

**Preliminary Results on Emergence Behavior,
Crawl Speed, and Swimming Speed of
Hatchling Leatherback (*Dermochelys
coriacea*) Sea Turtles at Index Nesting
Beaches in the North Coast of Bird's Head
Seascape – Papua, Indonesia**

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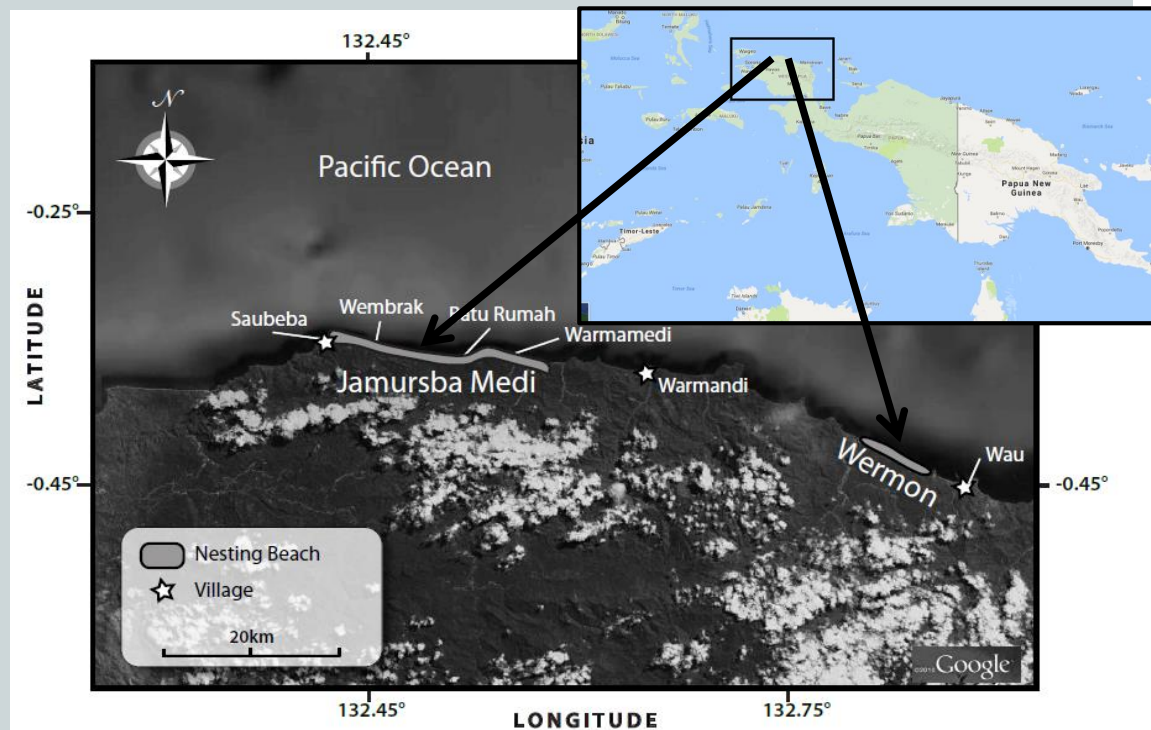
LEATHERBACK SEA TURTLE

- Largest, deepest diving, most migratory of the sea turtles
- During nesting season lays more clutches of eggs than any other sea turtle species
- Found temperate & tropical waters in Pacific, Atlantic, and Indian Oceans
- Declined significantly worldwide
 - IUCN – Critically Endangered in Pacific
- Last remaining stronghold of nesting in western Pacific located at Bird's Head beaches, Papua Barat



BIRD'S HEAD BEACHES: WERMON AND JAMURSBAMEDI

- Year-round nesting at both Wermon and Jamursba Medi
 - Boreal: Unimodal distribution of nesting at Jamursba Medi
 - Peak June-July
- Boreal and Austral: Bimodal distribution of nesting at Wermon
 - Peaks:
 - December-February
 - June-July



CURRENT STUDY

- Hatchling production is paramount to saving the western Pacific Leatherback
- Enhancing hatchling fitness and survival is vital
- 3 aspects of hatchling behavior and fitness were investigated at the Bird's Head Beaches:
 - Emergence Time
 - Crawl Speed
 - Swimming Speed



HATCHLING EMERGENCE

- Time of emergence affects survival:
 - Predation
 - Type and abundance of predators
 - Orientation cues
 - Ambient temperature
 - Can affect activity level/dessiccation
- We evaluated hatchling emergence July-August, 2016 at Wermon and Jamursba Medi



