Māui Dolphin Abundance Estimate: 2020-2021

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Stakeholder Working Group Meeting, 27 October 2021

University of Auckland & Department of Conservation photo

Estimating the abundance and effective population size of Māui dolphins using microsatellite genotypes in 2020-21, with retrospective matching to 2001

Rochelle Constantine, Debbie Steel, Emma Carroll, Rebecca M. Hamner, Cara Hansen, Garry Hickman,

Kristina Hillock, Mike Ogle, Pearson Tukua and C. Scott Baker

Selected previous publications

- Baker, C. S., D. Steel, R. M. Hamner, G. Hickman, L. Boren, W. Arlidge, and R. Constantine. (2016). Estimating the abundance and effective population size of Māui dolphins using microsatellite genotypes in 2015–16, with retrospective matching to 2001–16. Report to the Department of Conservation, Auckland.
- Baker, C. S., R. M. Hamner, J. Cooke, D. Heimeier, M. Vant, D. Steel, and R. Constantine. (2013). Low abundance and probable decline of the critically endangered Maui's dolphin estimated by genotype capture–recapture. *Animal Conservation* 16:224-233.
- Hamner, R. M., P. Wade, M. Oremus, M. Stanley, P. Brown, R. Constantine, and C. S. Baker. (2014). Critically low abundance and limits to human-related mortality for the Maui's dolphin. *Endangered Species Research* 26:87–92.
- Hamner, R. M., R. Constantine, M. Oremus, M. Stanley, P. Brown, and C. S. Baker. (2014). Long-range movement by Hector's dolphins provides potential genetic enhancement for critically endangered Maui's dolphin. *Marine Mammal Science* 30:139-153.

Objectives – 2020-2021

- Collect & archive Māui dolphin tissue samples from boat surveys 2020-2021 + beachcast carcasses
- Complete DNA profiles, sex & subspecies ID
- Compile a minimum census & describe individual movements
- Identify Hector's migrants in amongst Māui dolphins
- Estimate the abundance of Māui dolphins using a two-sample, closed population, capture-recapture model
- Compile & revise retrospective histories of Māui dolphins 2001-2021
- Estimate the effective population size (N_e) using one-sample, linkage disequilibrium methods

Mahi tahi

Long-term investment in building a team pays off

Skippers – Cara Hansen & Pearson Tukua

Biopsy – Mike Ogle

Two iwi trips (Taranaki – Kaipara)

