ROUNDTABLE 1
CRAYFISH PROTECTION PROGRAMMES IN EUROPE

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ABSTRACT

One of the goals of the European network CRAYNET – entitled "European crayfish as keystone species-linking science, management and economics with sustainable environmental quality" – is to identify current crayfish protection programmes carried out in individual countries. During this roundtable held at the CRAYNET meeting in Innsbruck 2004, we tried to evaluate the projects that aimed directly at crayfish conservation or at habitat improvement in order to protect crayfish environments. Different approaches and new skills were discussed in order to increase understanding of the advances and positive results obtained on the management of native populations (species status, habitat, population, control of aliens, diseases etc.).

Key-words: crayfish protection, European research programmes, skills, habitats.

TABLE RONDE 1

LES PROGRAMMES DE PROTECTION DE L'ÉCREVISSE EN EUROPE

RÉSUMÉ

L'un des buts du réseau thématique européen CRAYNET – intitulé "European crayfish as keystone species-linking science, management and economics with sustainable environmental quality" – est d'identifier dans chaque pays les programmes de recherche en cours pour une protection des écrevisses. Au cours de la table ronde, nous avons essayé de lister les projets ayant trait directement à la conservation des écrevisses et à la restauration de l'habitat en vue d'une protection environnementale. Différentes approches ont été discutées et de nouvelles compétences repérées dans le but d'augmenter la connaissance des avancées et des résultats positifs obtenus pour la gestion des populations natives (par exemple statut de l'espèce, habitat, contrôle des écrevisses exotiques, maladies)

Mots-clés : Europe, protection des écrevisses, programmes de recherche, compétences.

INTRODUCTION

In the past decade, an initial survey was conducted on the astacology of the genus *Austropotamobius* in Europe (VIGNEUX, 1997). Key words were used to identify the main

research topics and how the current programs were carried out. Three major areas of research were identified: behavioural and ecological studies, restoration programs and population conservation, and knowledge-based management/exploitation of the stocks. From this survey, the necessity to improve the organisation of the research by developing contacts between scientists and bringing them together with managers so as to focus work on the most urgent needs was evident. Since 1997, the situation has progressed well in this sense with the organization of several regional meetings (for example: Leeds, 2000 (ROGERS and BRICKLAND eds), Nottingham, 2002 (HOLDICH and SIBLEY, eds); Forum Flusskrebse meetings every two years), a European meeting (Poitiers, 2001, proceedings SOUTY-GROSSET and GRANDJEAN, 2002), and now continuously through the activities of the European network CRAYNET. About 500 persons (scientists and managers) – working towards improving the management of our natural heritage – i.e. towards sustainable management- have been identified throughout Europe. Starting from the mailing list, the CRAYNET secretariat has been gathering an inventory of information in response to questionnaires about research and environment programmes on European crayfish. Further the present roundtable on 'species protection programmes'at the CRAYNET meeting in Innsbruck 2004, attempts to focus on a number of main objectives/actions taken, such as monitoring, restocking, habitat optimisation, catchment optimisation, legislation, public information. The information obtained from both investigations is presented.

GLOBAL VIEW: INVENTORY OF RESEARCH AND MANAGEMENT PROGRAMMES ON EUROPEAN CRAYFISH (Indigenous – ICS – and non indigenous – NICS – crayfish species).

Starting from the received questionnaires (Annex 1), we attempted to categorize the importance of topics studied on each species under 26 keywords, grouped in 9 redefined topics in order to facilitate the data treatment (Table 1).

Table I
List of the 26 keywords used in the questionnaire and of keywords associated per topic.

Tableau I
Liste des 26 mots-clés utilisés dans le questionnaire et leur regroupement par thème.

