Taxonomy and Phylogenetics of Alaskan *Aegialites* Beetles

Casey Bickford & Derek Sikes
University of Alaska Museum

Introduction and Rationale

- Coleoptera: Salpingidae: Aegialitinae
- Northern Pacific distribution
- Found in intertidal rock crevices
- Very habitat specific
- Lack wings

Introduction and Rationale

- "All species of the genus are local endemics" (Zerche 2004)
  - No species known from more than one location
- Over-splitting?
  - Described species based on male genitalia
  - Slide mounted genitalia preparations not consistently aligned
- Under-sampling error?
  - Rarely collected
  - 414 specimens examined
  - Only 4 Alaskan populations examined and described
  - May have missed populations of the same species occurring nearby

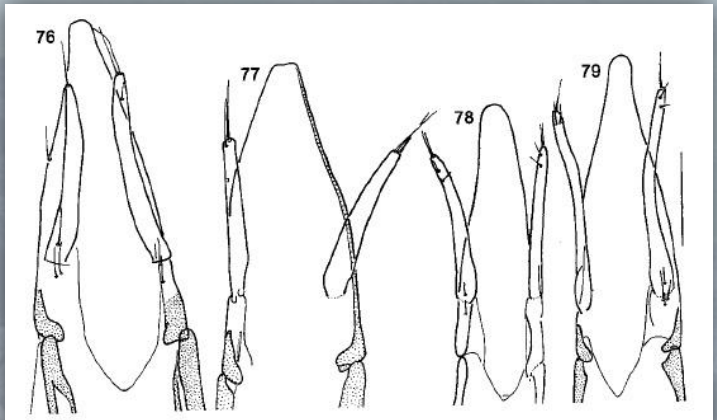


Abb.76–79. *Aegialites* spp., Tegmen, apikaler Teil. – 76. *A. saintpaulensis* n. sp., Paratypus. 77. *A. beringensis* n. sp., Holotypus. 78. *A. steynegeri*, Topotypus. 79. *A. shumshuensis* n. sp., Holotypus. – Maßstab: 0,1 mm.

