FISH BIODIVERSITY OF THE VILLAGE FORESTS OF PUNAN LONG ADIU NORTH KALIMANTAN

(Final Report)

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EXECUTIVE SUMMARY

The village of Long Punan Adiu, (LPA) is located in South Malino Distric, North Borneo Province. The villagers of LPA have Punan Long Adiu Village Forest (PLAVF) of 17,496 Ha which is border to 7 other villages. Topography PLAVF is hilly and has many rivers. Adiu River is the main river that passes HALPA with more than 50 tributaries. The rivers in the PLAVF area have characters as rocky, clear-watered, fast-flowing and have some bottom and cascade, and are inhabited by fish with distinctive characters that are fast swimmers, moss eater and paste on rocks. . The diversity of fish in the PLAVF include ; 41 species, 24 genus and 10 family. Family Cyprinidae dominates (58%). Based on the IUCN red list there are 4 group fish in PLVF; 1 species of Data Deficient (DD), 17 species of Least Concern (LC), 22 species of Not Evaluated (NE), and 1 species of Near Threatened (NT). An important finding related to conservation is that the Adiu River is a habitat for North Kalimantan's endemic fish are *Nematabramis evertti* and *Nemtobramis borneensis* with abundant amounts. (24%). Both species are evenly distributed in all habitat types; upstream, middle steram, down streams, tributary, pond, and lake. In addition in the area of PLAVF also live fish *Tor soro* and *Tor Tambra*. It is a consumption fish with high economic value and has started rarely found.. Aquatic ecosystems in the PLAVF have HCV values (HCV 1, HCV 3, HCV 4, HCV 6) , due to endemic and rare animals, and have a natural landscape that can provide environmental services such as clean water sources and community livelihoods.

1. Introductions

Punan Long Adiu Village (PLA) is located in Malino Selatan District, Malino Regency of North Borneo Province with total area of 4316 Ha. Hereditary PLA life is very close to the forest, which is by utilizing forest products such as hunting, fishing, and looking for non-timber forest products. (NTFP). PLA has Punan Long Adiu Village Forest (PLAVF) covering an area of 17,496 hectares with 7 other villages. (Elyn et al 2016). The PLAVF area is in the hills with a height of 200-300 m above sea level consisting of secondary forests that still have a good number of rivers. The main river that crosses PLAVF is Adiu River and has ± 50 tributary (Annex 2) there are Aren River, Ann River, Bunut River, Kelop River, and Abot River. The Adiu River will empty into the larger river of Malino River. PLA Village is located on the banks of the Malino River. The Malino River is a river character in PLAVF having clear water, medium to heavy and substract of rocky base up to gravel. Along the banks of the river Adiu found many river cliffs composed of rocks and some bottom (limbo), and water cascades. According to Kottelat et al. 1993. The distinctive character of rivers in the hills and mountains is the continuous hard friction between large stones and water flow and very few living plants. Generally the fish that live in the area is adapted to have attachment organ on rocks such as family Balitoriade (litoralfish), or fast fish swimmer from the family Cyprinidae. The rivers in the PLAVF, although clear, but not all the time, when the rain water color immediately turns brown because of the run off of the soil material in the forest, however soon it will return clear after 2-3 hri and the degree of brilliance does not last long. Changes in this condition allegedly led to changes in the composition of fish species, because when the turbid water fish need to rely on babrbae (grouch) in the search for food such as from the family Bagridae (baung) and Claridae (catfish). The condition of rivers and creeks in the PLAVF area that has a distinctive character, will be populated by various types of fish with a unique adaptation tray, this is because different aquatic habitats will be inhabited by different fish species. The fish will perform an ecomorrphological adaptation according to its habitation (Sukmono, et al.2013). However until now there has been no research on fish and fisheries that exist in the PLAVF area. Fish and fishery data is very useful especially for Punan Adiu indigenous people in utilizing non-timber forest products (NTPF) as part of their livelihood, so that PLAVF area is still sustainable.

2 Objective

The purpose of research are:

a. Knowing the condition of the waters in the area of Punan Adiu Village Forest (PLAVF)

b. Identify Biodiversity of fish in PLAVF area
c. Identify HCV in the aquatic cosystem in PLAVF area
d. Developing knowledge for fish monitoring in PLAVF area

3. Survey Sites

The aquatic ecosystem in PLAVF area consists mainly fast-flowing and rocky rivers, lakes, and swamps. The main river is Adiu river which will connecting into Malino River. Lake of Sigung Klafang , and Swamp.

