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Every dolphin is different: individual-based modelling offers insight into long-term growth patterns of bottlenose dolphins

Growth dynamics of bottlenose dolphins (*Tursiops truncatus*) at the southern extreme of their range

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INTRODUCTION

- Two Fiordland bottlenose dolphin sub-populations in southwestern Aotearoa-New Zealand (Fig. 1)
- Share traits of both coastal and offshore ecotypes (Fig. 2)
- No size/growth rate metrics across all ages and sexes in this population

METHODS

- Drone photogrammetry from video
  - DJI Inspire 1 Pro, Olympus 25mm f1.8 lens, custom added LiDAR/IMU/GPS
  - Individuals ID from dorsal body marks (Fig. 3)
  - Measured total length (TL) and blowhole to dorsal fin length (BHDF) (Fig. 3) using *whalength*
- Multivariate growth modeling with individual random-effects using Bayesian approach (Stan)
  - Von Bertalanffy growth curve to estimate:
    - max length of TL & BHDF
    - Growth rate of each length metric
  - Estimate correlation between growth parameters
  - Estimate measurement + biological error

RESULTS

- Over a 1.5-yr period, 1218 photos used to measure 143 individuals (all 63 in Doubtful pod, 80 from Dusky pod)
- Individuals measured 1–30 times overall
- TL & BHDF = 785 images, BHDF only = 414, TL only = 19
- Population-level estimate (Fig. 4):
  - Max length, TL: 2.94 m, 90%CI = 2.68–3.18
  - Max length, BHDF: 0.94 m, 90%CI = 0.84–1.04
  - Growth rate, TL: 0.39, 90%CI = 0.35–0.44
  - Growth rate, BHDF: 0.40, 90%CI = 0.35–0.46
- Positive correlation between
  - TL and BHDF length
  - Both growth rates
- Faster growth rates tend to be associated with shorter dolphins (and vice versa, Fig. 5)
- Measurement & biological error:
  - TL (σ) = 0.068 m, 90%CI = 0.065–0.071
  - BHDF (σ) = 0.035, 90%CI = 0.034–0.036
- No clear sex or pod differences (Fig. 6)

DISCUSSION

- Better estimates of growth dynamics by incorporating individual variability
- Possible decrease in maximum length over several decades
  - May reflect ecosystem changes
  - Extreme heatwaves in Fiordland
- Our estimates similar to offshore and coastal populations, may need more ecotype categories!
- Continued measurements will help to monitor dolphin and ecosystem health