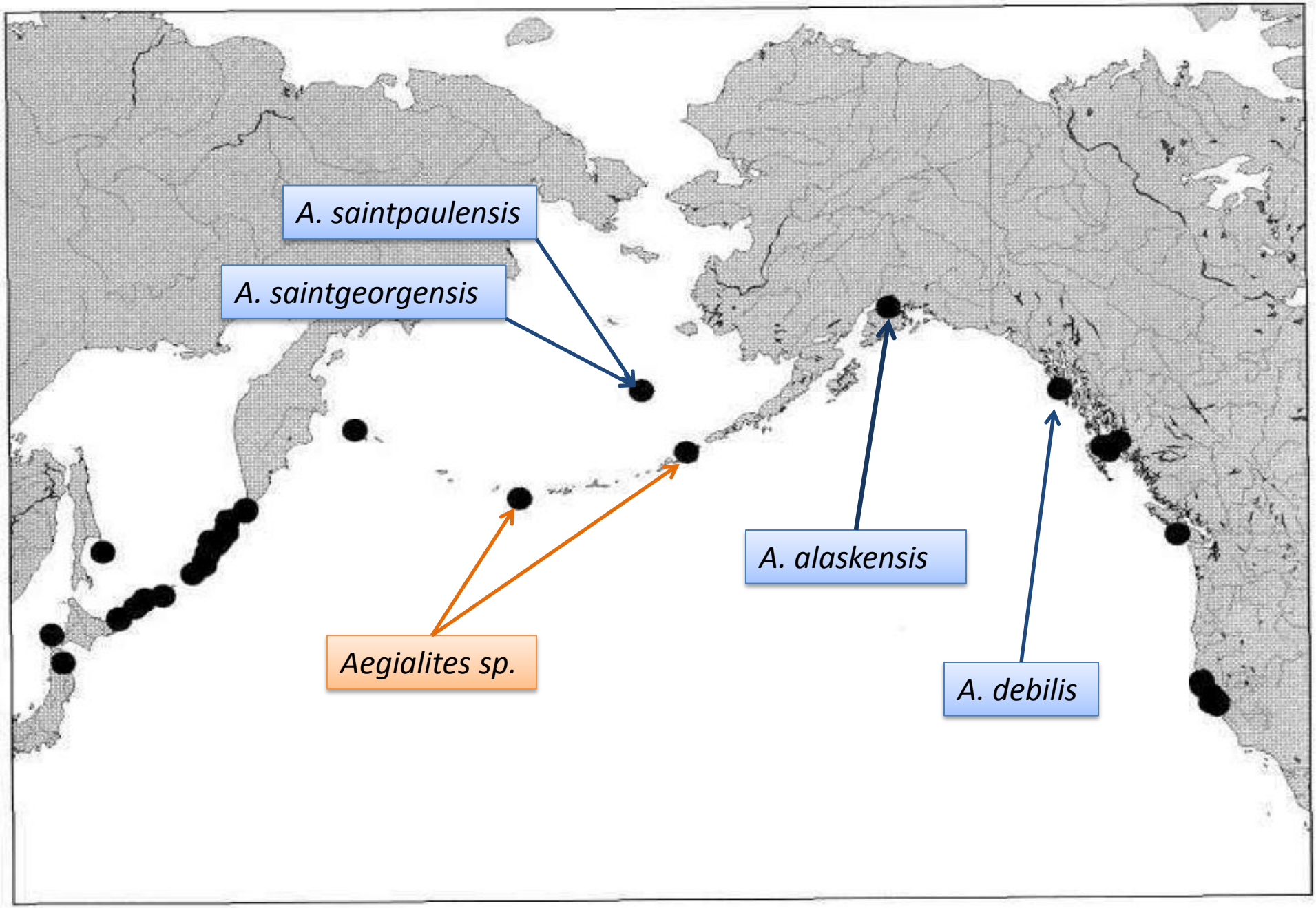


Abb. 1. Verbreitung der Gattung *Aegialites*. – Breite des Kartenausschnitts ca. 10.900 km.

Goals and Questions

- Test Zerche's hypothesis
- Explore genetic and morphological diversity in *Aegialites*
  - How much variation exists
    - Within species?
    - Among species?

Aegialites sp. larva

Goals and Questions

Three Objectives:

1. Population structure in *Aegialites debilis* from Sitka
   - Variation between populations of the same species
   - Indirect measure of gene flow and dispersal ability
2. *A. saintpaulensis* and *A. saintgeorgensis*
   - Variation between species
3. Describe the new species of Kasatochi Island
   - Determine whether or not it persists on nearby Aleutain islands post-eruption
   - Likely extinct if found to be unique

No clearly different but closely related species of *Aegialites* have been compared using DNA

– The 2 Pribilof endemics provide us this opportunity

Saint Paul Island

Saint George Island

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Image © 2012 TerraMetrics

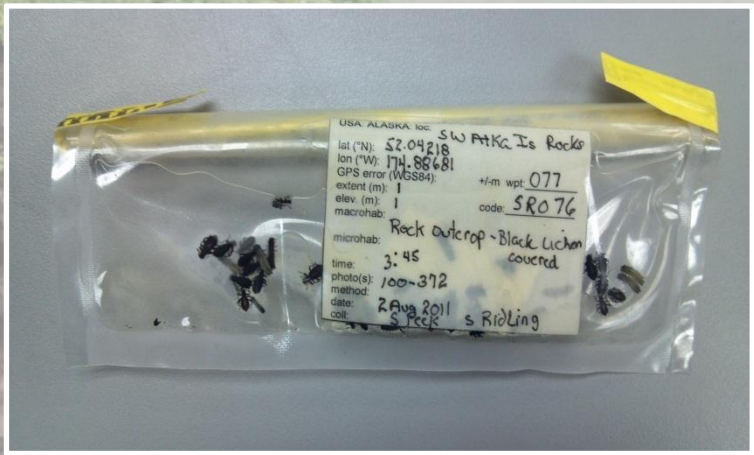
207 mi

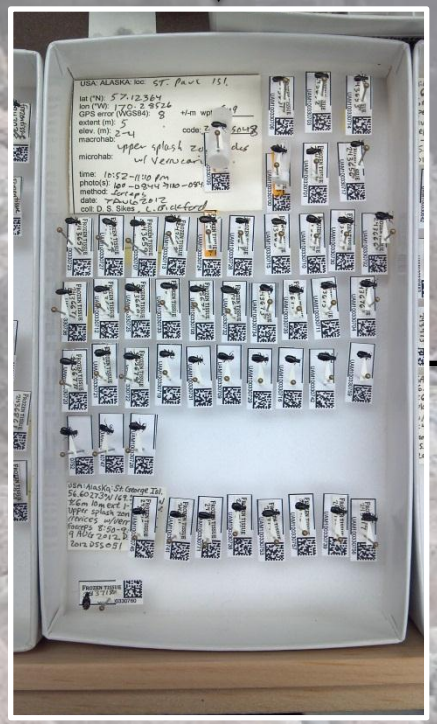
lat 58.117643° lon -170.830324° elev -216 ft

Eye alt

Field Work

- Search *Aegialites* habitat
  - tall mid to upper tide rocks with crevices
  - with *Verrucaria* lichen
  - Without terrestrial plants



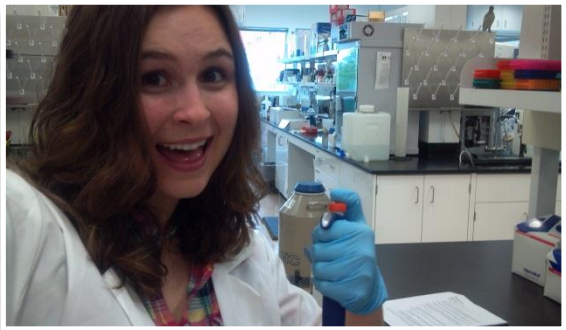


Aegialites saintpaulensis Zerche, 2004
Animalia Arthropoda Insecta Coleoptera Polyphaga Salpingidae Aegialitinae Aegialites saintpaulensis
Identified by Casey Bickford on 2012-10-03
Nature of ID: expert
Remarks: ID based on locality

