April 28, 2015

MEMORANDUM

TO: **Council members**

FROM: **Jim Ruff**

SUBJECT: **Quantifying Avian Predation on Fish Populations presentation**

BACKGROUND:

Presenters: Allen Evans, Fisheries Scientist with Real Time Research, Inc. and Dan Roby, Professor and Unit Leader of the Oregon Cooperative Fish and Wildlife Research Unit at Oregon State University.

Summary: Avian predation on ESA-listed fish populations is a concern among fisheries managers. To more accurately measure population-level impacts of predation, an integrated tag-recovery model was applied that accounts for the fraction of fish tags consumed by birds that are not subsequently deposited on their nesting colonies. Results indicate that predation rates (the percentage of tagged fish consumed) by Caspian terns, double-crested cormorants, and California gulls were higher than those calculated based solely on the proportion of fish tags deposited on-colony, especially when predation by gulls nesting in the Columbia Plateau region were considered. The methods improve the accuracy of tag recovery approaches to estimate predation impacts and the results have been incorporated into the most recent avian management and evaluation plans, including the U.S. Army Corps of Engineers' Columbia River Estuary Double-crested Cormorant Environmental Impact Statement. These results, along with an update on the status of fish-eating waterbird colonies (size and locations) in the Columbia River Basin, will be presented.

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Relevance: This information is relevant because preserving Fish and Wildlife Program effectiveness by supporting expanded management of predators, including avian predators, is a high priority identified in the Program. Management of predator birds is a key sub-strategy identified in the Program. A Program measure calls on the federal action agencies to continue to implement predator bird management actions in the Columbia Basin in coordination with state and federal fish and wildlife agencies and tribes.

Workplan: This presentation addresses Council work plan item 2.B, which promotes regional fish and wildlife recovery by prioritizing and implementing 2014 Fish and Wildlife Program actions.

Background: This presentation will summarize the findings from a recent scientific paper entitled, “Quantifying Avian Predation on Fish Populations: Integrating Deposition Probabilities in Tag Recovery Studies on Bird Colonies.” The authors of this paper are Nathan Hostetter, Allen Evans*, Bradley Cramer, Ken Collis, Donald Lyons and Daniel Roby*. The paper is available for review upon request.

More Info: None.

Quantifying Avian Predation on Fish Populations: Integrating Deposition Probabilities in Tag Recovery Studies on Bird Colonies

Briefing for the Northwest Power and Conservation Council May 5, 2015

OSU Oregon State University

RTR REAL TIME RESEARCH

USGS science for a changing world

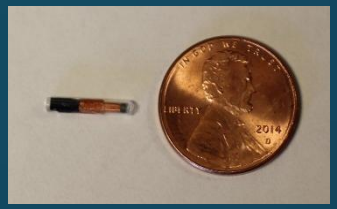
Acknowledgements

Authors: Nathan Hostetter, Allen Evans*, Bradley Cramer, Ken Collis, Donald Lyons, and Daniel Roby*

Funding: U.S. Army Corps Walla Walla District (Dave Trachtenbarg)
U.S. Army Corps Portland District (Cindy Studebaker)
Bonneville Power Administration (Dave Roberts, John Skidmore)
Grant County PUD and Priest Rapids Coordinating Committee (Curt Dotson)

Support: NOAA Fisheries (Scott Sebring, Jen Zamon, Ben Sandford)
US Fish and Wildlife (Lamont Glass)

Background



- PIT tags detected on bird colonies can be used to determine predation rates (number consumed/number available)

Advantages of Using PIT Tags

- Provides an accurate and precise measure of predation rates
- Estimates are population-specific (ESU/DPS)
- Can be used to identify which colonies pose the greatest risk to smolt survival
- Can be used to evaluate the efficacy of avian management plans
- Provides survival data to multiple RM&E programs basin-wide; over a million PIT tags detected on bird colonies since 1998; representing multiple fish families and species

Challenges of Using PIT Tags

On-colony (detectable by researchers)

Off-colony (not detectable by researchers)

- Some fraction of PIT tags consumed by birds are not deposited or detected on bird colonies; underestimating actual impacts

Methods: Deposition Trials

Present PIT-tagged fish containing known tag codes to birds

- Five years of research (2004-2006; 2012-2013)
- Three bird species, seven different nesting colonies
- 2,696 tagged fish consumed

California Gull

Caspian Tern

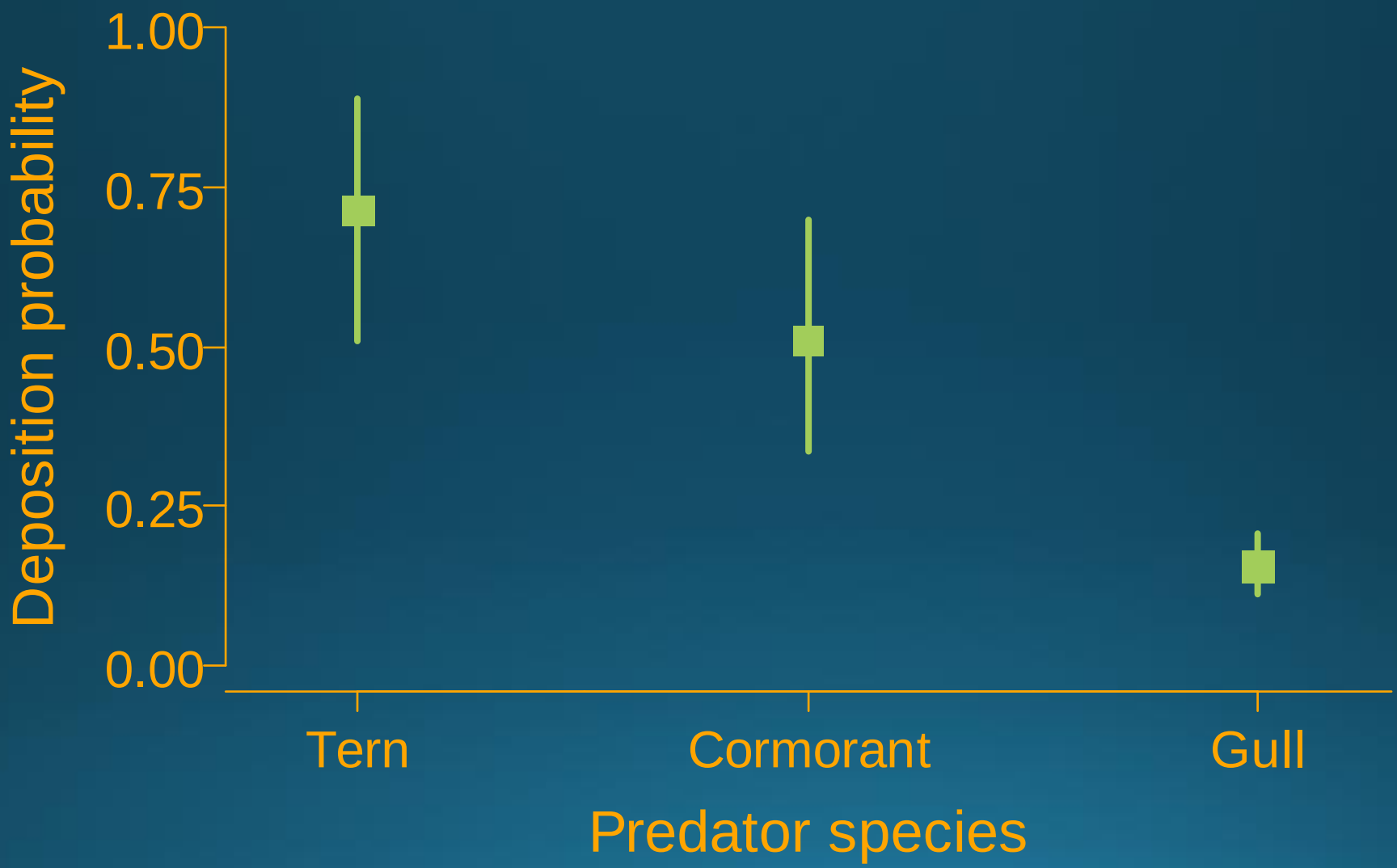
Double-crested Cormorant

Methods: PIT Tag Scanning

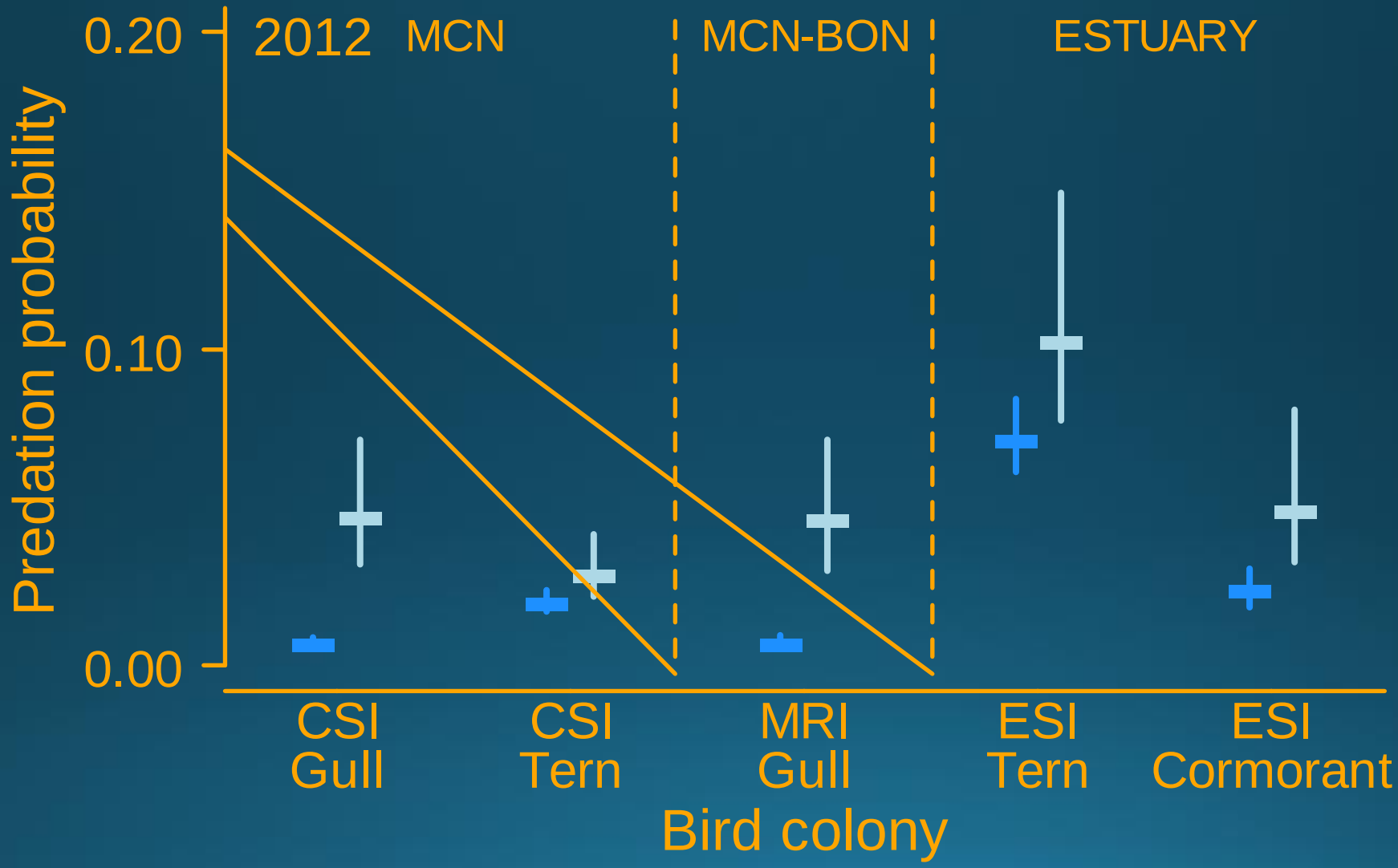
- Scan colonies post-breeding season to recover PIT tags
  - Hand-held antennas on rocky or uneven substrate
  - Flat-plate antennas on sandy or smooth substrate

