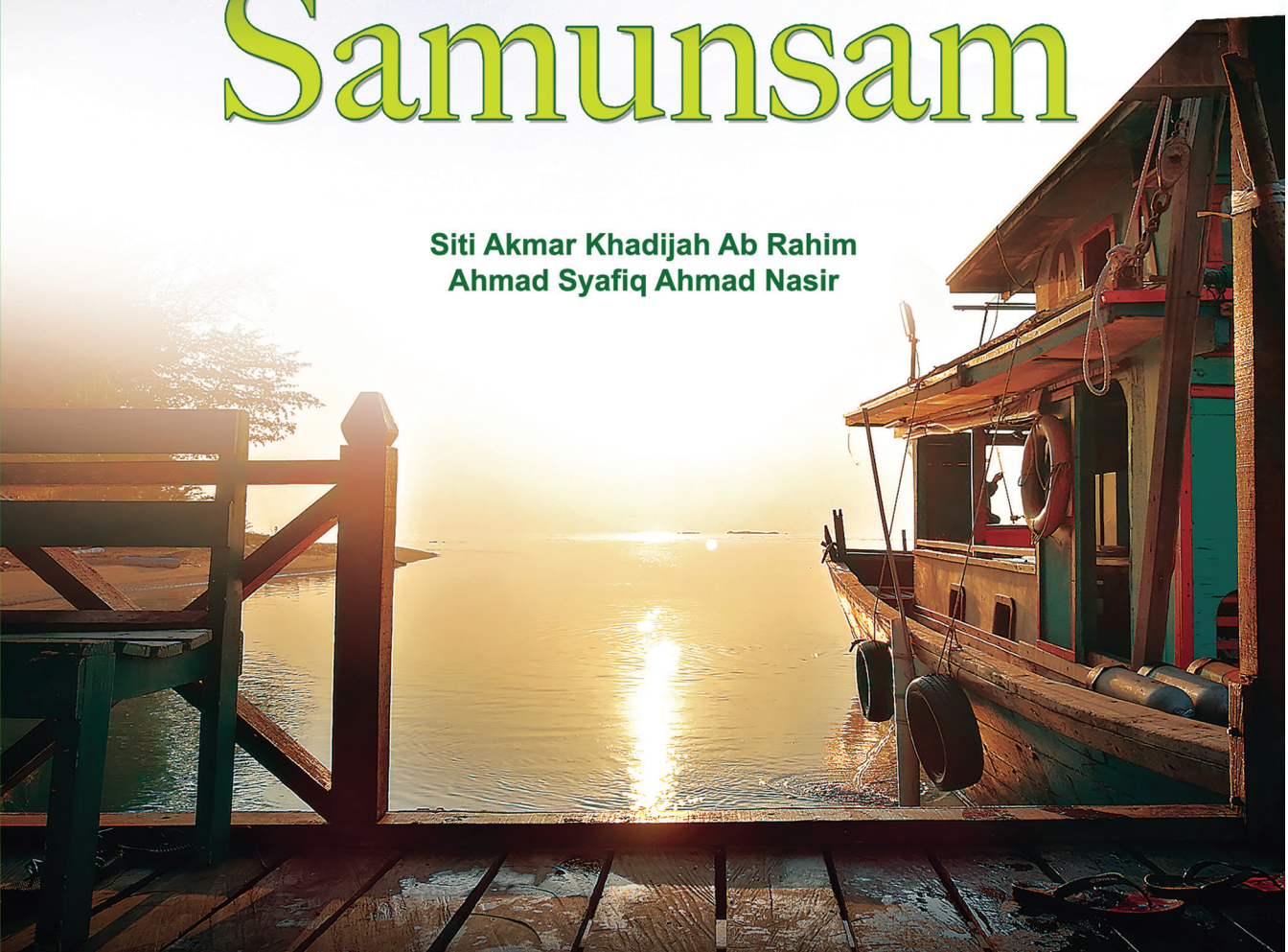
Proceeding of
Aquatic Science Colloquium 2019 (AQUAColl 2019)
Experience Sharing in Aquatic Science Research V

Tanjung Datu National Park to Samunsam

Siti Akmar Khadijah Ab Rahim
Ahmad Syafiq Ahmad Nasir



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Published in Malaysia by

UNIMAS Publisher,
Universiti Malaysia Sarawak,
94300 Kota Samarahan,
Sarawak, Malaysia.

