

# PRELIMINARY SIMULATIONS OF WESTERN PACIFIC LEATHERBACK TURTLE MOVEMENTS USING AN INDIVIDUAL BASED MODEL

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Pacific-Atlantic Sea Turtle Assessment  
(PASTA)

## Why bother?

Much concern about this endangered species, especially with regard to fisheries impacts

Much unknown about their distribution – found across the Pacific (and Atlantic) but they are considered LOST for large parts of their life (espec. juvenile phase)

By developing a movement model incorporating what we do know of their behaviour, especially in relation to environmental variables, we can try to FIND them

By comparing predictions with observations we can improve understanding of behaviour and distribution by seeing what movement rules generate observed patterns

## The approach...

KISS - keep it simple, stupid!

Many unknowns, therefore best to explore some tractable problems (e.g. drift of hatchlings; aggregation of juveniles) using a simple model

Use an Individual/Agent-Based Model (I/ABM) because it's computationally feasible to model individual animals as individual agents

I/ABMs also allow you to explicitly incorporate individual variability in behaviour or any other biological trait

## Technical stuff

Model defines a population of individuals/agents each with certain characteristics:

- Age
- IF mature
- IF migrating
- Years since nesting
- Location of nesting beach
- Present location
- $u$ -component of current (from ESSIC model)
- $v$ -component of current (from ESSIC model)

Turtles are immortal (i.e. we are modelling the survivors) – a movement/distribution model, not a population dynamics model (yet...)

## Model pseudocode

Initiate population at the nesting beach

Read environmental (i.e. current) data

Drift with currents until mature (ca. 9 yrs)

Migrate back to nesting beach

Carry on drifting til it's time to migrate again  
(i.e. no directed movement other than for nesting)

## Migration algorithm

Track time of year and GCP (Great Circle Path = shortest) distance from nesting beach

Calculate time needed to swim to beach

If time needed approx. = time left before breeding season, it's time to migrate!

Calculate direction (azimuth) to beach

Move 60 km per day in that direction

SHOW DRIFT TRAJECTORIES...



## Immediate future work

Get the migration algorithm working ASAP

Integrate drift over vertical habitat – current vectors might then be different to surface drift

Investigate whether movement vectors from tagging studies are predicted by drift alone (null hypothesis) or if they are the result of directed migration

Investigate whether residence times in defined areas are similarly consistent with drift or if position maintenance is required

## Future future work

Get better resolution at Papuan coasts

Incorporate other environmental preferences and constraints

Find data and person to do same for Atlantic

The background is a warm, golden-yellow color. It features several faint, white line-art illustrations of fish, including a large one in the foreground and several smaller ones in the background. A subtle grid pattern is overlaid on the entire background.

Thanks to ...

Molly Lutcavage, Selina Heppell

and the rest of the PASTA people for sharing ideas and knowledge, and proving that just because you work on turtles doesn't mean you can't spell collaboration