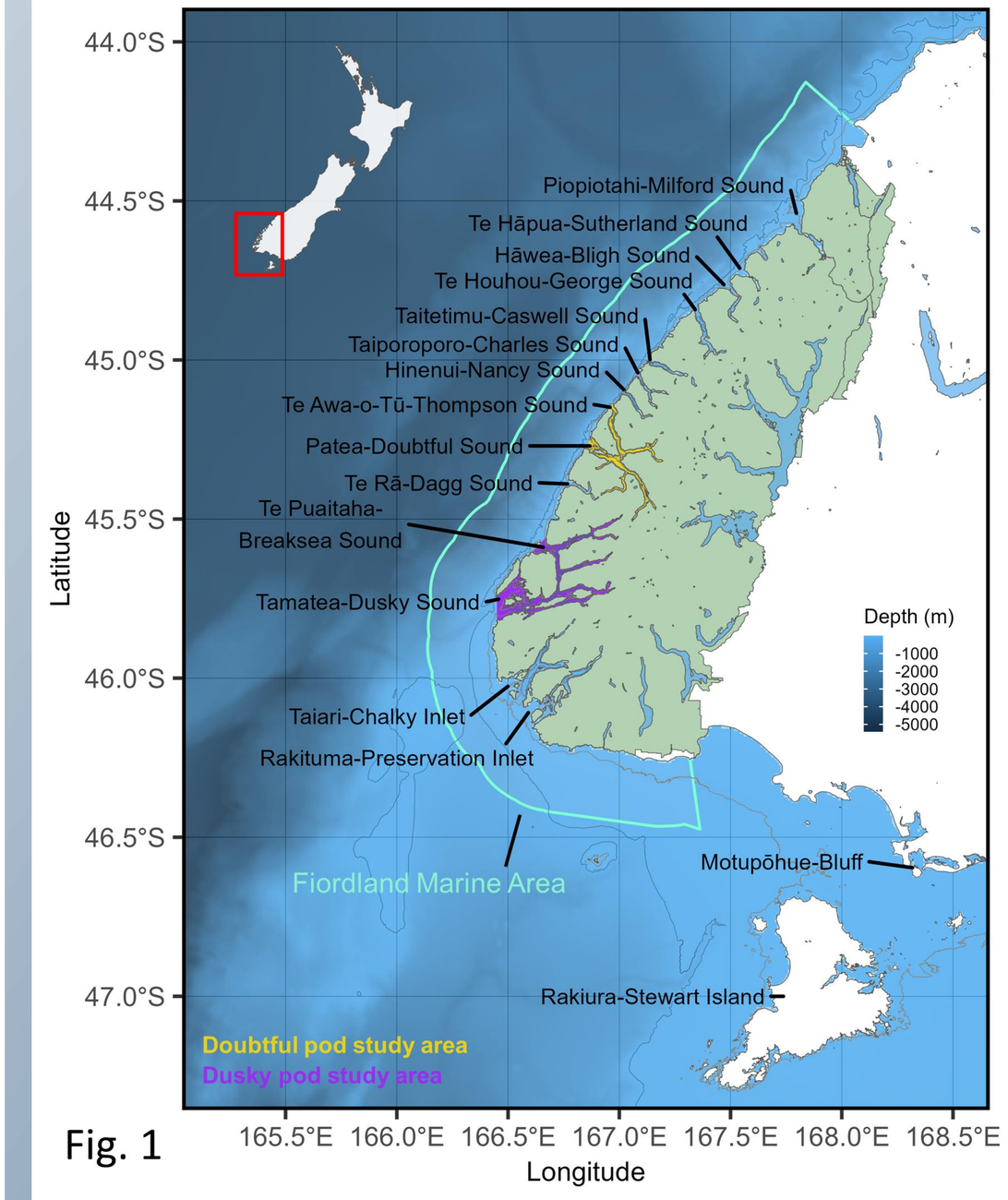

Fig. 1

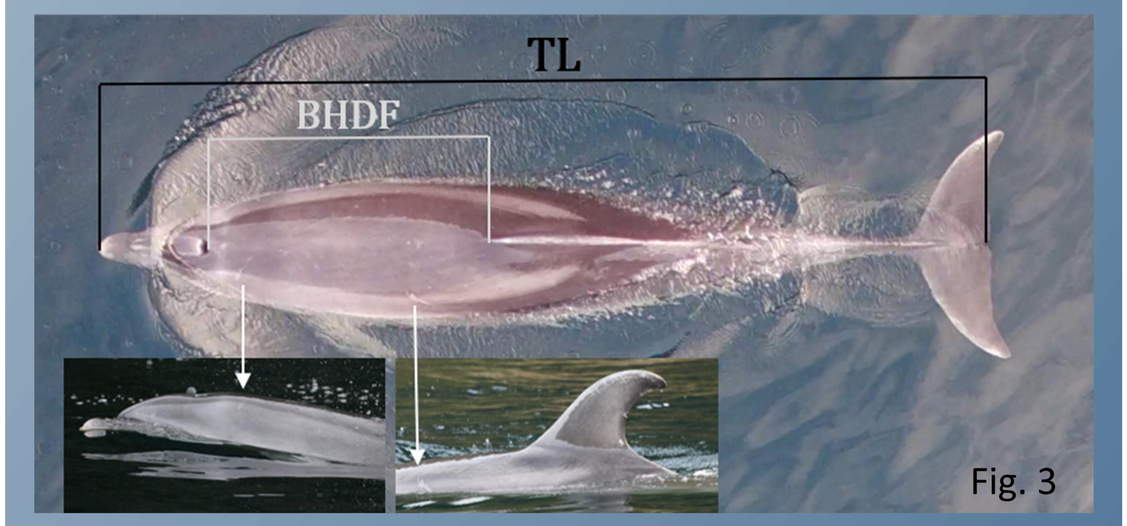

Fig. 3

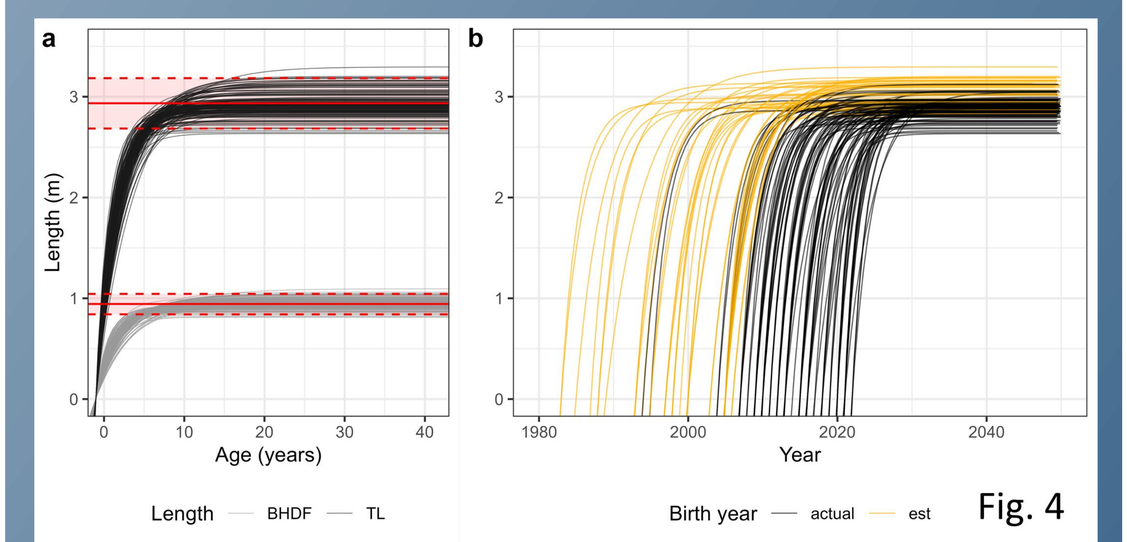

Fig. 4

Fig. 2

