Dai Fishery in the Tonle Sap River of Phnom Penh and Kandal province (including a Review of the Census Data of 1996-97)

by

Ngor Peng Bun

Fisheries Officer, Department of Fisheries and Counterpart of the MRC/DoF/Danida Fisheries Project in Cambodia

1. Abstract

The bag net fishery known as the Dai fishery is a large scale fishing practice which takes place from October to March each year during the so-called open fishing season. A Dai is a stationary trawl positioned in the river to capture "white" fish species migrating out of submerged areas around the Great Lake and Tonle Sap River to the Mekong River. The migration is strongly influenced by the lunar phase.

During 1996-97 fishing season, the Department of Fisheries conducted a census survey of the Dai fisheries in order to find out what each Dai was catching. This collected data allowed a stratification of the Dais for sampling purposes.

This paper describes the catch rate changes in the Dai fishery, which are influenced by the lunar phase and the velocity of the receding floodwaters. It also shows that the number of hauls is critical for catch estimation, particularly in the time window of 6 – 1 days before the full moon. Haul frequency increases in correspondence to increased fish migration.

The annual variations occurring in this fishery in overall yield and trends in species composition and average species length provide a good measurement of the status of the white fish stocks in the country.

The relationship between the size of the Tonle Sap area that is annually flooded and Dai fishery yield will be discussed.

2. Introduction

The bag net fishery or Dai fishery was introduced to Cambodia in the years 1873-89 (Tana, 1998). It is one of the large-scale inland water fisheries of Cambodia. It operates only in the lower part of the Tonle Sap river about 4-35 kilometers north of Phnom Penh.

Its operation starts in October and lasts till March in the open season when the water flows from the Great Lake and its surrounding submerged areas to the Mekong River allowing a large number of fish to migrate downstream through the Tonle Sap River. From a previous study it can be seen that the fish catch of the Dai fishery peaks in December and January during full moon (Lieng *et al.,* 1995).

The Dai fishery plays an important role in the annual fish supply of rural people and contribute significantly to food security (see figure 3.7, 3.8, 3.9 and 3.10). It also contributes a significant portion to the total catch of the freshwater fisheries in Cambodia (Deap, 1998). The Dai fishery during the period from 1994 to 1997 contributed 4 - 5 % to the total annual inland fish production (including the catch from family fisheries and rice fields) of 290,000 to 430,000 tons (Deap *et al*. 1998; Ahmed *et al.,* 1998).

A new data collection scheme using a new sampling design was introduced in 1994. Length frequency data collection of some common "white" species was carried out during the 1995-96 and 1998-99 fishing season. During 1996-97 fishing season, the Department of Fisheries conducted a census survey of the Dai fishery in order to find out what each Dai was catching. This collected data provided useful information for a stratification of the Dais for sampling purposes. The results of this survey and the average lengths of some "white" fish species are presented here.

3. Data collection

Of the 63 Dai units in operation in 15 rows 25 units (row 1-6) are in Phnom Penh and 38 units (row 7-15) are in Kandal province. It was the intention of the DoF to carry out a census, ie. measuring all catches made by all Dais in operation between October 1996 and March 1997. All data collectors were the staff of the Department of Fisheries and of Phnom Penh and Kandal fisheries offices. The data collectors were supposed to stay at the Dai unit for 24 hours to observe and constantly record every catch per haul and the time between the successive hauls. However, in reality only 49 % of the total Dai effort could be monitored because it was difficult to sustain the monitoring effort continuously. Census catch sheets were provided to every data collector for this survey. The observation was mainly focused on the catch per haul and number of hauls per day. These two main factors are very critical for catch estimation.

4. Data Analysis

The collected census data was sent to the project center and entered into the Electronic Spreadsheet software for processing, analysis and estimation of Dai catch and effort.

LENFREQ and ARTFISH – computer software – designed by Stamatopoulos, 1995 are also used to input length frequency and catch data of Dai fishery for processing and analysis. The results are presented in this paper.

