Trialling seawater irrigation to combat high nest temperature feminisation of green turtle *Chelonia mydas* hatchlings

Caitlin Smith, WWF-Australia

David Booth, UQ

Anne Crosby, UQ

Hayley Versace, CICI

Melissa Staines, UQ

Christine Madden Hof, WWF-Australia

Smith CE, Booth DT, Crosby A, Miller JD, Staines MN, Versace H, Madden-Hof CA (2021) Trialling seawater irrigation to combat the high nest temperature feminisation of green turtle *Chelonia mydas* hatchlings. Mar Ecol Prog Ser 667:177-190. https://doi.org/10.3354/meps13721

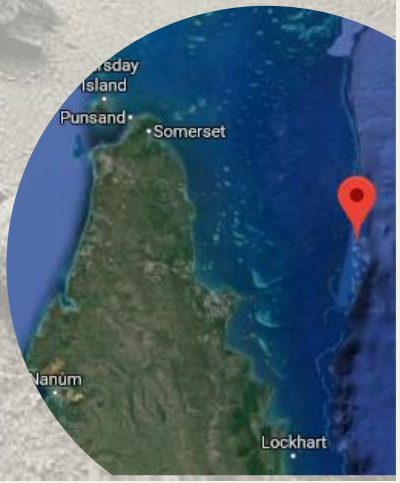
Feminisation in the nGBR green turtle stock

99% female

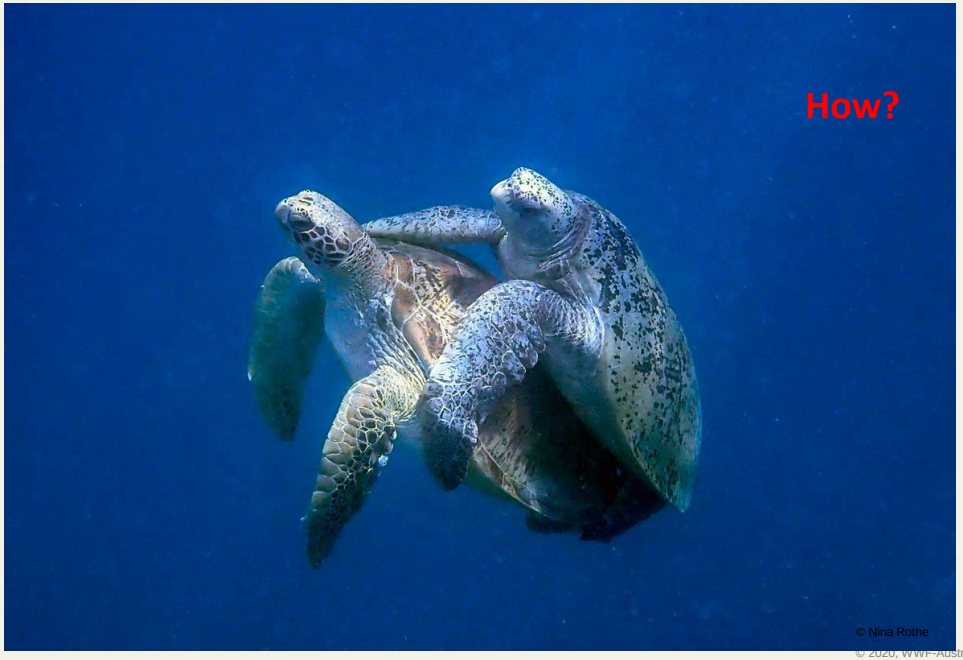
By 2030, 2.4 % hatchlings will be male

1% in 2060

0.4% in 2090 (Jensen *et al.* 2018)

