Department of Conservation
Te Papa Atawhai

Campbell Island New Zealand Sea Lion/Rāpoka Research Planning Workshop – May 2019

Workshop report for the Department of Conservation, Te Papa Atawhai

New Zealand Sea Lion/Rāpoka (*Phocarctos hookeri*) pup at Bog colony

Prepared by Dahlia Foo in June 2019 with reviews and comments from workshop participants and Jim Campbell (DOC, 2018/19 NZSL Summer Research Team Leader).

1 TABLE OF CONTENTS

2 CONTEXT

On 27 May 2019, the Department of Conservation (DOC) held a half day workshop to discuss and plan the short- and long-term work proposal at Campbell Island. The workshop was one of the actions recommended from the DOC CSP and NZSL TMP Technical Working Group meeting held on 8 March 2019. A brief overview on our current understanding and status of pup mortality and production at Campbell Island was first presented. This was later followed by discussions around potential action plans in the short and long-term that will help reduce overall pup mortality to < 40% on Campbell Island (an objective of the NZSL Threat Management Plan). Recommendations to include in the 2019/20 work plan were proposed at the end of the meeting. Key discussion points and recommendations from the meeting were recorded and are outlined below.

3 WORKSHOP PARTICIPANTS

Laura Boren (DOC), Enrique Pardo (DOC), Helena Dodge (DOC), Wendi Roe (Massey University), Greg Lydon (Fisheries NZ), Ben Sharp (Fisheries NZ), Sharleen Gargiulo (Deepwater Group), Dahlia Foo (UTAS), Mary-Anne Lea (University of Tasmania), Simon Childerhouse (Cawthron Institute), Micah Jensen (Wild Vet Care)

4 PRESENTATIONS

4.1 OVERVIEW/HISTORY

L. Boren gave an overview on the history of NZSL monitoring and pup mortality. This included the current understanding of contributing factors to early pup mortality, methodology and data collected from post-mortem work, pup production estimates, pup mortality rates, and pup mass on Campbell Island from 2007/08 to 2018/19.

Summary points:

- 2007/08 – Paradise breeding site discovered.
- In 2009/10 this site has split into two breeding sites; however, Paradise East has now disappeared (most likely individuals from there have merged with Paradise West to form Shoal Point).
- Paradise West is now called Shoal breeding site and has increased in contribution to overall pup production on Campbell Island over time.
- Mortality between 50 – 60 % since 2007/08 other than a single low year of 25 % mortality at Davis Point in 2017/18.
- Davis Point is a poor breeding site and has a higher mortality rate in comparison to Shoal and all other monitored NZSL breeding sites
- Davis pup production is slowly declining while Shoal is slowly increasing, may be due to movement of breeding adults.
- Many deaths early this year at Davis Point appear to be due to starvation/exposure. The spike in deaths occurred between 4 – 8 January 2019 (2.4 times more deaths daily on average during this period than the previous days' average) during the significantly poor weather event.

5 TOPICS DISCUSSED AND RECOMMENDATIONS

5.1 GOAL OF THREAT MANAGEMENT PLAN

- While it is desirable to reduce mortality as much as possible, a goal of decreasing the early pup mortality rate to 40% is to meet one of the specific goals of the TMP. This should be an important focus and kept in mind when making decisions
    - While this goal was achieved in 2017/18, it was due to an unusually dry season

5.2 CAUSES OF PUP MORTALITY

W. Roe made some general comments regarding causes of mortality for clarification mentioning:

- Starvation and exposure are impossible to distinguish at necropsy and thus should be linked together rather than separate.
- We know *Klebsiella* exists in the environment and in the intestinal tract of adults on Campbell, however to date only a few samples have been collected from dead pups that were able to be cultured for *Klebsiella*.
- From existing information, neither conjunctivitis/rhinitis nor flipper ulcers (though they could both be a route for potential bacteria to enter the body) do not seem to be a cause of mortality.
- Some ulcers are caused by contact with the substrate, but there are also cases of ulcers on other parts of the body, which could be caused by viruses. Massey has tested for some of the viruses that can do this (all negative), but the samples used weren't optimal so this testing is not conclusive.
- Hookworm appears weeks earlier on Campbell than it does on Enderby which may imply pups are born earlier on Campbell – hookworm appears late December on Campbell compared with mid-January on Enderby. Larvae take 2-3 weeks to develop. It would be good to look into this further to improve knowledge of basic breeding biology such as mean pupping date.
- Blubber thickness in pups – can be low due to shivering, illness or starvation (difficult to tell without other contextual data). Knowledge of maternal body condition would help assess whether starvation/nutritional stress plays a role.
- Skinny pups this season are likely to be due to pups being cold from the extreme weather this season. Density dependent factors were also discussed and, although unlikely, data to reject this possibility are not available at the moment.