Results

Results: PIT Tag Deposition Rates



Colony-specific Predation Rates on Snake River Steelhead (deposition uncorrected and corrected)



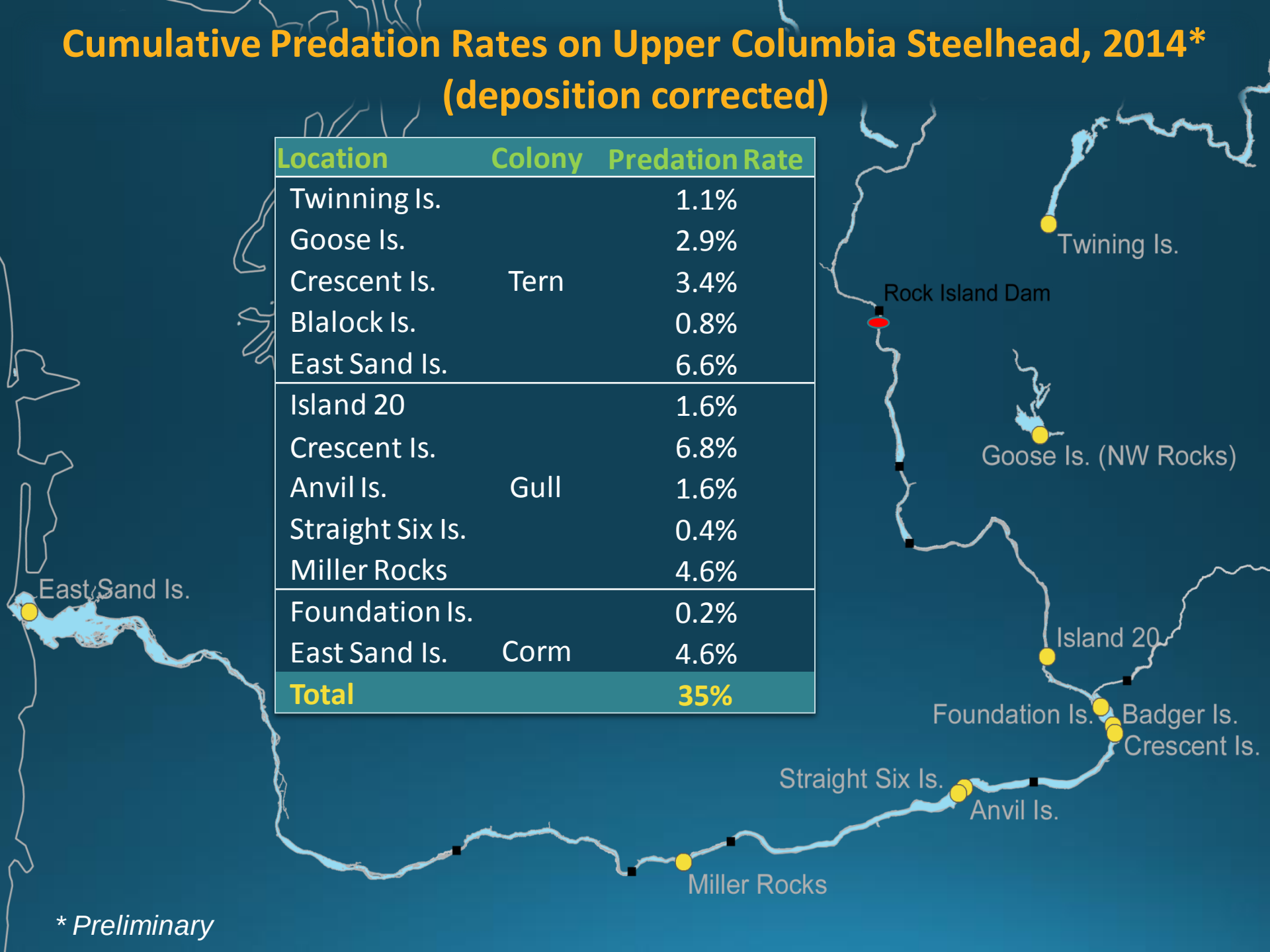
Salmonid Population-Specific Predation Rates, 2014* (deposition corrected)

Salmonid Population	ESI Terns	ESI Corm	MRI Gulls
Snake River Steelhead	8.6%	7.8%	5.3%
Upper Columbia Steelhead	11.4%	10.4%	6.1%
Middle Columbia Steelhead	9.5%	6.4%	-
Snake River Fall Chinook	1.0%	2.4%	1.8%
Snake River Sp/Su Chinook	1.1%	8.5%	1.0%
Upper Columbia Sp Chinook	1.4%	6.1%	2.3%
Upper Willamette Chinook	1.2%	1.8%	-
Snake River Sockeye	1.6%	4.5%	4.4%

** Preliminary*

Cumulative Predation Rates on Upper Columbia Steelhead, 2014*
(deposition corrected)

Location	Colony	Predation Rate
Twinning Is.		1.1%
Goose Is.		2.9%
Crescent Is.	Tern	3.4%
Blalock Is.		0.8%
East Sand Is.		6.6%
Island 20		1.6%
Crescent Is.		6.8%
Anvil Is.	Gull	1.6%
Straight Six Is.		0.4%
Miller Rocks		4.6%
Foundation Is.		0.2%
East Sand Is.	Corm	4.6%
Total		**35%**



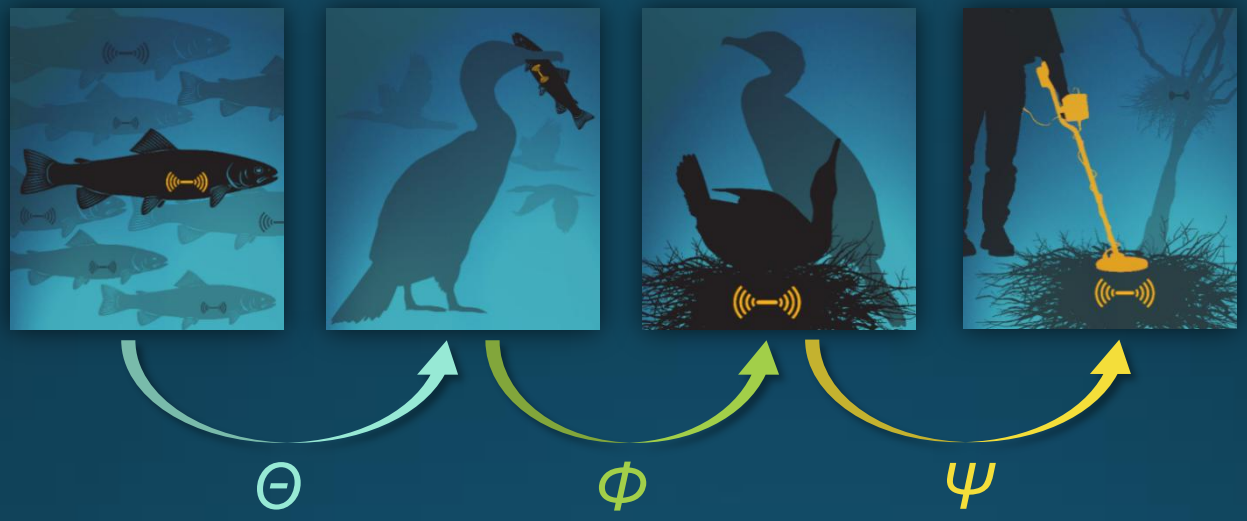
** Preliminary*

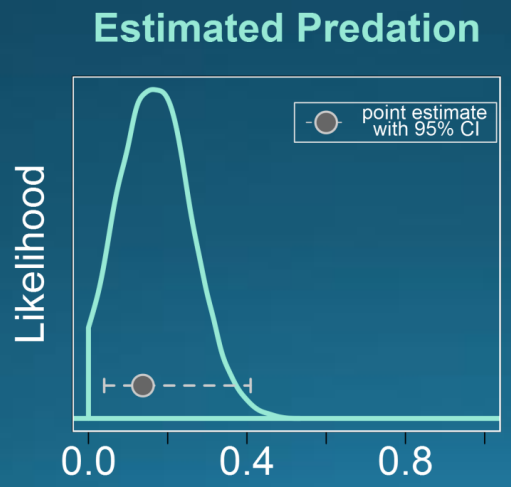
Summary of PIT Tag Study Results

- Deposition rates influence PIT tag detections on bird colonies
- Updated methods are more accurate and allow for comparisons across colonies, salmonid populations, and years
- Predation rates vary by colony, salmonid population, and year; not all colonies have an equal impact on smolt survival
- Cumulative losses on salmonid smolts can be substantial