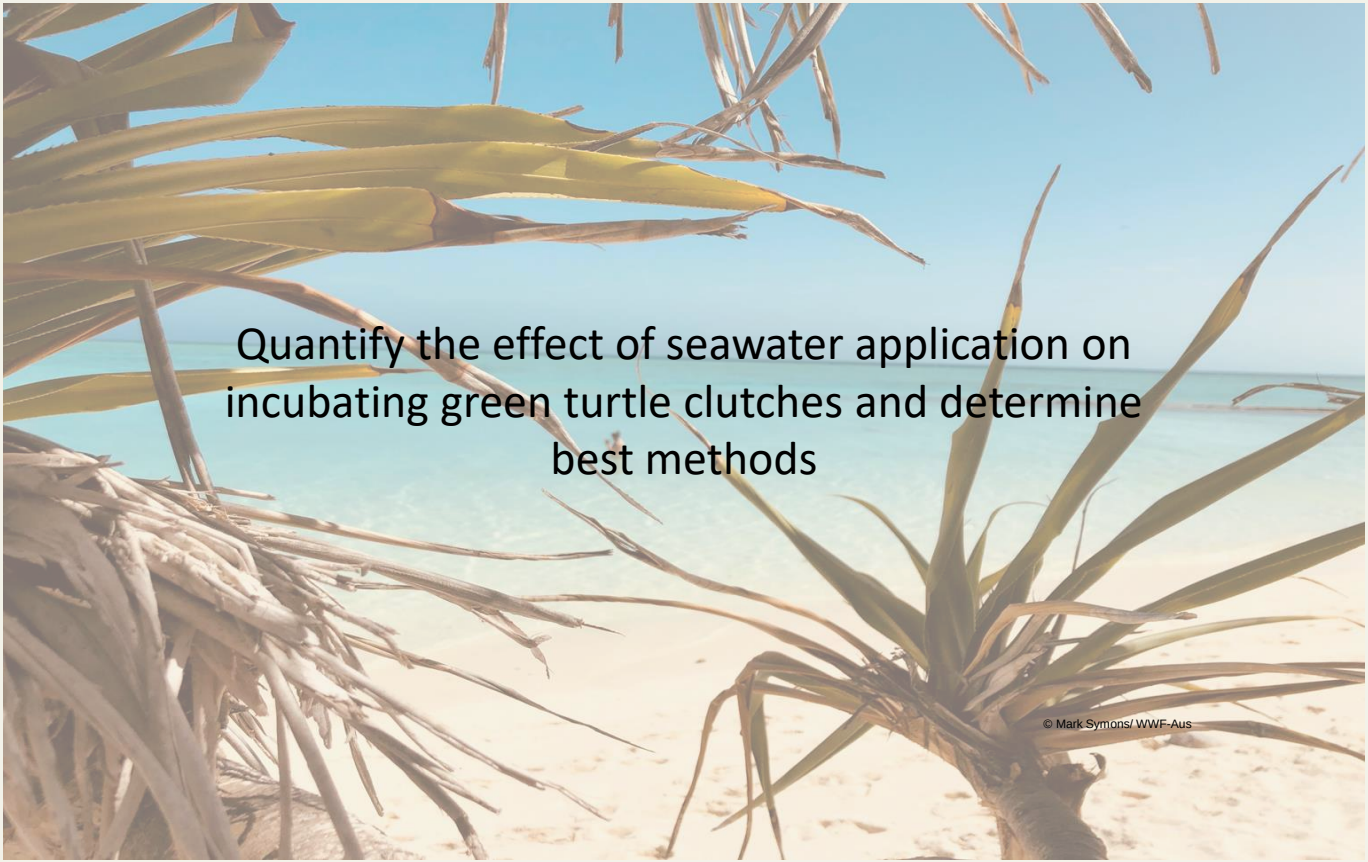


What do we need to know?



