Fish larvae and juvenile drift at the confluence of four rivers near Phnom Penh: the Mekong upstream and downstream, the Tonle Sap and the Bassac River June - September 2002.

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1. Abstract

This paper is based on a study of the drift of fish larvae and juveniles in the four rivers, which meet at Phnom Penh. Daily samples were taken every day from June 24th to September 30th, 2002, in each of the rivers close to Phnom Penh. The samples were taken four times per day at each location and the larvae were caught using a bongo-net with 1 mm mesh-size and a one-meter diameter. The net was set near the right riverbank. Water samples were collected to determine several environmental variables, such as water depth, temperature and flow in each of the rivers.
The highest densities of Pangasiidae larvae were found in the Mekong upstream of Phnom Penh and the lowest in the Bassac River. Larvae of 163 species from 35 families and 16 orders, were identified. The preliminary results show that the average density of fish larvae and juvenile drift was: in the Tonle Sap river (81 larvae/1000m^3, max 1831), Bassac river (5 larvae/1000m^3, max 62), the upstream Mekong (4823 larvae/1000m^3, max 18529) and the downstream Mekong (3 larvae/1000m^3, max 31). Densities decreased in August.

2. Introduction

The Mekong Basin is home to one of the most diversified fish faunas found in any single river system and it sustains one of the most important fresh water fisheries in the world. Most Mekong fish spawn at the onset of the rainy season in May or June (Poulsen *et.al*., 2001). Fish can be divided into floodplain spawners and mainstream spawners. For most species the exact spawning grounds have not been identified. This is especially true for species spawning in the mainstream of the Mekong or large tributaries. It is assumed, however, that many mainstream-spawning fish spawn in the mainstream between Kratie and Stung Treng in northern Cambodia. Eggs, larvae and juvenile drift downstream to nursery areas associated with the large floodplain around the Great Lake and along the Tonle Sap, Bassac and Mekong Rivers. This part of the lifecycle is almost completely unstudied, partly due to difficulties in identification involved with larvae and juvenile fish, since most taxonomic literature focus on adult fish. The study of fish larvae is important in order to identify the origin of fish larvae and to assess their dependence on hydrological factors of the river system.

3. Objectives

The objectives of this study were:

- To characterize the species/family composition of larvae and juvenile fishes at different sampling sites
- To identify larvae and juvenile fish collected from the each site.
- To determine abundance of larvae and juvenile fish (individuals/1000m^3) at the sites.

4. Materials and methods

4.1 Study Area

Figure 1. Map of Cambodia, showing the four rivers meeting at Phnom Penh

Sampling was carried out in the following four river-reaches (see Figure 1): the Tonle Sap River, the Bassac River and the Mekong (upstream and downstream of Phnom Penh, respectively). All sites are located near Phnom Penh around the Chaktomuk area (point where the four rivers meet), in Chruuy Changva district. The mean flow ranged from 5.5 to 8 cm/s during the study period. Nets were set near the right of the riverbank at a distance of 30 – 40 m from the bank and at a depth of 1-1.5 m.

4.2. Sampling

4.2.1 Sampling times

The sampling began on the 24th of June and ended on the 30th of September 2002. The larvae and juvenile fishes were collected four times per day (6:00, 12:00, 18:00 and 24:00) at six-hour intervals. Each location was sampled for thirty minutes. Sampling was done every day in the Mekong (upstream) and The Tonle Sap rivers and three times per week in the Bassac River and the Mekong River (downstream).

4.2.2 Sampling gear

Sampling was carried out using bongo-nets. The net was 1m in diameter and 5 m long with a half-liter plastic jar situated at the cod end. Each bongo-net was equipped with a

flow-meter to measure the volume of filtered water. This was set one meter from the water surface. The larvae were collected from the half-liter plastic jar using a filter. Larvae and juveniles caught were fixed and preserved in 8% formaline and subsequently identified to the lowest possible taxonomic level. Additional samples were taken during the peak period of larvae occurrence (Pangasiidae). Some environmental parameters such as water current and water quality were recorded (temperature, pH and turbidity).