Edit

Determination Type:	accepted place of collection assigned by Casey Bickford on 2012-10-02
Higher Geography:	North America, Bering Sea, United States, Alaska, Pribilof Islands, St. Paul Island
Verbatim Locality:	St. Paul Isl.
Specific Locality:	St. Paul Island
Specimen/Event	2012DSS048
Remarks:	
Habitat:	upper splash zone rocks with Verrucaria
Collecting Method:	forceps
Collecting Source:	wild caught
Event Date:	7 AUG 2012
Verification Status:	unverified
Event Coordinates:	57.12364/-170.28526
Datum:	World Geodetic System 1984
Original Coordinate Format:	decimal degrees
Elevation	2 to 4 m
Error:	13 m
Georeference Source:	GPS
Georeference Protocol:	MaNIS georeferencing guidelines

57.124,-170.285; Elev. 9 m

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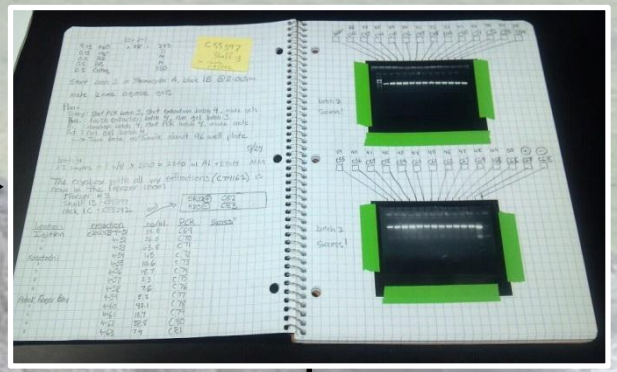
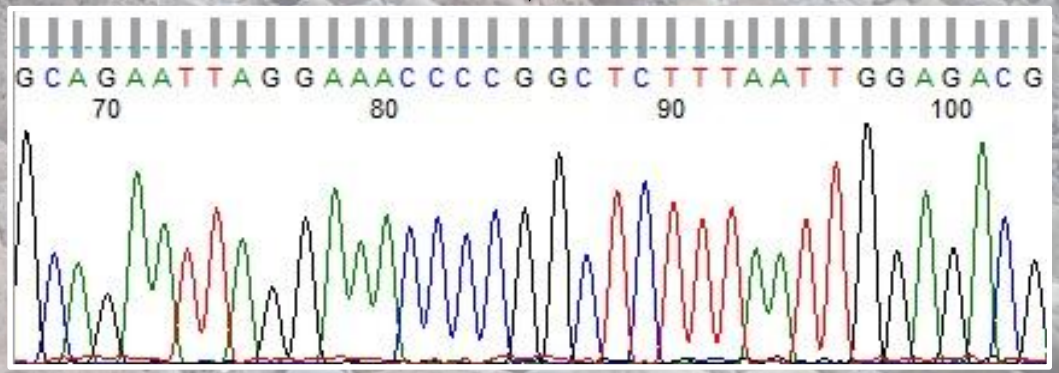
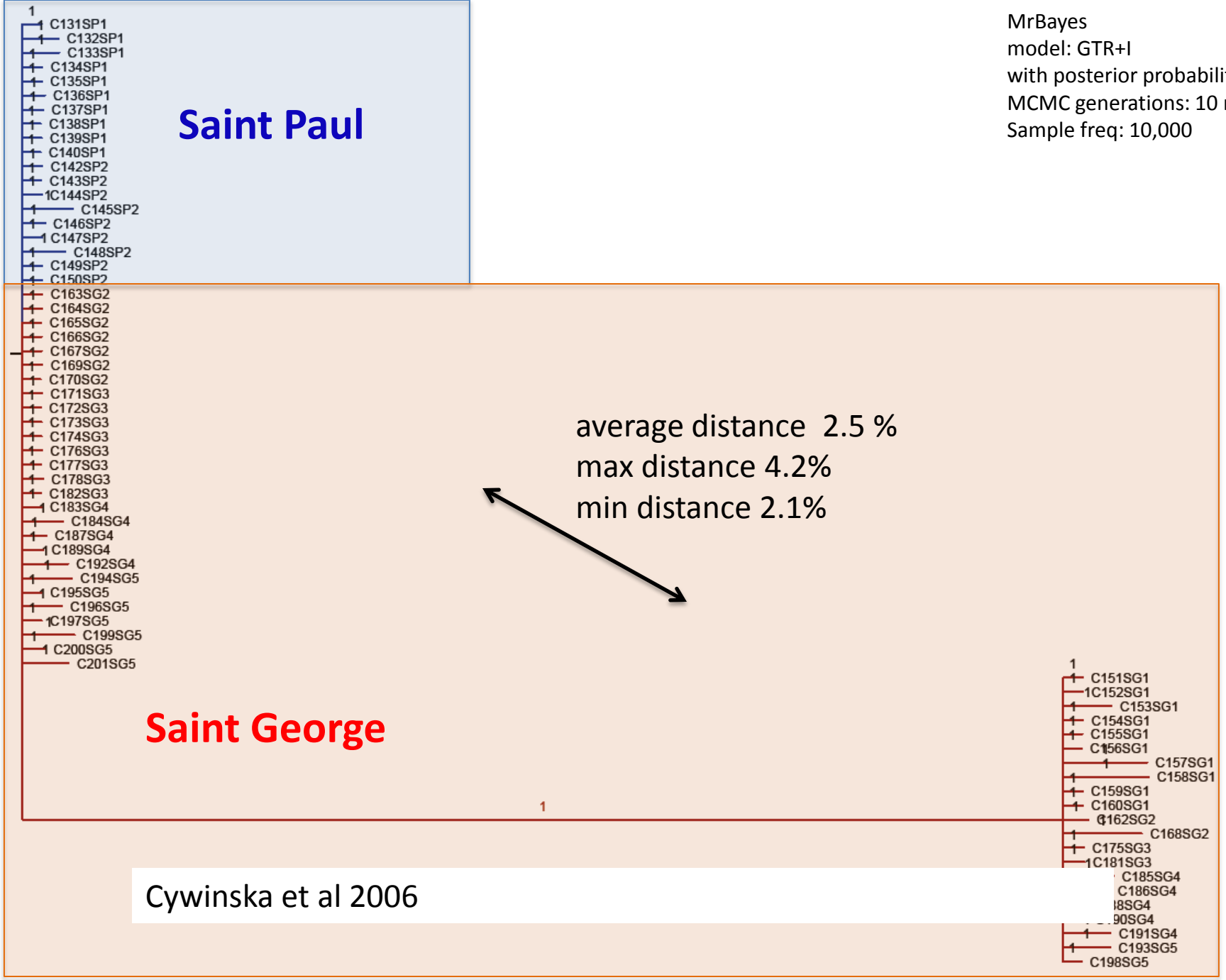
Sign up




