Apr 4th, 1:45 PM - 2:00 PM

Sightings of Southern Resident killer whales in the Salish Sea 1976-2014

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Sightings of Southern Resident Killer Whales in the Salish Sea 1976-2014:

The importance of a long-term opportunistic dataset

Photo credit: Jeanne Hyde

Background

Killer whales or orcas, *Orcinus orca*, are one of the most widely distributed marine mammals and can be found in every ocean

In the Northeast Pacific, three distinct ecotypes of killer whales are recognized and initially named for their movement patterns: resident, transient, and offshore.

The most studied resident killer whale population in the world is the Southern Resident Killer Whale (SRKW). There are 3 recognized matriarchal pods: J, K and L

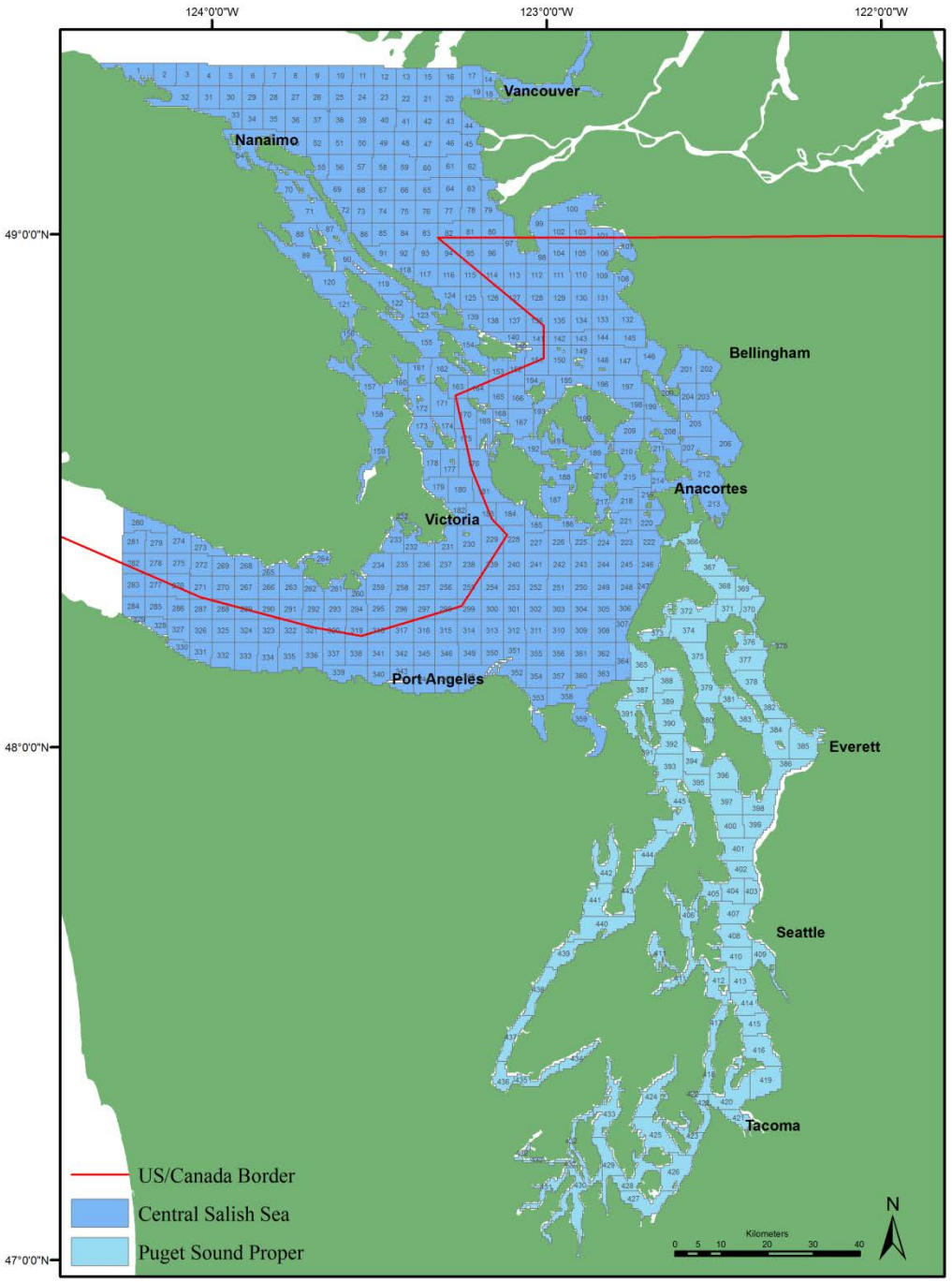
The SRKW population is currently estimated to consist of approximately 76 whales , a decline from its historical level of close to 200 during the late 1800s

Opportunistically collected data from wildlife sightings are a valuable tool for monitoring species distribution and movement patterns

Here we report data on SRKW sightings in the Salish Sea from 1976-2014 to illuminate long-term spatial and temporal patterns in habitat use

Photo credit: Jeanne Hyde

Where:
Central Salish Sea
And
Puget Sound Proper



Methods

- The complete Orca Master dataset incorporates records dating back to 1948
- Historical records prior to 1976 include only 46 anecdotal observations in TWM's archives
- Given the onset of systematic photo-identification surveys and the initiation of the public hotline in 1976, only data from 1976-2014 are reported here.

