LAKE SEMAYANG AND MELINTANG, EAST KALIMANTAN, AS THE HABITAT OF FRESHWATER DOLPHIN

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ABSTRACT

Semayang and Melintang are floodplain lakes, the lake water level are influenced by the Mahakam River. Annual water level fluctuation is up to four meters, implicates a flooding regime and modified the waler quality, aquatic plant, and fish composition. Freshwater Dolphin (*Orcaella brevirostris*, Gray 1866) or in local name is *Pesut* inhabited the Mahakam River, between Muara Kaman to Long Iram, spread out as far as 250 km. Lake Semayang and Melintang are one of the Dolphin habitat in Mahakam River system. The availability of fish in Semayang and Melintang lakes, especially whitefish group (Cyprinidae), fulfill the need of Dolphin food. Over fishing in Semayang and Melintang lakes is a threat to Dolphin existence, besides high sedimentation rate which shallow the lake, and due to mechanized water traffic.

INTRODUCTION

Lake Semayang and Melintang are two out of many lakes located in the Mahakam floodplain system. The Mahakam floodplain system is a vast of complex inland waters, which are interconnected one with another, and finally to Mahakam valley. These inland waters include the bigger lakes Semayang (13 000 ha), Melintang (10 000 ha), and Jempang (15 000 ha), and smaller lakes Siran (750 ha), Batubunbun (450 ha), Loakang (400 ha), Jantur (200 ha), Kahoypongkol, and Balikpapan. They are surrounded by freshwater swamp forest and peat swamp forest. The area is inhabited by a large number of people. The Mahakam River is important for transport besides other domestic needs.

SEMAYANG -MELINTANG AS A FLOODPLAIN LAKE

Semayang and Melintang are part of the Mahakam floodplain area that are influenced by the fluctuation of Mahakam River water level. It could be called as floodplain type lakes. This interaction affects the physical, chemical, and biological condition of the lake, which can fluctuate very extremely on annual period.

The area of Semayang and Melintang watershed as sub Mahakam watershed reaches 2430 km^2 (Schuettrumpf., 1986 *in* Fakhrudin, 1996). The flooding areas of both of the lakes are relatively small compared to the watershed area. On the other hand the depth of the lake is very shallow, indicate that the influence of the river is very important. Unquestionably that, the quality and quantity water of the lake is determined by river water which flow into and out of the lake.

Lake Semayang has two main water inputs, the first one comes from the south, it is Melintang River as the outlet of Lake Melintang, and the second one is Semayang (Kahala) River coming from the north. Lake Melintang has also two main water inputs, that is, Enggelam River in the north and a small stream coming from Mahakam River in the south. The outlet of Semayang lake is Pela River that connects the lake and Mahakam River (Fig. 1). River Pela can act as the inlet Lake Semayang when of the water surface of Mahakam River rises.

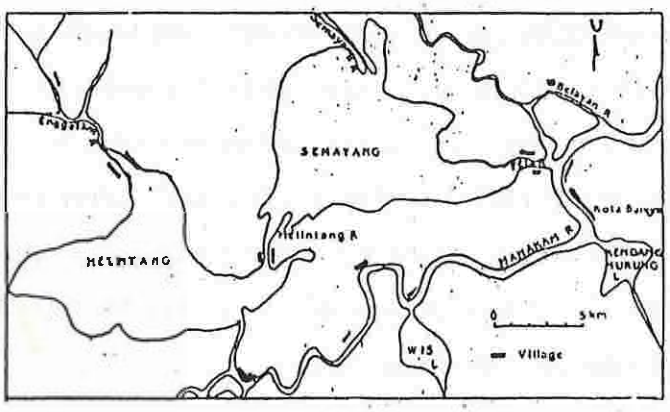


Figure 1. Lake Semayang and Melintang Situation

Water Level Fluctuation

Water level in Lake Semayang is the implication Mahakam River water level fluctuation, as a result of the changes of the level rain fall in the watershed. Besides, in this area Mahakam River lies under the influence of the sea tide, which varies from 0.5 to 1.5 m (Anonymous, 1995). The water level fluctuation observed in Kota Bangun is about 4 - 6 meter, with the highest occurred twice usually in May and October (Christensen *et al*, 1996). Fakhrudin (1997) gives the regression pattern of Mahakam River water level fluctuation in Kota Bangun with the water level at Pela River (Outlet Semayang), as follows:

$y = -2.95 + 1.0267\ x$; r: 0.9968 (1979 - 1984)

y = the hight of water level at Pela Station

x = the hight of water level at Kota Bangun Station

(after Fakhrudin, 1997)

The water level fluctuation at Lake Melintang shows the monthly water level fluctuation of approximately 110 - 210 cm, and yearly fluctuation of approximately 405 cm. Water level fluctuation at Pela River, from September 1995 to August 1996, shows the maximum water level at the end of November 1995 and the minimum water level in the middle of August 1996. The fluctuation of water level reaches 3.8 meter (Fig. 2).

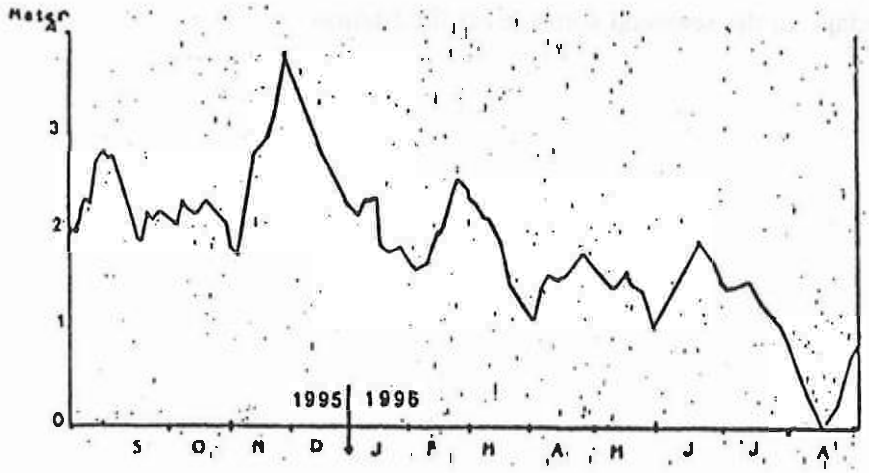


Figure 2. The water level fluctuation of Pela River (September 1995 - August 1996)

Flooding Regime

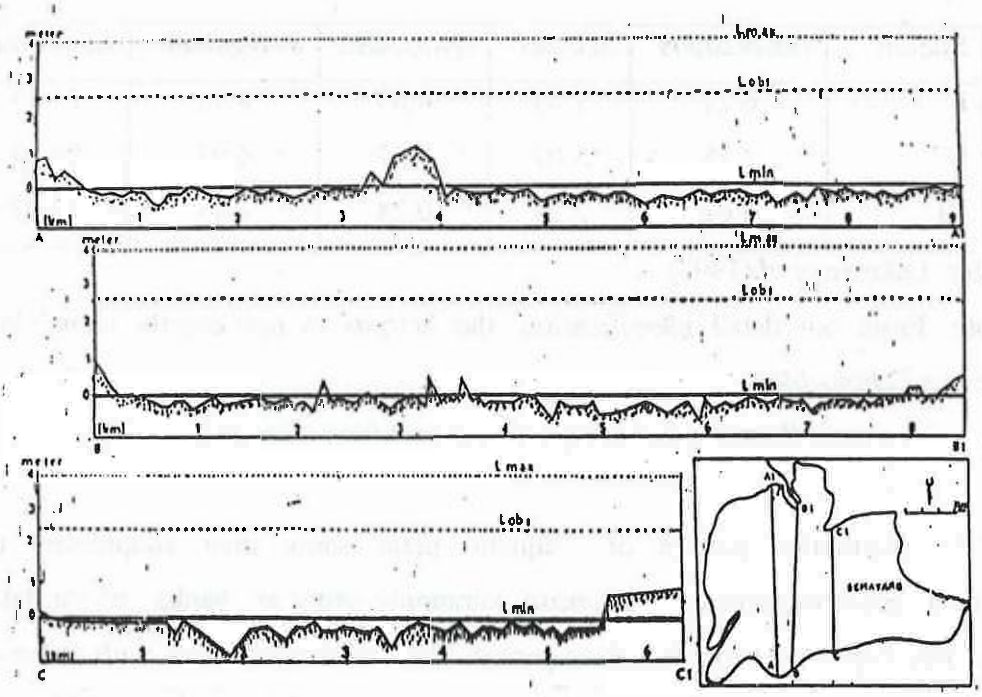
As the consequence of the progressive water level fluctuation, part of the flooding area (*drawdown* area) which are shallow will become dry for a certain period, and will become wet in other period. The drawdown area will suffer extreme change during the dry season, especially at shallow flooding area, they become fertile for the growth of certain aquatic plant. In the rainy season however, the area will be flooded and the plant will be drowned and decayed. It is an important detritus resource that becomes the feed of detritus feeder.

