



**Preliminary Report
On
Ghost Fishing Phenomena by Drifting FADs
In Eastern Indian Ocean**

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Abstract

The preliminary report on the Ghost Fishing Phenomena by Drifting Fish Aggregating Devices (DFADs) In Eastern Indian Ocean has main objective to study on the incidental death of marine animal around the Drifting Fads in the Eastern Indian Ocean during December 2002 to January 2003 while the shipboard purse seining of M.V.SEAFFDEC No.68-1/2002 was conducted. The data of incidental catches included the payao setting position from 17 drifting Payaos and 3 abandon European payaos were collected.

13 species, 103 marine animals had been caught by the accidental at 17 SEAFFDEC and 3 abandon European drifting payaos. 30 Marine turtles were the highest number of accidental catch. 18 of them were caught by abandon European drifting payaos. 11 Marine turtles were caught by SEAFFDEC drifting payao No.2, which entangled with abandon European in the garbage area. 27 leather jackets were highest number of marine fish caught by SEAFFDEC and abandon European drifting payaos. Others were 7 porpoises, 10 sharks, 7 tripletails, 13 rainbow runners, 3 seachubs, 2 wahoo, a skipjack, a barracuda and a remora.

The best tuna and skipjack catch result, 19 tons was conducted from the SEAFFDEC drifting payao with only incidental catch. The poorest tuna and skipjack catch result, 0 ton was conducted from the SEAFFDEC drifting payao with 25 incidental catches. From the result of the recorded, it has shown no significant relation between the quantities of tuna and skipjack target catches and number of incidental catches but the data should be continued to collecting for the final conclusion in the future.

Keywords: Ghost fishing, incidental catch, Drifting Fish Aggregating Devices (DFADs), Drifting payao

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1) Introduction

Tuna resources become one to the most important marine resource in the world. The FAO's recorded in 1998, that 5.5 million metric ton of tunas group were harvested. Tuna purse seine becomes the most important fishing gear of tuna fishing industrial in the world because their excellent catch capability. Most of world's tuna catches, including about 70 % of skipjack and yellowfin is taken by some 400-450 large purse seiner operating worldwide with each landing on the average 4000-5000 mt./ year (Ben-Yami, 1997).

Tuna purse seine net is a type of surrounding net with ring that can enclose the tuna school by a giant net. The development of the tuna fishing operation is raised up with the development of fishing net technology, modern purse seiner with their hauling devices. To achieve the massive catches, the fisherman has got to apply few techniques for fish school gathering, i.e.

1. *Fishing with the free swimming tunas.* This technique is used when tuna schools are swimming close to or at the sea surface especially when they jump with their prey. This technique does not produce unwanted catches but the technique is the most difficult for implement.

2. *Fishing tunas associated with porpoises.* Nowadays, the catch from this technique has been abandon from public consumer. To protect the dolphin population, US government and Inter-American Tropical Tuna Commission (IATTC) has cooperated to restrict on the import tunas caught with porpoise (namely: *setting on porpoise technique*) especially in Eastern Pacific Ocean.

3. *Fishing with drifting objects (Flotsam).* This technique is included the fishing with drifting payao, become the most important technique for tuna fishing in the world.

Tuna fisheries in Indian Ocean can be separated by area, i.e. Western and Eastern Indian Ocean. The Western Indian Ocean covers the fishing area from Eastern Africa, Madagasca to the Chagos Archipelago. French and Spanish tuna purse seiners are dominant flag for tuna fishing industry in the Western Indian Ocean. European purse seiners prefer the *Fishing with the free swimming tuna technique* but Japanese fishermen have experience on the *Fishing with drifting object (Flotsam)*. Since 1993, Japanese tuna purse seiner has been withdrawn from Western Indian Ocean. But they left their technique for European fishermen. At present, tunas harvesting by DFADs or flotsam technique becomes the most important role for European purse seiners. 2/3 of the catches, pre-dominantly skipjack, are taken while setting on logs and FADs mainly in April to May in Mozambic channel, and in September to October off Somali. The main season for fishing, free swimming school of skipjack is during December to January (Ben-Yami, 1997).

The Eastern Indian Ocean covers the fishing area from Chagos Archipelago, Maldives to West of Sumatra, Indonesia. This fishing area has less significant for world tuna fisheries than the western. Few tuna purse seiners have operated in this area since last decade. All of them are tuna research vessels. Two research vessels from Thailand and one research vessels from Japan are exploiting the tuna resources in The Eastern Indian Ocean. All research vessels use drifting payao for tuna purse seine fishing. Drifting Fish Aggregating Devices (DFADs) which included drifting payao have become the most important tools for gathering tuna school because rarely to find any free-living fish school or drifting objects in the Eastern Indian Ocean.

Now a day, Drifting payaos are complaint by the tuna longline fishermen on the deplete of juvenile yellowfin and bigeye tunas because both juvenile species are always associate with the drifting payao. From the observation of the implementation on drifting payao in Eastern

Indian Ocean, not only the catch of juvenile yellowfin and bigeye tuna but bycatch and ghost fishing phenomena can be taken place as well.

