Status, Trends, and Other Issues Related to Aquaculture and Marine Birds in Nearshore of Washington's Puget Sound

Washington Department of Fish and Wildlife
Wildlife Program

Derived from work by the Marine Bird Component of Puget Sound Assessment and Monitoring Program (PSAMP)
Plus collaboration with state and flyway-wide partners

Project Staff:
David Nysewander, Joe Evenson, Bryan Murphie, and Tom Cyra

Acknowledgements

- Puget Sound Action Team
- North American Sea Duck Joint Venture
- U.S.G.S, Western Ecological Research Center
- Environment Canada, Canadian Wildlife Service
- The SeaDoc Society
- Ducks Unlimited Canada
- Centre for Wildlife Ecology, Simon Fraser University
- Puget Sound Estuary Program UFWS
- Pacific Coast Joint Venture
- Washington Department of Fish and Wildlife
- All those others who helped with captures and tracking

Geoduck culture and cover net near Stretch Island, Case Inlet

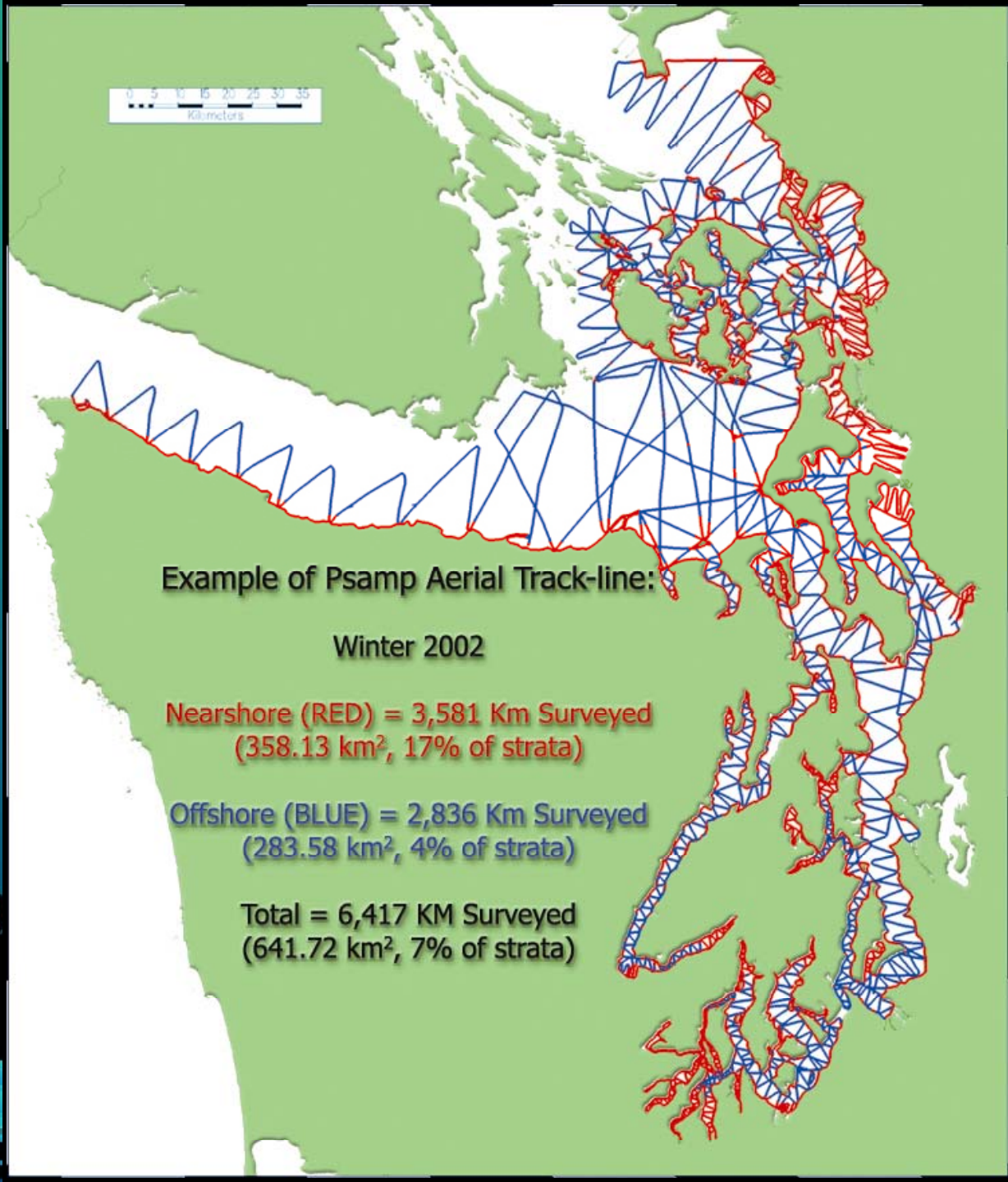
Geoduck site with some invertebrate settlement, Stretch Island

Some geoduck tubes still holding up net, Stretch Island

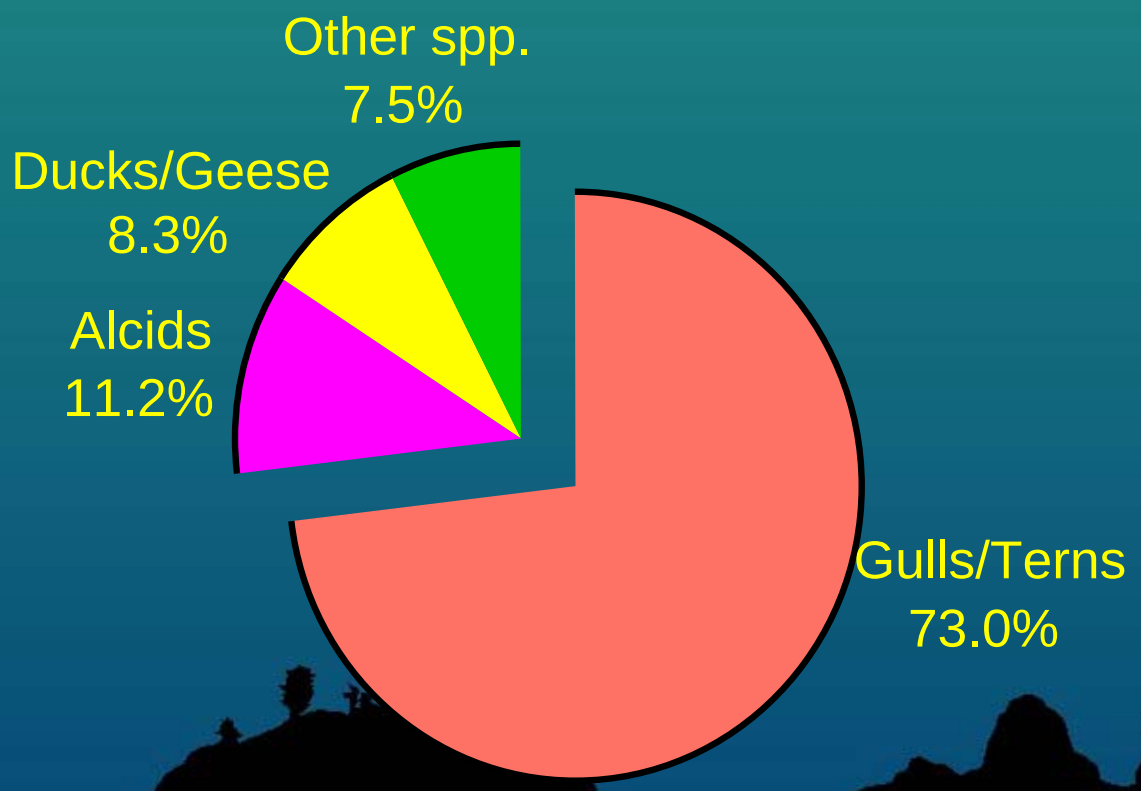
PSAMP 1992-2008 Aerial Survey Tracks:

Stratified Random Strip Transects by Two Strata

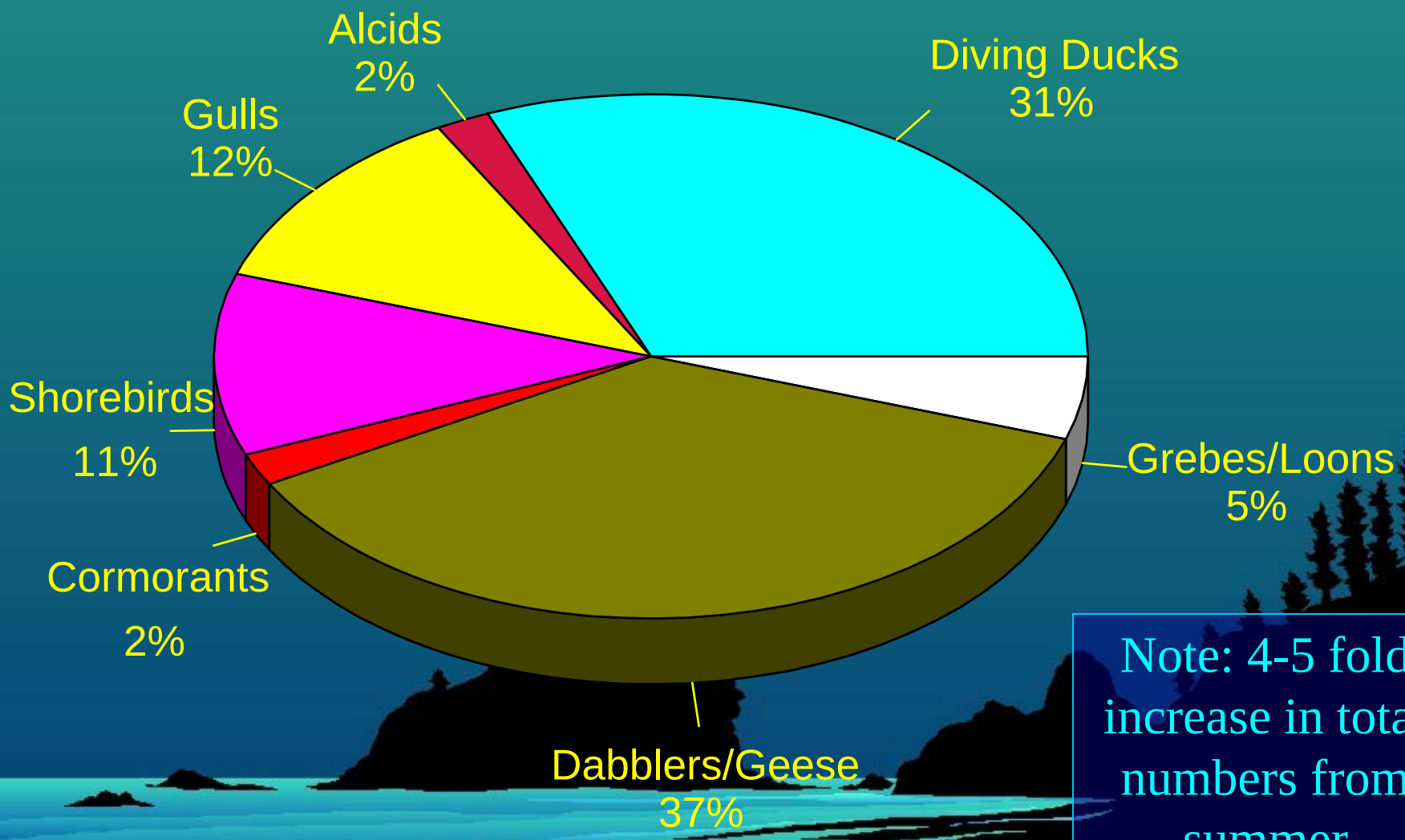
Nearshore transect line in red < 20 m depth
Offshore transect line in blue > 20 m depth



Summer Bird Abundance, Inner Marine Waters of Washington



Composition of Marine Bird Populations Seen in Winter in Greater Puget Sound



Note: 4-5 fold increase in total numbers from summer

Marine Bird Atlas on WDFW Web Site

Washington Department of Fish and Wildlife - Microsoft Internet Explorer

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WILD About Washington

WE GET MAIL

IN THE NEWS

April 10, 2008

OLYMPIA - The Washington Department of Fish and Wildlife (WDFW) will hold a new drawing for 2008 multiple-season hunting permits after invalidating a drawing conducted last week due to a technical error. Full Story

OLYMPIA – Great trout fishing for anglers throughout Washington gets under way April 26, when several hundred lowland lakes open for a four-to five-month-long season. Full Story

OLYMPIA – The Washington Fish and Wildlife Commission is scheduled to take action on new hunting rules for the 2008 season at a public meeting April 11-12 in Pasco. Full Story

KENNEWICK – Youngsters and families can connect with nature and learn outdoor skills at a Youth Outdoor Adventure Expo May 16-17 at the Benton County Fairgrounds here. Full Story

- Sport Fishing Regulations & Rule Changes
- Outlook for ocean salmon fisheries reflects poor coho forecasts
- Hoh River will close to protect wild steelhead

WeekEnder REPORT — The latest in fish and wildlife opportunities around Washington State

North of Falcon — Setting 2008 Salmon Fishing Seasons

WDFW email Lists — SUBSCRIBE TODAY!

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online mapping

Featured Sections

WDFW Image Gallery

- Gray Wolf Conservation and Management

Marine Bird Atlas on WDFW Web Site

WDFW -- Interactive Mapping - Microsoft Internet Explorer

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Address http://wdfw.wa.gov/mapping/index.html

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Interactive Mapping

- What is GIS?
- GIS at WDFW

WHAT is INTERACTIVE MAPPING?

The interactive mapping applications available on our web site provide a relatively easy way for you to directly view our GIS data without being a GIS expert. These applications draw data from our GIS databases and present it to you in a web browser interface. The complexity of the data means that a special web browser format is needed (see browser requirements). It may take some time for you to learn how to use the tools and manipulate the data. The on-line help screens and tools should help you get started.

WDFW INTERACTIVE MAPPING APPLICATIONS

GoHunt offers a wealth of information for other outdoor recreation enthusiasts. This site includes maps of major public lands, including WDFW wildlife areas and water-access sites, topographic maps and aerial photos. The site's interactive query feature allows users to retrieve stream names and information on wildlife area amenities.

Salmonscape is an interactive mapping application designed to display and report a wide range of data related to salmon distribution, status, and habitats. The data sources used by Salmonscape include stream specific fish and habitat data, and information about stock status and recovery evaluations.

Marine Bird Density Atlas provides detailed information regarding birds found on Puget Sound waters during WDFW winter and summer surveys. This interactive application includes density distribution maps that can be scaled to specific areas of interest, for all bird species, species groups, and selected species. The application also provides a comprehensive look at status, trends, survey methods, and habitat use for these important Puget Sound resources.

MORE ABOUT INTERACTIVE MAPPING

WDFW uses a system called Arc Internet Map Server (ArcIMS), developed by Environmental Systems Research Institute, for our interactive mapping applications. ArcIMS interprets your requests, does the "heavy lifting" with the GIS databases, and presents the results in your web browser. For technical information on ArcIMS, see http://arconline.esri.com/arconline/whitepapers/ims_/arcims4_architecture.pdf

Find a bug or error in the system? Let us know about it!

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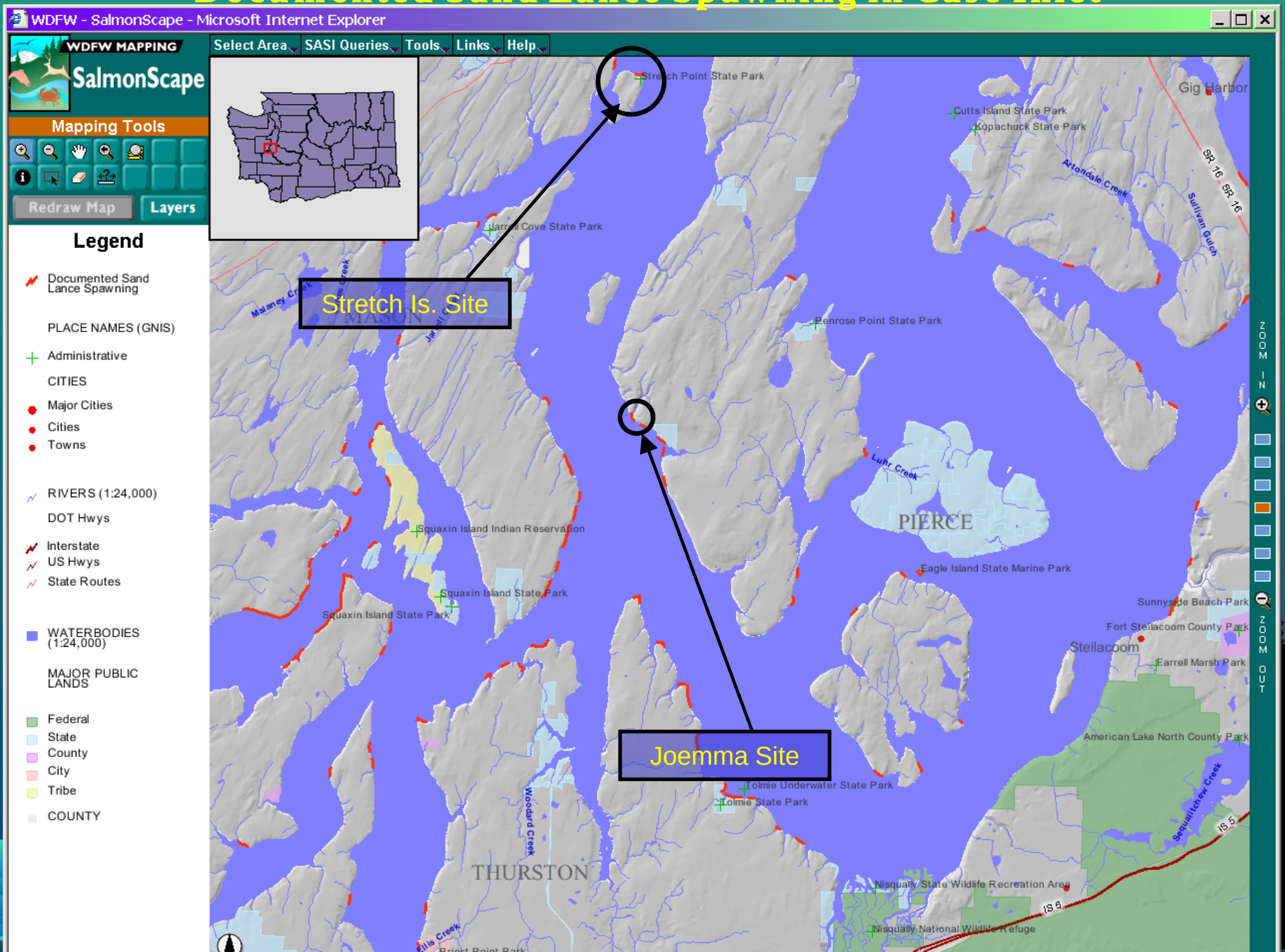
E-mail <webmaster@dfw.wa.gov>