Cataloguing-in-Publication Data

Perpustakaan Negara Malaysia

A catalogue record for this book is available from the National Library of Malaysia

eISBN 978-967-0054-79-7

Contents

Preface

The articles published in this proceeding are the research outcome of a joint scientific expedition in 2018 between the Programme of Aquatic Resource Science and Management, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak (UNIMAS) and Sarawak Forestry Corporation Sdn Bhd (SFCSB) entitled Tanjung Datu National Park – Samunsam Wildlife Sanctuary Marine and Coastal Resources Expedition: Biodiversity Conservation and Sustainable Utilization'. The expedition was the second research collaboration between UNIMAS and SFCSB after the first 'Pulau Sampadi Marine Life Expedition' in 2012. The objectives of this expedition are: (1) to collect information and establish baseline data on the aquatic environments and its available resources from Tanjung Datu National Park to Samunsam Wildlife Sanctuary areas; (2) to contribute to the development of Sarawak Marine and Coastal Conservation Master Plan and also (3) to identify and recommend potential sustainable economic activities for the local communities.

This expedition's findings were presented during the Aquatic Science Colloquium 2019 (AQUAColl 2019) which is the fifth series of a biennial academic event that acts as a scientific platform for researchers to update, exchange and sharing of research information and findings explicitly obtained from the scientific expedition.

This AQUAColl 2019 proceeding comprises 18 research papers which reflect the aquatic and terrestrial biodiversity, physical oceanography, the status of marine pollution and socio-economic activities occurring inside or surrounding the Tanjung Datu National Park – Samunsam Wildlife Sanctuary. It is hoped that these scientific data may provide important baseline information and be beneficial towards future fisheries, oceanographic surveys and ecotourism activities in these areas.

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UNIMAS

Acknowledgement

A huge number of people helped in conducting the expedition and colloquium, and made the publication of this proceeding a success. The editors are grateful to the researchers who have contributed their research findings during the colloquium and to this proceeding. The scientific committee also wish to extend their heartfelt gratitude to all reviewers that had worked diligently and made valuable suggestions on the improvement of the articles' quality. The reviewers are as follows:

Prof. Dr. Ramlah Zainudin (UNIMAS)
Assoc. Prof. Dr. Devagi Kanakaraju (UNIMAS)
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Ms. Cindy Peter (UNIMAS)
Mr. Oswald Braken Tisen (SFC)

Last but not least, we thank everyone for their hard work and dedication, and we look forward to future continuous collaboration. Well done and thank you to SFC and UNIMAS!

Short Notes of Fish Larvae from Samunsam River, Sarawak

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Abstract

Fish larvae studies are important to fisheries management as they provide information that might aid fisheries management and can contribute in predicting fish stocks recruitment. Plus, the composition can also serve as an indicator for the health status of aquatic environment. There is not much of information about fish larvae composition in Sarawak freshwater especially from Sarawak's state sanctuaries. Therefore, this study was conducted to determine the composition of fish larvae of Samunsam River which is located within Samunsam Wildlife Sanctuary - the oldest wildlife sanctuary in Sarawak. Samples were collected from ten stations using ring plankton net (0.5 mm mesh size) and towed horizontally by a boat. A total of 8,191 fish larvae which belongs to 15 families were identified, namely Ambassidae, Apogonidae, Bagridae, Belonidae, Clupeidae, Cyprinidae, Engraulidae, Gerridae, Gobiidae, Haemulidae, Hemiramphidae, Muraenidae, Phallostethidae, Serranidae and Tetraodontidae. Family Phallostethidae showed the highest number of catch mostly from upstream stations. These baseline data are hoped to be useful for future management of Samunsam River.

Keywords: fish larvae composition, Samunsam, sanctuary

Introduction

Fish larvae is a stage of development and growth phase of common fish which in general differs ecologically and morphologically in comparison with their adult counterparts along their growing processes (Rezagholinejad *et al.,* 2016). According to Freitas and Muelbert (2004), most larval fishes tend to occupy the habitat with high food availability, low predation rate and stable ocean condition for growth. The fish larvae inhabit different habitats, picking different food resources, and having different predators and different behaviour (Rezagholinejad *et al.,* 2016). Habitats that fulfil these requirements usually are seagrass beds, estuaries, littoral areas and reef habitats where the water is mostly shallow and the larger predators will tend to avoid such environments (Anand and Pillai, 2005; Ara *et al.,* 2011).

