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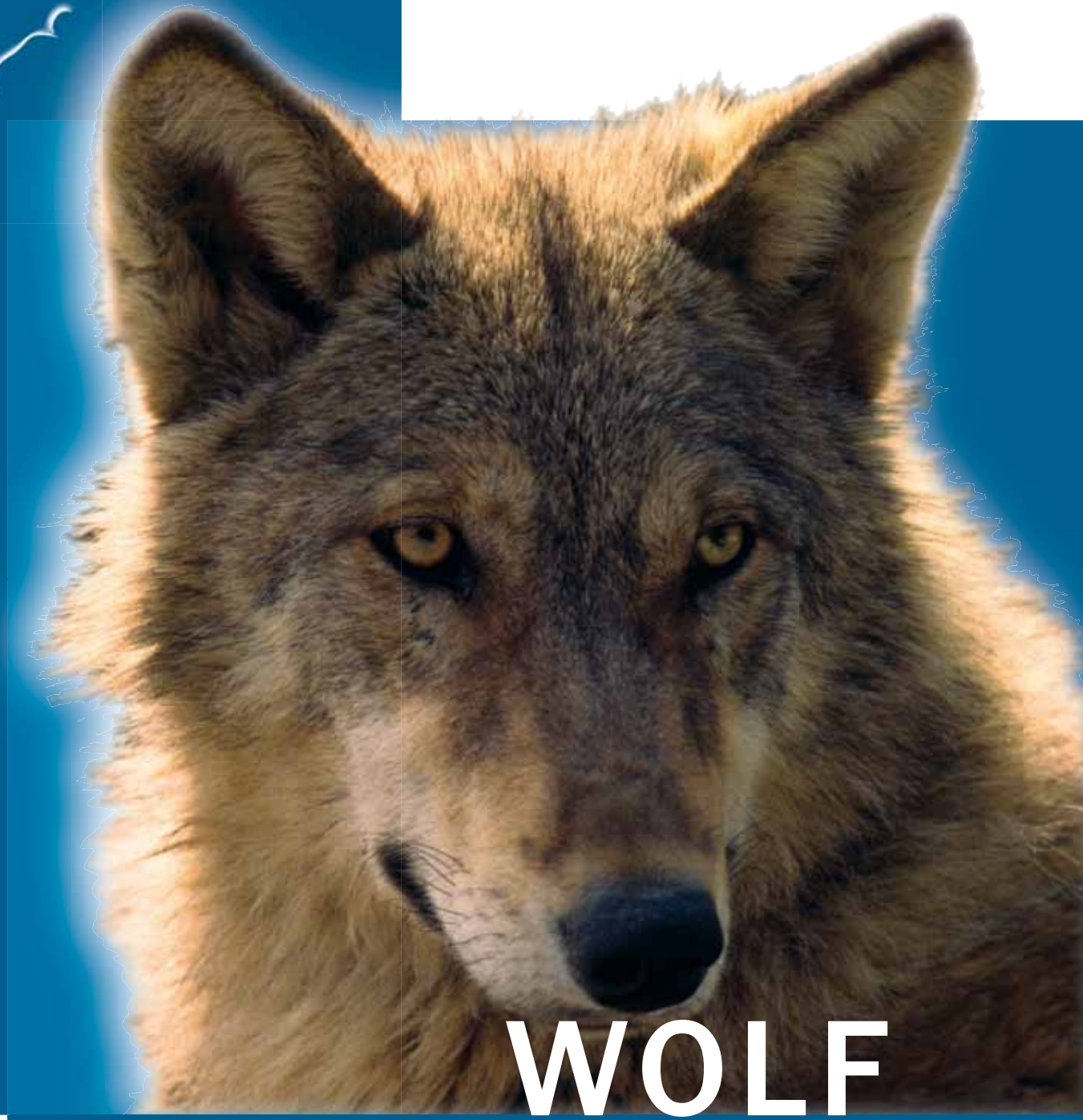
REPUBLIC OF CROATIA



WOLF

Management Plan for Croatia

Towards understanding and addressing key issues in wolf management planning in Croatia

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ZAŠTITA I UPRAVLJANJE VUKOVIMA U HRVATSKOJ

Zagreb 2005

Publisher:
State Institute for Nature Protection

Consolidated and edited by:
Ana Štrbenac

Authors of texts produced according to workshop reports:
Ana Štrbenac, Đuro Huber, Josip Kusak, Aleksandra Majić-Skrbinšek, Alojzije Frković, Želimir Štahan, Jasna Jeremić-Martinko, Sonja Desnica, Petra Štrbenac

Consulting editors:
Luigi Boitani, Alistair Bath

English Translation:
Irena Brnada, Ksenija Strbad

Photos by:
Alojzije Frković, Đuro Huber, Josip Kusak, Ana Štrbenac, Boris Krstinić/Applaudo group, Aleksandra Majić-Skrbinšek, Sonja Desnica, Jasna Jeremić-Martinko, Petra Štrbenac, Nikica Skroza, Dragan Šarić, Ines Pulić

Artwork by:
Ermego d.o.o.

Printed by:
Denona d.o.o.

Printed in:
1000 copies

ISBN: 953-7169-06-5

CIP - Katalogizacija u publikaciji
Nacionalna i sveučilišna knjižnica - Zagreb

UDK 502.743:599.742.1>(497.5)
599.742.1:502>(497.5)
502.743:639.111.7>(497.5)
639.111.7:502>(497.5)

WOLF management plan for Croatia : towards understanding and addressing key issues in wolf management planning in Croatia / <authors of texts produced according to workshop reports Ana Štrbenac ... <et al.> ; photos by Alojzije Frković ... <et al.> ; consolidated and edited by Ana Štrbenac>. - Zagreb : State Institute for Nature Protection, 2005.

Bibliografija.

ISBN 953-7169-06-5

I. Vukovi -- Zaštita -- Hrvatska

II. Divljač -- Ugrožene vrste

450323158

This publication is published with the financial assistance of the European Commission LIFE Programme for Third Countries.

The Wolf Management Plan is a result of joint efforts of experts and representatives of the following institutions/ organisations / groups:

County Hunters Associations
(counties of Dubrovnik-Neretva, Lika-Senj, Primorje-Gorski kotar, Split–Dalmatia and Šibenik-Knin)
Croatian Association for Wolf Protection
Croatian Forests
Croatian Hunters Association
Croatian Livestock Selection Centre
Department for Economic Development, County of Primorje-Gorski kotar
Faculty of Forestry, University in Zagreb
Faculty of Science, University in Zagreb
Faculty of Veterinary Medicine, University in Zagreb
Green Action
Krka National Park
Livestock Breeders Association
Ministry of Agriculture, Forestry and Water Management, Division of Forestry and Hunting, Division for Veterinary Science
Ministry of Culture, Division for Nature Protection
Ministry of Environmental Protection, Physical Planning and Construction
Northern Velebit National Park
Oikon d.o.o
Paklenica National Park
Plitvice Lakes National Park
Risnjak National Park
Slovenian Department of Forestry, "Jelen" Hunting Ground
State Institut for Nature Protection
University of Slovenia, in Ljubljana
Velebit Nature Park

Aknowledgements to the participant of the Wolf Management Plan Workshops:

Adamič, Miha
Alavanja, Gordana
Bata, Ingeborg
Bath, Alistair
Boitani, Luigi
Bosiljevac, Damir
Bračulj, Zoran
Brenko, Zlatko
Budor, Ivica
Bukovič-Šošić, Branka
Bulić, Ante
Bušljeta, Dujo
Čulinović, Krešimir
Dasović, Željko
Dečak, Đuro
Desnica, Sonja
Duić, Josip
Erceg, Ozren
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Kiš, Konrad
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Kotarac, Miro
Križanić-Brigić, Andrea
Krupec, Ivan
Kulić, Blaženka
Kusak, Josip
Lindić, Vladimir
Lipovac, Branko
Ljubičić, Marko
Majić-Skrbinšek, Aleksandra
Marinčič, Anton
Matoš, Stjepan
Mijatović, Ivana
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Štalcar, Andrija
Štrbenac, Ana
Štulić, Siniša
Šupe, Ivica
Tomaić, Josip
Ugarković, Mile
Veljančić, Vesna
Volner, Matija
Vukelić, Milan

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Foreword

The Wolf Management Plan is a result of many years of work on the gathering and processing of all known scientific, ecological, social and economic factors affecting wolf conservation in Croatia. There were three main starting points in the development of this Plan: ensuring long-term survival of the wolf population in Croatia; understanding and minimizing problems between wolves and humans; and coordination of planned activities with those in neighbouring countries with which wolf populations are shared - Slovenia and Bosnia and Herzegovina.

The Plan starting points clearly show that numerous activities have been carried out in the last decade which have enabled better management planning for this species. Many years of scientific research and monitoring have enabled better knowledge of the wolf population. Sociological research has been carried out as well, demonstrating human attitudes to wolves. Donation of guarding dogs and electric fences, as protective measures against wolf attacks on livestock, is one of the activities, which could encourage development of livestock guarding culture as one of the preconditions for modern livestock breeding. One of the surely greatest achievements is the establishment of communication channels among all interest groups as a basis for future cooperation. This plan is the result of many different interests with strong views about wolves, who were willing to listen to different viewpoints and work together to explore possible solutions. In the protection of nature, as in all economic sectors, it is crucial to plan activities jointly, through collaboration among all sectors and social groupings actively engaged in the issues. Narrow sectoral approaches yield no practical results. Successful implementation of management plans lies in effectively working with all interest groups and involving the public in the decision-making process.

Croatia is a country which can still take pride in its preserved nature. It is a value often minimised and neglected, failing to use it to our development advantage, especially in the form of environmentally sustainable tourism.

This management plan proposes a number of activities that include research and monitoring of populations, changes in the management methods for game and livestock, some management of the wolf population, public education, information and participation in decision-making, tourist development and cross-border cooperation.

Development of the Plan involved representatives of all interest groups. Through joint workshops and awillingness by the goverment too let a diverse group of interests strive for a common solution, increased communication between groups occured. The result was better decision-making and good quality management of wolves in Croatia. Significant contribution was given by representatives of scientific institutions from Slovenia. Despite of regular invitations to the representatives of Bosnia and Herzegovina, they have not participated in the workshop.

It should be noted that the Wolf Management Plan was prepared in the framework of the project "Conservation and Management of Wolves in Croatia", implemented with financial support of the LIFE - Third Countries program of the European Commission. This funding has enabled covering of costs of the workshops, in order to ensure multi-interest group participation in many possible ways.

The Plan was officially adopted by the Decision of the minister of culture on 7 December 2004.

The Plan has been designed as an active document which will be revised at least every two years, and it will bring about amendments to the valid laws and regulations governing the areas of hunting, nature protection, veterinary science and other activities.

The revision procedure will be carried out again through a multi-interest group approach in the same way in which it was first developed, i.e. through facilitated workshops.

Summary

Wolf Management Plan is an active document that represents guidelines for the activities that will ensure a long-term conservation of wolves in Croatia and their co-existence with humans.

The Plan consists of two main parts: Background and Operative Management Plan. The first part includes analyses of all available data that are important for wolf population. They represent a basis for the Operative Management Plan.

The Plan includes the following themes:

1. **Research and monitoring**
2. **Habitat preservation**
3. **Hunting**
4. **Livestock breeding**
5. **Interventions into the wolf population**
6. **Education and information**
7. **Public participation in decision-making**
8. **Tourism**
9. **Cooperation with neighbouring countries**
10. **Implementation of the Plan**
11. **Revision of the Plan**
12. **Financing implementation of the Plan**

One of the basic activities regarding research and monitoring is the establishment of a national system for monitoring wolf population, that includes collection of data on wolves (telemetric research, genetic analysis, mortality analysis, monitoring based on wolf tracks in snow) and monitoring of prey population.

This Plan also proposes the measures for maintaining habitat integrity and quality. These measures include, among all, building "green bridges"; maintaining the existing spatial proportions among forests, meadows and arable plots; monitoring quality of habitats physical planning that takes into account the presence of wolves, selective forest management and prevention of introduction of alochthonous animal species.

The Plan also proposes certain measures for harmonisation of hunting management with the conservation measures for wolf and other predators. Thus, when calculating the game increment cofficient and game fund, the presence of wolf must be considered. A system of game monitoring must be established and game population increased. Scientifically justified objective assessment of the impact of wolves and other predator on game populations must be implemented. A special emphasis is given on the prevention of illegal kills both of wolves and game. It is agreed that the stricter sanctions should be introduced.

Livestock breeding should include proper management that stimulate larger herds. Certain measures for livestock protection must be implemented as well. Continuation of the dog and fences donation programme is strongly recommended. Livestock registration process of Croatia must be finalised. The existing system of damage compensation should be improved as well. The Plan also proposes the improved coordination among livestock breeders, solving the problem of strey dogs and prevention of illegal disposal of slaughterhouse waste.

The Plan also includes a chapter about possible interventions into the wolf population, if those do not disturb the stability of the wolf population and on strictly selective basis.

These interventions are allowed only if there is no other solution and in cases of big damage to domestic animals, contagious disease, unacceptable and proven impact on game and threat to humans. The Large Carnivores Monitoring Committee proposes the quota on annually basis, concidering regional differences. These quotas include regional quotas, emergency response, traffic kills and other death causes. It also takes into account the social capacity and acceptance. After the first 6 months a status analysis must be made, which may result in a decrease or an increase of the planned intervention size. This intervention is only allowed in the period that exclude reproduction time. It is performed by a local game concessionaire in cooperation with the local coordinators that should report about this activity. In certain situations (rabbies, attacks on humans etc.), outside the planned annual intervention, emergency response may be required. In that connection, it is necessary to develop an emergency plan. Wolf carcasses should be used only for scientific purposes, if there is no other interest. A broader group to control the intervention process will be established, including representatives of all interest groups.

Education and information activities should continue with already started educational and information campaigns. Lectures on wolves, publications, exhibitions and regular press conferences and public announcements are foreseen. The knowledge on wolves will be monitored through human dimension research.

Public participation in decision-making should be furtherly enforced through direct involvement (joint workshops, meetings etc.) and quantitative monitoring of broad public and interest groups attitudes.

Wolf tourism should be initiated as well, as the possibility for economic benefits from wolves. In this regard, the establishment of an educational and information centre for all three large carnivores in Croatia is proposed, along with the design and organisation of visiting tours and design of thematic souvenirs.

The Plan puts a special emphasis on international cooperation with the neighbouring countries – Bosnia and Herzegovina and Slovenia. Bosnia and Herzegovina must join the Bern Convention and Croatia is willing to assist in implementation of this convention, wolf management planning and public involvement.

Cooperation with Slovenia is already started with the preparation of this Plan. However, it should be improved through regular meetings and joint implementation of the certain activities proposed in this Plan.

The Ministry of Culture is responsible for implementation of this Plan in cooperation with the Ministry of Agriculture, Forestry and Water Management and Ministry for Environmental Protection, Physical Planning and Construction. Other relevant institutions and bodies are also included in this process like the State Institute for Nature Protection, Large Carnivores Monitoring Committee and other interest groups. The Plan should undergo its first revision within two years and later as necessary.

Funds for its implementation must be ensured from the State Budget with possible assistance from international sources and the Fund for Environmental Protection

Introduction

Similar to other large carnivores, wolf is at the top trophic level of the food chain of inland ecosystems and for many this makes the wolf an important element of biodiversity. However, this very function in the ecosystems often makes them direct competitors with humans. Namely, the wolf's basic diet is at the same time the object of economic exploitation by humans, whether for food, hunt or for other interests.

Further, the wolf has always been a subject of severe prejudice. After all, everyone remembers the stories about Little Red Riding Hood, The three Little Pigs, Wolf and seven kids. Through much of children's literature, it is considered a bloodthirsty animal dangerous for humans. But in reality the wolf teads to be totally the opposite; the wolf tends to avoid direct contact with humans. Unfortunately, negative attitudes to wolf lead to the extermination of this species from many parts of Western Europe.

For some, the wolf is an indicator of preservation and a value of biological diversity of a country. One such country is Croatia that, apart from the wolf, still harbours even bear and lynx populations.

The wolf has been protected by law since May 9, 1995. Four years later, the Interim Wolf Management Plan for Croatia was enacted. The plan was called "interim" due to the fact that the level of the scientific knowledge on wolf status was insufficient and that the Plan did not involve the main interest groups - livestock breeders, hunters, non-governmental-organisations (NGOs), environmental groups, government authorities and the general public.

In the meantime scientific research of wolves has continued by radio-telemetric methods, through human dimensions research on attitudes of various interest groups and of the general public toward wolves in the area of its occupancy, reports on damages done by large carnivores are being electronically processed, a program of donation of guarding dogs started, and certain educational and information activities have been carried out. Intensification of activities in wolf conservation and management by the end of 2002 was made possible by the international LIFE III project titled "Conservation and Management of Wolves in Croatia", which provided a framework for developing the Plan that is before you. All principles of wolf management in Croatia have been agreed through multi-interest group workshops. Implementation of these principles will be defined in annual action plans, and revisions will be possible into the overall Plan.

Workshop participants and authors of this material are aware that wolf management, as well as any other large carnivore, brings about many challenges and requires compromises from all groups. Our joint obligation for the future will remain to secure the survival of wolves in their natural habitats in Croatia, in coexistence with the local population and in line with European trends and expected integration of our country into this milieu.

Methodology of making the Plan

Traditionally, a wolf management plan would have been created by the governmental bodies directly responsible for wolf conservation with little to no involvement of various interest groups. In fact, the first national wolf management for Croatia took this approach resulting in a plan that was not widely accepted and could not be effectively implemented. This management plan is result of a human dimensions approach involving people. Public involvement is about redistributing power from managers/decision-makers to the various publics. The Croatian State Institute for Nature Protection actively involved all interest groups, involving a facilitated workshop approach using trained facilitators and human dimension researchers.

Development of the present management plan has followed the recommendations of the Action plan for the conservation of wolves (*Canis lupus*) in Europe and its methodology. Involvement of the public in decision-making is a process through which attitudes of all interested parties (interest groups) integrate into the process of making a decision (Praxis, 1998). Selection of the method to involve the public is today one of the greatest challenges faced by decision-makers in the field of management of wild animals (Decker and Chase, 2001). Table 1 shows a continuum of public involvement approaches available to integrate various interest groups into the decision-making process.

Although certain below presented methods of public involvement (eg. persuasion and education) assume one-way information flow, real involvement should include two-way communication involving listening first before talking, with the final goal of making better decisions to be implemented by a governmental body, or a country as a whole.

Table 1. *Scale of public involvement methods – "persuasion" is the lowest, and "independent decision-making" the highest level of public involvement and participation (Praxis, 1998). "Joint planning" was the method chosen for the development of the Wolf Management Plan.*

Public involvement levels	Description
Persuasion	Using various methods of public involvement attempting to change the public opinion, but without raising expectations of the public that it will be involved in the planning processes.
Education	Distribution of information and general guidelines with the aim of creating general awareness on programmes and issues.
Feedback	Distribution, by the state, of information on the stage of planning of a certain programme on which the state has a defined attitude, and at the same time request for getting feedback on the public attitude on the same issue.
Consultation	Formal dialogue between the state and the public based on mutually accepted and preliminarily defined goals.
→ Joint planning	Joint decision-.making. Representatives of the public are members of national committees where they have an equal right to vote. Issues decided upon must be geographically defined and comprehensible to members of the public.
Authorisation	Transfer or responsibility, usually related to government agencies, to the public or some other governmental level, which has sufficient expertise to undertake a task.
Independent decision-making	Direct implementation of the entire planning process by the public.

Benefits of public involvement (Praxis, 1998):

- Improved quality of the decisions made
- Improved management efficiency
- Saving money and time
- Easier implementation of plans
- Avoiding major conflicts
- Maintaining credibility and legitimacy
- Improving management expertise
- Developing possibilities for joint work
- Developing public knowledge and ingenuity
- Better consensus

Joint work

For the purposes of creating a Wolf Management Plan for Croatia a relatively high level of public involvement was chosen. "Joint planning" involves joint decision-making, and in certain cases also joint implementation of activities. The public was involved through a series of facilitated working meetings - "workshops", with representatives of various interest groups and those of the competent ministry being equal participants. Workshops have resulted in a consensus over all controversial issues identified by the participants (see sample Minutes from a workshop in Annex 1). Due to limited time and funding and by consensus from the group, the text of the Plan itself was assembled by a smaller working group according to the agreed results of workshops (Authors). This took 8 workshops, out of which two lasted for two days. Final text of the management plan was adopted on the ninth workshop by the broader interest group.

It is important to note that one of the main assumptions for this type of work is the will of the competent government institution to involve the public in the process.

Participants of workshops for the development of the Wolf Management Plan for Croatia, thus also the authors of the Plan, represent the groups that have shown interest in these issues. Participation in this process depended therefore exclusively on the will of a interest group. In order to avoid a situation in which an interested interest group or organisation would be omitted from the process, the first workshop was used to identify and inform all possible interest group. Invitations for the subsequent workshops were then sent to all groups and organisations identified on that occasion.

Since Croatia is a signatory to the Convention which obliges it to cooperation in the management of wolf populations with neighbouring countries that share the same wolf population, eminent wolf management planning experts from Slovenia took part in the workshops as well.

Unfortunately, despite of regular invitations, representatives of Bosnia and Herzegovina did not participated in the workshops.

Rules of cooperation defined by the the workshop participants:

- Open to listening to different attitudes
- Focus on working toward solutions
- Willing to work in smaller groups if necessary
- Work is based on the principle of consensus, no voting in the room
- Process involves representatives of different stakeholder groups
- Transparent to all interested groups / individuals

Roles of individuals

- Support to the process of management plan development
- If we accept a task, we also accept the obligation to fulfil it
- Inform superiors and other members of the interest group
- Win support from your stakeholder group for the attitudes adopted in the workshop
- Representative of a group must represent attitudes of the entire group
- Representative of a group should present the process of plan development in their organisation
- Take part in the development of the plan continuously (show up at workshops)
- Listen and respect other people's opinions

Figure 1.
The Workshop on the Wolf Management Plan preparation held in Velebno, 13-14 October 2003 (J. Jeremić-Martinko)

Figure 2.
The Workshop on the Wolf Management Plan preparation held in Skradin, 15-16 December 2003
(S. Desnica)

Vision

Strengthening public awareness and support to wolves and ensuring long-term conservation of wolves in Croatia, while minimizing conflicts between wolves and people.

Values

Workshop participants defined the basic values-guidelines in the planning of wolf management in Croatia:

- Long-term conservation of the wolf population in Croatia
- Contribute to the improvement of life in rural communities
- Reduce conflicts between various interest groups and encourage mutual respect and cooperation
- Improve public recognition of wolf management
- Raise public awareness of wolves
- Strengthen political support for wolf management
- Have a flexible approach to management (i.e., adoptive management approach)
- Plan for the future (what if wolves appear where there aren't any today?).
- In areas where wolves appear occasionally efforts should be made that they stay there, unless this causes excessive conflicts
- Involve local interest groups and local communities
- Make decisions based on sound scientific facts
- International cooperation in management (cooperation with Slovenia and Bosnia and Herzegovina).

Background

Biology and Ecology

Scientific classification

Figure 3.
Grey wolf (Canis lupus) (B. Krstinić/ Applaudo group)

The grey wolf (*Canis lupus*) is a mammal of the order *Carnivora* and the dog family *Canidae*. Besides the grey wolf there are two more free-living types of wolf known – the red wolf (*C. rufus*) and the Abyssinian wolf (*C. simensis*). The red wolf used to inhabit the southeast part of the USA, but natural populations were most likely exterminated by the 1980s. The Abyssinian wolf considered the jackal until recently, numbers about 550 individuals at the moment, mostly inhabiting the Bale National Park in the mountainous regions of Southeast Ethiopia (Route and Aylsworth, 1999). All dog breeds were created by domesticating wolves, in a process that started some 100,000 years ago, although some mixing with the wolf was recorded occasionally too (Vila et al., 1997). So nowadays the dog (*C. lupus familiaris*) and the wolf are considered to be the same species. The genus *Canis* includes also the coyote and two types of jackal who can all be crossbred.

Distribution, status and populations of wolves in the world

The grey wolf historically inhabited each habitat of the Northern Hemisphere (from about 20° of northern geographical latitude up to the Pole) in which large even-toed mammals were to be found (Mech, 1995). The grey wolf belongs to the ecological niche of large predators of the Earth's Northern Hemisphere. Besides the wolf this niche comprises also the mountain lion (*Felis concolor*) of North America and the tiger (*Panthera tigris*) and the leopard (*Panthera pardus*) of Asia, but the wolf is the most valuable predator owing to its high density of population and considerably wider area of occupancy (Mech, 1970). According to the data collected by Route and Aylsworth (1999) the grey wolf population in the world is currently estimated at some 150,000. This number of wolves lives in populations spreading through 41 countries worldwide for which the data on their number, population trends and the legal status were available (Table 2).

Table 2. The grey wolf populations, trends and legal status in the world in 1999 (Route and Aylsworth, 1999). For countries not listed there are no data available.

COUNTRY	NO. OF WOLVES	TREND	LEGAL STATUS
Albania	250	upward	unknown
Bangladesh	< 10	-	-
Belarus	2000 – 2500	upward or stable	unprotected
Bosnia&Herzegovina	800	upward or stable	unprotected
Bulgaria	800 – 1000	upward	some protected areas
Canada	55 000 – 65 000	stable, but varying	hunted, protected
China	6000	stable	protected
Croatia*	100 – 150	stable, upward	protected
Czech Republic	< 20	upward	protected
Denmark (Greenland)	50 – 75	likely downward	protected
Estonia	< 500	downward or stable	unknown
Finland	150	upward or stable	unknown
France	30 – 40	upward	protected
Germany	5 – 10	upward	protected
Greece	200 – 300	downward	unknown
Hungary	< 50	stable	protected
India	1200 – 1500	downward	protected
Israel	150	stable	protected
Italy	400 – 450	upward	protected
Latvia	600	upward	unknown
Lithuania	900	stable	unprotected
Macedonia	> 1000	upward or stable	unprotected
Mexico	0	exterminated	endangered
Mongolia	30 000	stable	unprotected
Netherlands	0	exterminated	unknown
Norway	5 – 10	upward or stable	protected
Poland	1000 – 1100	upward	hunted, protected
Portugal	250 – 300	stable	protected
Romania	2500	stable or upward	hunted with restriction
Russia	30 000	stable, but varying	unprotected
Saudi Arabia	600 – 700	stable	unprotected
Serbia and Montenegro	500	unknown	unknown
Slovakia	350 – 400	downward	hunted, protected
Slovenia	50 – 100	stable	protected
Spain	2000	upward	hunted
Sweden	45 – 60	upward	protected
Switzerland	5	upward	protected
Ukraine	2000 – 3000	unknown	unknown
USA	9790 – 13 500	upward	hunted, protected

** Original data (50–100) corrected by new data (Kusak, not published).*

Outer appearance, physical features

The grey wolf is the largest member of the dog family. The largest wolves live in the north (average weight 41 kg – Alaska, Northwest Territory; Mech, 1970), whereas the representatives of more southern populations (India, Pakistan, Afghanistan) are half that size (Kumar, 1998). A full-grown wolf from the area of Croatia weighs on average 31 kg (Huber et al., 2002). From the top of the nose to the top of the tail wolves are 170 cm long on average (tail = 42 cm), with an average height of 70 cm measured on the ridge. The colour of the wolf's fur depends on the share of black, grey and brown covering hairs. In Croatia wolves are always grey; the back and the tail have dark-grey colour turning into light-grey towards the belly and the legs. On the front side of the forearm there is usually a dark stripe, although certain specimens were found to have none (Kusak, unpublished).

Various parts of the world are inhabited by wolves of a colour varying from white, through light brown and reddish to grey and black (Mech, 1970). By it's constitution the wolf is well adapted to running, especially to a long-lasting trot. It's rib cage is narrow, elbows retracted inwards and paws turned outwards. This enables the front and rear leg on one side to move in the same plane. The wolf has four toes on the rear and five on the front legs, but steps never on the first toe of the front leg (big toe, inner side of the leg). Legs are comparatively longer than with other members of the dog family (Young, 1944), which contributes to the speed of moving over relatively long distances. Since the wolf feeds almost exclusively on flesh, bones and other parts of bodies of animals it preys on, the build of it's head facilitates catching and eating of the prey. The wolf's head is elongated forwards, it is 25 cm long and 14 cm wide on average. The brain volume is 150-170 cm, exceeding the volume of the majority of dogs by at least 30 cm. Massive jaws form a basis for strong masticator muscles and 42 specialized teeth. The dental formula is I:3/3, C:1/1, P:4/4, M:2/3. The largest teeth are canines that serve for catching and killing the prey. With a full-grown wolf the spacing between the tops of upper canines is 45 mm and of lower canines 40 mm on average (Kusak, unpublished). For chewing and "cutting" of flesh and sinews the wolf mostly uses the fourth upper premolar and the first lower molar, acting as scissors, and for breaking the bones its strong molars. All the wolf's senses, especially that of smell and hearing, are perfectly developed.

Figure 4.
The wolves are hardly seen in the wild, because they are always looking for a shelter
(J. Kusak)

Wolf's way of life

In order to hunt a large prey predators must either be almost as large as their prey (for example, carnivores of the cat family) or can be smaller and hunt in packs (e.g. wolves, African wild dogs) which accounts for their evolutional success. Besides being able to catch a larger prey because they hunt in a group, they can also eat it up immediately and make full use of it. The group in which wolves live together is called a pack. The core of a pack consists of a reproductive pair and all other members of the pack, the young and elder brothers, are the descendants of the same parents. Wolves travel, hunt, feed and rest in packs, which means

Figure 5.
The wolves live in packs
(B. Krstinić/Applaudo group)

they are together all year round. In order to be able to carry out all of these activities successfully, the pack has a relatively complex social structure. The wolf pack is arranged in a hierarchical manner, with the pair of parents keeping the dominant position and other members of the pack building among themselves a relationship of superiority and subordination.