Research on the diversity of fish in the Punan Long Adiu Village Forest is conducted in several aquatic habitats representing up stream , middle stream and down streams Adiu river, tributaries, bottom (limbo), lakes and swamps. The fish survey was conducted in Lubuk (Limbo) Adiu River; namely Limbo Dalop and Limbo Benuhup, River Estuary (Ann, Aren Mawan, Ibau, and Aren), Belanai River, Mpuaram River, Rawa Mpen, and Sigung Kelafang Lake. The research station is divided into 13 stations: Upstream river (2 stations), middle river and Bottom (2 stations), Estuary / down stream (5 stations,), creeks (2 stations), Swamp (1 unit), Lake station). It aims to obtain optimal fish biodiversity, because different habitats will be populated by different species of fish following the pattern river continuum concept (Kottelat et al., 1993). The description of the location of the study is presented in Table 1

Table 1. Research stations

No	Station (St)	Locate	coordinte
1	St 1	Estuary / downstream An river	3º15’22.7” N 116º26’22.3” E
2	St 2	Bottom (limbo) Dalop	3º17’47.2” N 116º25’26.9” E
3	St 3	Estuary/ downstream An Ibay	3º17’46.5” N 116º25’45.9” E
4	St 4	Bottom (Limbo) benuhup	3º18’13.6” N 116º25’24.4” E
5	St 5	Mpen swamp	3º15’21.7” N 116º26’33.4” E
6	St 6	Belanai Tributary	3º15’18.9” N 116º26’33.0” E
7	St 7	Mpuaram Tributary	3º15’28.9” N 116º27’00.8” E
8	St 8	Estuary/ downstream Aren mawan river	3º15’46.4” N 116º27’05.5” E
9	St 9	Estuary / downstream Akat river	3º14’35.2” N 116º27’19.1” E
10	St 10	Bottom (limbo) Betunong	3º16’45.7” N 116º25’420.2” E

11	St 11	Upsteram Abot river	3°15’51.6” N 116°25’34.1” E
12	St 12	Sigung Klafang Lake	3°20’28.2” N 116°30’23.3” E
13	St 13	Estuary/ downstream Aren river	3°20’23.6” N 116°30’15.5” E

4. Methods and Analysis

Research on the diversity of fish in the PLAVF area was conducted in October 2017 for two weeks. To search the initial information on the diversity of fish in the PLAVF area based on secondary data, interviews with local people who frequently sought fish in the Adiu River and surrounding areas. Information digging is done by showing photographs of freshwater fish in Indonesia based on West Freshwater Fish book of Indonesia West and Sulawesi (Kottelat et al., 1993).

Fish sampling is done by using various active and passive fishing tools, including: nets, net, scoop net, and fishing rod. Nets with openings of ± 2 m and mesh size Gill net with 30 m long and 0.5 and 1 inches and fishing rods with various sizes of fishing rods and bait. Installation of the net is done according to the habitat character. (Figure 1) In a river-basin station, the net setting is carried out at a river encounter at the bottom of the river with some mesh sizes (Sukmono et al, 2016). In the staiun of swamp and lake mounting nets is done mainly in the outlet, and inlet lake. Installation of nets per station for 6 hours and fish samples lifted every 3 hours. Samples with fishing rods are done with local fisihing techniques (mancing mentik) is the fishing pole in throw-pull, throwing pull until there are fish that grab a bait of insects and maja fruit. Scoop net is used primarily for catching fish in vegetation or in a limited range of water.