Recommendations:

- *Stop using the term "malnutrition" as it is not the most appropriate term to use regarding starvation*
- *Reports to be written in consistent manner and using standardised terminology*
- *Set up a necropsy protocol and blubber depth protocol so that comparisons can be made in future years*
- *Investigate use of ultrasound (with a protocol) to determine pup blubber depth at all breeding sites*

5.3 POST-MORTEM WORK

- Necropsy data has been inconsistently collected over the years as a result of a range of factors including how pups were selected, what was achievable, what the focus was (looking for infection etc), the extent of tissue sampling and varying levels of resourcing and experience. The most comprehensive year of data was 2017/18 but it was focused on detecting a range of possible causes of death in which the necropsied pups were selected on their freshness and least amount of scavenging. Maximising the value of necropsy findings and samples requires better planning and reporting long-term.

Recommendations:

- *For necropsy – use the Massey standard protocol for NZSL pups (provided). Need to specify how many pups and how to select, how to make choices when something changes (e.g. communication table/network with appropriate person to call if an issue arises around a certain focused area)*
- *In W. Roe's opinion, there is not a lot of point in doing gross necropsies but not collecting samples. Findings at gross necropsy are often misleading or non-specific, meaning that the diagnosis is often incorrect, even in the hands of experienced pathologists. The additional effort required to collect samples is not significantly more than doing the gross necropsy. If cost of analysis is a factor, samples can be archived (for years) and tested at a later date*
- *It is not logistically possible to necropsy all dead pups on Campbell, therefore a method of selecting pups should be determined, based on the specific question being asked (e.g. presence/absence of Klebsiella vs range of causes of mortality vs true prevalence of each cause). The protocol should be easy to implement and clear to maximise consistency and reduce uncertainty in the team collecting the information.*
- *W. Roe would like to play a role in choosing the necropsy person. Ideally a vet experienced in NZSL or marine mammal pathology should be included in the team. This markedly increases the chance of getting useful information from necropsies.*
- *Good idea to look at all mortality data collected thus far – bit of a stocktake and comparison (e.g. what age animals are dying at, although this requires a known pupping date). Note however that results are not directly comparable due to the differing methods of pup selection, experience of the necropsy person, and quality/quantity of samples collected*
- *Utilising a PhD student for moving forward with some of these mortality investigations can be highly advantageous in terms of cost efficiencies as well as the ability to pick up any nuances and better understanding of the species due to them spending lots of time in the field with the animals and data. Although, whether the PhD framework will also slow completion of results and final reports needs to be considered and managed.*

5.4 PUP MORTALITY FROM TERRAIN TRAPS

- Due to a high mortality rate in 2019 from exposure due to very hard weather conditions (i.e. cold, wet and windy), most pups did not survive long enough to explore the terrain traps.
- Causes of pup mortality may vary between years based on the weather and other environmental conditions.

5.5 PUP MASS

- Pup mass was considerably (by 2 kg) lower weight at Davis this year in comparison to other sites (Shoal Point and Auckland Islands).

- Pup mass is an important and useful variable in assessing health and survivorship in many species of pinnipeds. There is good data from the Auckland Islands indicating that there appears to be a strong correlation between pup mass and long-term survival (pers. comm. Jim Roberts, NIWA). Therefore, pup mass at standardise times is a very useful and simple metric to collect.

Recommendation:

- *Scales must be calibrated before the field season and ensure that the same type of scales and calibration are being used at all known breeding sites*
- *Weigh bags should be regularly weighed during the weighing event and recorded to ensure accuracy in the data collected*
- *The timing of weighings and measurements should be standardised to ensure that the data collected from a single cross-sectional sampling event is useful*

5.6 IDEAS FOR ACTIVE MANAGEMENT

5.6.1 IVERMECTIN

- Not recommended. (Note that ivermectin kills most parasites, including internal parasites such as hookworm, as well as external parasites. It does not affect bacteria or viruses. Parasite resistance can occur). Ivermectin may improve survival on Enderby (data analysis in progress, S. Michael pers. comm.) but this is likely to be due to the combination of hookworm and *Klebsiella* infection that occurs there. We have no evidence that *Klebsiella* is causing pup deaths on Campbell, and no evidence that pups there are dying of hookworm, therefore there is no indication to use it on Campbell Island without a better understanding of causes of mortality at the site

