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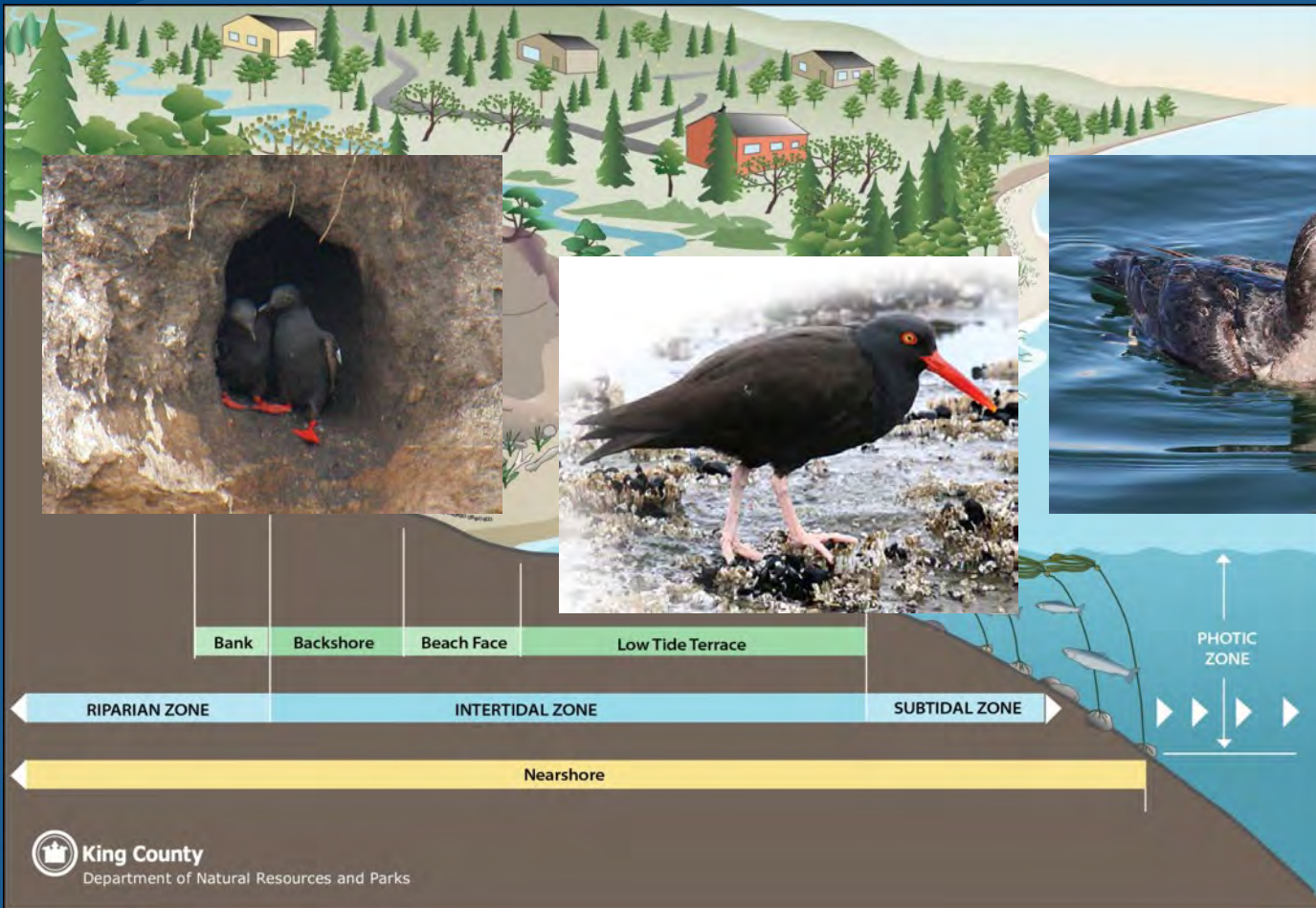
Northwest
Fisheries
Science Center

