

Leiðandi
vettvangur í tíu ár



Abundance and distribution shifts of humpback whales (*Megaptera novaeangliae*) in Ísafjarðardjúp

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SJÁVARÚTVEGS
RÁÐSTEFNAN

ISI ICELAND
SEAFOOD

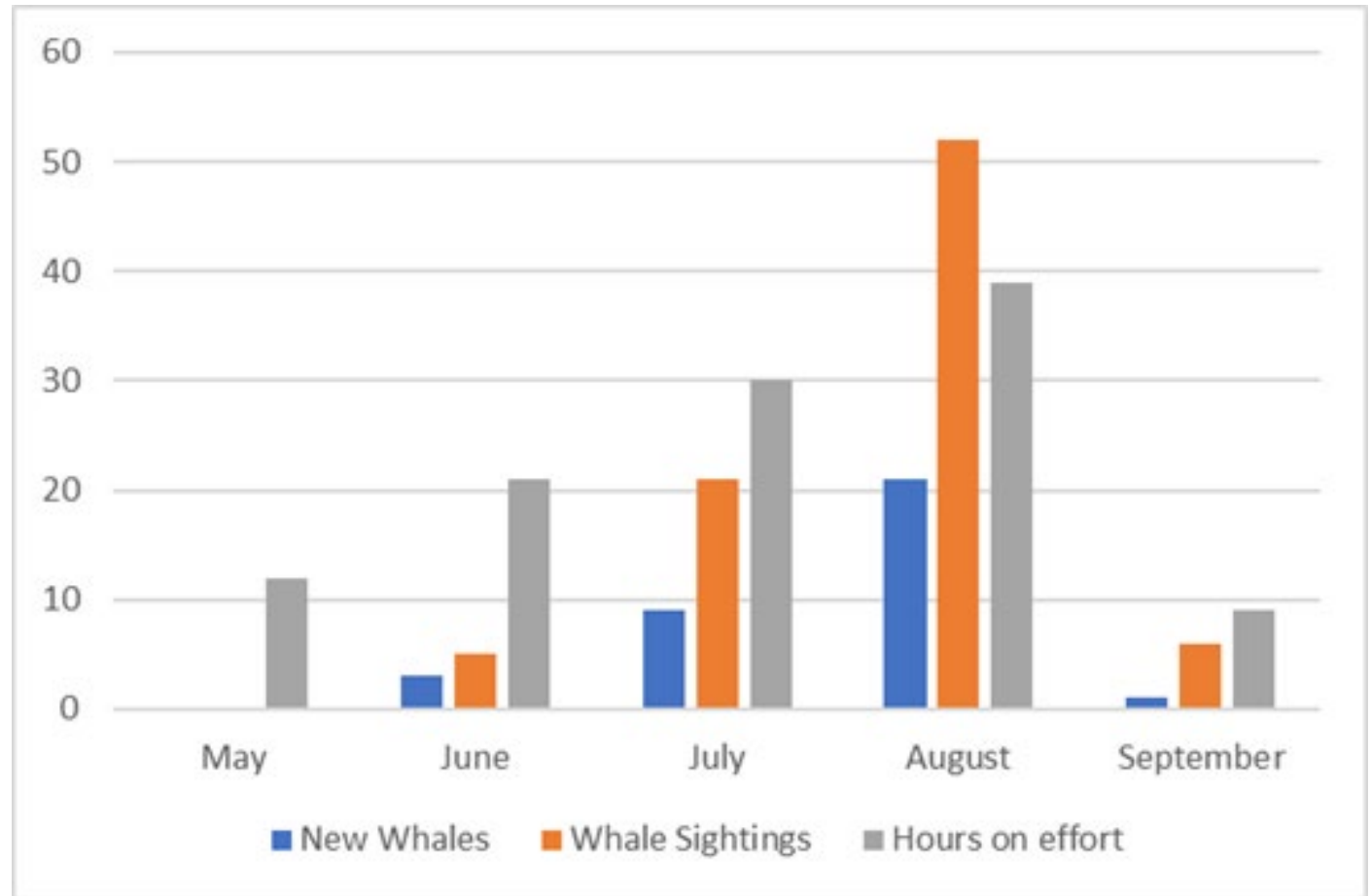


HAMPIÐJAN

Hrífa Óháris

Results: Photo-Identification

- 111 hours spent on effort on 37 shipboard surveys
- The majority of the survey time was between 13:30 and 16:30 and onboard the Ölver
- The number of new whales, total sightings, and hours of effort increased each month till the beginning of September



Results: Photo-Identification

- SPUE per month followed the same trend
- Similar SPUE for July and September
- The observation season revealed that 3 whales could be expected to be seen every 4 hours

	SPUE
May	0.000
June	0.238
July	0.700
August	1.333
September	0.667
Total	0.757

Results: Photo-Identification

- 34 individual whales observed over the field season
- A total of 80 sightings were made
- 20 whales were seen again 46 times
- Whales were seen an average of 2.353 times
- The mean length of stay for whales observed more than once is 20.75 days

















