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Freshwater Crayfish in Latvia

Status and Recommendations for Conservation and Sustainable Use

Trond Taugbøl
Augusts Arens
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Freshwater Crayfish in Latvia

Status and Recommendations for Conservation
and Sustainable Use

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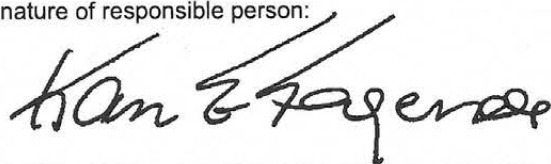
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Abstract

Taugbøl, T., Arens, A. & Mitans, A. 2004. Freshwater crayfish in Latvia: Status and recommendations for conservation and sustainable use. NINA Project Report 29.23pp.

The aim of this project has been to improve the basis for a sound management of crayfish in Latvia through the development of a management plan. The management plan consists of two parts: (1) the present report giving status for the crayfish situation in Latvia and recommendations for conservation and sustainable use, and (2) a database containing available information on Latvian crayfish populations.

Distribution

There are three crayfish species present in Latvia; the European species noble crayfish (*Astacus astacus*) and narrow-clawed crayfish (*Astacus leptodactylus*) and the North-American signal crayfish (*Pacifastacus leniusculus*) species. Probably only noble crayfish are native and migrated into the country after the last glaciation. Narrow-clawed crayfish has also been present at least since the beginning of the 20th century. In total there are current information on crayfish from 258 localities in Latvia. Most of these localities are lakes (175), but many crayfish populations are also found in river and streams (66). A few populations are found in reservoirs, ponds and gravel-pits.

The noble crayfish (*Astacus astacus*) is the dominant crayfish species in Latvia, and 220 out of 258 localities contain only noble crayfish. In 26 localities narrow-clawed crayfish (*Astacus leptodactylus*) is the only species, whereas signal crayfish (*Pacifastacus leniusculus*) is found as the only species in 4 localities. Noble and narrow-clawed crayfish are reported to coexist in 8 localities.

The noble crayfish is widely distributed in all regions of Latvia. The situation is much the same as in the 1960's, the most obvious change being that more noble crayfish populations are established in the area south of Riga. The narrow-clawed crayfish has expanded its distribution since the 1960's when it was reported in 13 localities. Current records include 34 populations. Previously, the narrow-clawed was confined to the southern part of the country. The present distribution includes several populations around Riga and in other parts of the Vidzeme region. The signal crayfish was introduced to one small lake in 1983. In 2004 it is found in another 3 localities (2 rivers and one gravel-pit) quite a distance from the first locality. This indicates stocking by man and not a natural dispersal. Probably the signal crayfish is more widespread than the current data show.

Crayfish legislation and harvest

There are two categories of fishery and crayfish catching in Latvia: commercial and amateur/recreational. For both categories of crayfish catching apply: catching only in licensed lakes, minimum size of 100 mm totallength, catching season July 1 – September 30, egg-carrying females must be released, specified restrictions on catch effort and amount. For amateur fishing only 5 dip-nets and maximum 50 individuals of crayfish are allowed per license.

For many years there were no licensed catch of crayfish at all. Since 2002 four lakes, L. Āģes (Limbažu district), L. Černavas (Daugavpils district), L. Kukšu (Kuldīga district) and L. Vaidavas (Valmieras district), have been licensed for recreational/amateur catching (Fig. 3). In 2004, L. Černavas was also licensed for commercial catching. In L. Černavas and L. Āģes the crayfish species is narrow-clawed crayfish, in L. Kukšu the species is noble crayfish, and in L. Vaidavas both species occur. Annual licensed catch is supposed to be less than 1 tonn. However, the very restrictive license system contributes to an extensive illegal catch. Probably the total yield of crayfish in Latvia, illegal catch included, is 15-20 tonnes.

Stocking of live crayfish in natural waters needs a permission from environmental authorities and a veterinary certificate stating that the stocking material is healthy. Import of live crayfish to Latvia is allowed, only a veterinary certificate is needed. It is not allowed to use crayfish as bait.

Threats, management objectives and recommended actions

The main threats to the noble crayfish include: 1) spread of plague-carrying North-American crayfish species, 2) pollution and habitat deterioration, and 3) overfishing and insufficient management.

The main objectives for the management of natural crayfish populations in Latvia should be as follows: 1) prevent further spread of signal crayfish and introduction of spiny-cheek crayfish, 2) restoration and enhancement of noble crayfish populations, and 3) sustainable exploitation and local involvement and responsibility.

Actions to achieve the proposed objectives are discussed and recommended, the most important being: ban import of live crayfish, ban catching of non-native crayfish, information, mapping/monitoring and research, stocking of noble crayfish to restore populations, and cancel the system of licensed lakes (i.e. exploitation of crayfish should in general be allowed). The last action requires, however, that private owners, associations and local authorities are given authority and responsibility for exploiting the crayfish resource.

Keywords: freshwater crayfish, Latvia, conservation, sustainable use

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Kopsavilkums

Taugbols, T., Ārens, A., Mitāns A. 2004. Saldūdens vēži Latvijā: Stāvoklis un rekomendācijas aizsardzībai un ilgtspējīgai izmantošanai. NINA projekta ziņojums 29. 23 lpp.

Projekta mērķis bija pilnveidot pamatu stabilam vēžu menedžmentam Latvijā, izveidojot menedžmenta plānu. Menedžmenta plāns sastāv no divām daļām: (1) ziņojums par vēžu stāvokli Latvijā, rekomendācijas aizsardzībai un ilgtspējīgai izmantošanai, (2) datubāze, kura ietver informāciju par Latvijas vēžu populācijām.

Izplatība

Latvijā ir trīs vēžu sugas; Eiropas sugas – platspīļu vēzis (*Astacus astacus*), šaurspīļu vēzis (*Astacus leptodactylus*) – un Ziemeļamerikas signālvēzis (*Pacifastacus leniusculus*). Domājams, ka tikai platspīļu vēzis ir vietējais vēzis, kurš imigrējis teritorijā pēc pēdējā ledus laikmeta. Arī šaurspīļu vēzis Latvijā ir bijis vismaz no XX gadsimta sākuma. Kopā darbā ietverta pašreizējā informācija par 258 vēžu atradnēm Latvijā. Vairums no šīm atradnēm ir ezeri (175), bet daudzas vēžu populācijas atrastas arī upēs un strautos (66). Dažas populācijas atrastas arī ūdenskrātuvēs, dīķos un grants karjeros.