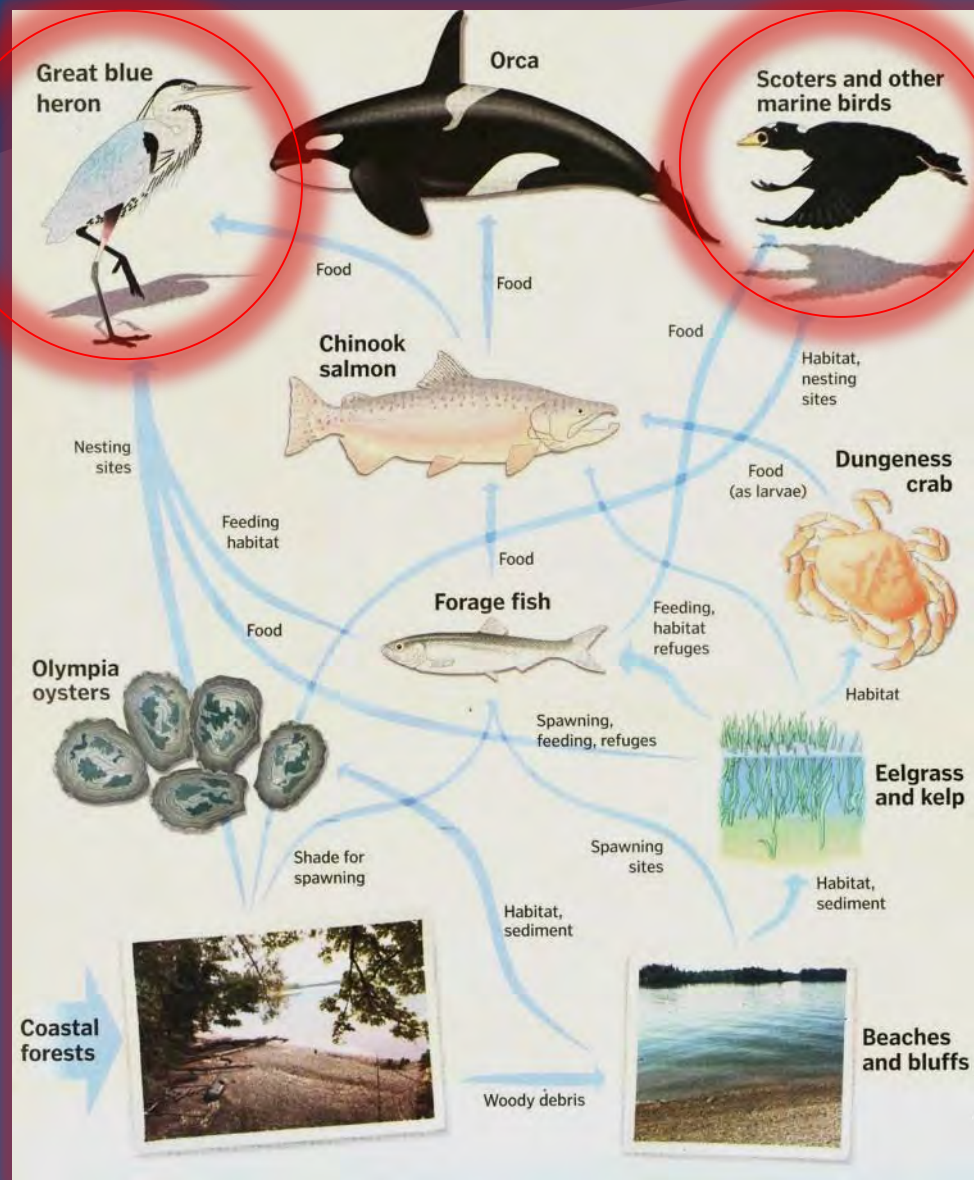
Birds in the Puget Sound Nearshore

The Nearshore: Why We Care
Northwest Straits Initiative MRCs Conference
Bellingham, WA



November2015





Birds in the nearshore: why we care

- **Birds for birds' sake**
- **Population declines**
- **Food web connections**
- **Anthropogenic threats**

BIRDS of PUGET SOUND

GREAT BLUE HERON

Overview: The largest heron in North America, this stately bird is commonly seen prowling the shorelines of Puget Sound.

Length: 36-54 inches

Timing: Found year-round in a variety of calm, shallow waters.

Habitat: Adaptable to many conditions, they often nest in forest colonies close to shore but away from human disturbance.

Food: Fish, amphibians, reptiles, invertebrates, small mammals, other birds.

Population/trends: Although still widespread, numbers appear to be declining along with increased human development and threats from eagles and crows.



GREBES

Overview: Four species are common in Puget Sound — horned, red-necked and western grebes, along with fewer numbers of eared grebes.

Length: Western grebe, 22-29 inches; horned grebe, 22-25 inches; red-necked grebe, 17-22 inches; eared grebe, 12-14 inches.

Timing: September to May in Puget Sound, moving to Canadian lakes in summer.

Habitat: Open waters and nearshore areas. Eared grebes stay farther from shore than horned or red-necked grebes. Western grebes prefer deep water.

Food: Sticklebacks, herring, sculpins, crustaceans — except for the smaller eared grebes, which prefer shrimp and amphipods.

Population/trends: All species appear to have declined, but western grebes more than the others. Greater numbers of western grebes now winter in California.



Pictured: Horned grebe

MARBLED MURRELET

Overview: Nesting habits were a great ornithological mystery until recently. The birds lay a single egg on a large mossy limb in old-growth forests, as much as 50 miles from shore.

Length: About 5.5 inches

Timing: Found year-round, especially in northern Puget Sound. During summer, parents take turns flying back and forth from the nest to the water to feed their young.

Habitat: Calm shallow waters for feeding; forests for nesting.

Favored locations: Strait of Juan de Fuca, San Juan Islands.

Food: They dive for small schooling fish.

Population/trends: Listed as "threatened" in 1992. Puget Sound population, estimated at 4,400 in 2016, is declining by 7.4 percent per year.



SCOTERS

Overview: In winter, Puget Sound supports large numbers of scoters, including surf scoters, white-winged scoters and a smaller number of black scoters.

Length: 17-22 inches

Timing: From September to late May in Puget Sound, before migrating to lakes in Canada for breeding. Some non-breeders stay in Puget Sound.

Habitat: Shallow waters, including eelgrass beds.

Food: In winter, small clams, mussels, other invertebrates. In spring, some feed on herring eggs.

Favored locations: Greatest densities in Central and South Puget Sound.

Population/trends: Surveys suggest declines from the 1990s until about 2003, with stable numbers since in most areas.



Pictured: Surf scoter

BARROW'S GOLDENEYE

Overview: These large-headed ducks often swim together and dive for food at the same time. They live longer than most ducks.

Length: 17-19 inches

Timing: In Washington, they nest in tree cavities, primarily in the Cascade and Olympic Mountains during summer. Common in Puget Sound in winter months.

Habitat: In summer, freshwater ponds. In winter, shallow protected bays, estuaries and large lakes.

Food: Aquatic insects in summer. In winter, clams, shrimp, crabs, fish and occasionally fish eggs.

Population/trends: Numbers appear to be stable, but uncertainties surround their limited range, from Washington to Alaska.



PIGEON GUILLEMOT

Overview: Common resident of Puget Sound. One of the few residents of the auk and puffin family to lay two eggs instead of one.

Length: 12-14 inches

Timing: Year-round in Puget Sound.

Habitat: Typically found in rocky sheltered bays, close to shore.

Food: Abalone to dive to 150 feet. These birds often feed in waters 33 to 66 feet deep, eating fish, crustaceans and invertebrates.

Population/trends: Relatively stable.



TUFTED PUFFIN

Overview: Striking appearance with white "mask" and tuft of black feathers sweeping back from its head. It can hold up to 26 small fish at once in its bill.

Length: 14-16 inches

Timing: Spring/summer residents of Puget Sound, less seen in winter when they may stay in the open ocean.

Habitat: Like rhinoceros auklets, they nest in burrows, typically on slopes or cliff tops on islands and offshore rocks.

Food: Small fish, shrimp, crabs, clams.

Population/trends: Once common in Puget Sound, the population has declined 66 percent or more over the past 25 years. Vulnerable to fishing nets and predators.



RHINOCEROS AUKLET

Overview: Named for a vertical off-white "horn" at the base of its bill. Closely related to the tufted puffin. Unlike the puffin, these birds return to their nests mostly at night.

Length: 11 inches

Timing: Common from February through September, less abundant in winter.

Habitat: They nest in burrows, typically on slopes of islands.

Favored locations: In Puget Sound, the vast majority nest on three islands, with Protection Island supporting one of the largest colonies in North America.

Food: They dive for small fish, mostly sand lance and herring.

Population/trends: Populations declined significantly from the 1970s through the 1990s, in part because of pilfered fishing. More recent trends show increases.



Pictured: Common loon

LOONS

Overview: Three species commonly found in Puget Sound — common loon, Pacific loon, red-drowned loon.

Length: 2-3 feet

Timing: All three species winter in Puget Sound, but more commonly west here.

