



International Journal of Fisheries and Aquatic Studies

E-ISSN: 2347-5129

P-ISSN: 2394-0506

(ICV-Poland) Impact Value: 5.62

(GIF) Impact Factor: 0.549

IJFAS 2019; 7(4): 321-326

© 2019 IJFAS

www.fisheriesjournal.com

Received: 06-05-2019

Accepted: 10-06-2019

Naing Win

Assistant Lecture, Department
of Zoology, Mawlamyine
University, Myanmar

Si Si Hla Bu

Rector, Dr, Patheingyi University,
Myanmar

Food and feeding aspect of Irrawaddy dolphin *Orcaella brevirostris* (Owen in gray, 1866) related to fish abundance

Naing Win and Si Si Hla Bu

Abstract

Food and feeding aspects of the Irrawaddy dolphin *Orcaella brevirostris* (Owen in Gray, 1866) was conducted from March 2009 till April 2010, along the Dolphin Protected Area (PA), a segment of Ayeyawady River, stretching from Mingun to Kyaukmyaung, approximately 74 km stretch of water way. Investigation of fish fauna to access the feeds and feeding behaviour of the dolphins revealed a total of 47 fish species confined to 7 orders, 18 families. Fishes of the order Siluriformes (787.22 kg), and Cypriniformes (700.12 kg) were the abundant relative to the whole catch. The lowest weight represented by Osteoglossiformes with 38.19 kg. The stomach contents of dolphins and incidents of the fish remains indicated that dolphins took the soft body parts of the larger species and discarding the harder head region. A total weight of fishes landed in eight villages recorded was highest, from Myayzun, followed by Sein Pan Gone and Hmaw Oo while Zee Gone and Ywa Thar village presented the lowest weight. On seasonal concern, the highest weight of landed fish was 1154.198 kg in March whereas the lowest in December in 2009 year. In 2010 year, the highest weight was recorded in November (3989.312 kg) whereas the lowest in April (198.37 kg).

Keywords: Irrawaddy dolphin, fish species, Ayeyawady river

1. Introduction

Most cetaceans in the wild are opportunistic feeders and consume a wide variety of fish, mollusks, and crustaceans [1]. The choice of cetaceans depends on their size, whether or not they have teeth, and various other factors. Most of the larger whales feed on huge shoals of fish or tiny shrimp like creatures, while dolphins and porpoises tend to catch individual fish or squid [1]. The Irrawaddy dolphin, *Orcaella brevirostris* feed on fishes, crustaceans, cephalopods, and fish eggs. Cyprinid fishes are thought to be important food source for Irrawaddy dolphin which is also found in northeastern Cambodia and Laos. In the Mekong River of Laos, the foods of Irrawaddy dolphins mainly consist of cyprinid fish and dolphins often eat the lower fleshy portions only of large fish, leaving the dorsal and pectoral spines behind [2]. With respect to the foraging of the Irrawaddy dolphin, it is disclosed that, most records of feeding are inferred from field observation or more commonly, from secondary report of such observations. Another incidence of freshly severed head of a cyprinid was retrieved from the midst of Irrawaddy dolphins [3]. It is noteworthy that, Irrawaddy dolphins are known to discard the head and upper bodies of at least some fish they prey upon. The upper remains of *Channa striata*, *Mystus nemurus* and *Arius* species have been recorded. Stomach contents of the dolphin examined include *Cirrhinus lobatus* and give some indication that the species is an important food fish for the dolphins and this species is considered to be a keystone fish species in the study area [1]. In Myanmar, fishermen reported that, catfish was the primary food of Irrawaddy dolphin [4]. Many species found in the stomachs of Irrawaddy dolphins, include various catfish and carp [1, 5]. Tint Tun [6] also supported the point that catfish and eel were preyed by Irrawaddy dolphins. There were evidences of eel with hind portion absent and catfish with missing caudal fin, preyed upon by dolphins. Irrawaddy dolphins avoid eating dorsal spines, but consumed only the fleshy portion behind the dorsal fin of a fish. Irrawaddy dolphins have a fishing activities with local fishers by traditional fishing in daily livelihood in study areas. Fishermen in India recall when they would call out to the dolphins, to drive fish into their nets. In Myanmar, Irrawaddy dolphins drive fish towards fisherman