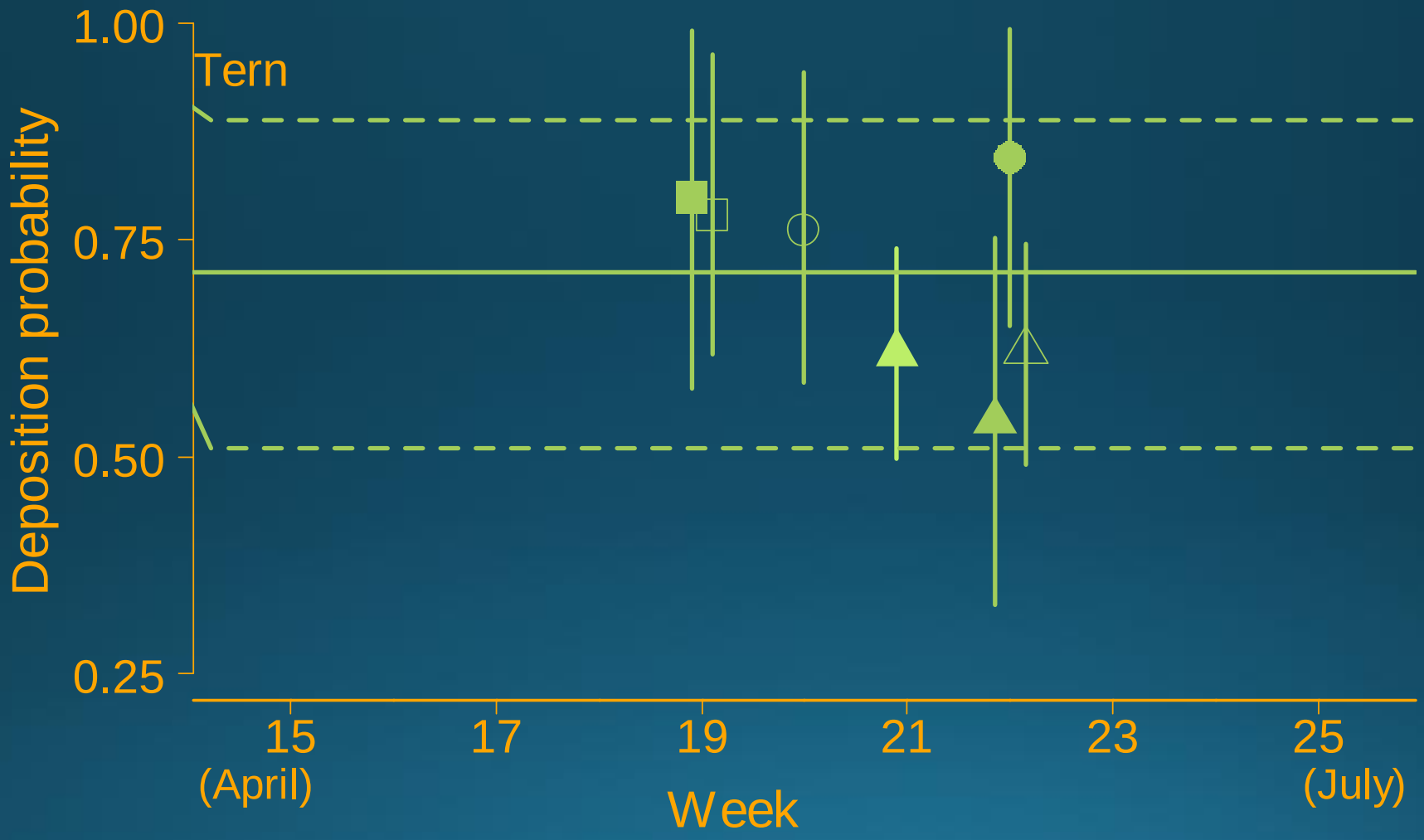
Back Up Slides

Methods: Predation Rate Models

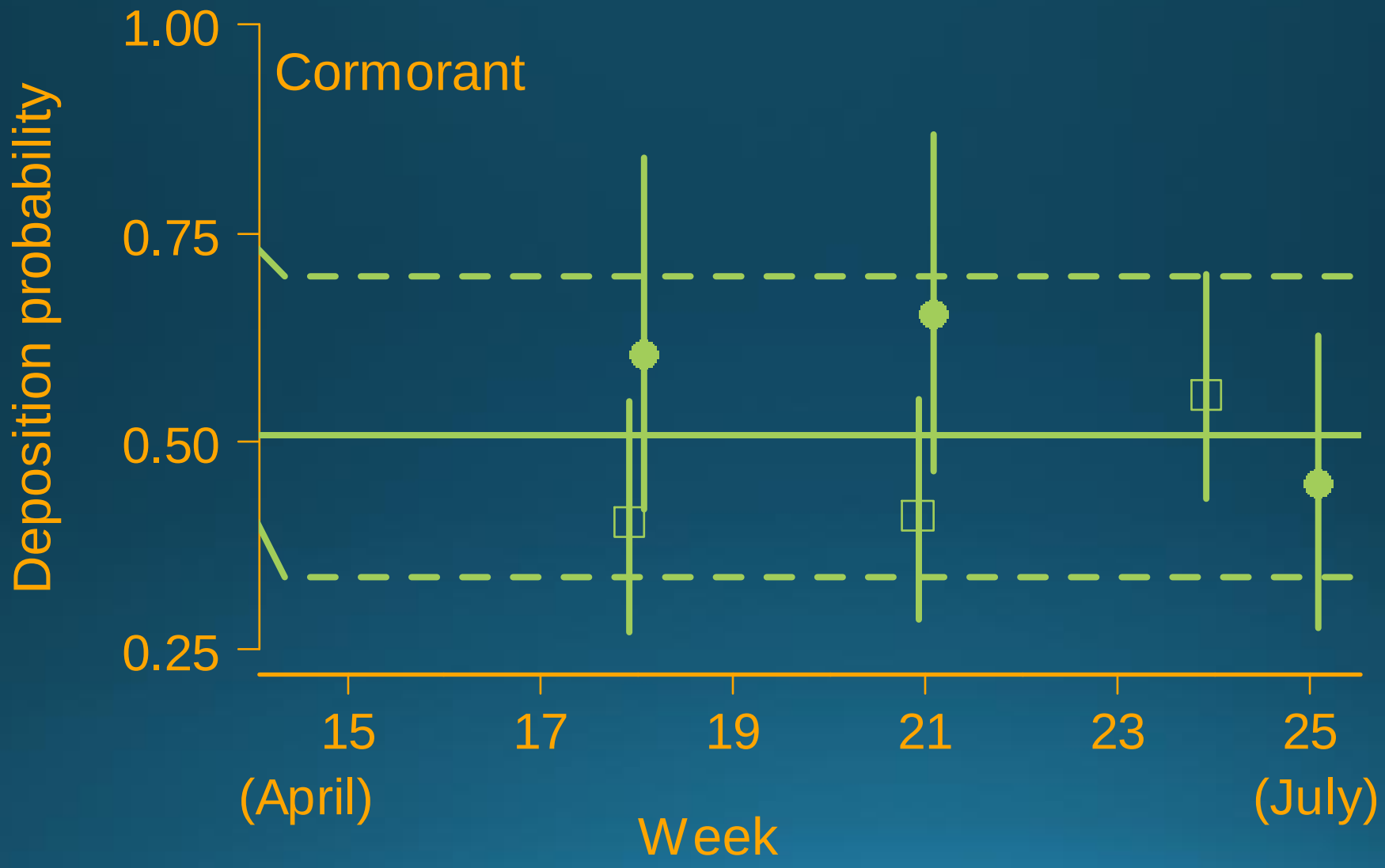




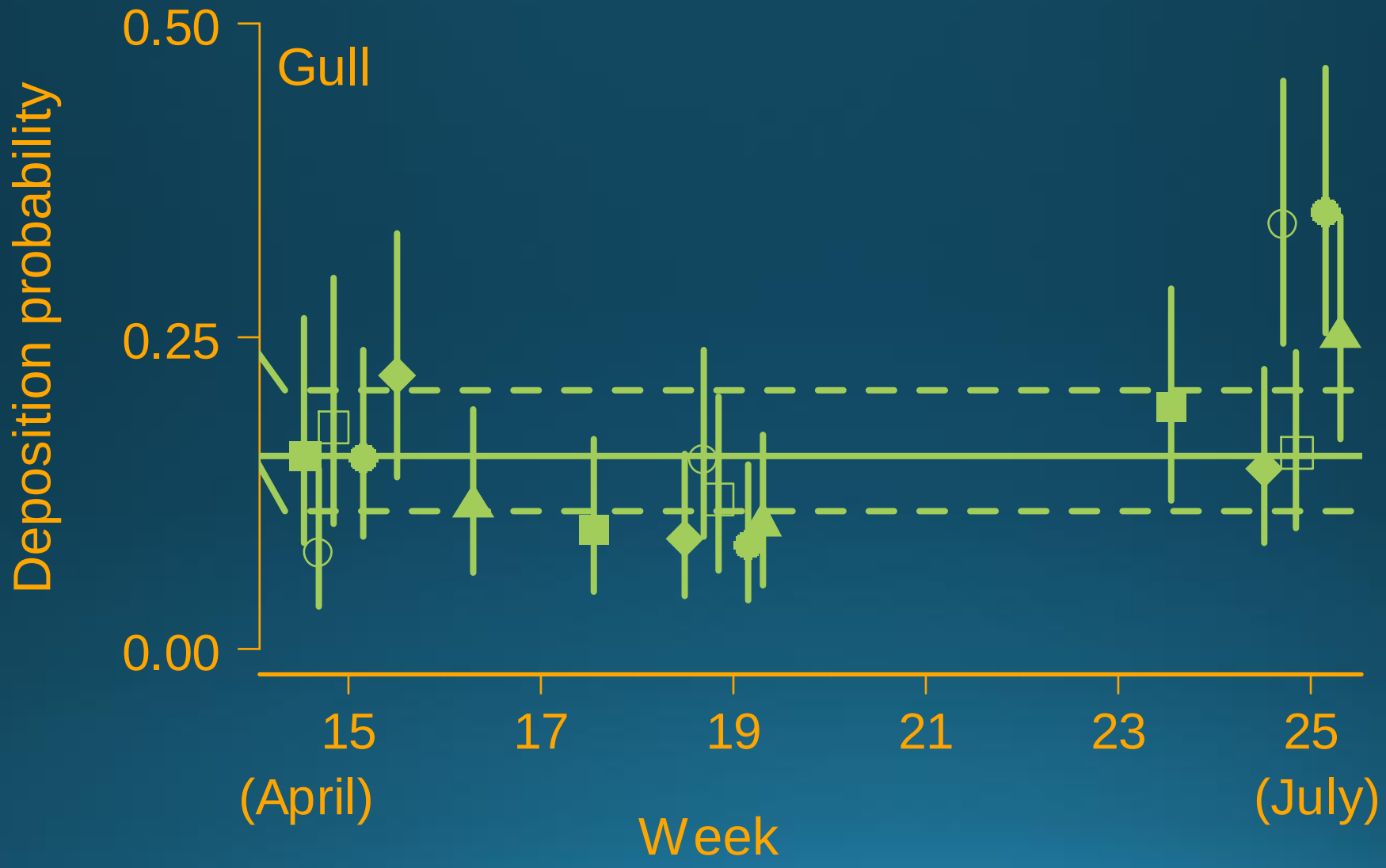
Results: Colony-specific PIT Tag Deposition Rates



Results: PIT Tag Deposition Rates



Results: PIT Tag Deposition Rates



Status of Caspian Tern Breeding Colonies at Managed and Un-managed Sites in the Columbia Basin and at Corps-constructed Islands

Briefing for the Northwest Power and Conservation Council
May 5, 2015

Oregon State University

Real Time Research, Inc.

USGS-Oregon Cooperative Fish & Wildlife Research Unit

OSU Oregon State University

RTR REAL TIME RESEARCH

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Acknowledgments

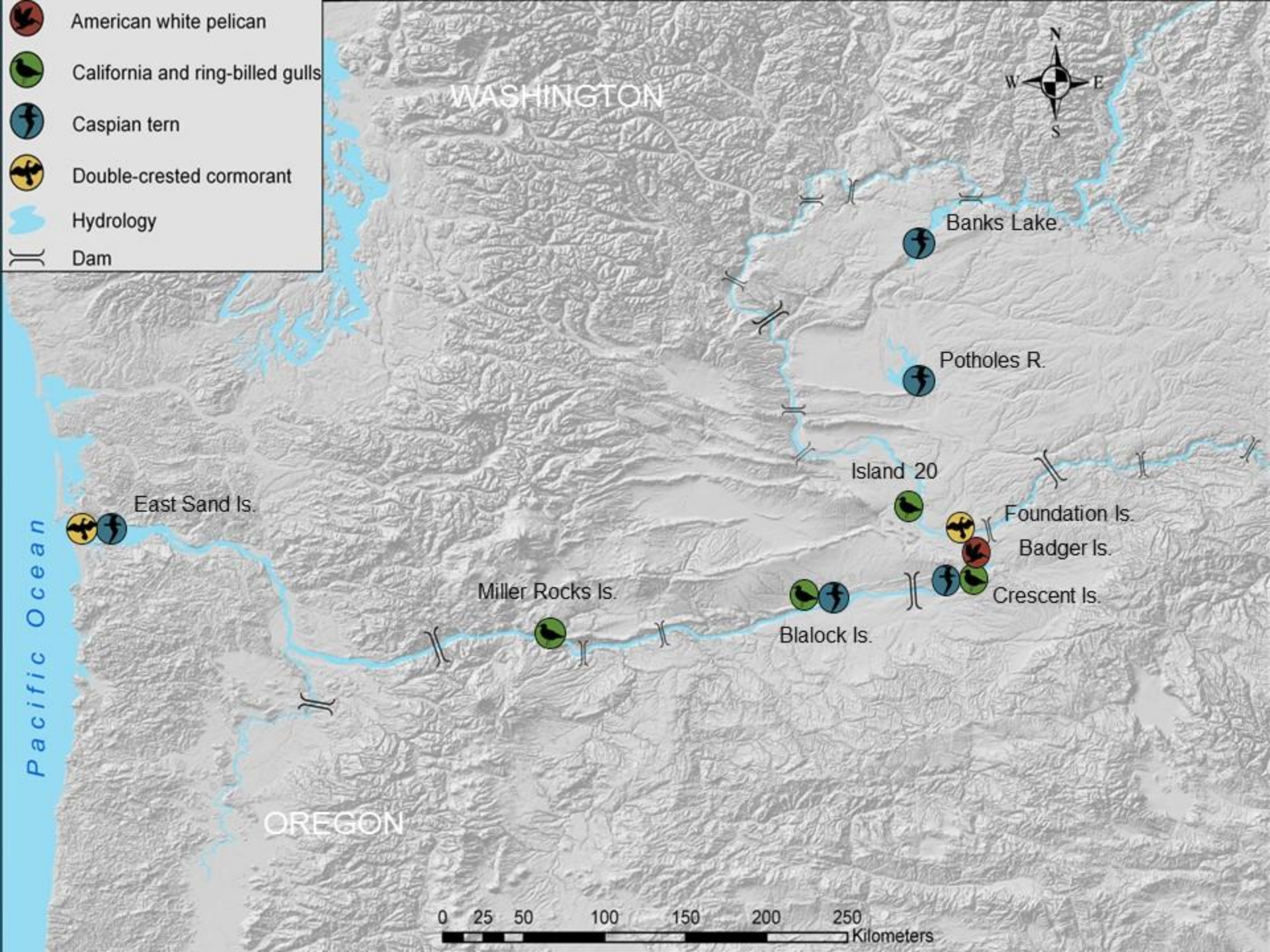
Co-authors: Ken Collis (Co-PI), Don Lyons, Allen Evans, Pete Loschl, Tim Lawes, Yasuko Suzuki, Brad Cramer, Kirsten Bixler, Alexa Piggott, Cheryl Horton, and Mike Hawbecker

