PROGRESS REPORT ON PHOTO-IDENTIFICATION SURVEYS OF MĀUI DOLPHINS IN 2019

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SUMMARY

The 2019 Māui dolphin surveys were dedicated to collecting photo-identification data to extend the 2010-2011 and 2015-2018 surveys. From 8th to 20th of February 2019, five small-vessel surveys were completed along the North Island's west coast from north of Muriwai to south of Raglan Harbour. Over 685 km and 39 hours of survey effort was conducted with Māui dolphins sighted on four trips. There was a cumulative total of 18 Māui dolphin groups encountered; an average of 3.9 groups per day when dolphins were sighted (range = 0-7 groups per day). Group size ranged from 1-9 individuals (minimum and maximum average = 3.9-5.0, s.e. = 0.4-0.6), and a minimum estimate of 1.1% (n = 2) of all dolphins sighted were calves; no neonates were observed. Dolphins were sighted from north of Muriwai to south of Port Waikato, but were concentrated between Cochrane's Gap and Hamilton's Gap, as has been reported in previous years. We photo-identified 10 Māui dolphins, nine were previously sighted individuals (between 2010 and 2018), and one was added to the catalogue (ID#155 – M046; seen in 2017 and 2018) as it had gained sufficiently distinctive marks to meet the catalogue criteria.

INTRODUCTION

The New Zealand's endemic Māui dolphin *Cephalorhynchus hectori maui,* a sub-species of the Hector's dolphin *Cephalorhynchus hectori*, is categorised by the IUCN as critically endangered and nationally critical under the Department of Conservation (DOC) Threatened Species Listing (Baker et al. 2019). Further conservation measures were therefore implemented in order to protect this sub-species, supported by the abundance estimates and analysis of distribution (Oremus et al. 2012, Hamner et al. 2014, Derville et al. 2016, Baker et al. 2016). A review of the current Hector's and Māui Dolphin Threat Management Plan is currently underway.

We summarise the results from small-vessel surveys dedicated to the photo-identification of Māui dolphins during the summer of 2019. The recent comprehensive assessment of photo-identification data (Garg et al. 2018) has resulted in a catalogue of 38 individually identifiable Māui dolphins. The individual mark rate of Māui dolphins is 25% using relaxed criteria for distinctiveness (D1-D3 included) but is effective if only high quality images are used in the analysis. The research will complement and extend the genetic data (see Oremus et al. 2012, Baker et al. 2013, Hamner et al. 2014, 2016) to inform demographic features of the population such as individual movement patterns, calving rates and epigenetic aging.

SURVEY EFFORT

We completed five coastal surveys from the Department of Conservation (DOC) vessel *Tuatini* from the 8th – 20th February (Figure 1, Table 1). Effort was focused alongshore (within 1NM from shore), as per previous surveys, to ensure consistency with previous recent surveys. The boat was launched from Raglan Wharf (n = 1) and then operated out of the Manukau Harbour, from a mooring at Clarks Beach (n = 4). On the 12th February, we conducted a shorter survey with a focus on testing the efficacy of using a drone (Mavic-Pro) to detect dolphins from different flight altitudes. The flights were conducted by experienced operator, Richard Robinson (Depth) and have been used to inform machine learning tools designed to detect dolphins in future use of long-range unmanned autonomous vehicles (UAVs) to conduct surveys (under investigation by Rochelle Constantine).

In total, 39 hours 24 minutes were spent on the water, covering a distance of 685.2 km. As in previous surveys (2015 – 2018), we started our survey 'on effort' once leaving the Raglan Harbour or from Cornwallis Point when operating from Clarks Beach, Manukau Harbour (Figure 1).

Overall, weather conditions were good with most surveys conducted in a Beaufort 1-2 sea state. Conditions ranged from Beaufort 1-4 with only short periods of time with higher sea-state.

The research team included:
- Skipper: Garry Hickman, Pearson Tukua, Cara Hansen (DOC*)
- Chief scientist: Rochelle Constantine (UoA)
- Photographers: Rochelle Constantine (UoA), Cara Hansen, Kristina Hillock (DOC), Richard Robinson (drone operator)
- Data recorders: Anthony Muyt, Gabrielle Goodin (DOC), Richa Garg (UoA)

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Table 1. Boat surveys completed along the North Island's west coast, from 8th - 20th February 2019.