Topics	***Keywords associated***
Conservation	Action plan, Bioindicator, Conservation, Legislation, Monitoring, Population restoration, Stock management
General biology	Growth, Nutrition, Reproduction
Physiology	Bio-accumulation, Immunology, Osmoregulation
Behaviour	Behaviour, Tagging
Population structure & dynamics	Biogeography, Migration, Modelling, Population density Dynamics & structure
Ecology	Ecology, Habitat
Disease	Bacteria, Specific disease, Virus & parasites
Genetics	Genetics
Farming	Farming

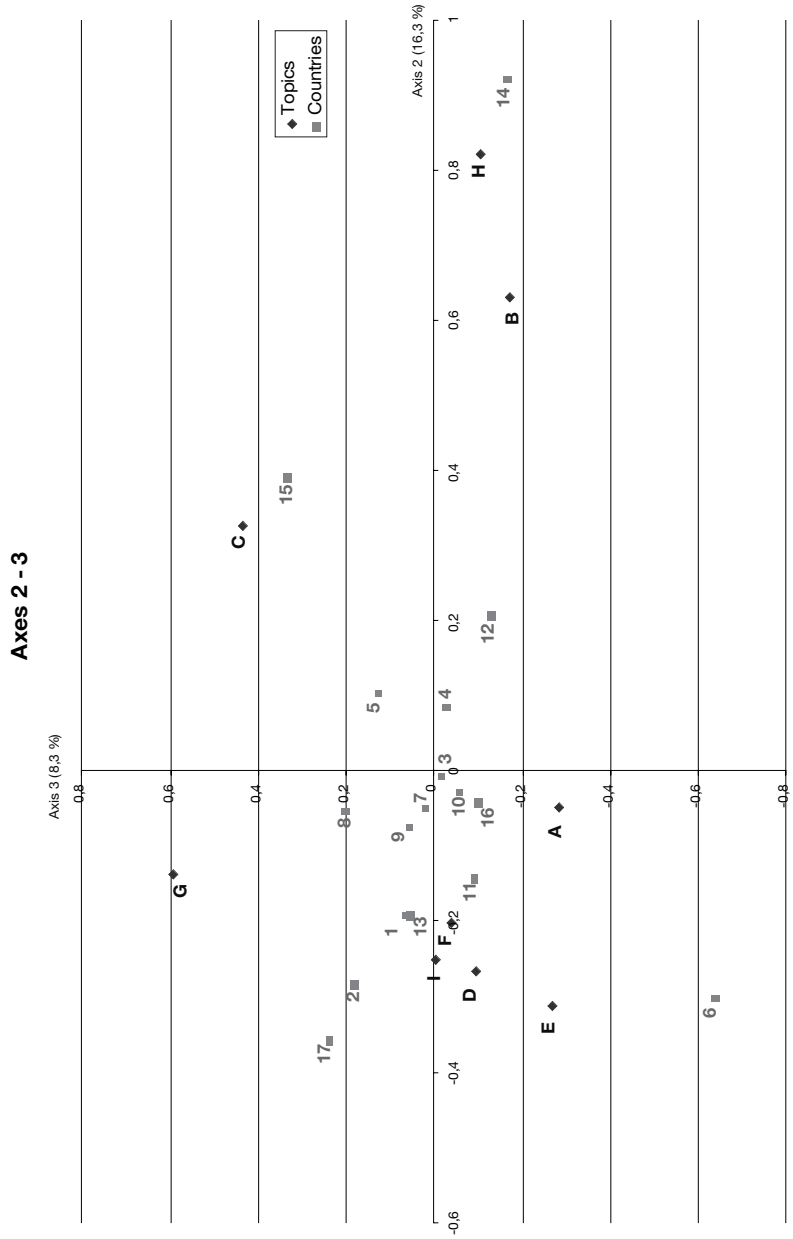

Figure 1

PCA (Principal Coordinates Analysis) expressing the results obtained about four native crayfish species (NICS) *Astacus astacus (ASA), Austropotamobius pallipes (complex AUP + AUI), Austropotamobius torrentium (AUT), Astacus leptodactylus (ASL)* and four non native crayfish species (NICS): *Orconectes limosus* (ORL), *Pacifastacus leniusculus* (PAL), *Procambarus clarkii* (PCL) and *Cherax destructor* (CHD).

