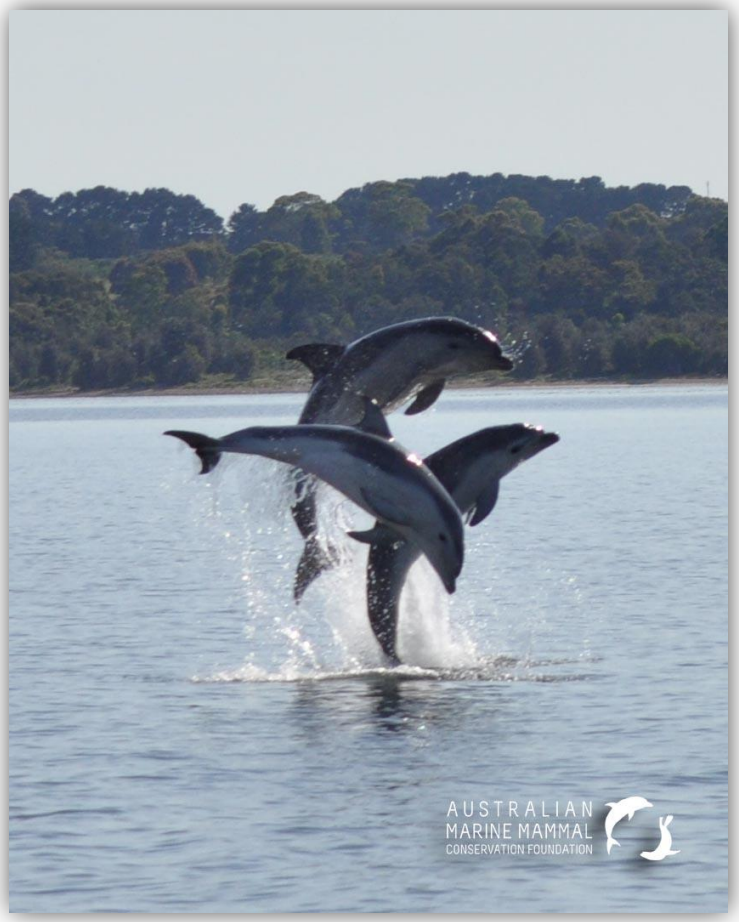
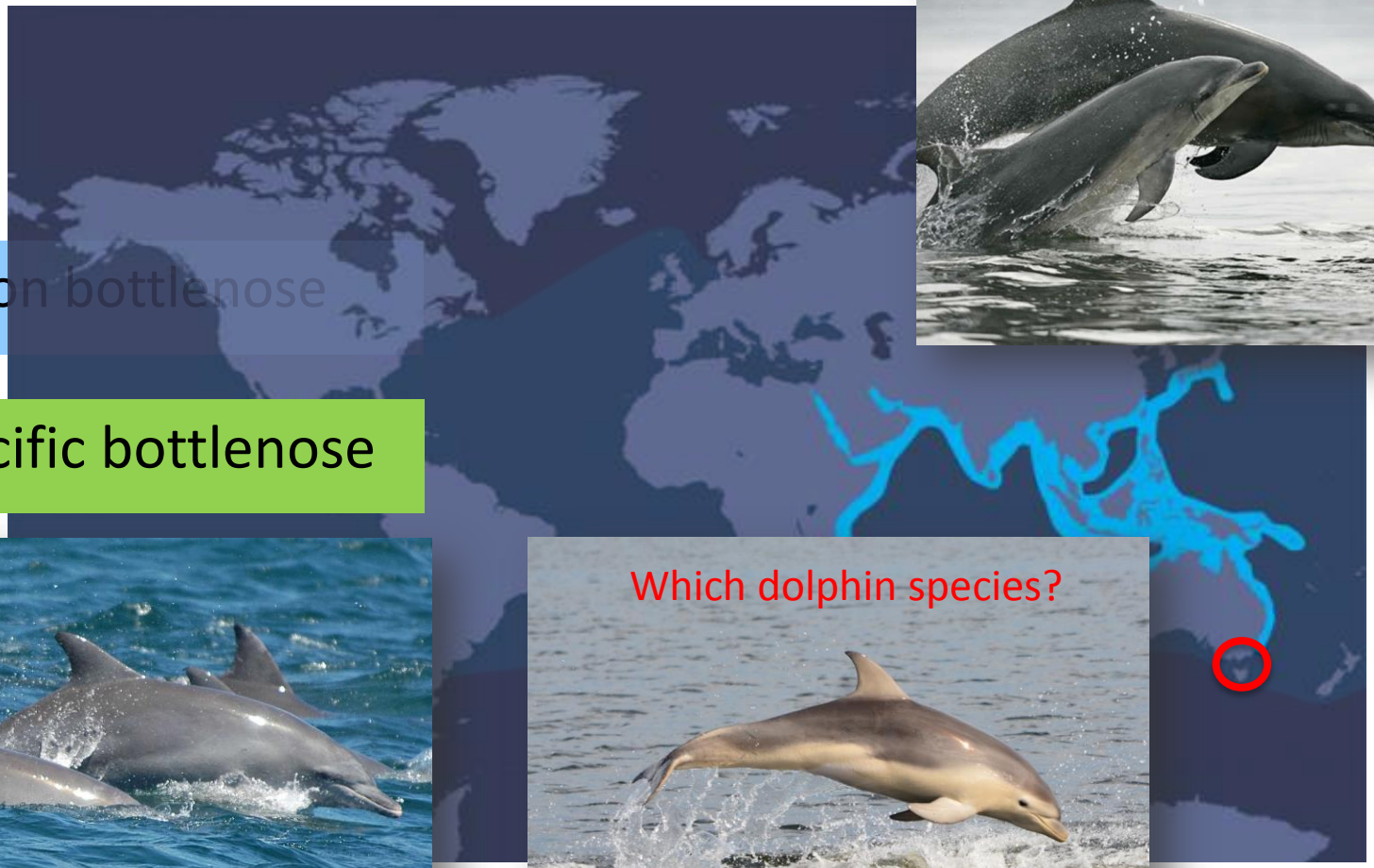
AUSTRALIAN MARINE MAMMAL CONSERVATION FOUNDATION



The Burrunan dolphin *Tursiops australis* Gippsland Lakes

Dr Kate Charlton-Robb
Angus Henderson

Tursiops species



Common bottlenose

Indo – Pacific bottlenose

Tursiops australis – Burrunan dolphin

New species

- *Tursiops australis* – Burrunan dolphin
- Multiple lines of genetic and morphological evidence

- Endemic to southern & south-eastern Australia

- Distribution
  - Victoria
  - Tasmania
  - South Australia

OPEN ACCESS Freely available online PLoS one

A New Dolphin Species, the Burrunan Dolphin *Tursiops australis* sp. nov., Endemic to Southern Australian Coastal Waters

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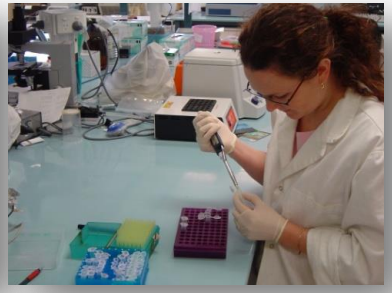
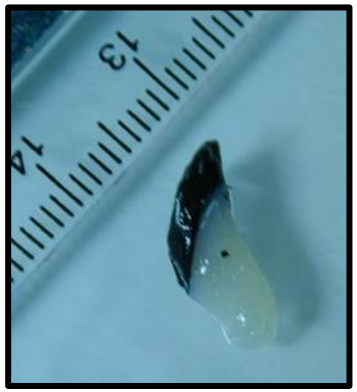
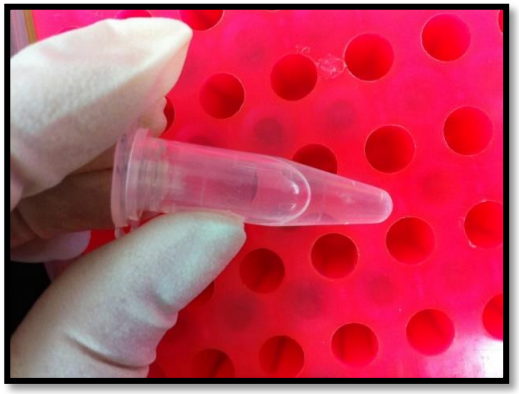
Abstract

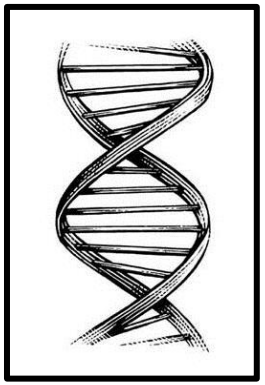
Small coastal dolphins endemic to south-eastern Australia have variously been assigned to described species *Tursiops truncatus*, *T. aduncus* or *T. maugeanus*; however the specific affinities of these animals is controversial and have recently been questioned. Historically 'the southern Australian *Tursiops*' was identified as unique and was formally named *Tursiops maugeanus* but was later synonymised with *T. truncatus*. Morphologically, these coastal dolphins share some characters with both aforementioned recognised *Tursiops* species, but they also possess unique characters not found in either. Recent mtDNA and microsatellite genetic evidence indicates deep evolutionary divergence between this dolphin and the two currently recognised *Tursiops* species. However, in accordance with the recommendations of the Workshop on Cetacean Systematics, and the Unified Species Concept the use of molecular evidence alone is inadequate for describing new species. Here we describe the macro-morphological, colouration and cranial characters of these animals, assess the available and new genetic data, and conclude that multiple lines of evidence clearly indicate a new species of dolphin. We demonstrate that the syntype material of *T. maugeanus* comprises two different species, one of which is the historical 'southern form of *Tursiops*' most similar to *T. truncatus*, and the other is representative of the new species and requires formal classification. These dolphins are here described as *Tursiops australis* sp. nov., with the common name of 'Burrunan Dolphin' following Australian aboriginal narrative. The recognition of *T. australis* sp. nov. is particularly significant given the endemism of this new species to a small geographic region of southern and south-eastern Australia, where only two small resident populations in close proximity to a major urban and agricultural centre are known, giving them a high conservation value and making them susceptible to numerous anthropogenic threats.