Platspīļu vēzis (*Astacus astacus*) ir dominējošā vēžu suga Latvijā un 220 no 258 atradnēm mīt tikai platspīļu vēzis. 26 atradnēs šaurspīļu vēzis (*Astacus leptodactylus*) ir vienīgā suga, turpretī signālvēzis (*Pacifastacus leniusculus*) kā vienīgā suga ir atrasts 4 atradnēs. Platspīļu un šaurspīļu vēžu līdzās pastāvēšana fiksēta 8 vietās.

Platspīļu vēzis ir plaši izplatīts visos Latvijas rajonos. Stāvoklis ir līdzīgs kā 1960-os gados, bet pārmaiņas liecina, ka vairāk platspīļu vēža populāciju nostiprinājušās rajonā uz dienvidiem no Rīgas. Šaurspīļu vēzis ir paplašinājis savu izplatību kopš 1960-iem gadiem, kad tas tika konstatēts 13 atradnēs. Pašreizējie ieraksti ietver 34 populācijas. Sākotnēji šaurspīļu vēzis bija ierobežots valsts dienvidu daļā. Pašreizējā izplatība ietver dažas populācijas Rīgas apkārtnē un citās Vidzemes reģiona daļās. Signālvēzis introducēts vienā mazā ezerā 1983.gadā. Kopš 2002.gada tas konstatēts 3 citās atradnēs (2 upes un 1 grants karjers) diezgan tālu no pirmās atradnes. Tas norāda uz izplatību ar cilvēka līdzdalību un nevis dabīgu izplatību. Iespējams, ka signālvēzis ir daudz plašāk izplatīts nekā pašreizējie dati liecina.

Vēžu likumdošana un vēžošana

Latvijā ir divas zvejas un vēžošanas kategorijas: komerciālā un amatierzveja. Abām vēžošanas kategorijām atļauts: vēžošana tikai licencētos ezeros, minimālais izmērs ir 100 mm, vēžošanas sezona no 1.jūlija līdz 30.septembrim, mātītes ar olniām ir atļaujamās, īpaši ierobežojumi noteikti vēžošanas veidam un apjomam. Amatieru vēžošana atļauta tikai ar 5 krītiņiem un maksimāli atļauts noķert 50 vēžus uz licenci.

Ilgus gadus licencēta vēžošana Latvijā bija aizliegta. Kopš 2002.gada četri ezeri: Aģes (Limbažu rajons), Černavas (Daugavpils rajons), Kukšu (Kuldīgas rajons) un Vaidavas (Valmieras rajons) ir licencēti rekreācijas/amatieru zvejai (3.tabula). 2004.gadā Černavas ezers licencēts arī komerciālai vēžošana. Černavas un Aģes ezeros ir šaurspīļu vēzis, Kukšu ezerā ir platspīļu vēzis un Vaidavas ezerā ir abu sugu vēži. Licencētās vēžu zvejas apjoms gadā vērtējams mazāks par 1 tonnu. Kā parasti, ļoti ierobežojošā licencēšanas sistēma veicina plašu nelegālo vēžošana. Iespējams, ka vēžu ieguve Latvijā, ieskaitot nelegālo vēžošana, ir 15-20 tonnas gadā.

Vēžu ielaišanai dabīgajos ūdeņos nepieciešama vides institūciju atļauja un veterinārais sertifikāts, kas apliecina, ka ielaižamais materiāls ir vesels. Latvijā ir atļauta dzīvu vēžu ieviešana, nepieciešams tikai veterinārais sertifikāts. Nav atļauta vēžu izmantošana ēsmas makšķerēšanā.

Draudi, menedžmenta pasākumi un rekomendējamās darbības

Galvenie draudi platspīļu vēzim ir: (1) vēžu mēra sēnītes pārnēsātāja Ziemeļamerikas sugnālvēža izplatība, (2) piesārņojums un dzīves vides degradācija un (3) pārzvejošana un nepietiekams menedžments.

Galvenajiem mērķiem dabīgo vēžu populāciju menedžmentam Latvijā jābūt: (1) novērst tālāku signālvēža un šaurspīļu vēža izplatību un sarkanspīļu vēža introdukciju Latvijā, (2) platspīļu vēža populāciju atjaunošana un izplatības paplašināšana un (3) ilgtspējīga izmantošana, vietējo iedzīvotāju iesaiste un atbildība.

Lai sasniegtu noteiktos mērķus, jāveic rekomendējamās darbības, starp kurām nozīmīgākās: dzīvu vēžu importa aizliegums, signālvēžu un šaurspīļu vēžu nekontrolētas ķeršanas aizliegums, informēšana, izplatības kartēšana/monitorings un pētījumi, platspīļu vēža ielaišana, lai atjaunotu populācijas, licencēto ezeru atcelšana, vēžu izmantošanai vispār jābūt atļautai. Pēdējā darbība pieprasa, kā parasti, lai privātiem īpašniekiem, asociācijām un vietējām pašvaldībām tiktu dotas tiesības un atbildība vēžu resursu izmantošanā.

Atslēgas vārdi: saldūdens vēzis, Latvija, aizsardzība, ilgtspējīga izmantošana.

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Foreword

The project "Conservation and sustainable use of natural crayfish populations in Latvia" started in 2002 and is a collaboration between the Latvia Crayfish and Fish Farmers Association (LCFFA) and the Norwegian Institute for Nature Research (NINA). The Latvian Fisheries Research Institute (LFRI) has been associated to the project. The background for the project was the need for better knowledge on the crayfish situation in order to develop a sound management system for the conservation and sustainable use of this valuable resource. In Latvia, the project leader has been Dr. biol. Augusts Arens (president of LCFFA). Responsible for the project from the Norwegian side has been Dr. Trond Taugbøl.

The project has included several mutual visits aimed at exchanging knowledge and experiences between the project participants.

