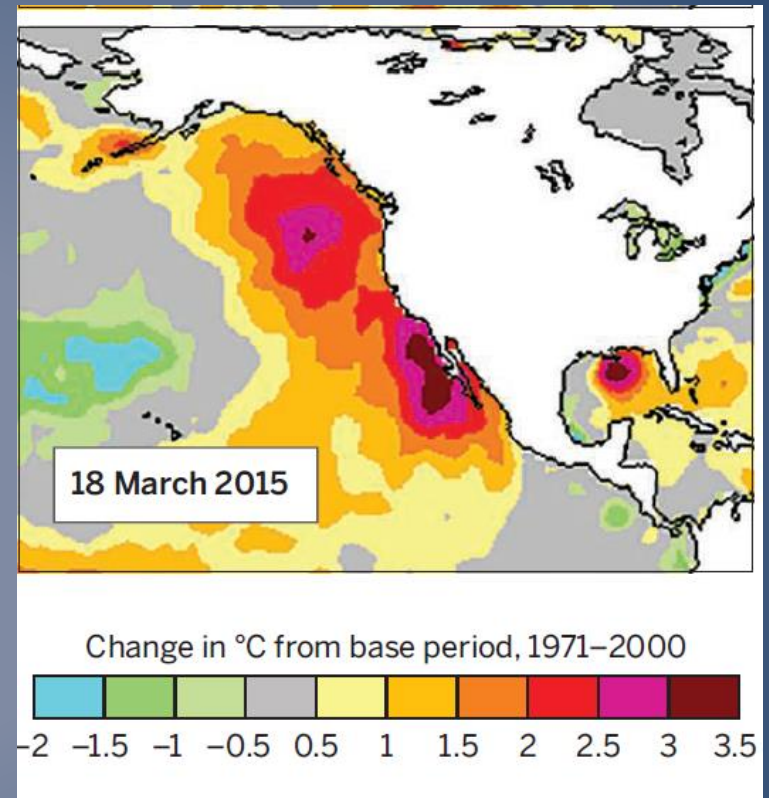
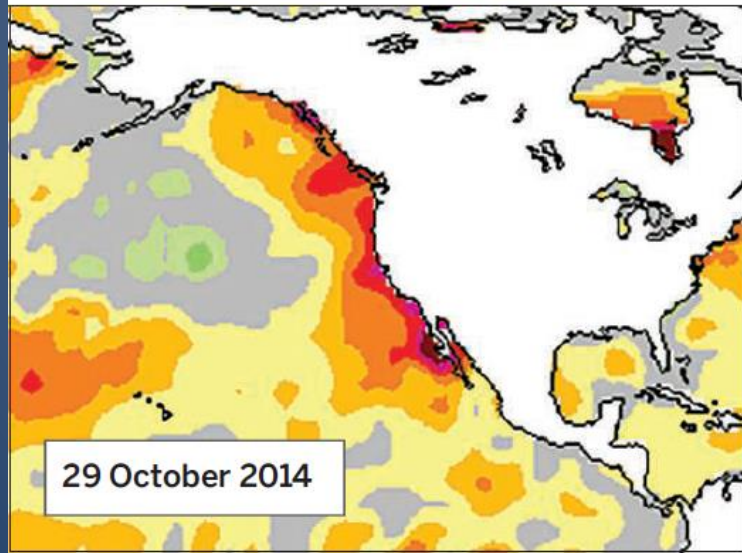
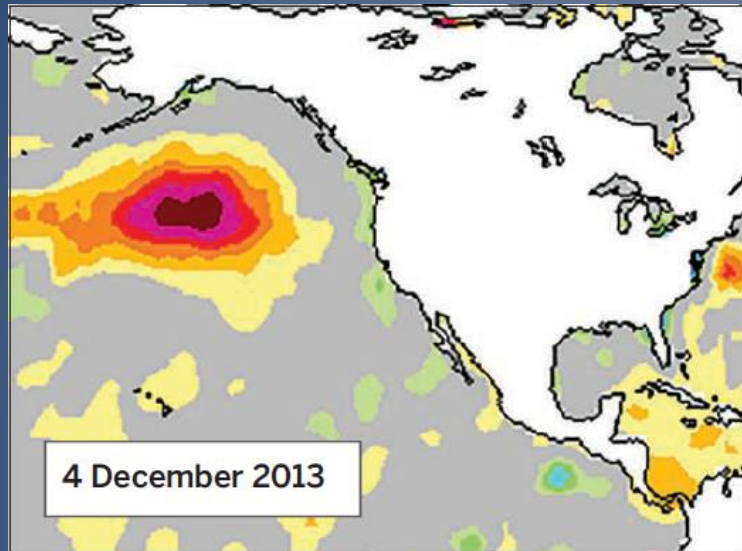