Fish larvae composition status can be used as indicator of the health of water body and aquatic environment because they will use suitable area as their growing grounds. The identification of fish larvae and species composition will aid fisheries management to have good policies and having a good control on marine ecosystem (Kawaguchi, 2003). Fish larvae survey is a way of generating fishery independent stock assessment and key component in understanding role of marine ecosystem (Moser *et al.,* 1993). The fish larvae composition data give related information of the factors that affect fish larvae distribution and abundance that will help the fisheries scientists to find a solution to protect fishery resources.

The fish larvae composition is also an indicator of healthiness of fish (Deepananda and Arsecularatne, 2013). According to Ooi and Chong (2011), study of fish larvae ecology is useful to identify their spawning ground, feeding habitats, nursery grounds and the condition of fish larvae. This information will help researchers to understand the interactions between the habitat and fish larvae composition.

Surveys of fish larvae composition and identification have been done worldwide including in Malaysia as well. For examples at coastal area less than 5 nm in Sarawak (Muhamad and Rahim, 2013 and 2014; Rahim *et al.,* 2015) and selected estuaries in Sarawak and Sabah (Blaber *et al.,* 1997); seagrass beds and outside of seagrass beds of the Southwestern Johor and estuary of River Pendas in Johor (Ara *et al.,* 2011).

Information on the composition and diversity of fish larvae from freshwater ecosystems are still limited in Malaysia, especially from Sarawak's state sanctuaries which has potential in providing baseline data to aid the fishery and resource management in

future management. Appropriate documentation about fish larvae composition and diversity are essential fundamental information for future research needs. This study was conducted as an initiative which aims to determine the composition and assemblages of fish larvae in Samunsam River, which is located within Samunsam Wildlife Sanctuary - the oldest wildlife sanctuary in Sarawak.

Materials and Methods

Field sampling

This study was conducted on 20th February 2019 by boat along Samunsam River that flow through the Samunsam Wildlife Sanctuary, Sarawak, Malaysia (Figure 1). A total of ten stations were selected and the coordinates of each station are shown in Table 1.

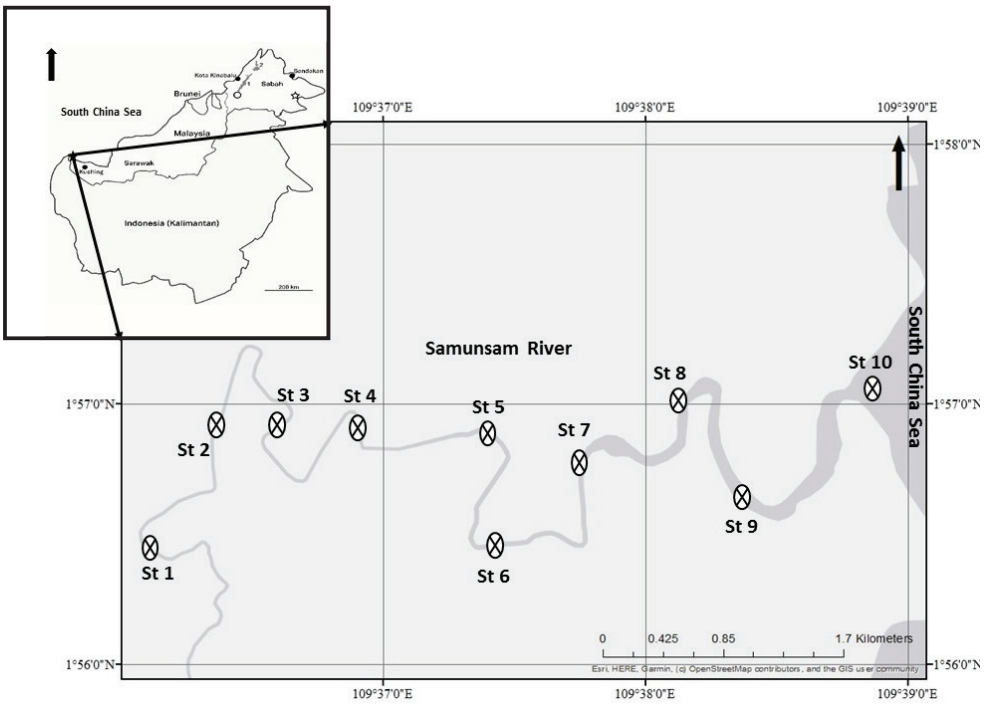

Figure 1 : Sampling stations at Samunsam River, Sarawak.