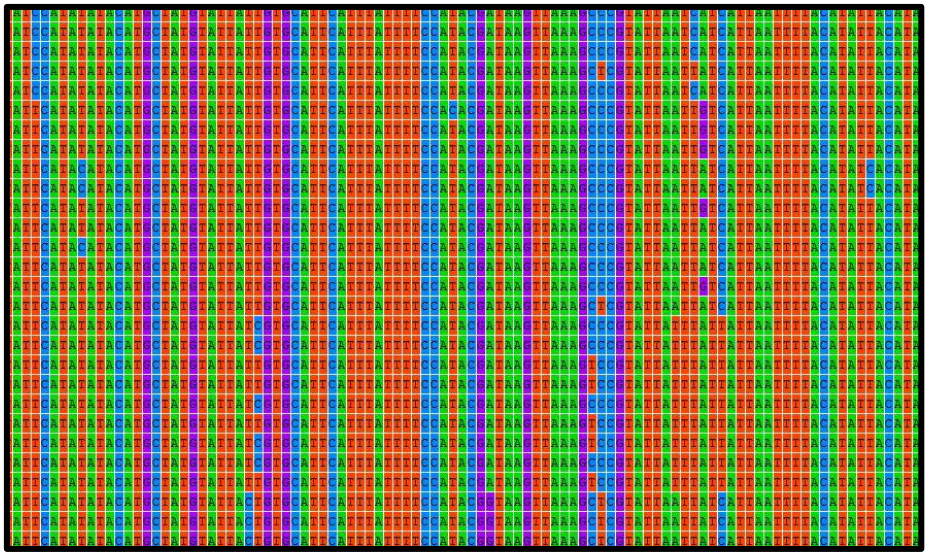


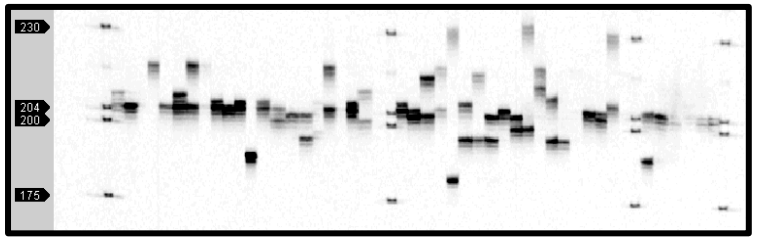
Genetics – dolphin DNA

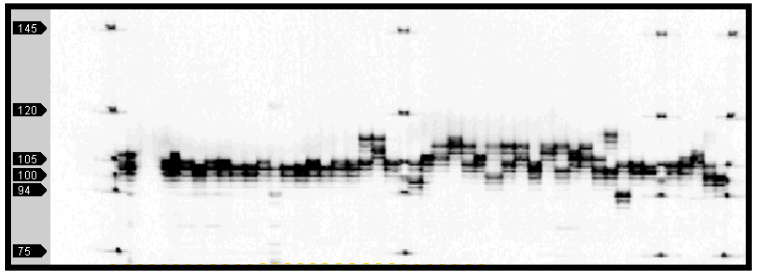


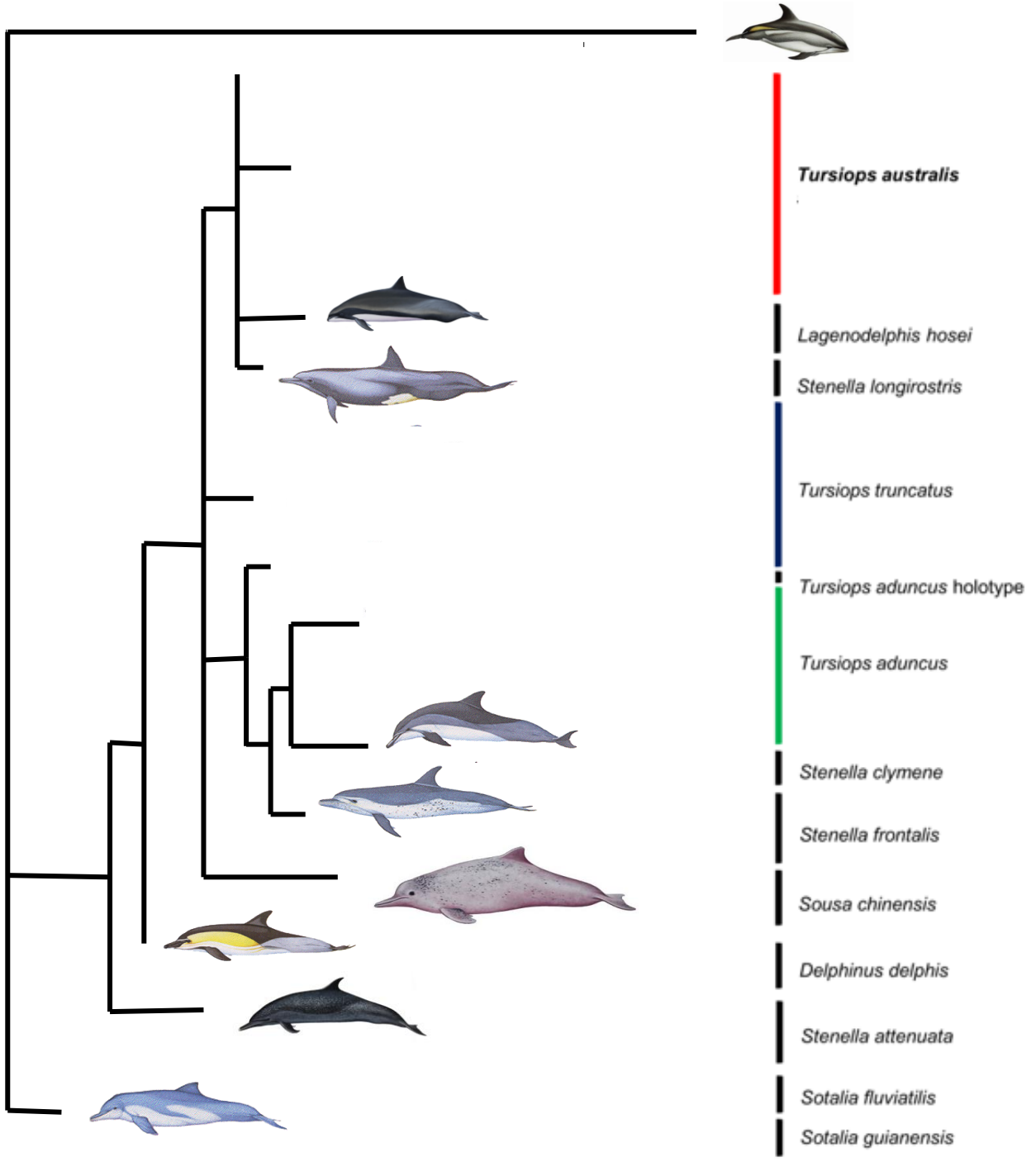




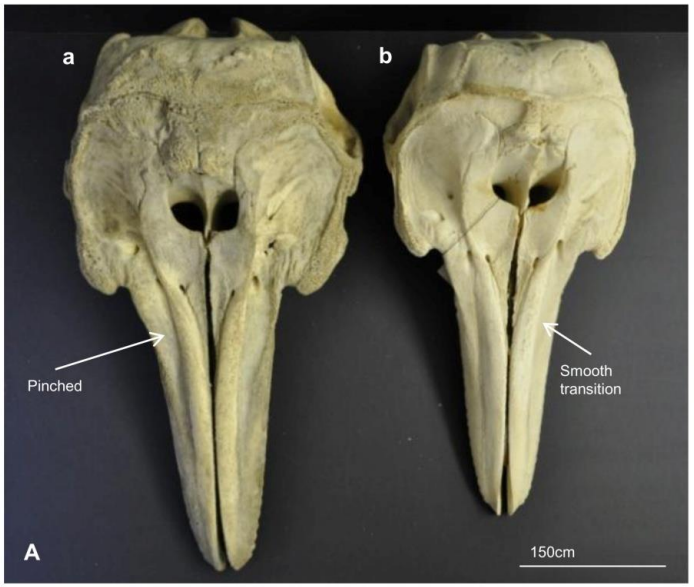


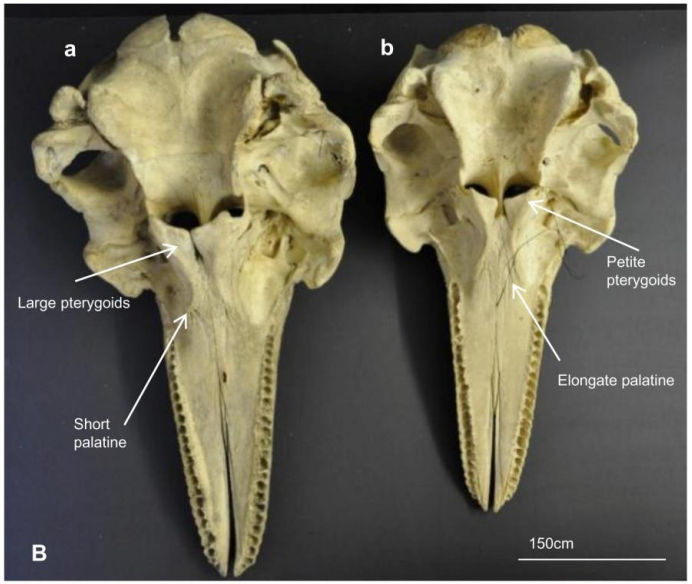


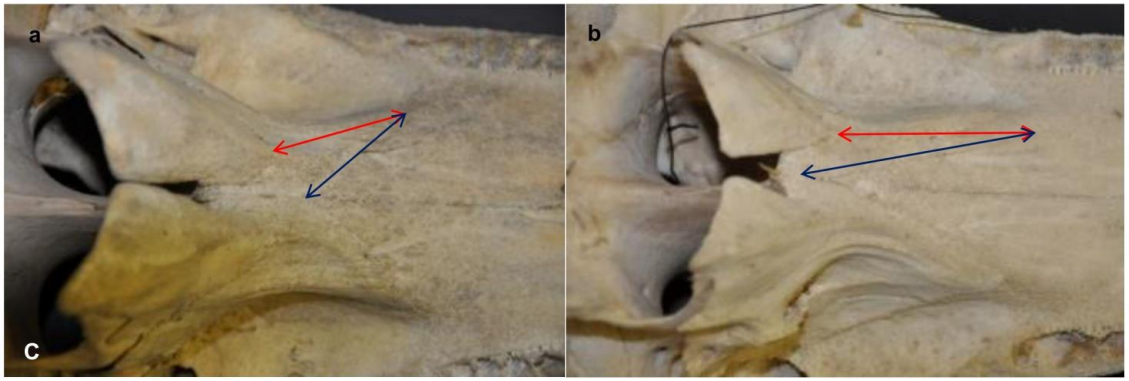


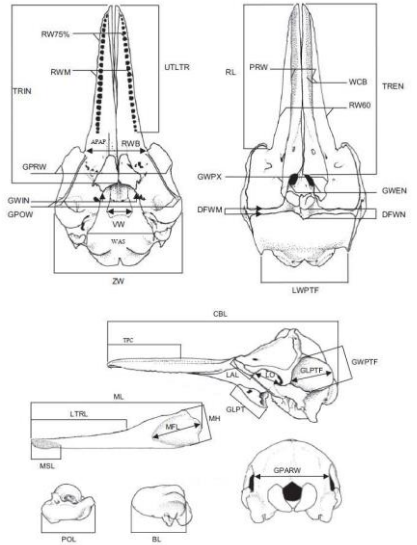

Tursiops australis
Lagenodelphis hosei
Stenella longirostris
Tursiops truncatus
Tursiops aduncus holotype
Tursiops aduncus
Stenella clymene
Stenella frontalis
Sousa chinensis
Delphinus delphis
Stenella attenuata
Sotalia fluviatilis
