Efficeincy Comparison of Circle Hook versus J-Hook in Pelagic Longline Fishery, Andaman Sea

Santiphong Putsa and S. Promjinda

Southeast Asian Fisheries Development Center, Training Department, P.O.Box 97, Phrasamutchedi, Samutprakan 10290, Thailand

Introduction

The FAO Guidelines specified that longline fishery must develop and implement combinations of hook design, type of bait, depth, gear specification, and fishing practices that minimize sea turtle bycatch, incidental catch, and mortality (FAO, 2005). Hook modifications in particular are expected to be one of the most effected tolls in reducing incidental sea turtle mortality.

Take into account on the geo-topographic features in the Southeast Asia waters, about 60% of the sea water areas identify as deep sea where the sea is deeper than 200 m, for examples, in the Andaman Sea, South China Sea, Sulu Sea, Celebes Sea, Eastern Indian Ocean, Banda Sea, Sulawesi Sea., highly migratory species such as tunas, tuna like species, billfishes and others are classified as highly migratory species. It is expected that those large pelagic species existed in the region are still resources. SEAFDEC therefore proposed to conduct the fishing experiment base information collection in many sea areas namely Andaman Sea, the South China Sea and Sulu Sea of member countries' EEZ. A series of field surveys has been carried out accordingly in collaboration with the SEAFDEC member countries using SEAFDEC Research vessel M.V.SEAFDEC and M.V.SEAFDEC2

Materials and Methods

The data is taken from fishing logbook that had been recorded during the cruise surveyed. The survey area was located at Andaman Sea within EEZ of Thai Waters and Myanmar Waters with a depth was varied between 300 and 2700 m (**Fig. 1**). Thirty nine (39) pelagic longline fishing operations were conducted, which were 34 operations from M.V. SEAFDEC 2 (2006-2008) and 5 operations by M.V. SEAFDEC (2010-2011).

The Pelagic longline fishing gear was composed of a nylon monofilament mainline (4.0 mm diameter) and stored in a 2.0 meter winch mainline reel by hydraulic power. Branch lines (2.0 mm nylon monofilament) with a length of 12 m attached to the mainline by stainless steel snap clip. One tuna hook was attached to the branch line by aluminum sleeve at the end. One 40 g lead sinker was attached at 1.5 m above the hook. The distance between each branch line was maintained at 40 m. A PVC float line (300 mm diameter) was attached to a 25 m long nylon rope (5 mm diameter) was further attached to the mainline gear after every 15-20 hooks (which is called one basket). Two types of tuna hook were used **(Fig. 2)**, the stainless steel circle hooks size 14/0 and sun stainless steel tuna hook (J-hook) size 2.8 were set alternated along the longline in order to investigate and compare the efficiency of both types. The number of hooks range from 300 to 620 hooks per operation were deployed. Three species difference of frozen fishes; Round scad (*Decapterus* sp.), Saury fish (*Cololabis* sp.) and Indo-Pacific mackerel (*Rastrelliger brachysoma*) were used for baited. The shooting operation normally was done during the evening hours whereas the hauling was carried out in the next day morning. The emersion time was range for 8.00 to 14.00 hours.

To determine the efficiency of circle hook and J-hook with respect to catch composition and hooking position. At the time of retrieval, the species caught, hook type, and hooking position of all target fishes, as well as by-catch fishes were recorded. The hooking positions were categorized as Upper jaw, lower jaw, and jaw angle were considers as "Mouth". The hooking position inside the moth such as esophageal sphincter, and gill arch were considered as "Internal". All other positions excluding foregoing explanation were considered "Other".