Correspondence

Naing Win

Assistant Lecture, Department
of Zoology, Mawlamyine
University, Myanmar

using cast nets in response to acoustic signals from them practiced in the upper reaches of the Ayeyawady River. The dolphins chase fish into net, and help the fishers. In return, the dolphins are rewarded with some of the fishermen's by catch indicating the dolphins engage in co-operative fishing with cast-net fishermen. Irrawaddy dolphins increase the amount of fish to the fishermen catch [7-8]. Along the Ayeyawady River within the PA, a several places were used as landing sites for fish catch. As the fish are the main food of dolphins, it needs to study the relation of the amount and types of fish catch to the dolphin sighting in the study area.

The objectives of the study are thus as follows;

- To record the species composition of fish caught by fishermen in the vicinity of dolphin habitats
- To relate the dolphin sighting to the quantitative landed fish species in the respective landing sites.

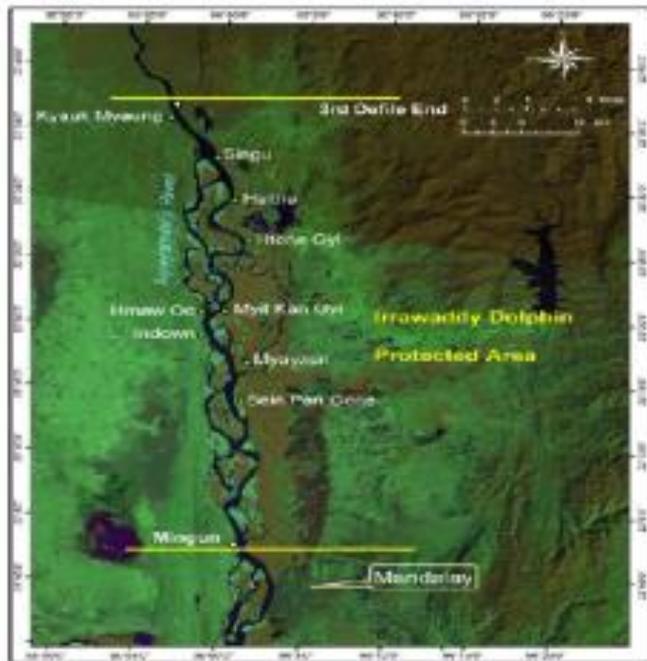
2. Materials and Methods

2.1 Study area

The Ayeyawady River is about 2170 km long and has a total drainage of about 411,000 km², its forests floodplains and form the cultural and economic heartland of Myanmar. The upper reaches of the Ayeyawady between Mingun and Kyaukmyaung (74km) is the study area, which is also the area where the dolphins are protected (Fig.2.1).

2.2 Study periods

The data required were collected from March 2009 to April 2010.



Source: WCA

Fig 2.1: A map of study area between Mingun and Kyaukmyaung (Protected area)

2.3 Materials used

The materials used during the study are a pair of 7x50 binoculars, global positioning system (GPS 72) and Cannon Eos 40D camera with 400 mm zoom lens, graduated ruler, digital balance, data form and 5 % formalin.

2.4 Detection of the residue fish fed by dolphin

The residues of fish fed by dolphins were detected by

interviewing with fishermen at the field sites. Questionnaires survey was also made in fishing community to assess the fish consumed by the dolphins. The stomach contents of the specimens which accidentally died were examined to trace the food remains.

2.5 Recording of fish species and fishing gear at landing sites

The monthly total catch of fish were recorded at eight landing sites (villages); Myayzun, Sein Pan Gone, Hmaw Oo, Myit Kan Gyi, Indown, U Dein, Zee Gone, and Ywa Thar. For ten months of each study year except for January and February, the landed fishes were recorded and weighted. The total catch of each landing sites was related to the dolphin sighting. The fishing gear operated in the vicinity of the landing sites was recorded twice a month and taken as pool data. The number of fishing gear was allied with the total fish caught (weight) at each landing sites.