We have received valuable help from a number of persons. Special thanks are due to Nils Arens, Egils Tinte, Galina Kanejeva and Erik Aleksejev. We would also like to thank other colleagues and friends in the international crayfish research community, for many fruitful discussions on crayfish management problems and challenges.

We hope Latvian environmental authorities will find the present report useful in their future management of freshwater crayfish. NINA, LCFFA and LFRI aim at a continued contact and cooperation, and are willing to assist the authorities in environmental questions and problems whenever requested.

The project has been financed by the Norwegian Ministry of Foreign Affairs, The Norwegian Institute for Nature Research, the Latvian Ministry of Agriculture, Fish Fund, the Latvian Ministry of Environment, the Latvian Environmental Protection Fund and the Latvian Crayfish and Fish Farmers Association.

Lillehammer/Riga, November 2004

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1 Introduction

Freshwater crayfish are a major component of the freshwater systems in large parts of the Nordic and Baltic countries. There are two European crayfish species (noble crayfish, *Astacus astacus* and narrow-clawed crayfish, *Astacus leptodactylus*) and two species introduced from North America (signal crayfish, *Pacifastacus leniusculus* and spiny-cheek crayfish, *Orconectes limosus*) in the region, and all but one (spiny-cheek crayfish) are present in Latvia. However, only the noble crayfish are native to this area. The noble crayfish, *Astacus astacus* L., is a threatened or vulnerable species according to the Bern convention, EC's Habitat Directive and the IUCN Red List (Taugbøl & Skurdal 1999). Countries with native noble crayfish populations have a special international obligation to protect this species. In addition, noble crayfish has a high economical, as well as ecological, social and cultural value, and there is a considerable interest to increase harvest from wild and cultured populations. In areas with crayfish catching traditions, the exploitation and conservation of noble crayfish are closely linked and mutually dependent (Taugbøl 2004).

The aim of this project has been to improve the basis for a sound management of crayfish in Latvia through the development of a management plan. The management plan consists of two parts: (1) the present report giving status for the crayfish situation in Latvia and recommendations for conservation and sustainable use, and (2) a database containing available information on Latvian crayfish populations. The database will be hosted and continuously updated by the Latvian Crayfish and Fish Farmers Association.

In Latvia, only the noble and narrow-clawed crayfish have common name and are mentioned specifically in the legislation. In this report we use the English names for the three different species present. For more information on crayfish biology we refer to Holdich (2002).

2 General information

2.1 Inland waters

Latvia has 12500 rivers and streams with a total length of 60000 km. Most of the rivers are less than 10 km, 209 rivers are between 20 - 50 km, 50 rivers are 50 - 100 km, and only 17 rivers are longer than 100 km (the largest being R. Daugava, R. Lielupe, R. Venta and R. Gauja).

Latvia has 2256 lakes with an area of at least 1 ha making up a total area of 100 000 ha, or 1,5% of the total area of the country. Most lakes are quite small, only 13 lakes exceed 1000 ha (10 km²). The three largest lakes are L. Lubana (8200 ha), L. Razna (5800 ha) and L. Engure (3800 ha). 140 lakes are between 100 – 1000 ha and 800 lakes between 10 – 100 ha. Most lakes are eutrophic and shallow with average depths from 1 – 4 m. Only 7 lakes are deeper than 10 m.

In addition to the lakes there are some 300 small water reservoirs dammed up in the rivers. In the R. Daugava there are 3 large hydroelectric power station reservoirs with a total area of 10200 ha.

2.2 Ownership to water, fish resources and fishing rights

The Civil Act of the Republic of Latvia states that 189 lakes and 39 rivers (or parts of a river), are public (state-owned) and the other waterbodies are private.

According to the Fishery Law, the fish resources in all public and private natural waters are state property. Exceptions are artificial ponds, and lakes and water reservoirs approved for aquaculture.

With respect to fishing rights, Latvian waters are categorised as follows:

- 1) Public lakes: the State has the fishing right
- 2) Public rivers: owners of the riverbank have the fishing right
- 3) Private lakes and rivers: owners have the fishing right
- 4) In some private lakes (209) and rivers (17) listed in the Civil Act: the State has the fishing right

The National Board of Fisheries usually transfer the State fishing right to the local government for renting out to commercial or recreational fishery.

3 Crayfish situation in Latvia

3.1 Historical data

The numerous lakes and rivers of Latvia offer good natural conditions for crayfish. Early in this century many Latvian rivers and lakes supported good populations of crayfish, representing a substantial economic value. In the 1920's, the Latgale region of Latvia supplied more than 20 tonnes of crayfish for the consumers market per year. The harvest was also great in other regions, but there is a lack of catch statistics.

From about 1930 on, the situation changed dramatically. The crayfish plague disease reached Latvia and eradicated many crayfish populations. Also physical habitat alterations, pollution and overfishing contributed greatly to the decline of crayfish populations. In the 1950's the total annual crayfish yield in Latvia was approx. 14 tonnes according to official statistics. The yield has further decreased during the last decades, and there was no official/legal crayfish catch in Latvia in the 1990's (Arens 1998).

There are three crayfish species present in Latvia; the European species noble crayfish (*Astacus astacus*) and narrow-clawed crayfish (*Astacus leptodactylus*) and the North-American signal crayfish (*Pacifastacus leniusculus*) species. Probably only noble crayfish are native and migrated into the country after the last glaciation. Narrow-clawed crayfish has also been present at least since the beginning of the 20th century. Surveys undertaken in the 1960's (Jurane 1967) concluded that noble crayfish inhabited waters all over Latvia, and narrow-clawed crayfish occurred only in the southern part with an exception for a population close to Riga. In total, 194 noble crayfish and 14 narrow-clawed crayfish populations were registered (Fig. 1). Signal crayfish was first introduced to Latvia from Lithuania in 1983 as part of a scientific experiment. It was then stocked in only one lake.