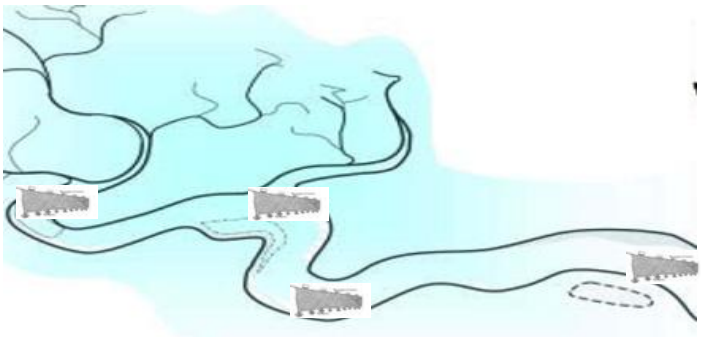


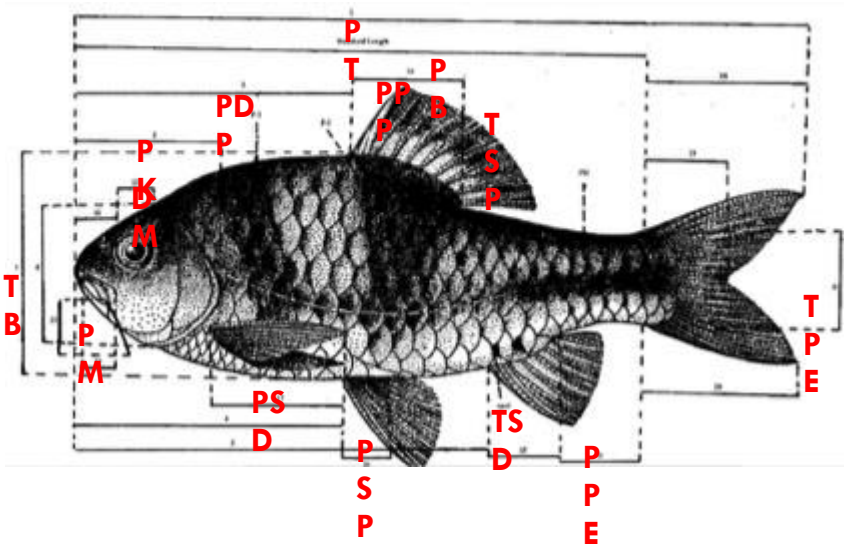
Figure 1. Installation of nets in the river area (Sukmono et al, 2016)

Identification and Preservation

Captured fish samples will be photographed in fresh condition with the head facing left, then performed the identification based on 15 morphometric characters and 7 meristic characters. (Table 2 and Figure 2)

Table 2. List of meristic measurements

No	Meristic	Description
1	Dorsal Fin	Number of soft and hard rays in dorsal fin
2	Pectoral Fin	Number of soft and hard rays in pectoral fin
3	Ventral Fin	Number of soft and hard rays in ventral fin
4	Anal Fin	Number of soft and hard rays in anal fin
5	Lateral Line	Number of pores along lateral line
6	Cross sectional scales	Number of scales from dorsal fin until lateral line
7	Transverse caudal scales	Number of scales transverse caudal stem



PT = total length
PDP = pre dorsal length
PSP = length of abdominal fins
TSD = height of anal fin
LSP = width of dorsal fin
PS = length of standard
TB = height
TSP = high
LK = width of head
PM = length of mocong
PK = length of muzzle
PSD = length of pectoral fin
PPE back fins = long base of tail
TPE = height of base of tail
DM = eye diameter

Figure 2. Measurement of morphometric fish (Haryono, 2006)

The results of identification will be fitted with various journals and fish identification books based on Sukmono et al (2013), Sukmono et al (2016, Kottelat et al (1993), Kottelat & Whitten (1996), Tan &

Kottelat (2009), Rachmatika (2004), Ng & Lim (2008), Haryono (2010), and online through *www.fishbase* (Froese & Pauly, 2016)

The samples will be deposited in the Zoologicum Bogoriens Museum (MZB), LIPI Cibinong Biology Research Center, to obtain the collection catalog number so that it can be accessed for research and development of the next knowledge.

Data Analysis

The morphometric and meristic character measurements of each individual fish are used to make the description as a species determiner and will be compared with the species character of various fish identification books and online via the *www.fishbase.org* website (Froose & Pauly, 2017). If there is a discrepancy or revision of the scientific name, then the latest source followed by the valid name. The determination of the species high-concentration (HCV) status refers to *www.iucnredlist.org* and *www.fishbase.org*.

To determine the management and monitoring management further, it will calculate the abundance of each species by considering its utilization so far

5.Result And Discussion

Description Research location

The aquatic ecosystem in the PLAVF area consists mainly of clear rivers, fast-flowing and rocky rivers, lakes, and swamps. The main river is Adiu River which will join into Malino River. In addition Sigung KLafang lake , and Mpen Swamp .