Figure 1

Résultats de l'analyse en composantes principales, ACP, obtenus pour quatre espèces natives, *Astacus astacus (ASA), Austropotamobius pallipes* (complex species *pallipes* & *italicus: AUP + AUI*), *Austropotamobius torrentium* (AUT) et *Astacus leptodactylus (ASL), et* quatre espèces non natives *Orconectes limosus (ORL), Pacifastacus leniusculus (PAL), Procambarus clarkii (PCL) et Cherax destructor (CHD).*

While the first axis give only the number of answers per country (consequently not represented), the second and third axes revealed how countries are grouped around topics important for management of crayfish populations; only a few countries are concerned with diseases, physiology and farming. This grouping indicates a concern of the European community (scientists and stakeholders) for managing crayfish populations because the initial survey (VIGNEUX, 1997) showed three global orientations forming three unequal large-scale areas of concern: restoration programmes and population conservation were only studied in Spain and UK, Italy considered only behaviour and France, genetics.

Generally population structure, dynamics and ecology are well studied. Genetics – essentially applied in the past to *Austropotamobius pallipes* – is now studied for all species and it is pointed out that, as *Austropotamobius pallipes* is a species complex (FRATINI *et al*, 2005), investigations about the genetic status of populations is essential before undertaking management of these populations (SOUTY-GROSSET *et al.,* 2003; SCHULZ *et al*., 2004), such as restocking programmes (SCHULZ *et al*., 2002). Studies on crayfish conducted at the landscape level were summarized in an earlier CRAYNET roundtable (SCHULZ and SCHULZ, 2004) Diseases are recorded for each species but presently, the field is currently ill-equipped to determine the cause(s) of these epizootics. Moreover, crayfish conservation strategies may be detrimental to the long-term goals; e g, stocking programs may spread undetected pathogens. Therefore, critical limitations in the field of crayfish pathology have major repercussions in management of freshwater crayfish. Guiding principles and a concept for a trans-European Community research and education program are proposed to address this serious issue (EDGERTON and JUSSILA, 2004). The present figure demonstrates well that a programme must be proposed to respond to the disease threats to European freshwater crayfish, as suggested by EDGERTON and JUSSILA, 2004.

FOCUSING ON SPECIES PROTECTION PROGRAMMES (ICS)

During the Innsbruck CRAYNET meeting a second questionnaire focussing on species protection programme was distributed, filled in and analysed. Figure 2 shows how the main topics were answered. Table 2 lists some examples for crayfish protection programmes based on information provided by the roundtable participants.

There is no figure about the topic habitat because, surprisingly, only Austria, Italy and France documented this aspect and other countries indicated that no specific actions are undertaken about habitat optimisation and catchment optimisation **(or** none are included in a specific programme). To date, studies are focused on water quality, habitat characteristics for restoration and land-use control.

It is remarkable to note that Norway record the distribution of crayfish annually over the last 24 years! Only now, for most countries and often through CRAYNET activities and the Atlas project, are specific distribution maps being drawn. Species protection programs are often local or regional ones, particularly in countries divided into regions as for example Italy, Spain. However it is interesting to point out that now programs can involve two countries without considering the borders but only the eco-region: this is the case of the programme conducted in Tyrol, Austria and Italy and involving the three native species *Austropotamobius torrentium*, *Austropotamobius pallipes/italicus* and *Astacus astacus* or Germany and Poland involving *Astacus astacus* (SCHULZ and SMIETANA, 2001, Table 2) Priority areas are now well defined as in U.K and Ireland (SACS: Special Areas of Conservation): In UK, there are 608 SACs including Irish cross border sites14 SACS are retained for the species in Ireland (5 rivers, 9 lakes). In France, 166 Natura 2000 sites are related to the white-clawed crayfish *A. pallipes* (http:naura2000.environnement.gouv.fr/especes/1092.html). If there is often no specific action on legislation: this aspect is still actively debated through CRAYNET meetings (see the roundtable legislation conducted by

Table II

Examples of crayfish protection programmes based on information kindly provided by roundtable participants (see also reference list).