Sotalia guianensis

Cranial morphology









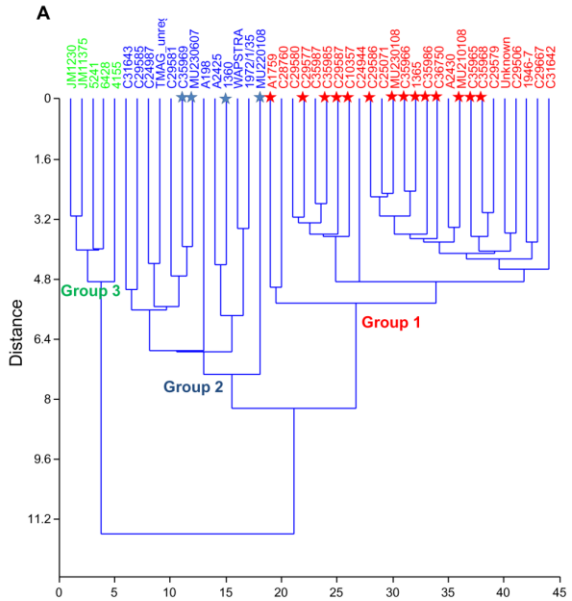
Modified from Kemper (2004)

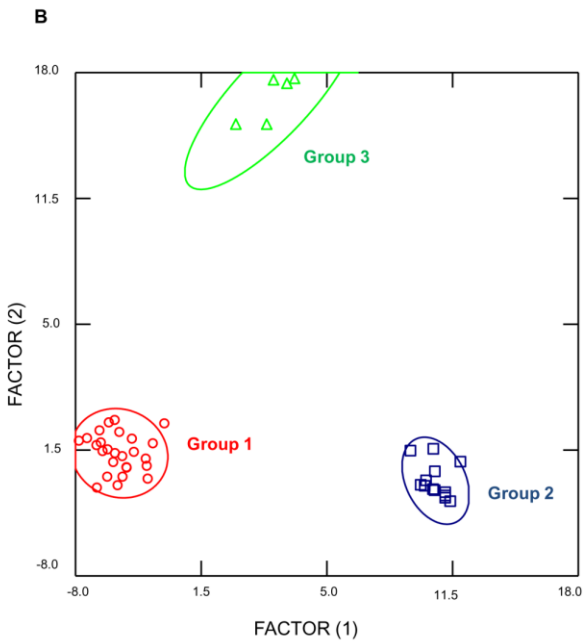
- 40 cranial measurements & tooth counts
- 44 specimens of ‘bottlenose’ dolphin
- Qualitative traits

External morphology

- 14 external measurements
- 17 complete adult ‘bottlenose’ dolphin
- Multiple locations across coastal Victoria

- Genetic sampling also conducted





Hierarchical multivariate cluster analyses

Discriminant function analyses

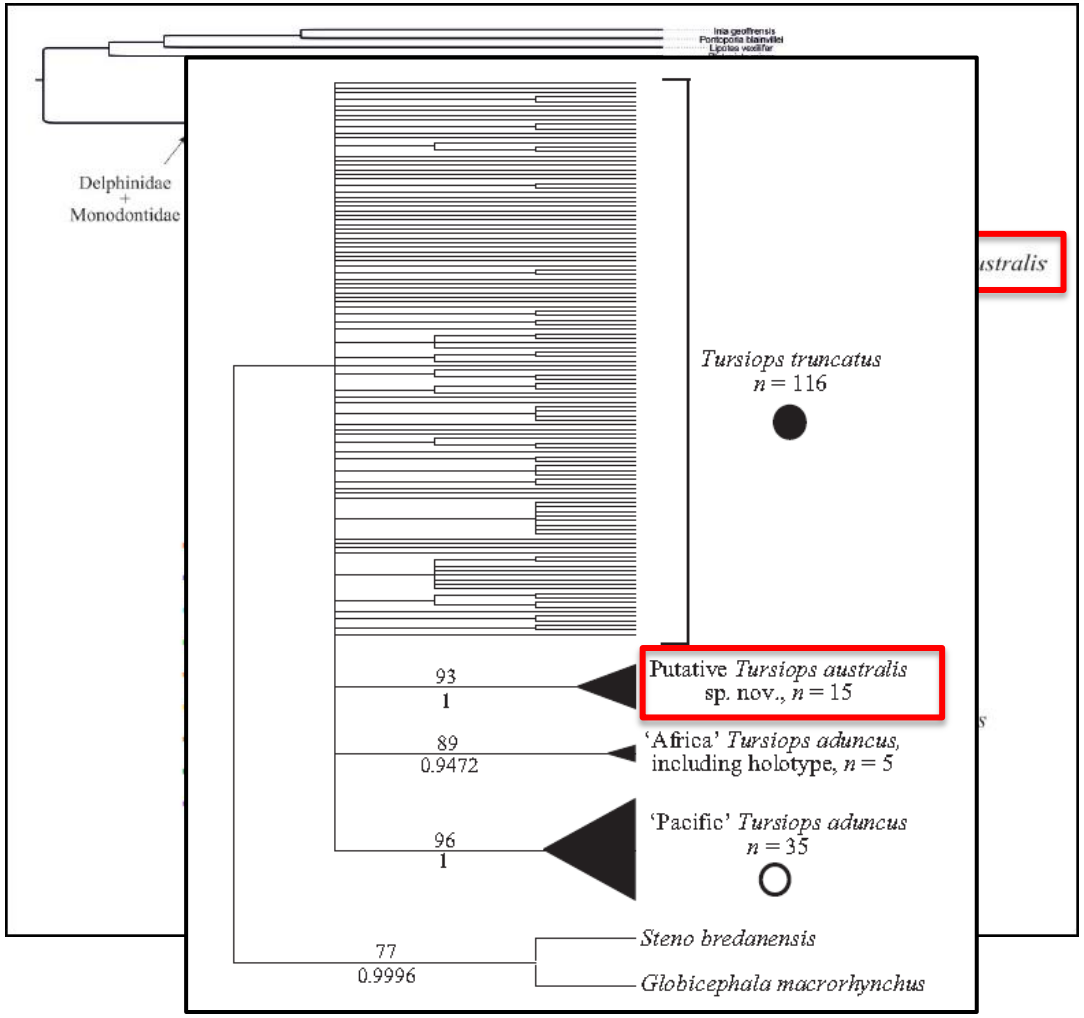
Recent research

Moura et al. (2013) Syst Biol.

