Structured decision-making framework for evidence-based assessment of threats and protection of sea turtle eggs and hatchlings

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Background

- This framework was facilitated by the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA MoU) Work Programme 2020-24 Objective 1.2 Action 15 to "*Develop guidelines on the management of beaches for successful hatchling production, including management of hatcheries if and when required*".

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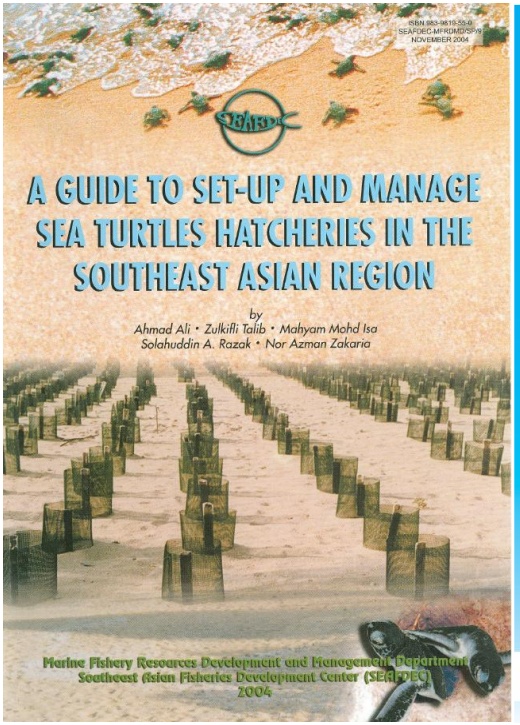
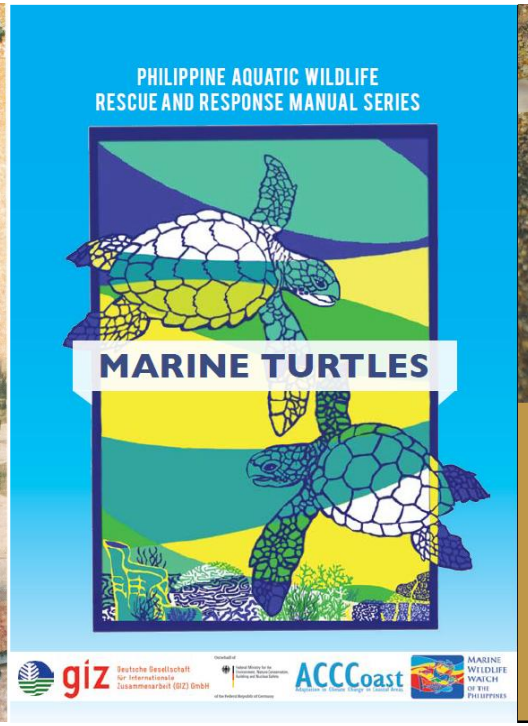
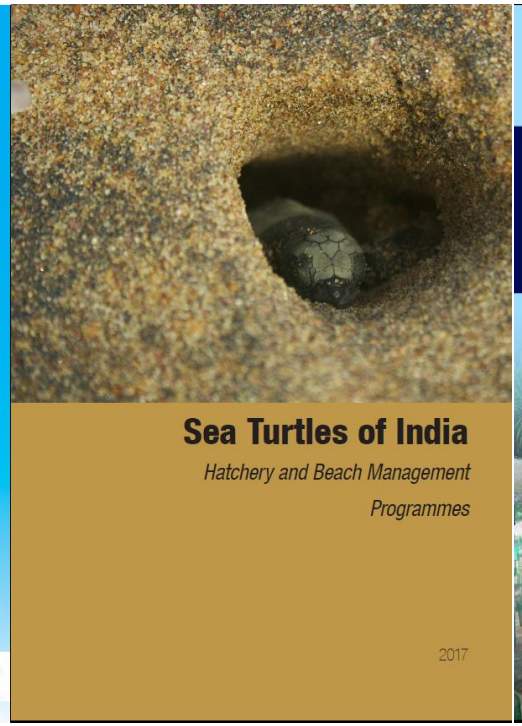
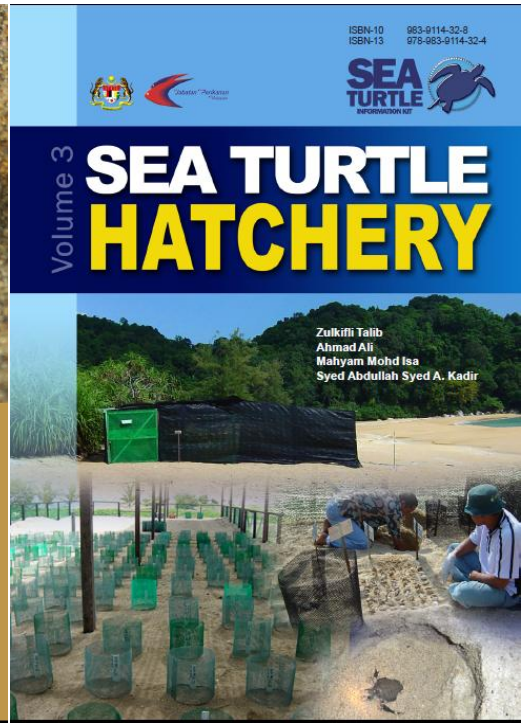
Marine Turtle MOU