Habitat: Common loons, marshes and freshwater; Pacific loons, offshore, red-drowned loons, estuaries and shallow water.

Food: Fish and invertebrates.

Favored locations: Northern Puget Sound, Whidbey, Camano Islands, Bainbridge Island.

Population/trends: Common loons are probably declining; Pacific loons and red-drowned loons may be stable or slightly increasing.



CORMORANTS

Overview: Three species are common in Puget Sound — double-crested, Brandt's and pelagic cormorant.

Length: Brandt's cormorant, 27-31 inches; double-crested cormorant, 27-35 inches; pelagic 26-30 inches.

Timing: All three species winter in Puget Sound, but only the double-crested and pelagic cormorants nest here in substantial numbers.

Habitat: Wildly distributed. Pelagic cormorants are often seen near steep cliffs where they nest.

Favored locations: A large colony of pelagic nests under Bremerton's Walton Avenue Bridge.

Food: These are deep divers, often feeding on bottom fish and herring, as well as crustaceans.

Population/trends: The population of the double-crested cormorant appears to be on the increase in Puget Sound.



Pictured: Double-crested cormorant



BRANT

Overview: Fall flocks, these geese nest in the high Arctic during summer and often return to the same areas of Puget Sound in winter.

Length: 22-26 inches

Timing: Males and females forer long for in fields on wintering grounds, including Puget Sound where they are common except in summer.

Habitat: Shallow bays and salt marshes, particularly near and beds.

Food: Almost exclusively eelgrass, but also grasses and aquatic invertebrates.

Favored areas: Widespread, except for a unique population, the gray-billed brant, that winters mostly in Skagit County.

Population/trends: Long-term decline may have stabilized.

WESTERN SANDPIPER

Overview: The most abundant shorebird in Washington.

Length: 5-7 inches

Timing: Most breed in Alaska but fly great distances to winter in warmer climates, stopping in Puget Sound during their migrations.

Habitat: They prefer mudflats and sandy beaches, where they can probe for food with their long bills.

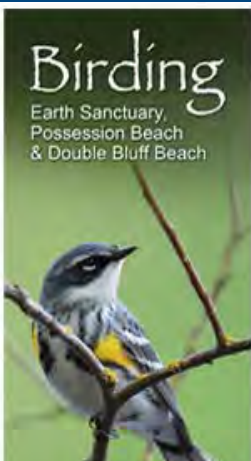
Food: Shrimp, clams, worms.

Population/trends: The West Coast population has been estimated at up to 6.5 million birds, but trends are uncertain.

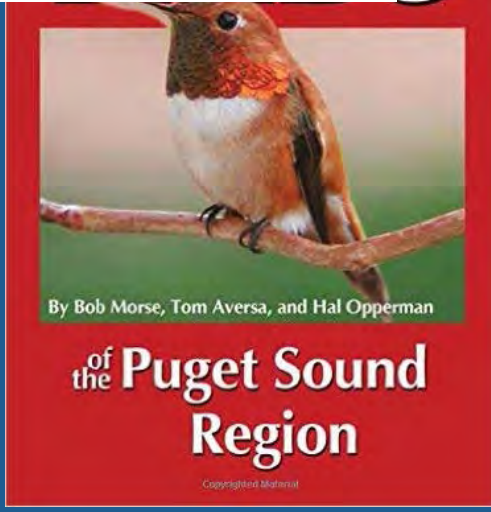
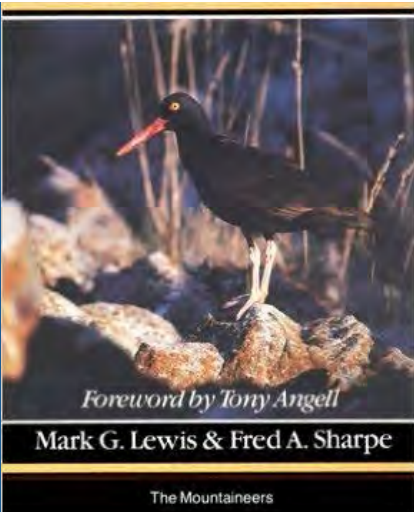


People love birds!





Wildlife observation has become one of the most significant economic activities in Washington and elsewhere in North America

