

Note on the crayfish monitoring methods used in Norway

Main goals for the monitoring programme

In 2001, a monitoring programme for noble crayfish was established in Norway. The main goal for the programme is to monitor a selected number of important crayfish localities in order to reveal prominent changes in density. The knowledge obtained from the programme will be the basis to implement measures to strengthen and conserve the crayfish populations.

The monitored populations/localities were chosen, as they are representatives of a range of different environmental factors, harvest pressure and geographical location. Locations with re-established populations after crayfish plague outbreaks or acidification was included in the programme.

Fieldwork and sample parameters

In the different localities, crayfish are sampled with baited traps and by handcollecting crayfish from scuba diving, giving values of relative densities (number of crayfish per trapnight and number of crayfish per hour of diving). In addition we sample data on total length, sex and maturity before releasing the crayfish back into the water.

Trap surveys

Trap surveys are conducted with collapsible cylindrical two-funnel traps with 12 mm mesh size. The traps are set in the evening and emptied the following morning. The catchability of crayfish in traps varies over time, and are dependent on, especially, moulting periods and temperature (Appelberg & Odelström 1985, Skurdal *et al.* 1985). To minimize the confusing effects of moulting and temperature, the monitoring are usually conducted in the period from the end of august to the middle of September. In this period, the fraction of moulting adult individuals are low and the water temperatures are above 10 °C. With few exceptions, we also standardize the trap catches by using standard trap types (as described above) and bait. In general, trap catches are size- and sexselective, and favour large crayfish and males (Qvenild & Skurdal 1988). Crayfish less than 75 mm in total length are rarely caught in traps.

The number of crayfish per trapnight (C/TN) is a relative measure of crayfish density, and is found to be a reliable proxy of population size (Appelberg & Odelström 1985, Zimmerman & Palo 2011). Scuba dive surveys provide additional information on smaller sized crayfish.

Scuba diving

Scuba diving is less influenced by moulting and temperature, but are conducted at the same time as the trapping. During diving, the rock formation is searched, rocks turned and visible crayfish caught by hand. As mentioned above, scuba dive surveys give more information on smaller crayfish. In scuba dive catches, crayfish are usually in the length interval 55-75 mm. The relative density are measured as the number of crayfish caught per hour dive, often converted from a 15-20 minute dive.

Characterizing the crayfish populations based on CPUE

From many decades of crayfish surveys, we have developed a criteria system to characterize crayfish populations. These criteria should be regarded as guidelines more than strict limits.

C/TN (number of crayfish/trapnight):

C/TN < 0.5: Very small population size

0.5 < C/TN < 2.5: Small to medium population size

2.5 < C/TN < 5: Large population size

C/TN > 5: Very large population size

C/TD (number of crayfish/hour diving):

C/HD < 10: Very small population size

10 < C/HD < 50: Small to medium population size

50 < C/HD < 100: Large population size

C/HD > 100: Very large population size

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Skurdal, J., Fjeld, E. & Taugbøl, T. 1985. Fieldmethods for crayfish studies. *Fauna* 38: 77-82 (in Norwegian).

Zimmerman, J.K.M. & Palo, R.T. 2011. Reliability of catch per unit effort (CPUE) for evaluation of reintroduction programs – A comparison of the mark-recapture method with standardized trapping. *Knowledge and Management of Aquatic Ecosystems*. 401: 07.