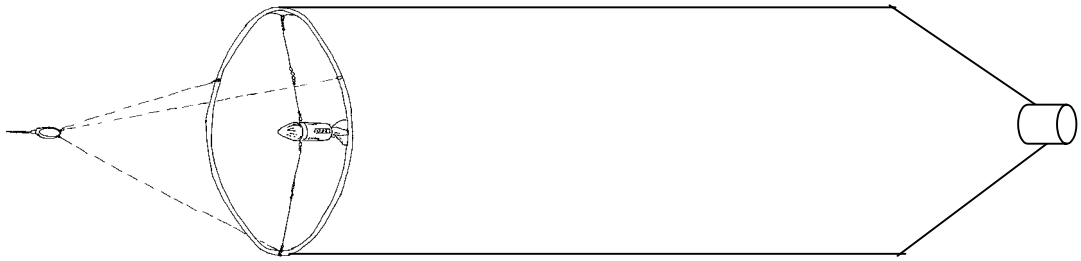

Figure 2. The bongo-net used for collecting fish larvae

4.3 Analysis of samples

4.3.1 Examination of Specimens

Fish larvae were examined using a stereomicroscope with magnification up to 40 or 50. The microscope was provided with both black and white background. The black background is most suitable for examining external pigmentation, fin–rays, fin–fold structure and myomeres, whilst the white background is essential in order to see the internal pigmentation and any pigmentation on the fins.

4.3.2 Patterns of pigmentation

The pattern of pigmentation is very important in the identification of young fishes, particularly because their physical appearance can vary substantially, depending on the condition in which fish were captured and their subsequent treatment.

4.3.3 Myomeres

In some instances, reliable distinction between species is only possible by counting the number of myomere (muscle bands). In identification keys, a distinction is often made between those myomers that are situated anterior to the anus (pre-anal) and those lying posterior to the anus (post-anal).
In the laboratory the fish larvae were identified to the lowest taxonomic level possible and number codes were given to each species. (Dr. Chavalith and Dr. Apichart, from the department of fisheries in Thailand, did the final identification). For larvae and juvenile identification, I refer to Chevey (1930), Yen (1992), and Rainboth (1996).

4.3.4 Counting and sub-sampling

All the larvae in each sample were counted and stored. Sometimes a sample consisted of several thousand tiny larvae mixed with lots of organic material. In such cases, we resorted to sub-sampling. Sub-sampling was carried out in the following manner:

Weigh the total sample.
Take three sub-samples from different parts of the sample.
Weight each sub-sample individually.
Identify all species in the sub-sample and count them.
Estimate the number of larvae in the full sample according to the following formula:

$$Ntotal = \frac{N\ 1}{W\ 1} + \frac{N\ 2}{W\ 2} + \frac{N\ 3}{W\ 3} * \frac{Wtotal}{3}$$

N_{total}: Number of larvae fish in the sample
N_1: Number of larvae fish in the sub-sample 1
N_2: Number of larvae fish in the sub-sample 2
N_3: Number of larvae fish in the sub-sample 3
W_{total}: Weight of larvae fish sample
W_1: Weight of sub-sample 1
W_2: Weight of sub-sample 2
W_3: Weight of sub-sample 3

Samples of larval fish were collected and standardized by volume (equal to 1000m^3). The relative densities of larvae were analysis by ANOVA.

5. Results

A total of 1344 samples have been analyzed from the four locations (562 samples in the Tonle Sap River, 347 samples in the Bassac River, 212 samples in the upstream Mekong and 223 samples in the downstream Mekong). 133 species belonging to 16 orders and 26 families were identified.

The highest density of larvae was found in the upstream Mekong (average of 4823 larvae/1000m^3, maximum of 18529 larvae/1000m^3). 56 species in 12 families were identified, including 30 species of Cyprinidae (53%), 10 species of Pangasiidae (17%) and 3 species of Cobitidae (5%).

In the downstream Mekong site, the average density was 3 larvae/1000m^3 (with a maximum of 31 larvae/1000^3). 29 species of Cyprinidae (45%), 11 species of Pangasiidae (16%) and 4 species of Cobitidae (6%) were identified

In the Tonle Sap River, the average density was 81 larvae/1000m^3 (with a maximum of 1831 larvae/1000m^3). 88 species from 19 families were identified, including 45 species of Cyprinidae (51%), 11 species of Pangasiidae (13%) and 6 species of Cobitidae (3%).

Finally, in the Bassac River, the average density was 5 larvae/1000m^3 (with a maximum of 62 larvae/1000m^3). 68 species in 14 families were identified, including 31

species of Cyprinidae (47%), 10 species of Pangasiidae (16%) and 6 species of Cobitidae (9%).

For all the sites, the peak period for occurrence of Pangasiidae larvae was from 24th to 27th of June.

Although the highest larval densities were recorded in the upstream Mekong, the highest species diversity was recorded in the Tonle Sap River (88 species). This may indicate that some species spawn in the Quatre Bras (the junction between the four rivers), subsequently drift into the Tonle Sap together with larvae from upstream Mekong. However, these results are only based on the analysis of approximately 60% of the samples and more comprehensive analyses will be completed in the near future.