2.6 Identification and preservation of fish

Identification of recorded fish species was carried out according to Talwar and Jiggrin [9], Rainboth [10] and Ferraris [11]. Photographic record was made for each collected species for assisting the identification. Some voucher specimens and the remains of the fish retrieved were preserved in 5% formaldehyde for further confirmation and reference.

2.7 Recording of dolphin sighting

Search effort was carried out by three observers taking position at the bow of the vessel; one taking position at the port (left), one at starboard (right) and one in the center. Duration of 30 minutes was allotted to each person for recording the sightings, after which the position of each person was changed until each person has logged 1 hour 30 minutes each. This was followed by two hours break to reduce fatigue; however care was taken to ensure that dolphins are not missed during rotations. The center person or another person was assigned to record the sighting data.

3. Results

3.1 Recorded fish species at landing sites

Altogether, 47 fish species confined to seven orders, 18 families along with 33 genera and some freshwater prawns were recorded during the study which commenced from March 2009 till December 2010 (Table 1). Fishes of the order Cypriniformes and Siluriformes were the abundant by the occurrence of the whole catch. It was also found that Cyprinidae and Bagridae were abundant families in both weight composition and occurrence among the catch. These two families; Cyprinidae and Bagridae were also the most abundant in species as they had 15 and 8 species respectively (Table 2). Based on the interviewing with fishermen, nine fish species were recorded in the study area (Table 3). Among them, four species (*Labeo boga*, *Osterobrama belangeri*, *Cabdio morar* and *Cirrhinus mrigala*) were represented from Cyprinidae, two species (*Mystus menoda* and *Aorichthys aor*) from Bagridae, one species (*Wallago attu*, *Rhinomugil corsula* and *Silonia silondia*) from Siluridae, Mugilidae and Schilbidae.

3.2 Feeding and foraging

During the study period, Irrawaddy dolphin sightings were most common in the morning and decreased throughout the day. Many species found in the stomachs of Irrawaddy

dolphin, which include various catfish and carp. Irrawaddy dolphin, feed on the hind part of freshwater catfishes. Although it is difficult to determine all the species of fish that the dolphins feed on, it is noteworthy that large numbers of small cyprinids, including *Cirrhinus mrigala*, *Cabdio morar*, *Osteobrama belangeri*, *Labeo boga*, silurids, *Mystus menoda*, *Aorichthys aor*, *Wallago attu*, *Rhinomugil corsula*, *Silonia silondia* are very abundant in and around the study areas. Fishermen also caught *Cirrhinus* sp., *Cirrhinus mrigala*, *Cabdio morar*, *Osteobrama belangeri*, *Labeo boga* and other small species were noted in large quantities mainly using gillnets with the mesh size of 1.5 cm. There is significant evidence, based on fish catch monitoring and fishermen interviews survey. After water level rises in July, these species of fish especially small ones cannot be found in the study area. According to fishermen, they believe that small fish make up an important part of the dolphins' diet and dolphins feed on most other species of scaled and non-scaled fish as well. Small cyprinids are eaten whole. They also reported that only the lower halves of many larger species of fish, some reaching over a meter long, are preyed upon by the dolphins. Fishermen retrieve and consume these upper halves of fishes, if they are still fresh. They predicted or personally retrieved as "dolphin prey leftovers" in the past.

During the study, it was observed the head of *Mystus cavasius* and *M. mendoa*, which were retrieved (Plate 3.1). The head and upper body of fish, from pectoral spine up were only recorded. In all cases, the lower body, right up to the spines, was totally consumed. The heads were totally intact, and there were no bite marks on the fish above the pectoral fins. In the examination of stomach contents of two dolphins found dead at Hsith village and Nge Ye village, remains of one *Labeo boga* (Nga-lu) (Plate 3.2) and 26 *Xenentodon cancila* (Nga-hpaung-yo) (Plate 3.3A) were observed in the stomach of one dolphin. The other included 6 of *Hemipimelodus jatius* (Nga-young) (Plate 3.3B) and one *Mystus mendoa* (Nga-ike) (Table 4). During the study period, dolphin feeding was recorded at the study area where water spitting with fish often seen jumping.