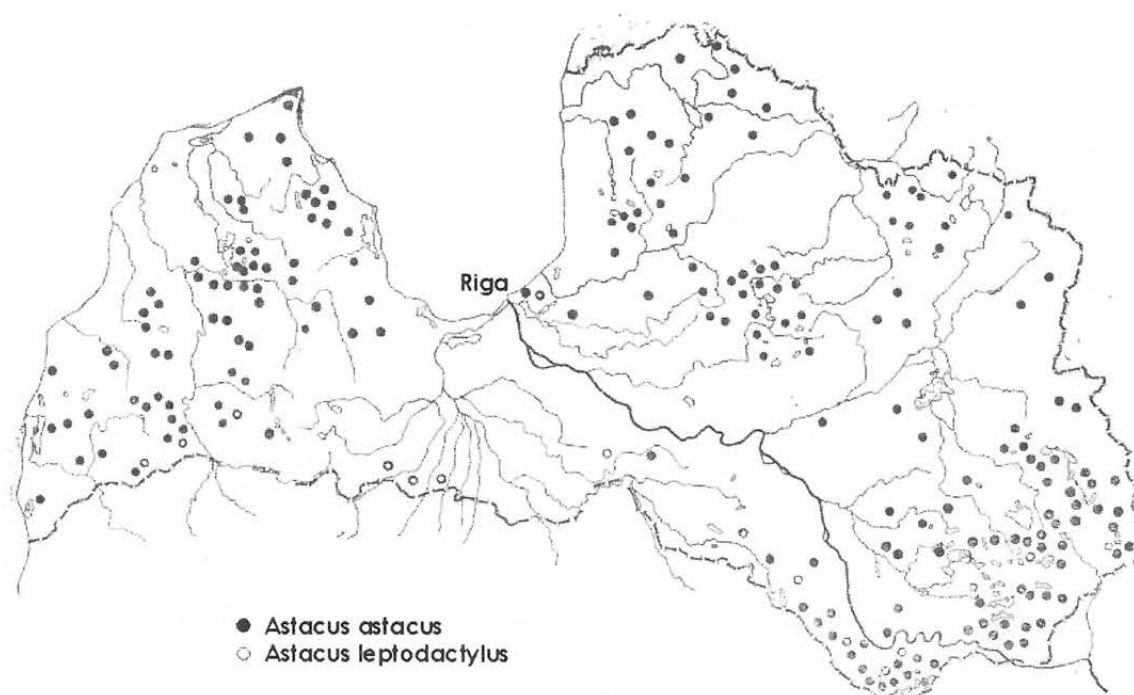


Figure 1. Distribution of crayfish in Latvia in the 1960's (from Jurane 1967).

3.2 Distribution and abundance – current situation

In this section we present the current knowledge on crayfish distribution and abundance in Latvia. Available previous results of investigations and official statistics have been collected and systematized, and new data obtained from inquiries and field investigations. Data on the crayfish distribution and abundance are stored in a special database, and the results presented below are extracts from this database. It is most likely that new investigations in the years to come will significantly influence the number and type of localities and pattern of distribution. The term "locality" means a distinct lake, reservoir (basin for watermill/hydro power), pond, gravel-pit, or river/stream. For more detailed information, we refer to the database and the host institution, the Latvian Crayfish and Fish Farmers Association.

In total there are information on crayfish from 258 localities in Latvia. Most of these localities are lakes (175), but many crayfish populations are also found in river and streams (66). A few populations are found in reservoirs, ponds and flooded gravel-pits (Table 1). Rivers are the dominating locality in the Kurzeme region, whereas in the Latgale region only 5 out of 68 localities are rivers (Table 1). Number of registered crayfish localities are approximately the same (68-78) in the Kurzeme, Latgale and Vidzeme regions, and a bit fewer (38) in the Zemgale region (Table 1).

Table 1. Number of crayfish localities in different waterbody categories in the regions of Latvia

Region	Waterbody category					Total
	Lake	River	Reservoir	Pond	Gravel-pit	
Kurzeme	30	35	4	3	2	74
Latgale	63	5	0	0	0	68
Vidzeme	61	14	1	1	1	78
Zemgale	21	12	4	1	0	38
Total	175	66	9	5	3	258

The noble crayfish (*Astacus astacus*) is the dominant crayfish species in Latvia, and 220 out of 258 localities carry only noble crayfish. In 26 localities narrow-clawed crayfish (*Astacus leptodactylus*) is the only species, whereas signal crayfish (*Pacifastacus leniusculus*) is found as the only species in 4 localities. In 8 localities noble and narrow-clawed crayfish coexist (Table 2).

Table 2. Number of crayfish localities with the different species in the historical regions of Latvia

Region	Crayfish species				Total
	Noble crayfish	Narrow-clawed crayfish	Signal crayfish	Noble + Narrow-clawed crayfish	
Kurzeme	74	0	0	0	74
Latgale	63	4	0	1	68
Vidzeme	59	10	4	5	76
Zemgale	24	12	0	2	40
Total	220	26	4	8	258

Type of waterbody in which the different species occur are shown in Table 3. Interestingly, narrow-clawed crayfish have not been recorded in rivers.

Table 3. Number of crayfish localities in different waterbody categories

Crayfish species	Waterbody category					Total
	Lake	Reservoir	River	Pond	Gravel-pit	
Noble crayfish	143	6	64	5	2	220
Narrow-clawed crayfish	23	3				26
Signal crayfish	1		2		1	4
Noble and narrow-clawed crayfish	8					8
Total	175	9	66	5	3	258

The total number of registered crayfish populations are 266 (in 8 localities noble and narrow-clawed crayfish co-exist). A majority of the populations are weak, however, more than 25% are classified as good. For more than 30% of the populations there are no information about the population status (Table 4).

Table 4. Number and proportion (in percent) of crayfish populations in different population status categories.

Crayfish species	Population status				Total
	Weak popula- tion	Medium good population	Good popula- tion	No info on status	
Noble crayfish	74 (32%)	36 (16%)	46 (20%)	72 (32%)	228
Narrow-clawed crayfish	18 (53%)	1 (3%)	5 (15%)	10 (29%)	34
Signal crayfish	0	0	1 (25%)	3 (75%)	4
Total	95	18	68	85	266

3.2.1 Noble crayfish (*Astacus astacus*)

The noble crayfish is the dominant crayfish species and widely distributed in all regions of Latvia (Fig. 2, Tab. 2). The pattern of distribution is much the same as described by Jurane (1967), the most obvious change being that more populations are established in the area south of Riga (Fig. 1 and 2). Jurane (1967) reported 194 noble crayfish populations whereas the current database contains 228 noble crayfish populations (Table 4). Of the present populations, 36% are classified as medium or good and 32% as weak. For 32% of the populations there are no information on population status. In 1967, no coexisting populations of noble and narrow-clawed crayfish were reported. Current information include 8 such localities, dispersed in three of the regions (Fig. 2).

