

## Habitat Adaptation Nature and Tolerance of Water Salinity of Some Fishes of Kispnadi River

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### Abstract

Tolerance of salinity is an index of distribution of fish species. Adaptability favors the distribution of fishes along the Kispnadi River. It is composed of different habitats. It originates from Tarover River, Chin mountain, at India-Myanmar border line. Kispnadi River flows near the first study site Pletwa, Chin State. It also passes through Kyauktaw township. It is still freshwater habitat. Then, the river flows through Ponnagyun township. Its salinity changes to 3.00 p.p.m. Finally, this river enters Bay of Bengal at Sittwe township. Salinity was 4.00 p.p.m to 4.5 p.p.m. Salinity of Sittway water fluctuates from 4.5 to zero. However, zero salinity was recorded during the rainy season. Brackish fish can withstand those conditions. The brackish fish species *Arius thalassinus*, *Glossogobius aureus*, *G.giruris* were recorded from freshwater habitat, Kyauk Taw township. 23 freshwater fish species and 47 brackish fish species were recorded. During the study period, knowledge on distribution type of fishes leads to catchment map for fish production.

**Keywords:** Tolerance, distribution, brackish, fluctuate, habitats.

### INTRODUCTION

Kispnadi River is famous in Rakhine state. It is joined by the two streams that originate from Chin State, namely Var-raw-ver stream near Reed Lake, and Boy-nu stream near Htan-Ta-Lan area. This river is 912 km long. Firstly, it flows backward and enters into India and it passes through Chin State again. Then it flows into Bay of Bengal at view point of Sittway township.

Therefore, Kispnadi river is of freshwater nature in upper 3 of 4 parts and the lower part is brackish in nature. Mouth of this river is adjacent to the Bay of Bengal at view point of Sittway township.

Different salinities were recorded along Kispnadi River. Due to this nature, freshwater, brackish and marine habitats are diverse along this river. Many available foods exist in mudflats and brackish water. The fishes or prawn, were sold in a landing style in this study area. However, commercial price (local or export) is also becoming higher and higher. Export sector is more and more important in Rakhine state recently. The capacity of catchment gradually decreased year by year.

From 1980 to recent years the Catch Per Unit Effort (CPUE) decreased from 200 kilograms per hour to approximately 75-80 kilograms per hour. 356 of Myanmar's known species are considered to be globally threatened with extinction. In Myanmar, the total of freshwater fishes and marine fishes are 775 species (2014, fifth National report to NASAP). According to the IUCN Red list (2013), 7 fish species are vulnerable. Therefore, occurrence of

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fish resources is critically needed to record (Fifth National Report to the United Nations convention on Biological Diversity, 2014).

We aimed to record the current status of fish fauna and tolerance of habitat that means the salinity variations along the Kispnadi River.

The objectives of this study were:

- To record the fish species occurrence of Kispnadi river
- To study the different salinity variations of each segment of the river

## MATERIALS AND METHODS

### Study site (Fig. 1)

Pletwa Township, Kyauk Taw, Ponnagyun and Sittway township were chosen as the study site.

Site I, Pletwa Township is located between the 20°45"-22°9" N and longitudes 92°30"-93°42" E and it is 172 feet above sea level.

Site II-Kyauk Taw Township is located between the 20°50"-37°4" N and longitude 92°28"-48°8" E. It is situated on the bank of Kispnadi River.

Site III, Ponnagyun Township is located at the latitudes 92°58"-48°8" E. It also lies on the bank of Kispnadi River.

Site IV, Sittway Township is located between 20°70" N and 92°56"-92°46" E. It is seven feet above sea level.

### Study period

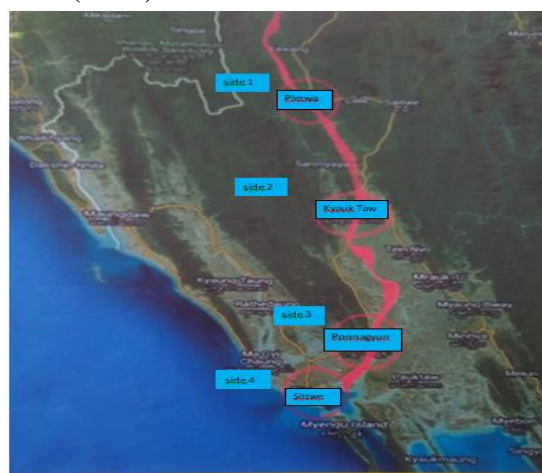
Study period was from July 2017 to December 2019.