Tableau II

Exemples de programmes de protection de l'écrevisse basés sur des informations gracieusement fournies par les participants à la table ronde (voir aussi la liste de référence).

Country	Region	Duration	Funding (Source and/ or level, e.g. national)	Responsible institution/person; Program title	Type and/or no. of water bodies	Target species	Main objectives/actions taken					Results obtained	Economic aspects involved	Any other aspects
							Monitoring	Restocking	Habitat or catchment	Legislation	Other measures			
Italy	South Tyrol	2002-2004	National/regional	Uni Innsbruck, L. Füreder; "Artenschutz Südtiroler Bachkrebs"	Streams/ lakes	AUP	yes, four ICS population	yes, from two source population	Yes	Some	Folder, public information	Distribution of ICS and NICS, habitat analysis, several new founded stocks	No	Evaluation of species protection measures
Austria	Tyrol	2002-ongoing	National/regional	Uni Innsbruck, L. Füreder; "Artenschutz Flusskrebse"	Stream/ lakes	ASA, AUT	Yes	Yes	Yes	Some	Book, public information, folder	Two new founded stocks	No	Evaluation of species protection measures
Latvia	Latvia	2002-2004	NINA, Latvian Environ. Prot. Found, Ministry of Agricul., Latvian Crayfish and Fish Farmers Assoc.	T. Taugbøl (NINA), A. Arens (LCFFA)	Lakes and rivers	ASA	Development of monitoring system (15 lakes)	Yes, in monitoring lakes	Proposals for species specific management	Proposals for optimization of legislation	Public information brochure, media presence	Maps, data base and population status; established 5 monitoring lakes & > 30 crayfish farms	Rural development	No
Norway	SE Norway	Annually since the 1980's	Directorate for Nature Management (national level)	Norwegian Institute for Nature Research (NINA)	27 specific monitoring lakes	ASA	Yes	Yes	No	When adjustments are necessary	Information to the public	A very good overview of the crayfish situation in Norway	Sustainable harvest by the landowners encouraged	Close links to other projects aimed at habitat optimisation
Italy	Marche, Abruzzo and Molise	2004-2006	European Commission	Ing. Giancarlo Moca – Province of Chieti – LIFE Nature, T. Pagliani	Running waters in SAC	AUP	Control of wild population health and of quality of water bodies	Develop-ment of aquaculture and reintroduction of juveniles	No specific actions	No specific actions	Public information, Natura 2000 Network	Increase of AUP distribution along the three regions involved	Small scale aquaculture for restocking	No
Germany /Poland	Brandenburg/ Pommerania	2001-2003	Private foundation & local EPA	TU BS & Uni Sczecin: R. Schulz, H.K. Schulz, P. Smietana	About 50 isolated lakes	ASA	Complete coverage of whole area (NICS and ICS)	Following site evaluation in more than 10 sites	No specific actions	No specific actions	Public information, brochures	Distribution maps, 6 newly established stocks	Small scale aquaculture for restocking	National differences in situation and actions

Table II (suite)