Ghost fishing is the fishing of lost or abandon fishing gear. Ghost fishing can define as the ability if fishing gear to continue fishing after all control of that gear is lost by fisherman. Type of fishing gear known to ghost fish include gillnets and crustacean/fish pot. However other fishing gears and their parts (such as trawls, seines and longlines) may cause the various problems to the resource and the environment. (He, 1997) Purse seine can become the ghost gear by the abandonment. Drifting payao for tuna fishing operation can become a ghost gear also. Drifting payao construction can be brought ghost fishing occur by the net part of payao.

Since 1993, M.V SEAFDEC has operated tuna purse seine fishing with drifting object techniques. To gain the successful of catch, the development of drifting payao need to be considered. There were two major concepts to increase the gathering performance of drifting payao. The first concept is; to let some sessile organisms, such as barnacles, attach with some part of DFAD especially the skirt net part. The primary consumer fishes are gathered around the payao then the new pelagic habitat is possible to grow up. The second concept is; to enmesh and entangle small preys at the net. The small preys are baits for other predator fishes, which swim around the payao. It is possible to develop as pelagic habitat of deep sea. Some accidental deaths of unwanted fishes by drifting payaos can be happened by the second concept. These non-intention catches are realized to be the ghost fishing phenomena especially on the abandon drifting payao. 10-20% of drifting payao had lost in the fishing ground every year.

The objectives of the report are; 1) To determine and record the data of species composition, length, weight and number of accidental catch by Drifting Fish Aggregating Devices (DFADs) in the Eastern Indian Ocean. 2) To determine the relative between the accidental catch and the target catch by Drifting Fish Aggregating Devices (DFADs) in the Eastern Indian Ocean.

2) Materials and Methods

The 28 SEAFDEC drifting payaos were drifted during October and December 2002. M.V. SEAFDEC could retrieve 24 drifting payaos back and lost 4 payaos, during 7-27 January 2003. 17 SEAFDEC drifting payaos and 3 abandon European payaos were checked and recorded the accidental catches. Figure 1 shows area of M.V SEAFDEC operation in the Eastern Indian Ocean. Figure 3 shows the SEAFDEC payaos setting and retrieve position, the drifting direction of each payao and the positions of 3 abandon European payaos are included.

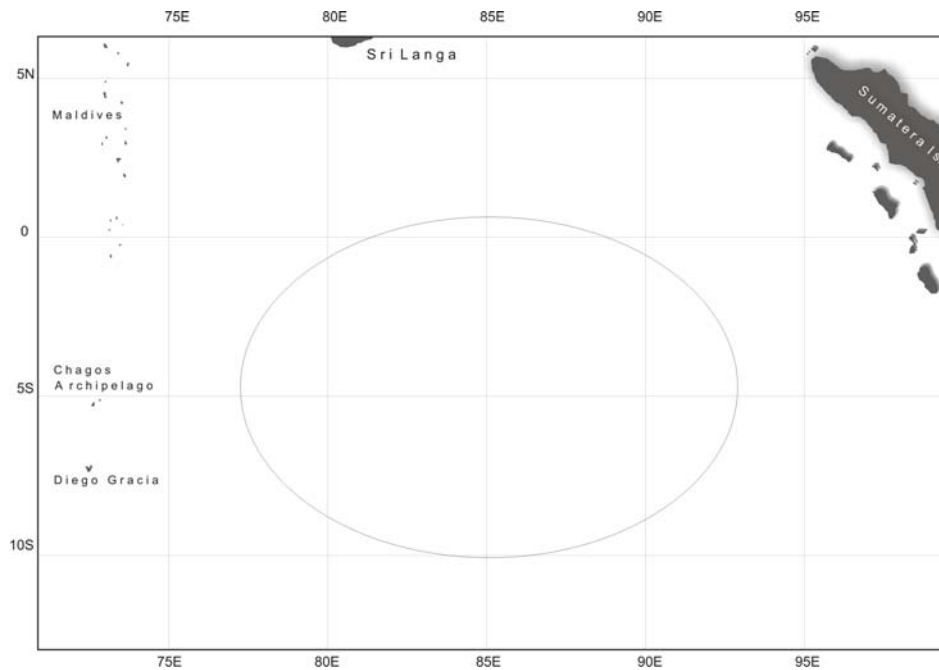


Figure 1. Tuna purse seine fishing ground in Eastern Indian Ocean of M/V SEAFDEC during December 2002 to January 2003



Figure 2. M/V SEAFDEC Tuna purse seine training/research vessel

2.1 Drifting fish aggregating device (DFADs)

Drifting payao is a type of Drifting Fish Aggregating Device (DFADs). It is set for gathering tuna and skipjack school in the vast oceanic fishing ground. SEAFDEC drifting payao has 2 designs.

1) *Raft type* The raft is 2.4×2.7 meters, square shape. The square frames of Payao are made from iron pipe, diameter 2 inches. The supporting bar of frame is made from iron pipe, diameter 1.5 inch. There are 20 - 25 bamboo poles, 3 meter length and 10-12 cm diameter, tight together with the frame of payao. There are 8 purse seine floats fixed at the corner the payao. They used for support the buoyancy of payao. The payao is covered by sheet of nylon net; mesh size 25 mm. Figure 3 shows the construction plan of raft payao.