GCAGAATTAGGAAACCCCGGCTCTTTAATTGGAGACG
70
80
90
100

MrBayes
model: GTR+I
with posterior probabilities
MCMC generations: 10 million
Sample freq: 10,000



Cywinska et al 2006

MrBayes
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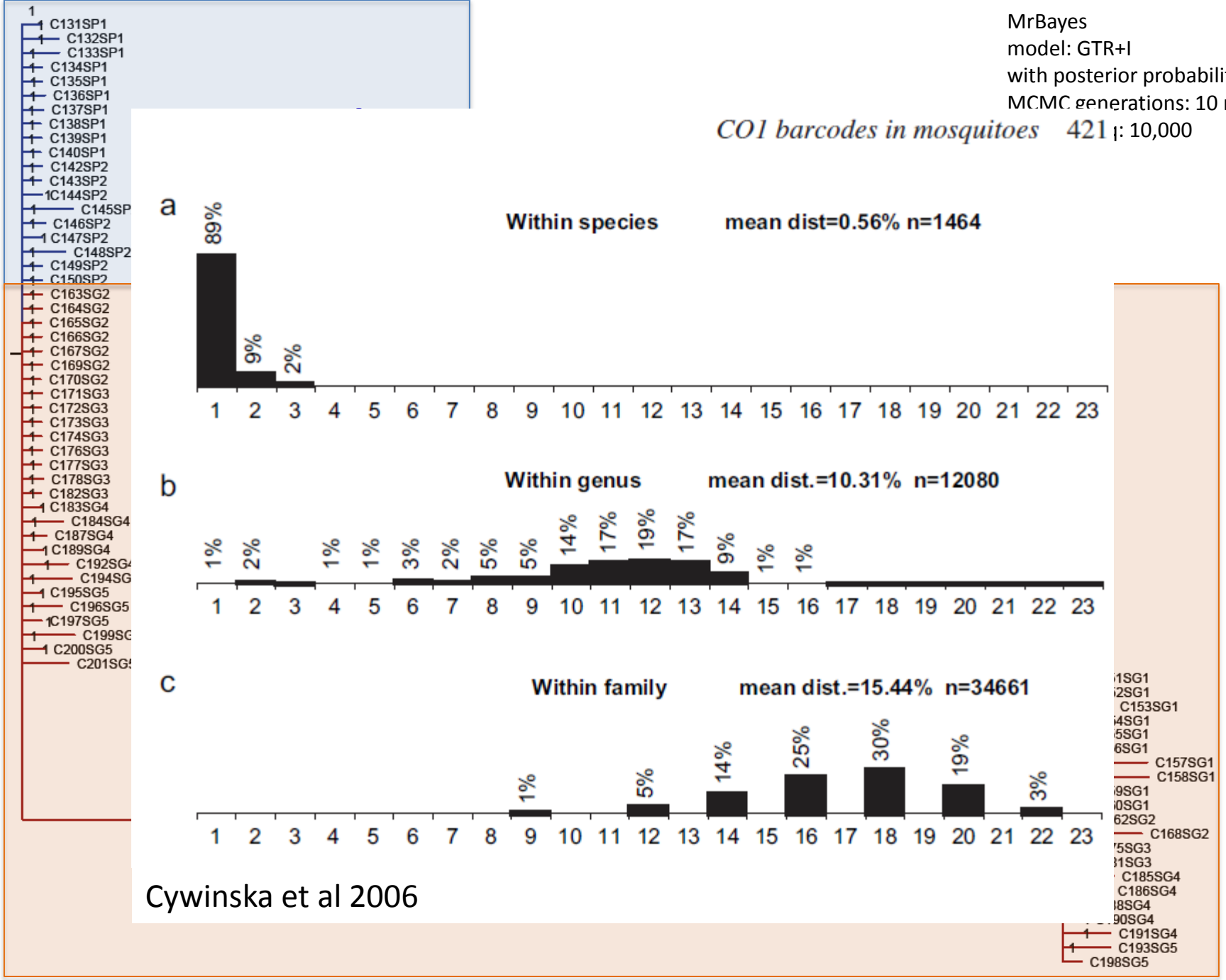
