Eavesdropping on Northern Resident killer whales: passive acoustic monitoring reveals overlap with endangered Southern Resident killer whales in proposed critical habitat

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North Pacific Resident Killer Whales

Long lived (50-80 years)

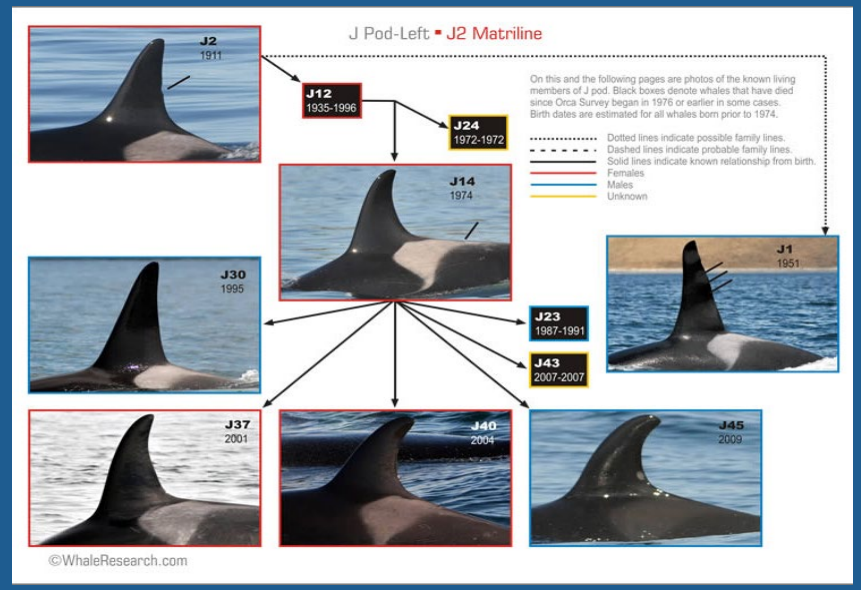
No dispersal

Closed population

Matrilineal, not harems

Fish eaters, primarily Chinook salmon

Each group has a unique dialect



fr. Center for Whale Research, Whaleresearch.com

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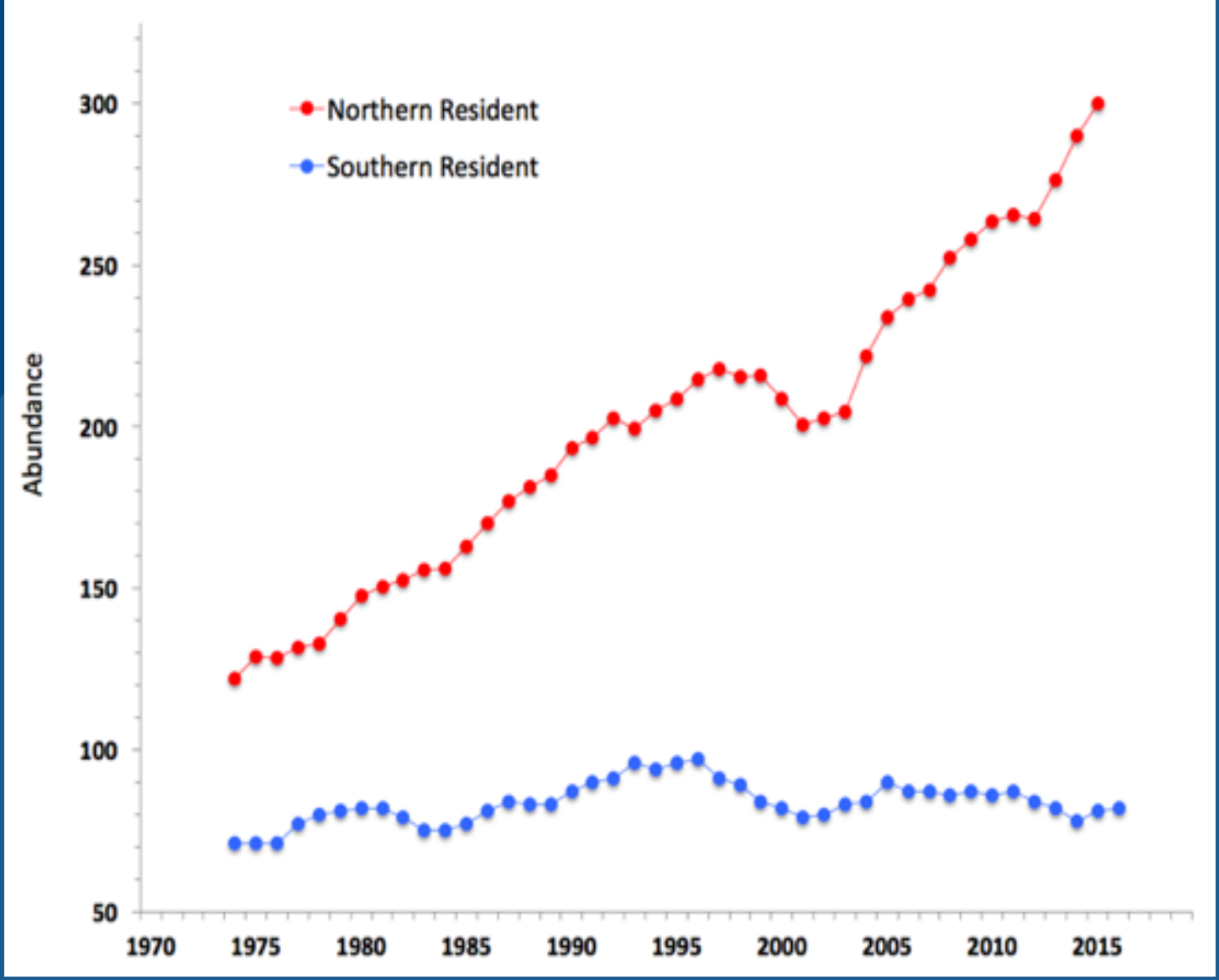
Northern and Southern resident killer whales



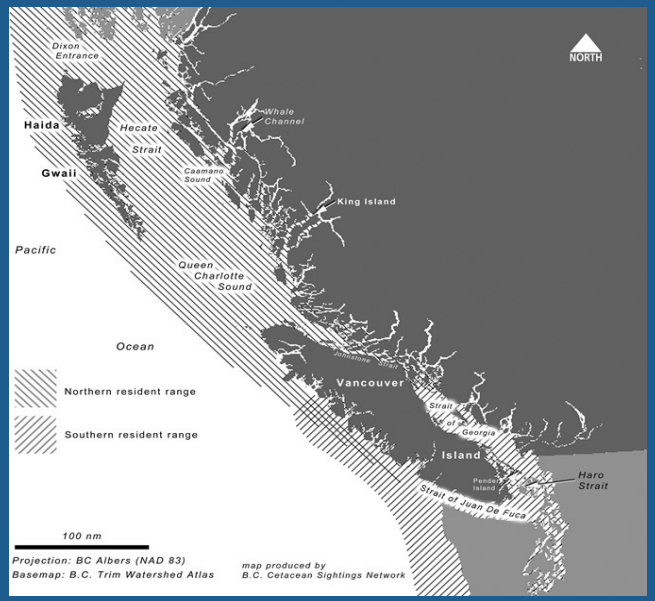
Data sources: Dept. Fisheries Oceans Canada and Center for Whale Research.

Northern resident killer whales (NRKW)

- Approximately 300 individuals
- 3 clans: A (158), G (94), R (50)

Southern resident killer whales (SRKW))

- Approximately 75 individuals
- 1 clan: J



The coast of British Columbia and northwest Washington State showing the general ranges of Northern and Southern Resident Killer Whales.

