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Short communication

The enclosure trap, a new tool for sampling juvenile crayfish

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ABSTRACT

Key-words: *crayfish, sampler, juvenile crayfish, young-of-year crayfish,* Pacifastacus leniusculus

When managing crayfish populations, it is important to have access to reliable data on population densities and growth of juveniles. Present sampling methods are mostly active and often labor intensive, do not always yield quantitative data, and may harm the crayfish. A new passive method is described which aims to avoid these disadvantages. It uses a 0.09 m^2 trap which is set on the river or lake bottom, well in advance of expected hatching of crayfish eggs. The trap has a substrate which juveniles colonize and a net that fences them in and captures them when the trap is lifted. In field tests, the new trap provided data on mean density (29·m^{-2}) and mean total length (22 mm) of young-of-year signal crayfish which were comparable to data from suction sampling. The enclosure trap may provide data for recruitment studies and become a tool in crayfish research in general.

RÉSUMÉ

La balance d'encerclement, un nouvel outil d'échantillonnage des juvéniles d'écrevisse

Mots-clés : *écrevisse, échantillonneur, juvénile d'écrevisse,* Pacifastacus leniusculus

Quand on gère des populations d'écrevisses, il est important d'avoir des données fiables sur les densités de populations et la croissance des juvéniles. Les méthodes d'échantillonnage actuelles sont pour la plupart actives et souvent coûteuses en temps, elles n'aboutissent pas toujours à des données quantitatives et peuvent blesser les écrevisses. Une nouvelle méthode passive est décrite ici, qui permet d'éviter ces désavantages. Elle utilise une balance de 0,09 m^2 qui est disposée sur le fond d'une rivière ou d'un lac, bien avant la date estimée de l'éclosion des œufs d'écrevisse. La balance a un substrat que les juvéniles colonisent et un filet qui fait obstacle et les enferment quand la balance est relevée. Lors de tests sur le terrain, cette nouvelle balance fournit des données sur la densité moyenne (29 individus·m^{-2}), et la longueur totale moyenne (22 mm) de jeunes écrevisses signal, qui sont comparables aux données obtenues avec échantillonnage par succion. La balance d'encerclement peut fournir des données pour les études sur le recrutement et devenir un outil pour la recherche sur les écrevisses en général.

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INTRODUCTION

Data on year-class strength are central in the prediction of stock size variations of crayfish. Important procedures currently in use for sampling juvenile freshwater crayfish are: manual collection within fenced-off areas (Lamontagne and Rasmussen, 1993; DiStefano *et al.*, 2003; Dorn *et al.*, 2005; Larson and DiStefano, 2008), electrofishing (Westman *et al.*, 1978; Rabeni *et al.*, 1997; Alonso, 2001; Price and Welch, 2009) and hydraulic dredge-sieving (Odelström, 1983). Some methods are used in combination (Rabeni *et al.*, 1997; Byrne *et al.*, 1999; Acosta and Perry, 2000). Each method, or combination of methods, has its own characteristics as it comes to selectivity, precision, complexity, sampling effort and possible harm to the crayfish, and likewise its own limitations in relation to water depth, substrate, turbidity and water current. All methods are time consuming. It would be useful to have a simple passive sampling method for juvenile crayfish which yields quantitative data, can be employed in most habitats and does not harm the crayfish. Trials have been carried out with a new technique, the enclosure trap.

DESCRIPTION AND USE OF THE ENCLOSURE TRAP

The new trap is basically a tray, consisting of a series of rings of 4 mm stainless steel rods (Figure 1) which support a cylindrical bag of thin synthetic fabric (insect netting) with a mesh size of 1 mm and a cross-sectional area of 0.09 m^2. The top edge of the bag is secured to the upper ring with a lifting structure above. The bag is supported below with a stiffer net of 1 mm monofilament nylon (2 mm mesh) and a framework consisting of two additional rings held together with plastic cable clips. The stiff net protrudes slightly outside the supporting ring to facilitate deposit of substrate material extending to the surrounding bottom. When in place on the lake or river bed, the bag is collapsed and the sides fold under the top ring. The exposed surfaces are then covered with bottom substrate (gravel and small stones) from the surrounding area to a depth of about 50 mm with only the lifting structure exposed. The trap is retrieved by pulling the lifting structure quickly upward with the sides of the bag unfolding as it rises, entrapping the crayfish. The new device is a development of a colonisation trap used for sampling bottom fauna in streams (Anon, 1986).

The trap is deployed on the bottom of a lake or a stream at least two weeks before the anticipated hatching of crayfish eggs, and within the appropriate depth interval for the species studied. Once the crayfish juveniles are released from their mothers, they disperse and colonise the bottom substrate, including the substrate covering the trap. When the trap is lifted from the lake or river bed, a number of crayfish are captured in the bag which is emptied and the crayfish separated from the substrate. This procedure can be repeated three times at monthly intervals during the Scandinavian growth season. This provides data on density and growth rate.

