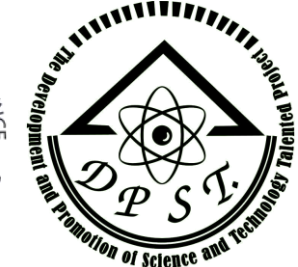
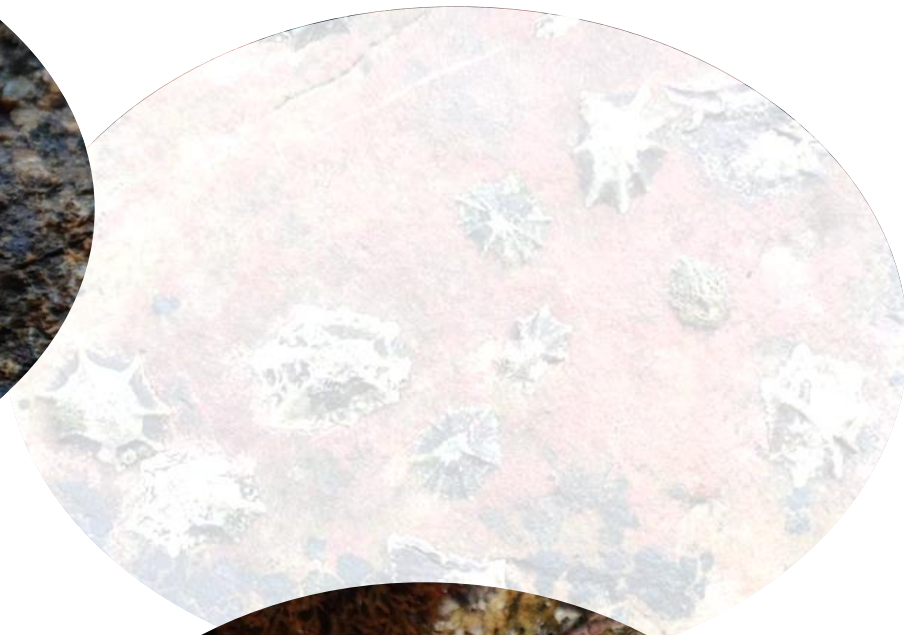


Thermal physiology of pulmonate limpets: a preliminary comparison of *Siphonaria* from Thailand and Hong Kong

Suphatsara Sangphueak (May)*, Williams A. Gray and Kringpaka Wangkulangkul (Farng)

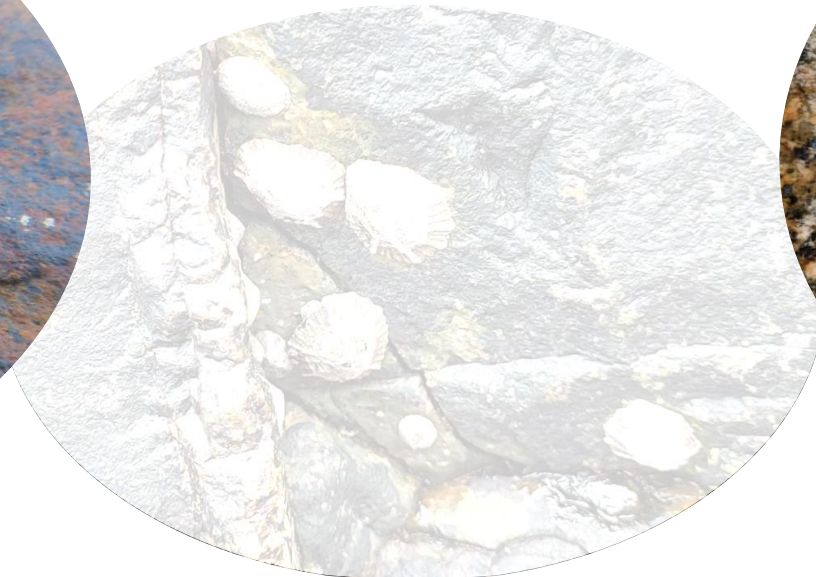


Siphonaria japonica



Limpets

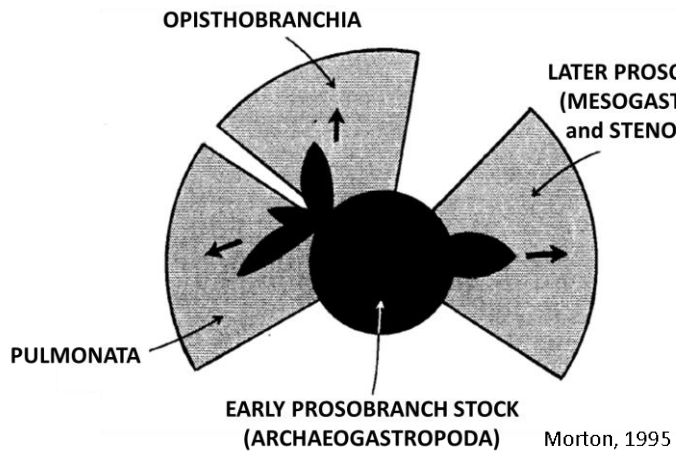
Siphonaria guamensis



Siphonaria laciniosa



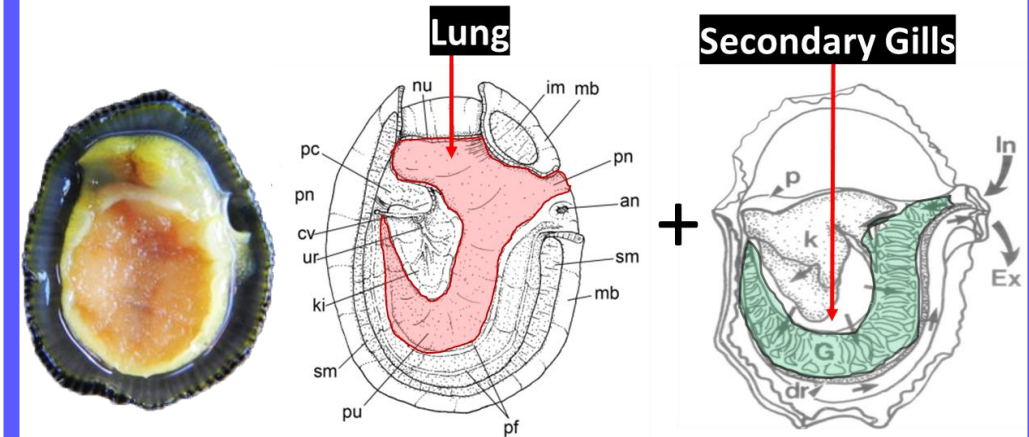
✓ The oldest extant pulmonate genus



EON	ERA	Date*	PERIOD	
PHANEROZOIC	CENOZOIC	2.0	QUATERNARY	
		2.3	NEOGENE	
		66	PALAEOGENE	
	MESOZOIC	PALAEOZOIC	145	CRETACEOUS
			201	JURASSIC
			252	TRIASSIC
			299	PERMIAN
			359	CARBONIFEROUS
	EARLY	LATE	419	DEVONIAN
			444	SILURIAN
			485	ORDOVICIAN
			541	CAMBRIAN
	PROTEROZOIC (part)	NEOPROTEROZOIC (part)		