- The Orca Master dataset includes five different data sources:
  1. TWM Sightings Archive-public and expert reports-year round '76-'14: 41,054
  2. Pager Data-whale watch co. pagers-summer '97-'07: 18,893
  3. Soundwatch-recorded every half hour-summer '98-'14: 13,179
  4. Lime Kiln Station-sightings from lighthouse research station-summer '91, '94-'14: 1,881
  5. SPOT data-satellite GPS-summer '08-'14: 8,467

Photo credit: Jeanne Hyde

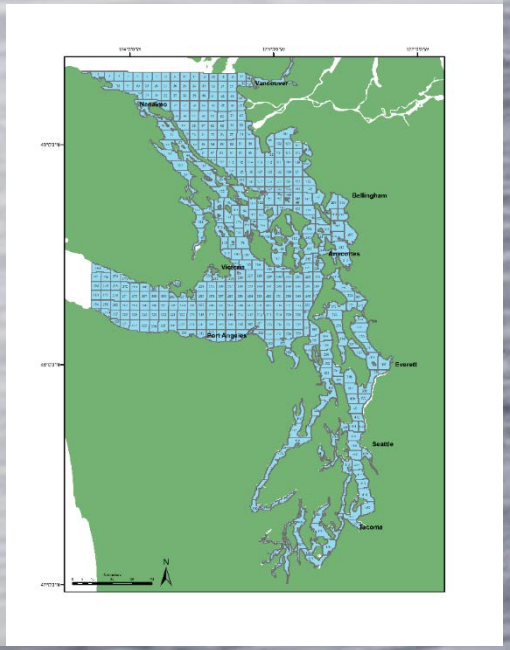
Location of whales was described in three distinct ways:

1. TWM Quadrants-445, 4.6 km by 4.6 km each
2. Fishery Areas: Washington Department of Fish and Wildlife (WDFW) and Department of Fisheries and Oceans Canada (DFO)
3. Latitude/longitude.

Note: quadrants only extend about two thirds of the way out the Strait of Juan de Fuca and as far north as Burrard Inlet, whale sightings outside of these areas will have a fish area but not a quadrant

All reports with lat/long were assigned a quadrant plus coordinates

Effort: There are a variety of sighting platforms, observers, and qualifications
Thus to reduce the effect of effort, the metric “whale day” was calculated
by eliminating multiple sightings of whales on the same day within a given area:
Most analyses focus on two large areas: The central salish sea and puget sound

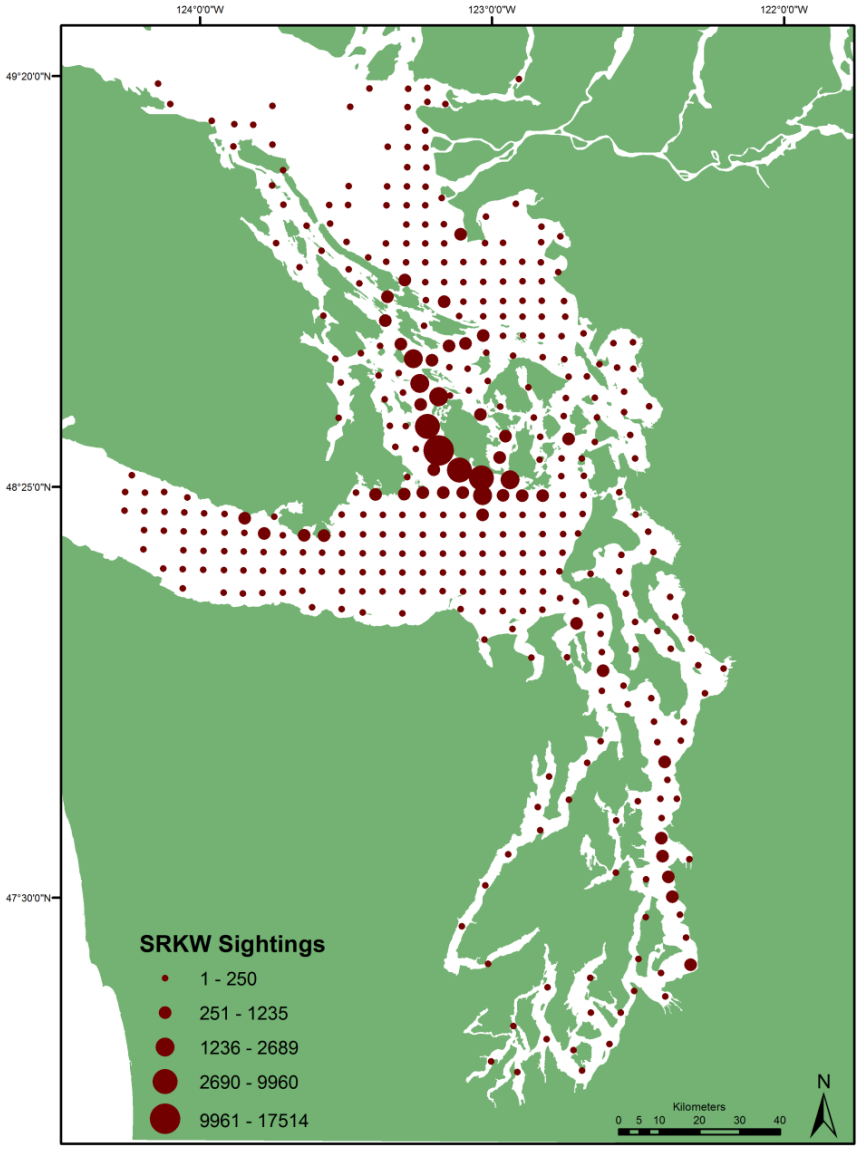


Sightings reports for SRKWs are thought to be robust due to continuous search efforts and public awareness thus whales were unlikely to be missed