### Collection

The specimens were collected from four study sites. Fresh specimens were recorded with scaled photographs. Fin formula, morphometric scales and colors were recorded as quickly as possible. Specimens were preserved in ten percent formalin. The collected specimens were brought into Zoology Department of Sittway University for further study.

### Species identification

The identification of fishes was followed after Day (1887), Tau (1982), Talwer and Jhingran (1991) and Rainboth (1996).



Source: Google earth  
Figure 1. Map of Kispnadi River

## RESULTS

A total of 60 fish species of 48 genera belonging to 34 families under 8 orders was found to be abundant along Kispandadi River. Among them, 25% were freshwater species (Fig. 2) (Table 1).

Study site I, Pletwa, is a hilly mountainous region, composed of many tributaries around the study area. Seven fish species were recorded from this study site. The species *Notopterus notopterus*, *Aillia coila*, *Ompok bimaculatus*, *Puntius chola*, *Strongylura leiura*, *Mastercembellus armatus* and *Channa striatus* were recorded.

Study site II, Kyauk Taw township, is a delta and low land. The river lies under the mountain. Twelve fish species were recorded from this study site. The species recorded were *Puntius chola*, *P brevis*, *P sophore*, *Channa striatus*, *C punctatus*, *Lates calcarifer*, *Arius thalasinus*, *Mystus wolffi*, *Pseudoapocryptes lanceolatus*, *Glossogobius giuris*, *G aureus* and *Johnieop coitor*.

The third study site, Ponnagyun township, is a brackish environ. This study site is not far from Sittway. Salinity was 3 p.p.m. 18 fish species were recorded from this study site. The recorded fish species were *Notopterus notopterus*, *Tenulosa ilisha*, *Arius thalassinus*, *Puntius chola*, *Ompok bimaculatus*, *Glossogobius giuris*, *Leptocephalichthys birmanicus*, *Johnieops coitor*, *Pseudoapocryptes lanceolatus*, *Taenioides gracilis*, *Lates calcarifer*, *Strongylura leiura*, *Platycephalus scabe*, *Rhinomugil corsula*, *Polynemus paradiseus*, *Channa striatus*, *Anabas testudineus* and *Plotosus canius*.

The fourth study site is Sittway township. This area is a river mouth. 47 fish species were recorded from this study site. The recorded species were *Dasyatis zygei*, *Muraenesox telabonoides*, *Trichurus lepturus*, *Dussumeria acuta*, *Tenuulosa ilisha*, *Mystus wolffi*, *M gulio*, *Arius thalassinus*, *Strongylura leiura*, *Plotosus canius*, *Hyporhamphus limbatus*, *Lates calcarifer*, *Psammoperca waigensis*, *Cephalopholis formosa*, *Epinephelus erythrurus*, *E macrospilos*, *Scomberomorus guttatus*, *Euthymus affinis*, *E cordyla*, *Serranus maculatus*, *Equala ruconius*, *Gerres filamentosus*, *G poeti*, *Parastromateus niger*, *Alectis indica*, *A ciliaris*, *Urapis carangoides*, *Alepes melanoptera*, *Acanthophagus berda*, *Polynemus paradiseus*, *Drepane punctatus*, *Scatophagus argus*, *Eppiphus orbis*, *Terapon jarbua*, *T theraps*, *Glossogobius aureus*, *G giruris*, *Boleophthalmus boddarti*, *Pseudoapocryptes lanceolatus*, *Taeniodes gracilisis*, *Lutjanus rivularis*, *L madras*, *L crythroteus*, *Johneops coitor*, *Rhinomugil corsula*, *Silaginopsis panijus* and *Rachycentrum canadum*. Identification of each fish species from Kispandadi River was shown in Table 1.