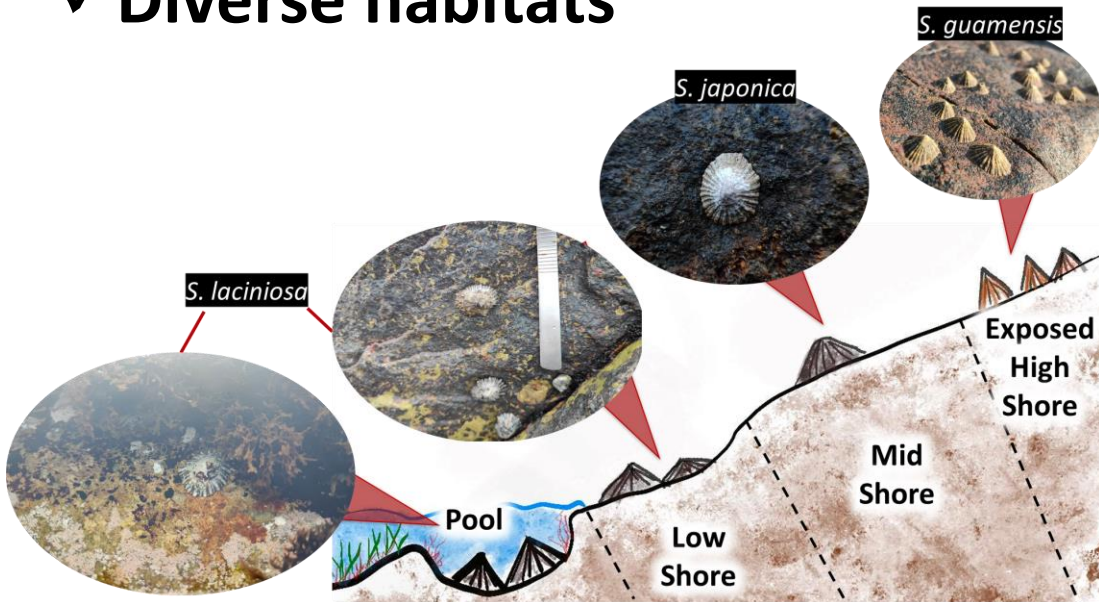
<https://www.bgs.ac.uk/discovering-geology/fossils-and-geological-time/geological-timechart/>

✓ Breathe in air and water



Facts

✓ Diverse habitats



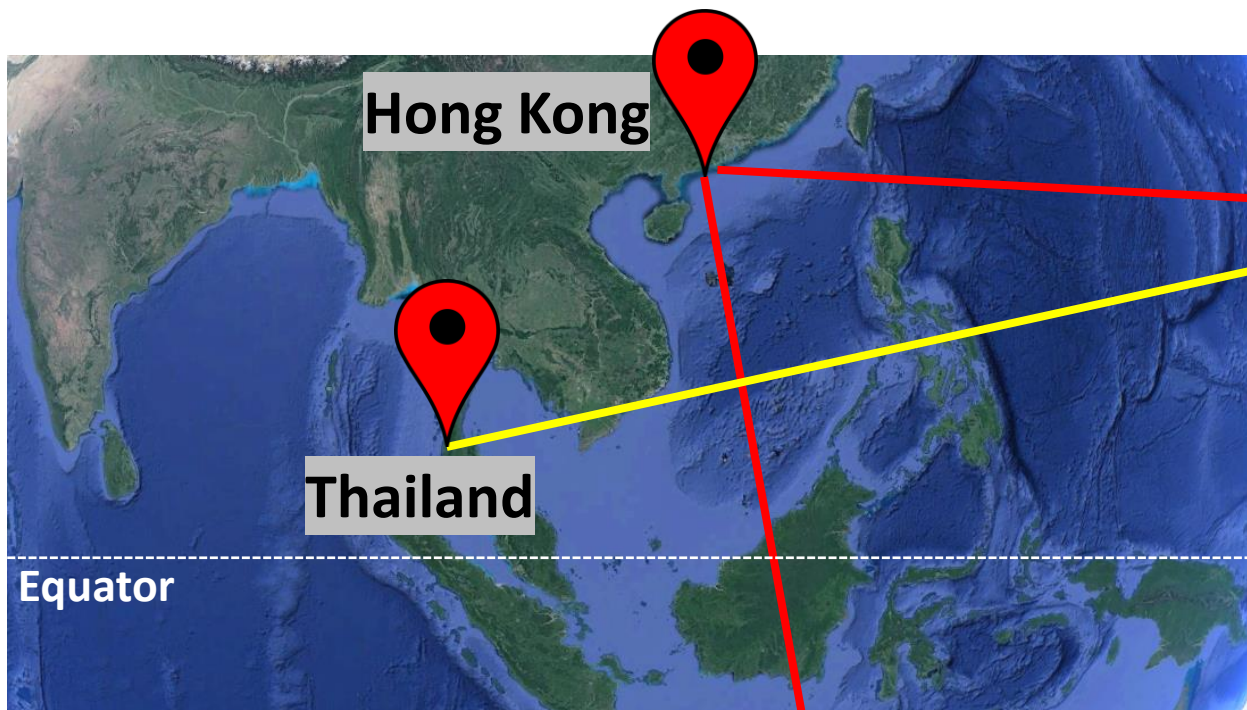
✓ Successful in tropical regions

Hodgson, 1999



<https://content.meteoblue.com/en/research-education/educational-resources/meteoscool/general-climate-zones/tropical-zone>

Do tropical *Siphonaria* spp.
perform better in air and water
???



Hong Kong

Thailand

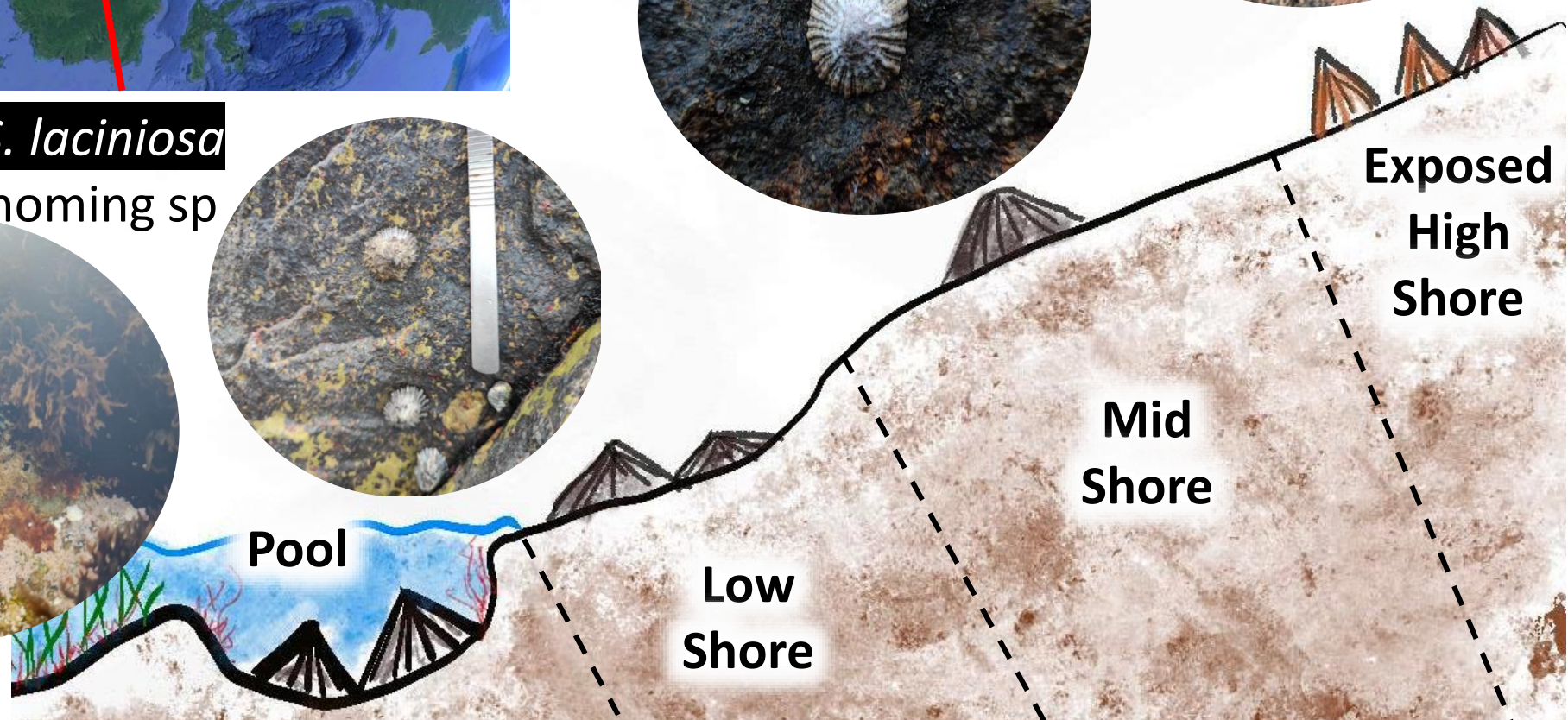
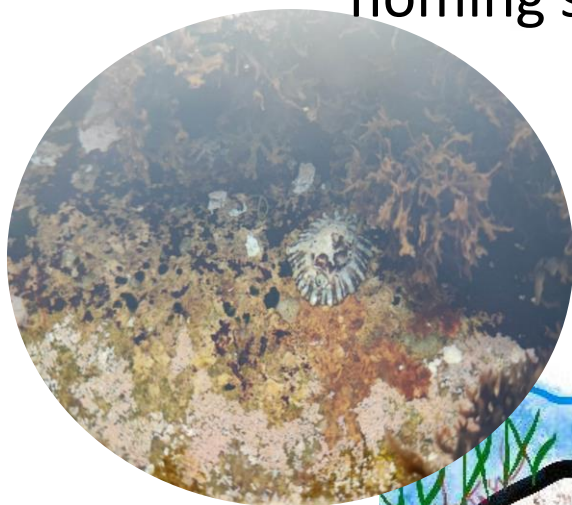
Equator