2) *Curtain type* The raft is 5-6 bamboo poles, tight together. Bamboo pole length is 5-6 m. length and diameter about 10-12 cm. The raft may be buoyancy supported by 10-15 purse seine floats. The payao is covered by sheet of nylon net; mesh size 25 mm. Figure 4 shows the construction plan of raft payao.

Both types of designs are fixed with old purse seine net sheets. These old net sheets are always called “skirt” and tight at below part of drifting payao. The skirt has 10 m length, is made from the old purse seine net sheets, (black nylon net 210d/40) mesh size 105 mm and Spanish mackerel gillnet (green nylon net 210d/18), mesh size 100 mm (See figure 3 and 4)

Each payao is attached with a radio beacon buoy. The radio buoy transmits the radio signal, which can be received by the radio direction finder. The radio direction finder shows the direction from the ship to the radio buoy.

From the observation, European drifting payao was copied from the Japanese model but weaker. The raft is about 2×2 meters, square shape. The square frame of payao was made from bamboo. It was easy to broken, submersed and became abandon payao. Skirt of payao has about 10 m length, made from old knotted purse seine net (nylon 210d /180) mesh size 100 mm.

2.2 Payaos setting and Data collection

Setting position and restore position were recorded and presented by the figure 1 and 2. The accidental catches were classified by species and showed by the number of catches composition. Size, weight and the relationship of each species were recorded and shown by graph.



Technical drawing of a fish trap and its components. The main diagram shows a rectangular trap with dimensions 2.70 m width and 2.40 m height. It is divided into sections with a width of 0.90 m and a height of 0.80 m. A note indicates a 'Frazz.c. per il c.a. 1.5°' (Frazz.c. per il c.a. 1.5°) with an arrow pointing to a specific section. Below the main diagram, the width is further divided into 0.10 m, 0.90 m, 0.90 m, 0.90 m, and 0.10 m. To the right, a 3D perspective view shows the trap's construction with a wooden frame and a mesh net. The net is labeled 'PA 210/18 (Green) Mesh size 10 cm.' Below the main diagram, the components are listed: 'Bamboo dia 10-12 cm Lenght 300cm', 'Float' (three dark, rounded objects), 'Sinker 4.5-5.0 Kg' (a cylindrical weight), and 'Net' (a long, dark, textured strip) with 'Net size 11-20 m length'.

A 3D perspective diagram of the experimental setup. It shows a rectangular mesh structure with a rope attached to the top center. A vertical dimension line on the left indicates a height of approximately 10 m. A vertical dimension line on the right indicates the mesh is composed of 4 rows. The rope at the top is labeled 'Rope dia 16 mm'. The mesh material is labeled 'PA 210/42,60 (Black) Mesh size 10 cm'. The base of the structure is supported by several vertical rods with weights.

Diagram illustrating the components and assembly of a fish trap:

- Float** (X 15 P'cs)
- Bamboo** (Ø10-12 cm 6.00 m) (X 5)
- Net** (Mesh size 11 cm ~20 m length)
- Sinker** (Cement 4.5-5.0 Kg)

The assembly shows the net being hung from the bamboo poles, secured with floats at the top and sinkers at the bottom, and the net being baited with fish.

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Figure 4. Constructions of SEAFDEC drifting payao

3) The results and Discussion

3.1 Payaos drifting and the retrieving

The 28 SEAFDEC drifting payaos were set during fishing season 2002-2003. 4 drifting payaos, No.1, No.2, No.3, and No.4 were set by R/V NIPPONMARU on 25 October 2002. The setting area was from Latitude 04°30'S and Longitude 082°32'E to Latitude 04°50'S Longitude 083°05'E. Two of them, No.1 and No.4 were lost in the Indian Ocean. The others, No.2 and No.3 were done fishing operation and picked up for the resetting. So that SEAFDEC payaos No. 2 and 3 could not be recorded the incidental catch information of their operations. The second setting of SEAFDEC payao, No. 2 and 3 were done in 13/12/2002 on the area of Latitude 05°31'S Longitude 89°31'E by R/V NIPPONMARU. Drifting payao No.2 was found with some abandon European payao in the garbage area. There were a lot of marine turtle entangling with these payao. SEAFDEC payaos No.3 separated drifting to southwestward then fished and picked up by M/V SEAFDEC. The incident catches of this group has shown in table 2.

The 24 pieces of SEAFDEC drifting payaos were set during 4-6 December 2002 by M.V.SEADEC. The setting area were the Latitude 03°00'S Longitude 085°00'E to latitude 05°20'S longitude 087°30'E. Six of them, No.16, No.19, No.20, No.21, No.22, No.26 were picked up after drifted for 10 days so that the incidental catches record was not mention on these SEAFDEC drifting payaos.

After drifted for one month, 2 of SEAFDEC drifting payao were lost in the ocean. The 22 SEAFDEC drifting payaos were retrieved in the vast area. The details of setting and retrieving positions are shown in the table 1 and figure 2.