At the minimum water level (middle of August 1996), estimated that 60% the bottom of the lake appear to the surface of the lake. In places where the depth is about 15-20 cm, they are cultivated with paddy. In other places, the bed appeared, is around 10 - 40 cm, upper lake waters surface (Anwar *et al*, 1997).

The Characteristic of Aquatic Plant

Aquatic plants are important part of flood plain system. Seasonal water level fluctuation as mention above, is the possible cause for changing aquatic plant coverage composition. Welcomme (1979) explained that aquatic plant in floodplain is characterized by the small number of species, especially plants that are able to adapt to the seasonal water level fluctuation.

Figure 3. Diagonal appearance of flood regime on three meridians lines in Lake Semayang



Lmax : maximum water level (end of November 1995)
Lobs : observated water level (middle of Januariy 1996)
Lmin : minimum water level (middle of August 1996)

Figure 3. Diagonal appearance of flood regime on three meridians lines in Lake Semayang

The plants contribute directly as the feed source of herbivore and detrivore fish. Indirectly, as attachment substrate for some groups of invertebrate like insects, which become the food source of various fish, or as egg's attachment substrate for certain fish.

Lake Semayang and Melintang have, at least 17 species of the aquatic plant. *Eichornia crassipes* and *Mimosa nigra*, is the most, *Scirpus grossus*, *Polygonum barbatum*, *Fimbristylis dichotoma*, and *Nymphaea* sp., is much (Purnomo, 1993).

From field observance, the density of the dominant aquatic plant is about 0,28 - 29,53 kg/m^2 (Table 1).

Table 1. Biomass (kg.wet. weight/m^2) of some the aquatic plant at lake Semayang and Melintang, December 1994

Station	*Fimbristylis*	*Scirpus*	*Nymphaea*	*Polygonum*	*Eichornia*
I	6.27	1.83	0.63	8.32	21.13
II	2.75	5.02	1.67	4.93	29.53
III	5.62	2.28	0.28	4.43	17.07

After: Lukman *et al* (1995)

Note: From our detail identification, the *Scirpus* is not exactly name, but identified as *Echinochloa stagnina* (Beauv.) and *Ishaemum intermedium* (Brogn.).

The disribution pattern of aquatic plant show their adaptibility to environment condition change. *Mimosa* commonly grow at banks of the lake which is only flooded in a relative short period. The *Fimbristylis* lies with dense at the banks of the lake, on the depth where the roots can reach the substrate although the water rises. When the water level is low, *Fimbristylis* will grow in the plain as soon as the plain dry. Some *Eichornia* is found aggregated with *Fimbristylis*, and the biggest part spread on the open waters. *Barbatum* is usually found at the bank where the river flows, for example at the bank of Pela, Melintang, and Semayang River. When the low water level, the *Scirpus* grow and blooming at shallow muddy area, and flooded when the water rises, and die.