S. guamensis
homing sp

S. japonica
non-homing sp



S. laciniosa
homing sp



Exposed
High
Shore

Mid
Shore

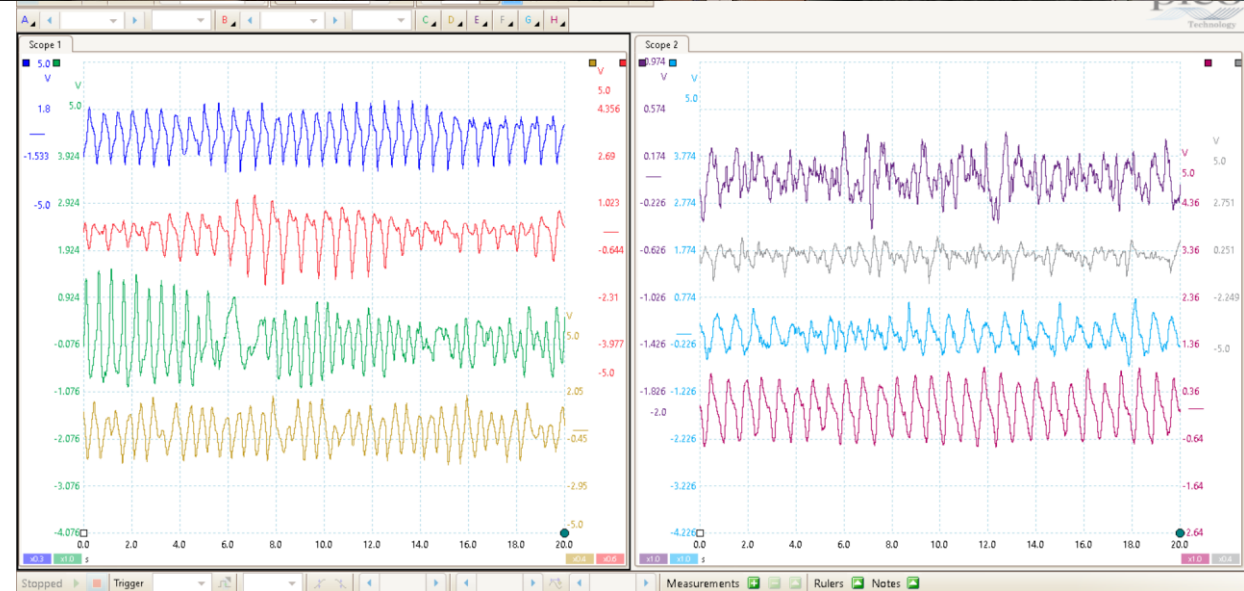
Low
Shore

Pool

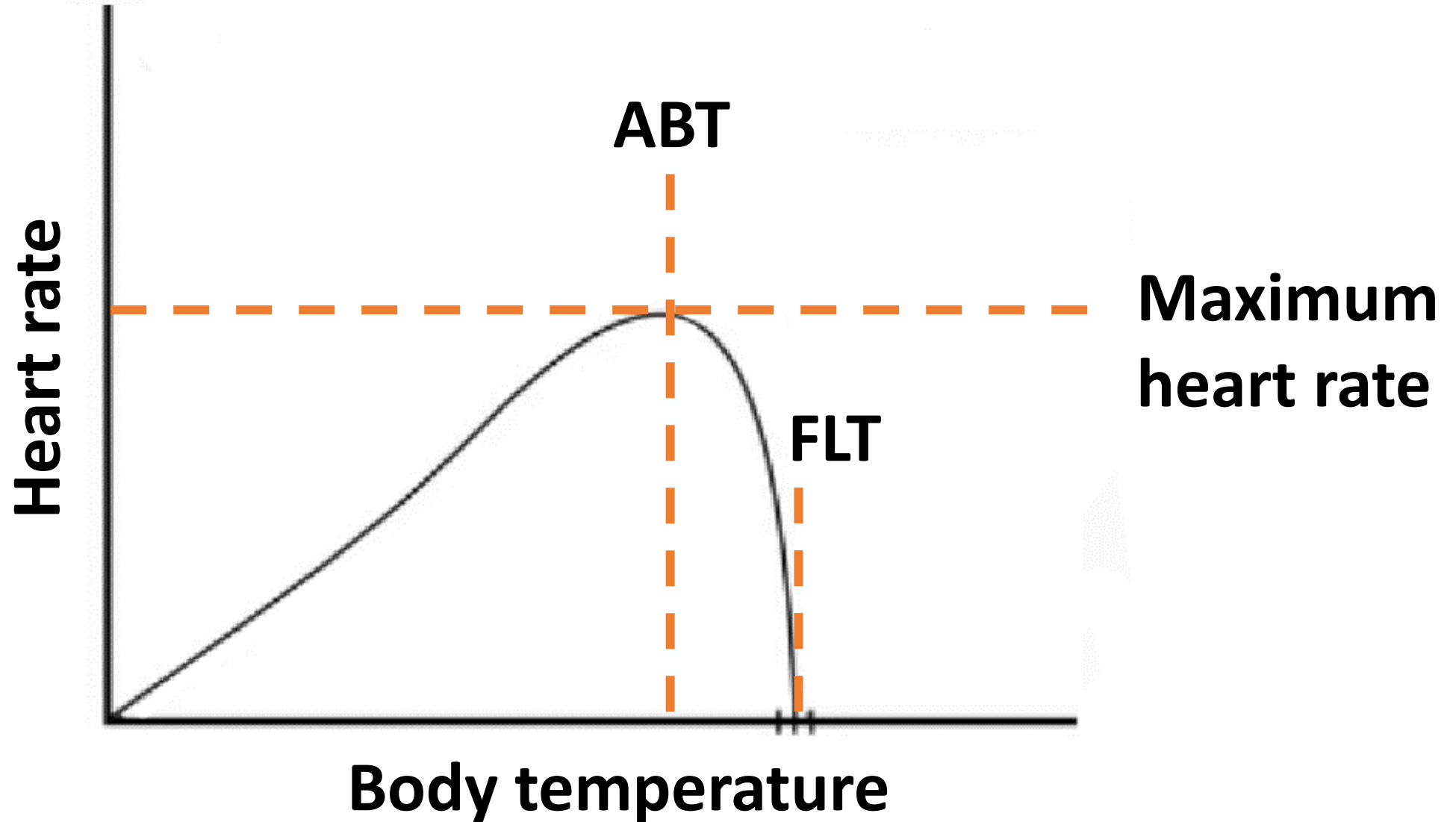
Heart rate measurement

Species	Habitat	Location	Medium	Experiment
<i>S. guamensis</i>	Bare rock	Thailand	Air	✓
<i>S. guamensis</i>	Bare rock	Thailand	Water	✗
<i>S. japonica</i>	Bare rock	Hong Kong	Air	✓