Ten traps were placed out in Lake Erken (N 59° 51′ 14″ E 18° 39′ 4″), a mesotrophic lake with a dense population of signal crayfish (*Pacifastacus leniusculus*). The traps were installed by hand on level spots at depths of 0.5 to 2 m using snorkelling gear (Figure 2). Suitable spots had to be searched out because the lake bottom was mostly covered with boulders with few level patches in between. For some traps, bottom material (gravel) from other locations had to be added. During retrieval, some traps were lifted by hand during snorkelling (Figure 2) and some by means of a boat-hook from a boat. For each of the three lifting rounds, data on one trap was lost, two traps disappeared, and one was found on the shore, empty. During 27 trap liftings, 71 signal crayfish were captured (Table I). All but one was deemed to be young of the year. The mean lengths and growth of the crayfish during the season were consistent with past data from this lake (20 mm at mid-August, 25 mm at mid-September and 30 mm at mid-October; Odelström, pers. comm.). The mean density (number of crayfish per m^2) was higher than the normal level (10–40 per m^2) found when using the suction sampling method in this lake (Odelström, pers. comm.). The difference could be because the traps were placed in higher quality habitats than those in the surrounding area, or because the substrate covering

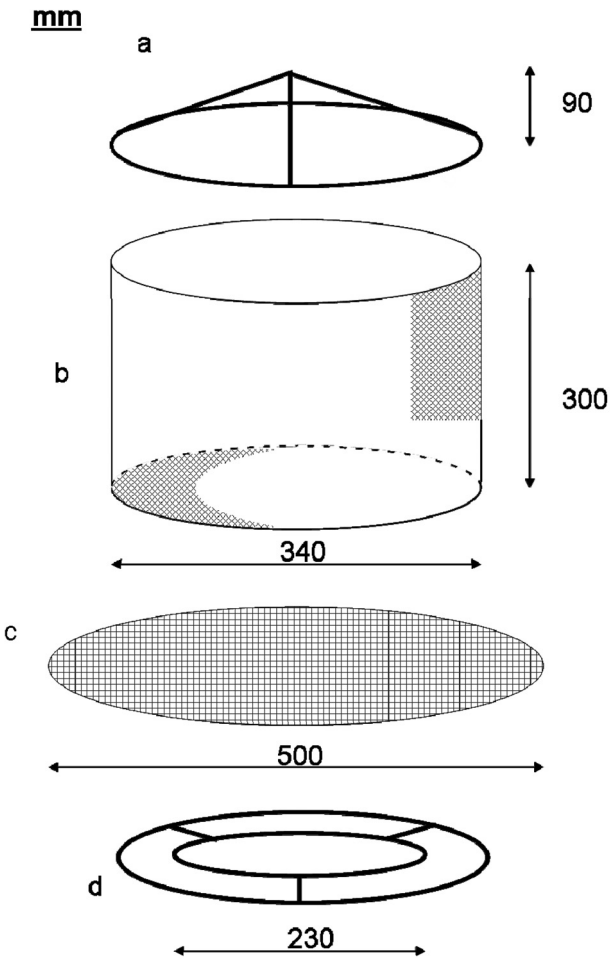

Figure 1
Enclosure trap for crayfish juveniles: (a) upper ring with lifting hook, (b) fine mesh bag, (c) supporting net and (d) bottom frame consisting of two rings fixed together.

Figure 1
La balance d'encerclement pour juvéniles d'écrevisse : (a) anneau supérieur avec système de relevage, (b) sac en maille fine, (c) filet du fond et (d) cadre de la base fait de deux anneaux concentriques solidaires.

the traps was of better quality than the natural situation (unfavourable silt was washed out during the handling). The high percentage of crayfish of a single cohort (y-o-y) reflects the suitability of the substrate (coarse gravel) for this species and size class. The aim at y-o-y was intentional since this size class is the most difficult to sample (Westman *et al.*, 1978; Alonso, 2001). If the spots chosen for deployment, and the substrate utilized for covering the traps, are carefully selected, enclosure traps may possibly be used for sampling other species and cohorts throughout a wide range of waters.

No crayfish were seen escaping or trying to escape during hauling. It took 4 h to set out 10 traps and 2 to 3 h to haul and empty them. Edge effects (accumulation or avoidance) would not be expected as the upper ring of the bag is well hidden under the substrate. The size of traps should not be critical and could be adapted according to local conditions. The traps are designed to take a fine or medium substrate (silt, gravel, small stones), a very coarse substrate (large stones, blocks) can not easily be utilized. It may be difficult to make the substrate at a trap site identical to the surroundings, therefore it may be better to use a standardised substrate for some studies, such as trends over time. This would also serve to reduce the handling time. Sampling schemes should be stratified and traps set by hand