Declining Abundance, Reproductive Success, and Body Condition in Southeast Alaska Humpback Whales During and After the North Pacific Marine Heatwave

Christine Gabriele and Janet Neilson
Glacier Bay National Park



The Blob: Marine Heatwave



1-4 degrees Celsius higher than average

Science **348** (6230), 17-18.

DOI: 10.1126/science.348.6230.17

Before 2013 and “The Blob”



After 2013 and “The Blob”

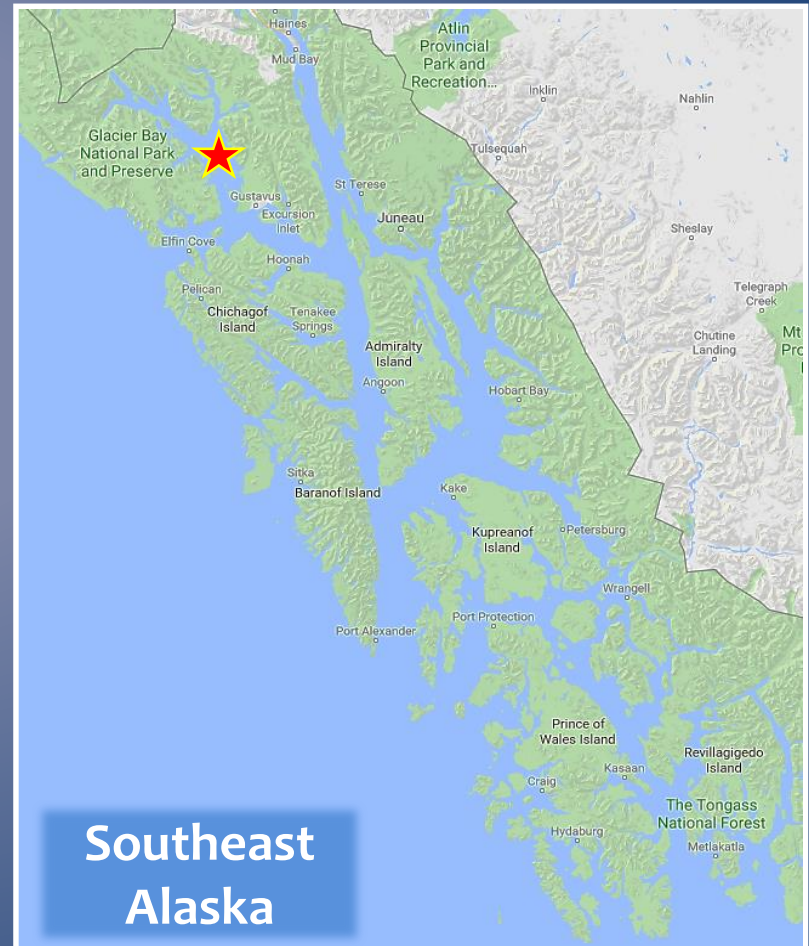
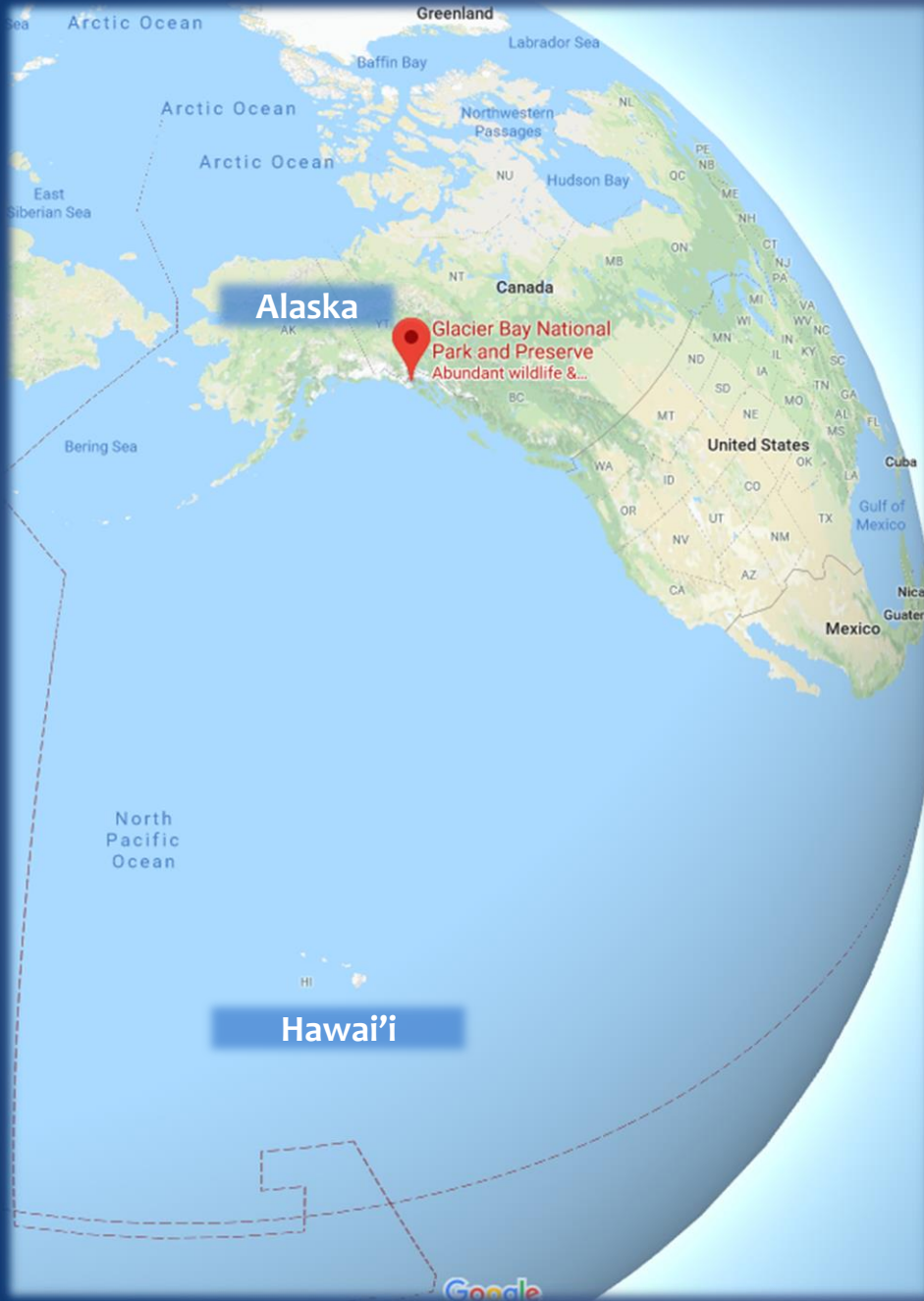


