Proposal for the Development of a National Strategy on Invasive Alien Species in Croatia

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1 Summary

In order to ensure a prompt and coordinated response to prevent the introduction of IAS into nature in Croatia and continue resolving the issues of existing IAS – as foreseen within the Strategy and action plan for the protection of biological and landscape diversity of the Republic of Croatia - it is urgent to develop and implement dedicated national strategy on IAS. This Draft proposal for the development of a National strategy on IAS in Croatia, built as part of the WWF MedPo project Protected Areas for a Living Planet – Dinaric Arc Ecoregion Project: Study on invasive species sets out the Croatian regulatory framework relevant to the issue, and details the key actions required to address the problems caused by IAS. The aim is the future development of a comprehensive national policy framework on IAS, to be harmonised/integrated with other frameworks implemented in Europe.

Indeed this strategy provides a framework for a more co-ordinated and structured approach to dealing with IAS and any potential invasive threat in or to Croatia. It includes better co-ordinated and strategic prevention measures aimed at reducing the introduction of damaging IAS into Croatia. Its implementation will enable more rapid detection of potential IAS through improved and better targeted monitoring and surveillance. Where appropriate, and subject to adequate resources and technical capability, contingency planning and improved capacity to act decisively will enable rapid responses with a view to eradicating newly arrived invasive species. Implementation should lead to more targeted and efficient control, mitigation and, where both necessary and feasible, eradication of established IAS. It will also lead to greater public awareness, more strategic research and proposals for an improved legislative framework.

More in detail, the proposed strategy focuses on the following four strategic goals:

1. **To minimise the risk of IAS entering and becoming established in Croatia**, by promoting best practices for prevention, including an increased and widespread awareness and understanding of the negative impacts caused by IAS, and an improved regulation of trade through the support of black list and risk analysis tools;

2. **To establish a national guiding framework for responding promptly and effectively** to biological invasions before they take hold, through a coordinated system of measures for detection, surveillance and monitoring, diagnosis, risk assessments, identification of proper response and implementation of mitigation, control or eradication initiatives;

3. **To develop and maintain a central information system** coordinated at the national level to allow the collection, the validation, the analysis and the circulation of all data and information related to IAS, and promote research activities to fill in knowledge gaps;

4. **To ensure a sound implementation of the strategic framework on IAS** by establishing a lead responsible coordination body (which should take the form of a National Advisory Committee on IAS) and clarifying the roles and responsibilities of all concerned actors, in order to promote a stronger sense of shared responsibility across government, key stakeholders, organisations, land managers and the general public for actions and behaviours that will reduce the threats posed by IAS or the impacts they cause.
2 Introduction

According to the 2008 *Strategy and action plan for the protection of biological and landscape diversity of the Republic of Croatia* - hereafter referred to as the *National Biodiversity Strategy* - the introduction of alien species into ecological systems is recognised as one of the factors behind the “prevailing trend towards the loss of biological and landscape diversity”.

As highlighted also in the *Millennium Ecosystem Assessment*, invasive alien species (IAS) are one of the most important direct drivers of biodiversity loss and ecosystem service changes. Indeed they are widely recognised as a major threat to biodiversity on a global scale, second only to direct habitat destruction, and the greatest threat to fragile ecosystems such as islands. According to the *IUCN Red List*, IAS are responsible for more extinctions occurred worldwide, than any other agent. For example, at the global level one third of birds, 6% of mammals, and 11% of amphibians are threatened by IAS. Europe is particularly affected by IAS, that are invading the territory of the old world at an unprecedented pace. Indeed over 10,000 IAS have been recorded in Europe, with the result that many of the rarest endemic species are on the brink of extinction because of their impact.

Because of the increasing trends in the global movement of people and goods, IAS pose a growing problem in the conservation of biodiversity, and are a threat to many socio-economic interests, among which agriculture, forestry and fisheries. Biological invasions not only threaten our biodiversity. Apart from the cost in terms of biodiversity loss, IAS can also have an adverse impact on human life and health, affect our well-being and cause serious economic damage, endangering the ecosystem services we rely on. Past introductions have usually occurred with little awareness of the potential consequences. But in recent times the true extent of the threat posed by IAS in both ecological terms and socio-economic terms has become much better understood. For example, at the European level it has been estimated that damage caused by IAS exceed 12 billions Euro a year (Kettunen et al. 2009).

Also Croatia is particularly vulnerable to biological invasions, because of both the geographical context and the biogeographical specifics. This is shown also by the many projects financed so far in order to face and mitigate this threat. Besides, more is known on species present, vectors and pathways. For example, it is known that over 350 alien species occur in the country, and is clear that trade, followed by unintentional introduction, remains a major pathway. Although comprehensive analysis of their impact are not available, is clear that like in all other countries, not all introduced alien species pose a threat to the environment or the human welfare (e.g. economy, health, etc.). However, some of them can become invasive in the environment and may impact on native species, transform ecosystems and have negative ecological and economic impact. These are the IAS which form the central concern of this document.

In order to ensure a prompt and coordinated response to prevent the introduction of IAS into nature in Croatia and continue resolving the issues of existing IAS – as foreseen within the *National Biodiversity Strategy* - it is urgent to develop and implement dedicated national strategy on IAS. In fact, to fulfil the obligations arising from international treaties in the field of nature protection, such as the implementation

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1 Already in 1999 the Republic of Croatia adopted the Strategy and Action Plan for the Protection of Biological and Landscape Diversity (OG 81/99) recognised alien species as a major threat

of the Convention on Biological Diversity (CBD), and in the light of the future European Union (EU) accession, Croatia needs to develop mechanisms compatible with instruments developed in Europe so far, as well as replicable in the region to be able to effectively deliver on the issue of IAS.

Indeed for addressing this threat it is crucial to develop strategies aimed at harmonizing and implementing measures at the international, as well as regional, national and local level. Guidance for the development of regional and national strategies on IAS, so as to contribute to fulfil the provisions of the CBD (e.g. to achieve CBD goal of reducing/halting the loss of biodiversity) is provided by the European Strategy on IAS developed in 2003 by the Bern Convention. Also, the key outputs of a number of documents developed at the European level (see Shine et al. 2010) and national level in both Europe (The Invasive Non-Native Species Framework Strategy for Great Britain, 2008) and worldwide (the National strategy on invasive species in Mexico, prevention, control and eradication, 2010), have been taken into account.

As a result, this Draft proposal for the development of a National strategy on IAS in Croatia, built as part of the WWF MedPo project Protected Areas for a Living Planet – Dinaric Arc Ecoregion Project: Study on invasive species marks a significant achievement in this context. In particular, this document aims to facilitate development of a specific policy on the issue by identifying measures to support the development and/or improvement of regulatory/legislative framework to prevent invasions (e.g. by adapting the existing legislation rather than developing a new complementary one) and by proposing the structure of early detection and rapid response system and related decision support tools to implement measures to remove established IAS, or managed them when removal is not appropriate.

To formulate the Croatian response to it, and recognising the importance of this issue and in the light of a number of international biodiversity commitments, the Croatian section of WWF MedPo has worked closely with a some key partners, i.e. the Ministry of Culture – Nature Protection Directorate, and Directorate for Nature Protection Inspection, the State Institute for Nature Protection, and the Croatian Environmental Agency. Indeed the proposed strategy sets out the Croatian regulatory framework relevant to the issue, and details the key actions required to address the problems caused by IAS. The aim is the future development of a comprehensive national policy framework on IAS, to be harmonised/integrated with other frameworks implemented in the Balkan region and in Europe.
3 Invasive alien species in Croatia

In this chapter general information on the state of the art regarding IAS in Croatia, e.g. species and threats, impact and pathways, management measures carried out, researches activities, legislation, etc. is reported. Such information is mostly excerpted from the proceedings of the following two international meetings organised in Croatia, which provided an important opportunity to assess and summarise some of the key information available at the national level:

1) The meeting of Expert Group on Invasive alien species (IAS) of the Bern Convention (Brijuni, 5-6 May 2009).
2) The “EEA/EIONET workshop on invasive alien species in West Balkan Countries” (Zagreb, 28-29 October 2010).

Additional information were reported also in the following key documents:


Given the increasing threat from IAS and in the light of the accession to the EU, in the last years numerous activities were intensified in the field of IAS issues in Croatia, including the implementation of eradication and control programmes, and many improvements in the national legislation (see Annexes I, II, II, and IV).

3.1 Species, threats and pathways

Like many other European countries, Croatia has increasing problems with IAS. In fact over the centuries many IAS have been deliberately introduced in the country, either directly or indirectly (i.e. as a result of dispersion events from neighbouring countries where such species were previously introduced).

<table>
<thead>
<tr>
<th>Taxon group</th>
<th>Number of species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnoliophyta</td>
<td>161</td>
</tr>
<tr>
<td>Insecta</td>
<td>128</td>
</tr>
<tr>
<td>Araneae</td>
<td>6</td>
</tr>
<tr>
<td>Fungi</td>
<td>16</td>
</tr>
<tr>
<td>Osteichthyes</td>
<td>17</td>
</tr>
<tr>
<td>Mammalia</td>
<td>9</td>
</tr>
<tr>
<td>Mollusca</td>
<td>2</td>
</tr>
<tr>
<td>Chromista</td>
<td>2</td>
</tr>
<tr>
<td>Aves</td>
<td>4</td>
</tr>
<tr>
<td>Crustacea</td>
<td>1</td>
</tr>
<tr>
<td>Nematoda</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 1 – Taxon groups of species introduced in Croatia from the DAISIE online database http://www.europe-aliens.org/ (accessed 1/7/2011)
For example, according to some preliminary data excerpted from the DAISIE database the alien species introduced in Croatia are 346, most of which are plants (Magnoliophyta account for 46% of all introduced species) followed by Insecta (37%). Vertebrates account all together to 9% (Fig. 1). The DAISIE database is currently being updated for a number of taxa, and due to the low and uneven coverage of the area for all taxon groups, cannot be considered comprehensive. Therefore the excerpted data must be considered only indicative. In any case, it is known that a number of IAS occurring in the country have a negative impact on Croatian biodiversity.

The oldest known IAS related problem dates from the year 1910, when 11 specimens of the Indian mongoose (*Herpestes javanicus aumpunctatus*) was released in the island of Mljet. This species is being trapped on some islands by hunters in an attempt to limit its impact on wildlife (particularly on birds, small mammals and reptiles), but might already be spreading into Montenegro and Bosnia and Herzegovina.

Many other alien species of mammals are present in Croatia. Among the game species, examples are the fallow deer (*Dama dama*), spotted deer (*Axis axis*), mouflon (*Ovis aries musimon* and *Ovis orientalis*) and others (e.g. wild-boar *Sus scrofa* in islands), which have been deliberately introduced to hunting grounds where they have negative impacts on the biodiversity and represent a serious problem. In fact, apart from competing with domesticated animals, they compete with indigenous wildlife, and are often carriers of new pests and diseases, which might have a negative impact on indigenous populations. In islands in particular, IAS present a special problem since island ecosystems are particularly sensitive due to their isolation. In island IAS destroy habitats, contributes to the reduction of biodiversity, and affect negatively the rural activities, such as traditional agriculture and extensive cattle breeding. The presence of such IAS is also the main reason for the use of poison in nature on the islands. Examples include the wild boar (*Sus scrofa*) - whose populations in the islands in Kvarner Bay are out of control, thus inflicting losses to the economy and changing the natural island ecosystems - the mouflon (*Ovis aries musimon*) - which in Peljesac Peninsula destroys traditional grape plantations because of the lack of natural pastures – but also the Barbary sheep (*Ammotragus lervia*) - introduced to the area of Mt. Mosor - the nutria (*Myocastor coypus*) - introduced to the Mirna River estuary, etc. There are also other terrestrial vertebrates among IAS in Croatian islands, such as the Mediterranean form of black rat *Rattus rattus* and the Italian lizard *Podarvis sicula campestris* have a strong, negative impact on the native island fauna.

Among freshwater vertebrates, during the last century at least 17 alien species of fish were introduced into the rivers of the Danube and Adriatic catchments areas. These species cause great damage to the indigenous ichthyofauna, especially in the rivers of the Adriatic catchments area, rich in endemic taxa. Some of invasive alien freshwater fish are *Oncorhynchus mykiss*, *Carrasius gibelio*, *Leponis gibbusus*, *Ameiurus melas*, *Gambusia affinis*, *Pseudorasbora parva* etc. In 2008 the species *Perothus glebii* was recorded for the first time. In addition, over the past 15 years, the spread of Ponto-Caspian species of goby along the Danube River upstream from the Black Sea has been recorded. These species - namely the river goby (*Neogobius fluviatilis*), round goby (*Neogobius melanostomus*) and Kessler’s goby (*Neogobius kesslerii*) which are also present in the Croatian part of the Danube River – are likely to compete for habitat and food with the native goby species. Other examples of invasive species include invertebrates such as the zebra mussel (*Dreissena polymorpha*) and other clams (*Corbicula fluminea*, *Anodonta (Sinanodonta) woodiana*) as well as the snail *Potamopyrgus antipodarum*, and some species of freshwater crayfish *Pacifastacus leniusculus* and *Orconectes limosus*, carrier of the crayfish plague.

Regarding the marine environment, at least 35 new alien fish species became new elements of the Adriatic ichthyofauna until 2007, representing by 22 families out of which eight new ones: *Hemiramphidae*, *Leiognathidae*, *Haemulidae*, *Siganidae*, *Ipnopidae*, *Zoaridae*, *Monacanthidae*, *Cylophteridae*. At least two new alien fish
species have been recorded since 2007: *Terapon theraps* and *Fistularia commersonni*. There are other marine alien species, being more or less invasive, like the seaslug *Bursatella leachi*, *Melibe fimbriata*, the limpetlike snail *Siphonaria pectinata*, the red algae *Asparagopsis armata*, *Asparagopsis taxiformis*, *Womersleyella setacea*, etc.

Invasive terrestrial plants also pose a threat. A section concerning allochthonous flora of Croatia (including invasive species) has been developed within the Flora Croatia Database and a list of neophyte taxa of the Croatian vascular flora, and the habitat types that host these species, has been compiled. The commonest IAS plant is the common ragweed (*Ambrosia artemisifolia*). This plant overgrows grassland habitats, suppressing native weed and ruderal species, and due to its massive pollen production is identified as one of the greatest allergens in Europe. Another example is the false indigo (*Amorpha fruticosa*), a plant which was deliberately introduced because of its honey-bearing properties, and which today is spreading rapidly through the humid grasslands in lowland areas (e.g. Lonjsko Polje Nature Park). A serious threat is also posed by the tree of heaven (*Ailanthus altissima*) which is rapidly spreading across islands and displacing indigenous flora. Up to 2006, there were no organized efforts in plant invaders inventory, monitoring or appropriate actions against plant IAS in Croatia. Diverse data on distribution, taxonomy, vegetation, biology, etc. of IAS plant have been sporadically collected for centuries. Recently, within the activities of the University of Zagreb (Faculty of Science, Department of Botany) and the Croatian Botanical Society, knowledge basis and the majority of international standards were developed for all botanical activities, including alien plant species research and monitoring.

There are also allochthonous green algae in the Adriatic Sea which raise a major concern. For example *Caulerpa taxifolia* was initially observed at three locations: Starogradski zaljev (Stari Grad Bay) and Malinska in 1994, and Barbatski kanal (Barbat Channel) in 1996. In Barbat channel the species is actually eradicated, while in Stari Grad Bay the population is expanding (despite the eradition/control activities carried out) and in Malinska is decreasing (due to low winter temperature and eradication). Also the green algae *Caulerpa racemosa* var. *cylindracea* - first found in autumn 2000 near Pakleni Islands - by the end of 2009 was observed at 91 locations from Cavtat to Poreč (Istria). A distribution map of *Caulerpa racemosa* var. *cylindracea* in Adriatic (end of 2009) is available. Eradication of *Caulerpa racemosa* var. *cylindracea* is difficult and less effective than *Caulerpa taxifolia*. Besides, there are 6 other invasive algae in Adriatic Sea: 5 red algae - *Acrothamnion preissii*, *Asparagopsis armata*, *Asparagopsis taxiformis*, *Womersleyella setacea*, *Hypnea* sp. and a brown algae - *Colpomenia peregrina*. The species *Womersleyella setacea* and *Asparagopsis armata* are widely spread, unlike other above mentioned red and brown algae.

Finally, it is worth remarking that in the last twenty years, ballast waters have been a major concern, because they have been the main cause of introduction of the IAS in many aquatic and especially marine ecosystems, and of course there are a number of agricultural pests that should be considered an essential part of the IAS related problems.

### 3.2 Legislative Framework

The legislative framework to address IAS issues in the Republic of Croatia has already a number of established rules and systems in place (for details see Annex I).

Croatia is a contracting party of a number of international agreements such as the Convention on Biological Diversity (CBD), the Bern Convention, the Bonn Convention, the Ramsar Convention, etc. all of which include some provisions related to the IAS issue. As such, many important related initiatives have been undertaken in the last years. For example, in May 2008, at the CBD COP 9, Croatia has committed to the effort to combat IAS, including the prevention, detection, management, and eradication of IAS through the development and use of international, regional and national mechanisms. More in detail, the
Strategy and Action Plan for the Protection of Biological and Landscape Diversity (NBSAP) of the Republic of Croatia (Official Journal 143/08) – provides information on the current status of IAS in Croatia and defines strategic objectives and action plans for their fulfilment (Chapter 3.3. Elimination of IAS). The objectives of the National Biodiversity Strategy in relation to IAS include monitoring and eradication. Besides, a National strategy on IAS was foreseen to be developed as one of action plans.

At the national level, the main legislation governing this problem area is the Nature Protection Act (Official Journal 70/05, 139/08). This Act defines nature as an overall biological and landscape diversity protected on the whole territory of the Republic of Croatia, both in the areas of conserved and “wild” nature and in the built-up and economically used areas, and regulates the introduction of alien wild taxa into nature through specific provisions. In brief, according to the Nature Protection Act:

- Introduction of alien wild taxa into nature is forbidden, but exceptionally it can be authorized by the competent authority (Ministry of Culture) if scientifically and technically founded and acceptable from the standpoint of nature protection and sustainable management;
- The permit can be issued on grounds of a study on the assessment of the risk of introduction into nature, but it is a subject to prior approval from the ministers competent for agriculture and forestry/hunting;
- In the case of accidental introduction of alien taxa, or if there is a grounded suspicion that such introduction is to occur, the Ministry of Culture can prescribe the measures for proceeding with the scope of destroying, eradicating or preventing further propagation of introduced alien species.

On the basis of the Nature Protection Act the two following ordinances to regulate problematic IAS have been enforced:

- The Ordinance on the method of preparing and implementing risk assessment studies with respect to introduction, reintroduction and breeding of wild taxa (Official Journal no. 35/08) regulating in detail the methods of preparing and implementing risk assessment studies with respect to introduction of alien wild taxa into nature. Exceptions may be granted after risk assessment studies;
- The Ordinance on transboundary movement and trade of protected wild species (Official Journal no. 72/09 and 143/10) regulating in detail the import of live specimens of alien taxa (establishing the need of import permits, and a list of species whose import is prohibited, e.g. *Trachemys scripta elegans*, *Oxyura jamaicensis*, etc.).

The provisions regulating the introduction of IAS into nature are also incorporated into other sectoral regulations:

- The Hunting Act (Official Journal no. 140/05, 75/09) permits introduction of new wildlife species into hunting grounds (preceded by the approval of the minister competent for nature protection); since 2009 hunters are allowed to hunt species that are not game species;
- The Islands Act (Official Journal no. 34/99, 149/99, 32/02 and 33/06) prohibits introduction and breeding of non-native game species on islands, except in enclosed hunting grounds;
- The Animal Protection Act (Official Journal no. 135/06) prohibits setting free of pets and introduction of non-native species into nature;
- The Marine Fisheries Act (Official Journal no. 56/10) prohibits introduction of non-native fish into the fishing, while farming of non-native fish and other marine organisms, must be permitted by competent authority (CA) for marine fishery and previously approved by the CA for nature protection and preceded by the opinion of authorized scientific institutions for marine research;
• The Freshwater Fisheries Act (Official Journal no. 49/05 - consolidated version) prohibits farming and introduction of non-native freshwater fish, as well as import and trade of living specimen of these species;
• The Forestry Act (Official Journal no. 140/05, 82/06, 129/08 and 80/10) proscribes usage of those species approved on the basis of the expert study and recommends usage of native species in reforesting to avoid all negative impacts on nature;
• The Ordinance on management and supervision of ballast waters (Official Journal no. 55/07, 38/08) adopted on the basis of the Maritime Code (Official Journal no. 181/04). This ordinance includes a number of provisions useful to prevent the introduction of harmful organisms by way of ballast water. The central state administration body in charge of maritime affairs is responsible for dealing with this issue at national level.

