

# MIDDLE MAHAKAM CONSERVATION PROGRAM

## TECHNICAL REPORT:

### 2005 Socio-economic Assessment Surveys in the Middle Mahakam Area in East Kalimantan, Indonesia



**YAYASAN KONSERVASI RASI**

**March 2006**

**Sponsored by the Global Nature Fund**

## CONTENTS

	<b>page</b>
PREFACE & ACKNOWLEDGEMENTS . . . . .	i
SUMMARY . . . . .	1
1. INTRODUCTION . . . . .	1
1.1 <i>Background</i> . . . . .	1
1.2 <i>Objectives</i> . . . . .	2
2. SURVEY AREA . . . . .	2
3. SURVEY METHODS . . . . .	3
3.1 <i>Data collection</i> . . . . .	3
3.2 <i>Survey techniques</i> . . . . .	3
4. RESULTS . . . . .	4
4.1 <i>Social economic livelihoods of fishermen</i> . . . . .	4
a. Fluctuation in prices per fish species . . . . .	4
b. Availability of fish resources . . . . .	4
c. Seasonal availability of fish resources . . . . .	6
d. Problems experienced by fishermen . . . . .	6
4.2. <i>Mapping and zonation of fish resources</i> . . . . .	7
a. Protection of fish spawning areas . . . . .	7
b. Mapping of fishing activities and fish spawning areas . . . . .	7
4.3. <i>Fishermen's responses to conservation issues</i> . . . . .	9
a. Utility of Pesut Mahakam . . . . .	9
b. Reason for protecting the pesut . . . . .	9
c. Protected areas for the pesut. . . . .	10
d. Fishermen's willingness to abide to regulations in protected dolphin areas . . . . .	10
e. Fishermen's willingness to engage in more sustainable fisheries . . . . .	10
f. Catch of protected species . . . . .	11
g. Bird breeding protected areas . . . . .	11
h. (Dis-)advantages experienced by local communities from logging and mining activities . . . . .	11
5. CONCLUSION AND RECOMMENDATIONS . . . . .	12
5.1 <i>Conclusion</i> . . . . .	12
5.2 <i>Recommendations</i> . . . . .	12
6. REFERENCES . . . . .	13
APPENDIX I. Questionnaire . . . . .	14
TABLE 1. Number of respondents per village . . . . .	3
TABLE 2. Mean annual catch from top 5 fish species caught between 2000-2005 . . . . .	5
Box 1. Habitat degradation and fish decrease . . . . .	5

## **PREFACE**

Indonesian territory only occupies 1,3% of the earth's surface area, but possesses one of the highest biodiversity in the world: 10% of all plant species, 12% of all mammal species, 16% of all reptile and amphibian species, 17% of all bird species and 25% of fresh- and saltwater fish species. This rich diversity not only represents a natural heritage, but also contains some human life-supporting systems, some goods and transport systems, which support the health, life and prosperity of the community. Some 40 million people (almost one-fourth) of the total number of inhabitants in Indonesia directly depend on the natural resources for their survival from the production of coastal and inland fisheries, small-scale, and occasional collection of wood products, and culture-products from fruits, vegetables and spices that origin from "natural" plants. Conservation of several natural ecosystems and diversity as well as natural transport systems are of utmost importance for economic development for several production sectors in Indonesia, such as forestry, agriculture and fisheries, health, science, industry and eco-tourism.

Protection and use of natural resources in a sustainable way requires an understanding and knowledge of the ways in which ecosystems function and interact to maintain a natural and healthy environment. This report summarizes the results of biodiversity and socio-economic assessment surveys that were conducted between April and May 2005 in order to obtain the latest information on faunal diversity and management/ use of natural, aquatic resources in particular fisheries in the Middle Mahakam Area and lakes.

These surveys represent an initial phase within the project "Zonation and management planning of the Mahakam wetlands and lakes in East Kalimantan". This project is conducted by Yayasan Konservasi RASI (Conservation Foundation for Rare Aquatic Species of Indonesia), supported by Global Nature Fund (GNF) and is part of the Middle Mahakam Conservation Program, which has been running since 2001.

The project's main goal is to establish a community supported and law-enforced zonation design for critical wetlands, lakes and river habitat in the Middle Mahakam Area (MMA) with regards to extractive, restricted and prohibitive use of natural resources and bird, fishspawning and freshwater dolphin protected areas.

We are very grateful for the support of all people and organizations, which have supported our efforts. In the first place we would like to thank Udo Gattenlöhner and Bettina Jahn from Global Nature Fund for their trust in our capacity to conduct the activities and their support. We also thank Dr. Sumaryono and Dr. Sigit Hardwinarto (Forestry Faculty, Mulawarman University) and Dr. Christian Goenner.

We also would like to thank our field assistants Hikmatullah, Suimah, Faisal, Firman, Leli and Lusy. Furthermore, we would thank the Local Government of West and Central Kutai Districts, the local communities of Muara Pahu, Tanjung Isuy, Kota Bangun,

Muara Kaman and Semayang villages and sub-districts for their participation in our activities.

**Samarinda, 6 March 2006,**



Budiono, Ir.