The dominant wolf or female wolf decides when the pack is going to hunt and where the lair will be situated, and the hierarchical structure is best seen when feeding on a prey: the subordinates eating after the superiors. Besides, a strong domination primarily in the female line makes the mating of subordinate members with each other or with one of the dominant wolves impossible. So only one female wolf in a pack can have the young, which is one of the mechanisms to regulate the population size of this top predator. At the same time this prevents mating with kinship. The inability of mating and the lack of food force the subordinate wolves to leave the parent's pack and its territory. This happens mostly with young wolves at the age of two and three.

In search of a new habitat and partner they leave for areas unknown to them, which is called dispersion. Wolves have a markedly territorial character; they mark the space they inhabit by urine, excrements, by scratching the soil and howling. By defending their living space from other wolves, they secure their prey. An alien wolf may enter the territory of a pack, but if found by the pack, it will almost surely be killed and

Figure 6.
The wolves communicate by howling (J. Kusak)

sometimes eaten. The same may happen to a dog entering the wolves' territory, because it will probably be seen as an alien wolf. Consequently, in wolf populations not affected by human activities, as much as 65 to 70 per cent of the total wolf mortality are caused by other wolves. This is another mechanism for self-regulation of the wolf population.

If a wolf in dispersion succeeded in finding a space not inhabited by other wolves and containing enough prey, and if at least one young, not related wolf of opposite sex enters the same space, this will result in a new pack. After they come closer and socialize with one another, a new pair of wolves starts marking their new space with great intensity; they mate next winter and raise their first litter in spring (Mech, 1970; Mech et al., 1998).

Reproduction of wolves

The female wolf is in heat once a year, in the period from the end of January till April, later in northern parts and earlier in southern parts. The heat lasts three weeks and the mating itself takes place in the third week. She is with pups for 63 days and bears the young in a lair that she has prepared earlier. If not disturbed in their lair, wolves can use it several years successively. The litter normally consists of 4 young

Figure 7.
The wolf and the young (Đ. Huber)

who are blind and deaf until they are 11 to 15 days old and suck until six to eight months of age when they start turning gradually to food brought to them by all other members of the pack.

The place in which wolf-pups live during growing up and to which full-grown wolves of the pack return every day is called a haunt. During summer wolf-pups may be moved from one haunt to another a number of times. Until the first winter wolf-pups reach the size of a full-grown wolf and start travelling with the pack. They are sexually mature at the age of 22 months after which they leave their pack (Mech, 1970; Garms and Borm, 1981).

Wolf's habitat and diet

Wolves may live in any habitat that provides enough prey and shelter. To this very day wolves have managed to survive in hardly accessible areas and are therefore often seen as a symbol of wilderness. Wolf needs shelter only to avoid humans, because it has no other enemies in nature. Wolves may live even very close to humans, in a livestock breeding area (Kusak, 2002), in a grain field or on the outskirts of a town. This is possible if tolerated by humans and if the wolf mortality rate caused by man lies below the annual growth. In such cases they can almost completely switch to feeding on domestic animals. Domestic animals (sheep, goat and to a lesser extent small stock and dogs) account for 84 per cent of the wolf's diet in the area

Figure 8.
The wolves live also in the area of Dalmatinska zagora (A. Štrbenac)

Figure 9.
Gorski kotar represents the top-quality wolf habitat (A. Frković)

of Dalmatia, as opposed to Gorski kotar where wild even-toed animals (roe deer, red deer and wild boar to some extent) with their share of 77 per cent make the main wolf's prey.

The wolf's ecological niche is a "hunter of large mammals", meaning that it's main prey are large even-toed mammals (*Artiodactyla*) and rarely those odd-toed (*Perissodactyla*). Wolves will eat up any other animal it may catch too, this known as an opportunistic hunter. It has long since been known that when hunting, wolves choose the prey easier to catch at the particular moment (Mech, 1970; Frits and Mech, 1981), but this changes during the year (Mech et al., 1995). So in an ecosystem containing more types of prey they will hunt the type more readily available and therefore easily accessible, taking animals weakened by their age, illness and famine or the young (Ballard et al., 1981; Mech, 1970, 1998; Peterson, 1977). In this way wolves affect positively the health of the prey population and contribute to the stability of the entire ecosystem. Without predators the number of herbivores in unaffected ecosystems can increase to such an extent that it may result in the reduction of their nutritional basis (e.g. disturbance of forest restoration, even a complete defoliation up to creation of karst) which can ultimately lead to a considerable reduction in the number of herbivores themselves or their complete disappearance.

Figure 10.
The unguarded livestock is the easiest prey for the wolf (J. Jeremić-Martinko)

Figure 11.
The wolf carrying a piece of its prey (G. Gužvica)

Status in Croatia

Historical overview

Distribution, current population and causes of population decrease

It is considered that back in 1894 wolves inhabited the entire territory of Croatia; each county of that time had recorded at least one killing of a wolf. Later on, the species started disappearing, first from the lowland continental Croatia (Frković and Huber, 1995). In spite of the efforts for their extermination, wolves managed to survive in the Dinaric area and in Dalmatia. According to Schwenk (1985), at the turn of the 20th century the annual kill of wolves in Dalmatia averaged approximately 10 individuals, followed by approximately 10 times more kills of jackals. After World War II, extermination actions increased, and in Gorski kotar alone in the period 1946-1986 there were 540 wolves killed (Frković et al, 1992), while a single hunter in Dalmatia in the area of Svilaja, Dinara and Kamešnica in the approximately same period killed 68 (Mile Lovrić, verbal account). This resulted in the decrease of the wolf population to approximately 50 individuals in the late 1980s in the areas of Gorski kotar and Lika, and their complete disappearance in Dalmatia (Frković and Huber, 1995).

Figure 12.
In Gorski kotar the wolves used to be hunted individually or in shoots (A. Frković)

The former wolf's area of distribution is today best seen from the data on wolf kills and captures. The available statistical data (covering Croatia and Slovenia of that time) for the period 1891-1921 account for the killing or capture of 1,324 wolves - 42 wolves per year (with maximum annual quantity of 120 wolves, recorded for 1892). The next statistically processed period for Croatia concerns 1954-'72, when a total of 5,206 wolves were captured, on average 274 per year. In the period 1960-'61 this number decreased to 50, only to fall to 32 in 1989-'90. In Gorski kotar,the number of killed or captured wolves, from the average 15 per year in the period 1945-1976, first decreased to 9 per year in the period 1977-1986 but, in subsequent years, to only one individual. During this time there were no changes in the legal status of the species, nor in the number of hunters, which leads to a conclusion that the overall wolf population had decreased. The last proven damage done by wolves in Gorski kotar, prior to its legal protection in 1995, occurred in 1984.

In the period after World War II, the wolf was listed among unprotected game to be hunted by "anyone with all available hunting means and methods" throughout the hunting legislation and in other legal acts (Decree on Permanently Protected Game, Game Protected by Close Season, and Unprotected Game; Decree on Extermination of Wolves and Prizes for Killing), coupled by financial incentives. Thus hunting pressure

Figure 13.
The decline in the wolf's area of occupancy in Croatia over the last hundred years
(Source: Faculty of Veterinary Medicine)

had followed the gradual decrease in the wolf population; but until the early 1980s the wolf population in the alpine areas of the country had not been threatened.

At that time, the unchanged hunting pressure was aggravated by the changes in habitat. Boundaries of the total available space for wolves were reduced and became more pronounced due to human impact in the border areas of wolf distribution. Habitat quality decreased in the central parts due to construction of forest roads, opening, exploitation and dying off of forest stands. These actions consequently reduced the populations of available prey, both natural and domestic animals.

Present status

Wolf distribution in Croatia

Wolves have managed to survive in the areas of Gorski kotar, Lika and Dalmatia, in 32.4% of the total land area of the country (17,468 km^2). Areas of occasional wolf presence cover 17.7% of inland Croatia (9,543 km^2) and include the Dinaric border areas in the north (peripannonian area) and south (southern slopes of Velebit, near Ravni kotari, Kaštela, Biokovo). The territory of Istria (except Ćićarija and Učka) and the continental lowland areas of Croatia are not inhabited by wolves, and the size of this area amounts to 26,843 km^2 (49.8%) (Figure 1, Table 3).

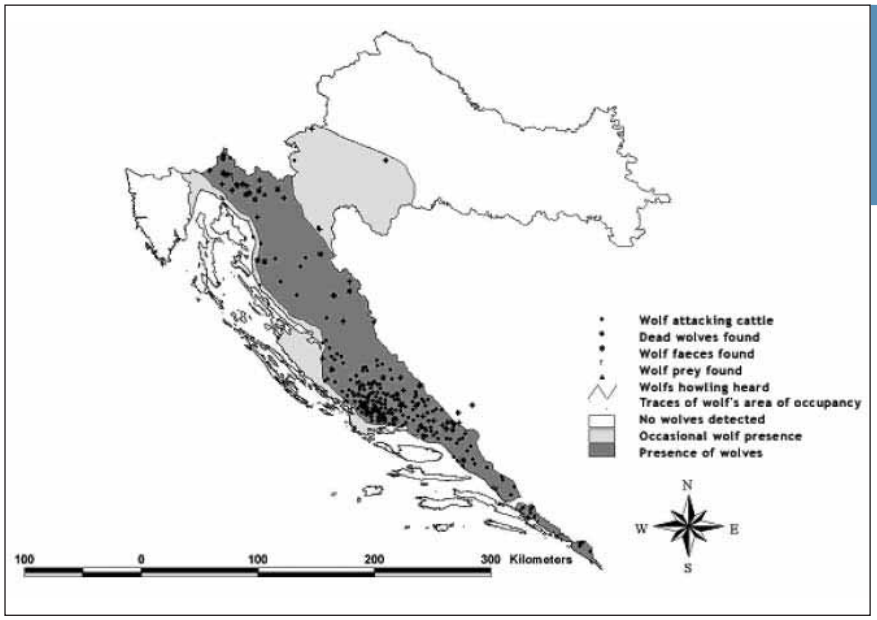


Figure 14.
Distribution of traces of wolves and wolf's area of presence in 2001.

Table 3. Surface areas per extent of presence of wolves in Croatia in 2001.

Presence of wolf	Extent of occurrence (km²)	%
Constant	17,468	32.4
Occasional	9,543	17.8
None	26,843	49.8
Total	53,854	100

Population density, number and trends

Introductory remarks and basic knowledge

Estimates of populations of wild animals in nature, especially concerning large carnivores like wolf, are very difficult to make and are usually imprecise.

This document presents the results obtained by several independent methods. Although each method has its limitations, their application was consistent and without subjective manipulation. The resulting estimate shows that there are approximately 130 to 170 wolf individuals in Croatia. There are interest groups in the Wolf Management Plan development process who believe that the number of wolves is lower than the minimum estimate, as well as those who believe the opposite - that there are more wolves than the maximum suggested.

When making decisions in the management of any population it is more important to know the trends than the real number of individuals. By carefully monitoring the trend and impacts of the management measures appllied, it is possible to achieve long-term successful management of a species without ever actually finding out its absolute size. An objective analysis has shown that the wolf population in Croatia reached its minimum in the late 1980s, and in early 1990s started its gradual increase until the end of the decade. Since then, in the last 3 to 4 years, it has stabilised to its present level.

There is a state-of-the-art method that can be used in this respect, but its application in Croatia is just starting, so there are no usable results yet. The method implies identification of each individual on the basis of DNA analysis of a sample taken from the fresh faeces. The samples should be conserved in alcohol (accompanied by a note on the time and place of the finding), and wolf DNA (originating from epithelium cells of the mucous membrane of digestive tract) is isolated in the laboratory. DNA is analysed for the sequence of nucleic bases (genetic code) in a certain number of genes that is sufficient for individual identification of wolves. A big enough sample can be statistically processed to show, with high certainty rate, the number of wolves in the same area. The bigger the sample, the lesser the error margin, with over 90% accuracy. Such certainty is achieved when having the number of samples higher than one third of the number of individuals in a local population. Genetic research of wolves in Croatia has begun, however the usability of results can only be guaranteed by collecting a sufficient number of samples (with the assistance of all interest groups in the field), and ensuring adequate funding to cover laboratory costs.

Local population density may vary greatly, depending on external influences (mainly of anthropogenic character), and it is also hard to make an accurate calculation. However, it is considered that wolf population density in Croatia ranges between 0.53 and 2.38 individuals/100 km^2.

Methods and results of the estimates used are shown below in greater detail.

Estimates of the wolf population in Dalmatia based on attacks on livestock

In 1997, a total of 355 wolf attacks on domestic animals were recorded in the area of the counties of Šibenik-Knin and Split-Dalmatia. Land area of these counties is 6,462 km^2, out of which wolf is present on 5,937 km^2. Based on the spatial and temporal distribution of attacks, there could have been 20 wolf packs in the area in 1997 (Figure 15). Viewed against the average territory of a pack amounting to 150.5 km^2 it turns out that the wolves covered approximately 3,000 km^2 (46.4%) of the total area, or 50.5% of their estimated area of occupancy in these counties. If a pack is made of 3-4 adult individuals, in 1997 there could have been 60 to 80 wolves in the given conditions.

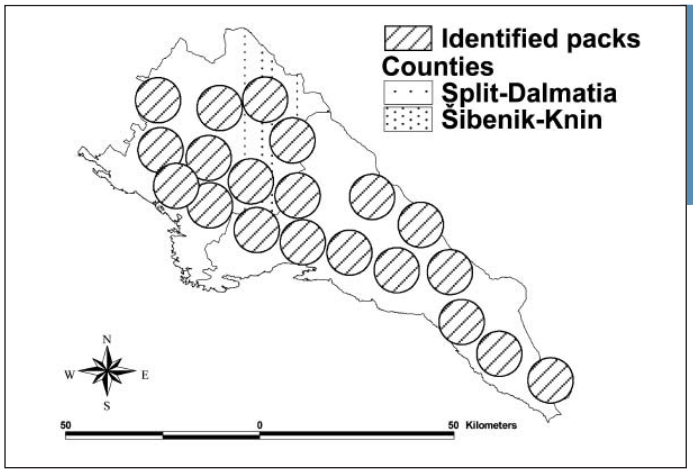


Figure 15. *Possible packs identified according to attacks to domestic animals in the counties of Split-Dalmatia and Šibenik-Knin in 1997.*

Estimates of wolf population in Dalmatia based on eaten quantities of domestic animal flesh

In the counties of Split-Dalmatia and Šibenik-Knin in the period from 30.08.1996 until 30.08.1998 (730 days), 657 wolf attacks to domestic animals were recorded, which averaged to 0.9 attacks per day. 1,807 head of livestock available to wolf fell victims or disappeared in such attacks. In the given counties, livestock had on average 2.5 head attacked at a time, or 2.3 head per day. Out of the total number of attacked livestock, 94% were sheep and goats. Given the average weight of a sheep or a goat (25 kg), as the main prey, this amounted to 57.5 kg of prey daily. Since a wolf needs on average 3.8 kg of biomass per day, this would have sufficed for 15.0 wolves. Since domestic animals make up approximately 84.4% of the wolf's diet, the remaining 15.6% being satisfied from other sources, in the given period there could have been 17.3 wolves in the two given counties.

If 17.3 wolves in the counties of Split-Dalmatia and Šibenik-Knin killed or harmed 1,807 livestock head within 2 years, in the counties of Zadar and Dubrovnik-Neretva there could have been another 2.9 wolves

(one pack), which would account for 302 livestock head. All of the above would total to 20.2 wolves in Dalmatia in the period mentioned.

Estimates of wolf population in Croatia based on local expert reports

Estimates of wolf population have been made for the land area of 16,131 km^2, or 92.3% of its area of distribution. According to estimates of local experts (certified by the former Ministry of Environmental Protection and Physical Planning), there were 173 wolves in this area in 1999. The reported wolf distribution density for separate areas ranged from 0.53 to 2.38 wolves/100 km^2, on average 1.3 wolves per 100 km^2 (Figure 16). Ten of the thirteen areas also show the population trends for the last five years. It was estimated that wolf population has been increasing in the five areas with total surface 8,327 km^2 (47.7% of their permanent area of occupancy). On 3,321 km^2 (19.0% of area) the number of wolves hasn't changed, and on 3,284 km^2 (18.8% of area) it has been decreasing in the period 1995 to 1999 (Table 4).

Table 4. *Population trends for wolves in Croatia in the period 1995 to 1999 according to local expert estimates (certified experts of the former Ministry of Environmental Protection and Physical Planning).*

Population trends	Surface area km^2	No. of areas
Upward	8,327	5
Unchanged	3,321	3
Downward	3,284	2
No data	1,199	3
Total	16,131	13

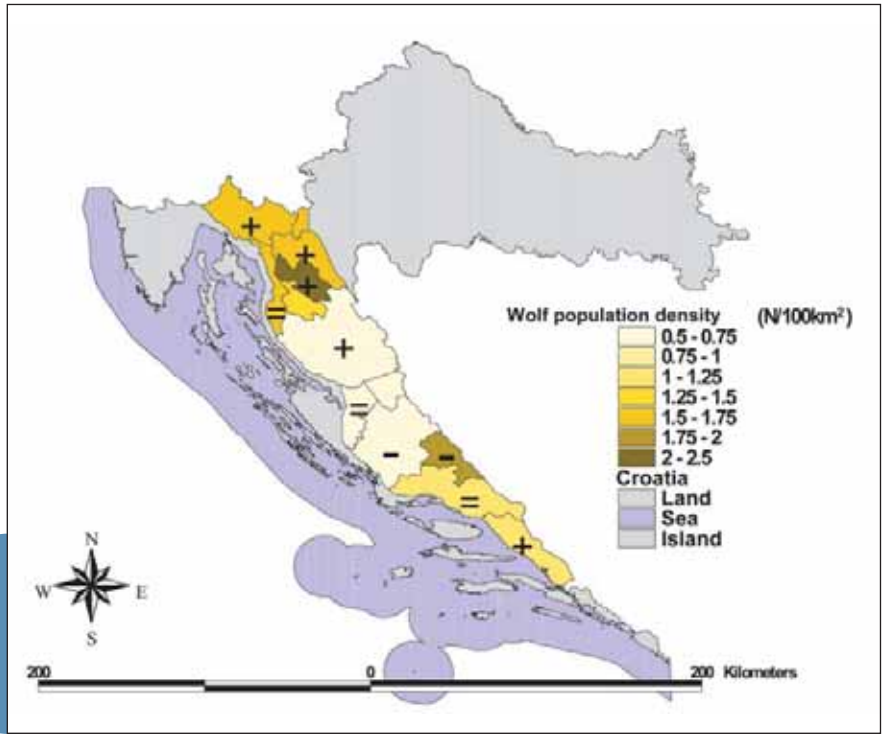


Figure 16. *Density of the wolf population in Croatia in 1999 and the trends in the 1995-1999 period based on local expert estimates (population trends: "+" upward; "–" downward; "=" unchanged).*

Estimates of wolf population in Croatia based on population density of the major species of natural prey

In the period 1998-2002, in hunting grounds in the area of Gorski kotar, Lika and Dalmatia there were several surveys undertaken to gather data on game. These have shown that the average density of wolf's prey is 169 head/100km^2. Compared to the data from Poland (Białowieża), such average density of prey might suggest that there could be 1.06 wolves per 100 km^2. This means that there could be 58.6 wolves on 5,525 km^2 of the land area for which data have been gathered (Table 5). Assuming that this density of prey persists in the entire territory of Gorski kotar and Lika where wolves are present (9,374 km^2), it could be possible that there are 99.3 wolves in the area.

Table 5. *Summarised data for 50 hunting grounds in Gorski kotar and Lika, with total surface area 5,525.71 km^2.*

Species	Km^2 registered	No.	No./100km^2	Share of the taxon (%)
Chamois	1,267	299	24	3.2
Wild boar	5,509	2,436	44	26.0
Deer	4,537	1,983	43	21.3
Fallow deer	122	59	48	0.6
Mouflon	422	302	72	3.2
Roe-deer	5,368	4,280	80	45.7
Total	5,526	9,359	169	100

Estimates of wolf population in Croatia based on available biomass of the main prey species

On the surface of 5,526 km^2 (parts of Gorski kotar and Lika) it has been estimated that there are 9,359 ungulate mammal individuals (Table 5). The total biomass of this quantity has been estimated at 306,930 kg. For the entire territory of Gorski kotar and Lika (9,374 km^2) this amounts to 521,781 kg. Annual biomass increment of 40% provides 208,712 kg available for wolves, lynx, hunters and poachers. The kill quota on 5,526 km^2 is 44,982 kg, while on 9,374 km^2 it amounts to 76,337 kg, same as estimated for poaching, while 19,006 kg get eaten by lynx. It is estimated that lynx consume 1,399 head of roe deer and that this totals 29.8 individuals. Lynx requires 1.75 kg/day = 19,006 kg/year. After all, 37,032 kg is left for wolves. If a wolf requires 3.8 kg/day, this could result in 26.7 wolves in Lika and Gorski kotar.

Overview of wolf populations throughout Croatia

1. Dalmatia - based on pack distribution areas and attacks on livestock: 60-80 wolves.
2. Dalmatia – based on biomass of slaughtered livestock: 20.2 wolves.
3. Lika and Gorski kotar – based on prey distribution density: 99.3 wolves.
4. Lika and Gorski kotar – based on prey biomass: 26.7 wolves.
5. Total Croatia, based on local expert assessments: 173 wolves.

In view of the above, it is estimated that Croatia harbours approximately 130 to 170 wolves. According to the IUCN criteria, wolves are included in the Red Book of Mammals in Croatia.

Telemetric research

Introductory remarks and basic knowledge

Telemetric research of wolves in Croatia have been done as follows:

1. Dalmatia (1998 – 2001) –3 wolves tracked
2. Gorski kotar (since 2001) - 6 wolves tracked
3. Lika (since 2003) – 1 wolf tracked

Figure 17.
Catching radio-signals of a wolf radio-collared
(Đ. Huber)

The method includes the capturing of live, healthy wolves and collaring them with installed transmitters that emit radio signals for two or three years. With the help of a guided antenna it is possible to get a signal at a distance of more than 10 km (unless blocked by a hill in between), and determine the source of the signal and status of the activity recorded. Measuring from several different positions, the researcher can define a wolf's location by triangulation method. Such tracking for at least one year can help in determining the territory of a pack to which the collared individual belongs. It can additionally define whether the pack had any young, the location of the lair, locations of diurnal rest and nocturnal activity, possible abandonment of the pack, and deaths. Determination of activities helps in learning about the complete 24-hour and seasonal activity rhythms. Traces in snow, genetic analysis of faeces, listening to the howling sounds or, rarely, observation of wolves, can define the number of wolves in a pack. Remains of the prey and analysis of faeces give insight into the wolf's diet in a certain area.

Figure 18.
Anja, a female wolf captured in the Dalmatian area on 23 August 1999 *(J. Kusak)*

Slika 19.
Pepa, a female wolf captured and radio-collared near Mačkovac, Lećevica, on 30 October 1998
(J. Kusak)

Satellite tracking is a state-of-the-art technology. The system works in the way that every few hours a link is established with at least 4 geostationary facilities and the carrier's location is determined within 20-meters. Approximately 1,000 times more data is obtained than through conventional telemetry.

Main results of the telemetric and other scientific research done so far are presented below.

Figure 20.
Ines, the first wolf captured in Gorski kotar at the foot of the Guslica hill on 21 June 2002 (J. Kusak)

Figure 21.
Berni, a wolf captured at Vučje Stine, Uble, in the Dalmatian area on 28 October 2000 (J. Kusak)

Figure 23.
Blaža, a female wolf captured in Gorski kotar on 23 October 2002 (J. Kusak)

Figure 22.
Hilda, a female wolf captured at the foot of the Šija hill in Gorski kotar on 2 July 2002 (J. Kusak)

Figure 25.
Mila, a female wolf captured on 11 September 2004 and GPS-GPM collared in Gorski kotar (J. Kusak)

Figure 24.
Felix, a pup of the female wolf Hilda captured in Gorski kotar on 25 August 2004 (J. Kusak)

Figure 26.
Tanja, a female wolf captured in Gorski kotar on 17 September 2004 (J. Kusak)

Figure 27.
Jelica, a female wolf captured in the area of Jelovac above Krasno in Lika on 25 November 2003 (G. Gužvica)

Dalmatia

Pack territory

Within 996 days of operation of radio-transmitters installed on wolves in Dalmatia, locations of the tracked individuals were determined 430 times.

The average smallest known territory size of the two tracked packs is 150.5 km^2. Comparing the spatial relation between the two neighbouring packs ("Opor" and "Vučevica"), there is partial overlapping on 16 km^2 (Figure 28). Overlap occurs on 11.3% of the entire territory of the "Opor" pack, and on 10% of the entire territory of the "Vučevica" pack. It needs to be noted also that the packs haven't been using the same area simultaneously. That part of the habitat was used by the "Opor" pack in 1998/1999, and taken over by the "Vučevica" pack in 1999-2001. In the summer of 2000, observations and attacks of livestock have shown the occurrence of a stray dogs pack in the central part of the territory formerly covered by the "Opor" pack.

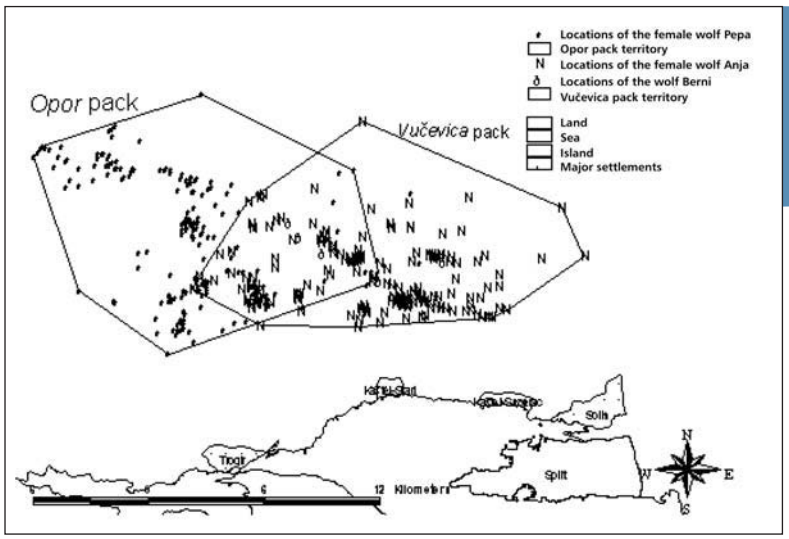


Figure 28. *Locations of the female wolves W1 (Pepa), W2 (Anja) and the wolf W3 (Berni); territory of the "Opor" pack in the period from 30.10.1998 to 21.12.1999; and territory of the "Vučevica" pack in the period 23.08.1999 to 22.07.2001.*

Habitat features and movement of wolves

Tracked wolves mostly dwelled in forests of early successional stage oak and oriental hornbeam or in degraded types of such forest (only hornbeam without oak). Regarding other "types" of vegetation, they often used thick spruce stands. Disregarding the cases of meadows, pastures and rocky grounds, vegetation thickness in locations of wolf finds averaged at 97.2%. Wolves dwelled on meadows, pastures and rocky grounds - which as such present poor shelters - at dusk, sunrise or during the night.

Comparing the distances from the nearest houses, roads and water wells, with randomly selected locations, it turned out that wolves choose places further away from houses but closer to water wells (N=100). The differences between the two were statistically significant (distance to house p=0.031; distance to water p=0.024; t-test).

Activities of the tracked wolves

The most commonly estimated wolf activity was resting or absence of movement (N=98, 52.9%), followed by movement (N=78; 42.2%). Other activities are significantly rare.

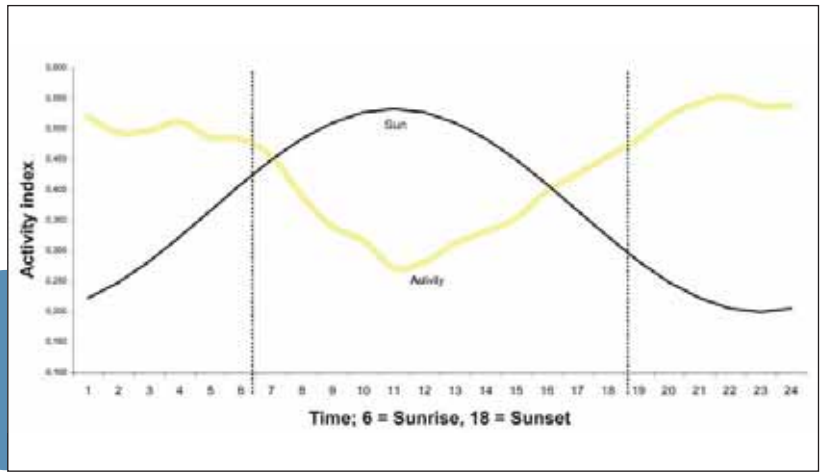


Figure 29. Total diurnal activity of both female wolves per intervals.