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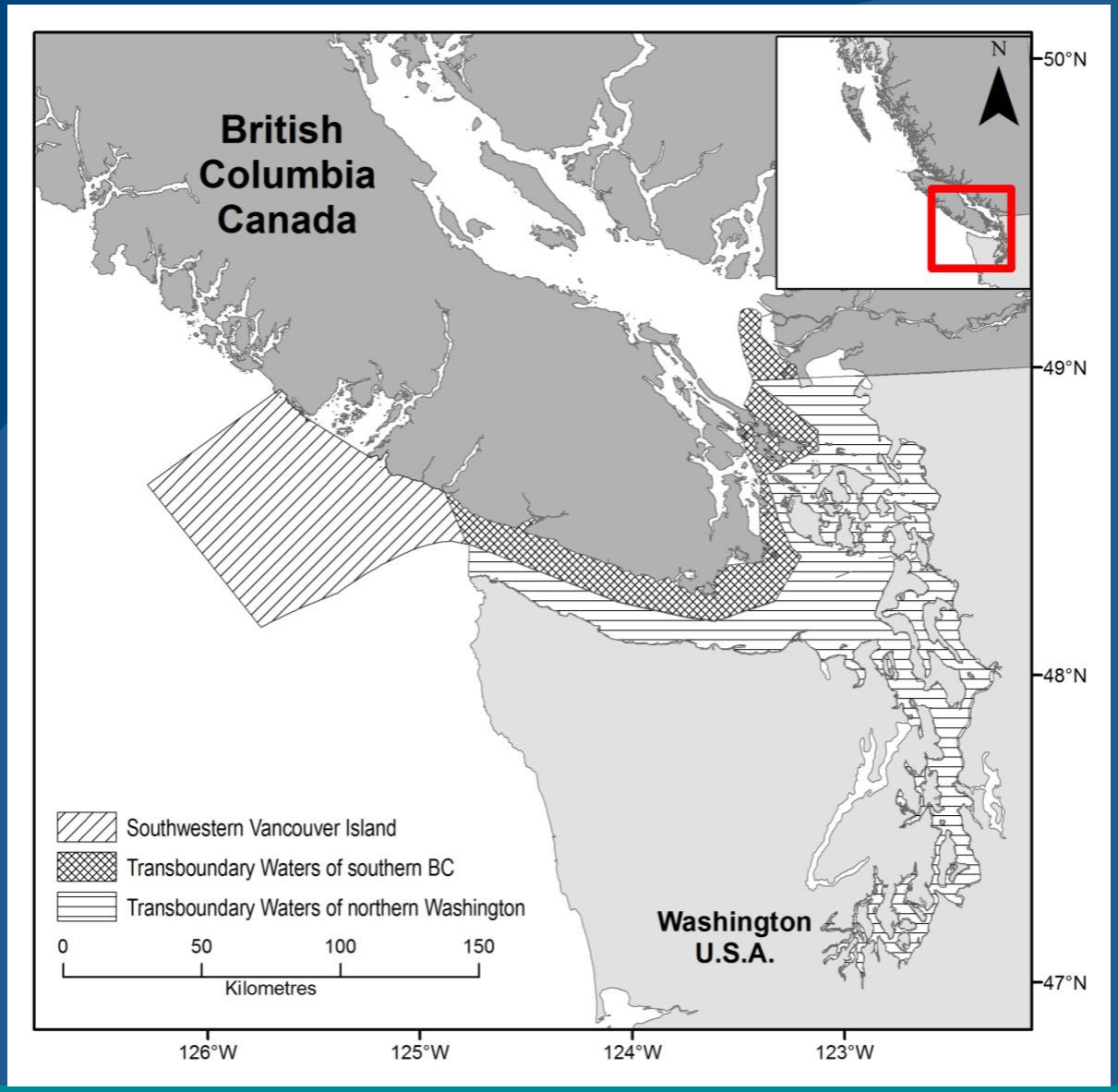
Critical Habitat



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Methods

Expanded to 17 sites spanning the WA coast (2014 – 2017)

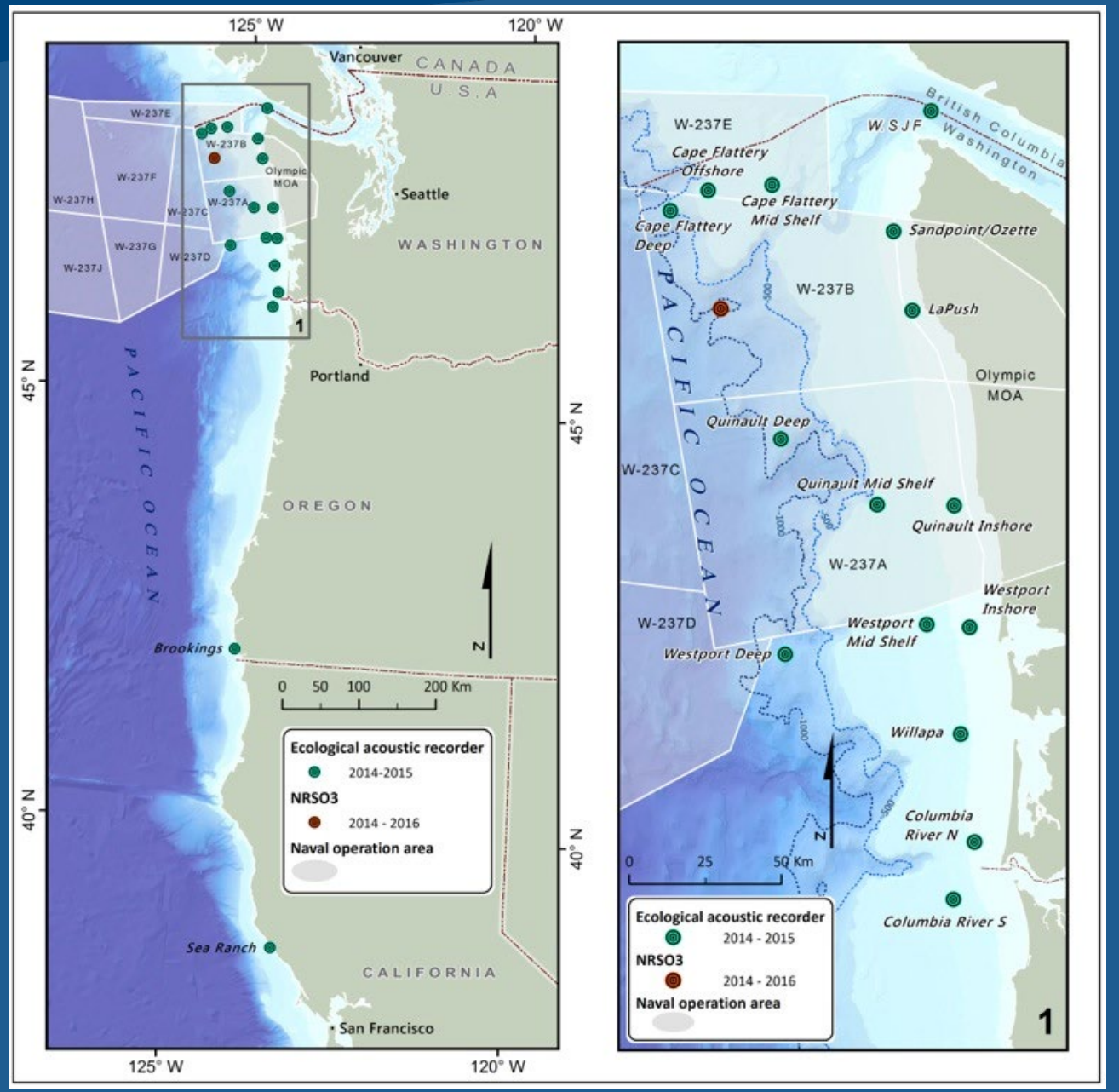
Ecological Acoustic Recorders (Lammers et al 2008)