Both saw Māui dolphins & team at work

DOC-led initiative – Kristina Hillock & Ian Angus

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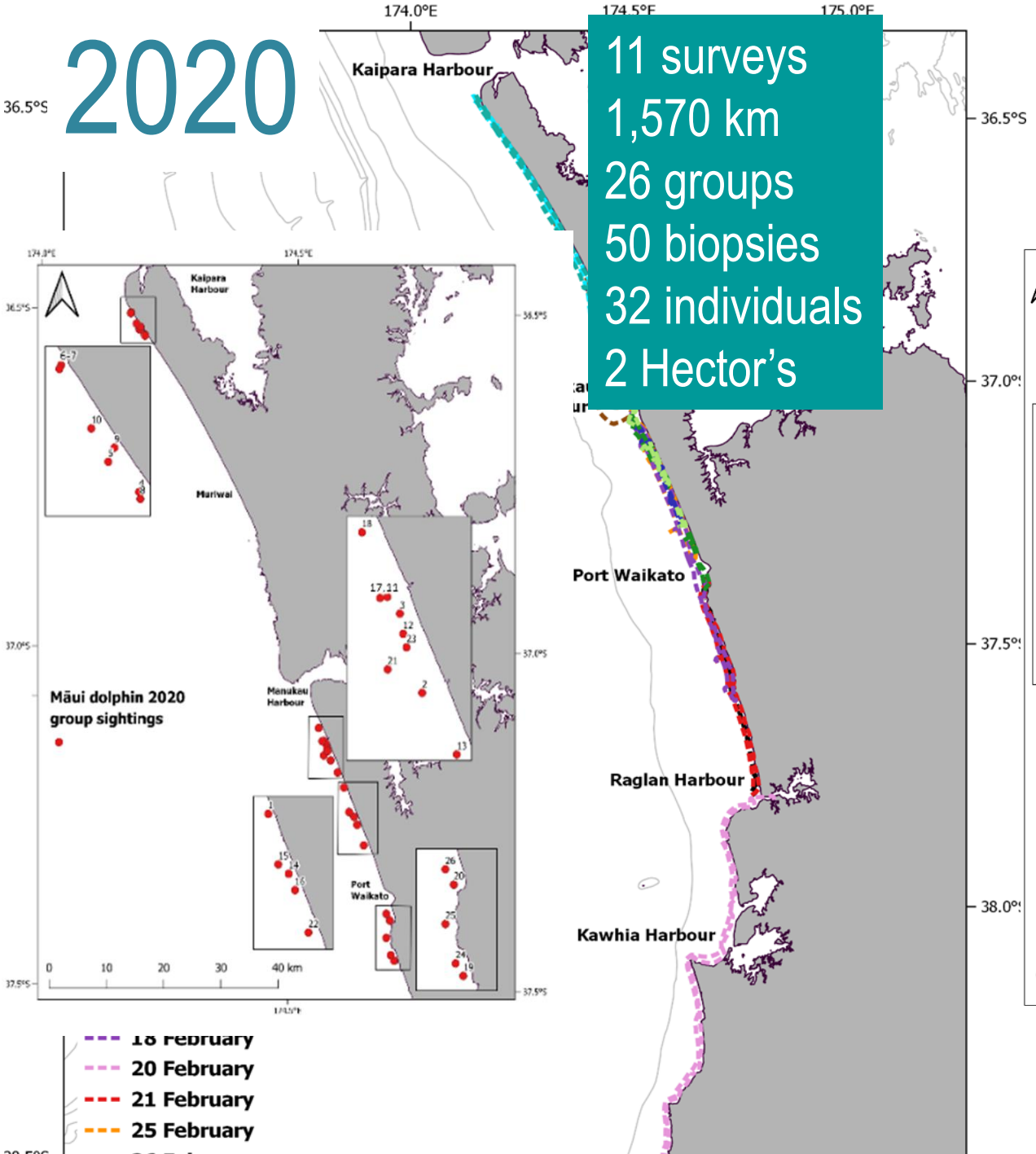
2020

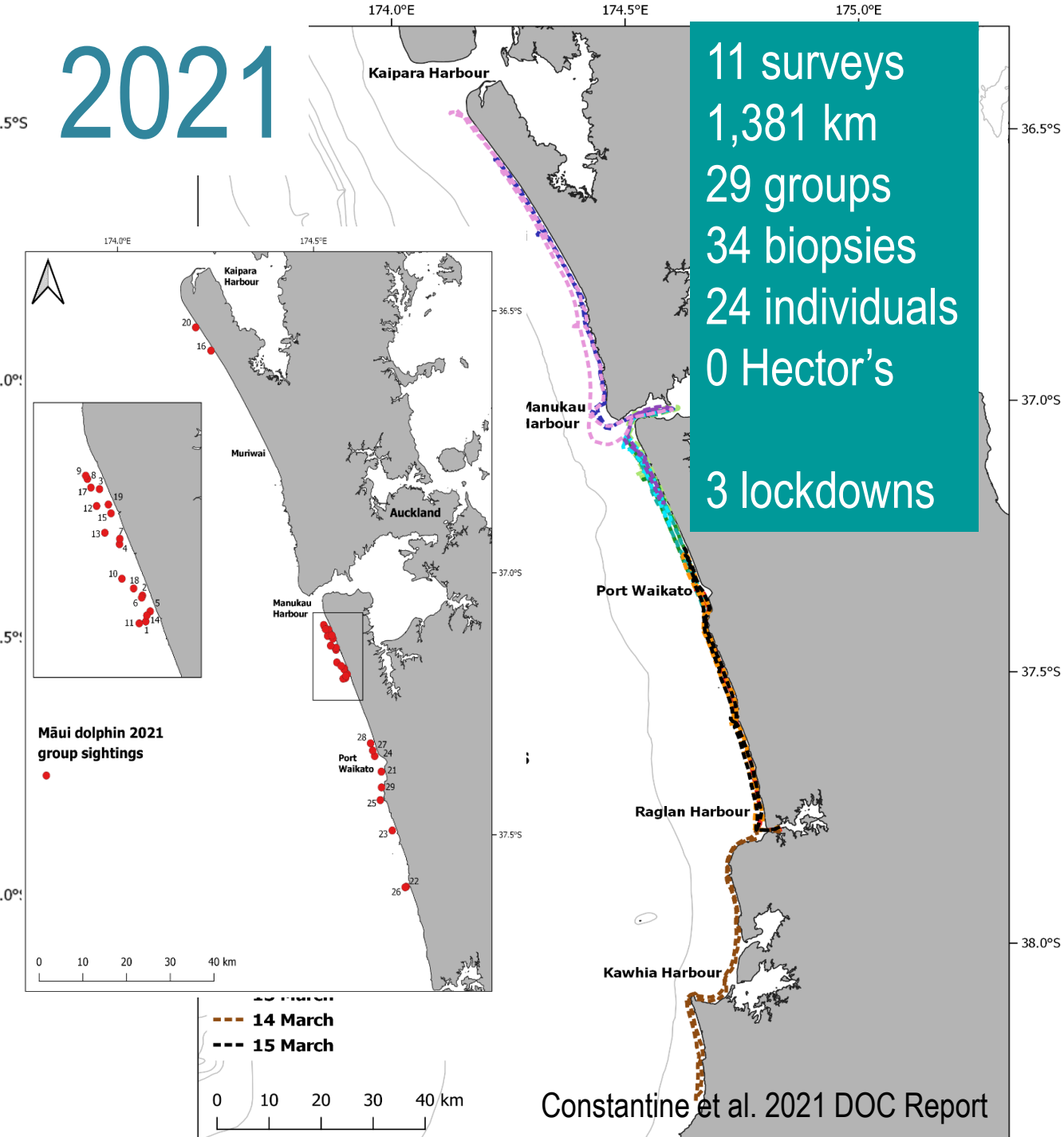
11 surveys
1,570 km
26 groups
50 biopsies
32 individuals
2 Hector's