Gorski kotar

Pack territory

For the total of 279 days of tracking wolves in Gorski kotar (21.06.2002 to 27.03.2003), locations of wolves were determined 138 times. Further tracking was impossible, since the female-wolf Ines was killed by other wolves on the 177th day after collaring. The female-wolf Blaža was found shot on the 41st day after collaring,

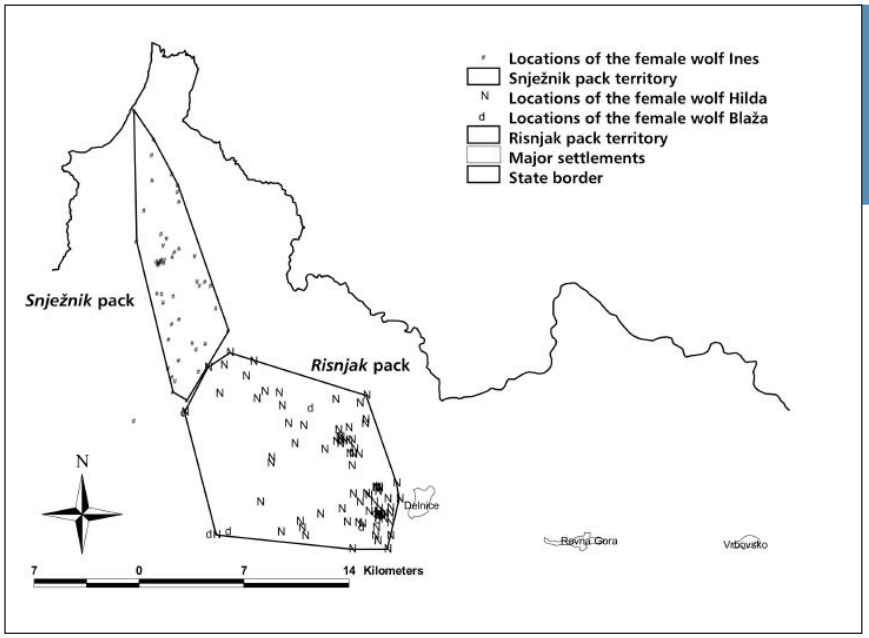


Figure 30. Locations of the female wolves W4 (Ines), W5 (Hilda) and W6 (Blaža); territory of the "Snježnik" pack in the period 21.06.2002 to 15.12.2002; and territory of the "Risnjak" pack in the period 02.07.2002 to 27.03.2003.

while the female-wolf Hilda abandoned the pack 268 days after collaring. Therefore the results obtained are not the real territories of the packs; however their partial territories amounted to 59.3 km^2 and 140.5 km^2 (Figure 30).

Activities of the tracked wolves

The first results show that wolves in Gorski kotar, as opposed to those in Dalmatia, could exhibit high activity during the day. Telemetry has recorded movement of the "Risnjak" pack during the day, and a video camera recorded the rare sight of an uncollared wolf from the pack walking the forest road.

Genetic research of wolves in Gorski kotar

Collection of the samples of fresh wolf faeces for genetic research purposes started in 2002. The first results fit in and complement the telemetric data. Genetic analyses have confirmed that a considerable number of wolves haven't managed to survive the winter of 2002/2003, or have abandoned the pack territory, especially the ″Snježnik″ pack. During the summer of 2002, samples of faeces have been collected over all

Figure 31.
Wolf's faeces
(Đ. Huber)

area of 123 km^2, and the corresponding analysis has determined the existence of eight different wolves in this territory. Layering of this map with the maps of the territories of the tracked packs has lead to a conclusion that six wolves belonged to the ″Risnjak″ pack (individuals 3, 4, 5, 6, 7 and 8), and the remaining two to the ″Snježnik″ pack (individuals 1 and 2), in addittion that the lowest number of wolves in these packs were in the summer 2002. It is possible that some other individuals haven't been found yet, because the number of faeces samples was relatively small. At the end of winter only four more wolves from the ″Risnjak″ pack were still alive (according to the tracks in snow). This means that, besides Blaža, at least one more wolf from the pack had disappeared (killed or left the pack) during the winter of 2002/2003.

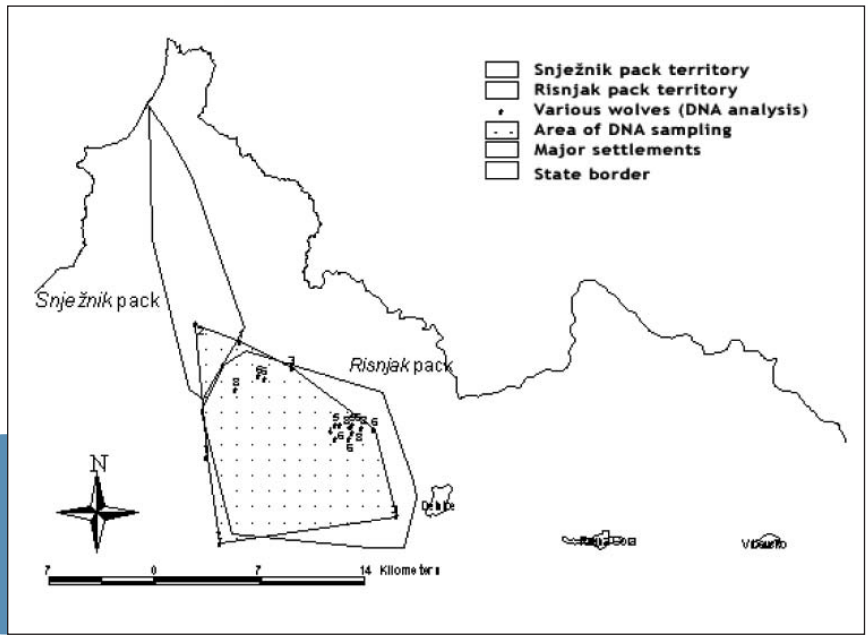


Figure 32. *Relation between the positions of genetically determined wolf individuals and the territories of telemetrically tracked wolves in Gorski kotar in 2000.*

Lika

In August 2003, the research of wolves was initiated in the territory of Lika, oriented towards the region of Kuterevo, Krasna and Kosinj, and the northern slopes of Velebit. On November 25, a young female wolf (W7, Jelica), seven months old, was captured in the territory of Jelovac above Krasno. It received a collar, which enabled satellite tracking of the animal. The female wolf was in good health and weighed 18 kilos. Basic physical measurements were made, a registration mark tattooed on its earlobe, and blood and hair samples taken for laboratory testing. Upon releasing the collared female, the subsequent intensive monitoring confirmed that she had joined the pack on the fourth day after release. During the first 10 days, the collar monitored through GPS its geographical location on the hour, and after that 4 locations a day (every 6 hours). On 13.12. 2003 a link with the collar was established, and 202 pieces of data on its geographical location and 5,200 pieces of data on its activities in the period 25 November to 13 December 2003 were obtained. It was confirmed that the pack to which the collared female belonged had been moving in the range of 156 km^2 during that period. After that, the female was tracked by classical telemetry, and six more positions located within the formerly confirmed territory of this pack's movement were determined.

Wolf mortality

In the period from 1986 until the end of 2003, 108 deaths of wolves were registered in Croatia, which on average amounts to 6.4 per year. The upward trend in wolf deaths was quite pronounced in the period 1990 to 2000 (Figure 34), out of which 33 (35.9%) carcasses or partial carcasses were found and used for research purposes. As to the causes of death, in 8 cases (12.5%) wolves have by natural causes; in 5 (4.6%)

cases they fell victims to rabies; in one (1.0%) it was leishmaniasis; while in 2 cases (1.9%) the wolf was killed by other wolves. For 6 (5.6%) dead wolves the death cause is unknown, while the remaining 94 (87.0%) died by human intervention. The majority of the latter - 62 (57.4%) were shot; 30 (27.8%) of them were killed in traffic (Figure 33). Sex has been determined in 50 cases. There were 28 (56%) females and 22

Figure 33. *A female wolf killed on a road in the area of Prgomet in Dalmatinska zagora (J. Kusak)*

(44%) males. Age of individuals, estimated in 36 cases, ranged from 0.3 to 6.0 years, with the average age 1.9 years (median = 2). For the remaining 38 dead wolves, weight ranged from 7 to 47 kg, with 28.4 kg on average. The lowest wolf mortality rate in Croatia was recorded in late 1980s and early 1990s. In 1987 and 1989 there were no recorded deaths, and in 1988 and 1990 only one record of a dead wolf. Since 1990, wolf deaths started increasing, up to the maximum count of 16 dead wolves in 1999 (Figure 34). Frković et al (1988) documented the average annual mortality rate of wolves in Gorski kotar in the period 1945-1986 as 13 individuals (range = 13-27). These data were merged with the recent ones (mortality until 2001, Figure 36). It can be assumed that the number of dead wolves reflects the trend of wolf population in Croatia in general, as well as the intensity of wolf tracking. In the period before its legal protection the death tolls varied, indicating changes in the population size, which was occurring regardless of the kill quotas, probably following the changes in the prey populations.

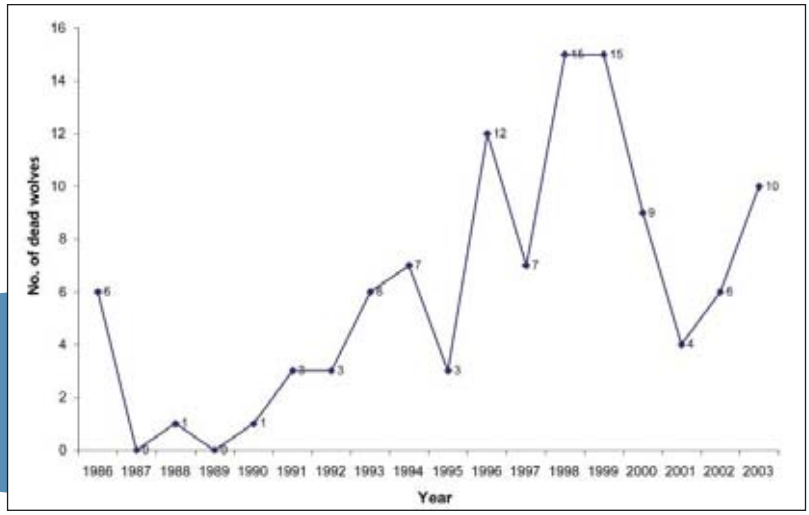


Figure 34. *Number of wolves killed in Croatia, annually since 1986.*

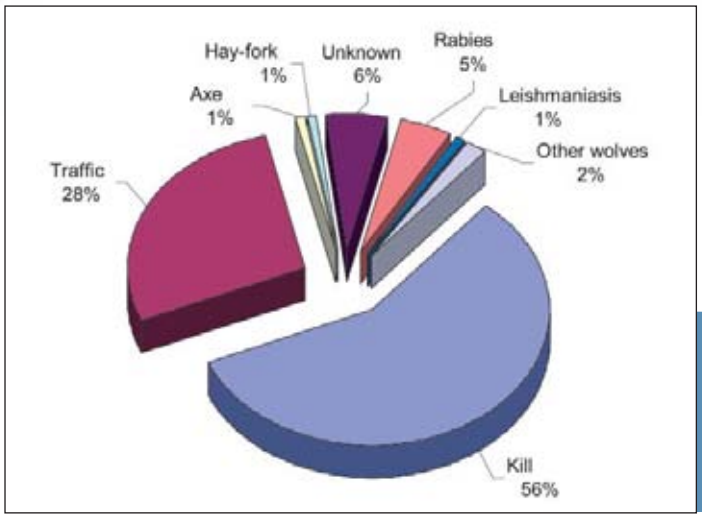


Figure 35. *Causes of wolf deaths since 1986.*

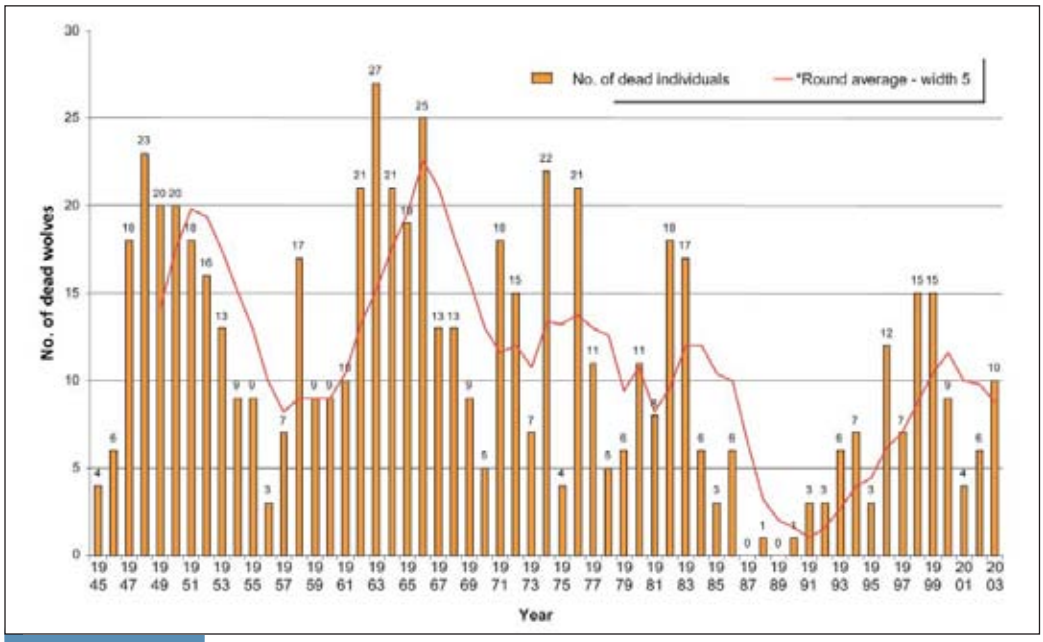


Figure 36. *Wolf mortality in Croatia since 1945. Source of data until 1986: Frković et al. (1992). The red line presents the trend, shown as a round average, width 5.*

Habitats

The entire land surface of Croatia (53,160 km^2) is divided into three macro regions (simple division, see: Rogić 1961). Size of the Pannonian macro region is 30,734 km^2, the alpine macro region covers 8,558 km^2, and the Mediterranean macro region - 13,868 km^2. Habitat variable values (minimum, maximum, average) are shown in the Table 6 below.

Table 6. Values of wolf habitat variables for three macro regions of Croatia.

Habitat variable	Pannonian macro region			Alpine macro region			Mediterranean macro region		
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
Altitude (m)	79.6	1,178.0	197.9	194.2	1,604.0	834.2	0.0	1,548.2	366.5
Forest cover (%)	0.0	100.0	29.9	0.0	100.0	61.1	0.0	100.0	27.2
Road density (km/km^2)	0.00	3.23	0.52	0.00	1.77	0.53	0.00	2.23	0.45
Population density (n/km^2)	0.0	*19,646	87.1	0.0	325.1	16.1	0.0	5,584	66.0
No. of species of even-toed wild mammals (n)	2	3	2.02	3.0	3.0	3.0	1.0	1.0	1.0
Sheep density (n/km^2)	0.0	58.6	4.0	0.0	89.4	8.9	0.0	322.7	18.9
Bovine livestock density (n/km^2)	0.0	82.8	11.8	0.0	29.7	3.9	0.0	23.4	2.2

** City of Zagreb – high value is due to grouping of all values into one reference point*

Average altitudes are the lowest in the Pannonian macro region, and the highest in the alpine macro region, although each macro region displays altitudes above 1,000 m.

Forest cover

Concerning the forest cover of 17.9% of the Pannonian macro region, wolf habitation is possible on 5,508 km^2. The alpine macro region is forest-covered on 5,654 km^2 (66.1%) that are suitable for wolf. The forest cover in the Mediterranean macro region can accommodate wolf on 3,310 km^2 (23.9%).

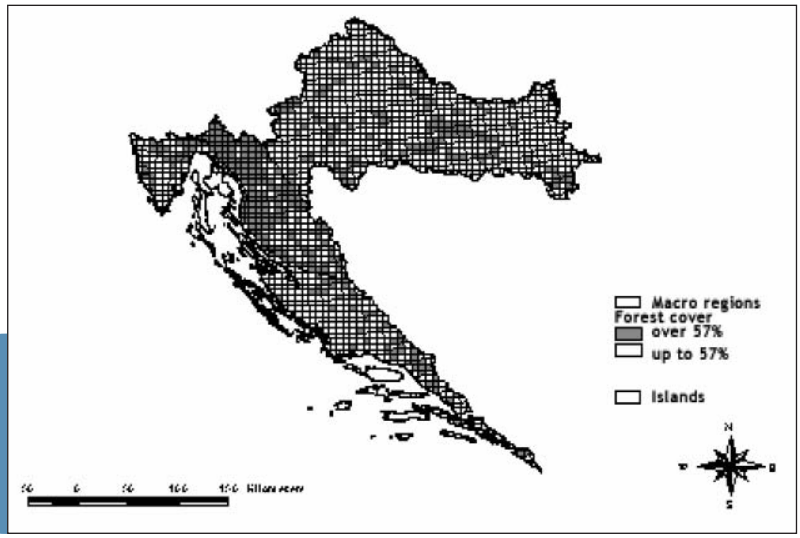


Figure 37. *Share of areas suitable for wolf regarding the forest cover exceeding 57% in inland Croatia.*

Road network

The most dense road network section in the Pannonian macro region is 3.23 km/km2 (Table 6).

Suitability of the region for the wolf regarding road density (up to 0.5 km/ km2) is high on 12,199 km2 (39.7%) the areas, mainly in the eastern part. The alpine macro region displays moderate road density on 3,619 km2 (42.3%). The majority of appropriate areas are in Lika, while Gorski kotar displays higher road density (Figure 38). The Mediterranean macro region has moderate road density of 5,751 km2 (41.5%). There are many reasons why roads and other large obstacles in the wolf habitat significantly reduce the habitat capacity to sustain their survival.

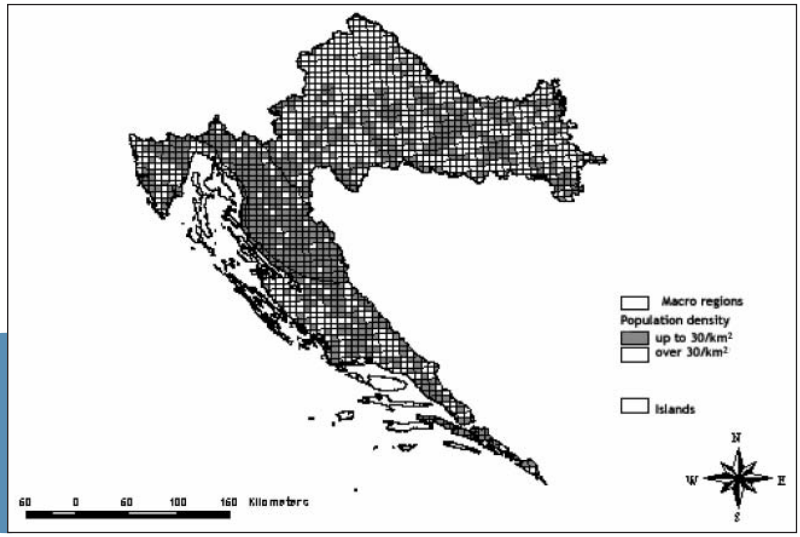


Figure 38. *Share of areas adequate for the existence of wolves viewing the road density (up to 0.5 km/km²) in the mainland part of Croatia*

The wolf lives, hunts and rears its young in packs, which are family groupings consisting of a reproductive pair, the young and their elder siblings from an earlier litter. The pack has its territory, which they need to actively defend against neighbouring wolf packs, and have it large enough to enable members of the pack to hunt enough prey for themselves and for their litter. The litter requires additional room for the lair, which should be calm and easily accessible to wolf's hunting grounds. Introduction of obstacles into the territory of a pack may disable survival of the entire group, as it decreases the territory size, prevents access to certain hunting grounds and compromises the calm of the lair. Too small a territory will not provide enough food to rear the young, and the entire group might be destroyed. In the meantime, more damage to domestic animals can be expected, due to inaccessibility of the natural prey. Restricted movement and other changes in habitats due to the construction of roads affect the biology and size of populations of the wolf's natural prey (mainly even-toed mammals), as well as its own population.

Roads, especially motorways, create the most common obstacles in habitats. They affect wolf living conditions in a number of ways: restricting the size of pack territories, restricting the size of population of natural prey and access of wolves to that prey, general disturbance, and wolf mortality. In the period from 1945 to 1995 at least 20 wolves have been killed in traffic. Approximately 300 km of motorways is currently under construction or in operation within wolf habitats in Croatia, namely sections Karlovac-Rijeka and

Bosiljevo-Split, and the planned extension to Dubrovnik. The environmental impact assessment studies for the section between Dugopolje and Ploče are prepared. They foreseen 2-3 green bridges and certain number of viaducts.

For example, the motorway route Bosiljevo-Split for the most part, on at least 200 km length, passes through wolf habitat, so it can be expected to interfere with the territories of approximately 15 wolf packs. Assuming that in Croatia the average number of wolves in a pack is no more than 6, this leads to a conclusion that approximately 90 wolves, i.e. over 50% of the population in Croatia, is under the influence of road construction. Theoretically, loss of such a large part of the population could lead to its extinction. Therefore crossing of the roads should be made possible in all critical spots. Places where wolves and other animals can cross over a motorway are areas above tunnels, under viaducts, and across specially constructed green bridges. Each such structure must be large enough for the animals to feel safe while crossing to the other side. As a rule, only structures opening up over 100 m wide corridors are usable as non-selective passages for all animal species, including wolves.

An example of a specially constructed crossing on the motorway through Gorski kotar is a green bridge (100 m wide) on Dedin near Delnice. Since May 1999 we have been examining the use of this Dedin bridge by using infrared (IC) sensors for recording animal movement. IC rays have been placed at the height of 40 cm so smaller animals (up to the size of a fox, hare or a badger) would go unregistered. The recorder has a memory to allow for 1,000 IC ray interruptions, and records the day and time of each such occurrence. A total of 11,620 IC ray interruptions have been recorded during 792 days of active operation of the monitors (Table 7). Traces on the ground were recorded during 64 site visits. Number of passages of a species has been calculated out of the total number of passages recorded, according to the percentage of traces found.

Shown at the annual scale (365 days), there is an estimated 5,396 passages or an average of 14.8 per day. At the same time 529 animal traces on the ground were recorded, out of which 395 belonged to animal species higher than 40 cm. Share of the wolf is 1%, therefore estimates of the number of passages would be 55 in one year.

Motorway Bosiljevo-Split has 5 green bridges.

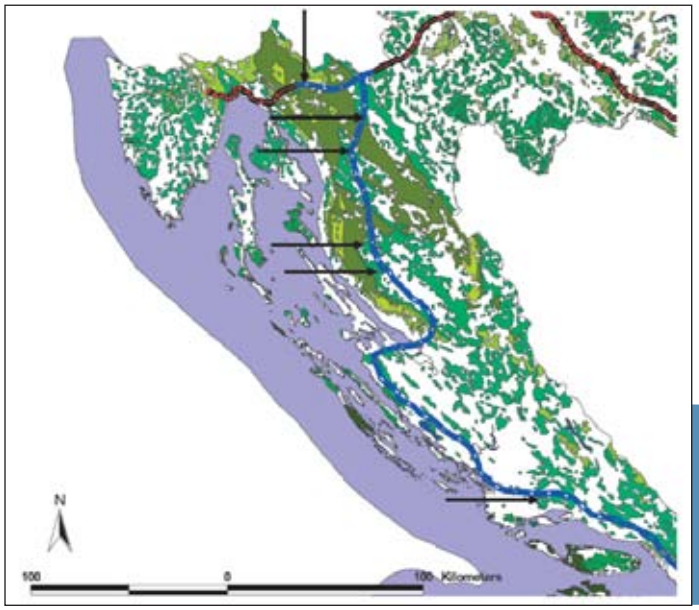


Figure 39.
Green bridges of Croatia

Table 7. Results of monitoring of the passage of animals over the green bridge on Dedin near Delnice.

Species	No. of traces found	Percentage	Estimated total no. of passages	Estimated daily no. of passages	Estimated annual no. of passages
Roe-deer	166	42.0	4,881	6.2	2,263
Deer	103	26.1	3,033	3.8	1,387
Wild boar	66	16.7	1,941	2.5	913
Bear	39	9.9	1,150	1.5	548
Wolf	4	1.0	116	0.15	55
Man	16	4.1	476	0.6	219
Lynx	1	0.2	23	0.03	11
Total	395	100.0	11,620	14.78	5,396

Figure 40.
The Osmanovac green bridge on the Zagreb-Split motorway - Prgomet-Dugopolje section, constructed due to the presence of wolves
(J. Kusak)

Population

According to the data of the National Bureau of Statistics for 1991, population density is highest in the Pannonian macro region (87.1/km^2), and lowest in the alpine macro region (16.1/km^2) (Table 6). The local population isn't equally distributed across the area, but rather concentrated in several towns and by the coast.

On 11,949 km^2 (38.9%) of the Pannonian macro region the human population density allows for the coexistence of wolves, mainly in the areas of Posavina and western Slavonia. The major part of the alpine macro region - 7,442 km^2 (87.0%) is a favourable habitat for wolves due to the low density of human habitation. In light of the human habitation density, the Mediterranean macro region enables wolf presence on the surface of 7,739 km^2 (55.8%) (Figure 41).

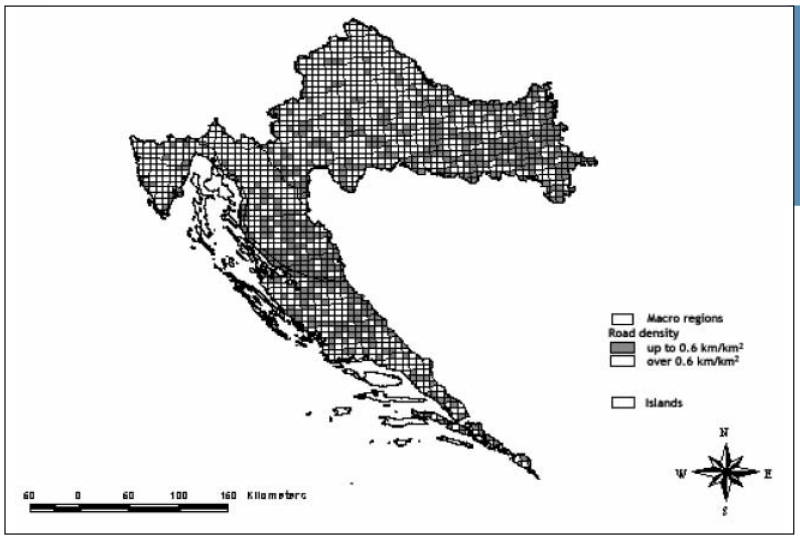


Figure 41. *Share of areas suitable for wolf regarding road density (up to 0.5 km/km²) in inland Croatia.*

Wolf's diet

The main source of food for wolves are even-toed mammals (roe deer, red deer, wild boar) and smaller mammals, like rabbit and other rodents. In areas with developed extensive livestock breeding they eat livestock as well, which is simpler to hunt than game, unless guarded. However, such actions may cause significant damage.

The research focused on the feeding habits of wolves in Gorski kotar and Dalmatinska zagora (County of Split-Dalmatia) (D. Pavlović, J.Kusak and Đ. Huber). For that purpose in the period 1999-2002 there were 147 samples of faeces and 10 stomach contents collected. Frequency of appearance (%) of certain categories of findings and animal species has been established for each separate region. In the territory of Dalmatinska zagora domestic animals make up the major part of the wolf's diet (73.4%). A large share (22%) of bovine livestock in the food of wolves in Dalmatinska zagora suggests that wolves feed at slaughterhouse waste disposal sites, where such livestock is the most common carcass type. Since a relatively large share of canine hairs (32. 6%) could have been predominantly caused by licking their own body, this hasn't been

Figure 42.
In the Dalmatian area the wolf feeds mainly on livestock (A. Štrbenac)

Figure 43.
Roe deer and red deer are the main prey of wolves in the area of Gorski kotar (A. Frković)

included in the calculations. Goat hair is found in wolf faeces (36%) more often than accounted for in the damage compensation requests. The reason for this is the fact that goat's diet involves underbrush, where it's more difficult to guard it and easier for the wolf to get closer. Also, wolf can eat up the entire goat more often than an entire sheep, because in the latter humans disturb them. In Gorski kotar the main prey includes even-toed mammals (red deer, roe deer, wild boar), which account for 84.21% of the wolf's diet.

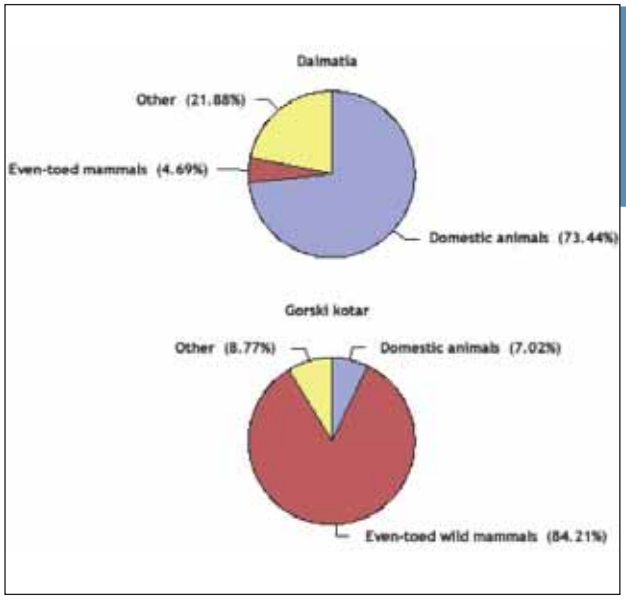


Figure 44. *Frequency of traces of various animals in wolf faeces in Croatia*

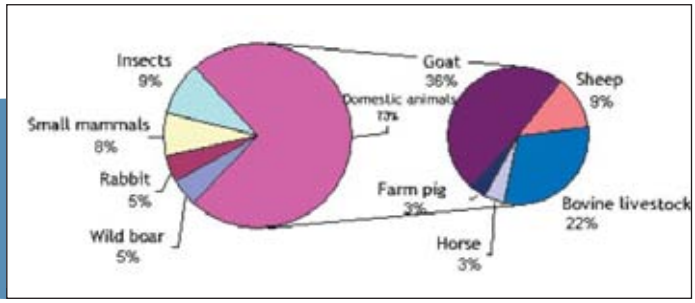


Figure 45. *Frequency of various animal species remains in wolf faeces in Dalmatinska zagora.*

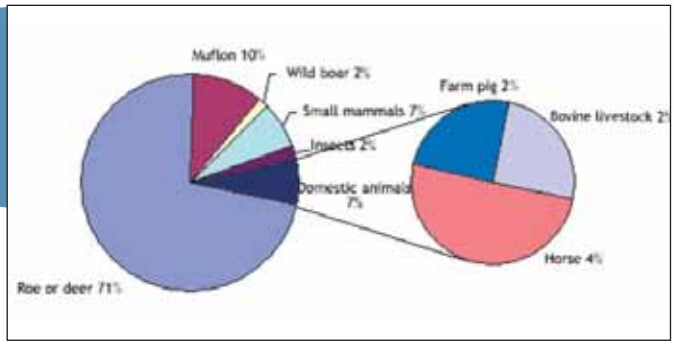


Figure 46. Frequency of various animal species remains in wolf faeces in Gorski kotar.