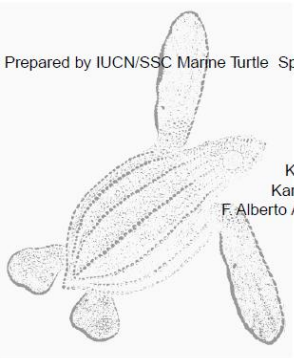








Research and Management Techniques
for the Conservation of Sea Turtles



WWF CMS SSC NOAA MTSG CMC

Decision-making Frameworks:

systematic approaches that give a structured way of analysing and evaluating different options before making a decision.

reduce the complexity of decision-making by breaking it down into smaller pieces, making it easier to understand and manage.

can help conservationists and managers make more informed and rational choices, leading to better outcomes.

Decision-making frameworks reduce the challenges in conservation decision-making that come from:

- Uncertainty about what the decision is
- Complicated governance structures
- Multiple actors and stakeholders
- Differing value judgements
- Multiple competing objectives
- Intangible objectives
- Scarce resources
- Complex alternatives
- Irreversible consequences and tipping points
- Risk
- Cognitive biases

Hemming et al. 2022. Conserv Biol 36:e13868

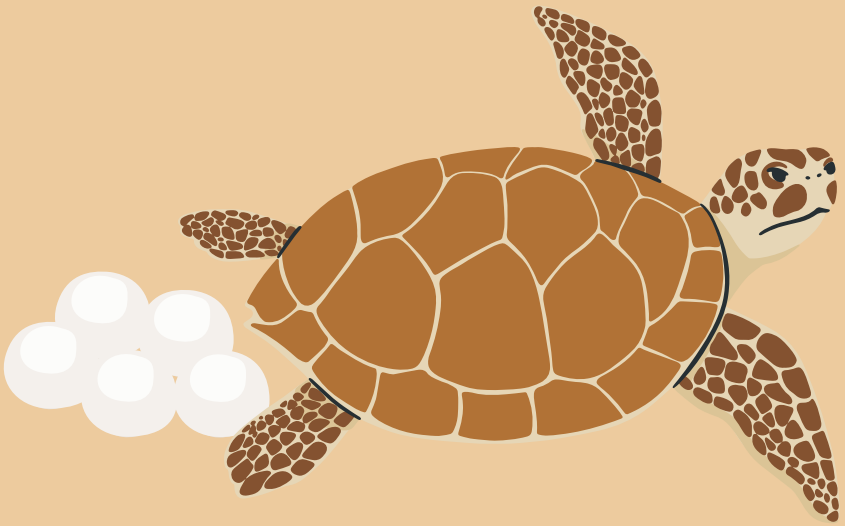
This decision-making framework:

is designed to help conservationists, managers, beach monitoring personnel etc decide on which action(s) to take in protecting sea turtle eggs and hatchlings to maximise hatchling production.

recognises that eggs and hatchlings have an important ecological role as a nutrient source, and not every egg/hatchling needs to be protected.