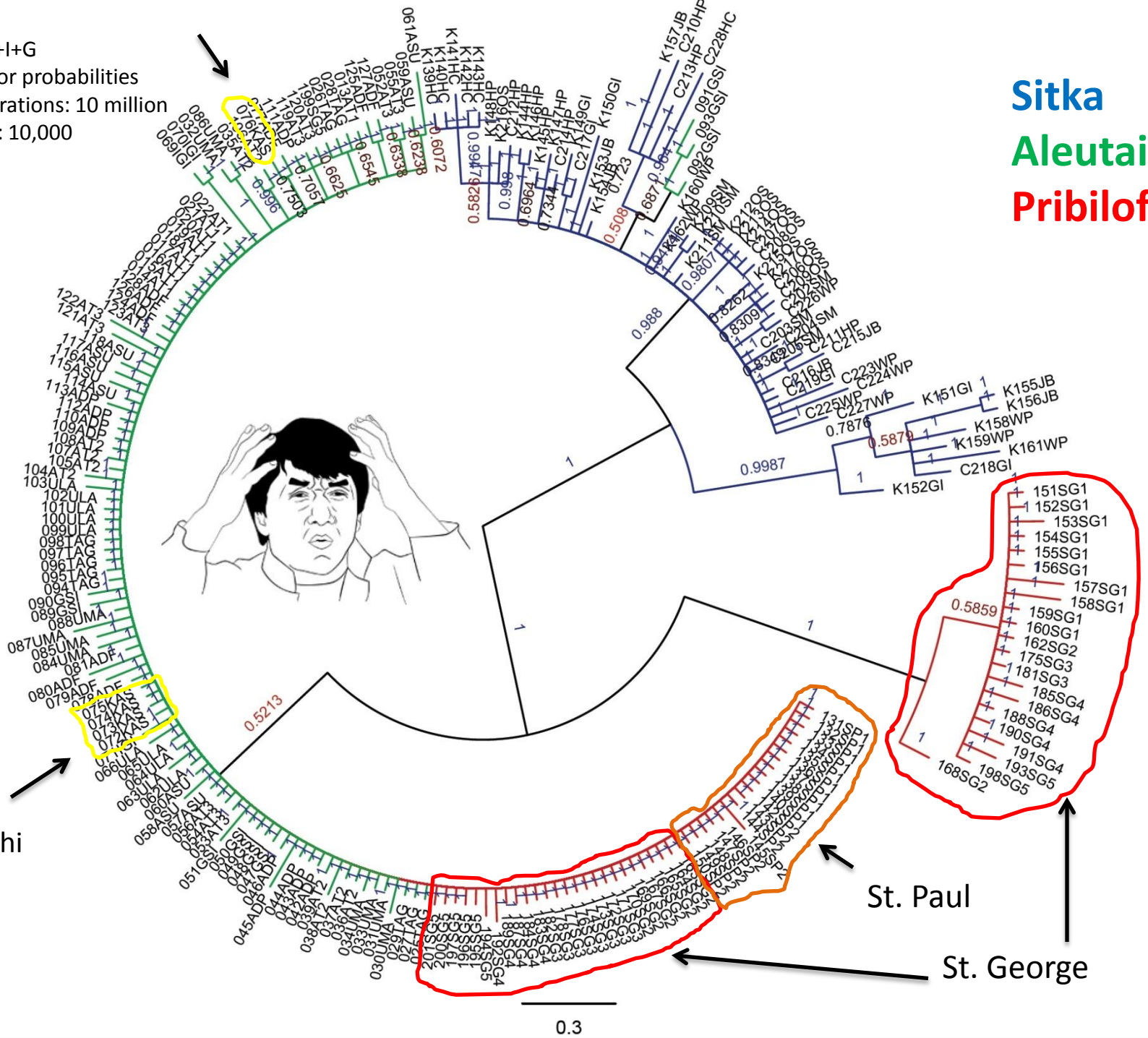
MCMC generations: 10 million
: 10,000



Cywinska et al 2006

MrBayes
model: GTR+I+G
with posterior probabilities
MCMC generations: 10 million
Sample freq: 10,000

