to assist with factors affecting Ro and mandated visitor access ongoing)
- Nest habitat selection (to assist with carrying capacity)
- Movements between CALO and CAHA
- Habitat Use and Survival of Migrating and Wintering plovers on CAHA