Collaborators:

U.S. Bureau of Reclamation
NOAA Fisheries
Oregon Department of Fish and Wildlife
Washington Department of Fish and Wildlife
U.S. Fish & Wildlife Service
Northwest Power and Conservation Council
Pacific States Marine Fisheries Commission

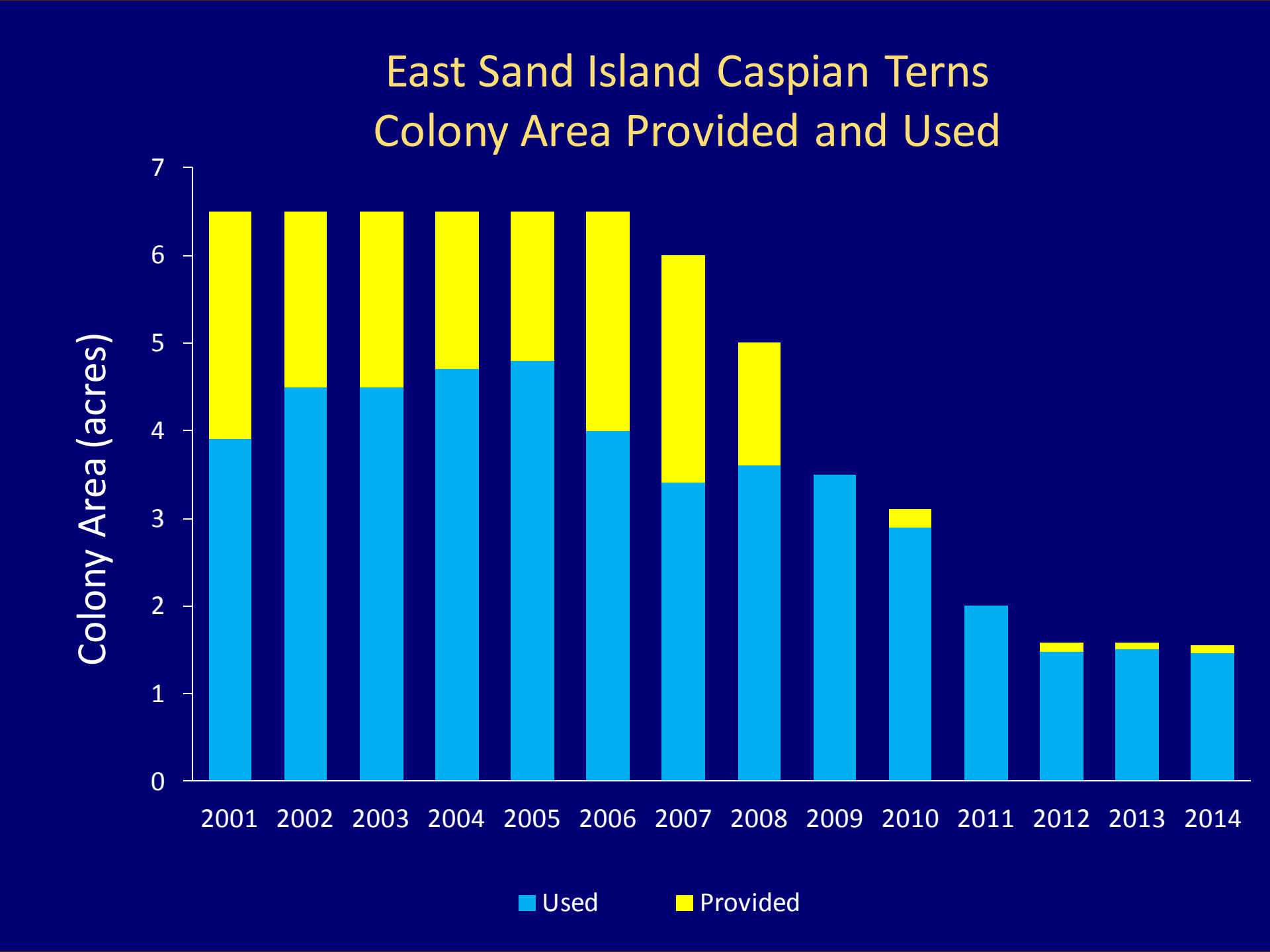
Funding:

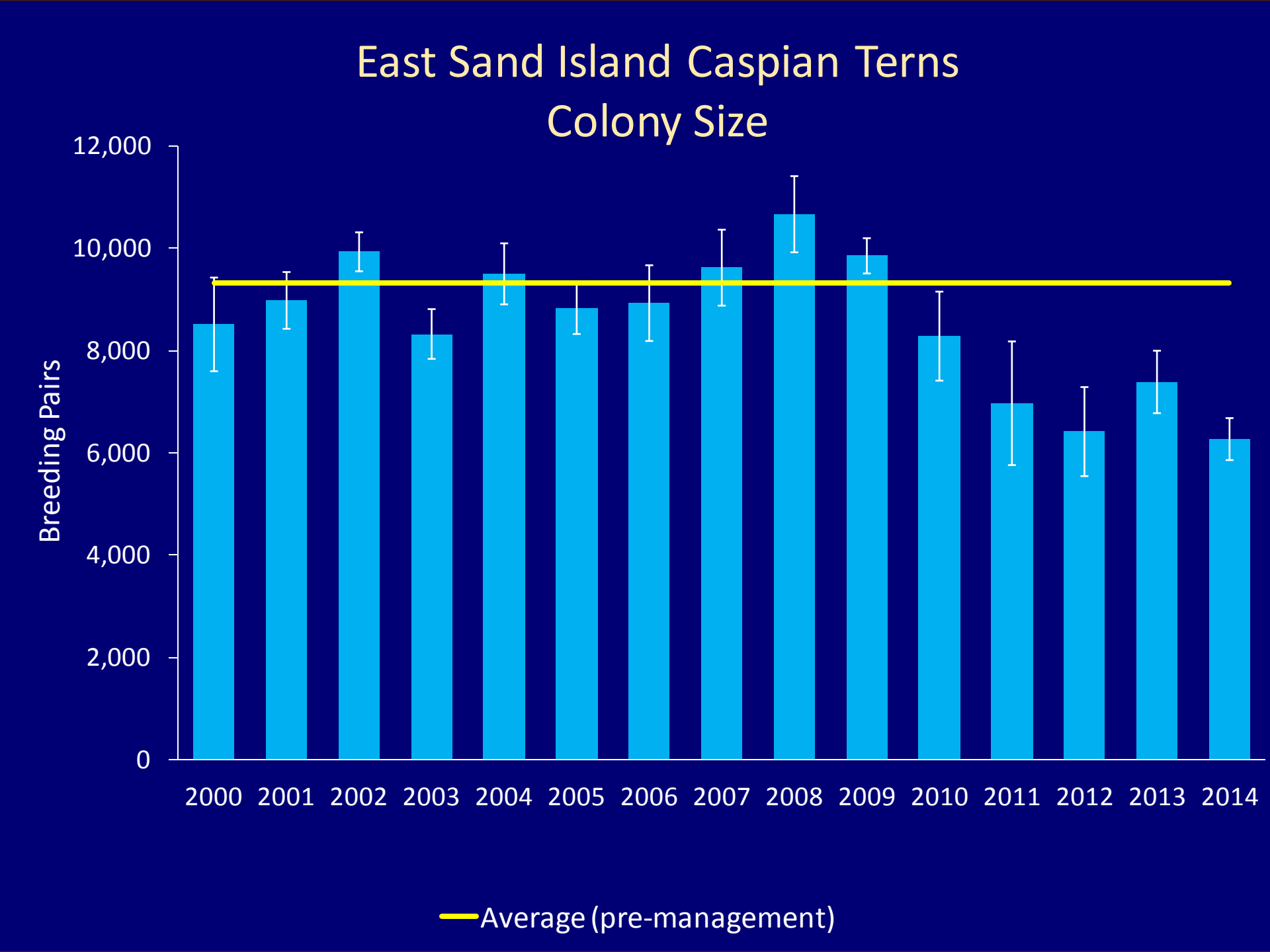
Bonneville Power Administration (Dave Roberts & John Skidmore)
U.S. Army Corps of Engineers, Walla Walla District (David Trachtenbarg)
U.S. Army Corps of Engineers, Portland District (Cindy Studebaker)
Grant Co. Public Utility District & Priest Rapids Coordinating Committee (Curt Dotson)
Bureau of Reclamation (Mike Lesky & Ann Haynes)


American white pelican
California and ring-billed gulls
Caspian tern
Double-crested cormorant
Hydrology
Dam
WASHINGTON
OREGON
Pacific Ocean
N
W
E
S
Banks Lake.
Potholes R.
Island 20
East Sand Is.
Foundation Is.
Badger Is.
Crescent Is.
Miller Rocks Is.
Blalock Is.
0 25 50 100 150 200 250
Kilometers

Caspian Tern Colony on East Sand Island
The "Push"

Limiting Caspian terns to 1 acre of suitable nesting habitat in the Columbia Estuary


East Sand Island Caspian Terns
Colony Area Provided and Used
Colony Area (acres)
0
1
2
3
4
5
6
7
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Used
Provided


East Sand Island Caspian Terns
Colony Size
12,000
10,000
8,000
6,000
4,000
2,000
0
Breeding Pairs
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Average (pre-management)

The “Pull”