Synopsis: What Data Indicate Change?



- *Whale numbers*
- *Calving and juvenile survival*
- *Site fidelity*
- *Body condition*
- *Group size*
- *Feeding behavior*
- *Prey availability and condition*

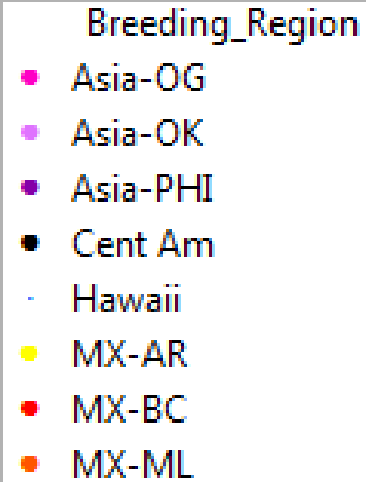
Where In the World is Glacier Bay?



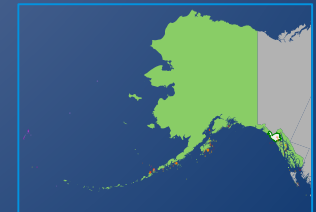
Alaska Feeding Grounds for Endangered, Threatened and Unlisted DPS Humpback Whales

ALASKA SPLASH
SIGHTINGS OF WHALES
WITH KNOWN DPS
(AVAILABLE DATA: 939
SIGHTINGS OF 491
WHALES)

About 50% of
Alaska whales
sighted in SPLASH
were from a
known DPS



Source:
SPLASH database
1 sighting per whale per day
Hawaii whales shown smaller in blue



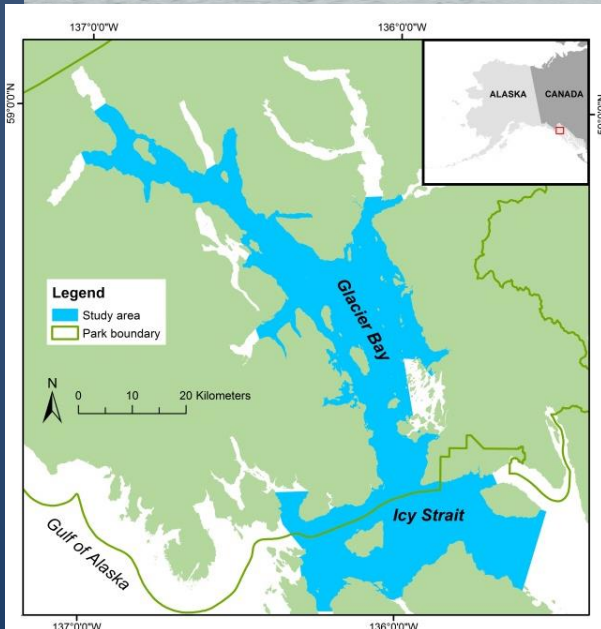
Standardized Photo-ID Monitoring Surveys (1985 – present)