3.3 Monthly record of landed fishes

During two-year study from 2009 to 2010, a total weight of 15166.526 kg of fishes in eight landing sites in the protected area was recorded. In 2009, March was the landed fishes of the highest weight (1154.20 kg) whereas the lowest weight in December (100.94 kg) recorded in the study area (Fig. 3.1). In 2010, the landed fishes of weight differed from those resulted in year 2009. The highest weight was recorded in November (3989.31 kg) whereas April (198.37 kg), June (305.44 kg) and July (269.75 kg) were the lowest weight recorded (Fig. 3.1). The catch weight of fish in terms of order in each landing site was given in Table 5.

3.4 Dolphin sighting related to occurrence of landed fishes

During 2009 to 2010, a total of 55 dolphin sighting were recorded in the protected area. A total weight of landed fishes in eight villages was recorded. The highest weight was resulted in Myayzun, Sein Pan Gone and Hmaw Oo with 3791.63 kg, 3159.69 kg, and 2527.76 kg respectively. On the other hand, Zee Gone and Ywa Thar villages presented the lowest weight recorded (758.33 kg, 505.55 kg). Among the five orders of landed fishes recorded, Siluriformes was found to be the mean highest weight (787.22 kg), followed by Cypriniformes (700.12 kg). The lowest weight represented by Osteoglossiformes with 38.19 kg (Table. 6).

3.5 Relation of monthly landed fish by weight and fishing gears utilized

Out of 15166.53 kg of landed fishes recorded during two years in PA, 3817.25 kg was landed in the first study year while 11349.28 kg in the second year. (Fig. 3.2) illustrated that during March 2009 to December 2009, the highest weight of landed fish to be 1154.198 kg in March whereas the lowest weight in December. In the second year, March 2010 to December 2010, the highest landed fish weight was recorded in November (3989.312 kg) whereas the lowest weight was in April (198.37 kg).

Table 1: List of fishes landed in the study area

Order	Family	Species	Common Name	Local Name
Osteoglossiformes	Notopteridae	<i>Notopterus notoptreus</i>	Grey feather back	Nga-phe
Clupeiformes	Clupeidae	<i>Gudusia variegata</i>	Burma river shad	Nga-la-bi
Cypriniformes	Cyprinidae	<i>Cirrhinus mrigala</i>	Mrigal	Nga-gyin-phyu
		<i>Labeo boga</i>	Boga-labeo	Nga-lu
		<i>Labeo calbasu</i>	Black-rohu	Nga-net-pyar
		<i>Labeo rohito</i>	Rohu	Nga-myint-chin
		<i>Labeo angra</i>	Angra-labeo	Nga-lu-me-net
		<i>Labeo nandina</i>	Nandina	Nga-ohn-don
		<i>Osteobrama belangeri</i>	Manipur osteobrama	Nga-hpeh-oung
		<i>Osteobrama cunma</i>	Cunma osteobrama	Nga-lay-dount
		<i>Osteobrama feae vinciguerra</i>	Rohtee feae	Nga-phant
		<i>Puntius sophare</i>	Spotfin swamp barb	Nga-khone-ma-mi-kute
		<i>Salmostoma sardinella</i>	Sardinella razorbelly minnow	Nga-yin-baung-zar
		<i>Salmostoma saladoni</i>	Burmese razorbelly mainnow	Nga-yin-baung-zar
		<i>Cabdio morar</i>	Aspidoparia morar	Nga-phunt
		<i>Raiamas guttatus</i>	Barilius guttatus	Nga-la-war
		<i>Hpyothalmichthys molltrix</i>	Silver carp	Ngwe-yaung-nga-gin
	Cobitidae	<i>Botia histrionica</i>	Burmese loach	Nga-saut-kyar
		<i>Botia berdmorei</i>	Botia hymenophysa	Nga-tha-le'-doh