Country	Region	Duration	Funding (Source and/ or level, e.g. national)	Responsible institution/person; Program title	Type and/or no. of water bodies	Target species	Main objectives/actions taken					Results obtained	Economic aspects involved	Any other aspects
							Monitoring	Restocking	Habitat or catchment	Legislation	Other measures			
Italy	Lombardia	2001-2004	LIFE Nature2000 (EU)	Parco Valle Lambro & del Ticino: Conserv. of AUP in two N Italian SIC	2	AUP	Complete coverage of whole area (two SICs)	Introduction of breeders	Hydraulic optimisation of introduction sites	No specific actions	Public information, brochures	Repopulation into two focal areas	No	Small scale aquaculture for restocking specimen
Ireland	Whole	2001-2003	University scholarship; short contracts to National Agency	J. Reynolds, A. Demers, Trinity College: Crayfish distribution in relation to water quality	7 river catchments	AUP	Complete coverage of area	No specific action	No specific action	Designation and checking of SACs	No specific action	Updated distribution (communicated, published)	No	Provided information for National Parks and Wildlife Service
France	Poitou-Charentes	2002-2007	Europe LEADER Plus	Pays de Gâtine/Uni Poitiers C. Souty-Grosset: Château d'eau du Poitou; Management of AUP populations	9 streams	AUP	2006-2007	Last step	Habitat	No	Education of the public	Importance of organic matters in relation to the absence of crayfish	Agriculture and environment, ecotourism	Hydrocitizenship
Spain	La Rioja	2000-2006	Regional	Consejería de Turismo y Medio Ambiente del Gobierno de la Rioja	Various	AUP, AUI	Complete coverageof the whole area (ICS and NCIS)	In isolated areas	No specific action	Specific Program of Control and Exclusion of NICS	Public information (TV, news-papers, brochures, web page)	Not available	No	No
Croatia	No details	4 years	Ministry of science, education and sport	R. Erben; Aquaculture of noble crayfish and repopulation of natural habitats	Lakes, rivers	ASA, AUP, AUI, AUT	Distribution on ICS and NICS	No	No	*ASA, AUT, AUP* are protected by Law, but no law enforcement	Public information, leaflets, posters	Information on the distribution of ICS and NICS, biology and ecology of *crayfish* in Croatia	No	No
Italy	Allessandria province, Piedmont	2002-2004	Provincial administration	Pavia University (Nardi), ARPA University, Aless. Provi.: Freshwater crayfish in the Aless. prov.	Whole province	AUP, AUI	Water quality	No specific actions	No specific actions	No specific actions	Public information Monography	Distribution maps	No	Ecological observations
Italy	Piedmont	2004-2006	Local administration	Daniela Pessani, Guido Badino	Rivers	AUP, AUI	Monitoring the Torino district, species distribution and health	Eventually following site evaluation	No specific actions	No specific actions	Public information brochures	The project is at the beginning	No	No

Table II (suite)

Country	Region	Duration	Funding (Source and/ or level, e.g. national)	Responsible institution/person; Program title	Type and/or no. of water bodies	Target species	Main objectives/actions taken					Results obtained	Economic aspects involved	Any other aspects
							Monitoring	Restocking	Habitat or catchment	Legislation	Other measures			
Italy	Lombardia	2004-2007	CEE, regional administration, regional parks, province administration	UNIPV – Pavia – Nardi: LIFE 2003 Requalification of the Valvestino and Corno della Marogna biocenoses	18 brooks/ streams	AUP, AUI	Catchments of two SICs (Corno della Marogna, Valvestino), crayfish distribution	Start in 2005	No specific actions	No specific actions	Public information brochures, posters and environmental education	Distribution maps, 1 newly established stock	No	Ecological observations
Italy	Tuscany	2002-2004	UN.D.A.FELIX (fishing association)	F. Gherardi, B. Renai, S. Brusconi: Characterising streams for the management of *AUI*	23 watercourses	AUI	Crayfish population size, geophysical and ecological habitat characteristics	Following site evaluation in six areas	No specific actions	No specific actions	Public information brochures	Up to now: no significant differences between sites	No	No
Italy	Tuscany	2004-2005	Province of Arezzo	F. Gherardi, L. Aquiloni	Lakes and lentic watercourses	PCL	Evaluation presence/absence and density	No specific actions	No specific actions	No specific actions	No specific actions	Map distribution	Impact evaluation	Risk evaluation of diffusion
England	Britain	2000 onwards	Government conservation agency, e.g. English Nature	B. Lebas and D. Rogers. LIFE in UK Rivers project	One River	AUP	Yes	Yes. Population in river was lost due to crayfish plague	No specific actions	No specific actions	Setting up rearing and holding facilities	Papers and reports on success of project	Improvement of fishing	The programme is ongoing
England	Britain	1986-1999	Environment Agency – local	M. Frayling, J. Spink	Two rivers	AUP	Yes	Yes, in 1982, 1986, 1987 and 1994	No specific actions	No specific actions	No specific actions	Reintroduction programme successfull	No	The programme is ongoing