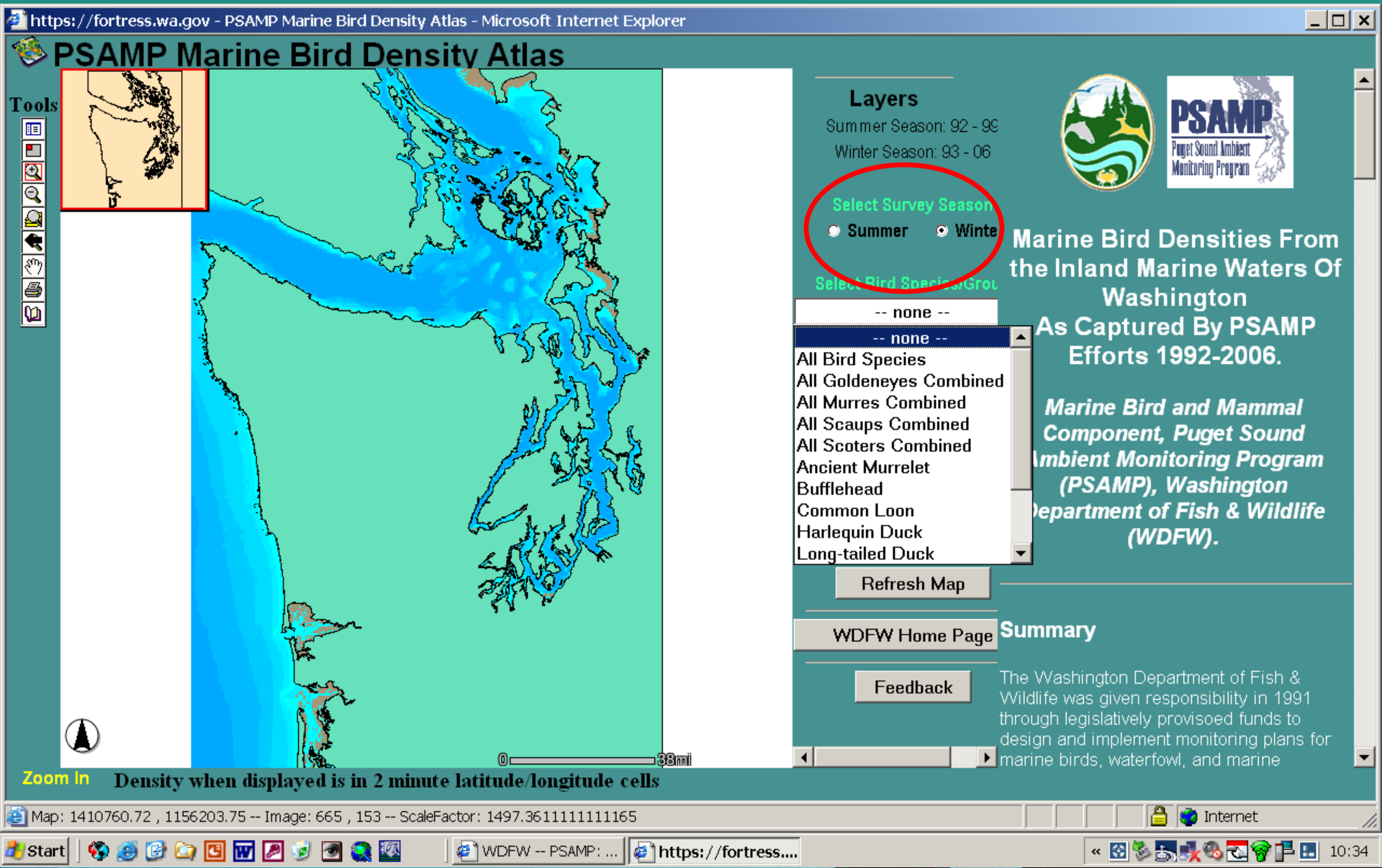
Done

Internet

Documented Sand Lance Spawning in Case Inlet



Marine Bird Atlas on WDFW Web Site



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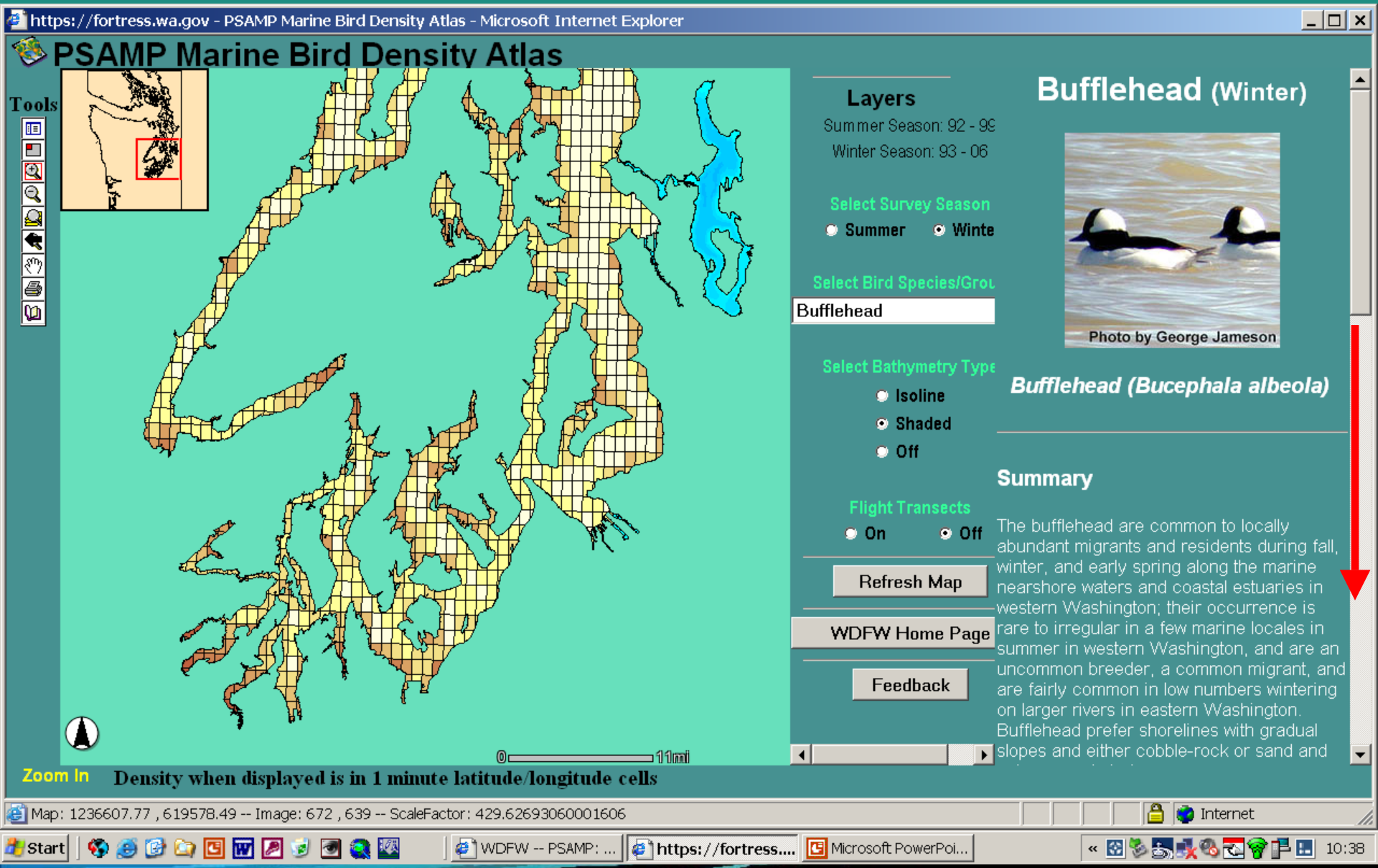
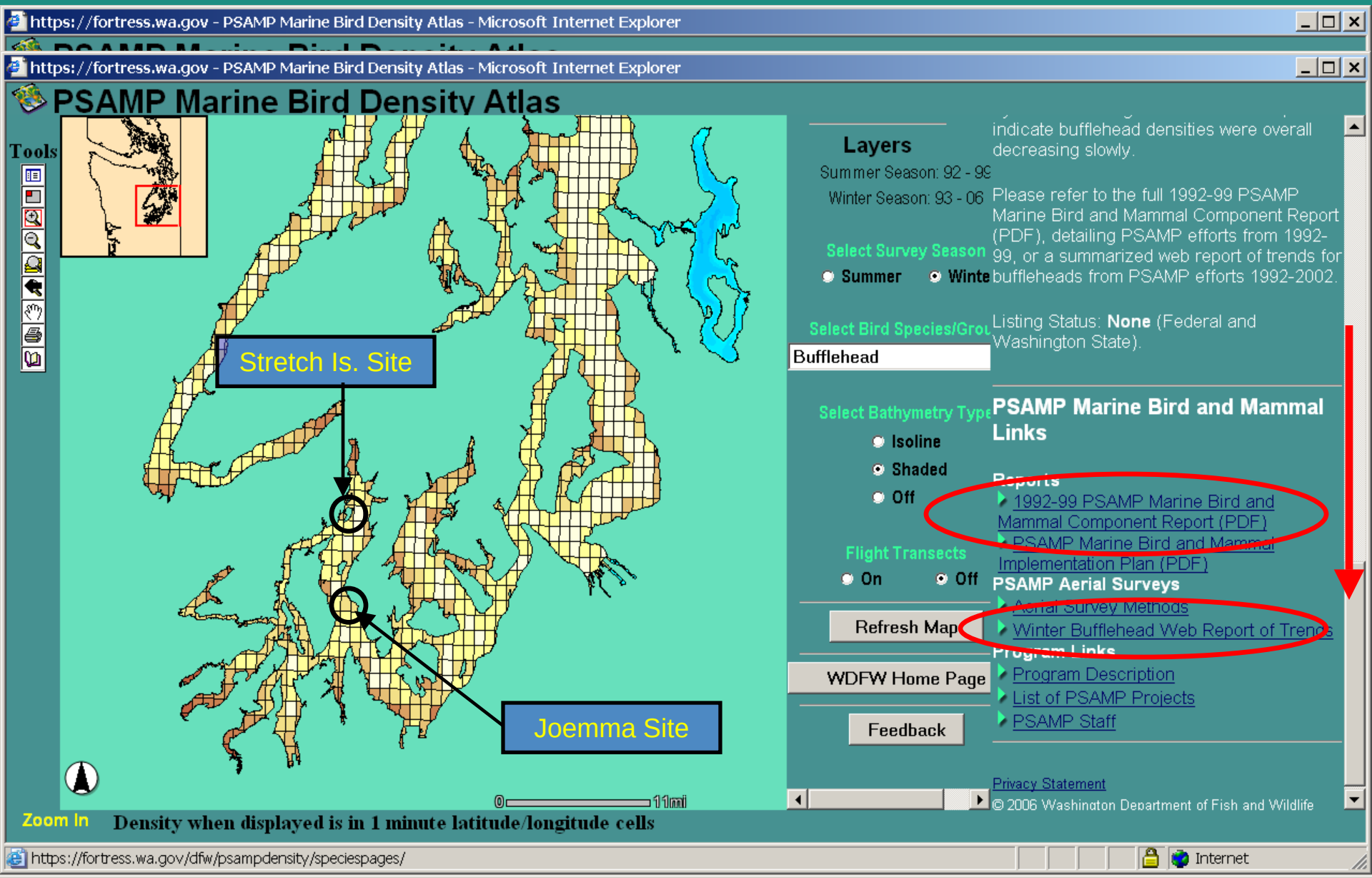


Marine Bird Atlas on WDFW Web Site



Coastal Atlas, WA Department of Ecology

One of the more widespread breeding marine birds, Pigeon Guillemot, utilizing southern Puget Sound in summer and typical nesting habitat used here

Plumage of juvenile fledgling

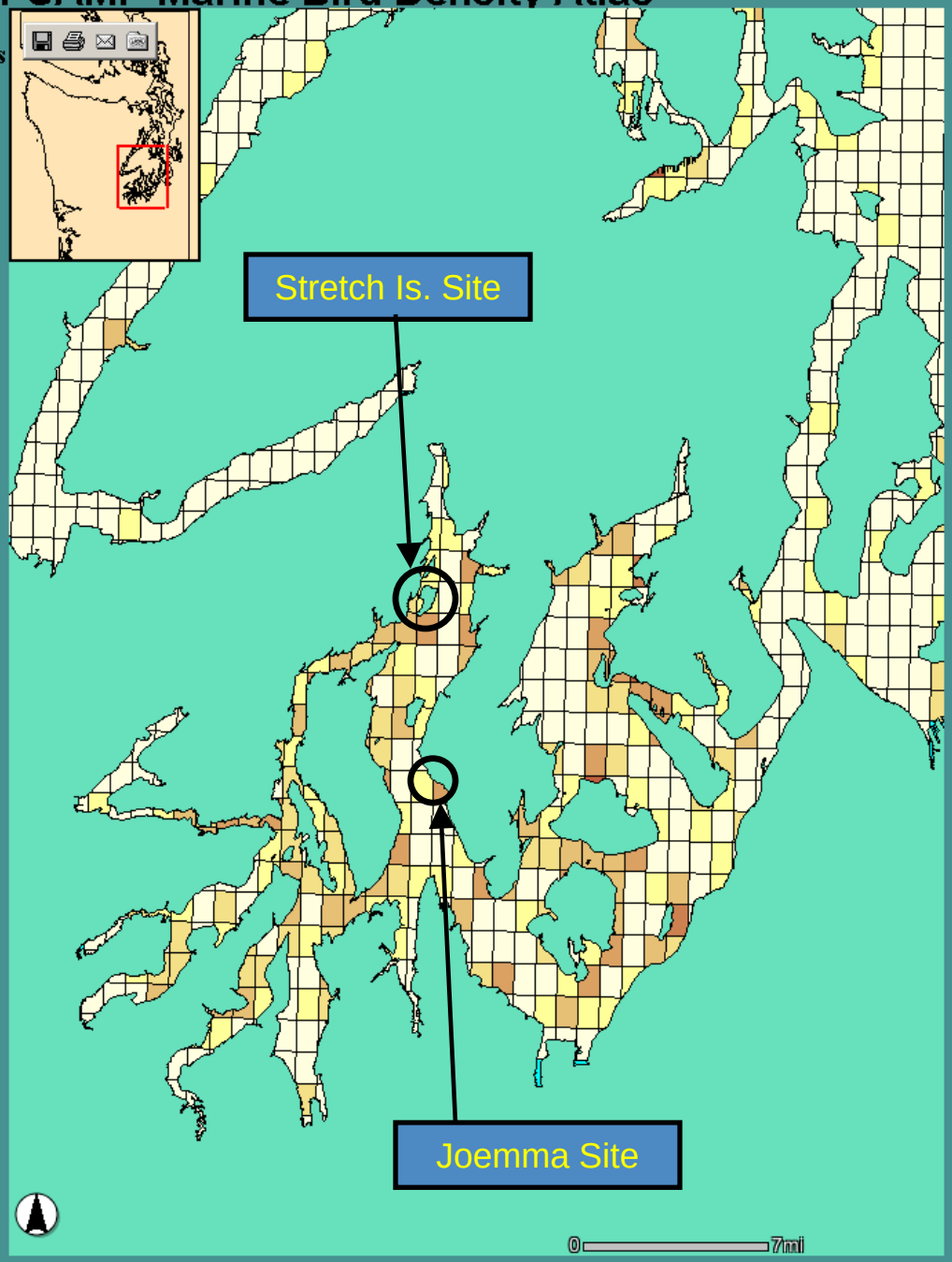
Winter plumage of adult

Plumage of breeding adults

PSAMP Marine Bird Density Atlas - Microsoft Internet Explorer

PSAMP Marine Bird Density Atlas

Tools



Legend

Land

Pigeon Guillemot

Areas Sampled

LE 2 Birds/km2

2 - 5 Birds/km2

5 - 10 Birds/km2

10 - 25 Birds/km2

25 - 50 Birds/km2

GT 50 Birds/km2

Bathymetry

LE 10 Meters

10 - 20 Meters

20 - 40 Meters

20 - 40 Meters

40 - 60 Meters

60 - 100 Meters

GT 100 Meters

Tidal Flats

Pigeon Guillemot
(Summer)

Pigeon Guillemot (Cepphus columba)