5. Results and discussion

5.1 Catch rate changes in the Dai fishery (1996-97)

Figure 3.1: Catch rate changes in the Dai fishery from October 1996 to March 1997 on a lunar month basis

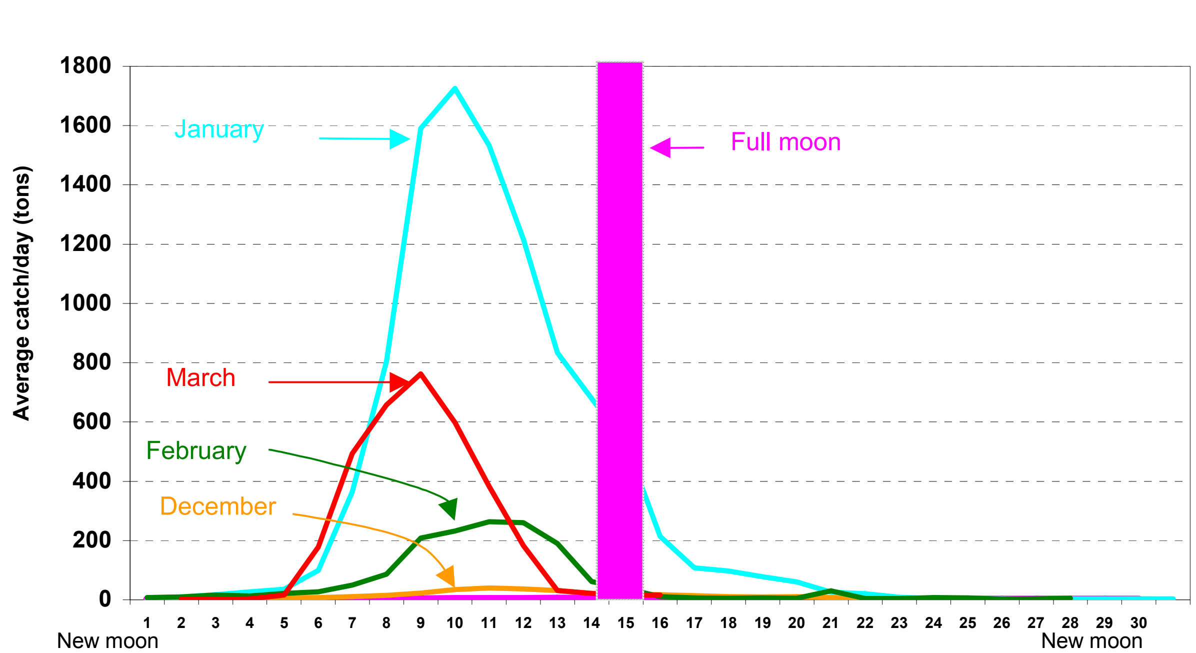


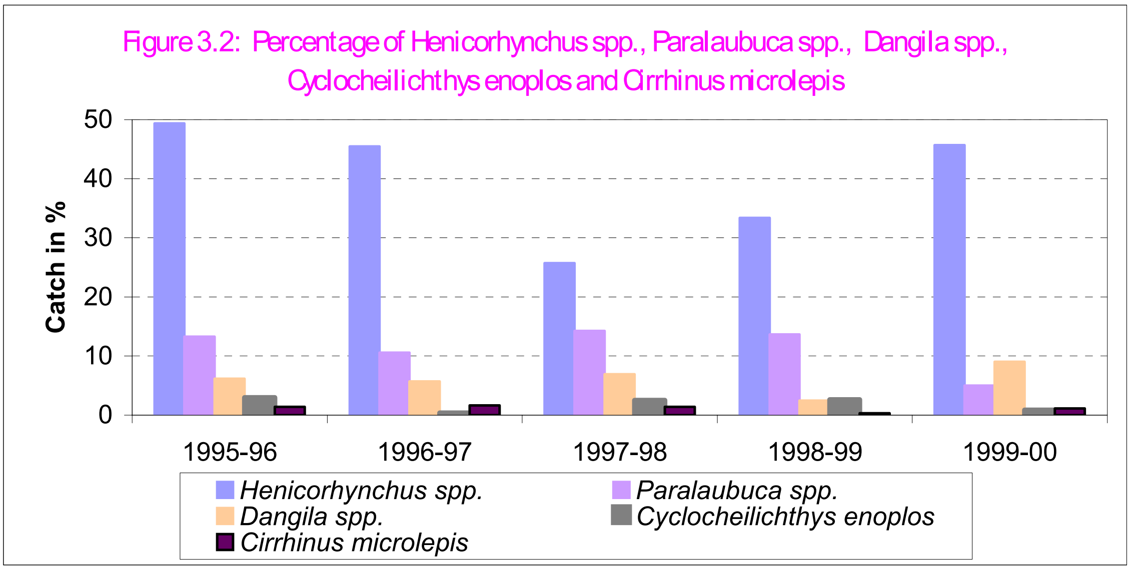
Figure 3.1 shows the results of catch rate changes in Dai fishery data census during 1996-97. From December to March, the catch rate per day started to increase from the 6th day after new moon. The catch was peaked from 9th to 12th moon after the new moon or 6-3 days before the full moon (see

figure 3.11). During these peak periods, the average catch of the 63 units per day was around 34 tons in December, 1,600 tons in January, 240 tons in February and 600 tons in March. The catch rate started to decrease gradually from the 13th until 30th day of the lunar month which is called the dark moon period. There was no clear peak before the full moon in October and November. The average catch of the 63 Dai units per day was 1.04 ton in October and 2.36 tons in November.