Adiu River

Adiu River as the main river becomes the boundary of the village forest with HPH PT Rimba Makmur Sentosa (RMS) has ± 60 children of the River, so the whole year does not experience drought. In the rain water the river will turn brown, because there is soil material into the river (run off) but in 2-3 days will be clear again. Adiu River from upstream to downstream, among others; Klungan River, Awong River, Uwang River, Benuhup River, Ibau River, Dalop River, Ann River, Akat River, Sungai Belanai, Sungai Mpua Aram, Aren River and Maleo River . As the main river, Adiu River has a width of 50-70m with a depth of 50 cm-3m. There are at least 4 cascades along the Adiu river and several waterfalls. Adiu River ecosystem is very typical with the many streams of river, bottom, cascade, and waterfalls. In addition there are several sources of salt water like in Betunang sekukan Bottom often visited by wild animals to drink (Figure 3)

Figure 3. Landscape Adiu River

Lake Sigung Klafang

Sigung Klafang Lake is a semi-natural lake, because of the Sigung River bridges that is cut off and is in the forest boundary of Punan Adiu village with Setarap Village. Based on information society was found

Labi-labi (like a turtle) from the punan people called it Sigung Klafang. The formation of the lake due to the breaking of the bridge that passes through the Sigong River is on the road former HPH PT Barito, so that the flow of water into puddles and formed lake. Sigung Klafang Lake means a brownish water polymorph with a depth of 45 cm - 1.8 m. Inlet stream and outlet come from Sigung River. (Figure 4).

Figure 4 Sigung Klafang Lake

Fish Diversity in Punan Long Adiu Village Forest

During the sampling, 378 fish were collected; 41 species, 24 genus and 10 family (annex 1). All species are native, introduced and invasive fish in Indonesia such as mujair (*Oreochromis mossambicus*), dumbo catfish (*Clarias gariepinus*), indigo (*Oreochromis niloticus*), and goldfish (*Cyprinus carpio*) (Dewantoro and Rachmatika, 2016), not found in the area survey. This shows that the waters in the forest area of Punan Long Adiu village have not experienced anthropogenic disturbance and are still awake to its authenticity. This is also demonstrated by the discovery of the ujuk species (*Channa lucius*) which is one of the best bioindicator of forest vegetation (Kottelat et al.1993)

Based on IUCN status (www.iucnredlist.org, www.fishbase.org), fish in Punan Long Adiu village forest area is divided into 4 categories: Data Deficient (DD) there is 1 species, Least Concern (LC) 17 species, Not Evaluated (NE) 22 species, and Near Threatened (NT) 1 species is *Ompok bimaculaus* (Figure 5). Families with species diversity occupy the three highest order are Cyprinidae (24 species), Bagridae (5 species), and Belontidae (3 species). Based on abundance, the 5 most common types are *Nematobramis everetti* (24.3%), *Rasbora caudimaculata* (12.9%), *Puntius sealei* (9.2%), *Nematobramis borneensis* (8.5%), *Rasbora dusonensis* (5.8%), and *Barbodes schwanefeldii* (5.3 %).