Photo credit: Jill Berger

Results:

TWM Sightings 1976 to 2014 = 82,447
75,374 were in the Central Salish Sea
6,670 were in Puget Sound
398 were outside the defined quadrant area



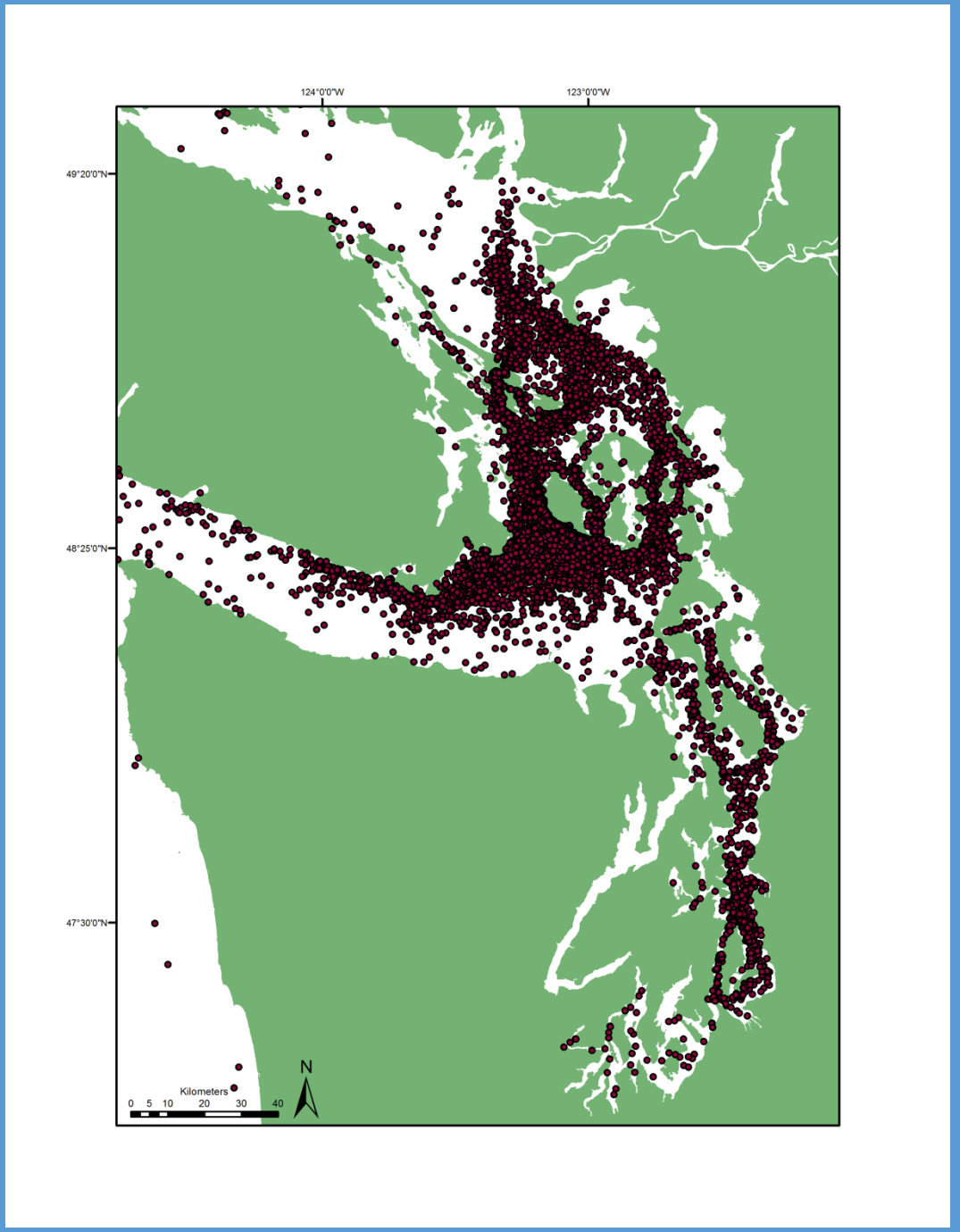
Of the 82,447 sightings, 16,856 had lat/long coordinates