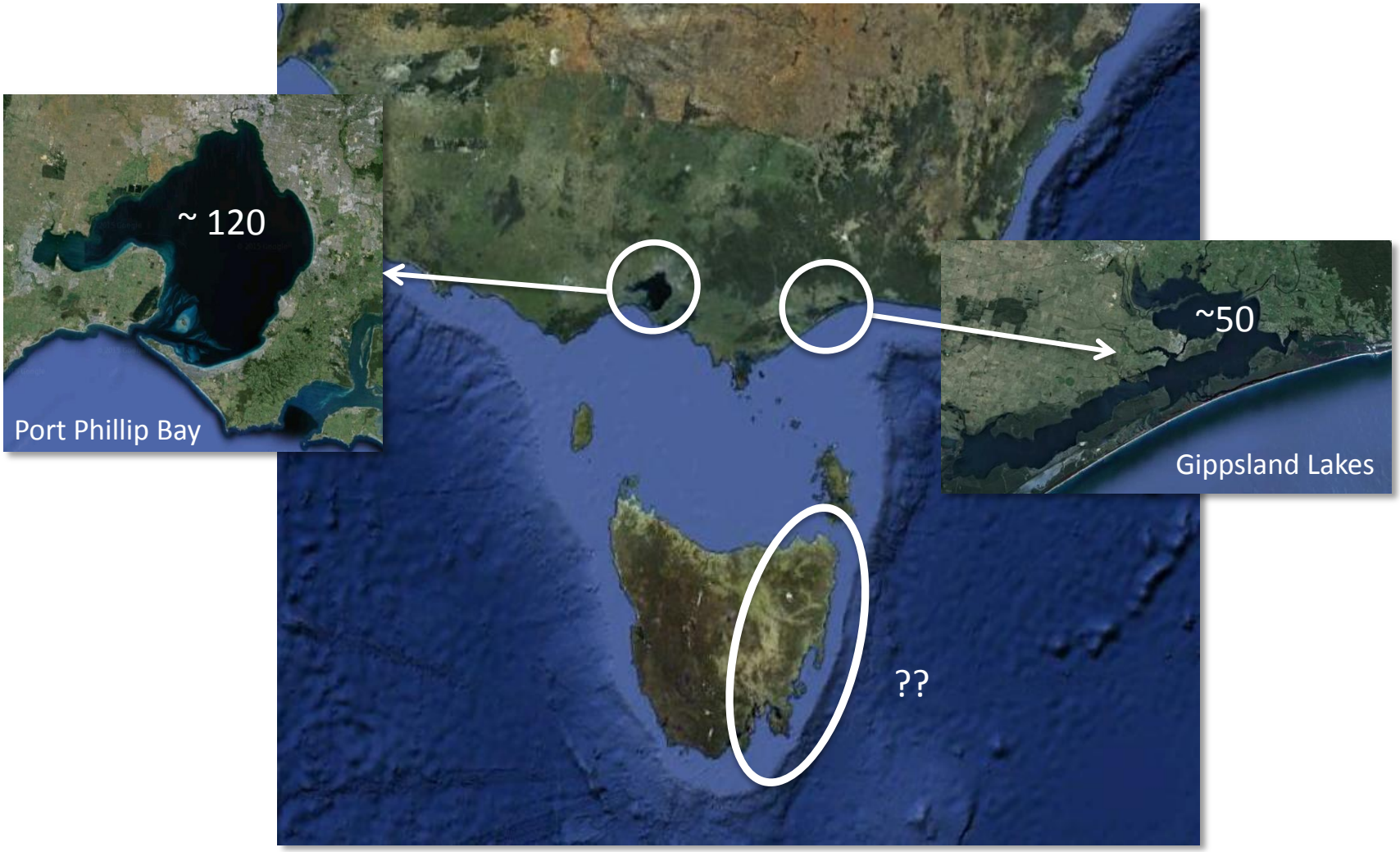
- The earliest node defining the *Tursiops* lineage was *T. australis* at ~1.086 Ma
- "the deepest *Tursiops* node has strong support for an Australasian origin"

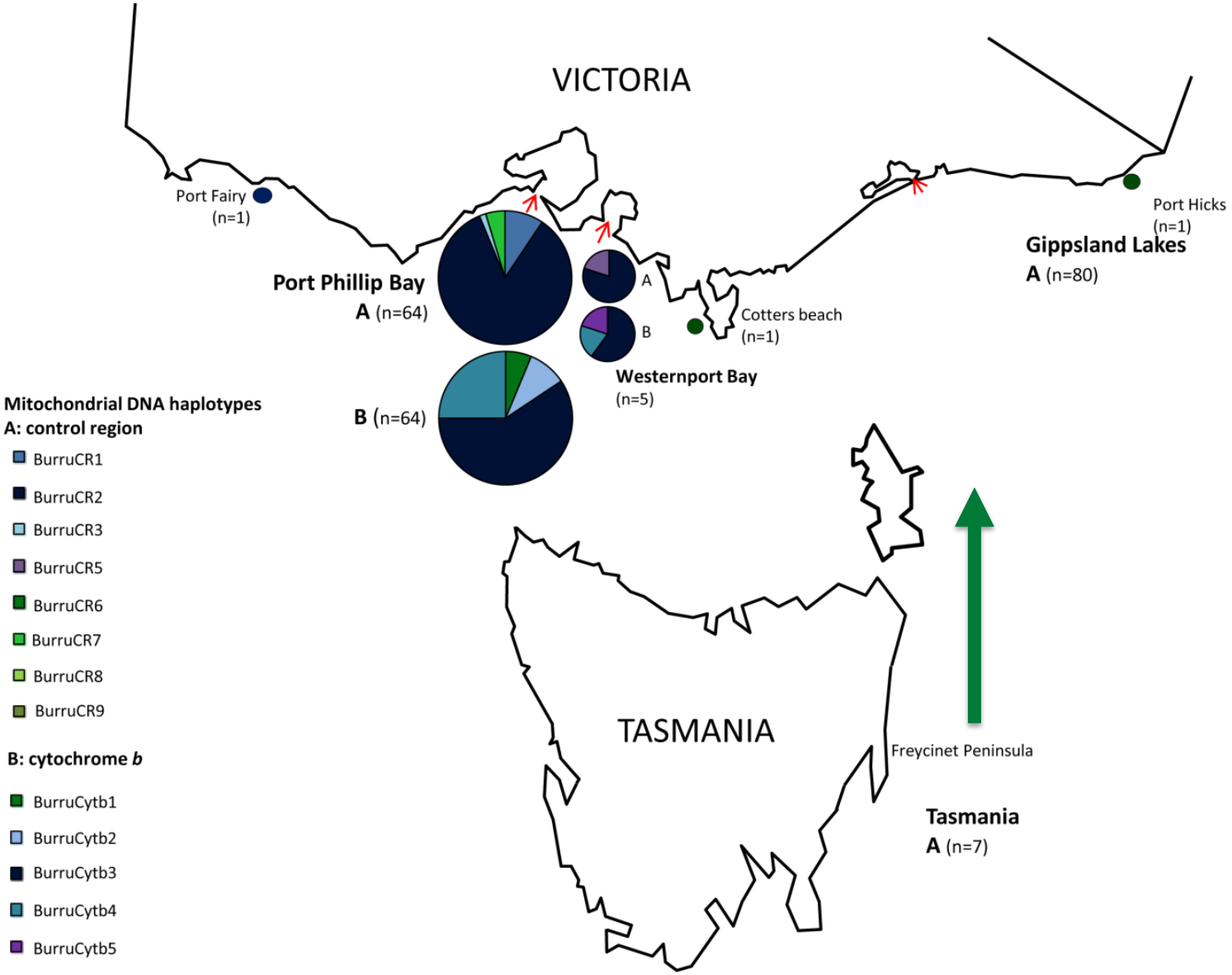
Oremus et al. (2015) Mar Mam Sci.

- Phylogenetic reconstructions and measures of evolutionary distances clearly support the distinctiveness of "Pacific" *T. aduncus*, "African" *T. aduncus*, *T. truncatus*, and putative *T. australis* sp. nov.