Executive Director  
Yayasan Konservasi RASI  
P.O. Box 1105  
Jl. Pandan Harum Indah  
(Erlisa), Blok D, No. 87  
Samarinda, Kalimantan Timur  
Indonesia  
Tel/ fax: + 62.541.206406  
E-mail: [yk-rasi@samarinda.org](mailto:yk-rasi@samarinda.org)  
[http://www.geocities.com/yayasan\\_konservasi\\_rasi](http://www.geocities.com/yayasan_konservasi_rasi)

---

**Socio-economic Assessment Surveys in the Middle Mahakam Lakes and Wetlands Area in East Kalimantan, Indonesia, 2005****by Syachraini<sup>1</sup>, Danielle Krebs<sup>2</sup>, & Budiono**

<sup>1</sup>Program coordinator, <sup>2</sup>Scientific Program Advisor, <sup>3</sup>Executive Director.  
Yayasan Konservasi RASI, P.O. Box 1105, Jl. Pandan Harum Indah, Blok D, No. 87,  
Samarinda, Kalimantan Timur, Indonesia. Tel/Fax: + 62.541.206406,  
E-mail: [yk-rasi@samarinda.org](mailto:yk-rasi@samarinda.org), [http://www.geocities.com/yayasan\\_konservasi\\_rasi](http://www.geocities.com/yayasan_konservasi_rasi)

**Summary**

A socio-economic assessment survey among 230 respondents, which are actively involved in fisheries, was conducted in April 2005 in the Middle Mahakam Area in East Kalimantan, Indonesia. This survey is part of the “Middle Mahakam Conservation Program” to determine zones for the protection of dolphin-, breeding birds-, and fish-spawning sites to safeguard biodiversity and future fish potential and familiarizing fishers with more sustainable fishing (production), processing and marketing methods. From the interview surveys, we found that fish resources have been decreasing in time as well as in species diversity. Pressure on fish resources results from the economic price inflation whereas fish prices have remained stable so that fishermen need to intensify their fishing activities. Fishermen mostly attributed the fish decrease to electro-fishing but also to logging and mining activities. They overall agree upon establishment of protected fish spawning and dolphin areas and are willing to engage in alternative sustainable fisheries (aqua-culture) if support in the form of low-interest loans or subsidized spawnlings/ fish food is provided to overcome the initial pre-harvest investment period. The alternative fisheries will benefit fish-stock recovery and dolphin conservation through decreased use of gillnets and related entanglements.

**I. Introduction****1.1. Background**

Indonesia represents one of the richest tropical countries in relation to biological diversity. Due to increasingly higher human living standards, pressure on natural resources also increases and causes a decrease in biodiversity. Human awareness on the importance of protection of natural resources is still relatively low.

Conservation has recently started to become a common public discussion topic for many Indonesians after a series of natural disasters occurred in a short time span (e.g. tsunami, flooding, forest fires, landslides) as a result of human-caused environmental damage or which could have been less destructive if environmental precautions were taken (a.o. protection of natural coastal and hill-forest vegetation).

Compared with developed countries such as the United States, which had already gained an environmental awareness at the beginning of the 20<sup>th</sup> century, Indonesian policy only became concerned with conservation some two decades ago as a result of international pressure. Although several laws and regulations have been developed since then, there has been no actual enforcement of these laws so far.

In East Kalimantan Province many unique ecosystems exist varying from dipterocarp low- and highland rainforest to mangroves and wetlands areas with peat swamp forests. In

these last areas many communities along the Mahakam River try to make their living as fishermen. In order to assess how sustainable these livelihoods in fact are and in order to provide information for future planned zonation management of these areas, Yayasan Konservasi RASI aided by sponsorship of the Global Nature Fund (GNF) has conducted a socio-economic assessment survey in the Middle Mahakam Area, where most fishing activities take place. This area includes the main river and tributaries as well as lakes and wetlands area in the districts of Central and West Kutai.

Besides gathering information on fisheries from structured interviews, we also hope to obtain support from the local communities and government to establish conservation areas for important fish spawning areas and the “Critically Endangered” freshwater Irrawaddy dolphin (*Orcaella brevirostris*) or locally named Pesut Mahakam.

## 1.2. Objectives

The objectives of the socio-economic assessment survey are:

1. Assess development of fisheries in the Mahakam based on qualitative and quantitative fisheries aspects.
2. Understand which constraints local community experience in fish resource exploitation and management.
3. Gain support of local community in establishing conservation areas for spawning fish, breeding birds and the freshwater dolphin Pesut Mahakam.

## II. Survey Area

Interview surveys were held in two districts within East Kalimantan Province, i.e. Central Kutai (27.263,1 km<sup>2</sup>) and West Kutai (31.628,7 km<sup>2</sup>). The survey area covered the Middle Mahakam Area (between 180km and 380km upstream), which is richest in fish resources including several minor and three large lakes and tributaries (Figure 1). The three largest lakes are Danau Semayang (± 13.000 Ha) and Danau Melintang (± 11.000 Ha) in Central Kutai and Danau Jempang (± 15.000 Ha) in West Kutai.