EMERGENCY: EXECUTION

- Temperature data loggers were placed into nests at the beginning of the incubation period
- Recorded nest temperature hourly
- Infrared, time-lapse wildlife cameras placed above nests on nights of expected emergence
- Recorded photos every 10 minutes
 - Photo taken if motion occurred in front of camera between 10 minute intervals
- Nest monitored for 4 consecutive nights following initial emergence event



EMERGENCY: CAMERAS





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EMERGENCE: PRELIMINARY RESULTS

- Hatchlings emerged between 1800 h to 0100 h (n = 5)
- Average emergence time of 2214 h \pm 0146 h (n = 5)



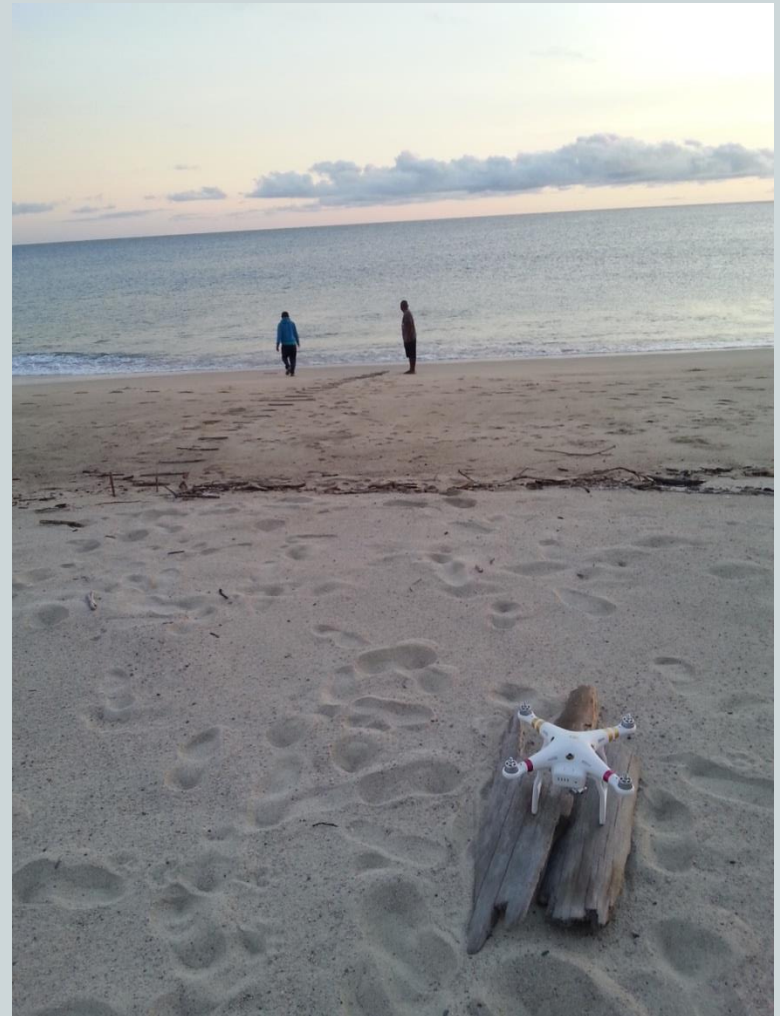
EMERGENCE: CONCLUSIONS

- Hatchlings tend to emerge in the late afternoon-midnight at Jamursba Medi
- Uncertain if hatchlings at Wermon and Jamursba Medi emerge at similar times'
 - We had no recorded emergence at Wermon



CRAWL SPEED

- Recorded using DJI Phantom 3 Pro camera drone
- Hatchlings released an average of 10m from the water
- Naturally-occurring driftwood marked 0.5m intervals down length of beach
- Drone flown at 5m above sand