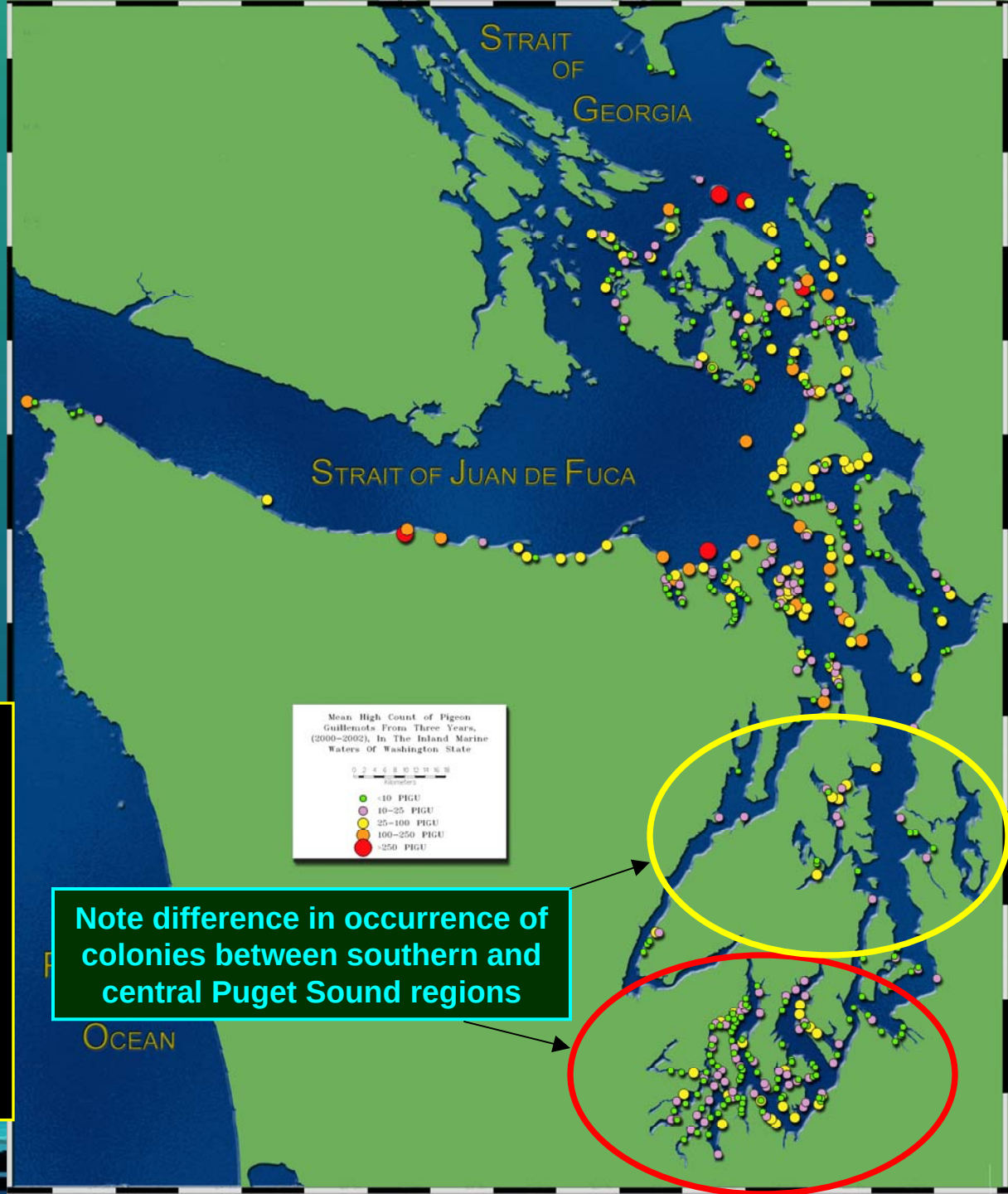
Summary

The proportion of summer marine bird populations composed of alcids ranged from 5.9% to 14.6%, averaging 10.3% over the eight summers in the northern and western survey area covered every July 1992-99. Pigeon guillemots comprised 29.6% of the five alcid species identified to species level, and were the most widely distributed alcid species throughout the inner marine waters of Washington year round. They occurred primarily along shorelines near breeding sites and nearby feeding areas during July, with certain very high concentrations found near large colony sites like Protection and Sucia Islands. The density of pigeon guillemots in the nearshore waters still varied considerably because of their movements to or from colonies during the day. The aerial survey design used works best when birds are not moving much geographically during a diurnal period since time of day can not be standardized for survey of all sites. The diurnal movement of this species in the

Pan

Density when displayed is in 1 minute latitude/longitude cells

Pigeon Guillemot Colonies Surveyed Each May 1999-2003

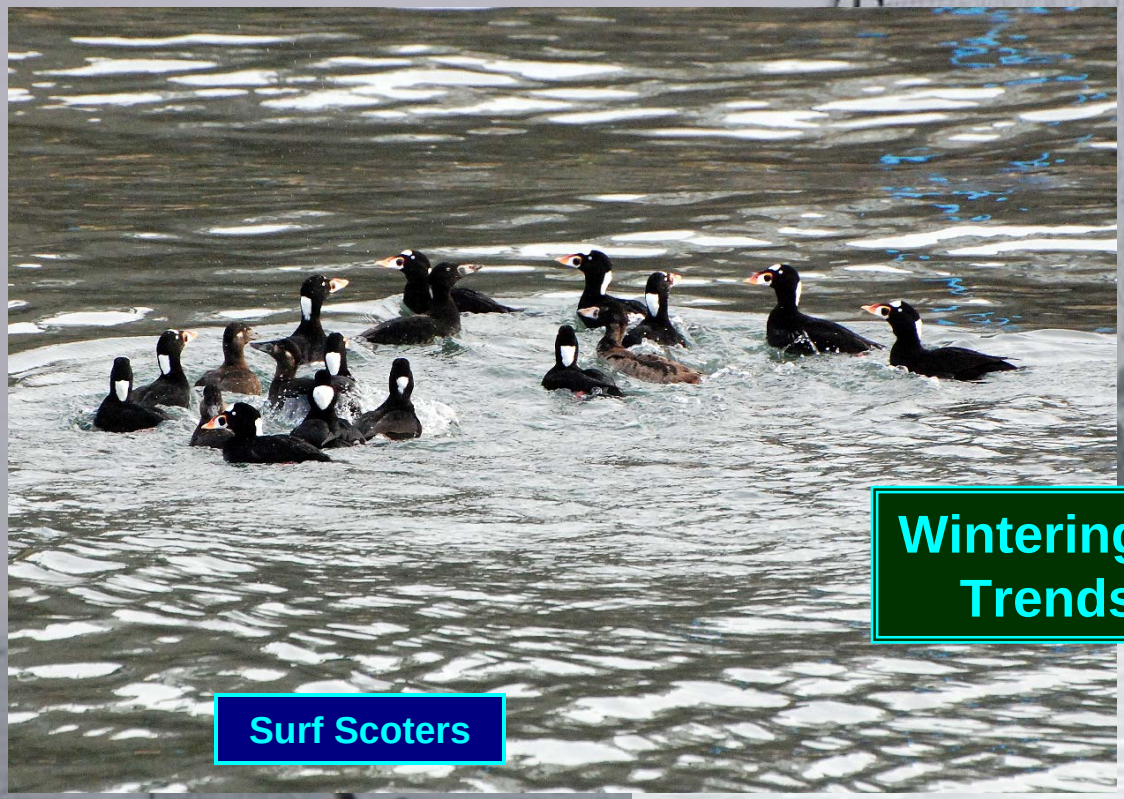


Note difference in occurrence of colonies between southern and central Puget Sound regions

Pigeon Guillemot Colonies In Inner Marine Waters Now Known To Include 481 Sites Containing Almost 16,000 birds

125 of 481 sites located in Southern Puget Sound

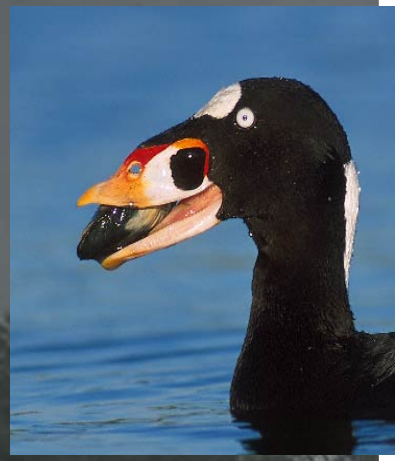
Wintering Status, Distribution, and Trends of Key Scoter Species