The mean sightings per year = 2,114

The mean whale days per year =193.1

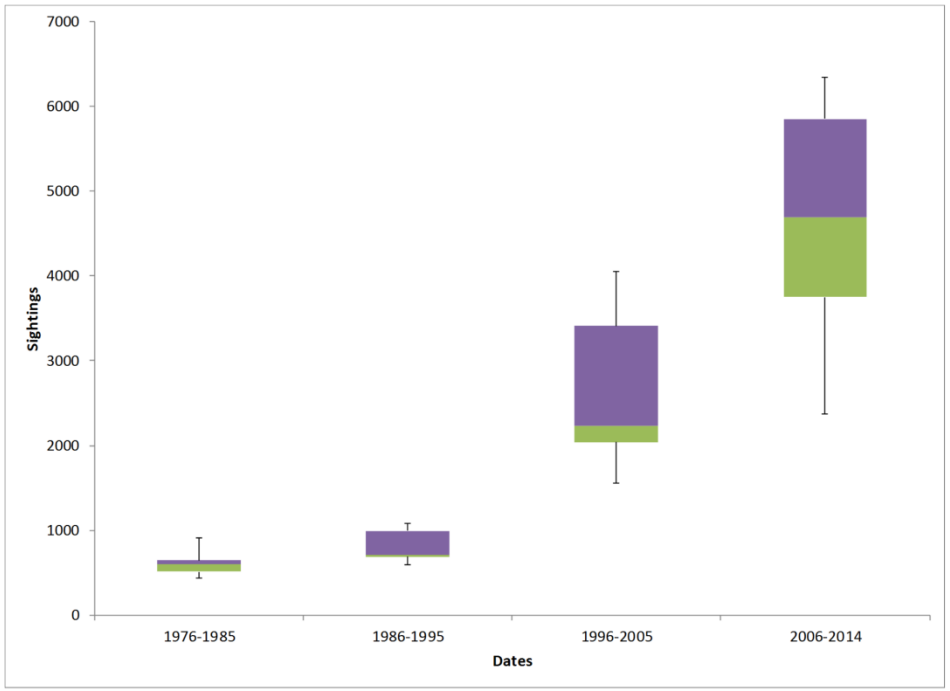
Low of 139 whale days in 1977

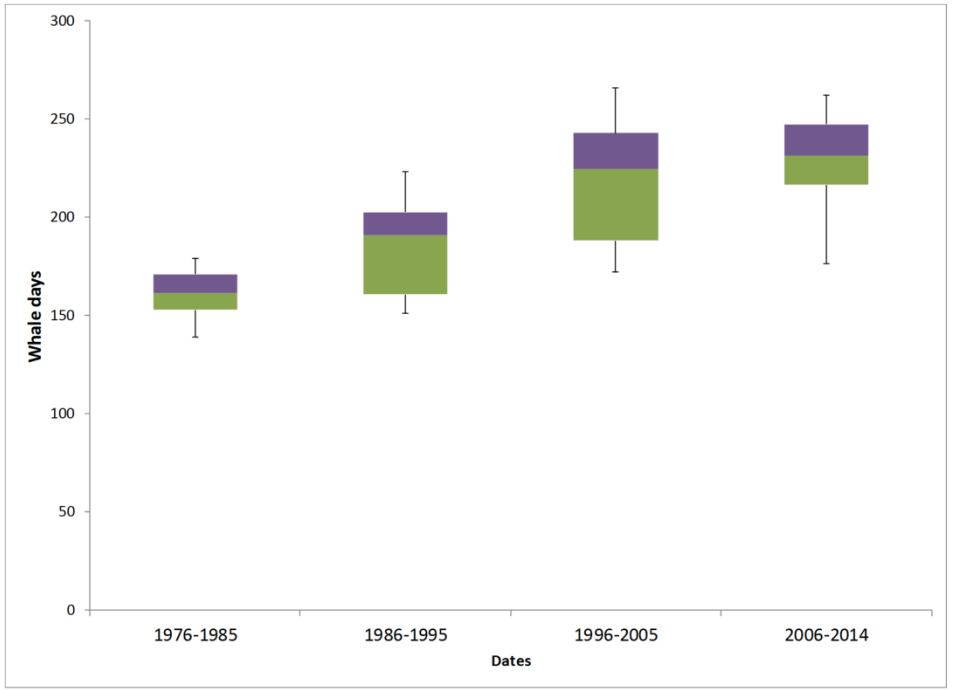
High of 266 whale days in 2001



Mean sightings per year between decades has changed significantly (Kruskal Wallis-Test P < 0.001)

Mean whale days per year between decades of data has also changed significantly (Kruskal Wallis-Test, P < 0.001)