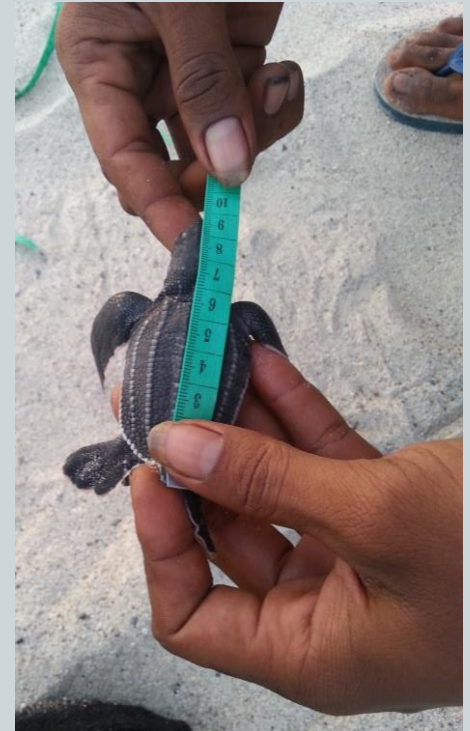
CRAWL SPEED: RESULTS AND CONCLUSIONS

- Time for hatchling to crawl the distance between the driftwood markers
- Mean crawl speed of hatchlings observed:
 - 0.04 ± 0.01 m/s or
 - 2.2 ± 0.55 m/min
 - (n = 6)
- For comparison: Leatherback hatchlings at Playa Grande moved down the beach at a rate of **3.11 m/min¹**

¹Tomillo, Pilar Santidrián, et al. "Predation of leatherback turtle hatchlings during the crawl to the water." *Chelonian Conservation and Biology* 9.1 (2010): 18-25.