R/V Ogive, 1986 - 2001



R/V Sand Lance, 2001 - present



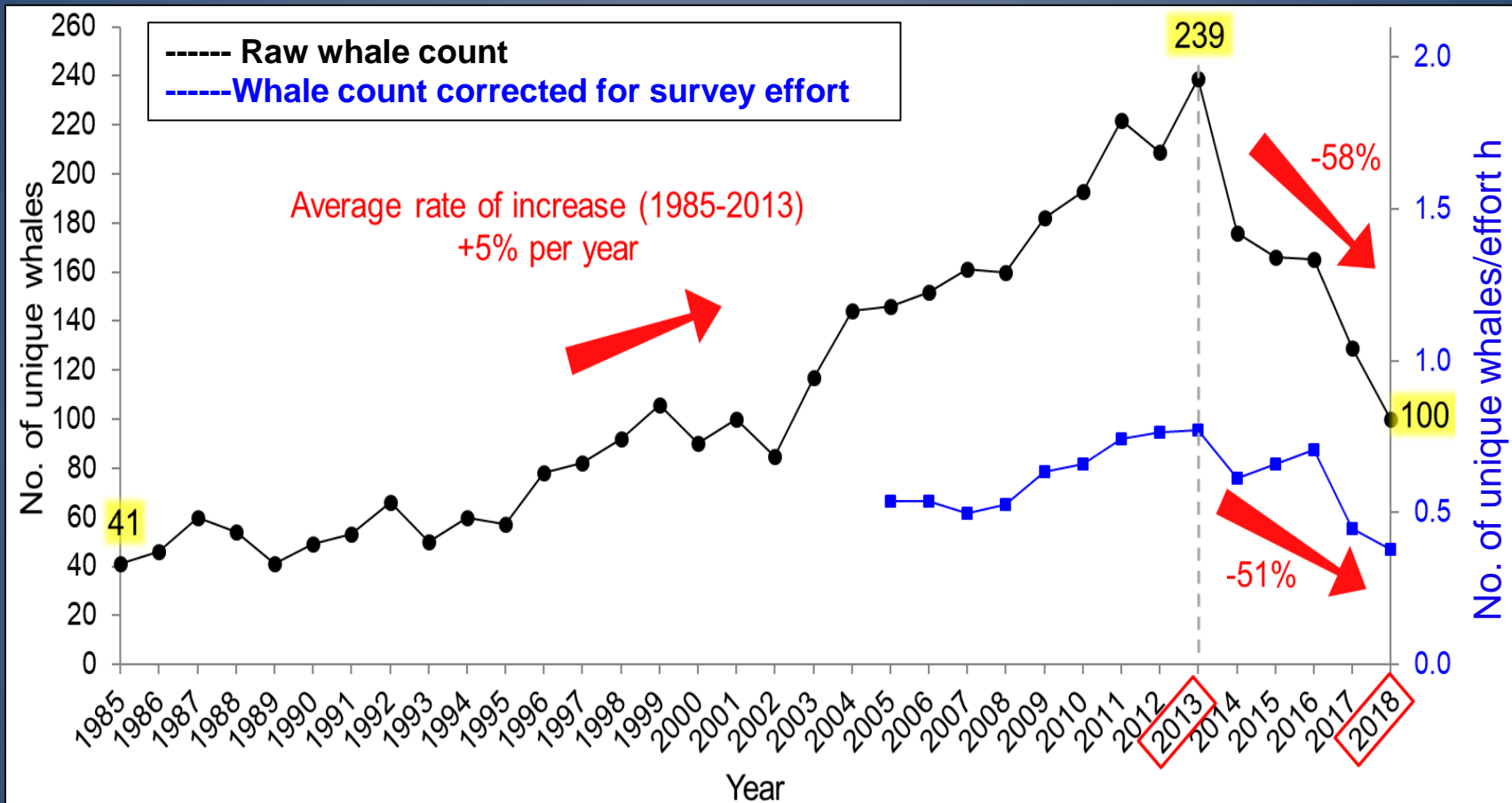
Glacier Bay and Icy Strait

4 - 5 surveys/week, June 1 – August 31

Avg 359 hours/year (= >10,000 hrs of effort!)



Humpback Whale Abundance in Glacier Bay & Icy Strait, 1985-2018



Abundance has dropped by > 58% since 2013

The two factors that drove population increase are also what underlie the decline
Site Fidelity and Calf Production, Return and Recruitment

Humpback Whales Show Very Strong Site Fidelity in the Feeding Grounds

11 whales seen
EVERY year for 30 years!

[illegible]

EVERY year for 30 years!

EVERY year for 30 years!

[illegible]

One Whale Eventually Returned, Two Others Sighted Elsewhere

11 whales seen
EVERY year for 30 years!

Came back
2017, 2018

Sitka
Sound
2018

Sitka
Sound
2017, 2018

[illegible]

Decreased Site Fidelity Affects All Ages

“Regularly sighted” = seen for 10 consecutive years

66 whales seen every year in Glacier Bay/Icy Strait (2004-2013:
Jun 1 – Aug 31)

Overall, 68% (n = 45) of the regularly sighted whales had one or more breaks in their site fidelity in 2014-2018.

