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A report on turtle harvest and trade in Solomon Islands

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Cover Photo: Juvenile turtles tied up with rope and being shipped to Honiara for sale.

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Executive summary

Background

- All five species of marine turtles in the Solomon Islands have been assessed at risk of extinction in the IUCN's Red List as Vulnerable to Critically Endangered (IUCN Red List 2015).

- The Solomon Island government allows turtles to be harvested for subsistence purposes but banned the trade of all turtle products in 1993. Despite this, the sale of turtle products continues.

- In Solomon Islands turtles are typically hooked, held or speared by free diving spearfishers. Often this occurs at night, when spearfishers use an underwater flashlight to search shallow reef slopes for resting reef fish, crayfish and turtles. Turtles usually make up a small (<5% by weight) component of the total landings in multispecies spearfisheries.

- Prior to this study, there had been no efforts to estimate the number of turtles harvested annually in Solomon Islands. Similarly, there had not been any attempts to assess whether contemporary harvest rates are sustainable.

- A primary objective of the survey was to provide the Solomon Islands government with the data required to determine whether their current efforts to conserve turtle stocks are sufficient.

Findings

This study summarises the findings of turtle surveys that were conducted across Solomon Islands from October 2016 to May 2018. Most of the data was collected by 10 community monitors who were trained, equipped and paid to document turtle catches in their coastal communities. All ten community monitors were men and were from Lata, Kaonasugu, Marau, Radefasu, Toa - Gella, Buala, Kia, Wagina, Munda and Taro. In the ten communities surveyed all fishers that were reported to capture turtles were free divers and all were men (N=278). To the best of the authors knowledge spearfishing while freediving (day and night) is exclusively conducted by men in Solomon Islands (Hamilton, Pita and Vuto, personal observations).

- We estimate that 9473 turtles are harvested each year by spearfishers in Solomon Islands, with 95% confidence intervals of 5063 to 22,423 turtles. Turtles are long-lived species with low natural mortality, so this harvest probably represents a significant source of turtle loss.

- Interviews with 26 experienced spearfishers indicate that the current rates of turtle harvest are unsustainable. Spearfishers that had used the same method of capturing turtles for their entire life (free diving at night) reported that their average catch per trip had declined up to 95.7% (mean 65.0 ± 21.7 st. dev.), with catches declining by an average 3.4% per year.

- 1107 harvested marine turtles were observed by community monitors between October 2016 – April 2018. Most of these turtles were green turtles (*Chelonia mydas*) (73.8 %) and hawksbill turtles (*Eretmochelys imbricata*) (25.7 %), with very few olive ridley turtles (*Lepidochelys olivacea*) (0.5 %).

- Green and hawksbill catches were dominated by immature sized turtles (88.7% and 76.4 %; respectively). This low proportion of adults is suggestive of excessive take of adult turtles and points to an unsustainable fishery.

- Adult turtles were typically harvested near or on nesting grounds. For example, adult hawksbill turtles made up 46% of the landings at Wagina. Wagina is near the Arnavons Community Marine Park (ACMP) which supports one of the largest rookeries for the critically endangered hawksbill turtle in the South Pacific Oceania region. Hawksbill turtles' nest year-round at the ACMP, and persistent poaching from Wagina fishers presents a serious threat to ACMP, Solomon Islands first national park.

- The communities of Kia in Isabel Province and Wagina in Choiseul Province had far higher catch rates of turtles than the other communities surveyed.

- Large numbers of green turtles (17% of which were adult size) were harvested from Edwards Bank. This foraging ground for green turtles lies approximately 45 km Northeast of Buala and is 75 km from Ramos Island, a known nesting site for green and hawksbill turtles. Buala spearfishers only began harvesting turtles from Edwards Bank in 2010.

- The field work conducted by the community monitor in Makira revealed that olive ridley turtles' nest at Waihaoru beach. This is the first time that nesting of olive ridley turtles has been confirmed in Solomon Islands.

- Green and hawksbill turtles were most commonly used for subsistence purposes (88.2% and 81.6% respectively) and were most likely to be consumed by the family of the fisher that captured the turtle(s).

- Hawksbill turtle products were far more likely to be illegally sold (32.3%) than green turtle products (12.1%). This species-specific difference can be largely explained by the trade in hawksbill shell, which was documented in 3 of the 10 communities surveyed but was only a common practice in Wagina. In the Wagina community, the shells of 87.5% of hawksbill turtles harvested were sold to local buyers, who then on sold to Asian buyers in Honiara.

- Hawksbill shell is also sold to local carvers, and the sale of hawksbill jewellery is widespread in Solomon Islands, despite this being banned under the national fisheries policy. Furthermore, although Solomon Islands is a signatory to the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) which restricts international trade in turtle products, hawksbill jewellery can regularly be purchased the international departure lounge in Honiara.

Recommendations

The findings of this study were shared with the Solomon Islands Ministry of Fisheries and Marine Resources (MFMR), the Solomon Islands Ministry of Environment Climate Change Disaster Management & Meteorology (MECDM) and Solomon Islands National University in July 2019. This generated discussions around how turtle populations in Solomon Islands could be better managed and these discussions subsequently led to the development of the recommendations that are presented here. Implementing some (or all) these recommendations is likely to improve the sustainability of turtle populations in Solomon Islands.

- Enforce current national policies that ban the sale of turtle products, with a focus on curbing the trade in the scutes of the critically endangered hawksbill turtle.
- Provide further training to provincial and national fisheries officers on the status of turtle fisheries in Solomon Islands, the laws and regulations relating to turtles, and the reasons why it is important to enforce them.
- Manage hawksbill turtle harvest by Wagina fishers. Suggested measures are: 1) Provincial fisheries officers increase their presence and undertake compliance and enforcement at Wagina. A high priority would be to prosecute buyers in Wagina and Honiara who purchase hawksbill scutes from Wagina fishers, since these buyers are driving the poaching of hawksbill turtles from within the Solomon Islands only national park, the Arnavons Community Marine Park (ACMP).
- Manage the green turtle stocks at Edwards Bank. This region supports an important stock of adult green turtles that are coming under recent and increasing exploitation. Suggested measures are; 1) Provincial fisheries officers at Buala enforce the ban on the trade of all green turtles harvested from Edwards Bank 2) Ban the harvesting of all adult turtles (> 90 cm) at Edwards Bank and 3) MFMR and MECDM consider establishing Edwards Bank as a protected area since Edwards Bank is located within national waters.
- Support a greater number of communities in Solomon Islands to protect and monitor their nesting beaches and strengthen existing efforts. Turtles are extremely vulnerable while nesting and protecting nesting turtles and the eggs they lay is an effective way to increase the sustainability of turtle populations. The ACMP provides an encouraging example of where ongoing conservation efforts have resulted in the number of clutches of eggs laid by hawksbill turtles at the ACMP doubling since 1995, despite persistent poaching issues.
- Investigate if community-based turtle monitoring programs (for nesting and foraging turtles) could be developed hand in hand with sustainable nature-based tourism initiatives in line with *Solomon Islands National Tourism Policy 2015 – 2019*. This in turn could help promote community conservation stewardship and provide an economic return to communities as an alternative to harvesting turtles.
- Conduct socioeconomic and household surveys to determine what impacts a moratorium on subsistence turtle harvest would have on the food security of coastal communities.

- Revisit 'hotspot' turtle harvest locations and undertake sociocultural surveys to understand the motivations behind turtle take, and to inform alternative livelihood recommendations.

- Update and revise The Solomon Islands Turtle Strategic Action Plan 2008-2012.

- Undertake a national wide awareness campaign that targets the youth of Solomon Islands and highlights the cultural values of turtles, their plight and why turtle management is important for cultural preservation.

Introduction

The green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), leatherback turtle (*Dermochelys coriacea)* the olive ridley turtle (*Lepidochelys olivacea*) are known to forage and nest in Solomon Islands. There have also been infrequent sightings of foraging loggerhead turtles (*Caretta caretta*), which are often referred to as 'devil turtles' in Solomon Islands. On the International Union for Conservation of Nature (IUCN) Red List of Threatened Species the green and olive ridley turtles are listed as Vulnerable and the hawksbill, South Pacific loggerheads and Western Pacific leatherbacks are listed as Critically Endangered. In the past century, marine turtles have experienced rapid population declines due to excessive exploitation (Humber *et al.,* 2014). The abundance of hawksbill turtles in the Pacific Ocean for example, is estimated to be at least 75% lower than historical levels, with many populations still declining (Mortimer and Donnelly 2008). Whilst many countries in the Pacific have strong cultural and social dependencies on marine turtles, both legal harvest and the illegal trade in turtles is driving exploitation to unsustainable levels in some regions (Wallace *et al*., 2010).