Three abandon European Payaos were found and recorded in the garbage area, position Latitude 02°27'N and Longitude 087°16'E. These payaos had some radio beacon buoys with the label, *TXORI URDEN*, *IZARO*, *AVEL VAD*, *ALAI*, *ELG*, *T. BURRI*. This area has a lot of fertilizer plastic bags, garbage which found entangle to some marine turtles. The positions can be read in the table 1.

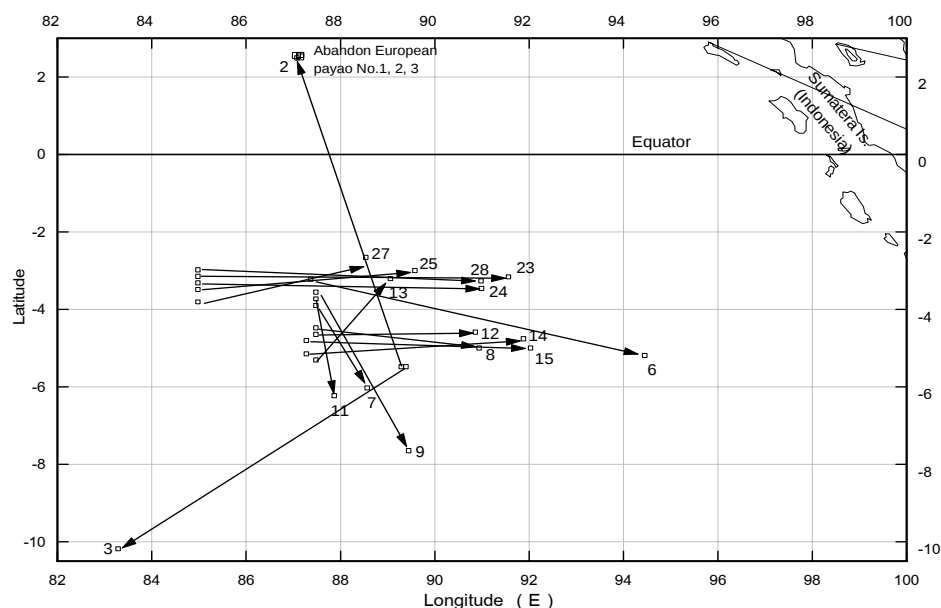


Figure 5. Setting and retrieving position of SEAFDEC Drifting payao during December 2002-

January 2003

Table 1. SEAFDEC drifting payao setting and retrieving position

Payao No.	Setting		Heave up		Target Catches
	Date	Position	Date	Position	
SEAFDEC 2	13-12-2002	Lat. 05°30′.5 S	15-01-2003	Lat. 02°28′.2N	0 ton
		Long. 089°31′.5 E		Long. 087°06′.1E	
SEAFDEC 3	13-12-2002	Lat. 05°31′.5 S	25-01-2003	Lat. 010°12′.8S	19 ton
		Long. 089°40′.9 E		Long. 083°18′.6E	
SEAFDEC 06	04-12-2002	Lat. 03°14′.6 S	20-01-2003	Lat. 05°12′.8S	6 ton
		Long. 087°23′.6 E		Long. 094°28′.4E	
SEAFDEC 07 (Curtain type)	04-12-2002	Lat. 03°54′.9 S	22-01-2003	Lat. 05°02′.9S	No fishing
		Long. 087°29′.8 E		Long. 088°32′.6E	
SEAFDEC 08	05-12-2002	Lat. 04°29′.9 S	18-01-2003	Lat. 05°00′.9S	9 ton
		Long. 087°30′.0 E		Long. 090°57′.6E	
SEAFDEC 09 (Curtain type)	04-12-2002	Lat. 03°34′.9 S	22-01-2003	Lat. 07°39′.7S	No fishing
		Long. 087°30′.2 E		Long. 089°46′.7E	
SEAFDEC 11	04-12-2002	Lat. 03°45′.0 S	23-01-2003	Lat. 06°15′.5S	10 ton
		Long. 087°30′.2 E		Long. 087°53′.1E	
SEAFDEC 12	05-12-2003	Lat. 04°40′.2 S	10-01-2003	Lat. 04°36′.5S	No fishing
		Long. 087°30′.3 E		Long. 090°53′.0E	
SEAFDEC 13	05-12-2002	Lat. 05°19′.9 S	16-01-2003	Lat. 03°13′.8S	No fishing
		Long. 087°30′.2 E		Long. 089°04′.8E	
SEAFDEC 14	05-12-2002	Lat. 05°10′.1 S	19-01-2003	Lat. 04°47′.2S	0.9 ton
		Long. 087°29′.9 E		Long. 091°53′.6E	
SEAFDEC 15	05-12-2002	Lat. 04°49′.8 S	19-01-2003	Lat. 05°01′.1S	No fishing
		Long. 087°30′.1 E		Long. 092°39′.0E	
SEAFDEC 17	05-12-2002	Lat. 05°00′.0 S	21-01-2003	Lat. 05°13′.5S	4 ton
		Long. 087°29′.0 E		Long. 092°03′.5E	
SEAFDEC 23	06-12-2002	Lat. 03°10′.1 S	29-01-2003	Lat. 010°12′.8S	11 ton
		Long. 085°00′.0 E		Long. 083°18′.6E	
SEAFDEC 24	06-12-2003	Lat. 03°20′.2 S	10-01-2003	Lat. 03°28′.8S	1 ton
		Long. 084°59′.9 E		Long. 091°00′.5E	
SEAFDEC 25	06-12-2002	Lat. 03°30′.3 S	17-01-2003	Lat. 03°01′.1S	0.5 ton
		Long. 085°00′.0 E		Long. 089°36′.1E	
SEAFDEC 27	06-12-2002	Lat. 03°20′.2 S	12-01-2003	Lat. 02°41′.9S	3 ton
		Long. 085°00′.0 E		Long. 088°34′.9E	
SEAFDEC 28 (Curtain type)	06-12-2002	Lat. 03°00′.1 S	09-01-2003	Lat. 03°17′.1 S	No fishing
		Long. 085°00′.0 E		Long. 091°00′.1 E	
European 1			14-01-2003	Lat. 02°27′.4N Long. 087°16′.6E	No fishing
European 2			14-01-2003	Lat. 02°29′.2N Long. 087°17′.8E	No fishing
European 3			14-01-2003	Lat. 02°29′.2N Long. 087°17′.8E	No fishing