Game

In forest habitats of the Pannonian macro region, the main types of prey include roe deer and wild boar, also red deer in larger forests. The alpine macro region in its entirety supports roe deer, wild boar and red deer, and in southern habitats of Velebit (transition area towards the Mediterranean macro region) there are populations of chamois and mouflon. The Mediterranean macro region for its larger part supports only wild boar, although chamois can be found on Biokovo. Only the areas supporting three or more even-toed mammal species can be considered suitable for wolf.

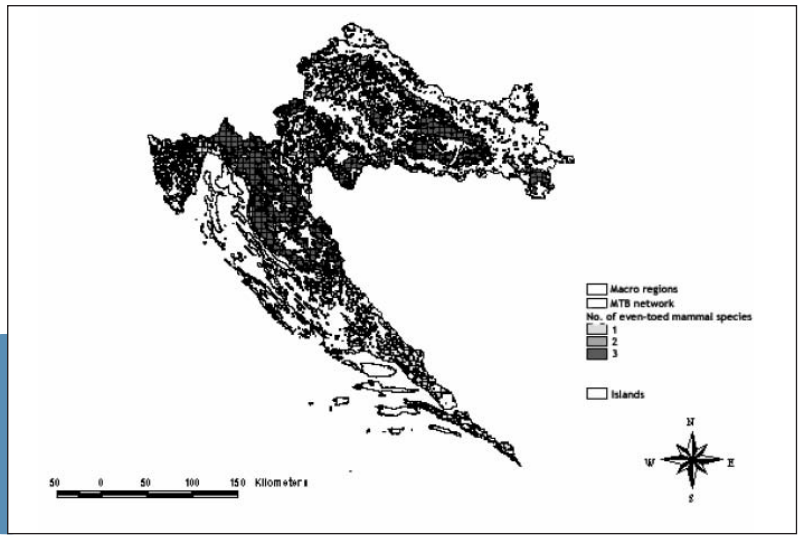


Figure 47. Number of even-toed wild mammals in coastal Croatia

Livestock

The most complete data on livestock can be found at the Croatian Livestock Selection Centre (CLSC). The data do not reflect the true state of affairs however, since they include only the livestock registered at CLSC, and this is based on the information from the requests for state subsidies. Rough estimates say that it shows approximately 80 % of the actual situation in the field, and in some areas even less.

Sheep

According to CLSC data for 2003, based on requests for state subsidies, the largest part of registered sheep has been recorded in the counties where wolf normally dwells. In 2003 the most heads were recorded in the counties of Zadar (83,304), Šibenik–Knin (61,957), Lika-Senj (50,330), Split–Dalmatia (43,532) and Primorje-Gorski kotar (40,372). The numbers are significantly lower in other two counties: Karlovac – 12,968, and Dubrovnik–Neretva – 2,522 head.

Following the trends in the sheep population, a large increase of registered sheep farmers occurred in Croatia in the period 1997-2003; from 254 people in 1997 to 8,207 of them in 2003 (32 times increase). This increased the overall quantity of registered head: from 20,354 head in 1997 up to 440,430 in 2004 (even 20 times more).

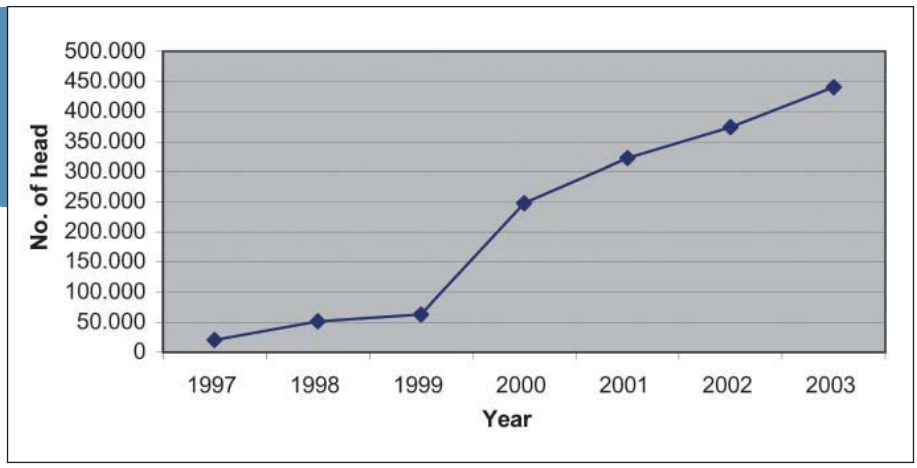


Figure 48.
Population trends for registered sheep head since 1997

Among the 6 counties inhabited by wolf, the largest increase in the number of owned sheep was recorded in the County of Šibenik–Knin - as much as 35 times. It must be stressed that this increase is closely connected with introduction of registration for state subsidies.

The sheep population per km^2 according to the data of the National Bureau of Statistics from the early 1990s was lowest in the Pannonian macro region (4.0 km^2), and highest in the Mediterranean macro region (18.9 km^2), largely in Dalmatia (Zadar, Šibenik-Knin and Split-Dalmatia counties). Istria and southern parts of Dalmatia keep sheep in lower quantities.

According to the model developed by Dupré et al. (1995), only the areas where sheep population is lower than 16/km^2 are suitable for wolves to dwell. Therefore 28,452 km^2 (92.6%) of the Pannonian, 6,397 km^2 (74.7%) of the alpine, and 9,132 km2 (65.8%) are suitable for wolves. Areas unsuitable for wolf regarding the number of sheep are the counties of Zadar, Šibenik-Knin and Split-Dalmatia (Figure 49).

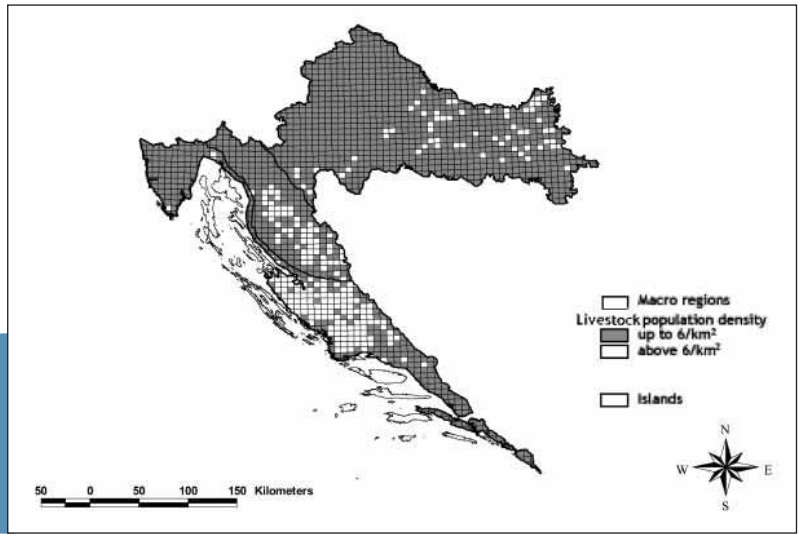


Figure 49. *Share of areas suitable for wolf regarding sheep population (up to 16/km²) in coastal Croatia.*

Goat

If we were to follow the trend of the registered goat population in the period 1997-2003, an increase would be noticed, although not as big as it was with the sheep (Figure 50). It is interesting that a sudden increase of the number of registered breeders has occurred in the period between 1997 and 2000 (from 236 to 3,912), only to stabilise 1,281 breeders.

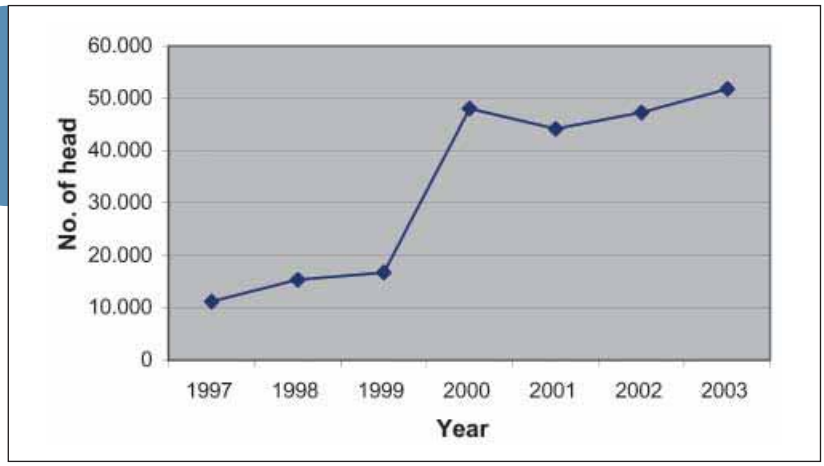


Figure 50. *Trends in the number of registered goats in the period from 1997 to 2003*

Same as with the sheep, the highest number of goats were documented in 2003 in the counties of Zadar (221), Split–Dalmatia (159) and Šibenik–Knin (128). In relation to 1997, the number has increased 6 fold in the Zadar County.

According to the data on the number of goats and percentage of damage done by the wolf, goats fall victim more often than it would be expected given the total population of domestic animals in the areas of wolf range.

Bovine livestock

The bovine livestock population subject to selection is around 250,000 head according to data for 1991-2002, and this is quite a stable amount. In contrast to sheep and goat, the number of livestock is highest in Pannonian, and lowest in the Mediterranean macro region, i.e. in the areas of wolf distribution. Livestock population is highest in the north-western Pannonian macro region, as it is kept in sheds and thus out of the possible range of wolf attacks.

Population of livestock in the Pannonian macro region on the territory of 10,330 km^2 (33.6%) allows for wolf presence, with a density of over 6 head per km^2 in 20,404 km^2 (66.4). However, even there the life of wolves would be impossible because livestock is mostly kept in sheds. As concerns livestock, the alpine macro region enables wolf habitation on 6,118 km^2 (69.1%). Life of wolves is possible on 11,357 km^2 (81.9%) of the Mediterranean macro region (Figure 51).

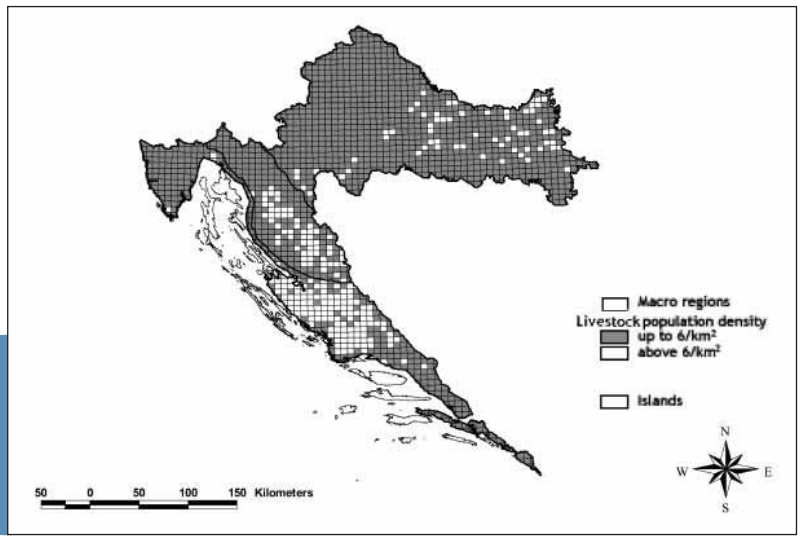


Figure 51. *Share of areas suitable for wolf regarding livestock population (up to 6/km^2) in coastal Croatia.*

Key issues affecting wolf conservation

Economic Considerations

Human impact on wolf population

Direct human influence on wolves

As shown in the chapter on wolf mortality, according to available data the main cause of wolf deaths are humans. Average annual wolf mortality rate is 10, which includes only those individuals where carcasses have been found and analysed (mainly wolves killed in traffic).

Illegal killing of wolves is also pronouncedly present; however the real figures are unknown. So far no perpetrators were appropriately charged. For instance, all collared wolves in the territory of Dalmatia have been shot. Also shot was one of the three collared wolves in the territory of Gorski kotar.

Further, in the territory of Dalmatinska zagora people use poisonous baits as a method of wolf elimination, which often kill some other, "non-targeted", animals.

Human influence on the natural prey and habitats

Humans influence the even-toed mammal populations through legal and illegal kills. According to the data provided by the National Bureau of Statistics, 51,787 hunters were registered in Croatia in 2003. For the sake of illustration, in the area between the rivers of Zrmanja and Cetina, where biggest damage to livestock has been recorded, there are approximately 8,000 registered hunters and still large quantities of various firearms remaining in private possession after the war.

Neither the planned legal kill, nor other aspects of game management take proper consideration of predator presence. Illegal kills exists, but it is hard to point out the real data. This is largely contributed by inefficiency of relevant inspection services that are in charge of sanctioning the illegal kill.

Figure 52.
The wolf killed by poaching
(J. Kusak)

Data on the planned and performed legal kills are submitted to the Ministry of Agriculture, Forestry and Water Management and to the competent county authority. The National Bureau of Statistics receives data on game per counties, but the data are not reliable for many reasons. For example the hunting year and the calendar year do not match in scope - according to hunting management documents, this data are managed according to hunting years, while the National Bureau of Statistics collects and processes data on a calendar year basis. In any case, it is evident that the available data are not systematised or unified, and there is no real picture on the status of game in Croatia that could form a basis for planning and monitoring of game management at the national level.

In the past few years, Croatia has intensified its national roads network construction. The inevitable negative impact of this will be somewhat reduced by the existence of a certain number of tunnels and crossings, and especially by the construction of green bridges on critical spots (6 of them in wolf habitats). Special guidelines were developed to help the road designers "Animals crossing the road (Proposal of Designing Guidelines)" (Huber et al. 2002).

Figure 53.
Man affects indirectly the wolf population by shooting his natural prey (A. Frković)

Slika 54.
The construction of roads often causes interruption of animal migration routes
(A. Štrbenac)

Impact of wolves on domestic animals

Efficient protection has also been made difficult by various problematic issues related to livestock breeders, which often complain about damage to livestock done by wolf. In the framework of the LIFE project an analysis was made in order to get a clearer picture of the status and trends in livestock breeding and the actual impact of wolf on livestock. The Croatian Livestock Selection Centre generously assisted in the collection of data on the populations of registered livestock in Croatia for 2002 and 2003. The State Institute for Nature Protection maintains a database of damages to livestock by wolf, made on the basis of damage inspection reports.

As analyses have shown, the biggest damage on livestock has been recorded in the territory of Dalmatia, where due to the lack of natural prey, the wolf feeds mostly on domestic animals. At the same time, in this area the culture of livestock guarding has been abandoned, unlike for instance in the area of Lika. Another aggravating circumstance is the heavy war aftermath, because of which a large number of households were reduced to elderly people, incapable of livestock guarding. Only in the post-war period the development of modern, large farms with organised livestock breeding began, bringing along an improved livestock guarding culture.

Slika 55.
The wolf causes damage to livestock
(A. Štrbenac)

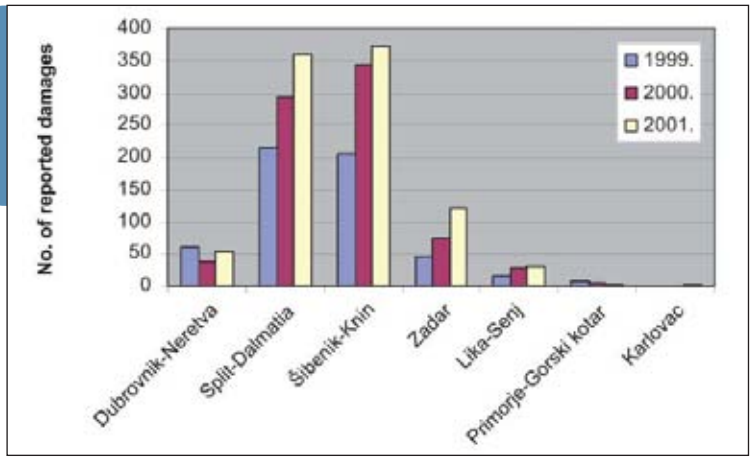
Analysis of requests for the compensation of damage done by protected animal species

In the period from 1999 to 2001 a total of 2,267 requests for compensation for damage done by protected animal species was received and analysed (Table 8, Figure 56). Most damages were reported in the counties of Šibenik–Knin and Split-Dalmatia, and the least reported in the County of Karlovac.

Table 8. *Number of reported damages done on livestock per counties, in the period 1999-2001*

County	1999	2000	2001
1. Dubrovnik-Neretva	61	38	52
2. Split-Dalmatia	215	294	359
3. Šibenik-Knin	204	344	371
4. Zadar	45	73	122
5. Lika-Senj	15	27	31
6. Primorje-Gorski kotar	8	4	2
7. Karlovac	0	0	2
Total	**548**	**780**	**939**

Figure 56. *Number of reported damages per counties in 1999, 2000 and 2001*



In the same period, granted compensation payments ranged from HRK 690,576.00 in 1999 to HRK 1,254,575.00 in 2001 (Table 9, Figure 57) - 1 EUR ~ 7,5 HRK.

Table 9. *Total amount granted for compensations in the period 1999-2001*

County	1999	2000	2001
1. Dubrovnik-Neretva	74,625.00	58,170.00	93,420.00
2. Split-Dalmatia	325,545.00	481,110.00	516,456.00
3. Šibenik-Knin	184,100.00	371,225.00	422,190.00
4. Zadar	60,910.00	153,800.00	183,849.00
5. Lika-Senj	22,150.00	35,030.00	30,660.00
6. Primorje-Gorski kotar	23,246.00	8,350.00	700.00
7. Karlovac	0,00	0.00	7,300.00
Total	**690,576.00**	**1,107,685.00**	**1,254,575.00**

It is clearly seen from the data that the greatest number of reports has come from the counties of Šibenik-Knin and Split-Dalmatia (79%), and that the number of reported damage in the year 2000 increased by 232 (42%) with regard to the year 1999, and by 159 in 2001 (20%) with regard to 2000.

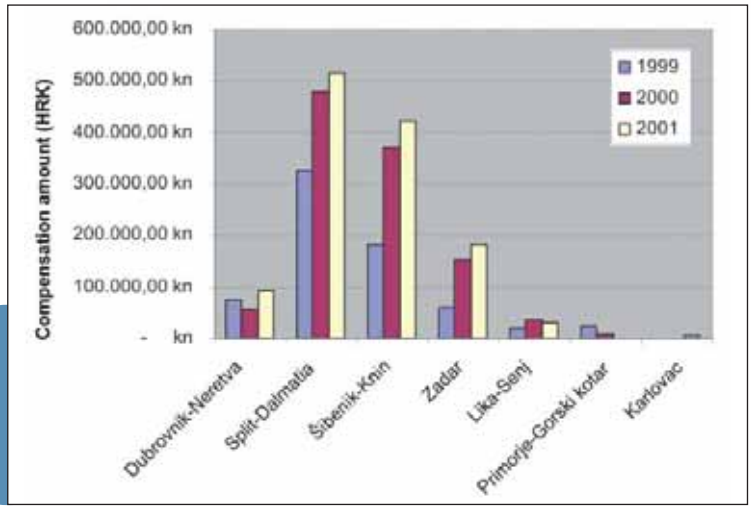


Figure 57. *Total financial value of compensations per counties from 1999 to 2001.*

Since inspections are done whenever there is a doubt that damage was done by a protected animal (wolf or lynx), the number of inspections doesn't necessarily mean the number of damages done by wolf. Moreover, it has been estimated in 2067 (91.2%) cases of all the reported damage that wolf was the perpetrator of the damage, lynx in 7 (0.3%) cases, bear in 5 (0.2%), jackal in 21 (1%) and dog in 28 (1.2%) cases. In 139 (6.1%) cases, estimate was insecure or was not stated (Tables 10, 11 and 12, Figure 58).

Table 10. *Distribution of reported damage done to livestock according to the estimated predator type, per counties in 1999*

1999	Wolf	Lynx	Bear	Jackal	Dog	Unknown	Total
1. Dubrovnik-Neretva	50	0	0	0	3	8	61
2. Split-Dalmatia	202	0	0	0	6	7	215
3. Šibenik-Knin	178	0	0	10	4	12	204
4. Zadar	43	0	0	0	0	2	45
5. Lika-Senj	11	2	1	0	1	0	15
6. Primorje-Gorski kotar	8	0	0	0	0	0	8
7. Karlovac	0	0	0	0	0	0	0
Total	**492**	**2**	**1**	**10**	**14**	**29**	548

Table 11. *Distribution of reported damage done to livestock according to estimated predator type, per counties in 2000*

2000	Wolf	Lynx	Bear	Jackal	Dog	Unknown	Total
1. Dubrovnik-Neretva	36	0	0	0	0	1	37
2. Split-Dalmatia	274	0	0	0	4	15	293
3. Šibenik-Knin	311	0	0	2	2	28	343
4. Zadar	73	0	0	0	0	1	74
5. Lika-Senj	26	1	1	0	1	0	29
6. Primorje-Gorski kotar	4	0	0	0	0	0	4
7. Karlovac	0	0	0	0	0	0	0
Total	**724**	**1**	**1**	**2**	**7**	**45**	780

Table 12. Distribution of reported damage done to livestock according to estimated predator type, per counties in 2001

2001	Wolf	Lynx	Bear	Jackal	Dog	Unknown	Total
1. Dubrovnik-Neretva	52	0	0	0	0	0	52
2. Split-Dalmatia	326	0	0	0	6	27	359
3. Šibenik-Knin	335	0	1	9	1	25	371
4. Zadar	109	0	0	0	0	13	122
5. Lika-Senj	26	4	1	0	0	0	31
6. Primorje-Gorski kotar	1	0	1	0	0	0	2
7. Karlovac	2	0	0	0	0	0	2
Total	851	4	3	9	7	65	939

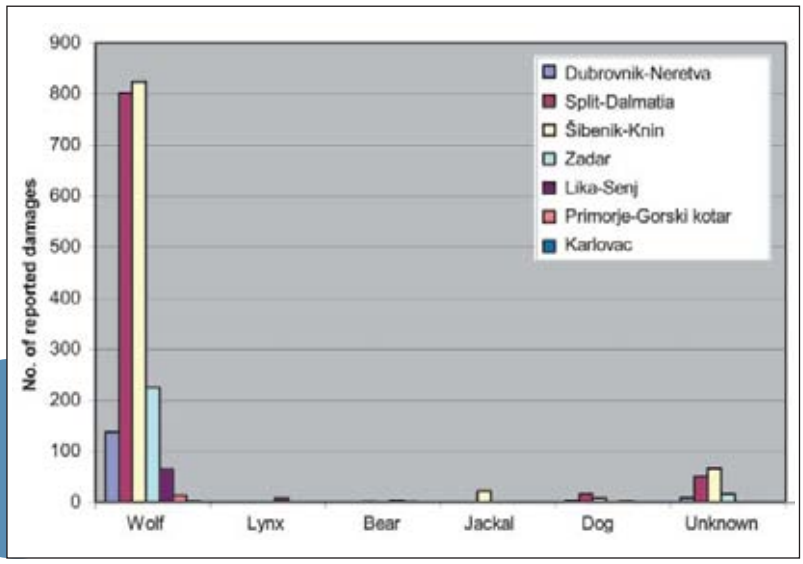


***Figure 58.** 1999-2001 summary overview of distribution of reported damage done to livestock according to estimated predator type, per counties*

Wolves attack a variety of domestic animals – horses, donkeys and bovine livestock, through sheep and goat, even dogs. Annual populations of each attacked type of livestock per counties are shown in tables 13 through 15, and Figure 59.

Table 13. Populations of each attacked type of livestock per counties in 1999

1999	Donkey	Dog	Goat	Bovine livestock	Sheep	Horse	Total
1. Dubrovnik-Neretva	2	0	26	20	77	2	127
2. Split-Dalmatia	18	22	197	19	282	9	547
3. Šibenik-Knin	6	5	27	1	359	1	399
4. Zadar	1	0	56	1	94	0	152
5. Lika-Senj	0	0	0	0	58	0	58
6. Primorje-Gorski kotar	0	0	0	0	46	1	47
7. Karlovac	0	0	0	0	0	0	0
Total	27	27	306	41	916	13	1330

Table 14. Populations of each attacked type of livestock per counties in 2000

2000	Donkey	Dog	Goat	Bovine livestock	Sheep	Horse	Total
1. Dubrovnik-Neretva	1	2	10	21	23	0	57
2. Split-Dalmatia	20	29	203	34	343	11	640
3. Šibenik-Knin	15	3	97	18	527	1	661
4. Zadar	0	1	98	0	173	0	272
5. Lika-Senj	0	0	0	0	61	0	61
6. Primorje-Gorski kotar	1	0	0	0	11	3	15
7. Karlovac	0	0	0	0	0	0	0
Total	37	35	408	73	1,138	15	1,706

Table 15. Populations of each attacked type of livestock per counties in 2001

2001	Donkey	Dog	Goat	Bovine livestock	Sheep	Horse	Total
1. Dubrovnik-Neretva	4	0	22	27	20	1	74
2. Split-Dalmatia	29	27	250	40	367	0	713
3. Šibenik-Knin	11	6	96	34	506	3	656
4. Zadar	2	0	154	1	217	0	374
5. Lika-Senj	0	0	6	0	39	0	45
6. Primorje-Gorski kotar	0	0	1	0	0	0	1
7. Karlovac	0	0	0	0	11	0	11
Total	46	33	529	102	1,160	4	1,874

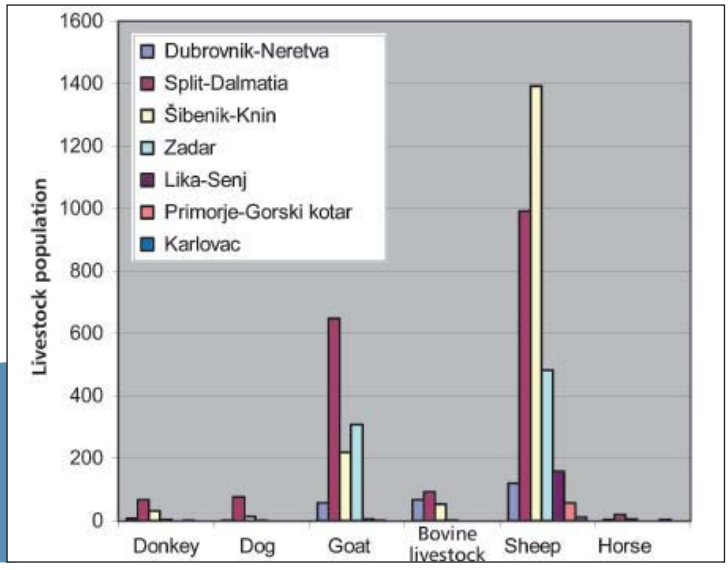


***Figure 59.** Populations of each attacked type of livestock per counties, summary for 1999-2001*

It is evident in the data on damage that the greatest number of damages is done by wolf to sheep and goat. Comparing these data with the data of the Croatian Livestock Selection Centre we get the share of livestock killed by wolf in relation to the total number of livestock. Unfortunately, the data on the total number of livestock is not totally correct and does not reflect the real situation. This only refers to the livestock that are registered by the CLSC, and the percentage stated in tables 16 and 17 is not therefore completely correct and the real share of livestock killed by wolf is probably a little lower.

Table 16. Share of sheep and goat killed by wolf compared to total number of sheep and goat per counties in 2000

2000				
Type	Sheep		Goat	
Livestock no. / County	* Total registered by CLSC	Share of livestock killed by wolf (%)	** Total registered by CLSC	Share of livestock killed by wolf (%)
Dubrovnik-Neretva	3,676	0.6	4,846	0.2
Split-Dalmatia	47,433	0.7	14,492	1.4
Šibenik-Knin	36,590	1.45	4,827	2
Zadar	70,512	0.25	14,918	0.65
Lika-Senj	25,157	0.25	1,304	0
Primorje-Gorski kotar	30,615	0.04	618	0
Karlovac	10,783	0	2,760	0
Total	**224,766**	0.5	**43,765**	0.93

**Total numbers of sheep head (incl. lambs) in 2000, registered by CCSC*
***Total numbers of goat head (incl. kids) in 2000, registered by CCSC*

Table 17. Share of sheep and goat killed by wolf per counties in 2001.

2001				
Type	Sheep		Goat	
Livestock no. / County	* Total registered by CLSC	Share of livestock killed by wolf (%)	** Total registered by CLSC	Share of livestock killed by wolf (%)
Dubrovnik-Neretva	2,127	0.6%	2,767	0.5%
Split-Dalmatia	52,808	0.6%	10,980	2.2%
Šibenik-Knin	63,744	0.8%	5,722	1.7%
Zadar	59,822	0.35%	9,848	1.5%
Lika-Senj	60,019	0.06%	4,083	0.15%
Primorje-Gorski kotar	21,582	0%	548	0.2%
Karlovac	10,435	0.1%	1,872	0%
Total	**270,537**	0.4%	**35,820**	1.4%

**Total numbers of sheep for which requests for incentives have been submitted in 2001.*
***Total numbers of goat for which requests for incentives have been submitted in 2001.*

Analysing the data on the damage done to livestock it has been noticed that there are differences in the frequency of wolf attacks among seasons and times of day. It is clearly visible that attacks are more frequent in summer than in other months of the year.

