ROUNDTABLE SESSION 3

REINTRODUCTION OF NATIVE CRAYFISH AND HABITAT RESTORATION

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ABSTRACT

The aim of this roundtable session was to discuss reintroduction of native crayfish and habitat restoration providing practical recommendations of value to environmental authorities, decision makers and local managers.

A (re)introduction may be appropriate: a) to reintroduce a population recently lost, b) to extend the distribution of an ICS into historic range and c) to create new or isolated populations to conserve genetic diversity or the species. Before (re)introduction it is imperative to demonstrate the probability that the receptor locality is empty of crayfish, to know the reason for crayfish extinction, and that the reason is removed before restocking.

Before restocking, the receptor locality should also be assessed for crayfish suitability, including: water type and chemistry, physical conditions (shelter), presence of crayfish plague, risk of NICS, predatory fish.

In general, major constraints in a restocking project is money and availability of stocking material. General recommendations: a) if have abundant/readily available and acceptable donor population use adults and young/juveniles as available, b) if short of stock boost with hatchery rearing, and c) if want population quickly, stock as many as can afford and several times. Trade offs: time vs. cost. Genetic distinctiveness/possible spread of diseases must be considered. In general, the preferential ranking is donor from: 1) same watercourse, 2) same catchment, 3) adjacent catchment or one nearby in the same biogeographic region for crayfish, and 4) any other catchment.

Habitat restoration can be a valuable action, and should be prioritised to: 1) give greatest overall benefit to the ecosystem, 2) benefit ICS and 3) be achievable and cost effective. Natural characteristics of waterbodies in local area should be considered.

A key factor in the protection of ICS populations is the knowledge and attitude of local people. Objectives and actions should be agreed with local stakeholders to improve chances of success.

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RÉINTRODUCTION DES ÉCREVISSES AUTOCHTONES ET RESTAURATION DE L'HABITAT

RÉSUMÉ

Le but de cette table ronde a été de discuter la réintroduction des écrevisses natives et la restauration de l'habitat pour fournir des recommandations de valeur pour les autorités environnementales, les décisionnaires et les gestionnaires locaux.

Une (ré)introduction peut être appropriée a) pour réintroduire une population récemment disparue, b) pour étendre la distribution d'une écrevisse autochtone dans son aire d'origine et c) pour créer de nouvelles populations ou des populations isolées afin de conserver le diversité génétique de l'espèce. Avant toute (ré)introduction, il est impératif de démontrer la probabilité de l'absence d'écrevisses du lieu récepteur, de connaître la raison de l'extinction de la population d'écrevisses, et d'éliminer cette cause avant toute réintroduction.

En général, les contraintes majeures d'un projet de réintroduction est l'argent et la disponibilité des animaux à réintroduire. Les recommandations générales sont : a) si la population donneuse est abondante, disponible aussitôt et acceptable, utiliser des adultes et des jeunes/juvéniles ; b) si les stocks sont justes, compléter par des écloseries et c) si la population doit être obtenue très vite, introduisez le plus d'animaux que vous pouvez et plusieurs fois. Compromis : temps/coût. Statut génétique/dissémination possible de la maladie doivent être considérés. En général l'ordre préférentiel du donneur est : 1) être du même ruisseau 2) du même bassin hydrographique 3) du bassin hydrographique adjacent ou d'un de la même région biogéographique des écrevisses 4) de tout autre bassin.

La restauration de l'habitat peut être une action de valeur et devrait être la priorité pour 1) donner le bénéfice optimal pour l'écosystème 2) donner le bénéfice pour l'espèce d'écrevisse patrimoniale et enfin être réalisé complètement avec un coût efficace. Les caractéristiques naturelles des cours d'eau au niveau local devraient être prises en compte.

Un facteur clé pour la protection des populations d'écrevisses natives est la connaissance ainsi que l'attitude des acteurs locaux. Les objectifs et les actions doivent être adoptées avec les acteurs locaux pour augmenter les chances de succès.

INTRODUCTION

This roundtable session was aimed at discussing reintroduction of native crayfish species (ICS) and habitat restoration. A main objective was to provide recommendations which could be of practical value to environmental authorities, decision makers and local managers. A few specific questions were posed beforehand, but the group discussed freely within the whole topic. The main questions discussed and concluded on are given below.

Initially, monitoring was also included as a topic in this roundtable session but due to time constraints it was decided to concentrate on reintroduction and restoration. In general, the roundtable group agreed to the aspects of monitoring and pros et contras of different monitoring methods outlined by Stéphanie in her keynote talk (PEAY, 2004).

