

„Improving the conservation status of endangered freshwater fish species that are endangered or in unfavourable-bad conservation status in Šibenik-Knin and Split-Dalmatia Counties“
ReFresh Fish LIFE (LIFE24-NAT-HR-101216203)

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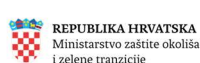


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1. INTRODUCTION

The client, the Institute for Environmental and Nature Protection within the Ministry of Environmental Protection and Green Transition, is implementing a project co-financed under the LIFE programme entitled *Refresh Fish LIFE* (LIFE24-NAT-HR-101216203) – “Improving the conservation status of endangered freshwater fish species that are threatened or in an unfavourable/poor conservation status in Šibenik-Knin and Split-Dalmatia Counties.”

The overall objective of the project is to improve the conservation status of specific freshwater fish species that are endangered or in an unfavourable/poor conservation status in Šibenik-Knin and Split-Dalmatia Counties.

The project targets five freshwater fish species assessed as endangered (or critically endangered) on the *IUCN Red List*, or classified with an unfavourable/poor (U2) status at the biogeographical level in accordance with Article 17 of the *EU Habitats Directive reporting process to the European Commission*. The project focuses on the following target species: *Knipowitschia mrakovcici* (endemic to the Krka River), *Phoxinellus dalmaticus* (endemic to Croatia, found in the Čikola, Vrba, and Krka rivers), *Aulopyge huegelii*, *Telestes tursky* (endemic to the Čikola River) and *Phoxinellus alepidotus* (endemic to Croatia). The project area comprises four key Natura 2000 Ecological Network sites: the wider area of Krka National Park (HR2000918), Čikola (HR2000919), Vrba (HR2001266) and the middle course of the Cetina River with the Hrvace and Sinj fields (HR2001313). The project addresses urgent conservation measures and aims to improve the population status of the above target freshwater fish species in Croatia's karst river ecosystems, through the control of alien and invasive alien fish species, research, freshwater ecosystem restoration activities, waste removal from the Čikola River, monitoring, and raising public awareness of the target fish species and their conservation and habitat protection.



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1.1. Objective of this assignment

The objective of this assignment is a preliminary (baseline) study aimed at assessing the public's level of knowledge and awareness of invasive alien fish species, endemic species, and the Natura 2000 Ecological Network prior to the start of project activities. This objective will be achieved through a public opinion survey on the topic of invasive alien fish species conducted on a sample of 400 citizens of the Republic of Croatia, supplemented by an additional sample of 100 citizens in Šibenik-Knin County and 100 citizens in Split-Dalmatia County. The public opinion survey will enable the Client to establish a baseline of citizens' opinions and knowledge, which is necessary for the subsequent evaluation of the success of the project's public-awareness activities, through comparison with the end-of-project results.

This report presents comparative results for the general population (a nationally representative sample) and for the sample of residents of Šibenik-Knin and Split-Dalmatia Counties, obtained through the core and additional (boost) samples.



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1.2. Research methodology

1.2.1. Method

The research was conducted using the quantitative method of online interviewing (CAWI – *Computer Assisted Web Interviewing*) among members of Henda's hrNation online panel. Given the method chosen, the survey was self-administered, which provided respondents with full anonymity and sufficient time to answer all the questions in the questionnaire.

All randomly selected respondents received a secure link through which they accessed the questionnaire on their computers, tablets, or mobile devices. The data-collection system generated a unique ID for each panel member, preventing the same person from completing the survey more than once.

The sample was stratified, i.e., divided into quota cells by gender, age, region, and settlement size. The survey software monitored quota fulfilment in real time throughout fieldwork.

Once a given subgroup was filled, the system automatically closed access to the survey for new respondents matching that profile. Invitations to participate were also not sent to the entire panel at once, but in controlled batches to a randomly selected sample of panel members within the required quota groups.

1.2.2. Quality control

Data-collection quality was monitored throughout all three phases of the research — before fieldwork, during fieldwork, and during data processing — through the following mechanisms:

1. Logical skip patterns were built into the questionnaire at the programming stage. For example, it was not possible to skip questions without providing an answer, and skip logic and filter questions were built in.
2. During fieldwork itself, careless completion was detected by monitoring completion time: respondents who finished the survey in a time significantly shorter than the median were automatically excluded, on the assumption that they had not read the questions properly. Completion patterns were also checked — for example, on attitude scales (such as Likert scales), straight-lining (automatically selecting the same answer on every item) was monitored.
3. During data preparation, responses were further analysed to identify inconsistencies across related questions. No inconsistencies were identified during the data-quality review.



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The research was conducted in accordance with ISO standard 20252:2019 and the ESOMAR International Code on Market and Social Research, as well as in accordance with the GDPR.

1.2.3. Presentation of results

The results obtained are presented for a nationally representative sample of 400 respondents representing the population of the Republic of Croatia (hereinafter, in the text, figures, and charts: the general population), and for a boost sample of 260 respondents from Šibenik-Knin and Split-Dalmatia Counties (hereinafter, in the text, figures, and charts: the boost sample). The boost sample consists of all surveyed residents of these two counties who form part of the sample drawn from the general population of Croatia, together with a targeted sample (a „boost“) that additionally covered 100 residents from each county (200 in total). The total size of the boost sample therefore consists of 60 respondents from the general-population sample plus 200 additional respondents from the two counties — 260 respondents in total.