On a landscape level, these lakes and wetlands play an important buffer role for the natural regulation of the Mahakam River and also downstream human settlements. Recently, the hydrological controlling function has greatly decreased and villages often get flooded during the rainy season. The quantity and quality of the lakes water has also decreased as a result of human activities. The following impacts have been identified:

1. High sedimentation rates (1-2 cm/ year) due to the opening of forested swamp areas for agriculture, coal-mining and oil-palm plantations, together with extensive logging and forest fires in areas connected with the lakes. This is visible from the water colour. Sedimentation is directly responsible for the detected decrease in fish resources and increase of aquatic weeds (*Eichornia crassipes*), *Salvinia natans*, *Panicum colonum*, *Panicum stagninum* and *Mimosa nigra*.
2. High rates of phosphor from fertilizer and soap-products were detected, which also cause an increase in aquatic weeds.
3. Pollution occurs through fishing methods, which use poison and pesticides used in farming. Also, relatively high ammonium levels were found from domestic and agricultural waste products.
4. Overfishing and unsustainable fishing techniques such as electro-fishing have caused a decline in fish resources.

### III. Survey methods

#### 3.1. Data collection

Interview methods were structured with 30 open questions but interactive and respondents were encouraged to discuss and talk about their fish catch results, available fish resources and the sustainability of their livelihoods. Also they were encouraged to discuss about their opinion towards conservation of fish resources and the Pesut Mahakam. In this way, a large quantity of valuable information was gathered in a more familiar manner.

The number of respondents was minimal 20 persons per village on average and totaled 230 respondents. Thirteen villages in two different districts were interviewed.

**Table 1. Number of respondents per village**

No	Village/Area	Sub-district	District	Total Respondents
1	Gunung Bayan	Muara Pahu	Kutai Barat	5
2	Muara Bolowan	Muara Pahu	Kutai Barat	5
3	Kampung Baru	Muara Pahu	Kutai Barat	20
4	Muara Pahu	Muara Pahu	Kutai Barat	20
5	Tanjung Isuy	Tanjung Isuy	Kutai Barat	20
6	Tanjung Jone	Tanjung Isuy	Kutai Barat	20
7	Sebemban	Muara Wis	Kutai Kartanegara	20
8	Muara Wis	Muara Wis	Kutai Kartanegara	20
9	Semayang	Kahala	Kutai Kartanegara	20
10	Melintang	Kota Bangun	Kutai Kartanegara	20
11	Pela	Kota Bangun	Kutai Kartanegara	20
12	Muara Siran	Muara Kaman	Kutai Kartanegara	20
13	Muara Kaman	Muara Kaman	Kutai Kartanegara	20
<b>TOTAL</b>				<b>230</b>

#### 3.2. Survey techniques

The interview survey lasted 13 days. One full day was spent in each village. Four team members conducted the interviews and each obtained 5 respondents/ day / village. The interview period was determined by field conditions. During the dry season many fishermen are very busy during the day catching fish, whereas during the rainy season fishing activities drastically dropped, especially since many villages got flooded and fishermen worked on the restoration of their houses. Therefore, most interviews were conducted in the fishermen houses.

## IV. Results

From 30 different questions related to fisheries and conservation that were asked, we have compiled the following interview results:

### 4.1. Social-economic livelihoods from fishermen

#### A. Fluctuation in prices per fish species

Species that are most often caught by fishermen are Kendia (*Thynnichthys thynoides*), Biawan (*Helostoma temmincki*), Repang (*Chela oxygastroides*), Haruan and Baung (*Mystus nemerus*). For all fish species prices since 2001 until April 2005, have remained rather stable except for Haruan/ Gabus (*Ophiocephalus striatus*) (Fig 1). However, fuel prices have increased with 100% between 2001- and April 2005 and living costs and prices of other costs have increased with 30%. In September 2005, fuel prices have increased again by 100% and, therefore another survey is needed to determine the effects of this last price increase on the socio-economic livelihoods of fishermen communities.

The reason that fish prices did not increase between 2001 and April 2005 following the price increase of other products, is that all respondents sell their fish to middlemen that collect all the fish and sell the fish again at markets downstream. Individual fishermen do not have the means to transport their fish and sell at other markets by themselves. Even though fish may be sold at higher prices, when subtracting for transport and other costs, profit will be similar as when they sell to the middlemen. Only the fish species Haruan has increased in price because it is much consumed in fresh and dried form by the community in East Kalimantan and is marketed in Samarinda and Balikpapan, but also outside East Kalimantan.

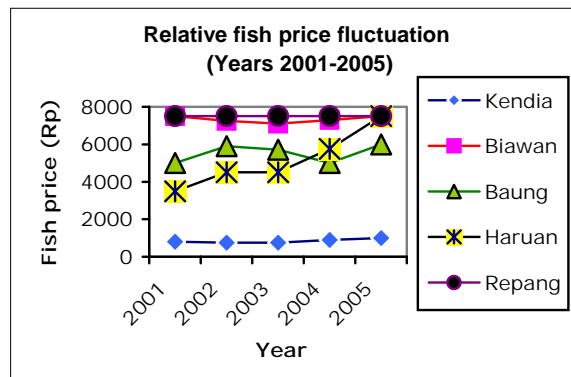


Fig. 1. Fish price fluctuation between 2001 – 2005

#### B. Availability of fish resources

According to most of the respondents (63%) fish catch has been decreasing between 2000-2005 except for Haruan fish (Table 2), whereas 9% experienced an increase and 28% said that their fish catch fluctuated over years. The decrease in fish catch in combination with the prices for fish that have more or less remained stable between 2001-2005 (inspite of a 30% increase in livelihoods costs) underlines the difficult economical position of fishermen. The fish catch decrease also indicates that there is over-fishing of economically valuable fishes, which is unlikely to put a hold to since the pressure on fish resources will remain intensive or even become more intensive after the latest 100% fuel price increase in September 2005 in order to sustain livelihoods. Respondents attributed the decrease of fish catch to 1) increased



competition caused by population growth and increased human needs, 2) decrease in quality of the river as a result of pollution.