The roundtable group consisted of 15 persons representing 8 countries and thus a broad basis of experiences from different parts of Europe (cf. Acknowledgement).

In the following text we use the acronyms:
NICS = non-indigenous crayfish species (alien, exotic).
ICS = indigenous crayfish species (native).

MAIN QUESTIONS DISCUSSED

Why do a (re)introduction?

Before a (re)introduction is carried out, it is important to find out whether the receptor locality is empty of crayfish. There are difficulties in detecting populations at low density or abundance and the chance of detecting crayfish varies according to the method used and the intensity of effort in the survey. It may be necessary to carry out an intensive survey by one or several methods to see whether crayfish are present. (PEAY, 2003a, 2004; PEAY and HIRST, 2003). If a weak population still exist, the reasons why the population are weak must be explored and addressed if possible. Then, additional stocking of crayfish to accelerate population development may be considered appropriate, but in such cases where crayfish still exist, a general recommendation is to let the crayfish population develop or recover naturally.

By definition, however, a (re)introduction is carried out in a crayfish-empty locality and may be appropriate:

– to reintroduce a population recently lost,

– to extend the distribution of an ICS within its historic range,

– to create new or isolated populations to conserve genetic diversity or the species.

If a population is lost it is imperative to know the reason and that the reason is removed before restocking. In many cases of lost ICS populations the reason is crayfish plague. The source of the plague infection may have been by illegal stocking of NICS, or with infected water only. In the first case, restocking with ICS is useless because the disease has become permanently established with the NICS. The problem is that it may take years before the NICS are detected, either because the point of introduction is not known, or because it takes time for the population to increase to an abundance which is sufficient for the population to be detected in surveys. An undetected population of NICS may be a source for further outbreaks of crayfish plague, if ICS are restocked in areas affected by plague (TAUGBØL, 2004). Costly restocking efforts may be condemned to failure if NICS are present in the waterbody or catchment.

In the case of plague spread with infected water, restocking is possible a few weeks after the plague outbreak, because the plague fungus will die out after the loss of all the ICS hosts. Where there is an abundant and widely distributed population of ICS, transmission of crayfish plague is rapid and comprehensive. Where there is only limited movement of individual crayfish between the river and its various tributaries, for example due to limitations of suitable habitat, it is possible for the outbreak of crayfish plague to be continued for longer than usual. With partially isolated populations, there is less likelihood of crayfish being exposed to crayfish plague, but there are still sufficient cases of infection for the disease to persist. One year elapse from plague outbreak to restocking is recommended (CERENIUS *et al.,* 2002).

Where there is a high risk of unauthorised stocking with NICS the environmental authorities should be very active regarding information to the local society and support for reintroduction of the ICS (TAUGBØL and SKURDAL, 1999). Local stakeholders should be involved and the ICS restocked as quickly as possible.

Current distribution of the ICS today is, in general, very restricted compared to their historic ranges. Extending the distribution into the historic range by reintroduction, where conditions are favourable, is a very appropriate and recommended conservation action. There will not necessarily be historic records of crayfish, but often the historic range can be inferred. For example, crayfish may be present only in restricted parts of a catchment, due to industrial or other urban pollution that persisted for decades or longer. If polluted parts of the catchment have plenty of habitat which is potentially suitable for crayfish and

natural water chemistry that is acceptable, it is reasonable to assume that crayfish would have been present throughout the potentially suitable range prior to the pollution and therefore if water quality is improved sufficiently to support crayfish, a reintroduction into formerly polluted areas is potentially suitable.

Suitable locations within historic range may be non-existing due to the presence of NICS and/or bad water quality or physical conditions that cannot be improved. Introductions into new locations may therefore be the only alternative to provide ”refuge populations” for conservation of the species and/or genetic diversity.

If there is no recent history of crayfish, whether the waterbody is within the historic range or an entirely new site, an EIA should be carried out before an introduction. Crayfish should not be introduced if this could lead to the local extinction, or significant reduction of species important for nature conservation.

Assessing the health of the donor population and the risk of disease transmission is an important factor prior to stocking, especially if the stocking is to supplement a weak population or if there is a population of ICS anywhere in the catchment. However, lack of knowledge and techniques required for diagnosis of freshwater crayfish pathogens means that infections by a whole range of pathogens including viruses and rickettsia-like organisms may go undetected (EDGERTON and JUSSILA, 2004). This should be taken into account especially when introducing crayfish into another catchment.

One should be realistic about time scale. Natural recolonisation and restocking/ introduction take time (e.g. 5-15 years or more to abundant population) (TAUGBØL, 2004; HOWELLS and SLATER, 2004; HILEY, 2003). This has implications for monitoring.