Statistical significance was further calculated with respect to gender, age, region, urbanity, and level of education. Only larger differences are interpreted in the text of the report.

Data collection took place from June 26th to July 7th 2026.

1.2.4. Sample

The sample was representative in terms of population parameters (gender and age), and it reflected the actual urban–rural population ratio.

The table below shows the sample structure achieved by demographic variable (shown for the nationally representative sample and the boost sample):



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Table 1: Sample structure

	General population		Boost sample (Šibenik-Knin & Split-Dalmatia Counties)	
GENDER	N	%	N	%
Male	190	47,5	98	37,7
Female	210	52,5	162	62,3
AGE GROUP	N	%	N	%
18-24	35	8,7	11	4,2
25-34	55	13,7	38	14,6
35-44	65	16,2	70	26,9
45-54	65	16,2	65	25,0
55+	180	45,0	76	29,2
REGION	N	%	N	%
Zagreb	110	27,5	0	0,0
Northern Croatia	61	15,2	0	0,0
Slavonia	69	17,2	0	0,0
Lika, Kordun, Banovina	30	7,5	0	0,0
Istria, Croatian Littoral, Gorski Kotar	48	12,0	0	0,0
Dalmatia	82	20,5	260	100,0
URBANITY	N	%	N	%
Rural	155	38,8	47	18,1
Urban	245	61,2	213	81,9
LEVEL OF EDUCATION	N	%	N	%
No schooling / incomplete primary education	12	3,0	1	0,4
Completed primary education	58	14,5	2	0,8
Completed vocational/industrial secondary school – 3 years (skilled/highly skilled worker)	51	12,7	28	10,8



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Completed grammar school / secondary school (4 years)	178	44,6	104	40,0
Completed higher education / university bachelor's degree (2/3 years)	29	7,1	34	13,1
Completed university / college / master's degree (4/5 years)	62	15,6	78	30,0
Master of Science degree	6	1,6	10	3,8
Doctorate	3	0,8	3	1,2
HOUSEHOLD INCOME ACTIVITY	N	%	N	%
Agriculture and livestock farming	22	5,5	12	4,6
Fisheries and aquaculture	3	0,7	5	1,9
Forestry	16	3,9	6	2,3
Viticulture	15	3,7	9	3,5
Hunting	5	1,3	0	0,0
Beekeeping	6	1,4	2	0,8
Nature conservation	5	1,2	4	1,5
Protected area management	3	0,7	3	1,2
Tourism (e.g., ecotourism, rural tourism)	19	4,9	31	11,9
Water management	2	0,5	0	0,0
Household income comes from other fields of activity	316	79,1	201	77,3
Don't know / prefer not to answer	17	4,3	9	3,5
TOTAL	400	100,0	260	100,0



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1.2.5. Research instrument

The questionnaire consisted of 34 questions (6 demographic questions and 28 questions in the main part of the questionnaire) with standardised response scales (e.g., agreement scales), as well as single-response and multiple-response questions. The Client supplied the questionnaire, which Henda then revised in agreement with the Client prior to fieldwork.

Once the questionnaire was approved by the Client, it was programmed in the online survey software (WarpIt), which allows for the definition of logical skips within the questionnaire and links between individual answers.

The average survey duration was 10.34 minutes.

The questionnaire used in the research is provided in Appendix 1.



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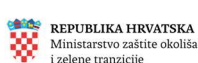
2. RESEARCH RESULTS

2.1. Biodiversity

After checking respondents' demographic characteristics, the initial part of the main questionnaire assessed citizens' level of familiarity with the term *biological diversity*, or *biodiversity*.

The results indicate a relatively high level of recognition of this term. At the Croatian level, 61% of citizens state that they have heard of the term *biodiversity*, while the share of those familiar with the term is somewhat higher among residents of Šibenik-Knin and Split-Dalmatia Counties (65%). At the same time, 36% of Croatian citizens state that they have heard of the term *biodiversity* but do not know its meaning, while 3% have never heard of it. Among residents of Šibenik-Knin and Split-Dalmatia Counties, 31% of respondents state that they have heard of the term *biodiversity* but do not know what it means, while 4% state that they have never heard of the term.

Looking at socio-demographic characteristics, respondents from the Istria, Croatian Littoral, and Gorski Kotar area report to a significantly greater extent than others that they have heard of the term *biodiversity* but are not sure of its exact meaning.