Table 18. Frequency of wolf attacks in 1999, 2000 and 2001 across the months of the year

Month	1999	2000	2001	Total
January	16	11	30	57
February	19	14	37	70
March	23	44	57	124
April	27	48	64	139
May	40	72	74	186
June	73	79	87	239
July	63	96	119	278
August	54	108	96	258
September	75	81	99	255
October	48	71	94	213
November	45	55	63	163
December	7	44	31	82

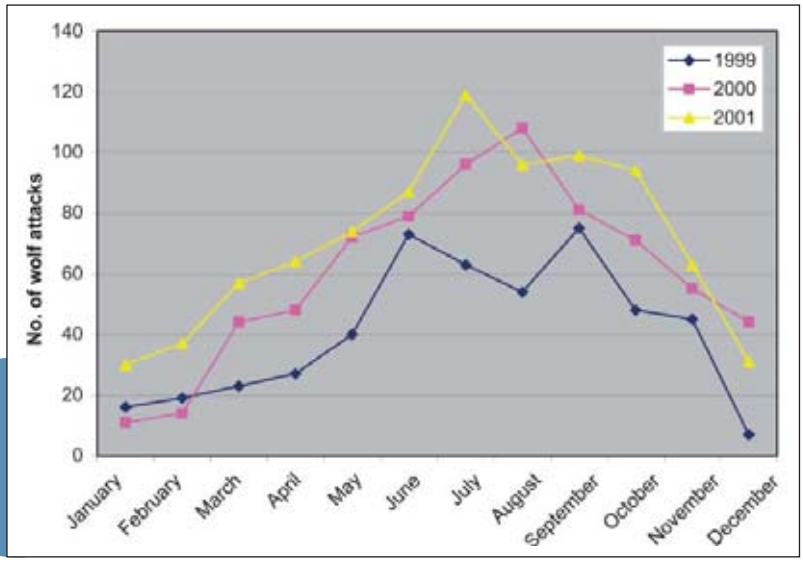


Figure 60. *Frequency of wolf attacks per months and years*

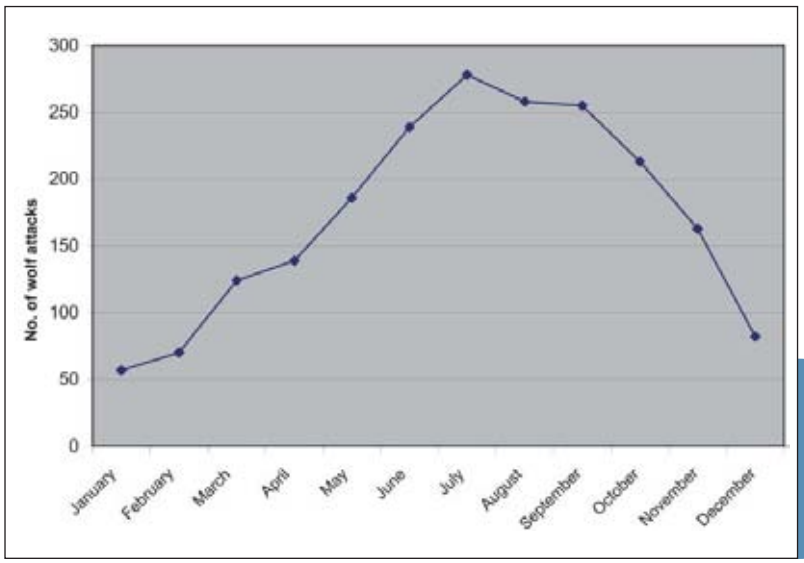


Figure 61. *Frequency of wolf attacks per months - summary for 1999, 2000 and 2001*

In 2,052 (90.5%) of the processed records there is information on the time of day when the damage was done. In some of the records there was an exact hour of attack, while others mentioned only the time of day when damage occurred. For comparison purposes, all data have been grouped into four categories – morning, day, evening, and night. The categories have been defined according to the hour of sunrise and sunset, and therefore slightly differ among seasons, which have been accounted for during analyses (Table 19, Figures 62 through 65). This clearly shows that the frequency of damage is highest in the morning and during the day, when livestock is grazing, which coincides with a relatively larger number of damages during summer (compared to winter) when livestock spends more time in the open.

Table 19. Frequency of wolf attacks on livestock during the day regarding seasons of the year in 1999, 2000 and 2001

Season	Time of day	1999	2000	2001	Total
Winter	Morning	3	16	8	27
	Day	34	25	65	124
	Evening	2	6	23	31
	Night	10	13	13	36
Spring	Morning	44	61	74	179
	Day	50	70	83	203
	Evening	24	38	43	105
	Night	10	8	16	34
Summer	Morning	101	143	152	396
	Day	29	37	80	146
	Evening	32	70	48	150
	Night	21	27	29	77
Autumn	Morning	38	73	71	182
	Day	48	78	84	210
	Evening	46	40	26	112
	Night	10	13	17	40

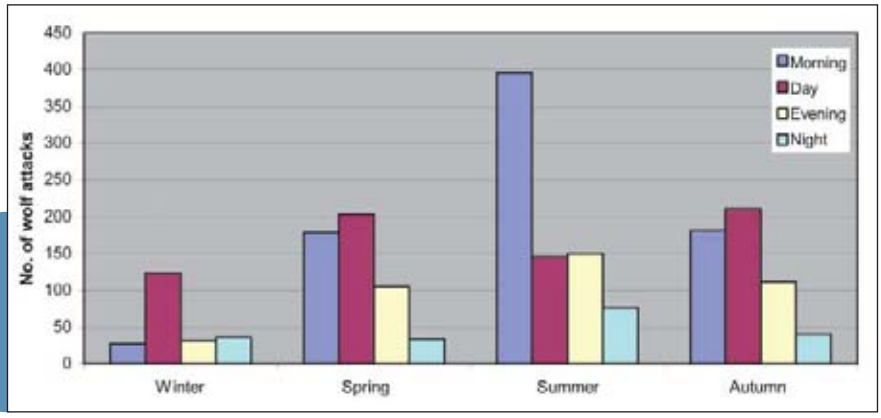


***Figure 62.** Frequency of wolf attacks on livestock during the day regarding seasons of the year, summary for 1999, 2000 and 2001*

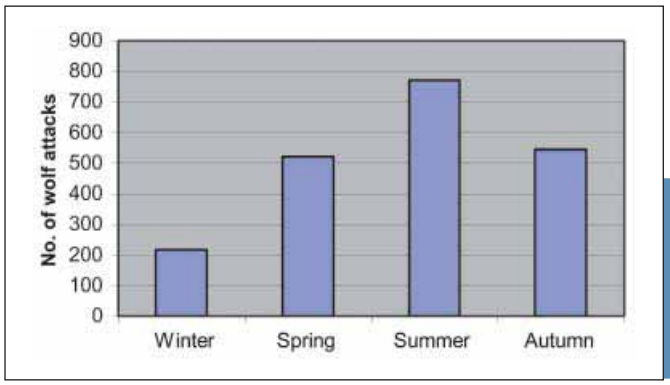


***Figure 63.** Frequency of wolf attacks on livestock regarding seasons of the year, summary for 1999, 2000 and 2001*

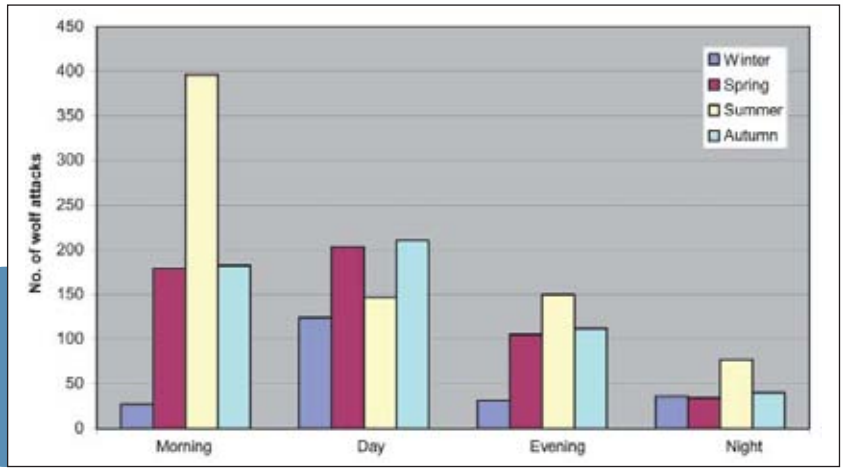


Figure 64. *Frequency of wolf attacks on livestock during the day regarding seasons of the year, summary for 1999, 2000 and 2001*

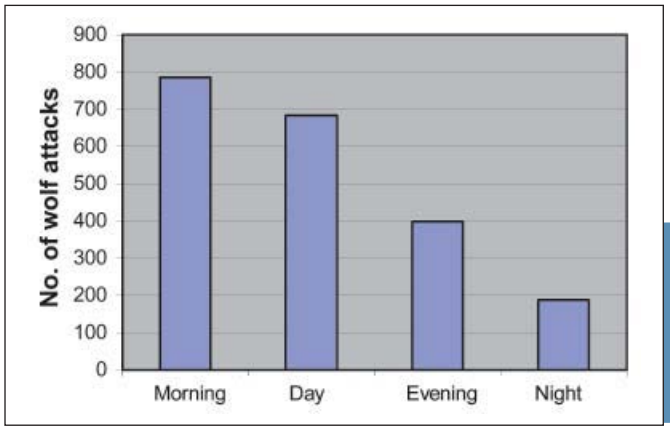


Figure 65. *Frequency of wolf attacks on livestock during the day regarding time of day, summary for 1999, 2000 and 2001*

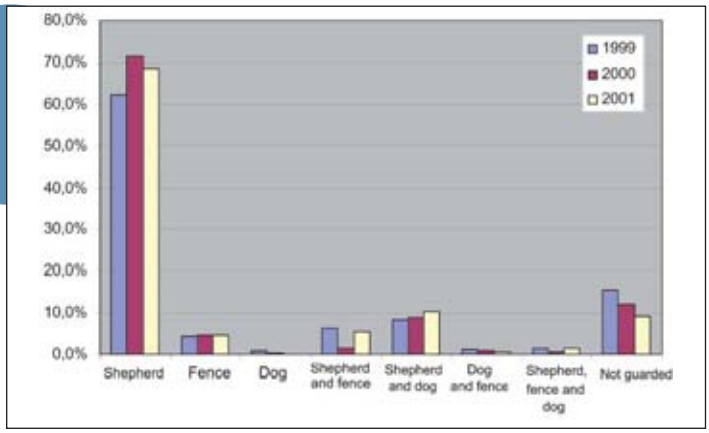
Inspection records also contain data on the guarding of livestock at the times when damages have occurred, which clearly display three different guarding methods - shepherd, guardian dogs, or a fence. The fence usually encloses a stable or a pen where livestock is kept during the night, or a pastureland where livestock stay during the day. Combinations of these three basic guarding methods are also possible (Table 20, Figures 66 and 67).

Table 20. *Share of various methods of livestock guarding for 1999, 2000 and 2001*

Methods of livestock guarding	1999		2000		2001	
	#	%	#	%	#	%
Shepherd	306	62.2%	514	71.3%	583	68.5%
Fence	21	4.3%	33	4.6%	40	4.7%
Dog	4	0.8%	2	0.3%	1	0.1%
Shepherd and fence	31	6.3%	10	1.4%	46	5.4%
Shepherd and dog	41	8.3%	64	8.9%	88	10.3%
Dog and fence	6	1.2%	7	1.0%	4	0.5%
Shepherd, fence and dog	7	1.4%	4	0.6%	11	1.3%
Total keeping	416	84.6%	634	87.9%	773	90.8%

** Note: Percentage stands for shares of each livestock-guarding method in the total annual number of wolf damage.*

Figure 66. *Share of various methods of livestock guarding for 1999, 2000 and 2001*



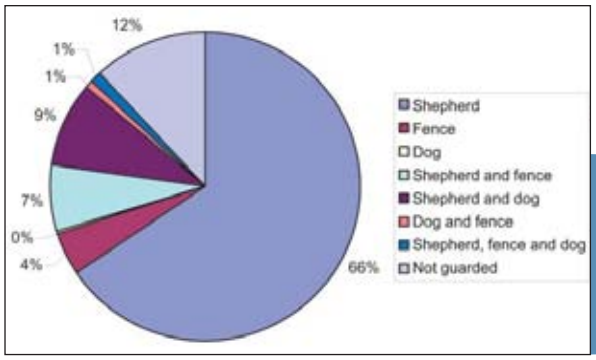


Figure 67. *Share of various methods of livestock guarding, summary for 1999, 2000 and 2001*

The data show that by far the most frequent method of livestock guarding is by a shepherd alone (66%), followed by combinations of shepherd with a dog (9%) or with a fence (7%), and the fence alone (4%). The least used methods are those with guarding dogs, a combination of a dog and a fence, or a combination of all three. A slight upward trend in livestock guarding is also visible – in 2000 livestock guarding measures have increased by 3.3 % in relation to 1999, and by 2.9% in 2001 in relation to 2000.

Livestock guarding data can be compared per counties as well, in order to see whether there is a guarding method dominant for a certain area (Table 21, Figure 72).

Table 21. *Share of various methods of livestock keeping per counties, summary for 1999, 2000 and 2001*

	Total shepherd		Total fence		Total dog	
	#	%	#	%	#	%
Dubrovnik-Neretva	36	25.9%	35	25.2%	5	3.6%
Split-Dalmatia	607	72.8%	104	12.5%	73	8.8%
Šibenik-Knin	807	94.2%	31	3.6%	50	5.8%
Zadar	217	91.6%	22	9.3%	91	38.4%
Lika-Senj	45	68.2%	25	37.9%	21	31.8%
Primorje-Gorski kotar	12	85.7%	4	28.6%	4	28.6%
Karlovac	0	0.0%	2	100.0%	1	50.0%
Total	1,724	80.2%	223	10.4%	245	11.4%

** Note: Percentage stands for shares of each livestock-guarding method in the total annual number of wolf damage per each county, summarised for 1999, 2000 and 2001*

Figure 68.
A shepherd tending goats (in the Karlobag area)
(A. Štrbenac)

Figure 69.
A shepherd tending goats (in the Ervenik area) (P. Štrbenac)

Figure 70.
Bongo tornjak *with sheep on the foot of the Dinara Mountain*
(A. Štrbenac)

Figure 71.
A drystone wall in Dalmatia (P. Štrbenac)

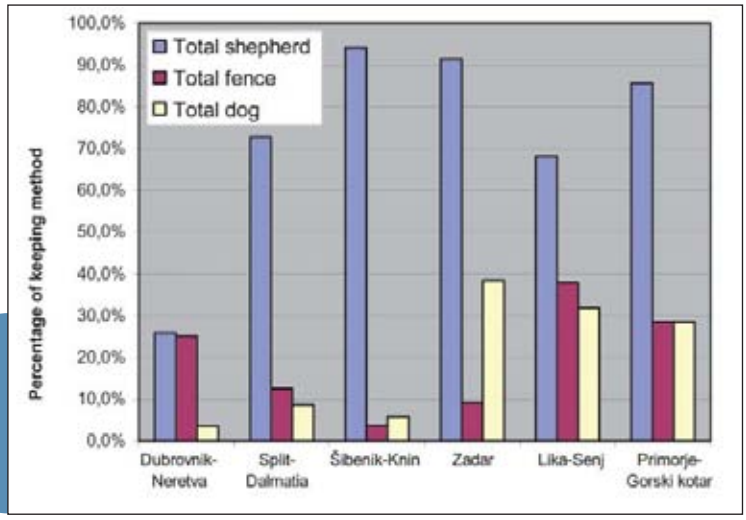


Figure 72. *Share of various methods of livestock keeping per counties, summary for 1999, 2000 and 2001*

The data show that in all counties percentage of livestock guarding by shepherds alone is much higher than the percentage of using other methods, such as dogs or fences, with the exception of the County of Dubrovnik-Neretva where livestock is equally guarded by shepherds and by fences. It is interesting that the percentage of using dogs and fences in the counties of Split-Dalmatia, Šibenik-Knin and Zadar were very low in relation to the percentage of shepherds (except in the Zadar County, where there is frequent usage of guardian dogs), while oscillations among different methods in the counties of Lika-Senj and Primorje-Gorski kotar are much less, i.e. significantly higher percentages represent both guardian dogs and fences.

Damage done by uncontrolled and stray dogs

In the territory of Dalmatia quite a few attacks on livestock by wild and abandoned dogs have been recorded. In the territory of Lika only one damage done by a wild dog has been recorded, and none of such cases occurred in Gorski kotar.

As already mentioned, during the war rural farms were devastated, which resulted in killing, dying and unrestricted wandering of livestock and other domestic animals. This lead to an increase of stray dogs

Figure 73. *Abandoned dogs organizing into packs*
(I. Pulić)

which, left to their own, took over the behavioural pattern of wild animals, differing from them by the lack of fear from humans. Often such dogs are mistakenly thought of as wolves by the local population, so three cases have been recorded when the Faculty of Veterinary Medicine received a body of a dead animal considered a wolf, but the genetic and other tests have proven them to be dogs. Such a situation is especially pronounced in the area of Dalmatinska zagora. Therefore this area suffers from damages done by wild or abandoned dogs. There is no actual data on the number of such dogs, nor are there measures for elimination of such dogs adequately applied.

Crossbreeding of wolves with dogs also occurs, which has been proven so far for one case in Croatia (Perković settlement, 1996).

Livestock protection measures against wolves

Donation of guarding dogs

Along with the existing damage compensation system, the state decided to provide additional assistance to livestock breeders, in order to minimise the damage done by wolves. In 1997 the former State Directorate for the Protection of Nature and Environment started the donation programme of guarding dogs - *tornjak*,

Figure 74.
Donation of tornjak *puppies in Lika*
(J. Jeremić-Martinko)

Slika 75.
Livestock breeders from the Zadar hinterland who received donations
(N. Skroza)

a native Croatian breed of large guarding dogs, traditionally used for guarding livestock against large predator attacks. Donations included puppies aged between 7 weeks and three months. Namely, in the training of *tornjak* dogs it is vital that they live freely near the livestock since early age, especially when it moves around in nature. A dog raised on a chain, in a cage or as a pet, is not useful in herd protection. *Tornjak* dogs can successfully perform their role after they have turned one year, reaching full maturity at the age of two and a half. The work-span of a guarding dog exceeds 10 years. All the donated puppies have been regularly registered in the Croatian Kennel Club, with genealogies.

By the end of 2002, a total of 120 *tornjak* puppies have been donated, most of them in the counties of Zadar and Šibenik-Knin, in the areas where biggest damage to livestock has been recorded. Due to insufficient funding in that period, it was impossible to systematically monitor the condition of the donated dogs, so monitoring relied on the information supplied by the experts, agricultural advisers, phone contacts and occasional site visits. Although proper dog training isn't a particularly complicated process, unfortunately large number of donees failed to follow the instructions of the donations coordinator. So dogs were often improperly fed or kept on a chain too often, or haven't made social connection with the herd due to incorrect training and treatment as pets.

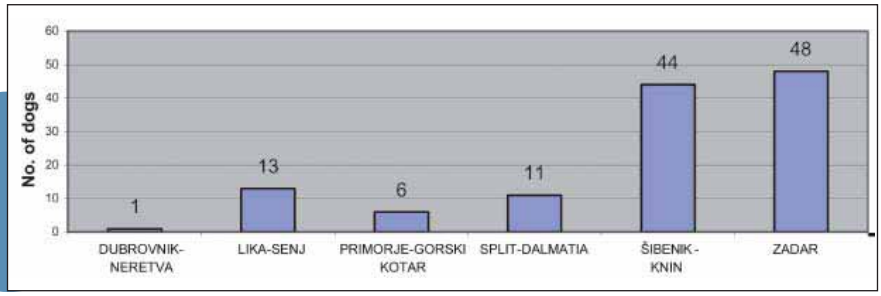


Figure 76. *Number of donated dogs per counties*

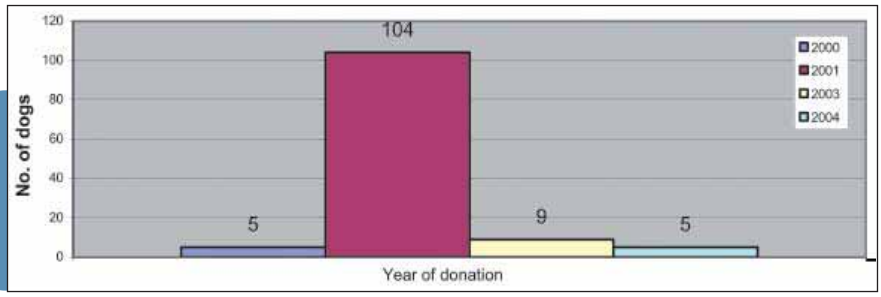


Figure 77. *Number of donated dogs annually*

In the beginning of 2004 a phone survey was carried out on a test sample of donees until 2002 - until the start of the LIFE project. This helped in gaining an insight into the condition of donated dogs, method of keeping and their efficiency, breeding system and livestock guarding methods. Based on the responses of donees, we can see that that the livestock breeding methods are based on a combination of stables and pasture land, where livestock is mostly grazed on rocky ground and abandoned agricultural land, and kept in stables during the night. Herds have on average 200 head (mainly sheep), which are constantly guarded by a man of over 60 years of age. Dogs are with livestock during the day and kept on chain during the night, fed by the household food. Most dogs have had contact with predators, mainly wolves, in which situations the dog was mainly chasing predators away. When the dog was near the herd, there were no damages by the wolf or other predators. Part of the donated dogs died, which was caused mainly by poisoning.

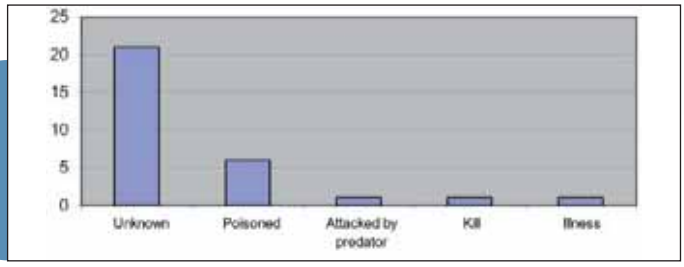


Figure 78. *Causes of death of donated dogs*

Figure 79. *A donated* tornjak *poisoned in Ražine Donje in the Šibenik hinterland (N. Skroza)*

The actual total impact of guarding dogs on the downsizing of damage inflicted by wolves is difficult to quantify. There is no reliable baseline data, and many other factors might have decreased the number of wolf attacks; these should be systematically analysed. Some important factors are certainly various illegal acts that have reduced the wolf pack sizes (illegal killing and poisoning), and also the improved care of the herds. At the same time, respect for nature, especially towards "harmful" species, is in certain areas at a disturbing level.

So the donation of *tornjak* dogs, in the thoughts of some local inhabitants, is a poor strategy that requires costs and efforts, and assumes a permanent survival of wolves. Therefore the satisfaction good words about the dogs by their successful users is often clouded by objections of others. Those who "know their way around dogs" say that this breed – tornjak - is not aggressive enough for fighting wolves; others spread the "information" that this breed cannot endure the scorching heat and is useless during hot summers. Such rumours, prejudice or misunderstandings can be easily averted or avoided through more regular site visits of experts and active education and monitoring.

Based on the lessons learned and deficiencies of the *tornjak* donation programme by the end of 2002, the LIFE project envisaged a systematic donation scheme with public awareness campaign and education of the current and future beneficiaries and constant monitoring of the donees.

The *tornjak* donation programme within this project, envisaging 60 donations in total, started in July 2003 by printing leaflets with basic information on this breed and criteria for donation (Figure 80). Young *tornjak* dogs could have been donated only to the livestock breeders from regions in which there was a possibility of wolves attacking livestock and which are affected by wolves, the herds of which regularly graze in nature, and are not let into pastures without supervision, whose herds number at least 50 head, and who didn't and wouldn't have any poisonous substances on pastureland in a form that would be dangerous for dogs. The leaflet has been distributed through regional project offices to the livestock breeders from the territories of Gorski Kotar, Lika and Dalmatia.

Only those breeders who satisfied the prescribed criteria and committed to adequate dog management were selected, so as to obtain the best possible results in livestock protection from wolf attacks, which included mainly those from the territory of Dalmatia. Lectures were held for the selected livestock breeders and written instructions distributed on raising, keeping and feeding of dogs. In order to ensure purchase of the envisaged 60 puppies, the information on project and purchase of puppies has been sent to the addresses of all registered livestock breeders in Croatia, and the data on bitches and predicted terms of litter have been requested as well.

Figure 80.
An informative leaflet about tornjak *dogs*

The first takeovers of puppies began in December 2003, and by end March 2004 livestock breeders from Karlobag, Lukovo Šugarje, Ervenik, Kijevo, Mrkopalj and Lukovdol, ten in total, received them as well. Upon receiving the dogs, each breeder was obliged to sign a contract whereby assuming the right of using guarding dog, but also certain obligations in order to ensure adequate keeping and using the dogs for the protection of livestock against wolf attacks.

Regional coordinators inspected the condition of the donated dogs, through monthly visits to the donees. On each visit, coordinators completed the "Dog Protocol", made separately for every dog, containing the data related to efficiency of dogs. This was the method of monitoring the keeping and condition of the dogs. We will be able to estimate the real value of guarding dogs in the sense of herd preservation and protection only after they will have turned one year. A good cooperation in health treatment and inspection of dogs has been achieved with local veterinary stations.

The State Institute for Nature Protection joined the donations scheme by purchasing and donating 5 young female puppies in December 2003 and January 2004 to livestock breeders in the areas of Mrkopalj, Lukovdol, Karlobag and Gospić.

Namely, in the framework of the LIFE project implementation, livestock breeders have shown interest for independent breeding of *tornjak* dogs and for associating through establishing several small regional organisations, which would create centres for *tornjak* breeding in areas where they are most needed and revive the traditional livestock guarding methods.

In any case, based on the results of several years of guarding dog donation programmes it can be safely concluded that their reintroduction has brought about significant progress. An important indicator is the fact that those livestock breeders who invested sufficient efforts in guarding dogs are finally satisfied with their efficiency. Thanking to public focus and visible care of the state for livestock protection the breeders themselves take better care of their herds. Regardless of complaints, they have also benefited from guarding dogs. Many have learned or found out on their own how to use them efficiently. Therefore dogs with herds grazing in the wild are not only a welcome but also a necessary assistance, and again a commonly accepted notion in Croatia.

Quantities of small stock in Dalmatian hinterland are growing fast, human settlements are stabilising and the population standard is increasing as well. These are mostly emigrants returning after liberation of the country to the ruins of their homes, into the minefields and totally abandoned agricultural plots. At the same time, local authorities are still far from having the strength for operating a completely normal business and economic life. Therefore further structuring of local circumstances and relations is to be expected, during which the tendencies that are acceptable and those that are unacceptable will be better articulated.

Electric fencing

Electric fences are applied as an efficient way of livestock guarding against attacks of wolves and other large predators. Therefore the LIFE project has planned the first systematic donation of 20 electric fences. Same as the donation of pen guardians, the electric fences donation programme started in July 2003 by printing an information leaflet (Figure 81).

Byl March 2004 all donated fences had been installed, with the largest amount (16) in the area of Lika (Oteš, Smiljan, Bunić, Široka Kula, Kukuljanovo, Poljic), and the remaining 4 fences donated to livestock breeders in the broader Benkovac area of Dalmatia.

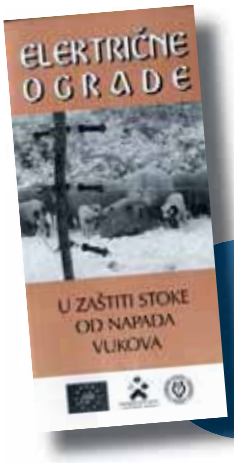


Figure 81.
An informative leaflet about electric fences

Figure 82.
Sheep surrounded by electric fence (A. Štrbenac)

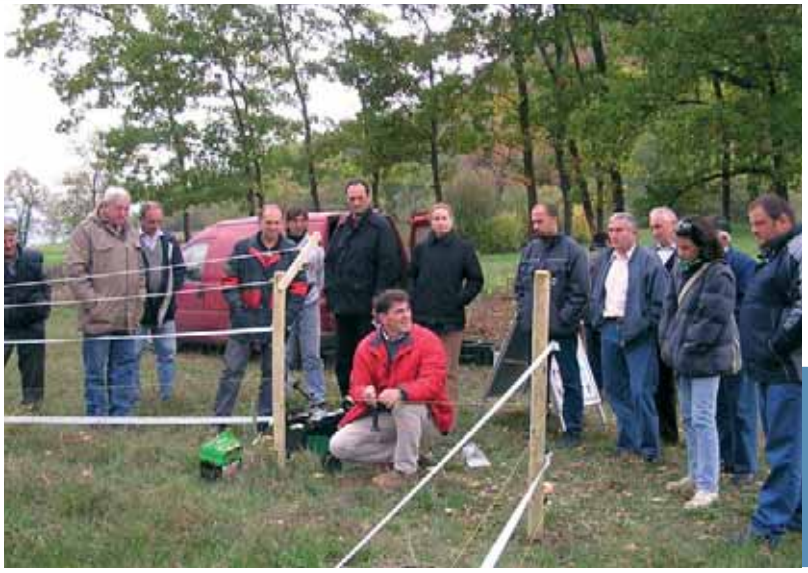


Figure 83.
Putting up an electric fence in Smiljan near Gospić (S. Desnica)

By signing a contract for the use of electric fences, the donees obliged themselves to their adequate maintenance and use. In order to increase efficiency of fences, the livestock breeders also obliged to regularly fill out the protocol for the use of fences and submission thereof to the regional coordinators. The protocol contains the data on fence switching dynamics, electric voltage, number of head enclosed by the fence, and on possible appearance of wolf near the fence.

Impact of wolf on its natural prey

Starting from the fact that the main prey in the natural (alpine) areas are large even-toed mammals such as; roe deer, red deer and wild boar, which it hunts successfully in packs, wolves potentially have a rather significant impact on game.