<i>S. japonica</i>	Bare rock	Hong Kong	Water	✓
<i>S. laciniosa</i>	Bare rock	Hong Kong	Air	✓
<i>S. laciniosa</i>	Bare rock	Hong Kong	Water	✓
<i>S. laciniosa</i>	Rock pool	Hong Kong	Air	✓
<i>S. laciniosa</i>	Rock pool	Hong Kong	Water	✓

Heart rate measurement

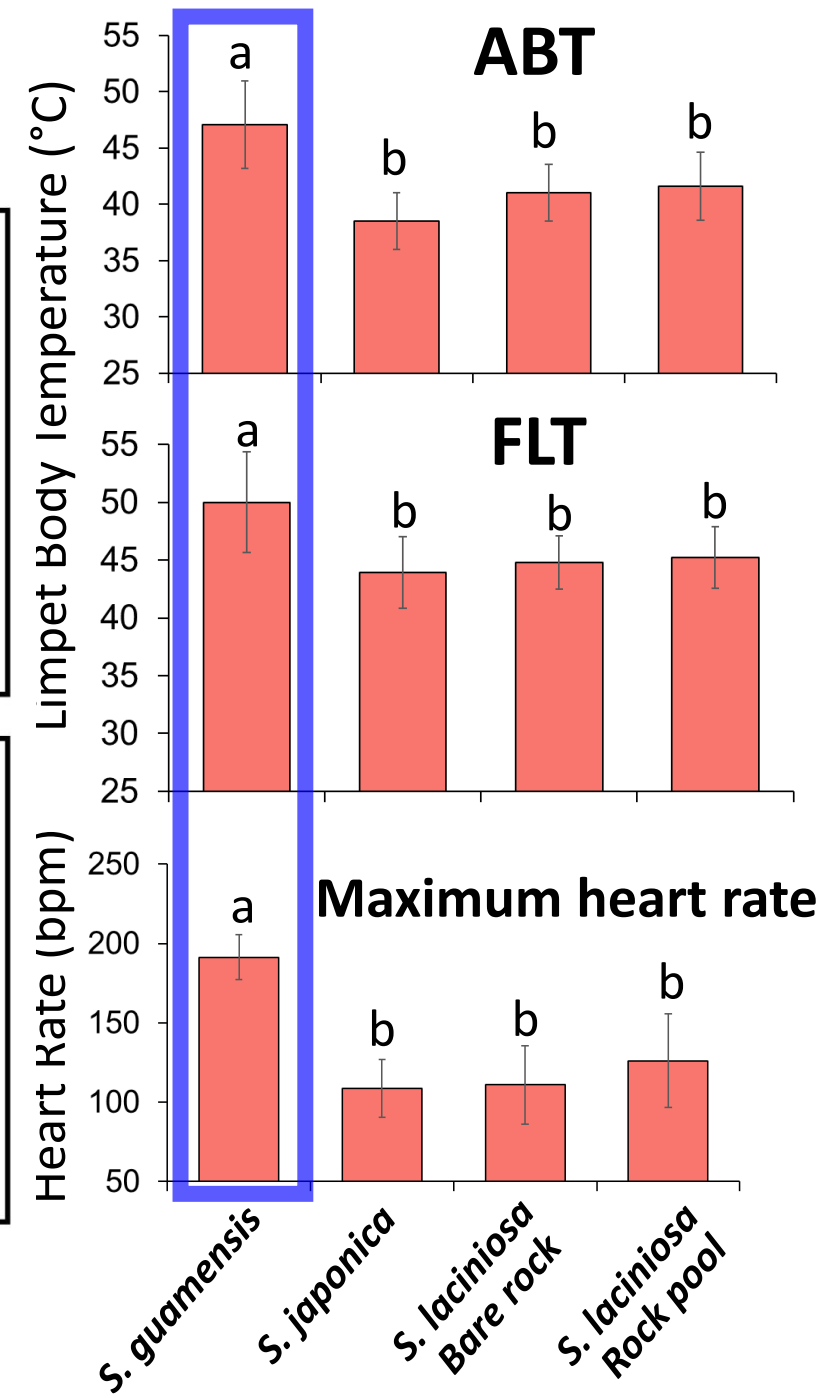
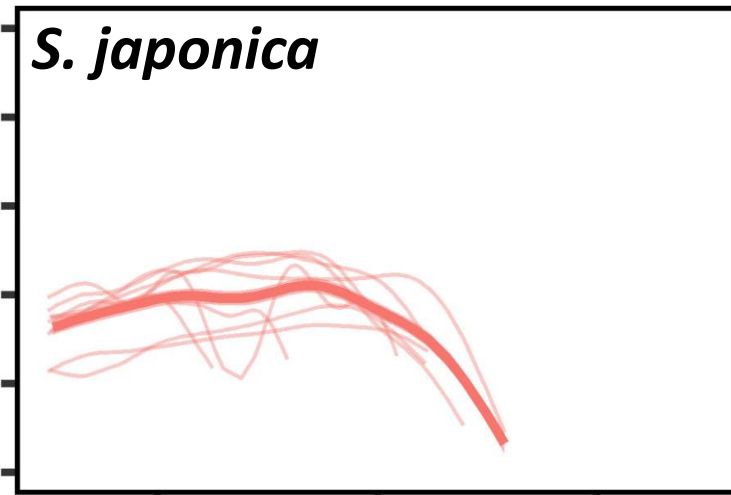
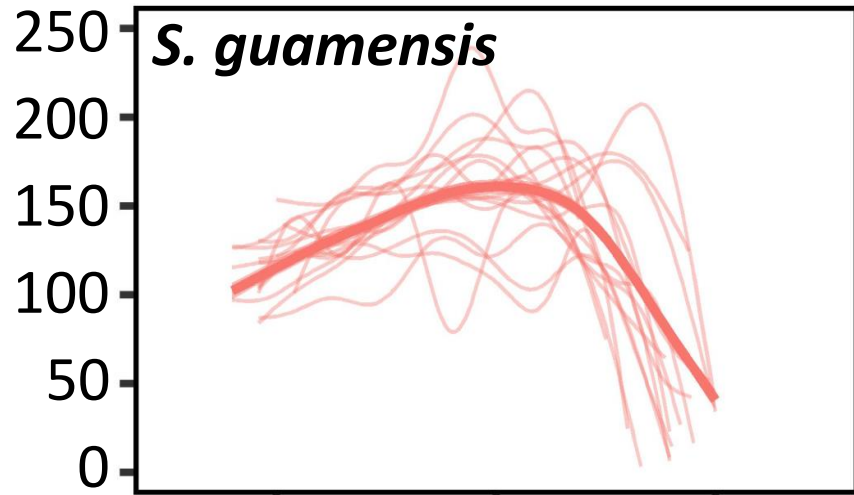


Thermal performance curve (TPC)