Corps-constructed Tern Islands as Alternative Colony Sites

Malheur Lake Tern Island, Malheur National Wildlife Refuge, OR

6 Corps-constructed Tern Islands monitored in 2014

Crump Lake
Warner Valley

Summer Lake Wildlife Area
East Link Impoundment

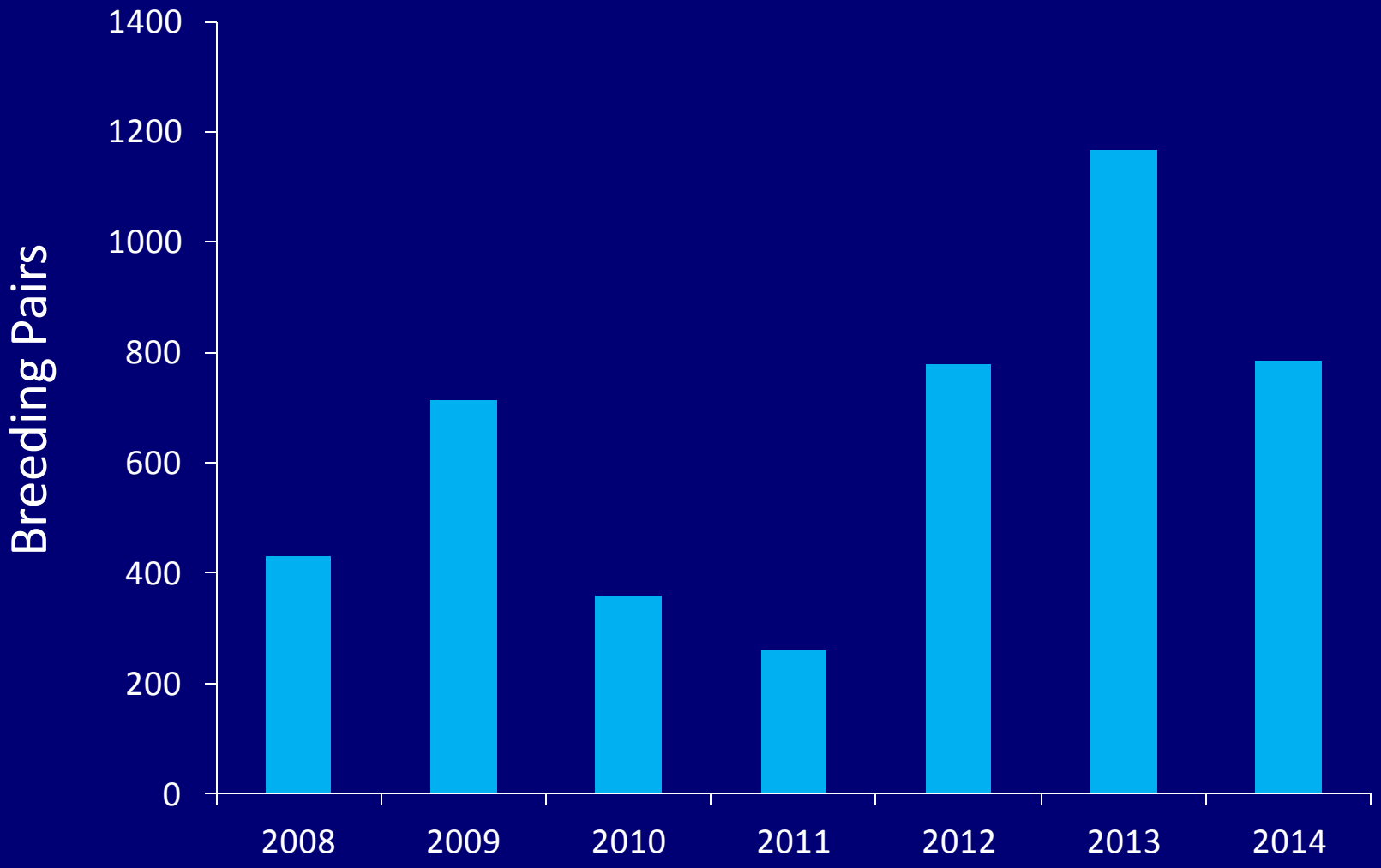
Summer Lake Wildlife Area
Gold Dike Impoundment

Malheur Lake
Malheur NWR

Sheepy Lake
Lower Klamath NWR

Tule Lake Sump 1B
Tule Lake NWR

Corps-constructed Tern Islands
Caspian Tern Nesting



4 Corps-constructed Tern Islands monitored in 2015

~~Crump Lake~~
~~Warner Valley~~

Summer Lake Wildlife Area
East Link Impoundment

Summer Lake Wildlife Area
Gold Dike Impoundment

Malheur Lake
Malheur NWR

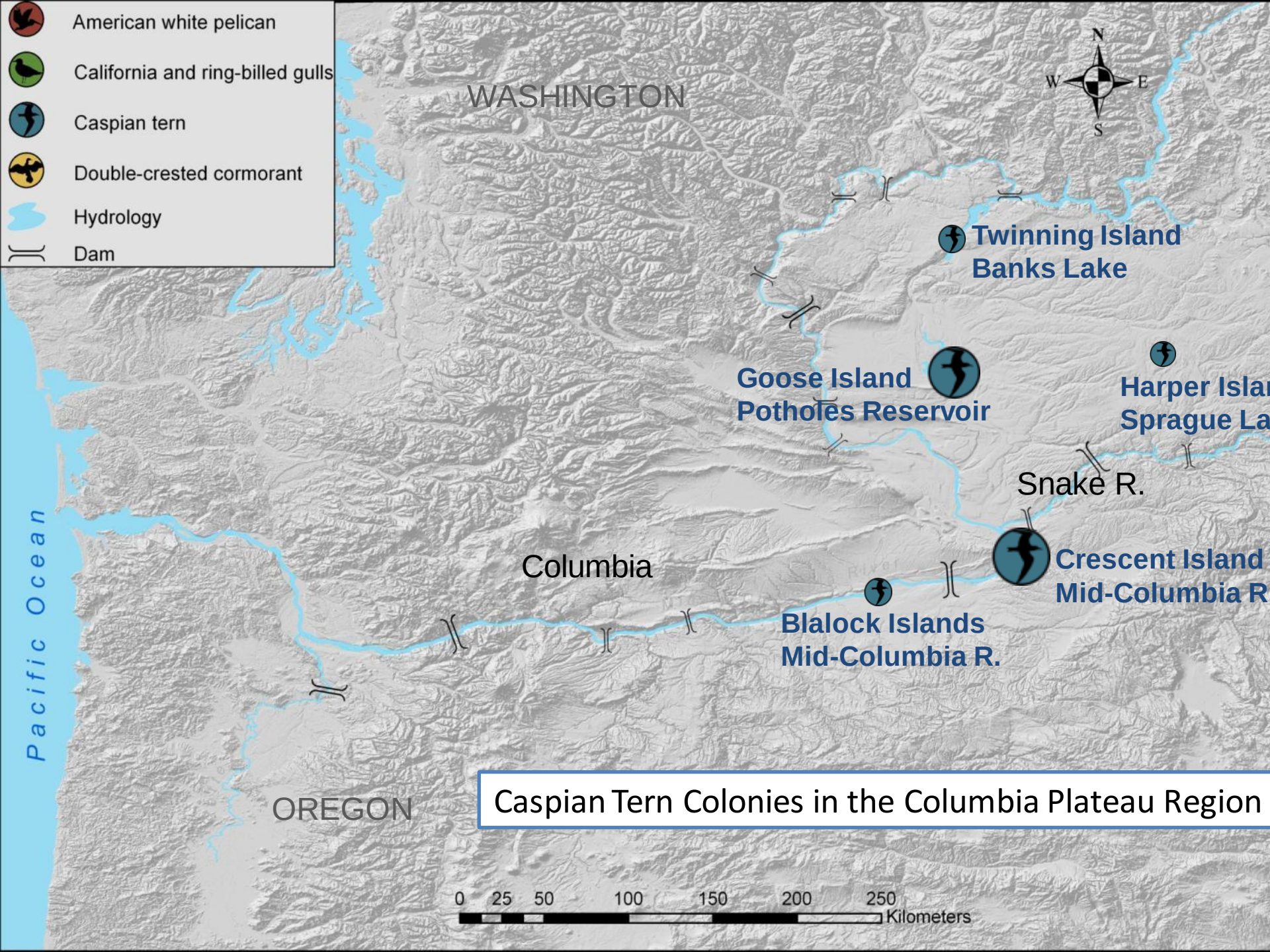
~~Sheepy Lake~~
~~Lower Klamath NWR~~

Tule Lake Sump 1B
Tule Lake NWR

New Corps-constructed Caspian tern islands in Don Edwards National Wildlife Refuge, south San Francisco Bay

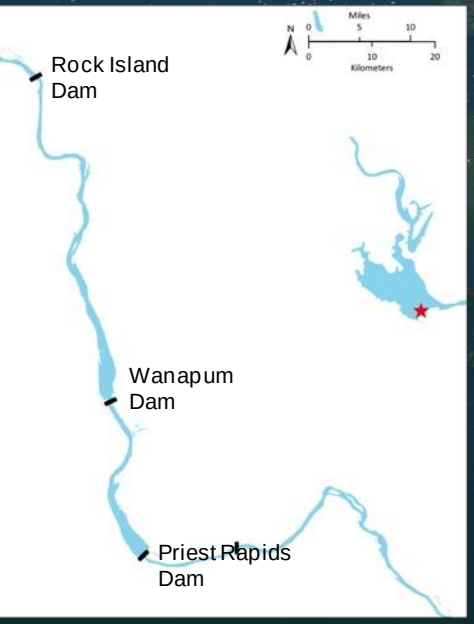
Pond SF2 New Tern Islands

Pond A16 New Tern Islands



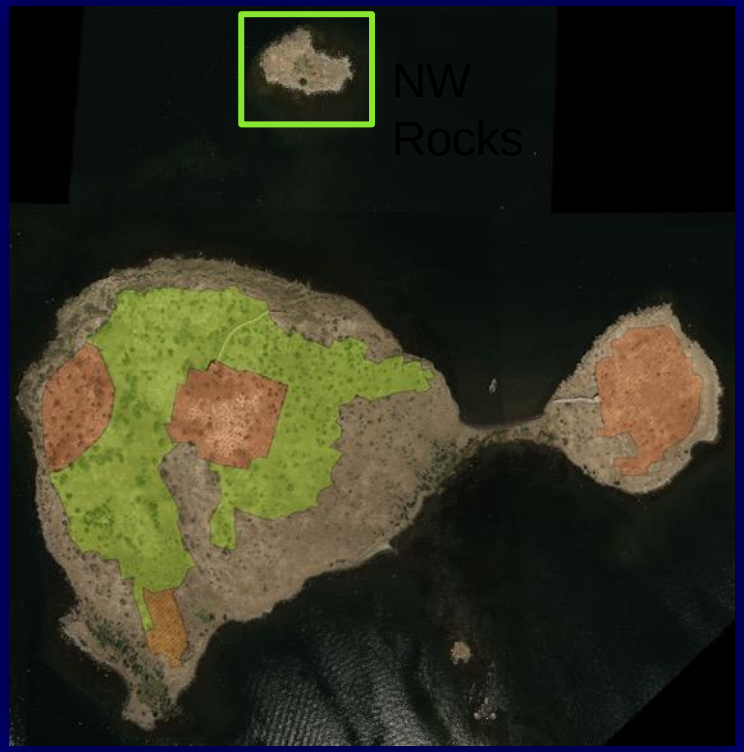
Caspian Tern Colonies in the Columbia Plateau Region

Goose Island Tern Colony, Potholes Reservoir More "Push"



- Former Caspian tern colony of 400-500 breeding pairs
- Much larger gull colony shares the island
- Management to reduce tern colony size initiated in 2014

Goose Island Passive and Active Dissuasion 2014



- Successful in preventing Caspian terns from nesting on Goose Island proper
- Some Caspian terns dissuaded from Goose Island nested on Northwest Rocks
- Action agencies decided not to haze terns at Northwest Rocks
- 159 Caspian tern pairs nested on Northwest Rocks; 46 young terns fledged

Goose Island, Potholes Reservoir - 2015

- Tern dissuasion installed on virtually the entire island plus Northwest Rocks
- Caspian tern colony has so far been prevented from forming due to hazing & dissuasion

Crescent Island Tern Colony, McNary Pool, Mid-Columbia River
More "Push"

- Former Caspian tern colony of 400-500 breeding pairs
- Much larger California gull colony shares the island
- Management to reduce tern colony size initiated in 2015

Crescent Island Tern Colony, McNary Pool - 2015

No Caspian terns have attempted to nest on Crescent Island so far this year

Summary of Key Findings in 2014

- Caspian tern colony at East Sand Island in Columbia River estuary was slightly smaller and smolt consumption slightly lower than in 2013
- Despite management that prevented all nesting by Caspian terns on Goose Island – Potholes Reservoir, some terns nested on small islet nearby
- Severe drought in the basins where Corps-constructed tern islands are located led to reduced colony size at most islands; combined breeding pairs declined 33% compared to 2013
- Total number of breeding Caspian terns at all colonies in the Pacific Northwest was somewhat lower in 2014 compared to 2013

Thanks! Questions?