Water Quality

The change of water quality apparently concure with the water level fluctuation. This happens not only because of the change in quantity so that dilution will began, but also the processes that increase current strength, decomposition of plants when flooded, and solution of mineral from the dry land after flooding. Some water quality parameter that undergo changes resulting form water level fluctuation

are dissolved oxygen (DO), turbidity, conductivity, pH, suspended solid (SS), and other nutrient content..

The water quality condition of Lake Semayang in May 1997, characterized by some parameters represent the drawdown lake water condition. The water condition when the lake was shallow (on the central area about 43 cm), shown with high turbidity and SS content. The intensive wind blows were considered cause that, if compared with the condition of the two inlets. The features of conductivity seem the combination of both inlets. Eventhough it can be seen that the one, Semayang River (inlet two) was relatively small. Many of the sources Semayang River has passed the marshes, therefore, the ionic composition of the water were low, marked by the low level conductivity.

Welcomme (1979) explain that backwater rivers that come from the forest have low concentration of dissolved ions. Seeing the content of the total nitrogen (N-total) and total phosphate (P-total), it seems that inlet two gave relatively high contribution, guessed coming from the decomposition processes in swamp area, which is also high. While the content inlet one N-total and P-total content are far little. This presumed that it has connection with a part the water source come from Mahakam. The high of dissolved oxygen in the lake presumably result of the active photosynthesis process.

The change water quality dynamically, which happened only five days could be observed at Pela River as the outlet of Lake Semayang. In the middle of May 1997, the lake had fallen, but three days later the water level rose, reaching one meter. Perhaps it was because the rain in up stream and high tide on the coast, water from Mahakam entered Pela River very past. Three days later the river drew again.

After the short flooding changed occurred, the increase of pH, content of SS, hardness, conductivity, and P-total, but turbidity, and N-total were decrease (Table. 2).

Table 2. Water quality of Lake Semayang on May 1997

No	Parameter		Inlet 1*	Inlet 2*	Lake *	Outlet*	Outlet**
1	DO	(mg/l)	5.5	3.1	8.0	7.3	5.1
2	pH		5.5	5.4	7.0	6.2	7.0
3	Temperature	(°C)	28.3	29.4	28.5	28.7	27.2
4	Turbidity	(NTU)	84	62	200	182	109
5	Conductivity	(mS/cm)	0.017	0.013	0.014	0.015	0.037
6	Hardness (mgCaCO3/l)		7.84	7.84	11.76	13.73	15.67
7	SS	(mg/l)	44.0	18.0	52.5	32.0	111.0
8	P- total	(mg/l)	ud	0.011	0.001	0.003	0.007
9	N-total	(mg/l)	0.030	0.064	ud	0.080	ud

Note: Inlet I : Melintang River; Outlet : Pela River,; * : 18 May 1997
Inlet II : Semayang River; ud : undetectable; ** : 23 May 1997

On that condition, of the effect dilution, turn over, and solution by water took place simultaneously. Dilution effect happened to the turbidity because the water of Mahakam River is clearer. Effect the swift current made it possible for the turn over the water, caused the increase of the SS content. Solution process of mineral and nutrient from the bed lake, could happen when the dry land become flooded. This is shown by the increase of conductivity and hardness Pela River. The turn over of water process might also happen in the anaerobic areas, caused the decrease DO content, which also caused decrease of the N-total content.

Fish Composition

There are 33 species of fish found in the Semayang and Melintang waters, 13 of which are include *blackfish* group (swamp fish) (Table 2). According to Welcomme (1979), the fish community in the floodplain can be distinguished based on their behavior response to flooding condition. *Whitefish*, especially Cyprinidae, is a group of fish avoid from severe condition on floodplain when the dry season by migration to the main river channel. *Blackfish* have considerable resistance to

deoxygenated condition. Their movement is more limited compared with those of *white fish*, and they often remain in the standing waters of floodplain during the dry period. The group of Siluridae, Ophiochepalid, Anabantid, and Osteoglossid are included on the *blackfish* group.