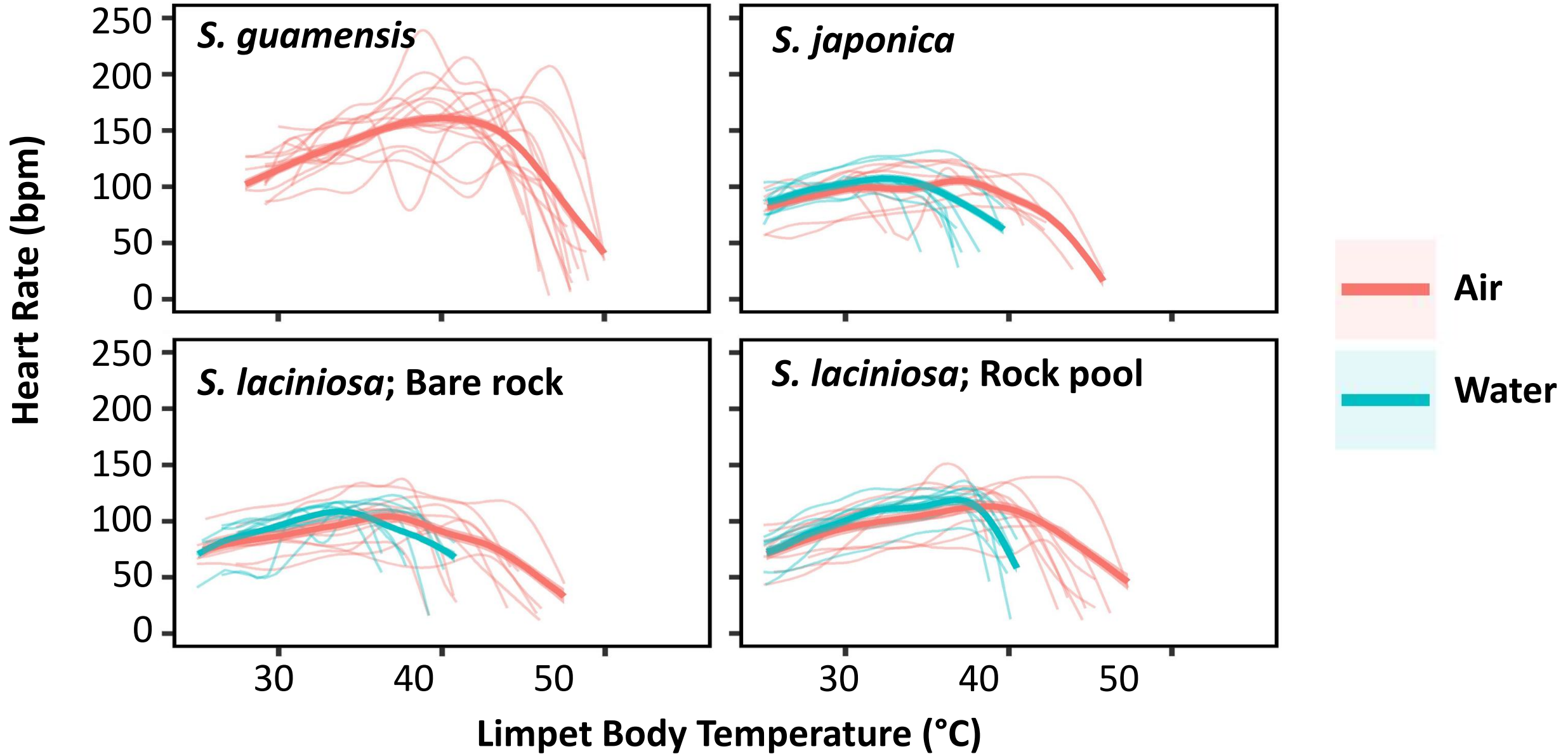


Results

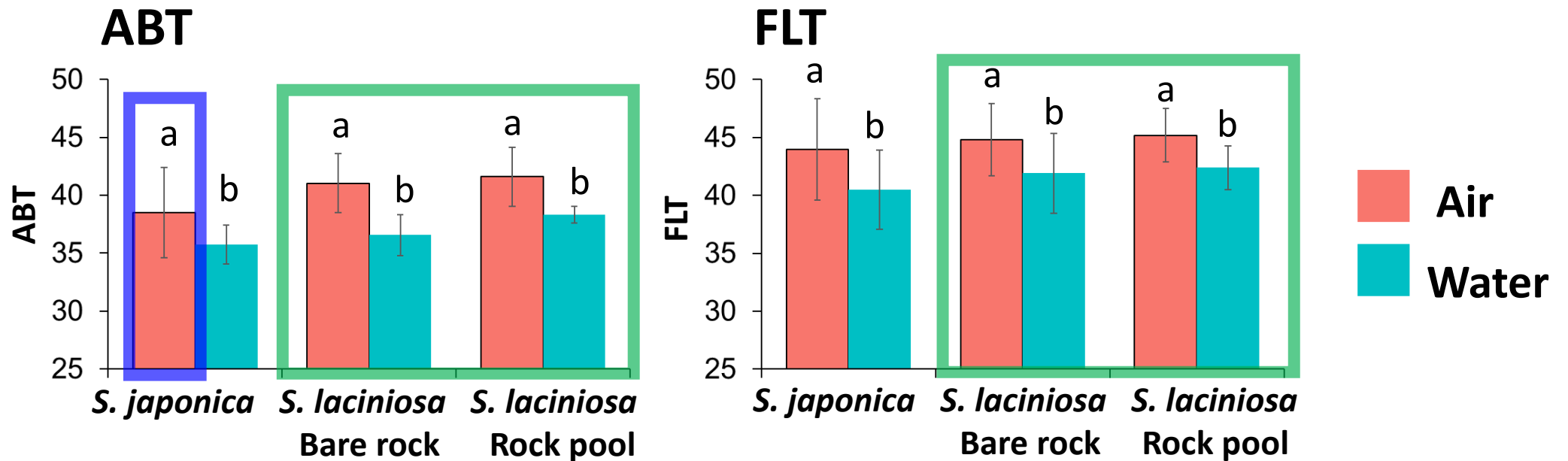
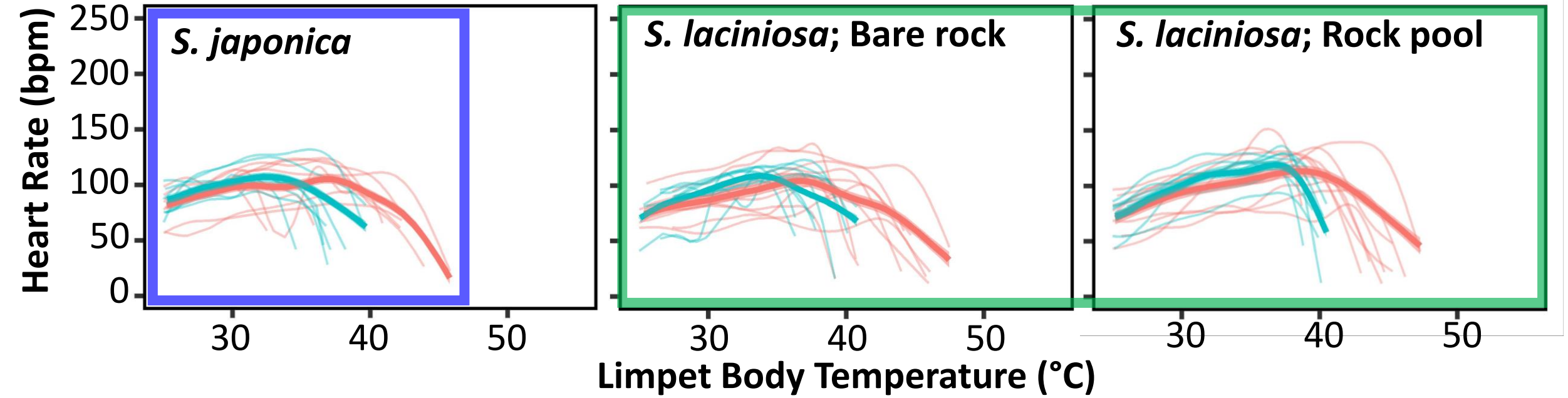
Air medium