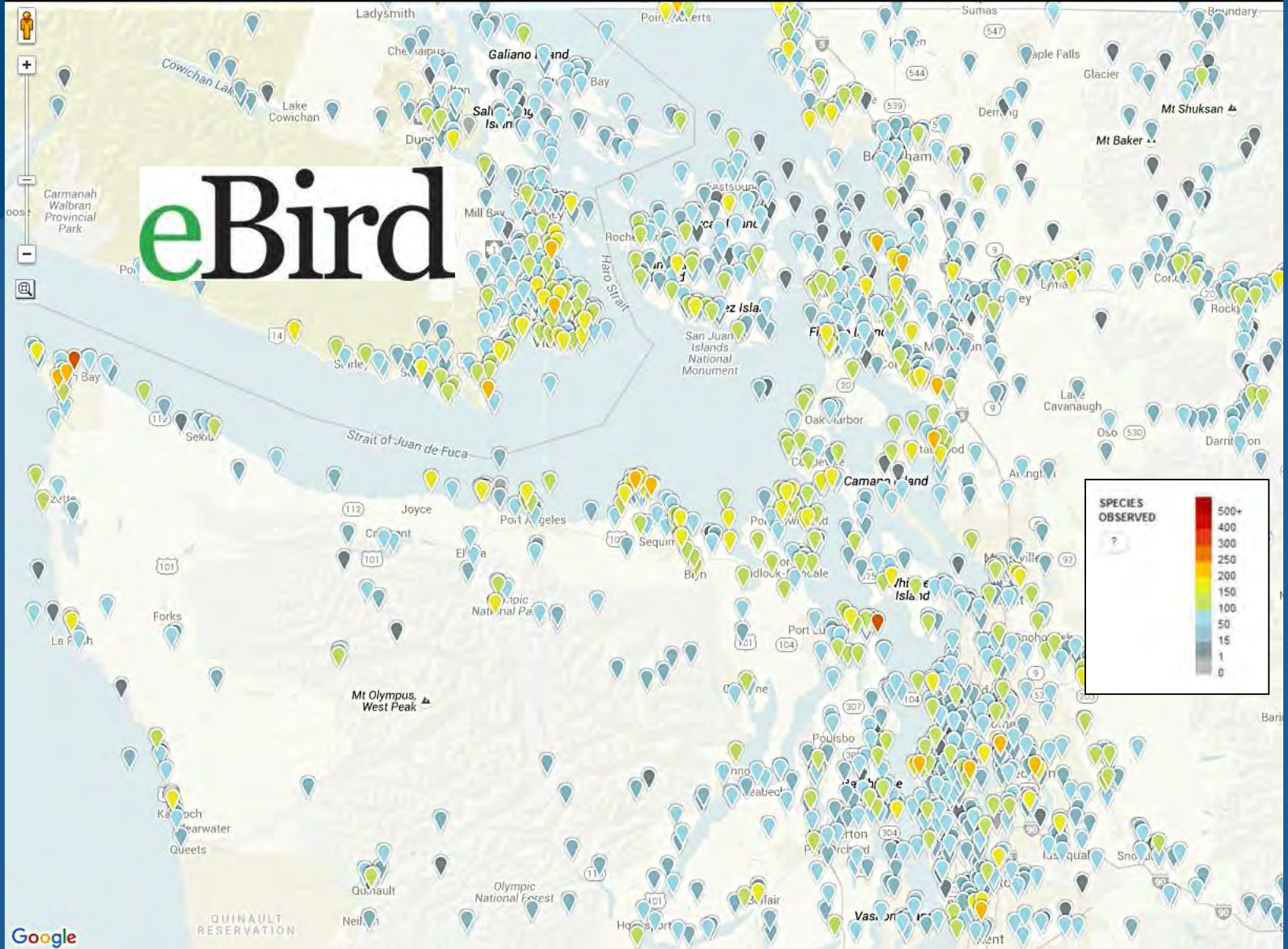


Hotspot:



Date: Year-round, All Years

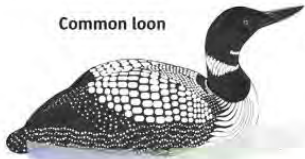
Location:



Bird declines in Washington state

Many species of common birds are declining in Puget Sound and other parts of the state and Northwest. Scientists increasingly are considering the possibility that declines in forage fish, particularly herring, may play an important role.

Common loon



These thick-necked birds spend their breeding season on huge lakes but can be found in winter on saltwater, where they feed on invertebrates and small fish, usually less than 10 inches long.



Scoters (surf, white-winged, black)



These mostly black or gray ducks spend winters on the coast, particularly in shallow bays or estuaries, and dive for mussels, insect eggs and herring eggs. In Alaska, there have been large die-offs that some suspect may be due to contaminants, such as pesticides.



Long-tailed duck

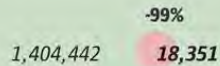


These heavy, low-flying ducks often eat shellfish and feed within the top 30 feet of water.



Western grebe

These long-necked gray, white and black birds spend time on saltwater bays but during breeding season are found on freshwater lakes. They rely extensively on herring and other forage fish.



These species also are in decline in Washington.



Marbled murrelet



Common murre



Glaucous-winged gull

NOTE: Many of these bird populations are counted using an index, which is designed to help identify trends rather than precise numbers of birds. The percentage change over time is a more accurate reflection.

Sources: Washington Department of Fish and Wildlife; Puget Sound Partnership; Seattle Audubon; Washington Sea Grant

MARGARET NG / THE SEATTLE TIMES

Declines in marine birds trouble scientists

Why did all the grebes leave? Where did they go? And what does their disappearance say about the health of the Salish Sea? Seasonal declines among some regional bird species could hold important clues to the overall health of the ecosystem.



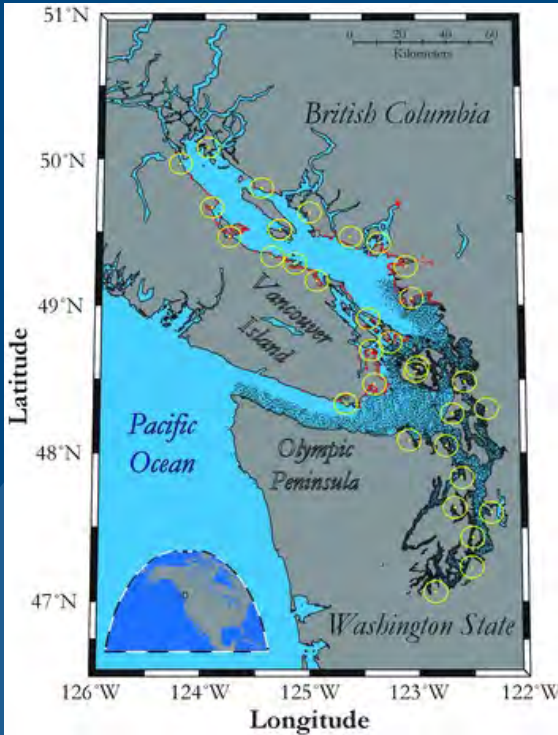
© Andrew A. Reding

Western grebe, Public Pier, Blaine, WA. Photo: Andrew Reding

<https://www.flickr.com/photos/seaotter/10298390254>

Key takeaways

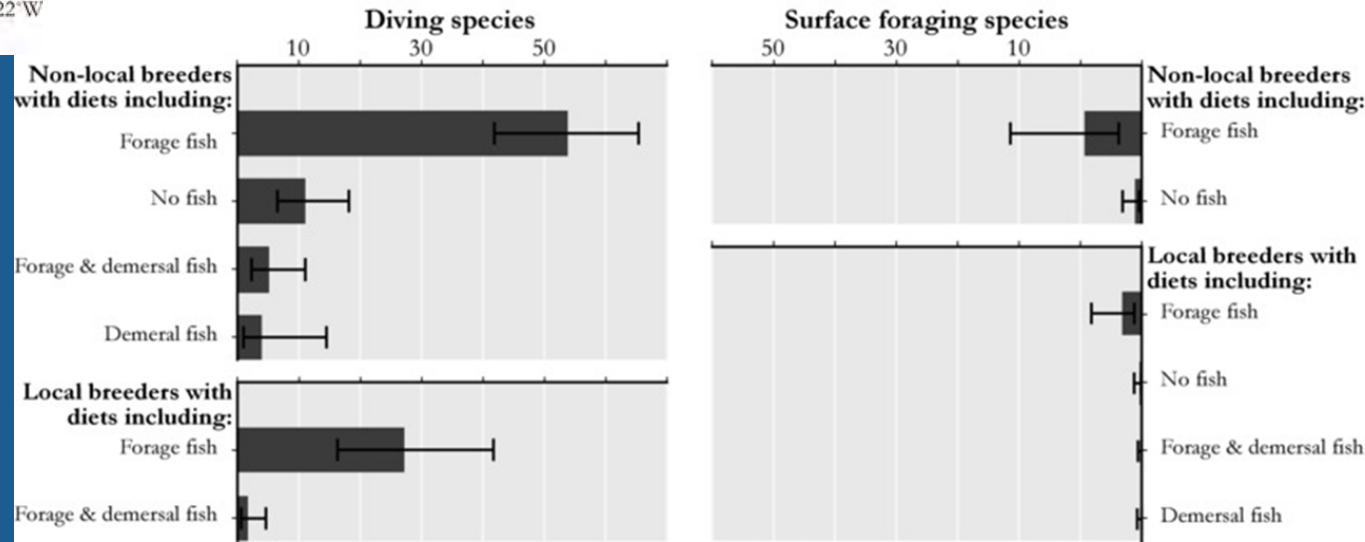
- ✓ Many bird species that winter in the Salish Sea are experiencing severe declines.
- ✓ Close to a third of all bird species in the Salish Sea are classified as "species of concern."
- ✓ **Birds are considered to be good indicators of the health of the ecosystem.**
- ✓ Some seabird declines may be related to declines in forage fish.
- ✓ The ecosystem is in flux and some species like bald eagles, rhinoceros auklets and some whales actually appear to be on the rise, potentially competing with declining species for food.