Table 1 : Coordinates of the stations involved in this study.

Station	Time (Hours)	Coordinates
1	1147	N 1° 56' 41.82" E 109° 36' 5.83"
2	1230	N 1° 57' 1.94" E 109° 36' 23.41"
3	1255	N 1° 56' 53.17" E 109° 36' 2.89"
4	1317	N 1° 56' 54.78" E 109° 36' 59.11"
5	1343	N 1° 56' 52.82" E 109° 37' 24.18"
6	1406	N 1° 56' 28.31" E 109° 37' 29.4"
7	1428	N 1° 56' 48.3" E 109° 37' 45.31"
8	1447	N 1° 57' 1.74" E 109° 38' 9.51"
9	1505	N 1° 56'42.94" E 109°38'21.62"
10	1524	N 1° 57' 2.17" E 109° 38' 44.59"

Fish larvae were collected using ring plankton net (500 micron mesh size, 1 m mouth diameter) with one horizontal tow per station for 10 minutes with gradual speed increment up to 2 knots. The stations' coordinates were taken before each tow using Global Positioning System (GARMIN 62S). All collected samples were immediately preserved in 10% formalin solution and brought back to Aquatic Histology Laboratory, Faculty of Resource Science and Technology, UNIMAS for further analysis.

Samples processing and identification

In the laboratory, all fish larvae were sorted from other zooplankton and transferred into 85% ethanol. With the aid of stereomicroscope (Motic SMZ-168 S) equipped with a digital camera (Moticam 2 Cmos Camera 2MP), the fish larvae were sorted based on their morphological characteristics, identified up to family level and the total individuals of fish larvae were counted according to their family. The identification of fish larvae was based on taxonomic keys by Leis and Trnski (1989) and Termvidchakorn *et al.* (2013).

Data analyses

The frequency of occurrence for each fish larvae family is expressed in percentage based on the number of individual presence of a particular family within ten stations throughout the survey. Based on the family list and number of fish larvae enumerated for every family and stations, several statistical analyses were performed to determine fish larvae composition and abundance, spatial distribution and species contribution to station ordination.

Analyses were carried out using PRIMER 7 (V7.0.12). In order to investigate the similarities between families composition at different locations, a non-metric Multidimensional Scaling (MDS) ordination based on Bray-Curtis similarities was applied. Then SIMPROF test was performed to cluster stations in statistically significant groups. One-way ANOSIM was used to test for differences in species composition between station clusters generated by SIMPROF and if the differences were found, SIMPER analysis was applied to identify which group/family accounted for observed differences in fish larvae assemblages (Clarke *et al.,* 2014).

Results and Discussion

Composition of fish larvae

A total of 8,191 fish larvae were collected from ten stations of Samunsam River. The fish larvae samples comprised eight orders and consisted of 15 families namely Ambassidae, Apogonidae, Bagridae, Belonidae, Clupeidae, Cyprinidae, Engraulidae, Gerridae, Gobiidae, Haemulidae, Hemiramphidae, Muraenidae, Phallostethidae, Serranidae and Tetraodontidae (Figure 2). The unidentified fish larvae were grouped separately as these samples were damaged and cannot be recognised. In this study, the most abundant fish larva was from Family Phallostethidae, which is known as priaprium fish. This group contributed 87.79% (Figure 2) of the total catch which was mostly found from 'upstream' stations. There are four species of priaprium fishes reported in Malaysia.

Spatial distribution of assemblages

The spatial distribution of fish larval abundance in Samunsam River is shown in Figure 3. The non-metric MDS analysis showed three distinct assemblages of stations and fish larvae assemblages namely 'a' and 'b'. Referring to the locality of sampling stations, distinct

separation between east-west could be observed probably related to the distance from the coast. Each of the recognised community assemblages was significantly dissimilar in their species composition (One-way ANOSIM R = 1, p < 0.05).