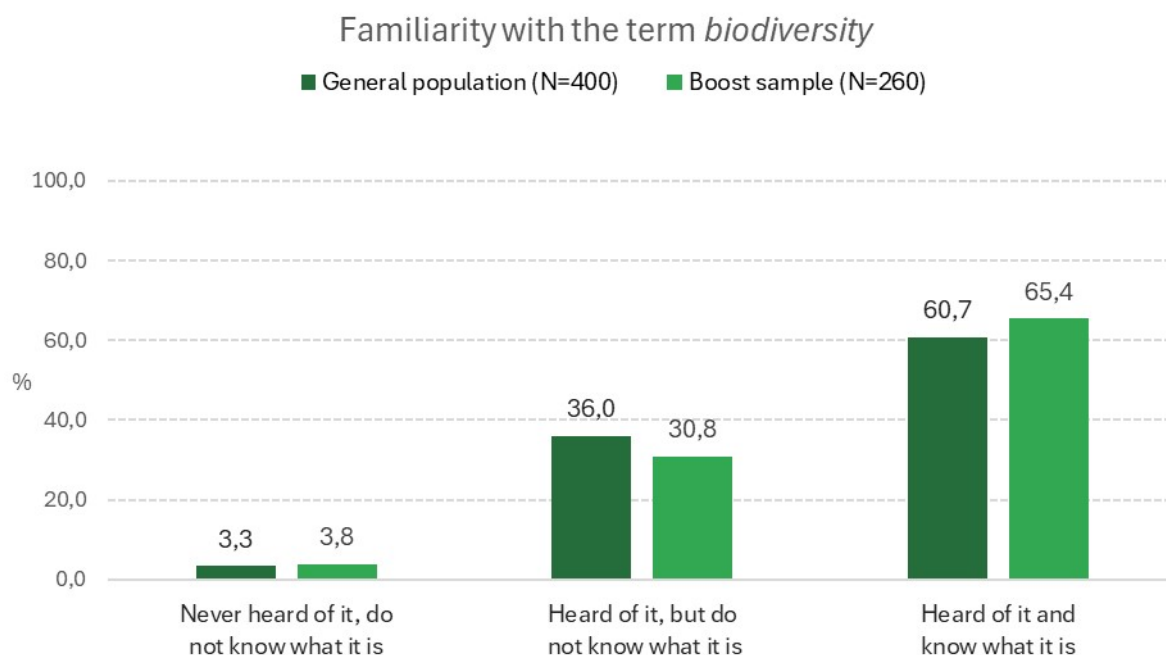


Figure 1 – Familiarity with the term biological diversity; Base: all respondents (general population N = 400 and boost sample N = 260)

After being asked about their familiarity with the term *biodiversity*, respondents assessed how serious they consider the problem of the decline and potential extinction of animal and plant species, natural habitats, and ecosystems to be in various environments. The assessment was made on a four-point scale, where a score of 1 indicated “not at all serious,” 2 “not very serious,” 3 “fairly serious,” and 4 “very serious.” Respondents were also offered a “don't know/cannot assess” option, which was not included in the calculation of average response values. For the purposes of analysis, respondents were divided into two groups: those who gave a score of 1 or 2 form the “not serious” category, and those who gave a score of 3 or 4 form the “serious” category.

The results show that respondents perceive the problem of the decline and potential extinction of animal and plant species, natural habitats, and ecosystems as most serious at the global level. This problem is considered serious by 89% of the overall population and 88% of residents of Šibenik-Knin and Split-Dalmatia Counties. A similarly high level of concern is present when the problem is viewed at the European level, where it is considered serious by 86% of Croatian citizens and 85% of residents of Šibenik-Knin and Split-Dalmatia Counties.

At the level of Croatia, i.e., the national territory, approximately three-quarters of respondents perceive the problem as serious (76% of the overall population and 77% of residents of Šibenik-Knin and Split-Dalmatia Counties). Although to the smallest extent, respondents also perceive the problem as serious at the local level, i.e., in the area where they live (60% of the overall population and 64% of residents of Šibenik-Knin and Split-Dalmatia Counties).

Analysis by socio-demographic characteristics shows that women, urban residents, and residents of Lika, Kordun, and Banovina consider the problem of the decline and potential extinction of animal and plant species, natural habitats, and ecosystems to be serious at the local level to a greater extent than men, rural residents, and respondents from other parts of Croatia. Furthermore, women assess the same problem as serious at the level of Croatia as a whole to a greater extent than men.