Although interventions by the Convention on International Trade in Endangered Species (CITES) resulted in a downward trend in the global trade of turtle products, turtle trade is alive and intact (CITES Secretariat, 2019), and is thought to be having long-lasting detrimental effects on turtle populations (particularly hawksbills) throughout the Asia-Pacific region (IOSEA, 2014). Legal harvesting of eggs and meat, illegal wildlife trade, bycatch from fishing vessels, unsustainable coastal development, plastic pollution and climate change all pose significant threats to Pacific's turtle populations (Hawkes *et al*., 2009; Humber *et al*., 2014; Jensen *et al*., 2018; Limpus and Miller, 2008; Pike 2014; Wallace et al., 2010). The future of marine turtle's remains far from certain. It should be noted however, that not all turtle stocks in the South West Pacific are declining, and heavily exploited turtle populations can respond well to effective management interventions. For example, in Australia the commercial harvest of green turtles in the Southern Great Barrier Reef (GBR) for soup manufacture and meat production ceased in 1950, and over the past four decades the Southern GBR green turtle nesting population has been increasing steadily at an average of 3% per year (Limpus *et al.*, 2013). The Solomon Islands hawksbill nesting population is also showing early signs of recovery following the establishment of ACMP in 1995 (Hamilton *et al*., 2015).

In Solomon Islands, turtles are a culturally important resource that have been harvested for centuries. In Solomon Islands Pijin turtle meat is often referred to as "Solomon beef" and

archaeological excavations have uncovered turtle bones and fish hooks carved from hawksbill shell that are five hundred years old (Walter and Green, 2011). The consumption of turtle meat and use of turtle shell in artwork and jewelry remain a central aspect of contemporary Solomon Island culture. The trade in hawksbill turtle shell also formed an important component of subsistence economies for centuries (Bennett, 1987). From 1840–1900 thousands of hawksbill turtles were killed each year in Solomon Islands and traded with European whalers and traders, and after WWII large volumes of hawksbill turtle shell was exported from Solomon Islands to Japan in what is known as the Bekko trade. In the late 1980s turtle shell exports from Solomon Islands peaked with over 4000 adult hawksbills being killed each year to supply Japanese markets (Limpus and Miller, 2008).

In response to rapidly declining hawksbill turtle populations, the Solomon Islands government made amendments to Fisheries regulations in 1993 and banned the sale, purchase and export of any turtle product, which saw the legal trade in hawksbill turtle shell cease (Richards *et al*. 1994). The regulations under the 2015 Fisheries Management Act provide the current policy framework for turtle conservation in Solomon Islands. Under the existing legislation, only the leatherback turtle (*Dermochelys coriacea)* is fully protected. Other marine turtle species can be harvested for subsistence purposes. However, the sale of any turtle product (meat, eggs or shell) is banned, as is the harvesting of turtle eggs or a nesting turtle (*Fisheries Management Prohibited Activities and Regulations*, 2018). In 2007 Solomon Islands also became a signatory to CITES. All species of marine turtles that are found in Solomon Island waters are listed under Appendix I on CITES. International commercial trade is therefore banned and trade in specimens for non-commercial purposes (e.g. research) must be legally obtained, sustainable and be subject to permits.

Since the 1990s there has been increased efforts by not for profit organisations (NGOs) and community groups to monitor and protect nesting populations of turtles in Solomon Islands (e.g. Ramohia and Pita, 1996; Argument *et al.,* 2009; Pita, 2015; Jino *et al.,* 2018). The best-known example of this is the Arnavon Islands, which are situated in the Manning Strait between Isabel and Choiseul Province, and supports one of the largest rookeries of hawksbill turtles in the South Pacific Oceania region. By the early 1990s the hawksbill population that nests at this rookery had been decimated by the hawksbill shell trade (Mortimer, 2002). In 1995 the Arnavon Community Marine Conservation Area (ACMCA) was formally established to protect this rookery, and in 2017 ACMCA became the Solomon Islands first national park and was renamed as Arnavons Community Marine Park (ACMP).

Analysis of nesting data collected between 1991-2012 revealed that the number of clutches of eggs laid hawksbill turtles at the Arnavons doubled following the establishment of the ACMCA in 1995 (Hamilton *et al*., 2015). This documented increase appears to relate primarily to the fact that the hawksbill population that nests at ACMP now have some protection at both their nesting and distant feeding grounds. Recent satellite tracking studies that were undertaken by The Nature Conservancy show that most hawksbill turtles that nest on the Arnavons migrate several thousand kilometres back to highly protected foraging grounds in Australia (Figure 1). These satellite tracking results align well with a genetic study by Bell *et al.* (2018), which revealed that 83% of hawksbill turtles found feeding on reefs in the Howick Group of Islands (HGI) in Northern Queensland had originated from nesting beaches in the Bismarck–Solomon Sea region. Bell *et al.* (2012) also found that juvenile hawksbill turtles that feed in the HGI had higher rates of survival than adults, the opposite of what is normally seen in turtle populations. It is probable that the lower survivability of adults

observed in the HGI is a consequence of the hunting pressure adults experience when they make their infrequent migrations back into the Bismarck-Solomon Sea region for nesting. The ban on legal commercial harvesting of hawksbill turtles in 1993 may also have had a positive impact on nest numbers in ACMP.

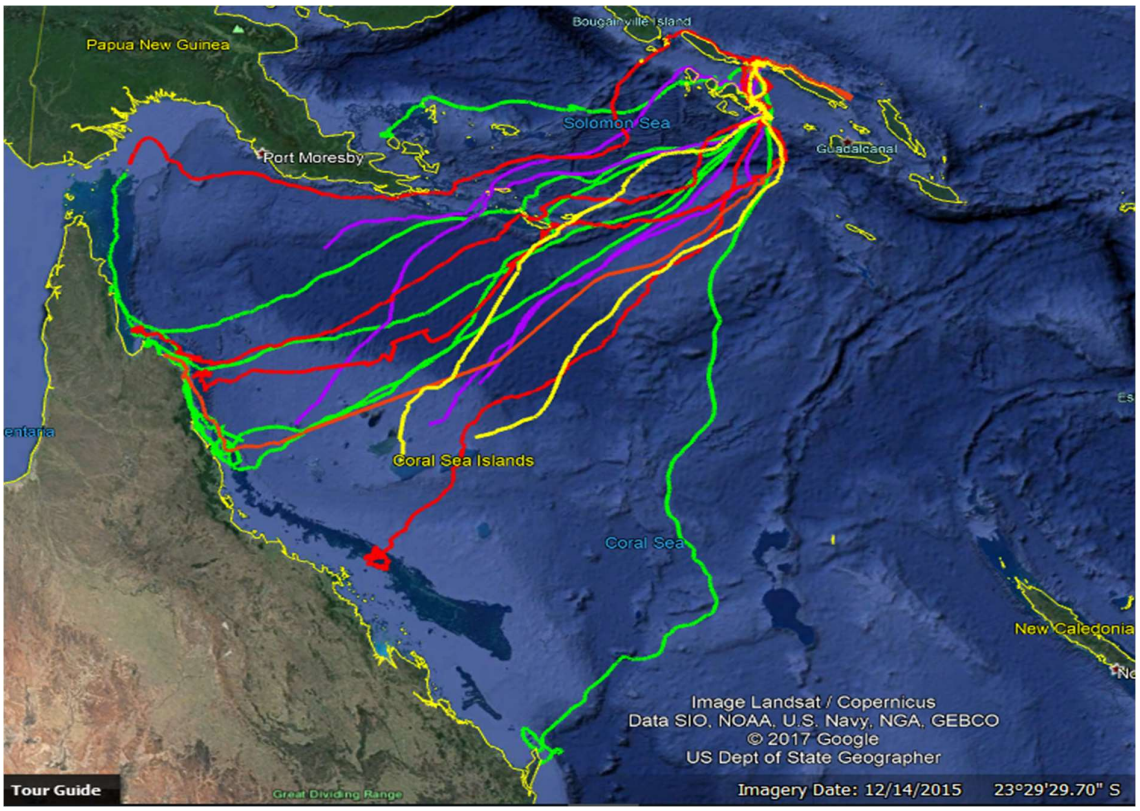


Figure 1. Post nesting migrations of 18 female hawksbill turtles that were tagged with satellite tags after nesting in the ACMP in April 2016 and May 2017. Two satellite tagged turtles were killed by poachers from Nikumaroro in 2016 while nesting in the ACMP and their satellite tags were destroyed by poachers. Red line: turtles tagged in 2016 that retuned to foraging grounds before satellite tags stopped transmitting. Green line: turtles tagged in 2017 that retuned to foraging grounds before satellite tags stopped transmitting. Yellow line: turtles tagged in 2016 whose satellite tags stopped transmitting prior to them returning to their foraging grounds. Purple line: turtles tagged in 2017 whose satellite tags stopped transmitting prior to them returning to their foraging grounds.

While local conservation efforts and national polices provide some protection to turtles that nest and forage in Solomon Islands waters, legal consumption of turtles remains high (Broderick, 1997), the illegal sale of turtle products is known to frequently occur and existing regulations are rarely enforced (Hamilton *et al*., 2015; Vuto, 2017). In the 4000 coastal communities that are scattered throughout the Solomon Islands archipelago, turtles represent a relatively infrequent yet highly prized component of multispecies subsistence and artisanal coral reef fisheries. Turtles are typically hooked, held or speared by free diving spearfishers. Often this occurs at night, when spearfishers will use an underwater flashlight to search shallow reef slopes for resting reef fish and turtles (Hamilton *et al*., 2012, Vuto, 2017).