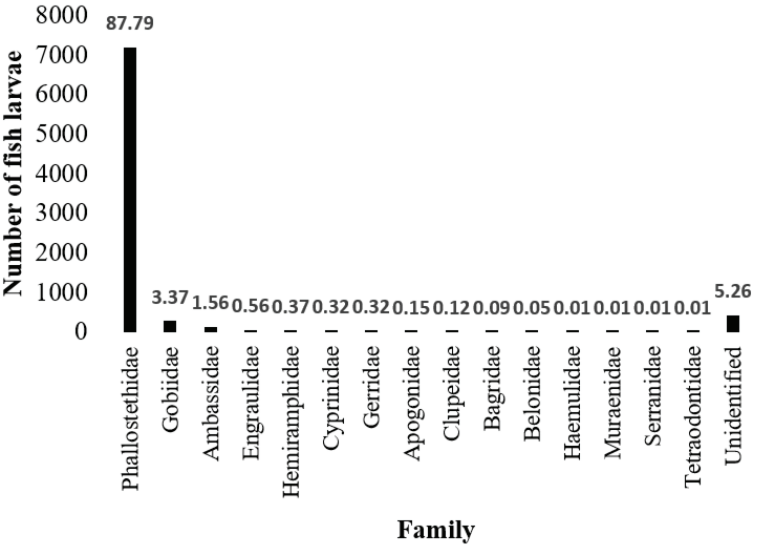

Figure 2 : Number of fish larvae caught and percentage (%) of fish larvae family (shown on the top of each bar) identified from Samunsam River.

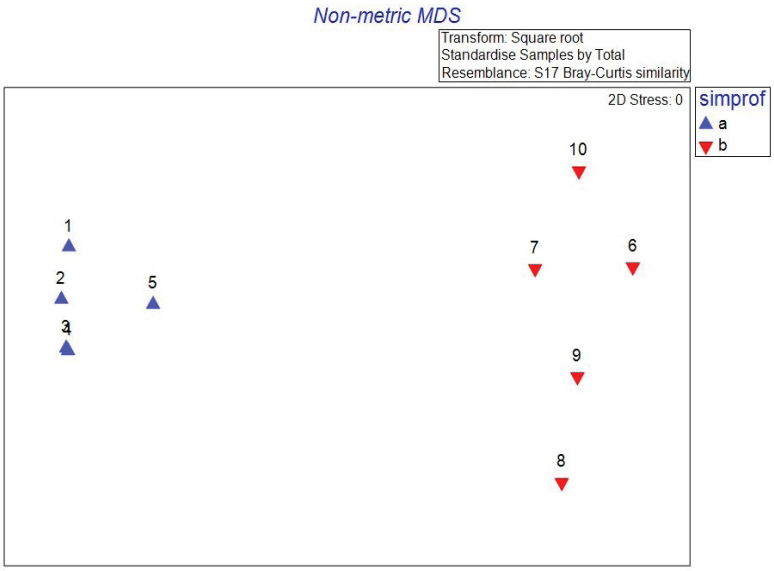

Figure 3 : Non-metric MDS ordination representing fish larvae assemblages from Samunsam River stations. The stress value is 0.

Figure 4 shows the shade plot for square rooted transformed abundance for this survey, showing all sampling stations grouped by Bray-Curtis similarities together with SIMPROF tests which identify two-groups with list of composition which were also grouped using index of association and agglomerative groupings. Based on Figure 4, the significantly different group of stations given by SIMPROF test are indicated by vertical line and the grouping can now be seen to be driven by dominant families (Phallostethidae for group 'a' and Ambassidae for group 'b') which clearly typify the two clusters/groupings (shown in Figure 3) and discriminate them from each other.