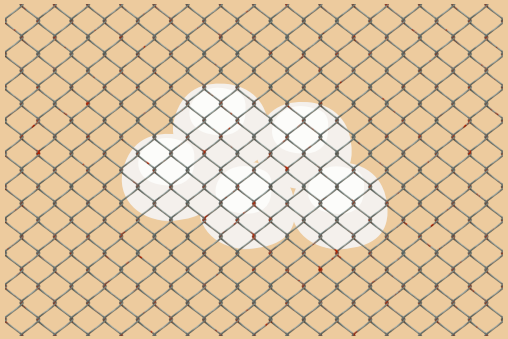
proposes that if <30% of clutches/eggs are threatened then conservation may not be required unless the population is demonstrating significant decline or is in the early stages of recovery.

Common Actions to Protect Eggs & Hatchlings



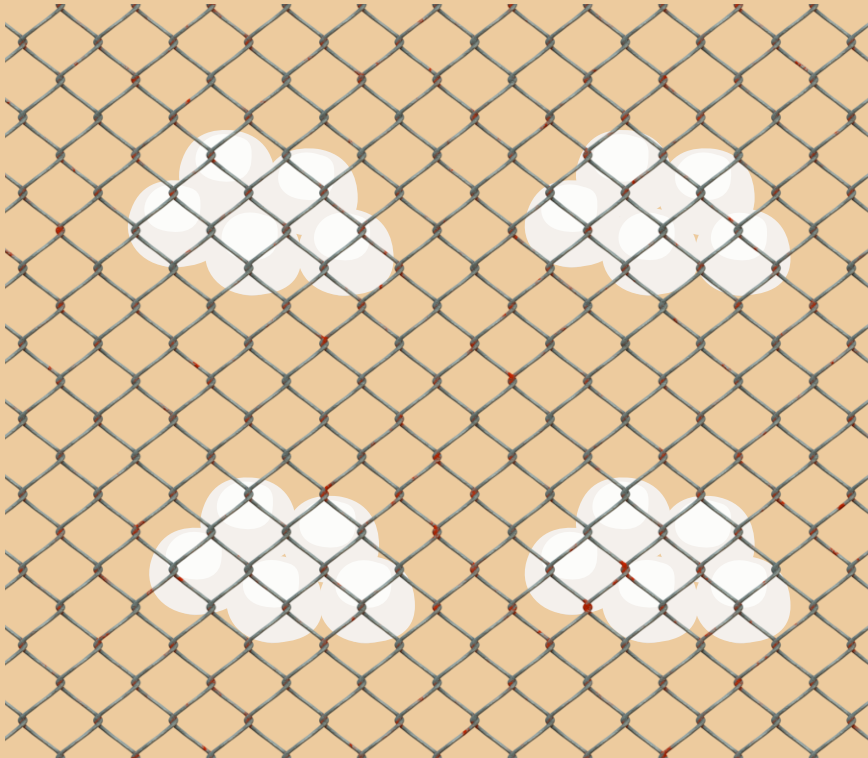
Unprotected *in situ*: Eggs remain where laid; no protective action