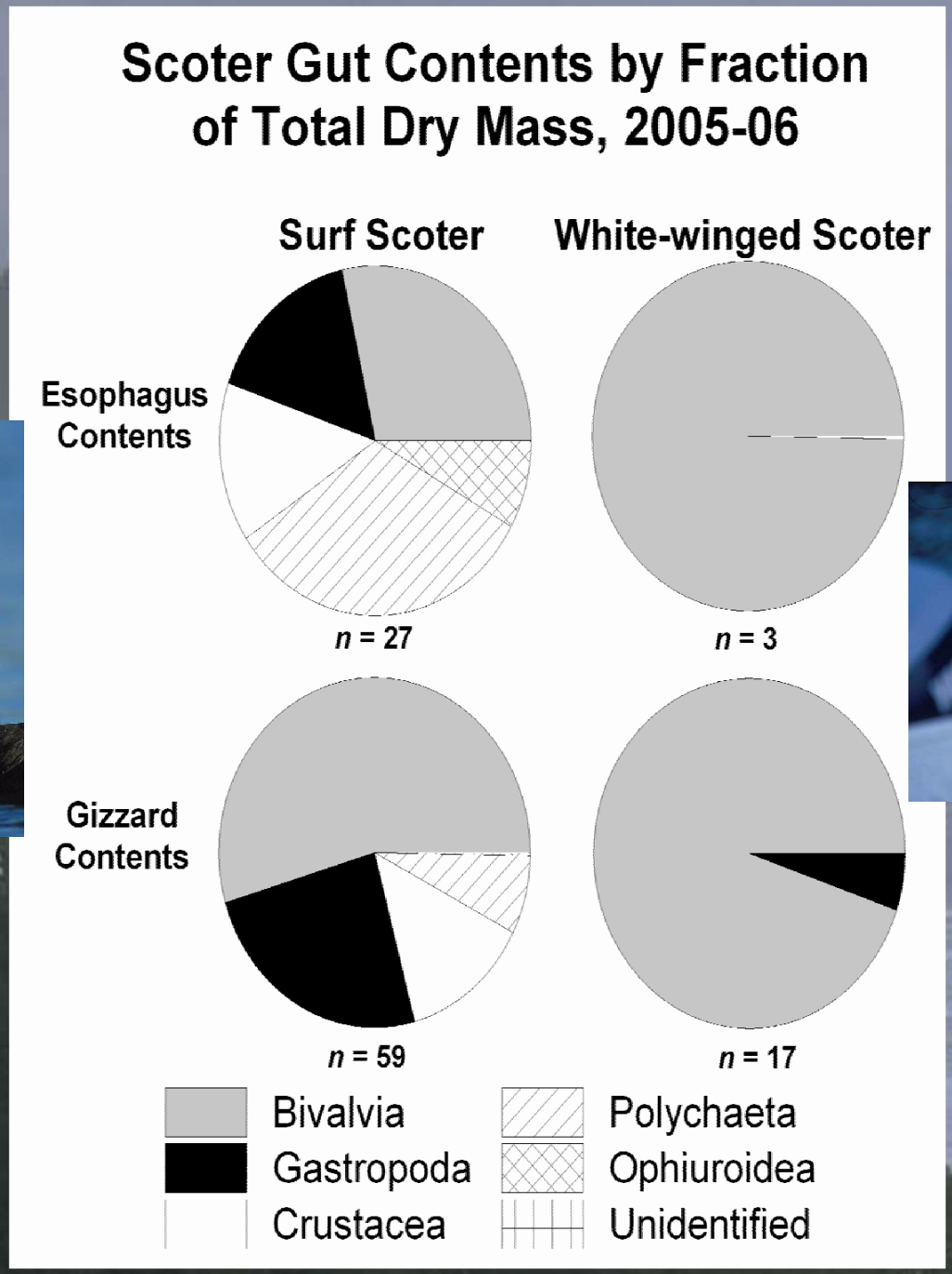


Surf Scoters

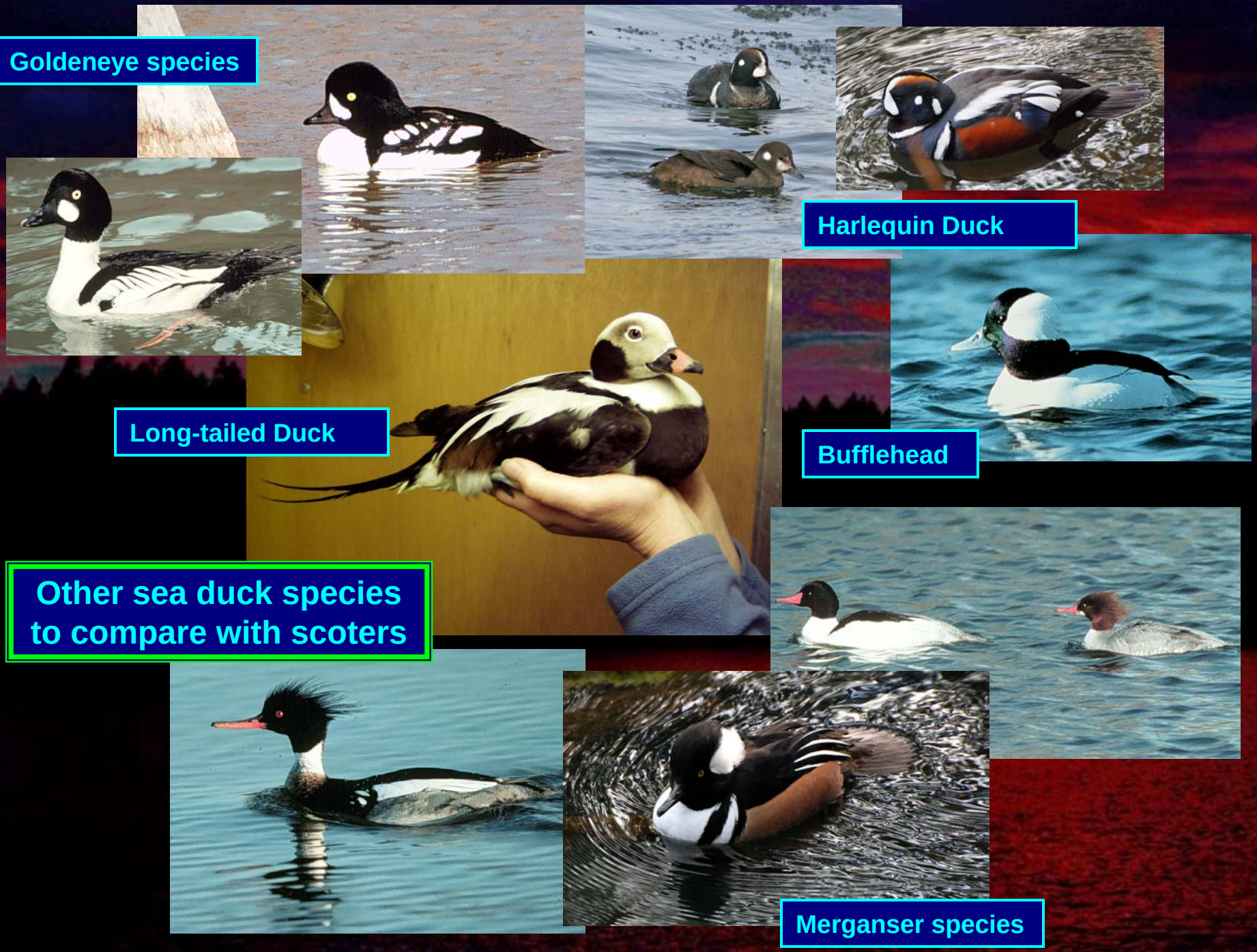
White-winged Scoters

Diet
2005-2006

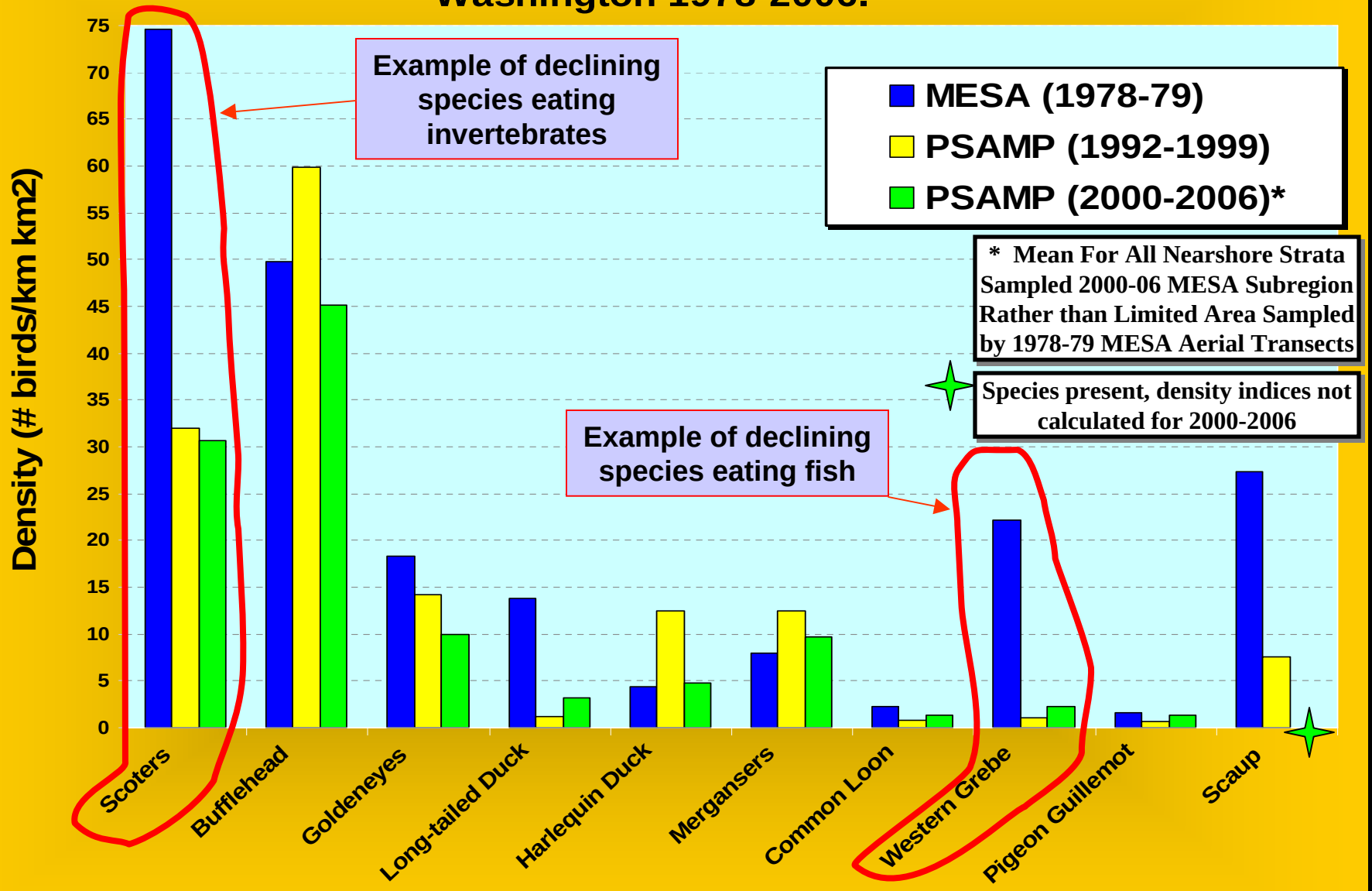




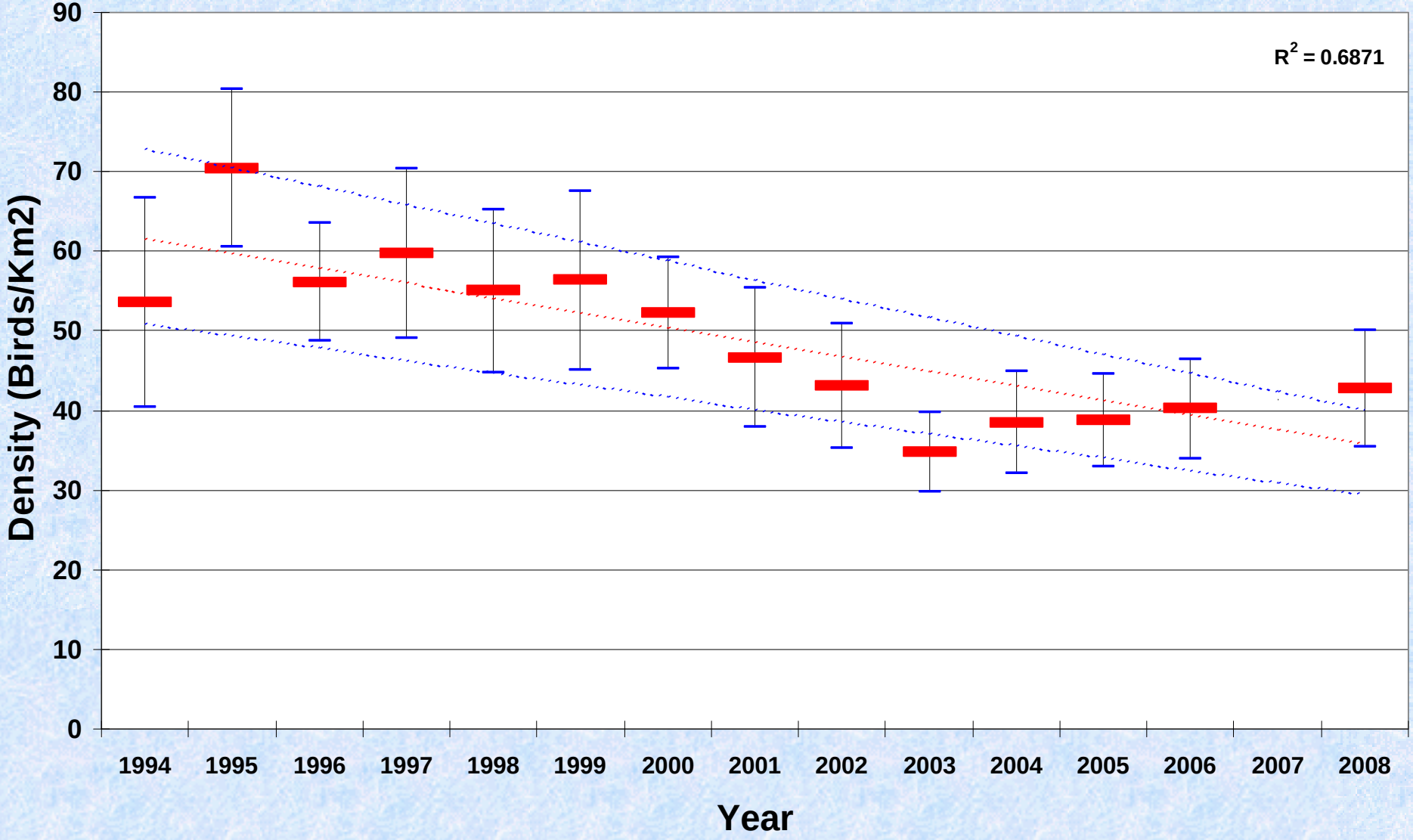
Graduate studies by Eric Anderson, University of Wyoming


Goldeneye species
Harlequin Duck
Long-tailed Duck
Bufflehead
Other sea duck species
to compare with scoters
Merganser species

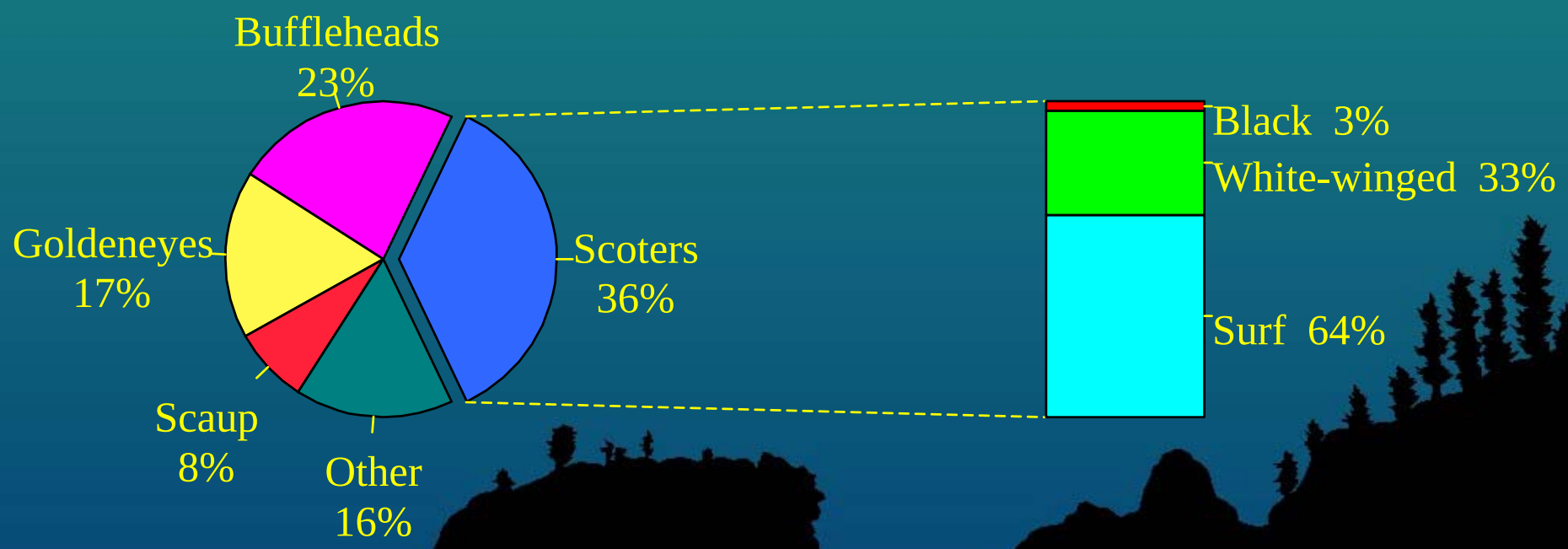
Relative Changes in Selected Densities of Wintering Marine Birds in Nearshore Strata of Northern Inner Marine Waters of Washington 1978-2006.



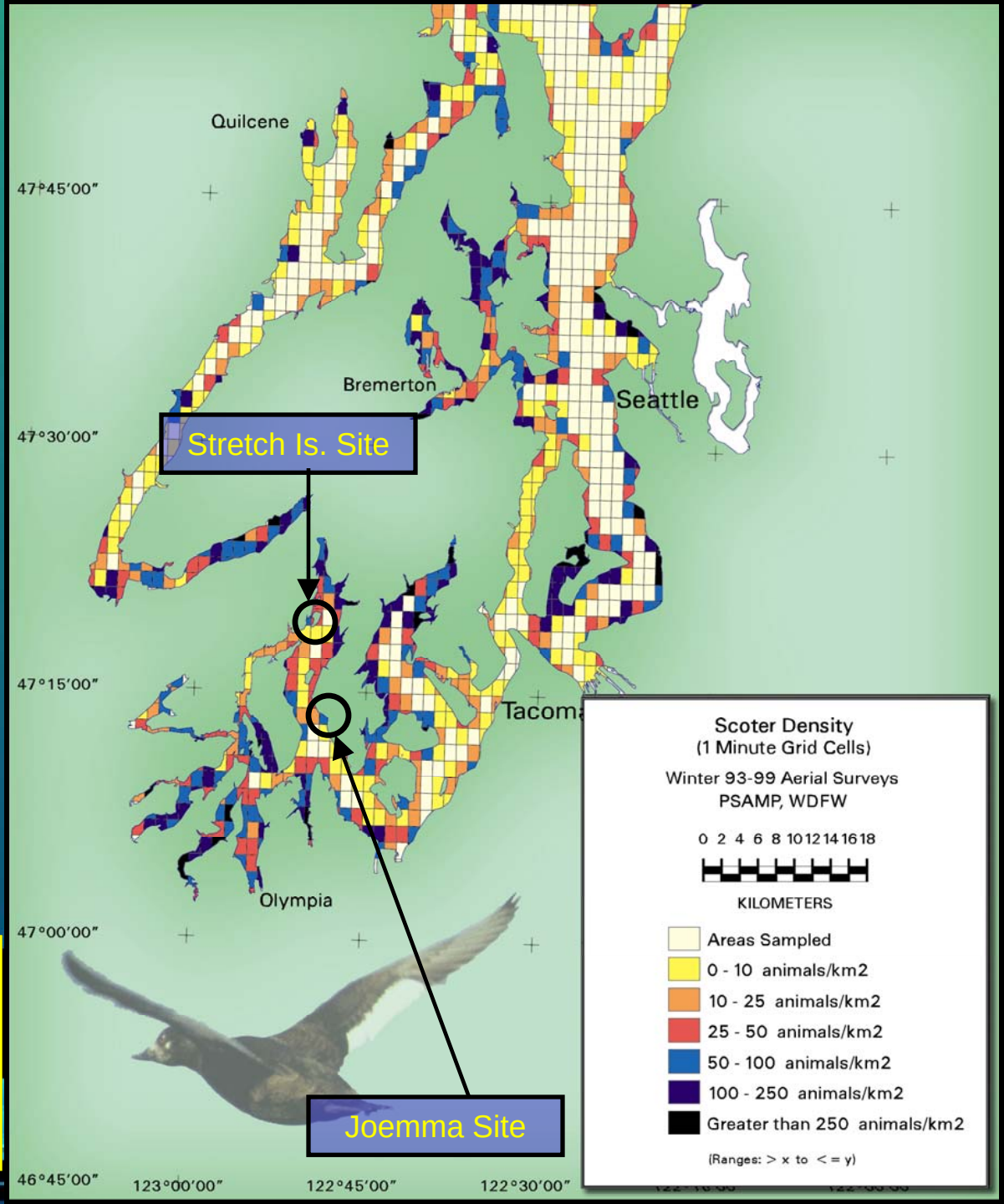
Winter Scoter Density Indices in Nearshore (< 20m Depth) Waters of Inner Marine Waters of Washington State, 1994-2008.



Diving Duck Composition, Winter Surveys in Greater Puget Sound 1992-99



Distribution of Wintering Scoter Densities in Southern and Central Puget Sound 1993-99

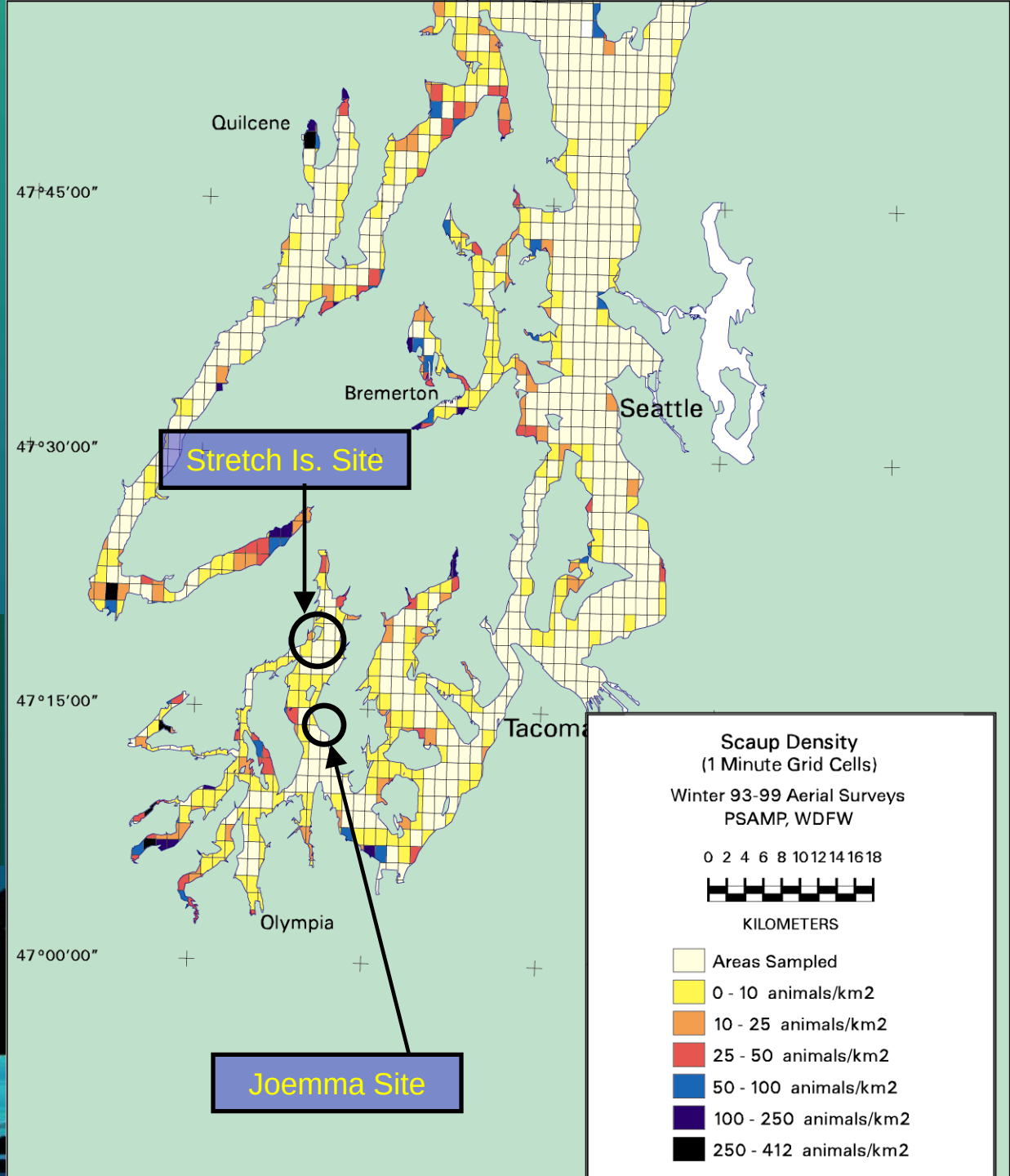


Close to 20% of scoters in all inner marine waters in winter occur in southern Puget Sound

Scaup Densities Observed in Southern and Central Puget Sound

Winters 1993-99

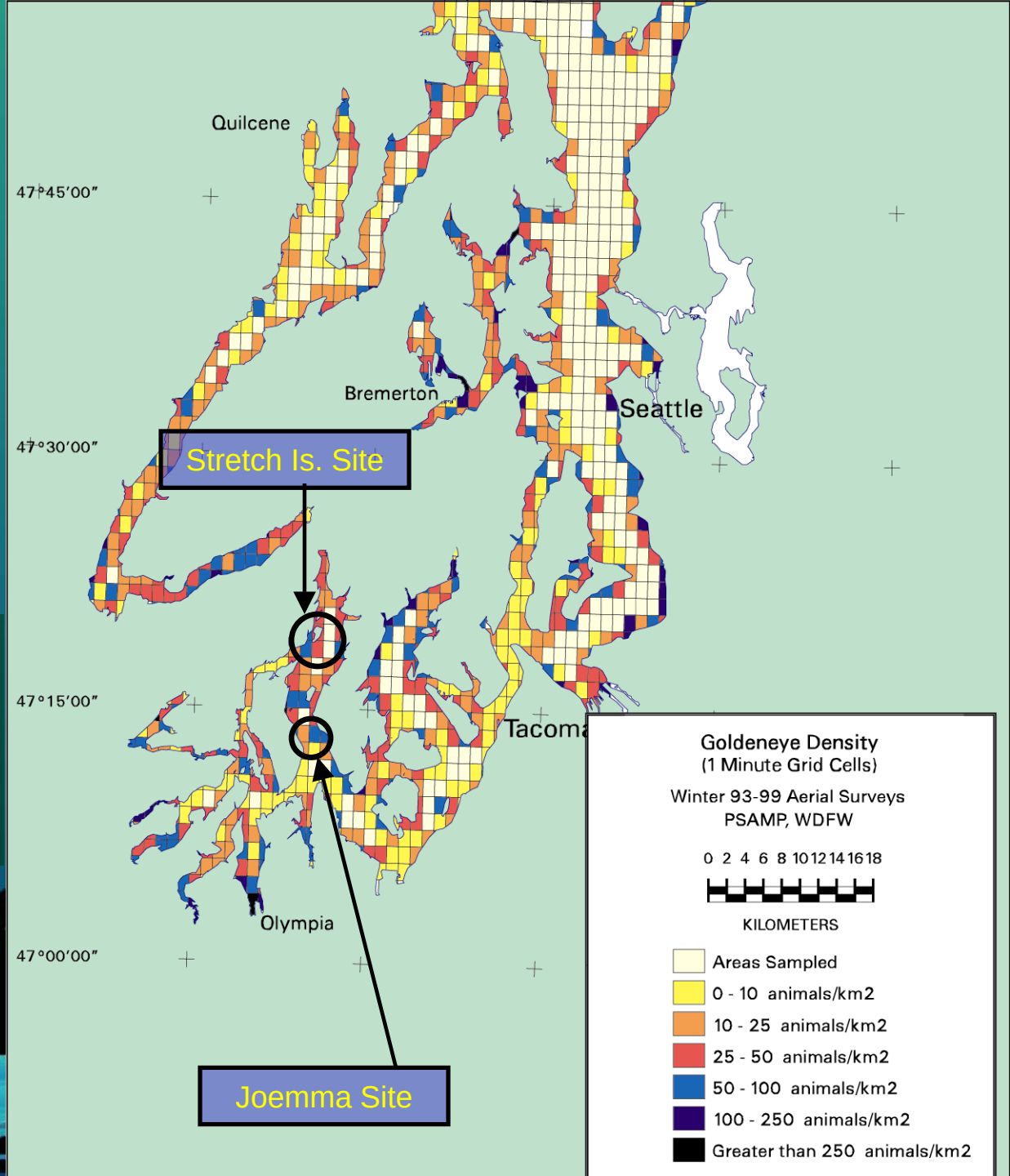
- Distribution of scaup more clumped than scoters
- Scaup also exhibited declines (72% percent)