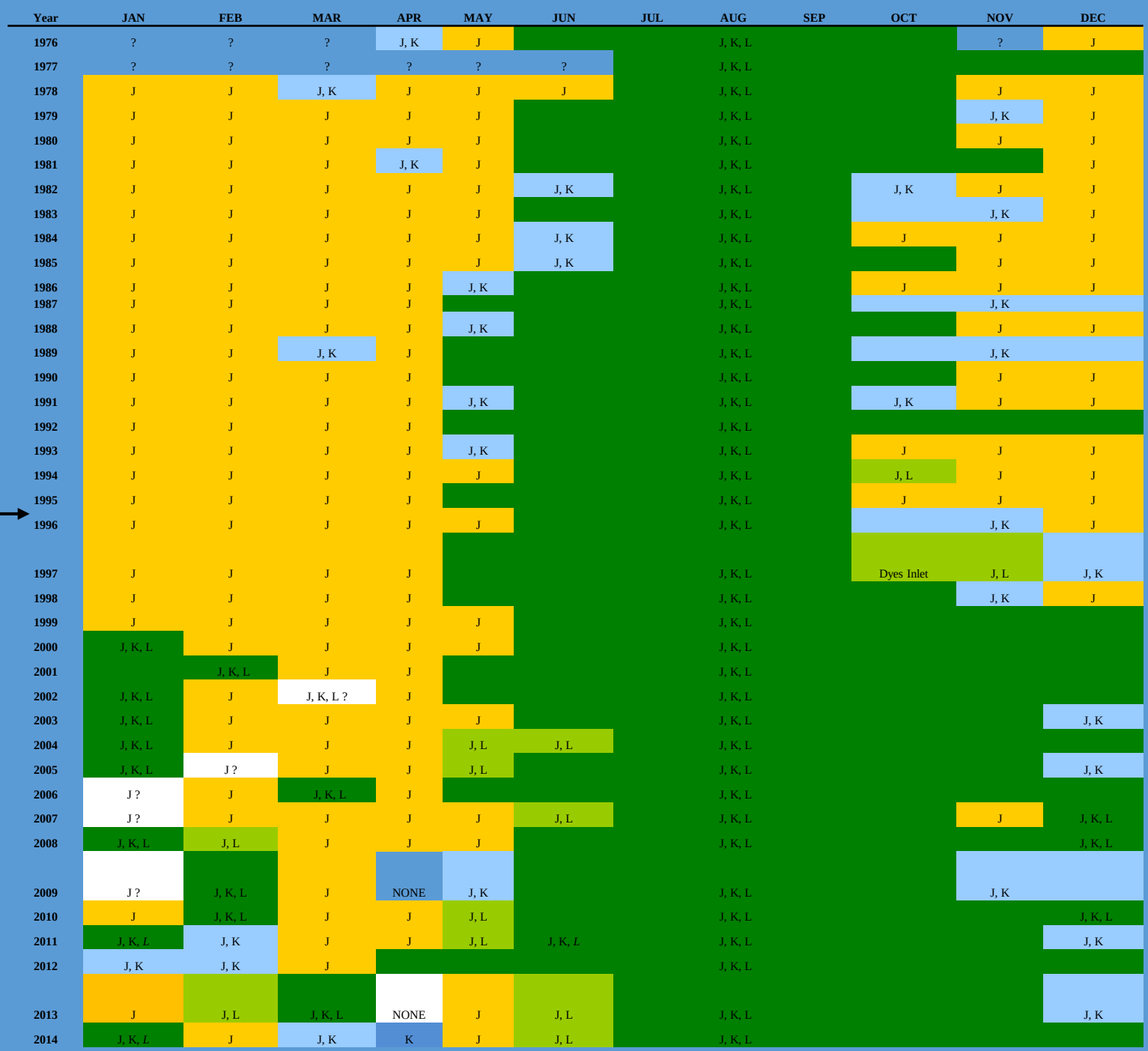


Presence/absence

J,K,L summer

J year round

Increased K,L presence starting in late 1990s



Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1976	?	?	?	J, K	J			J, K, L			?	J
1977	?	?	?	?	?	?		J, K, L				
1978	J	J	J, K	J	J	J		J, K, L			J	J
1979	J	J	J	J	J			J, K, L			J, K	J
1980	J	J	J	J	J			J, K, L			J	J
1981	J	J	J	J, K	J			J, K, L				J
1982	J	J	J	J	J	J, K		J, K, L		J, K	J	J
1983	J	J	J	J	J			J, K, L			J, K	J
1984	J	J	J	J	J	J, K		J, K, L		J	J	J
1985	J	J	J	J	J	J, K		J, K, L			J	J
1986	J	J	J	J	J, K			J, K, L		J	J	J
1987	J	J	J	J				J, K, L			J, K	
1988	J	J	J	J	J, K			J, K, L			J	J
1989	J	J	J, K	J				J, K, L			J, K	
1990	J	J	J	J				J, K, L			J	J
1991	J	J	J	J	J, K			J, K, L		J, K	J	J
1992	J	J	J	J				J, K, L				
1993	J	J	J	J	J, K			J, K, L		J	J	J
1994	J	J	J	J	J			J, K, L		J, L	J	J
1995	J	J	J	J				J, K, L		J	J	J
1996	J	J	J	J	J			J, K, L			J, K	J
1997	J	J	J	J				J, K, L		Dyes Inlet	J, L	J, K
1998	J	J	J	J				J, K, L			J, K	J
1999	J	J	J	J	J			J, K, L				
2000	J, K, L	J	J	J	J			J, K, L				
2001		J, K, L	J	J				J, K, L				
2002	J, K, L	J	J, K, L ?	J				J, K, L				
2003	J, K, L	J	J	J	J			J, K, L				J, K
2004	J, K, L	J	J	J	J, L	J, L		J, K, L				
2005	J, K, L	J ?	J	J	J, L			J, K, L				J, K
2006	J ?	J	J, K, L	J				J, K, L				
2007	J ?	J	J	J	J	J, L		J, K, L			J	J, K, L
2008	J, K, L	J, L	J	J	J			J, K, L				J, K, L
2009	J ?	J, K, L	J	NONE	J, K			J, K, L			J, K	
2010	J	J, K, L	J	J	J, L			J, K, L				J, K, L
2011	J, K, *L*	J, K	J	J	J, L	J, K, *L*		J, K, L				J, K
2012	J, K	J, K	J					J, K, L				
2013	J	J, L	J, K, L	NONE	J	J, L		J, K, L				J, K
2014	J, K, *L*	J	J, K	K	J	J, L		J, K, L				