Results

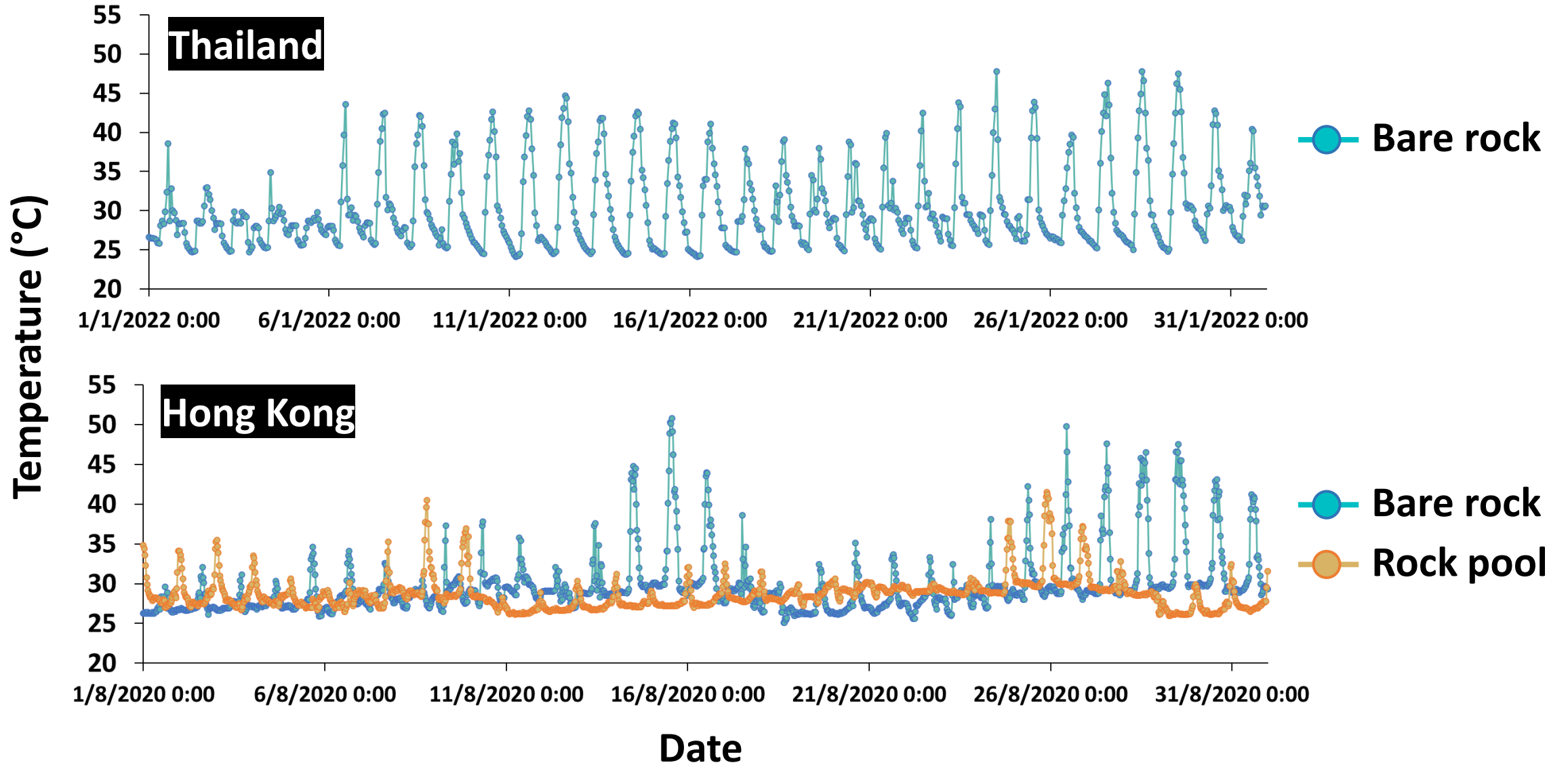


Results

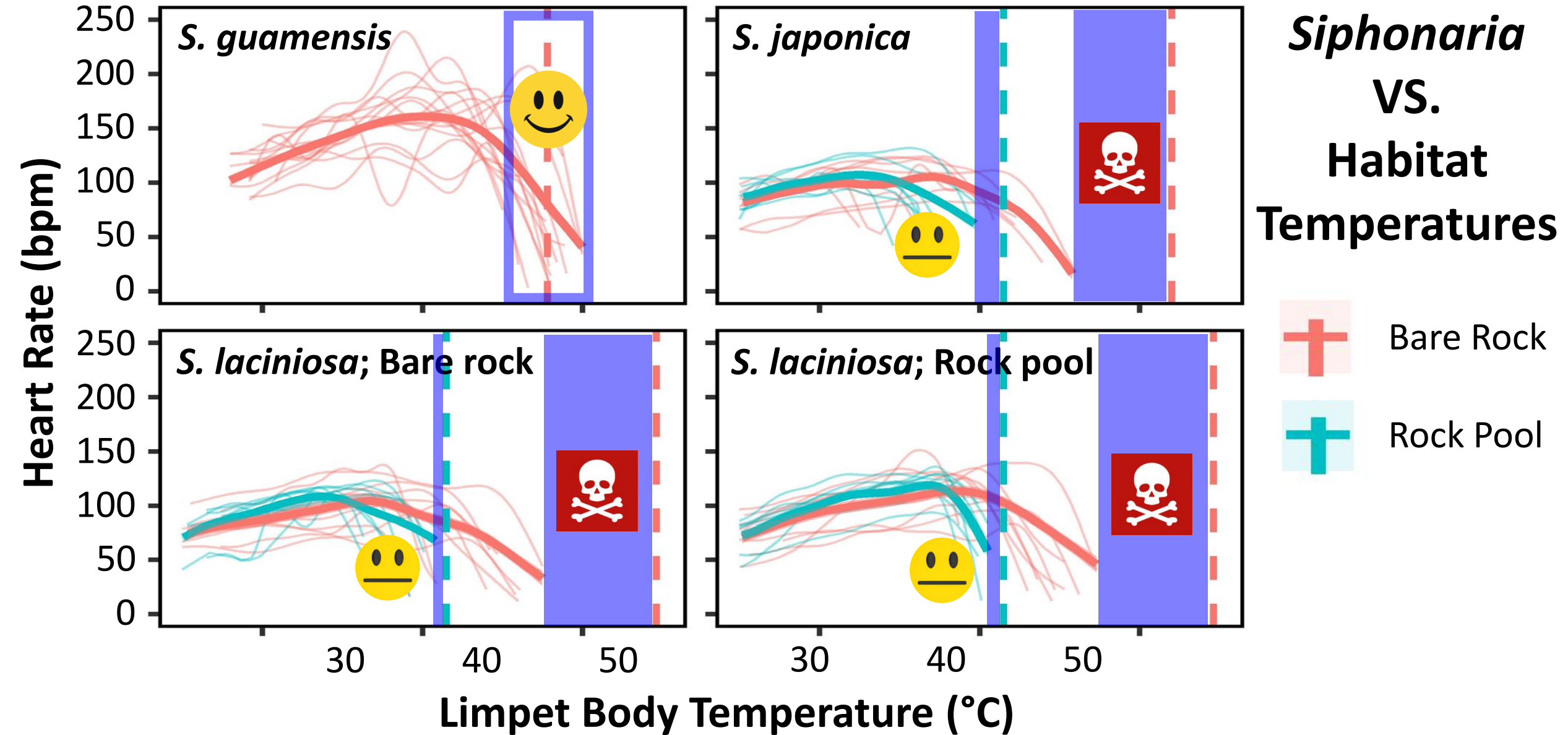


Results