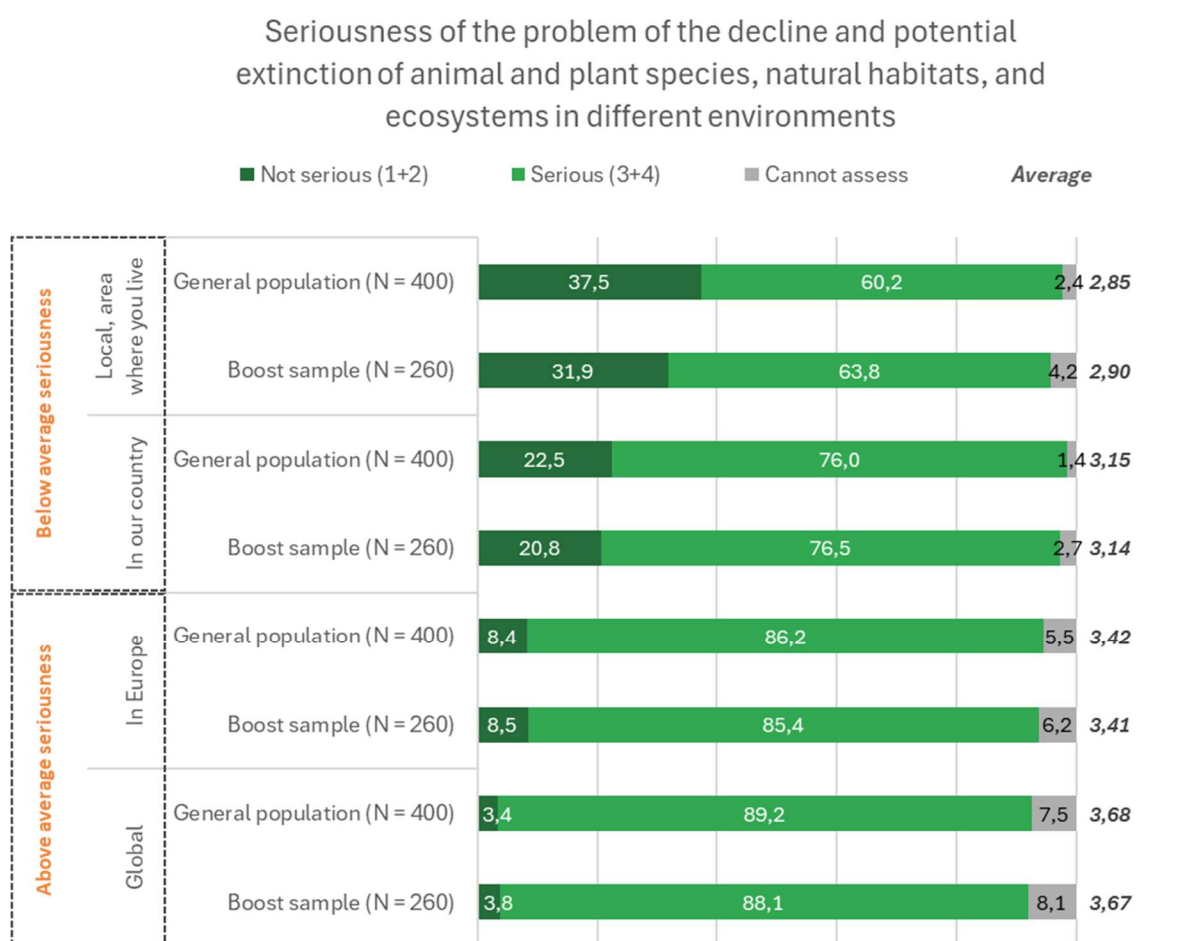


Figure 2 – Seriousness of the problem of the decline and potential extinction of animal and plant species, natural habitats, and ecosystems in different environments; Base: all respondents (general population N = 400 and boost sample N = 260)

After assessing the seriousness of the problem of the decline and potential extinction of animal and plant species, natural habitats, and ecosystems in different environments, respondents assessed the extent to which particular factors, in their opinion, threaten biodiversity. This assessment was also conducted on a four-point scale, where a score of 1 indicated “not at all,” 2 “not very much,” 3 “fairly,” and 4 “very much.” As in the previous question, respondents could select a “don't know/cannot assess” response marked with a score of 5, which was not included in the calculation of average values.

In respondents' opinion, air, soil, and water pollution (e.g., of seas, rivers, and lakes) represents the factor with the greatest, i.e., above-average, impact on biodiversity decline. This view is shared by 93% of the overall population and 96% of residents of Šibenik-Knin and Split-Dalmatia Counties.

Among the factors that also have a pronounced impact on biodiversity decline, respondents highlight the overexploitation of forests, overfishing, conventional intensive agriculture involving pesticide use, and the concreting of waterways, cited by 92% of the overall population and 97% of residents of Šibenik-Knin and Split-Dalmatia Counties. This is followed by human-caused disasters (e.g., oil spills and industrial accidents), recognised as a significant factor by 93% of the overall population and 95% of residents of Šibenik-Knin and Split-Dalmatia Counties.

The conversion of natural areas to other uses (e.g., the expansion of urban areas) is also cited as a factor threatening biodiversity by 94% of the overall population and 94% of residents of Šibenik-Knin and Split-Dalmatia Counties. Climate change is likewise perceived as a factor with a considerable impact, with 89% of the overall population and 93% of residents of Šibenik-Knin and Split-Dalmatia Counties considering it as such.

A somewhat lower, i.e., below-average, impact on biodiversity decline is attributed by respondents to the fragmentation of natural areas by transport, water, or energy infrastructure (e.g., motorways, hydropower plants, and dams on rivers), cited by 90% of the overall population and 92% of residents of Šibenik-Knin and Split-Dalmatia Counties. The smallest impact is attributed by respondents to non-native plants and animals introduced from other regions or countries, seen as a factor threatening biodiversity by 81% of the overall population and 82% of residents of Šibenik-Knin and Split-Dalmatia Counties.

Looking at socio-demographic characteristics, women rate almost all of the listed factors (with the exception of non-native plants and animals introduced from other regions and countries, and climate change) as significantly more serious compared to men. Furthermore, respondents older than 35 and urban residents perceive non-native plants and animals as a serious problem significantly more often compared to those younger than 35 and rural residents.