Humber et al (2014) used expert opinion to place Solomon Islands in the top ten countries in the world for legal turtle consumption, however no empirical information exists on the current level of turtle harvest in Solomon Islands, the demographics of harvested turtles or whether current harvest rates are sustainable. To address these data gaps, we trained, equipped and paid ten community monitors from across Solomon Islands to document turtle catches in their coastal communities. Humber *et al*., (2011) developed community-based monitoring methodologies to document turtle harvests in Madagascar, and we modified this methodology to also geo reference the location of harvested turtles, account for variation in monitors effort and determine the fate of harvested turtles (Vuto, 2017). We then used the turtle harvest data from our ten sites, the fishing footprint of each community surveyed and Solomon's Islands entire reef area to scale up our surveys to obtain an annual turtle harvest estimate for Solomon Islands. To assess changes in catch rates of turtles over time we conducted a local knowledge survey, where we asked experienced spearfishers questions about their historical and current turtle catch rates while free diving at night.

Methods

Study area

This study was conducted at 10 coastal communities located across eight of the nine Solomon Island provinces (Figure 2). Eight sites were selected to represent locations where turtle catch rates were believed to 'typical' for Solomon Islands. At a 'typical' site it was assumed that by weight, turtles made up a small (< 5%) of total landings made in multispecies spearfisheries (e.g. Hamilton *et al.,* 2012). These were the coastal communities of Marau, Toa, Radefasu and Kaonasugu, and the provincial headquarters of Buala, Munda, Taro and Lata. The authors were aware of five sites in Solomon Islands where catch rates of turtles were much higher than typical sites (Kariki, Wagina, Kia, Furona Island and Pileni Island), and two of these sites (Wagina and Kia) were included in this study. Sites that had high turtle catch rates also had high landings of reef fish. For example, in 2012, spearfishers from Kia could land over 600 kg of fish in a single night by targeting resting schools of the giant bumphead parrotfish (Hamilton *et al.*, 2016).

Figure 2. Map of the 10 study sites and three other sites which are known to have atypically high turtle catch rates but were not surveyed.

Monitoring Program

Pilot Survey:

Initially we trained four community members from Kia, Wagina, Taro and Buala in data collection methodologies, and paid them to collect daily information on turtle harvest within their respective communities between October 2016 and March 2017. Community turtle monitors were provided with cameras, data sheets, tape measures and background information on the purpose of this study. These four community turtle monitors were known to the authors prior this study and were selected based on the following criteria: reliable data recorders; well known within their communities and contactable by phone. All four community monitors were men and two were active spearfishers.

To assist community monitors in documenting information on turtle catches and turtle use we designed two data forms (Form A and B, Appendix 1). These forms were designed to be used when fishers that had captured turtles were willing to partake in the study and when harvested turtles could be physically inspected (Vuto, 2017). On Form A, the following information was recorded for each turtle catch inspected: date inspected; name of recorder; village name; local reef name of where the turtle(s) were captured; date and time of capture; fishing method; type of boat used and total number of turtles captured. For every turtle sighted curved carapace length (CCL) and species was also recorded. Monitors also recorded what the turtle catches would be used for (i.e. consumption, birthday celebration, sale). When fishers reported that their captured turtles were to be sold further information on what turtle products would be sold (shell, meat, blood) was also recorded. No information was recorded on the take of turtle eggs. To ensure confidentially, fishers names were not recorded.

For every turtle inspected community turtle monitors also completed Form B. On this shorter form the following information was recorded: date inspected; name of recorder; name of the

reef (in local language) where the turtle was captured; fishing method; date and time of capture; CCL and species. Once this information had been filled out, Form B was placed on the corresponding harvested turtle and a photo of the turtle and Form B was taken. This photographic record served as an independent means of validating species identifications that were made in the field.

Scaling up the study and accounting for effort

To take this study to a national scale we held a community monitoring workshop in the ACMP in March 2017 (Vuto, 2017). The four community members involved in the pilot study and six additional community turtle monitors from Lata, Kaonasugu, Marau, Radefasu, Toa and Munda attended this workshop. New community monitors were all men and were selected based upon recommendations from fisheries colleagues working in the provinces of Temotu, Makira, Guadalcanal, Malaita, Central and Western, and pre-requisites for selection were the same as those described for the four original community monitors from Isabel and Choiseul Province. During the community monitoring workshop, participants practiced recording turtle data. They were given large topographic maps of their communities fishing grounds and asked to populate these maps with local reef names in their indigenous languages so that each turtle harvested could be geo referenced (Appendix 2).

To obtain estimates of each turtle monitors effort and the relative percentage of turtle fishers in a community that monitors were able to engage with, community monitors were provided calendars and diaries. Community monitors were asked to mark each day of the year when they were present in the community and available to work. Diaries were used to record information on the number of fishers in their community that were known to harvest turtles and were willing/not willing to partake in the study, as well as information on turtle catches that they were not able to physically observe. See Vuto (2017) for further information on this workshop.

Roll out across all communities

The ten trained community turtle monitors returned to their various communities and explained to local fishers in their communities the purpose of this study and sought their participation. The ten community turtle monitors carried out monitoring in their respective communities from April 2017 to May 2018. Because most turtle harvest in Solomon Islands is done at night by free divers, the community monitors walked or paddled a dugout canoe around their community every morning checking for harvested turtles. Community monitors would also visit fishers at various times of the day or night if they learnt of turtle harvests through word of mouth or via a phone text message. Turtle community monitors were paid approximately USD $250 per month for their work.

Once a month the lead author would ring each community monitor to see how the sampling was going and to help with any problems they had. Community monitors were visited every three months by the lead author, who cross checked and made copies of their records in Excel, download photos and provided technical support. Cross checking of local reef names against the Excel database and digitising the local names of fishing grounds were also done with the support of local fishers in the field.

Estimating recent changes in turtle catch rates

In Pacific Island countries, fisher's local knowledge can often provide an accurate historical perspective on harvested species. For example, in the Western Solomon Islands, spearfishers from Roviana Lagoon reported marked declines in their nightly catch rates of the giant bumphead parrotfish between the early 2000s and 2018, and these reported declines were corroborated by in water surveys (Hamilton *et al*., 2019). To infer changes in the catch rates of turtles over recent decades, we conducted a local knowledge surveys in Kia, Wagina, Toa, Munda and Taro between April-June 2019. We interviewed 32 experienced spearfishers who had participated in the earlier part of this study. The questions we asked each fisher were:

1. What year did you start catching turtles?
2. What was the fishing method(s) you used when you started?
3. What fishing grounds did you catch turtles on when you started catching turtles?
4. When you first started catching turtles, what was the average number of turtles you would catch in a single fishing trip?
5. What is the turtle fishing method(s) you have used in past two years?
6. What fishing grounds have you caught turtles from in the past two years?
7. What is the average number of turtles you have caught in a single fishing trip in the past two years?

Statistical Analysis

Estimating recent changes in turtle harvest rates

To investigate changes in turtle catch rates we first excluded data from fishers who had been catching turtles for less than ten years (3 fishers), who no longer caught turtles (2 fishers), or who had changed fishing methods (1 fisher who historically caught nesting turtles). Where a range of values were reported for either the year that fisher began catching turtles, or average catch rates per trip, the midpoint of the range was used. From the remaining 26 spearfishers, we calculated mean and standard deviation of turtle catches per trip both when spearfishers first began catching turtles, and over the past two years. We also calculated mean and standard deviation of changes in catch rates (total and annual).

Annual harvest estimates for Solomon Islands

We scaled up the surveys from the 10 communities to obtain annual harvest estimate for all of the Solomon Islands. We first rescaled the survey data to get annual average harvest estimates per community. To do this we corrected for the fraction of days that the community turtle monitors reported working out of all days. We also corrected for the fraction of turtle fishers in a community that participated in the surveys. We then had annual estimates of harvest. We then calculated annual numbers harvested per hectare of reef within each communities fishing grounds footprint. To estimate the areal footprint of each community's fishery we created convex hull polygons around all the reefs fishers reported capturing turtles from. We then calculated the reef area within these polygons.

To scale up the community harvests to all of the Solomon Islands, we first split the communities between eight 'typical' communities and two communities with atypical high harvest values. The unusual communities were Kia and Wagina communities. These communities are 70 km apart and are situated in a region that is known to support high catches of turtles and reef fish (Broderick, 1997; Hamilton *et al*., 2016).