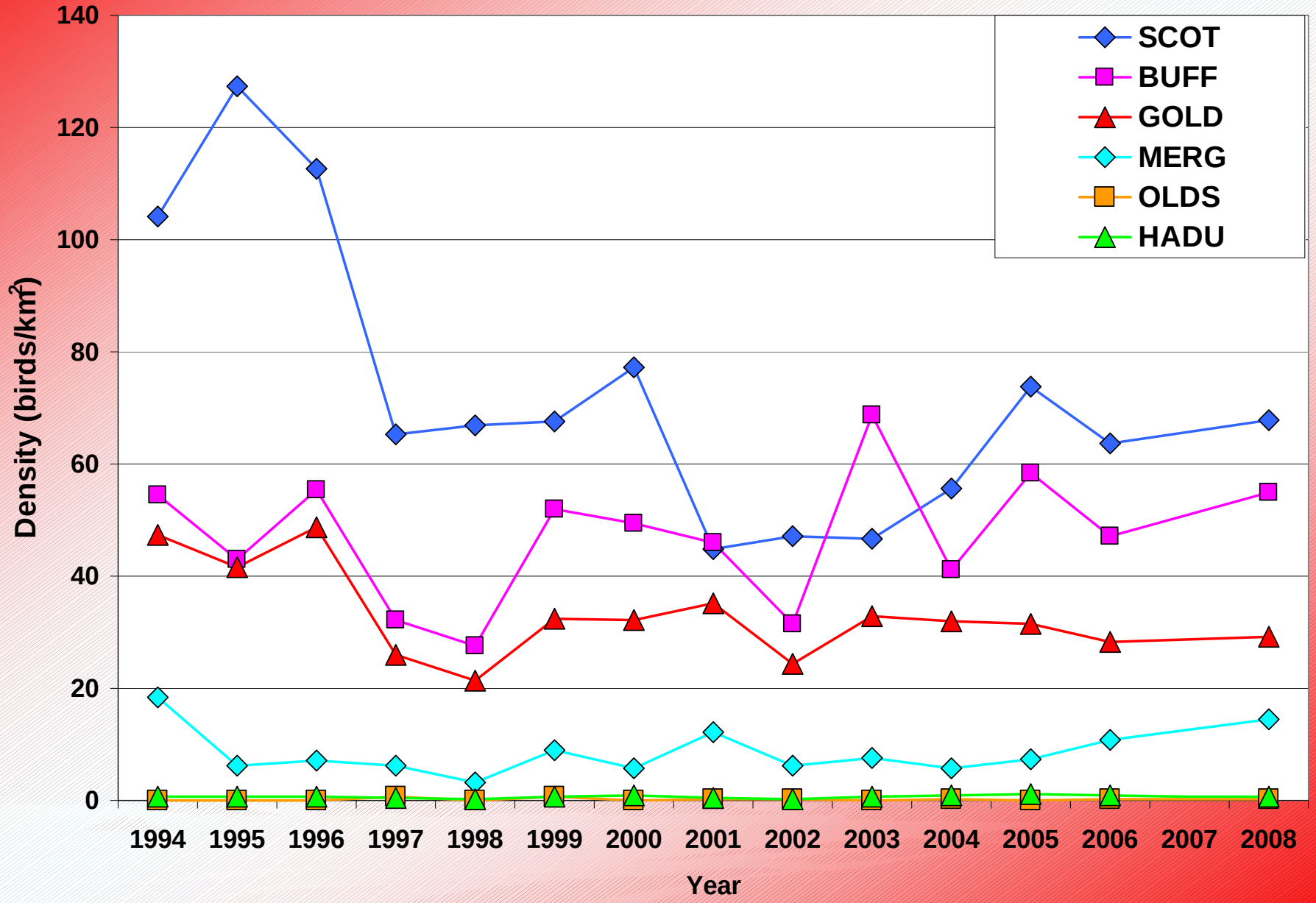
Goldeneye Species Densities Observed in Southern and Central Puget Sound

Winters 1993-99

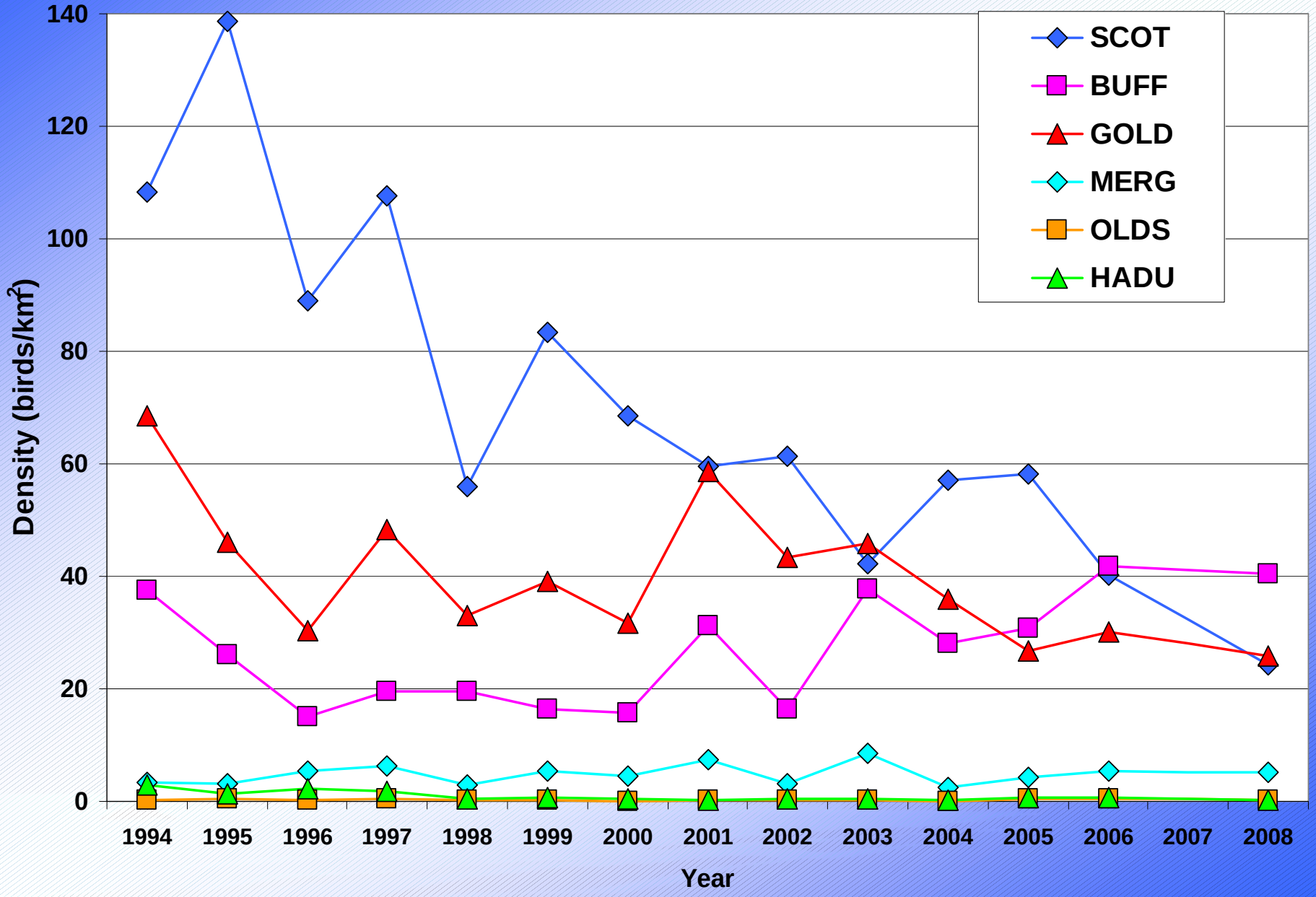
- Distribution of goldeneyes less clumped than scoters
- Goldeneyes exhibit less declines (23% percent)



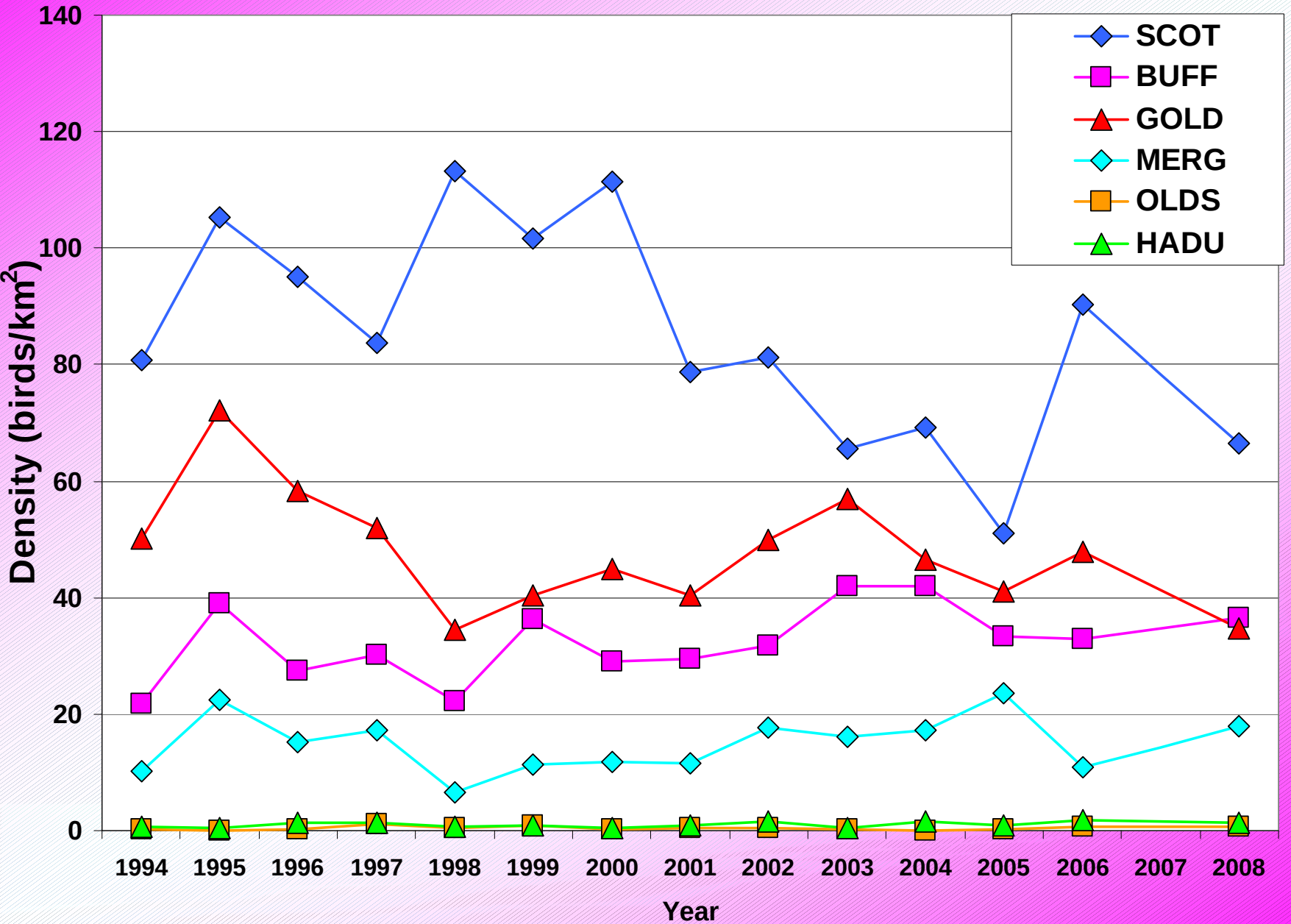
Sea Duck Trends in Southern Puget Sound 1994-2008



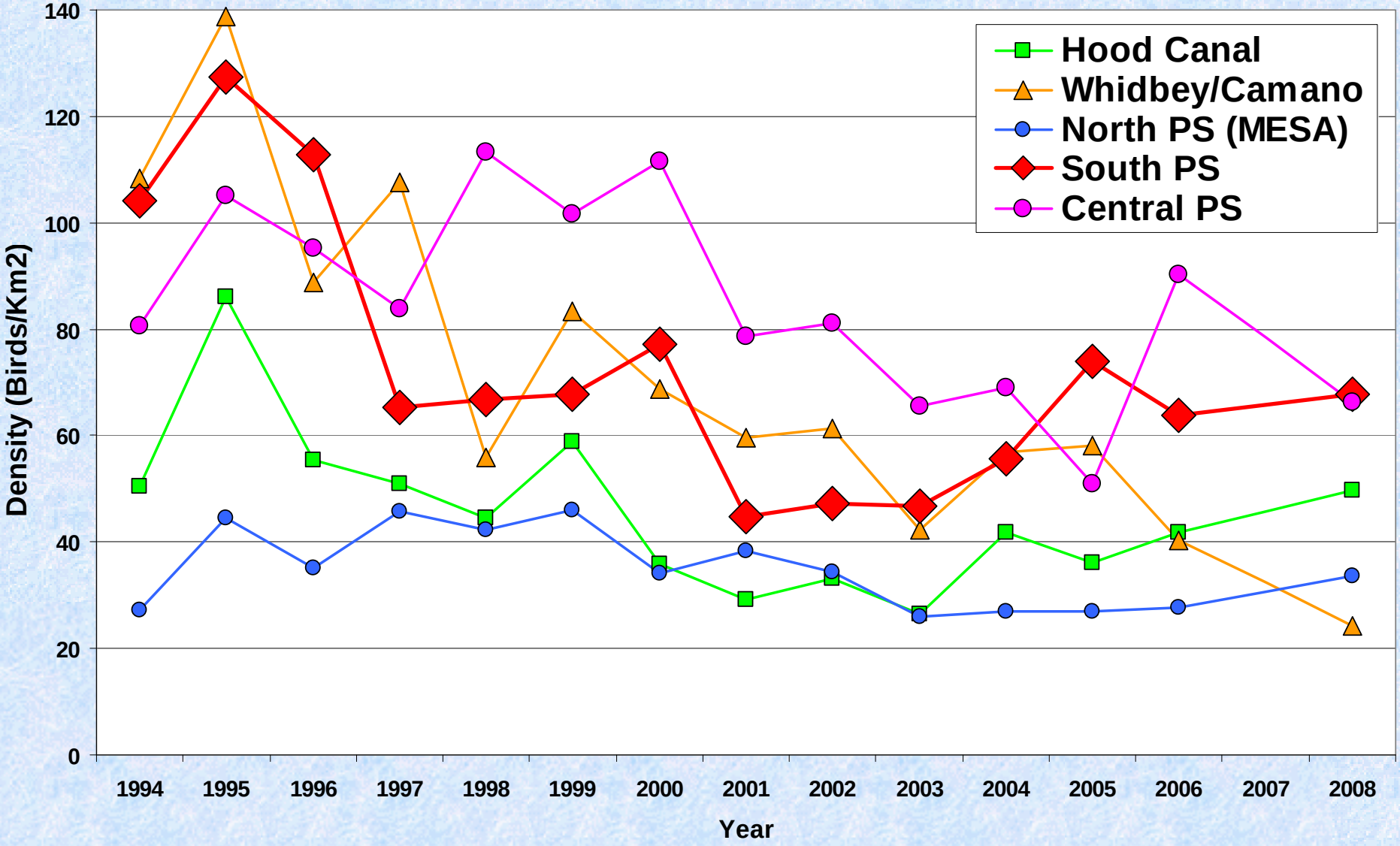
Sea Duck Trends in Whidbey Island Area 1994-2008



Sea Duck Trends in Central Puget Sound 1994-2008



Changes in Winter Scoter Density Indices in Different Subregions in the Nearshore (< 20m Depth) Inland Marine Waters of Washington State, 1994-2008.



Factors that may relate to changes in marine avian species in Washington State

- Declines in key herring spawning stocks
- Change in local food webs or quality of habitats
- Relationship to human factors (harvest, disturbance, contaminant loads, mortality events)
- Low survival of juveniles and/or adults
- Disruption of age/sex ratios of species population
- Change in reproductive success for Washington-oriented component of individual species
- Shifting distributions flyway-wise of wintering birds
- Effects related to acute and chronic contamination
- Global or climatic oscillations or changes

Focus Studies to Identify Mechanisms of Change

Capture Regions of Winter Surf Scoter Populations

- Captures generally conducted between Late November through mid-February
- Numbers of transmitters reported here are those that reported over entire spring
- VHF values only include data that WDFW collected.