2021

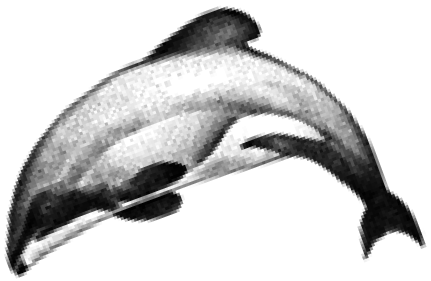
11 surveys
1,381 km
29 groups
34 biopsies
24 individuals
0 Hector's

3 lockdowns



Constantine et al. 2021 DOC Report

Effective population size



N_c – abundance estimate - genotype capture-recapture of age 1+

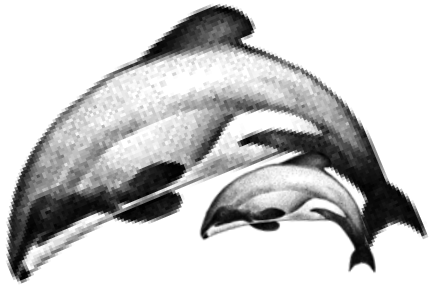
N_e – effective population size (reflects breeders in previous generation)

n – total number of individuals identified by genotyping during each of the two-year survey periods, after removal of within- and between-year replicates

	2001-07 n = 53	**2010-11** n = 39	**2015-16** n = 49	**2020-21** n = 41
Nc (95% CL)	**69** (38-125)	**55** (48-69)	**63** (57-75)	**54** (48-66)
Ne (95% CL)	69 (40-168)	68 (34-293)	34 (24-51)	35 (21-67)

DNA profiles – Māui dolphins 2001 - 2021

Mitochondrial DNA 'Haplotypes' reflect the maternal lineage
All Māui have haplotype 'G'



Of the 137 Māui dolphins (genetically identified)

118 sampled alive

16 sampled beachcast (dead)

3 sampled alive then dead

- dead 4 June 2003 – male; 2001 (genotype)
- dead 24 Jan 2018 – male; 2001, 2003, 2004, 2018 (genotype)
- dead 30 Sept 2018 – female+foetus; 2010, 2013, 2015, 2016, 2017, 2018 (photoID+genotype)

Minimum ages:

3 x males – at least 1 year old when sampled = minimum age

2001 – 2020 = 20 years old

2003 – 2021 = 19 years old

2004 – 2021 = 18 years old

Beachcast samples

Since last report (Baker et al. 2016)