Table 2: Continued

Order	Family	Species	Common Name	Local Name
Siluriformes	Bagridae	<i>Aorichthys aor</i>	Long whiskered catfish	Nga-gyaung
		<i>Mystus cavasius</i>	Gangetic mystus	Nga-zin-yaing
		<i>Mystus leucophasis</i>	Sittaung mystus	Nga-nauk-thwar
		<i>Mystus mendoa</i>	Menoda catfish	Nga-ike
		<i>Mystus microphthalmus</i>	Dwarf catfish	Nga-ike
		<i>Mystus Pulcher</i>	Pulcher mystus	Nga-zin-yaing-kyet-chee
		<i>Mystus gulio</i>	Long whiskered catfish	Nga-yway
		<i>Rita sacerdotum</i>	Rita	Nga-htway
	Siluridae	<i>Ompok bimaculatus</i>	Indian butter catfish	Nga-nu-than
		<i>Ompok pabo</i>	Pabo catfish	Nga-nu-than
		<i>Wallago attu</i>	Boal	Nga-but
	Schilbeidae	<i>Eutropiichthys vacha</i>	Batchwa vacha	Nga-myin-kun-mar
		<i>Proeutroplichthys burmanicus</i>	Butter catfish	Nga-myin-ok-pha
		<i>Silonia silondia</i>	Butter catfish	Nga-myin-yinn
	Sisoridae	<i>Bagarius yarrelli</i>	Goonch	Nga-maung-ma
		<i>Gagata cenia</i>	Indian gagata	Nga-nan-kyuang
	Pangasiidae	<i>Pangasius</i>	Butter catfish	Nga-dan
	Ariidae	<i>Hemipimelodus jatius</i>	River catfish	Nga-young
		<i>Arius</i>	River catfish	Nga-young

Table 3: Continued

Order	Family	Species	Common Name	Local Name
Perciformes	Ambassidae	<i>Parambassis ranga</i>	Indian glassy fish	Nga-zin-zat
	Cichlidae	<i>Oreochromis mossambica</i>	Mozambique cichlid	Tilapia
	Mugilidae	<i>Rhinomugil corsula</i>	Corsula mullet	Nga-zin-lone
	Gobiidae	<i>Glossogobius giuris</i>	Tank goby	Naing-lwin-nga
	Channidae	<i>Channa marulia</i>	Gaint snake head	Nga-yant-dyne
	Mastacembelidae	<i>Macragnathus aral</i>	Spiny eel	Nga-mway-ni-pyounge
		<i>Mastacembelus armatus</i>	Spiny eel	Nga-mway-na-gar
Beloniformes	Belonidae	<i>Xenentodon cancila</i>	Fresh water garfish	Nga-hpaung-yo
Tetraodontiformes	Tetraodontidae	<i>Tetraodon cutcutia</i>	Giobe fish	Nga-pu-tin

Table 4: Fish species fed by Irrawaddy dolphin learnt from interview survey in protected area during March 2009 to December 2010

Family	Species	Common name
Cyprinidae	<i>Cabdio mora</i>	Nga-phunt
	<i>Cirrhinus mrigala</i>	Nga-gyin-phyu
	<i>Osterobrama belangeri</i>	Nga-hpeh-oung
	<i>Labeo boga</i>	Nga-lu
Bagridae	<i>Aorichthys aor</i>	Nga-gyaung
	<i>Mystus menoda</i>	Nga-ike
Mugilidae	<i>Rhinomugil corsula</i>	Nga-zin-lone
Schilbidae	<i>Silonia silondia</i>	Nga-myin-yinn
Siluridae	<i>Wallago attu</i>	Nga-but

Table 5: Prey species found in the stomachs of carcass Irrawaddy dolphin in protected area during March 2009 to December 2010

Family	Species	Common name	Number
Ariidae	<i>Hemipimelodus jatius</i>	Nga-young	6
Cyprinidae	<i>Labeo boga</i>	Nga-lu	1
Belonidae	<i>Xenentodon cancila</i>	Nga-hpaung-yo	26
Siluriformes	<i>Mystus cavasius</i>	Nga-zin-yaing	1
	<i>Mystus mendoa</i>	Nga-ike	1

Table 6: Total fish weight (in kg) by orders recorded at eight landing villages within PA during March 2009 to December 2010

