

Incubation temperature does not determine sex in the critically endangered Western Swamp Turtle

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Introduction

- For many reptiles, sex is determined by incubation temperature during embryonic development – known as temperature-dependent sex determination (TSD).
- For the critically endangered Western Swamp Turtle (*Pseudemydura umbrina*), research has indicated that temperature may not determine sex, but this has not been tested experimentally.
- As a precaution, Perth Zoo incubates eggs between 24 - 29°C.
- Understanding whether TSD occurs is important in ensuring optimal management of the breeding program, as this species represents the highest conservation priority of all Australian tetrapods and the second highest globally (Gumbs et al 2024).

Methods

- **Data:** Historical Species 360 records from Perth Zoo's Western Swamp Turtle breeding program (1988-2024)
- **Sample:** 145 zoo-bred individuals released to the wild and later sexed as adults (6-20 years old). The animals were released at Ellen Brook Nature Reserve, Twin Swamps Nature Reserve, Moore River Nature Reserve or Lake Wannamal Nature Reserve.
- **Variables:**
 - Incubation temperature (°C)
 - Sex determined upon recapture
- **Analysis:** Chi-squared to assess differences in incubation temperature between males and females

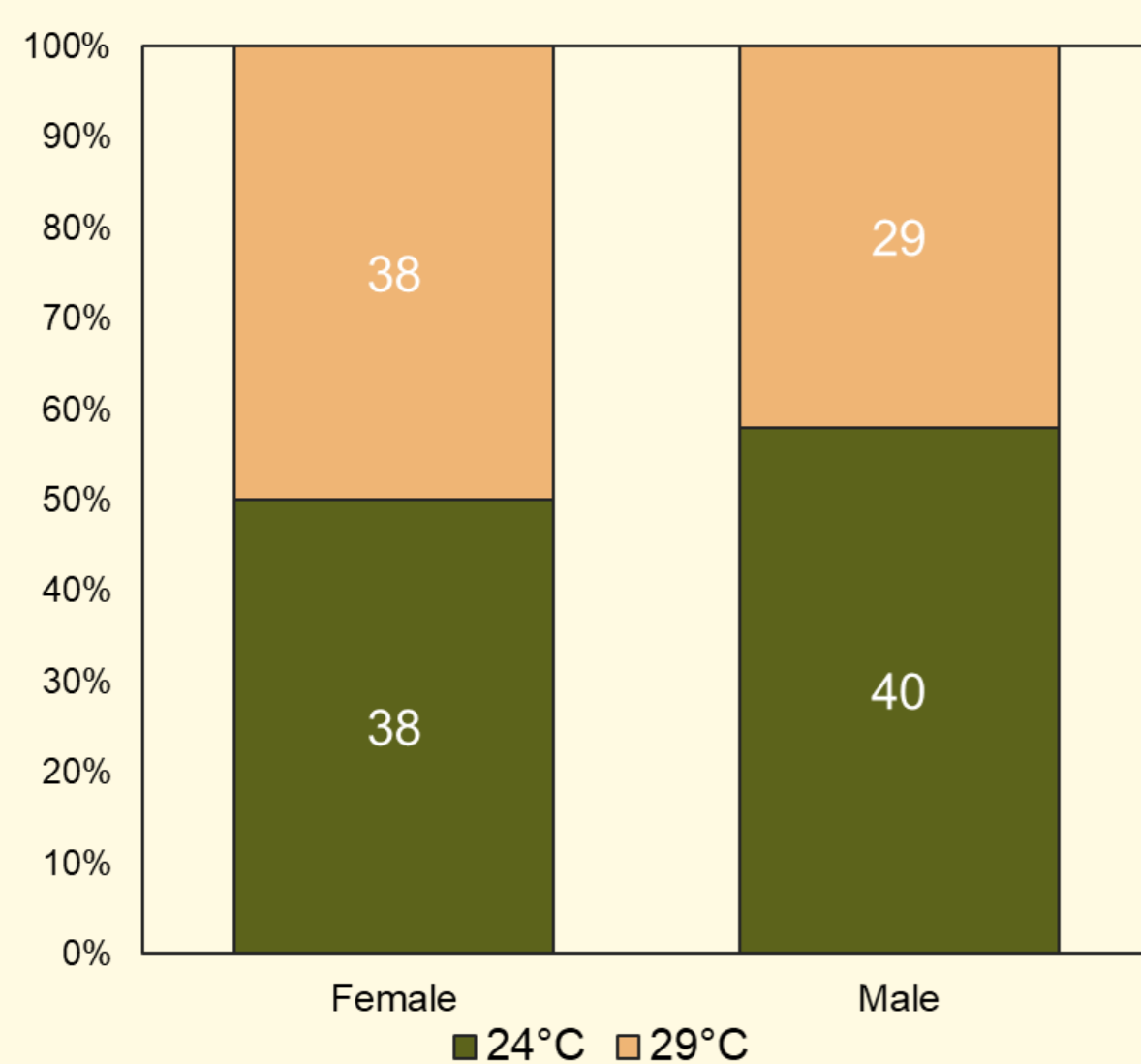
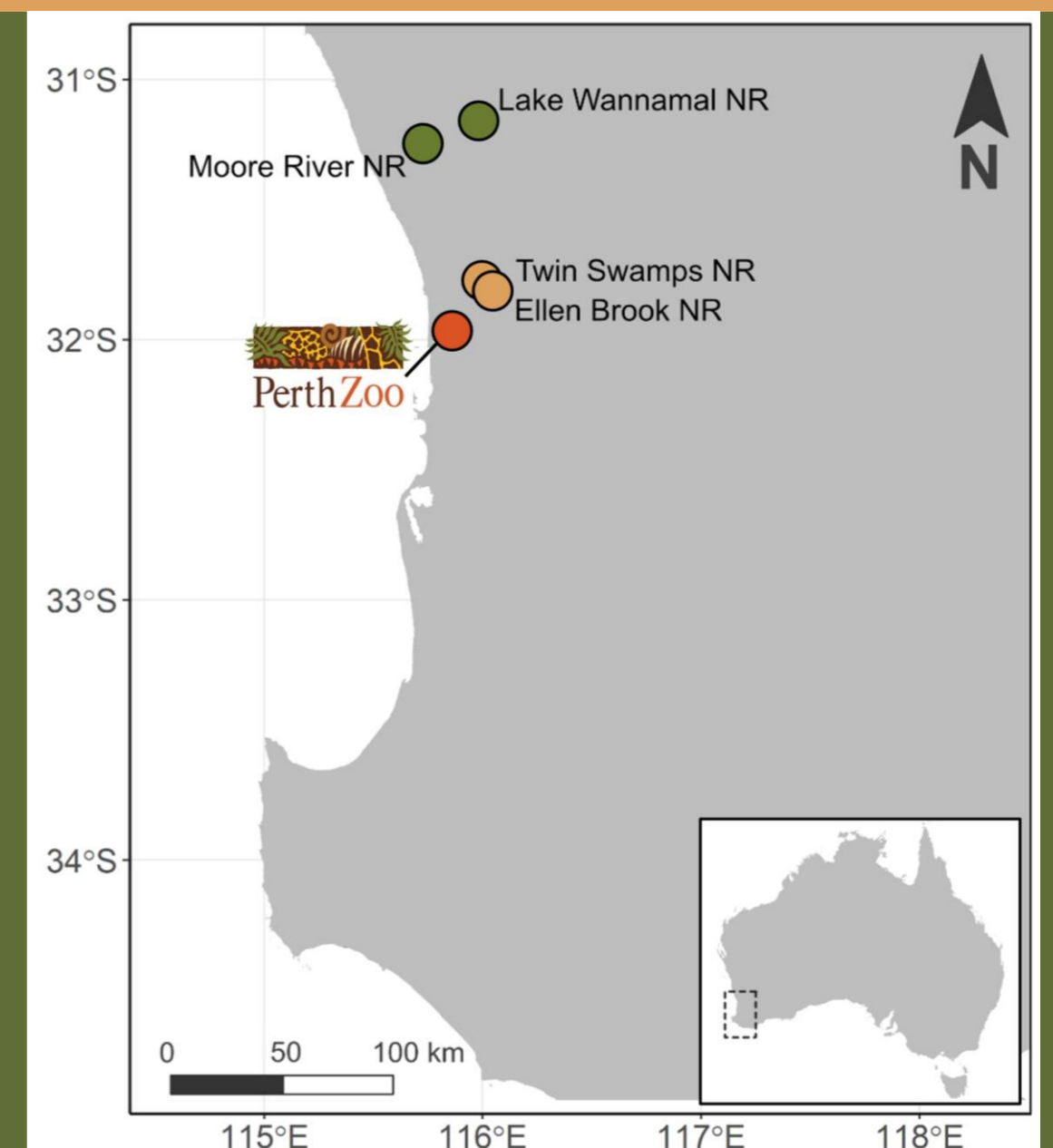