We then extrapolated the typical communities to all communities in Solomon Islands. The extrapolation followed this process:

1. For each community surveyed, estimate maximum distance travelled, based on reefs they hunted at.
2. Estimate the empirical density curves for annual harvest per hectare of reef. These curves were used as the probability of different harvest amounts per hectare.
3. Estimate the empirical density curve for distance travelled to reefs, based on the 8 typical communities. These curves were used to assign probabilities that a reef that is a certain distance from a community will be visited by fishers. Reefs nearer to communities had a higher chance of visitation, whereas reefs far from communities have a very low chance.
4. Calculate the distance of every reef in the Solomon Islands to the nearest community census point.
5. Calculate the probability that each reef would be visited for fishing, based on its distance to the nearest census point and the empirical density curve of distances travelled to go fishing.
6. Then we ran a bootstrap where we repeated the below steps 5000 times
    1. Randomly select reefs in proportion to the probability that each reef would be visited, given its distance from communities.
    2. Calculate the total area of randomly selected reefs
    3. Randomly sample a harvest per hectare value from the empirical curve of harvest values
    4. Multiple the total area by the harvest estimate to get one value of annual harvest
7. Step 6 resulted in 5000 estimates of annual harvest for typical villages for all of the Solomon Islands. We could then calculate the median value and 95% confidence intervals across this distribution of possible harvests.
8. We then added back in the Wagina and Kia annual harvests to the values generated above in step 7. We included also 3x the Kia value, because it is believed there are at least 3 other communities in the Solomon Islands that have similar catch rates to Kia (Pita and Vuto, personal observations).
9. Step 8 gave us the whole of Solomon Islands annual estimate, including typical and non-typical communities. The estimate account for uncertainty in per hectare turtle harvest and uncertainty in the distance that fishers will travel from their communities.

Results

Study participants

The ten community monitors identified 278 free diving spearfishers in their collective communities that were known to capture turtles. All these spearfishers were men. 151 agreed and 127 declined to participate in this study.

Changes in turtle harvest rates

Interviewed spearfishers reported first catching turtles from 10 to 34 years ago (21.3, ± 7.7; mean ± standard deviation, here and hereafter). Midpoints of initial catch estimates ranged between 1 and 35 (7.8 ± 7.4), and mid-points of current (over the past two years) catch estimates ranged between 0.5 and 4 (1.9 ± 1.1) (Figure 3). Reported catch per trip declined up to 95.7% (65.0 ± 21.7), with catches declining by up to 7.3% (3.4 ± 1.6) per year. No spearfisher reported increased catch rates of turtles (Figure 3).

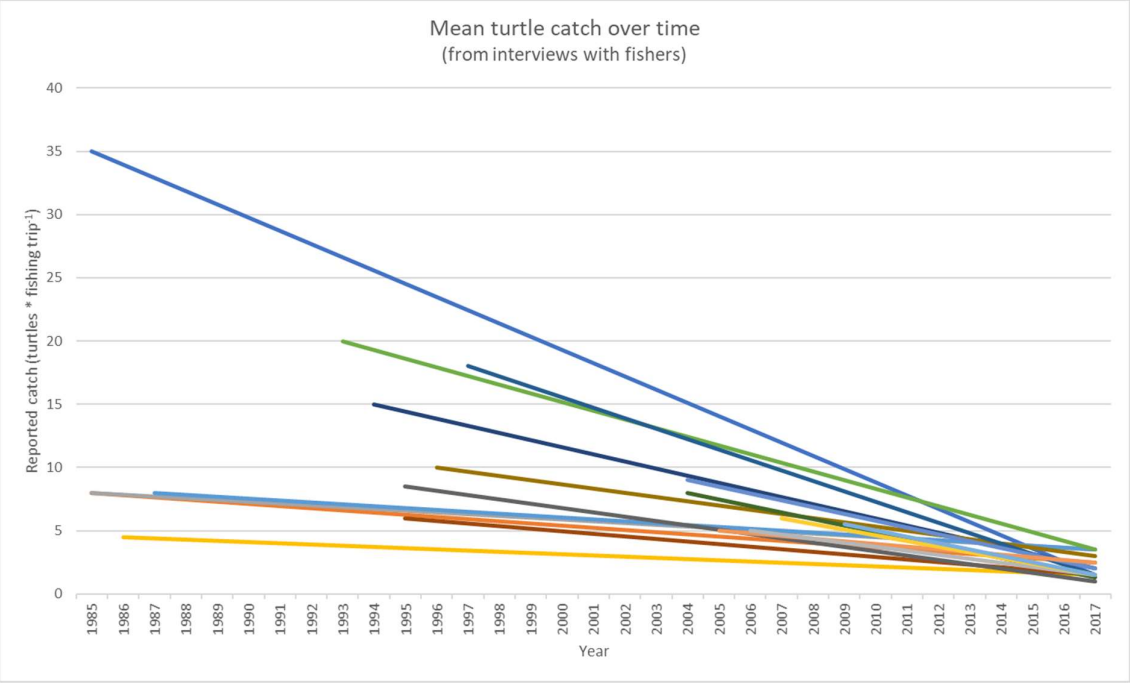


Figure 3. The mean catch estimates (turtles per fishing trip) over time, as self-reported by spearfishers during interviews.

Demographics of turtle catch

Turtle catches observed by community monitors was dominated by green turtles (73.8 %) and hawksbill turtles (25.7 %), with very few olive ridley turtles (0.5 %) (Table 1). The large majority of catches (80.9 %) were observed in Wagina, Kia, and Buala (30.1, 34.4, and 16.4 %; respectively).

Table 1. Catch composition of the 1107 marine turtles that were observed by community monitors between Oct 2016 – May 2018.

		Green Turtle		Hawksbill Turtle		Olive Ridley		
Community	Province	Immature: CCL <90cm (N)	Adult sized: CCL 90CM (N)	Immature: CCL less than 75cm (N)	Adult sized: CCL 75cm (N)	Immature CCL less than 60cm (N)	Adult sized: CCL 60cm (N)	*Total*
Wagina	Choiseul	220	16	52	44	1	0	*333*
Kia	Isabel	252	20	95	14	0	0	*381*
Buala	Isabel	129	52	1	0	0	0	*182*
Taro	Choiseul	20	1	7	1	0	0	*29*
Kaonasugu	Makira	11	0	6	0	0	5	*22*
Munda	Western	26	0	5	1	0	0	*32*
Auki	Malaita	6	0	13	0	0	0	*19*
Marau	Guadalcanal	15	0	15	0	0	0	*30*
Lata	Temotu	29	2	11	2	0	0	*44*
Toa-Gela	Central	17	1	12	5	0	0	*35*
Total		**725**	**92**	**217**	**67**	**1**	**5**	***1107***

Green and hawksbill catches were dominated by immature sized turtles (88.7 and 76.4 %; respectively) (Figure 4 and Appendix 2). The size distribution of harvested of green and hawksbill catches by community is shown in Figure 5.

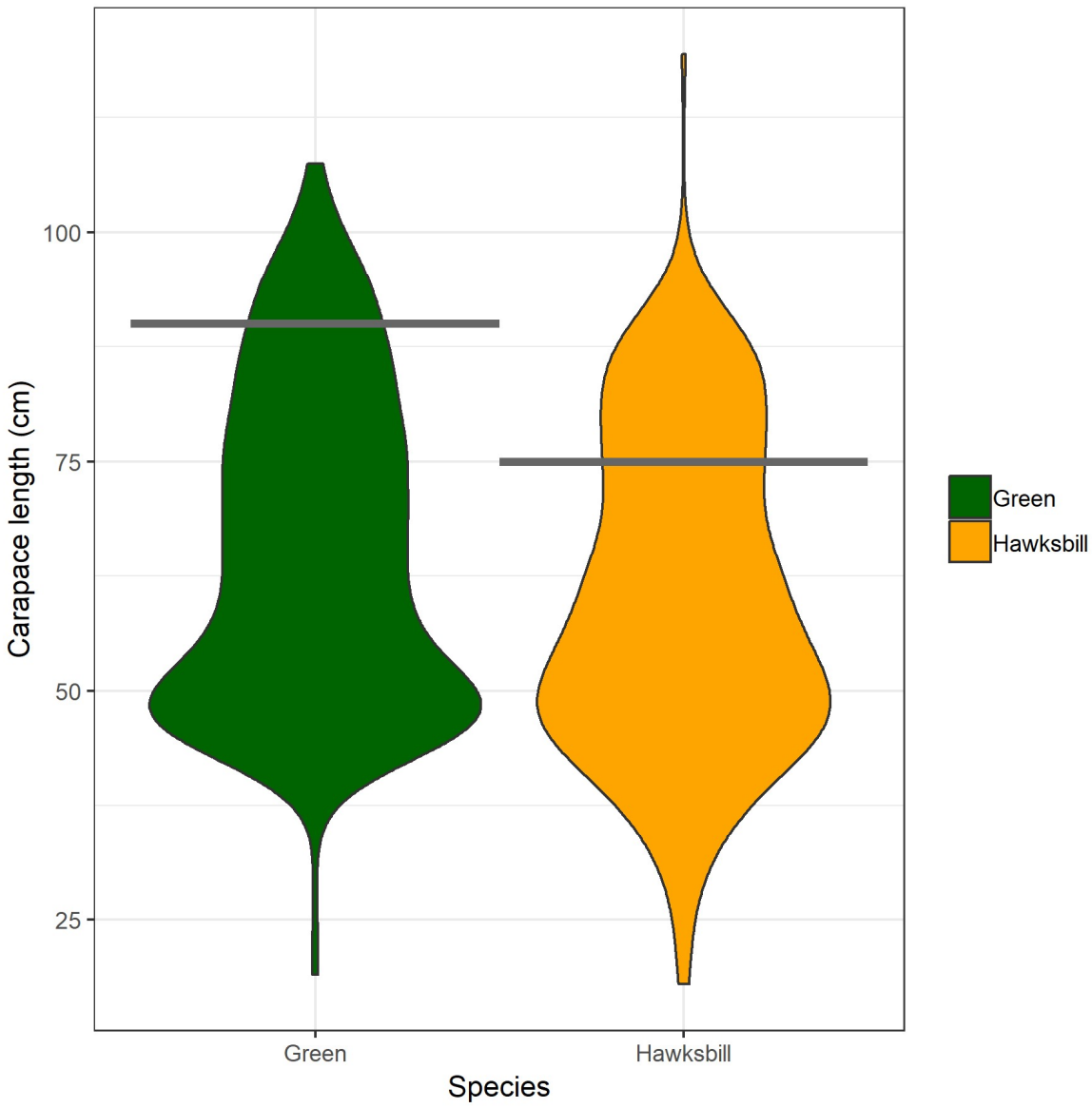


Figure 4. The size distribution of all turtle catches. The grey bar represents average carapace length at maturity (green turtle >90 cm and hawksbill >75cm).

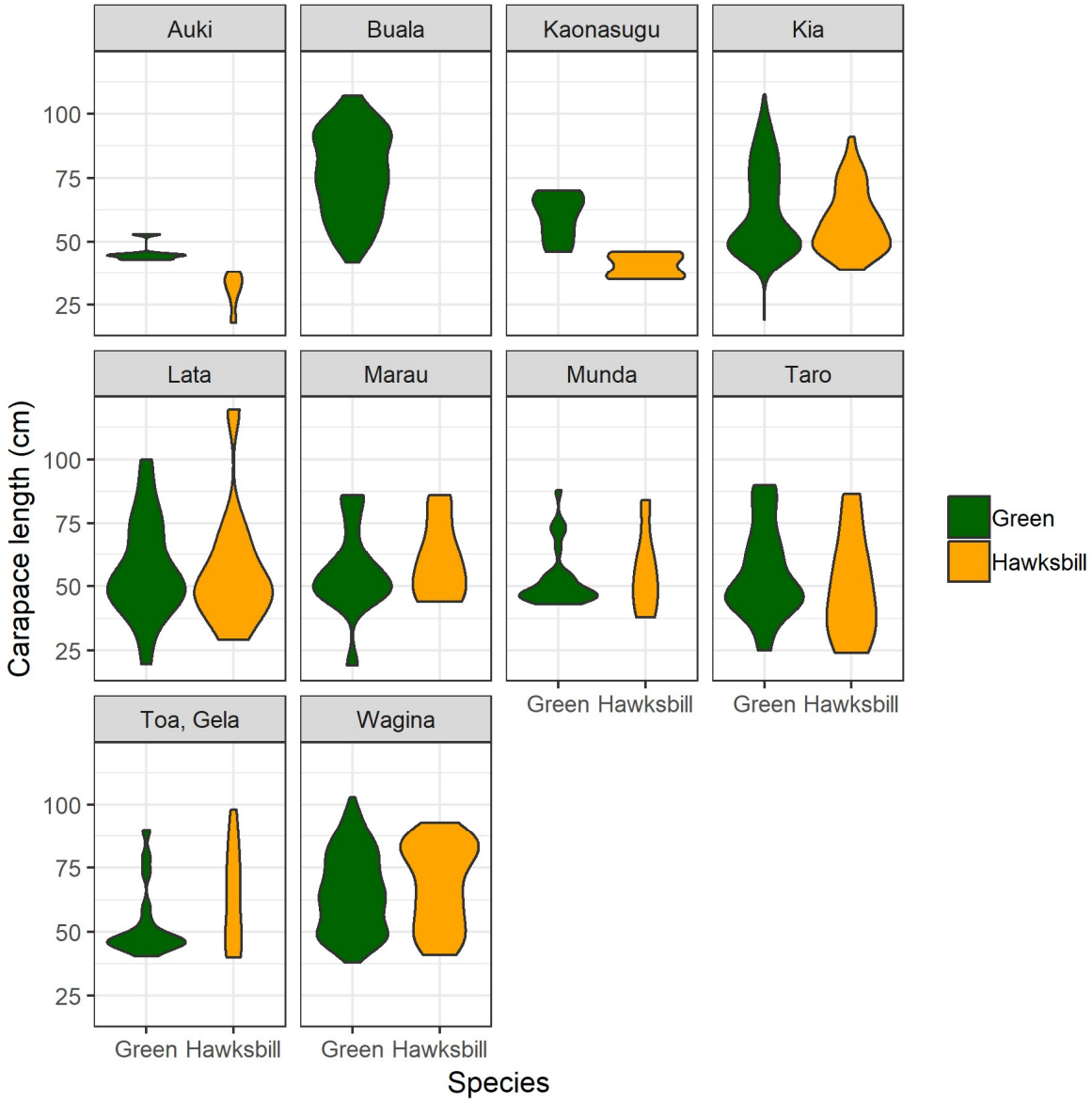


Figure 5. The size distribution of harvested green and hawksbill catches by community.

National harvest estimate

The national turtle harvest per year is estimated with a median of 9473, with 95% confidence intervals of 5063 to 22,423 turtles (Figure 6). We estimated a high probability (>99%) that annual harvest was greater than 5000 turtles per year.

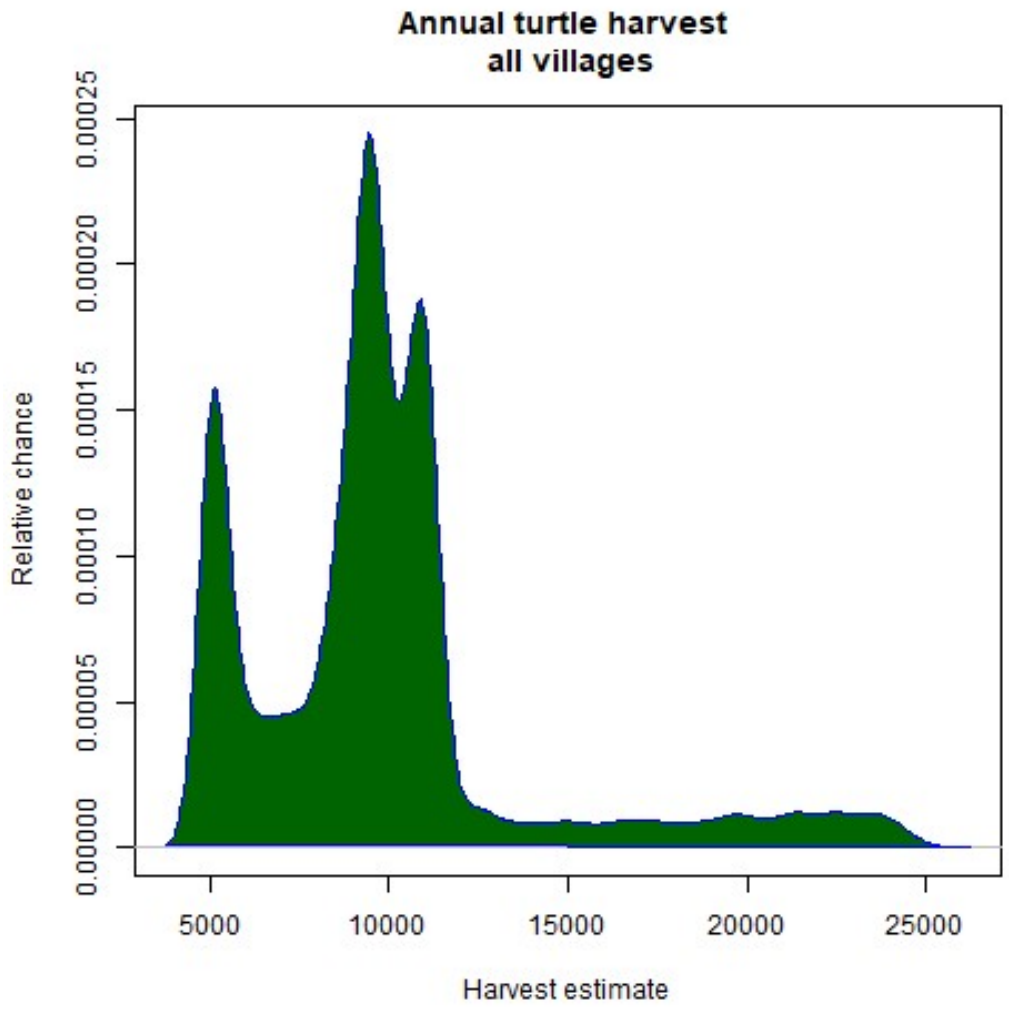


Figure 6. The probability distribution for national annual turtle harvest estimates, the mean estimate was 9473 with 95% confidence intervals of 5063 to 22,423 turtles.