Distribution Hot Spots

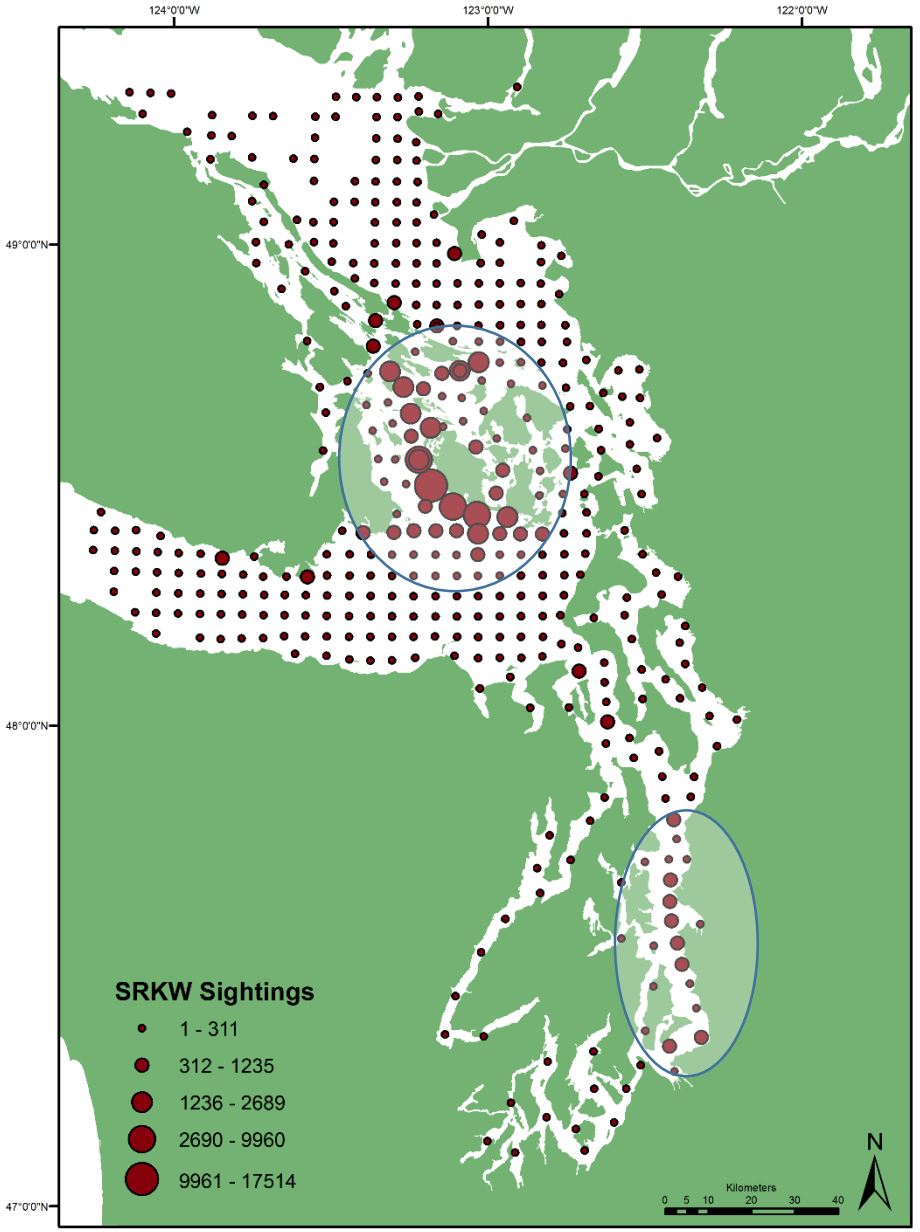
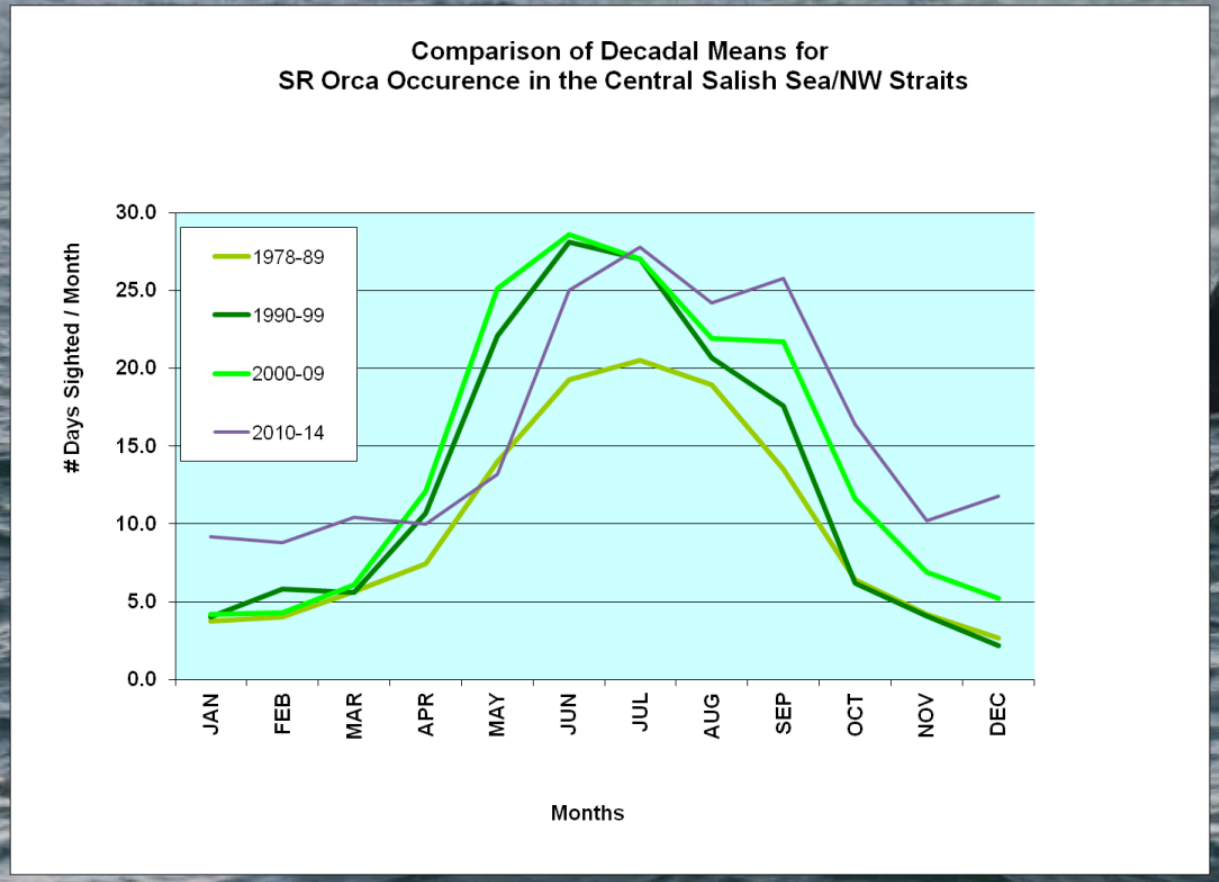