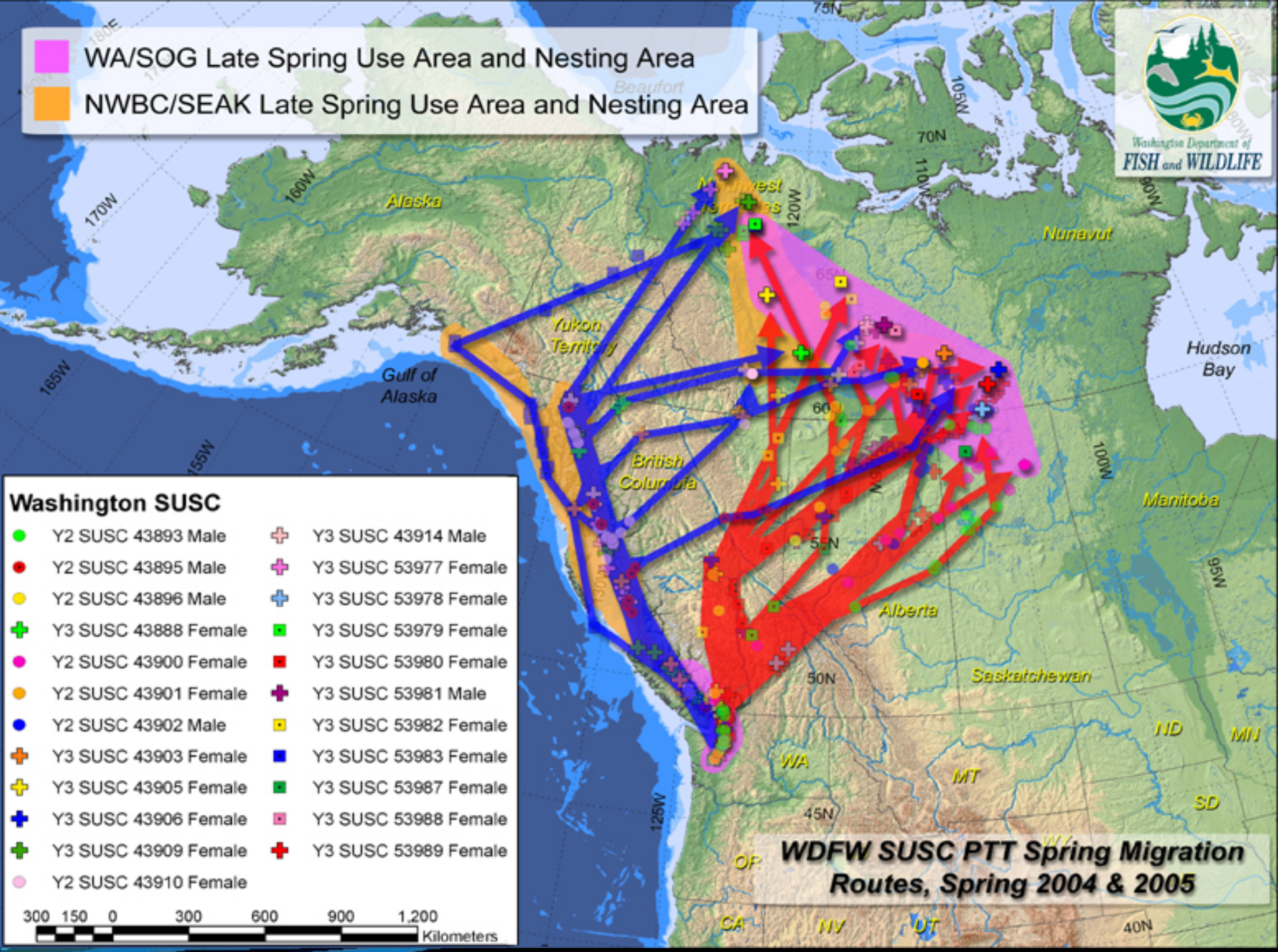
Winter Pop.	VHF's	Years
Georgia Basin, B.C.	6	2005
Puget Sound, WA	63*	2004, 2005, 2006
San Francisco Bay, CA	25	2005, 2006
San Quentin, MX	2	2005, 2006
Total	96*	

* Includes transmitters with 2 spring seasons of data.

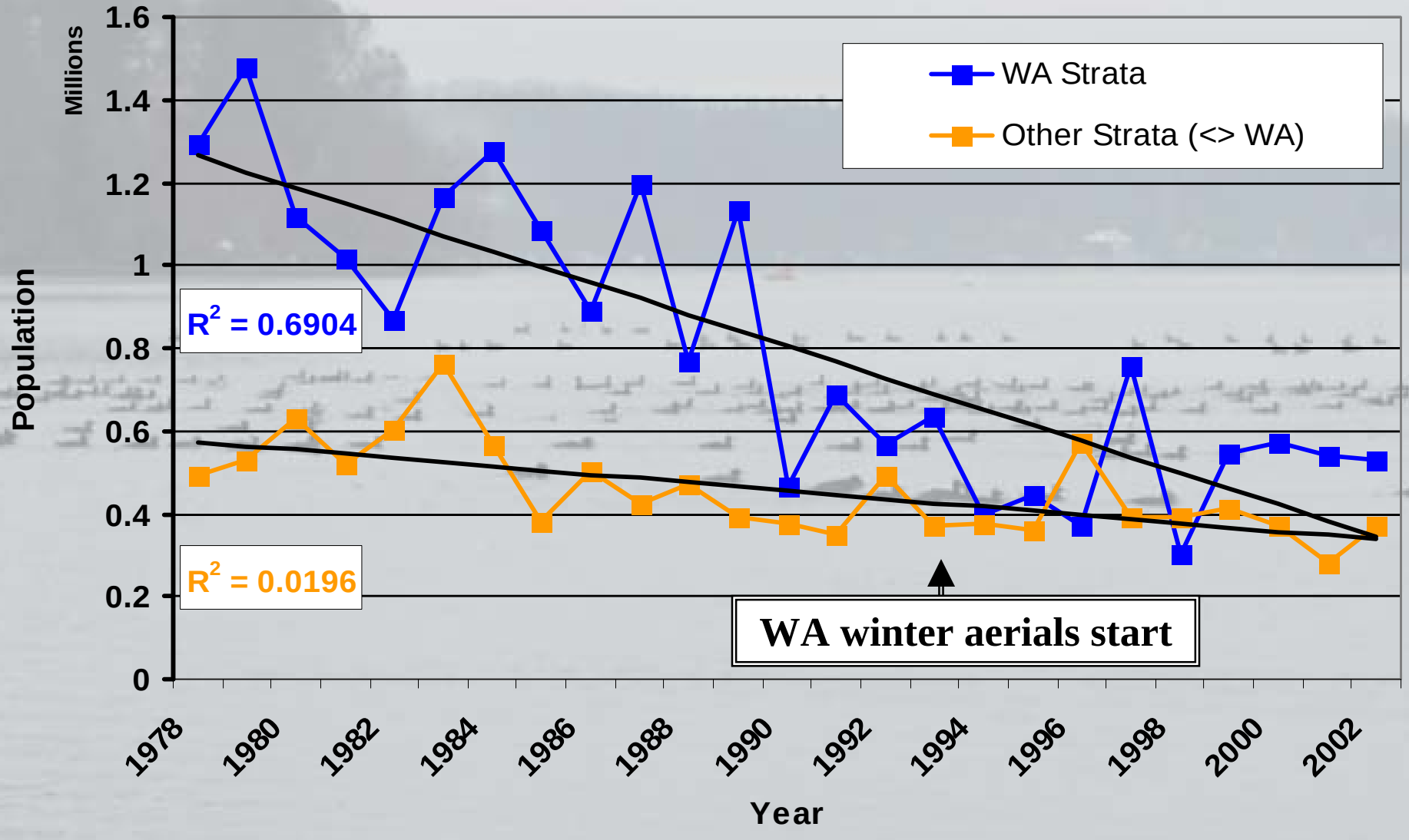
Winter Pop.	PTT's	Years
Georgia Basin, B.C.	8	2005
Puget Sound, WA	36*	2004, 2005, 2006
San Francisco Bay, CA	27	2003, 2005, 2006
San Quentin, MX	2	2005
Total	75*	

Capture Locations of Puget Sound Wintering Surf Scoters

- **NPS (Northern Puget Sound)**
  - Birch Bay - 2005
  - Penn Cove, Oak Harbor - 2004, 2005
- **Admiralty Inlet/Strait of Juan de Fuca**
  - Kilisut Harbor – 2006
- **CPS (Central Puget Sound)**
  - Port Orchard – 2004, 2005, 2006
- **SPS (Southern Puget Sound)**
  - Eld & Henderson Inlet, Peale Passage – 2004, 2005, 2006

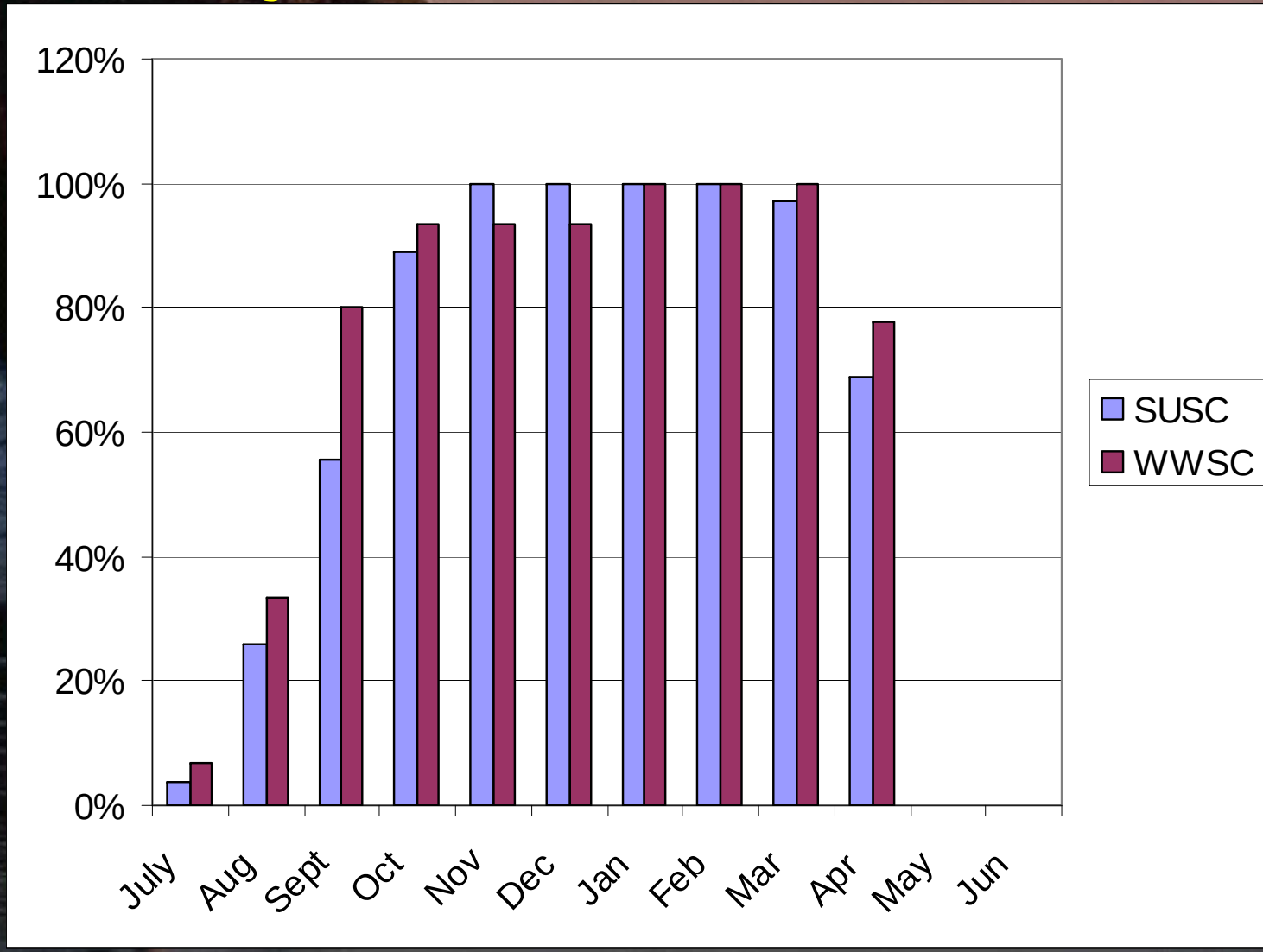

WA/SOG Late Spring Use Area and Nesting Area
NWBC/SEAK Late Spring Use Area and Nesting Area
Washington Department of FISH and WILDLIFE
Alaska
Gulf of Alaska
Yukon Territory
British Columbia
Nunavut
Hudson Bay
Manitoba
Alberta
Saskatchewan
ND
MN
SD
MT
WA
OR
CA
NV
UT
Washington SUSC
Y2 SUSC 43893 Male
Y2 SUSC 43895 Male
Y2 SUSC 43896 Male
Y3 SUSC 43888 Female
Y2 SUSC 43900 Female
Y2 SUSC 43901 Female
Y2 SUSC 43902 Male
Y3 SUSC 43903 Female
Y3 SUSC 43905 Female
Y3 SUSC 43906 Female
Y3 SUSC 43909 Female
Y2 SUSC 43910 Female
Y3 SUSC 43914 Male
Y3 SUSC 53977 Female
Y3 SUSC 53978 Female
Y3 SUSC 53979 Female
Y3 SUSC 53980 Female
Y3 SUSC 53981 Male
Y3 SUSC 53982 Female
Y3 SUSC 53983 Female
Y3 SUSC 53987 Female
Y3 SUSC 53988 Female
Y3 SUSC 53989 Female
300 150 0 300 600 900 1,200
Kilometers
WDFW SUSC PTT Spring Migration Routes, Spring 2004 & 2005

Scoter Population Trends from Breeding Surveys: Strata Used by Washington Scoters Versus Strata not Used by Washington Scoters, 1978 - 2002.



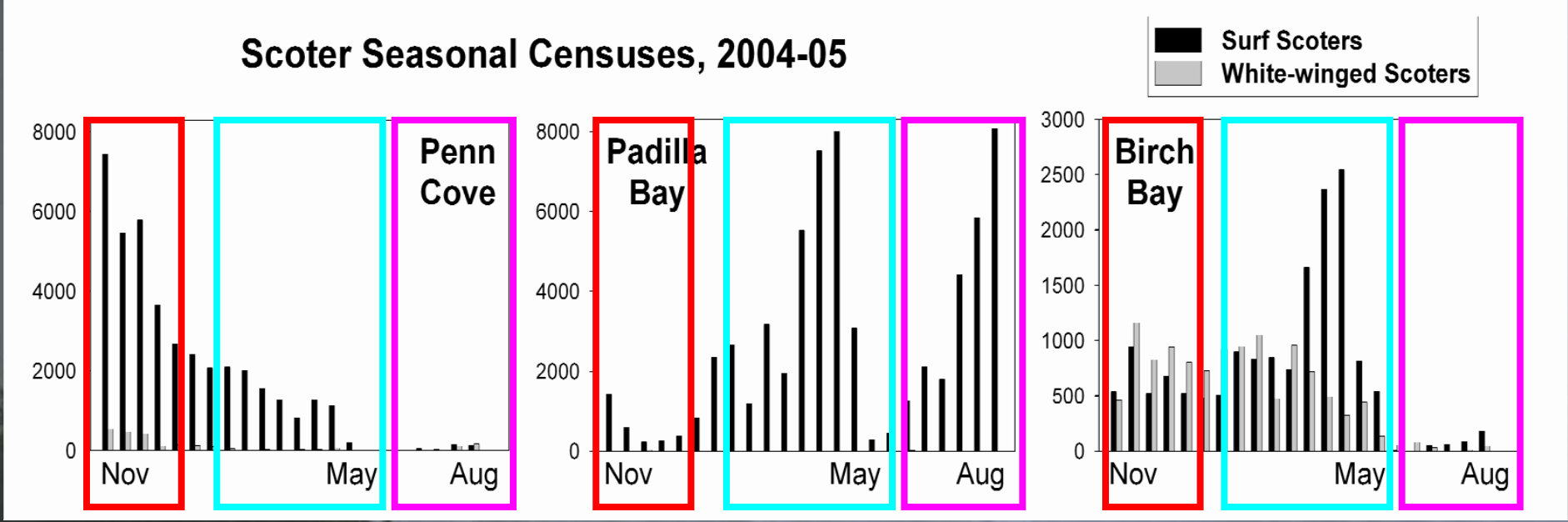
Percent Occurrence of Scoters in Salish Sea by end of each Month

- Both scoter species spend 8-10 months in marine habitats in Salish Sea
- Females and males exhibit two different patterns