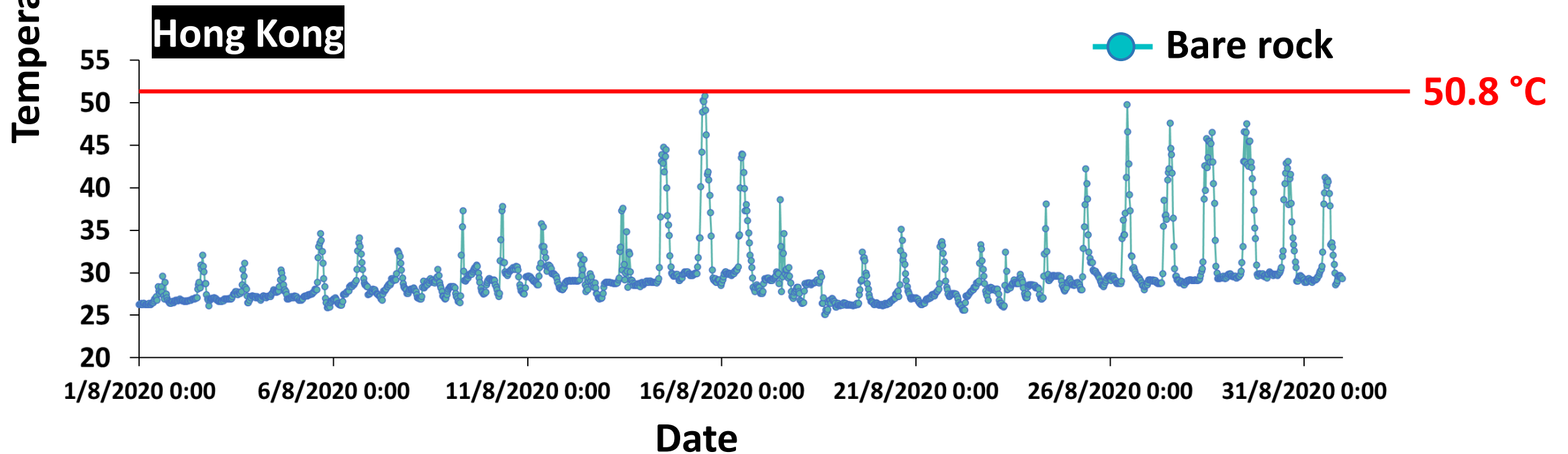
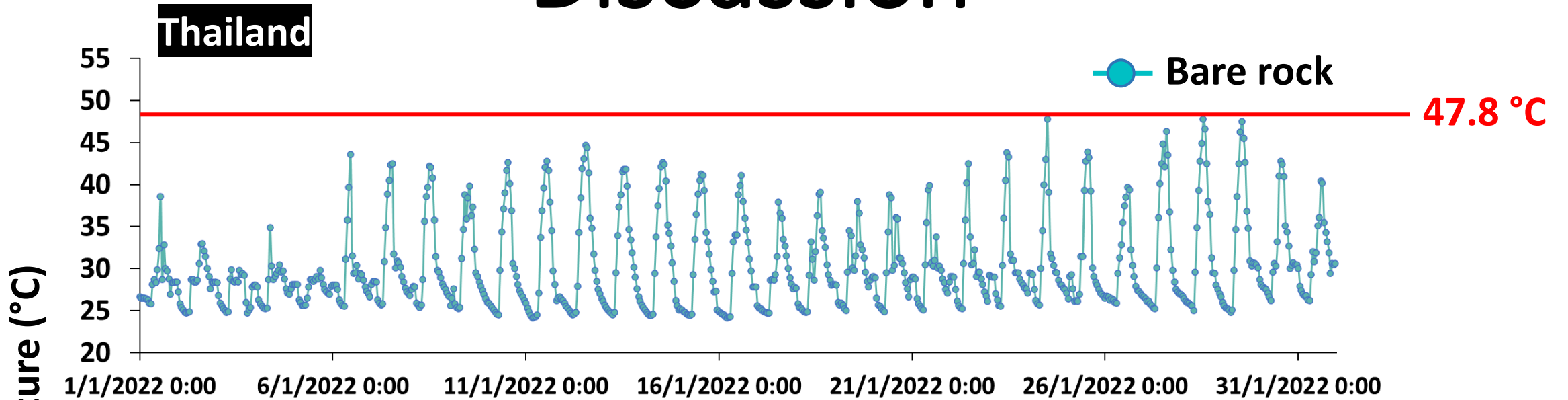
Habitat temperatures