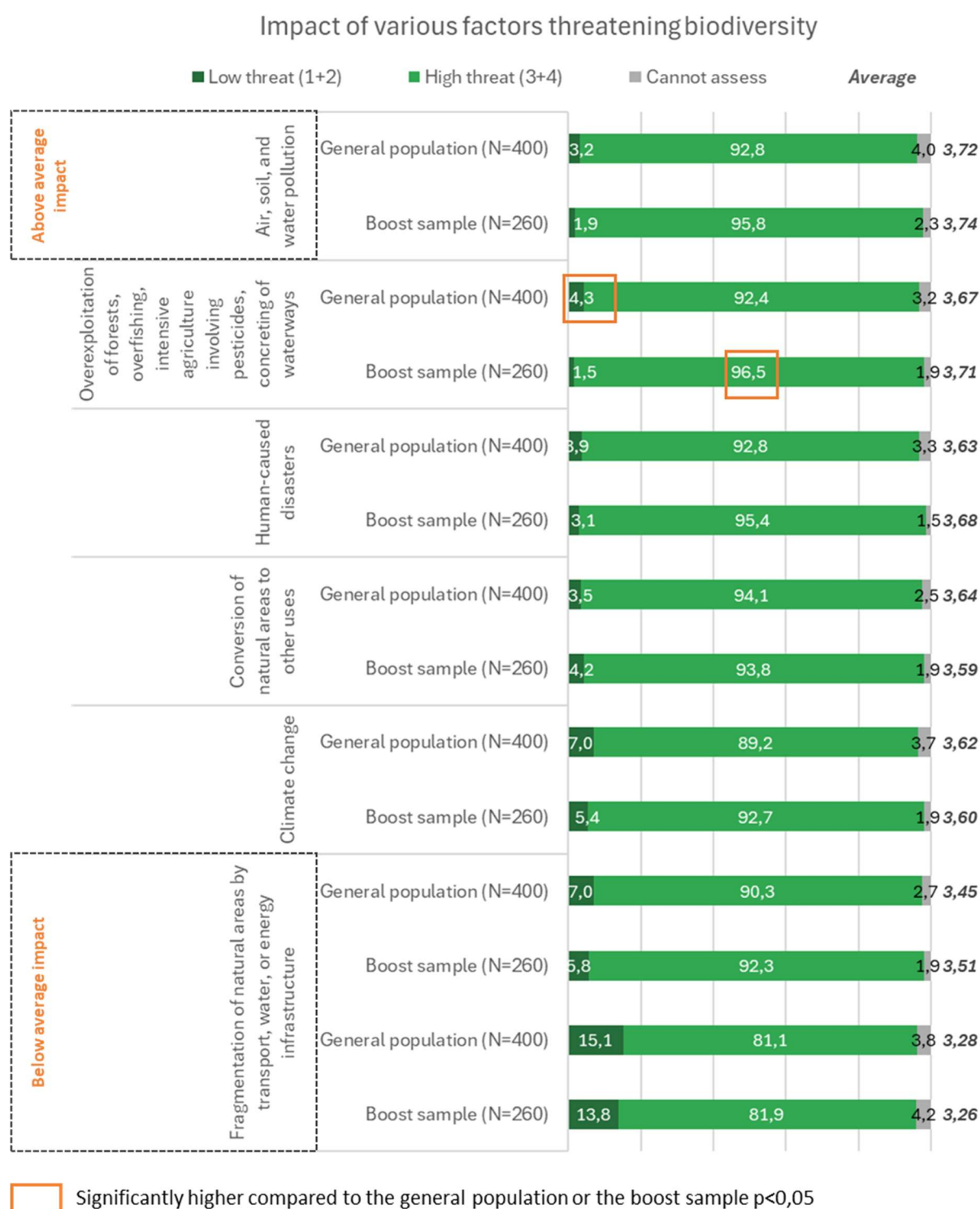


Figure 3 – Impact of various factors threatening biodiversity; Base: all respondents (general population $N = 400$ and boost sample $N = 260$)

2.2. Natura 2000 Ecological Network

On the question of familiarity with the Natura 2000 Ecological Network, the results show a relatively low level of full understanding of this term among Croatian citizens. Thus, 15% of citizens state that they are familiar with the Natura 2000 Ecological Network, while 39% of respondents have heard of it but do not know exactly what it represents. At the same time, 46% of Croatian citizens state that they have never heard of the Natura 2000 Ecological Network.

The results show that residents of Šibenik-Knin and Split-Dalmatia Counties are less familiar with the Natura 2000 Ecological Network than the general population. While at the national level more respondents state that they have heard of Natura 2000 but do not know what it represents (39% versus 30%), in the two counties observed there are more respondents who have never heard of Natura 2000 at all (57% versus 46%).

Analysis by socio-demographic characteristics shows that men are more familiar with the Natura 2000 Ecological Network than women, while the level of familiarity increases with age.

