

CHARACTERISTICS OF SEA TURTLE INCIDENTAL CATCH OF TAIWANESE LONGLINE FISHERIES IN THE ATLANTIC OCEAN

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SUMMARY

For understanding the incidental catch of sea turtles by longline fisheries, one hundred and three trips, 13096 observed sets and 40.75 million hooks from Taiwanese large scale longline fishing vessels were collected in the Atlantic Ocean from March 2004 to December 2011. Six hundred and twenty six turtles were caught. The incidental catch rates ranged from 0.000-0.0311 per 1000 hooks which were highest in tropical Atlantic Ocean from April to June. The major incidental catch species were leatherback (59.9%), Olive Ridley turtle (28.0%), and loggerhead turtles (9.3%). Around 40% were released alive and 35.1% were dead. Most sea turtles are hooking (56.1%).

RÉSUMÉ

Pour connaître les prises accidentelles de tortues marines réalisées par les pêcheries palangrières, les grands palangriers du Taipei chinois ont effectué 103 sorties, dont 13.096 opérations faisant l'objet d'observation et ils ont recueilli 40,75 millions d'hameçons dans l'océan Atlantique entre mars 2004 et décembre 2011. Six-cent vingt-six tortues ont été capturées. Les taux de capture accidentelle ont oscillé entre 0,000 et 0,0311 pour 1.000 hameçons, chiffre le plus élevé dans l'océan Atlantique tropical entre les mois d'avril et de juin. Les principales espèces accessoires capturées étaient la tortue luth (59,9%), la tortue olivâtre (28,0%) et la tortue couanne (9,3%). Environ 40% d'entre elles ont été remises à l'eau vivantes et 35,1% sont mortes. La plupart des tortues marines se sont hameçonnées (56,1%).

RESUMEN

Para conocer las capturas incidentales de tortugas marinas realizadas por las pesquerías de palangre se recopilaron datos de 103 mareas, de 13.096 lances y de 40,75 millones de anzuelos de los grandes palangreros de Taipei Chino en el océano Atlántico desde marzo de 2004 hasta diciembre de 2011. Se capturaron 626 tortugas. Las tasas de captura incidental oscilaban entre 0,000-0,0311 por 1.000 anzuelos, la cifra más elevada en el Atlántico tropical desde abril a junio. La captura incidental más importante de especies de tortugas marinas correspondía a la tortuga laúd (59,9%), a la tortuga golfina (28,0%) y a la tortuga boba (9,3%). Aproximadamente el 40% de las tortugas se liberaron vivas y el 35,1% murió. La mayoría de las tortugas se enganchó en los anzuelos (56,1%).

KEYWORDS

Leatherback turtle, Olive Ridley turtle, loggerhead turtle, bycatch, longline, observers

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1. Introduction

There are seven species of sea turtles, including leatherback turtle (*Dermochelys coriacea*), loggerhead turtle (*Caretta caretta*), hawksbill turtle (*Eretmochelys imbricata*), Kemp's Ridley turtle (*Lepidochelys kempii*), Olive Ridley turtle (*Lepidochelys olivacea*), flatback turtle (*Natator depressus*) and green turtle (*Chelonia mydas*). Most of them are distributed in tropical and subtropical waters. There are many reasons decreasing the number of sea turtles, including marine pollution, tourism and coastal development, plastic bags/debris, boat collisions, fisheries bycatch, the direct take of adults, the collection of eggs by humans, the predation of eggs by animals, loss of nests due to hurricanes, etc (FAO Fisheries and Aquaculture Department 2009). Six species of turtles have listed in the IUCN red list as Vulnerable (Olive Ridley), Endangered (loggerhead, green turtle), and Critically Endangered (Kemp's Ridley, hawksbill, and leatherback) (IUCN 2010).