- 90 seconds of continuous recording every 10 minutes
- 25 kHz sampling rate

Daily occurrence of all species detected

Killer whale detections

- Ecotype, Community and Pod identified
- Types of sounds in each 90 sec recording identified (calls, clicks, whistles, buzzes)
- Length of killer whale encounters (Riera et al 2011)



Results

Resident killer whales were detected on 429 days at all sites monitored except Quinault Deep

- 61% of detections were SRKW
- 39% of detections were NRKW

SRKW were detected on 263 days

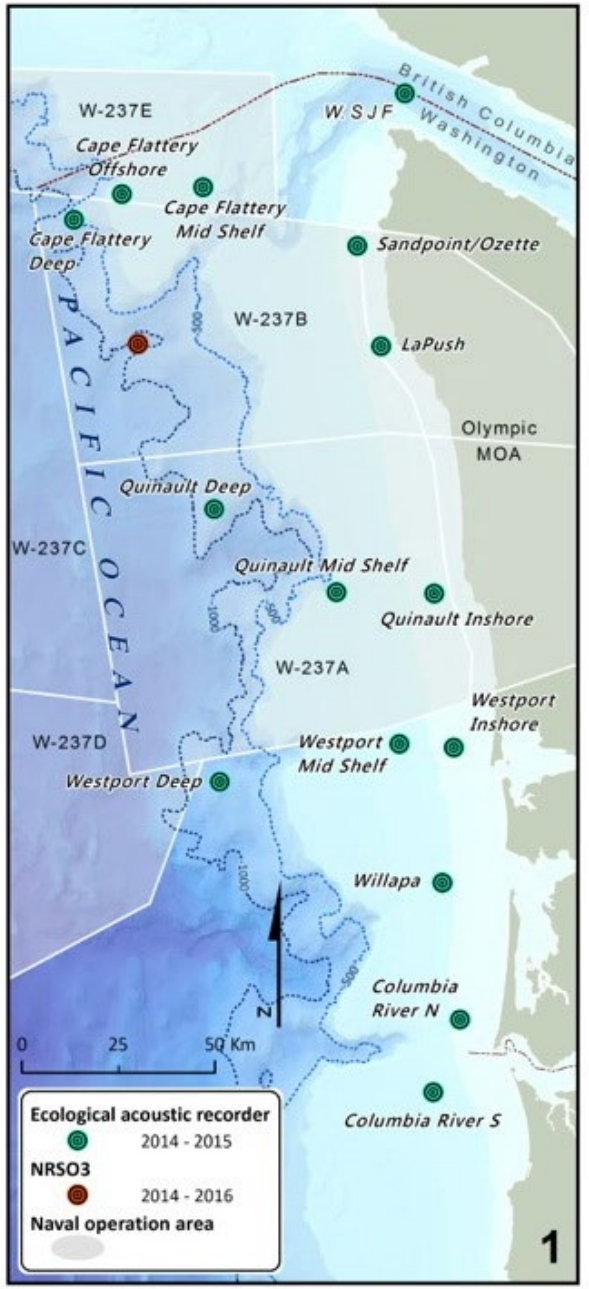
- All three pods detected, but only K and L pod detected in southern sites
- 10 sites
- Every month of the year except August