Outside the peak periods, the average catch per day was around 6 tons in December, 28 tons in January and 7 tons in February. In March all Dais stopped their operation after the full moon because the water velocity had become very slow and fish migration stopped. To improve estimation of the fish catch from Dai fishery, all Dais were stratified into two groups. The cumulative percentage of the catch of all Dais was used to rank the Dais by yield. The group of high-yielding Dais contributing 50 percent to the total catch was taken as one stratum and the rest of the Dais as the other.

It is important to note that large and medium size fish species such as *Pangasianodon gigas* (see figure 3.12), *Catlocarpio siamensis, Probarbus jullieni, Cirrhinus microlepis, Pangasius spp., Cyclocheilichthys enoplos* etc. are usually caught in October and November. In contrast, in the peak period of December, January, February and March, the Dai fishery usually catch small fish species such as *Henicorhynchus spp.*, *Paralaubuca spp., Dangila spp.* etc. We also have the impression that some important fish species such as *Cirrhinus microlepis* (Pruol), *Pangasius spp.* (Pra), *Cyclocheilichthys enoplos* (Chhkok) etc. were caught in larger numbers 4-5 years ago than now. The 1995-99 Dai fishery data show that there has been a change in catch composition. As shown in figure 3.2, *Henicorhynchus spp.* is still the most abundant by far. It just slightly changes between 1995-96 and 1999-00 fishing season. *Cirrhinus microlepis and Cyclocheilichthys enoplos* show decreasing trends from 1995-96 to 1999-00. In contrast, *Dangila spp.* shows an increase in percentage to the total catch from 6.2% in 1995-96 to 9.1% in 1999-00.

This is probably because of the sharp increase of monofilament gill nets and purse seines in the last 10 years (Van Zalinge *et al.*, 1999) which have increased fishing mortality on their migration routes.



5.2 Relationship between average catch per haul and average number of hauls per day

The number of hauls made by each Dai varies from one Dai unit to another even though they are in the same row. It also fluctuates from month to month. The observations show that the number of hauls from October to February is strongly correlated with the catch per haul. The higher the catch per haul, the higher the number of hauls (see Figure 3.3). However, in March or sometimes in February when the water velocity becomes slower, the frequency of number of hauls is lower even though the catch per haul is very high. During this period the bag net is replaced by the U-shaped net and the operation technique changes from only lifting the bag net at the cod-end to driving the fish to the U-shaped net from the mouth of the Dai.

Figure 3.3: Dai fishery 1996-97. Relationship between daily average catch per haul and number of hauls from October to February