Graduate studies by Eric Anderson, University of Wyoming

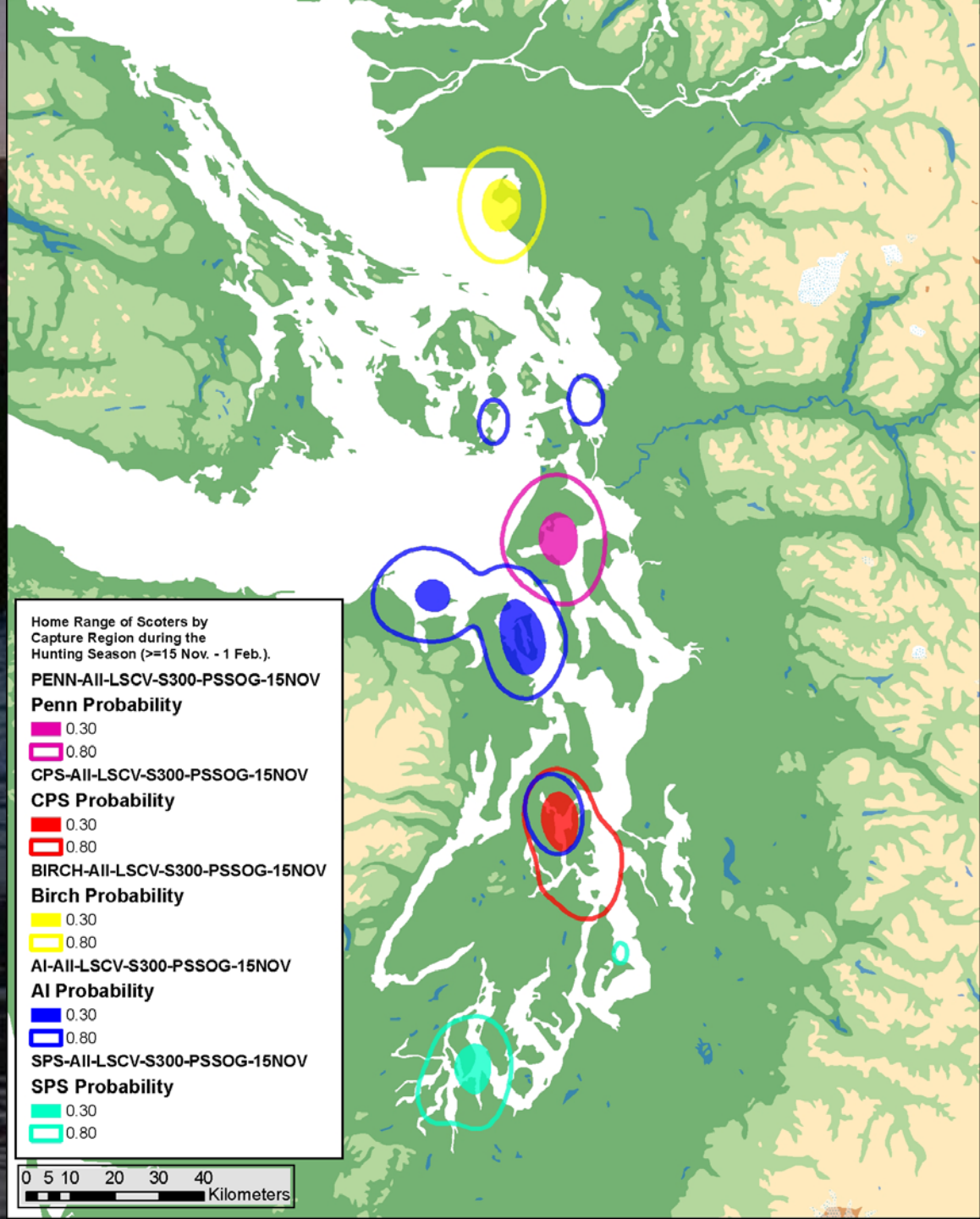
Censuses of Three Selected Bays



Fall	red box
Winter, Spring	blue box
Summer	pink box

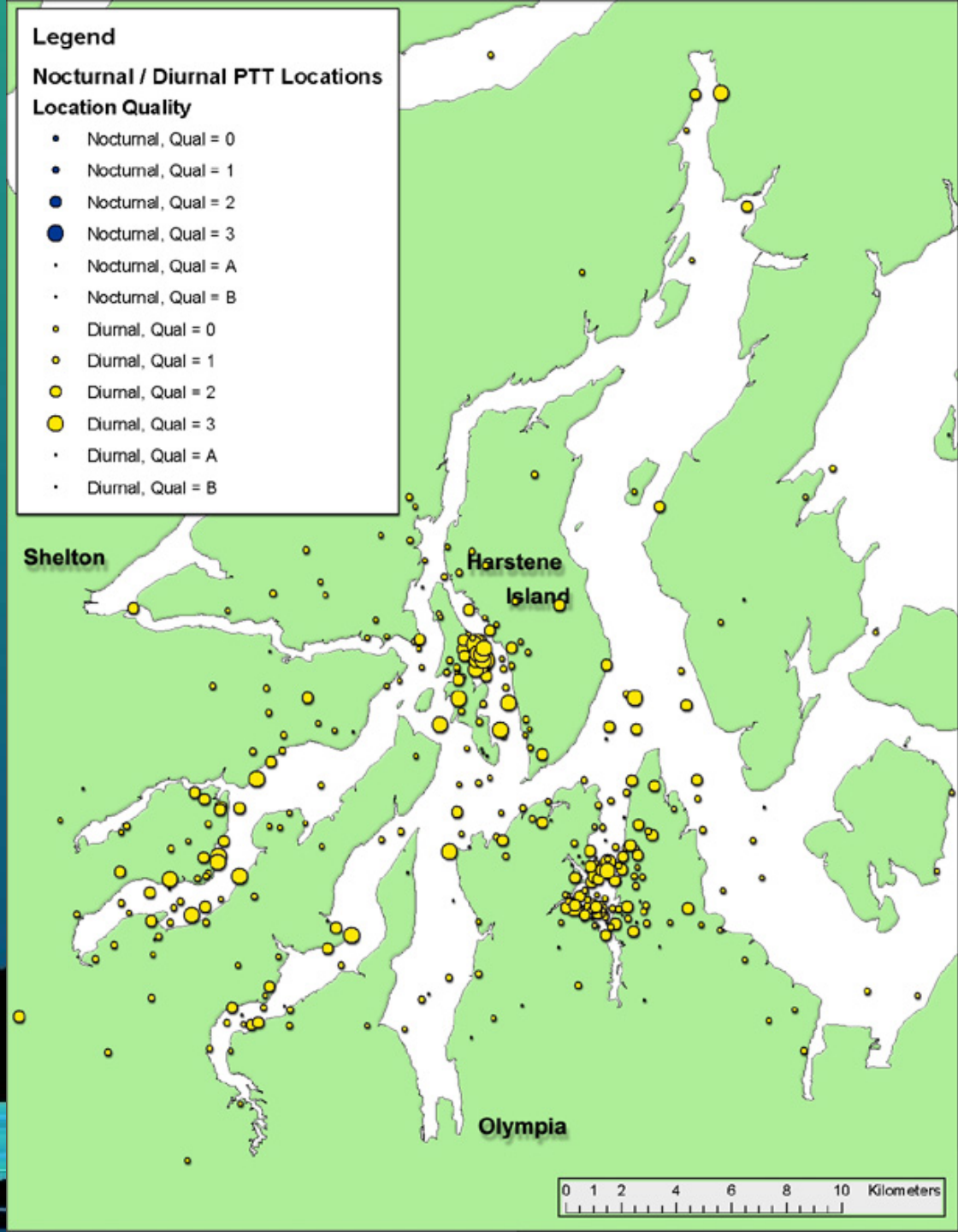
Home Range of Surf Scoters

- These home ranges determined during November to February
- Solid areas are where 30% likely and circles are 80% likely to occur
- Individual birds were observed to return to a number of the exact same wintering locations (89%+) in following years



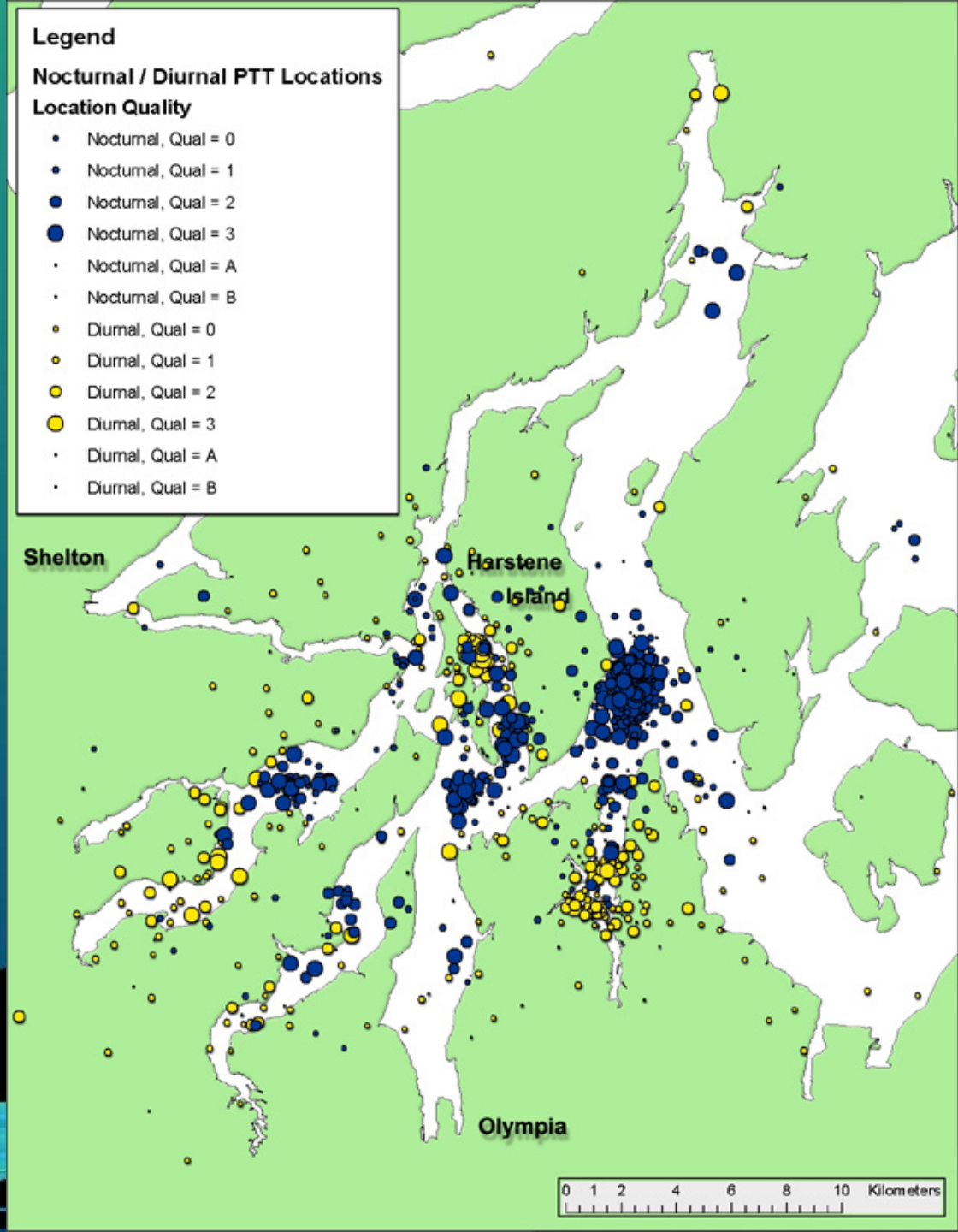
SOUTHERN PUGET SOUND PTT

- Diurnal PTT locations of scoters, 2003-2005
- Representative of diurnal densities from aerial surveys



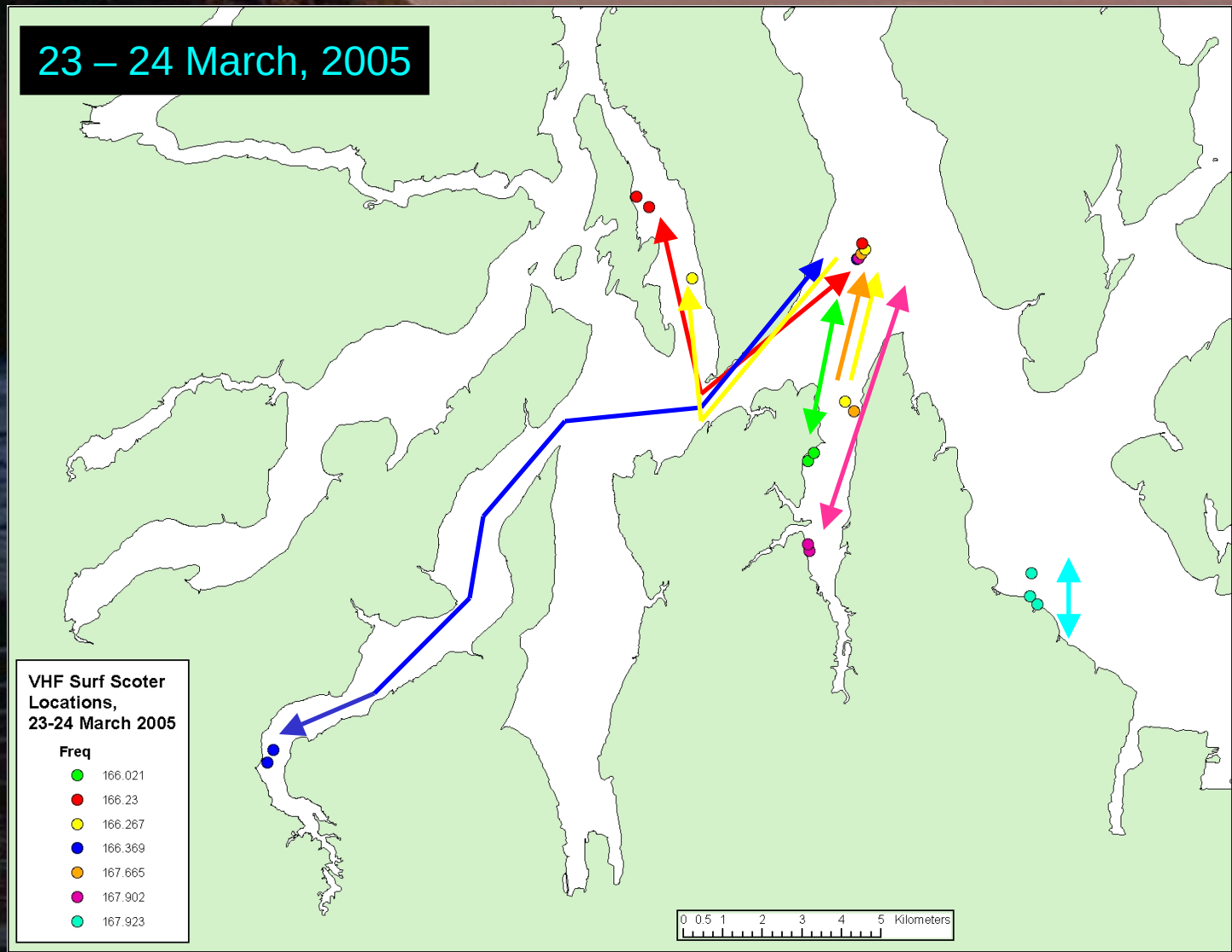
SOUTHERN PUGET SOUND PTT

- Nocturnal & Diurnal PTT locations of scoters, combined 2003-2005
- 372 nocturnal positions were obtained
- Shift towards more open water
- Most overlapping locations are
  - Near sunrise/sunset time
  - Within a few weeks of release



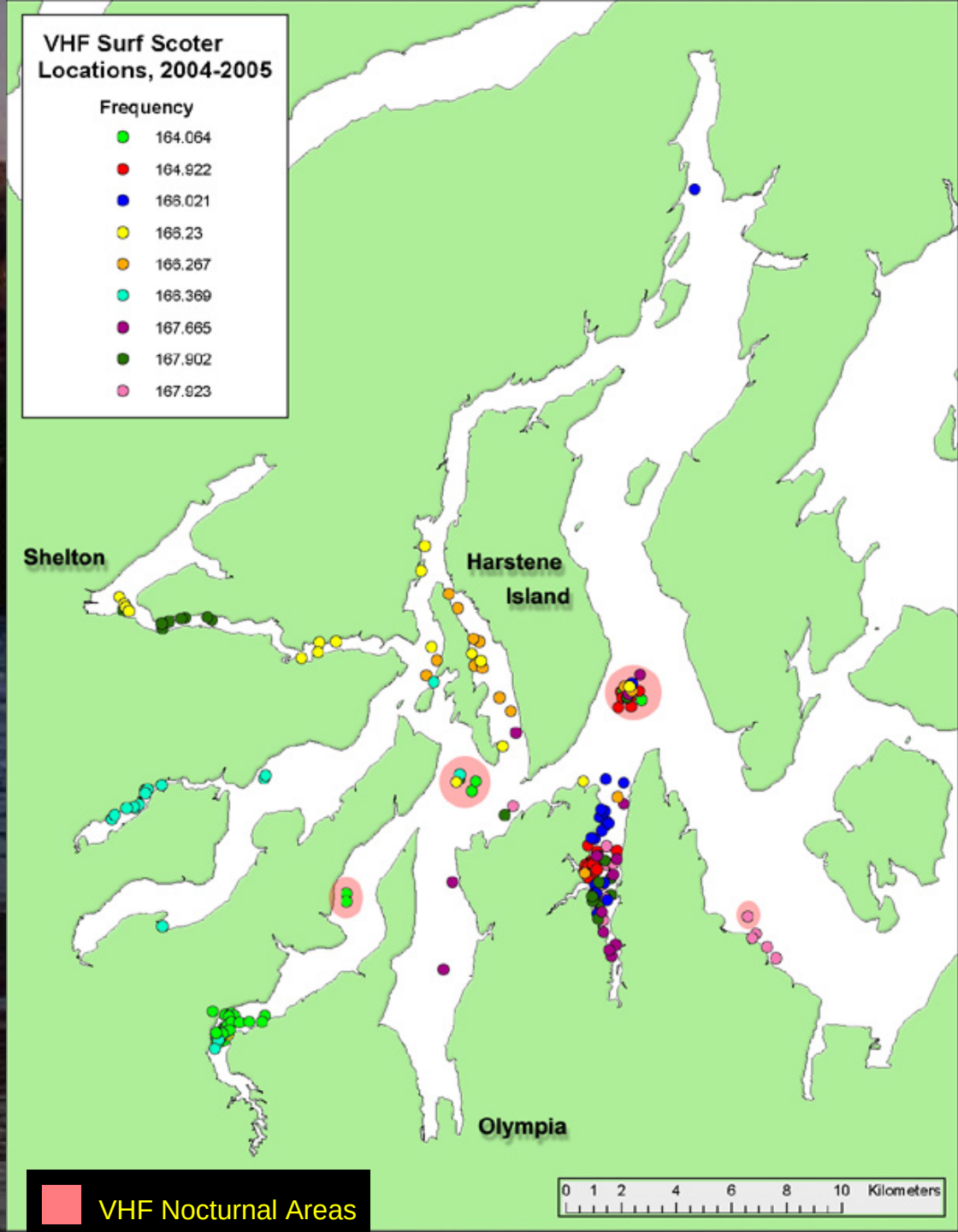
SOUTHERN PUGET SOUND VHF MOVEMENTS FROM DIURNAL TO NOCTURNAL TO DIURNAL

- 166.369 (21 Km each way)
- 166.230 (11 Km each way)
- 166.267 (4 Km then 9 Km)
- 166.665 (4 Km)
- 166.021 (5.7 Km each way)
- 167.902 (7.4 Km each way)
- 167.923 (0.8 Km each way)