3.3 Key initiatives
According to the Fourth National Report of the Republic of Croatia to the Convention on Biological Diversity (2009), the information reported in the assessment of progress in reducing the threats to biodiversity from IAS (Goal 6) shows some important advancements. For example, in relation to the control of pathways for major potential IAS (Target 6.1), a framework for the control of introduction of IAS into Croatia has been set with the Nature Protection Act and the Environmental Protection Act. Besides, provisions for the preventing the expansion of IAS have been included in the Hunting Act and the Islands Act. Also, rearing and introduction of IAS in freshwater and marine habitats have been regulated by the Freshwater Fisheries Act and the Marine Fisheries Act, while the release of pets into nature and the related introduction and expansion IAS has been prohibited by the Animal Protection Act.

In relation to the development of management plans for major alien species that threaten ecosystems, habitats or species (Target 6.2) there are a number of ongoing activities aimed at the systematic removal of the invasive seaweed Caulerpa racemosa and the invasive plants Ambrosia artemisiifolia and Amorpha fruticosa.

In addition, regarding the progress related to the Global Strategy of Plants Conservation, and particularly to the development of management plans for at least 100 major alien species that threaten plants, plant communities and associated habitats and ecosystems (Target 10) the following achievements have been mentioned:
• The legislative frame for the issues of invasive species exists;
• The preliminary list of the invasive vascular plants in Croatia is compiled and standard national classification scheme of the autochthonous species is developed;
• Within the “Flora Croatica Database” the model on allochthonous vascular flora was made which also analyses the invasive species (descriptions, effects, time of entry and distribution);
• The removal of the invasive alga Caulerpa racemosa is systematically done;
• Nature protection measures and requirements for prevention of entering the allochthonous species are included in the management plans for natural resources;
• A national workshop for IAS was held (the conclusions for further action and treatment of IAS were brought during this workshop);
• Under the patronage of the Ministry of Transport and Communications a working group for solving the problems of waste waters was founded. It consists of the members of the supervisory bodies and scientific institutions.

Finally, the following future activities were proposed:
• To find the existing situation of the invasive species and make their list (black, grey and white lists);
• To establish the technical and legislative working group which will advise and help the state bodies and agencies;
• To develop the National strategy on IAS;
• To strengthen the information system and education of the general public about the IAS;
• To make programmes of solving the most problematic invasive species;
• To make necessary legal acts that will arrange handling of waste waters from ships.

In the same document, a proposal for national biodiversity indicators in the Republic of Croatia is also included. Regarding the IAS Indicator, it is remarked that this would show the trend in introduction and spreading of non-native (allochthonous) and invasive species in nature in Croatia. Upward trends of introduction and their spreading would indicate an increasing risk of biodiversity loss. In accordance with the SEBI indicator 10, the data should be recorded from 1900 by ten year periods. Particularly important would be to compare which species occurring in Croatia is already in the European list of most dangerous IAS that threaten biodiversity in Europe.

### 3.3.1 Main projects targeting IAS

Many IAS related projects have been carried out in the last years in Croatia. Such projects concern both plants and animals, and focus on either acquisition of knowledge or implementation of concrete management measures (see additional information in Annex III and IV).

For example in 2006 the first national project about invasive Croatian flora - titled *Croatian botanical standards for IAS prevention and monitoring* – started thanks to the financial support of the State Institute of Nature Protection. The suggested strategy for invasive alien plants treatment was as follows:

- Adoption of national criteria and standards for terminology and categories of alien flora by botanists and other related experts;
- Development of the database and standard forms with required data about alien plants in Croatia;
- Creation of a preliminary check-list of plant IAS in Croatia;
- Investigation and documentation of threats posed by IAS;
- Development of management plans and control of IAS;
- Dissemination of information and public sensitisation and awareness raising.

So far the first three objectives of the suggested strategy which have been realised are the following:

- A proposals for Croatian national standards in terminology and criteria for alien flora treatment (Mitić et al. 2008);
- A separate module “Allochthonous plants” developed and incorporated in the Flora Croatica Database and accessible online (see [http://hirc.botanic.hr/fcd/InvazivneVrste/Search.aspx](http://hirc.botanic.hr/fcd/InvazivneVrste/Search.aspx));
- A preliminary check-list of IAS for Croatia (Borišić et al. 2008).

Another project dealing with plants was “Distribution of *Solanum elaeagnifolium* Cav. (Solanaceae) in Croatia” (Milenko Milović, 2009).

Regarding the project “Monitoring, control of spreading and removal of invasive algae Caulerpa in Adriatic” the Ministry of Culture continues to finance efforts on control of expansion and eradication in five marine protected areas (Brijuni, Kornati, Telašćica, Mljet and Lastovo), although eradication is possible only for small colonies and is recommended only in National Parks and areas of high biological or cultural values. In fact eradication is conducted at Channel Soline and Grate Lake in National Park Mljet (coral reef).
There are also projects that are being carried out on animals. Regarding vertebrates, examples are the eradication of coypu (*Myocastor coypus*) in the Mirna river in Istria (2007), the eradication of Barbary sheep (*Ammotragus lervia*) on the Mosor mountain in Split-Dalmacija County (2010) and the “Action plan for eradication of wild boar (*Sus scrofa*) on the islands of Krk and Cres” (2010).

Besides, there are a number of projects focusing on invertebrates, like the “Invasive invertebrate species in freshwater ecosystems of Croatia”. The goals of this project - financed by the Ministry of Science, Education and Sports and carried out by the Faculty of Science of the University of Zagreb (project manager: Radovan Erben, Prof. PhD) - are to determine the distribution of the invasive species and the speed of spreading, to identify new invasive species, and to raise public awareness on the problem. As a result, a detailed digital map on the distribution of the invasive species will be created, and a network for their monitoring and control will be established. Another project focusing on invertebrates, and particularly on research of zebra mussle and crayfish, is the one titled “Education and research of the IAS of freshwater ecosystems in Croatia”. This project was financed by a donation from the Ministry of Culture to the NGO Kapibara.

In addition, two projects focusing on crayfish are being carried out. The first one, titled “Invasive spinycheek crayfish (*Orconectes limosus*) species in Croatia” was financed by the State Institute for Nature Protection to the Association for Ecological Research “BioShock” (2008/2009). The aim of this project was to explore the distribution of spinycheek crayfish and its impact on the population of the native Danube crayfish (*Astacus leptodactylus*) on the rivers Danube and Drava and adjacent Nature Park Kopački rit, to assess the knowledge of the local inhabitants on the invasive species and to educate them on this growing problem. The project focused on a comparison between population size, density, morphological characteristics of both native and invasive species in side channels and in main river course, on a trial catching of the spinycheek crayfish to assess the catching effort needed for eradicating this invasive species from the side channels and stop the further spread to the main river course of Drava, and on an intensive information and education campaign for relevant stakeholders. The second phase of the project in the 2009 was more focused on testing the eradication efforts and slowing down the spread of the target species.

The second project is titled “Investigation of invasive alien crayfish (*Pacifastacus leniusculus*) on river Mura and its tributaries as a contribution to the development of management plan”. Specific goals of this project carried out in 2010 by the NGO Kapibara are collecting data on distribution and ecology of signal crayfish on Mura river area, and capacity building for informing and educating public on IAS.

Another interesting project dealing with IAS is the one titled “Developing a management plan for alien invasive plant and animal species on the island of Cres”. This project was financed by a donation from the Royal Netherlands Embassy in Zagreb to the NGO Ekocentar Caput Insulae – Beli. Among the results of the project, a booklet “Alien invasive plant and animal species on the Island of Cres” was published.

Finally, since 2008 the State Institute for Nature Protection has published a “Manual for inventory and monitoring of biodiversity”, which includes monitoring of IAS of some freshwater fish, freshwater crayfish and vascular plants. Also, in 2009 for the International Biodiversity Day, a poster and an article in the magazine Meridijani have been published, moreover a poster and a brochure on invasive plant species have been printed in the frame of activities of the COAST project.
The Brod Ecological Society and the Public Institution for Management of Protected Natural Values in the area of BrodPosavina County are implementing the CARDS project "Protection, conservation and improvement of biodiversity and the development of environmental awareness through the breeding of Croatian autochthonous breeds and stimulating ecological production". At the protected landscape of Gajina, the main problem was that pastures were overgrown with invasive species *Amorpha fruticosa*. Within the project framework a flock of Slavonian cattle, Croatian Posavac horses and a few Black Slavonian pigs were brought to the Gajina pastures. The pasture was fenced with tight chorale covering the area of 10 ha, while an additional 10 ha of pasture was fenced with electric shepherd fence. This enabled controlled release of bovine animals to specific pastures during certain number of days. Alternate cattle release on fenced pastures enabled intensive grazing and treading, which led to a visible reduction of overgrown areas of the desert false indigo (*Amorpha fruticosa*).

Simultaneously, the restoration of common flora of pastures and plant species growth was noted, which was previously disabled due to growth of *Amorpha fruticosa*. The Lonjsko polje Nature Park has been using the same methods for reduction of *Amorpha fruticosa* for years (see also LIFE05 TCY/CRO/000111 Central Posavina – Wading toward Integrated Basin Management). They started with buying off Slavonian cattle, and keeping it at the overgrown surfaces. Since the flock moved freely within the large fences, a mobile milking mechanism was bought. In cooperation with the local cattle breeders, the area of the Nature Park is at present being used as a grazing land, not only by keeping cattle but also the Croatian Posavac horses and Pramenka sheep breeds. Presented ways of management are excellent examples of combining breeding and preservation of native breeds with restoration and preservation of the endangered habitats, resulting in promotion and protection of biological and landscape diversity.
4 The IAS strategy for Croatia

The need of a national strategy on IAS was already foreseen by the National Biodiversity Strategy. The need of a comprehensive strategy is also stressed by the result of the analysis of the state of the art concerning the current knowledge on IAS in Croatia, and all related initiatives undertaken so far. In fact, besides the positive progress in developing and implementing some relevant legislation, there are a number of weaknesses that need to be addressed with ad hoc and well planned measures. For example:

- The lack of a systematic approach;
- The lack of an early detection and rapid response system;
- The lack of sufficient financial resources;
- The lack of clear identification of responsibilities, which are currently shared among several sectors;
- The lack of adequate administrative capacity;
- The weakness of public awareness on the problem.

According to the National Biodiversity Strategy one of the Strategic Objectives is to “Prevent the introduction of IAS into nature in the Republic of Croatia and continue resolving the issues of existing invasive species”. To this regard, a special attention has been paid in this strategy in relation to the following Strategic Guidelines listed in the National Biodiversity Strategy:

- Establish the existing situation with regard to alien and invasive species, assess their impact, define and carry out activities that would contribute to the elimination or weakening of such negative impacts;
- Undertake necessary activities towards the prevention of introduction of new IAS;
- Systematically monitor the distribution of invasive species in Croatia.

In this strategy, also the following action plans reported in the National Biodiversity Strategy for implementation of the guidelines above are taken into account:

- Develop and implement the National Strategy on IAS;
- Establish the existing situation with regard to alien and invasive species, list and map their distributions;
- Implement elimination programmes for alien and invasive species;
- Scientifically determine the population count of introduced game on the islands, develop and implement elimination programmes;
- Promote research of invasive algae species in order to devise methods of control and lessening of their impact on the biodiversity of the Adriatic Sea;
- Conduct continuous public education on invasive species;
- Ensure co-operation with other sectors with the aim of preventing the introduction of alien species into nature;
- Develop and implement programmes on the systematic monitoring of invasive species distributions in Croatia;
- Monitor the distribution of invasive species that are indicators of climatic change.

The priorities listed above are somehow reinforced by the Fourth National Report of the Republic of Croatia to the Convention on Biological Diversity (2009). According to this report “given the major changes in the concept of nature protection, the establishment of new legislative and institutional framework of nature protection that occurred because of accession to all international treaties in the field of nature protection and because
of the process of joining the European Union\(^3\) and the harmonization of legislation with the relevant Directives and the regulation of the EU, not only the revision of the previous Strategy, but a review of strategic objectives and guidelines on an entirely new basis was needed”. For this purpose, the “strategic guidelines for conservation of species and genetic diversity in the coming Period” have explicitly included the “Suppression of invasive species” by implementing the following measures, which are also embodied in the present strategy:

- Identifying the current state of non-native and invasive species, assessing their impact and identifying and implementing the necessary activities which would remove or reduce negative impacts;
- Taking necessary actions to prevent entry of new non-native species;
- Systematically monitoring distribution of IAS in Croatia.

### 4.1 General objectives

The overarching aim of this Strategy is to reduce the negative impacts caused by IAS in Croatia. To this regard, once the current situation has been defined, the objective is to provide some guidance of the priority actions to be undertaken for dealing with IAS in Croatia, and more specifically to:

- Assess the needs for the improvement of the regulatory framework to prevent new invasions;
- Create a framework for a more co-ordinated and structured approach to dealing with the IAS in Croatia;
- Improve the overall co-ordination and clarify responsibilities and functions within government and its associated bodies;
- Improve co-ordination of actions to tackle IAS in partnership with key interest groups outside government;
- Reduce and where possible, prevent the intentional and unintentional introduction of IAS;
- Propose how to set up the early detection and rapid response system (EDRR) needed to deal with unwanted invasions;
- Provide an effective decision-making framework and associated communications processes concerning control, mitigation and eradication of IAS;
- Identify gaps and priority issue areas for further development (for example in relation to prevention, monitoring, control and legislation);
- Identify the tools needed to implement the EDRR system so as to manage or remove established IAS, when appropriate;
- Raise awareness among all institutions, key stakeholders and the general public in relation to IAS issues;
- Promote appropriate changes of attitudes of citizens and institutions in relation to IAS issues;
- Ensure that effective contingency response capabilities are in place and resourced to prevent the establishment of new invasions;
- Ensure that sustainable action to control established IAS is adequately resourced and delivered;
- Make optimum use of available capacity and resources to improve detection and monitoring capabilities.

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\(^3\) The objective 5 of the “EU Action Plan to 2010 and Beyond” annexed to the EC Communication of 2006 on “Halting the Loss of Biodiversity by 2010 – and Beyond” calls on Member States to develop national strategies on IAS (besides calling upon the EC to develop a EU Strategy).
A key outcome of developing and implementing a *IAS Strategy in Croatia* will be making the most of existing capacity and expertise, and closing as many gaps as possible through more effective co-ordination of existing management activities. This can be achieved by strengthening the administrative capacity, enforcing effective legislation and ensuring adequate financing (through internationally financed projects, state/county budget and other sources e.g. private sector and different organizations).

### 4.2 Strategic goals

This strategy aims to address IAS issues at the national level in Croatia, thus including the island and the seas around the coasts. This strategy is concerned with the economic, environmental and social impacts of IAS in the terrestrial, freshwater and marine environments. Since invasive potential is not constant, the scope of this strategy includes therefore all those alien species of flora and fauna that are known to be invasive, or identified as potentially invasive.

More in detail, this strategy focuses on the following four strategic goals in line with the three-stage approach adopted by the CBD to tackle IAS - which is based on prevention, early detection and eradication, and control and containment measures (with prevention given the highest priority) - in combination with other relevant themes:

1. To minimise the risk of IAS entering and becoming established in Croatia, by promoting best practices for prevention, including an increased and widespread awareness and understanding of the negative impacts caused by IAS, and an improved regulation of trade through the support of black list and risk analysis tools;
2. To establish a national guiding framework for responding promptly and effectively to biological invasions before they take hold, through a coordinated system of measures for detection, surveillance and monitoring, diagnosis, risk assessments, identification of proper response and implementation of mitigation, control or eradication initiatives;
3. To develop and maintain a central information system coordinated at the national level to allow the collection, the validation, the analysis and the circulation of all data and information related to IAS, and promote research activities to fill in knowledge gaps;
4. To ensure a sound implementation of the strategic framework on IAS by establishing a lead responsible coordination body and clarifying the roles and responsibilities of all concerned actors, in order to promote a stronger sense of shared responsibility across government, key stakeholders, organisations, land managers and the general public for actions and behaviours that will reduce the threats posed by IAS or the impacts they cause.

Given the range of measures involved, key governmental bodies will need specific responsibilities and relevant expertise to play their part. These bodies will include the key competent authorities, as well as others. Many of the measures will need to be taken forward in partnership between such bodies but also with key non-government stakeholders, including landowners and sectoral interest groups whose input and advice will be essential. In fact this strategy acknowledges that IAS issues are relevant to the interests of a very large number of stakeholders, including government departments and agencies, non-governmental organisations, a wide range of trade and industry sector interests, land-owners, researchers and the general public.

Successful implementation of this strategy will undoubtedly require a strong partnership approach with the active involvement of all interests. Success will involve, for example, the combined results of control efforts by landowners, the surveillance and monitoring work of conservation bodies and operation of the
high-level mechanisms set in place by the governments. Most of all, it will require greater public awareness and understanding of the issues.

In drawing up this strategy substantial input from national authorities was sought, particularly during a dedicated workshop organised in Zagreb on 4 April 2011 by the Croatian section of WWF MedPo in collaboration with the ISSG, the IUCN/SSC Invasive Species Specialist Group. During the workshop a preliminary draft of the document was presented and discussed with a selected panel of key representatives of the Ministry of Culture – Nature Protection Directorate, and Directorate for Nature Protection Inspection, the State Institute for Nature Protection, and the Croatian Environmental Agency so as to gain all required input and insight for improving this document. Also, during the workshop the results of a dedicated questionnaire circulated in advance to all participant to fine tune some key aspects of the strategy where discussed. The main outcomes of both the questionnaire and the related discussion are reported/integrated within the relevant sections of this document.

4.3 Terminology

The following terminology is based on the Decision VI/23 of the Conference of the Parties to the CBD, the Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species (2000) and the Recommendations No. 57 and 99 of the Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats.

**Alien species** (non-native, non-indigenous, foreign, exotic) is a species, subspecies, or lower taxon occurring outside of its natural range (past or present) and dispersal potential (i.e. outside the range it occupies naturally or could not occupy without direct or indirect introduction or care by humans) as a result of a movement by human agency, and includes any part, gametes or propagule of such species that might survive and subsequently reproduce. According to the *Nature Protection Act* Alien species means a non-indigenous species which did not naturally inhabit a particular ecosystem of the area, but was deliberately or incidentally introduced therein.

**Control.** Maintaining a determined population within certain levels or under a threshold (in terms of the number of individuals in the population and its area of distribution), in which the negative impact on the natural resources or, in particular, on native species is practically eliminated, or considered tolerable or acceptable.

**Eradication.** The permanent removal of the entire population of a species within a specific time and area.

**Indigenous species** (or native species) is a species or lower taxon living within its natural range (past or present) including the area which it can reach and occupy using its natural dispersal systems. According to the *Nature Protection Act* Indigenous species means a species naturally inhabiting a specific ecosystem of an area.

**Introduction** means deliberate or accidental release, into the environment of a given territory, of an organism belonging to a non-native taxa (species or lower taxon, including any part, gametes or propagule that might survive and subsequently reproduce) that has not been observed as a naturally occurring and self-sustaining population in this territory in historical times. This movement, by human agency, can be either within a country or between countries. According to the *Nature Protection Act* Introduction into nature means the deliberate or incidental populating of, or the introduction of species or subspecies into, the ecosystem of a particular area which they have never before inhabited naturally.
Invasive alien species (IAS) are broadly defined as species whose introduction and/or spread threaten biological diversity and/or have other social, economic or health impacts. According to the Nature Protection Act Invasive alien species means an alien species whose introduction or propagation poses a threat to biodiversity.
5 Prevention of Introductions

**Strategic Goal 1:** To minimise the risk of IAS entering and becoming established in Croatia, by promoting best practices for prevention, including an increased and widespread awareness and understanding of the negative impacts caused by IAS, and an improved regulation of trade through the support of black list and risk analysis tools.

