Trends in the Cambodian dai fishery: floods and fishing pressure

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Cambodia's bagnet catch this season is the lowest on record at 6,550 tonnes, down 47 percent from a year earlier. Low water levels are partly to blame but the catch has now declined for three years in a row, indicating increased pressure from fishing.

The Tonle Sap reverses around July each year when rising Mekong waters flow 'up' the system towards the Great Lake, flooding the surrounding plains and wetlands. The floodwaters bring millions of fry, the progeny of fish, which have spawned upstream in the Mekong and its tributaries. The small fish feed and grow rapidly in the flooded areas and are joined by larger adult fish, some of which spawn.

Water levels begin to fall in October and the Tonle Sap starts to flow back to the Mekong. Fish are forced to follow the receding waters back into watercourses, and eventually migrate en masse down the Tonle Sap. The largest migrations are in January and February, when fishing activity of all kinds is intense.

The largest type of fishing gear along the Tonle Sap is the bagnet, known as dai in Khmer. Suspended in one location to filter the current, they are similar to trawl nets. French researchers have dated their use back to 1884. Each net is about 25 metres wide and about 120 metres long, extending a few metres to the bed of the river. Several nets are set across the river in a row. For the latest season, there were 63 nets in 13 rows. Peak

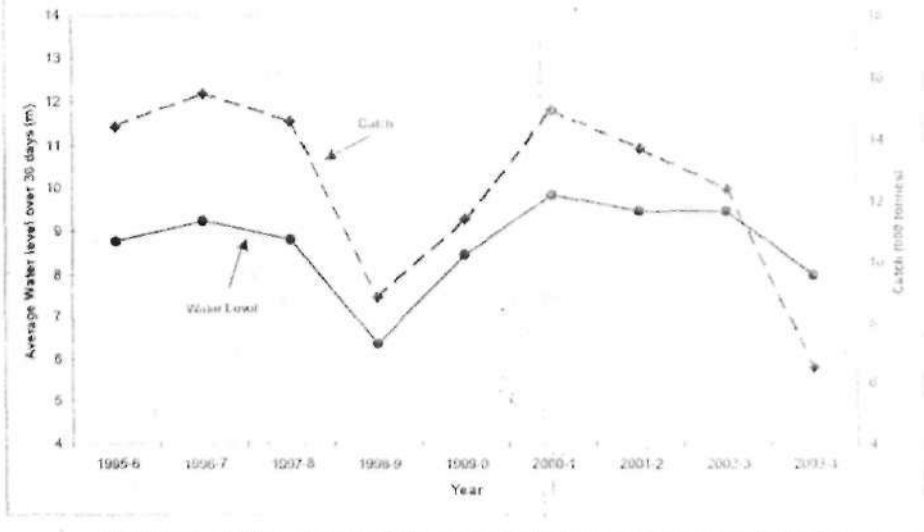
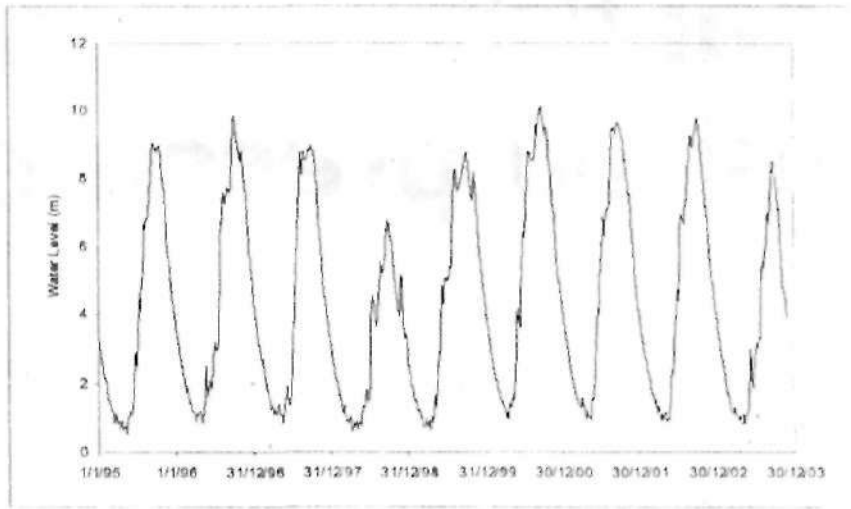