Table 2. Fish Species of Lake Semayang and Melintang, Spatial Strategi, Main and Additional Feed

No	Scientific Name	Local Name	Spatial * Strategy	Main** Food	Additional** Food
1	*Helostoma temmincki*	Biawan	BW	P;D	-
2	*Anabas testidineus*	Pepuyu	BW	T;	S; I; D; F
3	*Trichogaster pectoralis*	Sepat Siam	BW	P;D	-
4	*Trichogaster tricopterus*	Sepat Rawa	BW	P;D	-
5	*Pristolepis pasciatus*	Tempe	BW	I	T;C
6	*Mystus nemurus*	Baung	BW	F	-
7	*M. nigriceps*	Kelebere	BW	F	-
8	*Leiocassis stenosus*	Tangkara	BW	ta	ta
9	*Ophiocephalus striatus*	Gabus	BW	F	-
10	*O. lucius*	Kesong	BW-WW	ta	ta
11	*Oxyeleotris marmorata*	Bakut	BW	ta	ta
12	*Clarias leiacanthus*	Keli	BW	D;F	-
13	*C. batrachus*	Lele	BW-WW	ta	ta
14	*Rasbora argyrotaenia*	Seluang	WW-BW	ta	ta
15	*Barbichthys laevis*	Berukung	WW-BW	P;D	-
16	*Callichrous bimaculatus*	Lepok	WW-BW	F	-
17	*Chella oxygasteroides*	Lalang	WW	I	T; F
18	*Thinnichthys vaillanti*	Kendia	WW	D	P
19	*Osteochilus kelabau*	Kelabau	WW	P	D
20	*O. hasselti*	Puyau	WW	D	T;P
21	*O. repang*	Repang	WW	ta	ta
22	*Osteochilus* sp.	Curing	WW	P;D	T;
23	*Puntius schwanefeldi*	Salap	WW	ta	ta
24	*P. nini*	Pahat	WW	ta	ta
25	*Leptobarbus hoeveni*	Jelawat	WW	T; I	D;F;C
26	*Cryptopterus micronema*	Lais	WW	F	T
27	*C. apogon*	Bentilap	WW	ta	ta
28	*Macrognathus acueleatus*	Sisili	WW	ta	ta
29	*Arius maculatus*	Gagok	WW	ta	ta
30	*A. thallasinus*	Lampa	WW	ta	ta
31	*Pangasius micronema*	Lancang	WW	ta	ta
32	*P.nasutus*	Patin	WW	ta	ta
33	*Cynoglosus wandersi*	Sebelah	WW	ta	ta
34	*Toxotes jaculator*	Sumpit	WW	ta	ta

After : *) Hartoto (1997) Note : T:Plant; P : Plankton; F : Fish;
**) Purnomo *et al* (1992) S:Snail; D : Detritus; I : Insect;
C:Crayfish; ta : no data.
BW : Blackwater Fish
WW : Whitewater Fish

Considering Riyanto (1995), it is known that the highest of fish species diversity found at Pela River. This can be understood because Pela River is the ecoton area between Mahakam River and Lake Semayang. The fish that exist are the combination of both ecosystems, or the combination of *white fish* and *blackfish*.

Biawan (*H. temmincki*) apparently has the widest distribution pattern with dominant level of population in Lake Semayang. Biawan is known have high adaptability to minimum oxygen content, because have a additional respiratory organ. Besides that the food of Biawan is detritus, which is available in Lake Semayang.

Based on seasonal pattern, whitefish dominate Lake Semayang at high level water. Whereas at low level water, the whitfish are only prominant in Pela River. In the middle part of the lake and in Melintang River, the composition of *white fish* and *blackfish* are balanced. In the high water level water, the *white fish* can enter the open water of lake, on the other hand, the *blackfish* will return to the shore of the lake and live among the aquatic plants. At the low water level, both *white fish* and *blackfish* are concentrated in the lake which becomes shallow. When the low water level, only *blackfish* that can resist acidity (pH 4,5) will survive in Semayang River.