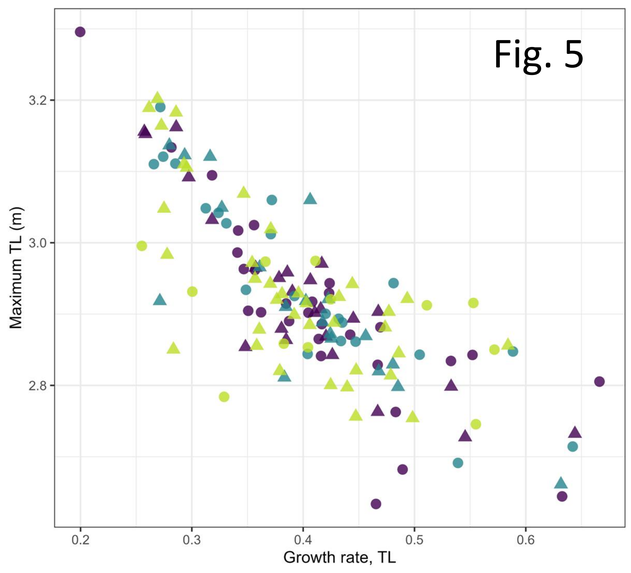

Fig. 5

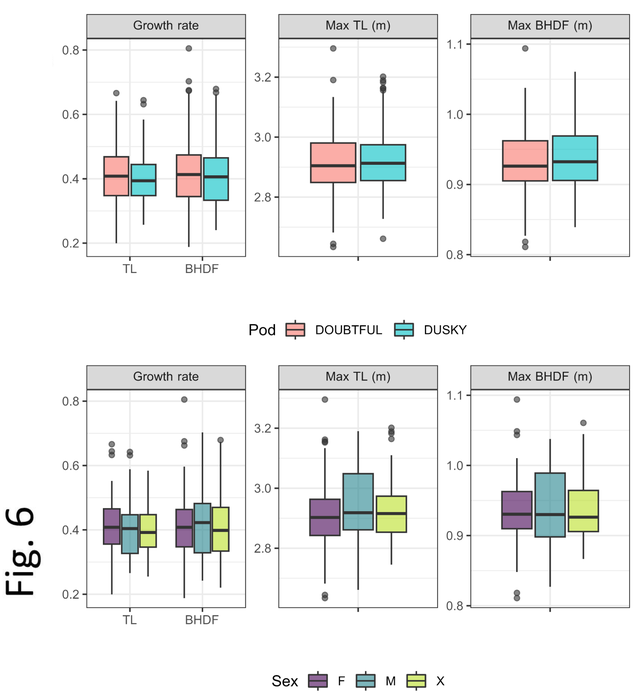

Fig. 6

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