Prevention is the least environmentally damaging management option, and can, with adequate resources, be applied to a greater or lesser extent across the whole spectrum of species over the long term. Indeed, prevention of either intentional or unintentional introductions will maximise the potential reduction in adverse impacts and the costs associated with tackling invasions once they achieve a foothold, and as such must be considered the first line of defence against the threat posed by IAS as suggested by all relevant international instruments.

Regarding the intentional introduction of IAS as commodities, public and private actors in many sectors carry out relevant activities such as forestry, agriculture (including biofuels), horticulture, hunting (e.g. game stocking), fishing (e.g. fish stocking, live bait), fisheries and aquaculture, landscaping (erosion control, reclamation), animal trade including for pets and aquaria, tourism (e.g. souvenirs), biological control, scientific research. On the other hand, the two key pathways for unintentional introductions concern contaminants in transported commodities and stowaways in transport vectors. Transport of agricultural products, freight, trade in commodities and goods by post and courier services, repatriation of military and aid vehicles, aquaculture, ships’ ballast water, tourism and other movements of travellers (by land, sea and air) are key examples of trade related pathways and vectors for a number of potential IAS.

The ecological risks associated with these pathways are not efficiently managed under existing policies and instruments. In fact, although systems to completely prevent both intentional and unintentional introductions would be impossible to devise and implement, there are potential preventative tools and measures that can help to minimise IAS introductions, the main ones being:

1) information and public education campaigns; and  
2) improved regulation (including risk analysis techniques) of trade.

The same measures are important to prevent the spread of indigenous species outside their natural range within Croatia. Some native species may pose a threat when translocated (particularly if introduced into islands where they do not naturally occur). However, such measures should not apply in case of natural range expansion. The same considerations also apply to discouraging the movement of species from Croatia that may become IAS elsewhere in the world.

5.1 *Environmental Education*

Improved awareness and understanding of the issues surrounding IAS is key to ensure effective preventative measures, to gain wider support for the relevant policies and programmes, and to engage the public in decision-making. In fact the general public could play several key roles on the fight against IAS, but despite some notable exception (e.g. represented by some key stakeholders directly affected by the problem) the general public and many organisations, including some institutional bodies, have limited knowledge and understanding of the threats posed by IAS.
Indeed a special attention should be paid to the diversity of target audiences, who may have major differences in perception and response. Moreover there might be a range of different optimal ways of reaching them. For example for communicating with these different groups there are a number of different means to be considered, such as websites, mass media, posters, information leaflets, codes of practice, identification guides, public talks, face to face meetings and information campaigns via representative bodies.

According to the results of a dedicated questionnaire, the following targets should be considered as a priority for awareness raising campaigns in Croatia:

1. Importers and traders (e.g. ornamental fish, ornamental plants, pets, trees, fish and insects);
2. Companies licenced for risk assessment / expert basis for management planning;
3. Freshwater fishermen;
4. Hunters;
5. Forestry management institutions;
6. Water management institutions;
7. Pupils, students;
8. Tourists;
9. General public.

In addition, dedicated workshops should be organised for a number of authorities (e.g. for sectors such as fishery, agriculture, hunting, veterinary services):
1. Ministry of Agriculture, Fisheries and Rural Development and related institutions;
2. Ministry of Regional Development, Forestry and Water Management and related institutions;
3. Ministry of the Sea, Transport and Infrastructure;
4. phytosanitary and veterinary border inspectors, custom officers.

Monitoring the impact of the awareness campaign on the environmental problem targeted (e.g. reduction of the rate of introduction of new species) or on the public (e.g. change of attitude and perception, increase in knowledge and understanding) is very important to ensure that the expected results are being achieved through the foreseen measures. This requires the collection of baseline information against which to measure the impact of such measures (i.e. current trends in IAS introduction and public awareness and understanding of IAS issues) and will also allow the assessment of both the effectiveness and the value for money of all activities undertaken.

**Objective:** To raise awareness of IAS issues among the general public and other key target audiences and improve knowledge in an appropriate and efficient way to achieve a broad support to:
- Guarantee a wider acknowledgement of the impact of IAS on both the native wildlife and the environment, and on a number of socio-economic aspects (including human health);
- Guarantee a better understanding and support of the IAS related measures to be undertaken and programmes to be implemented, and to engage the public in the decision-making process;
- Involve the public in the measures aimed at detecting and monitoring IAS;
- Encourage responsible behaviour of the public to help reduce the likelihood of introducing IAS, and the risk of facilitating their spread;
- Ensure compliance to regulatory measures, including all relevant legislation and voluntary codes of conduct.
Priority actions:

• Assess the state of the art regarding the situation of IAS in Croatia by collecting baseline information on public awareness, perception and understanding related to the IAS issues;

• Identify key target audiences and priorities for action to increase their awareness, understanding and engagement;

• Ensure appropriate awareness and education messages addressed to the general public (including schools, tourist entering and leaving the country) and relevant stakeholders to help prevent potentially harmful impacts arising from escapes and/or releases of species outside their natural range in Croatia (especially into islands or between river catchments). For example, pet dealers should be required to educate their customers about the risks of escapes/releases in the wild of their animals kept in captivity;

• Develop a communication and media relations strategy, including, for example:
  1. The production and dissemination of information posters, identification guides, brochures, leaflets, etc.;
  2. The production of literature on key IAS and related issues, such as regular bulletins addressing key stakeholders;
  3. The creation of linkages and synergies with communications channels relating to pathways concerning human health and travel, wildlife health, trade, transport and so on (including relevant legislation);
  4. The development of information and/or teaching materials adapted to different audiences;
  5. The inclusion of IAS information packages in the schools curricula;
  6. The organisation of information events at the county or municipal level.

• Set up and maintain a website with updated information on IAS issues, which links to national authorities, institutional bodies, agencies, NGOs and all others key stakeholders interested on IAS issues (promote better access to information on governmental action and progress, and on other programmes and initiatives taking place in Croatia);

• Identify the role and the means by which the public can assist in detection, surveillance and monitoring;

• Discourage the movement of species from Croatia to other countries where they may become IAS.

5.2 Regulation of trade

Given the increasingly role of global trade and movement of individuals in the introduction of IAS, and the wide range of related introduction pathways, it is critical that some sound legislation exists to support whatever preventative measures are necessary. In particular in order to enable the effective implementation of measures to reduce or eliminate the most serious IAS related risks, it is essential to strictly regulate trade on certain species or group of species, e.g. through the integration of specific legislation (including black listing supported by robust risk assessment schemes) and the development of other tools such as codes of conduct and voluntary agreements with key stakeholders.

IAS-related measures aimed at safeguarding biodiversity (besides preventing damage to trade and economic interests) could be strengthened by an improved coordination between the different national authorities/key stakeholders, and in terms of IAS inspection capacity, and could benefit from reinforced controls at hubs (airports, harbours) and other relevant entry points. To this purpose, adequate resources should be allocated for deployment of appropriate detection aids (scanning equipment, trained sniffer dogs for baggage, etc.) and powers for the seizure and destruction of specified consignments. Some targeted
capacity support (e.g. identification and taxonomic guides) and training (e.g. national and regional workshops) would also be needed.

### 5.2.1 Risk analysis

The assessment of the risks connected to the introduction of an IAS can be done at very different levels of accuracy, depending on the objectives of the assessment. Although a quick screening of the risks connected to the introduced species is in general more than sufficient to identify the proper response actions when deciding how to respond to a new incursion (for management purpose, see § 6), in the case of implementation of preventative measures by means of legal regulations of trade (which involves also the support of the World Trade Organization) a full and comprehensive risk analysis is needed.

A full risk analysis – in accordance with EPPO terminology - is the comprehensive evaluation of the likelihood of entry, establishment or spread of an alien species in a given territory, and of the associated potential biological and economic consequences, taking into account possible management options that could prevent spread or impacts. Indeed the risk analysis includes risk assessment (the process of evaluating biological or other scientific and economic evidence to determine whether an alien species will become invasive) and risk management (evaluation and selection of options to reduce the risk of introduction and spread of an invasive alien species). For this reason, a full and comprehensive risk analysis is a complex process, which requires considerable time and human and economic resources.

The need of specific risk assessment studies is already foreseen by the Nature Protection Act and regulated by the Ordinance on the method of preparing and implementing risk assessment studies with respect to introduction, reintroduction and breeding of wild taxa (see § 3.2). Such risk assessment studies - limited to the need of authorising the introduction of alien species in the wild – are made by authorised firms and are assessed and validated by the State Institute for Nature Protection. It would be useful to extend such risk assessment studies also to species to be used for purposes other than intentional introductions, e.g. to species to be imported in the country for any trade related reasons (e.g. amending art. 11 of Ordinance on transboundary movement and trade of protected wild species, see § 8.3).

Some European countries have already started regulating the movement/introduction of species on the basis of the results of detailed risk analysis. Therefore, a good number of best practices are already available to this regard (e.g. EPPO, EFSA, DEFRA, etc.). The efficacy and consistency of a sound risk analysis would certainly benefit from a joint coordinated effort made at the regional level e.g. at the level of all concerned neighbouring countries, which would jointly endorse the relative results, though considering the local situations and conditions, or at the EU level within the context of the IAS strategy being developed.

### 5.2.2 Black list

According to the precautionary approach, if the result of a risk analysis concludes that certain target species represent or are likely to represent an ecological, social or economic threat, measures should be undertaken to prevent their further establishment or spread (or to remove them, see § 6). Therefore, in order to make the most of the result of a risk analysis, such target species should be included in a black list to be used as a legal basis to guarantee a consistent follow up (regulation of trade, monitoring of introduced populations, endorsement of management measures, including control, eradication, etc.). On the other hand, since

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4 In the light of the future EU accession, as EU Member States work towards implementing national invasive species strategies by 2010, it may be necessary to consider measures that will need to be integrated with rules on free movement of people and goods. EU Members States are bound by Articles 28 and 29 of the EC Treaty, which prohibit restrictions on imports and exports between Member States. However, there are some exceptions allowed by Article 30 of the EC Treaty; these include restrictions that protect the life and health of humans, animals and plants, and may therefore be applicable to certain IAS.
finding of harm/threat is precondition for listing, the development of a black list must be made only on the basis of the results of specific risk analysis.

The black list is an open system needed to regulate international/domestic trade, transport, movement and holding, release to the natural environment, etc. of a limited number of harmful species (no restrictions are foreseen on non-listed species). As opposite to the white list - a closed system which would probably be politically, commercially and publicly unacceptable as well as unenforceable in Croatia (as shown also in the EU context, see Shine at al. 2010 for additional details) - the black list is considered the politically most familiar and acceptable precautionary approach to managing IAS.

The black list is a fundamental tool for the implementation of preventative measures by means of regulations of trade and could be based on an extended concept of what is the Register of the Ordinance on the method of preparing and implementing risk assessment studies with respect to introduction, reintroduction and breeding of wild taxa or simply extending the scope of the Annexes of Ordinance on transboundary movement and trade of protected wild species. In any case, in order to guarantee the effectiveness of this strong prevention tool, it is important that specific legal provisions are integrated in the Nature Protection Act.

Objective: To integrate, harmonise and implement specific legislation and/or other voluntary tools to prevent IAS introductions including:

1. Clear and transparent procedures and protocols for risk analysis;
2. A dedicated black list based on comprehensive risk analysis;

Priority actions

• Make appropriate use of existing legislative tools to prohibit the sale, the keeping, the movement and the release of species which present the highest ecological and socio-economic risk (as identified by the risk assessment process). Define rules differentiated by sector and occupational activity (e.g. import may be allowed by holding permits limited to special raising facilities);
• Integrate and harmonise the national legal framework to regulate the introduction and management of IAS;
• Develop detailed standard protocols for risk assessment processes for use on species or groups of species (particularly those not already covered by existing screening mechanisms e.g. excluding species already covered by EPPO, OIE) and keep them updated;
• Perform, where appropriate, a detailed, standardised and transparent risk assessment to identify the highest impact IAS that are most likely to enter and establish themselves in Croatia after being introduced either intentionally or unintentionally (differentiate between high and low risk species);
• Revise and harmonise procedures for proposals for risk analysis (e.g. to be proposed by national authorities or other relevant stakeholders, e.g. NGOs too);
• Consider the establishment of a dynamic Risk Analysis Panel (or the engagement of single experts);
• Define work procedures and rules by identifying existing tools and analysing international standards to be applied in the national context, with the aim of:
  1. Implementing standardised techniques and protocols defined at the national or regional level (in relation to the EU strategy which is being developed);
  2. Involving relevant stakeholders (e.g. the horticultural sector for the introduction of invasive alien plants) in developing or revising protocols for risk assessment and in relevant assessment processes, including decision-making.
• Produce and validate a black list on the basis of the results of specific risk analysis, embody such a list
in relevant legislation, and circulate the list to all relevant authorities and concerned actors;

- Consider developing practices to perform “pathway risk assessments”, a particular kind of risk assessment that does not focus on particular species but rather on a whole set of species (usually pests) using a specific pathway to minimise the risks associated with them;
- Produce, disseminate and implement action plans and codes of conduct for specific key pathways that promote responsible behaviour so as to guarantee a flexible approach based on partnership with relevant stakeholders, and seek to monitor their effectiveness;
- Promote risk analysis procedures jointly coordinated at the regional level e.g. at the level of all concerned neighbouring countries, so as to guarantee a jointly endorsement of the relative results.


6 Early Detection and Rapid Response

Strategic Goal 2: To establish a national guiding framework for responding promptly and effectively to biological invasions before they take hold, through a coordinated system of measures for detection, surveillance and monitoring, diagnosis, risk assessments, identification of proper response and implementation of mitigation, control or eradication initiatives.

Early detection and rapid response (EDRR) is the most cost-effective way of preventing the establishment and wider spread of a introduced IAS within the country. In fact, to address any invasive threats posed by both new and established IAS once preventative measures have not succeeded, the sooner action is taken, the greater the chance of success and the relative cost-benefit both in terms of biodiversity and of human and economic resources to be invested.

In order to respond adequately to the threat of alien species, an effective EDRR system should be based on a framework of activities. These include measures to detect the occurrence of new propagules and invaders, supported by activities to diagnose new species correctly and acquire all related information. Such information (see also § 7) represents a necessary basis for science-based risk assessments carried out through a quick screening aimed at evaluating the severity of the threat and consequently at identifying the best management options available for the target species.

In Figure 2, the logical framework that underpins the activities mentioned above is presented as a workflow, which includes the following five linked elements:

- Surveillance and monitoring;
- Diagnosis and data processing;
- Quick screening;
- Response action;
- Follow up.

Each element (described in detail below) should be under the responsibility of one or more competent authorities acting at the national level (see § 8). The procedure and protocols for an optimal circulation of information can vary according to the actual species in question, the region targeted and the available knowledge and tools (including the legal instruments).

A key element for adequate coordination of all the activities in a national EDRR system is the establishment of a dedicated National Advisory Committee on IAS (NAC, see § 8.1.1). Such a body should ensure prompt and transparent access to high level scientific knowledge and expertise on the different aspects of the EDRR system, with the primary task of implementing and maintaining the central information system on alien species (see § 7). In addition, the efficiency of the EDRR system is guaranteed by an optimal and rationalised circulation of information among all involved actors through an effective information system including all needed decision support tools (see § 7).
6.1 Surveillance and monitoring

Monitoring and surveillance activities are essential to collect the information needed to guarantee rapid response actions and implement measures to prevent newly-introduced IAS from establishing self-sustaining wild populations.

The difference between surveillance and monitoring activities can be summarised as follows:

- Surveillance is an activity aimed at identifying IAS new to a country, and as such is a pivotal element of early detection;
- Monitoring programmes are useful to acquire a better understanding of the ecology, distribution, patterns of spread and response to management of an IAS, and as such can strengthen the capacity to predict the consequences of IAS introductions, and identify or assess the best management options if required.

Dedicated surveillance programmes across a wide spectrum of taxonomic groups can be established at entry points (i.e., points of import) in the form of border controls and quarantine measures. Implementation of such programmes is key to enable early detection of new arrivals and can help prevent or minimise the risk of introducing alien species that are or could become invasive, or protect particularly
vulnerable areas, such as islands. Surveillance programmes would be of limited efficacy if carried out on a local scale. As such, it would be important to launch a surveillance system at the regional level able to optimise use of existing capacity; involve key societal sectors; and promote standardised procedures to collect, analyse and promptly circulate information on new incursions.

Contrastingly, monitoring programmes can be designed for specific areas, pathways or species and are useful to provide the information needed to predict the consequences of IAS introductions (e.g. on occurrence, distribution, ecology, patterns of spread, etc.) and to identify/assess the best management options for supporting IAS prevention, mitigation and restoration actions. Monitoring of species that are known to be present and potentially invasive is useful to assess whether their status is changing (e.g. in terms of population levels and/or range). Monitoring programmes may also provide a stronger scientific basis for decision-making and allocation of resources for implementation of identified response actions.

A useful tool which could help the implementation of surveillance and monitoring activities is the alert list (or alarm list). This tool should represent a list of alien species not yet present in the national territory or present only in a very limited range, that may pose risks to the invaded area, and for which it is recommended to apply particular attention, in order to enhance prompt response in the case of arrival/expansion. A comprehensive and regularly updated species alert list (including information to be readily available for highest-risk IAS about host commodities; source regions; seasonal/environmental factors important for their introduction and establishment; and actual/potential pathways for their introduction) should always be available to national/local authorities.

So far in Croatia only a few examples of surveillance and monitoring schemes in place for IAS are available, and therefore the coverage is clearly incomplete (e.g. for a limited number of taxonomic groups only, mostly plants, freshwater crayfish and freshwater fish). As a consequence IAS occurrence or changes of range risk of not being recorded early enough to implement rapid response.

Objective: To improve the ability to promptly detect new incursions of IAS and respond to their threat by increasing capacity of dedicated surveillance activities and monitoring programmes (to be established under the central coordination of the NAC). In particular, the specific measures to be undertaken are aimed at:

• Bridging the gaps in taxonomy and environments not covered by existing programmes;
• Ensuring that existing monitoring programmes focusing on native species are integrated in a coordinated system so that all sightings of potential IAS are promptly reported;
• Enabling better coordination among all national and local surveillance and monitoring efforts and coordinating data collection and data-holding mechanisms to centralise the existing data that are likely to be scattered amongst various agencies, institutes, NGOs, universities and individuals.