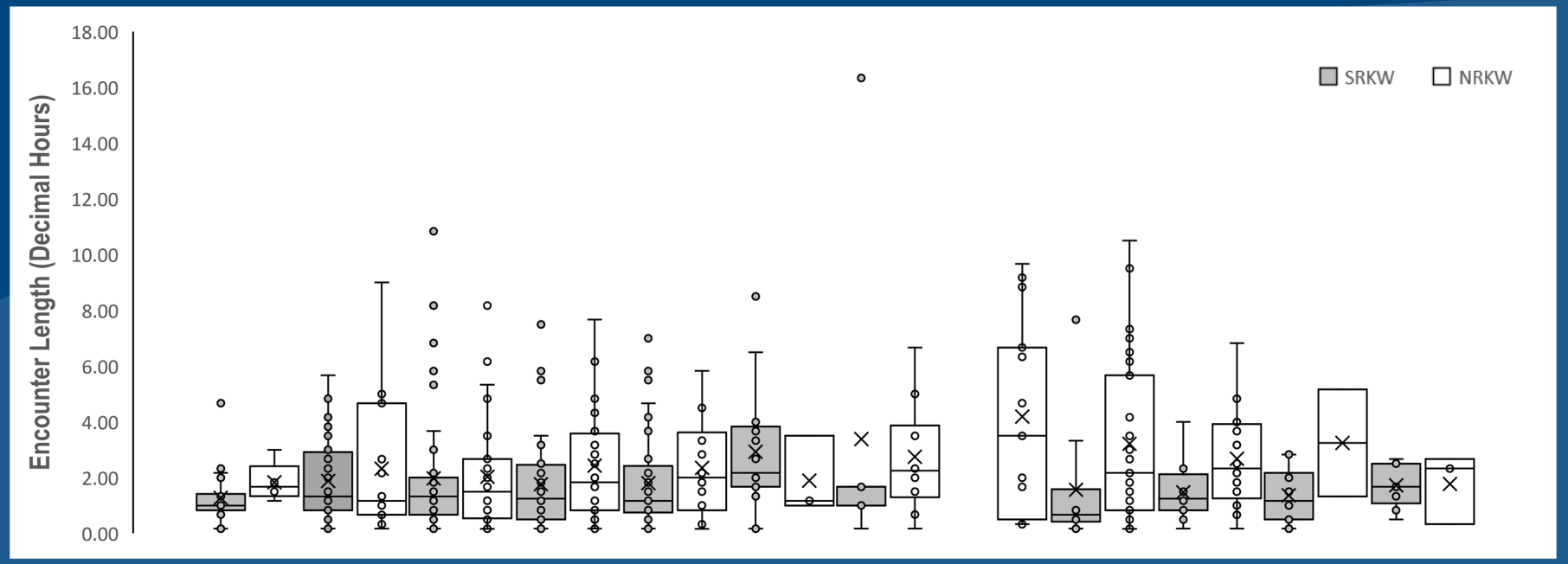
NRKW were detected on 166 days

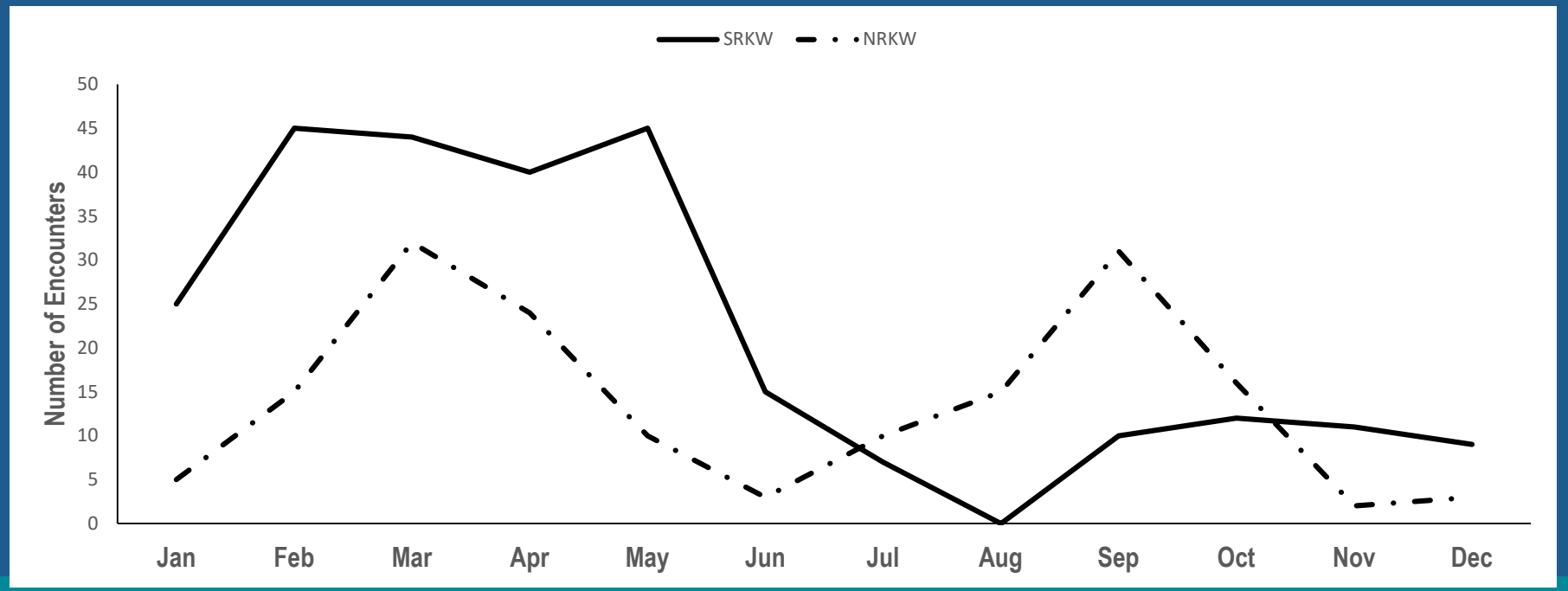
- Primarily G clan, but all three clans detected
- 11 sites
- Every month of the year

No differences in measures of sound production

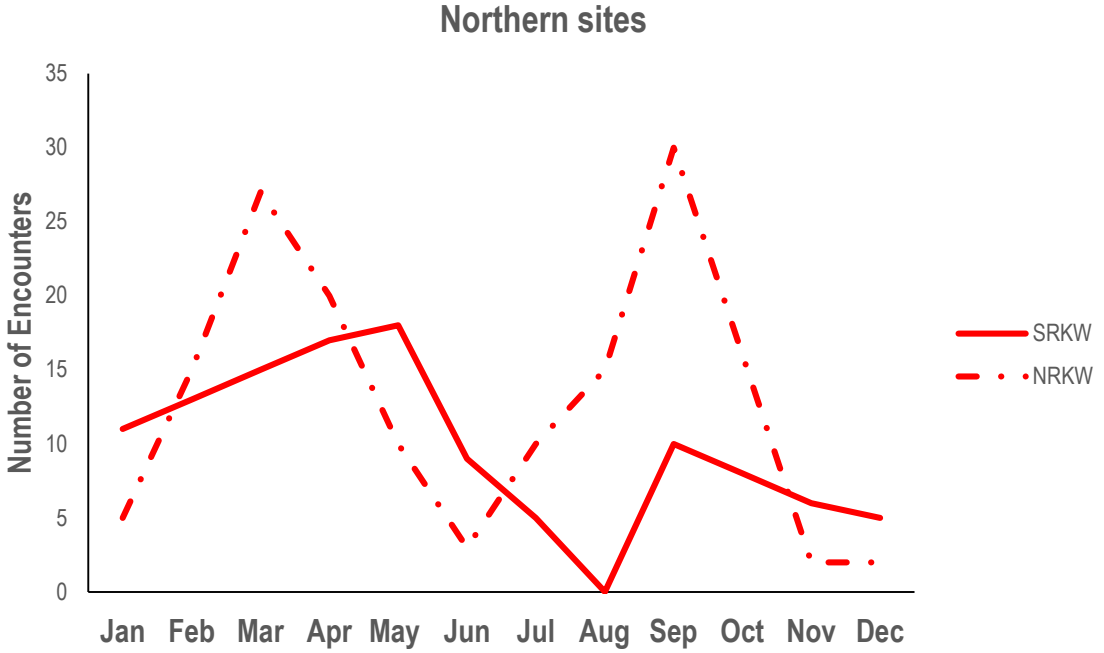
The mean encounter length for NRKW (2.7 hrs) was significantly longer ($p<0.0001$) than for SRKW (1.8 hrs).