Protected *in situ*: Eggs remain where laid; protective action

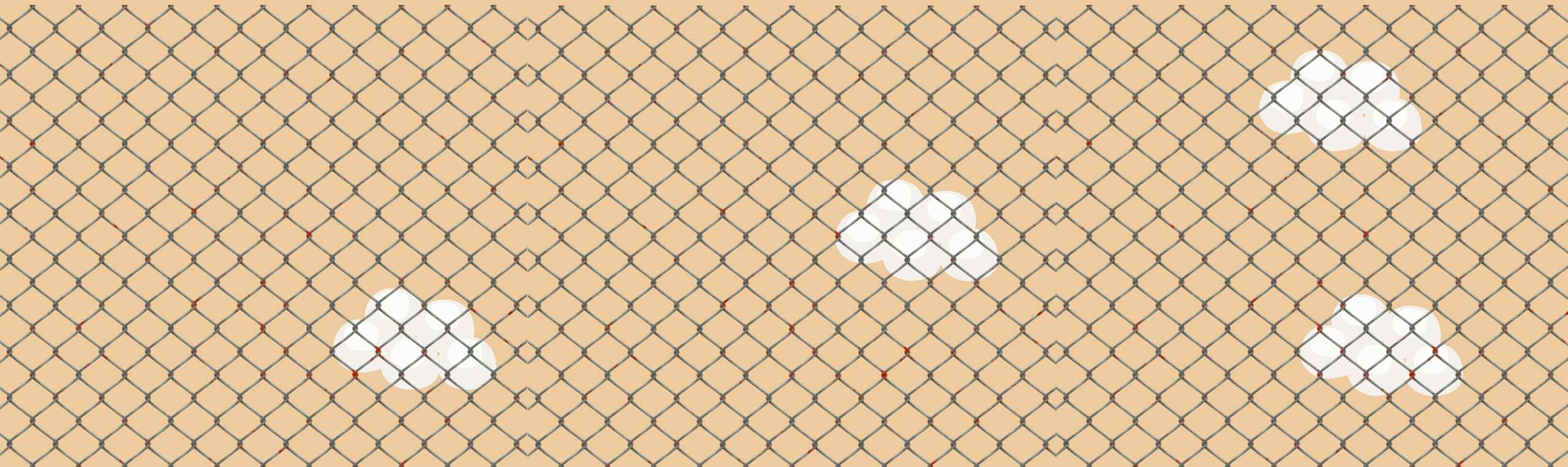