Priority actions

• Establish and update an inventory of active surveillance activities and monitoring programmes;
• Analyse the information to verify consistency of individual monitoring schemes, compatibility among monitoring schemes, coverage of species, staff and budget already allocated, costs, needs for optimal circulation of information, areas for development and opportunities for more effective collaboration (also with programmes undertaken at the regional and European level e.g. by strengthening cooperation with neighbouring countries and enhancing transnational surveillance and monitoring programmes where appropriate);
• Establish a surveillance system aimed at collecting and storing information on new incursions through

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direct contacts with institutions, museums, government laboratories, local authority pest controllers, universities and members of the public, stakeholders and experts, and regularly screening scientific journals, grey literature, newsletters, etc.;

- Identify priority target species by developing *ad hoc* alert lists based on predictions of the spread or arrival of IAS so as to concentrate surveillance efforts on those species; produce, validate and communicate alert lists to relevant authorities and actors;

- Identify and encourage regular surveillance of key pathways and high-risk areas, such as: areas of predicted spread of established IAS; main entry points for commercial or tourist arrivals (airports, ports, harbours, open moorings, train stations) and areas frequently visited by tourists; areas adjacent to containment facilities for potential IAS; highly disturbed areas (land clearance, construction, storm damage) and areas where disturbance occurs regularly (roads, railways etc.); isolated ecosystems and ecologically sensitive areas (e.g. islands);

- Provide guidance on effective techniques for rapid detection of newly arrived IAS; disseminate information on best practices; implement training and capacity-building programmes for field officers, protected areas staff and other public employees;

- Establish a monitoring system aimed at integrating monitoring schemes/data into broader monitoring programmes (i.e. unifying existing monitoring schemes) and broader monitoring goals (i.e. combining monitoring schemes with complementary monitoring goals) to monitor IAS more effectively and more representatively;

- Promote monitoring programmes of pathways, vectors and vulnerable points, as appropriate (e.g. through identification and risk analysis of different pathways and vectors for species introductions or spread, including methods to predict potential invasiveness of alien species prior to introduction);

- Involve relevant stakeholders and the general public in citizen science based monitoring and surveillance activities by:
  - Improving awareness of IAS issues through specific information campaigns tailored to specific target audiences (public, commercial and institutional);
  - Supporting recruitment and training of volunteers for EDRR efforts at the local level, utilizing existing programs and infrastructures;
  - Developing information materials to assist farmers, gardeners, birdwatchers, foresters, fishermen, hunters, divers, hikers and photographers to detect and report new arrivals;
  - Encouraging specialist NGOs to participate in reporting networks, i.e. through Memorandum of Understanding;
  - Introducing reporting requirements for key stakeholders based on a list of priority IAS (e.g. farmers and landowners might be requested to inform competent authorities about the presence of target IAS in their lands);

- Ensure that both the surveillance system and the monitoring system are established under the central coordination of the NAC.

### 6.2 Diagnosis and data processing

Identifying a species correctly is the first step in an EDRR process aimed at preventing the establishment of IAS in a newly invaded area. Therefore, a mechanism to enable access to taxonomic expertise and diagnostic tools is a crucial component in any EDRR framework. While some well-known groups of species can be identified using specific guides and manuals or other identification tools (e.g. online
illustrated species accounts, such as DAISIE, NOBANIS and Gisd) for most groups - particularly marine and terrestrial invertebrates and plants - competent expert support is often needed. Tools like the Aliens-L. list of the IUCN/SSC Invasive Species Specialist Group (ISSG) and the DAISIE expert registry, represent an important support to this need, facilitating contacts among experts all over the world (see § 7.2).

In a number of cases, identifying new invaders can be a major challenge. Factors include the large number of unwanted organisms potentially arriving; the difficulty of identifying species in different life stages (i.e. eggs, seeds, spores, larvae); gaps in taxonomic knowledge; and the absence of relevant expertise. For the reasons above, the traditional taxonomy practices are sometimes inadequate and diagnosing new invaders may require a framework of identification techniques relying on image assessment, digital image capture and internet-based identification. DNA barcoding could even provide valuable support to timely and cost-effective identification of invaders.

Once a species has been identified and its status ascertained, information should be compared with an up-to-date European inventory (i.e. see DAISIE), and with ad hoc developed black lists and alert lists (see § 5.2 and 6.1). For species recorded for the first time in Europe, other basic data should be searched in global inventories and databases or - if necessary - in scientific and “grey” literature.

**Objective:** To guarantee a quick and reliable identification of the detected species and its status in the concerned area (i.e. whether the target species is alien to Croatia, alien to the concerned area but native in other areas of Croatia, cryptogenic, or unknown) to enable, in the event that the target *taxa* is considered alien, a prompt start of the entire process for an EDRR.

**Priority actions**
- Develop adequate capacity among staff of national authorities and support capacity building among other involved actors for prompt and reliable taxonomic identification of possible new incursions;
- Promote existing capacity, establish procedures to collect, analyse and circulate information on IAS, including identification keys for different taxonomic groups;
- Maintain and update a national inventory of IAS, including data on recorded impacts, and ensure integration of data with other existing European and global databases (e.g. DAISIE, NOBANIS, GISD, ISC, etc.) with descriptive pictures, and other identification tools, in order to define the status of recorded species (e.g. alien to Croatia, alien in Croatia, native, cryptogenic or uncertain);
- Maintain a regularly updated register of experts;
- Process the collected data relating to new recorded alien species to enhance subsequent data analysis (quick screening, risk assessment, identification of response actions, etc.);
- Ensure production and circulation of *ad hoc* guides and manuals for identifying IAS.

**6.3 Quick screening**

The data and information collected further to the implementation of the surveillance and monitoring activities need to be duly analysed and circulated to allow the competent authorities to undertake the needed response action. For this reason, another fundamental element of the EDRR system is the risk analysis. The level of detail required for the purpose of assessing the potential risks posed by a newly introduced species as soon as it is detected is a quick screening.

The quick screening represents the necessary step that builds on the information collected on a target IAS (before or soon after its introduction) and that leads to a decision on the actual measures to be undertaken
as a response action so as to prevent its introduction, its spread or its permanent establishment (e.g. eradication, control, etc.). In particular, in the case of detection of an organism included in the list of species with records of invasiveness elsewhere (alert list), eradication measures should be undertaken immediately without further delay.

Basic elements to take into account when performing a quick screening of a species include: distribution (already widespread, present and invasive, localised, etc.), species status (invasive in other European contexts, not yet present in Croatia and invasive elsewhere, considered as low risk, etc.) and biology (native range with similar climatic conditions to Croatia, high spread potentiality, etc.). The evaluation process should be as transparent as possible and based on concrete and rapidly accessible information.

**Objective:** To perform a quick screening of the potential risks posed by a potentially harmful IAS whenever a new incursion of such species is detected so as to decide which response action should be promptly undertaken. Such risk assessment should be based on available records of invasiveness in other situations, available information on ecological characteristics, etc.

**Priority actions**
- Identify existing tools and analyse international standards to be applied in the national context;
- Develop and update protocols for quick screening of groups of species not yet covered by existing screening mechanisms (e.g. excluding species already covered by EPPO, OIE);
- Perform a detailed, standardised and transparent quick screening of any newly recorded IAS;
- Search and collect all relevant updated information on management techniques regarding the newly recorded IAS;

**6.4 Response actions**

Once a new incursion is detected, and associated risks are preliminarily screened, it is crucial to decide promptly what measures have to be implemented (either eradication, control, containment or no action), what techniques have to be applied and who should enforce them. In the case of an IAS having or likely to have a substantial negative ecological, social or economic impact, eradication or control measures should be envisaged, providing that such measures are financially and technically feasible, reasonably humane and safe for both people and other native species.

Eradication is the most effective solution in terms of ecological results. When carried out successfully, it is more cost-effective than control, which requires continuous expenditures over a long period of time. As a general rule, eradication is considered to be feasible in the early stages of invasion when the newly introduced populations are small and localised, and particularly in areas of manageable size, such as islands or other isolated ecosystems (which should be always considered priority areas for this type of intervention).

In addition to a sound feasibility study, a successful eradication campaign requires the technical and political support of the competent authorities, good coordination among all administrations responsible for the territory and sufficient economic resources devoted for a sufficient duration. This helps ensure that other interventions, which are at odds with the objectives of the project, are not carried out in the same area. To be successful, the methods applied should take into account any possible consequences for native species, and should be socially, culturally and ethically acceptable.
When eradication is not a feasible or practicable option, the best alternative may be control. The aim of control is to reduce the density and abundance of an IAS in order to keep its impact below an acceptable threshold. Effective control may be achieved through a range of integrated management techniques, including mechanical, chemical and biological control. Control methods should be selected after taking into consideration their efficiency and selectivity and undesired effects they may cause, as well as prevailing regulations and codes.

Another option is containment, which aims to limit the spread and restrict IAS within geographically reduced areas, especially when eradication is no longer feasible. Spread of IAS in suitable habitats can be avoided through natural or artificial barriers, and exclusion fencing can be an effective control measure in some circumstances. This strategy is appropriate only if the range of the introduced population is small enough to achieve a significant result. Either control or containment is a high priority for IAS that could spread to neighbouring countries and to ecologically sensitive areas.

A last option is “do nothing”. This is selected when the measures described above are considered not feasible because of major technical or financial constraints, or because the actions are not considered socially or politically acceptable. In this case, an alternative option to mitigate the negative impacts of a newly introduced IAS is to establish refuges for threatened species or to implement actions to maintain or restore resilient ecosystems, so as to improve adaptation capacity to IAS and continued supply of ecosystem services.

### 6.4.1 Ecological Restoration

Response actions should include restoration of biodiversity affected by IAS as far as feasible. Restoration is an integral part of managing IAS. Although IAS removal is sometimes a goal in itself, it should also be seen as an important element in achieving other environmental targets such as recovery of endangered species or repair of ecosystem function.

Many restoration efforts have succeeded in mitigating negative IAS impacts with important benefits. However, some may have unforeseen consequences that exacerbate rather than mitigate the original IAS problem. For example, as reported by Shine et al. (2010):

- Invasions can cause long-lasting changes to the ecosystem that persist well after the removal of the IAS;
- “Secondary invasions” involve the rapid replacement of the removed species by others that capitalise on the disturbance caused by the control operations and/or the resource alteration caused by the IAS;
- IAS management can degrade ecosystems and negatively affect indigenous species;
- Where alien species invade by infiltrating ecosystem networks (e.g. pollination and dispersal networks, food webs), their removal can cause trophic collapses;
- Restoration efforts can be compromised by conflicts of interest, an example being IAS that provide habitat or food for endangered native species.

These examples highlight the need to consider all implications of planned control and restoration programmes. On the other hand, in order to contain the risk of escalating environmental damage, ecological restoration can also be considered as a second-best choice of a management plan in the case the eradication programme does not achieve its objective.
Well-designed restoration of IAS-damaged sites can reduce their vulnerability to future invasion and may strengthen ecosystem resilience to other environmental stresses to avoid ecosystems being pushed beyond certain thresholds or tipping points. Restoration may include release or stocking of native specimens, e.g. native crayfish in alien-free rivers or river catchments. Restoration programmes can also secure broader socio-economic benefits where they contribute to the maintenance and enhancement of ecosystem functions and services. They may also strengthen public acceptance and understanding of necessary control measures.

Even when technically feasible, restoration can be potentially very expensive and needs continuous supervision, assistance and monitoring of developments. It is usually executed locally as a by-product of eradication or control actions, rather than as an overarching target at national or local scale. Generic elements for effective programme design should therefore include:

- Incorporating prevention objectives into relevant sector policies e.g. primary production, land and water management, spatial planning;
- Defining the situations in which national authorities may be required or encouraged to carry out restoration;
- Defining the state to which restoration should be carried out, taking account of feasibility and an appropriate timescale;
- Providing guidance if restoration includes the release of specimens;
- Establishing responsibilities for restoration actions.

The re-introduction of native species, following the control/eradication of IAS which represent a threat to them, may be envisaged provided that such programmes are fully consistent with international guidance. Such a re-introduction would not only justify the removal of the alien species but can also facilitate gaining support of the public opinion. However, this should not be confused with assisted colonisation (i.e. translocating and releasing species beyond their current range limits as part of a climate change adaptation strategy).

Objective: To minimise and manage the negative impact of newly established IAS having or likely to have a substantial negative ecological, social or economic impact in a cost effective manner, e.g. by means of specific eradication or control measures, or any other kind of mitigation and restoration programmes, providing that such measures are financially and technically feasible, reasonably humane and safe for both people and other native species.

Priority actions

- Adapt existing legislation in order to include provisions on mandatory responses to incursions, to remove all possible obstacles to response measures and make possible the adoption of emergency orders where urgent measures are deemed necessary, and possibly to establish priorities for mitigation, eradication and control action at a national level;
- Ensure that all competent authorities have sufficient legal powers to remove IAS in accordance with relevant laws and policies;
- Provide guidance on best available financial resources and relevant funding instruments, and provide adequate funds and equipment for rapid response to new invasions and train relevant staff to use the control methods selected;
- Establish dedicated funding instruments based on a clear, transparent and prompt decision-making process, to ensure adequate and timely support to national authorities or other competent actors for enforcing rapid responses to new invasions;
• Streamline and support a transparent decision process aimed at identifying appropriate management measures (e.g. rapid eradication, control, monitoring, do-nothing), also based on a quick screening and risk assessment and contacting relevant experts if appropriate;
• Establish, within the decision process, consultation mechanisms with national and local authorities, especially if the decision process may affect trade regulations or other economically relevant issues (e.g. recorded presence of regulated pests with effects on exports);
• Carry out sound feasibility studies to plan a successful eradication or control campaign e.g. identify best practices and methods taking into account any possible consequence for native species, and by ensuring that is socially, culturally and ethically acceptable;
• Encourage competent agencies, including protected areas, to enhance training of staff to use selected eradication and control methods and to set up basic control equipment;
• Prepare, in contact relevant stakeholders if appropriate, contingency plans for eradicating or containing selected sets of, as yet undetected species, whose introduction is considered probable (e.g. those species included in alert lists);
• Prepare national and local contingency plans for eradicating, controlling or containing groups of species with similar characteristics (e.g. terrestrial and water plants, invertebrates, marine organisms, freshwater invertebrates, freshwater fish, reptiles, amphibians, birds, small mammals, large mammals) and eventually consider the use of emergency orders where urgent eradication, control or containment actions are needed;
• Contribute to regional cooperation on research and development of emergency response materials (e.g. prepare a toolkit aimed at providing guidance on best practices and procedures to establish the optimal management option);
• Establish dedicated monitoring activities in areas where control and eradication measures are being implemented or have been carried out;
• Agree, with the key stakeholders, a set of guiding principles for assessing and identifying which actions are feasible in terms of containment, control or eradication, and encourage effective partnerships, and support individuals in tackling the problems caused by IAS;
• Prepare management plans for the priority IAS and impacted habitats, taking into account scope for integration with any relevant action plans already created for biodiversity conservation purposes (e.g. consider also including such plans in management plans for protected areas);
• Develop and update a database of projects to facilitate better information sharing and to make the best of opportunities for partnership and other resource synergies;
• Empower and support land-owners and managers to minimise the impacts on their land (to protect their private interests and prevent nuisance for owners of neighbouring land) through provision of advice and practical information, and involve them in control programmes;
• Encourage and support the establishment and work programmes of local or regional fora to investigate how best to achieve some co-ordinated management;
• Identify mechanisms and initiatives to involve the public in prevention, control and eradication efforts in an organized manner, to minimize or eliminate the negative impacts of IAS and favour ecosystem restoration and conservation.

6.5 Follow up
A final but essential element of the EDRR is reporting to the competent authorities by the actors in charge of enforcing the response actions. Such reporting - which refers to the progress of management measures and assessment of their impact once the task is considered complete - can allow a follow-up by the NAC to
inform the scientific communities or national authorities from other concerned countries of the efficacy of the management options applied and to aid preparation should similar incursions occur elsewhere.

This part of the communication flow is crucial to enable independent technical evaluation of the activities and a more transparent supply of information on progress to the entire community of concerned people and stakeholders.

The EPPO communication framework provides an example of a system where countries are called to report on the enforcement of recommended actions in the case of incursions by regulated organisms (list A1). The Bern convention can open case files against countries that fail to comply with their obligations under the Convention, and the text of the Convention provides for the possibility of recourse to arbitration for any dispute. But the general mechanism of the convention is based on a moral suasion of Contracting Parties to comply with recommended actions, and does not include mechanisms for infraction proceedings (such as those for example for infringement of EU directives).

**Objective:** To addresses the progress and impact of the implemented management measures to inform the national authorities from Croatia or other concerned countries, as well as the scientific community, of the efficacy of the management options applied and to aid preparation should similar incursions occur elsewhere.

**Priority actions**

- Establish a legal mechanism to guarantee a mandatory, prompt, regular and detailed activity report on both the progress and the impact of the actions carried out in response to the detection of an alien species, as enforced according to the decision by competent authorities of the territories affected by new incursions or by any other concerned actor;
- Establish a reporting mechanism to enhance the information flow between national and local authorities (and other actors), and to promote the circulation of information on the results of response actions carried out by the NAC to other interested countries and actors.
7 Decision support tools

**Strategic Goal 3:** To develop and maintain a central information system coordinated at the national level to allow the collection, the validation, the analysis and the circulation of all data and information related to IAS, and promote research activities to fill in knowledge gaps.

The successful implementation of an effective IAS strategy and particularly of a sound EDRR system, must be based on scientific information of the highest quality. Therefore it is necessary to develop a mechanisms to collect, validate, exchange, manage and access information particularly at national level (but also international) and fortify the scientific research that generates knowledge for a better understanding of biological invasions, their impacts and the management measures to prevent biological invasions and - in case of incursions of new IAS - react more rapidly and effectively.

For this purpose it is fundamental to develop and maintain a Central Information System (CIS) coordinated at the national level. Such CIS is meant to be characterised by a number of key technical/scientific tools which should be available to the competent authorities to support the decision process, particularly for EDRR actions toward new invasions. Such decision support tools can be distinguished into the following main categories:

1) Databases and inventories;
2) Experts register;
3) Research activities;
4) Species identification tools;
5) Species accounts.

Additional tools which are fundamental for the implementation of both a preventative approach and an EDRR systems are the black and alert lists (described and discussed in § 5.2 and 6.1), and the legal instruments needed at the national and local levels, including the available financial tools.

The CIS and its components listed above need to be designed in a way that incorporates a coordinating function. For this reason the CIS should be permanently hosted by a central coordinating body – such as the National Advisory Committee on IAS (NAC) described in § 8.1.1. In this context a basic requirement is that the NAC, possibly supported by an expert steered group, ensures the maintenance of such a system so as to guarantee its long term sustainability.

Many information tools that have already been developed in Europe and the rest of the world could provide support to the activities reported above, from species identification, to management options, to access to expertise. The CIS in Croatia should build on the experience and tools developed within such existing information tools (e.g. DAISIE, NOBANIS, EPPO, etc.) and should link to them.

### 7.1 Databases and inventories

The capacity to identify, prevent and mitigate IAS threats depends on the availability of accurate and updated information that is easily accessible at the right scale. This requires the creation and maintenance of a national portal for IAS information, possibly including functions for interoperability with other national or regional IAS databases and inventories. The most comprehensive and updated information mechanism on IAS with data available at the national level also for Croatia is currently DAISIE.
For this reason, a new effective and comprehensive database should be developed, based on a common and agreed data shell, and including the information already made available by the DAISIE project. Besides, on the basis of experiences carried out in Europe, particularly in implementing the DAISIE project and developing associated tools, it is possible to define the structure of a comprehensive and dynamic database, including specifying priority data and updating mechanisms. Ideally, there should be a list of all alien species found in Croatia for all taxonomic groups, together with their status — whether breeding, increasing, extinct, casual, vagrant and so forth. Additional information should address when the species was introduced, together with data on distribution (e.g. native and non-native ranges), biology, ecology and impact.

In particular a core element central to an optimal CIS is a comprehensive register of IAS. The IAS register should be an up-to-date and extensive inventory of terrestrial, freshwater and marine alien species within terrestrial, coastal and marine regions of Croatia, built upon:

- Robust definitions of alien species status, impact and invasion that can be applied across the alien taxa in marine, freshwater and terrestrial ecosystems;
- Formats and standards for recording information agreed to at the European level (defined in common with other European countries, e.g. based on DAISIE) in order to maximise interoperability, compatibility and coordination with and among initiatives operating at the national, regional and global levels.

**Objective:** To ensure the creation and the maintenance of a national portal for IAS related information, including a register of IAS for all taxonomic groups.

**Priority actions:**

- Establish a Central Information System on IAS (CIS) including an inventory of IAS in Croatia based on the DAISIE list of alien species in Europe;
- Link with other existing European inventories and mechanisms such as NOBANIS, EPPO, etc. and with other global IAS information networks, such as the Global Register of Invasive Species (GRIS) being developed by the IUCN/SSC ISSG, to ensure rapid dissemination of information;
- Update the CIS regularly to include newly detected IAS recorded in the country (e.g. integrate information from data collected through surveillance activities and monitoring programmes, and from produced black and alert lists);
- Mobilise existing expertise for species inventory and review, based on a partnership approach, e.g. with universities, research institutes, botanic gardens, non-governmental organisations and other stakeholders;
- Work closely with counterpart national focal points, relevant instruments and organisations (e.g., European Commission, European Environment Agency, Bern Convention Secretariat, CBD Secretariat, IUCN/SSC ISSG, Ramsar Secretariat, CMS Secretariat, UNESCO Man and the Biosphere Programme, IMO, IPPC/EPPO Secretariat, European Maritime Safety Agency) to exchange information and promote effective responses to biological invasions;
- Promote coordination among countries, sectors and key institutions to harmonise the CIS structure and contents with particular reference to shared IAS pathways and problems;
- Maintain contacts with colleagues dealing with IAS policy issues in other European countries and encourage consistent representation of issues of concern to Croatia;
• Promote and support a network in the Balkan region;
• Ensure sufficient resources to maintain and update the national inventory permanently.

