

SC/68A/IA/02

Report of the Intersessional Working Group on the Comprehensive Assessment of North Pacific Humpback Whales

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INTERNATIONAL
WHALING COMMISSION

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

During SC67a, an intersessional Working Group was formed to advance work on the Comprehensive Assessment of North Pacific Humpback Whales. The Terms of Reference for this group were to further the preparation for the assessment, specifically to:

- (1) Consolidate and prioritise the stock structure hypotheses developed at the first Workshop [held in April 2017] from a modelling perspective and develop appropriate draft presence/absence and mixing matrices for consideration at the next Workshop;
- (2) Facilitate the additional work on abundance estimates; and,
- (3) Finalise plans for a second Workshop.

At SC67b in 2018, some progress was reported (SC/67b/IA3) with regard to clarification of stock structure in both feeding and breeding areas, and four potential modeling scenarios based upon a simplified stock structure were proposed. Catches to each of the proposed areas were allocated by Ivashchenko.

In SC/67b/IA3, the following new intersessional work plan was anticipated:

1. The Working Group agreed that S. Baker would be approached to assess the feasibility of conducting mixed-stock analysis in the feeding grounds to better inform the allocation of catches for the assessment model.
2. The Working Group also agreed that Wade should re-compute abundance and interchange rate estimates for North Pacific humpback whales using the model described in Wade *et al.* (2016) for the various stock structure hypotheses agreed by the Working Group.
3. Punt will revise the assessment model according to the stock structure hypotheses described above.
4. Ivashchenko and Zerbini will provide a “dummy” file with input parameters to Punt for further model development. They will also collate other information required for the assessment model (in addition to the ones provided by Wade’s model), which would be provided to Punt when all information needed for model runs becomes available.
5. Photo-id catalogue holders from key areas will be approached with a view to conducting an update of SPLASH photo matching, in order to provide new information with which to refine existing stock structure hypotheses.

Of these objectives, little progress has been made on the first two due to competing work priorities for both Baker and Wade. Consequently, objectives 3 and 4 have also not progressed since they are dependent upon the first two. However, considerable progress has been made towards the final objective, as detailed below.

Refining population structure through an updated matching effort

Over the past year, Ted Cheeseman has pursued improvements to the automated photo-id matching algorithm that underlay his website *happywhale.com*. Google agreed to sponsor a competition on the Kaggle platform to develop an automated matching program, which attracted a large number of entries. The top performers among responses to this competition achieved matching rates of greater than 97%, and were able to successfully match even highly challenging humpback whale fluke photos. The latter include images with poor orientation towards the camera (much rotation or distortion, or overall poor quality), and the winning entries all successfully matched images based upon shape and/or pigment, including the smallest details of the trailing edge. Tests of the new algorithms (one in particular) have correctly identified matches from calves to adults that were very difficult for the human eye to detect, and have also found many previously unrecognised duplicates in every catalog available to Happywhale, including those that have

been manually searched through for (in some cases) literally decades. The algorithm successfully matched other “difficult” flukes, including the previously problematic all-white tails from Southern Hemisphere animals. The matching rate for good quality photos is better than 99%. This powerful new tool largely eliminates the need for manual matching (certainly at any significant level of effort).

At the same time, Cheeseman has developed a collaboration with many of the major contributors of humpback whale photos in the North Pacific (Table 1 below). Together with the new algorithm, this now provides an opportunity to conduct a large-scale updated matching exercise across much of this ocean basin. The results of such an exercise are expected to further refine our understanding of population structure and interchange rates in the North Pacific, including for areas that were under-represented during the SPLASH project (e.g. Russia).

In light of this development, the Working Group agreed that it makes sense to further delay the work led by Baker and Wade until the updated matching is completed and the population structure of North Pacific humpback whales has been clarified.