**Table 2. Average annual catch (kg) from top 5 species of fish that are most often caught between 2000-2005 by 230 fishermen in the Middle Mahakam Area.**

Species	Fish Catch (Kg) Year						Condition
	2000	2001	2002	2003	2004	2005	
Kendia	150	120	100	80	80	80	Decrease
Biawan	65	60	65	55	45	30	Decrease
Haruan	35	30	35	35	25	30	Relatively stable
Repang	75	80	65	50	40	35	Decrease
Baung	20	15	16	10	12	8	Decrease

Besides overfishing and unsustainable fishing techniques, habitat degradation may also cause the decrease of fish resources as explained in Box 1.1.

**Box. 1- Habitat degradation and fish decrease:**

Of all species caught by fishermen, one carp species has become more and more rarely caught, i.e. Belida (*Notopterus borneensis*). This species is at the top of the food chain and may be a good indicator species for the decrease in river water quality (Furtado 1966; Lee 1981) because it is very susceptible to contamination and habitat disturbance (Kottelat et al . 1993; Scott 1989). Habitat degradation occurred because of upstream logging causing sedimentation, pollution from mining- and agricultural- waste products, and the illegal use of electro-fishing, which effects breeding and survival of this fish species.

Sedimentation stimulates aquatic plant growth in the river and lakes through the availability of high nutrients. However, an excess of aquatic plants cause a decrease in oxygen and increased acidity through decomposition. Logging of riparian forest also increases the surface current and decreases shade, which causes a temperature rise. Especially, in slow-flowing waters such as in the lakea and swamps, the high temperatures, low oxygen and high nutrients cause eutrophication and increased acidity, making the habitat less suitable for white-fish species such as Cyprinids and during excessive growth also more resilient black-fish species may not survive.

High temperatures also increase the fishes' demands for oxygen, but lower the affinity of their haemoglobin for oxygen. During periods of drought, this can lead to mass fish mortality (Santiapillai and Suprahman 1984). Increased sediment loads due to logging of riparian forest also directly impacts on fisheries because suspended sediment and flocculated iron salts can accumulate on the gills of certain fish, causing death from suffocation (MacKinnon *et al.* 1997). Furthermore, in parts where water is flowing slowly, silt settles on the bottom and can smother food resources, eggs and spawning grounds, as well as reducing the depth and width of channels or lakes (MacKinnon *et al.* 1997).

### C. Seasonal availability of fish resources

In general, fishermen's activity and fish catch depends on the seasonal and river conditions. From all respondents from 13 villages, we found that most fishermen (87,4%) catch most fish during the dry season (after flooding), whereas a minority caught most fish at high water levels (8,7%) and 3,9% answered that this was variable.

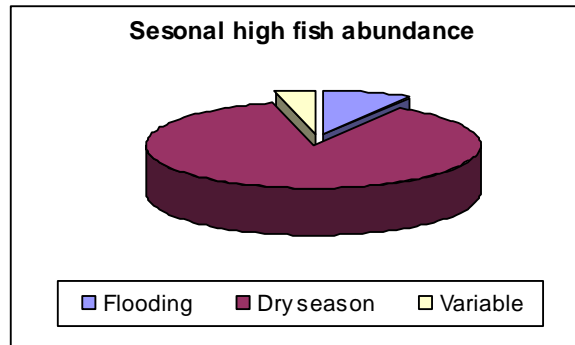


Fig. 2. Seasonal differences in fish catch.

During the dry season fish can be more easily caught because the decrease in water levels of the lakes causes fish to move into the main river channel, where they are an easy prey because the catch area has become much smaller and chance to catch fish is higher.

Flood plain areas are very important fishing areas (Giesen 1987). At high water levels, fish move high up the tributaries and lakes. Cyprinid fishes are important consumption fish that are dominant in rivers in Kalimantan (Roberts, 1989). These fishes spawn on the floodplains and their eggs mature very fast and may hatch in only a few days (Lowe-McConnel 1977). When water levels decrease, fish move back in open water areas or river channels, which have become more narrow and shallow and competition for feeding occurs among predator fishes, birds, and other predators, such as humans (Giesen 1987).

### D. Problems experienced by fishermen

Fishermen responded that they experienced the following problems:

- Use of illegal fish-techniques (electro-fishing)(19,6% of respondents).
- Transport of large coalbarges in a narrow tributary, which often collide with the river banks thereby destroying underwater logs where fish spawn and destroying their nets (7,8%).
- Natural disturbance such as flooding, which has become more and more unpredictable over the years and animals that destroy their nets (otters) (56,5%).
- Competition in fishing (13,5%).
- Selling their fish on the market (10,4%)

Of all the problems fishermen experience, most are very concerned with electro-fishing. They consider that if many people use electro-fishing, this will cause a drastic decrease of fish resources over years. Also, most fishermen (84%) responded that they did not agree with electro-fishing technique (Fig. 3).

