Biological Conservation **43** (1988) 1–7

The Incidental Capture of Sea Turtles in Fishing Gear in Terengganu, Malaysia

E. H. Chan, H. C. Liew & A. G. Mazlan

Fisheries and Marine Science Centre, Universiti Pertanian Malaysia, Mengabang Telipot, 21030 Kuala Terengganu, Malaysia

(Received 20 March 1987; revised version received 8 May 1987; accepted 16 May 1987)

ABSTRACT

Data derived from interviews with fishermen revealed that incidental captures of sea turtles in fishing gear contribute significantly to the mortality of these animals in Terengganu, Malaysia. Trawl nets were mainly involved, with drift/gill nets and bottom longlines also capturing appreciable numbers of turtles. It was estimated that trawl and drift nets each had the potential of capturing an average of 742 and 422 turtles, respectively, per year. A large number of the turtles caught were leatherbacks Dermochelys coriacea, *followed by both olive ridleys* Lepidochelys olivacea *and green turtles* Chelonia mydas. *No hawksbill* Eretmochelys imbricata *captures were recorded. Turtles caught in trawl nets were usually dead when landed, while drift/gill net and bottom longline captures had some chances of survival. The problem of squid jigging is also discussed. Methods for reducing the deleterious effects of fishing gear are presented.*

INTRODUCTION

The incidental capture of sea turtles in fishing nets and on lines is considered a major problem in sea turtle conservation worldwide. Numerous reports in the literature document the seriousness of the problem (Carr, 1977; Hillestad *et al.*, 1978, 1982; Lipske, 1980; Gunter, 1981). Most of the existing literature indicates the trawl net to be mainly responsible for the incidental captures.

In Malaysia, the problem of incidental captures also exists, but is poorly documented. Cantor (1847) observed that green turtles *Chelonia mydas* were

Biol. Conserv. 0006-3207/88/$03·50

plentifully caught in fishing stakes in the Straits of Malacca at all seasons. Siow & Moll (1982) attributed fishing to be responsible for the growing numbers of dead turtles on the beaches each year.

In 1985 an interview-based survey was conducted in Terengganu to assess the problem of incidental captures of sea turtles. Terengganu is endowed with the largest nesting turtle population in Peninsular Malaysia. The only nesting site for leatherbacks *Dermochelys coriacea* in the country is also found here. This paper reports the findings of the survey.

METHODS

A questionnaire prepared for the interviews was designed to provide information on fishing operations, sightings of turtles in the fishing grounds, incidental captures in fishing gear, condition of captured turtles and seasonality of captures. The fishermen interviewed operated mainly in the waters around Pulau Redang, Pulau Kapas, Pulau Yu, Pulau Bidong, Pulau Perhentian, Pulau Lima and Pulau Tenggol, and off the coasts of Batu Rakit, Merang, Chendering, Marang, Dungun, Paka, Kertih and Kemaman (Fig. 1). A total of 52 fishermen were interviewed in October and November 1985. Of these 24 operated drift/gill nets, 22 trawl nets and 6 longlines. The drift/gill nets were operated from boats measuring 5–15 m, with engines ranging from 5 to 37 hp. Trawlers ranged from 10–16 m in length, with engines from 22–40 hp, while bottom longlines were operated from boats ranging from 4–15 m long, with engines of 5 to 37 hp.

The information supplied by the fishermen refers to incidental captures made in 1984 and 1985.

RESULTS

Sightings of olive ridleys *Lepidochelys olivacea*, green turtles and leatherbacks were common in the fishing grounds. Around islands, olive ridleys and green turtles were more frequently sighted than leatherbacks, the majority of the latter occurring off Dungun, i.e. near their nesting beaches. An appreciable number of sightings of olive ridleys and green turtles were also recorded in waters off Dungun. Hawksbills *Eretmochelys imbricata* were rather rare and only a few sightings were reported off Pulau Redang, Pulau Kapas, Dungun and Chendering.

Of the 52 fishermen interviewed, 28 (54%) had experienced incidental captures of sea turtles in their gear, comprising 15 trawlermen (68% of those operating), 10 drift/gill net operators (42%) and 3 longliners (50%).