Remark: SEAFDEC Payao No.7, 9, 28 were curtain type payao.

SEAFDEC Payao No.2, European payaos No.1, 2, 3 were found in the garbage area.

3.2 Incidental catch record

The Incidental catches were recorded from 17 SEAFDEC drifting payaos and 3 European abandon Payaos. There were, at least 13 species, 103 marine livings enmeshed with the skirt sheets of drifting payao.

Marine turtle was dominant marine living (29.1%) caught by SEAFDEC drifting payaos and European abandon payaos. There were 30 marine turtles, 2 main species caught, 16 Hawksbill turtle and 5 Ridley's turtles the other 9 marine turtles had not been identified. 2 Ridley's turtles were caught by SEAFDEC drifting payaos. One of them was died before the releasing.

SEAFDEC drifting payao No.2 which entangled with abandon European payao had caught 11 marine turtle (2 were Ridley's turtles and 9 Hawksbill turtles) in the garbage area. 5 marine turtles (1 Ridley's turtles and 4 Hawksbill turtles) were died before releasing.

The other 17 marine turtles were caught at the abandon European payao group, in the garbage area. 2 of them were Ridley's turtles, 16 were Hawksbill turtle and 9 turtles were not identified. 12 marine turtles were release by SEAFDEC crew. 9 marine turtles were died before releasing and 6 marine turtles had no chance to release because the abandon payao could not be heaved up onboard. Almost marine turtles were not measured because the dead turtle were not removed from the payao. The alive turtle seemed to be exhausted so that crew released them back immediately without any measurements.

Leather jacket fish was the second dominant of marine living. 28 Leather jacket (27.2%) caught at 11 SEAFDEC drifting payaos. 6 leather jackets were alive when crew removed them from skirt sheets of payao. It seemed that they were caught while a working boat was towing the target payao out from the circle of purse seine net. 12 leather jackets were died and 10 had been decomposed already. The length of leather jackets were varied from 19-43 cm with the average length 31.4 cm. Weight was varies from 0.3-1.4 kg with average weight is 0.67 kg. The biggest size was 43 cm with 1.4 kg.

13 Rainbow runners (12.6%) were caught by 9 SEAFDEC drifting payaos. Most of them died before removed and 5 rainbow runners had been already decomposed. The length of rainbow runners were varied from 39-65 cm with the average length 48.3 cm. Weight was varies from 0.6-1.5 kg with average weight is 1.01 kg. The biggest size was 65 cm with 1.5 kg.

10 Sharks (9.7%) were accidental caught by 9 SEAFDEC drifting payaos. Most of them were genus *Carcharhynus* and died before releasing from the skirt sheets of payaos. 2 sharks had already decomposed. The length of sharks varied from 59-78 cm with the average length 66.4 cm. Weight was varies from 1.8-4.4 kg with average weight is 2.8 kg. The biggest size was 78 cm with 4.4 kg.

The unexpected deaths of marine life were porpoises. 7 porpoises were died at 6 SEAFDEC drifting payaos. Most of them had been decomposed already. One of them had been decomposed and remained only vertebra. All porpoises were not measured because their flesh was too soft and heavy to pick up onboard. Remarkable that SEAFDEC drifting payaos No.14 caught 2 porpoises. Another drifting payaos caught only porpoise each.

7 tripletails (6.8%) were incidental caught by 7 SEAFDEC drifting payaos. Most of them died before removed from the skirt sheets of payaos. 3 tripletails had already been decomposed. The length of tripletails were varied from 29-65 cm with the average length was 40.2 cm. Weight of them were varies from 0.9-5.5 kg with average weight was 1.6 kg. The biggest size was 65 cm with 5.5 kg.