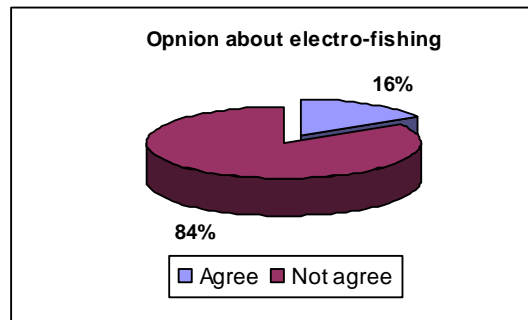


Fig. 3. Respondents' opinions about electro-fishing.

A small minority, which appeared to reside in a few villages where all fishermen engage in electro-fishing, agreed on electro-fishing because it represents a fast way to catch a large quantity of fish. They also mentioned that they believe that the fish stock in the Mahakam is still abundant and do not think about the future supply.

#### 4.2 Mapping and zonation of fish resources

##### A. Protection of fish spawning areas

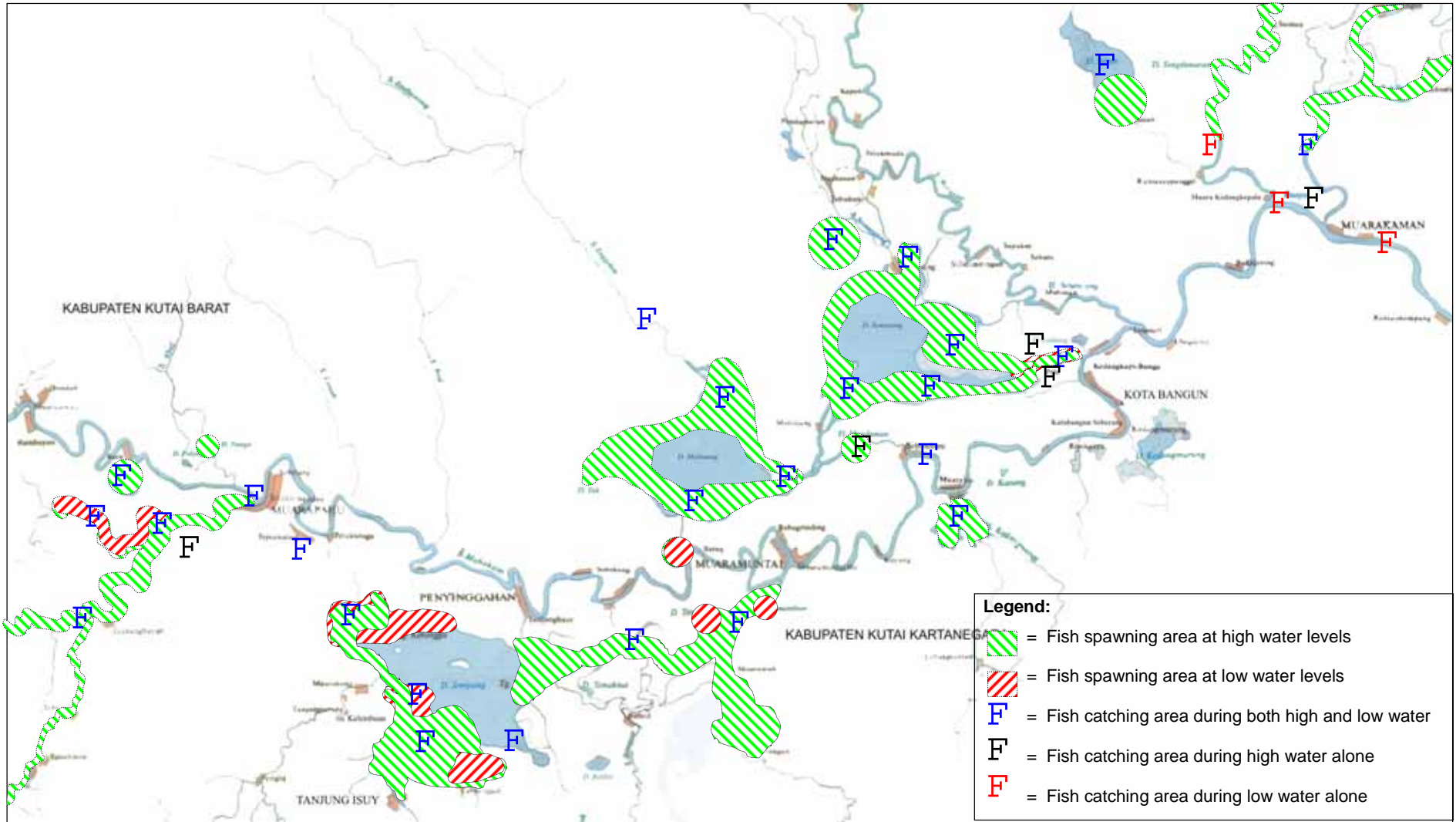
From the interviews, it became clear that there are no regulations or agreements on the use of fish spawning areas, except for the older reserves, which were set up during the Kutai Muslim Sultanate some 500 years ago, such as Loa Kang and Batu Bumbang, and which are locally managed under Kutai Regency since 1978 (*Perda Kabupaten Kutai No. 18, 1978*). In the village of Muara Siran, some community discussions were initiated by local fishermen to protect Siran Lake and exclude fishing activities, but there was no final decision yet at the time that the interviews were done. In relation to the zonation of protected areas of fish spawning areas in the Mahakam and lakes, nearly all respondents agreed on their establishment (97%), mostly in order to prevent the further decline of fish stock. Also, almost all (98%) agreed that no fishing should be allowed in protected fish spawning areas. For villages in the lakes such as Tanjung Isuy and Tanjung Jone in Jempang Lake, the villages of Melintang and Semayang in Semayang and Melintang Lake respondents expressed their hopes that there will be still areas left in the lakes where they are allowed to fish, because the lakes represent the only source of income for them, which should not be completely turned into a protected area.