5.6.2 SUPPLEMENTARY FEEDING

- There are many potential issues with this, including hygiene (milk could easily be contaminated and act as a source of illness), imprinting/habituation, and ensuring pups are being adequately fed

5.6.3 TERRAIN TRAP MITIGATION

- From observations of terrain trap mitigation solutions so far, D. Foo noted that the best solutions are the coir logs, ramps, and digging channels. This was based on the ability and ease of the field crew to use and put them into place, along with their effectiveness for allowing pups to self-rescue from terrain traps
- Longevity of coir logs potentially 5 years; it was noted that coir logs should not be cut to size as this would compromise their effectiveness. Coir logs are cheap, light, easy to fumigate and effective
- Noted that sand bags are not a good idea because there is not enough material on the island to fill the bags
- More pups were out on the exposed mud pan in 2019, hence figuring out solutions to minimise exposure for pups (e.g. shelters/wind breaks) in that area is key
- Considerations for pup shelters:
    - need to be able to withstand large male sea lions and be anchored securely in a high wind/storm area
    - pups will not somehow be crushed in it

  - entry/exit cannot be blocked by a territorial sub-adult male; have multiple entry/exitsentry to pups but not larger animals
    - will it increase transmission of disease?
    - needs to be DOC Southland approved
  - some good options already available in livestock management e.g. calf/lamb shelters
    - cons: may affect aspects of World Heritage Status of Campbell but this could be managed and minimised (e.g. shelters would be temporary). (Sharleen G comment that the Heritage Status should not prevent effective action being taken to conserve sea lions, as indeed it does not for say turtle breeding sites that are being modified in the Great Barrier Reef Marine Park)
  - Sandbags stacked up to create wind barriers for pups to huddle up. Note sand will have to be imported/fumigated as no material on island
  - Tie multiple coir logs together and have a long wall that pups can huddle up against. Will have to think of a good way to anchor them. Given the mainly rock substrate, it may be necessary to drill holes for attachment points, unless it soaks up mud during rain events and naturally becomes heavy over time
  - Some types of half concreate tunnels with extra entrance/exit points added
  - Potential translocation of pups higher at Davis point colony, less expose and muddy environment, but within the hearing range of their mums
- There is a limit to what can be achieved during the field season due to the colony already being established when the field team typically arrives, and aggressive territorial males present

Recommendations:

- *Possibly send a team (mostly engineers with a couple of biologists) down in October/November with the Navy during Operation Endurance to do pre-season preparations of the site including reporting back on condition of the site (e.g. dry/muddy) and installing terrain trap mitigation and DOC to advise/monitor them during that process*
- *Fence off the mud waterfall area (5 – 10 m). Will need to be a robust fence that pups cannot get trapped in and that adults cannot breach. Thought will need to be given by Navy Engineers on how fence post holes will be drilled into rock (power supply by generator etc)*
- *Measure success of mitigation over time (e.g. Do actions reduce pup mortality? Are we meeting the TMP Goal of 40% pup mortality?). Establish consistent methodologies for monitoring pup mortality and interactions with terrain traps to allow consistent long-term monitoring*

5.6.4 DISCOURAGING SEA LIONS TO BREED AT DAVIS POINT (LONG-TERM)

- Strong concern regarding fencing off Davis Point breeding site: whether or not mums will end up pupping somewhere more appropriate and achieve higher pup survival rate as well as whether they will mate successfully immediately after parturition is uncertain

Recommendation:

- *Park the idea of fencing off Davis Point completely*
- *Alternative idea of actively encouraging breeding at more suitable nearby sites using sea lion vocalisation recordings*

5.7 TAGGING VS. MICROCHIPPING

- Tagging is more invasive than microchipping, however chip reading success is very low at Campbell with the territorial/aggressive nature of the sea lions at Campbell and the high pup mortality rate
- In addition, it is too muddy to microchip pups

Recommendation:

- *Continue to tag for confirmation that mark recapture technique is a viable alternate to tagging all pups but do not microchip*

5.8 RECOMMENDED WORK PLAN FOR FUTURE FIELD SEASONS

5.8.1 SCIENCE MONITORING

- *Continue to monitor causes of pup mortality and population size*
- *Undertake a M-R count for Campbell as opposed to a population count. It will be a time saver (minimise field team workload) and allow for other goals to be worked on*
    - *There will need to be 1 – 2 years where the tagging and M-R are both performed to allow for comparison in accuracy of pup production estimate*
- *Increase effort into resighting tags*
- *Potentially flipper tag pups later in the season once pups manage to survive through the early and critical part. Note that older pups will be harder to handle, and will have thicker flippers for tagging (more invasive)*