Age range of missing ‘regulars’ is 20-44 years old

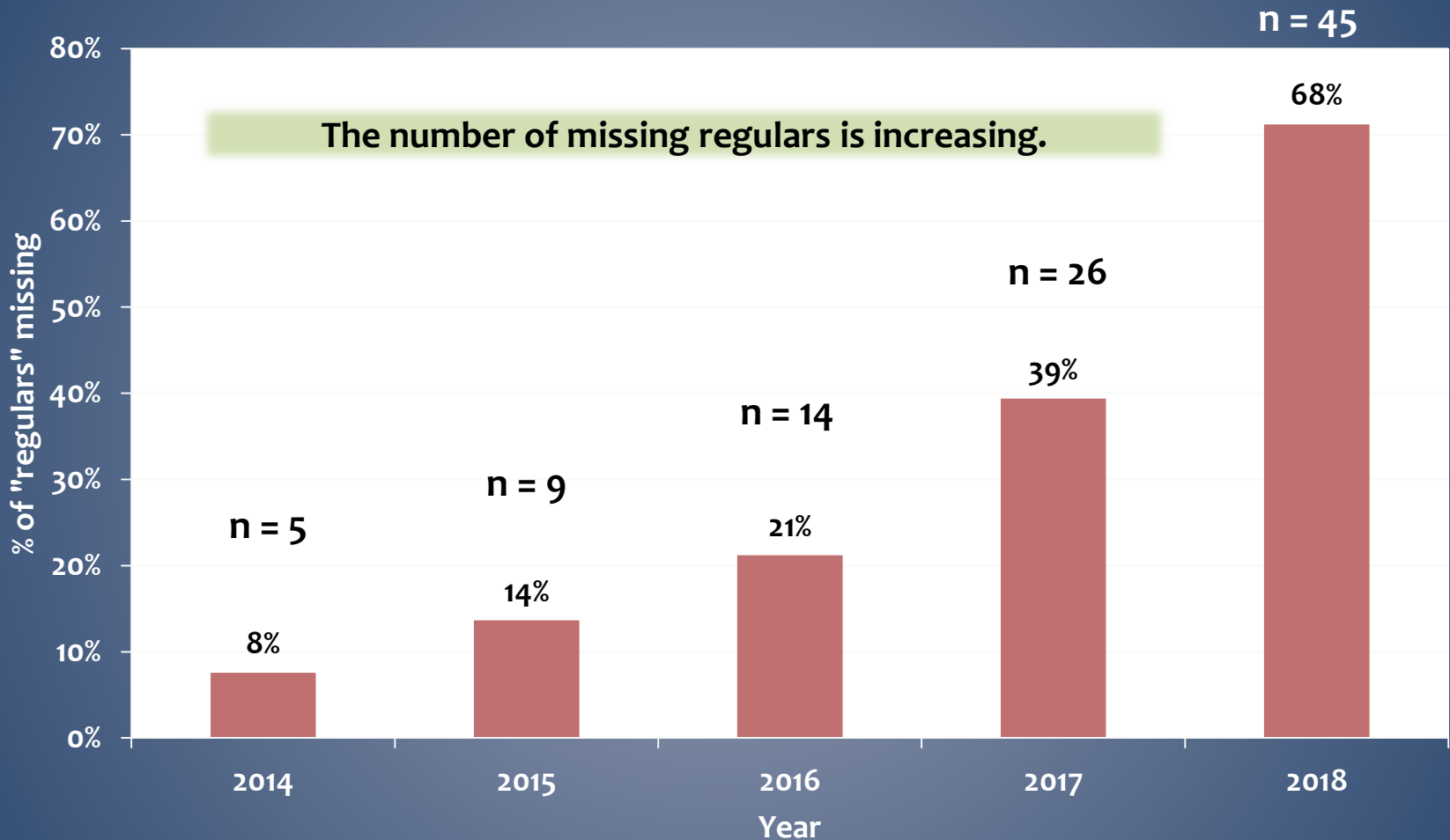
Female #581, June 2018

Fortunately, a few have made their way back to the area.

Whale ID:	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
159	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
352	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
875	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1012	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1019	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1065	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1082	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1083	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1244	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1293	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1299	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1302	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1313	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1432	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1461	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1486	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1659	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1808	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1836	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1840	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1896	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
117	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
118	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
155	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
221	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
351	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
1046	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	31
1900	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	14
1088	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	24
1438	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	20
1474	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	21
1485	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	19
1489	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
1505	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
1652	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
1807	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
1816	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
157	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
166	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗
186	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	34	35	36	✗
219	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
516	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	42	43	44	✗
573	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
581	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗
587	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
235	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
1018	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
161	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗
1246	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
1063	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
937	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
535	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
616	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
465	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
232	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
250	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
1532	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
1815	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
1817	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
1233	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	31	32
1042	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29	30	31	✗
1014	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	28	29	✗
1306	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	22	25	26	✗
1298	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25	26	✗
1421	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	17	18	19	20
1439	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	19	21	✓