##### B. Mapping of fishing activities and fish spawning areas

Based on the interviews we found that most fish spawn in the lakes and river edges, in particular of tributaries. Spawning usually occurs during flooding within 1-2 months per year. After high water recedes, many fish leave the lakes via small tributaries, so that many fishermen catch fish at the mouths of tributaries and lakes. These are also prime feeding areas for freshwater dolphins (Kreb & Budiono, 2005).

Fish spawning areas according to fishermen during the dry and wet season are presented in Figure 4. Lakes and tributaries in the Middle Mahakam Area have the highest fisheries potential, which is caused by the lower number of settlements in these areas and the higher occupancy of riparian forest. Chan (*et al.*, 1985) explained that high trees along the edges provide shadow and nutrients by decomposition of fallen leaves and fruits. Rivers with high forest cover are very rich in fauna with many fish species (such as Cyprinidae), shrimp and insects and are important fish spawning areas.

Fig. 4. Zonation of fishing activities and fish spawning areas in the Middle Mahakam Area, Kalimantan Timur



**4.3. Fishermen’s responses to wider conservation issues**

**A. Utility of Pesut Mahakam**

In principal, the occurrence of the freshwater dolphin pesut benefits many residents (79,6%) of all respondents) along the Mahakam River. A minority (7,8%) responded that the pesut did not bring any benefits and 12,6 didn’t know what kind of benefits.

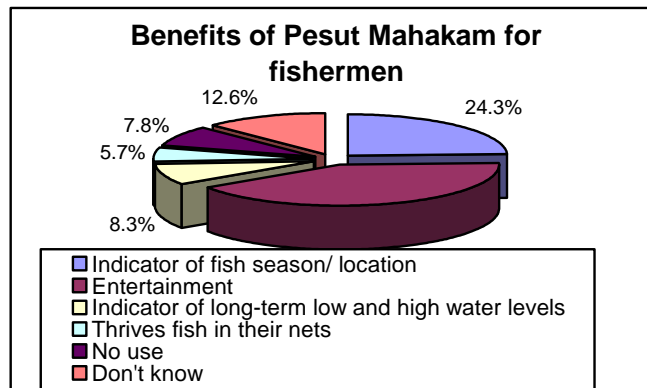


Fig. 5. Utility of the pesut for fishermen.

The following direct or in-direct benefits of the pesut are mentioned by the respondents:

1. They indicate the right time and location for fishing activities. If the pesut often appears in specific locations, this indicates that these areas are rich in fish.
2. They indicate when water levels will decrease or increase. When pesut is moving upstream in large numbers far into tributaries, this means that a prolonged high water season started and when many pesut are moving downstream, this signified the onset of the dry season.
3. They are entertainment for the local community.
4. Pesut helps in thriving fish into the direction of fishing nets when they are feeding close to the shore. On the other hand, they also often destroy part of the nets.
5. A small percentage was not aware of the utility of the pesut because they reside outside the dolphin area, for example in Jempang Lake.

**B. Reasons for protecting the pesut**

Most residents are aware that the population of the pesut has been decreased over time. All respondents agreed that conservation efforts are needed and should be implemented for the following reasons (Fig. 6):

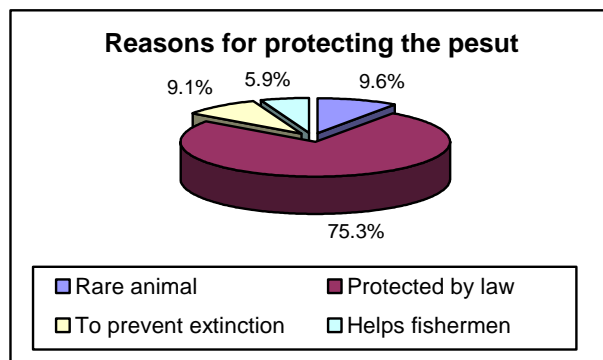


Fig. 6. Reasons from local fishermen for protecting the pesut

### C. Protected areas for the pesut

When respondents were asked what they conceived as the best to protect the pesut, most answered that the pesut should be protected in-situ.