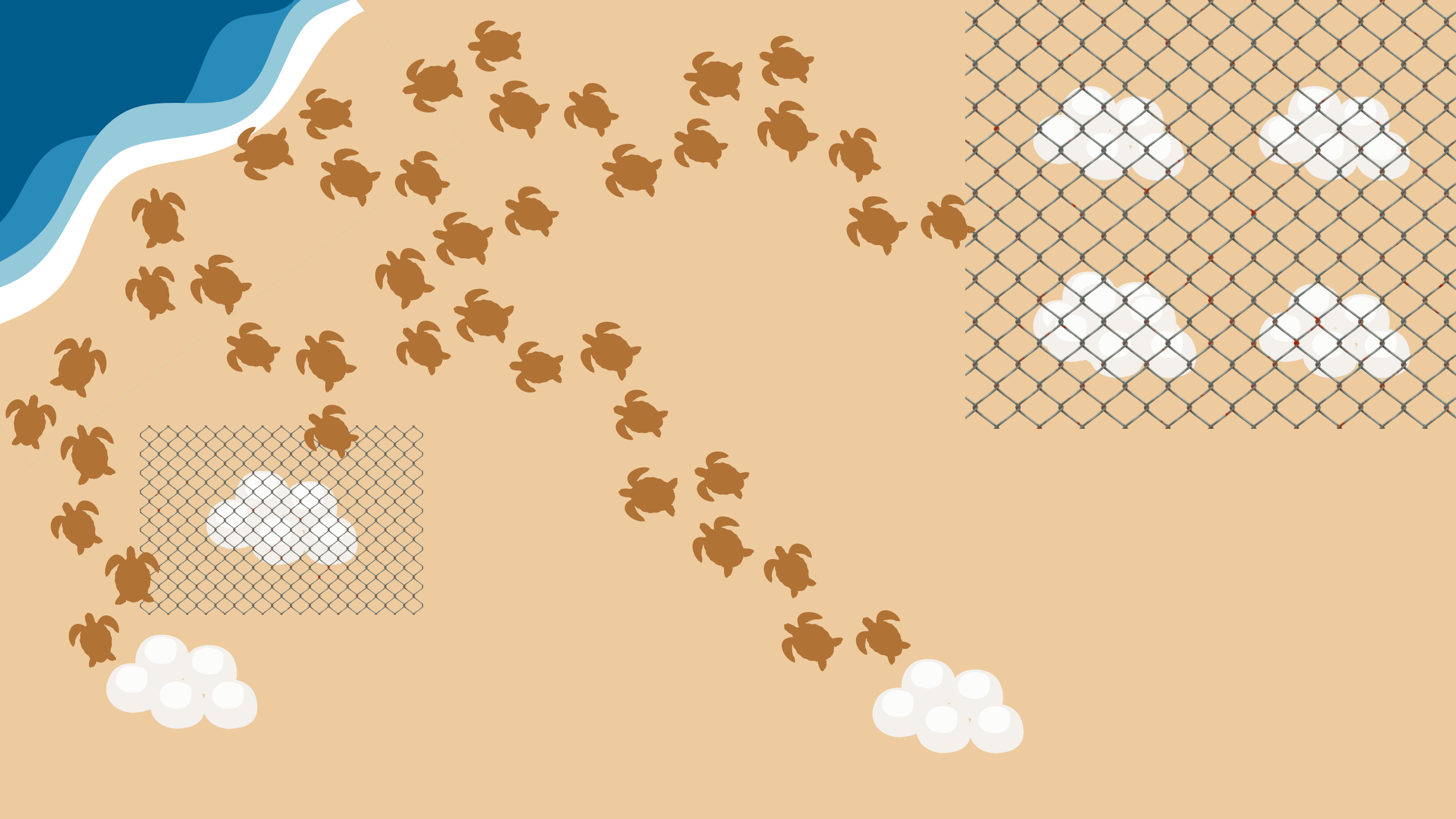
Relocated- Beach: Clutch moved to individual location on beach where specific threat is reduced