7.2 Experts register

Decision making requires the access to the most advanced scientific expertise on very different aspects, from the species taxonomy and biology (also for species not yet recorded in Croatia), to management alternatives, to legal aspects. In this regard it is important to ensure the rapid involvement of key experts, to be contacted not only in Croatia but also in Europe and the rest of the world.

Experts might be classified in two main groups:
• scientists, researchers and other professionals with specific expertise on IAS issues;
• scientists, researchers and other professionals without a specific expertise on IAS but whose skills might be useful for purposes related to diagnosis, identifying risks and managing alien species (i.e. specific fields of plant and animal biology, ecology and conservation, and taxonomy).

This expertise is distributed across research organisations, offices, university departments, museums and other scientific institutions throughout Croatia. In order to provide the competent authorities and all EDRR involved actors at national and local levels with the contact details of the key experts, a comprehensive and updated expert registry should be prepared. In alternative, it would be useful to organise the needed expertise within a dedicated network, such as the Belgian Forum on Invasive Species (http://ias.biodiversity.be/ias/) and the Centre for Invasive Species based at the University of Copenhagen (http://cis.danbif.dk/).

The dedicated European expert registry developed within the DAISIE project is currently the most comprehensive tool available, linking and mobilising current expertise on biological invasions with details of individuals experts on taxonomy, geographic units and thematic areas. It includes information on approximately 1858 experts from 92 countries, with specific competence on 3502 taxa. Since alien species invading Europe may originate from any region of the world, experts from all over the world were invited to register. So far 37 of the registered experts declared specific expertise on species in Croatia (about 2% of total, see: http://www.europe-aliens.org/expertSearch.do).

Objective: To develop an expert registry for providing national authorities with the needed expertise whenever useful for a sound implementation of this strategy.

Priority actions:
• Establish a Central Information System on IAS (CIS) including an expert registry;
• Identify existing expertise for species inventory and review (universities, research institutes, botanic gardens, non-governmental organisations and other stakeholders);
• Identify existing regional expertise and networks (e.g. IUCN/SSC ISSG, DAISIE network, NOBANIS network, International Commission for Scientific Exploration of the Mediterranean Sea, Regional Biological Invasions Centre hosting the virtual European Research Network on Aquatic Invasive Species, Hellenic Centre for Marine Research for the Mediterranean Sea, EPPO);
• Promote the organisation of a dedicated national network of experts based on a university or other scientific institutions;
• Ensure sufficient resources to maintain and update the expert registry permanently.
7.3 Research activities

The scientific community has shown a growing interest in biological invasions and related disciplines. Also in Croatia there is a growing amount of research on IAS occurring in the country (see § 3.3.1 and annexes III and IV). Universities and other scientific institutions, government agencies, NGOs etc. have received funding opportunities from a wide range of sources for many different type of research activities related to biological invasions, ranging from basic to applied.

Research is indeed a key area in relation to IAS management. Research outcomes are a pivotal component to perform EDRR activities, such as risk assessment, surveillance, detection, monitoring, control and eradication strategies. Applied research is particularly important to help inform and refine control methods (e.g. by providing innovative solutions for technological or biological control) as well as for assessing the feasibility of proposed response action (e.g. eradication attempts). The assessment of both costs and probability of success for control or eradication programme needs to be assisted by sound feasibility studies, which often involve also modelling. There is a need for strategic co-ordination of research efforts involving all the key funders, including government departments, statutory nature conservation bodies as well as all relevant actors. On the other hand a strong evidence base supported by sound research activities is key to underpin policy needs.

Objective: To encourage a more strategic and coherent approach to promote and carry out research activities aimed at supporting the implementation of the IAS strategy in Croatia and related policy.

Priority actions

• Promote and finalise research activities useful to support all actions related to a sound implementation of the strategy, like risk assessment, prevention, detection, surveillance, monitoring and management with the highest quality science available;
• Ensure that results from research as described is widely disseminated;
• Secure sufficient funding for research priorities (i.e. identified by the NAC);
• Encourage collaborative research projects and wide access to results;
• Monitor developments in research nationally and internationally to detect technological or biological advances and to ensure that research on IAS in Croatia is cutting edge and avoids duplication of research efforts;
• Ensure development of further research in the field of taxonomy and the development of other innovative diagnostic tools.

7.4 Species identification tools

Correct taxonomic diagnosis of species is essential to respond to biological invasions. In this respect, the CIS shall include references and/or links to the most advanced tools to assist species identification.

Ability to diagnose new invaders requires a framework of disciplines, ranging from traditional taxonomy, identification through image assessment, new technology such as digital image capture and internet based identification tools, and innovative techniques such as DNA barcoding, that can provide a valuable tool to rapidly and inexpensively identify invaders. For some groups, the identification of species can be done through specific identification guides and manuals (an example are the identification guides developed for enforcing the CITES) or through other identification tools, like the species accounts and profiles provided...
within the various inventories and databases (e.g. DAISIE, GISP, ISC). Indeed Europe has a very solid expertise on taxonomy, and has developed a number of identification tools which are currently available to support activities within the EWRR system (see Genovesi et al. 2010 for details).

**Objective:** To develop diagnostic tools to support the sound implementation of this strategy.

**Priority actions:**
- Establish a Central Information System on IAS (CIS), including diagnostic tools for IAS;
- Identify existing diagnostic tools for IAS and promote the development of new ones to fill in gaps;
- Ensure sufficient resources to develop and regularly update the diagnostic tools and make them promptly available.

### 7.5 Species accounts

To enhance response to invasions, the CIS should include detailed species accounts/profiles (including relevant details for species identification and management) primarily to provide a tool to competent authorities, practitioners and decision makers to perform targeted surveillance activities, identify the species, assess risks connected to the species arrival and spread, and identify management systems. Selected species accounts covering high profile IAS would not only be valuable for end users (such as agencies, resource managers, decision-makers and interested individuals) but would be also an important information tool to increase awareness on biological invasions among the general public.

Species profiles shall be populated with detailed descriptions, possibly including dichotomous keys, photographs, illustrations, etc. and should integrate information on the most effective and/or practicable management options to target new invaders. Accounts shall be characterised by detailed information on distribution of the target species, as well as relevant descriptions for identification of impacts and potential control methods. For this reason they should include synthetic but detailed and validated information on biology, ecology, distribution (described by maps), impacts, management information, references, links and images.

- Species name;
- Area invaded (with description of overall European range);
- Short description;
- Identification information, including description, designs, photos;
- Biology and ecology (with priority to basic info required for quick screening and/or risk analysis);
- Detailed distribution (within standard mapping grids, or standardised coastal/marine areas);
- Detailed information on impacts recorded in Croatia or elsewhere in Europe or in the world;
- Management techniques and methods;
- Sources of information.

The general aim of the CIS should be to have access to detailed profiles for all potential IAS, including both those already present in Croatia, and those not yet arrived in the country. In this regard it would be essential to support potentiating of global inventories of profiles (e.g. GISP). Species profiles can be produced specifically for the national inventory of Croatia, but can also be established by linking the national information system to other existing European or global databases (DAISIE, NOBANIS, GISP, ISC, EPPO, etc.), and in case integrating the information provided by these tools.
**Objective:** To ensure the creation and the maintenance of a national portal for IAS related information, including a register of IAS for all taxonomic groups, and a compilation of species accounts of a selection of the most concerning IAS.

**Priority actions:**

- Establish a Central Information System on IAS (CIS), including detailed species accounts relative to a selection of IAS occurring in Croatia, and based on the DAISIE list of alien species in Europe;
- Link with other existing European initiatives including species accounts, such as DAISIE, NOBANIS, EPPO, etc. and with other global IAS information networks, such as the Global Register of Invasive Species (GRIS) being developed by the IUCN/SSC ISSG, to ensure rapid dissemination of information;
- Update the species accounts and develop new ones regularly to include new data and information, particularly for species management and identification purposes;
- Ensure sufficient resources to maintain and update the species accounts regularly.
8 Implementation of the strategy

**Strategic Goal 4:** To ensure a sound implementation of the strategic framework on IAS by establishing a lead responsible coordination body and clarifying the roles and responsibilities of all concerned actors, in order to promote a stronger sense of shared responsibility across government, key stakeholders, organisations, land managers and the general public for actions and behaviours that will reduce the threats posed by IAS or the impacts they cause.

The identification of competent authorities, their roles and responsibilities, is a priority step towards developing an effective strategy on IAS in Croatia. The *European Strategy on IAS* (Genovesi and Shine, 2004) underlines the primary challenge of networking activities carried out at the national level, and recommends that each country establish appropriate structures or networks of structures for this purpose. Experiences in other regions of the world underline the need to prioritise establishing appropriate structures; all the frameworks that have led to positive outcomes in terms of prevention and response to biological invasions have created a coordination system.

The analysis of the state of the art in § 3 confirmed the need to organize prevention of unwanted introductions of IAS at the national level, to recognize and valorise the importance of IAS impacts on native biological diversity, and to take adequate response actions to deal with new incursions. The identification and implementation of all the range of needed actions still require cooperation between different governmental bodies, scientific institutions, NGOs and the general public, at the national and international level.

Therefore, key to a sound implementation of the strategic measures to deal with IAS discussed in the previous sections of this document is the identification of a central coordination body and the definition of clear roles and responsibilities of all concerned actors. In this context the definition of the decision-making process (and possibly of mechanisms for prioritisation) to deal with IAS soon after their detection and the identification of the risk they pose is of particular importance. The establishment of an effective system able to guarantee an optimal circulation of information among all concerned actors, at both the national level and the international level (e.g. through direct contacts with national authorities from other countries or regional networks) is also pivotal. Furthermore, the development of an effective legislation supported by sufficient operational capacity and adequate economic resources is a fundamental asset. To this regard, specific financial tools are needed. It is therefore essential to develop a specific and detailed action plan to guide the implementation of this strategy on a quinquennial basis. To this purpose, the results of a workshop on IAS held in Croatia under the works of the Bern Convention in 2006 (see Annex I) have been taken in consideration, as well as the contents of the relevant national legislation, and particularly the *Nature Protection Act*.

Finally, an important aspect for the successful implementation of the proposed strategy is to establish a mechanism for the periodical review of its impact on the problem targeted (the colonisation, spread and impact of IAS) so as to guarantee that the foreseen measures are correctly and effectively implemented, and all relevant activities are carried out in a way that is sufficiently flexible to adapt or respond to changing circumstances. To this purpose the impact of the strategy should be assessed by either the involved national authorities or an independent body on a quinquennial basis.
8.1 Roles and Responsibilities

A sound implementation of the strategy on IAS should consider the roles and competencies of the people and institutions involved. As experienced in many European countries the complex separation of roles and responsibilities on the issue might create significant obstacles to an effective response where institutions lack authorities with clear competences over biological invasions.

The engagement of people and institutions may vary in accordance with the tasks at hand and the level of political commitment to implementing the preventative measures and the overall EDRR system. Indeed the spectrum of activities related to a sound management of IAS - including identifying unwanted species, assessing the risks arising from their presence, and identifying and implementing measures to prevent associated socio-economic and environmental impacts - is very broad.

Responsibilities for carrying out these activities can be divided among different bodies, depending on the division of roles and on the legal basis. Most of the activities can be under the responsibility of government agencies and departments, but some can be under NGOs and relevant stakeholders (e.g. when based on codes of conduct or voluntary activities). There are also actions which might be carried out by voluntary network of experts or common people.

In general, the number of people and institutions that would be directly or indirectly involved in the activities needed for a sound and effective implementation of the strategy is enormous. The problems related to IAS concern many social, economic and environmental sectors, including transport, trade, forestry and agriculture, fishery and aquaculture, land and water management, infrastructure development, tourism and recreation, and health. For this reason, all key stakeholders should be adequately involved so as to include all sectors involved directly or indirectly in the movement, release, detection or management of alien species (e.g. horticulturists or fishermen).

8.1.1 National Advisory Committee on IAS

To address the impact of IAS in Croatia by ensuring sufficient co-ordination and strategic direction, making optimum use of existing capacity and resources, and ensuring that any decision to take action is proportionate to the level of risks identified, a central coordination body should be established. Such a single co-ordinating body should take the form of a National Advisory Committee (NAC) on IAS.

The NAC should be an officially recognised technical body, with a clear mandate and terms of reference, composed of a team of specialists, represented by competent officers and “leading experts”. In fact, in order to guarantee a sound implementation of the strategy by maintaining an optimal level of cost-effectiveness, such a body should be constituted by the key representatives of the national authorities responsible for the issue, and the key stakeholders, including all relevant experts and related scientific institutions. The essential role of such a technical body would be to provide a coordinate scientific body, with access to high level scientific expertise on all different and crucial aspects of the strategy and policy on biological invasions, such as the support to decision making on prevention measures (from awareness raising to trade regulations) and all other aspects related to the EDRR, as well as the key task of implementing and maintaining the Central Information System (CIS) on IAS.

The NAC should be chaired by the leading competent authority (supported by a Secretariat), and should be made up of a Steering committee or Council, and a Scientific authority working in collaboration with experts. In addition ad-hoc thematic working groups involving key stakeholders or their representatives should be envisaged as appropriate (Fig. 3).
The chair should be the competent authority responsible to take the overall lead role in driving forward implementation of the strategy. According the Nature Protection Act the central state administration body competent for nature protection is the Ministry of Culture (MoC). The chair should therefore be represented by the MoC - Nature Protection Directorate. The MoC should nominate a technical and advisory working group (including scientific institutions working on IAS, representatives of other relevant ministries, experts, etc.) which will be part of the scientific authority.

The Secretariat
The secretariat should support/facilitate the activities of the chair. Ideally, the Secretariat should include a core management team of 1-2 full time specialists (with expertise covering the most abundant/problematic taxonomic groups) plus some staff for IT support and secretariat work (e.g. ideally 2 full time positions).

The Steering committee or Council
The Steering committee or Council should work in close collaboration with the Secretariat, and should contribute to define a program of activities and ensure implementation of needed measures. To guarantee a successful implementation of this task, the Steering committee or Council should include high-level representatives of all competent authorities other than the chair of the NAC (e.g. State Institute for Nature Protection, Ministry of Agriculture, Fisheries and Rural Development, Ministry of Regional Development, Forestry and Water Management, Ministry of the Sea, Transport and Infrastructure, Hrvatske vode-Legal entity for water management, Hrvatske šume, public institutions for the management of protected natural areas, other local departments and agencies). For this purpose a registry of competent authorities and
relevant representatives should be created. In this context a key role should be given to officers and experts from the main institutional bodies working at either national level or local level on issues related to nature conservation, species and habitat management, implementation of environmental laws and regulations (e.g. national plant protection organisations, veterinary authorities, customs and quarantine services, CITES authorities). The main objective of the Steering committee or Council should be to review and identify needed revisions for the policy, legal and institutional framework, to select priority actions proposed by the scientific authority and to guarantee the sound implementation of the national strategy on IAS.

In addition, representative of key stakeholders and other concerned sectors (e.g. Association for Fighting Allergic Diseases) should be identified and involved in thematic groups as appropriate.

The Scientific Authority
The Scientific Authority should provide advice and assistance to the chair of the NAC and to the Steering committee or Council, and should be coordinated by the State Institute for Nature Protection, with the participation of working groups constituted by experts from the national authorities (representatives of relevant Ministries, scientific institutions working on IAS) with appropriate expertise on the issue (e.g. Institute for Plant Protection in Agriculture and Forestry, etc.), to be integrated with other scientific experts, including specialists in biodiversity monitoring, species biology and ecology, taxonomy, wildlife and plant management. It is crucial to involve universities (University of Zagreb, University of Dubrovnik, University of Josip Juraj Strossmayer in Osijek, etc.) and other scientific institutions (Croatian Natural History Museum, Institute of Oceanography and Fisheries, Center for Marine Research - Ruder Bošković Institute), relevant NGOs (Association for Biological Research – BIOM, Kapibara, BioShock, Eco Association ARGONAUTA, Green Action, Association for Nature, Environment and Sustainable Development SUNCE, Eko Center Caput Insulae Beli), free lances, etc. in order to make the most of the available expertise in all fields of IAS management and all related legal and policy issues. Such experts should be engaged as appropriate, e.g. could be invited to participate in working groups like the Risk Analysis Panel, or could be hired to provide advices on specific issues in relation to the many EDRR-related activities. For this purpose a registry of experts and/or groups of experts should be created.

In alternative, the Secretariat could invite key experts and concerned researchers to join together in a national network of scientist interested in biological invasions (examples of national networks of scientist interested in biological invasions are the Belgian Biodiversity Platform http://ias.biodiversity.be/ias/ and the Centre for Invasive Species based at the University of Copenhagen http://cis.danbif.dk/) and could develop specific forms of close collaborations, e.g. through specific agreements such as a Memorandum of Understanding (MoU). In any case, the involvement of both the experts in the works of the Scientific Authority and the stakeholders in the works of the Steering committee or Council should be facilitated by the Secretariat.

The NAC should be a simple, cost-effective, permanent, easy to manage, structure and would mostly act by maximising the use of existing technical instruments. The NAC should be more than a simple advisory body, because the key role of the competent authorities, in accordance with the existing legislation, should guarantee the enforcement of all required measures. For this purpose, the NAC should host the CIS to support decision making and management.

In order to guarantee the activities in the medium-long term, it is important to guarantee a legal basis and a clear political mandate increase the efficiency of the organisation of work, as well as the impact of the work in terms of either prevention or EDRR. The costs for the creation of the network of experts (employment of scientific staff and central coordination staff), organisation of meetings and maintenance/updating of
the CIS is estimated on the basis of other European experiences in 100,000 €/year. In order to overcome the risk of lack of continuation due to uncertainty in resources allocation, the NAC should be able to receive sufficient funding from national authorities and institutions, as well as private sponsors, or should be entitled to apply for funding from existing international instruments (i.e. EU, etc.). Continued financial support would ensure the sustainability of the results and the possibility to make best use of the available information systems and tools at least in the medium term.

**Objective:** To establish a well-structured National Advisory Committee (NAC) on IAS in order to identify a clear leadership and ensure appropriate coordination at the national level for IAS prevention and mitigation, involving all relevant sectors.

**Priority actions**
- Establish an internal coordination mechanism with the mandate to coordinate all existing structures, at the national and local levels, with competence over activities related to movement, holding, establishment and management of IAS;
- Identify the best options for implementation of the proposed strategy and the establishment of the NAC, taking into account a realistic level of commitment by national authorities, which also reflects a feasible amount of budget needed and of personnel involved. Such options should be chosen on the basis of the result of an evaluation of cost-benefits;
- Streamline decision processes, by developing a clear protocol for identifying and clarifying the distribution of roles and responsibilities in national and local institutions and departments;
- Provide a strong political mandate and ensure sufficient funding and adequate structures to guarantee long term activities;
- Develop an updated list of competent authorities, identifying contact officers for each;
- Support and coordinate existing surveillance and monitoring schemes, promote the development of new ones to ensure that records of alien species are regularly collected and reported, ensure that before being circulated, information collected by the surveillance and monitoring system is accurately checked and validated by the NAC and that all references are provided and verified to trace back the data;
- Provide the NAC with the task of ensuring the rapid screening of new records of alien species;
- Ensure that all activities undertaken will contribute to build scientific, technical, human and institutional capacities in order to strengthen the effectiveness of the strategy;
- Ensure sharing data with other countries from all relevant stakeholders (quarantine facilities, plant health, public health, maritime and port facilities);
- Engage the participation of a well-informed citizenship.