Backup Slides

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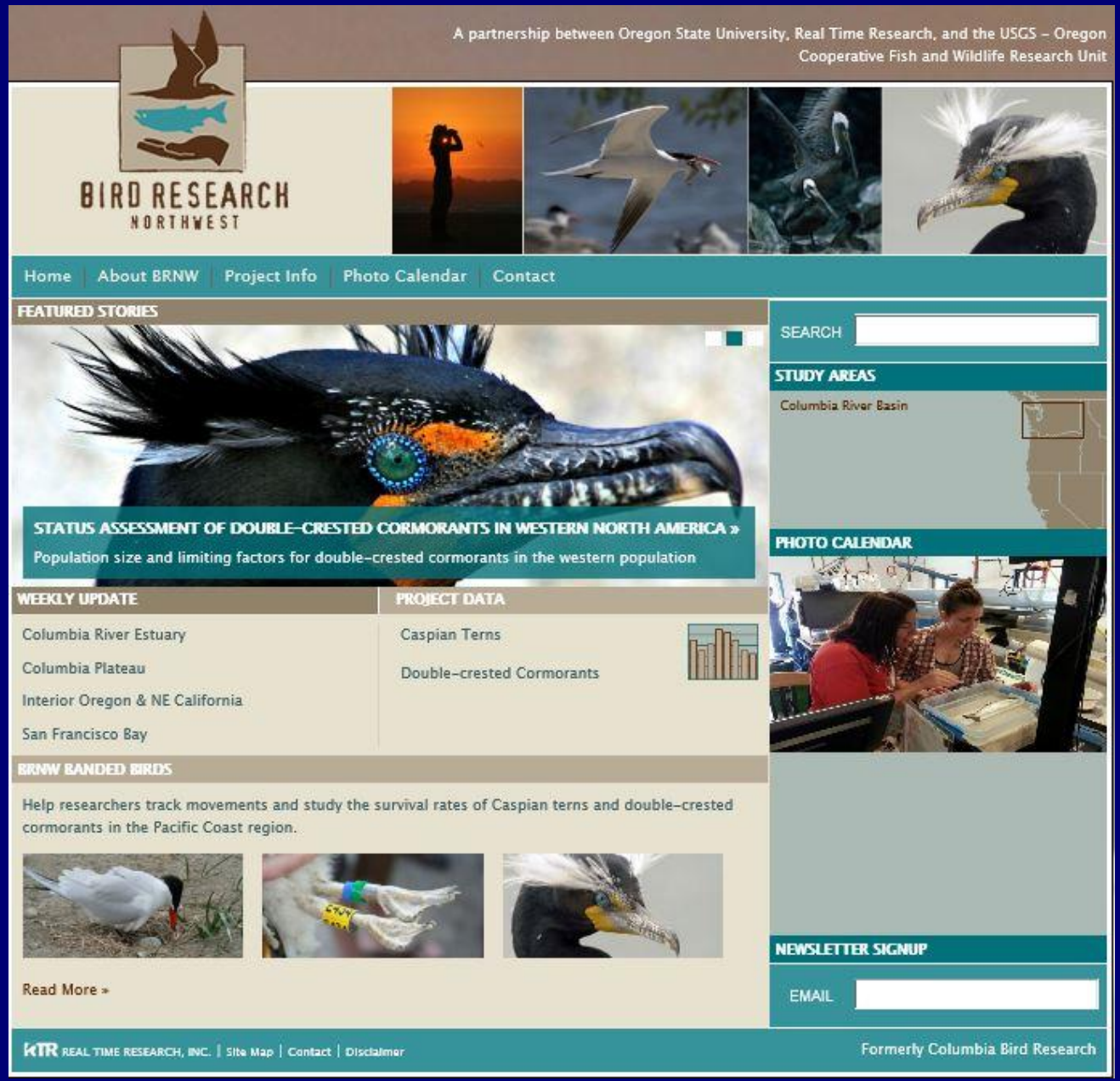
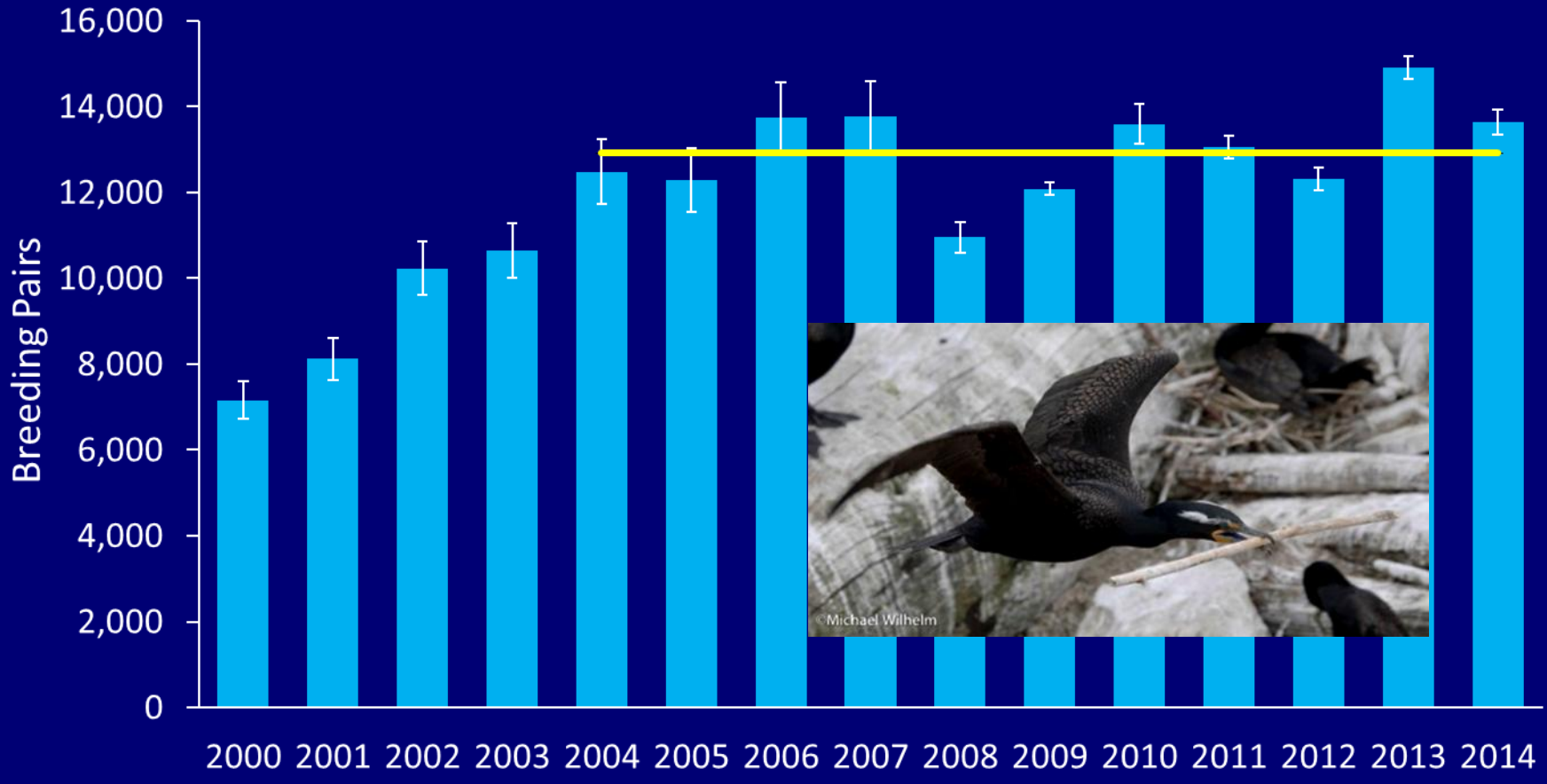
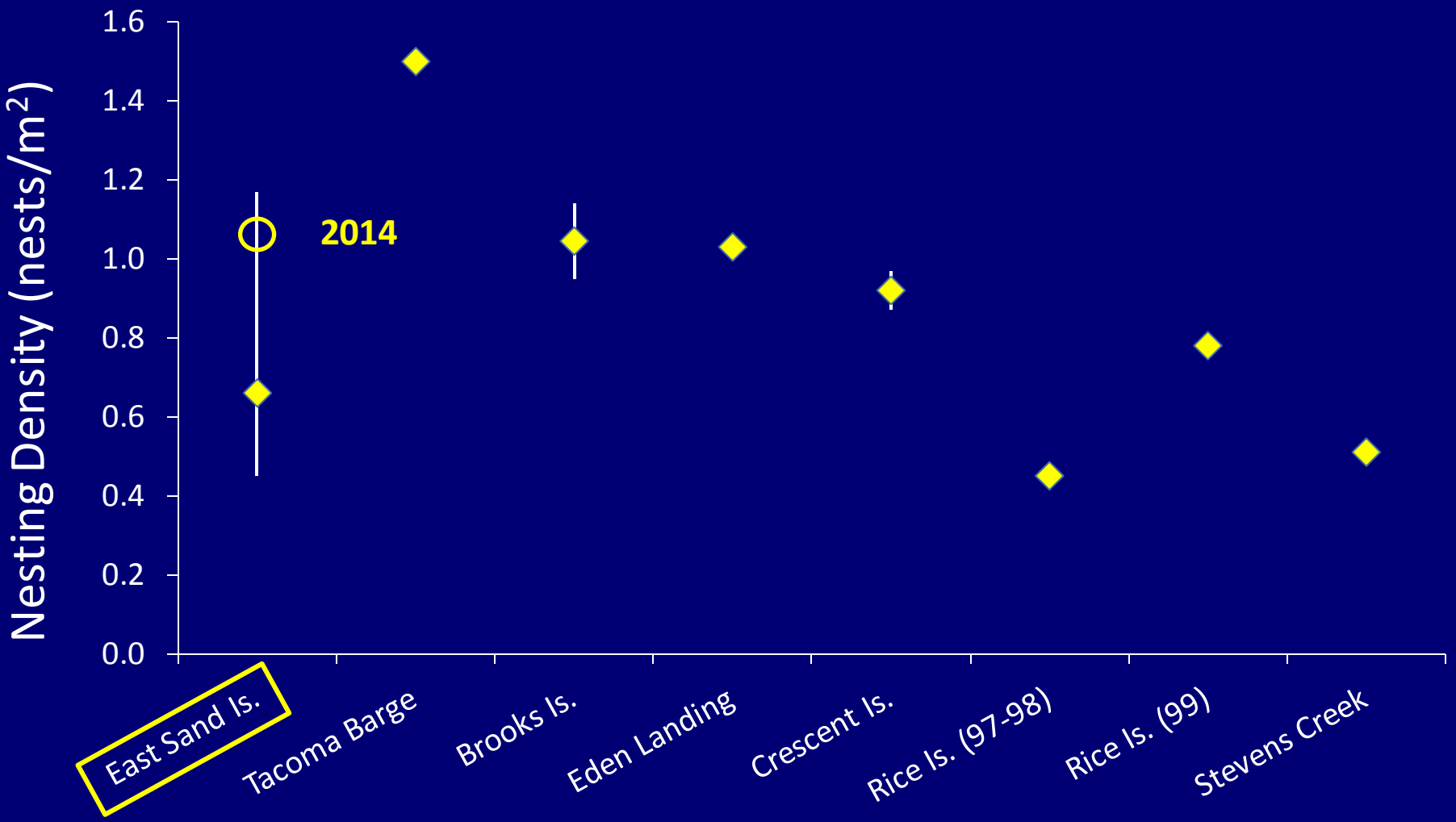
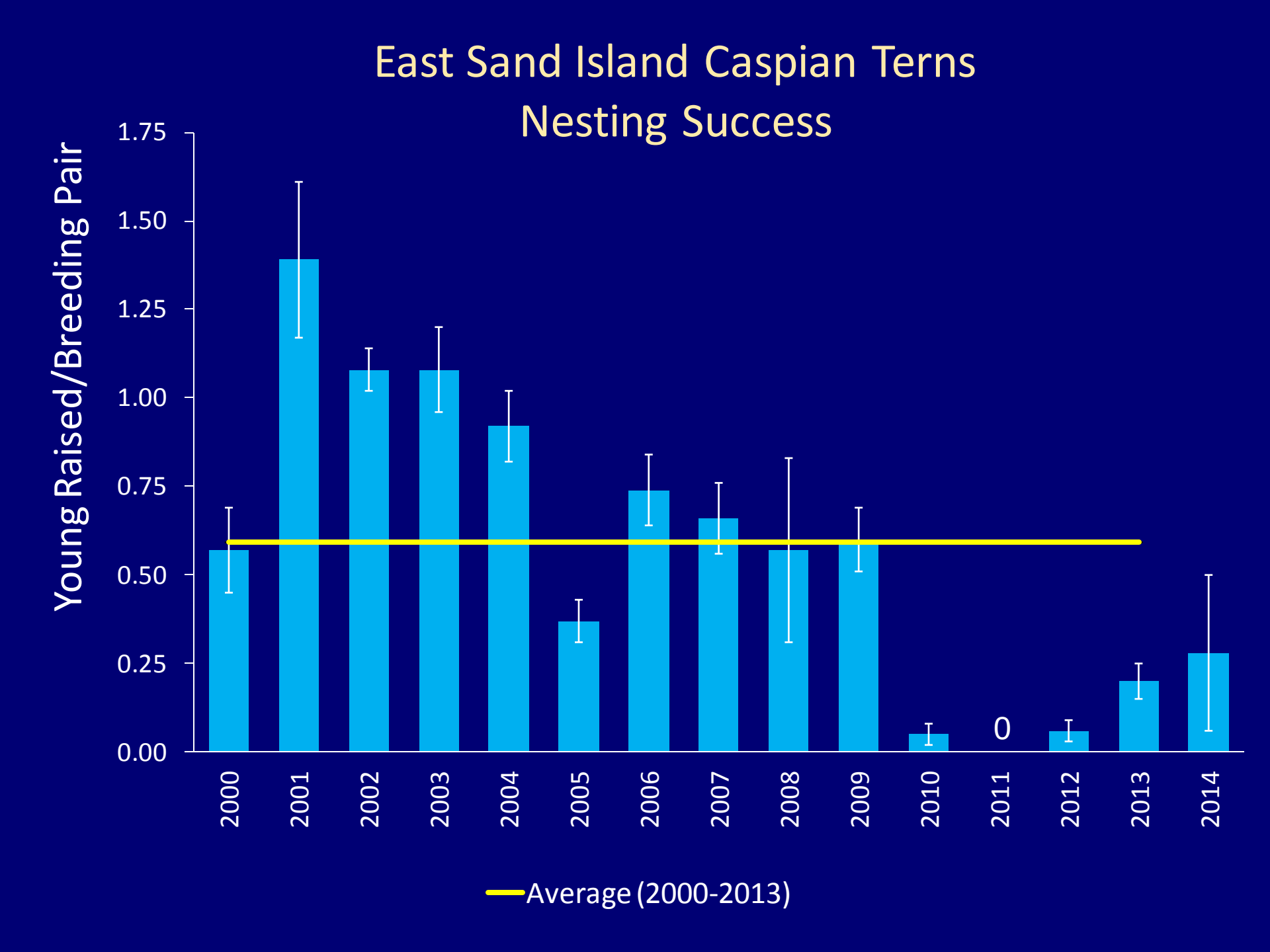