Marine birds undergoing declines:

- forage fish-eating birds
- diving birds
- breeders and non-breeders

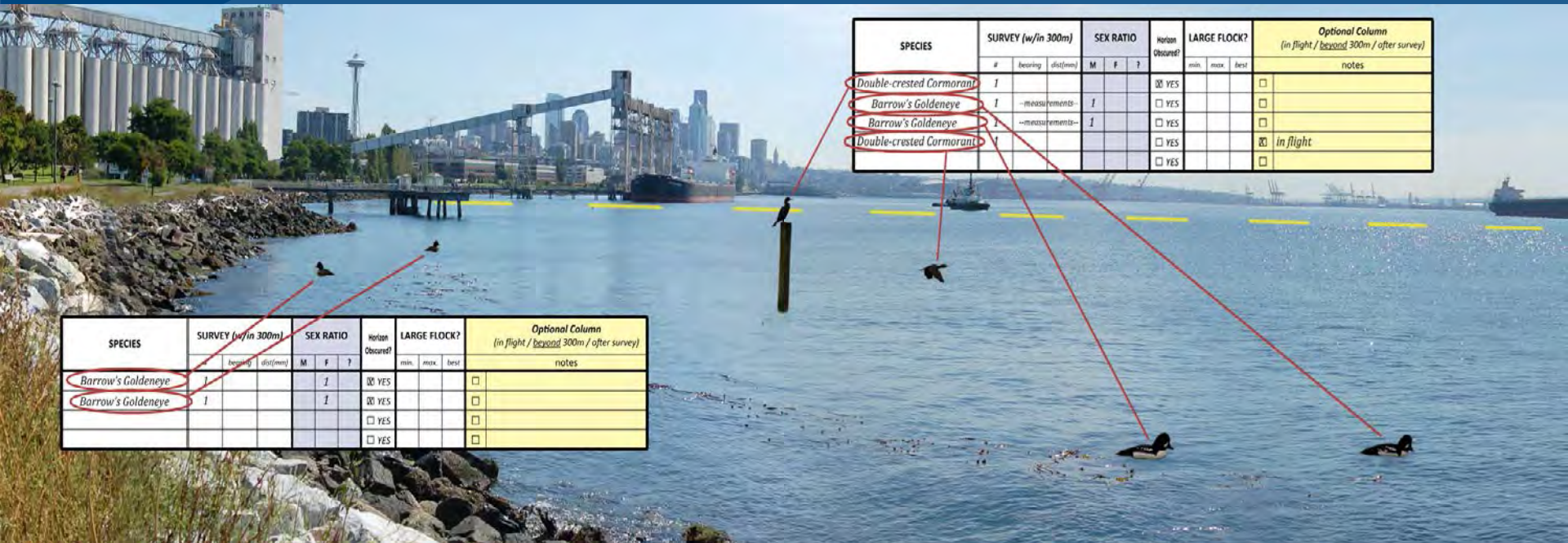
Estimated probabilities of undergoing declines (%)



Vilchis et al. (2014) Conservation Biology



Puget Sound Seabird Survey



SPECIES	SURVEY (w/in 300m)			SEX RATIO			Horizon Observed?	LARGE FLOCK?			Optional Column (in flight / beyond 300m / after survey)	
	#	bearing	dist(m)	M	F	?		min	max	best	notes	
Double-crested Cormorant	1						<input checked="" type="checkbox"/> YES				<input type="checkbox"/>	
Barrow's Goldeneye	1	--measurements--		1			<input type="checkbox"/> YES				<input type="checkbox"/>	
Barrow's Goldeneye	1	--measurements--		1			<input type="checkbox"/> YES				<input type="checkbox"/>	
Double-crested Cormorant	1						<input type="checkbox"/> YES				<input checked="" type="checkbox"/>	in flight
							<input type="checkbox"/> YES				<input type="checkbox"/>	

SPECIES	SURVEY (w/in 300m)			SEX RATIO			Horizon Observed?	LARGE FLOCK?			Optional Column (in flight / beyond 300m / after survey)	
	#	bearing	dist(m)	M	F	?		min	max	best	notes	
Barrow's Goldeneye	1						<input checked="" type="checkbox"/> YES				<input type="checkbox"/>	
Barrow's Goldeneye	1				1		<input checked="" type="checkbox"/> YES				<input type="checkbox"/>	
							<input type="checkbox"/> YES				<input type="checkbox"/>	
							<input type="checkbox"/> YES				<input type="checkbox"/>	