3.2.2 Narrow-clawed crayfish (*Astacus leptodactylus*)

The narrow-clawed crayfish has expanded its distribution since the 1960's. Jurane (1967) reported narrow-clawed crayfish in 13 localities, in the current database there are 34 populations (Table 4). Of the present populations, 18% are classified as medium or good and 53% as weak. For 29% of the populations there are lack of information. Previously, the narrow-clawed crayfish was confined to the southern part of the country (with one exception). The present distribution includes several populations around Riga and in other parts of the Vidzeme region (Fig. 1 and 2).

3.2.3 Signal crayfish (*Pacifastacus leniusculus*)

The signal crayfish was introduced to one small lake in 1983 (Fig. 2). In 2004 it is found in another 3 localities (2 rivers and one gravel-pit) quite a distance from the first locality (Fig. 2). This indicates stocking by man and not a natural dispersal. Probably the signal crayfish is more widespread than the current data show. Today, the signal crayfish is abundant in the lake it was first introduced to, but there is lack of information on population status from the other three localities (Table 4).

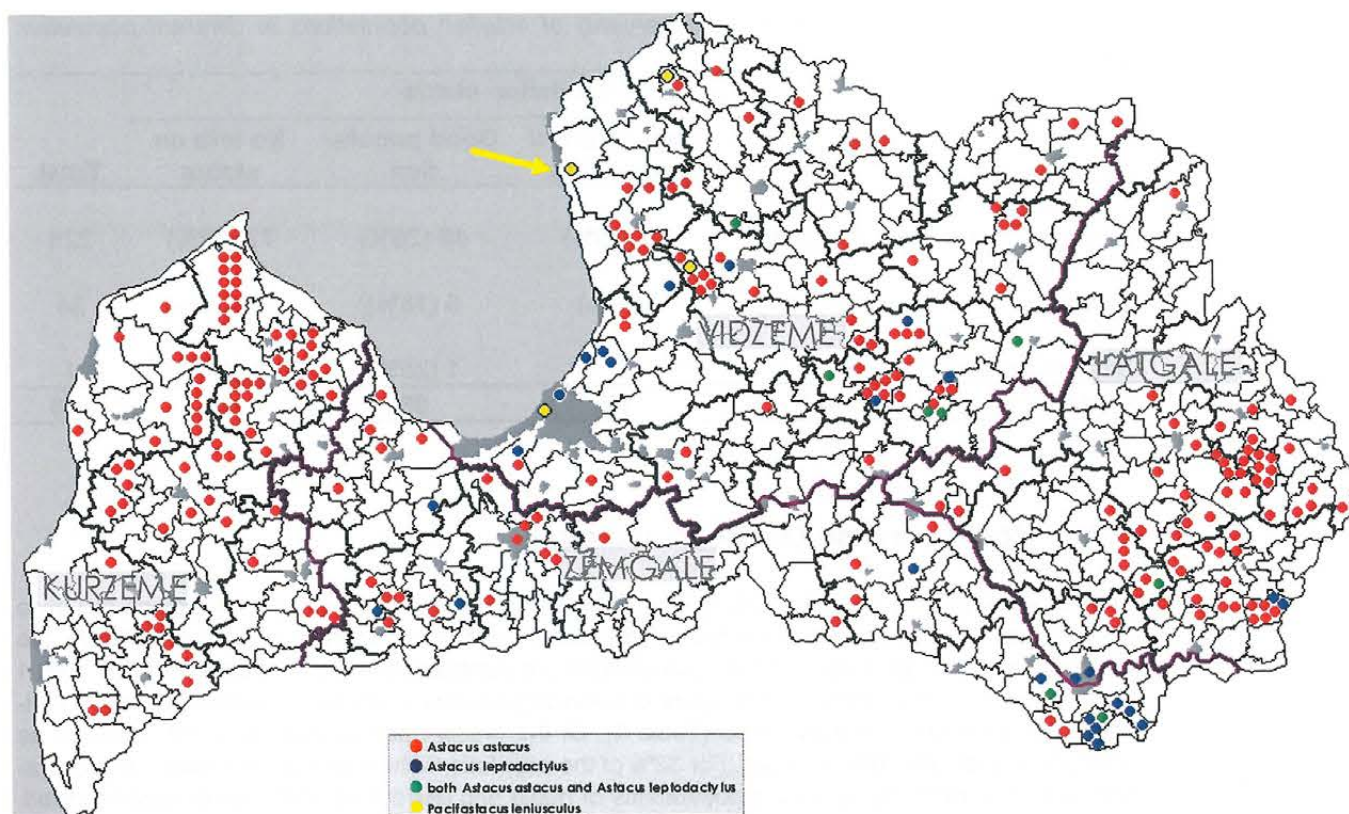


Figure 2. Distribution of crayfish in Latvia in 2004. Each dot represents a crayfish locality. Red dots: noble crayfish; blue dots: narrow-clawed crayfish; green dots: both noble and narrow-clawed crayfish; yellow dots: signal crayfish. Yellow arrow points to the first signal crayfish locality. The boldest lines are borders between the four historical regions of Latvia. Other lines are administrative borders between districts and municipalities. Grey areas are cities.

3.3 Legislation – crayfish management

3.3.1 Crayfish catching regulations

In the legislation crayfish is treated as fish. Only noble and narrow-clawed crayfish are mentioned specifically in the legislation. Signal crayfish is not mentioned, however, it can be assumed that the term crayfish includes all species of crayfish.

There are two categories of fishery and crayfish catching in Latvia: commercial and amateur/recreational.