Detritus is the main food of Semayang fish, and the detrivore fish dominate the lake (Purnomo, *et al*, 1993). Predator and detrivore fish show high proportion in floodplain area (Welcomme, 1979). The predatory fish in Lake Semayang are Gabus (*Ophiocephalus striatus*), Keli (*Clarias leiacanthus*), Lempok (*Callichrous bimaculatus*), Baung (*Mystus nemurus*), and Lais (*Cryptopterus micronema*). The detrivore fish are Biawan (*H. temmincki*), Berukung (*Barbichthys laevis*), Sepat siam (*Trichogaster tricopterus*), Sepat rawa (*T. pectoralis*), dan Puyau (*Osteochilus hasselti*).

FRESHWATER DOLPHIN (*PESUT*) COMMUNITY

Freshwater dolphin (*Orcaella brevirostris*) is one of the mammals that lives in freshwater ecosystem. *Pesut* is the local name of freshwater dolphin. Legakul (1967) *in* Priyono (1994) mentioned that the mammals live in muddy beach and estuary, distribute between Bengal Bay until the South China Sea, including the Malaka Strait, the East Coast of Malaka, Kalimantan, and Java. According to Sudjoko (1988), besides in Mahakam River, Pesut is found in Irawadi River (Burma), and Mouth River of Passur (East Pakistan). In the taxonomy structure, Pesut is class Odontoceti (toothed whales), ordo Delphinidae (Ocean dolphin), family Delphinidae, and genus *Orcaella*. A mature Pesut length can reach 2,1 meter, with 100 kg in weight.

Pesut from genus *Orcaella* is included into insufficiently known species (IUCN, 1988 *in* Priyono *et al*, 1993), so that have not been classified as vulnerable or even endangered species. Indonesian Government, however, has tried to protection by issuing Ministry of Agricultural Decision No. 35/Kpts/Um/I/1975. Eventhough the attempt to protect the natural habitats, have not been done. The attempt to conserv Pesut *in situ* has ever been propose by Hardjasasmita (1978) *in* Anonymous (1978) and Malik (1984).

The main food of Pesut is *white fish*, especially from Cyprinid group i.e., Berukung (*Barbichthys laevis*), Repang (*O. repang*), Kendia (*T. vaillanti*), Curing (*Osteochilus* sp.), and Salap (*P. schwanefeldi*), also from Anabantid group that is Biawan (*H. temmincky*) (Hardjasasmita *in* Anonymous, 1978). From the Pesut rearing experiment on captivity, known that the consumption rate, in this case, given ikan Mas (*Cyprinus carpio*) is 6,0 kg/day (Tas'an, 1985 *in* Priyono, 1994).

Distribution of Pesut in Mahakam System

Area of distribution of Pesut in Mahakam , ranges from Mahakam River around Muara Kaman to Long Iram, which stretches ± 250 km. Hardjasasmita *et al*., (1978) *in* Suwelo (1984) gave details of those area covering Mahakam River

around Muara Kaman, Pela River Mouth to Mahakam, Pela River, Lake Semayang and Melintang, Wis Mouth River, around the Lake Batubunbun (Muntai River), Mahakam River around Melak, and Long Iram. It is also reported at that time, the Pesut population in whole Mahakam was about 100 - 150 Pesut, and 200 in all. In August 1995 the writer found about two groups of Pesut in Pahu River, which is Mahakam tributary from southern Muara Pahu.