Isafjardardjup 2018			
Whale	No. of sightings	No. of resightings	Days between first and last
IsaMn001	3	2	26
IsaMn002	7	6	69
IsaMn003	2	1	1
IsaMn004	1	0	0
IsaMn005	1	0	0
IsaMn006	2	1	33
IsaMn007	8	7	41
IsaMn008	5	4	33
IsaMn009	1	0	0
IsaMn010	3	2	27
IsaMn011	3	2	52
IsaMn012	1	0	0
IsaMn013	3	2	12
IsaMn014	2	1	12
IsaMn015	7	6	19
IsaMn016	3	2	16
IsaMn017	1	0	0
IsaMn018	2	1	2
IsaMn019	1	0	0
IsaMn020	2	1	3
IsaMn021	1	0	0
IsaMn022	2	1	3
IsaMn023	3	2	9
IsaMn024	2	1	11
IsaMn025	3	2	24
IsaMn026	2	1	11
IsaMn027	1	0	0
IsaMn028	1	0	0
IsaMn029	1	0	0
IsaMn030	2	1	11
IsaMn031	1	0	0
IsaMn032	1	0	0
IsaMn033	1	0	0
IsaMn034	1	0	0
Mean	2.353	1.353	12.206
Median	2	1	3
Total	80	46	415
Max	8	7	69
Min	1	0	0

Results: Photo-Identification



Results: Photo-Identification




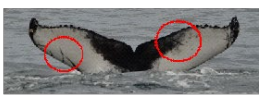



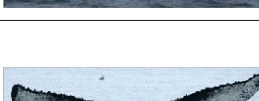

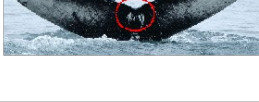




- 8 matches were made between Ísafjarðardjúp and Skjálfandi in 2018
- Each individual matched was first sighted in Husavik
- These individuals migrated to Ísafjarðardjúp in about 1 month

Whale Code	Ísafjarðardjúp 2018	Húsavík 2018
Ísafjarðardjúp -> Húsavík		
IsaMn004 -> Mn695		
IsaMn007->Not registered		
IsaMn012 -> Mn544		
IsaMn013 -> Mn171		
IsaMn017->Not registered		
IsaMn018 -> Mn33		
IsaMn022->Not registered		
IsaMn031 -> Mn702		

Whale Code	Date Sighted			Location
Isafjardardjup -> Husavik	Day	Month	Year	
IsaMn004 -> Mn695	10	June	2018	Husavik
	11	June	2018	Husavik
	6	July	2018	Isafjardardjup
IsaMn007 -> Not registered	4	May	2018	Husavik
	5	May	2018	Husavik
	7	May	2018	Husavik
	8	May	2018	Husavik
	10	May	2018	Husavik
	13	July	2018	Isafjardardjup
	22	July	2018	Isafjardardjup
	27	July	2018	Isafjardardjup
	28	July	2018	Isafjardardjup
	3	August	2018	Isafjardardjup
	13	August	2018	Isafjardardjup
	15	August	2018	Isafjardardjup
	23	August	2018	Isafjardardjup
IsaMn012 -> Mn544	16	May	2018	Husavik
	17	May	2018	Husavik
	20	May	2018	Husavik
	23	May	2018	Husavik
	25	May	2018	Husavik
	22	July	2018	Isafjardardjup
IsaMn013 -> Mn171	24	May	2018	Husavik
	3	July	2018	Husavik
	3	August	2018	Isafjardardjup
	13	August	2018	Isafjardardjup
	15	August	2018	Isafjardardjup
IsaMn017 -> Not Registered	28	June	2018	Husavik
	16	August	2018	Isafjardardjup
IsaMn018 -> Mn33	28	June	2018	Husavik
	1	July	2018	Husavik
	2	July	2018	Husavik
	6	July	2018	Husavik
	20	August	2018	Isafjardardjup
	22	August	2018	Isafjardardjup
IsaMn022 -> Not registered	19	July	2018	Husavik
	20	July	2018	Husavik
	22	July	2018	Husavik
	23	August	2018	Isafjardardjup
	26	August	2018	Isafjardardjup
IsaMn031 -> Mn702	30	June	2018	Husavik
	17	August	2018	Isafjardardjup

Results: Photo-Identification

- 7 individuals were match between 2018 and previous years in Ísafjarðardjúp.
- The 2018 observations brings the total individuals observed in Ísafjarðardjúp up to 68

Whale code	Ísafjarðardjúp 2018	Ísafjarðardjúp in Previous years
IsaMn008 -> Hwl2014		
IsaMn010 -> Hwk2014		
IsaMn011 -> Hwj2016		
IsaMn012 -> Hwh2017		
IsaMn018 -> Hwk2016		
tIsaMn023 -> Hwb2017		
IsaMn024 -> Hwe2016		