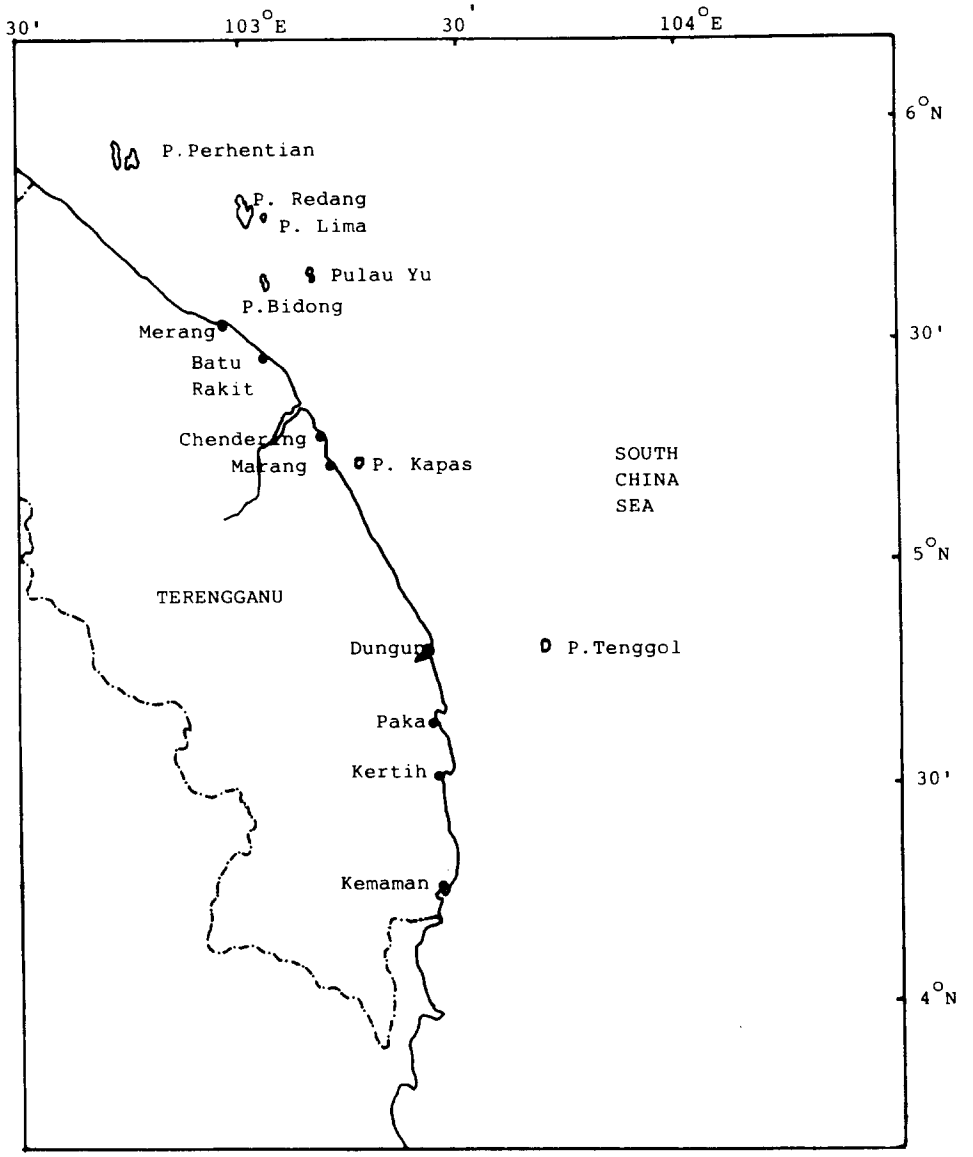

Fig. 1. Map of Terengganu showing the localities off which the fishermen operated.

A total of 128 cases of incidental captures were reported for 1984 and 1985. Forty-seven were leatherbacks and 40 and 41 were of olive ridleys and green turtles, respectively. No incidental captures were reported for hawksbill turtles. The frequency of incidental captures by each fisherman ranged from 0 to 5 per season (average 1·23 per year) (Table 1).

The relationship between species captured and gear was also obtained (Table 1). Of the 128 incidental captures, 29 were from drift/gill nets, 95 from

TABLE 1
Average Rate of Incidental Capture of Sea Turtles in 1984 and 1985
(Number of turtles caught per fisherman and per gear.)