5.8.2 POST-MORTEM

- *Necropsies will not be undertaken at Campbell Island in 2019/20 to focus efforts on the other goals of implementing mitigation actions to decrease pup mortality (unless perhaps research questions required post-mortem analysis and enough funding is available to develop a comprehensive necropsy program). A contingency plan should be in place however so that post-mortems could be carried out in the case of disease/mortality events (e.g. the mass mortality events that occurred on Enderby in 1998/99, 2002/03)*
- *resume PMs after 1 – 2 seasons with clear research goals and resourcing in the future*
- *In the meantime,*
    - *take photographs;*
    - *count dead pups;*
    - *collect faecal and oral swabs;*
    - *record date, state of decomposition, blubber depth, girth, length, mass and sex.*
    - *Note that a protocol (should also include commentary on why a corpse was selected for necropsy to aid in assessing selection biases) and adequate training for this should be put in place well before the field season*
- *Collect environmental samples for Klebsiella across the breeding season, ideally before, during and after pupping (a clear plan and set of protocols needs to be constructed for this e.g. stage time and location)*
- *Ultrasound blubber depth of live pups (when doing the cross-sectional weighing and measuring) to contribute to nutritional stress work*
    - *W. Roe noted that just measuring girth (armpits), length and weight would be more reliable for understanding nutritional stress.* Similar measurements of dead pups could be used to correlate these measurements with blubber depth

5.8.3 ISLAND SEARCH

- *Do an island search for presence of other sea lion breeding sites every two years. This should focus on areas previously recorded as areas used.*

5.8.4 IMPROVING CAMPSITE AT DAVIS POINT

- *At the least build a raised platform for camping*
- *Could potentially move apple hut from Dundas to Davis Point. Makes more sense since researchers only stay on Dundas for 3 days but at Davis Point for weeks.*
- *Discuss this with Southland DOC as soon as possible*

5.8.5 LOGISTICS AND TIMING OF FIELD SEASON FOR 2019/20

Number of teams:

- *Have one large team (instead of 1 small team each based at Davis and Shoal) that is based only at Davis. A portion of that team goes to Shoal for the period around the M-R tagging/weighing, but then return to Davis as that is where majority of the workload is.*
    - *This would give staff a chance to have breaks*
    - *This arrangement may be more of a consideration after the next year or two once the M-R/Tagging combo is done*
- *However, having one large team of 5-6 people at Davis Point may be too much logistically with regards to camping, food, water etc (it is not as easy to move fish bins around at Davis Point compared to Shoal Point). There could still be two teams of three, each based at Shoal or Davis Point. If specific skills aren't needed at the sites, the teams could do a swap every fortnight (or something else at the team's discretion) to have a break and check in at Beeman's, especially if Shoal is less intensive.*
    - *Furthermore, with Shoal's increasing population and dynamic nature of its location - they could potentially shift to a bad location and have higher pup mortality. Thus, it is still important to monitor the breeding site at Shoal Point closely to have good comparison with other sites*

Operation Endurance:

Navy vessel going out to Campbell Island before the breeding season

- *Opportunity to drop a team off for two weeks to put in terrain trap mitigation prior to the colony's arrival, insert the fence over the waterfall, the shelter for pups, and build some type of raised platform for tents for fieldwork team*
    - *also allows for assessing the potential environmental factors that will be faced this season*
    - *could also be a time for the first part of environmental sampling for Klebsiella to occur*

Timing of 2019/20 Field Season:

- *~18 December to ~ 18 January*
    - *Dates yet to be confirmed*
    - *Team not expected to handle pups in the first few weeks but do daily pup counts to get the pupping curve and mean date as well as monitor and count still births. However, to do this, teams will have to be on Campbell before 18 Dec, probably as early as the first week of December*

6 Information requests

- Kelly Buckle (vet at Davis Point 2018/19) to clarify the selection process for full vs gross PMs

7 Next steps

- Active management ideas and building of wooden platform for camping for the 2019/20 season must be discussed with and approved by DOC Southland urgently. If it is approved, then progress needs to be made on it asap to get it in place for this coming season.

8 Appendix 1: Workshop agenda

Campbell Island Research Planning W

9 Appendix 2: Overview presentation by L. Boren

10 Appendix 3: New Zealand Sea Lion Necropsy Protocol

Enderby necropsy protocol_copy.docx