It has been proven that traces of these game types in the wolf's faeces and stomach contents in Gorski kotar and some parts of Lika amount to almost 78% (Kusak, 2002). Reasons for such a high concentration of predatory actions on game in these areas can be found in the fact that livestock (sheep, goat) breeding is not common, and the rare herds are very well guarded (shepherds, dogs) and graze close to human settlements.

In the older hunting publications the wolf was usually considered "exterminator of red deer and roe deer" in mountainous hunting grounds (Car, 1967); this attitude hasn't changed much since. Some hunters still see the wolf and other large predators, which prey on a species hunted and managed by them, as direct competitors, but mostoure willing to share the pray with wolves realizing that wolves should exist in Croatia for future generations. Conflicts between game concessionaires and wolves occur and this may lead to the increase in illegal killing, even though the wolf is formal protected and high fines exist for poaching.

In the lack of reliable numeric indicators of wolf impacts on game, described is a randomly chosen calculation of the "damage" done by wolf on the game in the "Litorić" hunting ground, managed by the "Jelenski jarak" Hunting Association from Vrbovsko (Heski, 2004). According to the hunting management documents for this hunting ground of 6.600 ha in surface area, the available fund (brackets show the planned kill) of red deer 77(18), roe deer 180(42), and wild boar 65(42) make up a total of 332 big game head. Through constant monitoring and observation the game concessionaire has determined that there are 7 wolves dwelling in the area between the rivers Kupa and Dobra and the Ogulin – Vukova gorica motorway, which means 1 wolf per 4.000 ha, and that 1.5 wolves account for the "Litorić" hunting ground. Since, according to the concessionaire's calculation, a wolf eats 4 kg of game meat a day, and 1.400 kg a year, on average 40 big game head is killed by wolves. If one adds here the estimated 10 head "killed but not eaten by wolves" (excess kill), the total amount for the "Litorić" hunting ground would be 50 head per year, or 75% of the planned kill.

The share of prey eaten by the wolf, thus reducing the available killing quota for the game concessionaire, increases proportionally with a decrease in game population. In habitats with naturally big populations of ungulates, such as white-tailed deer in Minnesota (USA), the impact of wolf on its prey is negligible. It is also known that the wolf population does not grow indefinitely but is limited by innate self-regulatory mechanisms, and cannot by itself lead to the extinction of its main prey. It's a different question whether the wolf population size at its natural level (ecological capacity) is at the same time acceptable for the local population (social capacity).

In neighbouring Slovenia, density of ungulates is several times higher then in Croatia, despite the presence of wolf, lynx and bear. Impact of wolf on natural pray exists, but it does not pose a special problem.

Regardless of the above mentioned calculation, which is more or less used by all game concessionaires in the alpine parts of Croatia, there is no doubt that hunting grounds in which wolves regularly dwell are

in an unequal position towards those where this predator is naturally absent. Therefore, in line with the guidelines in this plan, when hunting grounds in which game is the most accessible and the easiest prey to the wolf, calculations of the hunting ground value and capacity should involve wolf presence and the related reduction of killing quotas and concession fees. The management plan should further anticipate the potential controlled interventions into predator populations in certain areas where it has been proven that the impact on prey populations is extremely significant.

Economic benefits of wolf

As demonstrated in the previous chapters, economic interests often prevail over ecological and ethical reasons for wolf conservation. One of the biggest challenges in nature conservation remains to find a fine balance between economic and ecological benefits. This is the case with the wolf. Simply put, attitudes toward wolves would probably be more positive if this species would yield economic benefits to the population in its area of occupancy. Although such opportunities have not been seriously discussed in Croatia, global practice already demonstrates possibilities of making a wolf population more profitable. The best example is in Yellowstone National Park in the USA, earning millions of dollars on account of reintroducing wolves back into the park. The only difference is that in this park, which is the size of Gorski kotar and Lika, visitors can see the wolves through high-powered binoculars, which is not the case in Croatia, where it is very difficult to see a wolf in the wild. However, this is not an obstacle for the development of eco-tourism, which is close to nature, in which signs of the wolf presence (e.g. howling,

Figure 84. *Numerous visitors of the Yellowstone National Park in a photo hunt for the wolf (Đ. Huber)*

footprints, faeces) and adequate events and products (publications, exhibitions, lectures) can be attractive enough, especially for people from the countries where the wolf has disappeared. This could at the same time be a good promotion of our country and demonstration that Croatia has preserved its nature.

Romania is an excellent example of this rural ecoturism approach, where a large carnivore conservation programme is being implemented in the Carpathians, including promotion of the large carnivores as part

of a tourist offer. A large carnivore educational and information centre will also be established within the project area where, through exhibits, publications, multimedia publications etc. information on large carnivores could be obtained. The centre is also the starting point of organised tours. The centre employs local residents, who are involved in the production of souvenirs as well. Funds collected by this centre are channelled into a special conservation fund for large carnivores and used on activities to further conservation of these animals. Croatia undoubtedly possesses enough potential to embark on a similar path.

Social Considerations

Lack of knowledge on wolves

Ignorance of the basic facts about the wolf is one of the reasons for developing prejudice and negative attitudes toward this animal. One of the most common prejudices is that wolf is dangerous for humans. The fact is, however, that the wolf does not attack people, but rather avoids them. The bear is actually much more dangerous to humans, but perceptions of this animal are extremely positive nevertheless.

The only concrete information pointing to the level of knowledge on wolves is the research of attitudes toward the wolf in the areas of Gorski kotar, Lika and Dalmatia, in its area of occupancy, which also included questions on the biology and status of wolves in Croatia. According to these results, the best experts in wolves are inhabitants of Dalmatinska zagora.

Inadequate level of information and education on the wolf by the media often results in subjective informing of the public, which hinders the efforts for conservation of this species. Also, the media often feature scandal-tinged news on the wolf, guided by the logic that such news is best sold. The newspapers are known to feature articles presenting the wolf as a dangerous bloodthirsty beast. Electronic media features pictures of bloodstained old women whose sheep were killed by wolf, etc. Such images may help reinforce existing negative attitudes in the general public.

Educational activities aimed at wolf conservation began in 1994, when the "Wolf" Group held lectures on wolves, printed an SOS Wolf poster and in cooperation with the Croatian Nature Science Museum organised an exhibition titled "Did Little Red Riding Hood Eat the Wolf?" This travelling show was first designed in Zagreb, and afterwards moved into Risnjak National Park and Ogulin.

In order to enhance the knowledge of wolves, the former Ministry of Environmental Protection and Physical Planning and the Faculty of Veterinary Science in Zagreb have organised a series of lectures on the wolf, delivered by Josip Kusak, D.Sc., in schools and through seminars for biology teachers.

In the framework of the LIFE project lectures on the wolf are being held in primary and secondary schools in the area of Gorski kotar, Lika and Dalmatia. By end of April 2004 seventeen of such lectures were held; all were positively recived by children and teachers. It has been proposed to include such lectures into the regular school curricula. NGO "Croatian Association for Wolf Protection" from Zadar also joined the organisation of the lectures.

Figure 85. *The exhibition in the Croatian Natural History Museum entitled "The Wolf or Has the Red Riding Hood Swallowed the Wolf?" (1994)* *(Đ. Huber)*

An educational brochure with basic information on wolf biology, human attitudes towards this species, status of the wolf population in Croatia and the importance of wolf conservation, was printed, and a poster is in preparation as well. Within the project, a brochure for kindergarten and young school children will be prepared, as well as a number of other activities that will bring the general information on wolf closer to the young generations.

Figure 86. *Lecture on wolves in a primary school* *(N. Skroza)*

In the area of public information, the project team maintains regular verbal contacts with journalists, organises press-conferences, and prepares detailed information on the chalanges of wolf conservation in Croatia. Some of this information can be found on the official web-pages of the project (*www.life-vuk.hr*). A project bulletin was published as well with information about project implementation.

Figure 87.
Educational material printed within the framework of the LIFE Project and a web site

Attitudes on wolves

In the past, similarly as in other parts of Europe, wolves in Croatia were exterminated by all possible means. The 1950s were especially marked by intensive wolf elimination actions. The Forestry Division of the Economic Council of the Government of the National Republic of Croatia of that time also had a unit called the State-level Headquarters for Organised Wolf Elimination.

With time, wolf elimination was no longer actively promoted, which testifies of the changing, more positive attitudes toward this animal. On the occasion of Earth Day 1994, the Croatian Postal Service issued a stamp featuring a picture of wolf.

The next milestone that has made a strong impact on human attitudes toward wolves in Croatia was the full absolute legal protection of the species introduced in 1995, which was achieved relatively quickly and simply. The initiative for full protection was started and lead by a small group of scientists and wolf enthusiasts, without any major opposition by the public or interest groups.

Upon putting into effect the full legal protection, two interest groups - livestock breeders and hunters - have become louder in expressing their dissatisfaction with the strict protection status, reminding people of the big damages done by wolves on livestock and the negative impact on game. In that connection, the Croatian Hunting Association (CHA) publicly announced its official standpoint in the Hunters Journal (Lovački vjesnik) in 2001. CHA suggested that the wolf remain under special protection in the entire Croatian territory, but with modified intensity in certain parts of the country; that compensations should still be paid for damage done to domestic animals, and damage prevented through spreading of the native breed of guarding dogs; that in places of frequent damage unpunishable elimination of an individual wolf or a pack be allowed, for reasons of preventing significant economic damage or threats to human health (rabies!); that wolf be integrated into hunting management documents in the areas of large forest complexes in Lika, Primorje and Gorski kotar, as a permanently present specially protected species, and that hunting ground value assessments take into consideration wolf's impact on big game populations and the possibilities for isolation, in line with the population status and habitat types and capacities; that areas in Croatia north from the Sava River may not be considered natural habitats of wolf and that certain isolated parts be measured according to the rules of the International Hunting and Game Protection Council, for this would be an important stimulus to the hunters to perform legal kills, and provide a possibility of comparison with the known national and international data.

Attitudes survey

The first human dimension research on public attitudes toward wolves in Croatia began in 1999, within which newspaper articles on wolves from the periods before and after enactment of their legal protection were analysed. The analysis illustrated that articles before the formal legal protection were far more positive towards wolves than those published afterwards. This lead to a conclusion that public attitudes toward wolves may have become more negative due to the protection status. (Bath & Majić, 2000). The study with all research results is available online at www.large-carnivores-lcie.org.

Figure 88.
The first survey on local population attitude about the wolves
(A. Majić-Skrbinšek)

Within the same project detailed survey was implemented to document on the attitudes of the public and various interest groups in the territories where wolves constantly dwell today (Gorski kotar, Lika and Dalmatia). The study used a random sample of the public, hunters, foresters and high-school students (future decision-makers). The sampling ensured reliability of results, with permissible error of +/- 5%.

Results documented a generally positive public attitude toward wolves. Looking geographically, the most positive attitudes were expressed by the inhabitants of Gorski kotar, followed by those of Lika, while people from Dalmatia were the least positive.

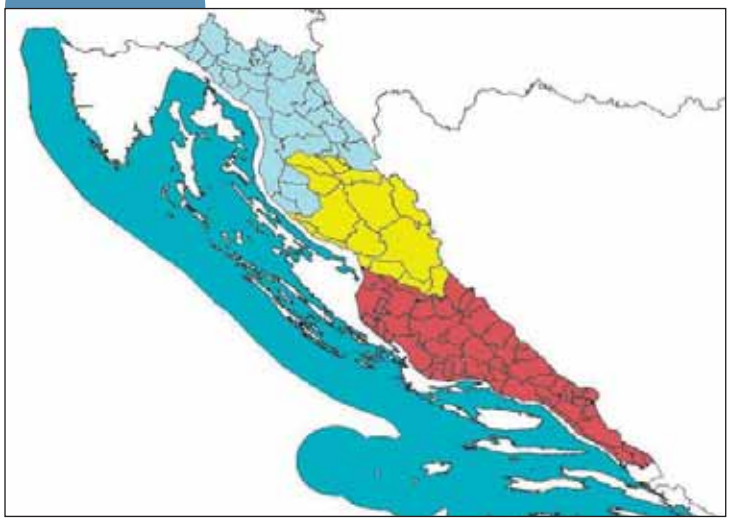
Among the various interest groups, the most positive were high school students, followed by foresters, hunters, with representatives of the broad public at the very end of the scale.

A second survey was carried out in scope of the LIFE project in order to register possible changes of attitudes, thus constituting the first step towards systematic monitoring of attitudes toward wolves in Croatia. The methodology applied was the same as in the previous research, aiming to obtain directly comparable results.

The questionnaire contained 82 questions that included the following topics:

- Viewpoints on wolves in general
- Attitudes on various topics related to wolf management (damage done by wolf on domestic animals, wolf population in Croatia, its protection, etc.)
- Fear of wolves
- Knowledge of biology and of the wolf condition in Croatia
- Experience of respondents with wolves
- Demographic data on the respondent (sex, age, education)

Figure 89. *For the purposes of the survey on attitudes toward wolves, the area of wolf range in Croatia was divided into three zones. Blue zone includes broader Gorski kotar area, yellow represents Lika, and Dalmatia is in red.*



All 1,200 responses were obtained through personal contact and quantitatives interviews at the respondents' residence. On average, one interviewer completed around 12 interviews a day, data

collection took approximately 99 days in total. Interviews were carried out in more than 360 settlements in the regions of Gorski kotar, Lika and Dalmatia. More than 80% of those individuals contacted at random agreed to be interviewed.

As one of the most important interest stakeholder groups, the viewpoints of which need to be carefully analysed and taken into consideration when making decisions on wolf management in Croatia, the livestock breeders have been a special focus of the research. Regional coordinators in Šibenik, for the territory of Dalmatia and in Gospić, for the territories of Lika and Gorski kotar, have contacted sheep-breeders and goat-breeders in person, and even offered assistance in filling out the questionnaire. 82 livestock breeders completed the questionnaire.

Besides listening to those residents from the wolf-dwelling territories of Croatia, the opinions of inhabitants in urban territories (more precisely in Zagreb) were included also. The questionnaires with a return address and pre-paid postage were mailed to thousands of addresses in Zagreb, selected at random from the phonebook, and 219 of them were returned completed and ready for analysis. The detailed results of this sample can be found in the study by Majić & Bath (2004).

Analysis of the results of the questionnaires filled in by the representatives of the public in the territories where wolves dwell has shown that the viewpoints on wolves in Croatia are still relatively positive. Although the majority of residents consider that their opinions on wolves haven't changed in the last few years, a shift towards more positive and neutral viewpoints compared to the 1999 data is noticeable. For instance, for the question ″Which of the following option best describes your attitude toward wolves? (Figure 90), the percentage of respondents who have chosen the answers ″I strongly dislike″ or ″I dislike″ has decreased in Dalmatia from 62% to around 50%, in Lika from 47% to 37%, and in Gorski kotar from 37% to 21%.

Attitudes toward wolves are still the most positive in Gorski kotar, and the least positive in Dalmatia. This fact can be explained by a very high rate of discontent of the residents of Dalmatia because of damage done by wolves, and the belief that wolves unnaturally inhabited this territory in the period after the Homeland war.

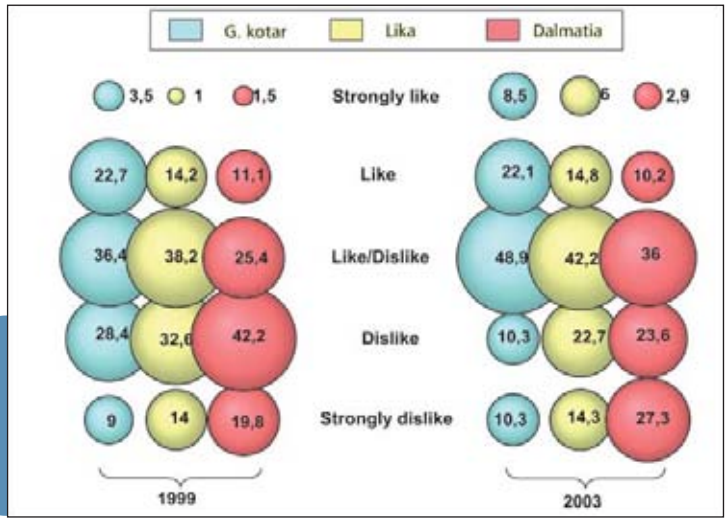


Figure 90. *Results of Human Dimension Research in 1999 and 2003. Values are expressed in percentages.*

The knowledge of biology and of the status of wolves in Croatia remained at the same level marked in Dalmatia for 1999, while the knowledge of wolves in Lika and Gorski kotar is statistically considerably worse than four years ago. The best experts in wolves are the inhabitants of Dalmatinska zagora region, while the inhabitants of Gorski kotar know the least about wolves. It is interesting that, contrary to expectations, the respondents that have the best knowledge on the biology of wolves and their status in Croatia have shown the least positive attitude on these animals.

Table 22. *Some results of the survey on public attitudes to wolves made in 2003*

Which of the following options best describes your attitude to wolves?					
Answers (%)	Broad public				Livestock breeders
	Gorski kotar (N=406)	Lika (N=384)	Dalmatia (N=382)	Zagreb (N=219)	(N=82)
Strongly against	10.3	14.3	27.3	1.4	13.6
Against	10.3	22.7	23.6	2.8	11.1
Neither against nor in favour	48.9	42.2	36	32.7	56.8
In favour	22.1	14.8	10.2	42.1	12.3
Completely in favour	8.5	6	2.9	21	6.2
Wolves in Croatia should be fully protected					
Answers (%)	Broad public				Livestock breeders
	Gorski kotar (N=406)	Lika (N=384)	Dalmatia (N=382)	Zagreb (N=219)	(N=82)
I strongly disagree	6.2	8.6	7.9	2.3	10
I disagree	32.8	40.7	46.6	15.2	36.3
I am neutral	15.9	15.1	17.3	12	13.8
I agree	31.8	31.6	25.9	39.2	30
I strongly agree	13.2	3.9	2.4	31.3	10
Wolves inflict big damage to domestic animals					
Answers (%)	Broad public				Livestock breeders
	Gorski kotar (N=406)	Lika (N=384)	Dalmatia (N=382)	Zagreb (N=219)	(N=82)
I strongly disagree	6	1	0.3	2.8	3.7
I disagree	30.3	16.7	7.1	30.4	12.2
I am neutral	18.5	9.9	8.1	27.6	15.9
I agree	35.5	53.5	62.8	31.3	43.9
I strongly agree	9.8	18.8	21.7	7.8	24.4
I support the increase of the wolf population in Croatia					
Answers (%)	Broad public				Livestock breeders
	Gorski kotar (N=406)	Lika (N=384)	Dalmatia (N=382)	Zagreb (N=219)	(N=82)
I strongly disagree	8.8	14.4	14.7	2.3	17.3
I disagree	35.8	49.9	53.7	12.3	32.1
I am neutral	24.8	19.1	16.8	27.4	30.9
I agree	25.8	17.8	13.7	45.2	14.8
I strongly agree	5	1.8	1.1	12.8	4.9

Table 22 presents answers to some of the key questions from the questionnaire per target groups. It illustrates that respondents from urban areas were most positive. Namely, over 63% of respondents from the City of Zagreb thought of themselves as being in favour or completely in favour of wolves. Next are the inhabitants of Gorski kotar (30.6% in favour), whereas inhabitants of the traditionally sheep farming areas (Lika and Dalmatia) mostly saw themselves as against the wolf (37% in Lika and 50.9% in Dalmatia). It might be important to notice that most respondents from the livestock breeders group from Lika and Dalmatia thought of themselves as being neutral (56.8% neither in favour, nor against). Knowing that the sheep and goat owners chosen by random sampling in the same areas had the most negative attitudes toward wolves, it may be argued that the results for livestock breeders probably do not reflect the true state of affairs. There are two possible explanations - either only the positively oriented livestock breeders were willing to take part in the survey, or the respondents were hiding their true feelings because they thought that the interviewer (ministry employee, which has all the relevant data on the respondent) wouldn't find their attitudes acceptable. A similar situation is seen also in the replies to the other questions, therefore caution is needed when analysing and interpreting results collected by this method.

Most respondents from the areas inhabited by wolves do not approve of the full protection of wolves in Croatia, while respondents from Zagreb approve of it by vast majority (70.5%). Blaming wolves for most damages done to domestic animals mainly originated from the inhabitants of sheep breeding areas, where such damage occurs (72.3% in Lika and even 84.5% in Dalmatia). In Zagreb as an urban area and in Gorski kotar respondents were hesitant regarding damage to domestic animals. Respondents from Lika and Dalmatia are against increasing the wolf population, respondents from Gorski kotar remain indecisive, while respondents from Zagreb would like to see more wolves in Croatia.

Communication and cooperation among interest groups

The wolf is today undoubtedly one of the most controversial wild animals in Croatia, and as such triggers strong feelings, both negative and positive. Traditionally livestock breeders and hunters were the two most interested groups in this issue - livestock breeders because of the damage done to their stock, and hunters because of the impact of wolves on the hunting game, but also because of the challenging wolf hunt that is attractive to them. Both these groups usually complemented each other's activities and attitudes to wolves, and there were no conflicts between them.

Recently certain new groups of stakeholders appeared on the scene – biologists and the so-called "environmentalists". Values and interests of these two groups regarding wolves are partially different from the traditional livestock breeders' and hunters' attitudes. Additionally, no necessary communication or cooperation channels were developed between the "new" and the "old" stakeholder groups, so they were forming pictures of each other based on frequently unobjective media reports, which resulted in the creation of mistrust and conflicts between the groups. It can be said that the conflicts reached the climax after introduction of the strict protection status for wolves in 1995, without consulting livestock breeders or hunters.

One of the key objectives of this management plan is exactly the establishment of communication and cooperation between these stakeholder groups, and the methodology of the plan development has been

adapted to this, as well as the future decision-making processes related to wolf management in Croatia. In that regard, all interests are important and need to be respected and involved.

Legal framework

International agreements governing the wolf conservation issues

- Convention on Biological Diversity, (NN: International Treaties # 6/96)
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) (NN: International Treaties # 3/00)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (NN: International Treaties # 12/99)
- Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive) (92/43/EEC)
- Council Regulation (EC) No 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein

The Republic of Croatia is signatory to all relevant international agreements in the field of nature protection, this being yet another way of joining the international community in the global nature conservation efforts. One of the framework agreements is the Convention on Biological Diversity, ratified by Croatia in April 1996, committing itself to preservation and enhancement of the existing biological diversity and sustainable use of its components.

Croatia ratified the Convention on the Protection of European Wildlife and Natural Habitats (Bern Convention) in 2000. This agreement sets all the measures to be taken by European countries to protect wildlife, especially the species listed in its Annexes, including the protection of their habitats. The wolf (*Canis lupus*) is listed in Annex II to the Bern Convention, i.e. in the list of strictly protected species whose exploitation, disturbance and habitat endangerment is prohibited. In special cases, the Bern Convention allows for exceptions from this rule when there is no other acceptable solution and providing that the exception would not be fatal for survival of the population in question. Such exceptions are granted only in well justified cases of protecting flora and fauna; preventing serious damage of crops, livestock, forests, fishponds, water and other property; in the interest of public health and safety, aircraft safety and other prevailing public interest, and for the purposes of research and education, repopulation, reintroduction and necessary reproduction. Further, exceptions can be granted only under strict supervision, on a selective basis, and with limited extraction, keeping and other wise use of certain wildlife species in small quantities. In such cases, the party in question is obliged to submit detailed biannual reports to the Standing Committee of the Bern Convention on the exceptions applied. In order to ensure protection of wolf habitats, parties to the Convention are obliged to include their areas of occupancy into the network of Areas of Special Conservation Interest (ASCI), the so-called Emerald Network. In such areas it is obligatory to implement protection measures and apply management methods aimed at preservation of their natural values. The Bern Convention adopted the Action plan for the conservation of wolves (*Canis lupus*) in Europe, developed by the Large Carnivore Initiative for Europe (LCIE), which has also listed recommendations for the action plan for the conservation of wolves in Croatia.

The Republic of Croatia is a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which obliges the parties to control the international trade in endangered species through a system of issuing import and export permits and certificates. Wolf is listed in the Annex II of CITES, meaning that it is a potentially threatened species, and that the related international trade must be strictly controlled.

The Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora, 92/43/EEC, is one of the basic regulations governing nature protection in the EU member states. The European Union members are obliged to integrate the provisions of this Directive into their domestic legislation, and the respective legal harmonisation is expected also from Croatia in the process of EU accession. The wolf is listed under Annex II of the Directive, dealing with plant and animal species of interest for the European Community, the preservation of which requires proclamation of Special Areas of Conservation (SAC) as parts of the Natura 2000 ecological network (with the exception of its populations in Spain, north from the Duero River, populations in Greece north of 39th parallel, and populations in Finland), and Annex IV, which includes animal and plant species of interest for the European Community in need of strict protection, with the exception of the above mentioned populations.

The Council Regulation (EC) No 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein, regulates the trade in protected animal and plant species within the European Union, and presents the legal basis for the implementation of CITES Convention in the EU territory. The wolf is listed in Annex A to this Regulation, which includes species that are threatened, extinct or rare, so any form of international trade in such species would endanger their survival.

The European Parliament approved on 24 January 1989 the Resolution (Doc. A2-0377/88, Ser.A) calling upon urgent action of European countries for wolf conservation, adopted the Wolf Conservation Manifest, and appealed to the European Commission to support wolf conservation efforts.

As a signatory to the above mentioned agreements, our country is obliged to undertake all appropriate and necessary legal and administrative measures, at local, regional, national and international levels, in order to ensure protection of wolf and its natural habitat, and also to provide conditions for maintaining its stable population which is also a genetic reservoir/tank and potential source for reintroduction of the species into other European countries wherefrom its populations have disappeared.

National regulations and documents governing the wolf conservation issues

- Nature Protection Law (NN # 162/03),
- Rule Book on the Protection of Certain Mammalian Species (Mammalian) (NN # 31/95),
- Rule Book on Compensation Fees for Damage Caused by Unlawful Actions on Protected Animal Species (NN # 84/96),
- Law on Hunting (NN # 10/94, 29/99, 14/01),
- Animal Welfare Law (NN # 19/99),
- Veterinary Science Law (NN # 70/97, 105/01, 172/03),
- Rule book on Dog Marking (NN#162/03)

- Rule book on treatment of animal carcasses and waste of animal origin and its destruction (NN#24/03)
- Livestock Breeding Law (NN # 70/97, 36/98),
- Law on State Subsidies in Agriculture, Fisheries and Livestock Breeding (NN # 87/02),
- Biological and Landscape Diversity Strategy with Action Plans for the Republic of Croatia - NSAP (NN # 81/99)

Nature protection regulations

According to the Nature Protection Law of 1994, based on the provisions of the Rule Book on the Protection of Certain Mammalian Species (*Mammalia*) (NN # 31/95), wolf is a protected species, which means that any disturbance of the animal in its natural life and development, hiding, sale, purchase, stealing or any other form of acquisition, including taxidermy, is prohibited. It is also prohibited to export, carry over the state border, or import protected species. Exceptionally, these actions are justified when done for scientific research purposes, with prior permission by the competent Ministry. Pursuant to the Rule Book on Compensation Fees for Damage Caused by Unlawful Actions on Protected Animal Species, penalty for killing a wolf is a HRK 40,000 fine.

In October 2003 a new Nature Protection Law was adopted, which has integrated all the obligations of the Republic of Croatia towards international agreements where Croatia is a party or a signatory. The new Law anticipates 2 categories of protected species, according to the Bern Convention model – (i) strictly protected species, whose protection regime is equal to the protection regime as per the 1994 law, with possibility of exceptional interventions under the conditions and in the ways defined by the Bern Convention; (ii) the second category includes protected species, i.e. those that may be used, with certain protection or control measures involved (e.g. game). The State Institute for Nature Protection is currently conducting a review of species and their categorisation.

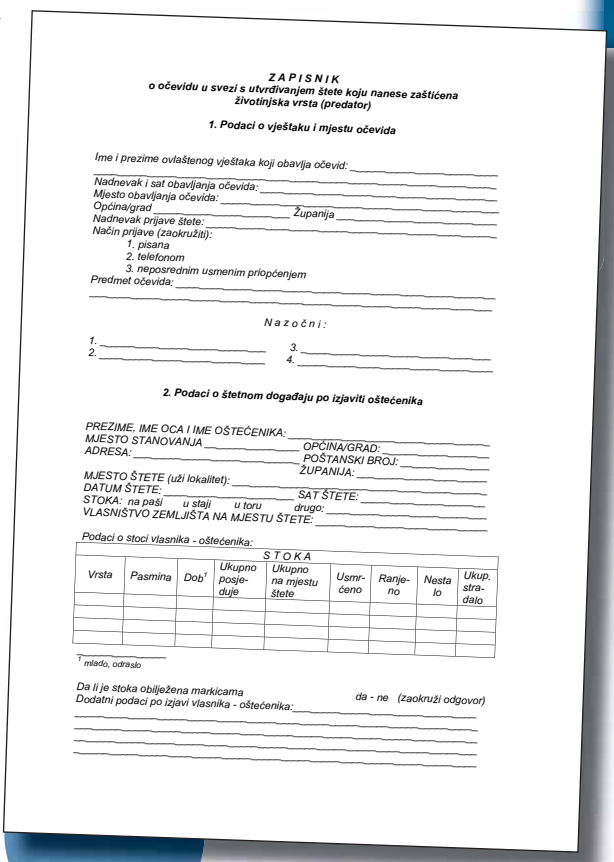
The Law anticipates the Republic of Croatia as a promoter and supporter of scientific research in the field of nature protection. Protected species research actions require permission by the competent ministry.

The Law also prescribes that nature protection requirements need to be issued by the competent government authority in the process of natural resource management plans development. These requirements are defined on the basis of expert thematic papers developed by the State Institute for Nature Protection. If the manner or scope of the natural resources use immediately endangers the favourable state of a species or a habitat type, the minister in charge may restrict or temporarily suspend the use until the threats have been removed, with the consent of the minister in charge of managing the natural resource in question. In an event of such restrictions being imposed, owners and authorised persons are entitled to compensation proportionate to the loss of income. The compensation amount is defined by mutual agreement.