Photo credit: Jeanne Hyde

Seasonality

Central Salish Sea Decadal means



Puget Sound Decadal means: Sig shift in late 1990s

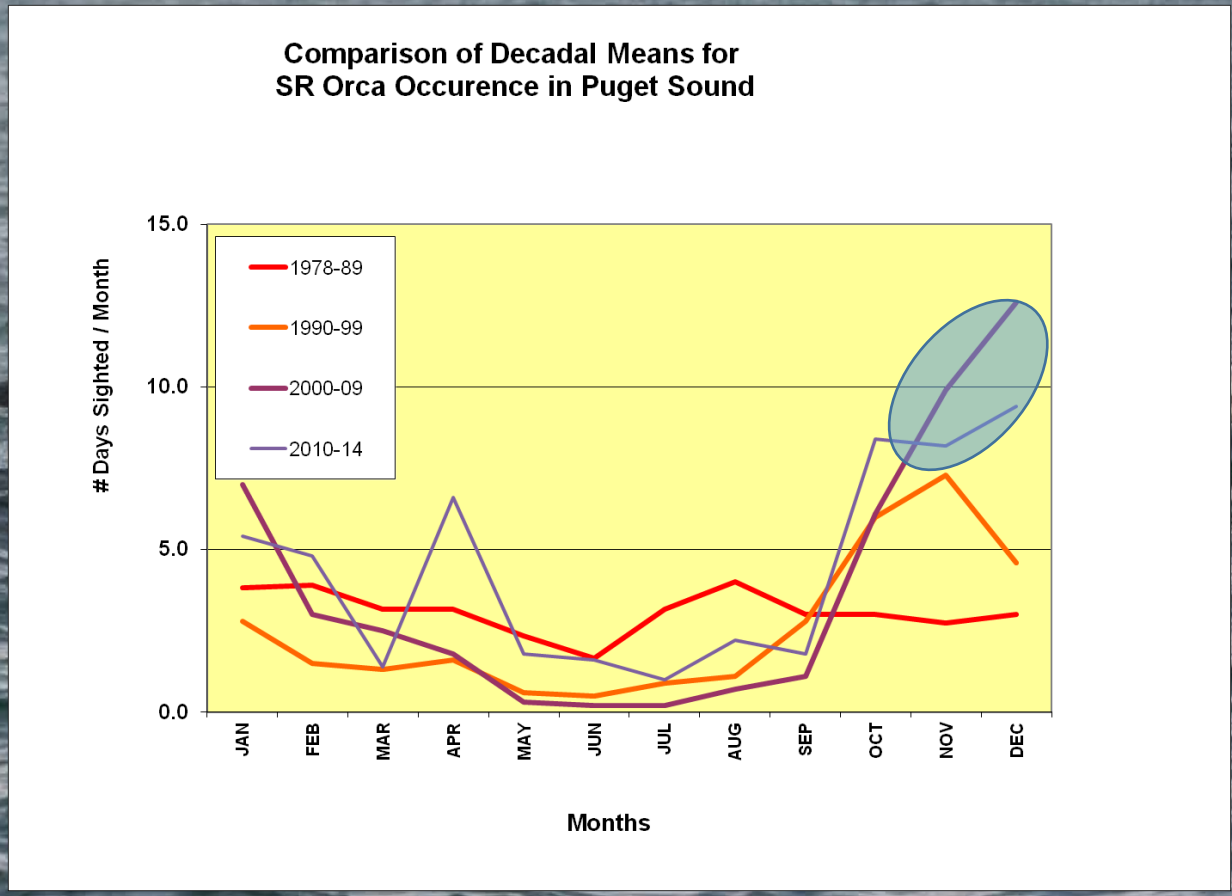


Photo credit: Jeanne Hyde

Conclusions

The SRKW's most consistent hot spot or region to be sighted is in the Haro Strait region in the Central Salish Sea.