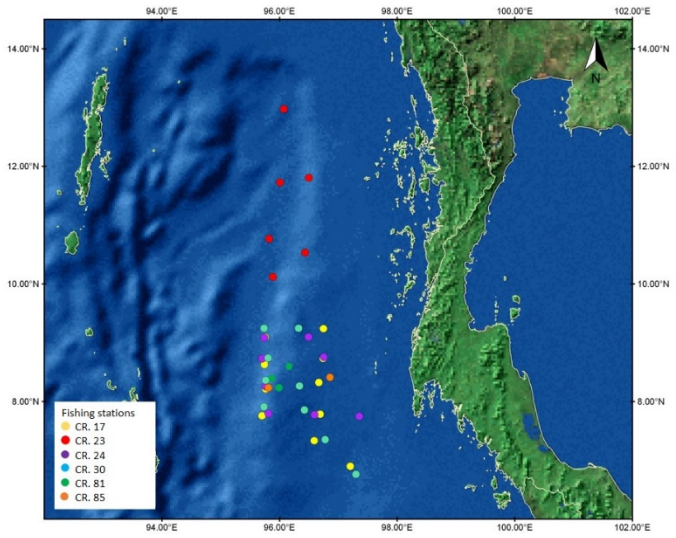

Fig. 1 Study area showing the survey stations of pelagic longline in Andaman Sea

Fig. 2 Photographs of circle and J-hook

Results and Discussion

M.V. SEAFDEC and M.V. SEAFDEC 2 were conducted 39 pelagic longline fishing operations and 20,842 hooks deployed. Hook trails caught 334 fishes representing 30 species, of those, the circle hook caught 205 fishes (28 species) and 129 fishes (14 species) were caught from J-hook. When comparing the target catches between hook types, circle hook were caught 62 (30.24%) whereas for 29 (22.48%) fishes in J-hook. Among the target group, Swordfish (*Xiphias gladius*) were the dominant species caught which high number in circle hook (n=36) than J-hook (n=15) **(Table 1)**. Few significant differences in catch rates of target or by catch species between circle hooks and J-hooks (Kersteter and Graves, 2006). However, the non-target species were caught much higher than target species, which 143 (69.76%) and 100 (77.52%) fishes for circle and J-hooks

respectively. Within this group, Bigeye thresher shark, Pelagic stingray and Snack mackerel were the dominant caught. The results similar to Yokota et al. (2006) and Curran and Bigelow (2011) reported the catchability on large circle hooks (18/0) was maintained target species catches. However, excluding ray species, our result contrary with their reported that large circle hooks reduced for incidental and other by-catch species compared to J-hooks (Curran and Bigelow, 2011).

Table 1 Total number of each species caught in circle hook (C) compared with J-hooks (J), (*) = Target species catches

	Scientific name	**Common name**	**No. caught**	
			C	**J**
Tunas and Billfish	*Thunnus albacares*	Yellowfin tuna*	6	5
	Tetrapturus audux	Striped marlin*	1	0
	Makaira indica	Black marlin*	3	0
	Istiophorus platypterus	Sailfish*	9	7
	Xiphias gladius	Swordfish *	36	15
Shark	*Carcharhinus amblyrhynchos*	Grey reef shark	1	0
	Alopias superciliosus	Bigeye thresher shark	42	20
	Carcharhinus limbatus	Blacktip shark	1	0
	Centrophorus moluccensis	Smallfin gulper shark	6	0
	Carcharhinus sp.	Deep Sea Shark	1	0
	Carcharhinus obscurus	Dusky shark	0	2
	Centrophorus granulosus	Gulper shark	1	0
	Heptranchias perlo	Sharpnose sevengill	4	0
	Carcharhinus longimanus	Oceanic whitetip	1	0
	Alopias pelagicus	Pelagic thresher shark	7	3
	Isurus oxyrinchus	Shortfin mako shark	2	0
	Sphyrna mokarran	Hammerhead shark	1	0
	Galeocerdo cuvier	Tiger shark	1	0
Ray	*Mobula* spp.	Devil ray	0	3
	Dasyatis sp.	Pelagic stingray	9	44
Others	*Sphyraena barracuda*	Great barracuda*	6	2
	Acanthcybium solandri	Wahoo*	1	0
	Alepisaurus ferox	Lancetfish	3	2
	Coryphaenoides sp.	Rattail	5	0
	Gempylus serpen	Snack mackerel	25	20
	Lepidocybium flavobrunneum	Escolar	1	0
	Mola mola	Sunfish	1	0
	Ruvettus pretiosus	Oilfish	1	1
	Lepturacanthus savala	Savalai hairtail	28	5
	Taractichthys steindachneri	Sickle pomfret	2	0
Total			205	129

From total fishes hooked, it was result that 65.66% of fishes caught were hooked in mouth, following 17.77% were found in internal and 16.57% were at other. In comparison, when used the circle hook, 64.22% of fishes caught were hooked in the mouth and only 17.65% were found in the internal. Using J-hook, the majority of hooked were also in the mouth 67.97% and following by 17.19% of internal **(Fig. 3)**.

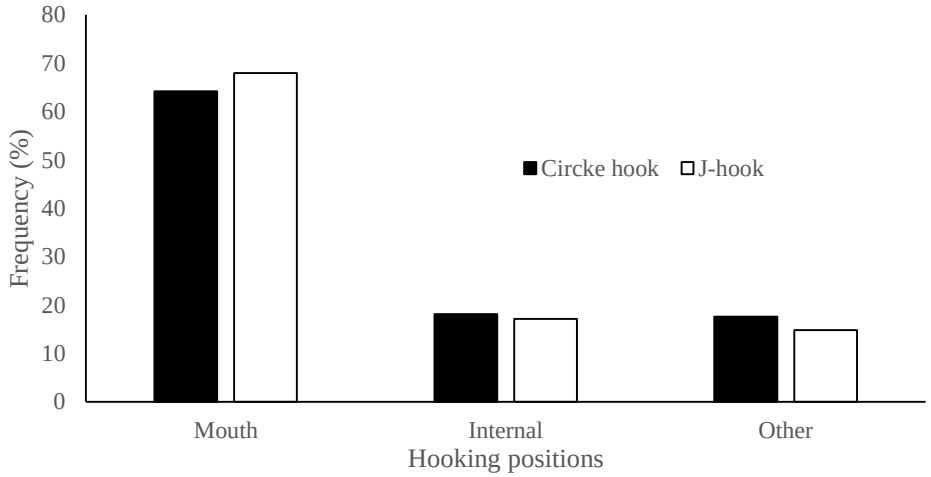

Fig. 3 Frequency histograms of the hooking position for total caught.