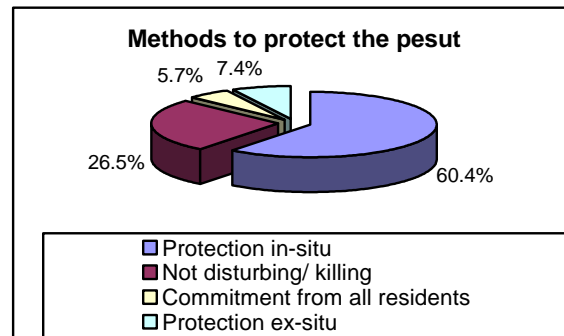


Fig. 7. Respondent ideas of methods to protect the pesut

When discussing further conservation efforts to protect the pesut by establishing protected dolphin areas, nearly all respondents (97%) agreed with this. Nevertheless, they hope that the protected area will not prevent fishermen's daily efforts to find fish. These answers indicate that the education awareness campaigns, which were conducted by Yayasan Konservasi RASI in the dolphin areas have received a positive response from the local communities. Therefore, we hope that in the near future, the local government, NGO's and local communities will work together in order to protect the pesut and natural (fish) resources in the Middle Mahakam Area.

### D. Fishermen's willingness to abide to certain regulations in the protected dolphin area

Nearly all respondents (98%) agreed with the regulations, which are planned to be set in the protected dolphin area: mesh-size not larger than 10cm; nets cannot be set out at night or at crucial spots (not in confluence area and only parallel to riverbanks); regular checking of gillnet.

### E. Fishermen's willingness to stop gillnetting and engage in more sustainable fisheries

The majority of fishermen (55%) in the MMA and all fishermen in the dolphin proposed protected area in Muara Pahu, expressed their willingness to stop gillnetting and engage in more sustainable fisheries, which would reduce over-fishing (pre-depletion) and prevent dolphin entanglement. They agreed on the alternative fisheries form that involves breeding fish in floating cages, which uses fish spawn and food not derived from the river, under the condition that they can use subsidized initial spawnlings and fishfood or low-rent loans as initial investment to construct the cages and buy fish-spawnlings/food. This investment is needed to overcome the first pre-harvest period. This type of fisheries would benefit dolphin conservation and fish stock resources. Currently, 80% of deaths (mean of 5 dolphins per year) are caused by gillnet entanglement, especially in dolphin core areas (Kreb & Budiono, 2005). In Muara Pahu an example project of this type of sustainable fisheries is set up with the hope to interest other fisheries and convince local government.

### ***F. Catch of protected species***

From the interviews it appeared that no protected species are hunted, but some protected bird species are caught as juveniles and raised outside on their floating rafts (e.g. Lesser Adjutant). They are not aware though that these are protected species and therefore, it is important to produce a poster with protected species that occur in their areas and distribute in the villages.

### ***G. Bird breeding protected areas***

Most fishermen (92%) also agreed on the protection of bird breeding protected areas, where they may not approach with their engine turned on.

### ***H. (Dis-)advantages experienced by local communities from logging and mining activities.***

The increase of logging and coal-mining has both positive and negative effects for fishermen, but mostly negative (Fig. 8).

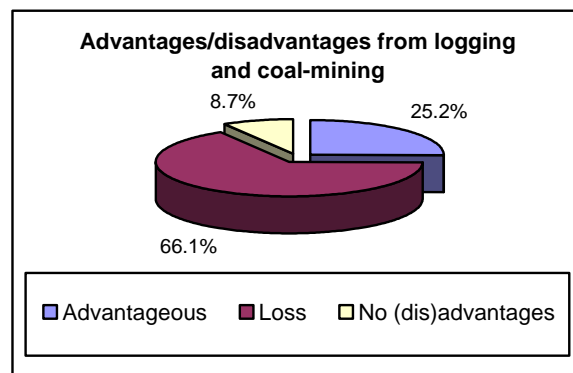


Fig. 8. Impacts of logging and coal-mining on individual livelihoods.

The following disadvantages or losses are felt by fishermen as a result of the logging and mining activities; a decrease in fish catch, pollution caused by coal that is spilt in the river during loading and transport, obstruction of fishermen transport (motorized canoe) and destruction of fishing gear due to logging waste products and transport of large coalbarges (this last activity only affects fishermen in Kedang Pahu tributary). A minority mentioned as advantages that logging as side-activity may generate extra income. In addition, financial compensation is provided to some fishermen that live in floating houses along the tributary where daily coaltransport takes place.

---

## **V. Conclusion and recommendations**

### **5.1. Conclusion**

Fish resources in East Kalimantan have been decreasing in time both in species diversity well as in quantity. This is caused by the unsustainable exploitation of natural resources without any consideration for future resources.

Logging and mining activities have negatively impacted natural resources in East Kalimantan. Based on the interview survey, we found that these activities disrupt the river-(shore) ecosystem and communities due to logging and mining waste including transport of coalbarges that destroy riparian fish spawning areas. The loss of shade caused by logging of riparian forest and increased sediments cause a decrease in natural living resources.

Protection efforts of the critically endangered and only freshwater dolphin species in Indonesia, the Pesut Mahakam, has received a positive response from the local communities that share the dolphin habitat. All respondents agreed upon the establishment of a protected area of the habitat of the pesut under the condition that they will not be limited in their daily fishing activities.