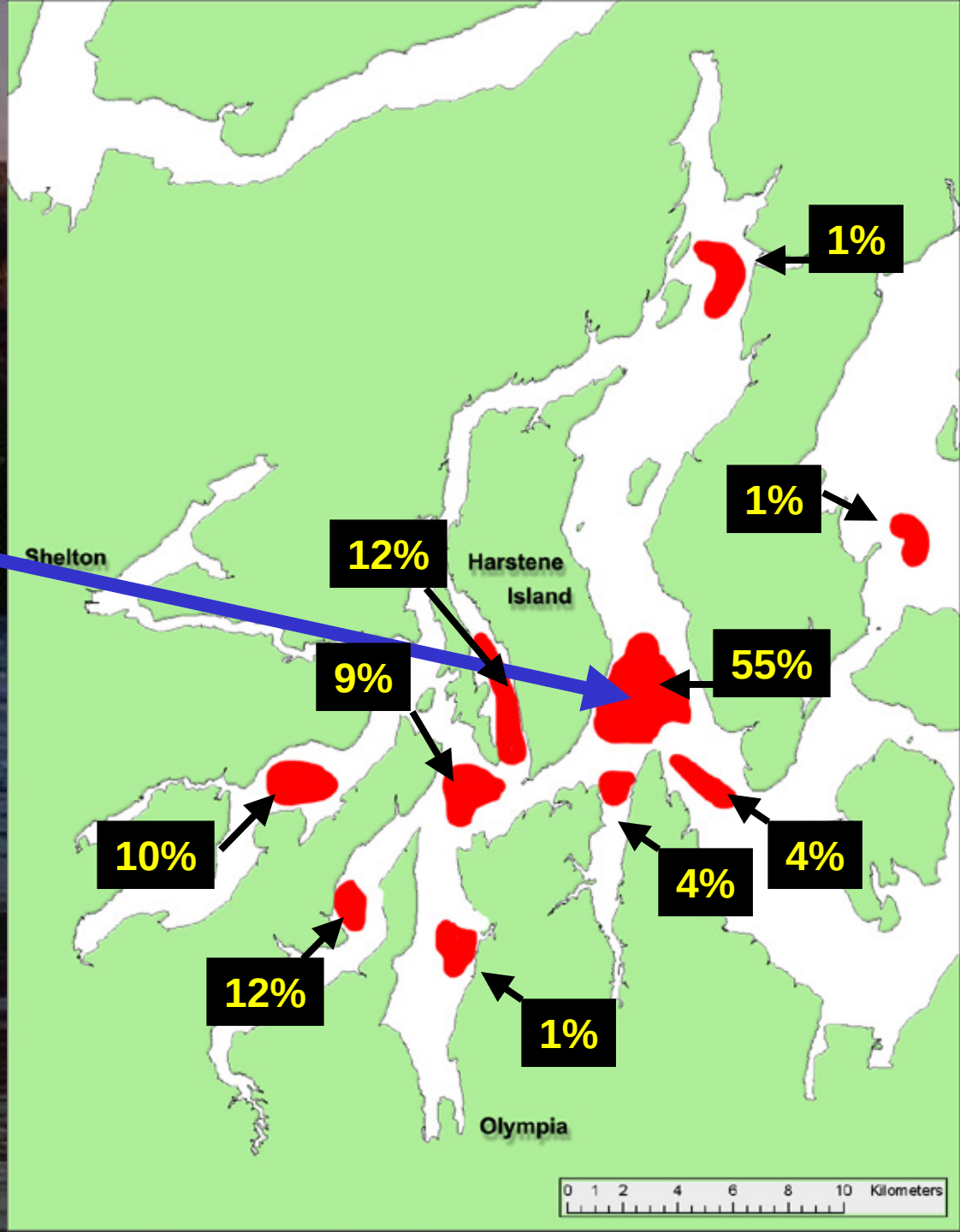
SOUTHERN PUGET SOUND VHF

- 4 nocturnal resting areas were identified
- Case Inlet was the primary resting area, used by all transmitted scoters
- Distances ranged from 0.5 to 25 Km between diurnal occurrences and nocturnal resting areas.
- Most of these evening movements were > 15 Km



SOUTHERN PUGET SOUND PTT

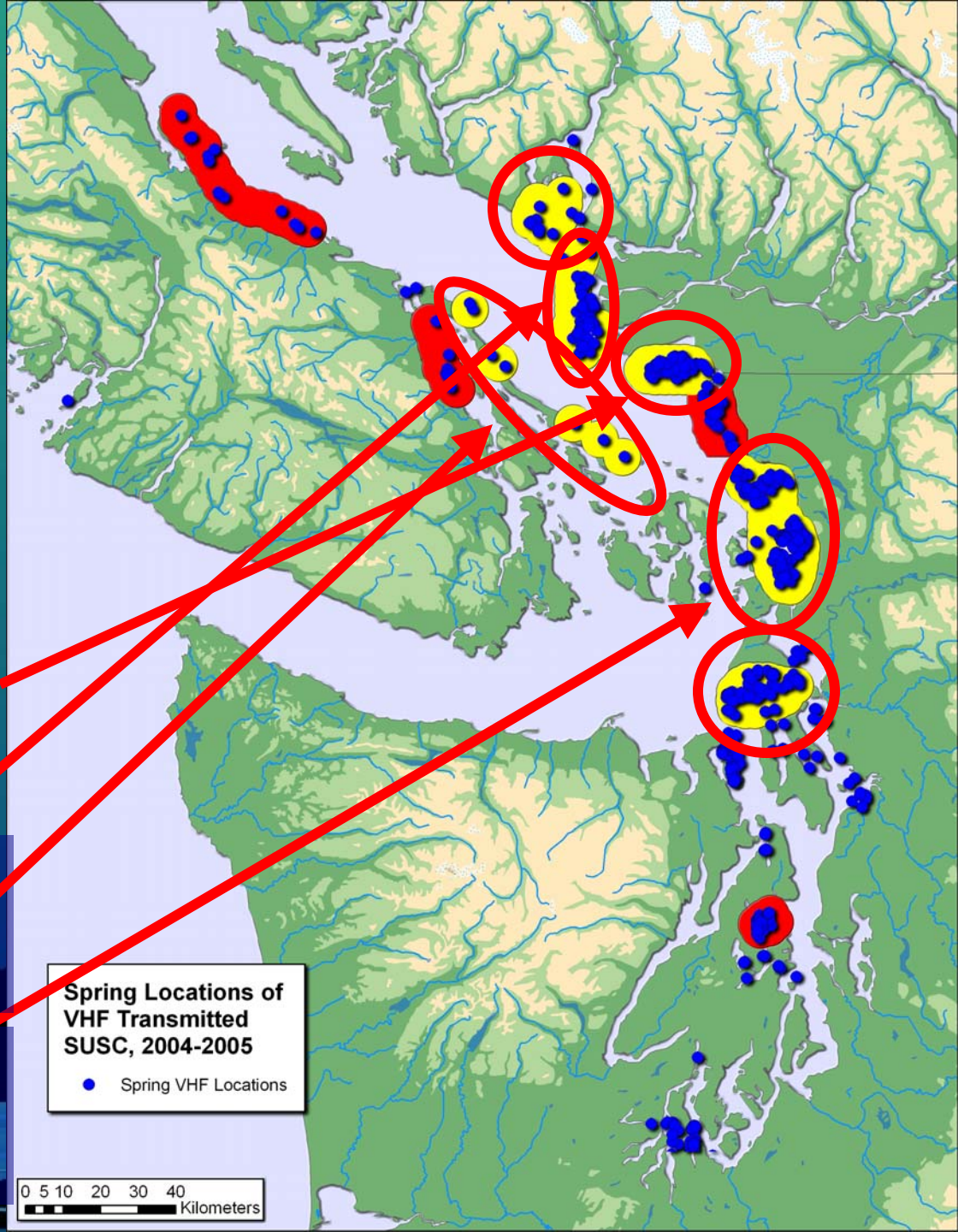
- 10 nocturnal resting areas were identified
- Case Inlet was the primary resting area, used by all transmitted scoters



Herring Spawn and Other Food Resources

- Red highlights herring spawning used and yellow other areas with high frequency of Telemetry locations, and high numbers of Surf Scoters visiting during Spring.

- Boundary Bay (~40-50,000)
- Fraser River (~25-40,000)
- Western SOG & Howe Sound, Rocky Habitat (groups of 1-5000).
- Padilla, Samish, Bellingham Bays & Oak Harbor area (several 1000 each)



Molting Locations Presently Known for Surf Scoters in Washington

Different patterns of molting locations associated with wintering flock locations:

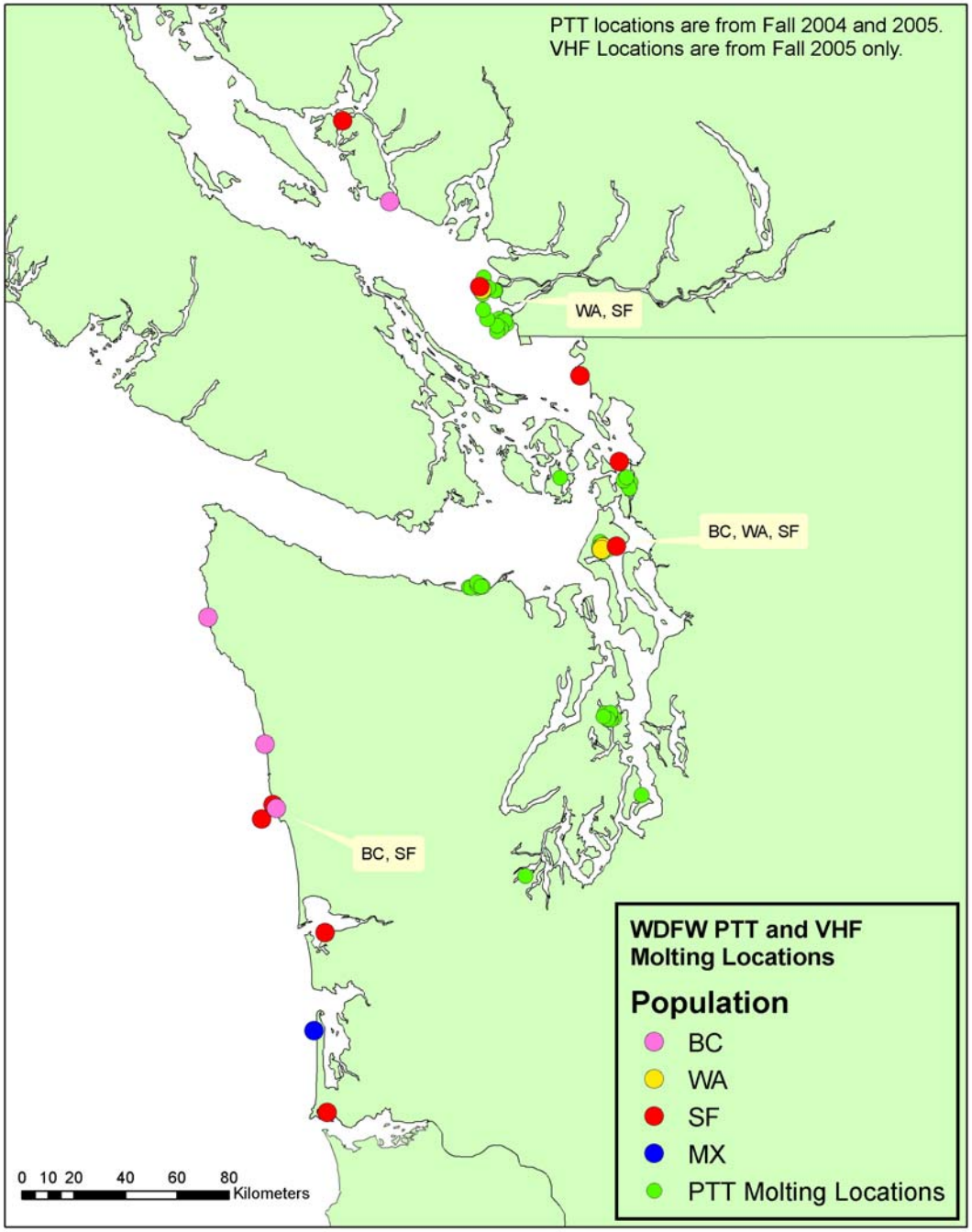
Yellow = Washington VHF

Green = Washington PTT

Red = San Francisco Bay VHF

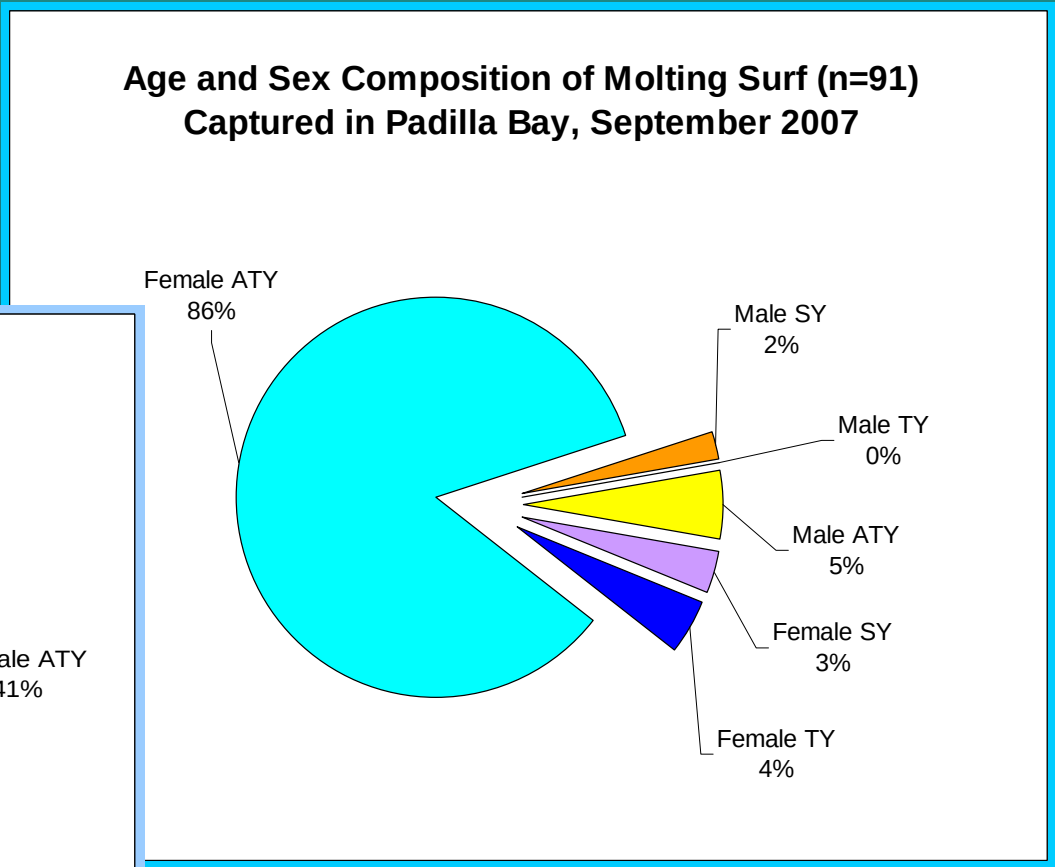
Pink = British Columbia VHF

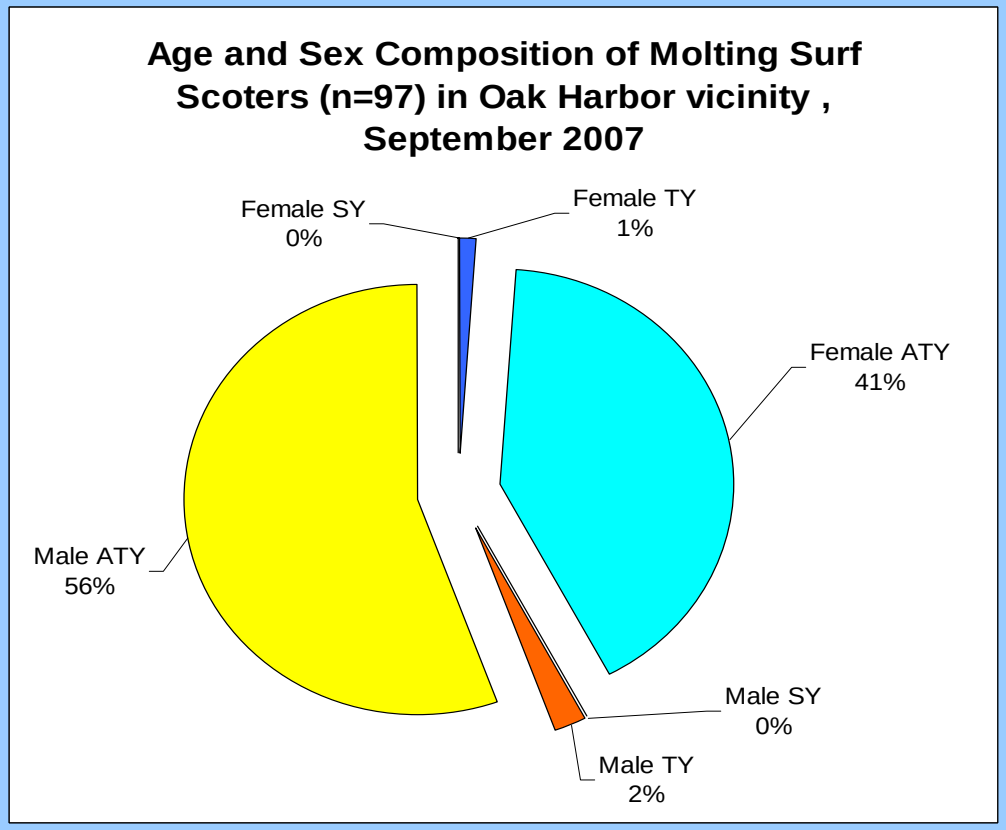
Blue = Baja Mexico VHF



COMPOSITION OF SCOTERS AT MOLTING SITES

Padilla Bay
(eelgrass)





Crescent Harbor
(non-eelgrass)

Different Facets of Scoter Demography, Feeding Strategies, and Movements or Distribution Relevant to Aquaculture

Changes in distribution by time of day and season, age, and sex.

Scoters (2 spp) exhibit different uses of habitat and food webs.

Considerable fidelity to wintering, molting, and staging areas.

Both species present in marine waters large percentage of year.

Some species appear to need more consideration and protection.

Trends perhaps different between Puget Sound subregions.

Sea duck species require higher rates of survival of adults (than dabblers like mallards); mortality causes are more critical.

Strategies for Management of Aquaculture Derived from Present Knowledge of Most Common Nearshore Birds

Avoidance of key areas or concentrations (time or geography) for certain species,probably those declining or most concentrated.

Determine if important gaps (knowledge or consequences) exist and how to address these, if pertinent for management.

Consider other actions like use of buffers, reduction of human disturbance, and mitigation to adjust for compromises.

Allow and plan for a diversity of habitats and food webs.

Address the changing baseline challenge in Puget Sound, suggesting we resist accepting declining levels of resources.

Strive for some balance of activities and focuses between human economies and the complex of species diversity and abundance that historically occurred here.