Regarding to hooking locations, the used of circle hook shown reduce the number of deep hooked (internal) and increase mouth hooking in some pelagic fish **(Fig. 4)**. For example, Yellowfin tuna were predominant (100%) hooks in the mouth with both hook types. Related to Kersteter and Graves (2006), found that 88% of Yellowfin tuna were hooked in the jaw by circle hooks. The specie of Snake mackerel were hooked at the mouth using circle hooks (80%), as compared with J-hooks (40%). In contrast, this species shown more hooked in the internal with J-hooks (60%), while only 12% were hooked in this location in the circle hooks. Similar to the result of Prince et al. (2002) which clearly indicated that the circle hook can minimize deep hooking for Sailfish in the recreational fishing. The circle hooks are more likely to hook animals external rather than internal (Kersteter and Graves, 2006). However, the result from Ward et al. (2009) indicated that both circle hook and J-hook, mostly, hooked at the mouth position (lip and jaw), with higher frequency than other positions. The large circle hook (size 16/0) may increase the probability of hooks exiting through the eye socket and they suggest that the use of circle hooks will result in lower mortality rate at haulback of target and non-target species (Kersteter and Graves, 2006).

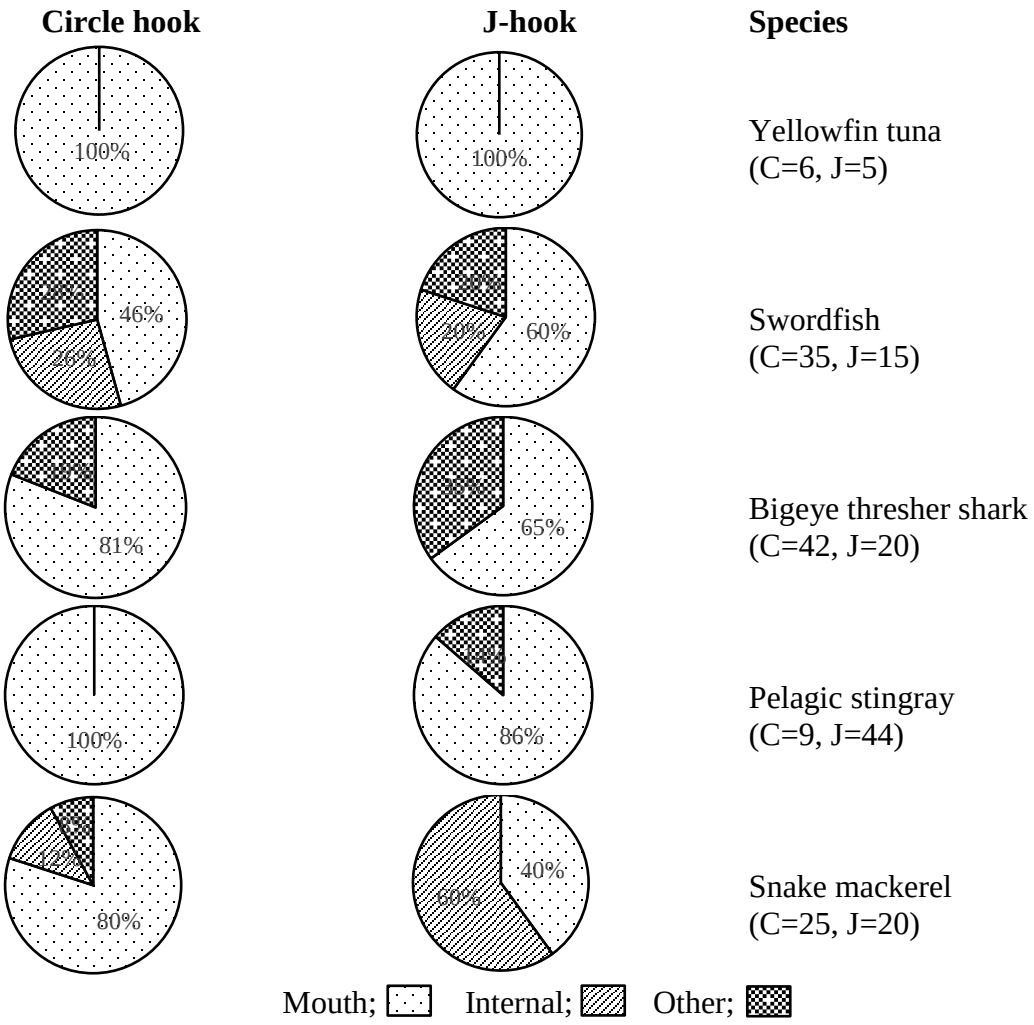

Fig. 4 The percentage of hooking position by species and hook types. The number of observed is indicated for circle hooks ("C") and J-hooks ("J").

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