Burrunan dolphin populations




VICTORIA
Port Fairy
(n=1)
Port Phillip Bay
A (n=64)
B (n=64)
A
B
Westernport Bay
(n=5)
Cotters beach
(n=1)
Port Hicks
(n=1)
Gippsland Lakes
A (n=80)
Mitochondrial DNA haplotypes
A: control region
BurruCR1
BurruCR2
BurruCR3
BurruCR5
BurruCR6
BurruCR7
BurruCR8
BurruCR9
B: cytochrome b
BurruCytb1
BurruCytb2
BurruCytb3
BurruCytb4
BurruCytb5
TASMANIA
Freycinet Peninsula
Tasmania
A (n=7)

Conserv Genet
DOI 10.1007/s10592-014-0652-6

RESEARCH ARTICLE

Population genetic structure of the Burrunan dolphin (*Tursiops australis*) in coastal waters of south-eastern Australia: conservation implications

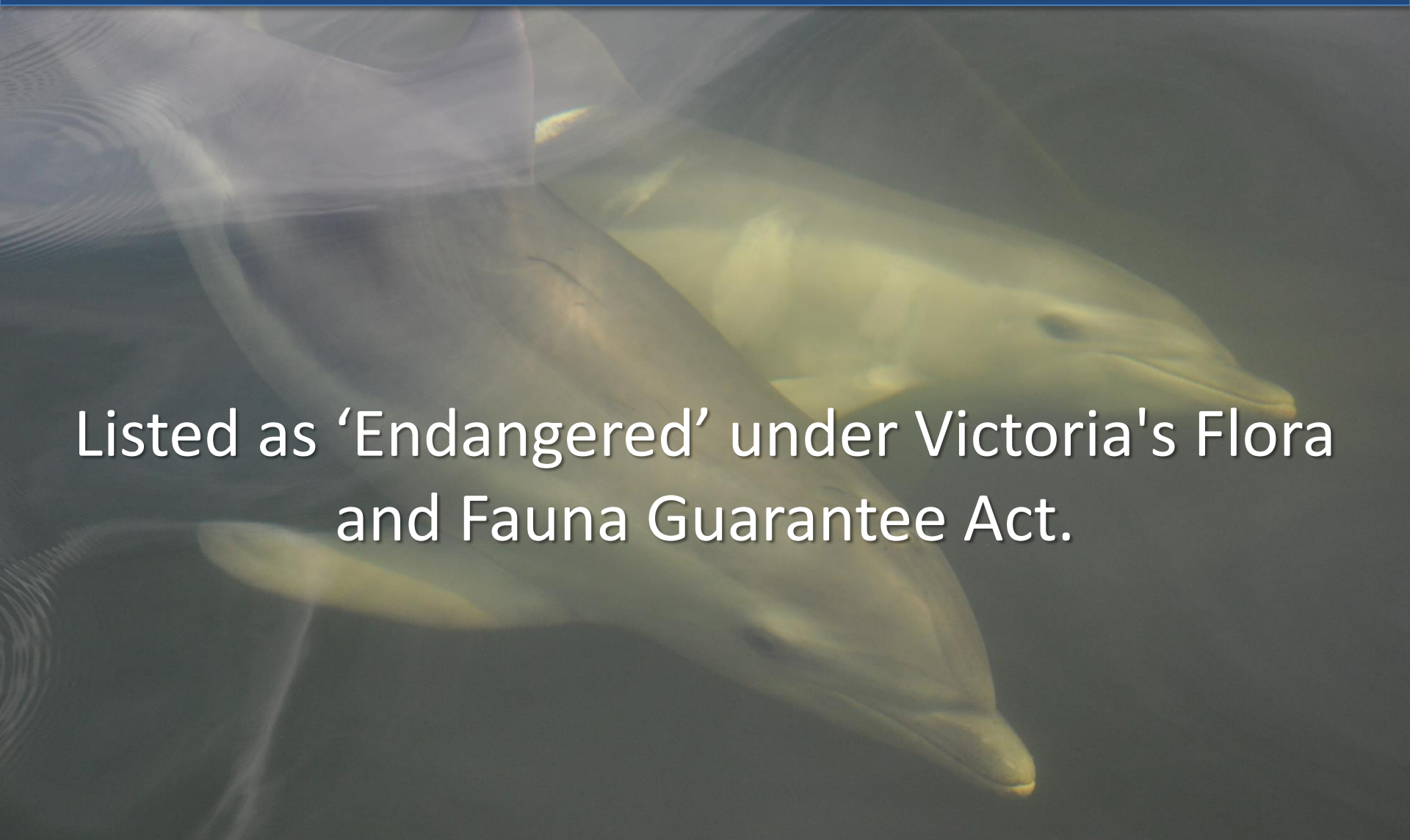
K. Charlton-Robb · A. C. Taylor · S. W. McKechnie

- Contemporary effective population size (Ne)
  - PPB is 81.5 (95 % CI 30.6–290.1; harmonic mean sample size = 51.8)
  - GIPS/TAS is 65.5 (95 % CI 38.3–144.5; harmonic mean sample size = 66.1)
- GIPS Maternal based
- PPB Natal philopatry
- Distinct population differentiation
- Little migration
- Low genetic variation

CONSERVATION CONCERN

Populations	F_{ST}	Φ_{ST}
PPB-GIPS	0.4137***	0.6094***
PPB-TAS	0.3914***	0.5573***
GIPS-TAS	0.3883***	0.0419

Burrunan dolphin



Listed as ‘Endangered’ under Victoria's Flora and Fauna Guarantee Act.

Project Burrunan Aims

Abundance estimate
- Fin photo-identification
- Capture-recapture modeling
- Robust Design

Maternal philopatry

Calving rate

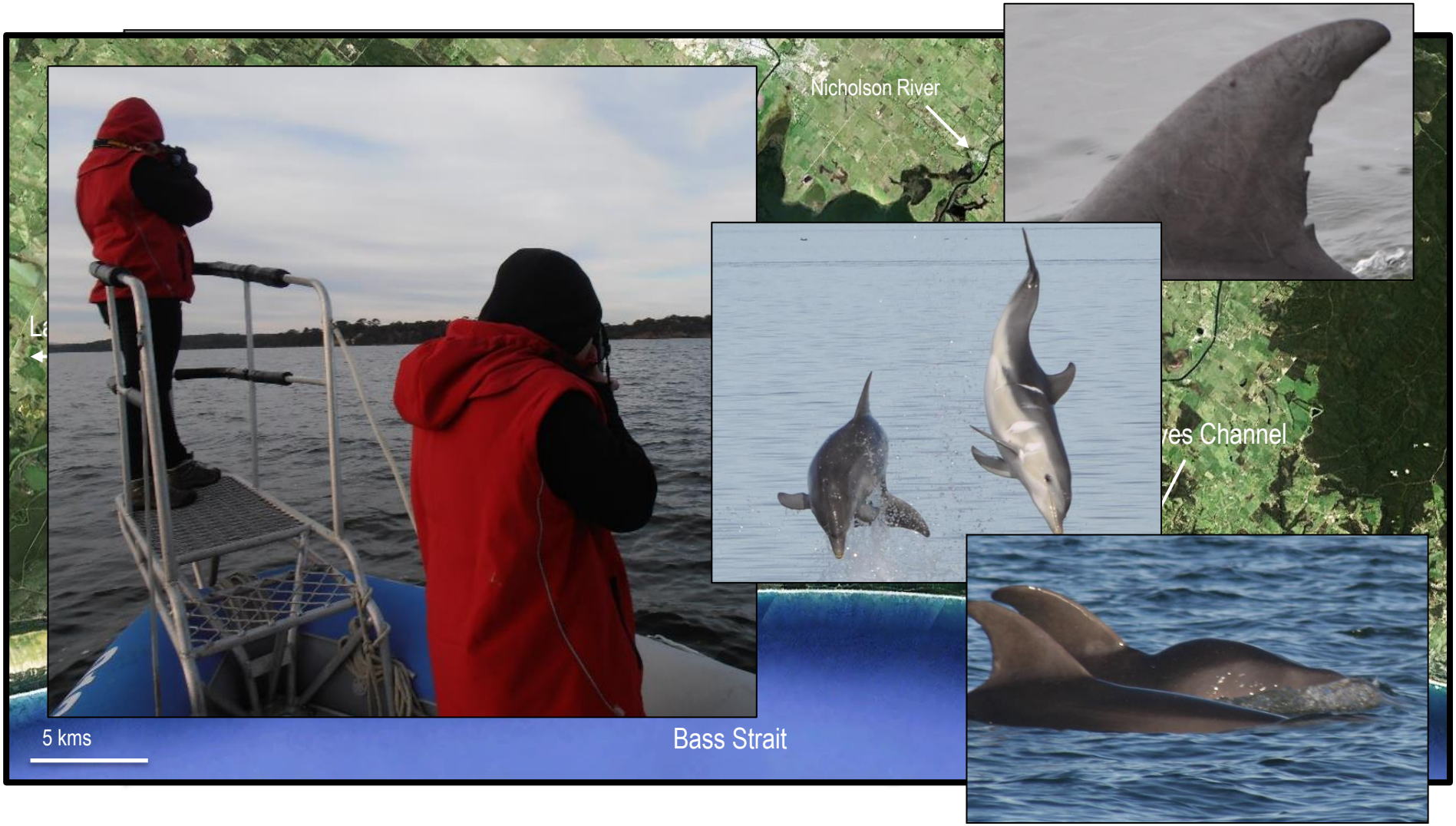
Seasonal Variation in Habitat Use

Migration levels

Population & Conservation genetics

Assess conservation status
- IUCN Red List
- Classified as ‘Endangered’ (Victoria only)