For both categories of crayfish catching apply:

- Catching can only be carried out in so-called licensed lakes, i.e. lakes that the National Board of Fisheries has decided can sustain exploitation (based on scientific advice from the Latvian Fisheries Research Institute).
- Minimum size of crayfish: 100 mm totallength
- Catching season: July 1 – September 30
- Egg-carrying females must be released

Specifically for commercial catching:

- A lease contract and a fishing license specifying terms for the fishery must be issued. The terms include number of traps and amount of crayfish allowed to catch.
- The license fee varies according to catch amount
- The by-catch of under-sized crayfish can not constitute more than 5% of the total catch.

Specifically for amateur catching:

- A special crayfish catching license is needed. The National Board of Fisheries limits the number of licenses for each locality.
- The license specify period of catching (within the legal catching season), specific catching site in the waterbody, crayfish species, and other possible regulations.
- Only dip-nets/balances and hand-catching are allowed as catching methods
- Maximum number of dip-nets per license is 5
- Maximum catch per license is 50 individuals
- License fee varies currently between 3 – 10 LVL
- It is not allowed to stay at the shoreline with catching gear outside the legal catching period

An overview of crayfish catching regulations in all Nordic/Baltic countries is given in Table 5. Restrictions on effort and catch and a system with licensed lakes are applied only in the Baltic countries. In the Nordic countries there are national catching season (except for Sweden) and minimum size (except for Sweden and Finland) regulations only. In the Nordic countries the right to catch crayfish normally belongs to the landowner, and experiences gained over several decades show that in such cases with local ownership there is no need for national effort and catch restrictions.

Table 5. Crayfish catching regulations in the Nordic/Baltic countries

Country	Species present	Season	Minimum size (cm)	Comments
Latvia	<i>A. astacus</i> <i>A. leptodactylus</i> <i>P. leniusculus</i>	July 1 – Sept 30	10	Effort and catch restrictions. Licensed lakes
Estonia	<i>A. astacus</i>	July 25 – Sept 25	10	Effort and catch restrictions Licensed lakes
Lithuania	<i>A. astacus</i> <i>A. leptodactylus</i> <i>P. leniusculus</i> <i>O. limosus</i>	July 15 – Oct 15	10	Effort and catch restrictions Licensed lakes
Norway	<i>A. astacus</i>	Aug 6 – Sept 14	9,5	Regional authorities may adopt other rules if necessary
Denmark	<i>A. astacus</i> <i>A. leptodactylus</i> <i>P. leniusculus</i>	F: Aug 1 – Sept 30 M: April 1 – Sept 30	9	No catching regulations on introduced species
Sweden	<i>A. astacus</i> <i>P. leniusculus</i>	No national regulations (except for the "four big lakes"). In many cases there are local rules for season and minimum size adopted by the landowners		
Finland	<i>A. astacus</i> <i>P. leniusculus</i>	July 21 – Oct 31	No national regulations. In many cases there are local rules for minimum size and shorter season adopted by the landowners	

In Norway, regional authorities may adopt stricter rules than the national regulations if necessary. This is applied only in one locality due to the unusual catching-rights. In this locality everybody has the right to catch crayfish, and to reduce the exploitation pressure catching season is only 10 days and maximum number of traps are 300 per person.

In Sweden and Finland, the landowners having the fishing right normally apply a minimum size and reduced catching season for crayfish even though it is not required by the authorities.

3.3.2 Regulations on stocking, import and crayfish as bait

In Latvia, stocking of live crayfish in natural waters needs a permission from environmental authorities and a veterinary certificate stating that the stocking material is healthy.

Import of live crayfish to Latvia is allowed. Only a veterinary certificate is needed. Export of live crayfish is also allowed. Exporter must be registered in Department of Food and Veterinary and a veterinary certificate is needed.

It is not allowed to use crayfish as bait.

3.4 Crayfish catching and yield

For many years there were no licensed catch of crayfish at all in Latvia. Since 2002 four lakes, L. Āģes (Limbažu district), L. Černavas (Daugavpils district), L. Kukšu (Kuldīga district) and L. Vaidavas (Valmieras district), have been licensed for recreational/amateur catching (Fig. 3). In 2004, L. Černavas was also licensed for commercial catching. In L. Černavas and L. Āģes the crayfish species is narrow-clawed crayfish, in L. Kukšu the species is noble crayfish, and in L. Vaidavas both species occur.

Annual licensed catch is less than 1 tonn according to official statistics. However, the very restrictive license system contributes to an extensive illegal catch. Probably the actual total yield of crayfish in Latvia, illegal catch included, is 15-20 tonnes per year.

3.5 Crayfish culture and stocking

The first private crayfish farm in Latvia was started in 1994. A following study conducted by the EU-PHARE program MEGAPESKA concluded that use of modern technology and semi-intensive growing methods could make crayfish farming financially profitable. The Latvian Crayfish and Fish Farmers Association (LCFFA) was founded, and plans for the establishing of Crayfish Centers and regional crayfish farms are currently being realized. Objectives of the LCFFA and the Crayfish Centers are to provide information and education on crayfish farming, and also on optimal and sustainable use and conservation of natural noble crayfish populations. Sustainable use and conservation includes the reestablishing of lost and strengthening of weak populations. Production of stocking material is therefore of great importance.

Fig. 3 shows the location of 4 Crayfish Centers (3 private, 1 state owned) and 18 private owned crayfish farms recently established. On the map is also shown so-called monitoring lakes. The aim of the monitoring is to provide valuable information on optimal management practices. This includes knowledge on population development after stocking, and effects of different harvesting regimes. Crayfish have been stocked in four monitoring lakes in 2003-2004 (blue squares in Fig. 3). In the potential monitoring lakes (blue circles) no actions have yet been realized.