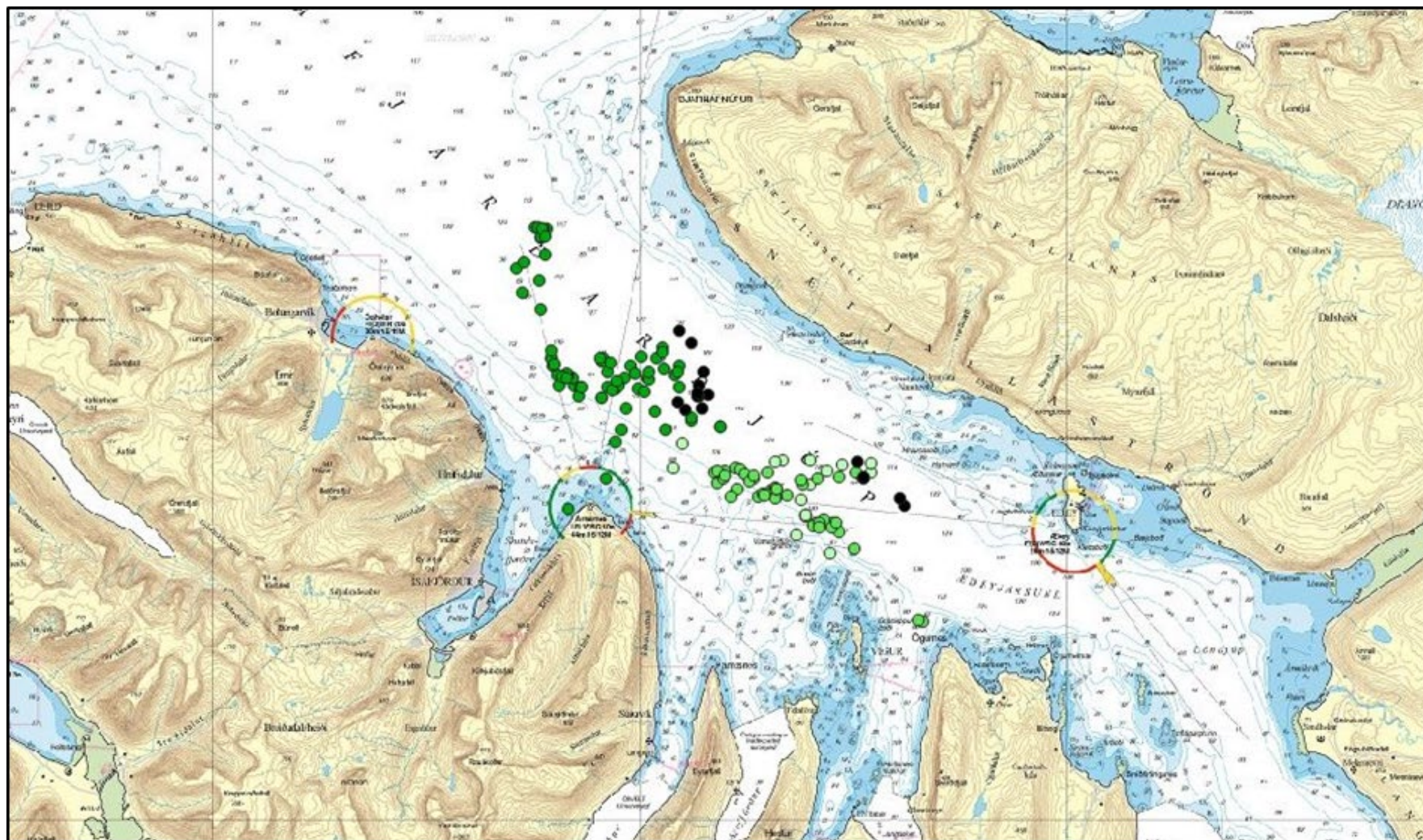
Whale Code	Date Sighted		
	Day	Month	Year
2018 -> Previous years			
IsaMn008 -> Hwl2014	N/A	August	2014
	13	July	2018
	3	August	2018
	4	August	2018
	15	August	2018
	15	September	2018
IsaMn010 -> Hwk2014	N/A	August	2014
	16	July	2018
	22	July	2018
	12	August	2018
IsaMn011 -> Hwj2016	N/A	November	2016
	1	July	2018
	22	July	2018
	22	August	2018
IsaMn012 -> Hwh2017	N/A	May	2017
	22	July	2018
IsaMn018 -> Hwk2016	N/A	November	2016
	20	August	2018
	22	August	2018
IsaMn023 -> Hwb2017	N/A	May	2017
	17	August	2018
	23	August	2018
	26	August	2018
IsaMn024 -> hwe2016	N/A	November	2016
	26	August	2018
	6	September	2018