Order	Myayzun	Sein Pan gone	Hmaw Oo	Myit Kan Gyi	Indown	U Dein	Zee Gone	Ywa Thar	Total Weight (kg)
Osteoglossiformes	61.1	53.47	49.65	45.83	38.19	22.91	19.1	15.28	305.53
Clupeiformes	100.77	88.18	81.88	75.58	62.98	37.79	31.49	25.19	503.86
Cypriniformes	1381.3	1208.64	1122.31	663.79	489.96	395.09	244.99	94.88	5600.96
Siluriformes	1756.78	1379.2	874.43	741.86	618.22	370.93	309.11	247.29	6297.82
Perciformes	491.67	430.21	399.48	368.75	307.3	184.38	153.65	122.92	2458.36
Total (kg)	3791.62	3159.7	2527.75	1895.81	1516.65	1011.1	758.34	505.56	15166.5

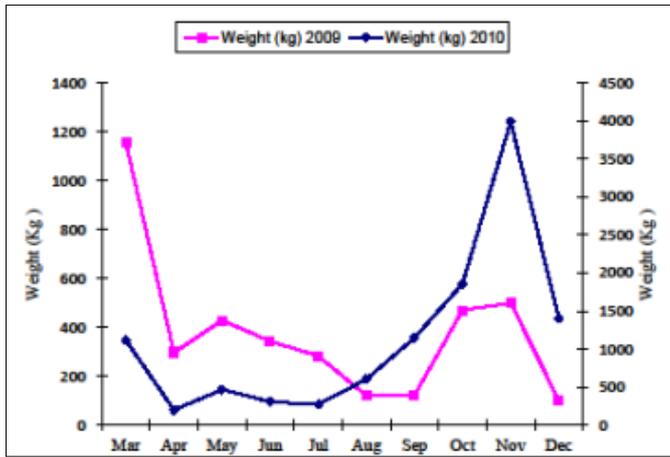


Fig 3.1: Monthly catches of landed fishes in kg during 2009-2010

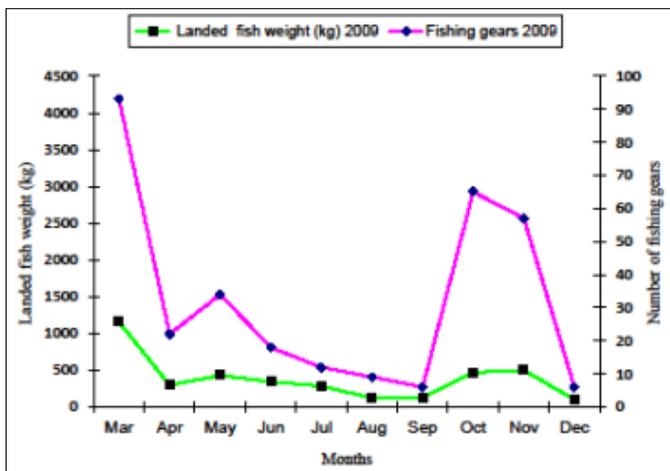


Fig 3.2: Monthly records of landed fish weight and fishing gears during March 2009 to December 2009

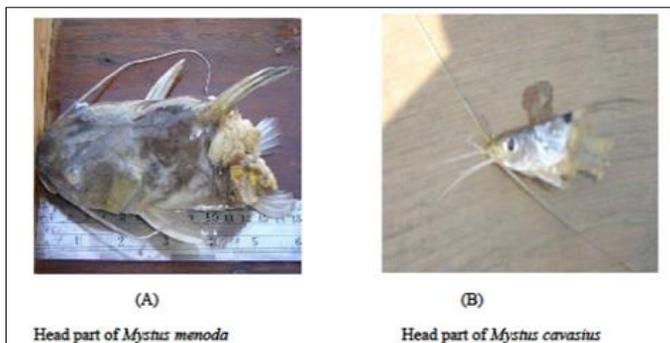


Plate 3.1: Monthly records of landed fish weight and fishing gears during March 2009 to December 2009