The Number of Missing “Regulars” is Increasing Each Year



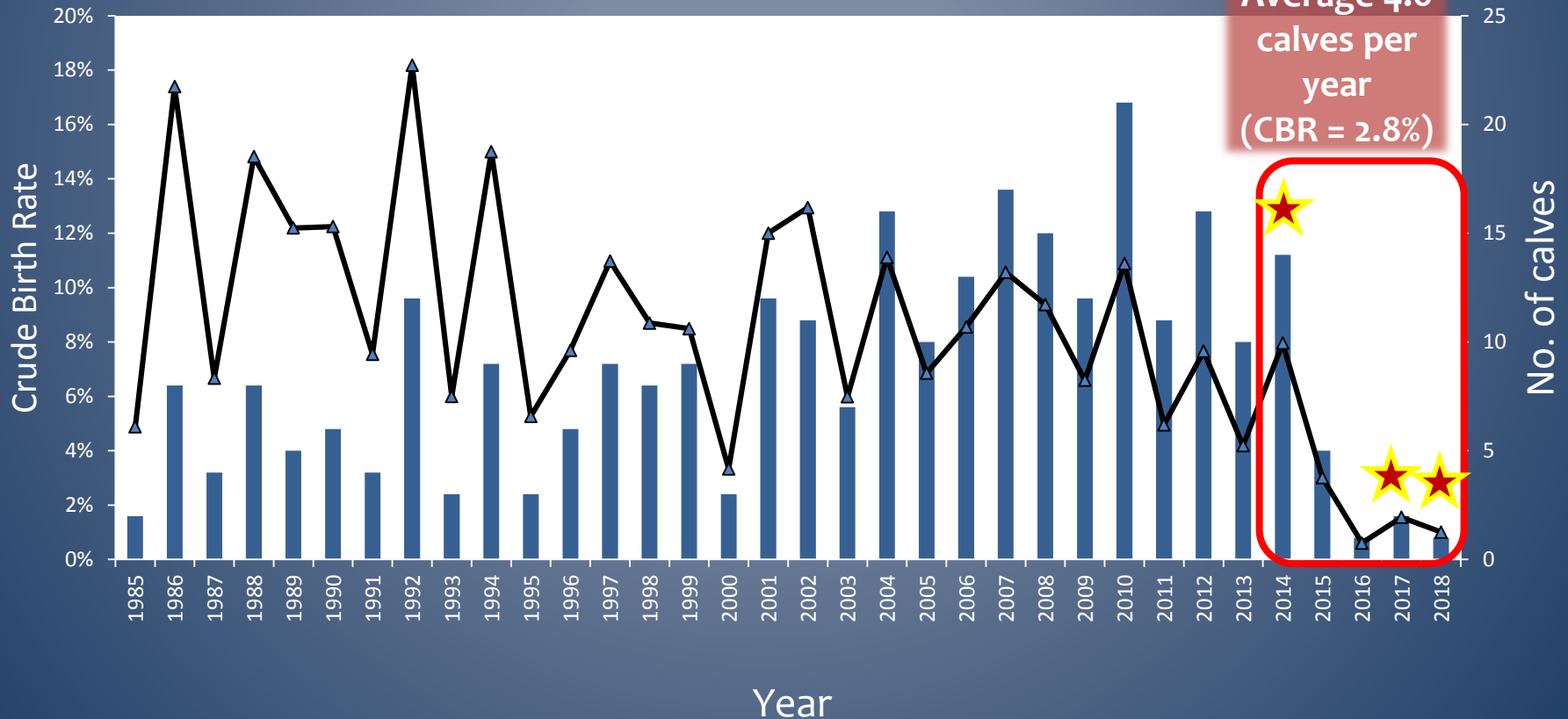
The fate of most of these whales is unknown
but a few have been seen elsewhere

Number of Calves Per Year Has Declined (2014-2018)





1985-2013: Average 9.1 calves per year (CBR = 9.3%)

2014-2018:
Average 4.6
calves per
year
(CBR = 2.8%)



Five Consecutive Years of Calf and Juvenile Survival Anomalies

Time Period	Number of Calves	Number of Calf Mortalities (%)	 Juvenile Returns Documented
1985-2013	191	8 (4%)	92 (48%)
2014	14	5 (36%)	0
2015	5	0	0
2016	1	0	0
2017	2	1 (50%)	0
2018	1	 1 (100%)	0

2018 was the first time we observed total reproductive failure in the 34 year study.

Recruitment was the key driver of population growth in the Glacier Bay study area over the past 30 years (Pierszalowski et al. 2016).

Sustained declines in calving and/or recruitment will have long-term effects in the local whale population.