(A) *Dasyatis zygei*



(B) *Notopterus notopterus*



(C) *Muraenesox cinereus*



(D) *Trichurus lepturus*



(E) *Tenuulosa ilisha*



(F) *Dussumeria acuta*

Plate 1. Recorded fish species of Kispandadi River

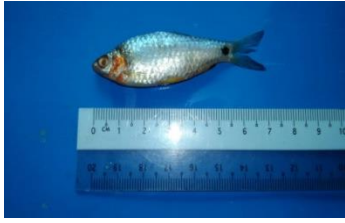
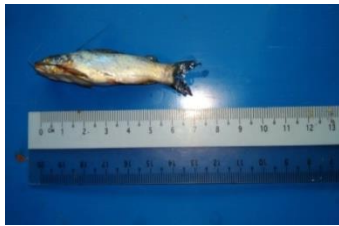
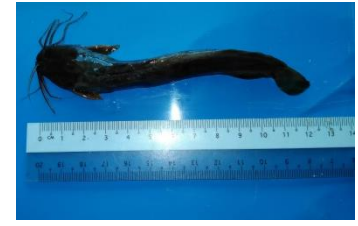
(G) *Puntius chola*(H) *Puntius brevis*(I) *Puntius sophore*(J) *Ailia coila*(K) *Lepidociphalichthys birmanicus*(L) *Ompok bimaculatus*(M) *Mystus wolffi*(N) *Mystus gulio*(O) *Clarias barachus*(P) *Arias thalassinus*(Q) *Platycephalus scabes*(R) *Strongylura leiura*(S) *Plotosus canius*(T) *Hyporhamphus limbatus*(U) *Maotercembellus armatus*(V) *Lates calcarifer*(W) *Psammoperca formosa*(X) *Cephalopholis formosa*

Plate 1. Continued





(Y) *Epinephelus erythrurus*



(Z) *Epinephelus macrspiros*



(AA) *Anabas testudineus*



(AB) *Channa striatus*



(AC) *Chana punctatus*



(AD) *Euthymus affinis*



(AE) *Euthmus cordyla*



(AF) *Scomberous guttatus*



(AG) *Serranus maculatus*



(AH) *Equala ruconius*



(AI) *Gerees filamentosus*



(AJ) *Gerees poeti*



(AK) *Parastromateus niger*



(AL) *Alepes melanoptera*



(AM) *Alectis indica*



(AN) *Alectis ciliaris*



(AO) *Urapis carancoides*



(AP) *Acanthophagus berda*



(AQ) *Polynemus paadiseus*



(AR) *Drepane puntatus*



(AS) *Scatophagus argus*



(AT) *Eppiphus orbis*



(AU) *Terapon jabua*



(AV) *Terapon theraps*



(AW) *Glossogobius giuris*



(AX) *Glossogobius aureus*



(AY) *Boleophthalmus boddarti*



(AZ) *Pseudoapocryptes lanceolatus*



(BA) *Taeniodes gracilis*



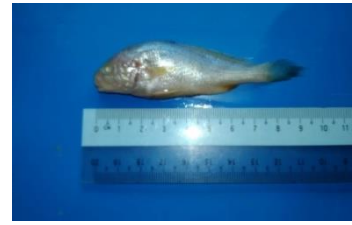
(BB) *Lutjanus rivularis*



(BC) *Lutjanus madras*



(BD) *Latjanus etythroteus*



(BE) *Johoieops coitor*



(BF) *Rhinomugil corsula*



(BG) *Sillaginopsis panijus*



(BH) *Rachycentrum canadum*

Plate 1. Continued

Table 1. Identification of recorded fish species of Kispnadi River

No.	Order	Family	Scientific Name	Salinity tolerance
1	Meliobatiformes	Dasyatidae	<i>Dasyatis zygei</i>	4.5
2	Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i>	zero
3	Anguilliformes	Muraenesoridae	<i>Muraenesox telabonoides</i>	4.5
		Trichiuridae	<i>Trichiururs lepturus</i>	4.5
4	Clupeiformes	Clupeidae	<i>Tenualosa ilisha</i>	4.5
			<i>Dussumeria acuta</i>	4.5
5	Cypriniformes	Cyprinidae	<i>Puntias chola</i>	0-3
			<i>Puntias brevis</i>	zero
			<i>Puntias sophore</i>	0-3
6	Silluriformes	Silluridae	<i>Aillia coila</i>	zero
			<i>Ompok bimaculatus</i>	zero
		Cobidae	<i>Lepidocephalichthys bimanicus</i>	zero
		Bagaridae	<i>Mystus wolffi</i>	0-3
			<i>Mystus gulio</i>	0-3
		Claridae	<i>Clarias batrachus</i>	0-3
		Aridae	<i>Arius thalassinus</i>	0-3
		Trichirurus	<i>Platycephalus scabe</i>	0-3
		Belonidae	<i>Strongylura leiura</i>	zero
		Plotosidae	<i>Plotosus canius</i>	4.5
		Hemiramphidae	<i>Hyporhamphus limbatus</i>	4
7	Synbranchiformes	Mastercembelidae	<i>Mastercembellus armatus</i>	zero
8	Perciformes	Centropomidae	<i>Lates calcarifer</i>	4.00
			<i>Psammoperca waigensis</i>	4.50
		Scomberidae	<i>Cephalopholis formosa</i>	4.50
			<i>Epinephelus erythrurus</i>	4.50
			<i>Epinephelus macrospilos</i>	4.50
			<i>Scomberomorus guttatus</i>	4.5
		Anabantidae	<i>Anabas testudineus</i>	zero
		Channidae	<i>Channa striatus</i>	0-3
			<i>Channa punctata</i>	zero
		Serranidae	<i>Euthymus affinis</i>	4
			<i>Euthymus cordyla</i>	4
			<i>Serranus maculatus</i>	4
		Leiognathidae	<i>Equala ruconous</i>	4
		Gerreidae	<i>Gerres filamentosus</i>	4.5
			<i>Parastromateus poeti</i>	4.5