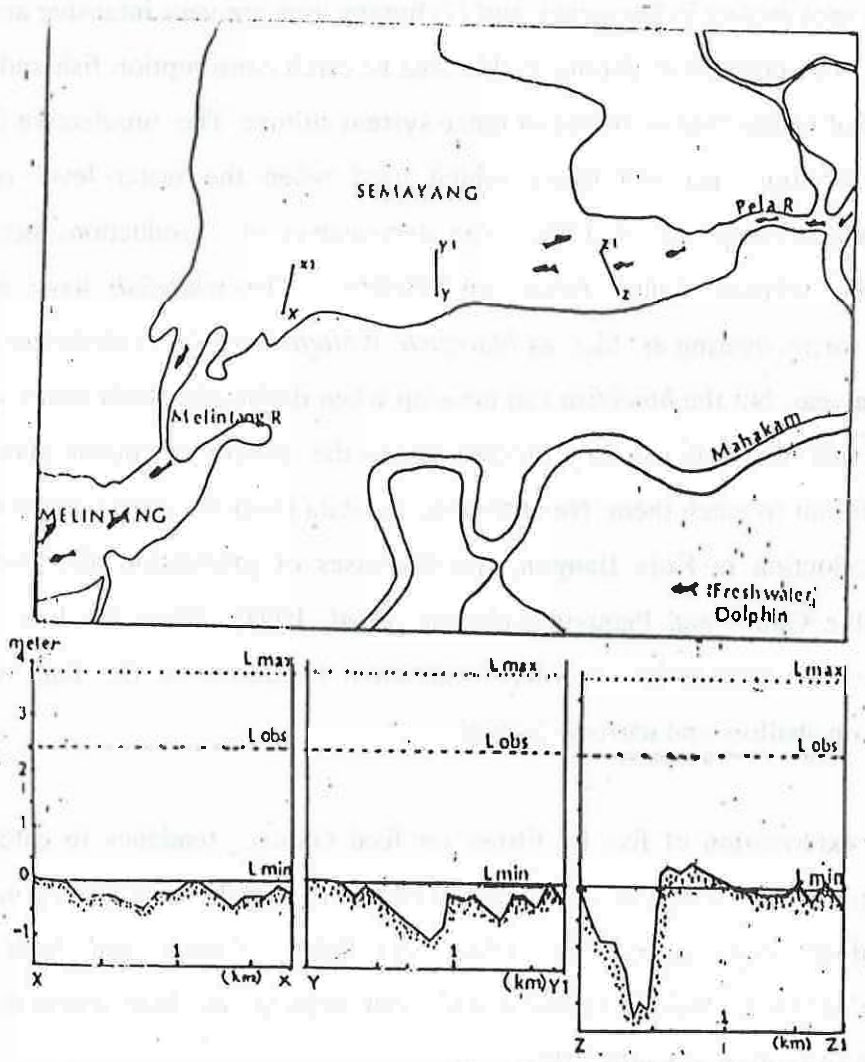
The Specifik Needs of Pesut in Semayang and Melintang

Around the outlet of Lake Semayang and Pela River, outlet Melintang and Melintang River is known as concentrate of Pesut population (Fig. 4). The habitat condition supports enough the existence of Pesut, primarily the depth aspect ($\geq$5.0 m), the water quality, and the availability of food i.e., sufficient fish (Priyono, 1994). Then it is mentioned that the down stream of Lake Semayang and Melintang are the *feeding ground*. The *playing grounds* are the down stream Lake Melintang until Melintang River, down stream Lake Semayang until Pela River, and Pela River Mouth to Mahakam. The *resting ground* is Melintang River and Pela River.

The down stream Lake Semayang and Melintang chosen as feeding ground can be understood. This area is supported by the provision of food. The Pela River is known to have enough various fish, even in low water, the *white fish* which is the food of Pesut are sufficient (Riyanto, 1995). The down stream of Lake Melintang has also high concentration of fish (Gunawan, 1997). In both areas lie location of the fish reservation, Loakang around the Pela River, and Berduit and Kedemba Bay around Melintang which is believed to be supporting factor to Pesut existence (Hartoto, 1997; Gunawan; 1997). Daily behavior of Pesut, include feed activity and playing in down stream lake Semayang and Melintang in the morning. They move out to Pela River, after the lake water warmer, and while searching the food they go to deeper part in Mahakam River. Pesut backs to Pela River and Lake Semayang for searching the food and playing in the afternoon. In the night time, they rest on the channel of Pela River. In Melintang area, the movement of Pesut is limited, they are isolated by shallow part of the lake (Priyono, 1994).