Species	*1984*			*1985*		
	Fisher-man	*Trawl*	*Drift/ gill*	*Fisher-man*	*Trawl*	*Drift/ gill*
Leatherback	0·60	1·29	0·09	0·31	0·67	0·05
Green	0·29	0·54	0·10	0·48	0·90	0·17
Olive ridley	0·34	0·46	0·31	0·44	0·58	0·40
Total	1·23	2·29	0·50	1·23	2·15	0·62

trawl nets, and 4 from longlines. Drift/gill nets were responsible mainly for capture of olive ridleys (18 cases), while appreciable numbers of green (7 cases) and leatherback (4 cases) turtles were also caught. Trawl nets frequently caught leatherbacks (42 cases) followed by green turtles (31 cases) and olive ridleys (22 cases). Estimates for bottom longlines were not made because of the small numbers of operators involved, but they seemed to catch an equal number of the three species.

The fishermen were also interviewed on the condition of the turtles caught. Of the 10 drift-net operators, 4 reported that the turtles caught by them were dead while 6 said that the animals were still alive. Fourteen of the 15 trawler fishermen said that the turtles landed were already dead while one said that the turtle was still alive. The three bottom longline fishermen said that their captures were still alive. All the fishermen who landed live turtles said that they cut their nets, or lines to release the turtles.

Incidental capture of turtles was reported to occur between the months of March to September with greater numbers of cases from April to July (Table 2). These months coincide with the nesting seasons. No reports of

TABLE 2
Seasonality of Incidental Captures

Month	*Relative frequency of capture* (%)	*Month*	*Relative frequency of capture* (%)
January	0	July	19
February	0	August	5
March	12	September	5
April	27	October	0
May	16	November	0
June	16	December	0

incidental captures were given between October to February, due mainly to reduced fishing activities with the onset of the monsoon. However, some prawn trawling is conducted during this period. Breakdown figures for the different species were not available.

DISCUSSION

This study shows that incidental capture of sea turtles in fishing gear in Terengganu waters is common, and contributes significantly to the mortality of sea turtles. The intense fishing activity which coincides with the nesting season aggravates the problem. Statistics from the Terengganu Fisheries Department show that there were 312 and 861 licensed trawl and drift nets respectively in 1984, while in 1985 there were 358 and 664 respectively. The potential total of turtles caught by trawl and drift nets in 1984 and 1985 has been extrapolated from these statistics and the average capture rates (Table 1), and is shown in Table 3. The figures, which include both juvenile and adult turtles, are alarmingly high when compared with the number of nestings recorded for each species (Table 4), and it can be seen that fishing nets have the potential of quickly decimating the current populations of sea turtles.

The highest frequency of capture reported here, i.e. 5 turtles per season, is comparable to the highest recorded in Western Florida, i.e. 6 turtles per season (Anon., 1976). However, in other parts of the US, as many as 30·7 turtles per shrimp trawler per season has been recorded (Hillestad *et al.*, 1978). In 1980, 1500 loggerheads *Caretta caretta* drowned as a result of shrimp trawling in Carolina and Texas (Lipske, 1980).

Most existing literature indicates that shrimp trawlers are solely responsible for the incidental captures. However Siow & Moll (1982) and

TABLE 3

The Potential Number of Turtles Estimated to have been Caught Incidentally by Trawl and Drift/gill Nets in 1984 and 1985 in Terengganu
(Includes captures of juvenile and adult male and female turtles.)

Species	*1984*		*1985*		*Average/year*	
	Trawl	*Drift/ gill*	*Trawl*	*Drift/ gill*	*Trawl*	*Drift/ gill*
Leatherback	402	77	240	33	321	55
Green	168	86	322	113	245	100
Olive ridley	144	267	208	266	176	267
Total	714	430	770	412	742	422

TABLE 4
Number of Nestings of Sea Turtles in Terengganu for 1984, 1985 and 1986
(Source: Terengganu Fisheries Department.)

Species	*Number of nestings per year*		
	1984	*1985*	*1986*
Leatherback	788	418	596
Green	4 292	1 169	4 492
Olive ridley	293	380	454
Hawksbill	9	20	123

Margaritoulis (1986) report that fishing stakes, drift nets and bottom longlines also catch sea turtles, and the study confirms that although trawl nets appear to be the major gear involved, drift/gill nets and bottom longlines also capture appreciable numbers.