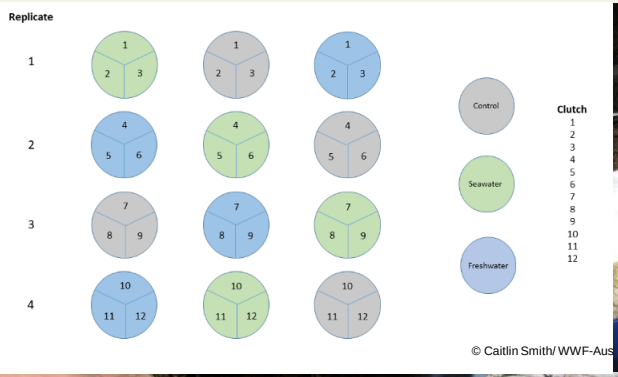
Using seawater to cool sand

Aims


Quantify the effect of seawater application on incubating green turtle clutches and determine best methods
© Mark Symons/ WWF-Aus

2019/2020 Seawater irrigation trials

Objectives | Approach | Results | Next Steps

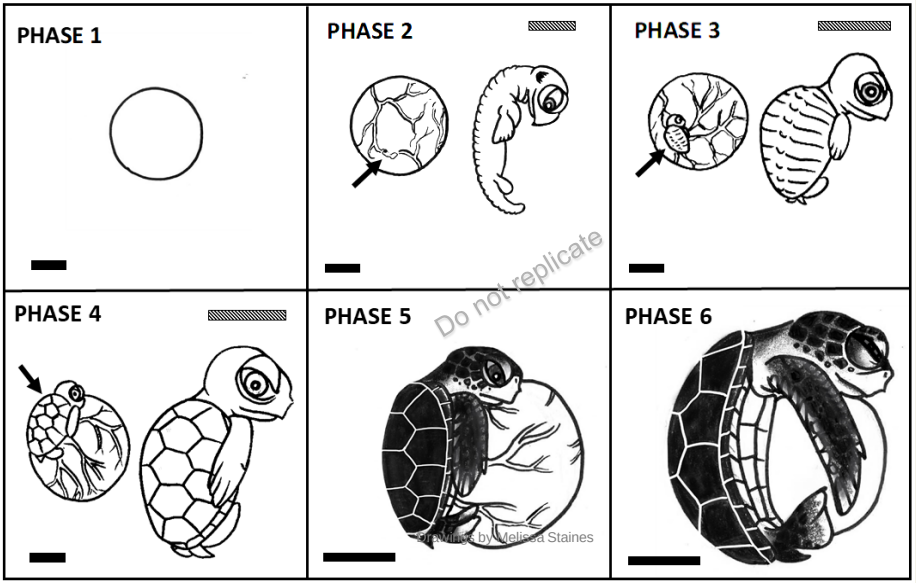


1241 EGGS RELOCATED

958 HATCHLINGS TO THE OCEAN

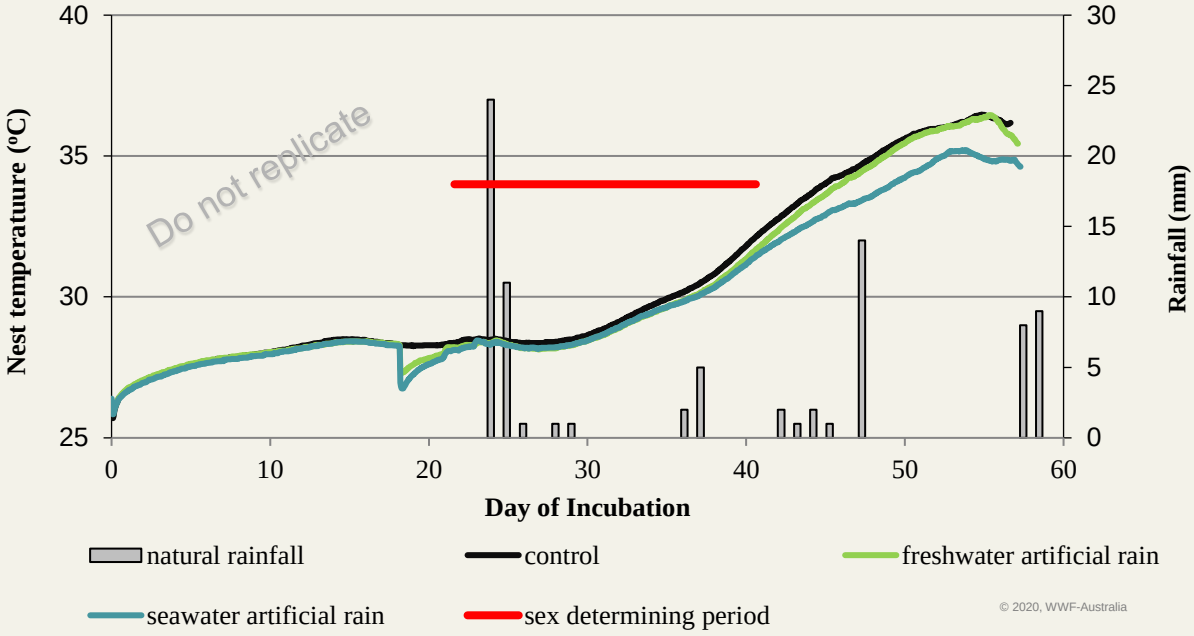
Seawater irrigation trials

Objectives | Approach | Results | Next Steps



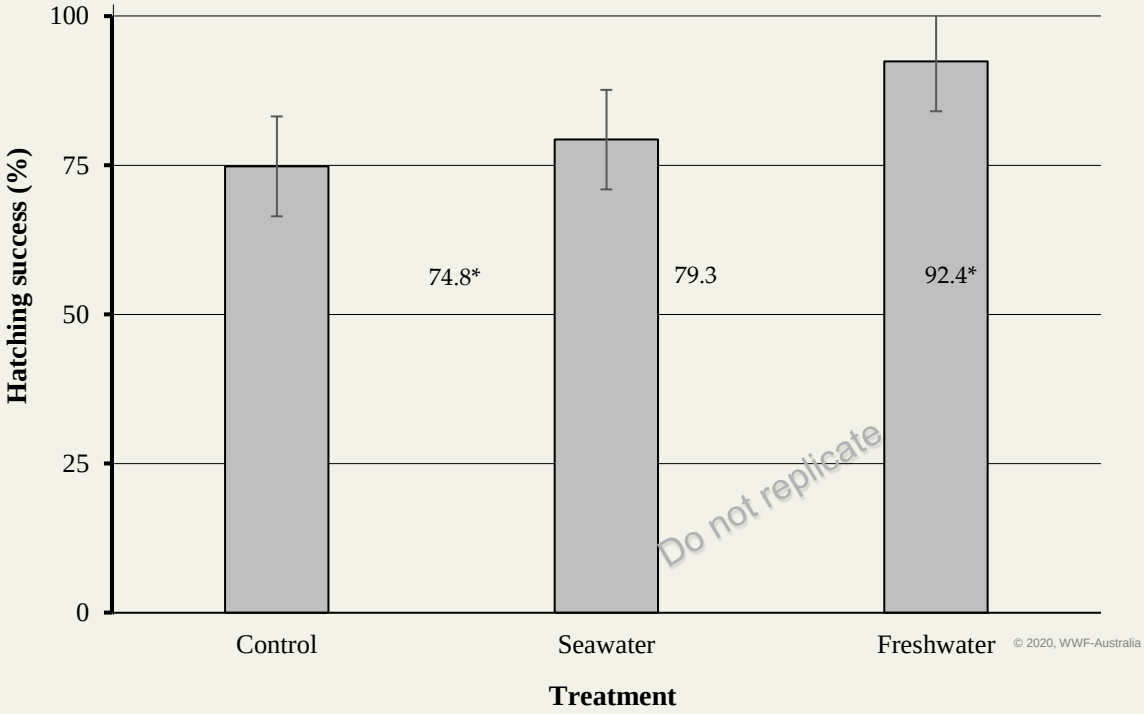
Temperature profile

Objectives > Approach > Results > Next Steps



Hatching success

Objectives > Approach > Results > Next Steps



Percentage of clutch mortality

Phase of embryonic development	1	2	3	4	5	6
Control	10.0 ± 4.5	3.7 ± 1.0	0.0 ± 0.0	1.0 ± 0.6	3.3 ± 1.4	18.0 ± 4.4
Seawater	7.6 ± 3.2	2.3 ± 0.8	0.3 ± 0.3	0.5 ± 0.3	3.1 ± 1.5	14.6 ± 4.7
Freshwater	8.0 ± 2.2	1.5 ± 0.8	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	6.7 ± 2.2
Average across all treatments	8.6 ± 1.9	2.5 ± 0.5	0.1 ± 0.1	0.5 ± 0.2	2.2 ± 0.7	13.2 ± 2.3