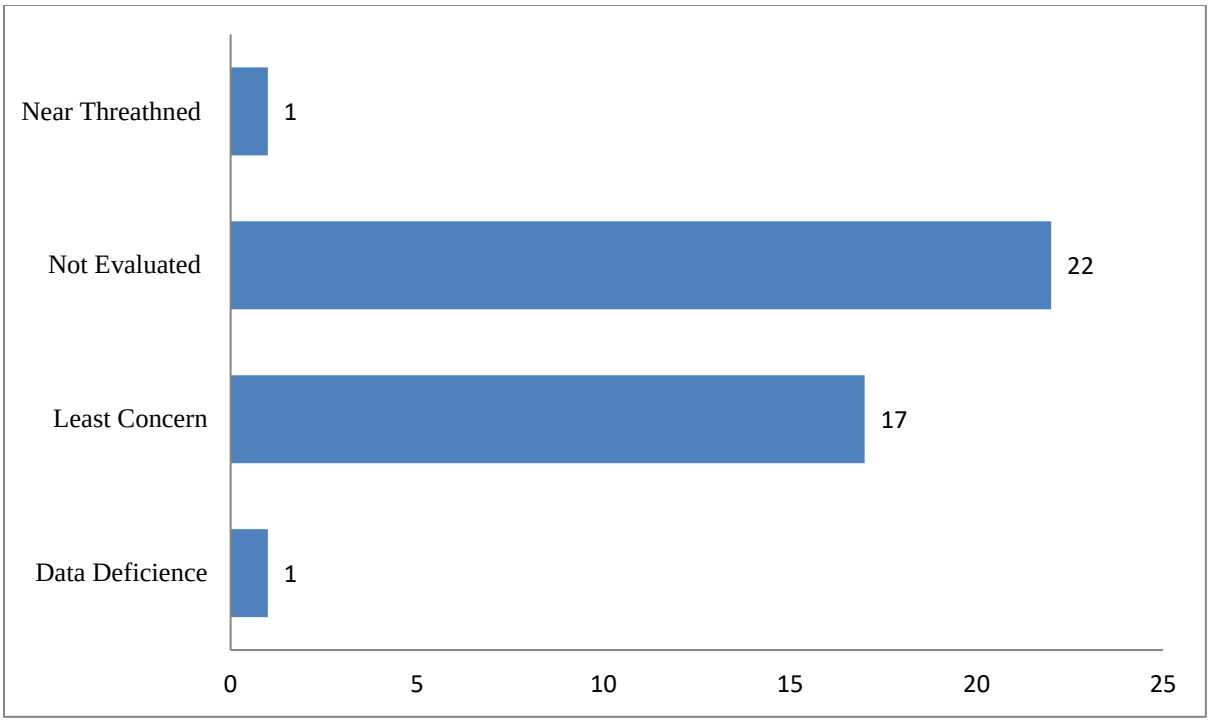


Figure 5 IUCN Status Fish diversity in Punan Long Adiu Village Forest

An important finding related to conservation is that the Adiu River is a habitat for North Kalimantan's endemic fish *Nemtobramis borneensis* with abundant amounts. (24%) and *Nematobramis evertti* (Frose & Pauly. 2017). Both types are evenly distributed in all types of upstream, middlestream, downstream, tributary, pond, and like habitats. (Figure 6). This suggests that the species of the Nematobramis genus can well adapt well in the Punan Long Adiu Forest area.

Figure 6 *Nematrobramic evertti*

Description *Nematobramis evertti*

Living in the clear river in the forest with a rocky base to the lake and swamp in the forest on the basis mud. The location of dorsal fin parallel to the anal fin. Body shape like a knife, head up, up the base of the tail there is a triangular note From the mid-body to the base of the tail there is a faint black line / On the back of the operculum there are black transverse bands. The color of the silvery body there are black spots. At the corners of the mouth there is a pair of rigid tentacles. The length of the tentacle approaches the tip of the pectoral fin (chest) The height ration of a standard length of 1: 4.25. Meristic Dorsal (D) 11, Anal (A) 16, Pectoral (P) 10, Pelvic (Pv) 5.

In addition to endemic fish, also founded jaran fish / semah (*Tor soro* and *Tor tambra*) which have high economic value, and dup in clear, rocky water habitat. In Indonesia its distribution is very limited, only in highland area. (Figure 7)

Figure 7 *Tor Soro*

Description *Tor soro*

Live upstream in the forest with clear water conditions and rocky grounds. It has 2 pairs of tentacle, located at the corner of mouth and upper jaw. The body is redness yellow color. The scale is very large. At the top of the mouth there is a bony bulge. Stomach is white, all reddish black fins, large scales and elongated body elongated. The ratio of standard height and length 1 to 3.7. Li 24-25, D I, 9. Pv I, 8, P I, 14, A I, 6 SMB 4.5

Discussion

Based on the research results it is known that the forest area of Puanan Long Adiu village has one main river, Adiu River with more than 50 tributaries of the Adiu River has the basic character of rocky, clear waters, forest vegetation on the river is still tight, has some holes, water cascades small plunge and salt water source. In addition to being in good forest area, along the banks of the Adiu River there are many wall-walls of stone scratched by water lines forming beautiful baty carvings and some also found wooden fossils. The experience in Adiu River to upstream like a trip to Geo Park (earth garden) is still very natural. In order to regulate the forest of lesatri and livelihood of Adiu River area is very suitable for ecotourism in the river and river rafting.