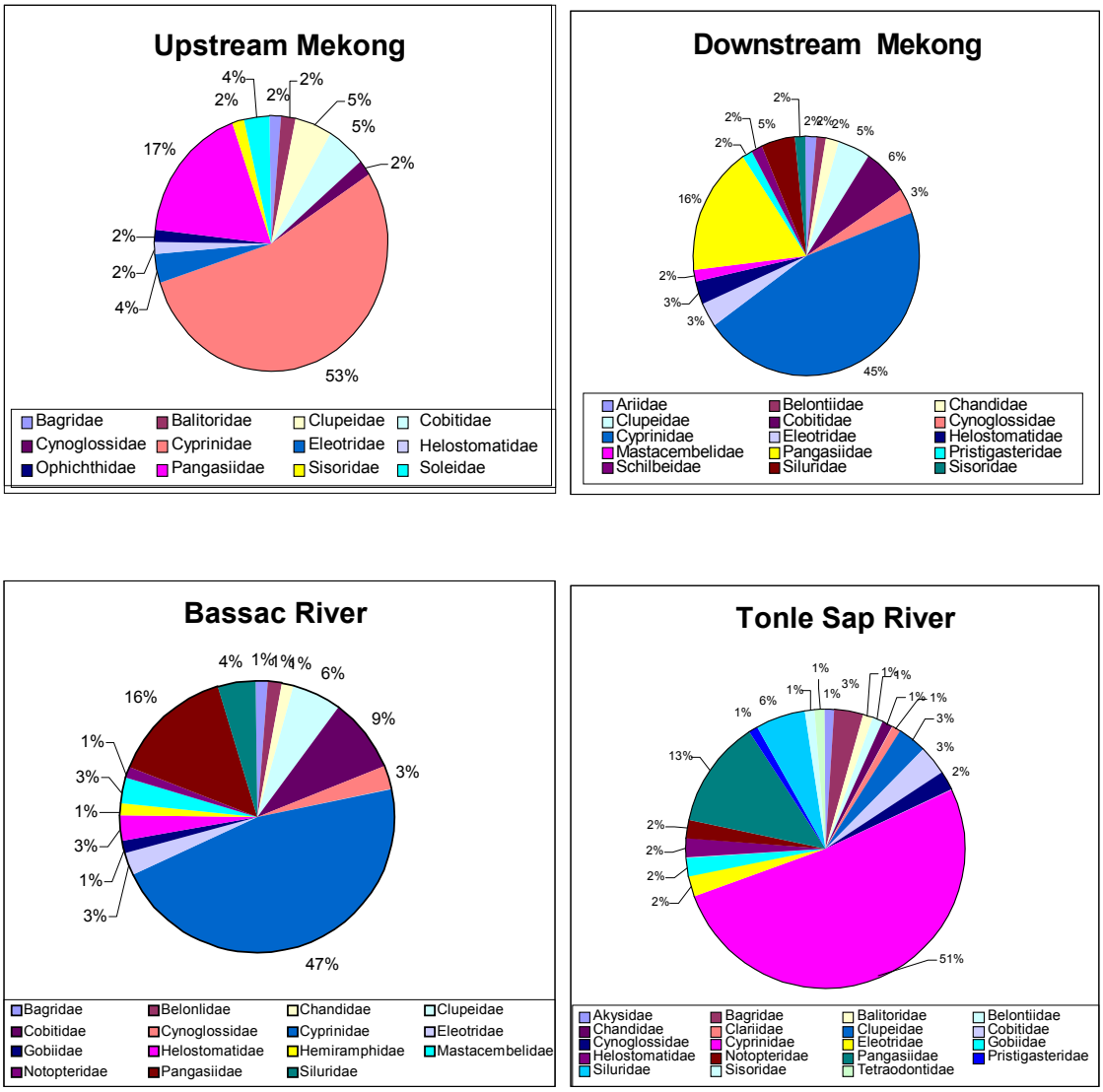

Figure 3. Species composition of larvae in the four rivers.

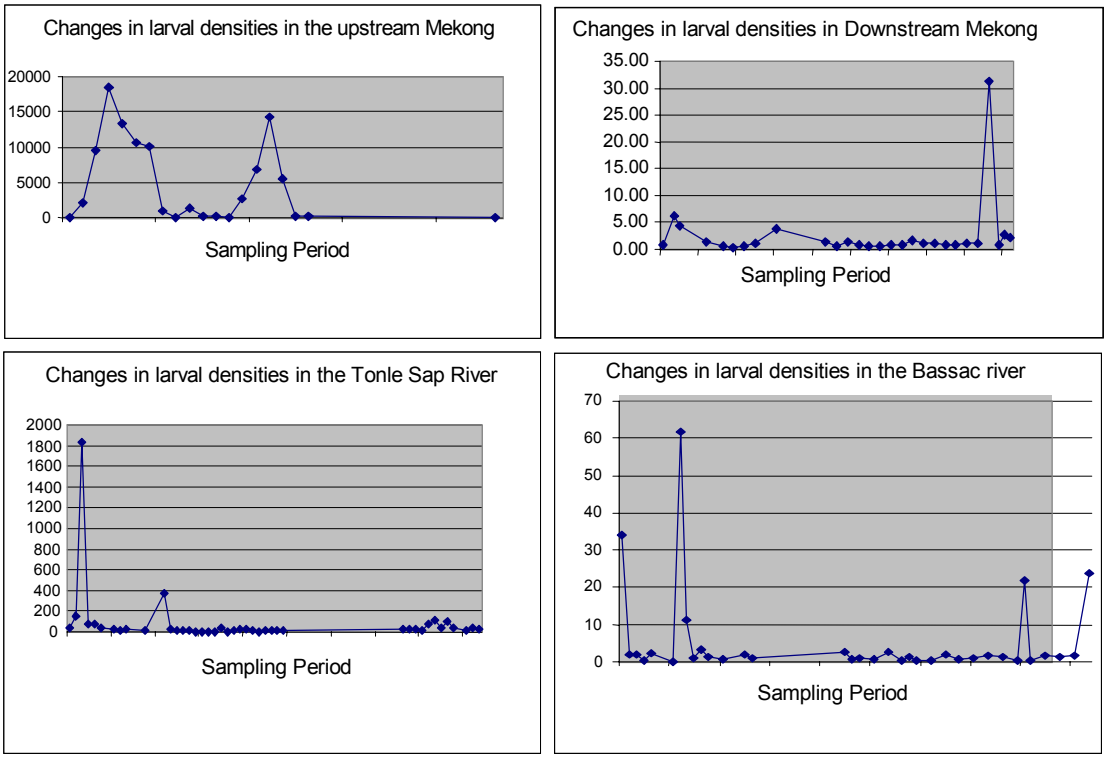

Figure 4. Larvae densities of the four sites during the study period (Number of fish/1000m^3)

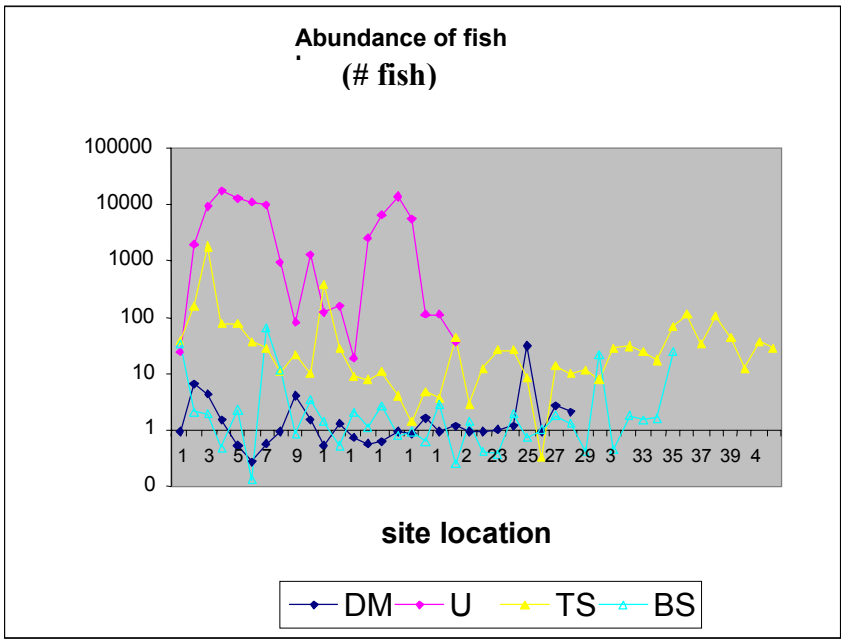

Figure 5. The relative densities of larvae collected in the four rivers

6. Discussion

The fish larvae and juvenile occurrence began on the first of June 2002. Since the sampling only started on 24th of June, the data are not enough for assessing the amount and species of fish larvae during the entire the rainy season.

Further, fish larvae should also be sampled from the Mekong near Kratie, both above and below the confluence of the Mekong and the Sesan in order to assess the importance of this tributary system for larvae recruitment. Sampling should also be carried out upstream of Stung Treng to identify fish larvae coming down the river from Lao PDR. If we know more about the timing and distribution of fish larvae throughout the lower Mekong, it will be easier to protect these species and, in turn, the fisheries they support.

7. Acknowledgments

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