### **5.2. Recommendations**

1. Regular patrols and law-enforcement are needed in order to stop illegal fishing techniques and to protect natural fish resources so that local communities can subsist from fisheries in a sustainable way.
2. Increasing the care and awareness of all layers of society, i.e. community and government, with regard to sharing the responsibility of conservation of natural resources.
3. The socio-economic assessment surveys should be repeated since the survey that is represented in this report was conducted before the 100% increase of fuel prices in September 2005. The socio-economic position of fishermen and the impacts on environment may therefore be totally changed compared with the previous situation.



---

## VI. References

- Chan, L., Kavanagh, M., Cranbrook, Earl of, Langub, J. & Wells, D.R. 1985.** Proposal for a conservation strategy for Sarawak. WWF Malaysia/State Planning Unit of Sarawak, Kuching.
- Crowther, J. 1982a.** The thermal characteristics of some West Malaysian rivers. *Malay. Nat.*
- Furtado, J.I. 1980.** Freshwater swamp and lake resources: a synthesis. Dalam *Tropical ecology and development*. (ed. J.I. Furtado), International Society of Tropical Ecology, Kuala Lumpur.
- Giesen, W. 1987.** Danau Sentarum wildlife reserve. Inventory, ecology and management guidelines. WWF/PHPA, Bogor, Indonesia.
- Kottelat, M., Whitten, A.J., Kartikasari, S.N. & Wiroadmodjo, S. 1993.** The freshwater fishes of western Indonesia and Sulawesi. Periplus. Singapore.
- Kreb, D. & Budiono. 2005.** Conservation management of small core areas: key to survival of a Critically Endangered population of Irrawaddy river dolphins *Orcaella brevirostris* in Indonesia. *Oryx*, **39** (2), 1-11.
- Lee, H.S. 1981.** Silvicultural management options in the mixed dipterocarp forest of Sarawak. M.Sc. thesis, Australian National University.
- Lowe-McConnel, R.H. 1977.** Ecology of fishes in tropical waters. *Studies on Biology* **76**. Edward Arnold.
- MacKinnon, K., Hatta, G., Halim, H. and Mangalik, A. 1997.** The ecology of Kalimantan. *The ecology of Indonesia series* 3. Oxford University Press: 152.
- Roberts, T.R. 1989.** The freshwater fishes of western Borneo (Kalimantan Barat, Indonesia). California Academy of Sciences. San Fransisco.
- Santiapillai, C. and Suprahman, H. 1984.** An ecological study of the riverine habitats in the Way Kambas Game Reserve. WWF, Bogor.
- Scott, N.J. 1976.** The abundance and diversity of the herpetofaunas of tropical forest litter. *Biotropika* **8** (1): 41-58.

# Appendix 1. Questionnaire

## A. Fisheries

1. Does your fishing activities provide you with sufficient income to sustain your livelihood?
2. Is your fish catch increasing or decreasing in years?
3. What type of fishing gear do you use and how much do you catch on average with each type of fishing gear during the abundant fish season?
4. If you use a gillnet, what is the mesh size? For which reason, you use this particular type of mesh size?
5. At what time do you set your net and when do you take the fish?
6. Do you check your net in between? How long after you set the net and how often (interval time)?
7.
  - a. Please mention which fish species you catch the most (top 5)!
  - b. How much kg on average per day per species do you catch during the abundant fish season. Please compare between years from 2000 onwards.
  - c. Are the species that you catch in- or decreasing?
8. From the top 5 species, how much is the price per kg when comparing between years from 2000 onwards?
9. What kind of problems do you experience in your profession as fisherman?
10. In your opinion, what should the government do or can they contribute in resolving this problem?
11. What do you think about electro-fishing? Do you agree or not and for which reasons?
12. Can you locate fish spawning areas in or near the area where you fish (please mark on the map)?
13. Is there any regulation about fishing activities in these fish spawning areas?
14. Do you think that there should be regulations about area usage, i.e. areas where fishing is allowed, seasonal use and non-fishing areas? Please explain.

## B. Conservation

1. Did you ever see Pesut Mahakam? When and how often?
2. Did you ever see or heard about a dead pesut? How did it die?
3. Do you think that the presence of pesut brings benefits? Please explain.
4. Do you think that the pesut needs to be protected? Provide reason.
5. If they need to be protected, what method do you consider best?
6. Do you have any benefits or suffer any losses from forest fires and mining activities? Please explain?
7. Do you understand how to release a dolphin that got entangled in a gillnet. How? (interviewer also provides info here).
8. Did you ever see or hear about someone catching protected animals? If yes or if this would happen, did or would you report to the police?
9. If the area where you usually catch fish becomes a fish(spawning) reserve or protected area for the pesut, do you agree to stop the use of gillnets in that area? And if some alternative modal is provided to engage in sustainable aqua-culture using subsidized initial spawnings and low-rent loans?
10. If you don't agree, what kind of initiative should be provided by the government?
11. Do you agree if there are protected areas for fisheries, breeding birds and dolphins?
12. Do you agree if in the protected dolphin area some regulations apply with regards to the mesh size of gillnets (should not be larger than 10cm); nets cannot be set out at night or at crucial spots (not in confluence area and nets should only be set parallel to the riverbanks); regular checking of gillnet. If you don't agree please provide a reason.
13. Do you agree if you are not allowed to fish in fish spawning areas? If not, please explain.
14. Do you agree if bird breeding areas are protected and you may not approach with your engine turned on? If not, why not?