**8.2 Reporting and circulation of information**

In principle, the establishment of the NAC should guarantee an optimal circulation of information. To this aim, specific protocols for reporting and relevant mechanisms to circulate information should be developed and implemented. Once a clear protocol for identifying roles and responsibilities has been developed it should be possible to guarantee an optimal information flow to address the risk of new IAS entering the country.

However, this is possible only if the NAC is in a condition to collect the information on the occurrence of new IAS and/or the trends of IAS populations already established. Therefore the NAC should work in close collaboration with all the actors in charge of the surveillance and monitoring activities.
In practice, monitoring agencies, scientific institutions, experts and specialists, but also the common citizens should be targeted by a specific communication campaign aimed at raising awareness on the need to promptly report such information to the NAC. Otherwise the risk is that long time lags between finding a new species and publicising the invasion might arise due to general unawareness of the invasion problem as a whole rather than inadequate expertise in identifying the species correctly. This could be often the case when an invasion is first detected by a layman not skilled in the field of nature conservation. However, expert biologists may also be unaware of the potential threats from IAS and as such may be reluctant to circulate results of their findings until their work is published. As a consequence, control actions may be considerably delayed.

The publishing of a dedicated bulletin might help overcome this risk by creating a mechanism for regular reporting. Regular reporting will also be needed to inform policy makers and those delivering action programmes as well as to provide feedback to those providing the data. Indeed access to up-to-date information on the distribution of IAS is very important for underpinning policy decisions. An example to show the potentiality of such a tool to help increase prompt reporting of records of new IAS threatening biodiversity is the open access, peer-reviewed international online journal Aquatic Invasions. It provides the opportunity for timely publication of first records of aquatic invaders and other relevant information needed for risk assessments and early warning systems. The journal’s record in publishing information quickly is remarkable: about 50 % of records are reported within a year from their ‘discovery’. Unfortunately, Aquatic Invasions has few counterparts in the terrestrial realm. One such is the EPPO Reporting Service, which promotes existing information and publications in the field of plant health, and records new occurrences of species.

8.2.1 Integration with regional networks

IAS are recognised as a threat to biodiversity on a global scale and as such many decisions concerning this issue have been undertaken at the last Conferences of the Parties to the CBD, most of which were embodied in the European Strategy on IAS developed in 2003 under the Bern Convention. Both the CBD Decisions and the European Strategy on IAS are considered in this document. Besides, in the light of the future EU accession this proposed strategy takes into account also the last documents realised as a basis for the development of the EC strategy on IAS, which should be finalised by 2012.

Croatia has already participated through appropriate contacts and representatives, to some international fora focusing on the IAS issue, such as the Bern Convention’s Experts Group, and contributed to other relevant initiatives, such as the European Commission work for the EU Strategy, and the DAISIE project for a European database on IAS. Furthermore, links with other global networks, such as the IUCN/SSC Invasive Species Specialist Group (ISSG) were also undertaken. In this context another major initiative was the Zagreb workshop - organized in October 2010 by the European Environment Agency (EEA) in cooperation with IUCN/SSC Invasive Species Specialist Group (ISSG) - aimed at encouraging and supporting the establishment of an EDRR in West Balkan countries, to be coordinated and/or integrated to the European one which is being developed.

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6 The organizers invited three experts from each West Balkan country with different backgrounds, and particularly from the administrative sector (i.e. a representative from both the Ministry of the Environment or related institution, and the Ministry of Agriculture) and the research sector. Some leading experts from WWF MedPO who have already been involved in, or informed on, recent policy activities at EU or WB level had been also invited.
**Objective:** To guarantee an optimal information flow to address the risk of new IAS entering the country and to ensure the NAC keeps up to date with IAS developments domestically and engages with developments internationally and particularly - in the light of the future EU accession - with the EC strategy on IAS which is being developed.

**Priority actions**

- Ensure the participation of the NAC as focal point of any pan-European dedicated network of structures, and the interaction with such network so as to maintain contact with colleagues dealing with IAS policy issues in other European countries and encourage consistent representation of issues of concern to Croatia;

- Link with other national, regional or pan-European dedicated network of structures dealing with IAS (e.g. NOBANIS network), or interact with the EU technical structure (if and once it will be developed);

- Promote the development of a regional network for the EDRR system to share information on IAS, help regional or local fora that seek to disseminate best practices and promote evidence-based actions on IAS and engage with initiatives on IAS in the Balkan region;

- Establish a prompt, simple and transparent web-based information exchange mechanism (e.g. supported by the publishing of a dedicated bulletin) where all information on newly recorded species, for all taxa and all environments, as well as all information on the relevant associated risks and appropriate responses, is adequately stored and circulated;

- Link the new database/inventory of IAS in Croatia to relevant European and global IAS information networks to ensure rapid dissemination of information;

- Link with other relevant governmental initiatives within Croatia through policy representation;

- Engage with global/international initiatives on IAS.

**8.3 Legislation**

An adequate legal framework at the national scale is key to ensure a proper response to the IAS issue in terms of either prevention or management. In Croatia there are several legislative provisions dealing with IAS, but they are dispersed over several laws because have been developed in isolation to tackle specific problems. For example, as summarised in § 3, besides the Nature Protection Act and related ordinances, which includes some useful and very specific IAS related measures, provisions relating to IAS are incorporated into several sectoral regulations. The Hunting Act and the Islands Act regulate the introduction of alien game species, whereas the Marine Fisheries Act and Freshwater Fisheries Act regulate breeding and introduction of alien marine and freshwater fish species. The Animal Protection Act prohibits the abandonment of pets, thereby further preventing the introduction of alien species into nature. Finally an Ordinance on management and supervision of ballast water was adopted in 2007 pursuant to the Maritime Code to deal with the great threat posed by ballast water over the past twenty years as a main cause of introduction of IAS into aquatic ecosystems, particularly marine ecosystems.

Although many provisions are available for specific IAS related purposes they are not suitable to guarantee a comprehensive and co-ordinated approach to addressing IAS issues. For example, some gaps have been identified in the existing legislation in relation to an optimal implementation of this strategy. The most evident concerns the legal provisions set on the Nature Protection Act (Official Journal 70/05, 139/08) and
the related *Ordinance on the method of preparing and implementing risk assessment studies with respect to introduction, reintroduction and breeding of wild taxa* (Official Journal 35/08) in relation to the need of performing risk assessment, which are limited to the authorisation for introductions of alien species in the wild. Such provisions should be extended to the import of alien species for all other trade related purposes. Additionally, trade should be strictly regulated for all species subject to management measures such as control, eradication programmes. To this aim, the scope of the *Ordinance on transboundary movement and trade of protected wild species* (Official Journal 72/09 and 143/10) should be extended, so as to make the most out of this important tool.

Moreover several departments and agencies are responsible for some aspect of IAS prevention and management. For this reason there is still a need to create a better sense of cohesion across sectors and a need for further improvements through a strong political mandate supported by specific legal provisions.

To guarantee such improvements it could be sufficient to consider making specific amendment to the existing legislation. In fact, if the EU Strategy which is being developed by the EC will include proposals for specific legislation concerning IAS - which might then need to be transposed into domestic legislation - it is advisable to start working on a new comprehensive legislation only when such EU strategy will be formally adopted.

**Objective:** To ensure that the legislative framework in Croatia for addressing IAS issues is coherent, comprehensive, suitable for the purpose, effective and fully enforceable.

**Priority actions**

- Identify challenges, gaps, inconsistencies and weaknesses posed by the different aspects of the IAS issue in order to harmonise the available legal instruments and streamline the institutional co-ordination and cooperation between the bodies from different sectors with relevant responsibilities and possessing relevant powers;

- Make the most of the existing legislation tackle IAS by identifying the issues that need addressing most urgently and the legislative anomalies that most need remedy; and seek to rectify the most urgent legislative issues as suitable opportunities arise;

- Encourage and support any initiatives to improve legislation and controls relating to the threat posed by IAS;

- Revise the legal frameworks in order to remove any legal obstacles to control and eradication;

- Build on the research done to date on the current legislation and develop a package of legislative proposals designed to provide a more coherent and comprehensive framework;

- Provide a clear political and legal mandate for a dedicated NAC linking and coordinating IAS management across the country and with other regional and European networks and strategies, and promote the identification/allocation of the needed human and financial resources;

- Establish specific financial tools dedicated to responding to new incursions of IAS, or adapt existing financial programmes (for example by including a specific reference to management and research on IAS), based on evaluation processes that enable rapid allocation and disbursement of funds to address contingencies caused by IAS;

- Streamline decision processes and ensure that all structures (including local authorities and protected areas authorities) with competence for response to invasions (eradication, control) have a formal
responsibility to act promptly and the legal power to take all needed actions;

- Ensure the possibility of adopting emergency orders where urgent eradication action is needed;

- Establish obligations for relevant agencies and institutions to report to the NAC promptly and in detail on the progress in enforcing management measures in territories affected by new incursions;

- Promote the development and the application of voluntary codes and practices; at the trader/producer level these might include clearer legal standards (e.g. a “duty of care” to follow agreed industry codes), labelling schemes linked to observing relevant codes, or economic incentives to promote the adoption of best practices.
References


CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS
Document prepared by the Directorate of Culture and Cultural and Natural Heritage
T-PVS (2006) 9

National Workshop on IAS (Zagreb, 22-24 May 2006)

Conclusions and recommendations

The participants of the national workshop on IAS;
Recognising the importance of potential and actual impacts of IAS on biodiversity, economy and health;
Having discussed the main international, regional and national issues regarding invasive alien species;
Taking account of the European Strategy on Invasive Alien Species;
Having identified priorities to be addressed, taking particular account of the exceptional ecological qualities of Croatia's islands and coastal and marine areas;

Agree on the following ten conclusions and recommendations for action:

1. The Ministry of Culture, in cooperation with the State Institute for Nature Protection, should make a survey or questionnaire on IAS to be sent to all relevant institutions to collect information on activities, plans, expertise, and inter-agency cooperation.
2. The Ministry of Culture should nominate a technical and advisory working group including scientific institutions working on IAS, representatives of relevant Ministries, and main stakeholders, including NGOs. The working group shall be coordinated by the State Institute for Nature Protection and provide advice and assistance to government agencies. The main functions of this working group shall be:
   a. Provide guidance on IAS-related definitions and terminology;
   b. Prepare a national list of allochtonous species in all taxonomic groups, specifically identifying invasive species, and including information on invasion pathways and vectors where available;
   c. Provide recommendations for revising the policy, legal and institutional framework;
   d. Provide recommendations on priority actions;
   e. Propose elements for a national strategy on IAS;
   f. Set up a web-based portal on IAS, including experts and projects. It should be in both Croatian and English, and be linked to other IAS information exchange mechanisms.
3. The Ministry of Culture should nominate a Panel, composed of high-level representatives from all relevant government sectors. The main tasks of the Panel shall be:
   a. Review and identify needed revisions to the policy, legal and institutional framework;
   b. Select priority actions based on the list provided by the technical and advisory working group;
   c. Produce a national strategy on IAS.
5. Allocate funding from the State budget and other sources.
6. Inform and raise public awareness on IAS and promote the following measures:
   a. a national education and public awareness campaign on IAS,
   b. develop teaching materials adapted to different audiences,
   c. organise information events at the county or municipal level.
7. Develop risk assessment procedures based on existing methodologies, such as the EPPO Pest Risk Analysis Scheme.
8. Strengthen monitoring and rapid response systems:
   a. integrate IAS criteria into existing monitoring schemes;
   b. create a network of volunteers and NGOs and train them on how to collect and report information.
9. Implement pilot projects to demonstrate best practices for prevention, mitigation and eradication of IAS (eg. eradication of Solanum elaeagnifolium)
10. Exchange information, making best use of existing mechanisms like the EPPO Reporting Service, and co-operate with neighbouring countries on joint approaches to common problems.
Annex II – National legislation dealing with IAS

Nature Protection Act (Official Journal 70/05, 139/08)

Article 91
(1) It shall be forbidden to introduce alien wild taxa into nature on the territory of the Republic of Croatia and into ecological systems which they do not populate naturally.
(2) It shall be prohibited to introduce alien wild fish into natural and near-natural waters, as well as to transfer such species from fish farms into other wetland habitats.
(3) By way of derogation, introduction referred to in paragraph 1 of this Article shall be authorised if scientifically and technically founded and acceptable from the standpoint of nature protection and sustainable management.
(4) Ministry shall issue the decision referred to in paragraph 3 of this Article on the basis of a study on assessment of the risk resulting from introduction into nature, subject to prior approval of the central state administration body competent for agriculture, forestry, hunting, sea and freshwater fisheries.
(5) The costs of producing the study and of enforcing the procedure of assessing the risk resulting from introduction into nature shall be borne by a legal or natural person that filed the request for the issuing of the permit.
(6) Any breeding of alien wild taxa in a controlled environment which obviates invasion of the natural environment shall not be deemed as introduction.
(7) The method of performing risk assessment and developing the study on assessment of the risk resulting from introduction, reintroduction and breeding and the procedure for issuing authorisations as well as the method of procuring the public opinion shall be prescribed by an ordinance by the Minister.

Article 92
Should incidental introduction of alien taxa into the territory of the Republic of Croatia occur, or if there is a grounded suspicion that such introduction is to occur, the Minister shall by an order prescribe measures for proceeding with the purpose of destroying or preventing further propagation of introduced alien species.

Article 105
(1) A natural or legal person who intends to keep animals of indigenous or alien wild taxa protected under the Act in captivity with the purpose of displaying those to general public in zoological gardens, aquariums, terrariums or similar spaces, must secure authorisation from the Ministry. The authorisation shall be issued in the form of a decision.
(2) The authorisation referred to in paragraph 1 of this Article shall be granted insofar as the applicant presents evidence that all statutory requirements have been fulfilled, and that the animals will be displayed in an environment imitating natural conditions in a habitat that does not misrepresent the biological perception of the taxon.

Article 106
(1) A natural or legal person who intends to breed indigenous or alien wild taxa must obtain authorisation pursuant to this Act or a lex specialis.
(2) Should an ecological risk be ascertained in the procedure of granting authorisation, the Ministry may request the applicant to draft a preliminary risk assessment survey prior to granting the permit in order to control negative impacts on local ecological systems and indigenous species.
(3) The Ministry may prescribe permanent and irreplaceable marking for animals referred to in paragraph 1 of this Article.
(4) The owner of the animals referred to in paragraph 1 of this Article must ensure that the animals will not escape into nature and shall be responsible for any damage that the animals may cause.

Article 107
(1) A legal and natural person trading in protected indigenous or alien wild taxa, for which it is specially prescribed by the ordinance referred to in paragraph 4 of this Article, shall obtain a certificate from the Ministry. In the case of refusal of a request, a decision shall be issued.
(2) Trading may be conducted only with specimens bred in a registered establishment or with specimens holding a document on authorised origin, provided the specimen or consignment is properly labelled.
(3) In trading in protected animals, the seller or the owner shall:
- provide for suitable conditions for keeping the animals pursuant to this Act and other regulations,
- keep records on trading with animals and
- issue a certificate of origin of the animal to the new owner.
(4) The conditions for trade and issuance of a trade certificate, contents of a request and certificate, keeping trade records and control shall be prescribed by the Minister by the ordinance referred to in Article 101, paragraph 4 of this Act.
(5) The certificates and other acts issued under this Act for the purpose of trade in wild taxa may be used exclusively for specimens to whom they refer.

Article 157
(1) The Institute [National Institute for Nature Protection] shall within the framework of its activities perform technical tasks of nature protection relating to:
– collecting and processing collected data in connection with nature protection,
– producing relevant data bases concerning plant, fungi and animal species, habitat types, ecosystems and landscapes,
– collecting and producing the data base of invasive alien species,
– monitoring the state of conservation of biological and landscape diversity and proposing the measures for protection thereof,
– drawing up expertise reports for protection and conservation of the parts of nature or natural assets,
– drawing up expertise reports with the object of establishing nature protection requirements, administering protected areas and use of natural resources,
– performing statistical analyses, consolidating results and drawing up the reports on the state and protection of nature,
– technical tasks in connection with nature impact assessment,
– preparation and implementation of projects and programmes in the field of nature protection,
– participation in implementing international treaties concerning nature protection in force to which the Republic of Croatia is a party,
– organisation and implementation of educational and promotional activities in nature protection,
– exercising other tasks set out in this Act.

Article 194
(1) A fine in the amount of HRK 100,000.00 to 500,000.00 for a misdemeanour shall be imposed on a legal person who:
– carries out a project for which nature impact assessment has not been carried out, or which is contrary to the assessment (Article 36 paragraphs 1 and 3),
– proceeds contrary to the measures for protection, conservation, improvement and use of protected areas and other protected natural assets laid down in the Ordinance on internal order (Article 71),
– introduces an alien wild taxon in nature on the territory of the Republic of Croatia (Article 91),
– reintroduces into the natural environment on the territory of the Republic of Croatia vanished wild taxa without approval from the Ministry (Article 93).
(2) A fine in the amount of HRK 15,000.00 to 50,000.00 for the misdemeanour referred to in paragraph 1 of this Article shall be imposed on a natural and responsible person within a legal person.

Article 196
(1) A fine in the amount of HRK 15,000.00 to 25,000.00 for a misdemeanour shall be imposed on a legal person who:
– does not apply protective measures prescribed by this Act while a natural asset is under preventive protection (Article 26),
– does not allow inspection and examination of natural components (Article 31),
– does not notify the discovery of speleological site or part thereof within a prescribed period (Article 47, paragraph 3),
– pursues exploration without approval from the Ministry (Article 67),
– does not proceed in compliance with the governance plan for a protected area (Article 80, paragraph 4 and Article 81),
– captures, injures or kills wild animals without justified reason (Article 85, paragraph 2),
– eliminates wild taxa (plants or animals) from their habitats, reduces their populations or destroys them without justified reason (Article 85, paragraph 2),
– picks, collects, destroys, cuts or uproots wild growing strictly protected plants or fungi (Article 97, paragraph 1),
– holds strictly protected plants or fungi (Article 97, paragraph 2),
– carries out exploration on strictly protected taxa without authorisation from the Ministry (Article 100, paragraph 1),
– keeps in captivity in inappropriate conditions or without adequate care, or contrary to prescribed requirements, animals of wild taxa (Article 104, paragraph 1),
– displays in zoos, aquariums, terrariums or similar spaces animals of indigenous or alien wild taxa protected under this Act without authorisation from the Ministry (Article 105, paragraph 1),
– breeds indigenous or alien wild taxa without authorisation or approval from the Ministry (Article 106, paragraph 1 and 2),
– does not mark bred animals of wild taxa in the prescribed manner (Article 106, paragraph 3),
– does not provide precautions for a bred animal not to escape into natural environment and inflict damage (Article 196, paragraph 4),
– exercises any activity at a discovery site that may result in destruction or degradation of a discovery site of minerals, speleothems or fossils (Article 111, paragraph 3),
– explores a discovery site of minerals, speleothems or fossils without authorisation (Article 111, paragraph 5),
– organises visiting and touring of a protected natural asset contrary to prohibition or restrictions (Article 128),
– does not authorise access to a protected natural asset pursuant to prescribed requirements (Article 129, paragraph 1),
– cares for or protects a natural asset in a protected area without contract or contrary to terms of contract (Article 131 and 132),
– in taking minerals, speleothems or fossils makes use of machinery or other unauthorised devices (Article 149, paragraph 1),
– does not provide for participation of the public in the course of drafting legislation or acts on designating protected natural assets, physical plans, governance plans and plans of utilisation of protected areas and natural resources (Article 166).

(2) A fine in the amount of HRK 5,000.00 to 20,000.00 for a misdemeanour referred to in paragraph 1 of this Article shall be imposed on a natural and responsible person within a legal person.
GENERAL PROVISIONS

Article 1

(1) This Ordinance establishes the method of preparing and implementing risk assessment studies with respect to introduction of alien wild taxa into nature, reintroduction of vanished indigenous wild taxa into nature and the breeding of alien wild taxa (hereinafter: the Study).
(2) This Ordinance also establishes the procedure of granting authorisations for the exceptional introduction of alien wild taxa into nature on the territory of the Republic of Croatia, for reintroduction of vanished indigenous wild taxa, as well as granting authorisations for the breeding of indigenous or alien wild taxa in the Republic of Croatia (hereinafter: introduction, reintroduction and breeding) and the method of procuring the public opinion.
(3) This Ordinance does not apply to the introduction or breeding of genetically modified organisms.