2020/2021 seawater trials

Time to cool sand is between 45 to 50 % of development, as this is the most likely time that the gonads differentiate.

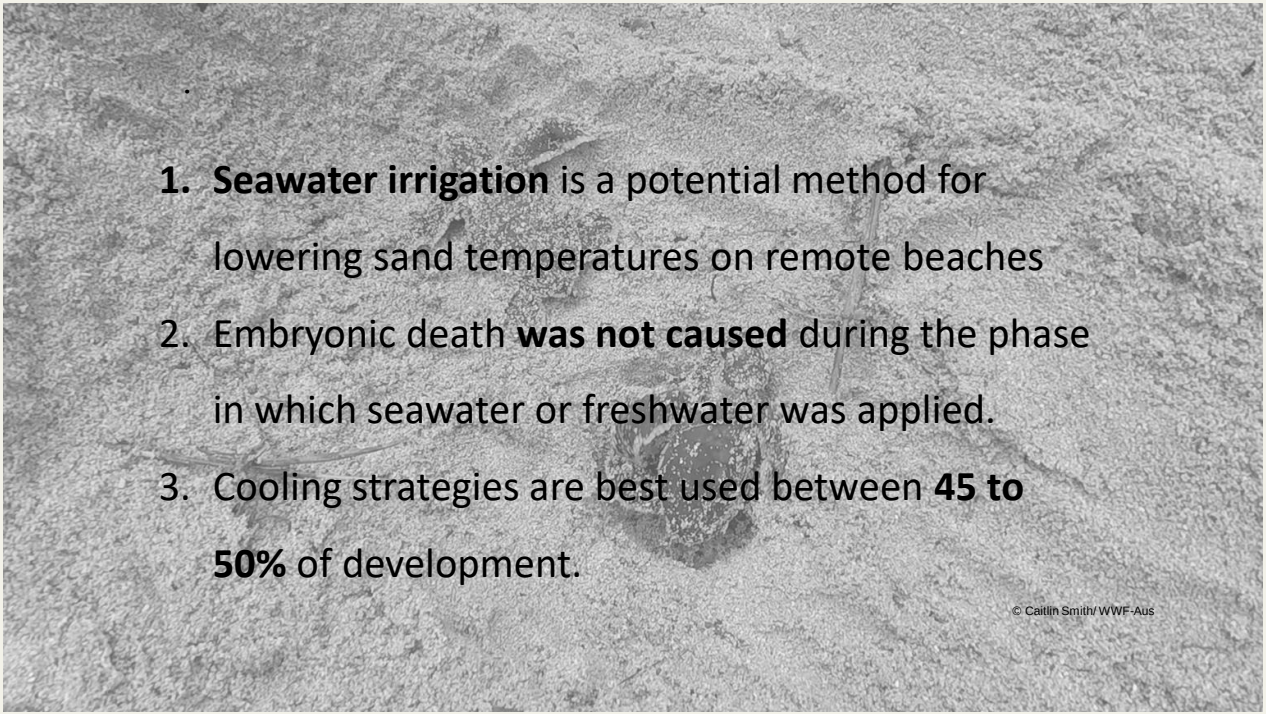
A great tool to use is the Bluetooth Hobo data loggers.

This will give you an estimate of embryonic development.

Took blood samples for sex identification.