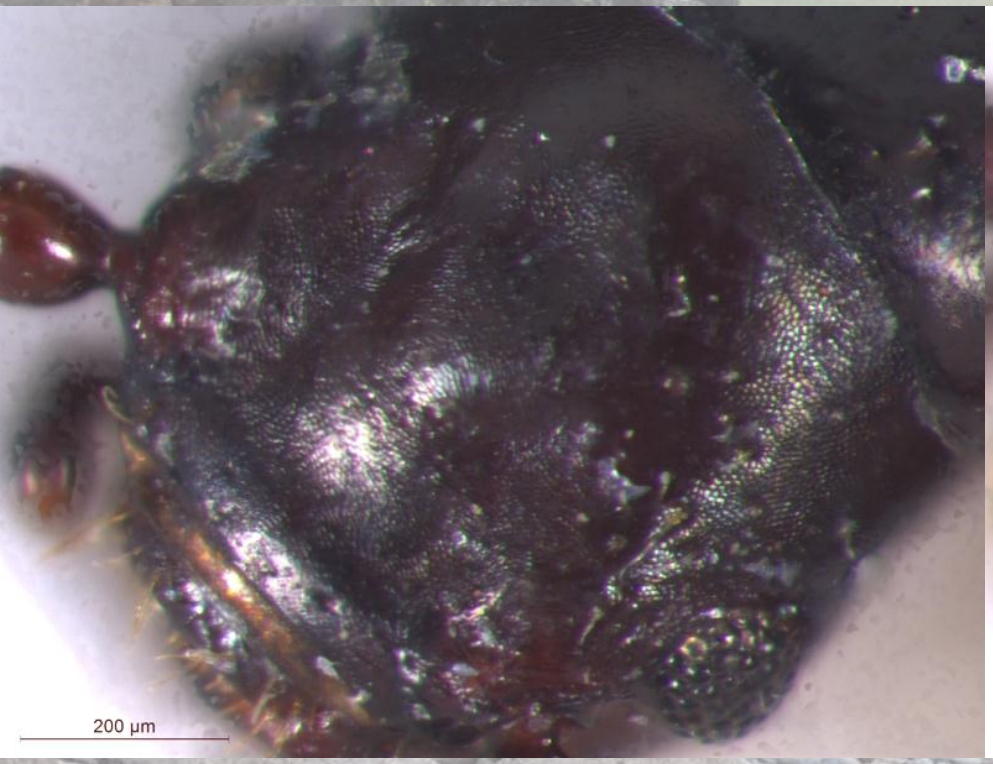


Zerche's morphological diagnostics

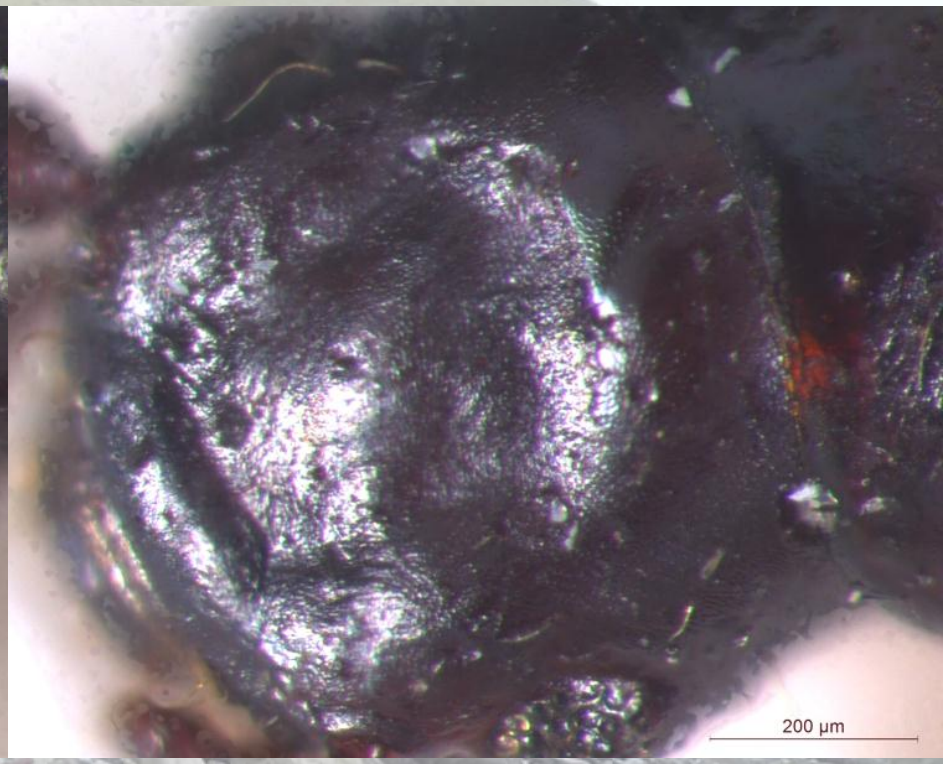
- *A. saintgeorgensis*
  - much finer punctures of the head
  - wavy elytra with four flat transverse ridges
  - sensilla of sternite 6 and 7 are not much longer than the sensilla of sternites 4 and 5
- *A. saintpaulensis*
  - coarse punctures of the head
  - poorly indicated transverse ridges of the elytra
  - considerably longer sensilla of sternite 6 and 7

Punctures of the head

A. saintpaulensis



A. saintgeorgensis



Coarser?

Finer?