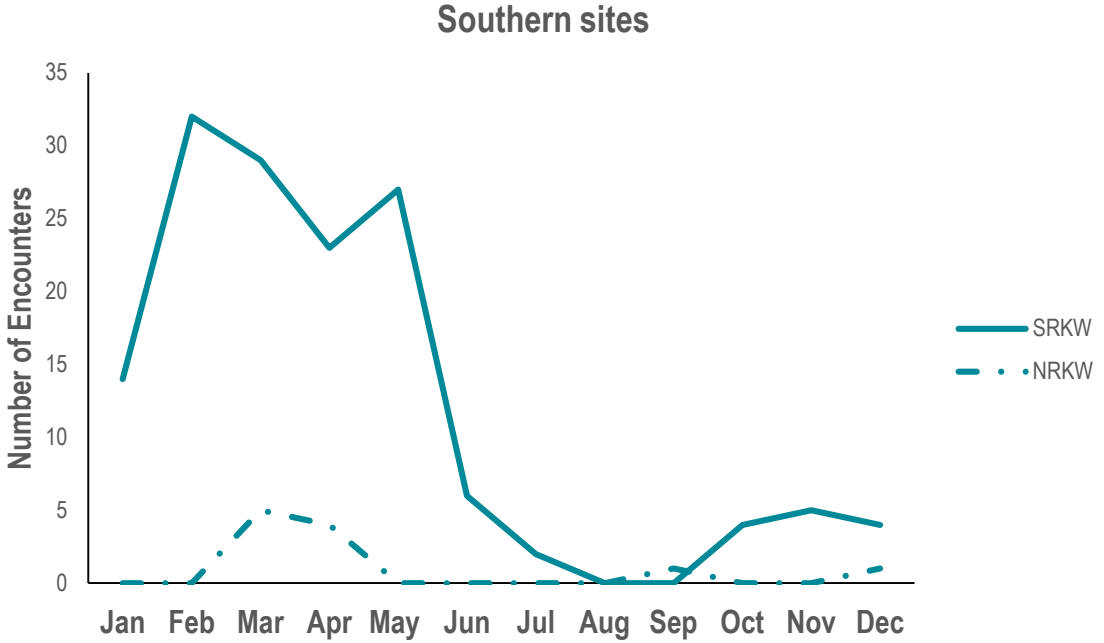


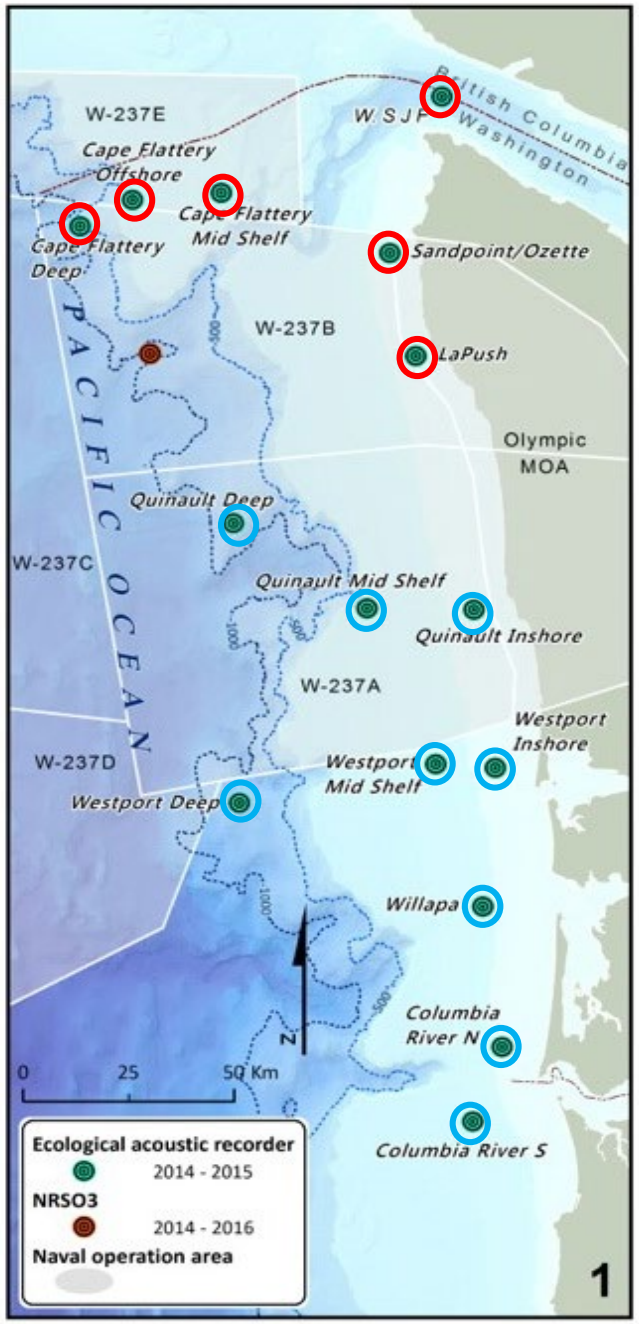

Encounter Length (Decimal Hours)
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
SRKW
NRKW


SRKW
NRKW
Number of Encounters
50
45
40
35
30
25
20
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


W-237E
Cape Flattery Offshore
Cape Flattery Mid Shelf
Cape Flattery Deep
Sandpoint/Ozette
W-237B
LaPush
Olympic MOA
Quinault Deep
W-237C
Quinault Mid Shelf
Quinault Inshore
W-237A
Westport Inshore
W-237D
Westport Mid Shelf
Westport Deep
Willapa
Columbia River N
Columbia River S
PACIFIC OCEAN
British Columbia
Washington
0 25 50 Km
Ecological acoustic recorder
2014 - 2015
NRSO3
2014 - 2016
Naval operation area
1


Northern sites