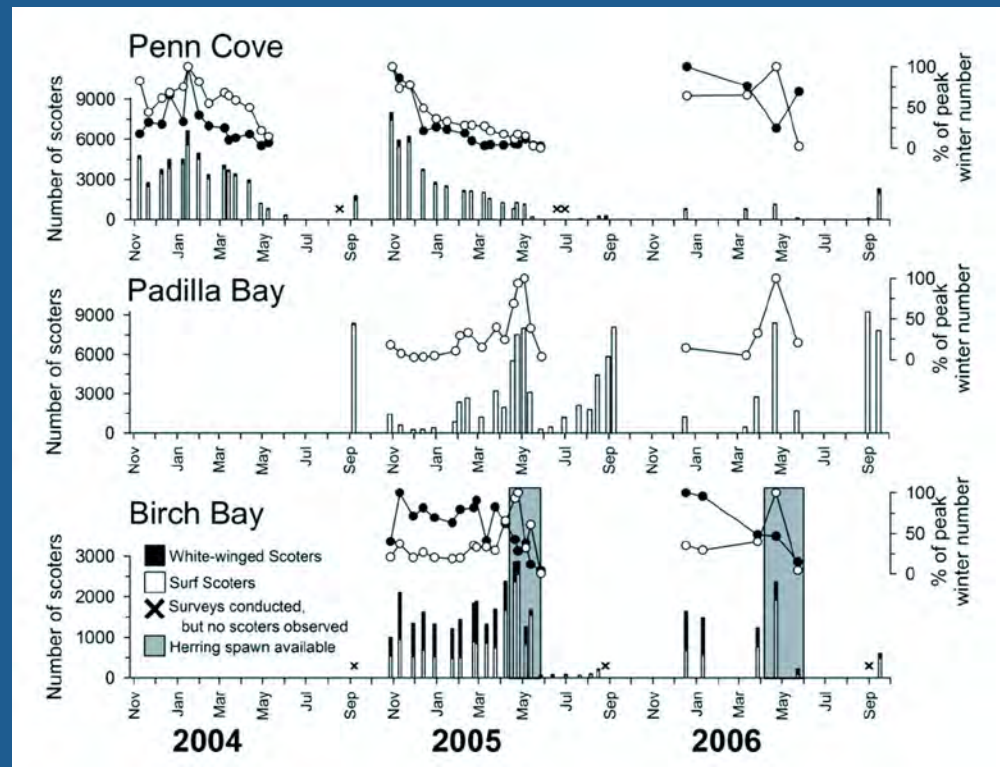
- Monthly (Oct.-Apr.)
- High tide (4-hour window)
- Shore-based (but of water)
- Random, pre-selected sites

- Geese, ducks, loons, grebes, cormorants, gulls, terns, alcids
- Spp., #, distance, bearing, sex ratio, flocks, weather

Habitat use and foraging



**Surf scoters ≠
White-winged scoters**



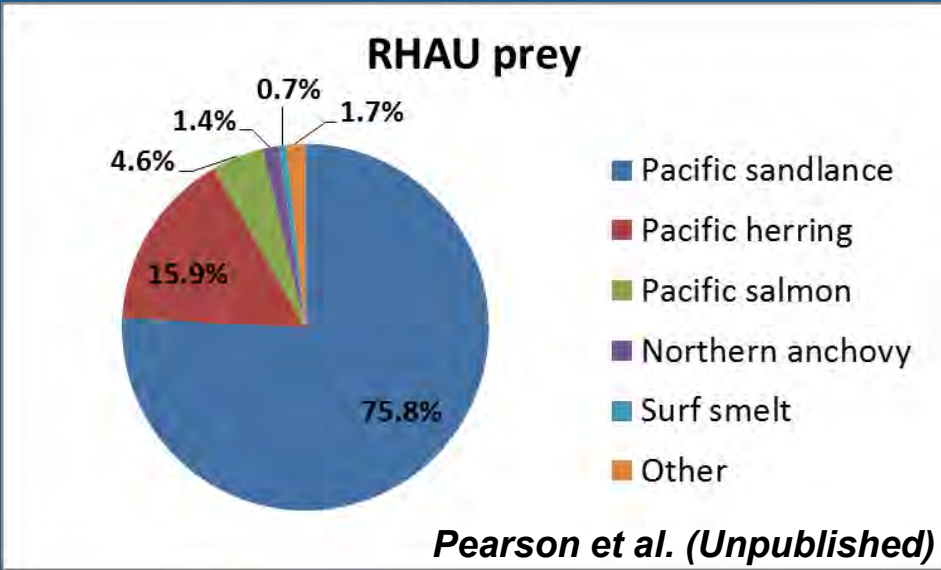
Anderson and Lovvorn (2011)



Peter Hodum



Peter Hodum



PREY SELECTION BY PIGEON GUILLEMOTS NESTING ON WHIDBEY ISLAND, WASHINGTON



Phyllis Kind, Govinda Rosling, Kirsten Kresmer, Houston Flores, Frances Wood
Whidbey Audubon Society and the Island County Marine Resources Committee

Pigeon Guillemots (*Cephus columba*) are an important indicator species for the Puget Sound because they are one of the few seabirds that breed here and many remain through the winter. In spring, approximately 1000 birds gathered at 24 breeding colonies around Whidbey Island where they nest in bluff burrows. Whidbey Audubon Society volunteers have monitored those colonies since 2004. Beginning in 2007, paid interns were charged with identifying the prey delivered to the chicks. During the breeding season (late June through late August), volunteers visited each colony weekly and observed the birds for one hour/visit. They counted the birds, mapped the active burrows and identified prey delivered to the nest burrows. A burrow was deemed active if adults entered the burrow or if they delivered food to the burrow. In 2008, 225 active burrows were identified, in 2009, 255 were identified and in 2010, 227 were identified. About 45% of the birds attempted to breed. Prey deliveries began in late June and reached a peak in late July. Prey were identified visually using binoculars and spotting scopes. Prey was delivered to 70% of the active burrows indicating at least one chick had hatched. In 2008 we observed 754 fish deliveries to 161 burrows, in 2009 we observed 1288 deliveries to 183 burrows and in 2010 we observed 1237 deliveries to 227 burrows. The fish delivered to the burrows were primarily gunnels (56%) or sculpins (25%). The other 19% of the deliveries were either unidentified or were prey other than gunnels or sculpins. The success of the Pigeon Guillemot population appears to be dependent upon the population of these bottom fish.

Table 2: Prey Delivery
Number and type of prey delivered to chicks in 2008, 2009 and 2010.

Year	Gunnels	Sculpin	Other
2008	405	181	154
2009	866	271	171
2010	548	376	313
Total	1819	828	638
% of Prey	56	25	19

Table 3: Fledging success

Deliveries of prey observed by the intern for 3 consecutive weeks was interpreted as a successful fledging.

Year	Burrows*	Fledged**	% Fledged
2009	38	29	76
2010	50	30	60

* Number of burrows that received at least one prey delivery

** Number of burrows that received prey for 3 consecutive weeks

METHODS

Time Period: Late June through the end of prey delivery in late August. Each volunteer observed for one hour weekly. Interns observed for 25 hours weekly.

Volunteers: Volunteers arrived at their assigned colony before 8:45 a.m. During their visit, they counted the adult birds, identified active burrows and noted prey delivered to those burrows. They also recorded any disturbances such as Bald Eagles, dogs running on the beach or walkers.