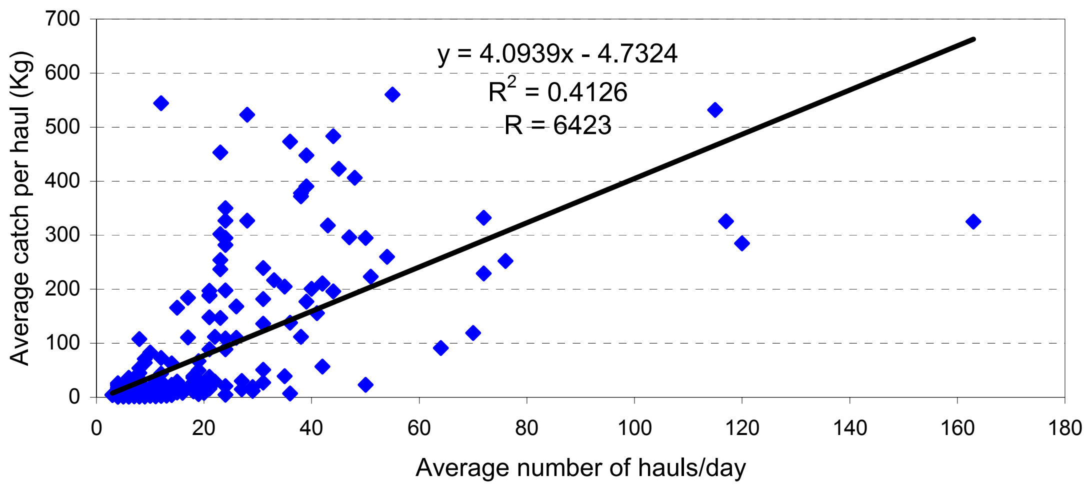
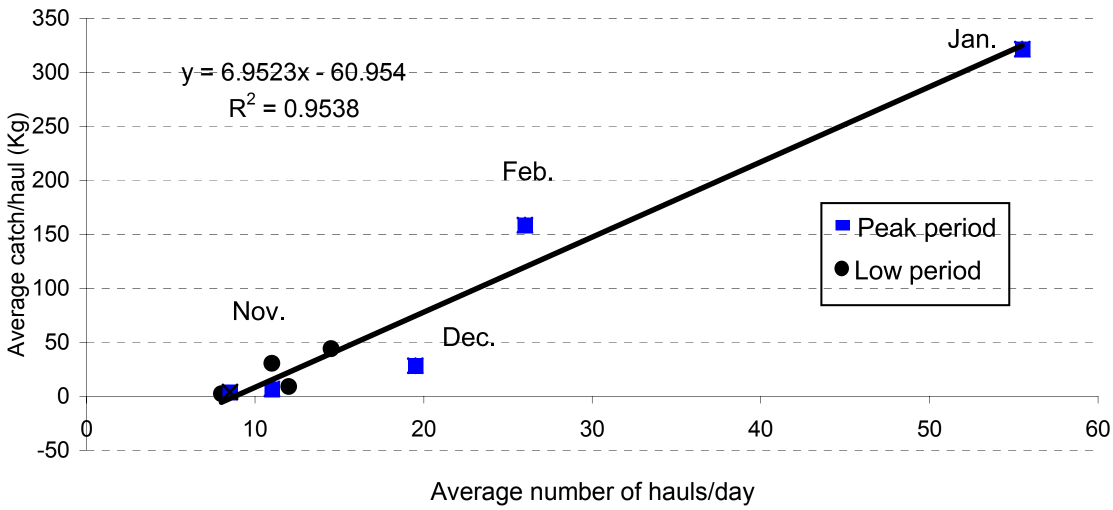


Figure 3.4: Dai fishery: 1996-97. Relationship between catch per haul and number of hauls average by low and peak periods from October to February (March peak period is left out, as capture technique is different from the one used in November - February)



Note: Average number of hauls per day in March was 18 with the average catch per haul of around 480 Kg. In this month the average number of hauls does not correlate with the average catch per haul because in this period the gear used and the operation technique are usually changed.

In the peak period, the number of hauls made by each Dai starts to increase gradually from October to January and then slowly decreases until March. The average number of hauls per day was 20 in December, 56 in January, 26 in February and 18 in March. However, the difference in the number of hauls made by the high yielding Dais and the low yielding Dais is especially large in January. In this month, the number of hauls was around 70 per Dai per day for the high yielding Dais with the average catch per haul of around 310 Kg and 35 per Dai per day for the low yielding Dais with the average catch per haul of around 330 Kg. The relationship between the average catch per haul and average number of hauls per day is given in Figure 3.3. Figure 3.4 shows the same with the difference that the averages have been calculated for the various low and peak periods in October 1996 to February 1997.