Finally, in accordance with the corresponding regulations of the European Union, the law defines special ecologically important areas, which include habitats of species threatened at national or at the European level. Protection of these areas is ensured by enforcement of prescribed nature protection measures and requirements.

Compensation for damage caused by a strictly protected animal species

By virtue of Article 200, a legal or natural person that is likely to suffer economic or other damage by a strictly protected species, is obliged to undertake all appropriate and permitted measures and actions, at their own cost, in order to prevent damage from occurring. The actions should be prescribed by a ministerial regulation. The damaged party may also request that the competent ministry undertake the prescribed actions, with cost sharing agreed by both parties. If the damaged party has previously undertaken all prescribed actions and measures, they are entitled to compensation. Damage compensation is based on the assessment of damage by certified experts, the list of which is published in the official gazette of the Republic of Croatia, "Narodne novine". Guidelines for the procedure of damage assessment caused by a protected animal (predator) have been enacted by a ministerial regulation. The Guidelines contain detailed procedures in the process of assessing damage caused by a protected animal, especially regarding actions to be taken by the damaged party, inspection procedure, and actions of the expert. It is important to know that damage compensation is paid on the basis of an inspection carried out by a certified expert, i.e. submission of the inspection record form. According to the new law, the damage assessment procedure will be prescribed by a ministerial regulation.



ZAPISNIK
o očevidu u svezi s utvrđivanjem štete koju nanese zaštićena životinjska vrsta (predator)

1. Podaci o vještaku i mjestu očevida

Ime i prezime ovlaštenog vještaka koji obavlja očevid: _____
Nadnevak i sat obavljanja očevida: _____
Mjesto obavljanja očevida: _____
Općina/grad _____ Županija _____
Nadnevak prijave štete: _____
Način prijave (zaokružiti):
1. pisana
2. telefonom
3. neposrednim usmenim priopćenjem
Predmet očevida: _____

Nazočni:

1. _____ 3. _____
2. _____ 4. _____

2. Podaci o štetnom događaju po izjaviti oštećenika

PREZIME, IME OCA I IME OŠTEĆENIKA: _____
MJESTO STANOVANJA _____ OPĆINA/GRAD: _____
ADRESA: _____ POŠTANSKI BROJ: _____
ŽUPANIJA: _____
MJESTO ŠTETE (uži lokalitet): _____
DATUM ŠTETE: _____ SAT ŠTETE: _____
STOKA: na paši u staji u toru drugo: _____
VLASNIŠTVO ZEMLJIŠTA NA MJESTU ŠTETE: _____

Podaci o stoci vlasnika - oštećenika:

STOKA

Vrsta	Pasmina	Dob[1]	Ukupno posje-duje	Ukupno na mjestu štete	Usmr-ćeno	Ranje-no	Nesta lo	Ukup. stra-dalo

[1] mlado, odraslo

Da li je stoka obilježena markicama da - ne (zaokruži odgovor)
Dodatni podaci po izjavi vlasnika - oštećenika: _____

Figure 91.
Title page of an investigation report

Figure 92.
Investigation conducted by appointed damage assessment experts (A. Štrbenac)

Other relevant regulations

Additionally to the Nature Protection Law, there is a line of other regulations directly or indirectly affecting wolf conservation in Croatia.

The Law on Hunting regulates breeding, protection, hunting and use of game and its parts. Hunting management basis (HMB) constitutes a detailed planning document that regulates management of game and hunting grounds for a certain period, in accordance with habitat capacity and the state and populations of the game being managed. The HMB content, development methods and the procedure of enactment of the hunting management basis, game management and protection programmes in areas outside the designated hunting grounds are prescribed by separate rulebooks, which address the following issues:

a) determining animal species populations
b) overview of types and populations of game and animal species
c) management of animal species
d) management of (other, auth. note) animal species that includes measures for their maintenance and preservation.

HMB enforcement service monitors the state of predators and other animal species and implements preventive sanitary measures in the hunting grounds aimed at game and other animals' health protection.

The law requires, inter alia, for the obligatory harmonisation of the hunting management basis and the game protection programme with the ratified international agreements in the fields of hunting, protection of nature and natural game habitats, as well as the Nature Protection Law.

Among domestic regulations governing animal protection issues, there is the Animal Welfare Law, in the competence of the Ministry of Agriculture, Forestry and Water Management. The Animal Welfare Law anticipates taking into account animal welfare during keeping, shelter, feeding, protection, and overall treatment of animals.

For the purpose of this law, "animals" mean vertebrates: fish, birds and mammals.

The owner of an animal, depending on its type and specific needs, is obliged to feed, water, look after, provide shelter and secure proper healthcare for the animal.

The owner of an animal may not:

1. abandon pets or other animals kept under human control,
2. expose a raised or cultivated wild animal to the wild or settle it in the wild, unless prepared for survival in such environment.

Animals protected by virtue of the Nature Protection Law, wild animals and animal species and breeds that are dangerous for humans, may not be kept as pets and are subject to a special regulation. The list of such animals is enacted by a ministerial regulation, upon consent of the state authority in charge of nature and environmental protection.

Actions by which entire populations of, or individual wild animals in nature are exposed to torture or lengthy deprivation from satisfying physiological needs (feeding, watering, reproduction) by various

interventions, such as blocking the access to water, destruction of a habitat or its parts, introduction of alien animal species into the habitat, capturing live animals or putting them to death through suffering, unless exceptionally justified by scientific research and for the purpose of helping a population, and other interventions inflicting harm to the animals, are prohibited.

Public institutions managing protected parts of nature, as well as concessionaires on hunting grounds, must ensure all necessary conditions for biological survival of natural populations of wild animals in natural habitats in accordance with ecological balance, restoration of existing or expected habitat disturbances, as well as veterinary healthcare.

A penalty of HRK 5,000.00-10,000.00 is to be imposed on a legal or natural person should they keep animals protected by virtue of the Nature Protection Law and wild animals as pets. A penalty of HRK 2,500.00-5,000.00 is anticipated for persons treating the animals and wild animals in ways contrary to provisions of this Law.

The law also regulates protection of abandoned and lost animals.

Abandoned and lost animals are caught by the municipal health utility staff in the way that is least harmful for the animals, and transported into animal shelters. When a wild animal is found, the health utility or the animal shelter is obliged to submit to the nearest hunting society a request for its return into the wild if possible; otherwise, the animal should be handed over to the nearest properly equipped zoological garden. In case that the zoological garden is unable to receive the animal, it should be put to death. In case of finding a specially protected wild animal, the authority in charge of nature and environmental protection should be notified, which than decides on further procedure. Municipalities, towns, counties and the City of Zagreb are obliged to take care of the proper management of abandoned and lost animals and encourage establishment of shelters and health utilities.

The Veterinary Science Law regulates animal health protection. Among others, provisions of this law anticipate obligatory marking of bovine livestock, sheep, goat, pigs and horses, carried out by certified veterinary stations and surgeries, and keeping the records thereof. Costs of animal marking are to be borne by the owner. Dogs also require proper markings, and the owner needs to possess a prescribed registration and rabies vaccination certificates. Dogs are entered into the central canine register, which is divided into epizootic sectors according to the area of competence of separate veterinary medicine stations. Conditions and requirements for dog keeping, treatment of unregistered dogs, as well as with abandoned and lost animals, should be prescribed by the municipal or town assembly in line with the Animal Welfare Law provisions.

The Division for Veterinary Science of the Ministry of Agriculture, Forestry and Water Management adopted a *Rule book on dog marking*. It prescribes a mode of dog marking, a form of obligatory mark and contents of dog register. All dogs must be marked by microchips (all pups born after 1 October 2003) or mark (all pups born before 1 October 2003). Owners can also mark dogs by microchips although they are subject to marking by special marks. All marked dogs will be registered in a central database within the Ministry of Agriculture, Forestry and Water Management. This regulation would enable uniformity in marking, thereby also facilitating identification of owners of the lost and abandoned animals.

Utilisation and harmless removal of carcasses and animal products, confiscates, inedible by-products of slaughtering and hatchery wastes is regulating by a *Rule book on treatment of animal carcasses and waste of animal origin and its destruction*. Designation or construction of utilisation facilities for management of carcasses, animal products originating from animals with contagious diseases, and hatchery wastes has been foreseen, and in certain cases it is allowed to perform harmless removal by destruction or incineration in specially designated facilities (livestock cemeteries, pits and incineration plants). Utilisation and harmless removal is subject to a fee prescribed by a ministerial regulation. Control of facilities, sites and resources is performed by the veterinary inspection.

The Livestock Breeding Law regulates a number of issues related to raising domestic animals, including breeding and production of animals used for further reproduction. Production of reproduction animals is carried out according to defined breeding programmes, in which target animals need to be permanently marked and recorded in the central parent head register. The Croatian Livestock Selection Centre maintains the register of breeders of reproduction animals. Protection of native and protected species and breeds is carried out under special programmes. Funds for the protection of necessary quantities of domestic animal reproduction heads, and of genetic material of certain native and protected breeds are regularly secured through the State Budget.

The Law on State Subsidies in Agriculture, Fisheries and Livestock Breeding regulates types and amounts of financial incentives and charges, areas in which certain incentives can be granted in larger amounts (strategic areas), beneficiaries and methods for securing and using of these funds. Funds used for such subsidies are secured through the State Budget. Eligible beneficiaries of subsidies are legal and natural persons performing agricultural and fishing activities, and implementing selective breeding measures in livestock management and dairy health protection, living or headquartered in the territory of the Republic of Croatia, i.e. providers of goods or services in the Croatian market. A subsidy can be granted for 26 types of activity, including: 1. production of cow's milk (HRK 0.55 per litre, strategic areas HRK 0.90), goat and sheep milk (HRK 1.00 per litre, strategic areas HRK 1.50); 2. raising of breeding bulls (HRK 1,480.00 per head, strategic areas HRK 2,000.00), pigs, sheep and goat (HRK 450.00 per head, strategic areas HRK 650.00), horses (HRK 1,850.00 per head, strategic areas HRK 2,500.00), rabbits, poultry and selected queen-bees; 3. keeping of reproduction heads of native and protected breeds: bovine – Istrian ox, Slavonian podolian cattle (HRK 2,000.00 to 5,500.00 per head), sheep – ruda of Dubrovnik, Istrian sheep, tzigai sheep (HRK 150.00 to 400.00 per head); 4. keeping seed-stock herds of bovine (HRK 300.00 to 800.00 per head), sheep and goat (HRK 75.00 per head) in a strategic area defined by virtue of this law. Administrative enforcement of this law and its by-laws is in the competence of the Ministry.

Documents of nature protection

The Croatian State Parliament in June 1999 approved the Biological and Landscape Diversity Strategy with Action Plans for the Republic of Croatia - NSAP (NN # 81/99) that, among others, states the obligation of developing action plans for the protection of threatened species. One of the priorities of this Strategy was the need to develop an action plan for the conservation and management of wolves in Croatia. NSAP also lists a number of action plans referring to the protection through other sectors. For instance, NSAP anticipates an action plan for incorporation of biodiversity protection measures into the hunting sector activity.

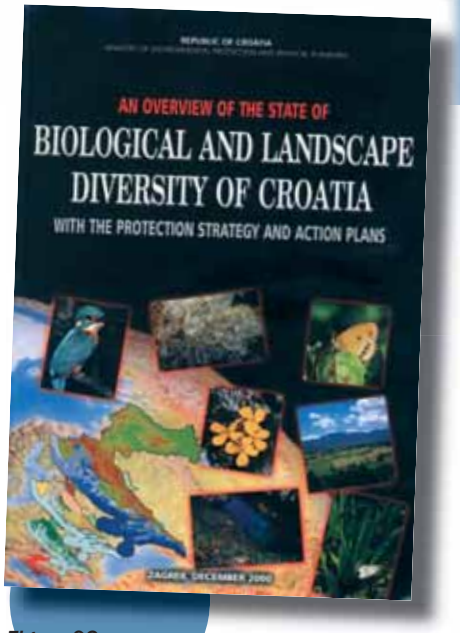


Figure 93.
National Strategy and Action Plan for the Protection of Biological and Landscape Diversity is the fundamental nature conservation document

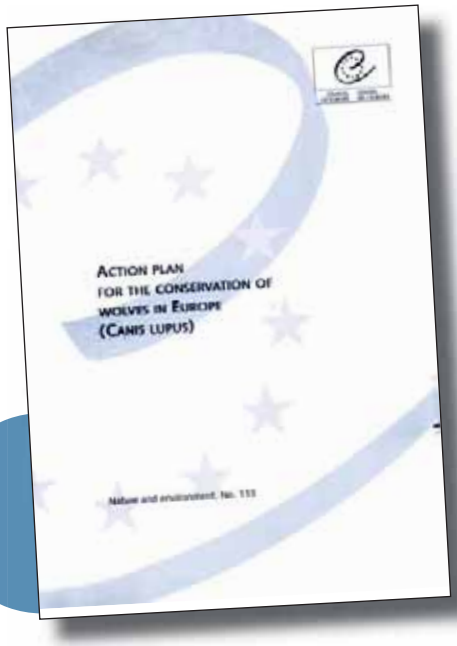


Figure 94.
The Action Plan for Wolf Conservation in Europe

Recommendations for the action plan for conservation of wolves in Croatia

The Large Carnivore Initiative for Europe was founded in 1995 with the aim to solve the problems of large carnivore protection or rather conservation of large carnivore populations (the brown bear, the wolf, wolverine, the Eurasian lynx and the Iberian lynx) in coexistence with humans. This group prepared action plans for conservation of large carnivores approved by the Council of Europe at the meeting of the Standing Committee of the Bern Convention held in November 2000. One of these plans was also the "Action Plan for the Conservation of Wolves in Europe". In its Recommendation No. 74 (2000) the Council of Europe urges national authorities to incorporate recommendations of the Action Plan for Conservation of Wolves in Europe into their national plans for the management of this species.

The following items were recommended to Croatia:

1.1 The Bern Convention adopts this Action Plan and the Country participates in establishing a Group of Experts on Wolf Management.

1.2 The Group of Experts produces a detailed European Wolf Management Plan and submits the Plan to be approved by the Bern Convention.

2.1 The Group of Experts identifies at large scale all areas of Europe where wolves or their potential wild prey are still present with viable populations.

2.2 The Group of Experts identifies all current and potential connection areas. Through this process, wolf recovery and management will be linked to the overall planning for the restoration of European ecosystems.

2.3 Each area (or group of areas at regional, national or sub-national level) is provided with a detailed Management Plan (National or Regional) drafted by national authorities in co-ordination with neighbouring countries.

2.4 The national and local public is involved in the process of area identification and drafting of the preliminary Management Plans.

2.5 The final European Wolf Management Plan, composed by all national and/or regional Plans is submitted to the Bern Convention for approval, and national legislation is adjusted accordingly.

3.1 Design a national PR campaign with the aim of informing the public opinion and making the wolf a political issue.

3.2 Prepare a document on the ways the Country and the EU are implementing the international laws and directives they have signed.

3.3 Organise logistics and funding for national and international networks of government and NGO representatives on wolf management issues.

3.4 Ask the European Union to review and correct the economic incentives policies to shepherds in areas with wolves.

4.1 Identify and establish national wolf management groups and empower them to design the national wolf management plan.

4.2 Co-ordinate the work at national level with that of the international Group of Experts established by the Bern Convention.

5.2 Evaluate the status of the food supply for the wolf in various regions and identify the needs for specific actions.

5.3 Evaluate the presence and impact of existing and planned infrastructure in zones where the wolf is present or recovering.

6.1 Assess the status of all recovering and small populations, including counting or monitoring wolf abundance, identifying wolf habitat quality and quantity (i.e., prey distribution and abundance).

6.2 Identify and manage source populations to ensure their continued existence.

6.3 Assess the attitudes of humans in wolf recovery areas.

7.1 Assess the feasibility and desirability of the management approach of removing selected problem wolves.

7.2 Assess and manage the problem of feral and stray dogs, and the existing legislation to control them.

7.3 Prepare a census of existing facilities with captive wolves.

7.4 Assess the genetic identity of local wolves.

7.5 Review and correct the economic incentives policies to shepherds in areas with wolves.

7.6 Establish a sound scientific programme for assessing and implementing the optimal use of large guarding dogs.

7.7 Establish a permanent monitoring programme for damages caused by wolves and other predators.

7.8 Define the most suitable compensation scheme for each national/regional group of wolf areas.

8.1 Assess the quality of wolf hunting in its biological and social perspectives.

8.4 Establish strong and credible fines for illegal hunting of wolves and enforce them.

8.5 Implement more research on the impact wolves and hunters have on local prey.

9.1 Assess the feasibility for an economic exploitation of the wolf.

10.1 Identify opinion leaders and stakeholders in wolf management; set up local management boards and involve them in management planning and implementation.

10.2 Establish a permanent protocol of consultations with local people about the management actions to be implemented in their area.

11.1 Identify the need/desirability of an educational campaign at local or national level.

11.2 Design and implement an educational and information programme.

11.3 Design and implement a press campaign.

11.4 Identify and empower credible wolf managers to represent the case of the wolf in front of the public and the press.

12.1 Co-ordinate a programme of scientific research at European level, distributing research topics along with local priority.

12.2 Contribute to maintaining a close link among all researchers working on the wolf in Europe.

12.3 Contribute to the regular gathering of all necessary data to monitor the management and biological conditions of the wolf in all European countries.

Protected areas

It is impossible to say that areas outside the boundaries of protected areas (national and nature parks) are not entitled to protection; protection of such areas is based on physical plans of various levels, forest management documents, Law on Agricultural Land, Hunting Law, etc. In these areas, economic priorities prevail, respecting environmental concerns to the highest extent possible.

Viewing from the aspect of managing the wolf population in Croatia, within boundaries of a national park – where priority is given to the protection of the entire territory, the fundamental natural phenomenon, flora and fauna – there is almost absolute protection and, in principle, tourism is the only economic activity that can exist there in its entirety.

Concerning Croatian national parks, wolf can be found regularly in the following: Risnjak, Plitvice Lakes, Northern Velebit, Paklenica, and Krka, making up the total area of approximately 669 km^2.

Nature park is defined as an area under the influence of constant human presence and impact on natural environment, which has not resulted in destruction or depreciation of natural resource values, but has been preserved by sustainable use in its specific landscape and biological diversity. As a rule, these are much larger territories than those covered by national parks.

Possibilities for the wolf population survival and management are realistic in the following nature parks: Velebit with 200,000 ha, and Biokovo with 19,000 ha. Wolves have been said to occasionally appear in the Žumberak-Samoborsko gorje Nature Park, Učka Nature Park and probably also in the Lonjsko polje Nature Park.

Hunting activity in the mentioned nature parks is carried out in an organised manner, through leaseholds or concessions on hunting grounds, with hunting management documents focusing on economically more important game types, while other animal species that (might) affect the hunting management are only briefly mentioned.

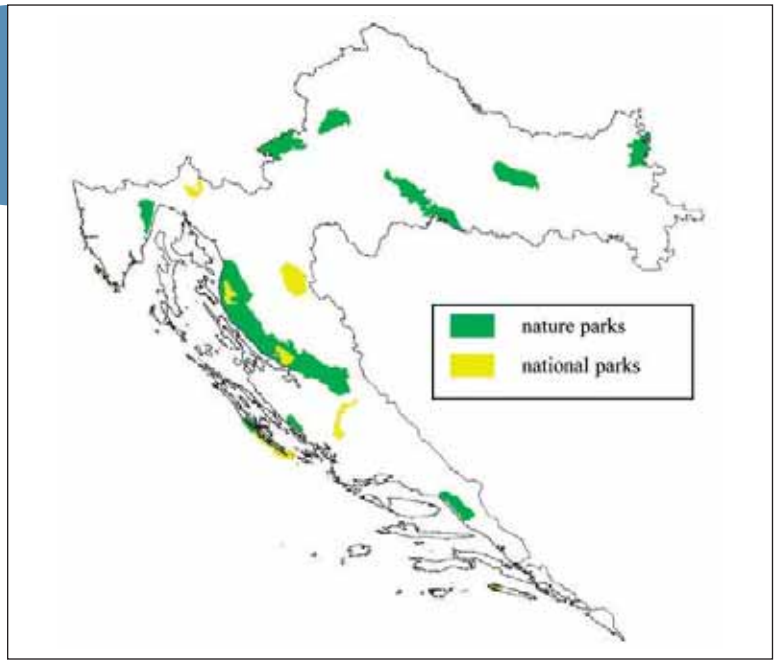


Figure 95. *Map of protected areas in Croatia*

Law enforcement

Illegal killing of wolves occurs despite their legal protection. No accurate data is available, because no one would willingly report such acts. Perpetrators have been found out only for two cases of killing. The first such case happened in January 1996, when hunters of the Perković hunting unit killed 5 wolves, but went unpunished until today. Another case was the one in hunting ground in Dragonožec near Zagreb. After the offence process the perpertrator was found guilty.

Other cases of illegal kills can only be left to speculation, although some prominent hunters claim the unwritten rule that every wolf has to be killed. Most hunters do accept that illegal killing is an issue that must be addressed. Not as much perhaps on biological ground as for establishing better trust and credibility with other interest groups, illegal killings need to be reduced. The agreement to allow some wolves to be killed annually is dependent upon illegal killing being reduced and eventually eliminated. Further, in Dalmatinska zagora there are frequent cases of poisoning, which often kills dogs and other animals.

The only section of legislation that is regularly enforced is the compensation for damages caused by a protected species. Damage assessment is carried out by certified experts - 13 for the Counties of Karlovac, Primorje-Gorski kotar, Lika-Senj, Zadar, Šibenik-Knin, Split-Dalmatia, and Dubrovnik-Neretva. Four seminars have been held to train the experts (Crni Lug 1995, Vodice 1997, Velebno 1999, Risnjak 2003), and the brochure "Who did it?" was printed as a guideline for identifying damage perpetrators.

Condition and status of wolf populations in neighbouring countries

Bosnia and Herzegovina

The wolf population is stable, not threatened, and it is estimated at 600-700 individuals. During regular monitoring periods, the average annual kill amounted to approximately 200 individuals. There are no natural or artificial barriers for the movement of wolves, therefore no isolated populations. Forest covers 48% of the country territory, and the area of permanent wolf range is known to be 2/3 of the territory. The wolf population is connected to the populations in Montenegro and Serbia towards the southeast, and those in Croatia all along the border south of the Sava River. There is a lack of natural prey. Damage to livestock is rather large, but the exact amount cannot be established, because damage is not reported and there is no compensation system in place. No public campaigns have occurred, nor would they be feasible in the current situation.

The wolf is not protected by any piece of legislation, with the exception of the Hunting Law calling for the protection of each species. Prizes for killing wolves were abolished in 1986. The wolf however is recognised as having a sanitary role in the ecosystem. The country is not yet a party to the Bern Convention, and there is no expert group for monitoring the wolf population. International cooperation does not exist in an organised manner, apart from occasional individual cooperation.

Slovenia

Since the establishment of a legal protection framework in 1993, the wolf population has been spreading geographically and in creasing in numbers. Estimates of the wolf population vary, and most probably there are at least 50 individuals. The population is concentrated along the southern border with Croatia in the length of 232 km, out of which there is constant wolf presence in 112 km, and occasional in the remaining 120 km (Table 23, Figure 96). Westward and northward there are anthropogenic barriers for the wolf to spread, although some individuals do manage to penetrate quite deep into that space. It is important that there is no possibility of connecting with other wolves in that direction, because there are no wolves in Austria or northeastern parts of Italy. Therefore the wolf population in Slovenia and its survival depends exclusively on its population in Croatia.

Table 23. Length of state border (km) between Croatia and Slovenia with permanent or occasional presence of wolf, bear and/or lynx

	Wolf	Bear	Lynx
Permanent presence	112	131	112
Occasional presence	120	196	120

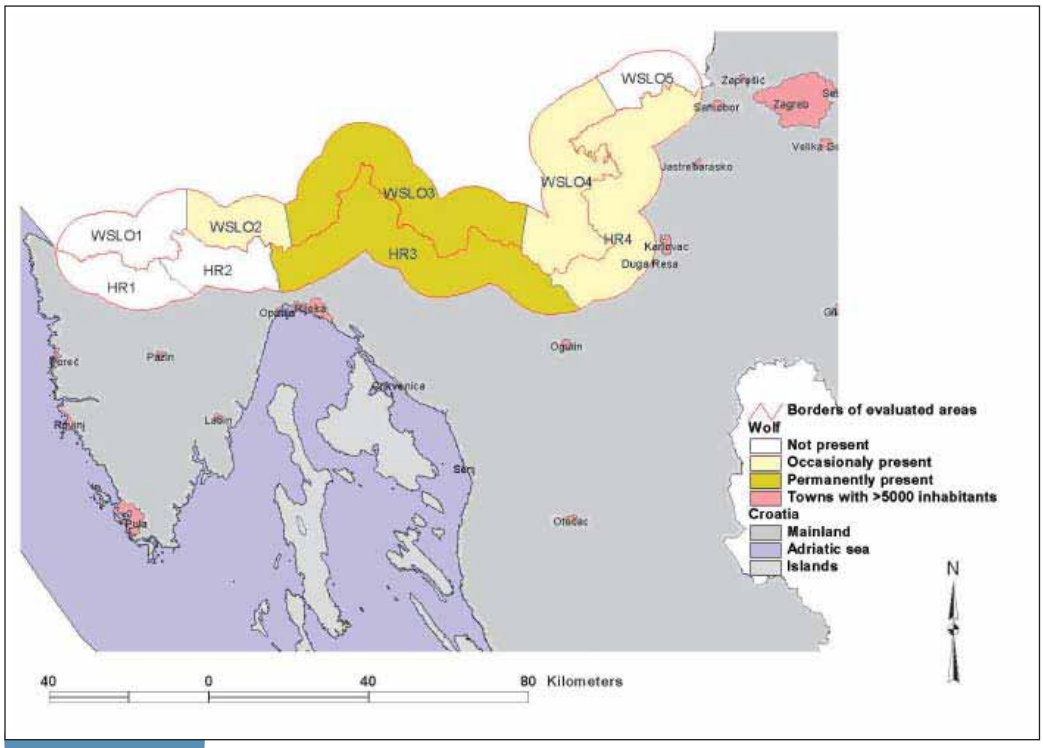


Figure 96. Border area between Croatia and Slovenia (10 km wide zone), showing presence of wolf

The natural prey for wolves in Slovenia is sufficient in its area of occupancy. Forest-covered surfaces have increased by 500 km^2 in the last 50 years, today amounting to approximately 3.500 km^2, which favours both the prey and the wolf itself. Damage to livestock is quite large, and similar in size to the damage caused by bear. The State pays compensation for damage done by wolves, which is especially increasing for sheep, because the number of sheep in the country in the last 10 years has increased 6 fold. Livestock protection measures have not been adequate.

The wolf is a species protected by law, and quotas of permitted annual intervention into the population are defined, usually in the range of 4 to 10 individuals. Wolves killed by traffic and from other causes are deducted from the annual quota, and the rest is killed by the local hunters. There is a well-established system of monitoring of the wolf population and its mortality.

Goal of the Plan

The main goal of the Wolf Management Plan is ensuring long-term survival of the population of this large carnivore which is capable of survival in qualitative and quantitative terms, in as harmonious coexistence with humans as possible. However, for planning such activities it is necessary to know the available resources. This includes knowledge of the wolf biology, diet and behaviour, as well as determining its population and area of distribution, populations of its natural prey and quality of its habitats. It is also necessary to determine intensity of the human impact on wolf and prey populations. On the other hand, one needs to be aware of the needs of the local residents as well as general attitudes of all interests groups; environmentalists, foresters, hunters, scientists, NGOs and the broad public. Only these basics will enable identification of concrete activities for achieving an efficient conservation of the species. It is also important to remember that this requires mutual consent of all stakeholders involved because this is the only way to ensure practical implementation of the proposed activities.

Since the Dinaric wolf populations capable of survival are distributed across several countries, wolf management in Croatia is planned in cooperation with neighbouring countries, Slovenia and Bosnia and Herzegovina.

Wolf Management Plan

1 Research and Monitoring

1.1 Establishment of a national system for monitoring wolf population

The Wolf Management Plan is based on the knowledge of the wolf population and the factors determining the state of this population. For that purpose it is necessary to establish a national system for monitoring wolf population, in accordance with the similar system established for lynx. Therefore scientific research, and monitoring of the population status, dynamics and ecology as well as the natural prey, human impact and competitor species, will be systematically implemented. This of course needs to be harmonised with international standards of wolf population monitoring which are stated in the Action Items of the Large Carnivore Initiative for Europe, as part of the Bern Convention.

In the collection of these data, the key element is cooperation among different stakeholders, as it was already partially achieved during collection of data for the development of the present management plan.

Monitoring of the wolf population

In order to obtain the most reliable data a combination of several research methods should be used.

a) Collecting wolf carcasses

- All stakeholders and other possible finders should report each wolf carcass (whatever the cause of death) to the competent medical institution. During development of this plan the competent institution is the Biology Institute of the Faculty of Veterinary Medicine in Zagreb (Heinzelova 55, 10000 Zagreb, phone +3851.2390.141, fax +385.1.2441.390, e-mail: huber@vef.hr). The carcass should be kept in one piece, preferably stored in a refrigerator or, if so agreed, in a freezer.
- The wolf carcass will be used for determination of all morphological parameters, sample keeping (skeleton, organs, bodily fluids), analysis of the digestive system contents, which will serve as a source of data on standard morphological features, genetic structure, health condition (fitness, parasite concentration, exposure to contagious diseases like rabies, etc.).
- Genetic analysis of the dead wolf tissue and faeces samples. Above described genetic methods enable identification of individuals, which serves as a basis for calculating population trends and size.