Number of Encounters
0
5
10
15
20
25
30
35
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
SRKW
NRKW


Southern sites
Number of Encounters
0
5
10
15
20
25
30
35
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
SRKW
NRKW


W-237E
Cape Flattery Offshore
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Sandpoint/Ozette
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Willapa
Columbia River N
Columbia River S
PACIFIC OCEAN
British Columbia
Washington
0 25 50 Km
Ecological acoustic recorder
2014 - 2015
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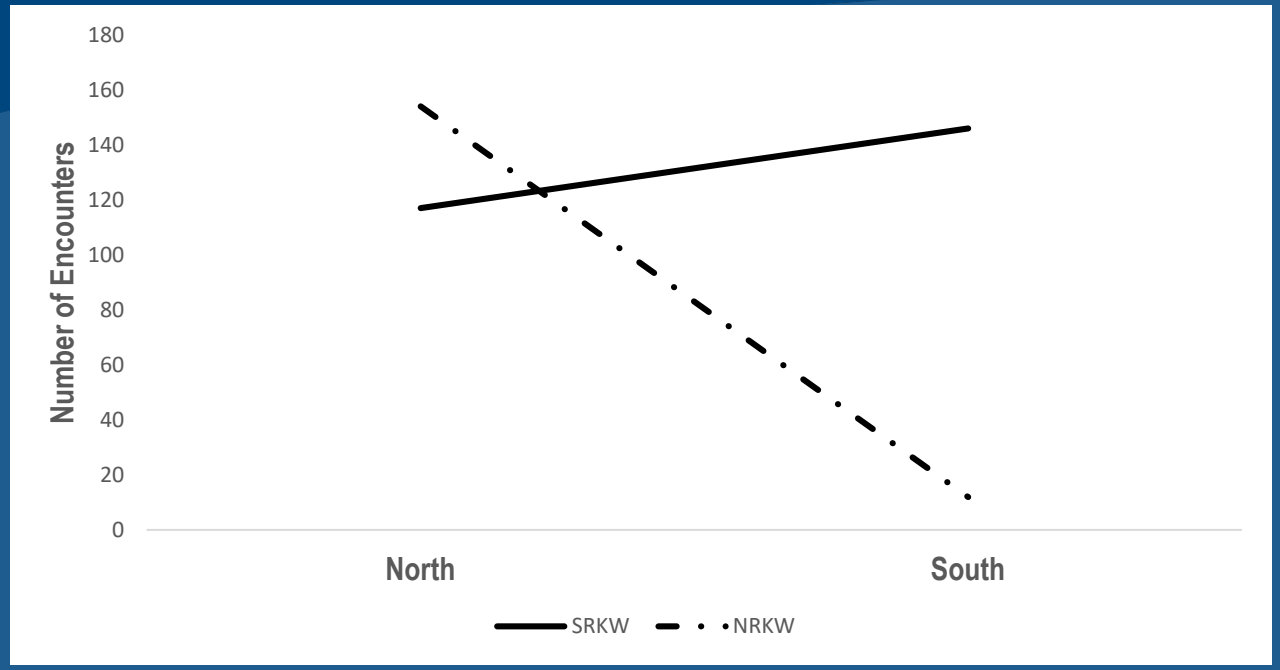
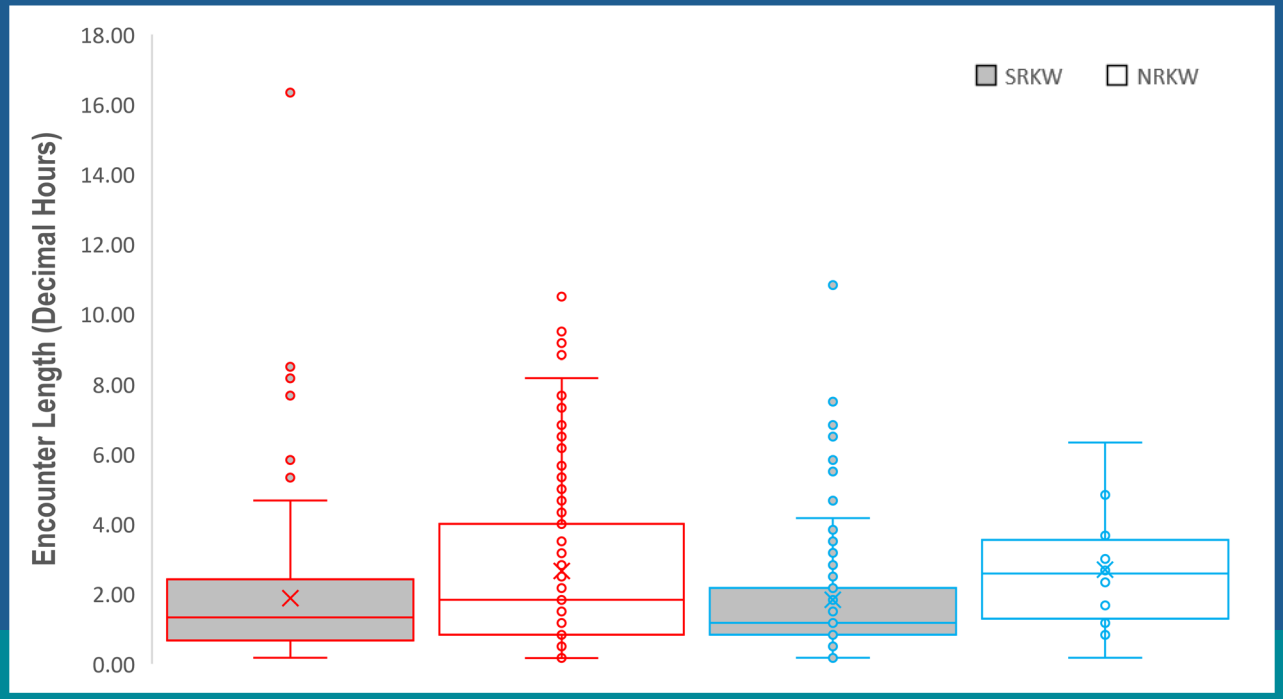
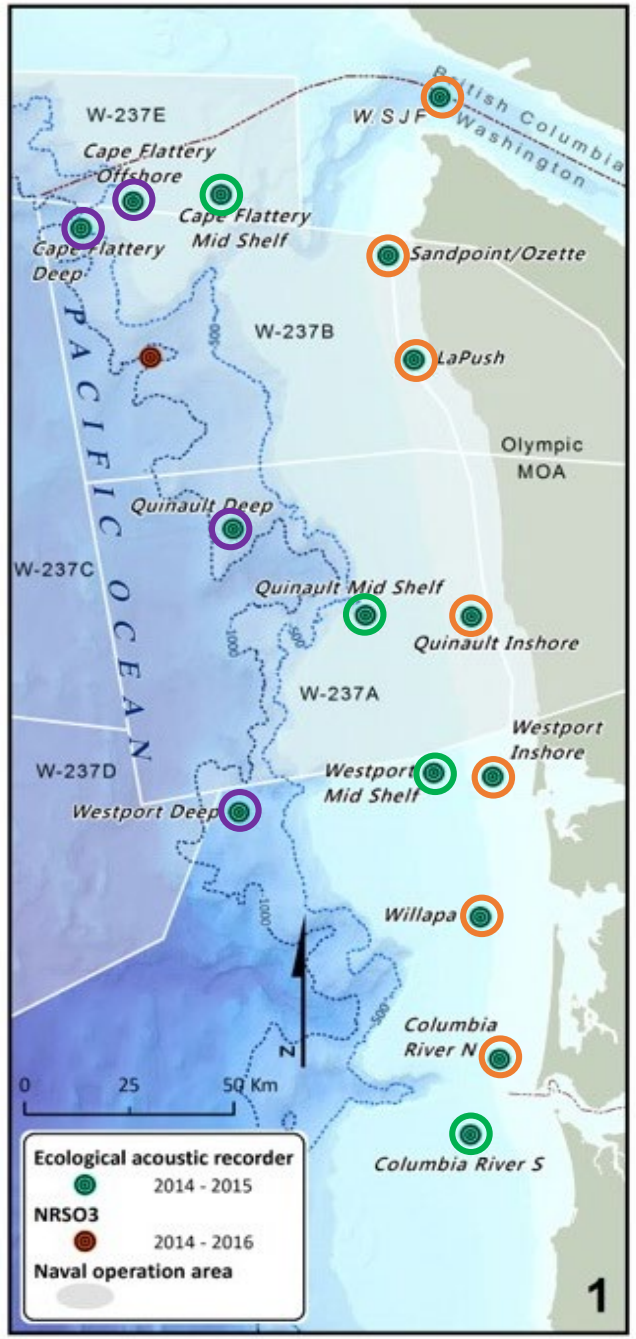
2014 - 2016
Naval operation area
1