Wavy elytra

A. saintpaulensis

poorly indicated transverse ridges?

A. saintgeorgensis

4 flat transverse ridges?

A. saintgeorgensis

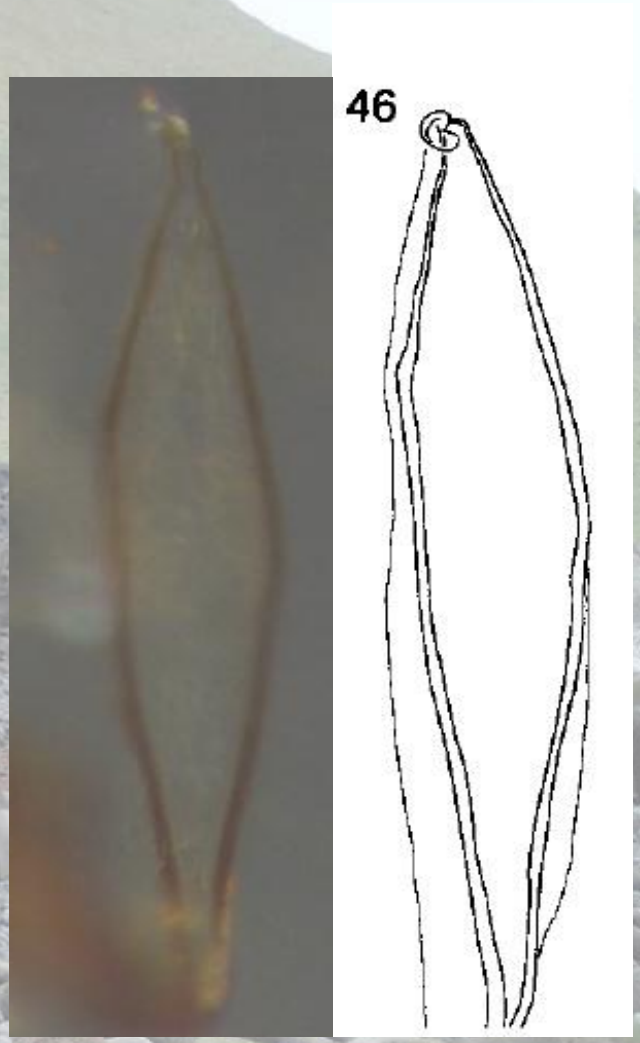
Holotype

Paratype

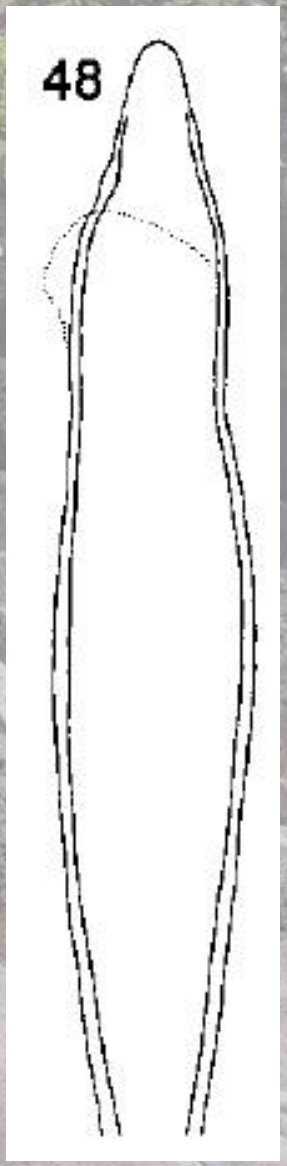
Zerche's diagnostics for two Pribilof species

A. saintpaulensis

A. saintgeorgensis



Saint Paul Island



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Saint Paul Island

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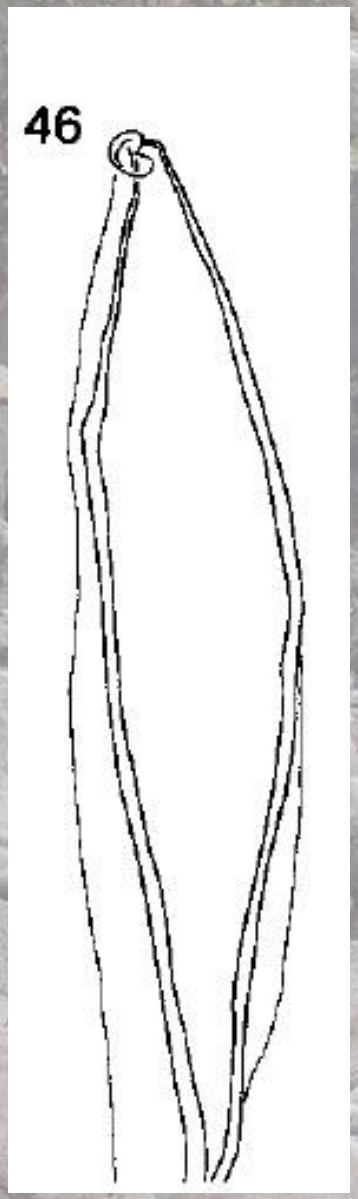
"Median Lobe"