The expansion of fishing activities, such as gillnets, pound nets, purse seines and the lines fisheries have caused the decline some of sea turtles populations. Fisheries bycatch has been implicated in population declines of several species of sea turtles (Hall et al. 2000; Lewison et al. 2004; Moore et al. 2009; Wallace et al. 2011). Turtles could be entangled in these fishing gears, or hook in the jaw, esophagus or flippers. Many researches showed the dramatically decreasing of some populations. Understanding the bycatch scale would be important for planning the conservation management measures. In the Atlantic Ocean, the estimated sea turtles bycatch rate were highest at 2.4 per thousand hooks for leatherback and 14 per thousand hooks for loggerhead turtles (Lewison et al. 2004). (Wallace et al. 2010) summarized the sea turtles bycatch research from 1980 to 2008. In the Atlantic Ocean, it showed the sea turtle bycatch of longline fisheries have high bycatch rate in the northwest Atlantic Ocean.

Facing the decreasing population of sea turtles, Food and Agriculture Organization of United Nations (FAO) adopted a Technical consultation on sea turtles conservation and fisheries in 2005 (FAO 2005). Guidelines to reduce sea turtle mortality in fishing operations were furthered developed in 2009 (FAO Fisheries and Aquaculture Department 2009). In the Atlantic Ocean, International Conservation for the Atlantic Tuna adopted Recommendation 10-09, requests each CPCs shall collect and report to ICCAT on the interactions of its fleet with sea turtles by gear, including catch rates. In addition, CPCs shall request their fishing fleets to take actions, including carry on board safe-handling, disentanglement and release equipment capable of releasing sea turtles in a manner that maximizes the probability of their survival (ICCAT 2010).

For understanding the interaction and possible impacts of Taiwanese Atlantic longline fleets on sea turtles, the incidental catch rates and location were explored (Huang 2010; Huang and Huang). This research was using observers' data in the period of 2004 to 2011 to analyze the incidental catch information for sea turtles.

2. Materials and Methods

2.1 Fisheries

Three distinct fleets of Taiwanese large-scale longline tuna-fishing vessels operate in the Atlantic Ocean, targeting albacore (*Thunnus alalunga*) and bigeye tuna (*T. obesus*). Most of the bigeye effort occurs in tropical waters between 20°N and 20°S. The bigeye tuna vessels deploy 3,000 hooks per set. The main line (monofilament nylon) is 90 to 150 km long. Secondary branch lines, which are attached to the main line, are about 40-50 m in length and have light-sticks connected to the 4.2-inch J hooks. Squid, mackerel, and milkfish are used as bait. The vessels spend six to nine hours setting lines and approximately twelve to nineteen hours hauling. The target species are bigeye tuna and yellowfin tuna (*T. albacares*) (Huang et al., 2009).

The northern and southern albacore fleets operate at higher latitudes in either the north Atlantic (N of 20°N) or the south Atlantic (S of 20°S). These vessels deploy 3,000 to 4,000 hooks per set, and the main line is 130 to 160 km long. Secondary lines are 26-30 m in length, and light-sticks are connected to the J hooks (3.2-3.8 inches). Squid, saury, and sardines are used for bait. The vessels set lines for nine hours and haul for thirteen to sixteen hours (Huang et al., 2009).

2.2 Data Collection and Analysis

Catch and bycatch data were collected by onboard observers. For each set, observers recorded basic information of the vessels, daily fishing activities (which included fishing position (latitude and longitude), number of hooks, time of set and hauling, use of bird-scaring equipment or not, and bait types), catch information (the number of

retained, discarded, live-released fish, and depredation by sharks, by cetaceans, and unknown animals, and the weight of the retained catch), ecologically related species information (the species and numbers sighted during fishing operations, and the number, species, and status (live/dead) of the incidental catch), and biological samples for specific species (Huang 2011).

Considering the possible spatial and temporal distribution of turtles and fishing activities. We separate the sets to four seasons (First: January to March, Second: April to June, Third: July to September, Fourth: October to December) and three areas (North Atlantic: north of 15 N, Tropical: between 15N and 15 S; South area: south of 15S). Capture per unit effort (CPUE) was calculated as number of specimens per 1000 hooks in each stratum.