Plate 3.2: Stomach contents

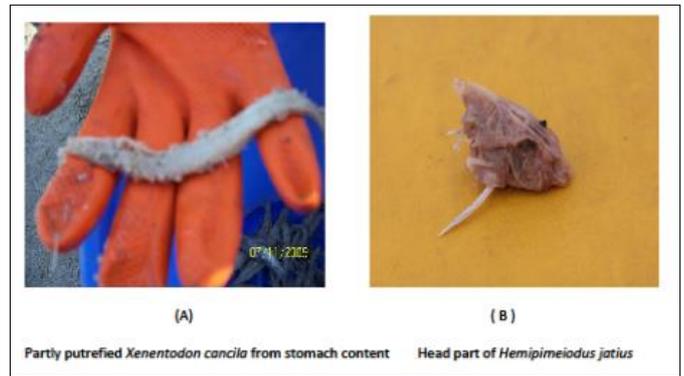


Plate 3.3: Retrieved fish

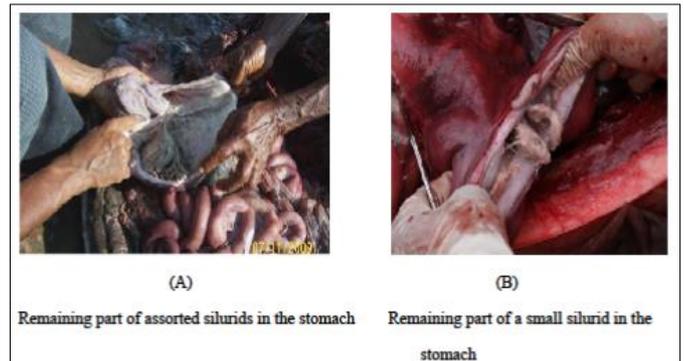


Plate 3.4: Entrails of dead Irrawaddy dolphin at Hsithe and NgaYe

4. Discussion

The study commenced from March 2009 to December 2010, and conducted between Mingun and Kyukmyaung segment of the Ayeyarwady River. Stacey [12] reported that in Lao PDR and Northeastern Cambodia at Boong Pa Gooang, the villagers believed that dolphin spend most of their time feeding. They determined that small cyprinid fishes especially *Cirrihinus siamensis* and *Paralaubuca typus* are abundant in Boong Pa Gooang in the dry season, but are absent during the rest of the year. Villagers also believed that these fish are an important part of the dolphins' diet.

Tint Tun [13] reported that castnet fisheries co-operated with dolphins at Hsithe showed that Cyprinidae was the most abundant family. In species, weight composition and occurrence *Labeo boga*, *Aspidoparia morar* and *Mystus cavasius* were predominant. During the present two years study, it was observed that the order Cypriniformes and Siluriformes were the most abundant in terms of weight in the study area during March and November. Baird and Mounsouphom [1] reported that the remains of the head and upper body part of a medium size specimen of the cyprinid fish was assumed to have been preyed upon by Irrawaddy dolphins. In the Mekong River in Lao and Mahakam River in Kalimantan, Indonesia, where they were also known to discard the heads and upper bodies of at least some of the fish that they prey on. They further stated that dolphins only eat the lower halves of larger fish and left the head part with the spines. The lower body right up to the dorsal and pectoral fin spines had been totally eaten by a predator, presumed to be a dolphin.

The same habit was observed in Irrawaddy dolphin in the Ayeyarwady River of Myanmar. Tint Tun [6] reported from his study in Hsithe and Chaung Wa villages along Ayeyarwady River that two fish, one eel and one cat fish were consumed by dolphin and that only the body part was eaten.

Under the study, the incidence at Hsithe indicated the feeding behaviour of the Irrawaddy dolphins. The incidence was recorded in March 2009 and April 2010 at Hsithe and Nge Ye villages. The stomach content was identified as remains of a head and upper body of fish species such as *Mystus cavasius*, *M. mendoa*, *Labeo boga*, *Xenentodon cancila* and *Hemipimelodus jatius*. In two years study, monthly catches of landed fishes were recorded. It was found that the landed fishes were of the highest weight in March and November while June and July presented the lowest weight recorded in the study area which might be an attributable concern on fish abundance and dolphin sightings.

During March 2009 to December 2010, a total weight of landed fishes was 15166.526 kg and a total of fishing gears used were 796 recorded in the study period. The finding of the present work is in agreeable with Smith^[14] who recorded a total of 5701 fishing gears in the main channel of the Ayeyarwady during the 2002 survey.