Other fishes were 2 Wahoo, Barracuda, Skipjack, Remora and few Seachub, caught by SEAFDEC drifting payaos. All of them were died before removed from the skirt sheets of payaos. Details can be read in table1.

Table 2. Incidental catch composition by SEAFDEC drifting payao in Eastern Indian Ocean

Marine catches (Scientific name)	Alive	Dead	Decomposed	total	%
Leather jacket <i>Cathidermis spp.</i>	6	12	10	28	27.18
Skipjack <i>Kutsuwonus pelamis</i>	0	1	0	1	0.97
Rainbow runner <i>Elagatis bipinulatus</i>	0	8	5	13	12.62
Wahoo <i>Acanthocybium solandri</i>	0	0	2	2	1.94
Baracuda <i>Sphyrena baracuda</i>	0	1	0	1	0.97
Tripletail <i>Lobotes surinumensis</i>	0	4	3	7	6.80
Seachub <i>Kyphosus bigibbus</i>	0	3	0	3	2.91
Remora <i>Unidentified</i>	0	1	0	1	0.97
Shark <i>Cacharinus spp.</i>	0	8	2	10	9.71
Ridley's turtle <i>Lepidochelys olivacea</i>	4	1	0	5	4.85
Hawksbill turtle <i>Eretmochelys imbricatus</i>	13	2	0	16	15.53
Unidentified turtle <i>Unidentified</i>	5	4	0	9	8.74
Porpoise <i>Unidentified</i>	0	0	7	7	6.80
Total	28	45	29	103	100.00

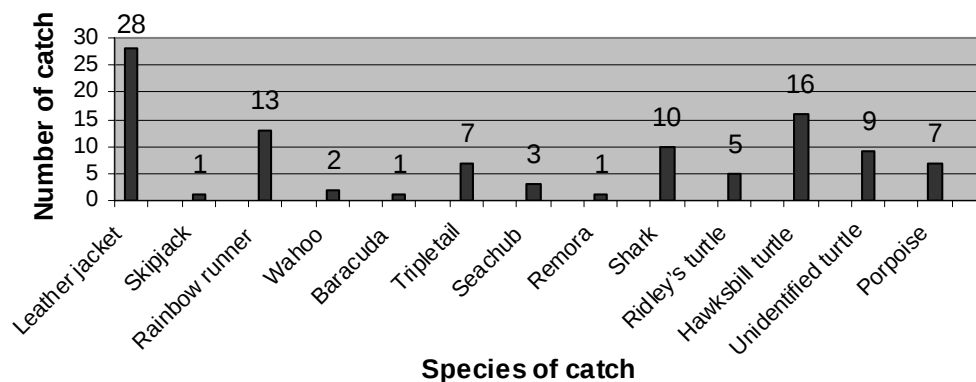


Figure 6. Graph of accident catch composition by SEAFDEC drifting payao

3.3 Target Catch quantity related with Payao

Record from the 17 SEAFDEC Payaos and 3 abandon European payaos, 9 fishing operations with 54.4 tons had been conducted with SEAFDEC drifting payaos. 5 operations had been conducted with the less catch, 0-1 ton, which total target catch was 2.4 tons. There were 59 marine livings had incidental caught by 5 payao-surrounding operations. These 59 marine livings are included 5 porpoises, 12 marine turtles, 2 sharks, etc. 25 accidental catches at SEAFDEC drifting payao No.2, is the highest number of the record but target catch at this drifting payao is 0 ton.

6 Payaos could not be conducted the fishing operation because too few fishes. There were 18 marine livings had incidental caught by these 9 payaos. The incidental catches were included a porpoise, 16 marine turtles and 7 sharks. Satisfactory catches with quantity of 3-19 tons were conducted from 11 payaos. The total target catch quantities by 11 fishing operations were 54.4 tons with 20 incidental catches. Tuna and skipjack 19 tons from SEAFDEC drifting payao No.3 is the highest catches but the incidental catch is only leather jacket.

3 abandon European payaos were not conducted fishing operation because too few tunas. There were 18 marine livings had incidental caught by these 3 payaos. 15 marine turtles, 2 tripletails and a shark were caught.

Table 3. Payao information and the incidental catch details

Payao No.	Target catch	Incidental catch	Length / Weight (cm / kg)	Catch condition	Remark
SEAFDEC No.2 with Garbage	0	Porpoise	No measurement	Decomposed	
		11 Marine turtle	No measurement	4 Dead, 7 Alive	
		Seachub	35/0.7	Dead	
		Seachub	39/0.9	Dead	
		Rainbow runner	55/1.3	Dead	
		Leather Jacket	43/1.4	Dead	
		Leather Jacket	41/1.3	Dead	
		Leather Jacket	33/0.6	Decomposed	
		Leather Jacket	30/0.5	Decomposed	
		Leather Jacket	35/0.8	Decomposed	
		Leather Jacket	32/0.8	Dead	
		Leather Jacket	32/0.7	Dead	
		Leather Jacket	32/0.6	Dead	
		Tripletail	29.5/0.6	Dead	
		Shark	71.0/3.4	Dead	
SEAFDEC No.3	19 ton	Leather Jacket	27.5/0.3	Decomposed	
SEAFDEC No.6	6 ton	Barracuda	82/8.0	Dead	
		Leather Jacket	31/0.5	Dead	
		Leather Jacket	24/0.6	Dead	
		Leather Jacket	30/0.6	Decomposed	
		Leather Jacket	28/0.5	Decomposed	
		Skipjack	66/7.0	Dead	
SEAFDEC No.7	No fishing	Rainbow runner	43/0.6	Dead	Curtain type payao
		Leather Jacket	27.5/0.3	Dead	
		Leather Jacket	27.0/0.3	Dead	
		Leather Jacket	30.0/0.5	Dead	
		Shark	65.5/2.7	Dead	
SEAFDEC No.8	9 tons	-	-	-	