Relocated- Hatchery: Clutch moved to a protected hatchery where all threats are reduced

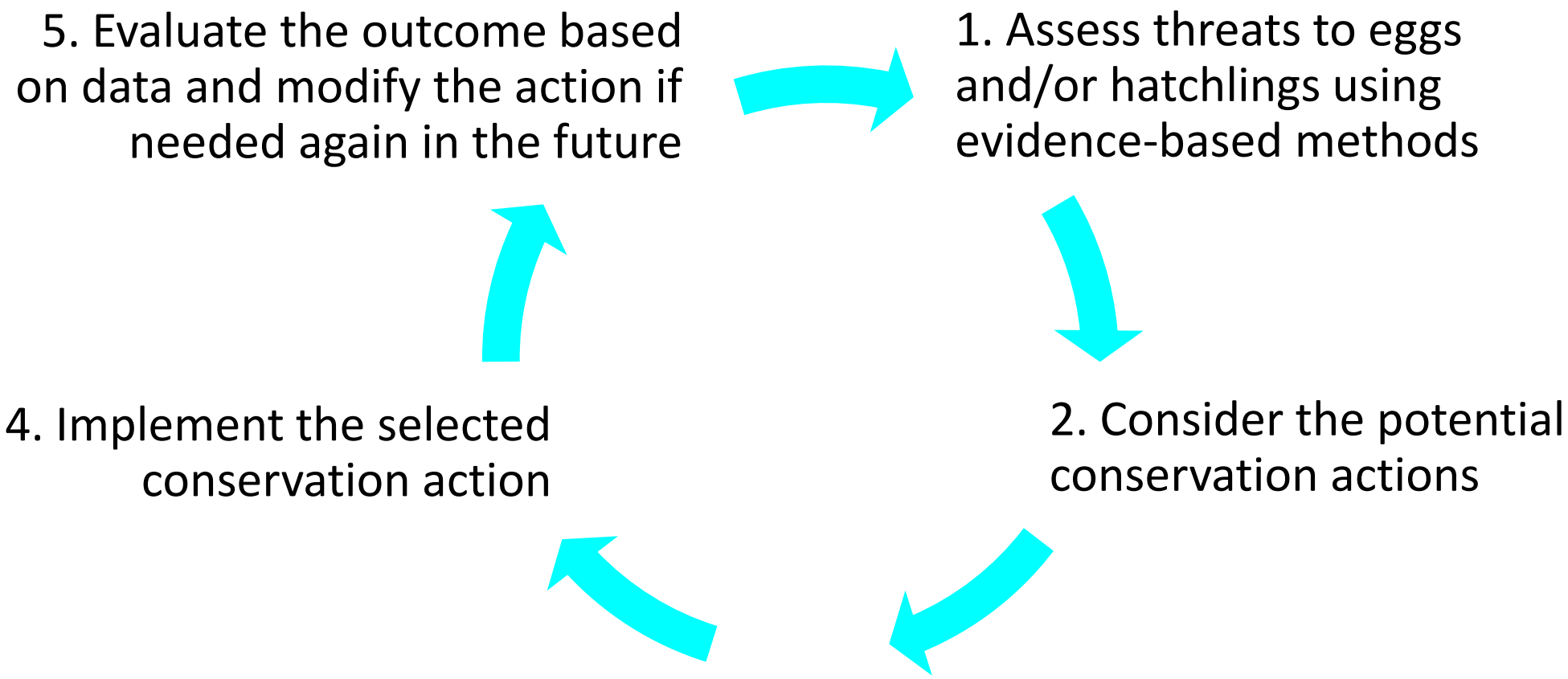


Beach-level action





Steps in the Decision-Making Process



Step 2. Consider potential actions

		Potential Actions if Clutches/Eggs Threatened				
		<30%		>30%		
Threat	**Threat Assessment**	**Unprotected *in situ***	**Protected *in situ***	**Relocated-Beach**	**Relocated-Hatchery**	**Beach Level**
Nest depredation	Monitoring (observations, camera traps); predation hazards modelling; LEK	✓	✓	✓	✓	✓
Illegal take of eggs/hatchlings	Monitoring; market surveys	✓	✓	✓	✓	✓

Step 3. Evaluate the requirements for each action

Action	Requirement(s)
Protected *in situ*	Resources are available to protect clutches *in situ* and monitor regularly to ensure effectiveness
Relocated- Beach	Experienced personnel are available to monitor beaches for nesting turtles throughout the night for the nesting season and move eggs within the time limit using best practices then monitor regularly to ensure effectiveness

Step 3. Evaluate the risk for each action

Action	Potential Risks	Risk Reduction
Protected *in situ*	Protective action may not be successful	Check protective action throughout incubation and reinforce if needed
	Clutch may be exposed to additional threat(s)	Assess for common threats when clutch is laid

Step 3. Evaluate the risk for each action

Action	Potential Risks	Risk Reduction
Relocated- Beach	Movement-induced mortality of embryos	Move eggs in <3 hr (optimal) or <6hr (acceptable) of being laid
	Clutch may be exposed to additional threat(s)	Assess for common threats when clutch is relocated
	Nest microclimate is different to the *in situ* nest	Select a nest location similar in substrate characteristics to the *in situ* nest and replicate the nest shape and depth known for that species

Step 4. Implement the conservation action

Image credits: Abhidnya Unhale, Sea Sense, Seh Ling Long

Step 5. Evaluate the outcome and modify the action if needed again in the future

- Monitor nests throughout the incubation period and excavate emerged nests to determine hatching and emergence success.

- If the action is not successful for >70% of clutches, exposes the nest to additional threats, or requirements for the action to be implemented correctly cannot be met, then a different conservation action should be selected in future.

- Protected clutches (*in situ*, relocated-beach, relocated- hatchery, beach level) should achieve an average higher hatching success over the nesting season than unprotected *in situ* clutches.

What next?

An outline of the decision-making framework is available on the IOSEA MoU website

The framework will be submitted for publication later this year