East Sand Island Double-crested Cormorant Colony Size



Caspian Tern Nesting Density

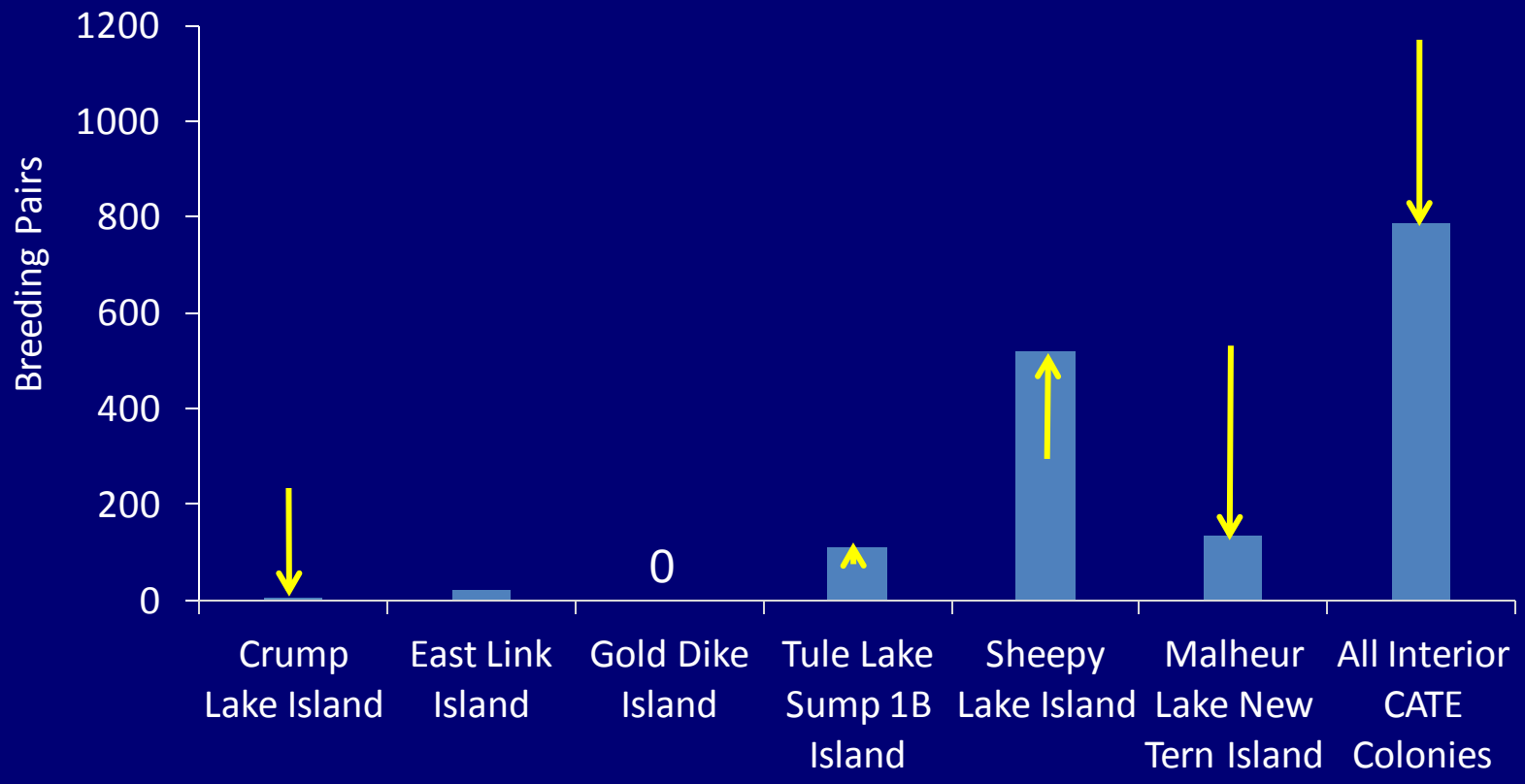



East Sand Island Caspian Terns
Nesting Success
Young Raised/Breeding Pair
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Average (2000-2013)

Corps-constructed Islands
2014 Results

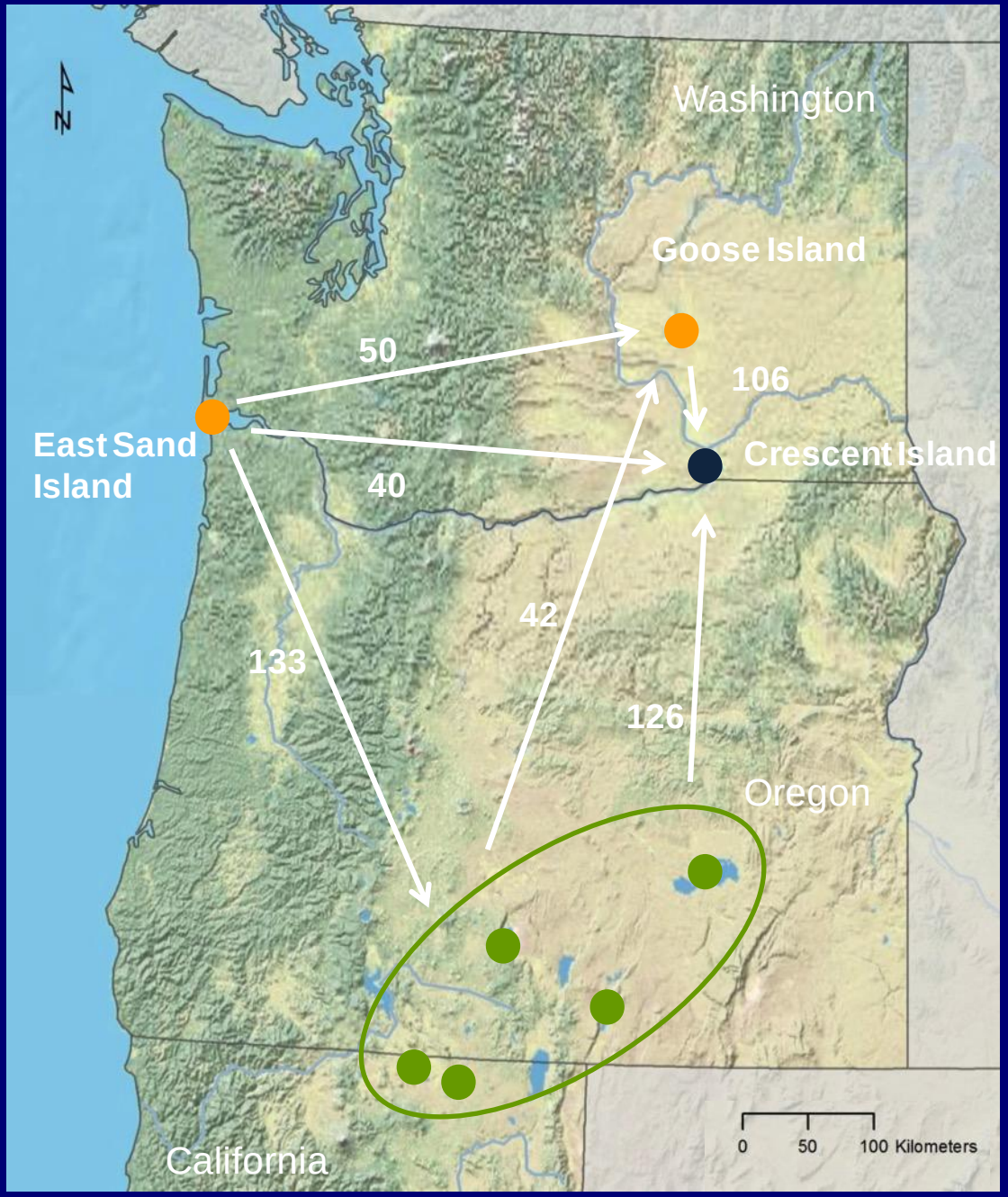
Location	Size (acres)	Colony Size (breeding pairs)	Produced fledglings (limiting factor)
Malheur NWR, OR	1	134	Yes
Lower Klamath NWR, CA (Sheepy Lake)	0.8	520	Yes
Crump Lake, OR	1	1	No (no water)
Tule Lake NWR, CA	2	109	Yes
Summer Lake, OR (East Link)	0.5	22	Yes
Summer Lake, OR (Gold Dike)	0.5	0	No (mink, raccoon)
Lower Klamath NWR, CA (Orems Unit)	1	0	No (no water)
Fern Ridge, OR	1	0	No (unknown)
TOTAL	7.8	786 pairs	