Article 2

(1) A legal or natural person who intends to introduce alien wild taxa or reintroduce vanished indigenous wild taxa (hereinafter: the applicant) shall be obliged to first carry out a risk assessment of the intended project by producing the Study.
(2) By way of derogation, for the purpose of additional reintroduction of indigenous wild taxa for which the Ministry, based on a submitted application, determines that it will result in the increase of biological diversity and nature conservation, the Study shall not be required. The additional introduction or additional reintroduction means the addition of individuals of the same taxon to the already existing population in order to ensure its stability.
(3) The applicant who intends to breed alien wild taxa shall be obliged to carry out a risk assessment by producing the Study, if the procedure for granting authorisation ascertains the presence of an environmental risk.

THE STUDY AND RISK ASSESSMENT

Article 3

(1) The introduction and reintroduction means a single or multiple introductions planned in advance (which consist of partial introductions) during a maximum period of five years in the case of introduction and breeding, or a maximum of ten years in the case of reintroduction.
(2) The Study shall be produced for each introduction and reintroduction separately, as well as for breeding where necessary, whereby the risk is assessed for each taxonomy category, even lower than species. The assessment shall also be required for individual parts of plants, animals and fungi which are in any way capable of breeding by themselves.
(3) By way of derogation, the risk shall not be assessed for each breeding separately, provided that the same applicant is breeding alien wild taxa of the same taxonomy category under the same conditions and at the same location since the start of breeding for a period of five years.
(4) In the case of additional introduction or breeding after the period of five years since the first introduction, or additional reintroduction after the period of ten years since the first reintroduction, a new risk assessment shall be carried out on the basis of the initial risk assessment, with supplementary assessment of likely effects which have resulted from the initial introduction, reintroduction or breeding, and with supplements of new scientific and expert knowledge in biology, ecology, invasiveness and other characteristics of the taxon.

Article 4

(1) In preparing the Study, risk shall be assessed on the basis of generally known information which may also include the already existing assessments for the same taxonomy category in the same or similar ecological systems at other locations.
(2) Ecological systems shall be considered similar if they do not significantly differ in quality and quantity according to their biotic and abiotic features (physical-chemical properties, climatic conditions, present habitat types, flora, fauna, etc.).
(3) The risk assessment data used for drafting the Study shall be quantitatively and qualitatively assessed and expressed.
(4) The precautionary principle shall be applied to all risk assessments.
Article 5

(1) During the preparation and evaluation of the Study, the following shall especially be taken into account:
– the purpose of the introduction, reintroduction or breeding
– the characteristics and features of the taxon which is being introduced, reintroduced or bred
– the features of the ecosystem and habitat into which the taxon is being introduced or reintroduced, and in particular the conservation of its natural state
– the effect of introducing the taxon on the habitat itself and on the ecosystem and
– the effect of introducing the taxon on the existing taxa in the ecosystem, especially on the protected and strictly protected taxa, and other taxa significant for preserving the integrity of the habitat and the ecosystem.

(2) When preparing the Study and assessing the impacts on nature, it shall be necessary to primarily take into account the hazards resulting from:
– invasion of the area of indigenous taxa, fight over food, etc.
– displacement or endangerment of indigenous taxa, endangerment of their health and/or human health
– cross-breeding with domesticated taxa and, in that regard, the potential loss of genetic material and diversity
– loss or degradation of the habitat and
– other effects which are harmful to nature, human health and biological diversity.

(3) When preparing the Study and assessing the impacts on nature, it shall be necessary to continually take into account the real and possible, short-term and long-term as well as direct and indirect impacts on nature.

Article 6

Contents of the Risk Assessment Study

(1) Mandatory contents of the Study are:
– the purpose and aim of the introduction, reintroduction or breeding
– the description of the used risk assessment methodology
– the description of biological and ecological characteristics of the alien wild taxon or the vanished indigenous wild taxon
– the description of the ecological system into which the taxon is introduced, reintroduced or bred
– the description of the intended introduction, reintroduction or breeding
– the assessment of expected impacts on nature and changes in nature
– the proposal of measures for the prevention of likely harmful impacts on habitats and ecosystems and the taxa which inhabit them
– special notices, instructions and recommendations
– the final risk assessment and
– the summary of the Study prepared for the general public in order to procure the public opinion.

(2) Mandatory annexes to the Study are:
– a map displaying the precise location, the individual spatial and geographical features and any specificities of the actual area of introduction, reintroduction or breeding (natural values, ecosystem, habitat and ecologically important areas) as well as the wider impact area
– a map of the potential range of the taxon which is introduced, reintroduced or bred
– separate annexes which present all results of measurements, graphs, tables and any other documentation which, due to its size or for other reasons, has not been included in the textual part of the Study; and
– sources of the data used.

(3) The maps referred to in paragraph 2 of this Article shall be drafted in the proportion determined by the Ministry upon submission of the application.

Article 7

Description of the used risk assessment methodology

The methodology used for risk assessment shall be described in detail, listing the reasons for selecting that methodology and providing an explanation of its advantages, suitability, applicability on the relevant case and the experience of using it in other cases.

Article 8
Description of biological and ecological characteristics of the taxon

The description of the taxon which is introduced, reintroduced or bred must contain the following:
– taxonomic status of the taxon, including the scientific and Croatian name of the species, genus and, where appropriate, the lower taxon (subspecies, variety, form, strain, breed, etc.) and, if there is no Croatian name, only the scientific name is listed
– the ecology of the taxon and the niche which it holds within the ecological system
– when introduction or breeding is concerned, the information on whether the taxon is on the European or the national black and/or grey list of invasive alien taxa
– the area of natural range, specificities of the subspecies or population
– when reintroduction is concerned, the historical data on the range and the reasons for the vanishing of the taxon
– breeding and propagation method of the taxon
– genotype and phenotype characteristics of the taxon, with emphasis on the characteristics which could affect indigenous taxa and habitats, particularly upon introduction, or the dynamics of the ecological system as a whole
– description of inter-related impacts between the taxon which is introduced and the already present taxa, particularly of those taxa on which the taxon which is introduced may have a negative impact, and
– description of impacts and effects of introduction, reintroduction or breeding of the same taxon in other countries in a similar ecological system.

Article 9

Description of the ecological system

(1) The description of the ecological system into which the taxon is introduced, reintroduced or the area in which it is bred shall be drafted based on public information obtained from the databases of state and local authorities or other legal persons with public authorities, and on the basis of publicly available, reviewed scientific or expert studies. In the case that there is no public information, it may be prepared by the author of the Study.
(2) The description of the ecological system must contain information on:
– the precise location of introduction, reintroduction or breeding
– climatic, geographical and ecological features and possible specificities
– biological diversity with the list of present indigenous plant, animal and fungi taxa and the habitats where impact of the taxa which are introduced, reintroduced or bred is expected
– the level of conservation of the ecosystem into which the taxon is introduced, reintroduced or the area in which it is bred
– specificities of the ecosystem – natural stability, vulnerability, as well as the capacity for self-regulation and regeneration
– the presence and proximity of protected natural values, ecological network and habitats of rare and endangered taxa
– the already present alien taxa, including data on their population size and impact on nature
– spatial features with the description of the terrain – relief, soil fertility, stability, bearing capacity, hydrologic properties, and
– infrastructural equipment and traffic in that area.

Article 10

Description of the intended introduction, reintroduction or breeding

The description of the intended introduction, reintroduction or breeding must contain information on:
– the number or volume of individuals of the wild taxon which will be introduced, reintroduced or bred, their developmental stages and forms, and for animal species also their gender and the age of individuals
– the origin of individuals which are introduced, reintroduced or bred
– the method of introduction, reintroduction or breeding, including the annual timetable
– the planned size of the populating or breeding area
– the features of the ecological system which may be affected by introduction, reintroduction or breeding
– the size of the wider impact area of introduction, reintroduction or breeding
– the results and information on the previous introductions or breeding of taxa in a similar or different ecosystem, if such information exist, and
– the constructional and spatial, technical and technological characteristics of the project for the purpose of mitigating or preventing adverse effects.

Article 11
Assessment of expected impacts on nature and changes in nature

The assessment of expected impacts on nature and changes in nature must list and assess all effects, including those which could be considered unimportant or negligible, and in particular the following:
– likelihood of an alien taxon becoming domesticated or invasive in the habitat or the wider ecosystem
– likelihood of an alien taxon in any way endangering the populations of the present indigenous wild taxa in the ecological niche which it will likely occupy
– likelihood of an alien taxon in any way endangering the populations of the present indigenous wild taxa which are potential food for the existing indigenous or alien taxa
– likelihood of the habitats within the introduction area being endangered in any way
– likelihood of an alien taxon endangering the existing populations of indigenous wild taxa which are vital for preserving the balance in the ecosystem
– likelihood of protected indigenous taxa, endemics and endangered and rare habitat types becoming additionally endangered in any way
– possibilities and the need of establishing protective zones in order to prevent any potential spreading of, or negative impacts from, alien taxa
– possibilities and the number of adverse impacts and irreversible effects with a financial assessment of potential damages.

Article 12

Proposal of measures for the prevention of potential harmful impacts

The proposal of measures for the prevention of potential harmful impacts on habitats and ecological systems and the taxa which inhabit them shall contain the following:
– types, number and characteristics of alien taxa and the planned management and measures for their use, storage, transport and removal
– potential and planned measures which would decrease the possibility of negative impacts on indigenous taxa, habitats and ecosystems
– description of damages to nature and the likelihood of damages which could occur, the size of the impact area, the effects on the ecological system and human health as well as potential economic losses, and
– required intervention measures for the purpose of mitigating or preventing likely negative effects.

Article 13

Special notices, instructions and recommendations

Special notices, instructions and recommendations of measures shall be incorporated into the Study if it is established in the risk assessment that the introduction, reintroduction or breeding represents a significant risk to nature. In doing so, it shall be required to list the area where such measures are necessary and to evaluate their suitability.

Article 14

Final risk assessment

(1) In the final risk assessment the following conclusions may be reached:
– that the introduction, reintroduction or breeding will not endanger the natural balance and biological diversity, or
– that the introduction, reintroduction or breeding will endanger or alter the natural balance, and endanger and damage biological diversity, or
– that the introduction, reintroduction or breeding may alter the natural balance or biological diversity, but the risk to nature is acceptable, expected and surmountable. In this case, the conditions and the scope of introduction, the method of risk control and the protection measures, the method for recovery of potential damages, monitoring and supervision of the taxa and reporting on the results and effects of introduction and breeding shall be determined.
(2) If the author of the Study establishes that the significance of introduction, reintroduction or breeding relating to the expected impacts on nature and protection measures could not be completely determined, this shall be stated in the final part of the Study and supported with an explanation.
Article 15

(1) The Study shall contain information on its author and on the persons who participated in the preparation of the Study or its parts.
(2) The Study and all of its constituent parts shall be certified by the author – natural person or the responsible person of the legal person if the author of the Study is a legal person.

GRANTING OF AUTHORISATIONS AND PROCUREMENT OF PUBLIC OPINION

Article 16

Submission of the application

(1) A legal or natural person planning to introduce, reintroduce or breed shall submit to the Ministry an application for the granting of authorisation.
(2) An application shall contain the following information:
   – the name and address of the legal person, or name, surname and residence address of the natural person who is the applicant
   – the scientific name of the taxon and Croatian name, if applicable
   – the purpose of introduction, reintroduction or breeding
   – the number or volume of individuals of the wild taxon which will be introduced, reintroduced or bred, their developmental stages and forms, and for animal species also their gender and the age of individuals
   – the origin of individuals
   – the method of introduction, reintroduction or breeding, including the annual timetable
   – the description of the breeding location with special emphasis on the limitations which prevent the entry and/or exit of individuals of the same or other species and/or the escape of individuals which are bred, their offspring, breeding cells or any other breeding forms, into the immediate environment, and
   – the planned size of the area with the precise location of introduction, reintroduction or breeding.
(3) An application shall be supplemented with the Study prepared in accordance with the provisions of this Ordinance. The costs of producing the Study shall be defrayed by the applicant.

Article 17

(1) If the submitted application is found to be incomplete, the Ministry shall provide the applicant with the deadline for supplementing the application. The deadline shall be set depending on the type of supplement required. If the applicant does not supplement the application within the given deadline, the Ministry shall reject it by virtue of a conclusion, pursuant to the provisions of the Act on General Administrative Procedure.
(2) By way of derogation, the Study may be subsequently annexed to the application for breeding in the procedure for granting the authorisation, provided that the Ministry during that procedure ascertains the presence of an environmental risk in accordance with Article 106, paragraph 2 of the Act. In that case, the Ministry shall suspend the procedure and set an appropriate deadline for preparing the Study. If the applicant does not deliver the Study within the given deadline, the Ministry shall refuse the application as incomplete.

Article 18

Expert opinion

(1) After receiving the application and possible supplements, the Ministry shall without delay submit the application to the State Institute for Nature Protection (hereinafter: the Institute) for the purpose of drafting an expert opinion on the Study.
(2) The Institute shall draft the requested opinion within a period of 30 days from the day of receiving the application.

Article 19

Granting of authorisations
(1) If the Ministry, based on the expert opinion of the Institute, determines that the Study has shortcomings which can be eliminated, it shall request the applicant to eliminate the identified shortcomings within the appropriate deadline.

(2) If the applicant does not eliminate the identified shortcomings in the Study within the given deadline, his/her application shall be processed on the basis of the submitted documentation.

(3) The supplement to the Study and any other information which is subsequently submitted by the applicant shall be forwarded by the Ministry to the Institute for obtaining an additional opinion.

(4) The Ministry, based on the expert opinion of the Institute on the Study and its possible supplements and after the consideration of any comments received in the course of procuring the public opinion which is carried out pursuant to Article 20 of this Ordinance, shall determine the acceptability of the requested introduction, reintroduction or breeding, and shall grant a decision on authorisation or refusal of authorisation to introduce, reintroduce or breed an alien or indigenous wild taxon. The mandatory content of the decision on authorisation shall be the nature protection requirements.

(5) The decision on authorising the introduction or reintroduction shall be granted subject to the prior approval of the minister competent for agriculture, forestry, freshwater and sea fisheries and hunting.

Article 20

Public inspection

(1) In the procedure of granting authorisations for introduction and reintroduction, the Ministry shall obtain the public opinion which is carried out by public inspection of the application and the Study summary published on the official website of the Ministry.

(2) In the course of the procedure for obtaining the public opinion, the Ministry shall collect written comments and proposals which may also be submitted by electronic mail.

(3) The procedure for obtaining the public opinion shall last 30 days from the day of publishing the application and the Study summary on the official website of the Ministry.

Article 21

Register of granted authorisations

(1) The Ministry shall keep the register of granted authorisations for introduction, reintroduction or breeding.

(2) The Register of granted authorisations shall contain the following information:

– class, register number and date of issuing the decision on granting the authorisation
– name of the taxon, including the precise taxonomic status
– number or volume of individuals which are introduced or bred
– precise location of the introduction, reintroduction or breeding
– purpose of the introduction, reintroduction or breeding
– the name and address of the legal person, or name, surname and residence address of the natural person who is the applicant
– the name and address of the author of the Study, and
– the period for which the authorisation is granted.

(3) The Register shall be kept permanently.

(4) The public shall have the right of access to information from the Register.
Ordinance on transboundary movement and trade of protected wild species (Official Journal 72/09 and 143/10)

Article 11
(1) Live specimens of alien species that are not listed in Annexes I to X may be introduced into the Republic of Croatia on the basis of an import permit issued by the Ministry, upon completion of the procedure at the border customs office at the point of introduction.
(2) The permit shall be issued where the following conditions have been met:
1) the applicant has enclosed a written statement from which the purpose of the import is evident,
2) the applicant holds a permit granting the introduction of alien wild taxa into the wild in the Republic of Croatia or a permit for breeding under controlled conditions, or the competent scientific authority has issued an expert opinion stating that:
   - the introduction into the Republic of Croatia would not have a harmful effect on the conservation status of the species or on the extent of the territory occupied by the relevant population of the species in the country of origin, taking account of the current or anticipated level of trade; this opinion shall be valid for all subsequent imports as long as the abovementioned circumstances have not changed significantly;
   - there is no threat to indigenous species, in case of incidental or intentional escape of the specimens to the natural environment of the Republic of Croatia,
   - the intended accommodation for live specimens at the place of destination is adequately equipped to keep them and care for them properly,
3) the applicant has submitted satisfactory evidence to the Ministry that each live specimen will be shipped in such a manner so as to minimize the risk of injury, damage to health or cruel treatment.

Article 53
(1) The customs service shall check the import, export, re-export and transit of the species listed in Annexes I to X to this Ordinance and of live animals of alien species, and it shall in particular:
   - check whether the specimens have, when crossing the border, valid permits, certificates or other documents which are issued by the Ministry in accordance with this Ordinance and the Nature Protection Act or the prescribed documentation of some other country issued in accordance with the Convention,
   - check, with the assistance of the border veterinary and phytosanitary inspection, whether the specimens and shipments correspond to the data indicated in the accompanying documentation,
   - check, with the assistance of the border veterinary inspection, the transport conditions indicated in the accompanying documentation,
   - perform also other activities in line with this Ordinance.
(2) The customs service shall inform the Ministry on the identification or reporting of specimens potentially subject to this Ordinance, or on the violation of the provisions of this Ordinance, the Nature Protection Act and the customs regulations that refer to live specimens of alien species and specimens of the species listed in Annexes I to X to this Ordinance.
Hunting Act (Official Journal 140/05, 75/09)

III Concession

Article 26
(1) Ministry can, before the end of the concession period, cancel the concession agreement to the concessioner, without the cancelling period, in the following circumstances:
2) If the concessioner introduces new wildlife species into the hunting ground, without the approval of the minister competent for nature protection.
7) If concessioner is managing the area under concession opponent to the Nature Protection Act.

Act on amendments to the Hunting Act (Official Gazette No. 75/09)

Article 13
Amendment to the Article 26
(1) Ministry can, before the end of the concession period, unilaterally cancel the concession agreement to the concessioner, without the cancelling period, in the following circumstances:
2) If the concessioner introduces new wildlife species into the hunting ground, without the approval of the minister competent for nature protection.
7) If concessioner is managing the area under concession opponent to the Nature Protection Act.
(One point is added by the amendment, but it doesn’t concern IAS or AS)

Article 27
Amendment to the Article 62, paragraph 1, after point 4, point 5 is added:
Ministry is authorized:
5) To permit hunt, with administrative order about measures and conditions for the use of hunting arms, and terms and method of hunt, on a non game species, by the meaning of this act, and who's eradication is regulated with administrative order, given by other competent authority.
### Act on amendments to the Hunting Act (Official Gazette No. 33/06)

Article 8
Amendment to the Article 13

1. It is prohibited to import and breed game which is not native to the island.
2. While managing hunting and breeding sites, Ministry of Agriculture, Forestry and Water Management (literal translation from the Act, now there is two ministries, one concerning agriculture and one forests, Ministry of Agriculture, Fisheries and Rural Development and Ministry of Regional Development, Forestry and Water Management) is obligated to secure protection of agricultural activities, and measures for mitigating and eradicating game who's import and growth is prohibited on the island.
6. Protection of Wildlife
Article 3

In this act following terms have the following meanings:
22) Alien animal species: animal species that don’t belong naturally on the territory of the Republic of Croatia.

Article 46

Forbidden acts, which disable wildlife in its normal functions (feeding, watering, breeding) or ones that expose wildlife, population or an organism, to torment, are the following:
3. Import of alien species into the habitat.

7. Protection of Pets

Article 48
(2) If a person acquires an alien species, or an animal protected under nature protection act, as a pet, special requirements should be fulfilled.
II Measures for management of marine biodiversity

Introduction of fish

Article 19
(2) It is prohibited to introduce non-native fish or other marine organisms into the fishing.