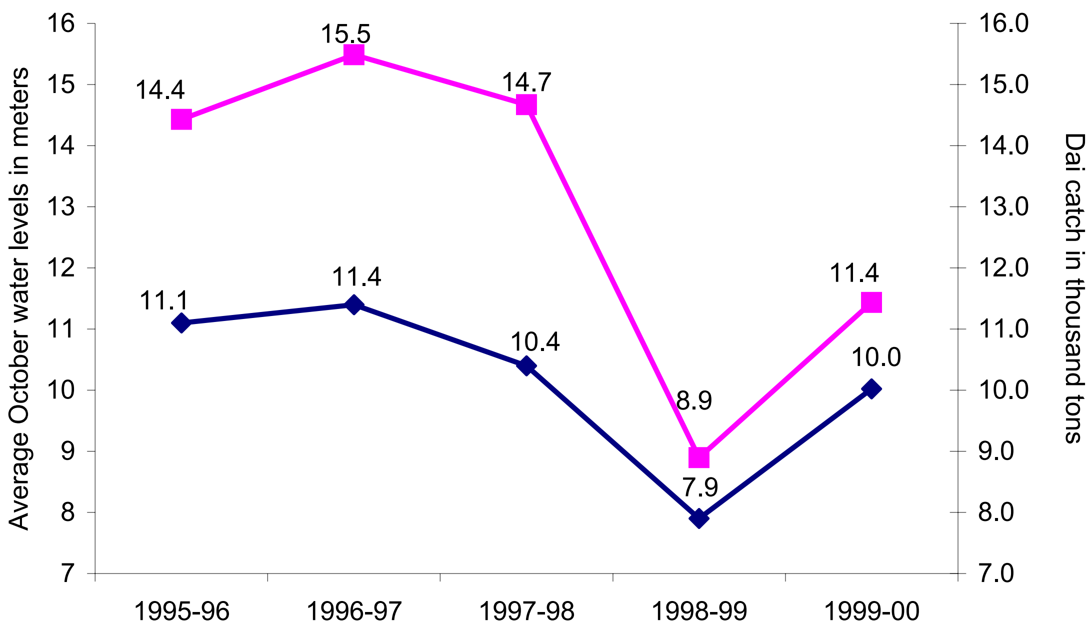
In October and November, the number of hauls in dark moon period is not different from those in full moon. The average number of hauls in these two months was 11 hauls per day.

5.3 Relationship between the area flooded and annual fish yield production

The annual fish yield of the Dai fishery appears to change from year to year. It is generally known that these changes are positively related to variations in the hydrological regime of the Mekong floodwaters. The higher the flood levels, the more water flows to the Great Lake and the more land is inundated. A greater inundation leads to a higher fish production and higher fish yields, as more food is available for fish survival and growth, and vice versa. The effect is particularly noticeable in short-lived species, such as *Henicorhynchus spp.* (Riel).

The overall catch, estimated since 1995-96 fishing season, shows a reasonable correlation between the fish catch and the maximum water levels in October. In 1995, the average October water level in Kompong Chhnang was 11.1 meters and fish yield production from Dai fisheries was estimated to be 14,429 tons. When the water level increased to 11.4 meters in 1996-97, the catch also rose to 15,488 tons. As can be seen from Figure 3.5 the catch dramatically dropped down to 8,894 tons when the maximum water level in Kompong Chhnang reached only 7.9 meters in October 1998. This shows that the catch declines strongly when the water level is very low, as measured against the October flood levels in Kompong Chhnang province.

Figure 3.5: Relationship between water levels and the annual Dai catch

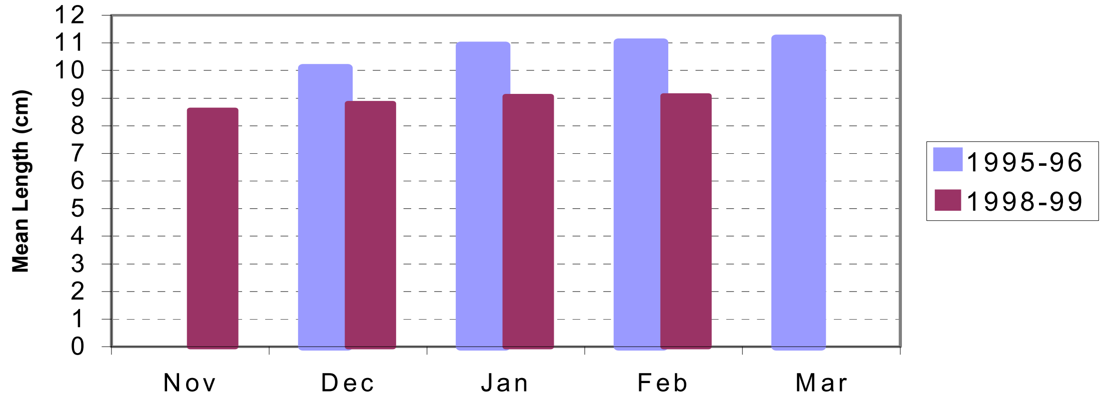


5.4 Annual variation of mean length of *Henicorhynchus spp.* (Trey Riel):

Henicorhynchus spp., known as a prolific species, contributed around 40% within the period 1995-2000 to the total catch from Dai fishery. Its length frequency data is analyzed to find out the variation in mean length in 1995-96 and 1998-99 fishing season. The length of 4,553 specimens were measured in 1995-96, and of 15505 specimens in 1998-99.