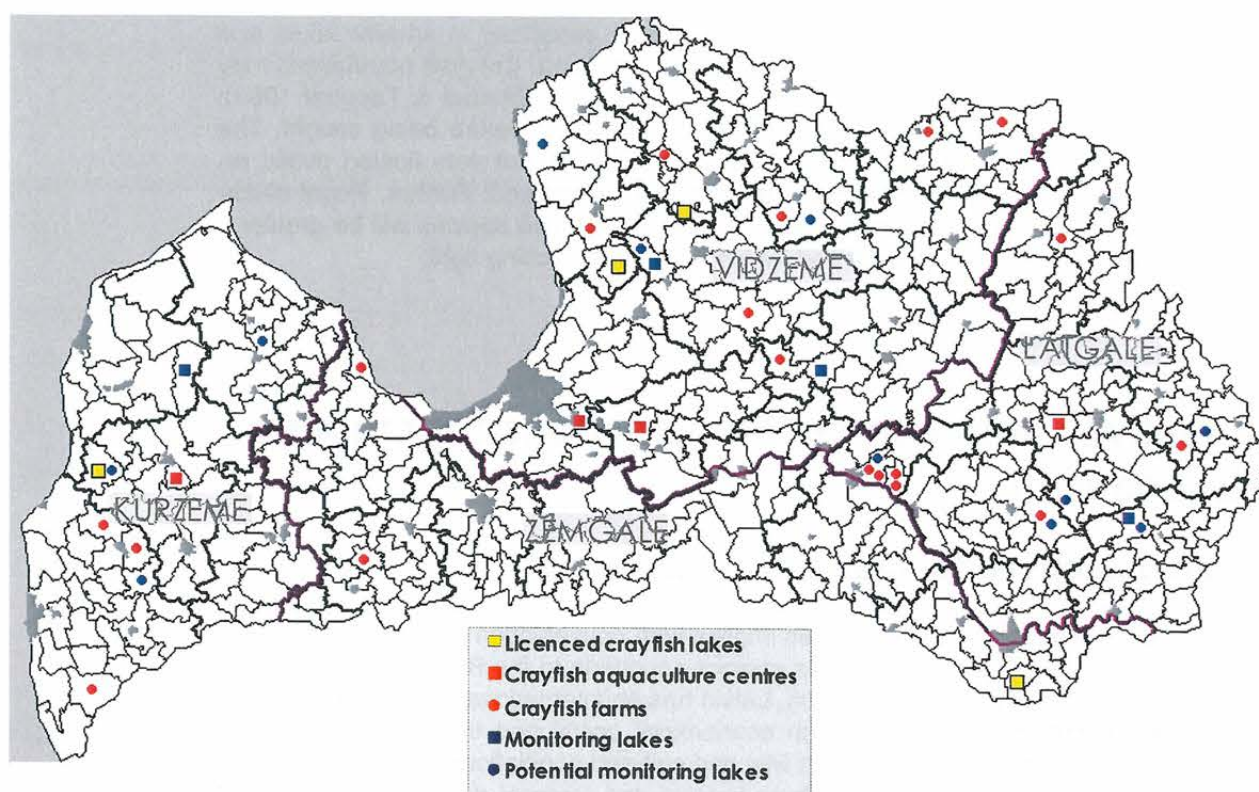


Figure 3. Overview of the Crayfish centers, crayfish farms, licensed crayfish lakes and monitoring lakes in Latvia.

3.6 Main threats to the noble crayfish

3.6.1 Spread of plague-carrying North-American crayfish species

The overall threat to the native noble crayfish is further spread of the signal crayfish already present in Latvia, and introduction of another North-American species, the spiny-cheek crayfish (*Orconectes limosus*) which is present in Lithuanian waters (Taugbøl et al. 1998, Skurdal et al. 1999). These North-American species are carriers of the crayfish plague fungus which cause total mortality in noble crayfish populations. When these species are introduced to a waterbody, the crayfish plague disease will be permanently established (Vogt 1999). Noble crayfish, if present, will be exterminated and reintroduction impossible. Also further spread of the narrow-clawed crayfish may have negative impact on the noble crayfish through competition (Holdich 1999).

3.6.2 Pollution and habitat deterioration

Pollution and habitat deterioration have destroyed the living conditions for crayfish and other biota in many freshwater localities. In the last century many rivers and streams lost their natural habitat as dredging was carried out to provide new forestry and agriculture land. Although pollution has been reduced or ceased in many waterbodies and habitat deterioration occurs at a much lower scale, these impacts still represent a major threat.

3.6.3 Overfishing and insufficient management

Overfishing is also a threat to natural crayfish populations, especially in smaller lakes and river/streams where the populations are more exposed to catching. Crayfish populations may stand high exploitation levels provided the minimum size is kept (Skurdal & Taugbøl 1994). The minimum size will ensure females to reproduce at least once before being caught. The catching regulations and license system in Latvia are very strict, but very limited public resources for control and enforcement make illegal catching widespread. Further, illegal catching and the risk for overfishing and uncontrolled spread of unwanted species will be greater if there are no local responsibility, authority and ownership to the catching right.

4 Objectives and recommended actions for crayfish management

4.1 Main objectives for crayfish management

Sustainable management of natural resources implies both conservation and exploitation. The noble crayfish is a threatened and vulnerable species according to the Bern convention, EU's Habitat Directive and the IUCN Red List. Thus, Latvia has an international obligation to protect this species. Noble crayfish has also a high economical, social and cultural value (Swahn 2004), and there is a great interest to harvest wild and cultured populations. Such harvest may give important additional income and contribute to local and regional development. In areas with crayfish catching traditions, the conservation and exploitation of noble crayfish are closely linked and mutually dependent (Taugbøl & Skurdal 1999, Taugbøl 2004).

Based on these facts and the threats listed above, the main objectives for the management of natural crayfish populations in Latvia should be as follows:

- 1) prevent further spread and new introductions of non-native crayfish species

Rationale: North-american crayfish species are the major threat to the noble crayfish as they carry and spread the crayfish plague. When such species are spread to and established in waterbodies, the noble crayfish will be exterminated if present, and impossible to introduce or reestablish. Also narrow-clawed crayfish have negative impact on the noble crayfish.

- 2) restoration and enhancement of noble crayfish populations

Rationale: Noble crayfish is a threatened species, but also very valuable from an ecological, recreational and economical point of view. Restoration and enhancement of populations will have major significance both for the conservation and for the sustainable use of the species.

- 3) sustainable exploitation and local involvement and responsibility

Rationale: The recreational and economical value of crayfish is a benefit to the society. Crayfish catching may represent important additional income and play a role in regional development. Provided reasonable regulations, crayfish populations can stand high exploitation levels. There is also a close link between exploitation and protection. Those who exploit a resource are motivated to do it in a sustainable way provided they have some kind of ownership to the resource. Without utility there is no motivation for conservation.