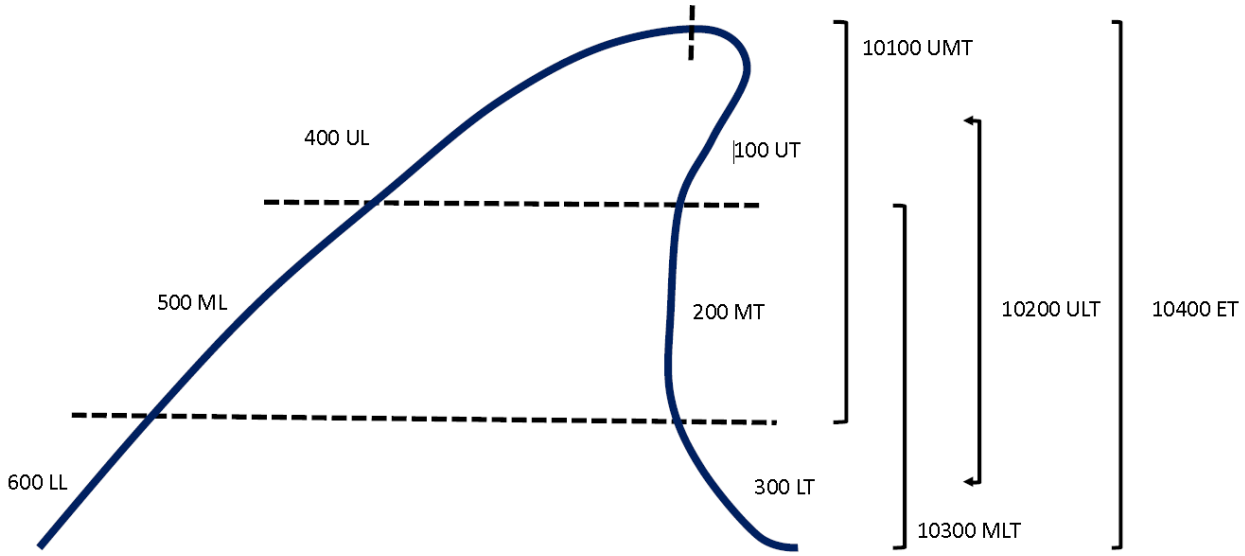
Photo Identification











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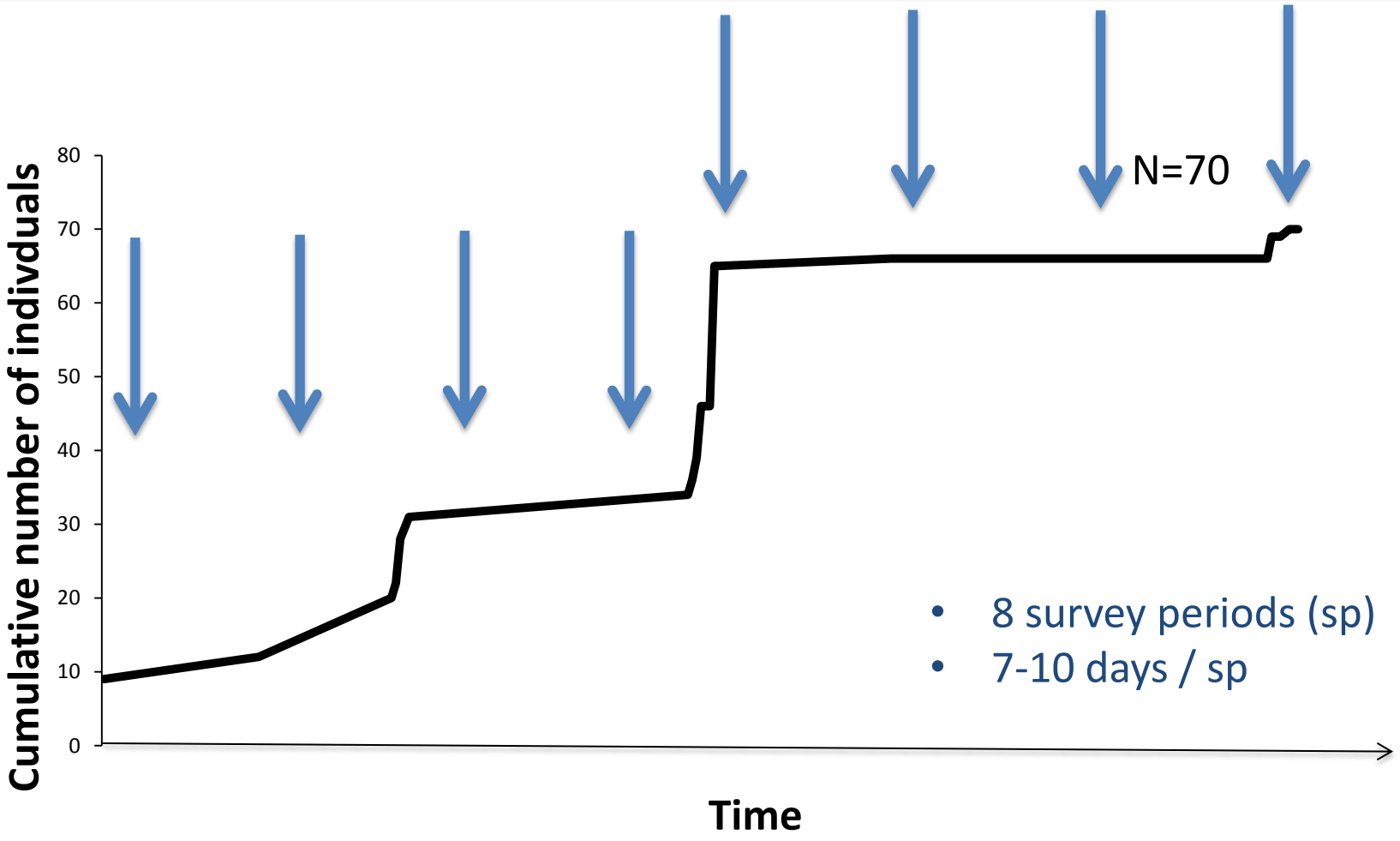
research•protection•conservation

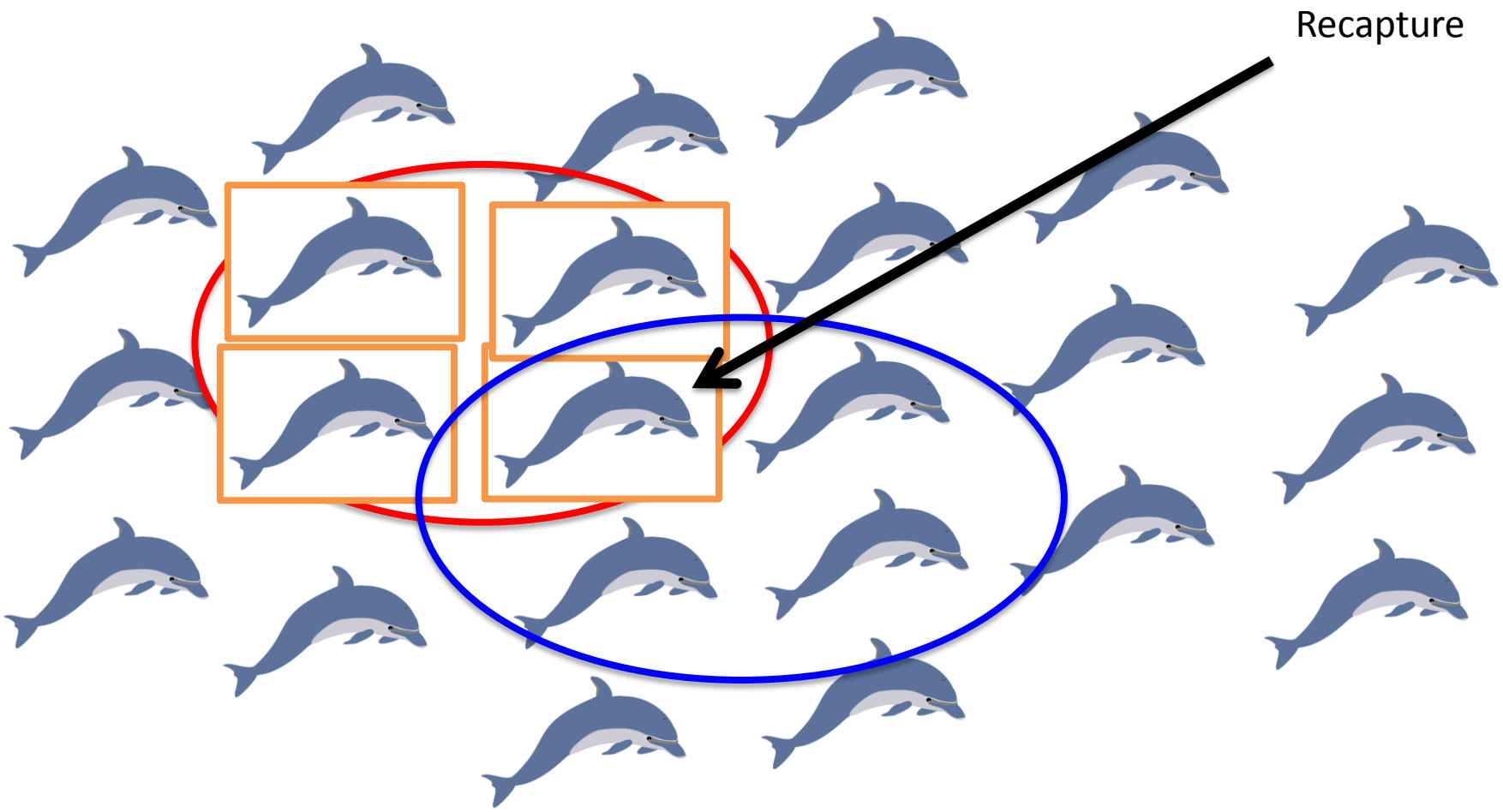
100 UT Upper Trailing
200 MT Mid Trailing
300LT Lower Trailing
400 UL Upper Leading
500 ML Mid Leading
600 LL Lower Leading