5 x beachcast samples
All Māui dolphins
All necropsied by Wendi Roe, Massey University

2018 – adult male – shark bite – ID 2001, 2003, 2004, 2018 (genotype only)
2018 – mother – brucella – ID 2004, 2010, 2013, 2015, 2016, 2017, 2018 (photoID + genotype)
2018 – foetus – brucella
2018 – neonate female – decomposed, unknown mortality
2021 – adult female – decomposed, unknown mortality

Hector’s dolphins in ‘Māui-land’ - recent

8 Hector’s dolphins sampled on the North Island

- 4 beachcast
- 4 alive in Māui aggregations

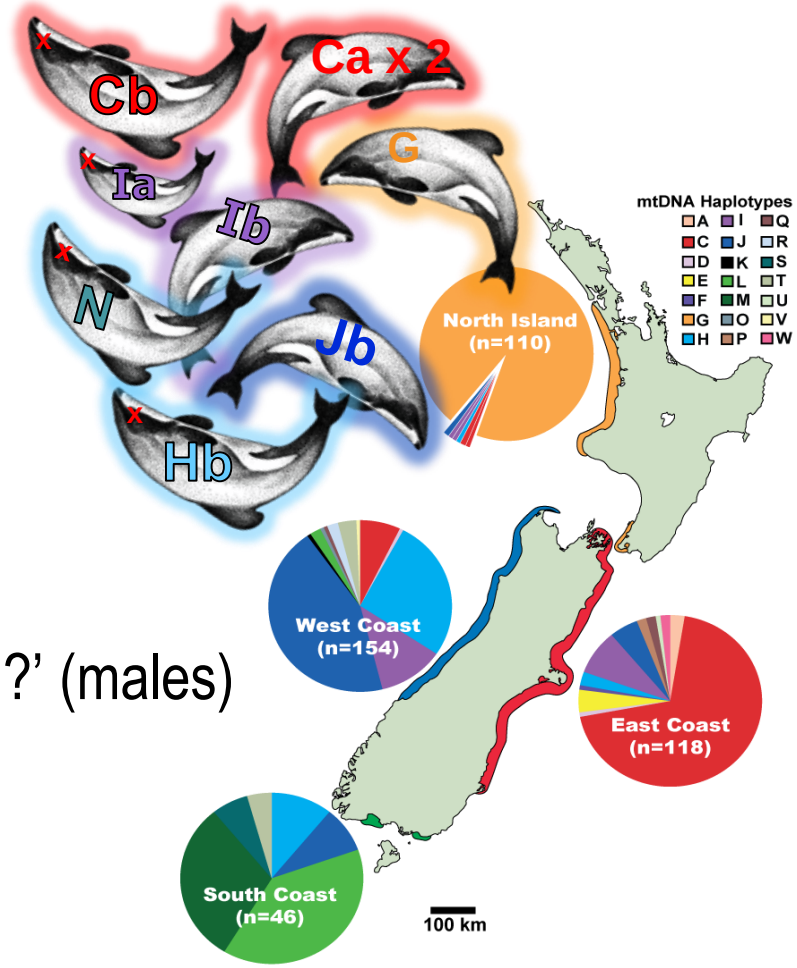
  1 female 4 x over 11-year period

  1 male 2 x over 1-year period

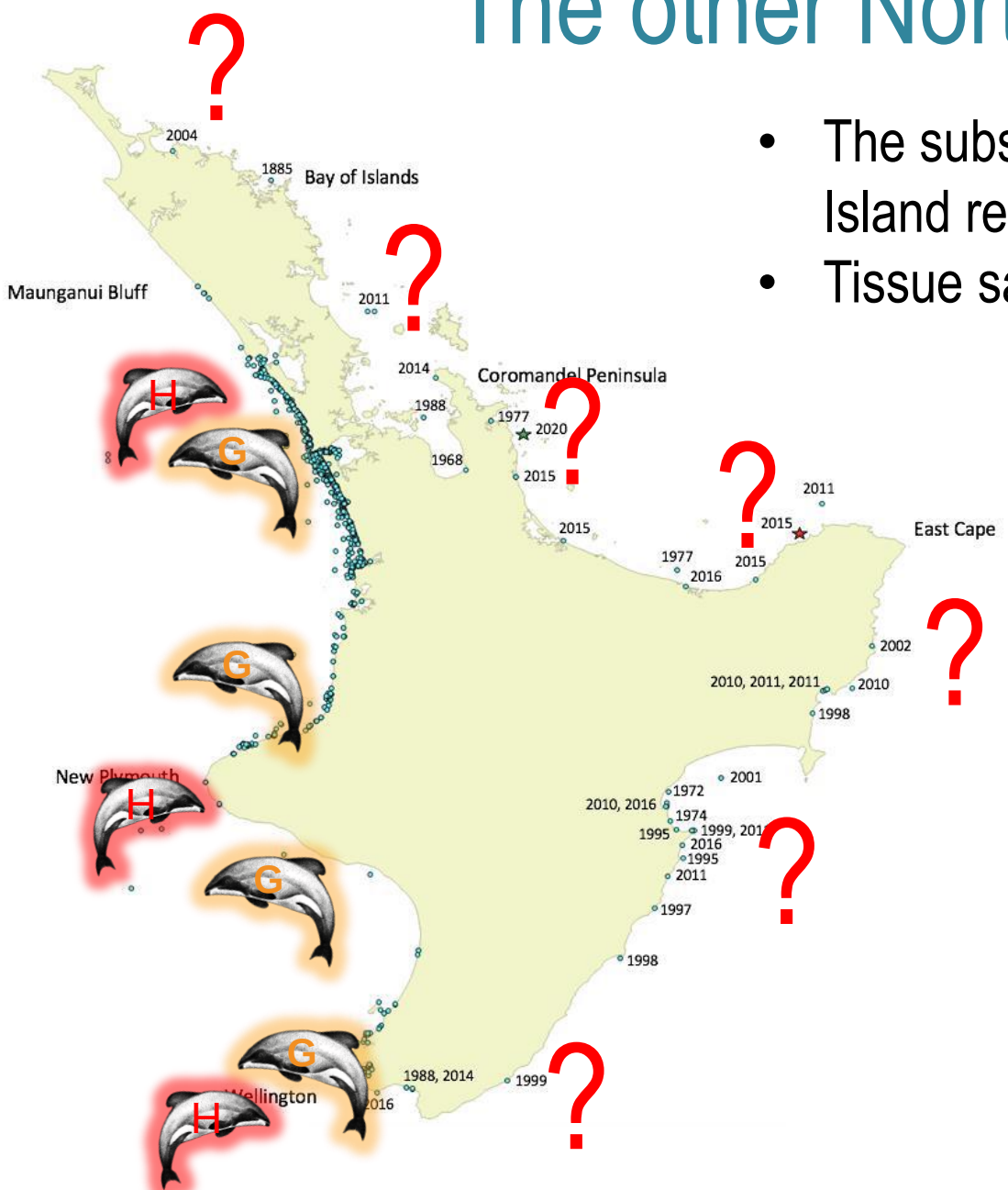
Likely origins of migrants,

- 2 west coast South Island (females), 2 ‘top of the South?’ (males)

To date, all individuals are diagnostic for subspecies, *i.e.*, no ‘hybrids’
No ‘genetic rescue’ by Hector’s… yet?



The other North Island “Hector’s”?



- The subspecies identity of dolphins from the east coast North Island remains unknown and in dispute
- Tissue samples - DNA will resolve this