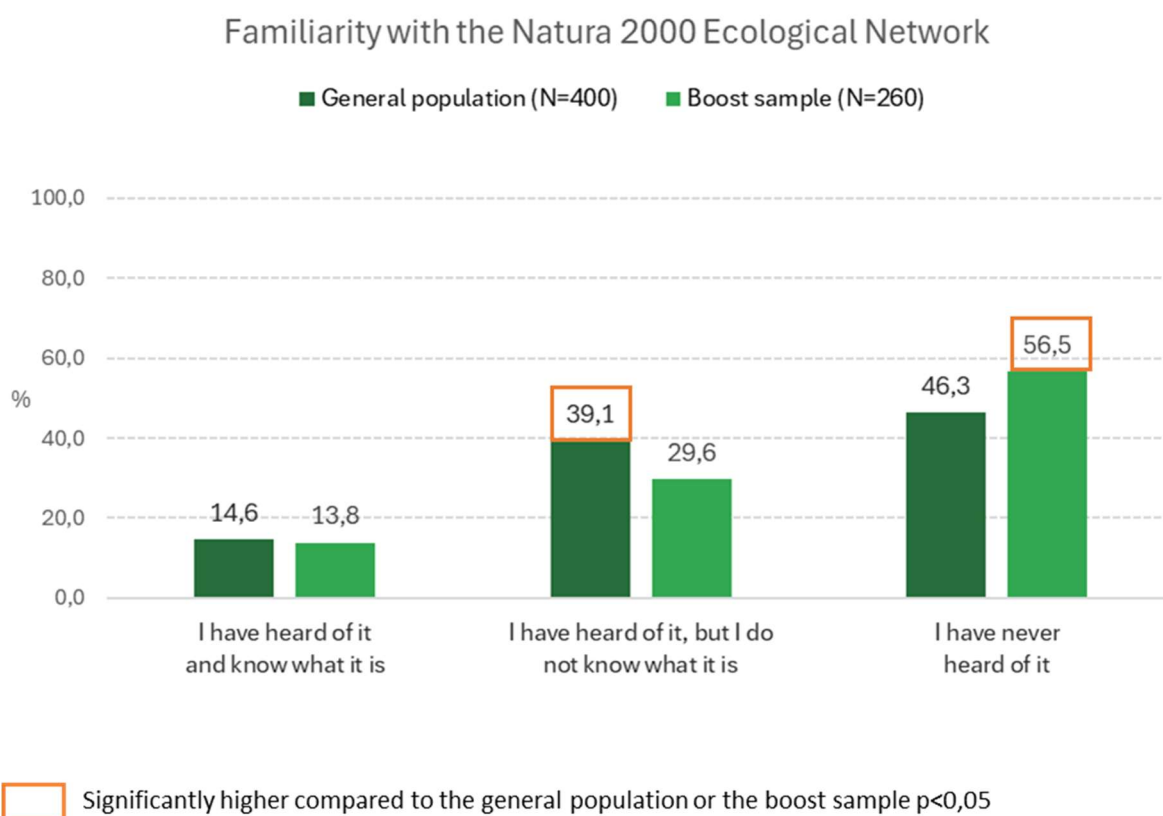


Figure 4 – Familiarity with the Natura 2000 Ecological Network; Base: all respondents (general population $N = 400$ and boost sample $N = 260$)

After the question aimed at determining spontaneous familiarity with the term Natura 2000 Ecological Network, respondents were shown an explanation of the term: *The Natura 2000 Ecological Network is a network of conservation areas for endangered species and habitats. It includes more than 27,000 protected natural areas across the EU, of which more than 780 are located in Croatia.* The purpose of the explanation was to familiarise respondents with the definition, after which they assessed how important protected natural areas are for various aspects of nature and society conservation.

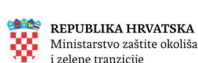
The results show that respondents recognise protected natural areas as extremely important for all aspects examined. The greatest importance is attributed to their role in protecting endangered animals and plants, cited by 95% of the overall population and 95% of residents of Šibenik-Knin and Split-Dalmatia Counties.

Respondents also attach high importance to the role of protected areas in preserving the role of nature in providing food, clean air, and water (94% of the overall population and 96% of residents of Šibenik-Knin and Split-Dalmatia Counties) and in preventing the destruction of valuable natural areas on land and at sea (94% of the overall population and 95% of residents of Šibenik-Knin and Split-Dalmatia Counties).

Protected natural areas are considered to be of average importance for promoting land use that does not harm nature (91% of the overall population and 92% of residents of Šibenik-Knin and Split-Dalmatia Counties) and for improving the quality of life of the local population (89% of the overall population and 90% of residents of Šibenik-Knin and Split-Dalmatia Counties).

Although still perceived as important, the lowest level of importance was recorded for the contribution of protected areas to tourism development, which respondents rate as below average compared to the other factors (76% of the overall population and 72% of residents of Šibenik-Knin and Split-Dalmatia Counties).

Analysis by socio-demographic characteristics shows statistically significant differences. Women, more than men, consider protected natural areas important for preserving the role of nature in providing food, clean air, and water, and for improving the quality of life of the local population. Furthermore, respondents older than 45 are significantly more likely than those younger than 45 to consider protected natural areas important for promoting land use that does not harm nature.