3. Results

During the period 2004-2011, a total of 103 trips, 13096 sets and 40.75 million hooks were observed. A total of 626 sea turtles were caught. Most distributed in tropical waters, between 15 N and 15 S, where are the major fishing grounds of bigeye tuna fleet.

Nominal Catch rates were the highest in tropical area from April to June (0.0311 sea turtles per 1000 hooks) and lowest in North Atlantic from October to December (zero bycatch; **Table 1**).

The major incidental catch species were leatherback turtle (59.9%), followed by Olive Ridley turtle (28.0%), loggerhead turtle (9.3%), green turtle (1.4%), hawksbill turtle (0.3%), Kemp's Ridley turtle (0.2%) and unidentified (1.0%). Female was more than male. However, most did not identify the gender (**Table 2**). As for the bycatch reasons, most (56.1%) were hooking, others were entangled (22.4%) or others (21.6%; **Table 3**).

Regarding the size of bycatch turtles, the straight carapace length of leatherback turtles ranged from 60-190 cm. The green turtles were 45-60 cm. Olive Ridley turtles were from 40-70 cm. Loggerhead turtles were around 40-60 cm. (**Figure 1**).

4. Discussion

The sea turtle incidental catch information of distant water longline fleets was very limited. This research collected seven years, 13096 trips data to analyze the spatial and temporal characteristics of sea turtle bycatch.

In the Atlantic Ocean, loggerhead turtle and leatherback turtles were most frequently caught turtles in this area (Honig et al. 2008; Pons et al. 2009). The South Africa and Spain also caught more loggerhead in the Atlantic Ocean. For Taiwanese fleets, the major species is leatherback turtle, followed by Olive Ridley turtle. The possible reasons are the fishing ground, or fishing gears. Taiwanese fleets operating at the high seas with deeper depth, which is different from those fleets targeting on swordfish or operating in coastal areas.

Regarding the bycatch rates comparisons, the previous researches showed variation among area by states. It ranged from 0.001-1.758 in the northwest Atlantic region; 0.03-1.05 in the northeast Atlantic region; 0.00-4.31 in the southwest Atlantic region, 0.001-0.527 in the southeast Atlantic region, and 0.03-3.27 in the Mediterranean (Coelho et al. 2012). Most of the rates were higher than Taiwanese fleets which were ranged from 0.000-0.0361 turtles per thousand hooks. The possible reason is the Taiwanese fishing grounds were major operating in the high seas. These could be further explored for looking for mitigation measures for reducing sea turtles bycatch in the future.

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Table 1 Nominal incidental catch rate by area by season in the Atlantic Ocean, 2004-2011.

Unit: N per thousand hooks

<i>Season Area</i>	<i>January to March</i>	<i>April to June</i>	<i>July to September</i>	<i>October to December</i>	<i>Sum</i>
N	0.0098	0.0030	0.0103	-	0.0062
T	0.0117	0.0311	0.0173	0.0154	0.0187
S	0.0062	0.0059	0.0022	0.0008	0.0038
Total	0.0107	0.0246	0.0131	0.0131	0.0154

Table 2. Species and Gender of incidental catch turtles in the Atlantic Ocean, 2004-2011.

<i>Species\Gender</i>	<i>Male</i>	<i>Female</i>	<i>Unknown</i>	<i>Total</i>	<i>%</i>
Leatherback turtle	23	17	335	375	59.9%
Olive Ridley turtle	29	52	94	175	28.0%
Loggerhead turtle	6	10	42	58	9.3%
Green turtle	2	3	4	9	1.4%
Hawksbill turtle			2	2	0.3%
Kemp's Ridley turtle	-		1	1	0.2%
Unidentified	1		5	6	1.0%
Total	61	82	483	626	

Table 3. Incidental catch reason of sea turtles by species in the Atlantic Ocean, 2004-2011.

