SC/68B/ISG/01

Report of Intersessional Correspondence Group on North Pacific Humpback Whales

Clapham (convener), Baker, Brownell, Calambokidis, Cheeseman, Donovan, Ivashchenko, Kato, Kitakado, Matsuoka, Palka, Punt, Urban, Wade, Weinrich, Yoshida, and Zerbini

INTERNATIONAL WHALING COMMISSION

REPORT OF INTERSESSIONAL CORRESPONDENCE GROUP ON NORTH PACIFIC HUMPBACK WHALES

Participants: Clapham (convener), Baker, Brownell, Calambokidis, Cheeseman, Donovan, Ivashchenko, Kato, Kitakado, Matsuoka, Palka, Punt, Urban, Wade, Weinrich, Yoshida, and Zerbini.

In 2019, the Committee re-established an intersessional correspondence group under Clapham to further the preparations for the North Pacific humpback whale Comprehensive Assessment. This is a report of the work conducted by this group.

Large-scale matching exercise

The first priority was to conduct the large-scale photo-id matching exercise which was to incorporate a substantial quantity of new data from many regions across the North Pacific; this was to be facilitated through Cheeseman's *Happywhale* platform. Cheeseman, with assistance from Clapham, undertook extensive discussions with numerous photo-id catalogue holders to develop a Memorandum of Understanding governing the terms of data submission and use. Following agreement among the collaborators, Cheeseman solicited submission of photos and associated data from the various parties. The current collaborators that have contributed photos are listed in the Annex.

In mid-April Cheeseman and Clapham initiated a photo-id comparison using the available photos submitted to *Happywhale*. The temporal distribution of the current records for this comparison ranged from 1979 to the present; however, the majority are relatively recent. Approximately <5% are from pre-SPLASH (30 Nov 2003 being the first SPLASH record, so from before that, representing 2,925 of the 66,055 ID'd encounters used). Seven percent (4,706 encounters) are from during the SPLASH time period (2003-2005). These records from this latter time period overlap with the SPLASH records; however, the current lack of a spreadsheet summarizing SPLASH records meant that all (~7,800) SPLASH records are not yet in the *Happywhale* database. This has resulted in data from some important areas (e.g. Ogasawara) being missing from the current comparison. Other than Okinawa, there was no representation from Japan because the research groups working in that region did not submit data.

This preliminary comparison utilized a large dataset, comprising 66,055 encounters of 17,230 unique individuals. Sample sizes from each region varied from 44 individual whales photographed in the Mariana Islands to 5,312 documented in Hawaii. In total, there were 7,796 matches across regions, ranging from a minimum of 2 (from Okhotsk/Kamchatka) to 2,867 (from Baja California, Mexico). Table 1 gives the interchange index (essentially the inverse of the Lincoln-Petersen capture-recapture formula) for all pairwise comparisons of regions.

As has been observed in previous investigations of connections between feeding and breeding areas, there were major migratory connections between the US and Canadian west coast (S California to S British Columbia) and Mexico (Baja and mainland), and between much of Alaska and Hawaii. Almost one fifth of the whales identified in the N Bering/Chukchi region were observed in Hawaii, with smaller numbers going to other destinations. The Aleutians/West Bering region continues to have a lower relative match rate to other feeding areas, ranging from 0.4% with the Marianas (2 matches), to 8.3% with Hawaii (139 matches). The largest proportion of matches from Okhotsk/Kamchatka (11.9% of the sample) was made with Okinawa/Philippines.

Whales from coastal Mexico and from Central America are primarily seen in Southern California. The predominant destination for whales from the Revillagigedos Islands (Mexico) in this sample was Alaska (notably the Gulf) and the Aleutians.