10100 UMT Upper Mid Trailing
10200 ULT Upper Lower Trailing
10300 MLT Mid Lower Trailing
10400 ET Entire Trailing
10500 SP Scaring/Pigmentation
10600 D Deformity

Discovery Curve 2014



Robust Design

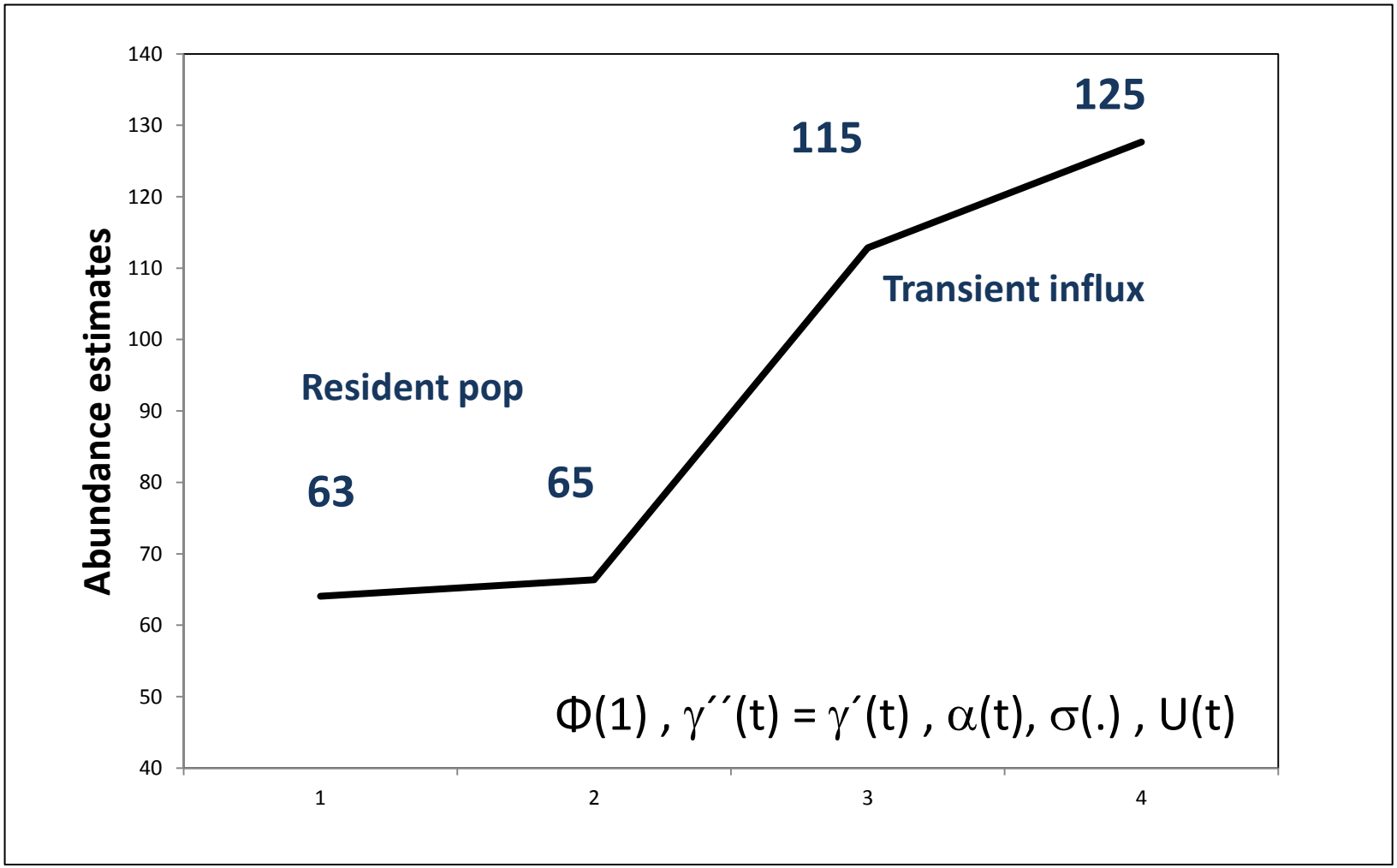


Top Model

$$\Phi(1) , \gamma''(t) = \gamma'(t) , \alpha(t), \sigma(.) , U(t)$$

- Φ – Apparent Survival
- γ'' – Emigration given a previous state of observed
- γ' – Emigration given a previous state of unobserved
- α – Resight rate (survey effort)
- σ – Error in resight rate
- U – Unmarked individuals

Abundance Estimates



Transients

Cumulative No. of marked IDs
80
70
60
50
40
30
20
10
0
January
July
September
December
Time
Male mediated gene flow
Heavily marked - July
Less marked – later second ‘wave’
~19% emigration rate

Calving Rate

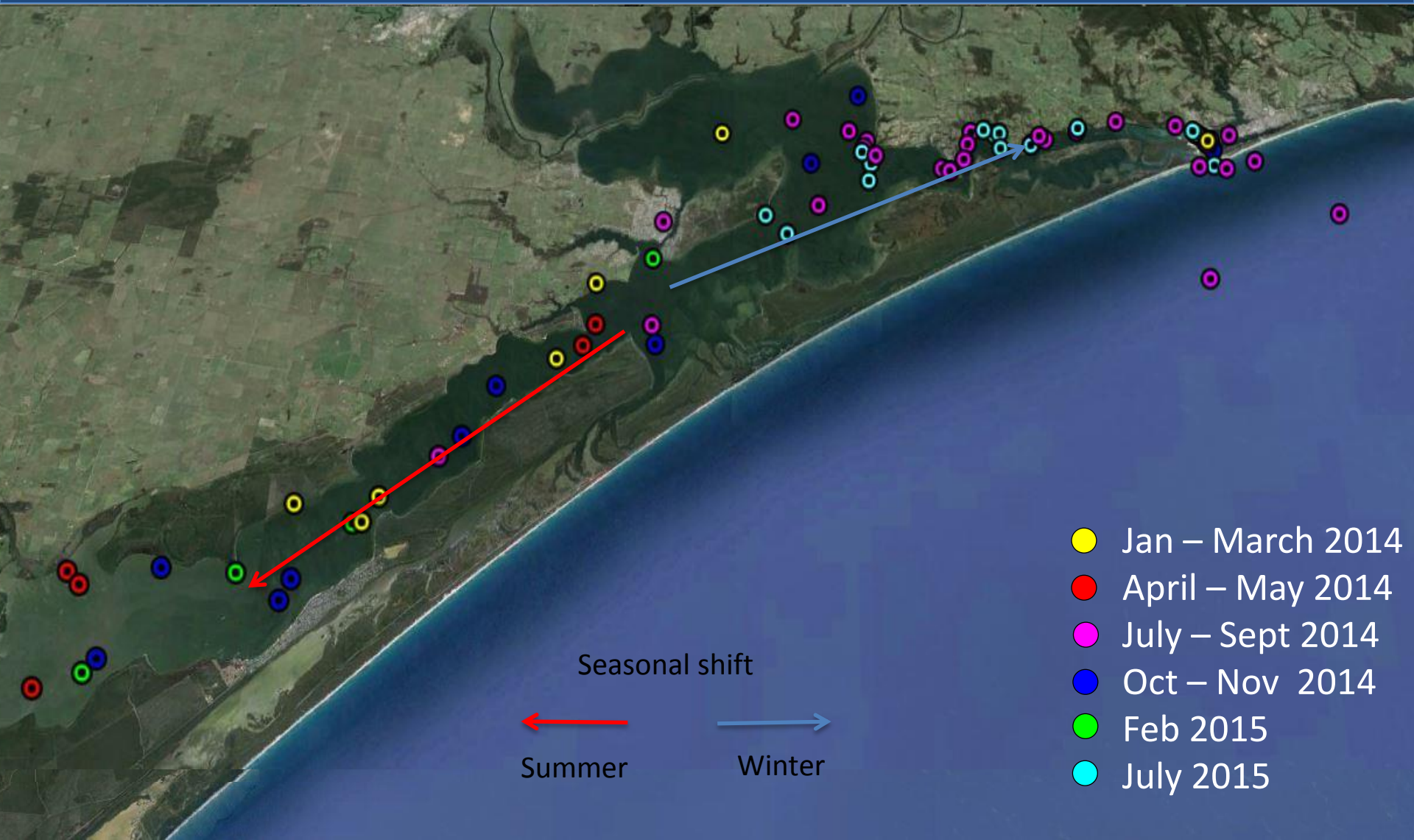
- 12 month gestation period
- Strong mother calf association 2 – 4 years
- Breed every 3-5 years

- 4 calves 2013
- 4 calves 2014
- ‘Boom’ in 2015?