Importance of protected areas for various factors

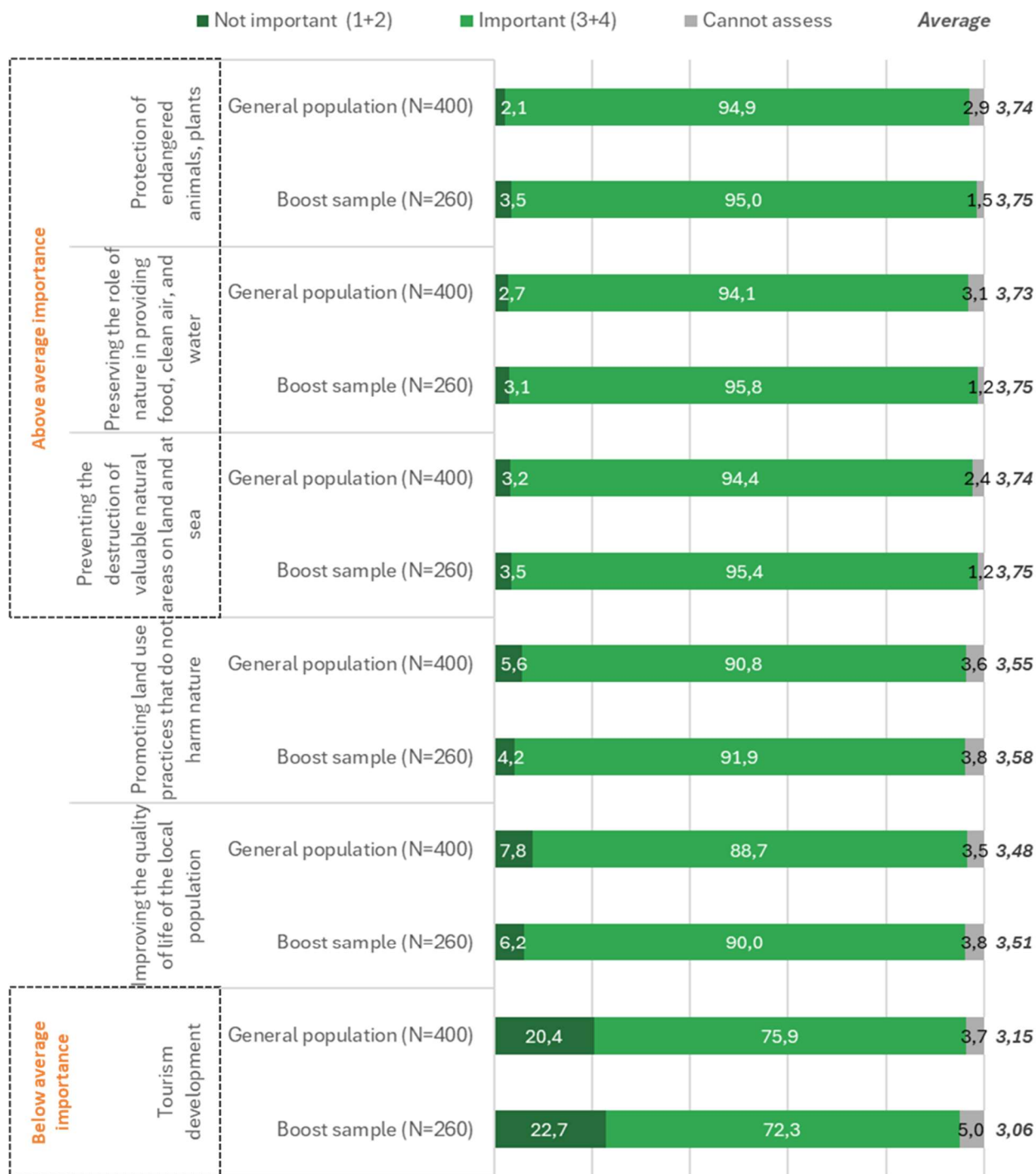


Figure 5 – Importance of protected areas for various factors; Base: all respondents (general population N = 400 and boost sample N = 260)

Respondents were then asked to select the statement closest to their view on the following: *Sometimes economic development results in damage to or destruction of nature in protected areas, such as areas included in the Natura 2000 network.*

The results show divided views among Croatian citizens. Forty-five percent of the population of the Republic of Croatia believe that such interventions should be prohibited because these are our most important natural areas, while 48% believe they are acceptable only for projects of major public interest, provided the damage caused is fully compensated. For 4% of respondents, such interventions are acceptable because economic development should take priority, while 3% did not express an opinion.

The views of residents of Šibenik-Knin and Split-Dalmatia Counties do not differ significantly from the national average. Slightly more than half of respondents from these counties (52%) believe that such interventions should be prohibited because these are Croatia's most important natural areas, while 44% believe they are acceptable only for projects of major public interest with full compensation for damage. For 2% of respondents, such interventions are acceptable because economic development takes priority.

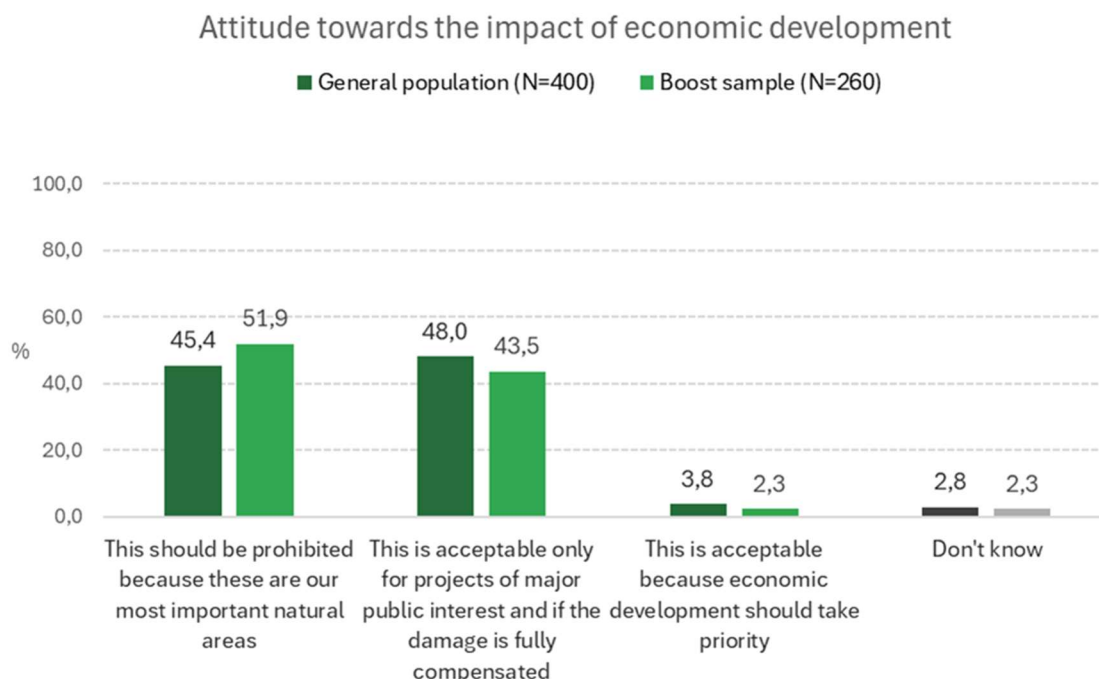


Figure 6 – Attitude towards the impact of economic development; Base: all respondents (general population N = 400 and boost sample N = 260)

2.3. Endemic species

On the question of familiarity with the term *endemic species*, the results show a high level of recognition of this term among Croatian citizens; 88% of the population of the Republic of Croatia state that they are familiar with the term endemic species, while 12% of respondents state that they are not familiar with it.