Existing Problems

The disturbance of the Pesut Habitat in Semayang and Melintang area has been explained by Priyono (1994). The problems involve the over exploitation of fish, the shallowness of the lake, and the busyness water transportation.



Note: L max: maximum water level (end of November 1995)
L obs : observed water level (middle of January 1996)
L min : minimum water level (middle of August 1996)

Figure 4. Pesut distribution in Lake Semayang and Melintang (after Priyono *et al.*, 1993) and the depth of several parts of river channel in Lake Semayang

According (19..) *in* Anonymous (1991), mentioned that the sedimentation rate of East Kalimantan lakes reached 1 - 2 cm per year. In the fig 4 can be seen the depth several parts of channel river in Lake Semayang, that connects Pela River to Melintang. In the low water level season, the water is very shallow and make it impossible for Pesut to get across. It is right to say that Melintang Pesuts have a very limited movement because they are isolated, and it is often reported that many Pesut are trapped in this area. (Priyono, 1995; Gunawan, 1997).

Fish exploitation in Semayang and Melintang area are very intensive and tend unselective. The purpose of fishing in this area to catch consumption fish and small fish for feed of Gabus that is reared in fence system culture. The unselective fishing gear are encircling net and trawl, which used when the water level is low. According Christensen *et al*, (1986) the decreasings of productions occur on *white fish* like Jelawat, Salap, Pahat, and Belida. The *white fish* have not an opportunity for recovering as like as *blackfish*. *White fish* can be exploited in a long time of the a year, but the *blackfish* can develop when during the high water season. Because on that time they can be protected among the swamp or aquatic plant area, and very difficult to catch them. Nevertheless, the data from the open water's system fisheries production in Kota Bangun, the decreases of production also occur on *blackfish* like Gabus and Pepuyu (Lukman *et al*, 1994). When the low water season, the fish exploitation is very intensive. In this time the fish will be concentrate on shallow and narrow channel.

The exploitation of fish by liftnet for feed Gabus, tendency to catch the small fish (juvenile). Based on report of Lukman *et al* (1994) some of Cyprinid fish that as food of Pesut catched by liftnet, like Salap, Curing, and Pahat. The requirement of fish for food of Gabus is very high, because the food conversion rate reaches 1 : 6 (Nasution & Sadili, 1991).

The conservation attempt to reserve genetic resources of fish done by establishing a fish conservatory in Loakang, around the Pela River. It seems ineffective, there are still, in fact, fishermen who enter the reserve area (Lukman, 1997)

Being the means of transportation connecting Mahakam and villages in the sides of Lake Semayang and Melintang, and short cuts to small villages along Semayang River. The area around Pela River is very busy with the water traffic. The Mahakam River it self is the most important means of transportation in East Kalimantan. It is important commercially.

The water quality of Mahakam River has already indicated to decrease. Although do not disturb yet the Pesut lives, but early precaution must be taken. Purnomo *et al*, (1992) said that the condition of Mahakam River environment around Samarinda city showed the tendency to decrease, caused by various industrial waste from coal mine, lumber, sawmill, and domestic waste. The observation done in Mahakam River by Lukman *et al*, (1995) from Muara Pahu to Samarinda, had the increase of SS content and total organic matter (TOM) on the sediments.

Alternative for Conservation

Establishment of conservation pratises that cover the areas of Lake Semayang, Melintang, Pela River, and surroundings, Muara Alok, to Muara Muntai (Batubunbun) has been proposed. In 1994 it was recommended to reserve and conserve the endanggered species. An attempt to emphase and extend the fish reservation area must be done around Loakang reserve and around the Melintang Lake, i.e., Teluk Kedemba and Teluk Berduit. To overcome high sedimentation rate, the watershed condition of Mahakam River as a whole has to be managed in one overall environmental panning.

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