In addition to the exotic landscape, the Adiu River has 41 species of fish, all of which are native species, not feeding introduced fish, this indicates that the Fish Habitat in the Village Forest is still natural and has not received anthropogenic pressure, however if more intensive research is conducted especially during the season rain and drought, more species will be found due to very limited research time. The dominated fish are typical fish, especially fast Cyprinidae family (58%). Cyprinidae is the most dominant family in Indonesian freshwater (Raharjo et al, 2010). Family Cyriniade dominates in the waters of the Harapan Jambi Forest, the waters of the Ecosystem Restoration of Riau, as well as the Ecosystem of Bukit Tiga Puluh Jambi Forest (Sukmono et al. 2013, Sukmono et al 2016, Sukmono et al 2017). In terms of diversity Adiu River fish have endemic fish of North Borneo and fish with high economic value and rare, and fish that have been threatened with extinction.

North Kalimantan's endemic fish from the Nematobranis Genus live naturally, spread and dominance abundant in Punan Long Adiu Village Forest, *Nematobramis everetti* (24.3%) and *Nematobramis borneensis* (8.5%). This indicates that the Long Aduan Long Puanna Adio forest has a high knight value. In addition to endemic fish, there also fish consumption with high economic value, namely jaran or semah fish is *Tor soro* and *Tor tambra*. Fish Semah is a fast water fish and fast swimmer its existence is getting rare due to arrest. Its spreading is limited to rocky rivulets. In some areas such as Lubuk Beringin, Jambi and Pesisir Tapan, West Sumatra, Semah fish in the in situ conservation with Lubuk Larangan (Prohibited area) determination by custom. To support the development of sustainable and sustainable use, the fish in the area of Punan Long Adiu Adat Forest can be conserved by the prohibition of the prohibition, especially in the area between the estuary of the Abot River and the mouth of the Ibay River. Because many found Lubuk-sub and vegetation conditions are still natural. Punan Long Adiu Adat forest waters ecosystem has high conservation value shown in the following table 3:

Table.3. HCV in PLAVF

No	Crirtera HCV	Detai	Source
1	HCV 1	Endemic species, at least 2 species endemic, north borneo (Nemtabramis everttii & Nematobramis borneensis) Treatned species, At least 1 species Near threatened (NT) *Ompok bimaculatus*	Sampling 2017
	HCV 3	Ecosystem Adiu river provides habitat to semah Fish (Tor soro & Tor tambra) as fish rare and high commercial to community livelihood Ecosystem Adiu River have salty pond in the forest as locate drinking and wildlife gather during dry season	Sampling 2017 Sampling 2017
	HCV 4	Ecosystem Adiu river have at least 50 triburary, provides clean water and habit for fresh water fish concumption.	Sampling 2017
	HCV 6	Sigong Klafang Lake, a border between Punan Adiu Village and Setarap Villaage. Locate to many fish	Sampling 2017

Monitoring Fish Biodiversity

To see the sustainability of fish diversity in Punan Adiu, it is necessary to monitor the various fish species, especially those that are endemic, broadly distributed and have high economic value. Monitoring can be done on the cipi fish (*Nematabramis everti*) and Jaran/ semah fis (*Tor soro* and *Tor tambra*).

An easy and cheap method to monitoring fish biodiversty in PLAFV use fishing (Mancing Mentik) and throwing nets

Mancing mentik (traditional fishing method) , is a fishing technique developed by the people of Punan Long Adiu, by way of fishing from a walking boat, throwing a hook and pulling back quickly over and over again. Bait of fruit of maja (available along Adiu river) with main target fish of Jaran / semah. If the fish semah is located around the fishing line that is thrown immediately will draw the bait.

Commonly the fish can spawan twice a year at the time (March and September) the end or the beginning of the rainy season so the normally monitoring can be done twice a year once. Monitoring methods are presented in Table 4

Table 4. Methods Monitoring of fish in PLAFV

Species Target	**Threat**	**Source of threat**	**objective**	**Locate**	**Methode / gear**	**Time**	**Information to Collect**
Nematobramis Borneensis, *Nematabramis evertti*	Fishing, Destruction habitat	Intrenal/ eksternal	Stability of population	Estuary ibauy river Belanai river Adiu river	Throwing net(mezh) 0.5 Inc	March & Septmbr	Prescence and abunance
Tor Soro *Tor Tambra*	Overfishing	Internal / eksternal	Stability of population	Adiu river (estuary ibau river until estuary an river)	Mentik fishing size hook carbon 8,10,12 and line 15-35 lbs, bait Maja fruits	March & Septmbr	Presence and abundance