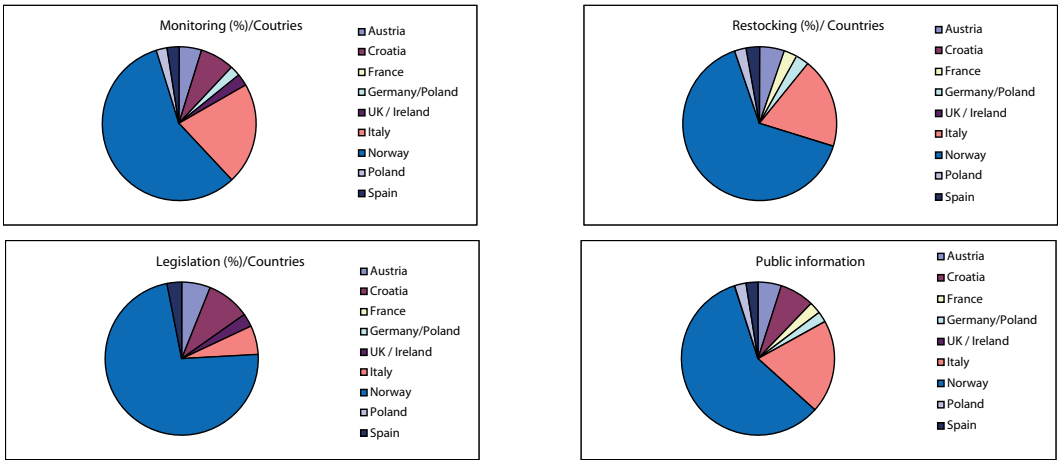

Figure 2
Results for major themes determined drawn from the answers to the second questionnaire.

Figure 2
Résultats pour les thèmes majeurs obtenus à partir des réponses au second questionnaire.

M. PÖCKL and D.M. HOLDICH following past debates – VIGNEUX *et al.*, 2002; EDSMAN and SMIETANA, 2004) and is certainly the more difficult remaining to be resolved. Public information is now an important concern because about the question "other measures?" most countries indicated at least two of the terms public information, brochures, posters, environmental education, web, TV, newspapers. This topic is often in the objectives of the organisations funding the programme; which is why Public education now takes an important place in the discussions between scientists and stakeholders (see the roundtable from REYNOLDS and PUKY in this same volume).

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Annex 1

Questionnaire sent about Inventory of research and management programmes on European Crayfish.

Annexe 1

Questionnaire envoyé sur l'inventaire de la recherche et opérations de gestion menées sur les écrevisses en Europe.

Date:

Name: Country:
First Name: E-mail:
Mr Ms Profession: Manager Scientific Other
Organisation Public (Governmental) Regional Private Other

SPECIES STUDIED

Native	**Alien**
Astacus astacus	*Cherax destructor*
Astacus leptodactylus	*Orconectes limosus*
Astacus pachypus	*Pacifastacus leniusculus*
Austropotamobius pallipes	*Procambarus clarkii*
Austropotamobius italicus	*Other*
Austropotamobius torrentium	

TOPICS

Monitoring in conservation and management of native crayfish populations
Interactions between natives & alien species
Control and management of alien species
Protection of native species in a plague situation
National & European legislation relating to crayfish
Management: reintroduction & restocking
Management: habitat & restoration
Education as a key to crayfish conservation
Other, specify:

KEY-WORDS

Action plan
Bacteria
Behaviour
Bio-Accumulation
Bio-Geography
Bio-Indicator
Conservation
Ecology
Farming
Genetics
Growth, development
Habitat
Immunology
Legislation
Migration
Modelling
Monitoring
Nutrition
Osmoregulation
Population density, dynamics, structure
Population restoration
Reproduction
Specific disease
Stock management
Tagging
Virus, Parasites

Other, specify:

RESEARCH PROGRAMMES

	Specify (ex: PCRDT, Interreg, Leader +)	**Title**
National		
International		
Other		

OUTPUTS

For managers	**For Public**
Leaflets	Leaflets
Guidelines	Guidelines
Other, specify	Other, specify