Interns: Interns monitored 5 colonies (one each day of the week) chosen to represent different habitats on Whidbey Island. Interns arrived at the colony within 1/2 hour of sunrise and observed for 5 hours. They counted the adult birds, identified active burrows and the prey delivered to those burrows. They documented their findings by still and video photography. They also recorded any disturbances.

IN CONCLUSION

1. Approximately 1,000 Pigeon Guillemots gathered in colonies on Whidbey Island, Washington each breeding season.
2. During 2008 to 2010, guillemot populations remained stable.
3. Prey delivered to the chicks was primarily gunnels and sculpins.
4. About 70% of the active burrows hatched at least one chick as indicated by delivery of prey.
5. Interns (2009 and 2010) monitored 88 burrows weekly. Fifty-nine of those burrows received prey for at least three consecutive weeks indicating chicks probably survived to fledging age.

Table 1: Summary of volunteer observations:
Pigeon Guillemot colonies on Whidbey Island, Washington.

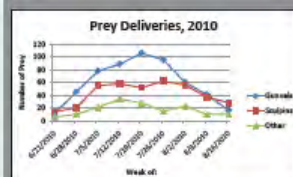
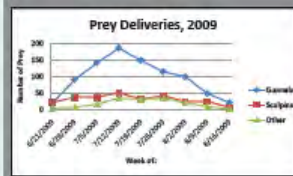
Year	2008	2009	2010	Mean	s.d.***
# of Adult Birds	1082	1069	1000	1050	44.1
# Burrows	225	255	227	236	16.8
# Burrows with Chicks	161	183	159	168	13.3
% Attempting to Breed*	41.6	47.7	45.4	44.9	3.1
% Hatching Chicks**	71.6	71.7	70.0	71.1	1.0

* ((# Burrows x 2) / Max # Birds) x 100

** ((# Burrows with Chicks / # Burrows) x 100

*** standard deviation

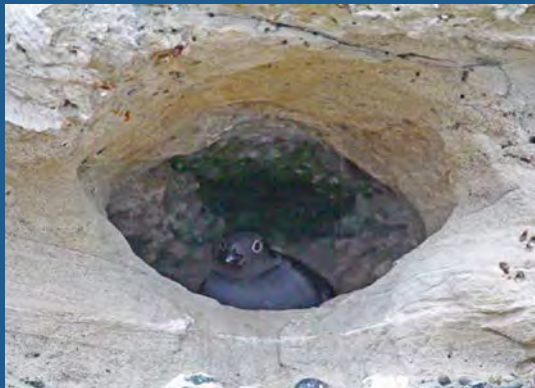
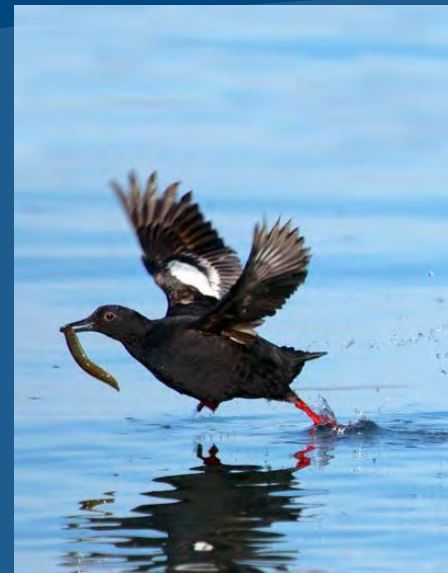
Figure 1: Weekly delivery of prey to chicks in burrows noted by volunteers and interns.



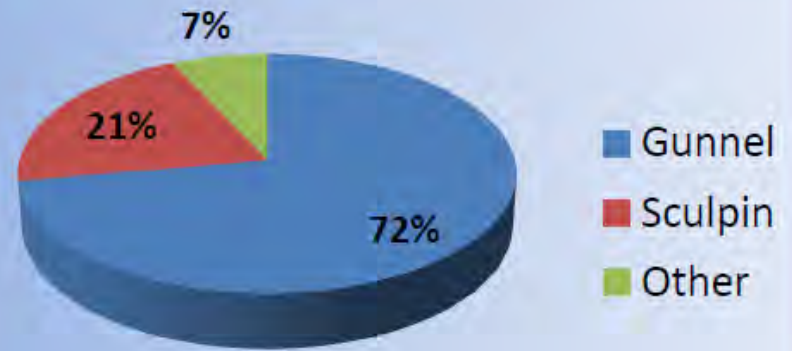
Photography by Craig Johnson and Govinda Rosling
Poster, Three Cheers Design



www.pigeonguillemot.org



Nisqually Reach Aquatic Reserve 2013



Mills and Joyce (2014)



Mean % habitat use (SD) of Pacific Dunlin in winter in the Skagit and Stillaguamish River deltas

	2006–2007 <i>n</i> = 29	2007–2008 <i>n</i> = 69
Estuarine habitats		
Tidal flat	28 (28)	35 (23)
High marsh	0 (0)	6 (5)
Low marsh	30 (29)	35 (22)
Agricultural habitats		
Bare soil	25 (29)	7 (8)
Crop residue	1 (4)	2 (3)
Pasture	2 (5)	<1 (1)
Cover crop	11 (12)	12 (11)
Woody agriculture	<1 (1)	0 (0)
Other agriculture	1 (5)	1 (1)
Other habitats		
River	1 (5)	1 (1)
Urban and forest	0 (0)	0 (0)



Estimates of prey from agricultural and estuarine sources in the Stillaguamish and Skagit River deltas

Source	Mean percent	95% CI
High- ¹⁵ N agriculture	53.1	50.8 to 57.9
Other agriculture	9.2	5.9 to 11.1
Freshwater plume	0.2	0 to 0.6
Marine/marsh	38.0	35.7 to 39.1

Hobson et al. (2013)

ORIGINAL PAPER

Differences in relative abundance and size structure of the sea stars *Pisaster ochraceus* and *Evasterias troschelii* among habitat types in Puget Sound, Washington, USA