- Unusual winter calving
- Linked to male transients

- Up to 50% mortality?
- Population viability assessments

Seasonal Variation

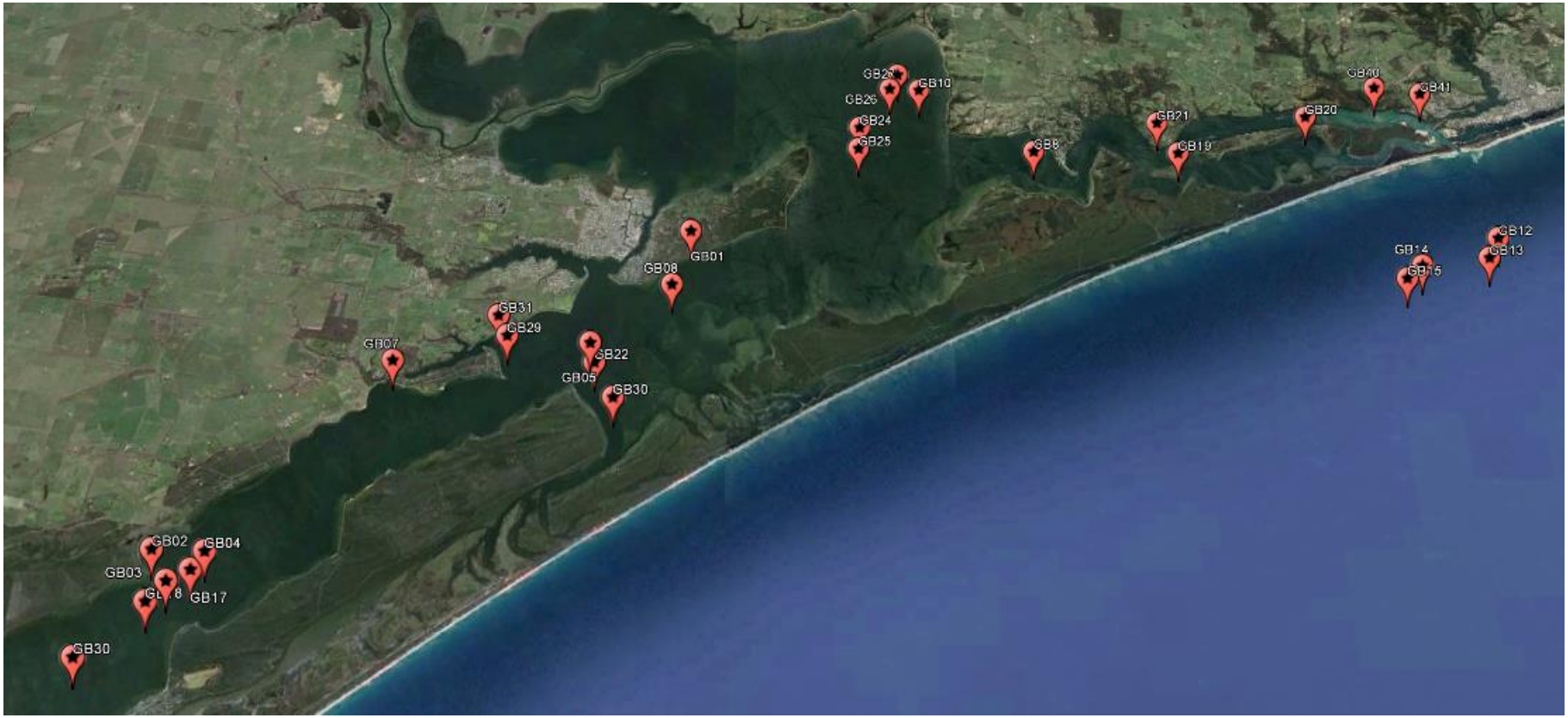


Seasonal Variation

Possible drivers for seasonal variation

- Mating strategy
- Prey availability
- Environmental conditions
- Anthropogenic impacts
  - Lakes Entrance visitor numbers double summer vs winter
    (50,268 and 23,297 respectively)
  - boat traffic known to disrupt important feeding, breeding, socialising and resting activities
  - increase in the number of boat interaction resulted in a 49% reduction in foraging activity (Scotland)

Genetic samples



Genetic samples

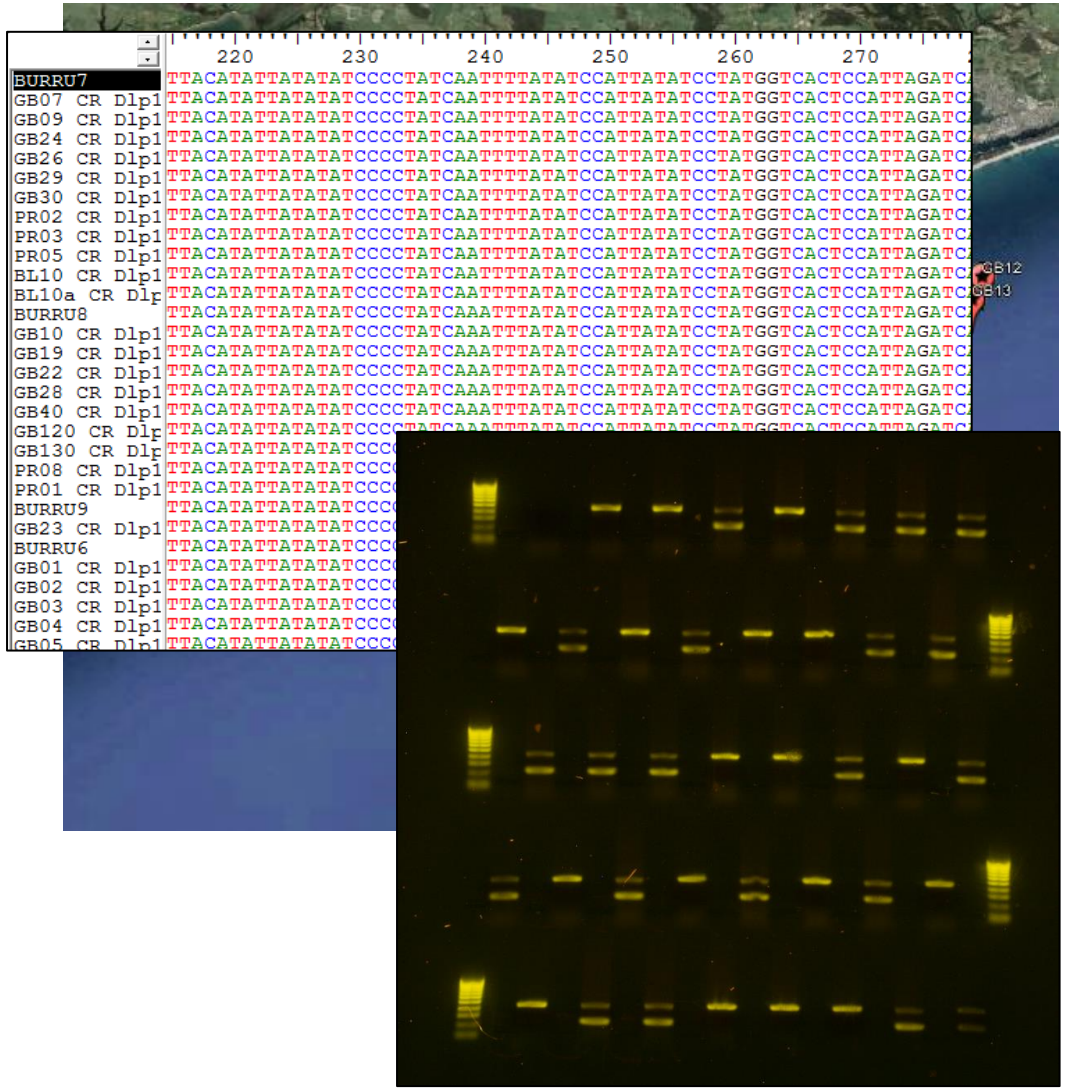
Gippsland Lakes

- Matched to catalogue for individual DNA profiling
- Mating strategy…next years calves
- mtDNA control region
  - Four haplotypes
  - No new haplotypes
- mtDNA Cyt b
  - One haplotype

Offshore & Wilson's Prom

- Male and Female
- New haplotype!
- Offshore population/s?
- Transient dolphins both sexes?

- Next Gen sequencing underway



Conclusions

Abundance estimate
- 65 resident individuals
- Seasonal doubling to 125

Maternal philopatry
- Added evidence
- Unusual male migration

Calving rate
- 8 calves 2013-14
- 2015 boom?
- Unusual winter calving

Seasonal Variation
- Clear shift in distribution

- Very small population size
- Important migration
- Conservation concern

- Gippsland lakes breeding and nursery region
- Protection from predators

- Important for PVA's
- Up to 50% mortality?
- Conservation concern

- Response to human interactions?
- Breeding?
- Prey distribution?

Conclusions

Conservation Assessment – Gippsland Lakes

- Small geographically and demographically isolated population
- High levels of environmental variation
- High anthropogenic threats
- Migration of >300kms

IUCN Red List – Threatened Species Criteria

- Criterion B1.a
  - Fragmented populations with extent of occurrence <5000km^2

IUCN Red List – Threatened Population Criteria

- Criterion D (Number of mature individuals)
  - Endangered
  - Abundance <250

First formal population assessment since being formally described (Charlton-Robb et al. 2011)

Future Research

- Population Viability analyses
- Long term populations trends
- Where are transient animals are coming from?
- Mating strategies
- Drivers of seasonal habitat shift
- How many populations? Offshore/Wilson's Prom/Tasmania?

- Social alliances/associations patterns
  - Resident population
  - Transient animals

- Australian and international conservation recognition

Thanks for listening!

Fieldwork, data collection and analyses undertaken by AMMCF

Wildlife Act 1975 Research Permit: Number 10006800

Animal Ethics BSCI/2008/21 & WSI AEC #33.14

Thanks to Gippsland Lakes Environmental Fund & AMMCF volunteers