<i>Species\Gender</i>	<i>Hooking</i>	<i>Entanglement</i>	<i>Unknown</i>	<i>Total</i>
Leatherback turtle	152	126	97	375
Olive Ridley turtle	140	4	31	175
Loggerhead turtle	50	4	4	58
Green turtle	7		2	9
Unidentified	2	4		6
Hawksbill turtle		2		2
Kemp's Ridley turtle			1	1
Total	351	140	135	626
Percentage	56.1%	22.4%	21.6%	100.0%

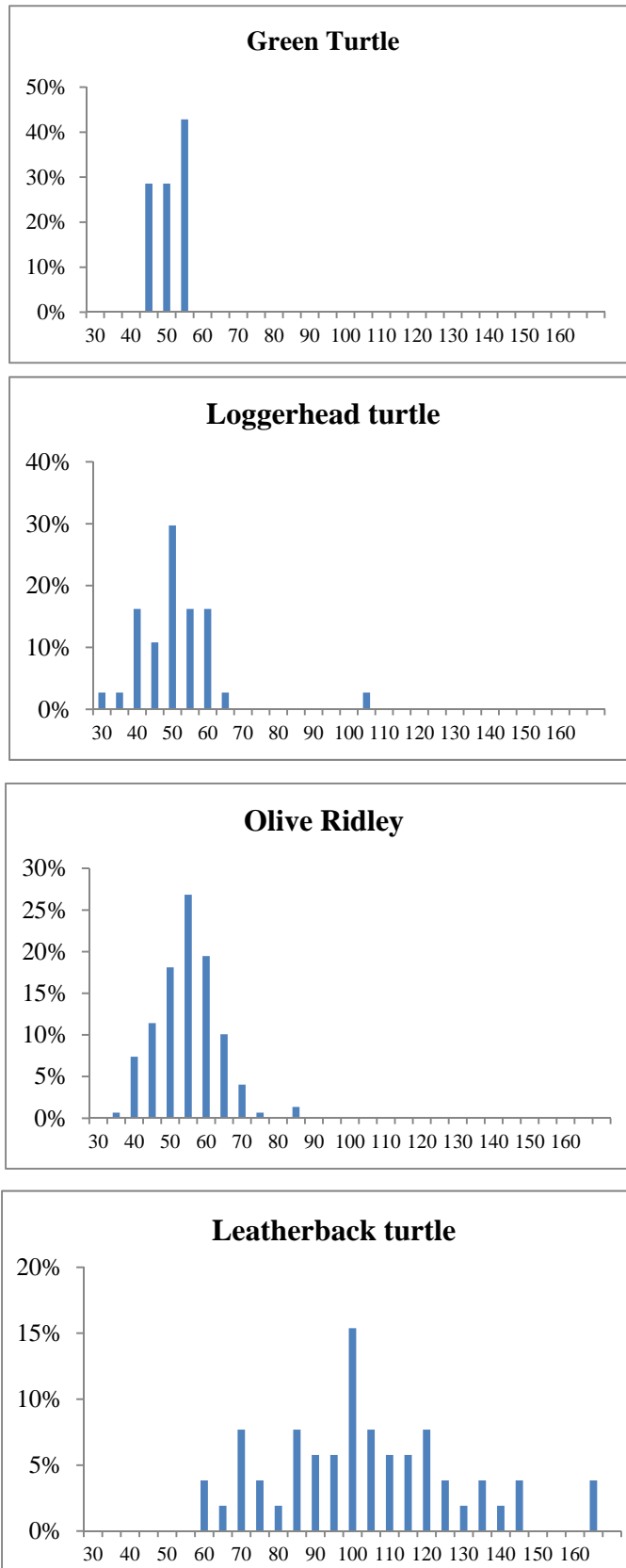


Figure 1. Length frequency of incidental catch turtles by species.