Number of Encounters
180
160
140
120
100
80
60
40
20
0
North
South
SRKW
NRKW


Encounter Length (Decimal Hours)
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
SRKW
NRKW


W-237E
W SJF
British Columbia
Washington
Cape Flattery Offshore
Cape Flattery Mid Shelf
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PACIFIC OCEAN
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Quinault Deep
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Columbia River N
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N
0 25 50 Km
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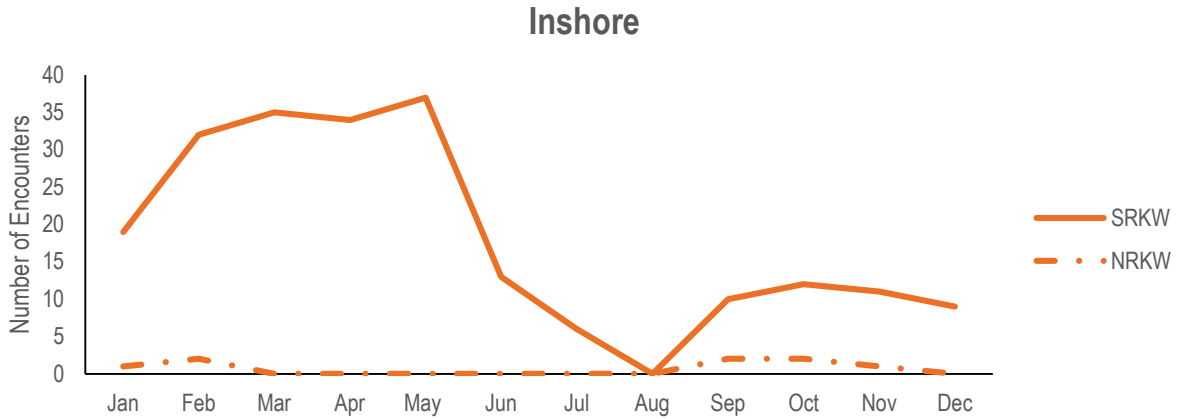
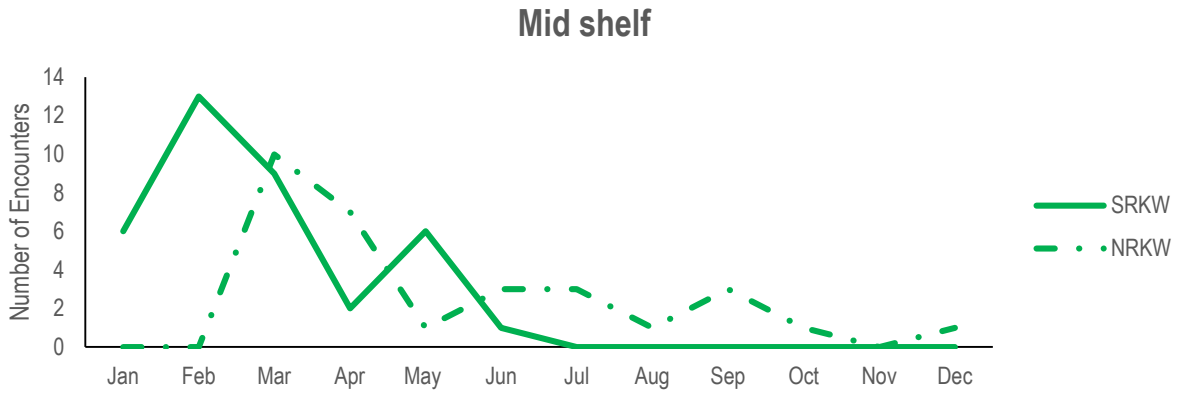
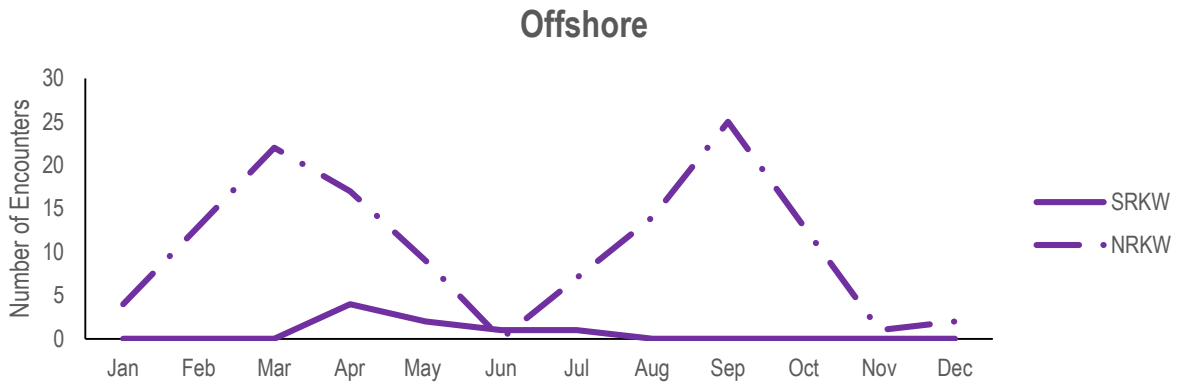
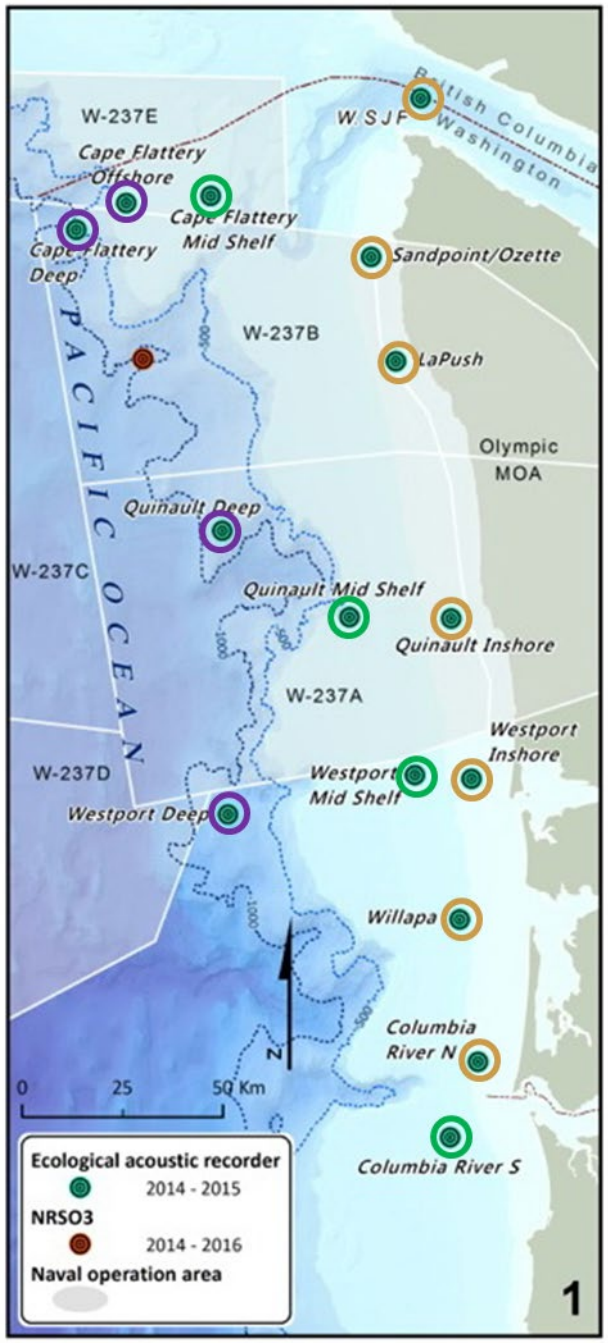
1


Inshore
Number of Encounters
0 5 10 15 20 25 30 35 40
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
SRKW
NRKW


Mid shelf
Number of Encounters
0 2 4 6 8 10 12 14
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
SRKW
NRKW