5. Conclussions & Recommendations

Conclussions

a. Forest Punan Adiu Village, has a unique ecosystem with Adiu River as Main River with at least 50 tributaries. All rivers flowed into the Malino River. The character of the stream is clear, subtract of rocky

b. The diversity of fish in the Aduanu Puata Forest, including 41 species, 24 genera and 10 families
c. Based on the forest area of Punan Long Adiu village is divided into 4 categories: Data Deficient (DD) there is 1 species, 17 species Least Concern (LC), Not Evaluated (NE) 22 species, and Near Threatened (NT) 1 species
d. Punan Adiu traditional forest is a habitat of endemic fish of north Borneo; *Nematabramis everttii* and *Nematobramis borneensis*.
e. Customary forest of Punan Adio become habitat of semah fish. Jaran (*Tor soro*) and (*Tor Tambra*), as rare fish and high economic value

Recommendation

The aquatic ecosystem along with the fish fauna in Punan Adiu can be used to support the direct or indirect harm of the community. For that we need to do the following activities:

a. For the utilization of fish jaran / semah sustainable and perceived together with the whole community needs to be made bottom prohibition by involving custom rules especially between Abot River Estuary and Estuary River Estuary
b. To support the economy of the community, along the Adiu River flow is suitable because of the cascades to be used as a natural tourist rafting
c. Sigung Klafang Lake can be utilized for fish restocking area, as a source of animal protein of the community, but not suitable for sprouts fish sauce, due to the difficult access of artificial fish feed and access from the village and the natural enemy of fish

6. Acknowledgements

We would like to thank all those who have supported the survey activities, especially from the traditional chairman Punan Long Adiu and head of the village Punan Long Adiu. In addition, thank you also to convey to Mr Niko and Mrs Wulan from LP3M , and team in field; Mr Martin, Daniel, Aseng, Ardy, Philipus, Mizon, and Ireng.

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Annex 1 List of Fish Biodiversity Long Punan Adiu Forest

NO	Scientific name	Vernaculare name	IUCN	CITES	Current condition	Drivers / Pressure
1	*AnguilLa marmorata* (Quoy &Gaimard, 1824)	Telakai/ belut besar	LC		rare	Consumed
2	*Barbonymus coolingwoodii* (Gunther, 1868)	Bunau	NE		abundance	Consumed
3	*Barbodes binototus* (Valenciennes, 1842)	Bunau	LC			Consumed
4	*Barbonymus gonionotus* (Bleeker, 1849)	Salap/ lampam	LC			Consumed
5	*Barbodes schwanefeldii* (Bleeker, 1854)	Salap/ lampam	LC		abundance	Consumed
6	Barbodes "sp" adiu	Bunau	NE		less	Consumed
7	Betta dimidiata (Robert, 1989)	bolong/ cupang	NE		less	Not specified
8	*Betta Foerschi* (Vierke, 1979)	bolong/cupang	NE		less	
9	*Betta patoti* (Weber & de Beaufort, 1922)	bolong/ cupang	NE		less	
10	*Channa lucius* (Cuvier, 1831)	edum	LC		rare	Consumed
11	*Channa striata* (Blach,1793)	Haruan	LC		rare	Consumed
12	*Clarias teijsmanni* (Bleeker, 1857)	kutet/ lele	NE		rare	Consumed
13	*Crossocheilos oblongus* (Kuhl & Van Hasselt, 1823)	ancak	LC		rare	Consumed
14	*Anematichthys armatus* (Kuhl & Van Hasselt, 1842)	turing	LC		less	Consumed
15	*Cyclocheilichthys enoplos* (Bleeker, 1849)	turing	LC		less	Consumed
16	*Gastromyzon borneensis* (Gunther, 1874)	dekot	NE		rare	Not specified
17	*Gymnothorax tile* (Hamilton, 1822)	Telakai/ belut besar	NE		rare	Consumed
18	*Hampala ampalong* (Bleeker, 1852)	rungan/ Barau	NE		rare	Consumed
19	*Hampala macrolepidota (*Kuhl & Van Hasselt, 1823)	rungan/ Barau	LC		abundance	Consumed
20	*Kryptopterus lais* (Bleeker,1851)	bilit/ lais	NE		less	Consumed
21	*Lobocheilos bo* (Popta, 1904)	ulom	NE		rare	Consumed
22	*Mystacoleucus marginatus* (Valenciennes, 1842)	Masai	LC		less	Consumed
23	*Mystus nigriceps* (Bleeker, 1846)	cike/ baung	NE		abundance	Consumed
24	*Hemibagrus nemurus*	cike/ baung	NE		less	Consumed