Saint George Island

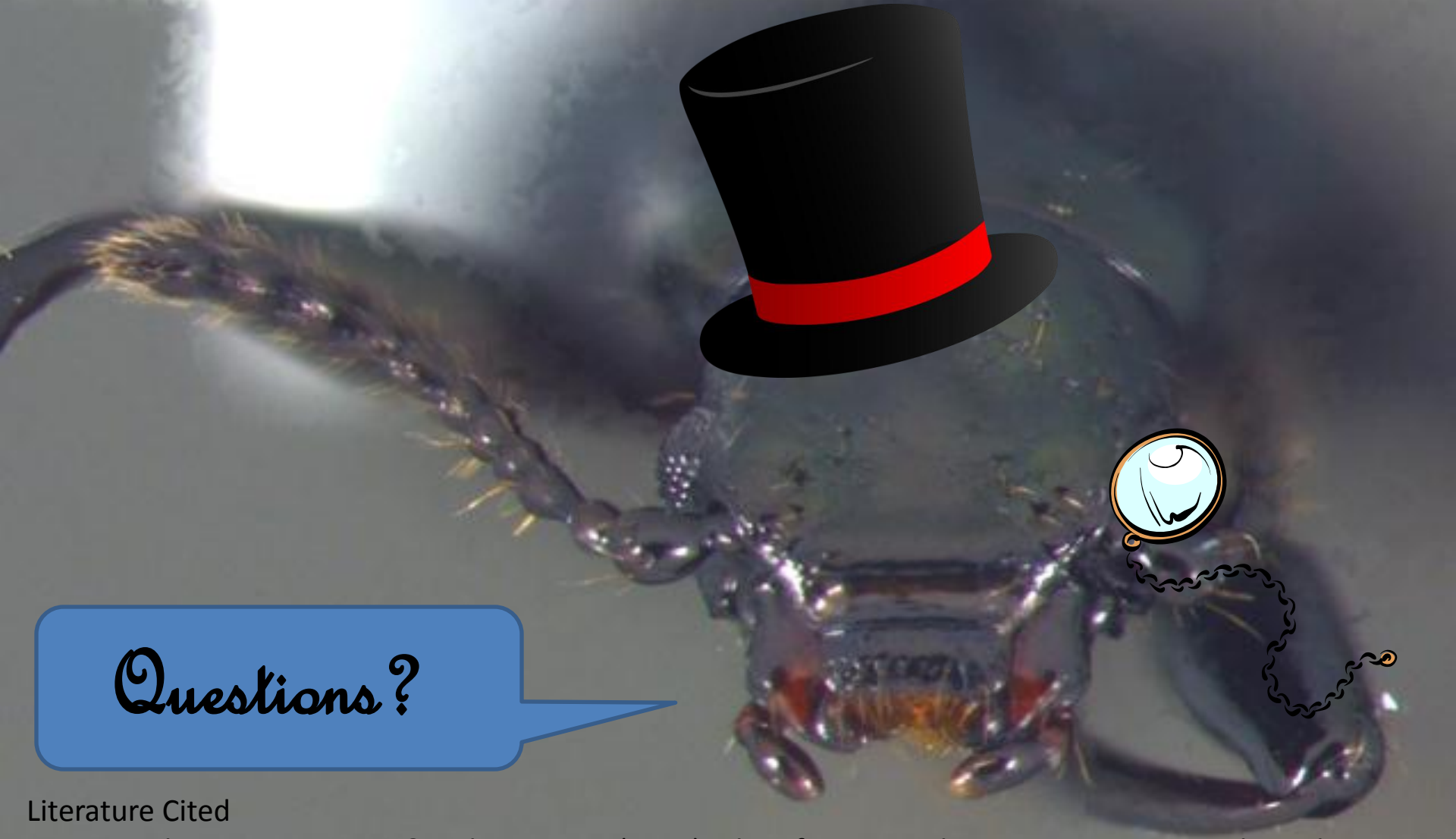


Preliminary Conclusions

- To our surprise, the Pribilof test case appears to fail to meet our expectations of providing two clearly different species to compare
- Zerche's morphological diagnostics for two Pribilof species not corroborated
- DNA data also fail to corroborate two island endemic species
  - If clades (groups) = species then at least one is on both islands

Preliminary Conclusions

- *A. saintgeorgensis* and *A. saintpaulensis* are probably not “good” species
- 2, maybe 3, species in the whole dataset
- Work in progress
  - morphometrics
  - sequence another gene
  - Population genetics statistics



Literature Cited

- Cywinska, A., Hunter, F.F. & Hebert, P.D.N.(2006). Identifying Canadian mosquito species through DNA barcodes. *Medical and veterinary entomology*, 20(4), pp.413–24.
- Ikeda, H., Nishikawa, M., & Sota, T. (2012). Loss of flight promotes beetle diversification. *Nature Communications*, 3, 648. Nature Publishing Group. doi:10.1038/ncomms1659
- Zerche, L. (2004). Revision der Gattung Aegialites Mannerheim (Coleoptera: Salpingidae: Aegialitinae). *Stuttgarter Beitrage zur Naturkunde*, *Serie A*(666), 1-99.