5. Conclusion

The study commenced from March 2009 to December 2010, and conducted between Mingun and Kyukmyaung segment of the Ayeyarwady River. During the present two years study, it was observed that the order Cypriniformes and Siluriformes were the most abundant in terms of weight in the study area during March and November.

6. Acknowledgement

I am greatly indebted to Dr. Mie Mie Sein, Professor and Head of the Department of Zoology, Mandalay University for accepting the research topic, providing facilities of the department and invaluable advice. My obligation goes to Professor Dr Naw Dolly Wilbur and Professor Dr Thant Zin, Department of Zoology, Mandalay University for their suggestion and advice. I am also obligated to Dr. Si Hla Bu, Rector, Myeik University for her close supervision and invaluable suggestions given throughout the course of study. Dr Brain D. Smith, Director, Asian Freshwater and Coastal Cetacean Programme, Wildlife Conservation Society and Asia Coordinator, IUCN SSC Cetacean Specialist Group is most appreciated for his excellent guideline given on the study. Sincere gratitude is owed to the members of Wildlife Conservation Society (WCS), in particular, U Than Myint, Country Co-ordinator, WCS (Myanmar Programme) for their funding contributions in conducting the research.

7. References

- Baird IG, Mounsouphom B. Distribution, mortality, diet and conservation of Irrawaddy dolphins (*Orcaella brevirostris*) in Lao PDR. *Asian Marine Biology*. 1997; 14:41-48.
- Baird IG, Mounsouphom B. Irrawaddy Dolphin *Orcaella brevirostris* in Southern Lao PDR and Northeastern Cambodia. *Rep. Int. Whal. Commn.* 1994; 42:159-175.
- Stacey PJ, Arnold PW. *Orcaella brevirostris*. *Mammalian Species*. 1999; 616:1-8.
- Leatherwood S, Peters CB, Santerre R, Santerre M, Clarke JT. Observations of cetaceans in the northern Indian Ocean sanctuary, November 1980-May 1983. *Reports of the International Whaling Commission*. 1984; 34:509-520.
- Marsh H, Lioze R, Heinsohn GE, Kasuya T. Irrawaddy dolphin *Orcaella brevirostris* (Gray, 1866). In: *Handbook of marine mammals*, Ridgway, S. H. and Harrison, S. R. (Eds). River dolphins and the larger toothed whales. Academic Press, London. 1989; 4:101-118.
- Tint Tun. Irrawaddy dolphins in Hsithe-Mandalay segment of the Ayeyawaddy River and cooperative fishing between Irrawaddy Dolphin, *Orcaella brevirostris*, and castnet fishermen in Myanmar. A report submitted to the WCS, 2004, 1-56.
- Smith BD, Phone Thant H, Lwin JM, Shaw CD. Preliminary investigation of cetaceans of the Ayeyarwady River and northern coastal waters of Myanmar. *Asian. Mar. biol.* 1997; 14:173-194.
- Pandawutiyanon Wiwat. Irrawaddy dolphin disappearing from the Mekong. *Mekong Currents*. IPS Asia-Pacific/Probe Media Foundation, 2005, 12-31.
- Talwar K, Jhingran AG. *Inland fishes of India and adjacent countries*. Oxford IBH publishing Co. Pvt. Ltd., New Delhi-Calcutta. 1991; 2:1027-1028.
- Rainboth WJ. *Fishes of the Cambodian Mekong*. FAO species identification field guide for fishery purposes. FAO, Rome, 1996, pp.265.
- Ferraris Jr. CJ. *Identification guide to the commercial Inland fishes of Myanmar*. FAO, 1997, pp.58.
- Stacey PJ, Hvenegaard GT. Habitat use and behavior of Irrawaddy Dolphins, *Orcaella brevirostris* in the Mekong River of Laos. *Aquatic Mammal*. 2002; 9:1-13.
- Tint Tun. Cast-net fisheries in cooperation with Irrawaddy dolphins at Hsithe, Myitkangyi and Myazan villages, Mandalay Division, in Myanmar. A report submitted to the Wildlife Conservation Society, 2005, pp. 44.
- Smith BD, Beasley IL, Krebs D. Marked declines in populations of Irrawaddy dolphins. *Oryx*. 2003; 37:401-406.