Offshore
Number of Encounters
0 5 10 15 20 25 30
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
SRKW
NRKW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Willapa
Columbia River N
Columbia River S
N
0 25 50 Km
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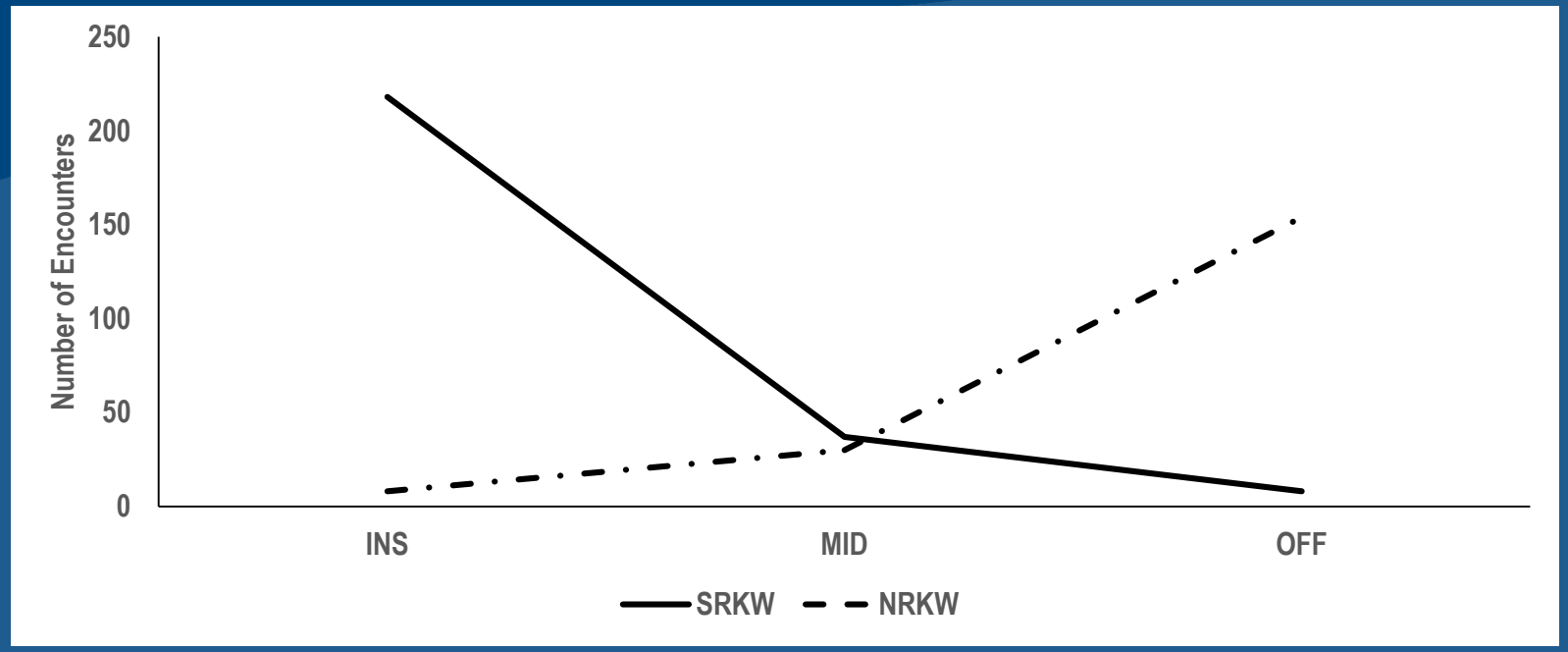
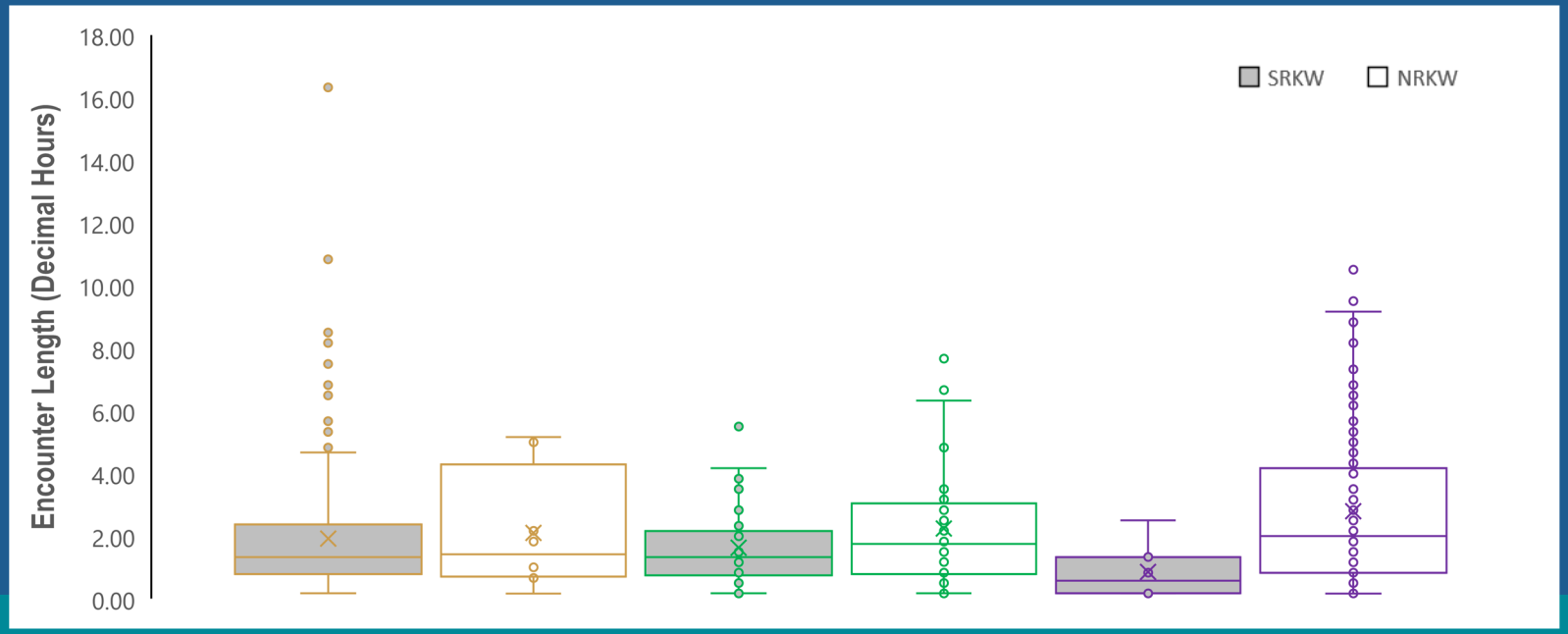
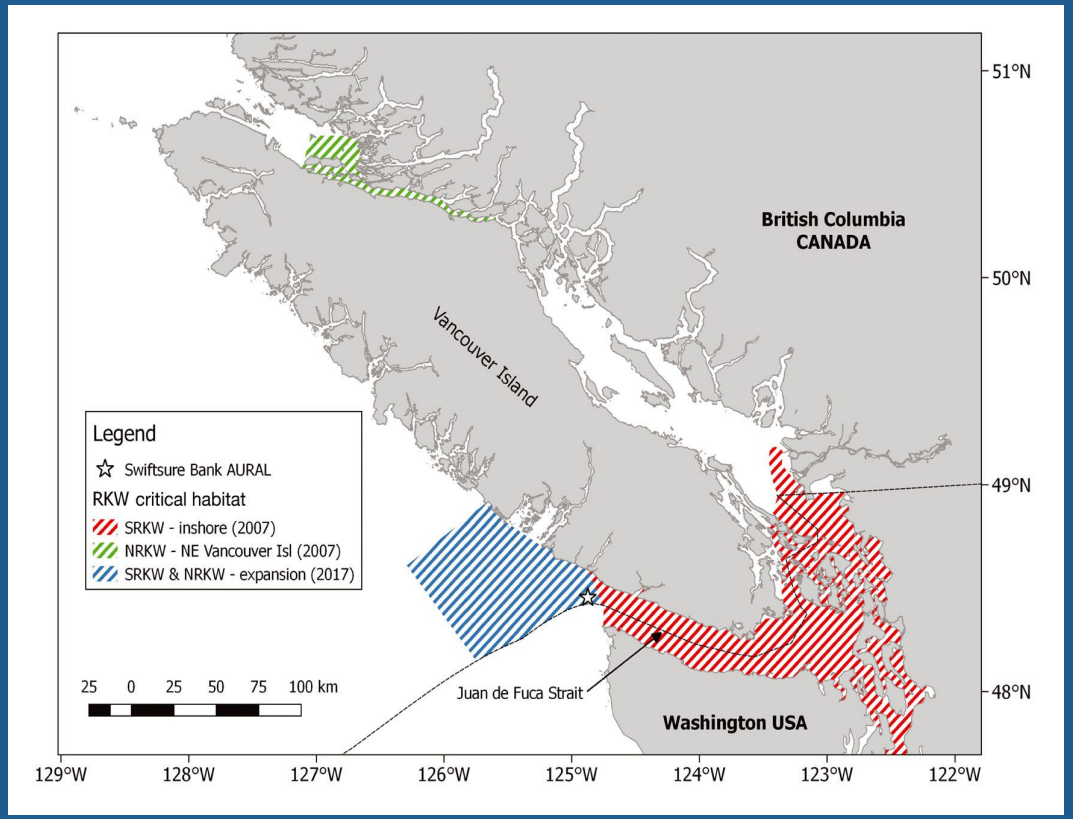
Naval operation area
1


250
200
150
100
50
0
Number of Encounters
INS
MID
OFF
SRKW
NRKW


18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Encounter Length (Decimal Hours)
SRKW
NRKW

Conclusions

- While the goal was to monitor SRKW, NRKW accounted for 40% of resident killer whale detections indicating extensive use of the northern WA coast
- NRKW encounters were longer than SRKW encounters
- Occurrence for both populations peaks in the spring, with a second fall peak for NRKW
- NRKW were predominately detected at sites along the shelf edge, while SRKW were mostly detected at sites close to shore



Riera et al 2019

- As the southernmost resident killer population, SRKW have the narrowest selection of Chinook salmon available to them, and this is the first step to understanding the role that competition on the WA coast may play in limiting the recovery of SRKW.

Acknowledgments

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Olympic Coast National Marine Sanctuary

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