Table 1. Continued

No.	Order	Family	Scientific Name	Salinity tolerance
		Carangidae	<i>Parastromateus niger</i>	4
			<i>Alectis indica</i>	4
			<i>Alectis ciliaris</i>	4
			<i>Urapis carangoides</i>	4.5
			<i>Alepes melanoptera</i>	4.5
		Sparidae	<i>Acanthopagus berda</i>	4.5
		Polynemidae	<i>Polynemus paradiseus</i>	3-4
		Drepanidae	<i>Drepane punctatus</i>	4
		Scatophagidae	<i>Scatophagus argus</i>	4.5
			<i>Eppiphus orbis</i>	4
		Terapontidae	<i>Terapon jarbua</i>	4.5
			<i>Terapon theraps</i>	4.5
		Gobiidae	<i>Glossogobius aureus</i>	3-4
			<i>Gobius giuris</i>	3-4
			<i>Boleophthalmus boddarti</i>	4
			<i>Pseudoapocryptes lanceolatus</i>	4
			<i>Taenioides gracilis</i>	4
		Lutjanidae	<i>Lutjanus rivularis</i>	4.5
			<i>Lutjanus madras</i>	4.5
			<i>Lutjanus crythroteus</i>	4.5
		Sciaenidae	<i>Johnieops coitor</i>	4
		Mugilidae	<i>Rhinomygil corsula</i>	4
		Siliginidae	<i>Silaginopsis panijus</i>	4
		Rachycentridae	<i>Rachycentrus canadum</i>	4.5

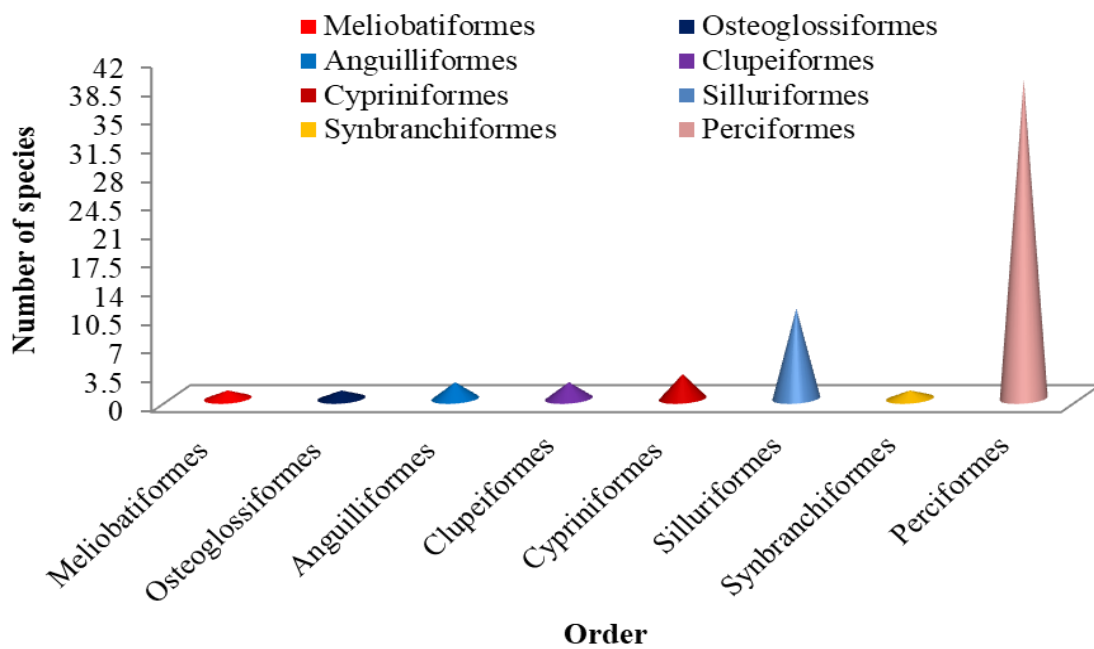


Figure 1. Composition of recorded fish species found in Kispandadi River in order



## DISCUSSION

A total of 60 fish species of 48 genus belonging to 34 families under 10 orders was recorded.