Movement across adjacent feeding regions was examined to test whether current region boundaries are valid. Potentially significant rates of movement were observed between the following adjacent areas:

- Eastern Aleutians/E Bering Sea and the Western Gulf of Alaska
- Western Gulf of Alaska and Gulf of Alaska
- Gulf of Alaska and Southeast Alaska/Northern British Columbia
- Washington State/Southern British Columbia and Oregon/Northern California
- Oregon/Northern California and Southern California

When expressed as a percentage of a region's sample size (= the number of individuals identified there), the degree of exchange sometimes varied considerably depending on which region was chosen as the "base". For example, 32% of the animals identified in Oregon/N California were observed in S California; however, that number of matches was only 3.8% of the much larger S California sample (the overall interchange index between the two regions was 0.11). This is instructive, since it implies that most of the exchange was likely to the northern portion of the S California region, and highlights a general need for geographically finer-scale comparisons.

A good example of this was discovered with further investigation of the movement between the Western Gulf of Alaska and the Eastern Aleutians. There, 4.6% of whales from the Western Gulf had been observed in the Eastern Aleutians region; the reverse figure (using the Eastern Aleutians as the base sample) was 9.1%, and the interchange index was 0.051. However, it was noted that this appeared to be largely focused upon a single area, the Shumagin Islands (south of the Alaska Peninsula), which are currently included in the Eastern Aleutians/E Bering Sea region. The great majority of the 82 Eastern Aleutians region animals observed in the Western Gulf of Alaska were photographed in the Shumagins, which had a much lower rate of exchange (9 whales) with the rest of the Eastern Aleutians; Ivashchenko noted that Discovery marks deployed and recovered in this region generally confirm this pattern of movement. Overall, this argues that the boundary of the Western Gulf of Alaska should be extended farther west to include the Shumagin Islands, which was in fact the case with a previously discussed stock structure scenario.

It was noted that there was also considerable movement across some of the Mexican regions. To interpret this addition information are needed from Mexican colleagues.

Outstanding stock structure issues

The intersessional group noted outstanding stock structure issues include the following:

- There is a lack of samples from the "unknown" breeding area and from the Aleutians and Bering Sea. The former is currently postulated to be the Mariana Islands, for which there are currently are fluke photos of only 44 individuals. Additional photos from the Mariana Islands would also be of considerable value given the uncertainty surrounding the migratory origin of whales wintering there.

- There is a major gap in coverage between the eastern Aleutians (primarily west of Unalaska Island) and the Commander Islands (although Wade noted he had a small number of photos from this area which he will work up and submit to *Happywhale*).
- It remains unclear how coastal Mexico should be divided up.
- There is a gap in recent coverage from Central America. Clapham noted that his PhD student Joëlle De Weerdt has images from Nicaragua which she has shared with Cascadia, and he is hopeful she will submit these to *Happywhale*. The recent NOAA funding secured by Barlow (and administered by Cascadia) includes some support to encourage additional data collection from Central America.
- The western North Pacific, notably areas such as Okinawa and Ogasawara and the newly recognized wintering grounds in the Mariana Islands, remain under-represented in current photo-id comparisons. Efforts to bolster the sample sizes from these areas would be very helpful to the Assessment, assuming new data can be obtained in a timely manner. The lumping of Okinawa and the Philippines should be reviewed given the distance between these two areas. One of the research groups in this Japanese area has agreed in principle to providing data, but to date there have been no submissions to *Happywhale* for inclusion in the assessment.

Work plan

Given the delay in many aspects of the assessment, the intersessional working group suggested the work plan to complete the assessment that was developed in 2019 can be modified accordingly with the tasks listed below:

1. Provide "dummy" datasets of abundances and catches to Punt to allow the development of the framework of the assessment model; led by Ivashchenko and Zerbini.
2. With input from the ASI working group of the Scientific Committee, refine abundance estimates (notably CVs) from the 2010-2018 POWER survey data (see Inai *et al.* 2020). It would also be useful to summarize western North Pacific sighting, photo-ID and genetic data from Japanese local research groups. Led by Matsuoka and Katsumata.
3. Update North Pacific photo-id matching with the 2019 IWC-POWER data and any submissions from key areas. It was agreed that the latter include Japan, Russia and the western North Pacific as well as the Aleutians and Central America; led by Cheeseman, Clapham and Ivashchenko. Information gathering from Japanese waters is expected to be coordinated through ICR and NRIFSF.
4. Conduct discussions to agree on a revised picture of population structure using the results of the photo-id matching and other data, as appropriate. Initially, this will be attempted (likely via teleconference) by a small group consisting of Baker, Barlow, Calambokidis, Cheeseman, Clapham, Ivashchenko, Palacios, Urban and Wade. The small group should consider examining the temporal distribution of photo-id data used in the recent match, and consider using a smaller subset (e.g. from more recent years, or ones with contemporaneous sampling across major regions) to decrease the impact of temporal sampling bias. However, it was noted that it was perhaps possible to "model around" these problems and thus use all the data. It would also be useful to attempt to use the new automated algorithm to match lower-quality fluke photos that were excluded from SPLASH. Clapham will convene the small group.

5. Revise and document whaling catch allocations in light of any changes arising from Step (4); led by Ivashchenko. An updated estimate of bycatch (e.g. from fishing gear entanglements) should also be undertaken (lead TBD) taking into account the recent increase in entanglements along the US West Coast and reported bycatch along Japan and Republic of Korea. With the withdrawal from IWC, Japan is no longer submitting national Progress Reports but has made reports of bycatch available through a national website https://www.jfa.maff.go.jp/j/whale/attach/pdf/research-25.pdf.
6. Revise and document sampling strata for the abundance estimates, and estimate interchange rates using the updated comprehensive mark-recapture analysis model; given the broad temporal scope of the latest photo-id matching exercise, it may be prudent to use those results to refine stock boundaries but to calculate abundance and interchange on the SPLASH data set, which is the result of standardized and contemporaneous sampling. Led by Wade, Barlow and J. Moore.
7. Initiate and document genetics-based mixed stock analysis in the feeding grounds, and apply genetic assignments to breeding areas from feeding grounds. This would better inform the allocation of catches for the assessment model in light of any changes arising from Step (4). Led by Baker.
8. Using results from Steps (1) – (5), conduct and document preliminary assessment runs; led by Punt.
9. Review revised input data (Steps 1-5) and analyses (Steps 6-7) to develop a work plan towards further assessment.

Somewhere within this timeline it would be very helpful to conduct a second workshop, after the small working group in Step 4 meets. The workshop could review the results of the photo-id matching exercise (including potentially additional data from Step 3 above), and agree on a revised stock structure accordingly; it would also review other progress, preferably including new abundance estimates and other work related to assessment modeling. The meeting would likely be held in Seattle, WA (with call-in as needed), and would involve the appropriate intersessional steering group members as well as key catalogue holders.

Table 1. North Pacific humpback whale interchange indices based upon photo-ID matches

AREA	*n*	Okin/Ph	Marianas	Hawaii	Mx Rev	Baja	N Mex	S Mex	C Amer	Okh/Kam	Ber/Chuk	Al/W Ber	l/E Ber	Gf of AK	f of AK	EAK/NBC	/A/SBC	Cal/OR	S Cal
		284	44	5312	315	2831	3002	375	113	202	335	1666	898	1792	473	1685	1015	350	2915
Okin/Phil	284		0.234	0.001						0.432	0.063	0.082	0.008	0.004					
Marianas	44						0.015			0.219		0.093							
Hawaii	5312				0.016		0.002	0.001		0.006				0.037		0.068	0.027	0.004	
Mx Revilla	315					0.047	0.039				0.018	0.021	0.060	0.067	0.020	0.025	0.028	0.027	0.004
Baja	2831						0.129	0.114	0.053	0.003				0.022	0.01	0.014	0.076	0.189	0.11
N Mexico	3002							0.158	0.100	0.005	0.002	0.005	0.027	0.019	0.007	0.013	0.077	0.154	0.117
S Mexico	375								0.373				0.006			0.006	0.100	0.212	0.189
C America	113													0.010				0.075	0.138
Okhotsk/Kam	202											0.018							
N Bering/Chukchi	335													0.003	0.013	0.003	0.006		0.002
Aleut/W Bering	1666												0.011						0.001
Aleut/E Bering	898													0.051	0.012	0.001			0.004
W Gulf of AK	1792														0.193	0.013	0.003		0.002
Gulf of AK	473															0.045	0.004		0.002
SEAK/NBC	1685																0.015	0.003	0.002
WA/SBC	1015																	0.530	0.006
N Cal/Oregon	350																		0.110
S California	2915																		