The number of SRKW sightings and whale days were relatively stable during first two decades until 1995 when there was a shift resulting in an almost three fold increase in total sightings per year for the last two decades.

Three primary distribution patterns that SRKWs exhibit:

1) **Summer (June - August) primarily centered in the straits around the San Juan Islands**
2) **Fall/winter (September - January) a variation on summer with extended excursions into Puget Sound**
3) **Winter/spring (Feb-May) with extended excursions outside the Salish Sea**

The summer occupancy coincides with the time when most of the ocean-going salmon return to the Salish Sea

In the late nineties there was a significant shift in the SRKW's distribution with all three pods showing an increased presence in the Puget Sound, likely to feed on chum salmon runs, which may have stemmed from the Dyes Inlet event

Photo credit: TWM

The SRKW sightings dataset is one of the largest, longest running and most comprehensive sightings dataset for any species in the Salish Sea, and for any orca population in the world

With 82,447 total sightings since 1976, it was critical in determining if the SRKWs should receive federal protection and establishing the central portion of the Salish Sea and Puget Sound as critical habitat

Long-term dataset such as Orca Master have the power to determine significant changes or shifts that would not be noticeable during shorter intervals-shifting baselines

It is important to recognize the inherent bias associated with opportunistic data collections, but robust sightings records like this dataset can be invaluable tools for illuminating long-term spatial and temporal patterns

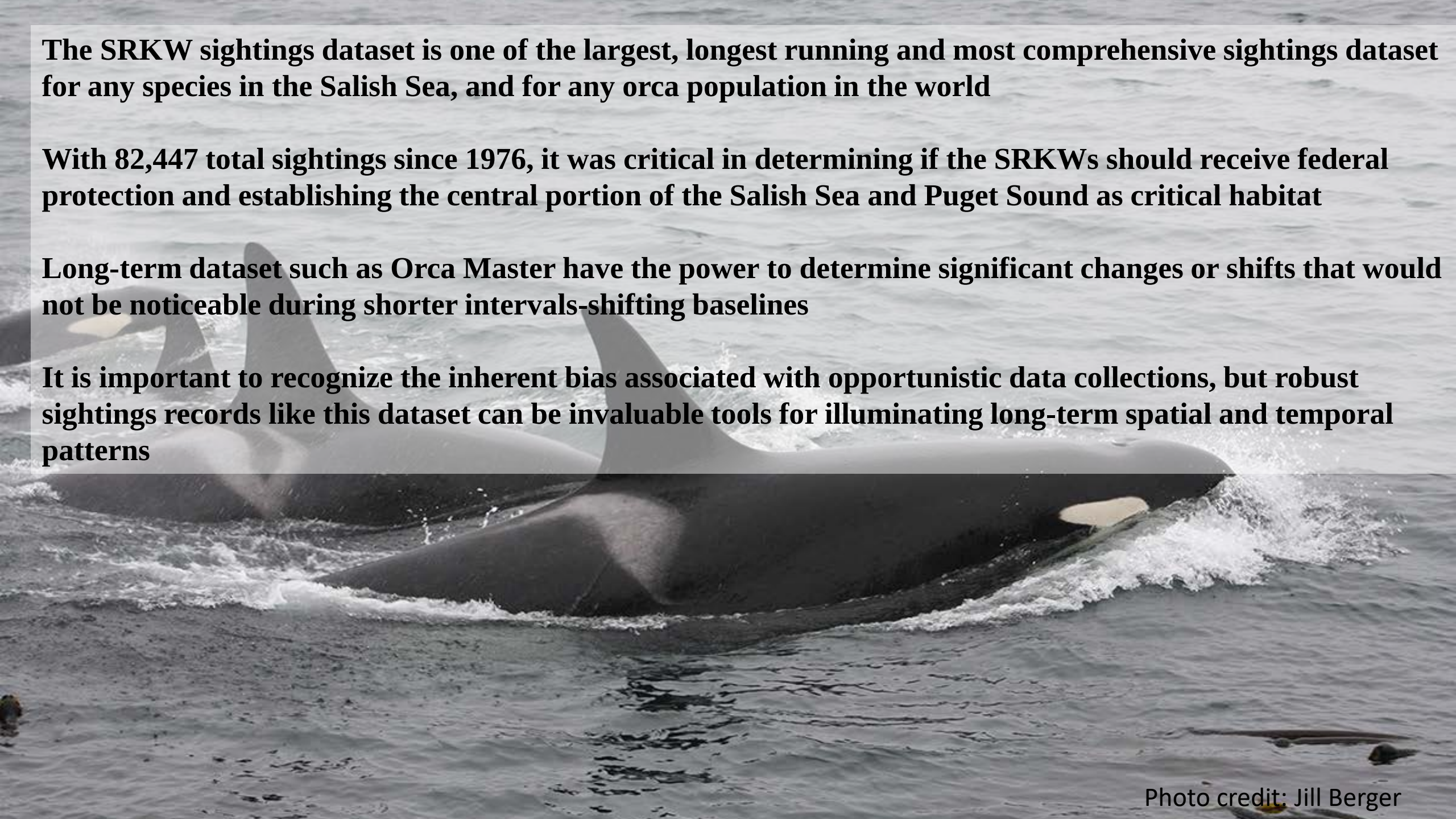


Photo credit: Jill Berger

Thank you!

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