Body Condition: Documenting Skinny Whales



New protocol in development

**2016:
13% of
sightings**

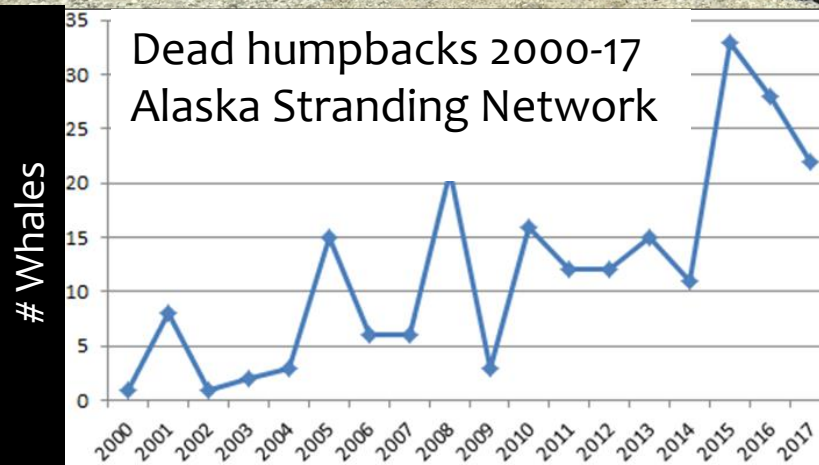
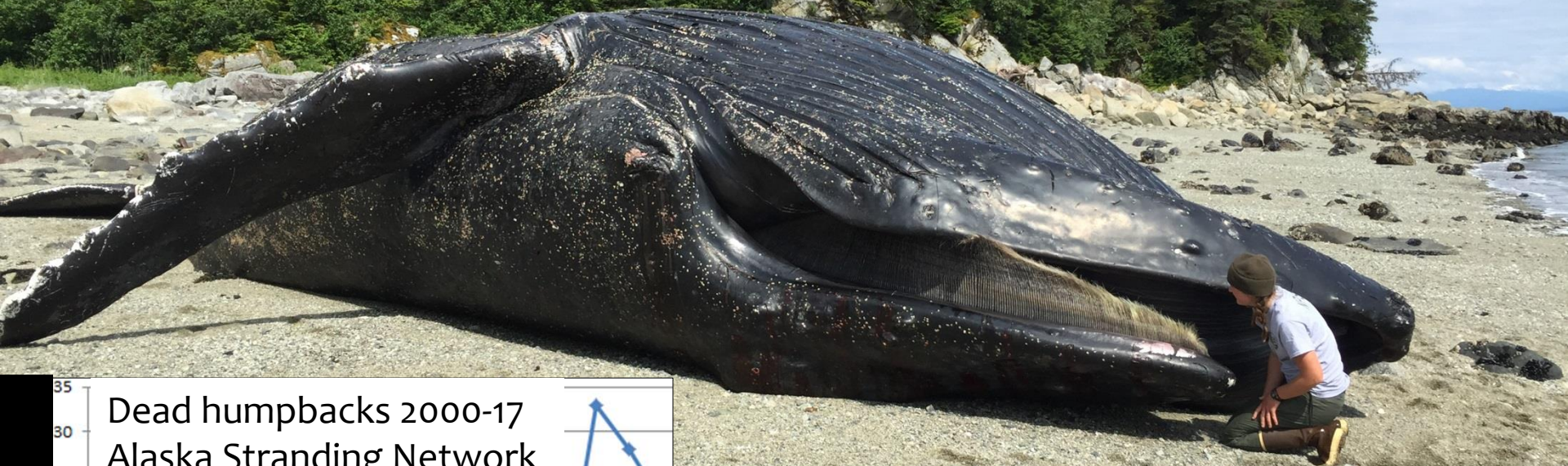


**2017:
24% of
sightings**



**2018:
17% of
sightings**

Strandings Increased After 2014, Several Dead Whales Were Emaciated



SEAK Whale #441 (Festus)
1972-2016
45 year sighting history
66 GLGs in ear plug (read by C. Lockyer)

NPS photo by Craig Murdoch

Increasing Prevalence of Unusual Skin Conditions



Whale #118 summer 2017
Courtesy of Captain Tod Sebens

bleeding



patchy dermatitis



Whale #118 ("Chop Suey") summer 2017



#117 Feb 4 2017
Sitka Sound
Photo : M. Kosma



bumps
a.k.a. nodular dermatitis

blotchy, rough skin