Results



Discussion

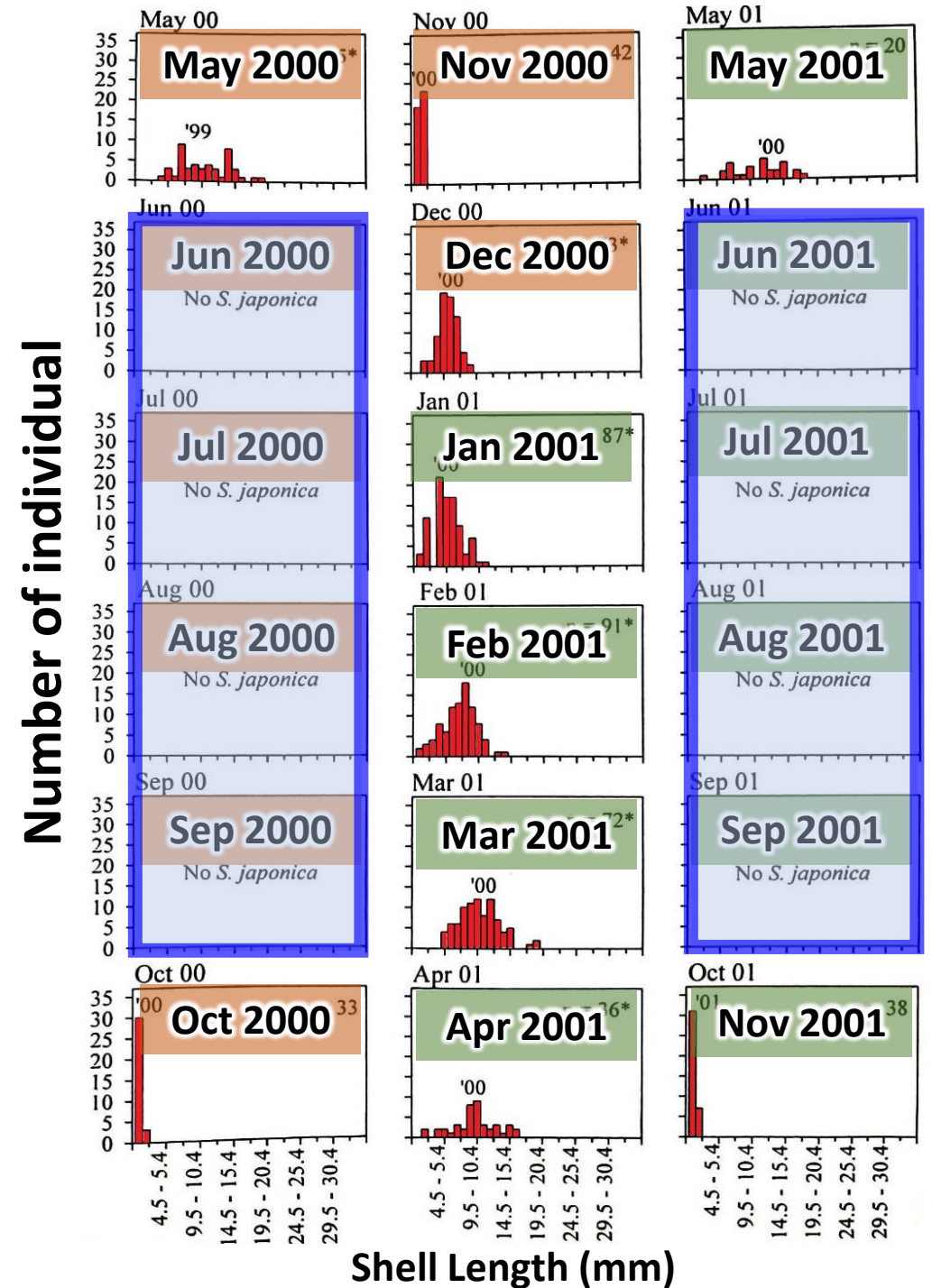


Discussion



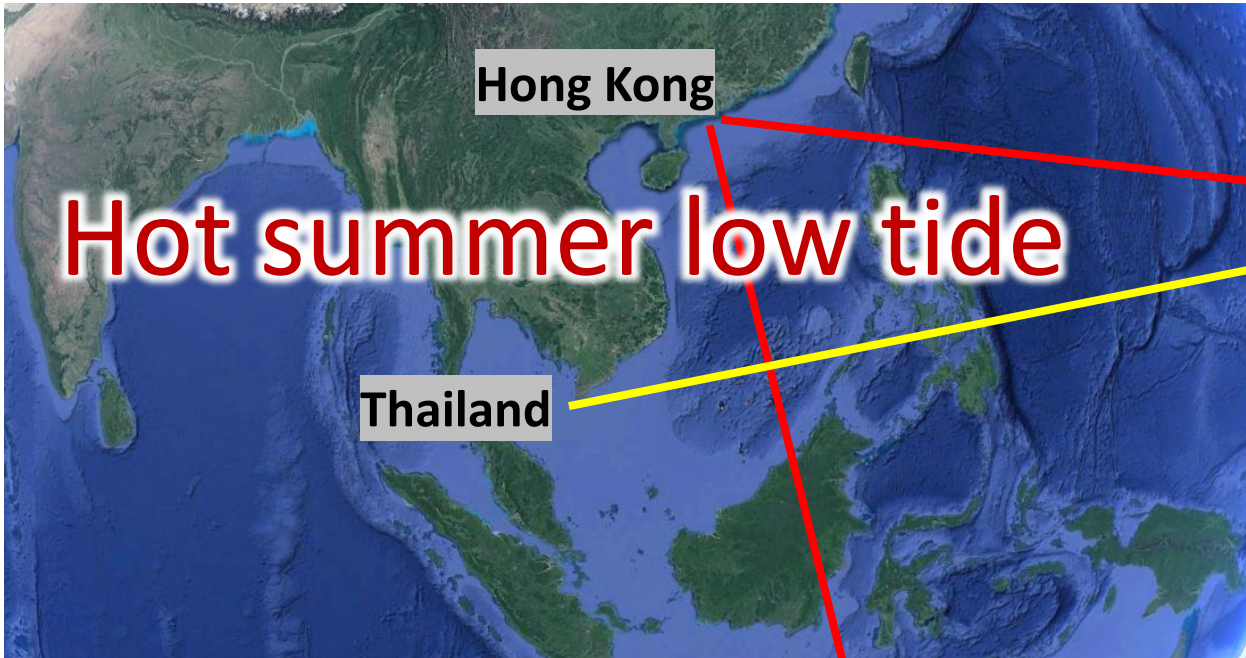
S. japonica died in summer.

KS Chan, 2002



Conclusions

- *Siphonaria* spp. has higher thermal performance in air than in water.
- The high shore *S. guamensis* was more tolerant of high temperatures than *S. japonica* and *S. laciniosa* in Hong Kong.
- In Hong Kong, the ABT of *S. japonica* was also lower than *S. laciniosa* in both air and water.
- In Hong Kong, population of *S. laciniosa* from bare rock and rock pool have similar thermal performance.



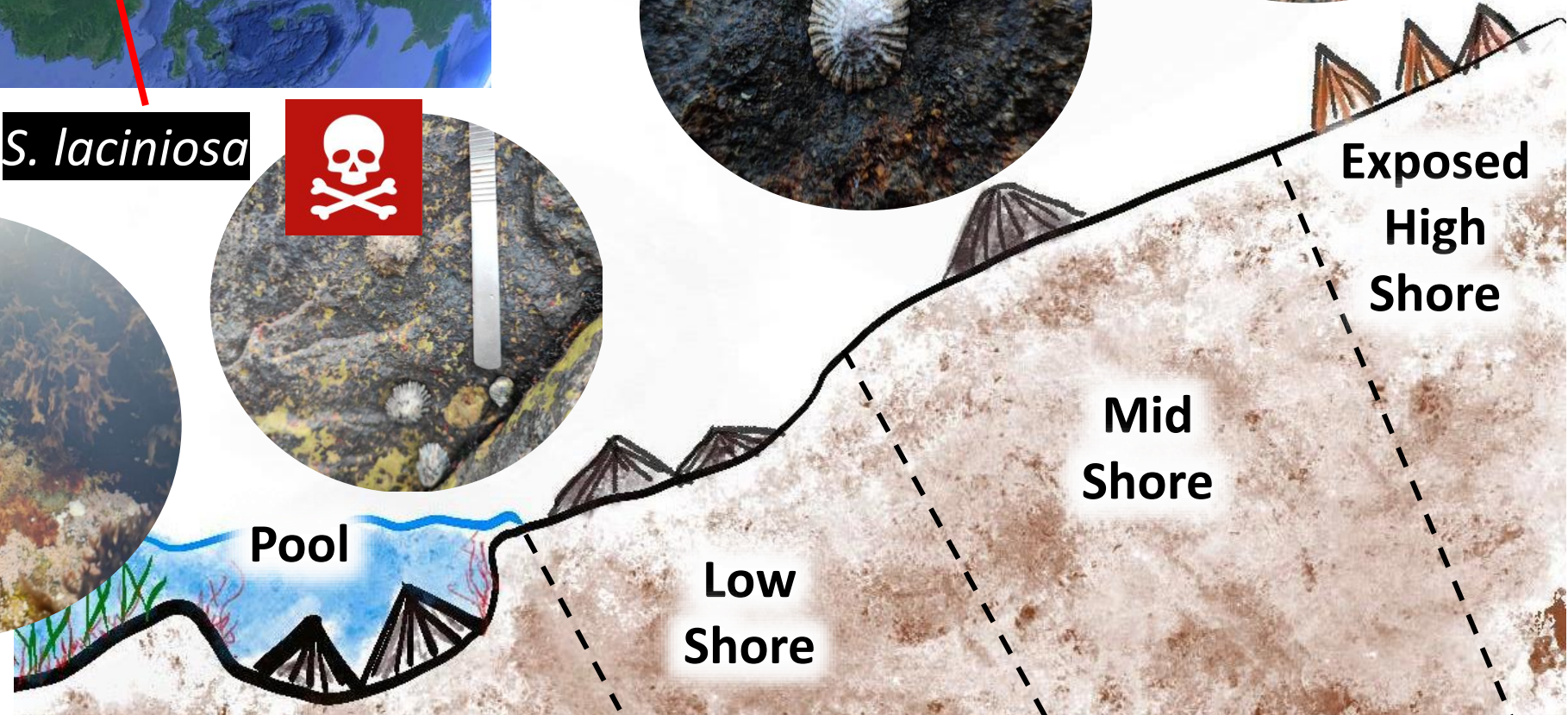
S. guamensis



S. japonica



S. laciniosa



Acknowledgements





Thank
you

