Developing adaptation actions and pathways

Flatback Futures – Update 2- September 2019

The Northwest Shelf Flatback Turtle Conservation Program (NWSFTCP) is coordinated by the Department of Biodiversity, Conservation and Attractions (DBCA) in Western Australia. It has a 30-year contract to increase conservation and protection of the Northwest Shelf Flatback turtle population including:

a) surveying, monitoring and research
b) reducing interference to key breeding and feeding locations
c) establishing information and education programs

Key to the success of the program will be its ability to ensure effective linkages between research and conservation outcomes by integrating and planning research and activities for turtles and the community-at-large. Our four-year project (2018-2021) is undertaking a range of activities, including development of approaches to support long-term adaptation planning.

The project team is developing tools and methods to aid managers and researchers to develop long term conservation actions.

Prioritising adaptation actions in response to threats

A large number of potential actions are available to reduce the impact of threats to flatback turtles due to (1) sea level rise, (2) predation from introduced species (3) climate change (4) light, (5) marine debris, and (6) beach changes. Following methods previously developed and applied to iconic species and habitats, we first apply a rapid screening tool to prioritise those actions which are lowest cost, highest social acceptability and lowest risk. A set of attributes for cost, acceptability and risk are qualitatively scored (low/medium/high) by stakeholders. The relative spread of these actions (**Figure 1)** reveals a set that can be explored in more detail in quantitative models (**Figure 2**).

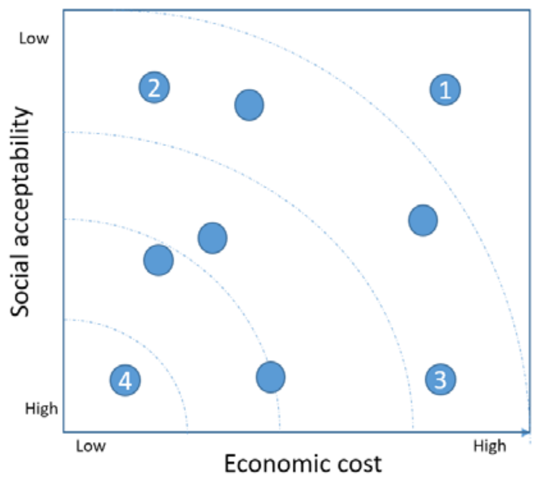

Figure 1. Scoring of each economic, social and risk attribute allows the action to be visualised in the above plot. Actions that are high cost and low social acceptability (action 4) will not be easy to implement compared to actions that are low coast and high acceptability (action 1). In the case where an action has low acceptability (action 2), additional education campaigns might be needed. Where economic costs are high, but acceptability is also high (action 3), additional research or investment is needed.

Following that stage, addition research and experiments, monitoring, or modelling may be selected. Example actions include:

- Nourishing beaches in response to sea level rise
- Relocating nests to reduce nest failure die to warming temperatures
- Predator exclusion fences

The economic costs of each action will depend on attributes such as:

- Cost of implementing the action
- The time scale over which the action will succeed
- The readiness of the action to deploy

The social acceptability of each action will depend on attributes such as:

- The likelihood that other species will be harmed by the action
- The reversibility of the action
- The time before benefits are seen

Risks include:

- Adverse impacts to the environment

Each of these actions is linked to a term in the adaptation model. The highest priority actions can be investigated in the adaptation model.

Adaptation modelling to investigate the priority actions

An adaptation model to aid turtle conservation decision-making is being developed. This tool is part of a suite of approaches aimed at promoting long-term persistence of *Natator depressus*.

The tool incorporates a simple population dynamics model that accounts for the fact that the focal species is long-lived, slow to reach maturity, and highly fecund but with low young survival. The model is stochastic and tracks annual population state, defined by adult and juvenile abundance.

The tool requires a well-defined management objective; for example, each year the sum of adult and juvenile abundance is above a specified threshold. Potential management strategies are specified with their anticipated effect on demographic rates. Management actions are assigned a cost that reflects both social and economic costs. The priority adaptation actions to include in the model are identified from the rapid screening tool (**Figure 1**). For example, relocating nests will increase egg hatching rates in the model, while predator exclusion will increase hatchling survival rates.

An operations research technique called stochastic-dynamic programming is applied to identify optimal state- and year-dependent strategies (including the `do nothing' strategy). An example, of a state-dependent optimal strategy map is presented in **Figure 2**. In this example protecting older animals is optimal when adults are rare, but juveniles are abundant, and egg protection is otherwise optimal, especially when adults are abundant.

The model is fast to run thereby allowing rapid exploration of actions. These actions, their cost, acceptability and risk will be explored with stakeholders

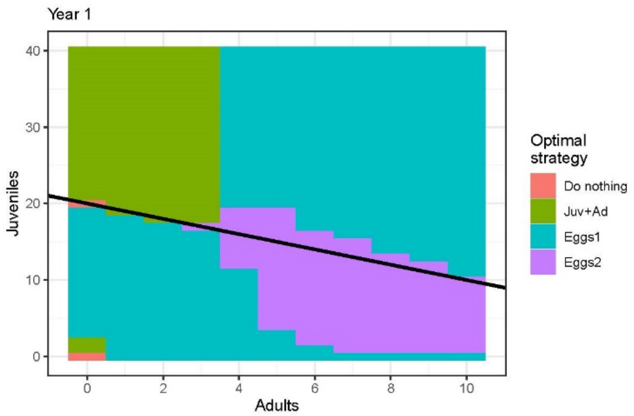

Figure 2. Example of state-dependent optimal strategies. States above the black diagonal line are desirable (>20 Juvenile + Adult groups). Eggs2 strategy is more expensive that Eggs1 but more effective at increasing egg survival, Juv+Ad improves survival of these groups. Abundance is in terms of population groups (not individuals).

Further information

The Flatback Futures project webpage will feature regular updates: https://research.csiro.au/teps/current-activities/mapping-and-monitoring- outcomes-and-developing-adaptation-pathways-for-the-northwest-shelf-flatback-turtle-conservation-program-western-australia/

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