Below we recommend actions to achieve the proposed management objectives. It is important to note the relationship between the different management objectives and actions. For instance, actions stimulating local responsibility and a sustainable fishery of noble crayfish also contribute to the protection and enhancement of the species. Sustainable exploitation will have a positive effect on the overall crayfish production.

4.2 Recommended actions

Objective 1: Prevent further spread of signal crayfish and the introduction of spiny-cheek crayfish

Actions:

- **Ban import of live crayfish.**
This is strongly recommended by the international society working on crayfish conservation (IAA 1988, Holdich et al. 1999). Despite the policy of free trade, EU members Ireland, Sweden and Estonia have succeeded in keeping a strict ban on the live import (Edsman 2004). At present, there is no ban on import of live crayfish to Latvia.
- **Ban catching of non-native crayfish.**
The greatest risk of further spread of non-native crayfish (signal and narrow-clawed) is from people catching crayfish and releasing them into other waterbodies. Thus, a general ban on non-native crayfish catching is recommended. Only catching by authorized personnel aimed at reducing/controlling the population should be allowed.
- **Information to the public on the adverse effects of spreading non-native crayfish.**
Knowledge and attitude of local people is a key factor. With an easy access to non-native crayfish, it is impossible to prevent spreading of such species if local people along the watersheds want otherwise. Local people must be convinced that noble crayfish is the best alternative, and that the greatest threat to this species is the spread of non-native crayfish. This can only be achieved through information.
- **More detailed mapping of the distribution of the alien species.**
Current knowledge is given in Fig. 2. Signal crayfish are recorded in only 4 and narrow-clawed crayfish in 34 localities. Further investigations will probably reveal a more widespread distribution. A prerequisite for an effective control of the species is accurate information on their distribution.
- **Establish contacts with Lithuanian authorities/institutions regarding spread of spiny-cheek crayfish in border watercourses.**
Spiny-cheek crayfish occurs in Lithuanian waters, mostly in the southern part, but is also recorded in the northwestern Plungės region, not far from the Latvian border (Taugbøl et al. 1998, Skurdal et al. 1999). It is important to get information from Lithuanian authorities regarding further spread towards Latvia.

Objective 2: Restoration and enhancement of noble crayfish populations

Actions:

- **Stocking of noble crayfish.**
Extinct noble crayfish populations should be reestablished by stocking if conditions are satisfactory (i.e. adequate water quality and no alien species present). Also weak populations may benefit from stocking provided there are no restricting bottlenecks making the stocking non-effective. This should be carefully examined before stocking.

- **Information leaflets/guidelines on the value of crayfish populations, stocking procedures and how to prevent spread of crayfish (and fish) diseases.**
The guidelines should include information on: crayfish species and catching regulations, permissions needed, recommended stocking material and methods, crayfish diseases and how to avoid their spread, and addresses to contact persons for more information. A general information leaflet on crayfish has already been produced by the Latvian Crayfish and Fish Farmers Association (Vēži Latvijā 2004).
- **Prevent water pollution and habitat deterioration.**
This is a general recommended action for the overall management of water resources. Crayfish, as one of the most valuable species in freshwater, can in this connection be focused on as a clean-water indicator and as a species that can increase the awareness and responsibility of local people/authorities.
- **Mapping, monitoring and research**
A knowledge-based management rely on updated information on the distribution and abundance of the crayfish populations. It is important to maintain, improve and continuously update the database currently established. Monitoring and research related to practical management issues like restoration and enhancement of crayfish populations, effects of exploitation, monitoring systems and the significance of local involvement are recommended.

Objective 3: Sustainable exploitation and local involvement and responsibility

Actions:

- **Cancel the system of crayfish catching only in licensed lakes. Exploitation of crayfish should be allowed in all private waters. In public lakes, local associations of fishermen/landowners or local/regional authorities should be given the authority and responsibility for exploiting the crayfish resource. (Exception for non-native crayfish populations, cf. objective 1).**
Current knowledge and experiences from the Nordic countries do not support the necessity of licensed lakes and national catch and effort restrictions. The main point is that those having the ownership to or responsibility for a resource will have a great motivation for a sustainable use, i.e. not overexploit or destroy the resource. Necessary restrictions on exploitation will be applied by those having the ownership or responsibility. This system will also counteract the great current problem of illegal catching. In public lakes a distinction between recreational and commercial must be considered.
- **Maintain national regulations on minimum size and season.**
Although Sweden and Finland have removed the minimum size as a national regulation, we still recommend this regulation being maintained. A minimum size of 95 mm will ensure females to reproduce twice before being caught. Season restriction is important in order to protect berried females.
- **Information on sustainable use and protection of crayfish populations.**
Information on how to best exploit the crayfish resource should be available to all involved in crayfish management.

4.3 Summary table – objectives and actions

Management objective	Actions
1. Prevent further spread of signal crayfish and introduction of spiny-cheek crayfish	<ul style="list-style-type: none"> - Ban import of live crayfish - Ban catching of non-native crayfish (signal and narrow-clawed) - Information to the public on the adverse effects of spreading non-native crayfish - More detailed mapping of the distribution of the non-native species - Establish contacts with Lithuanian authorities/institutions regarding spread of spiny-cheek crayfish in border water-courses
2. Restoration and enhancement of noble crayfish populations	<ul style="list-style-type: none"> - Stocking of noble crayfish - Information leaflets/guidelines on the value of crayfish populations, crayfish species and catching regulations, stocking procedures and how to prevent spread of crayfish (and fish) diseases. - Prevent water pollution and habitat deterioration - Mapping, monitoring and research
3. Sustainable exploitation and local involvement	<ul style="list-style-type: none"> - Cancel the system of licensed lakes - exploitation of crayfish should in general be allowed (except signal crayfish populations, cf. objective 1). - Owners should have the fishing right in private waterbodies. In public lakes and rivers, local associations of fishermen/ landowners or local/regional authorities should be given the authority and responsibility for exploiting the crayfish resource. - Maintain national regulations on minimum size and season. - Information leaflets/guidelines on sustainable use and protection of crayfish populations

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