Corps-constructed Tern Islands
2014 Caspian Tern Colony Sizes



Arrows indicate change from 2013

Net numbers of Caspian terns that moved between colonies (2013-2014)



Goose Island Passive and Active Dissuasion



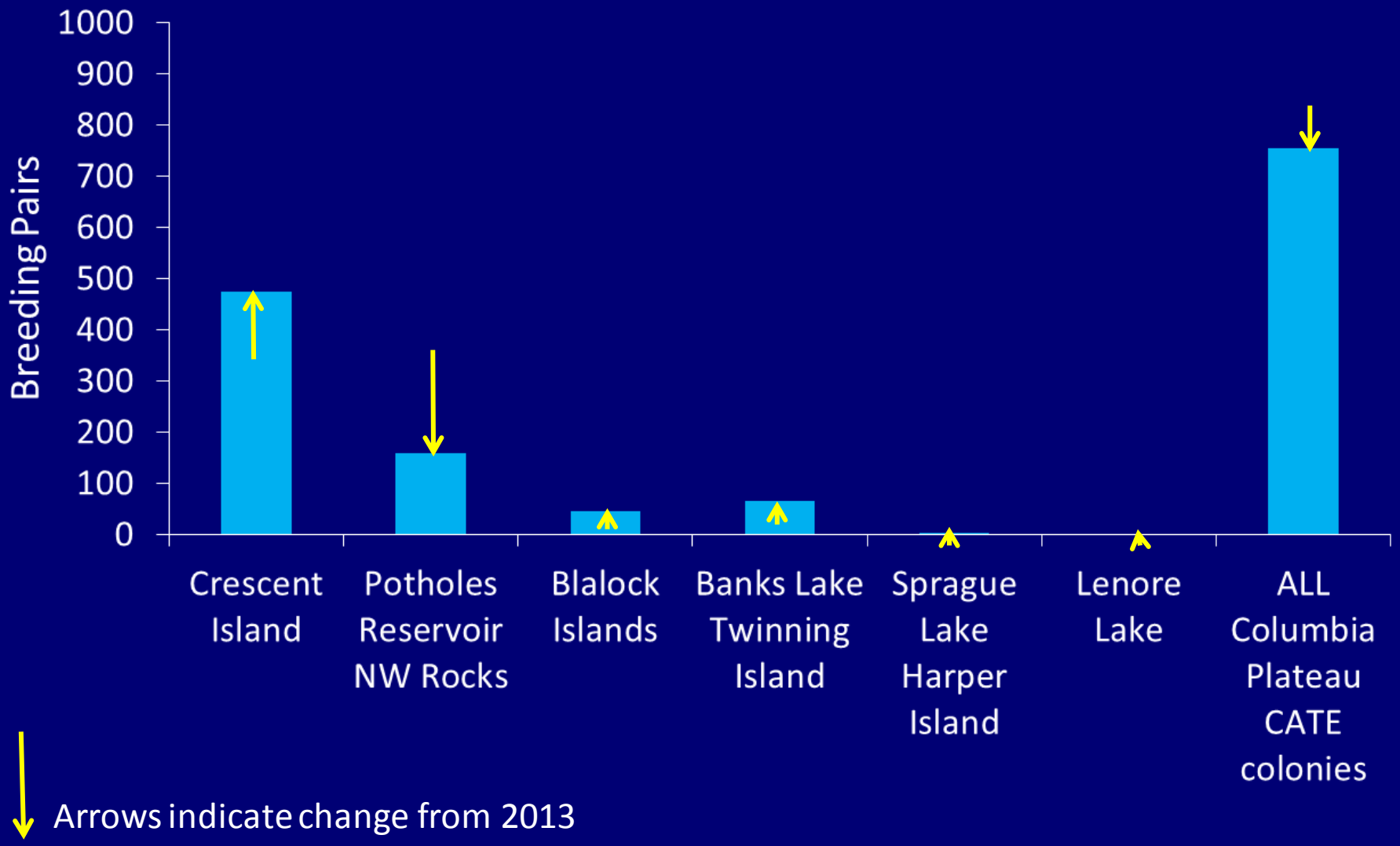

- Dissuasion materials delivered to Goose Island via helicopter (25 February)
- Passive dissuasion constructed with pier blocks, rebar, PVC tubing, polypropylene rope, and caution tape
- 2.38 acres of tern nesting habitat covered with passive dissuasion
- Active hazing of gulls and terns initiated in late March

Goose Island Passive and Active Tern Dissuasion - 2014

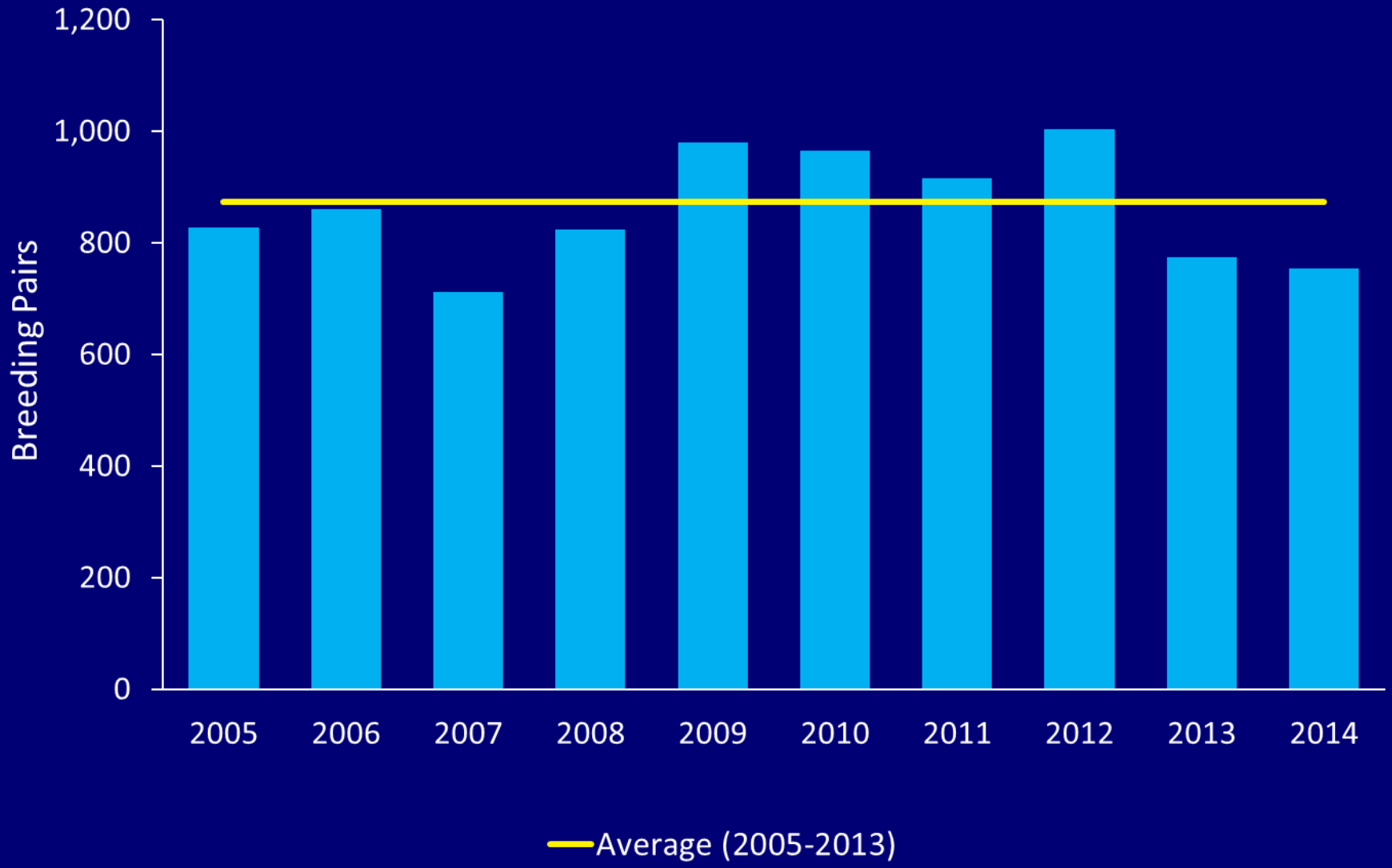
- Successful in preventing Caspian terns from nesting on Goose Island proper
- 3 pairs of Caspian terns attempted to nest
- 3 Caspian tern eggs were removed from nests by researchers soon after laying


Goose Island Archipelago
Potholes Reservoir

Columbia Plateau Region
2014 Caspian Tern Colony Sizes



Caspian Tern Breeding Population Size on the Columbia Plateau



Predation Rates by Goose Island Terns on ESA-listed Salmonid Populations (managed)

ESU/DPS	Pre-management 2007-2013	Post-management 2014	Change
UCR Spring Chinook	2.5% (1.7 - 3.6%)	0.3% (0.1 - 0.7%)	-2.2% (-1.6 - -2.9%)
UCR Steelhead	15.7% (14.1 - 18.9%)	2.9% (1.9 - 5.1%)	-12.7% (-12.2 - -13.8)

Tern Tagging Study: Methods

- Satellite tags deployed on 28 Caspian terns caught on former colony site at Goose Island, Potholes Reservoir during April 2-11, 2014
- Location data available on 28 hour cycle (6 hours on, 22 hours off)
- All tags collected data through the end of May
- 23 tags still functional and collecting data though May 1, 2015

Colony Associations of Satellite-tagged Terns - 2014

- Tagged birds displayed three general categories of response to displacement and habitat reduction:
  - Stay and compete for reduced habitat
  - Move and attempt to nest at other colony; return if nesting fails
  - Nomadic wandering without sustained colony association