Results: Photo-Identification

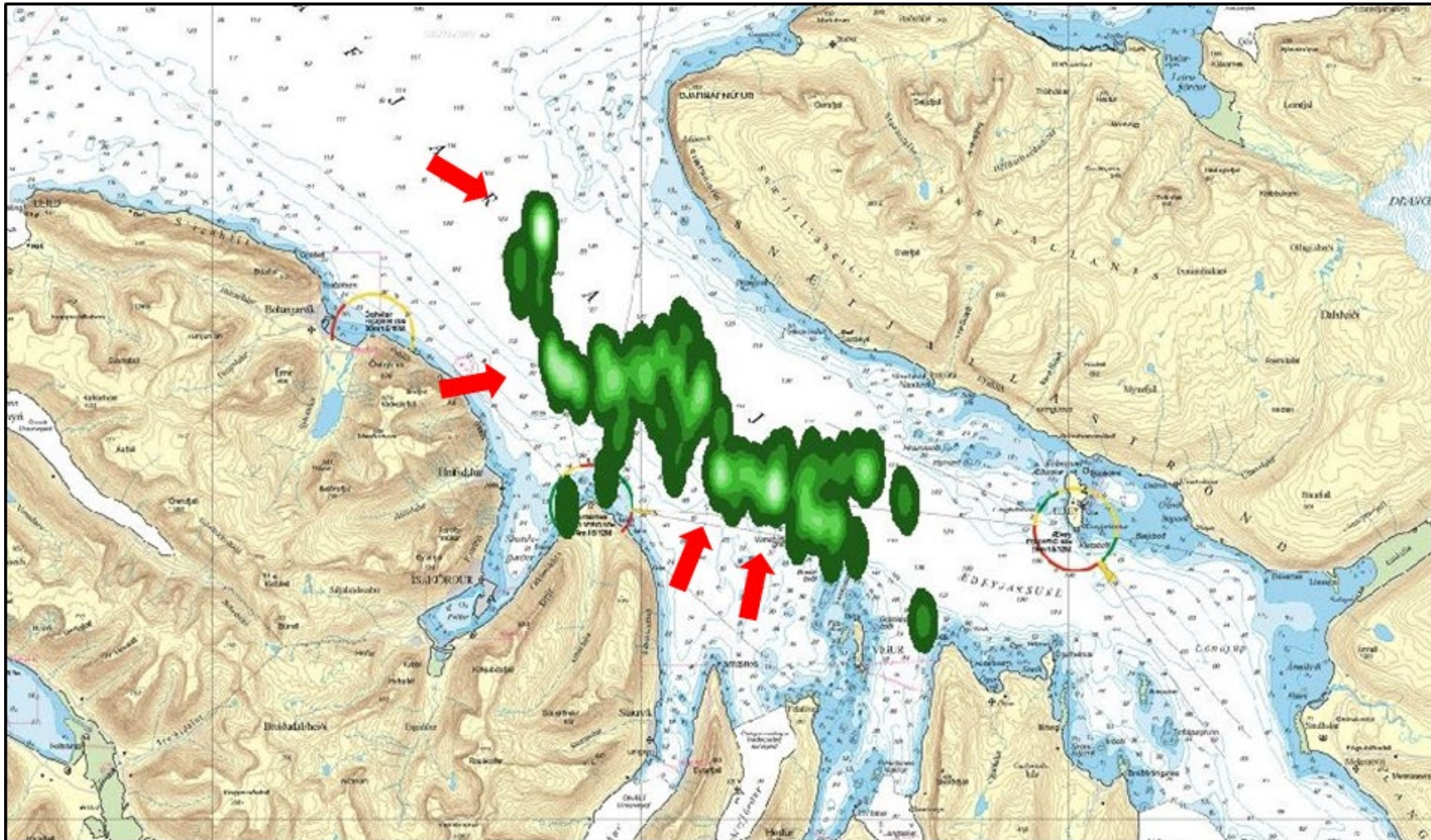
- Collaboration with Happywhale
 - A citizen science platform
- 5 whales were matched using this method
 - No data was available for one of the matches
 - 2 matches made between 2017 in Steingrímsfjordur and 2018 in Ísafjarðardjúp
 - 2 matches were made between Skjálfandi and Ísafjarðardjúp in 2018
 - This shortens known travel time and or minimum lengths of stay

Whale Code	Date Sighted			Location
	Day	Month	Year	
Isafjardardjup -> HappyWhale				
IsaMn003 -> HW-Mn0100270	17	June	2017	Steingrímsfjordur
	30	june	2018	Isafjardardjup
	1	July	2018	Isafjardardjup
IsaMn008 -> HW-MN0101181	N/A	N/A	N/A	N/A
	13	July	2018	Isafjardardjup
	3	August	2018	Isafjardardjup
	4	August	2018	Isafjardardjup
	15	August	2018	Isafjardardjup
	15	September	2018	Isafjardardjup
IsaMn013 -> HW-MN0100294	2	July	2018	Skalfandi
	3	August	2018	Isafjardardjup
	13	August	2018	Isafjardardjup
	15	August	2018	Isafjardardjup
IsaMn018 -> HW-MN0100285	28	June	2018	Skalfandi
	7	July	2018	Skalfandi
	20	August	2018	Isafjardardjup
	22	August	2018	Isafjardardjup
IsaMn021 -> HW-MN0100266	8	July	2017	Steingrímsfjordur
	19	June	2018	Steingrímsfjordur
	23	August	2018	Isafjardardjup

