RESEARCH SUMMARIES

FISHERIES AND TURTLES

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Issue 21 of IOTN focused on sea turtle-fisher interactions and presented new and important information on turtle by-catch in the Indian Ocean-South East Asian region. Collectively, these locally-based studies all reinforce the absolute need to involve local fishing industries in both the quantification of bycatch and developing solutions to the problem. Clearly, studies like these are valuable for local scale conservation of marine turtles.

Sea turtles, however, are international travellers and turtle populations can be exposed to fisheries in the waters of multiple nations or by many fisheries. At larger, national, or multi-national scales there are challenges to understanding and mitigating bycatch of marine turtles in commercial fisheries. Among them are: (1) the difficulty of assessing the impact of bycatch when both the rate of capture and the size of the affected marine turtle populations are not well known; and, (2) the challenges of cumulative fisheries impacts– i.e. that a particular turtle species or management unit is likely affected by more than one fishery.

These challenges have been addressed in part by research published in 2016. Casale and Heppell (2016) addressed the problem of not knowing the size of the species or populations impacted and thus not being able to quantify the severity of the bycatch problem. They did two key things. First they estimated the population size of two species in the Mediterranean by developing a theoretical demographic structure and abundance estimate that was as similar as possible to the Mediterranean populations. They then used Potential Biological Removal, a technique commonly applied to marine mammals, to examine whether the estimated loss of Mediterranean green and loggerhead turtles to bycatch was sustainable. The answer– it is likely unsustainable.

Another challenge to understanding and mitigating bycatch on large geographic scales is the lack of knowledge of the spatial and temporal degree to which a species/population is exposed to the threat. Lucchetti *et al.* (2016) used a combination of GPS tracking of turtles, GPS tracking of commercial fishing boats, and GIS analysis to quantify the extent to which turtles would be exposed to fishing activities. They calculated the probability of turtle occurrence in the northern and central Adriatic Sea and from this they estimated exposure of turtles to trawl fishing. These types of data combinations and analyses are becoming easier with advances in GIS based software and will be critical for designing spatial-based protection of sea turtles to fishing.

Sea turtle species or populations are generally spread over large geographic ranges. Thus, it is unlikely that a species or population of marine turtle is going to impacted by a single fishery. Understanding the cumulative impact of fisheries is challenging because bycatch data are often collected by different agencies or even the agencies in different nations. A PhD student at James Cook University in Australia, Kimmie Riskas, approached this problem by compiling all available bycatch data from multiple Australian fisheries to establish an estimate of total fisheries combined impacts (Riskas *et al.*, 2016). Her work stopped short of adding in international catch, but it would be an obvious next step if data were available. Kimmie's work also highlights the need to improve species identification so as to enable improved population based management.

Another key gap in managing fisheries bycatch programs is that the link between turtle captures and mortality to genetically distinct populations (see FitzSimmons & Limpus 2014) is mostly unknown. This gap is important to fill because a small population can withstand less mortality than a large one. While there are some challenges (e.g. CITES) to collecting skin samples from turtles caught by fisheries in international waters for genetic analyses, presumably international collaborations could overcome these. Plus national level projects could be attainable and would have considerable value.

Literature cited:

Casale, P. & S.S Heppell. 2016. How much sea turtle bycatch is too much? A stationary age distribution model

for simulating population abundance and potential biological removal in the Mediterranean. *Endangered Species Research* 29: 239-254.

FitzSimmons, N. N. & C.J. Limpus. 2014. Marine turtle genetic stocks of the Indo-Pacific: Identifying boundaries and knowledge gaps. *Indian Ocean Turtle Newsletter* 20: 2-18.

Lucchetti, A., J. Pulcinella, V. Angelini, S. Pari, T. Russo, & S. Cataudella. 2016. An interaction index to predict turtle bycatch in a Mediterranean bottom trawl fishery. *Ecological Indicators* 60: 557-564.

Riskas, K. A., M.M. Fuentes, & M. Hamann. 2016. Justifying the need for collaborative management of fisheries bycatch: A lesson from marine turtles in Australia. *Biological Conservation* 196: 40-47.

SUMMARY OF THE LOGGERHEAD TURTLE RED LIST ASSESSMENTS IN THE INDIAN OCEAN

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A summary based on:

Casale, P. 2015a. *Caretta caretta* (North East Indian Ocean subpopulation). The IUCN Red List of Threatened Species 2015: e.T84126444A84126520. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T84126444A84126520.en.

Casale, P. 2015b. *Caretta caretta* (North West Indian Ocean subpopulation). The IUCN Red List of Threatened Species 2015: e.T84127873A84127992. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T84127873A84127992.en.

Casale, P., K. Riskas, A.D. Tucker & M. Hamann. 2015. *Caretta caretta* (South East Indian Ocean subpopulation). The IUCN Red List of Threatened Species 2015: e.T84189617A84189662. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T84189617A84189662.en.

Casale, P. & A.D. Tucker. 2015. *Caretta caretta*. The IUCN Red List of Threatened Species. e.T3897A83157651. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T3897A83157651.en.

Nel, R. & P. Casale. 2015. *Caretta caretta* (South West Indian Ocean subpopulation). The IUCN Red List of Threatened Species 2015: e.T84199475A84199755. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T84199475A84199755.en.

Following decades of scientific debate over the appropriateness of using a global listing for sea turtles (Groombridge & Luxmoore, 1989; Mrosovsky, 2003; Godfrey and Godley, 2008), the IUCN Red List of Threatened Species now includes assessments for species at both the global and subpopulation levels. This enables systematic regional evaluation of each management unit, as threats, conservation efforts and recovery levels can vary significantly between regions.

A recent assessment of the loggerhead sea turtle (*Caretta caretta*) now lists the global population as 'Vulnerable', with the following listings assigned to each of its ten subpopulations (Casale & Tucker, 2015):

Critically Endangered: North East Indian, North West Indian, South Pacific
Endangered: North East Atlantic
Near Threatened: South East Indian, South West Indian
Least Concern: Mediterranean, North West Atlantic, South West Atlantic, North Pacific

The greatest threat to loggerheads worldwide is mortality associated with fisheries bycatch, followed by coastal development and direct harvest of eggs, meat and other products (Wallace *et al.,* 2011). Many of these threats also place loggerhead turtle populations in the Indian Ocean at risk (Casale & Tucker, 2015).