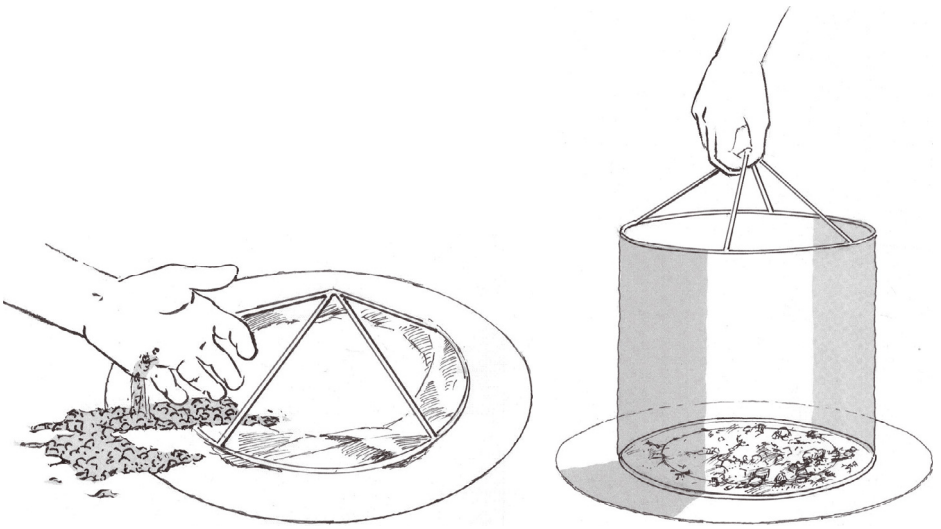

Figure 2
Operation of enclosure trap for crayfish juveniles: (a) trap being covered with bottom substrate; (b) trap retrieved by lifting, crayfish enclosed.

Figure 2
Manipulation de la balance d'encerclement pour juvéniles d'écrevisse : (a) balance recouverte par le substrat ; (b) balance relevée, écrevisses capturées.

Table I
Number of traps set and lifted, mean density of crayfish per m^2 and mean total length. Ten traps were set on the fifteenth of June, lifted and re-set at the initial spot successively in August, September and October. Missing traps were replaced.

Tableau I
Nombre de balances posées et relevées, densité moyenne d'écrevisses par m^2 et longueur totale moyenne. Dix balances ont été posées le 15 juin 2010 et relevées puis reposées sur les emplacements initiaux en août, septembre et octobre. Les balances manquantes ont été remplacées.

	Number of traps				Crayfish				
Date	Set	Lifted	Missing	Empty	Catch	Mean·m^{-2}	S.D.	Mean (mm)	S.D.
6/15/2010	10	-	-	-	-	-		-	
8/11/2010	10	9	1	0	45	53	7.5	19.5	2.9
9/6/2010	10	9	1	3	17	20	5.7	23.6	3.2
10/12/2010	10	9	1	3	11	13	3.5	28.5	7.0

when the bottom substrate is patchy. At even and deep locations, traps may be operated from a boat by means of a line. The enclosure trap may provide data for recruitment studies and become a tool in crayfish research in general.

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REFERENCES

Acosta C.A. and Perry S.A., 2000. Effective sampling area: a quantitative method for sampling crayfish populations in freshwater marshes. *Crustaceana*, *73*, 425–431.

Alonso F., 2001. Efficiency of electrofishing as a sampling method for freshwater crayfish populations in small creeks. *Limnetica*, *20*, 59–72.

Anon, 1986. Fiskevård i älvmagasin. Slutrapport från FÅK, del I, 115 p.

Byrne C.F., Lynch J.M. and Bracken J.J., 1999. A sampling strategy for stream populations of white-clawed crayfish, *Austropotamobius pallipes* (Lereboullet) (Crustacea, Astacidae). *Biology and Environment: Proceedings of the Royal Irish Academy*, *99(B)*, 89–94.

DiStefano R.J., Gale C.M., Wagner B.A. and Zweifel R.D., 2003. A sampling method to assess lotic crayfish communities. *J. Crustacean Biol.*, *23*, 678–690.

Dorn N.J., Urgelles R. and Trexler J.C., 2005. Evaluating active and passive sampling methods to quantify crayfish density in a freshwater wetland. *J. N. Am. Benthol. Soc.*, *24*, 346–356.

Lamontagne S. and Rasmussen B., 1993. Estimating crayfish density in lakes using quadrats: Maximizing precision and efficiency. *Can. J. Fish. Aquat. Sci., 50*, 623–626.

Larson E.R. and DiStefano R.J., 2008. Efficiency of a quadrat sampling technique for estimating riffle-dwelling crayfish density. *N. Am. J. Fish. Manag., 28*, 1036–1043.

Odelström T., 1983. A portable hydraulic diver-operated dredge-sieve for sampling juvenile crayfish. Description and experience. *Freshwater Crayfish*, *5*, 270–274.

Price J.E. and Welch S.M., 2009. Semi-quantitative methods for crayfish sampling: Sex, size, and habitat bias. *J. Crustacean Biol., 29*, 208–216.

Rabeni C.F., Collier K.J., Parkyn S.M. and Hicks B.J., 1997. Evaluating techniques for sampling stream crayfish. *N. Z. J. Mar. Freshwater Res.*, *31*, 693–700.

Westman K., Sumari O. and Pursiainen M., 1978. Electric fishing in sampling crayfish. *Freshwater Crayfish*, *4*, 251–255.