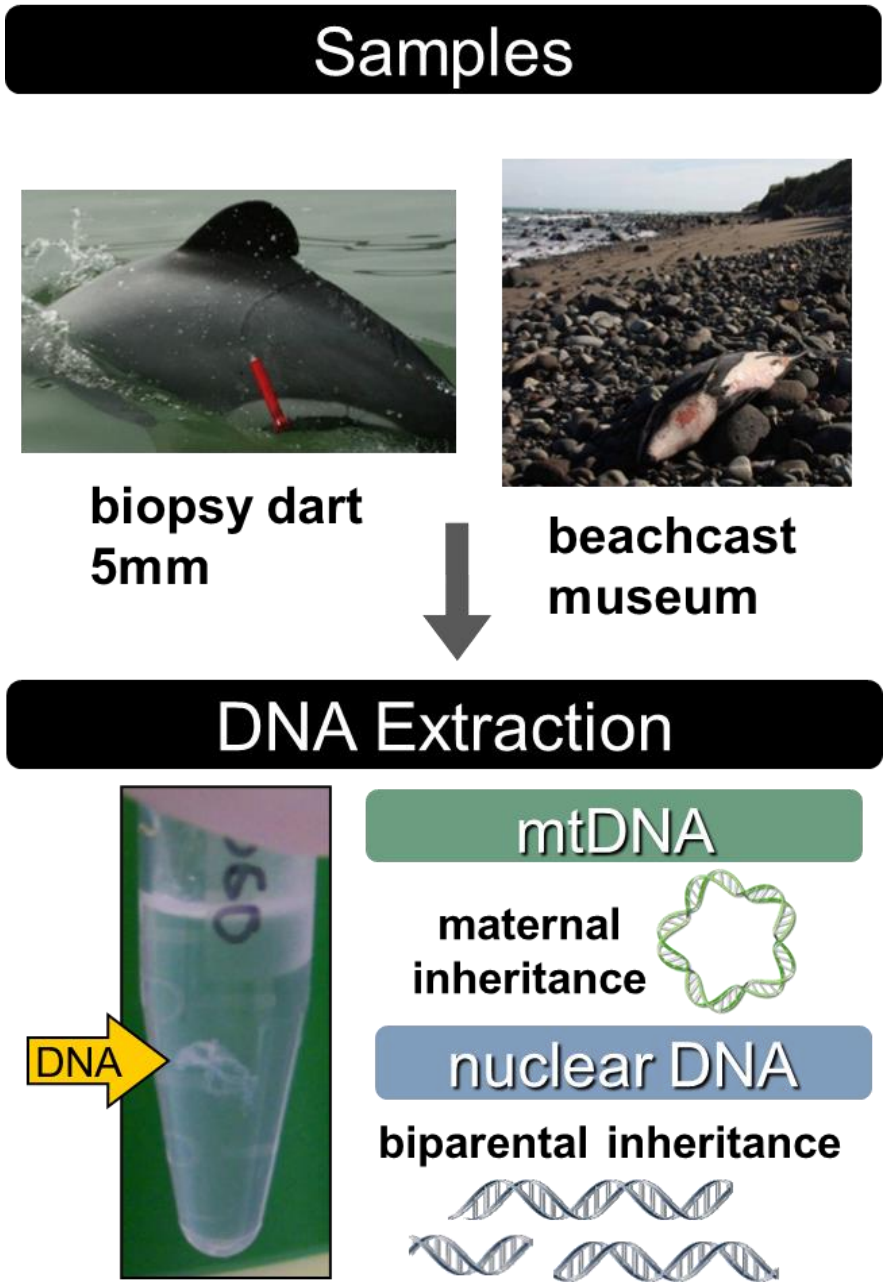
Sea Shepherd Legal, August 2020

SUPPLEMENTAL PETITION TO BAN IMPORTS OF FISH AND FISH PRODUCTS FROM NEW ZEALAND THAT RESULT IN THE INCIDENTAL KILL OR SERIOUS INJURY OF MĀUI DOLPHINS IN EXCESS OF UNITED STATES STANDARDS PURSUANT TO MARINE MAMMAL PROTECTION ACT SECTION 101

Figure 3. Māui dolphin sightings in the database provided the NIWA, as mapped by Dr. Slooten.The green star shows a sighting of a group of Māui dolphins at Hotwater Beach on Coromandel Peninsula in 2020. The red star shows a Māui dolphin caught in a recreational gillnet near Te Kaha on East Cape.

The value of these samples…

- Sub-species ID
- Sex-ID
- Genotyped 137 individuals
- Abundance – genetic mark-recapture
- Residence patterns
- Relatedness – ddRADSeq fo kinship analysis
- Epigenetic aging
- Diet – stable isotopes
- Progesterone – reproductive status
- Key to integrated analysis of all data



It still takes a village! Ngā mihi nui

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- Emma Carroll, Lily Kozmian-Ledward, Courtney Ogilvy, Leena Riekkola, Jess Ryder, Laura Zantis (University of Auckland); Kelly Lizewski, Becca Hamner (Oregon State University)

- Tangata whenua – especially those who came to the field in 2021

Courtesy, Harbers Foundation and Steve Hathaway

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