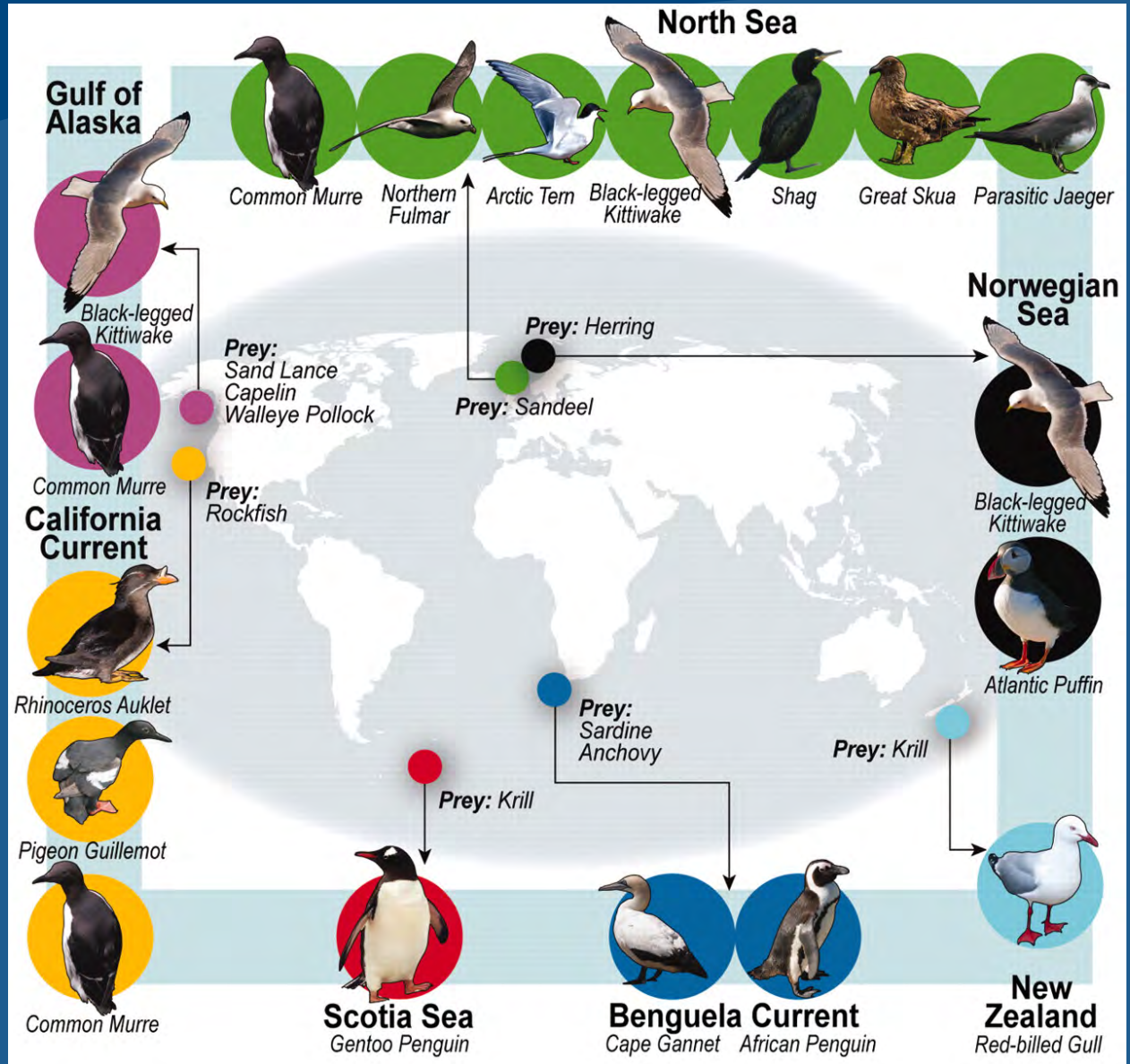
Tanya L. Rogers · Joel K. Elliott

Table 2 Observations of gull predation on sea stars in different habitat types

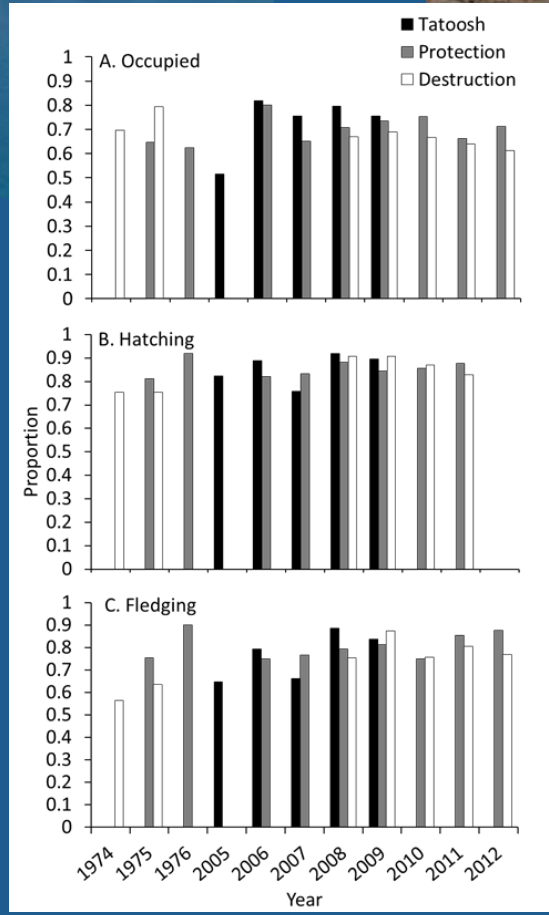
Species	Size	Arm length (cm)	Habitat				Percent
			Boulder	Rock	Piling	Dock	
<i>Evasterias</i>	Small	<6	43	0	1	0	37.9
	Medium	6–14	35	5	1	4	38.8
	Large	>14	1	0	0	8	7.8
<i>Pisaster</i>	Small	<6	7	1	1	0	7.8
	Medium	6–14	3	1	0	3	6.0
	Large	>14	1	0	0	1	1.7
Total sea stars attacked			90	7	3	16	
Percent <i>Evasterias</i>			87.8	71.4	66.7	75.0	84.5
Percent <i>Pisaster</i>			12.2	28.6	33.3	25.0	15.5



Global Seabird Response to Forage Fish Depletion — One-Third for the Birds



Cury et al. (2011)



Pearson et al. unpublished

Urbanization affects marine bird assemblages in Puget Sound

- Gulls ↗ w/urbanization
- Diving ducks ↘ w/urbanization
- Dabbling ducks ↘ w/urbanization
- Herons ↘ w/urbanization



Detail of shoreline segments (thick colored lines) in Commencement Bay showing alongshore bird points (colored dots) and urban (black) and nonurban (green) land cover.

Marine Bird and Waterfowl Assemblage Composition Along Urbanization Gradients in Greater Puget Sound (Rice 2007)

Factors affecting marine birds and/or nearshore environments

- Oil spills
- Contaminants
- Human disturbance at colonies, roosts and foraging areas
- Fisheries bycatch*
- Derelict nets* (>105' deep!)
- Nearshore habitat alteration