Payao No.	Target catch	Incidental catch	Length / Weight (cm / kg)	Catch condition	Remark
SEAFDEC No.9 (Curtain type)	No fishing	Rainbow runner	51.5/0.8	Dead	
		Rainbow runner	52.0/1.0	Dead	
		Shark	65.5/1.9	Dead	
		Leather Jacket	30.0/0.5	Decomposed	
		Marine turtle	40.0/5.6	Decomposed	
SEAFDEC No.11	10 ton	Rainbow runner	48.0/0.7	Dead	
		Shark	60.5/2.1	Decomposed	
SEAFDEC No.12	No fishing	Shark	65.0/3.0	Dead	
		Leather jacket	19.0/0.4	Alive	
SEAFDEC No.13	No fishing	Rainbow runner	65.0/1.5	Decomposed	
		Remora	11.0/0.01	Dead	
SEAFDEC No.14	0.9 ton	Marine turtle	No measurement	Alive	
		2 Porpoises	No measurement	Decomposed	
		Shark	66.0/3.1	Decomposed	
		Wahoo	No measurement	Decomposed	
		Leather Jacket	34.0/0.7	Dead	
SEAFDEC No.15	No fishing	Rainbow runner	No measurement	Decomposed	Remained only head
		Tripletail	42/1.3	Dead	
SEAFDEC No.17	4 ton	Porpoise	No measurement	Decomposed	
		Rainbow runner	50/12	Decomposed	
		Rainbow runner	39/0.7	Dead	
		Wahoo	No measurement	Decomposed	
		Leather Jacket	32/0.9	Decomposed	
		Leather Jacket	33/0.8	Dead	
SEAFDEC No.23	11 ton	Seachub	16.0/0.1	Decomposed	
SEAFDEC No.24	1 ton	Porpoise	No measurement	Decomposed	
		Leather Jacket	33.0/0.8	Dead	
		Tripletail	31.0/0.7	Dead	
SEAFDEC No.25	0.5 ton	Rainbow runner	40/0.7	Decomposed	
		Rainbow runner	43/0.8	Decomposed	
		Porpoise	No measurement	Decomposed	
		Tripletail	29/0.5	Decomposed	
		Leather Jacket	30/0.6	Alive	
		Leather Jacket	33/0.7	Alive	
		Leather Jacket	35/0.8	Alive	
		Leather Jacket	28/0.4	Alive	
		Leather Jacket	29/0.5	Alive	
SEAFDEC No. 27	3 ton	Rainbow runner	49/1.5	Dead	
		Rainbow runner	45/1.3	Dead	
		Tripletail	65/5.5	Decomposed	
		Leather Jacket	40/1.3	Decomposed	
SEAFDEC No. 28	No fishing	Porpoise	No measurement	Decomposed	Curtain type payao
		Shark	70/3.1	Dead	
European 1	No fishing	Tripletail	No measurement	Dead	With some Garbage
		4 Marine turtles	No measurement	4 Alive	
European 2	No fishing	Shark	67/3.1	Dead	With some Garbage
		7 Marine turtles	No measurement	3 Dead, 4 Alive	
		Tripletail	40/1.0	Dead	With some Garbage
European 3	No fishing	6 Marine turtles	No measurement	6 Alive	Garbage

4) General remarks and Conclusion

According to the catches, the fishes were incidental caught by payao can be separated by 3 groups. The first group was the fishes, which stayed the closest around payao, i.e. Leather jacket, tripletail and rainbow runner. This group was the largest numbers of accidental catches.

The second group was the predator fishes, i.e. shark, wahoo, barracuda and skipjack. They were caught with the less numbers than the first group. This predator group stayed around payao in further distance and came close to payao for the feeding. Porpoises are also classified within this group. There were not any references for the porpoise to stay with the payao because they are well known as cross-oceanic swimmer. By the mortality of porpoise at the drifting payao, it was believed that they possible stopped to feed around the payao and were entangled with the net while hunting their prey.

The last group was the marine turtles. Almost of marine turtles had been incidental caught by payao and garbage in the garbage area. The garbage area was the area where plenty of drifting objects, drifting logs, abandon payaos and other garbage. It was the big habitat and there were a lot of juvenile fishes such as rainbow runner, indian mackerel that are porpoise and turtle's food. Many marine turtles were found and entangled at the garbage area and abandon European payaos.