|	Date	Location surveyed	Launch	Time start*	Time end	Duration hh:mm	Distance km	# groups
1	8-Feb	Raglan to Port Waikato	Raglan	08:45	17:00	8:15	187.6	0
2	11-Feb	Manukau North to Cochrane's Gap	Clarks Beach	07:44	15:58	8:14	164.4	4
3	12-Feb	Manukau South to Karioitahi	Clarks Beach	07:30	14:45	7:15	53.6	4
4	19-Feb	Manukau South to Port Waikato South	Clarks Beach	07:55	15:48	7:53	123.4	7
5	20-Feb	Manukau North to Karioitahi	Clarks Beach	08:04	15:50	7:46	156.2	3
				Total		39:24	685.2	18
				Average		07:54	137.0	3.9
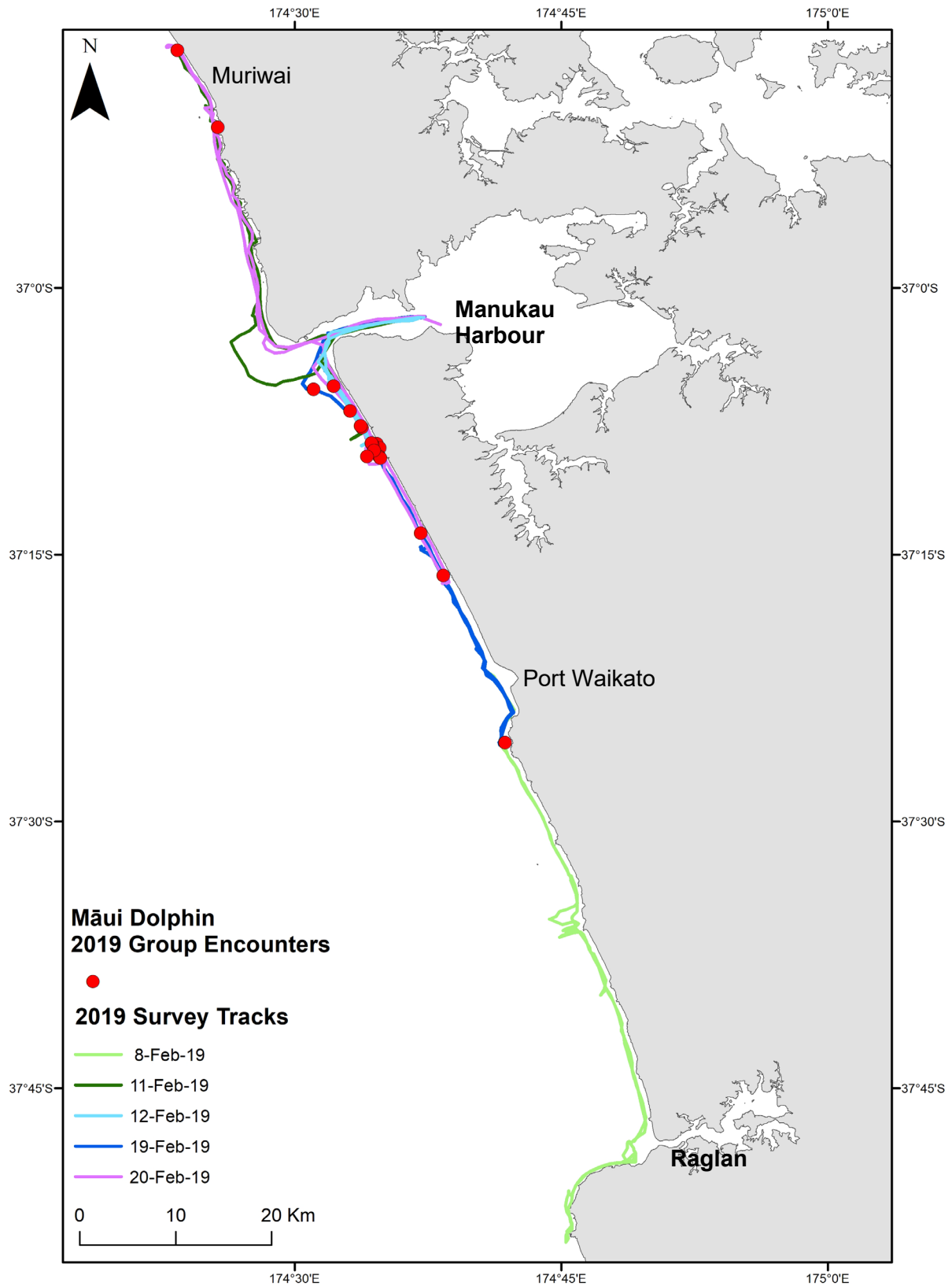
Figure 1. Map of the study site, GPS tracks of the research vessel and Māui dolphin group encounters for the five surveys.

GROUP ENCOUNTERS

   During the 2019 summer surveys, a total of 18 groups of Māui dolphins were
encountered (Table 2, Figure 1). Māui dolphins were encountered on four surveys with an
average of 3.9 groups sighted per survey (range = 0-7 groups). Māui dolphins were
concentrated primarily between Hamilton's Gap and Karioitahi, but small groups of 2-3
dolphins were found just south and north of Muriwai, and one group of five just south of
Port Waikato (Figure 1). In total, 5 hours and 15 minutes were spent with dolphins across
all surveys, with an average of 18 minutes (range = 3 min – 1 hr 27min) spent with dolphin
groups for each survey. The longest encounter was during drone surveys to test
detectability of the dolphins at different elevations.
   Groups ranged in size from 1-9 dolphins with an average of 4.2-4.3 dolphins per group,
as based on visual minimum and maximum counts (Table 2). There were no neonates (i.e.,
newborns with foetal folds) or juveniles (i.e., dolphins of approximately two-thirds the size
of adults) sighted during the surveys. There were 11 groups that contained calves (range =
0-2 calves) (i.e., dolphins of approximately one-half or less the size of an adult) with calves
accounting for 19.7% of all dolphins sighted, based on minimum total count (n = 76), which
includes multiple sightings within and between surveys.