Figure 97. *Measurement and dissection of killed wolves are carried out by the scientists at the Faculty of Veterinary Medicine of the University of Zagreb (J. Kusak)*

b) Telemetric monitoring of collared individuals

- Wolves will be captured alive into specially designed traps, chemically immobilised, and after measuring and sampling, marked by collars with installed radio-transmitters and released at the place of capture. Transmitters and portable guided antenna will enable tracking of the collared wolves, thus the direct collection of data on their movement and activity, and indirectly on the size, selection and use of the haunt, and activity rhythm. It will particularly provide insight into the frequency, hunting success and prey types, and on the method and level of exploiting the prey, areas of higher livestock depredation risk. It will further help in gaining knowledge on the social hierarchy within the pack, reproduction complex (sexual maturity, birth frequency, litter size, survival of the young), health, causes of mortality and life expectancy. As said above, 7 wolves in Croatia have been telemetrically monitored.

Figure 98. *Measuring and collaring the anaesthetized W5 wolf (Hilda) in Gorski kotar on 2 July 2002 (J. Kusak)*

c) Monitoring based on wolf tracks in snow

In the areas with lots of snow during the winter, the tracks of wolves in snow must be observed and monitored.

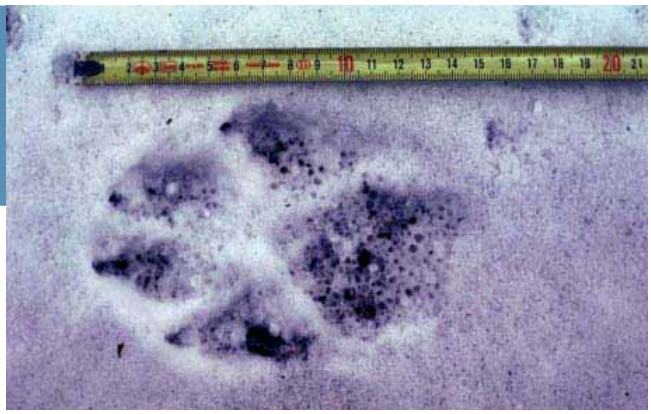


Figure 99.
Footprints in the snow may also provide information on wolves
(Đ. Huber)

Monitoring of prey populations

Quantitative and qualitative status of the prey populations will be monitored by:

- data on the kill and wastes,
- estimates of local game concessionaires and public authorities managing the protected areas,
- population estimates based on marking,
- monitoring the signs of presence,
- application of other available methods.

Using the Geographical Information System (GIS)

All data will be mapped through the Geographical Information System (GIS) which will enable their spatial and temporal interpretation, regarding natural habitat features, human impacts in the habitat, and their interrelations (e.g. distribution of prey, locations of damage, lairs, resting places, locations of guarding dogs and electric fences, roads, etc.).

2 Habitat preservation

In order to preserve habitats it is necessary to maintain their integrity and quality.

2.1 Maintaining habitat integrity

a) As much as possible avoid habitat fragmentation caused by construction, in order to preserve biological unity,

Figure 100.
The Medina gora green bridge on the Zagreb – Split motorway, the Otočac – Lički Osik section
(J. Kusak)

b) Build "green bridges" for safe passage of game during road construction,

c) To the largest extent possible maintain the spatial proportions among forests, meadows and arable plots.

2.2 Maintaining habitat quality

a) Monitor quality of habitats with recorded presence of wolf (monitoring of certain habitat elements and providing feedback on actual habitat conditions through field research),

b) Prevent excessive exploitation of natural resources and prevent modifications of fundamental habitat features,

c) Enable participation of members of the Croatian Committee for Monitoring Large Carnivore Population in the development of physical plans for counties, the territories of which are inhabited by wolf, in order to take into consideration known corridors of wolf movement during road construction, opening of new quarries and sports facilities etc.,

d) Viewing the well-preserved biodiversity of Croatian forests in European proportions – ensure the preservation of its current state. Maintain selective forest management in order to preserve forest stands of varying age structures and their use as shelter for daily rest and for rearing of the young.

e) Prevent introduction of alochthonous animal species into the habitats.

3 Hunting

3.1 Harmonisation of hunting management documents with the conservation measures for wolf and other protected predators

a) Establish a system of game monitoring in Croatia (obligatory submission of data on game to the relevant ministry by all game concessionaires, and setting up of a central GIS database),

b) When calculating the game increment coefficient and game fund, take into consideration the presence of wolf, so concession levels would reflect the presence of protected predators and a proven impact of wolves to natural prey,

Figure 101. *A wildlife monitoring system is to be established and shooting measures regulated (A. Frković)*

c) Increase game populations

- regulate the kill quotas so as to increase the current size of ungulate populations,
- introduction of adequate native game species,

d) Scientifically justified objective assessment of the impact of wolves and other predators on game populations (Slovenian example)

3.2 Prevention of illegal kills of game and wolves

a) Increase authorities of the competent inspectors and gamekeepers, education training of authorities,

b) Increase liability scope for game concessionaires in cases of illegal kill,

c) Education of authorities,

d) If illegal kills are not reported, increase the responsibilities of game concessionaires,

e) Introduce stricter sanctions for poaching (additional seizure of the weapon).

4 Livestock breeding

4.1 Streamline the livestock management and increase guarding efficiency

a) stimulate larger, but not excessively large, herds (optimal range is 50-100 sheep),

b) maintain assistance to livestock breeders in guarding against wolf attacks

- donation of *tornjak* dogs, Croatian shepherd dogs, and electric fences, accompanied by necessary training,

Figure 102. *Lecture on keeping donated* tornjak *dogs properly*
(D. Šarić)

- through the system of permanent control of beneficiaries and donations, maintain efficiency monitoring that has been set up under the LIFE project,
- permanent employment of regional coordinators and strengthening control via the farmers support services, and guiding the work of kennel clubs towards education on breeding and use of shepherd and guarding dogs,

c) set up an autonomous breeding and selection system for shepherd and guarding dogs in wolf and other predator areas of distribution.

4.2 Finalise livestock registration process for Croatia

a) the competent authority should ensure labelling of all domestic animals (veterinarian or CLSC labels),

b) develop an appropriate database and establish the central livestock register.

4.3 Improve the existing system of damage compensation

a) Ensure a more regular and quicker compensation payment

- increase the number of the competent ministry legal staff that would exclusively deal with processing of inspection reports,
- more regular submission of completed reports to the competent authority by experts,
- ensure and speed up withdrawal of budgetary resources intended for compensation payments,

b) Improve the work of experts

- organise periodic (annual) training for experts,

Figure 103. *A seminar on education of damage assessment experts – a lecture (S. Desnica)*

- regional coordinators should monitor the work of experts,

c) Revise the existing Instructions for assessing damage caused by a predator, with the list of compensation rates

- prescribe basic livestock guarding measures,
- condition the payment of compensation fees by proper application of guarding measures,
- withhold compensation for unlabelled mature livestock,
- condition the payment of compensation fees by the regular payment of charges for the use of state-owned pastures for grazing,
- payment of actual wholesale market prices for sheep and goat in the areas of permanent wolf presence (Gorski kotar, Lika, Dalmatia), which is defined on an annual basis (in June),
- damage to a registered reproduction head should be compensated in accordance with the value defined for it by the Selection Service.

4.4 Improved coordination among livestock breeders

a) activate the existing livestock breeder associations,

b) stronger cooperation among existing breeder associations,

c) fund local breeder associations in the entire area of wolf presence.

4.5 Solving the problem of uncontrolled and stray dogs

a) improve the work of sanitary utilities in the concerned counties.

4.6 Prevention of illegal disposal of slaughterhouse waste

a) inventory and remediation of illegal waste disposal sites,
b) strengthen inspection control and sanctioning of all offenders.

5 Interventions into the wolf population

Viewing the current state of the wolf population, reported damage to livestock and impact on game as well as failure to enforce efficient protection in the field, which results in illegal killing of this species, participants of several workshops have agreed to allow an intervention into the wolf population, upon enactment of the Plan. In planning the intervention it must be considered to preserve the present teritorial distribution of wolves. In cases of wolf presents outside this area, each case will be treated separately. This management regime would be implemented for a trial period of two years, starting with 2005, with obligatory monitoring of the results of such intervention. It is particularly important to assess whether this management approach will really contribute to solving the key wolf issues of minimisation of illegal killing and better cooperation among stakeholders, and livestock damage reduction. Further planning for wolf management in Croatia will depend upon this. The plan is a "living" document that will be regulary adapted based on new dana and new directions agreed upon by all interest groups.

The two key preconditions for this intervention are:

a) not to disturb the status (stability) of the wolf population,
b) intervene on a selective basis (problematic individuals and packs).

5.1 Implementing the intervention

Intervention should be made in the following cases:

- big and often damage to domestic animals in a certain area,
- contagious disease (individual rabies victims),
- unacceptable (questionnaires and monitoring based on tracks in snow),
- threat to humans.

Who should propose and decide on making an intervention

- the State Institute for Nature Protection in cooperation with the Faculty of Veterinary Medicine of the University of Zagreb develops annual reports on the status of the wolf population in Croatia,
- Data collection should involve local hunters were possible to help build credibility of the data and subsequent results,
- the Committee for Monitoring Large Carnivore Populations proposes a quota expressed as a percentage of the estimated wolf population,
- the competent authority makes a decision on the intervention, upon proposal by the Committee.

Defining the quota

- the quota is defined annually, the end of a calendar year, (suggestion at beginning of new year in January),
- the quota should be defined on a regional basis; larger intervention is due in areas where damage has been done to domestic animals; smaller intervention where wolf feeds on its natural prey. The regions concerned are Gorski kotar, Lika and Dalmatia.
- social carrying capacity is one of the factors in defining the quota,
- the total quota includes regional quotas, emergency responses, traffic kills and other death causes,
- after the first 6 months a status analysis shall be made, which may result in a decrease or an increase of the planned intervention size.

Intervention method

- the kill.

Period of intervention

- October to January; reproduction time (February – September) excluded, except in emergency situations.

Operationalisation of intervention

- the kill is performed by a local game concessionaire in cooperation with local coordinators (certified damage assessment experts that are at the same time hunters),
- each intervention should be recorded in writing, in order to be submitted to the Council of Europe,
- local coordinators in all regions have the role of facilitators between game concessionaires and the competent ministry and should take care of producing records on the killings,

Emergency response

In certain situations, outside of the planned annual intervention, emergency response may be required, namely:

- in the case of rabies, attacks on humans, and other deviant behaviour,

In that connection, it is necessary to develop an emergency plan.

Management of wolf carcasses (equal to the above described procedure during monitoring)

- carcasses of wolves killed within the quota shall be submitted to laboratory analysis at the Faculty of Veterinary Medicine of the University of Zagreb,
- skull and fur are returned to the hunting concessionaire if interested,
- wolf carcasses killed in some other way are permanently deposited with the authorised scientific institution.

Controlled intervention

- a broader group to control the process of defining and performing of the intervention is established, which will next to the present Committee members include the representatives of all interest groups. The broader group meets at least once a year,
- intervention is controlled in the field by the nature protection inspection in cooperation with experts, forestry and hunting inspections, gamekeepers, nature park guards and the police.

Financing

- costs of the kill are financed by the game concessionaire,
- wolf carcasses management is financed by the state budget (ministries in charge of science and nature protection).

6 Education and information

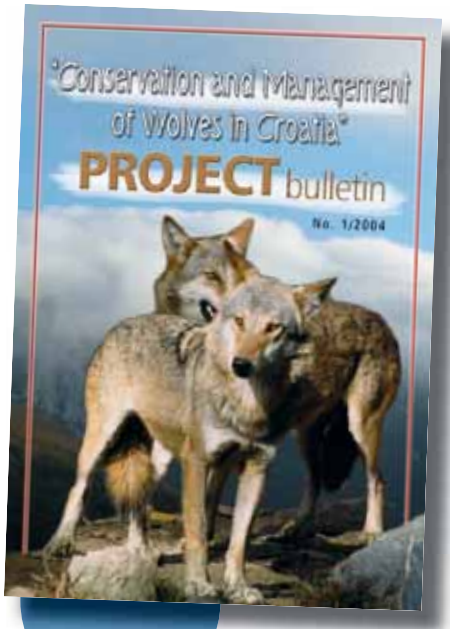


Figure 104.
The LIFE Project bulletin on "Conservation and Management of Wolves in Croatia"

6.1 Conducting an educational and information campaign

- designate an institution, agency etc. that will be in charge of fundraising for educational and information activities after the LIFE project ends,
- maintain the existing activities and design a wider information and education campaign (publications, exhibitions, TV commercials, production and sale of souvenirs in protected areas, etc.),
- hold lectures about the wolf for teachers and students in primary and secondary schools,
- propose introduction of lectures on wolves and other large carnivores into regular school curricula in the areas of distribution of these species,
- regularly inform the public on wolf conservation activities via press-conferences, public announcements, etc.,
- monitor levels of knowledge on wolves by sociological surveys, continue to work with all interest groups and local communities using various human dimension approaches.

Figure 105.
Lecturing on wolves in a primary school
(D. Šarić)

7 Public participation in decision-making

An important precondition for quality involvement of the public into decision-making is good public information (see above). There are two main ways to involve the public:

- direct involvement of active representatives of stakeholders into decision-making processes, especially concerning revision of the Plan, and development and adoption of action plans, through consultations, workshops etc.,
- quantitative monitoring of broad public and stakeholder attitudes to proposed measures and actions in wolf management, and use of these results for decision-making.

Figure 106.
The Workshop on the Wolf Management Plan preparation held in Velebno
(S. Desnica)

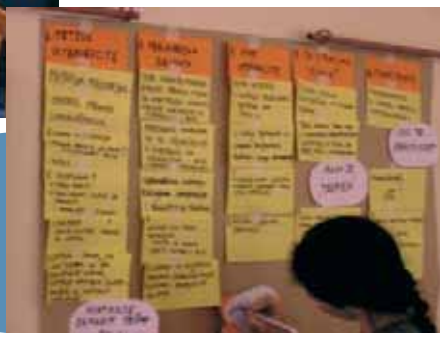


Figure 107.
The Skradin Workshop, work principles – writing down the participants' ideas
(S. Desnica)

8 Tourism

- establish an educational and information centre for all three large carnivores in Croatia in the areas of their occupancy (Gorski kotar or Lika) (see under 6),
- in cooperation with tourist boards design and organise visiting tours to areas inhabited by large carnivores,
- design thematic souvenirs on wolf and other large carnivores, that can be sold in the education and information centre and in protected areas, and motivate and involve local people in their production.

Figure 108.
Photo-hunting of a wolf
(J. Kusak)

9 Cooperation with neighbouring countries

Bosnia and Herzegovina

Cooperation and defining of the status of wolves in the country should be promoted. This requires for Bosnia and Herzegovina to sign the Bern Convention, designate an expert group for wolf management issues and develop a wolf management plan. The Croatian side can offer its assistance based on experiences with the implementation of the Bern Convention, wolf management planning and public involvement.

The existing known facts on the wolf population in Bosnia and Herzegovina do not call for the strict protection of this species. It is necessary to define the size of the wolf population that is in line with ecological and social capacities of habitats, determine quotas, introduce protection measures for livestock and a possible system for damage compensation.

Slovenia

The goal is to make the wolf population on both sides of the border permanently capable of survival, and to maintain the flow of individuals and their genes in both directions.

It is necessary to carry out regular harmonisation of population management plans, and especially the size of approved isolation quotas. The methods of population monitoring should be as similar as possible, for purposes of better comparison and summarising of results. Population monitoring through analysis of genetic features should be particularly encouraged.

It is proposed to organise regular annual meetings of experts and permanent reporting on all important events and developments.

10 Implementation of the Plan

Competent authority

Wolf related issues are in the competence of the Ministry of Culture – Nature Protection Division, which makes decisions based on thematic background papers developed by the State Institute for Nature Protection and through consultation with the Committee for Monitoring Large Carnivore Populations.

The Ministry of Agriculture, Forestry and Water Management, as the competent authority for hunting, livestock breeding and veterinary issues, is also obliged to take part in the implementation of the Plan, within the scope of its competence.

The Ministry of Environmental Protection, Physical Planning and Construction is also important in the Plan implementation, especially in the part concerning environmental impact assessment for the purposes of intervening into habitats.

Inspection and gamekeeping services

Practical implementation of all activities defined in the laws and regulations is ensured by inspection and other authorised services.

State Institute for Nature Protection

The State Institute for Nature Protection is in charge of preparing thematic background papers for monitoring of the wolf population in Croatia with the inclusion of any of the interested parties.

Committee for Monitoring Large Carnivore Populations

The Committee for Monitoring Large Carnivore Populations reviews, suggests and advises the competent authority on all activities envisaged by this Management Plan.

Stakeholder cooperation in the management

Precondition for successful implementation of a management plan is the cooperation among all interest groups. Environmentalists, scientists, hunters, foresters, non-governmental organisations and the local population, as well as other competent state and local authorities all need to work together on the collection of relevant data on wolves, planning and implementation of possible interventions in the population, and also implementation of activities aimed at preventing poaching and illegal actions related to protected animals. In that respect, it is necessary that stakeholder representatives meet at least once every year.

11 Revision of the Plan

The Wolf Management Plan should undergo its first revision within two years after enactment, and later as necessary. The revision should be initiated by the Ministry of Culture based on the thematic papers developed by the State Institute for Nature Protection and upon the proposal by the Committee for Monitoring Large Carnivore Populations. The revision process is carried out by representatives of all stakeholder groups in the same way in which the Plan was first developed (through workshops). This will ensure the possibility to review outcomes in relation to planned results, whether any changes have taken place, and make any necessary modifications and implementation of new activities if required.

12 Financing implementation of the Plan

Funds for implementing the Plan would largely have to be ensured from the State Budget, with possible assistance from international sources. County budgets may also provide part of the funding needed. The establishment of a Fund for Environmental Protection is another possibility for financing the implementation.

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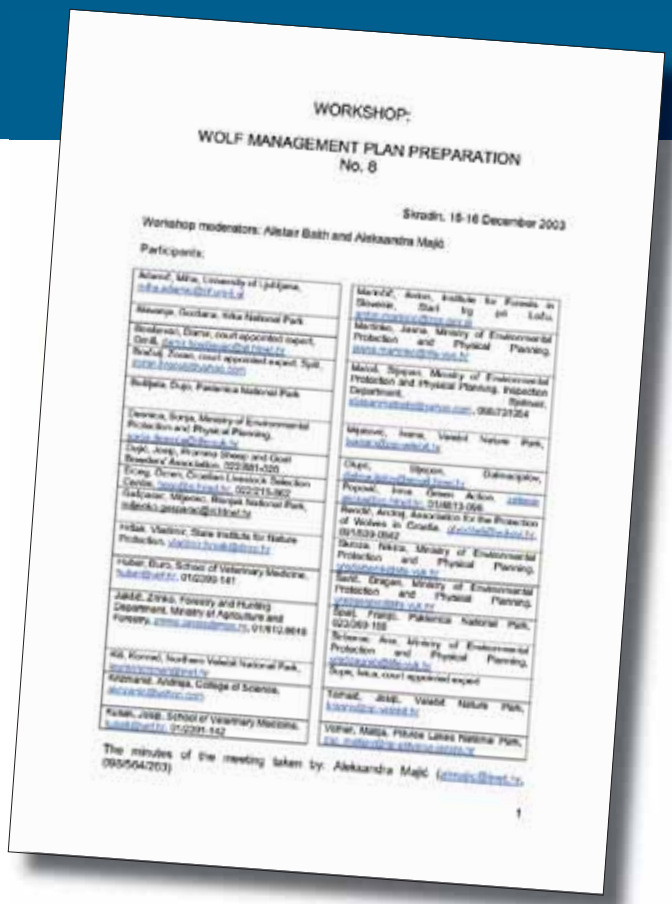
Annex 1

MINUTES FROM THE WOLF WORKSHOP



WORKSHOP:

WOLF MANAGEMENT PLAN PREPARATION
No. 8

Skradin, 15-16 December 2003

Workshop moderators: Alistair Bath and Aleksandra Majić

Participants:

The minutes of the meeting taken by: Aleksandra Majić (

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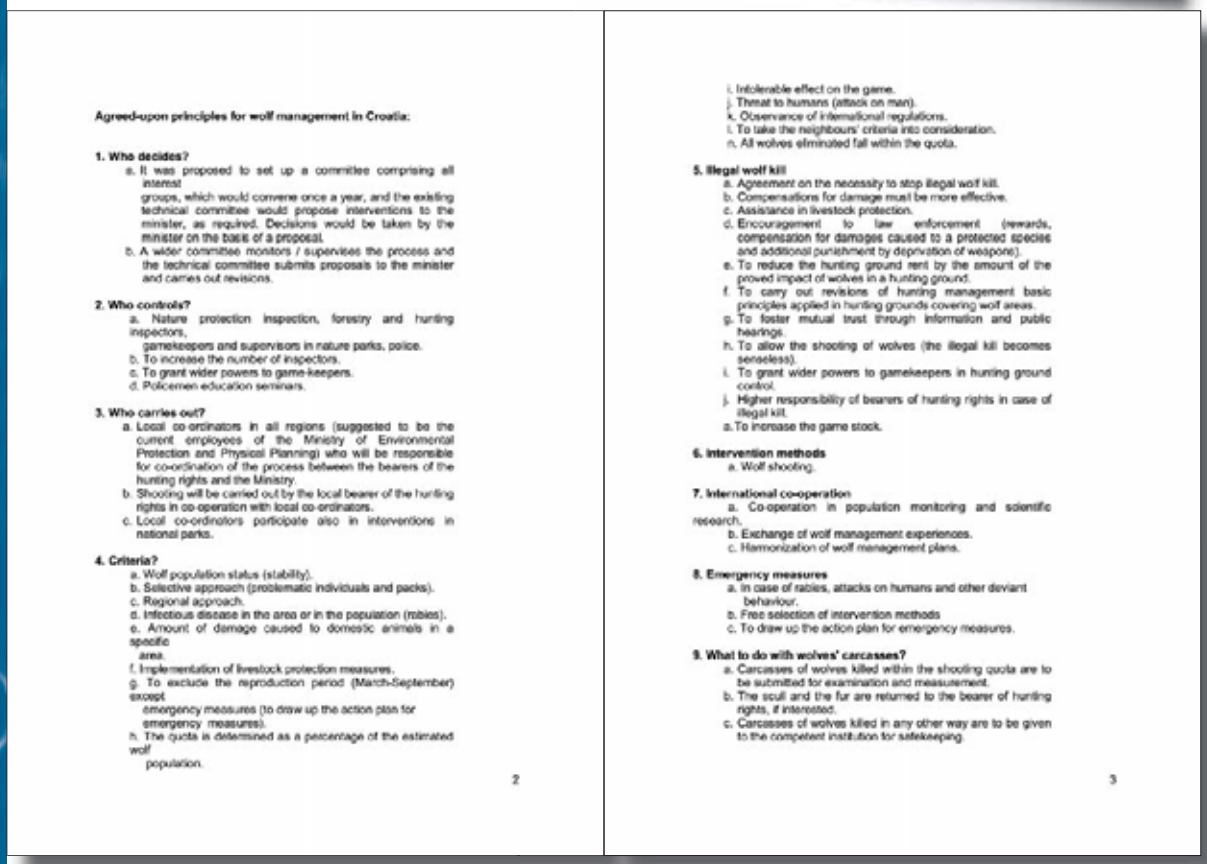

Agreed-upon principles for wolf management in Croatia:

1. Who decides?
a. It was proposed to set up a committee comprising all interest groups, which would convene once a year, and the existing technical committee would propose interventions to the minister, as required. Decisions would be taken by the minister on the basis of a proposal.
b. A wider committee monitors / supervises the process and the technical committee submits proposals to the minister and carries out revisions.

2. Who controls?
a. Nature protection inspection, forestry and hunting inspectors, gamekeepers and supervisors in nature parks, police.
b. To increase the number of inspectors.
c. To grant wider powers to game-keepers.
d. Policemen education seminars.

3. Who carries out?
a. Local co-ordinators in all regions (suggested to be the current employees of the Ministry of Environmental Protection and Physical Planning) who will be responsible for coordination of the process between the bearers of the hunting rights and the Ministry.
b. Shooting will be carried out by the local bearer of the hunting rights in co-operation with local co-ordinators.
c. Local co-ordinators participate also in interventions in national parks.

4. Criteria?
a. Wolf population status (stability).
b. Selective approach (problematic individuals and packs).
c. Regional approach.
d. Infectious disease in the area or in the population (rabies).
e. Amount of damage caused to domestic animals in a specific area.
f. Implementation of livestock protection measures.
g. To exclude the reproduction period (March-September) except emergency measures (to draw up the action plan for emergency measures).
h. The quota is determined as a percentage of the estimated wolf population.

2

i. Intolerable effect on the game.
j. Threat to humans (attack on man).
k. Observance of international regulations.
l. To take the neighbours' criteria into consideration.
n. All wolves eliminated fall within the quota.

5. Illegal wolf kill
a. Agreement on the necessity to stop illegal wolf kill.
b. Compensations for damage must be more effective.
c. Assistance in livestock protection.
d. Encouragement to law enforcement (rewards, compensation for damages caused to a protected species and additional punishment by deprivation of weapons).
e. To reduce the hunting ground rent by the amount of the proved impact of wolves in a hunting ground.
f. To carry out revisions of hunting management basic principles applied in hunting grounds covering wolf areas.
g. To foster mutual trust through information and public hearings.
h. To allow the shooting of wolves (the illegal kill becomes senseless).
i. To grant wider powers to gamekeepers in hunting ground control.
j. Higher responsibility of bearers of hunting rights in case of illegal kill.
a. To increase the game stock.

6. Intervention methods
a. Wolf shooting.

7. International co-operation
a. Co-operation in population monitoring and scientific research.
b. Exchange of wolf management experiences.
c. Harmonization of wolf management plans.

8. Emergency measures
a. In case of rabies, attacks on humans and other deviant behaviour.
b. Free selection of intervention methods
c. To draw up the action plan for emergency measures.

9. What to do with wolves' carcasses?
a. Carcasses of wolves killed within the shooting quota are to be submitted for examination and measurement.
b. The scull and the fur are returned to the bearer of hunting rights, if interested.
c. Carcasses of wolves killed in any other way are to be given to the competent institution for safekeeping.

3

10. Funding
a. Shooting costs are covered by the bearer of hunting rights.
b. The disposal of carcasses of wolves killed in any other way are funded from the budget.

11. Livestock breeding
a. Disbursement of compensations within a shorter period of time – a month upon signing the contract.
b. Payment of the actual regional market price.
c. The price is fixed on a yearly basis, regionally and by categories.
d. The disbursement of compensation is connected with looking after the livestock.
e. The state should keep on providing support to the prevention of damages cause by wolves.
f. The registering of sheep and goats is to be completed as soon as possible.
g. Better organization of livestock breeders.
h. To promote cattle and horse breeding rather than sheep breeding in Gorski kotar.

12. Public support
a. Public support is of vital importance for the avoidance of larger conflicts, but not the only decision-making criterion.
b. Public support is to be achieved by objective information and education (lectures, brochures, leaflets, forums, mass media).
c. Public support to be investigated by polls and focus groups.

13. Regional differences
a. Regions viewing the prey status and wolf presence: Gorski kotar, Lika, Dalmatia and lowland Croatia.
b. Vitally important for determination of quotas and the social carrying capacity.
c. A major intervention where damages are caused to domestic animals (e.g. 60% of the quota) and a minor in places where the wolf feeds on natural prey (e.g. 40% of the quota).

14. Frequency
a. The quota is determined on a yearly basis, at the end of the calendar year.
b. After 6 months the analysis of the state is to be carried out.
c. The quota includes the regional quotas, emergency measures, road-kills and other ways of kill.

It is also agreed as follows:
1. The management plan based on these principles will be completed by a narrower working group.
2. Ana Štrbenac will consult interest groups on the composition of the narrower working group.
3. The plan will be made available to all interest groups prior to its final adoption.

Fotografije ispisanih kartica:

Annex 2

List of damage assessment experts in 2004

#	Name	Address	Contact phone	County	Fax
1.	Željko Dasović	Brinje	+385.53.700688 *mobile:* +385.98.414355	Lika-Senj	
2.	Dragan Milković	Gospić	+385.53.679026 *mobile:* +385.98.9439187	Lika-Senj	
3.	Igor Hak	Gračac	+385.23.775070 *mobile:* +385.98.446665	Lika-Senj	
4.	Alojzije Frković	Rijeka	+385.51.546236 *mobile:* +385.91.6060641	Primorje-Gorski kotar	+385.51.546130
5.	Ana Grgas	Benkovac	+385.23.681997	Zadar	+385.23.681110
6.	Marko Ljubičić	Knin	+385.22.661402 *mobile:* +385.91.5338938	Šibenik-Knin	
7.	Ivica Šupe	Šibenik	+385.22.334333 +385.22.214126 +385.22.214549 *mobile:* +385.91.5052267	Šibenik-Knin	+385.22.331441
8.	Stipe Kokić	Sinj	+385.21.824901 *mobile:* +385.98.423159	Split-Dalmatia	
9.	Boris Šabić	Makarska	+385.21.612008 *mobile:* +385.91.5384585	Split-Dalmatia	+385.21.612008
10.	Damir Bosiljevac	Omiš	+385.21.863239 *mobile:* +385.91.5133263	Split-Dalmatia	+385.21.862553 +385.21.862140
11.	Zoran Bračulj	Split	+385.21.539814 *mobile:* +385.91.6060663	Split-Dalmatia	+385.21.539814
12.	Anita Petković	Dubrovnik	+385.20.331139 *mobile:* +385.98.9271007	Dubrovnik-Neretva	
13.	Dražen Matičić	Karlovac	+385.47.613439 +385.47.613400 *mobile:* +385.98.763981	Karlovac	+385.47.613438
14.	Berislav Šimunić	Senj	+385.53.881418 *mobile:* +385.98.1882833	Lika-Senj	+385.53.881404

STATE INSTITUTE FOR
NATURE PROTECTION

ISBN 953-7169-06-5