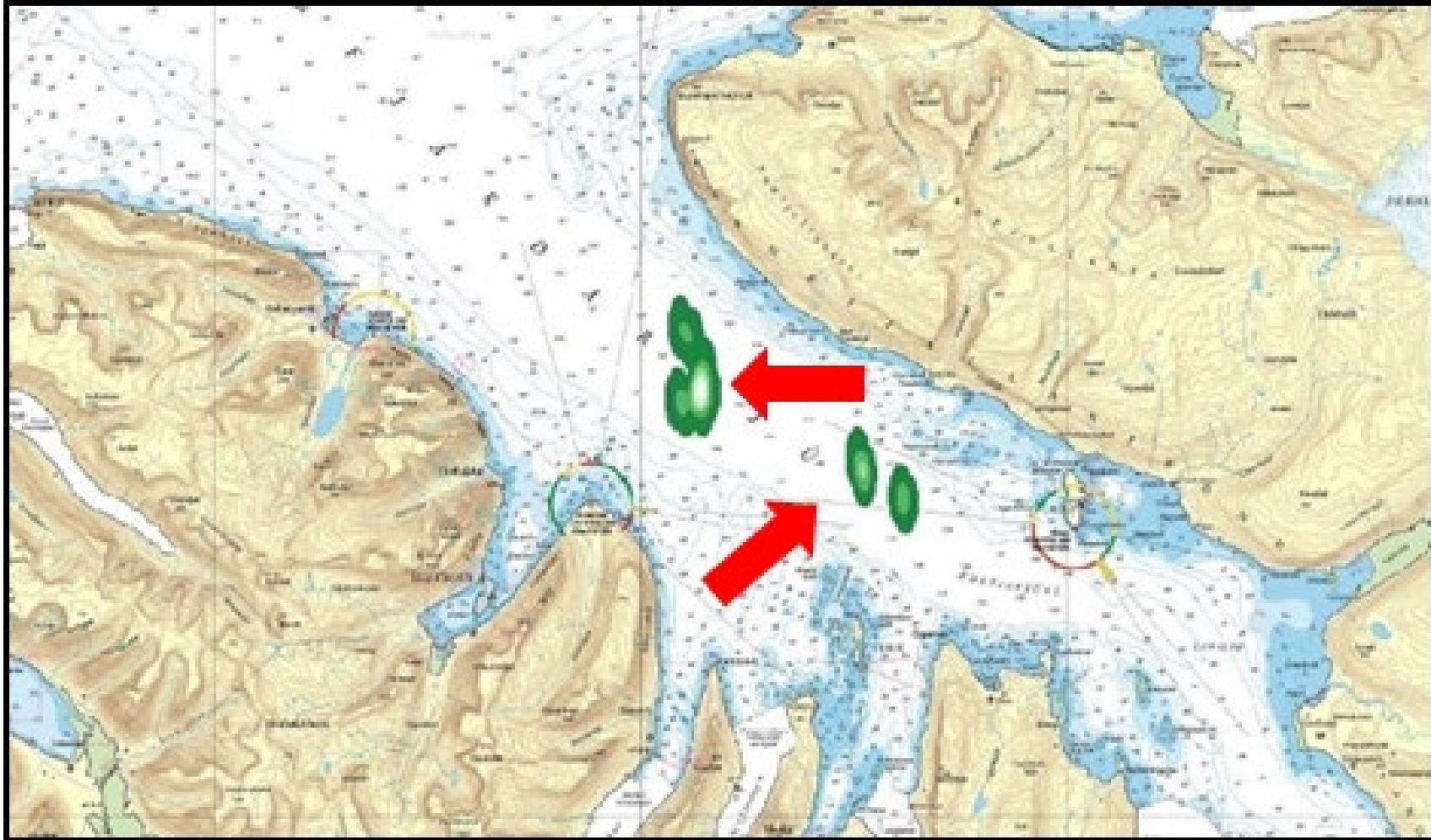
Results: Distribution



Results: Distribution

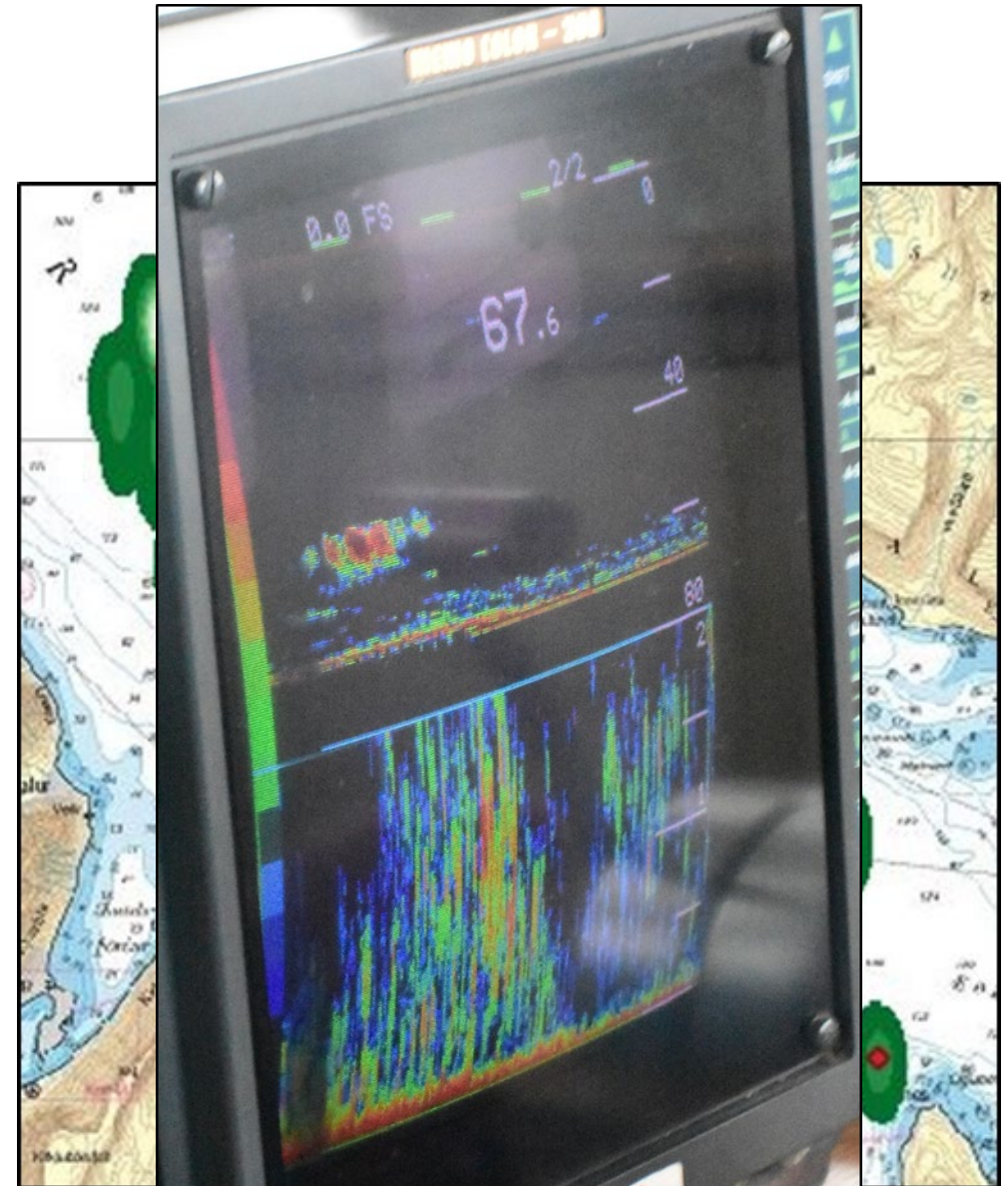


Results: Distribution



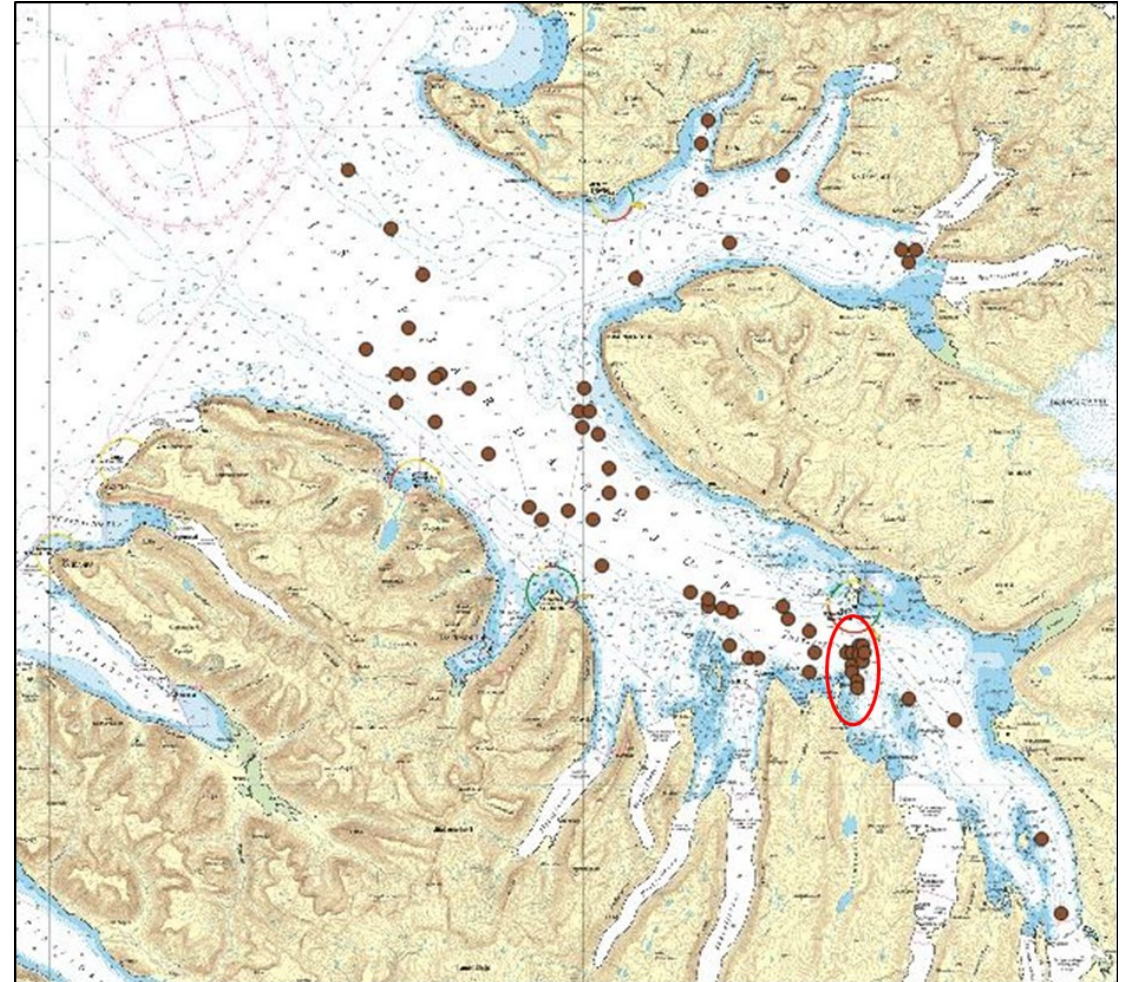
Results: Echosounder

- The locations of echosounder readings tend to be in areas of higher density
- The fishermen in the workshop revealed 14 echosounder images that revealed potential prey species
 - The 19 remaining images did not have enough information
- The majority of those images contained both fish and crustaceans
- The average number of individual whales observed in the presence of whales increase from 2.353 to 4 when in the presence of potential prey
 - Also true when broken down per month