How to know if the stocking site is suitable for crayfish?

Before restocking, the receptor locality should be assessed for crayfish suitability (KEMP *et al*., 2003). This may be a difficult task, ultimately only the crayfish itself (i.e. the population development) answers the question whether it will thrive or not. Restocking in localities that seem very suitable may end up as a failure, while other localities initially judged less suitable may end up as very good crayfish localities.

An assessment should be made prior to stocking, and include:
- water type and chemistry,
- physical conditions (shelter),
- presence and risk of crayfish plague,
- risk of invasion by NICS,
- predatory fish.

If there is doubt about the water quality or presence of crayfish plague, a pilot study including caging of live crayfish should be carried out. (HILEY, 2003; HERING, 2003). With respect to water quality (ROGNERUD *et al*., 1989) different stages such as juveniles and berried females should be included and where possible the time span should encompass events like hatching and moulting. It may be very difficult to prove that changed physical conditions is the reason for a previous extinction of a population of crayfish. In many waterbodies, increased sedimentation due to eutrophication and erosion from agricultural land has covered essential shelter structures and made bottom substrate unsuitable for crayfish (TAUGBØL and SKURDAL, 1993; HOWELLS and SLATER, 2004). Following changes in water quality and/or species compositon the abundance of predatory fish may increase, making reintroduction of crayfish more difficult (NYBERG *et al*. 1986; FISKERIVERKET, 1993). It is essential to assess the risk of NICS either being introduced to the restocking locality or arriving by natural colonisation from another area. If the risk is high (for instance if there is no barriers for migration), the restocking resources should be allocated to other localites or ICS conservation actions. KEMP *et al*. (2003) recommended

that there should be no reintroductions if there are any NICS within 50 km by water of a reintroduction site.

What to stock and how many?

This is a frequently asked question by landowners and managers and it is impossible to give an accurate answer. There are examples of failures and success with all kind of stocking material (juveniles of different sizes, adults, berried females) and different stocking numbers/densities (NYSTRÖM and RÖNN, 1990; ERKAMO *et al.* 1998). There are evidence of extensive post-stocking movements of adult crayfish, so juveniles seem to be more appropriate as stocking material if the goal is to establish a population at a specific site (SKURDAL and TAUGBØL, 1995; SCHÜTZE *et al.*, 1999). In general, major constraints in a restocking project is money and availability of stocking material. Genetic distinctiveness/possible spread of diseases (see below) must be considered as well.

General recommendations are:

– if there is an abundant/readily available and acceptable donor population, use adults and young/juveniles, as available;

– if there is a shortage of stock, boost with hatchery rearing (but this is expensive);

– if there is a need to establish a population quickly, stock as many as can afford and do this several times.

With stocking, there is a need to to find a locally appropriate balance between the time needed to achieve a sizeable population and the cost of achieving it.

How important is genetic distinctiveness when planning an (re)introduction?

Genetic variaton in freshwater crayfish populations has been demonstrated (GRANDJEAN and SOUTY-GROSSET, 2000; EDSMAN *et al*., 2002), and thus, genetic distinctiveness must be taken into account when planning a (re)introduction.

In general, the preferential ranking is to use a donor population from:

1. the same watercourse;
2. the same catchment;
3. an adjacent catchment or one nearby in the same biogeographic region for crayfish;
4. any other catchment.

Where there are several options of donor populations and biodiversity is a priority, population with naturally high genetic diversity should be selected and/or the introduction should be restricted to one local strain.

Where there is only limited diversity because of past restocking and a harvestable population is a priority, a mix from several local populations should be considered. This will give the best likelihood of crayfish being able to establish in the conditions at the restocking location.

Habitat restoration of value?

Habitat restoration can be a valuable action, but all the threats and opportunities in catchment and waterbody should be considered.

Actions should be prioritised to:

1. give greatest overall benefit to the ecosystem;
2. benefit the IC;
3. be achievable and cost effective.

Habitat restoration actions are in general site-specific and limited in range due to high costs. When planning, natural characteristics of waterbodies in local area should be considered. In general, natural materials are preferable, but wholly artifical materials may be of value e.g. in highly modified waterbodies (PEAY, 2003b).

Involvement of local stakeholders

A key factor in the protection, reintroduction or strengthening of ICS populations is the knowledge and attitude of local people (TAUGBØL and SKURDAL,1999). Objectives and actions should be agreed with local stakeholders to improve the chances of success. The greatest threat to the ICS is the man-facilitated spread of NICS. It is impossible to prevent further spread of such species if local people along the river catchments want otherwise.

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