Table 2: Summary of Māui dolphin group encounters from the 8th - 20th February 2019.

Group #	Date	Position start Latitude	Longitude	Group size Min	Max	Number of calves/juvs	Time w/animals
1	11-Feb-19	36 50 987	174.74144	3	3	0/0	0:21
2	11-Feb-19	36 46 651	174.72302	2	2	0/0	0:07
3	11-Feb-19	37 08 785	174.70935	2	2	0/0	0:12
4	11-Feb-19	37 09 017	174.69054	7	8	1/0	0:24
5	12-Feb-19	37 05 533	174.69373	3	3	1/0	0:44
6	12-Feb-19	37 08 827	174.55533	6	6	1/0	1:27
7	12-Feb-19	37 09 488	174.59145	7	7	2/0	-
8	12-Feb-19	37 09 584	174.58249	9	9	2/0	0:07
9	19-Feb-19	37 07 863	174.53253	3	3	0/0	0:09
10	19-Feb-19	37 16 185	174.56726	4	4	2/0	0:16
11	19-Feb-19	37 25 591	174.56508	5	5	1/0	0:16
12	19-Feb-19	37 13 802	174.58542	5	5	2/0	0:11
13	19-Feb-19	37 08 733	174.58719	3	3	1/0	0:14
14	19-Feb-19	37 06 941	174.61547	5	5	0/0	0:11
15	19-Feb-19	37 05 712	174.56369	2	2	0/0	0:03
16	20-Feb-19	37 09 161	174.36511	1	1	0/0	0:03
17	20-Feb-19	37 09 485	174.57593	7	8	1/0	0:29
18	20-Feb-19	37 07 782	174.57714	2	2	1/0	0:06
			Cumulative total	76	78		05:15
			Average	4.2	5.3	0.8	00:18

PHOTO-IDENTIFICATION

   Photographs of dolphin dorsal fins were taken on all surveys for the purposes of individual identification. Once graded for photo quality (Q1-4) and distinctiveness of markings (D1-4), only high quality images (Q1 and Q2) and animals with distinctiveness scores of D1-D3 were considered for analysis (see Garg et al. 2018, Slooten et al. 1992 for details).
   We matched all images that met the quality control criteria to the 38 individuals in the Māui Dolphin Catalogue up to 2018 and found nine matches of individuals first identified between 2010 and 2018. We added one new dolphin (ID155-M046) but we had seen this dolphin in 2017 and 2018 with nicks that were distinctive but not sufficient to include in the catalogue (D4). Sometime since the last sighting (30 January 2018) and the 2019 sighting, the dolphin gained new marks of sufficient quality to add it to the catalogue.

DISCUSSION

   The 2019 summer surveys (n=11) successfully matched previous efforts dedicated to photo-identification (2016-2018) covering a similar coastal range (Baker et al. 2016, 2017, Garg et al. 2018). Dolphins were found on four out of five surveys and were concentrated in the usual area of summer aggregation, between Hamilton's Gap and Karioitahi Beach. There were sightings of smaller groups (2-3 dolphins) further north near Muriwai Beach, an area where there were also public sightings.
   The average number of groups encountered per survey in 2019 (3.9) fits within the range of previous years (2010 average = 2.5 to 2016 average = 5.5).Similarly the group size in 2019 (4.2-5.3) was within the range of previous years (2010 range = 5-6 to 2016 range = 3.6-4.8).
   Calves were observed in 19.7% of all groups sighted but there were multiple sightings of a group that contained mothers with calves (all around the core area). There were no neonates and no juveniles observed which differs to most other previous surveys. The fluctuation in the number of dolphins that are in the neonate, calf or juvenile life-stage across the different survey years (2010 until present) is an area of interest. Unfortunately, with the low number of uniquely marked individual Māui dolphins, it is challenging to determine reproductive rates and offspring survival using photo-identification. Genetic tools are better suited to determine relatedness, in particular the use of ddRAD tools that allow greater resolution currently under development (Baker et al. unpublished data).
   The identification of 24% (n=9) of previously catalogued dolphins and the inclusion of one new dolphin (although it was sighted in 2017 and 2018) results in a catalogue of 39 uniquely identifiable Māui dolphins. Maintaining high quality control of images used for matching enables us to match very slightly marked individuals (D3). This is not typical practice for larger populations of dolphins but given the status of Māui dolphins the inclusion of these individuals is important.

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