Genetics work by Baker would in addition require funding to stratify the existing data for a mixed-stock analysis. Specific needs/tasks for a mixed-stock analysis include:

- Further discussion with the modelers on geographic stratification of the catches;
- Assistance from Cascadia Research to overlay genetic stratification results onto the SPLASH project database, and the updated matching exercise;
- Financial support for the time to run the mixed-stock and population assignment analyses;
- Feedback to the modelers.

Future work

The Working Group agreed that over the next year the following should occur:

- In collaboration with catalogue holders from various areas (Table 1), Cheeseman will conduct a large-scale comparison of humpback whale fluke photos from across as much of the North Pacific as possible;
- The results of this comparison will be used to update information on stock structure and exchange rates;
- As practical, this new information will be incorporated into the analysis by Wade and, if complete, provided to Punt, Ivashchenko and Zerbini for incorporation into a population model;
- Mixed stock analysis will be conducted by Baker, if there is time (and support) after updated population structure analyses are complete;
- If deemed necessary by the Working Group, a proposal for a second Workshop will be developed and presented to the Scientific Committee.

Table 1. Collaborators (to date) in an updated North Pacific photo-id matching effort led by Ted Cheeseman using the new automated matching algorithm.

Primary contact	Organization	Region
Mexico		
Katherina Audley	Whales of Guerrero Research Project	Guerrero, Mexico
Astrid Frisch	ECOBAC	Vallarta, Mexico
Nico Ransome	Murdoch University	Sayulita, Mexico
Jorge Urban and Pamela Martínez	UABCS	Mexico
Oscar Frey	https://www.oceanfriendly.com/about_us	Banderas Bay/Puerto Vallarta, Mexico
California/Oregon/Washington		
Craig Hayslip and Bruce Mate	OSU	N Pacific-wide
John Calambokidis and Kiirsten Flynn	Cascadia Research Collective	C America through WA/S BC
Phil Clapham	NOAA	N Pacific-wide
British Columbia		
Christie McMillan and Jackie Hildering	Marine Education and Research Society, Port McNeill	BC, Canada
Caitlin Birdsall and Karina Dracott	Coastal Ocean Research Institute (N Coast Cetacean Research Initiative)	Chatham Sound and adjacent areas (N coast, BC)
Jim Darling and Josie Byington	Pacific Wildlife Foundation	Clayoquot Sound/Barkley Sound, BC
Tasli Shaw		Salish Sea
Mark Mallison		Salish Sea
Alaska		
Janet Neilson	Glacier Bay National Park	SE AK
Jan Straley	University of Alaska Southeast Sitka	SE AK
Suzie Teerlink	Juneau Flukes	SE AK
Andy Szabo and Fred Sharpe	Alaska Whale Foundation	SE AK
John Moran	NOAA Auke Bay Lab/Univ of Alaska Southeast	Prince William Sound, GOA
Heidi Pearson	University of Alaska Southeast Juneau	SE AK
Olga von Ziegeler	Winged Whale Research	Prince William Sound, GOA
Bree Witteveen	formerly with University of Alaska Fairbanks	Kodiak
Denny Zwiefelhofer	photographs under Phil Clapham's NOAA permit	Kodiak

Hawaii

Rachel Cartwright

Keiki Kohola Project

Maui, Hawaii

Stephanie Stack and Jens Currie

Pacific Whale Foundation

Maui, Hawaii

Meagan Jones

Whale Trust

Maui, Hawaii

Ed Lyman

Hawaiian Islands Humpback Whale National Marine Sanctuary

Maui, Hawaii

Chris Gabriele

Hawaii Marine Mammal Consortium

Big Island, Hawaii

Adam Pack

UH

Hilo, Hawaii

Western Pacific

Jo Marie (Jom) Acebes

Philippines

Olga Filatova and Erich Hoyt

Russia

Vladimir Burkanov

Russia

Evgeny Mamaev

Commander Islands Nature and Biosphere Reserve

Commander Is., Russia

Koji Matsuoka/ Greg Donovan

Institute of Cetacean Research/IWC (POWER surveys)

North Pacific-wide