Figure 1 **Total catch of the dai fishery each year (x1,000 tonnes) and peak water levels in the Tonle Sap (mASL)**
Data from Phnom Penh Port, which are well correlated with water levels in the Tonle Sap and the Great Lake.

catches are in January and February, and mainly comprise small cyprinids known as trey riel, *Cirrhinus siamensis* and *C. lobatus*. Classed as fishing lots and auctioned every two years, the government earns about $182,000 a year from bagnet licenses.

French estimates put the catch at 13,569 tonnes in 1938-9 (Chevey and Le Poulain, 1940), and various estimates based on incomplete sampling were subsequently made (Lieng *et al.*, 1995). Since 1995-6, accurate monitoring has provided the only continuous long-term data set for an inland fishery in Cambodia.

Figure 2 Daily water levels of the Tonle Sap, 1995-2003
Data from Phnom Penh Port, which are well correlated with water levels in the Tonle Sap and the Great Lake.



The yield from flood plain fisheries is mainly determined by flooding (Welcomme, 1985). A larger flood creates more habitat and food, so fish production is higher, other factors being equal. If the fishery is based on young fish spawned in the same year, the best correlation is with the flood height in the same year. But if the fishery comprises mainly older fish, the height of floods in prior years affects catches.

The Tonle Sap fishery comprises mainly small fish spawned in the same year. Between 1995-6 and 2000-1, total catches were closely correlated with the height of the flood (Figure 1). Note that catches recovered after the 1998 drought but did not reach levels that might be expected based on the pre-1998 data, suggesting some lag in the recovery. But after 2001-2, catches were much lower than would be predicted from flood level alone. The 2003-4 catch is the lowest ever recorded, and far lower than might be predicted based on flood-levels alone.

Timing and duration of flooding are also important factors affecting catches. Were recent floods earlier or later than usual? The flood peaks in the Tonle Sap occur over a very narrow time slot each year. Between 1995 and 2003, the earliest peak was on 18 September (in 1995), and the latest on 4 October (in 1999) so the flood is predictable to within about two weeks. As well as the relatively consistent timing of the flood, annual variations in flood height are very small compared to some other large tropical rivers (MRC, 2003).

Can differences in flood duration or shape explain low catches? Figure 2 shows that in 2003 there was a very narrow flood peak, indicating a short duration flood. This would have contributed to the low dai catch in 2003-04. But there is no overall pattern, such as a series of low or short floods, which would explain the declining catches over the last few years.

Fishing pressure is continually increasing along the Tonle Sap and in the Great Lake. Each year there are more fishers and gears, both legal and illegal. Small-scale fishers - now numbering in the tens of thousands during the peak season - mainly use small-mesh nylon gillnets. Any fish not caught by the bagnets is highly likely to be caught by a gillnet, as observed earlier this year when many fish tagged and released from the most downstream bagnets were immediately caught by gillnets.

Other features of catches which are consistent with overfishing are continuing declines in both the number of larger species and the average size of the dominant small fishes.

So the low dai catches in recent years can be at least partly explained by high fishing pressure. Either some of the fish normally caught by bagnets are being caught by others - including those competing with different types of fishing gear - or total catches are falling. A fall in total catches is of great concern as it signifies overfishing, generally defined as catches falling below optimum levels. Scientists are traditionally reluctant to confirm any phenomenon without proof. But in fisheries

science, as in environmental science generally (see Downes *et al*, 2002), absence of proof is not proof of absence. We should not wait until the fishery collapses to bring in effective management measures.

Acknowledgments

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