Interchange is calculated as the inverse of the Lincoln-Peterson mark-recapture equation: (sample 1 + 1) x (sample 2 + 1) / (number of matches + 1); the result being then divided into 1,000

Values >0.100 highlighted in green

n column = Total individuals observed in each breeding area

ANNEX
LIST OF MAJOR COLLABORCOLLABORATORS FOR THE NORTH PACIFIC PHOTO-ID MATCH

Katherina Audley	Whales of Guerrero Research Project
Astrid Frisch	ECOBAC
Nico Ransome	Murdoch University / La Orca de Sayulita
Jorge Urban and Pamela Martínez	UABCS
Jeff Jacobsen	
Daniel Palacios, Craig Hayslip, Lisa Ballance	Oregon State University, Marine Mammal Institute
John Calambokidis and Kiirsten Flynn	Cascadia Research Collective
Cetacean Assessment & Ecology Program (Phil Clapham, leader)	NOAA National Marine Mammal Lab, AFSC, Seattle
Christie McMillan, Jackie Hildering, Nicole Doe	Marine Education and Research Society, Port McNeill
Janie Wray	North Coast Cetacean Society/Cetacea Lab
Caitlin Birdsall and Karina Dracott	Coastal Ocean Research Institute (North Coast Cetacean Research Initiative)
Jim Darling and Josie Byington	Pacific Wildlife Foundation
Tasli Shaw	
Mark Mallison	
Janet Neilson	Glacier Bay National Park
Jan Straley	University of Alaska Southeast Sitka
Suzie Teerlink	Juneau Flukes
Andy Szabo and Fred Sharpe	Alaska Whale Foundation
John Moran	NOAA Auke Bay Lab/Univ of Alaska Southeast
Heidi Pearson	University of Alaska Southeast Juneau
Olga von Ziegesar	Winged Whale Research
Bree Witteveen	Formerly with University of Alaska Fairbanks
Denny Zwiefelhofer	Formerly with Kodiak National Wildlife Refuge
Craig Matkin	North Gulf Oceanic Society
Rachel Cartwright	Keiki Kohola Project
Stephanie Stack and Jens Currie	Pacific Whale Foundation
Meagan Jones	Whale Trust
Ed Lyman and Rachel Finn	Hawaiian Islands Humpback Whale National Marine Sanctuary (NOAA)
Chris Gabriele	Hawaii Marine Mammal Consortium
Adam Pack	University of Hawaii, Hilo / The Dolphin Institute
Beth Goodwin	Jupiter Foundation
Kym Yano and Marie Hill	NOAA Pacific Islands Fisheries Science Center
Jo Marie (Jom) Acebes	Balyena.org
Nozomi Kobayashi and Haruna Okabe	Okinawa Churashima Foundation
Olga Filatova and Erich Hoyt	Russian Cetacean Habitat Project
Greg Donovan and Koji Matsuoka	IWC - POWER cruises etc.
Vladimir Burkanov	NOAA National Marine Mammal Laboratory, Seattle
Evgeny Mamaev	Commander Islands Nature and Biosphere Reserve