	(Valenciennes, 1840)					
25	*Hemibagrus planiceps* (Valenciennes, 1840)	cike/ baung	NE		less	Consumed
26	*Hemibagrus sabanus* (Inger & Chin, 1959)	cike/ baung	NE		less	Consumed
27	*Nematobramis everetti* (Boulenger, 1894)	cipi	NE		abundance	Not specified
28	*Nematobramis borneensis* (Boulenger, 1894)	cipi	NE		abundance	Not specified
29	*Ompok bimaculatus* (Bloch, 1794)	Laok	NT		less	Consumed
30	*Ophiocara porocephala* (Valenciennes, 1837)	ntek netek	LC		less	Not specifies
31	*Osphronemus goramy* (Lacepede, 1801)	kaluh/ gurami	LC		less	Consumed
32	*Osteochilus waandersii* (Bleeker, 1853)	Unton	LC		less	Consumed
33	*Oxygaster anomalura* (Van Hasselt, 1823)	cipi	LC		less	Not specified
34	*Parachela oxygastroides* (Bleeker, 1852)	lalangfu/ping ping	LC		less	Not Specified
35	*Barbodes everetti* (Boulenger, 1894)	Unton	NE		abundance	Consumed
36	Desmopuntius gamellus (Kottelat, 1996)	turing	NE		abundance	Consumed
37	*Puntius sealei* (Herre, 1933)	Unton	NE		abundance	Consumed
38	*Rasbora caudimaculata* (Volz, 1903)	Beteluh/ seluang batang	LC		abundance	Consumed
39	*Rasbora dusonensis* (Bleeker, 1850)	Beteluh/ seluang batang	NE		abundance	Consumed
40	*Tor soro* (Valenciennes,1842)	Jaran/ semah	NE		abundance	Consumed
41	*Tor tambra* (Valenciennes,1842)	Jaran/ semah	DD		abundance	Consumed

Annex 2. List Tributary in Adiu River (downstream-upstream)

No	Local name " river"	Means :Indonesian name"
1	Maleo river	Person name
2	Bio river	Person name
3	Lung river	bat
4	Lung 2 river	bat
5	Doco river	durio
6	Bunut river	Person name
7	Buco river	Big Lizard
8	Kelop icit river	Small turtle
9	Aren river	Aren plant
10	Tapa peri river	Mysteri name
11	Kelop ayo	Big turtle
12	Deralit river	Big root
13	Laru Luki river	Laru Wood
14	Utai river	Banana leaf to cigarette
15	Mpen river	Blocking wood
16	Betung river	Wood name
17	Aren Mawan river	Itchy effect
18	Anggung river	Flats Root
19	Mpuaran river	Bad smell
20	Belanai river	jars
21	Ann river	Ann wood
22	Beruk river	monkey
23	Kilud river	Forest turtle
24	Urat river	urat wood
25	Bunong river	frogs
26	Buni river	little
27	Riam river	durio
28	Lempang icit river	Smalls pig
29	Lempang ayo river	Bigs pig
30	Abot river	Part of body
31	Serupan river	Cigarette of pipe
32	Tuan icit river	Land slide (small)
33	Tuan ayo river	Land slide (big)
34	Dalop river	Declarations
35	Ibay river	Etnic name
36	Yang river	White stone
37	Bulu river	Bamboo
38	Iben river	Foot thumbs
39	Banya river	Rambutan fruits
40	Benuhu river	axe
41	Betung river	Bigs bamboo
42	Mempong river	Male pigs
43	Uang river	Result

44	Unyang icit river	Small Mountain turtle
45	Unyang ayo river	Big mountains turtle
46	Padenoto river	Leaf to camps
47	Managung river	hidden
48	Hai river	grass
49	Awai river	protected
50	Klawit river	Root
51	Tubuk lunuk river	Hill ranks
52	Jayang river	history
53	Tebukat river	resin
54	Nyang river	leaf
55	Jelunong river	Community people
56	Kejawan river	Long march
57	Klungan river	Fish name
58	Sekitam river	Fish name
59		