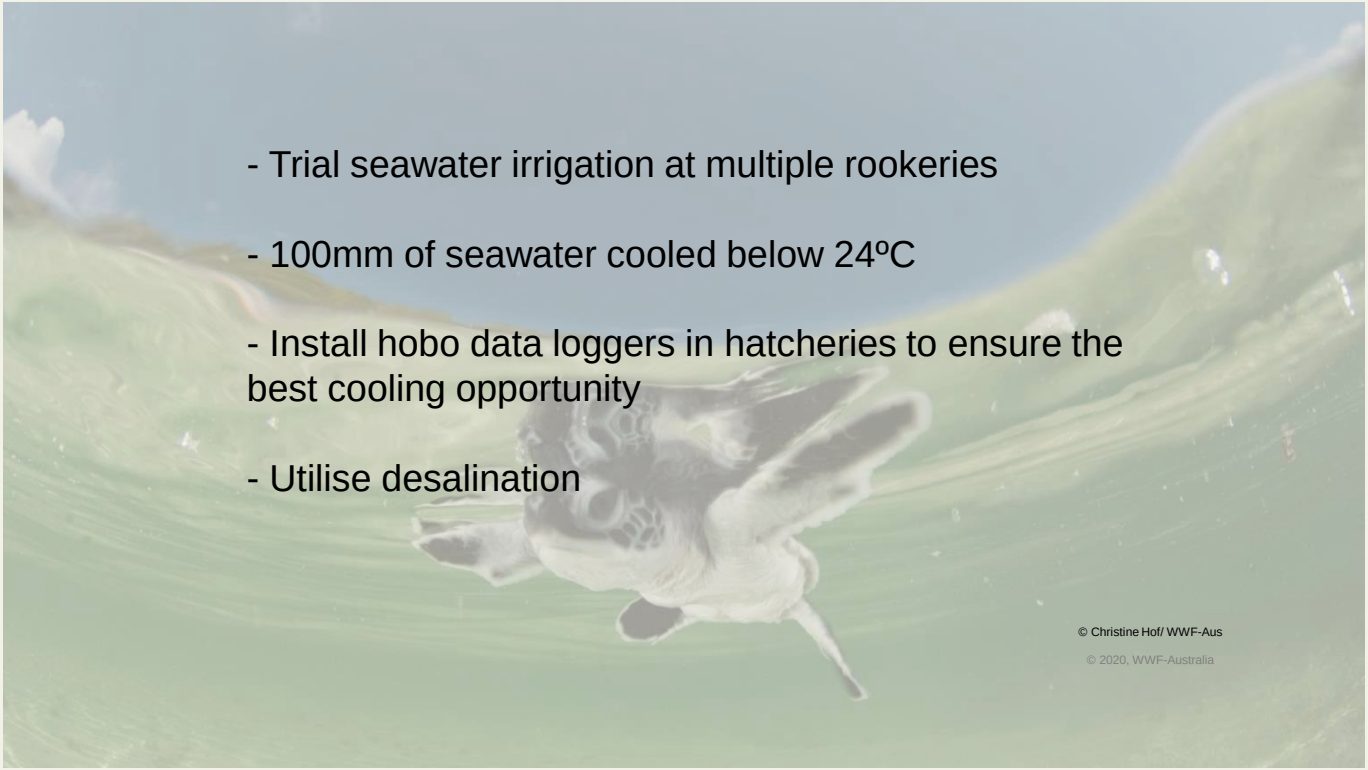
E. Porter, D. Booth, C.E. Smith, M. Staines and C. Limpus, 2021. Influence of short-term temperature drops on sex-determination in sea turtles. Journal of experimental zoology, in press.

Key findings



1. **Seawater irrigation** is a potential method for lowering sand temperatures on remote beaches
2. Embryonic death **was not caused** during the phase in which seawater or freshwater was applied.
3. Cooling strategies are best used between **45 to 50%** of development.

Recommendations



- Trial seawater irrigation at multiple rookeries

- 100mm of seawater cooled below 24ºC

- Install hobo data loggers in hatcheries to ensure the best cooling opportunity

- Utilise desalination

Thank you

CICI
CONFLICT ISLAND'S CONSERVATION INITIATIVE

WWF

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

koala