Results: Echosounder

- The fishermen expanded upon the known distribution of humpback whales in Ísafjarðardjúp and Jökulfjörður
- Identified one area of high density not observed during the shipboard survey season
- Confirmed the seasonal distribution shifts in and out of Ísafjarðardjúp throughout the feeding season



Discussion: Photo-Identification

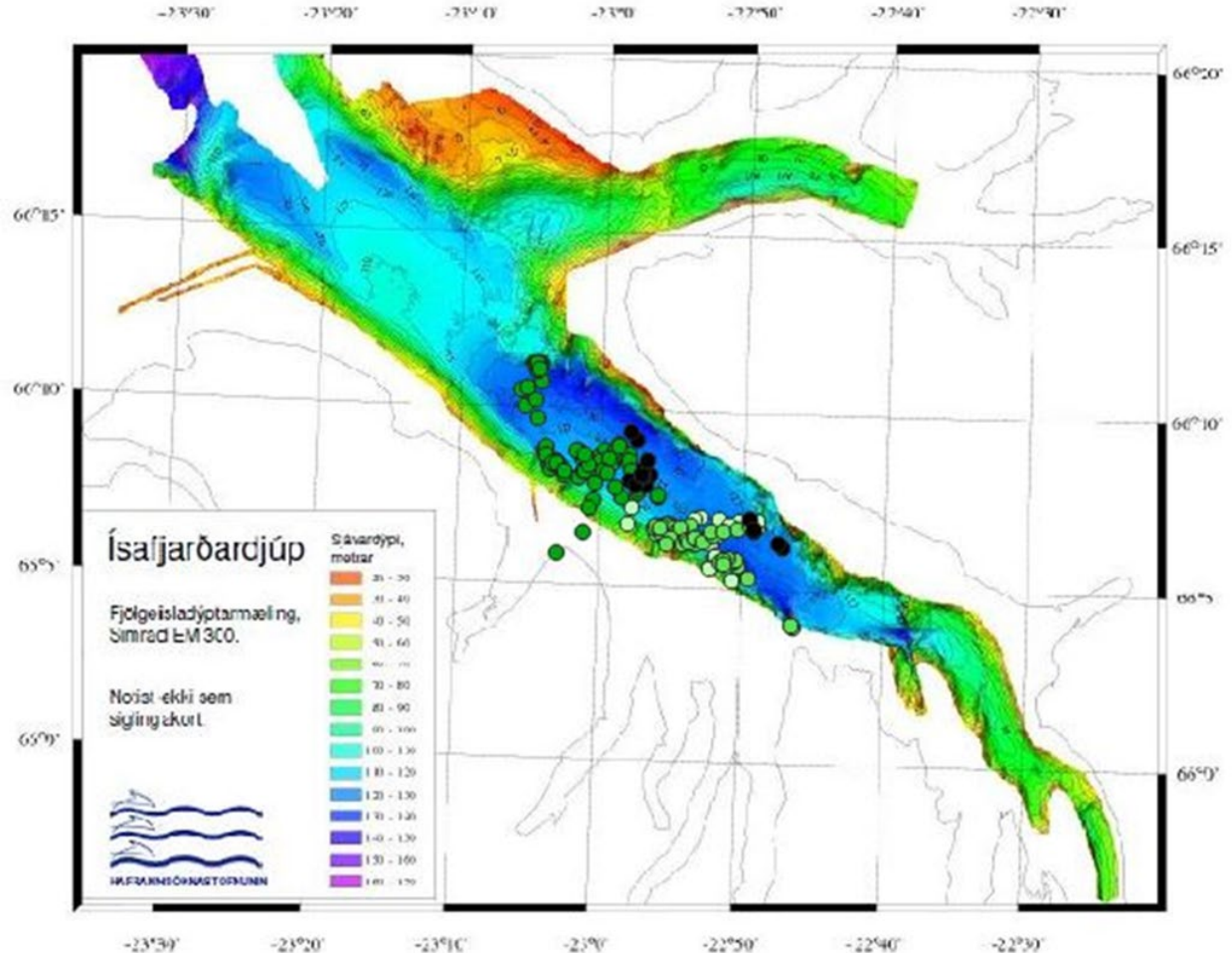
- Local knowledge suggests that there has been an increase in the abundance of humpback whales in Isafjardardjup recently
 - Abundance has increased in Icelandic shelf waters (Pike et al., 2009, Víkingsson et al., 2015)
- All matches between Isafjardardjup and Skalfandi concluded that the whales left Skalfandi and came to Isafjardardjup
 - Interspecific competition is unlikely between fin (*Balaenoptera physalus*), minke (*Balaenoptera acutorostrata*) and humpback whales
 - Intraspecific competition for space and resources (Braithwaite et al. 2012)