Turtle use

Green and hawksbill turtles were most commonly used for subsistence purposes (88.2% and 81.6% respectively) and were most likely to be consumed by the family of the fisher that captured the turtle(s) (Table 2 and 3). There is however an active trade in turtle products (whole turtle, meat and hawksbill shell) in Solomon Islands and hawksbill turtle products were more likely to be illegally sold (32.3%) than green turtle products (12.1%) (Table 2 and 3, Appendix 3). This species-specific difference can be explained by the trade in hawksbill

shell, which was documented in 3 of the 10 communities surveyed but was only a common practice in Wagina (Table 2 and 3). In the Wagina community, the shells of 87.5% of hawksbill turtles harvested were sold to local buyers, who then on sold to Asian buyers in Honiara. Interviews with fishers indicate that there are two markets for hawksbill shell in Solomon Islands. A local market which supplies Solomon Islands carvers and shell money makers, and another market that appears to be international, with hawksbill scutes being purchased by Asian buyers in Honiara, presumably before being exported overseas. Some local carvers we talked to in Honiara openly complained about not being able to compete with Asian buyers, who were paying a higher price for scutes than what they could afford. Fishers also provided reports of hawksbill scutes being sold to logging ships.

Table 2. Use of the 604 green turtles that were observed by community monitors between April 2017 – April 2018 (% of total catch by community). Only turtles with use recorded were included in this analysis. Community totals may not equal 100% as some turtles were used in multiple ways.

				Subsistence				Sale			
Community	Province	Total Turtle Sighted with use recoreded	Total Green Turtles	Food for Family	Family events (cement blessing & burial, birthday, wedding anniversary, baptism, OBM, celebration)	Community events (e.g. church festival, Christmas, Easter, St days, ordination & new years)	Total subsistence	Sale of whole turtle	Sale of turtle meat	Total sale	Keep as pet - kill later
Wagina	Choisuel	204	147	53.1	36.1	10.9	100.0	0.7	4.1	4.8	0.0
Kia	Isabel	310	214	64.5	25.2	5.1	94.9	1.4	3.7	5.1	0.0
Buala	Isabel	119	119	17.6	58.8	14.3	90.8	0.0	9.2	9.2	0.0
Taro	Choisuel	24	17	23.5	11.8	0.0	35.3	11.8	41.2	52.9	11.8
Kaonasugu	Makira	21	11	63.6	0.0	0.0	63.6	27.3	18.2	45.5	0.0
Munda	Western	32	26	50.0	23.1	11.5	84.6	15.4	0.0	15.4	0.0
Auki	Malaita	19	6	33.3	33.3	0.0	66.7	0.0	0.0	0.0	33.3
Marau	Guadacanal	23	13	46.2	38.5	0.0	84.6	15.4	7.7	23.1	0.0
Lata	Temotu	46	33	21.2	18.2	0.0	39.4	51.5	0.0	51.5	9.1
Toa-Gela	Central	35	18	66.7	0.0	0.0	66.7	0.0	33.3	33.3	0.0
Total		**833**	**604**	**47.7**	**32.8**	**7.8**	**88.2**	**5.3**	**6.8**	**12.1**	**1.2**

Table 3. Use of the 223 hawksbill turtles that were observed by community monitors between April 2017 – April 2018 (% of total catch by community). Only turtles with use recorded were included in this analysis. Community totals may not equal 100% as some turtles were used in multiple ways.

				Subsistence				Sale				
Community	Province	Total Turtle Sighted with use recoreded	Total Hawksbill Turtles	Food for Family	Family events (cement blessing & burial, birthday, wedding anniversary, baptism, OBM, celebration)	Community events (e.g. church festival, Christmas, Easter, St days, ordination & new years)	Total subsistence	Sale of whole turtle	Sale of turtle meat	Sale of turtle shell (Hawksbill)	Total sale	Keep as pet - kill later
Wagina	Choisuel	204	56	67.9	23.2	7.1	98.2	1.8	8.9	87.5	89.3	0.0
Kia	Isabel	310	96	81.3	7.3	1.0	89.6	0.0	1.0	5.2	6.3	0.0
Buala	Isabel	119	0	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0
Taro	Choisuel	24	7	0.0	0.0	0.0	0.0	28.6	57.1	0.0	85.7	14.3
Kaonasugu	Makira	21	5	60.0	20.0	0.0	80.0	20.0	0.0	0.0	20.0	0.0
Munda	Western	32	6	33.3	33.3	33.3	100.0	0.0	0.0	0.0	0.0	0.0
Auki	Malaita	19	13	15.4	0.0	0.0	15.4	0.0	0.0	0.0	0.0	84.6
Marau	Guadacanal	23	10	10.0	60.0	20.0	90.0	10.0	0.0	0.0	10.0	0.0
Lata	Temotu	46	13	38.5	0.0	7.7	46.2	38.5	0.0	0.0	38.5	15.4
Toa-Gela	Central	35	17	47.1	0.0	35.3	82.4	5.9	11.8	0.0	17.6	0.0
Total		**833**	**223**	**61.4**	**13.0**	**7.2**	**81.6**	**4.9**	**5.4**	**24.2**	**32.3**	**6.3**

Discussion

This study provides the first attempt to quantify the extent and trajectory of turtle harvests in Solomon Islands, the species composition and demographics of the turtles harvested and the reasons for harvest. A primary objective of the survey was to provide the Solomon Islands government with the data required to determine whether current efforts to conserve turtle stocks in Solomon Islands are adequate. In Solomon Islands most harvested turtles are captured at night by freediving spearfishers, who use an underwater flashlight to locate resting turtles on the reef, then either hold, hook or spear the resting turtle. In the western Pacific spearfishing is a very common fishing method and hundreds of species (mainly fish) are captured using this method (Gillett and Moy, 2006). A creel survey of night time spearfishing trips in the Western Solomon Islands revealed that by weight, green and hawksbill turtles made up 2% and 1% percent of total landings respectively (Hamilton *et al*., 2012). The fact that 26 experienced spearfishers who were well known to us and located in four different provinces all reported marked declines in their average catch rate of turtles over periods of one to four decades is a cause for concern.

In fisheries, declining catch rates typically have a constant proportional relationship to true abundance (Walters and Martell 2004), and there is no reason to believe this is not the case for turtle catches. Thus, it is probable that the declining catch rates report by free diving spearfishers reflect a substantial and ongoing decline in foraging turtle abundances in Solomon Islands. Most of the experienced spearfishers we interviewed began capturing

turtles after the national wide ban on the sale of any turtle products had come into effect. This implies that the existence of national polices banning turtle trade may not have not been effective in preventing declines in turtle numbers throughout the Solomon Island.

An anomaly to this pattern is the ACMP, where hawksbill nest numbers have risen in the past 25 years since ongoing efforts to protect the Arnavon nesting beaches (Hamilton *et al.,* 2015). ACMP is located near Kia and Wagina, communities that have the highest rates of turtle harvest in Solomon Islands, and where all interviewed spearfishers reported marked declines in turtle catch rates. Recent satellite tracking studies undertaken by The Nature Conservancy helps explain this anomaly. Most of the turtles that nest in the ACMP spend their entire nesting season (2-3 months) within the boundaries of the ACMP, before migrating thousands of kilometers back to highly protected waters in Australia. Thus, the increasing nest numbers reported at ACMP are due primarily to the boundaries of ACMP being large enough to protect nesting turtles, and the fact that most hawksbills that nest in the ACMP spend most of their lives at distant and highly protected foraging grounds.

Harvesting of hawksbills for trade had been centralized at the Arnavons for centuries, and while the ban on the hawksbill trade in 1993 ended legal harvest at the Arnavons, ongoing poaching and illegal trade in turtle shell continues and is centralized in Wagina. Given ongoing poaching in ACMP over the past 25 years despite a permanent ranger presence, it is impossible to see how the policy change alone would had prevented declines on ACMP without simultaneous site-based conservation efforts. The ongoing poaching issue that is centralised in Wagina is highlighted in the results of this survey. Nationally only 11% of the hawksbills harvested were adults, but in Wagina 46% of the hawksbill turtles harvested were adults. It is almost certain that many of these adults were poached within the ACMP. In contrast to Wagina, at the nearby Kia community which is also near ACMP, adult hawksbills only make up 13% of catch. If poaching ceases, it is likely that the number of clutches of eggs laid by hawksbill turtles in the ACMP will continue to improve.

This study shows that the Solomon Islanders turtle fishery is dominated by juvenile green and hawksbill foraging turtles, a pattern that has been observed earlier in the Wagina and Kia region (Broderick, 1997). It is also noteworthy that adults were only present in the catches in reasonable numbers when fishers took turtles from near (or possibly on) nesting beaches, or from distant and recently exploited foraging grounds such as Edwards Bank. The low numbers of adults in turtle catches in indicative of historical and potentially ongoing overfishing of adult foraging turtles in Solomon Islands. Alternatively, it is possible that the exploited shallow reefs of Solomon Islands largely act as sink areas for juvenile turtles that migrate to distant foraging grounds as they mature. Without comprehensive genetic assessment of neighboring nesting cohorts (Vargus et al 2015), this remains a gap in knowledge.

Humber et al., (2014) used literature searches and expert opinion to estimate that worldwide, 42,000 turtles are legally harvested each year. They ranked Solomon Islands as having the World's 5th highest annual legal take of turtles and estimated that in Solomon Islands 2000 turtles were legally harvested each year. The results of this survey suggest Humber et al. (2014) underestimated legal take in Solomon Islands by at least 2.5 times and up to 10 times. We calculated that the national turtle harvest rate in Solomon Islands in the 2016-2018 period was approximately 10,000 turtles per year, with an upper confidence interval of over 20,000 turtles. Of these harvested turtles, more than 80% are consumed legally for subsistence

purposes (food, family cultural and non-cultural events, or community events). In comparison to Humber *et al.,* (2014) study, our estimates indicate that either the Solomon Islands has one of the highest legal takes of turtles in the world, or alternatively, that the global estimate of 42,000 turtles legally harvest per year is conservative.

This decision to train local community monitors and pay them to collect information on turtle catches over a long period of time proved to be an effective way of obtaining empirical information on a fishery where catches are low and landing points are diverse. Having community monitors take photos of each turtle they inspected also provided a good way of checking data quality (Humber *et al.,* 2011), and provide some unexpected findings. For example, the community monitor in Makira photographed olive ridley hatchlings at Waihaoru beach, confirming nesting of olive ridley turtles in Solomon Islands for the first time.

The survey results show that while most turtles captured in Solomon Islands were consumed locally there is an active trade in turtle products, with most of this product being sent via coastal shipping to Honiara, where it was sold at multiple outlets. There also appears to be two markets for hawksbill shell in Solomon Islands, a local market which supplies Solomon Islands carvers and another market that appears to be international, with hawksbill scutes being purchased by Asian buyers in Honiara, presumably before being exported overseas.

The limited current enforcement of existing national laws that ban the trade in turtle products in Solomon Islands appear to relate to several factors that have also been noted in Madagascar turtle fishery (Humber *et al*., 2011). A lack of capacity for implementation, low awareness of existing policy, a reluctance to manage a fishery with strong cultural links and the difficulties of enforcing policy in a fishery that extends across the entire coastline of Solomon Islands. Efforts to address some of these factors may enhance the sustainability of the turtle fishery and the recovery of turtle populations in Solomon Islands and are outlined below.

Recommendations

- Enforce current national policies that ban the sale of turtle products, with a focus on curbing the trade in the scutes of the critically endangered hawksbill turtle.
- Provide further training to provincial and national fisheries officers on the status of turtle fisheries in Solomon Islands, the laws and regulations relating to turtles, and the reasons why it is important to enforce them.
- Manage hawksbill turtle harvest by Wagina fishers. Suggested measures are: 1) Provincial fisheries officers increase their presence and undertake compliance and enforcement at Wagina. A high priority would be to prosecute buyers in Wagina and Honiara who purchase hawksbill scutes from Wagina fishers, since these buyers are driving the poaching of hawksbill turtles from within the Solomon Islands only national park, the Arnavons Community Marine Park (ACMP).
- Manage the green turtle stocks at Edwards Bank. This region supports an important stock of adult green turtles that are coming under recent and increasing exploitation. Suggested measures are; 1) Provincial fisheries officers at Buala enforce the ban on the trade of all green turtles harvested from Edwards Bank 2) Ban the harvesting of all

adult turtles (> 90 cm) at Edwards Bank and 3) MFMR and MECDM consider establishing Edwards Bank as a protected area since Edwards Bank is located within national waters.

- Support a greater number of communities in Solomon Islands to protect and monitor their nesting beaches and strengthen existing efforts. Turtles are extremely vulnerable while nesting and protecting nesting turtles and the eggs they lay is an effective way to increase the sustainability of turtle populations. The ACMP provides an encouraging example of where ongoing conservation efforts have resulted in the number of clutches of eggs laid by hawksbill turtles at the ACMP doubling since 1995, despite persistent poaching issues.

- Investigate if community-based turtle monitoring programs (for nesting and foraging turtles) could be developed hand in hand with sustainable nature-based tourism initiatives in line with *Solomon Islands National Tourism Policy 2015 – 2019*. This in turn could help promote community conservation stewardship and provide an economic return to communities as an alternative to harvesting turtles.

- Conduct socioeconomic and household surveys to determine what impacts a moratorium on subsistence turtle harvest would have on the food security of coastal communities.

- Revisit 'hotspot' turtle harvest locations and undertake sociocultural surveys to understand the motivations behind turtle take, and to inform alternative livelihood recommendations.

- Update and revise The Solomon Islands Turtle Strategic Action Plan 2008-2012.

- Undertake a national wide awareness campaign that targets the youth of Solomon Islands and highlights the cultural values of turtles, their plight and why turtle management is important for cultural preservation.

References

Argument, D., MacKay, K. T., & Krueger, B. H. (2009). Foraging turtles around Tetepare Island, Solomon Islands. Marine Turtle Newsletter 123: 18-20.

Bell, I., & Jensen, M. P. (2018). Multinational genetic connectivity identified in western Pacific hawksbill turtles, Eretmochelys imbricata. Wildlife Research, 45: 307-315.

Bell, I., Schwarzkopf, L., & Manicom, C. (2012). High survivorship of an annually decreasing aggregation of hawksbill turtles, Eretmochelys imbricata, found foraging in the northern Great Barrier Reef. Aquatic Conservation: Marine and Freshwater Ecosystems, 22: 673-682.

Bennett JA (1987) Wealth of the Solomons. A history of a Pacific archipelago, 1800–1978. University of Hawaii Press, Honolulu. 529 p.

Broderick D (1997) Subsistence hunting of marine turtles in the Solomon Islands. In: Epperly SP, Braun J, editors. Proceedings of the 17th Symposium on Sea Turtle Biology and Conservation. pp. 15–18.

CITES Secretariat (2019). Status, scope and trends of the legal and illegal international trade in marine turtles, its conservation impacts, management options and mitigation priorities. Eighteenth (18th) meeting of the CITES Conference of the Parties (Geneva, August 2019), Document CoP18 Inf. 18.

Fisheries Management Prohibited Activates and Regulations (2018). This summary comprises the Fisheries Management (Prohibited Activities) Regulations 2018 and the Fisheries Management (Prohibited Activities) (Amendment) Regulations 2018. Prepared by the Ministry of Fisheries and Marine Resources, Honiara, Solomon Islands. 8 pg.

Gillett, R., Moy, W. (2006). Spearfishing in the Pacific Islands. Current Status and Management Issues. FAO/FishCode Review No. 19. FAO, Rome.

Hamilton, R. J., Hughes, A., Brown, C. J., Leve, T., and Kama, W. (2019). Community-based management fails to halt declines of bumphead parrotfish and humphead wrasse in Roviana Lagoon. Solomon Islands. Coral Reefs 38, 455–465.

Hamilton, R. J., Almany, G. R., Stevens, D., Bode, M., Pita, J., Peterson, N. A., & Choat, J. H. (2016). Hyperstability masks declines in bumphead parrotfish (Bolbometopon muricatum) populations. Coral Reefs, 35(3), 751-763.

Hamilton RJ, Bird T, Gereniu C, Pita J, Ramohia PC, Walter R, Goerlich C, Limpus C. (2015). Solomon Islands largest hawksbill turtle rookery shows signs of recovery after 150 years of excessive exploitation. PloS one. Apr 8;10(4):e0121435.

Hamilton R.J, Giningele M, Aswani S, Ecochad J (2012) Fishing in the dark—local knowledge, night spearfishing and spawning aggregations in the Western Solomon Islands. Biological Conservation 145: 246–257.

Humber F, Godley BJ, Ramahery V, and Broderick AC (2011). Using community members to assess artisanal fisheries: the marine turtle fishery in Madagascar. Animal Conservation 14: 175–185.

Humber F, Godley BJ, Broderick AC (2014) So excellent a fishe: a global overview of legal marine turtle fisheries. Diversity and Distributions 5: 579–590.

IOSEA, Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (2014). Illegal take and trade of marine turtles in the IOSEA region. MT-IOSEA/SS.7/Doc. 10.1 Agenda item 8c. Seventh Meeting of the Signatory States, Bonn, Germany, 8-11 September 2014.

Jensen, Michael P., Camryn D. Allen, Tomoharu Eguchi, Ian P. Bell, Erin L. LaCasella, William A. Hilton, Christine AM Hof, and Peter H. Dutton (2018). Environmental warming and feminization of one of the largest sea turtle populations in the world.Current Biology 28: 154-159.