Turtles caught in trawls have very little chance of survival because the nets are dragged for long hours across the sea bottom. It is estimated that if a turtle is rescued in less than an hour of trawling, it stands a good chance of survival (Pritchard *et al.*, 1983). If trawl nets and other fishing gear are pulled up more frequently, trapped turtles will have better chances of survival.

Fishing gear, besides causing direct mortalities, may also scare away turtles which approach nesting beaches at night to lay eggs. Nesting seasons coincide roughly with that for squid fishing, and during this time, squid jiggers operate along extensive stretches of inshore waters, often near nesting grounds. Their powerful lights which attract the squid may unfortunately also scare away approaching turtles.

The problems posed by fishing gear cannot be completely avoided. However, its deleterious effects can be reduced in a number of ways. Fishing in areas frequented by nesting turtles can be restricted, or the fishermen encouraged to reduce their trawling or setting times. They can also be taught the relatively simple method of resuscitating turtles (Pritchard *et al.*, 1983) and the TED (trawling efficiency device), which was developed to reduce incidental captures of turtles in shrimp trawls (Seidel & McVea, 1982; Taylor *et al.*, 1985), should be tested under local conditions to assess the benefits derived.

ACKNOWLEDGEMENTS

This study was funded by ESSO Production Malaysia Inc. The authors are grateful to the Fisheries Department of Terengganu for providing relevant statistics and the fishermen for their co-operation in the interviews.

REFERENCES

Anon. (1976). *Incidental capture of sea turtles by fishermen in Florida: Preliminary report of the Florida West Coast survey.* University of Florida Marine Advisory Program.

Cantor, T. (1847). Catalogue of reptiles inhabiting the Malay Peninsula and Islands. *J. Asiat. Soc. Bengal*, **16**. Reprinted 1966, Amsterdam, A. Asher and Company.

Carr, A. (1977). Crisis for the Atlantic ridley. *Marine Turtle Newsletter*, **4**, 2–3.

Gunter, G. (1981). Status of turtles of the Mississippi coast. *Gulf Research Rep.*, **7**, 89–92.

Hillestad, H. O., Richardson, J. I. & Williamson, G. K. (1978). Incidental capture of sea turtles by shrimp trawlermen in Georgia. *Proc. 32nd Ann. Conf. SE Ass. Fish & Wildl. Agencies, Hot Springs, Virginia, 5–8 Nov., 1978.*

Hillestad, H. O., Richardson, J. I., McVea, C. & Watson, J. M. (1982). Worldwide incidental capture of sea turtles. In *Biology and conservation of sea turtles, Proc. World Conf. Sea Turtle Conserv.*, ed. by K. Bjorndal, 489–95. Washington, DC, Smithsonian Institution Press.

Lipske, M. C. (1980). Wash-ups spur action on turtles. *Defenders*, **55**, 384–5.

Margaritoulis, D. N. (1986). Captures and strandings of the leatherback sea turtle, *Dermochelys coriacea*, in Greece (1982–1984). *J. Herpetol.*, **20**, 471–4.

Pritchard, P., Bacon, P., Berry, F., Carr, A., Fletemeyer, J., Gallagher, R., Hopkins, S., Lankford, R., Marquez, M., Ogren, L., Pringle, Jr, W., Reichart, H. & Withim, R. (1983). In *Manual of sea turtle research and conservation techniques*, 2nd edn, ed. by K. A. Bjorndal and G. H. Balazs, Washington, DC, Center for Environmental Education.

Seidel, W. R. & McVea, C. (1982). Development of a sea turtle excluder shrimp trawl for the Southeast US penaeid shrimp fishery. In *Biology and conservation of sea turtles, Proc. World Conf. Sea Turtle Conserv.*, ed. by K. A. Bjorndal, 497–502. Washington, DC, Smithsonian Institution Press.

Siow, K. T. & Moll, E. O. (1982). Status and conservation of estuarine and sea turtles in West Malaysian waters. In *Biology and conservation of sea turtles, Proc. World Conf. Sea Turtle Conserv.*, ed. by K. A. Bjorndal, 339–48. Washington, DC, Smithsonian Institution Press.

Taylor, C. W., Serra, A. F., Mitchell, J. F. & Watson, J. W. (1985). *Construction and installation instructions for the trawling efficiency device.* NOAA Technical Memorandum NMFS-SEFC-71.