Discussion: Photo-Identification

- Interspecific Competition
 - A decrease in Northern shrimp (*Pandalus borealis*) population correspond with an increase in Gadoid species in northern Iceland (*Gadus morhua* and *Melanogrammus aeglefinus*) (Jónsdóttir et al. 2017a)
 - Likely the result of the poleward expansion of Gadoids affecting the prey availability in fjords (Jónsdóttir et al. 2017b)
 - Ísafjarðardjúp also exhibits higher chlorophyll a levels than Skalfandi (Guðmundsson et al., 2009)
 - This would affect Krill abundance in Ísafjarðardjúp (Astthorsson, 1990)
 - The sea around Ísafjarðardjúp has shown high abundance of krill as compared to others areas around Iceland (Silva et al. 2017)

Discussion: Distribution

- Shifts within Isafjardardjup could be related to potential prey species reacting to changes in water temperature
 - Changes in distribution were observed when Average Sea Temperature reached 8 Celsius and again when it dropped back below 8 Celsius
- Whale presence tended to be located in or near the basin located in Isafjardardjup



Discussion: Echosounder

- Observations made between 13:30 and 16:30
 - Typically krill and shrimp are further down in the water column
 - As the most likely prey species in Isafjardardjup this would determine the lack of surface feeding observed
- Recording images of the echosounder more regularly would benefit this study
- As would increasing the number of fishermen interpreting the images

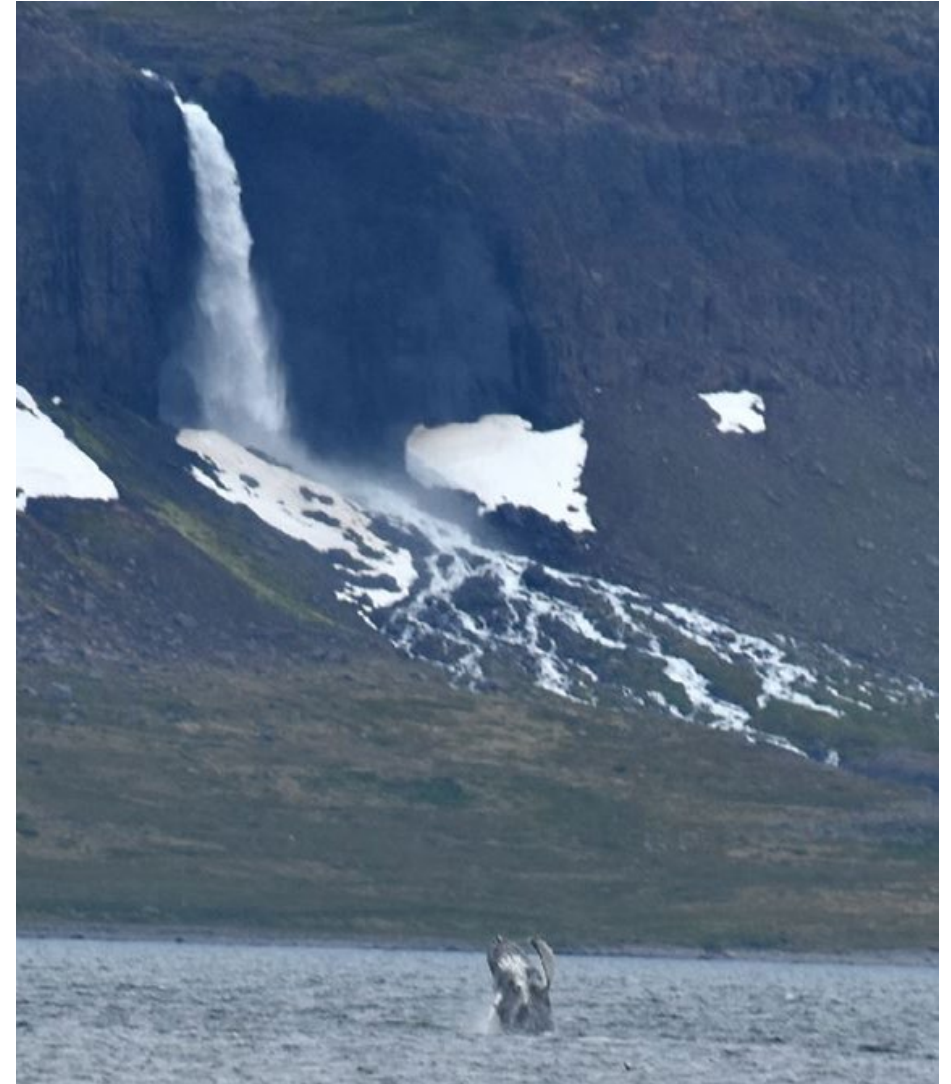
Results: 2019 The study continued!

- Identified 51 Individuals
 - 7 of which were seen in 2018
 - At this time it is expected to be a result of having a larger database
 - Whales were seen earlier and later than in 2018
 - Likely due to more time on the water
 - SPUE was also similar to 2018
 - Observed distribution of whales extended beyond 2018
 - Distribution resembled the distribution observed by fishermen
 - Image of whale feces in 2019 indicates based on the color that the assessment of the whales diet in Ísafjarðardjúp was correct



Conclusions

- One of the first attempts to understand Humpbacks in Ísafjarðardjúp
- Successful in identifying:
 - 78 individual whales
 - Areas of higher densities
 - Likely diet of whales
- Humpbacks also undergo a seasonal distribution shift within Ísafjarðardjúp
- Marine mammal studies can benefit the fishing industry by providing data on habit changes of top predators



Thank you for your attention!



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