The result of the analysis shows that there was a decrease in mean length caught by Dai fishery within these 3 years (see Figure 3.6). The average length of this species in the 1995-96 fishing season was 10.9 cm and it reduced to 9.0 cm in 1998-99. The average mean length of *Henicorhynchus spp.* shows an increasing trend from November to March in both seasons. However, the 1998-99 fishing season was an unusual fishing season. As the peak October 1998 water level in Kompong Chhnang was very low (7.9 m), much less land was flooded than in 1995, when the peak October level was 11.1 m. Consequently, less food resources were available to the fish. This probably reduced fish growth and increased mortality. In addition, the inundation period of the area around the Great Lake was short, causing the fish to migrate out to the rivers earlier than usual.

Figure 3.6: Mean length (cm) of *Henicorhynchus spp.* (Trey Riel) in 1995-96 and 1998-99



6. Conclusion

Through the results of the census survey, conclusions can be drawn as follows:

- The peak catch of the Dai fishery occurs within 6-3 days before full moon of December, January, February an March. In the full moon period of October and November the daily catch was not so high compared to dark moon period.

- The average number of hauls per day in the full moon period is largely higher than that in the dark moon period. The highest frequency of hauls lifted per day was observed in full moon period of January.

- The share of some important long-lived fish species in the Dai fishery seems to have decreased since 1995-96, while the share of small short-lived fish species increase.

- The average size of Trey Riel in 1995-96 was larger than in 1998-99. This also may reflect increased fishing pressure, but is likely due to the unusual low water levels in the Mekong and Tonle Sap in 1998-99, which have reduced access to flood plain areas and food resources, thereby limiting their growth.

- The annual catch of the Dai fisheries especially of short-lived species is positively related to the hydrological regime of the Mekong floodwaters.

7. References

- Ahmed, M.; N. Hap; V. Ly and M. Tiengco, 1998. **Socio-economic assessment of freshwater capture fisheries of Cambodia**. A Report on a Household Survey. MRC/DoF/Danida Project for the Management of the Freshwater Capture fisheries of Cambodia. Mekong River Commission, Phnom Penh, Cambodia. 186p.

- Deap, L. 1999. **The Bagnet [Dai] Fishery in the Tonle Sap River**. *In:* N. P. van Zalinge and T. Nao (Eds.), 1999. pp 141-159. Present Status of Cambodia's Freshwater Capture Fisheries and Management Implication. Nine presentations given at the annual meeting of the Department of Fisheries of the Ministry of Agriculture, Forestry and Fisheries, 19-21 January 1999. Mekong River Commission and Department of Fisheries, Phnom Penh, Cambodia, 149 p.

- Deap, L.; S. Ly and N.P. van Zalinge, 1998 (Eds.). **Catch statistics of the Cambodian Freshwater Fisheries**. MRC/DoF/Danida Project for the Management of the Freshwater Capture Fisheries of Cambodia. Mekong River Commission, Phnom Penh, Cambodia. In press.

- Lieng, S.; C. Yim and N. P. van Zalinge, 1995. **Freshwater fisheries of Cambodia: the bagnet (Dai) fishery in the Tonle Sap River**. Asian Fisheries Science 8: 255 – 262.

- Van Zalinge, N. P. and T. Nao, 1999. **Summary of Project Findings. Present Status of Cambodia's Freshwater Capture Fisheries and Management Implication**. *In:* N. P. van Zalinge and T. Nao (Eds.), 1999. pp 11-20. Present Status of Cambodia's Freshwater Capture Fisheries and Management Implication. Nine presentations given at the annual meeting of the Department of Fisheries of the Ministry of Agriculture, Forestry and Fisheries, 19-21 January 1999. Mekong River Commission and Department of Fisheries, Phnom Penh, Cambodia, 149 p.

- Stamatopoulos, C. 1995. **The microcomputer system for the statistical monitoring of artisanal fisheries**. Version 1. Consultant report, MRC/DoF/Danida Project for the Management of the Freshwater Capture Fisheries of Cambodia.

- Touch, S. T. 1998. **Inland fisheries in historic prospective, an afterthought of commercialization**. MRC symposium, 7-8 December 1998.17p.

Figure 3.7: Exchange of fish for rice in order to make Prahoc by rural high land people

Figure 3.8: Prahoc making activities

Figure 3.9: Dai Fishery: smoked fish processing

Figure 3.10: Ox-carts returning home after making enough Prahoc for one year.

Figure 3.11: Fish harvest in the peak period of January 2000

Figure 3.12: Endangered species *(Pangasianodon gigas)* caught in the bag net fisheries on 19 November 1999 (176 kg, 2.35m)