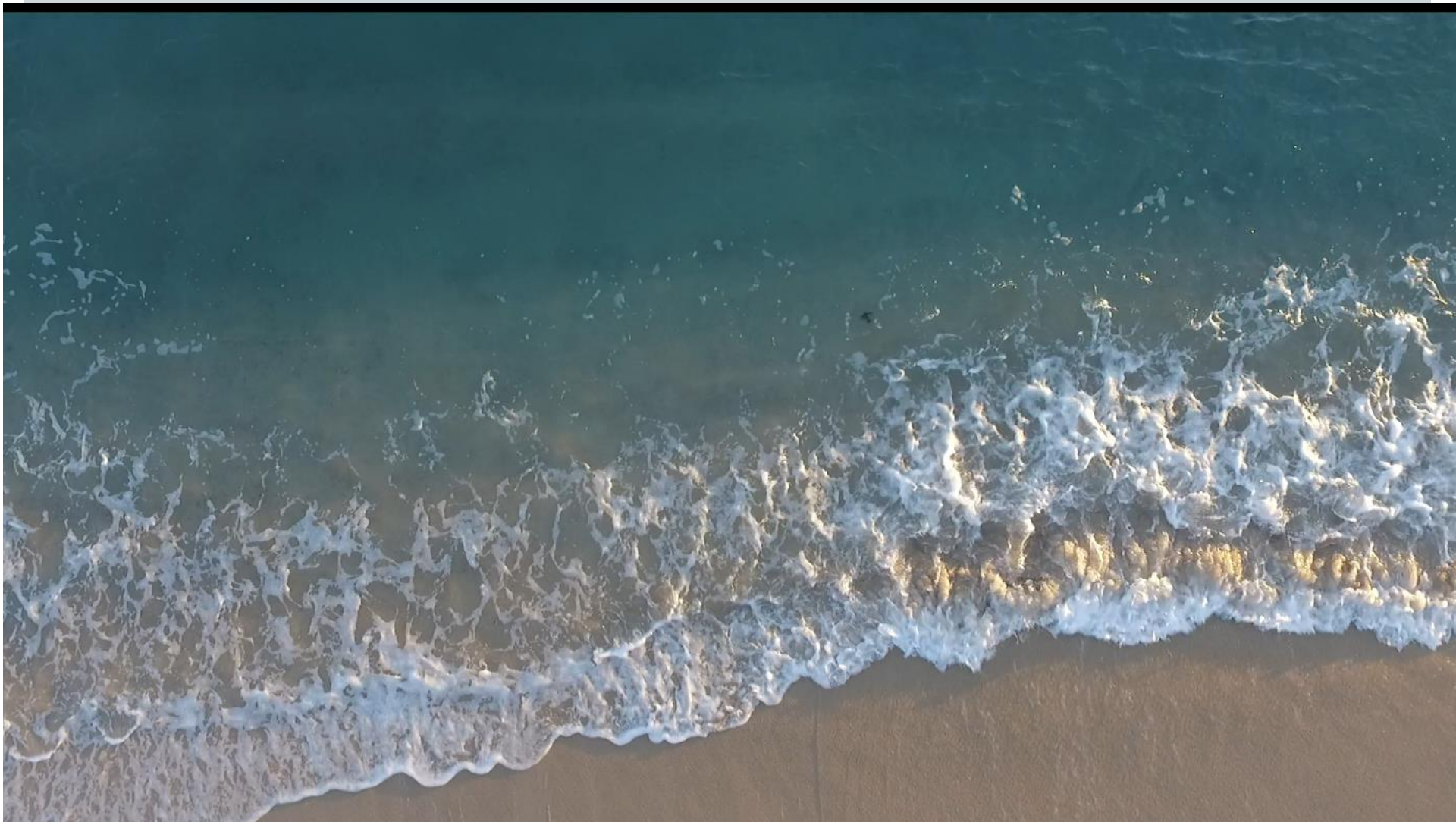
SWIMMING SPEED

- Previously, In-water movements of hatchlings primarily tracked:
 - Visually
 - Observer on boat
 - Small tags
 - Radio, Acoustic
- Camera drone provides ability to track hatchlings remotely from the shore
- Hatchlings followed from shore, through surf, and in nearshore waters
- Followed mean distance 134m from shore
 - Range: 30 - 300m



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SWIMMING SPEED: PRELIMINARY RESULTS

- Mean swimming speed:
 - 0.55 ± 0.13 m/s
 - 33.28 ± 7.77 m/min
 - (n=6)
- For comparison: Loggerhead hatchlings (off coast of FL) overall average swim speed 21.34 ± 2.64 m/min¹



¹Salmon, Michael, and Jeanette Wyneken. "Orientation and swimming behavior of hatchling loggerhead turtles *Caretta caretta* L. during their offshore migration." *Journal of Experimental Marine Biology and Ecology* 109.2 (1987): 137-153.

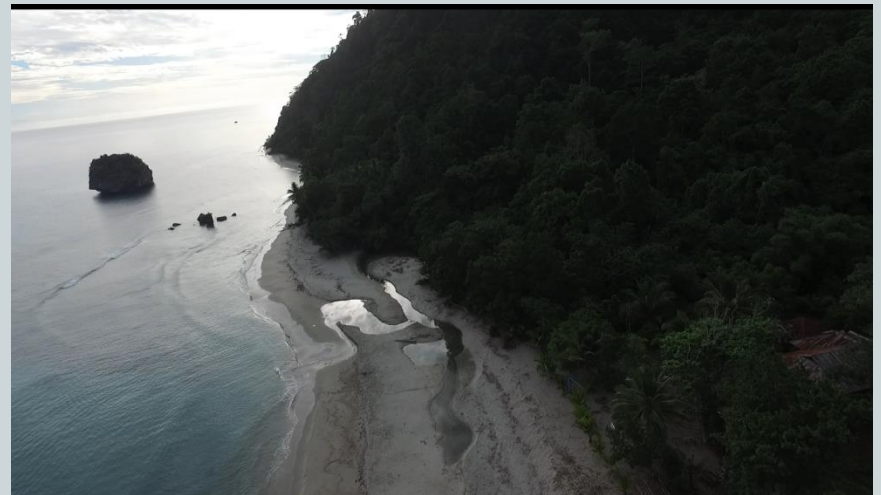
SWIMMING SPEED: CONCLUSIONS

- Clear waters off the coast of Jamursba Medi provide ideal conditions for evaluating hatchling fitness via swimming speeds
- Camera Drone provides video platform for effectively documenting swimming speed
- Limitations:
 - Difficult to track multiple hatchlings
 - Limited to approximately 20 minutes per flight/battery



OVERALL CONCLUSIONS

- Emergence times are non-random and may have evolved to maximize survival
 - Emergence Time of hatchlings may be species and/or population specific behavior related to the ecology of specific nesting beaches
- Development of drone-based methodologies for evaluating hatchling fitness:
 - Crawl Speed
 - Mean speed of 2.2 ± 0.55 m/min
 - Swim Speed
 - Mean rate of 33.28 ± 7.77 m/min



FUTURE DIRECTIONS

- **Enhancement of the production of hatchlings with optimal fitness is an essential component to the recovery of the species**
 - Evaluation of hatchling production and fitness from *InSitu* nests
 - Evaluation of hatchling production and fitness from egg hatchery nests

- **Emergence:**
 - Continue monitoring nest emergence at Wermon and Jamursba Medi (possible seasonal/yearly trends)
 - Further analysis of temperature data in association with time of emergence
 - Possible emergence cues

- **Crawl Speed:**
 - Investigating variations in crawl speed based on beach location

- **Swimming Speed:**
 - Swimming characteristics (surface, subsurface, and stroke style) should be investigated with future studies

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