The Kispnadi river flows through Pletwa township (study site 1). It is slow and steady. Its color is green. Water depth is about 10 feet. The salinity is zero. The recorded fish species were equipped with tiny small scales. The color of studied fishes is silver. The species *Notopterus notopterus*, *Strongylura leiura*, *Aolia coila*, *Ompok birmaculata*, and *Mastecembellus armatus* were recorded.

Secondly, the river runs near Kyauk Taw (study site II). The color of river is still green. Salinity is zero and study site 2 is still a freshwater habitat. Some brackish fishes are *Tenuulosa illisha*, *Dussumeria acuta*, *Mystus wolffi*, *Arius thalassinus*, *Lates calcarifer*, *Glossogobius aureus* and *G. giruris*. The freshwater species were *Puntius chola*, *P. brevis*, *P.sophore*, *Ompok birmaculata*, *Aillia coila*, *Rhinomugil corsula*, *Leptocephalichthys bimanicus* and *Channa striatus*.

Then, river color changes to silver and the width is broad in Ponnagyun township (site III). Salinity changes to 3.p.p.m. The species also change. The species recorded were *Puntius chola*, *P.sophore*, *Arius thalassinus*, *Mystus wolffi*, *Clarius batrachus*, *Channa striatus*, *Glossogobius acureus*, *G.giruris* and *Polynemus paradiseus*.

The river part of Sittway township (study site IV) becomes dusky in color. There is immense beautiful water color separation between Pha-Yone-Kar Island and Kispnadi river. Its salinity was 2.8-4.5 p.p.m. Habitats of studied species were diverse in this study. The salt water (3. p.p.m) adapted species: *Arius thalassinus*, *Glossogobius aureus*, *G.giruris* that were recorded from freshwater habitat, Kyauk Taw township. The tidal fishes namely *Mystus wolffi* and *M. gulio* inhabit to large river basin of Kispnadi river. The species diversity that changes with relative localities was now established. Migration between tidal and estuaries or between brackish and freshwater habitats was observed along the Kispnadi River.

Finding of this study would contribute to the information about the habitat preference and tolerance behavior of brackish fishes.

However, those two fish species were recorded and collected from Kyauk Taw (freshwater habitat) and Sittway township (brackish).

This salinity tolerance behavior was also reported for the *Mystus* species. Rainboth (1996) reported that those species occur in streams, canals, and reservoirs from upland areas down to the estuary. It moves to flooded forests to spawn and the young are usually first seen in August. It returns to rivers in November and December. *Mystus wolffi* were also recorded from Kyauk Taw in October.

Thus, this study was mainly based on salinity tolerance adaptation of brackish fish species.

## CONCLUSION

Seasonal movement and migration are more interesting subjects in fishes than seasonal occurrence in a limited study. Moreover, the behavior of feeding and reproduction leads to distribution of fish. Therefore, the estuarine species *Glossigobius aureus* were typically found at the bottom depths of in large tidal rivers and flood plain canals. *G.giuris* was also found at the bottom depths in estuaries and the lower courses of river. Also, it occurs in canals, ditches and ponds, (Rainboth, 1996).

However, those two fish species were recorded and collected from Kyauk Taw (freshwater habitat) and Sittway township (brackish habitat).

Those similar tolerances of adaptation behavior were also reported for the *Mystus* species. It occurs in streams, canals, and reservoirs from upland areas down to the estuary. It moves to flooded forests to spawn and the young are usually first seen in August. It returns to rivers in November and December (Rainboth, 1996).

This study observed that *Mystus wolffi* were also recorded from Kyauk Taw in October. Therefore, estuarine fishes can live in the brackish and sometimes return to river for breeding or mating purposes or their usually migration behavior.

Therefore, the findings of this study were mainly based on salinity tolerance and adaptation of brackish fish species.

#### Acknowledgements

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