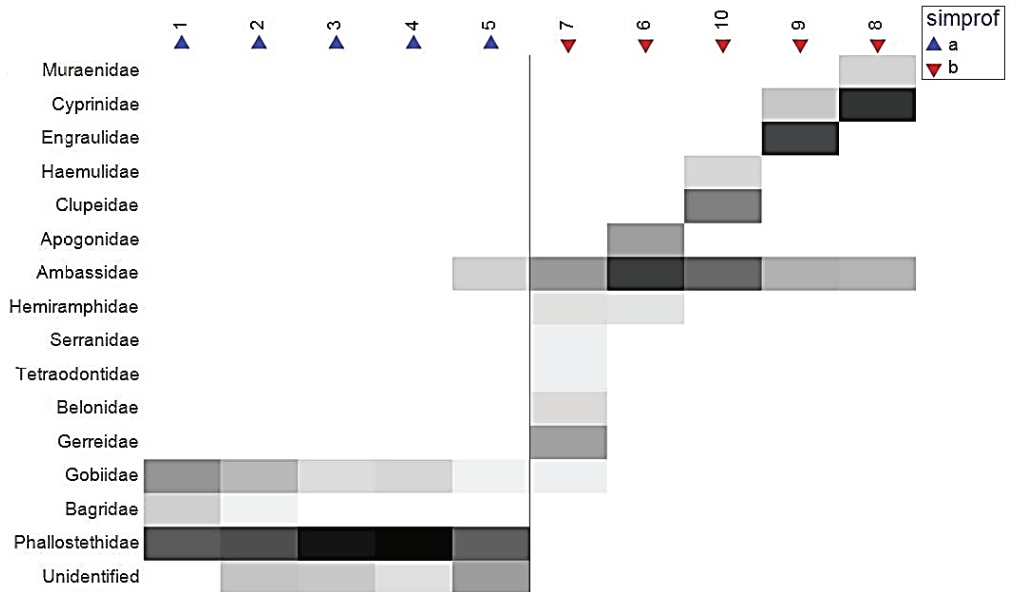

Figure 4 : Shade plot of abundance of 15 fish larvae families from the sampling, with linear grey-scale intensity proportional to square root abundance. Sites have been grouped using Bray-Curtis similarities on the transformed data together with SIMPROF test which identify two groups (a and b).

Further examination using SIMPER analysis supports those shade plots in terms of indicated numbers of family contributed to the significant differences (between assemblages) and similarities (within each assemblages). There are one family contributed to the similarity in both groups, namely Phallostethidae which contributed to the similarity within 'a' group (SIMPER, Group 'a', Contrib%: 74.18) and Ambassidae which contributed to the similarity within 'b' group (SIMPER, Group 'b', Contrib%: 91.44).

Based on the results above, larval assemblages can be distinguished on the basis of adult's habitat (Kent *et al.,* 2013; Zarrad *et al.,* 2013; Giordano *et al.,* 2015) which influence the spawning area. Group 'a' which can be found 'farther' from the coastal zone is characterised by Family Phallostethidae that prefer to inhabit freshwater to brackish and rarely marine. But this group belongs to peripheral division (Nelson, 1994). On the other hand, Group 'b' which aggregated 'nearer' towards coastal zone is characterised by Family Ambassidae that prefer marine environment (Nelson, 1994).

The assemblages of fish larvae can be influenced by intrinsic and extrinsic factors. For example, species behaviour, feeding environment (extrinsic factor), intrinsic factors such as density of the fish larvae and the contribution of environmental forcing (salinity, temperature, etc.) to the composition of fish larvae. For a better understanding on the dynamics of fish larvae populations and their response to the environmental changes, fish larvae identification to the lowest possible taxon might redraw the grouping and clustering pattern, characterisation of diversity and abiotic variables among stations and population parameters for specific group.

Summary

This study has shed some light on the composition of larval fish assemblages from Samunsam River which can be used for conservation and sustainable resource management. A total of 8,191 fish larvae belonging to 15 families have been identified and among them Phallostethidae or priaprium fishes are the best represented group as they contributed 87.79% of the total catch. Based on the relative abundance, two assemblages of fish larvae can be seen which are contributed by the two different families. More information needs to be gained which can be used for future fish community management of Samunsam River.

Acknowledgements

Authors are thankful to UNIMAS for providing transportation, laboratory facilities and funding during this study. Thanks to FRST staffs who had assisted in this study. Our appreciation also goes to Sarawak Forestry Corporation (SFC) for research permit and facilities in the Samunsam Wildlife Sanctuary.

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Tanjung Datu National Park to Samunsam

This proceeding contains an overview of inventory works performed at Tanjung Datu National Park to Samunsam Sanctuary in the year 2018 to 2019, encompassing the organisms of terrestrial and aquatic ecosystems. Simultaneously, the status of local ecotourism, fisheries and pollution were also reported. This wide coverage of findings is very useful to complement the current and future development of the Tanjung Datu – Santubong Marine and Coastal Conservation Master Plan. With the construction of the Pan Borneo coastal highway, the impacts on marine environment and socio-economic are very important to be monitored. Thus, this book can be used as the main reference for future research in that area by scientists, policymakers and stakeholders, especially the relevant state and federal agencies in Sarawak. Environmental consultancy companies can also use the baseline data for Environmental Impact Assessment purposes.

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e ISBN 978-967-0054-79-7

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