The body shape of fishes has no significant relationship with the catching. Almost body type of fishes around the payao could be incidental caught by drifting payao. The fishes with oblong shape, i.e. leather jacket, seachub and tripletail were catch by entangling with nylon green net (210/18). The porpoises were incidental caught and deaths by green net same as the oblong shape fishes. Elongate shape fishes were caught by the enmeshed with black nylon net and also entangling with nylon green net. Most of marine turtle were caught by the entangling with nylon black nylon.

During this cruise, the satisfactory catches were fished from the drifting payaos with small numbers of incidental catch. In the opposite, the poor catches were found with the large numbers of incidental catch. By the observation, entangled porpoise at all drifting payaos could not produce the massive school of tuna and skipjack around the drifting payao. The highest quantity of target catch at the drifting payao with dead porpoise was 4 tons. The others were 0, 0.5, 0.9 and 1 ton. There are not significant relationships between the quantity of target catch and number of incidental catch at the drifting payao. The hypothesis for increasing performance of the drifting payao by the dead fishes is doubtful and remained needs more carefully investigation. The other hypothesis for increasing the number of target catch needs to consider as well.

Nevertheless, the other parameters such as, some decomposed fishes could be lost from drifting payao while the payao was towing from the net circle by working boat. That possible to make the determination data is inaccurate. Some decomposed fishes were possible lost from the payao during rough sea. By these reasons, the study of ghost fishing by drifting payao should be continued until these doubts will be clarified because the death of porpoises, marine turtles and sharks shall be heeded by the global conservative organizations in near future.

Figure 7. Accidental catches by SEAFDEC drifting payao



(Up: left and right) Porpoise was entangle and death at the Curtain type drifting payao



(Up) 2 Porpoises were entangle and dead at the Raft type drifting payao
(Down) Garbage and abandon European payao which caught a lot of marine turtle





(Up) SEAFDEC crew took a marine turtle from an abandon European payao with garbage
(Down) SEAFDEC crew released a marine turtle from an abandon European payao with garbage



(Up) Dead Ridley's turtle from an SEAFDEC drifting payao



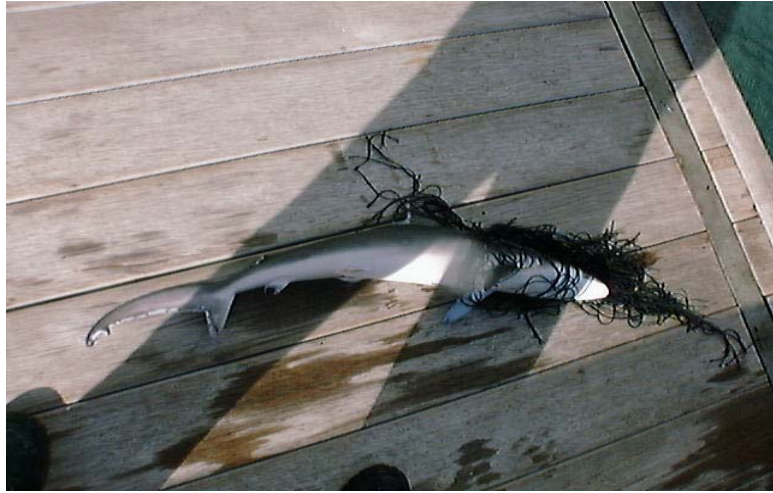
(Up) Decomposed hawksbill turtle from an Abandon European drifting payao



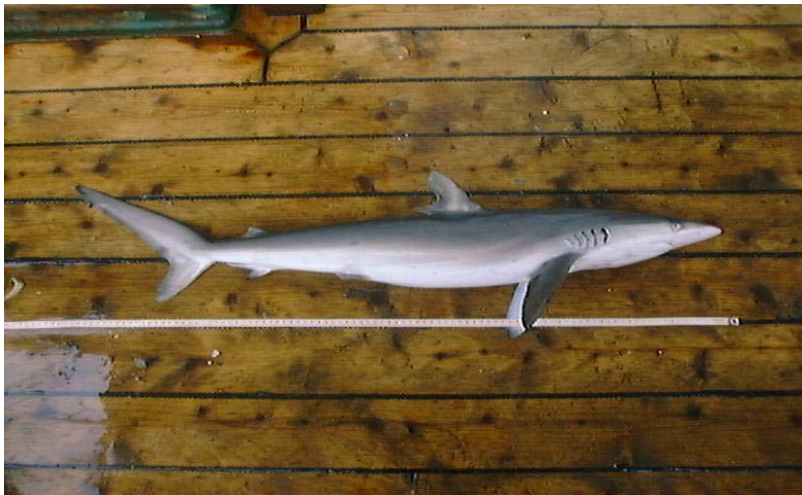
(Up) Dead hawksbill turtle and shark were dead at the curtain type drifting payao



(Up) A decomposed tripletail fish and 2 Rainbow runners



(Up, Down) A dead shark (*Carcharhynus* spp.) from the drifting payao



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