Jino, N., Judge, H., Revoh, O., Pulekera, V., Grinham, A., Albert, S. and Jino, H. (2018). Community-based Conservation of Leatherback Turtles in Solomon Islands: Local Responses to Global Pressures. Conservation and Society, 16(4): 459-466.

Limpus C.J., Parmenter C.J. and Chaloupka M. (2013). Monitoring of Coastal Sea Turtles: Gap Analysis 2. Green turtles, Chelonia mydas, in the Port Curtis and Port Alma Region. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program.

Limpus CJ, Miller JD (2008) Australian hawksbill turtle population dynamics project. Queensland Environmental Protection Agency. 140 p.

Mortimer J., Donnelly M. (IUCN SSC Marine Turtle Specialist Group) (2008). Eretmochelys imbricata. The IUCN Red List of Threatened Species 2008: e.T8005A12881238.

Mortimer JA (2002) Sea Turtle Biology & Conservation in the Arnavon Marine Conservation Area (AMCA) of the Solomon Islands. The Nature Conservancy, Honiara. 25 p.

Pita, J. (2015). Haevo Turtle Monitoring Results 2013-2015. July 2015, unpublished report. The Nature Conservancy.

Ramohia PC, Pita J (1996) Report to SPREP on the Regional Marine Turtle Conservation Programmes 1995 project in the Solomon Islands: Arnavon Islands Surveys. A report to the Fisheries Division, Ministry of Agriculture and Fisheries, Honiara. 20 p.

Richards AH, Bell LJ, Bell JD (1994). Inshore fisheries resources of Solomon Islands. Marine Pollution Bulletin 29: 90–98.

Vargas SM, Jensen MP, Ho SY, Mobaraki A, Broderick D, Mortimer JA, Whiting SD, Miller J, Prince RI, Bell IP, Hoenner X. Phylogeography, genetic diversity, and management units of hawksbill turtles in the Indo-Pacific. Journal of Heredity. 2015 Nov 27;107(3):199-213.

Vuto, S. (2017). A report on a turtle trade monitoring workshop on the Arnavons. 29th to 31st March 2017. The Nature Conservancy.

Walter, R., & Green, R. C. (2011). Su'ena: Five Hundred Years of Interaction in the Eastern Triangle, Solomon Islands. Department of Anthropology & Archaeology; University of Otago.

Wallace B., DiMatteo A., Hurley B., Finkbeiner E., Bolten A., Chaloupka M., et al. (2010). Regional Management Units for Marine Turtles: A Novel Framework for Prioritizing Conservation and Research across Multiple Scales. PLoS ONE 5: e15465.

Walters C, Martell SJD (2004) Fisheries ecology and management. Princeton University Press, Princeton.

Appendices

Appendix 1. Forms A and B

Form A.

Date: ……. Recorded by: ……

Village:…… Reef/Island Name where the Turtle(s) were Captured: ……

Fishing Method: ……Type of boat used: _____ ……

Date & Time of capture: ……Total number of turtles captured……

If Turtle Whole (please record for all turtles) i.e.

1. Turtle Length (CCL) ……..Species: ……..DNA number:…….
2. Turtle Length (CCL) ……..Species: ……..DNA number:…….
3. Turtle Length (CCL) ……..Species: ……..DNA number:…….
4. Turtle Length (CCL) ……..Species: ……..DNA number:…….
5. Turtle Length (CCL) ……..Species: ……..DNA number:…….

NB: If DNA sample is taken please write the DNA number down for that turtle. If no DNA sample is taken simply write No DNA.

Please fill out one Form B for every turtle sighted. Please then take photos of every individual turtle alongside its filled out Form B. Please make sure the turtle and the filled out Form B are in the same photo frame and check that the writing can be read clearly once the photos have been taken.

Photos taken (please take in order shown below and tick)

Form B with Turtle ☐ Turtle left head ☐ Bucher turtle (Gonad - Eggs) ☐

Use (i.e. Sale, Church day, birthday, cement blessing, Christmas feast):……
……

If Hawksbill:

What will you do with the shell?.....
.....

If turtle products (shell, meat, blood etc.) are to be sold:

To whom will the turtle products be sold to?
……
…….

What parts are being sold?
……
……

Approximate price for each product (meat, shell etc.)?

……

……

Other Notes: (E.g. if turtle has flipper tag please write down tag numbers and take photos of tags, record previous hunting wounds etc.):

……

……

……

Form B

- Please fill out one of these data sheets for each turtle. Then place the form on the turtles plastron (belly) and take a photo that shows this data sheet and all of the turtle in the same photo.
- Once you have taken the photos please check that the writing can be read clearly and the turtle can be seen
- If the photo is not clear please take another one

Date: _____ Recorded by: _____

Reef/Island Name where the Turtle was captured: _____

_____

Fishing Method: _____

Date and time of capture:_____

Turtle Curved Carapace Length (CCL): _____

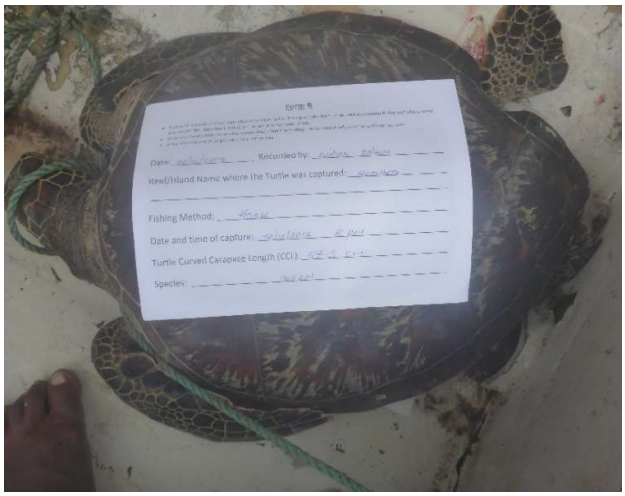
Species:

Appendix 2. Community monitors collecting information on turtle harvests

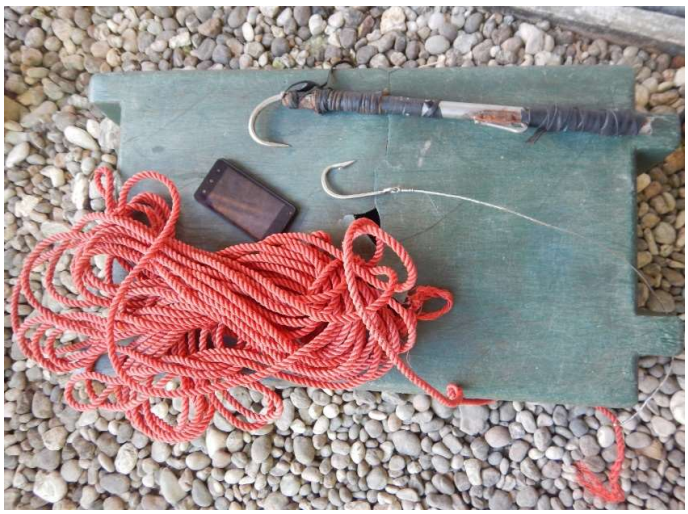
Community monitors practicing how to measure turtles

Community monitors practicing how to record local reefs names

Spearfishers catch of juvenile turtles



Captured turtle being photographed by community monitor with Form B



Rope and different types of hooks that free divers use to capture turtles

Spear attached to a floater that is used by spearfishers for capturing turtles

Juvenile turtles of various sizes

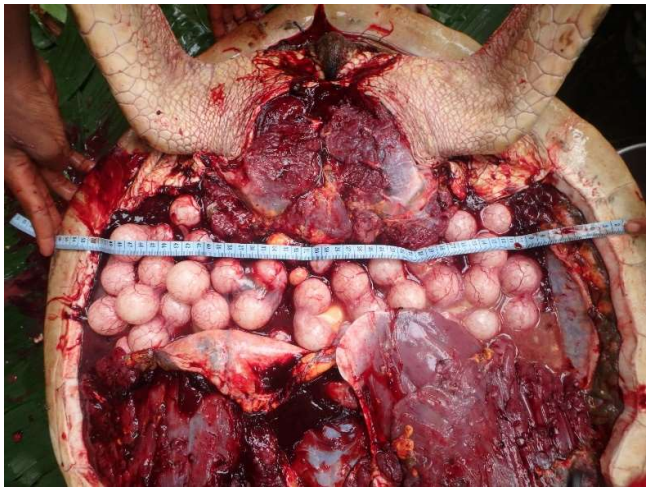
Juvenile hawksbill turtle wrapped with tarpaulin and being transported via island vessel to Honiara for sale

Appendix 3. Illegal sale of turtle products in Solomon Islands

Barbecued turtle meat being sold at Honiara Market

Bowl of cooked turtle meat being sold for SBD$5

Turtle meat for sale



Adult Olive Ridley turtle captured near a nesting beach and butchered for sale

Hawksbill shell used as a separator in traditional shell money

Finger rings made of hawksbill turtle shell being sold in Honiara street markets

Hair combs made from hawksbill shell sold at Honiara International Airport

Hand bangles made from hawksbill shell and being sold on the streets of Honiara