IV Management measures for farming of fish or other marine organisms

Farming of non-native organisms

Article 77
Farming of non-native fish and other marine organisms is permitted only when approved by the competent authority for nature protection and preceded by the opinion of authorized scientific institutions for marine research.

Penalty regulations

Article 108
(1) Any legal subject will be sanctioned with the money penalty between 20,000,00 and 300,000,00 HRK if the subject:
10) Introduces non-native fish or other marine organisms into the fishery (Article 19, Paragraph 2)
39) If non-native fish or other marine organisms are farmed without the approval of the ministry (Article 77).
I General provisions

Article 2
In this act following terms have the following meanings:
36) Non-native species of fish (allochthonous) is the one which is not native to the fishery.

V Fish protection

Article 55
(1) Farming of non-native fish is allowed only with the approval of the minister and when previously approved by classified authority for nature protection, based on primarily conducted environmental impact assessment study, as defined in environmental and spatial planning regulations.
(3) Import and trade of living specimen of non-native fish and/or fertilized roe for farming, is approved only when previously authorized by the minister in compliance with the minister responsible for nature protection.

Article 57
(1) It is prohibited:
4) Fishing while using non-native fish species (dead or living) as s bait.

X Penalty regulations

Article 80
(1) Any legal subject will be sanctioned with the money penalty between 20,000,00 and 120,000,00 HRK if the subject:
5) Without the approval of the minister, farm non-native species of fish (Article 55, paragraph 1).
7) Introduce, without the approval of the ministry, live specimen and/or fertilized roe of non-native fish for farming (Article 55, paragraph 3).

Article 84
(1) Any legal subject will be sanctioned with the money penalty between 2,000,00 and 10,000,00 HRK if the subject:
12) Is fishing from the fishery while using non-native species of fish (dead or living) as bait (Article 57, paragraph 1, point 4).
Forest management

Article 8
Croatian Forests Ltd. ("Hrvatske šume d.o.o.") and forest owners are obligated to manage the forests in a way to enhance and improve the status of landscape and biological diversity and care for forest ecosystem in a way to:
- maintain natural composition of forest and use native species while reforesting
- proscribe usage of those species approved on the basis of the expert study and recommends usage of native species in reforesting to avoid all negative impacts on nature.

(The amendments to the Forestry Act, 82/06, 129/08 or 80/10, do not refer to Article 8)
GENERAL PROVISIONS

Article 1

With the purpose to improve environmental protection, this Ordinance regulates the principles and procedures of ballast water management and inspection on floating facilities and ships while staying and navigating in internal sea waters, territorial sea and Protected Ecological and Fishing Zone of the Republic of Croatia.

This Ordinance applies to all the merchant ships, regardless of their nationality, as well as to other vessels and floating facilities built so as to be loaded with ballast water, calling at ports in the Republic of Croatia or navigating the internal waters, territorial sea or Protected Ecological and Fishing Zone of the Republic of Croatia.

This Ordinance shall not apply to merchant ships and other floating facilities and ships which navigate or stay exclusively in the internal sea waters or territorial sea of the Republic of Croatia.

All or some provisions of this Ordinance may by virtue of the order of the minister responsible for maritime affairs, apply to all or certain ships referred to in paragraph 3 of this Article should imminent hazard of transferring the harmful organisms by way of ballast water arise.

Article 2

The terms used in this Ordinance shall have the following meanings:

- "ballast water" is the water with substances therein, loaded on board the ship to control stability, trim, list, draft or stresses of the ship or floating facility;
- "ballast water capacity of a ship" is the total volumetric capacity of all the tanks, spaces or compartments on board a ship, used for transport, loading or discharge of water ballast, including also the multipurpose tanks, spaces or compartments built so as to transport ballast water;
- "ballast system" is the system of tanks, spaces and compartments aboard the ship used for transport, loading or discharge of ballast water, including also the multipurpose tanks, spaces or compartments built so as to transport ballast water together with ballast piping and associated pumps;
- "ballast tank" is any tank or hold aboard the ship used for transport of water ballast, regardless of whether the tank and hold have been constructed for such a purpose;
- "MARPOL 73/78 Convention" is the International Convention for the Prevention of Pollution from Ships 73/78, as amended;
- "oil" is oil as defined in Article 5, paragraph 1, point 44 of the Maritime Code;
- "IMO Guidelines" are the Guidelines for the Control and Management of Ship's Ballast Water, pursuant to IMO Resolution A.868 (20) and Resolution MEPC.127(53);
- "noxious liquid substances" are the substances as specified in Annex II to MARPOL 73/78 Convention - Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk;
- "Inspector" is the marine safety inspector or other authorized employee from the Ministry or Harbour Master Office, pursuant to Article 165 of the Maritime Code;
- "Ministry" is the ministry responsible for maritime affairs;

Article 3

Ballast water management involves individual or multiple operations of:

- ballast water exchange,
- ballast water treatment,
- ballast water discharge into reception facilities, or
- retaining ballast water on board the ship.
Master of the ship must, to the extent which the requirements concerning navigational safety and protection of the marine environment so allow, avoid or restrain loading of ballast water in the zones:
– for which the existence of harmful micro-organisms is commonplace,
– where industrial discharges are present
– where submarine dredging takes place,
– with exceptionally high tide variations,
– with high water turbidity resulting from the running of ship propulsion machinery (shallow ports, estuaries, berths)
– spawning of the fish, and
– of encounter of marine currents.

Article 5

A ship which loaded ballast water must prior to entering internal sea waters, territorial sea or Protected Ecological Zone of the Republic of Croatia implement one of the measures of ballast water management referred to in Article 3 of this Ordinance.
If a ship applies ballast water exchange as a measure of ballast water management, ballast water exchange must involve at least 95% of the ballast water volume.
A ship exchanging ballast water using the method of discharging/pumping shall be deemed to have complied with the standard referred to in paragraph 2 of this Article if discharge/pumping has been carried out at least three times per volumetric capacity of each ballast tank.
Ballast water exchange is authorized at the distance of at least 200 Nm from the nearest land and at sea depth of at least 200 metres.
When the ship has no possibility to exchange ballast water pursuant to paragraph 4 of this Article, ballast water exchange shall be performed pursuant to IMO Guidelines as far as possible from the nearest land, and in any case at a distance less than 50 Nm from the nearest land and at sea depth of at least 200 metres.
A ship is not obliged to deviate from the planned route or run behind the voyage schedule in order to perform the operation of exchange of ballast water.

Article 6

Master of the ship is not bound to implement the ballast water management measures with the view of minimising the introduction of harmful organisms and preventing their discharge:
– if the operation of loading or discharge of ballast water must be performed in order to preserve safety of the ship and persons on board and
– if loading or discharge of ballast water must be carried out in order to prevent or mitigate pollution of the sea by other hazardous or harmful substances.

REPORTING AND RECORDING THE BALLAST WATER

Article 7

Each ship designed to carry ballast water, calling at ports in the Republic of Croatia, must have on board and implement the Ballast Water Management Plan
The Plan referred to in paragraph 1 of this Article must be approved by competent authority of the state whose flag the ship flies taking into account applicable Guidelines developed by the International Maritime Organization – IMO.

Article 8

Any tanker of 150 GT or above, as well as any other ship of 300 GT or above, arriving from abroad, must report the quantities and origin of ballast water on board the ship to competent Harbor Master Office.
The report referred to in paragraph 1 of this Article shall be submitted on the Ballast Water Reporting Form.
The form of report referred to in paragraph 2 of this Article is presented in Annex 1 which constitutes an integral part of this Ordinance.
Report referred to in paragraph 1 of this Article must be delivered by master of the ship within 48 hours prior to calling of the ship at port, or immediately upon departure from the last foreign port if time of navigation prior to calling at Croatian port is less than 48 hours.
SAMPLING AND TESTING OF BALLAST WATER

Article 9

In order to examine the composition of ballast water, inspector may request the approved institution or the approved laboratory to perform sampling and testing of ballast water intended for discharge into the sea. Testing of ballast water consists of testing on the presence of micro-organisms in ballast water and of testing the salinity and nutrient salts in order to establish the origin of ballast water. Sampling and testing of ballast water must be carried out pursuant to applicable IMO Guidelines. The ministry responsible for the tasks of environmental protection will, upon approval of the ministry responsible for health, authorize the institutions or laboratories for performing the tasks of sampling and testing ballast water, while the data on such institutions will be published regularly. Approved institution or laboratory must have access to appropriate technical devices and expertise necessary for carrying out the tasks prescribed in this Article.

BALLAST WATER DISCHARGE

Article 10

Contaminated ballast water from ships which are allowed to load ballast water into fuel tanks may only be discharged into the sea through the oil filtering equipment fitted with alarm device and automatic arrest in case the oil content exceeds 15 ppm. Contaminated water ballast from ships which are allowed to load water ballast into fuel tanks may be discharged without the oil filtering equipment into the land-based reception facilities only. It is prohibited to discharge contaminated ballast water from ballast tanks, cargo tanks and tanks for oily mixtures of oil tankers into the sea. Contaminated water ballast from ballast tanks, cargo tanks and tanks for oily mixtures of oil tankers may only be discharged into land-based reception facilities. Discharge of clean or separated ballast into the sea from ships transporting oil in the bulk is permissible when it contains no organisms referred to in Articles 8 and 9 of this Ordinance.

Article 11

It is prohibited to discharge ballast water into the sea from ships transporting noxious liquid substances in bulk if ballast water contains noxious liquid substances, save when such discharge complies with requirements contained in Annex II to MARPOL 73/78 Convention - Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk. Discharge of clean or separated ballast into the sea from vessels transporting noxious liquid substances in bulk is permissible unless it contains organisms referred to in Article 12 and 13 of this Ordinance.

Article 12

Irrespective of ballast water management measures applied, it is forbidden to discharge in internal waters, territorial sea and the Protected Ecological and Fishing Zone of the Republic of Croatia the ballast water from ships and floating facilities when it contains micro-organisms mentioned in Annex 1, which constitutes an integral part of this Ordinance.

Article 13

Irrespective of the ballast water management measures applied, it is forbidden to discharge in internal waters, territorial sea and the Protected Ecological and Fishing Zone of the Republic of Croatia the ballast water from ships and floating facilities when it contains the following:
- cysts (resting phases) of any organisms
- *Vibrio cholerae*
- *Escherichia coli*
- Enterococci.

Article 14
It is forbidden to dump into the sea the ballast water sediment which remains settled in ballast tanks. The sediment referred to under paragraph 1 of this Article must be collected by mechanical means only, and dumped thereupon in the specially designated land-based reception facilities.

Article 15

An inspector may ban the discharge of ballast water pending completion of ballast water testing pursuant to Article 5 of this Ordinance. With the scope of avoiding unnecessary arresting of the ship and hampering the cargo loading and/or unloading operations, the ship master must forward in time the data concerning the quantity and origin of ballast water to be discharged from the ship and provide assistance to approved institution or competent body at sampling. The inspector must take all the measures required in order that the sampling would not result in unnecessary delays of the ship. The samples of water ballast may, on the basis of inspector's order, be taken from the tanks also prior to calling of the ship at port or in course of navigation. The results of tests on water ballast loaded in a foreign port and conducted by the body or organization authorized for sampling and testing the water ballast in such a port may be recognized in the Republic of Croatia.

Article 16

Where it is established that ballast water contains micro-organisms or substances which it must not contain pursuant to provisions of this Ordinance, the inspector will prohibit the discharge of ballast water, while the expenses of sampling and testing ballast water shall be borne by the ship-owner. Where it is established that ballast water does not contain micro-organisms or substances on account of which the discharge of ballast water is prohibited pursuant to this Ordinance, the costs of sampling and testing shall be borne by the Ministry.

Article 17

Port Authorities must within the time period of no more than a year conduct basic studies in order to analyse the state of the sea in port area.

Article 18

The Ministry responsible for the tasks of environmental protection shall within 90 days from the date of coming into force of this Ordinance publish the first list of approved institutions or laboratories referred to in Article 9 of this Ordinance.

Article 19

This Ordinance shall enter into force on the 8th day following that of its publication in the "Official Gazette", and shall apply as of 1st September 2007.

ANNEX 2

LIST OF MICROORGANISMS WHICH MUST NOT BE CONTAINED IN BALLAST WATER DISCHARGED IN INTERNAL WATERS, TERRITORIAL SEA AND PROTECTED ECOLOGICAL AND FISHING ZONE OF THE REPUBLIC OF CROATIA

Cyanobacteria

Hornhamnion enteromorphaides Grunow.
Lyngbia mayascula Harvey
Anabaena spp.
Apahniizomenon spp.
Micrysis spp.
Nostoc spp.
Oscillatoria spp.
Syneochoccus spp.
Trichodesmium spp.

Raphidophyta
Olisthodiscus luteus N. Karter
Heterosigma akashiwo Hada
Chatonella spp.

Haptophyta
Chrysochromulina spp.
Phaeocystis spp.
Prymnesium spp.

Dinoflagellata
Amphidinium carterae Hulburt
Alexandrium minutum Halim
Alexandrium tamarense (Lebour) Balech
Cocchidinium polykrikoides Margalef
Coolia monotis Meunier
Dinophysis acuta Ehrenberg
Dinophysis caudata Saville-Kent
Dinophysis fortii Pavillard
Dinophysis mira (Schurt) Abe
Dinophysis norvegica Claparède et Lachmann
Dinophysis rotundata Claparède et Lachmann
Dinophysis sacculus Stein
Dinophysis tripos Gourret
Gonyaulax polygramma Stein
Gymnodinium catenatum Graham
Karenia brevis (Davis) Hansen et Moestrup
Karenia mikimotoi (Miyake et Kominami ex Oda) G. Hansen and Moestrup
Lingulodinium polyedrum (Stein) Dodge
Pfiesteria piscicida Steidinger et Burkholder
Procentrum lima (Ehrenberg) Dodge

Ciliata
Mesodinium rubrum (Lohmann) Hamburger & Buddenbrock
## ANNEX III - Activities concerning IAS conducted in the period 2009-2011

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Implementing Organisation</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effects of suppression of the alien invasive species <em>Amorpha fruticosa</em> L. by</td>
<td>Nature Park Lonjsko Polje</td>
<td>2009</td>
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<tr>
<td>traditional land use methods on former agricultural land in the Nature Park</td>
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<tr>
<td>Lonjsko Polje</td>
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<tr>
<td>Monitoring the removal of invasive species on the pasture after mechanical pasture</td>
<td>Nature Park Lonjsko Polje</td>
<td>2010</td>
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<tr>
<td>renovation</td>
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<tr>
<td>Distribution and population characteristics of the invasive signal crayfish (</td>
<td>Public institution for management of protected natural values</td>
<td>2010</td>
</tr>
<tr>
<td><em>Pacifastacus leniusculus</em>) and autochthonous noble crayfish (<em>Astacus astacus</em>) in</td>
<td>of Medimurje County</td>
<td></td>
</tr>
<tr>
<td>the Medimurje area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research of the occurrence and ecology of the autochthonous fish species of the</td>
<td>Nature Park Vransko jezero</td>
<td>2009</td>
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<tr>
<td>Vransko jezero – Analysis of the impact of introduced Danube species and marine</td>
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<tr>
<td>species on autochthonous species – eel (<em>Anguilla anguilla</em>) and freshwater blenny</td>
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<tr>
<td>(<em>Salaria fluviatilis</em>)</td>
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<tr>
<td>Inventarisation and mapping of the invasive plant species</td>
<td>Nature Park Kopački rit</td>
<td>2010-2011</td>
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<tr>
<td>Monitoring and control of the invasive algae of the genus <em>Caulerpa</em></td>
<td>Nature Park Lastovo</td>
<td>2010</td>
</tr>
<tr>
<td>Action plan for control of the invasive crab species <em>Orconectes limosus</em> in the</td>
<td>State Institute for Nature Protection &amp; Association for</td>
<td>2009</td>
</tr>
<tr>
<td>wider area of Osijek</td>
<td>Ecological Research - BioShock</td>
<td></td>
</tr>
<tr>
<td>Research of the invasive alien species, signal crayfish (<em>Pacifastacus leniusculus</em>)</td>
<td>State Institute for Nature Protection &amp; Association Kapibara</td>
<td>2010</td>
</tr>
<tr>
<td>in the river Mura and its tributaries as a step towards management planning</td>
<td></td>
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<tr>
<td>Research of the invasive species <em>Solanum elaeagnifolium</em> Cav. in Croatia with the</td>
<td>State Institute for Nature Protection &amp; Ph.D. Milenko</td>
<td>2009</td>
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<tr>
<td>proposed measures of eradication</td>
<td>Milović</td>
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<tr>
<td>Database on invasive taxa of vascular flora of Croatia</td>
<td>Faculty of Science, Department of Botany</td>
<td>2007-2011</td>
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<tr>
<td>Removal of the invasive plant species <em>Amorpha fruticosa</em> for the purpose of</td>
<td>State Institute for Nature Protection</td>
<td>2009</td>
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<tr>
<td>conservation of the threatened species and habitats in the area of Croatian</td>
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<td>ecological network site Odransko fild.</td>
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</tr>
<tr>
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<tr>
<td>Research of the invasive alien species, signal crayfish (<em>Pacifastacus leniusculus</em>)</td>
<td>State Institute for Nature Protection &amp; Association Kapibara</td>
<td>2010</td>
</tr>
<tr>
<td>in the river Mura and its tributaries as a step towards management planning</td>
<td></td>
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<tr>
<td>Fight against invasive plant species</td>
<td>Ecological Society of Brod -BED</td>
<td>2011</td>
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<tr>
<td>Invasive alien species in freshwater ecosystems of Croatia</td>
<td>Association Kapibara</td>
<td>2009</td>
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<tr>
<td>Title</td>
<td>Institute/Department</td>
<td>Period</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-----------------------------------------------------------</td>
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</tr>
<tr>
<td>Ecological research on toxic phytoplankton and shellfish toxicity</td>
<td>Institute of oceanography and fisheries, Split</td>
<td>2007-2011</td>
</tr>
<tr>
<td>Invasive invertebrate species in freshwater ecosystems of Croatia</td>
<td>Faculty of Science, Biology Department, Zagreb</td>
<td>2007-2011</td>
</tr>
<tr>
<td>Monitoring of aeroallergens and a model of systematic control of</td>
<td>Faculty of Agriculture, Osijek</td>
<td>2007-2011</td>
</tr>
<tr>
<td>allergenic plants</td>
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<tr>
<td>Monitoring, control and eradication of the invasive algae of the</td>
<td>Institute of Oceanography and Fisheries, Laboratory for</td>
<td>2009-2011</td>
</tr>
<tr>
<td>genus Caulerpa in the Adriatic Sea</td>
<td>Benthos</td>
<td></td>
</tr>
<tr>
<td>The determination of the spatial distribution of economically</td>
<td>Faculty of Agriculture, Zagreb</td>
<td>2007-2011</td>
</tr>
<tr>
<td>important pests using GIS</td>
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</tbody>
</table>

In addition, as a result of educational activities, the following outputs on IAS have been published in the stated period:

<table>
<thead>
<tr>
<th>Title</th>
<th>Institute/Department</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>A poster - Invasive alien species</td>
<td>State Institute for Nature Protection</td>
<td>2009</td>
</tr>
<tr>
<td>Handbook for Inventorying and Status Monitoring of freshwater crayfish</td>
<td>State Institute for Nature Protection</td>
<td>2010</td>
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<tr>
<td>A poster and the leaflet - Invasive plants – a threat to biodiversity</td>
<td>UNDP Croatia - COAST project</td>
<td>2009</td>
</tr>
<tr>
<td>A brochure - Invasive alien species in the freshwater ecosystems of</td>
<td>Association Kapibara</td>
<td>2009</td>
</tr>
<tr>
<td>the rivers Drava, Mura, Dunav and Mura</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Annex IV – Main papers on IAS published in the period 2010-2011

Besides educational publications, as a result of the growing interest of the scientific community in Croatia, there have been 25 scientific papers dealing with distributional data of the invasive species and their impact on the native communities or on the economy published in the period 2010-2011:


