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Diurnal periodicity of activity in the spawning perch. P. fluviatilis L.

Kalamies 1972 (7); 3

Translated by T. Armitage.

The earliest observations on the diurnal periodicity of spawning in the perch are according to Fabricius, recorded by Kammerer, who has claimed that the species spawns in darkness and that strong light disturbs or even interrupts spawning. In a laboratory test carried out by Fabricius spawning started on two consecutive days immediately after 1700 hrs. Fish were kept in an aquarium in a room with windows.

As these descriptions are rather meagre and found to be partly contrary to experiences of perch anglers, a study was made on the spawning during a 5-day period in the spring of 1971 in the Kuusamo area.

Methods

The fish were caught at Ylempi Hiidenlampi lake where the perch population is well known, during the main spawning season, between 4 - 9 June 1971. The cage traps were checked 8 times a day at 3 hour intervals and the fish were counted each time. The perch were also often measured, weighed and then released back into the water. Some individuals were caught in the cages several times, the number of fish caught was 374, which gives an average of 75 fish per day.

During the sampling, observations were also made on roe, which appeared in the cages, both in and outside, and on fish discharging milt and roe. The time of day during which spawning occurred was also

studied in open water and with purpose built 'roe collecting equipment'. The equipment was raised to the surface every 3 hours and roe ribbons counted.

The immature perch

The young and still non-spawning fish were caught in the cages later than the others. During the 5-day study in June these were caught as follows: 9, 6, 21, 25 and 21 individuals. A few spawning fish were also caught.

This group of fish (immatures) were caught in the cages in greatest numbers during the night hours, especially late in the evening. 80% were caught in the four sampling periods from 1800 hrs to 0300 hrs. In some cases two thirds of the catch was caught in the mid-night sample, which generally proved to be the most productive. Of the total 5 day catch 38% was caught in the mid-night sample. On a few days the greatest number of fish was caught at 2100 hrs, which indicates brisk activity in the late evening. The period of least activity was during the morning between the hours 0600 to 1200. The catch for this period is only 6% of the total 5 day catch and consists entirely of the fish caught on the 8th June.

Activity periods of spawning perch.

The spawning perch show both similarities and significant differences in activity compared with the immature fish. Similarity was shown in the occurrence of a peak in activity, though a weak one. The differences between spawning and non-spawning perch are shown in the table below, which shows the distribution per 24 hours of catches during the total study period expressed as a percentage.

Hours GMT	Non-Spawning	spawning
12 - 15	6.1	12.3
15 - 18	4.9	10.3
18 - 21	21.9	22.3
21 - 24	37.8	16.4
00 - 03	15.9	14.0
03 - 06	7.3	8.6
06 - 09	1.2	6.5
09 - 12	4.9	9.6

The aforementioned weak peak in activity occurred 3 hours earlier in the spawning fish than in the non spawning ones. The period of least activity in the day occurred at 9 in the morning, after which activity increased up to 1500 hrs when it was followed by a small decrease at 1800 hrs.

The spawning fish were caught in the cages in fairly even numbers throughout the 24 hour period so the activity pattern is considered to be mainly non-synchronized. Therefore the distribution of activity shows no peaks at the various sampling times. Differences between sexes were not observed.

The time of roe discharge in a 24 hour period.

The roe was found on cages, waterplants and on the roe collecting equipment on 45 occasions. On the first day of study no roe was observed, on the second 2 roe ribbons, on the 3rd 19, on the 4th 15 and on the 5th 9. The distribution of roe during a 24 hour period is shown in a table below.

Hours GMT	% of roe
12 - 15	13.3
15 - 18	20.0
18 - 21	20.0
21 - 24	20.0
00 - 03	6.7
03 - 06	6.7
06 - 09	2.2
09 - 12	11.1

The distribution of roe discharging times differs from the activity hours of the immature fish. But is nearly identical to the times of catches of spawning fish. Roe was discharged during all sampling periods throughout the day, therefore this also confirms the non-synchronous activity pattern in the spawning fish. The main spawning period occurred during the evening, two thirds of spawn was observed at this period. The period of least spawning was the morning.

Activity and environmental factors

The male perch started discharging milt at the end of May when the lake was still under a strong ice cover. The ice melted in the beginning of June so that on the first day of study only a narrow strip of ice remained on the southwest shore. The study days were chosen to occur during the main spawning period, which was known from the number of spawning females and from previous experience.

The temperature of the surface water rose from 5 to 8°C during the study period. Possibly due to this rise, the immature fish showed an increase in hours of activity in the last days of the study. However their activity did not increase significantly during the 5 days, and the spawning fish showed no variation in activity, therefore temperature must

be regarded as a minor factor in establishing patterns of activity. Also the temperature variation was small during a 24 hour period, often not as much as a degree

In the timing of activity, light undoubtedly is a major factor. The distribution of fish caught and the amount of light (light intensity) in relation to the time of day is shown in the following table:

Hrs GMT	% of catch	light intensity Lux
12 - 15	10.8	33.000
15 - 18	9.1	20.000
18 - 21	22.2	4.600
21 - 24	21.0	800
00 - 03	14.4	2.200
03 - 06	8.3	14.000
06 - 09	5.6	35.000
09 - 12	8.6	51.000

The activity of the non spawning fish occurred during the periods of least light i.e. late evening and mid-night. The strong light of mid-day inhibits activity. This however, did not deter the activity of the spawning perch (compare Dahlström 1969). The activity of spawning fish shows a peak 3 hours earlier than that of the non-spawning fish, this therefore would indicate that the instinct for activity in the spawning fish is stronger than in the non spawning ones. In Ruoppilampi lake spawning fish were only caught between 2000 - 2400 hrs, which indicates the regulating effect of strong light. Ruoppilampi has very clear water whereas Hiidenlampi has brown water.

It has been shown earlier that after spawning, the activity of perch in the Kuusamo area, occurs mainly during late evening and mid-night (Lind & Tenhunen). In July the activity pattern showed 2 or 3 peaks and was non-synchronized and in August activity is clearly concentrated to the times of

sunset and sunrise, especially sunset. During mid-winter anging, fish were only caught in the day time and in the summer the inverse is the case. These inversed activity periods (phase shift) in the perch are known also in some other animals.

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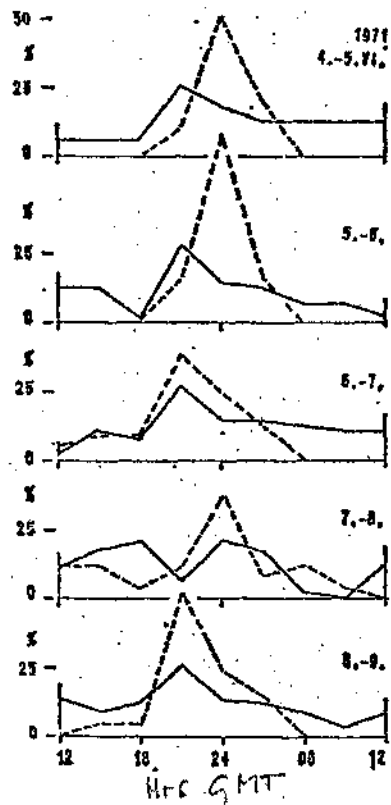
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The activity periods of the perch during spawning season in Ylempi Hiidenlampi lake. Continuous line shows the activity of the marked and mature fish. Broken line shows the activity of unmarked and mainly small fish. Vertical axis shows the distribution of fish caught per sample period. At this time of the year there is only about one hour between sunset and sunrise.

Notice

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