Figure 1. Proportion of each sex under two incubation temperature regimes.

$\chi^2 = 1.754$; $p = 0.625$; $n = 145$.

Table 1. Western Swamp Turtles released into the wild that have a known sex as of 2024 (e.g., have been recaptured and confirmed as either an adult female or male) at Ellen Brook Nature Reserve (EBNR), Twin Swamps Nature Reserve (TSNR), Moore River Nature Reserve (MRNR) and Lake Wannamal Nature Reserve (LWNR).

| | Total | EBNR | TSNR | MRNR | LWNR |
|------------------|-------------|-------------|-------------|-------------|-------------|
| Total | 175 | 24 | 60 | 71 | 20 |
| Female | 91 | 15 | 30 | 36 | 10 |
| Male | 84 | 9 | 30 | 35 | 10 |
| F:M ratio | 1.08 | 1.67 | 1.00 | 1.03 | 1.00 |

Results

- No significant difference in incubation temperature between males and females ($p = 0.625$).
- Sex ratios across the temperature range were approximately balanced (Figure 1).
- Within this temperature range, temperature was not a strong predictor of sex.
- Overall sex ratio of turtles released from Perth Zoo to the wild was close to equal, except for a bias towards females at Ellen Brook Nature Reserve (Table 1).

Conclusion

- Western Swamp Turtles do not exhibit temperature-dependent sex determination.
- This is the first confirmation of genotypic sex determination (GSD) in the subfamily Pseudemydurinae and is consistent with other Chelidae species which exhibit GSD (Mazzoleni et al., 2020; Viana et al., 2020; Ezaz et al., 2006).
- The next step is to determine whether GSD is based on macrochromosomes or microchromosomes.

References

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