Results among residents of Šibenik-Knin and Split-Dalmatia Counties also differ statistically significantly from the national average. Namely, in these counties a significantly higher share of respondents (95%) state that they are familiar with the term *endemic species*, while a significantly smaller share, 5%, state that they are not familiar with the term.

Looking at geographic areas, residents of Zagreb, Lika, Kordun, and Banovina, and Dalmatia state to a significantly greater extent that they are familiar with the term *endemic species* compared to residents of Northern Croatia, Slavonia, and Istria, the Croatian Littoral, and Gorski Kotar.

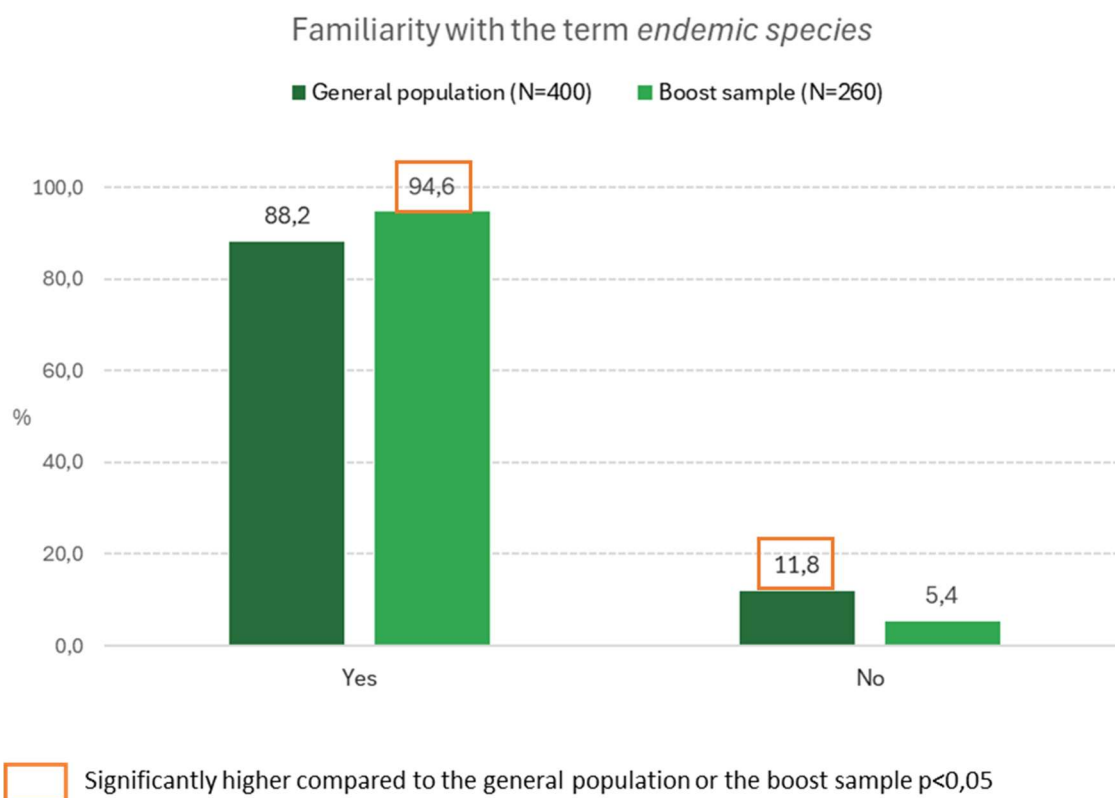


Figure 7 – Familiarity with the term *endemic species*; Base: all respondents (general population $N = 400$ and boost sample $N = 260$)

After the spontaneous assessment of familiarity with the term endemic species, in the following question respondents were shown the definition: *An endemic species is a species that occurs within a very limited geographic area, for example on an island, a mountain peak, or in a specific river.* After being presented with the definition, respondents were asked whether they know of any endemic species that live in the Republic of Croatia.

In response to the question asking respondents to name endemic species, some respondents named species that are not endemic (for example, the griffon vulture, and various plants, fish, and animals that are not endemic species). Such responses indicate that some citizens are not fully familiar with the term *endemic species* and have difficulty distinguishing endemic species from other plant and animal species.

The results show that 69% of Croatian residents state that they know of individual endemic species living in Croatia. At the same time, 15% of respondents do not know of any endemic species, while 16% are not sure whether they know of any such species.

On this question, too, residents of Šibenik-Knin and Split-Dalmatia Counties differ significantly from the Croatian average. Among them, 77% of respondents state that they know of some endemic species living in Croatia, which is significantly higher than at the national level. Furthermore, 10% state that they do not know of any endemic species, while 13% are not sure.

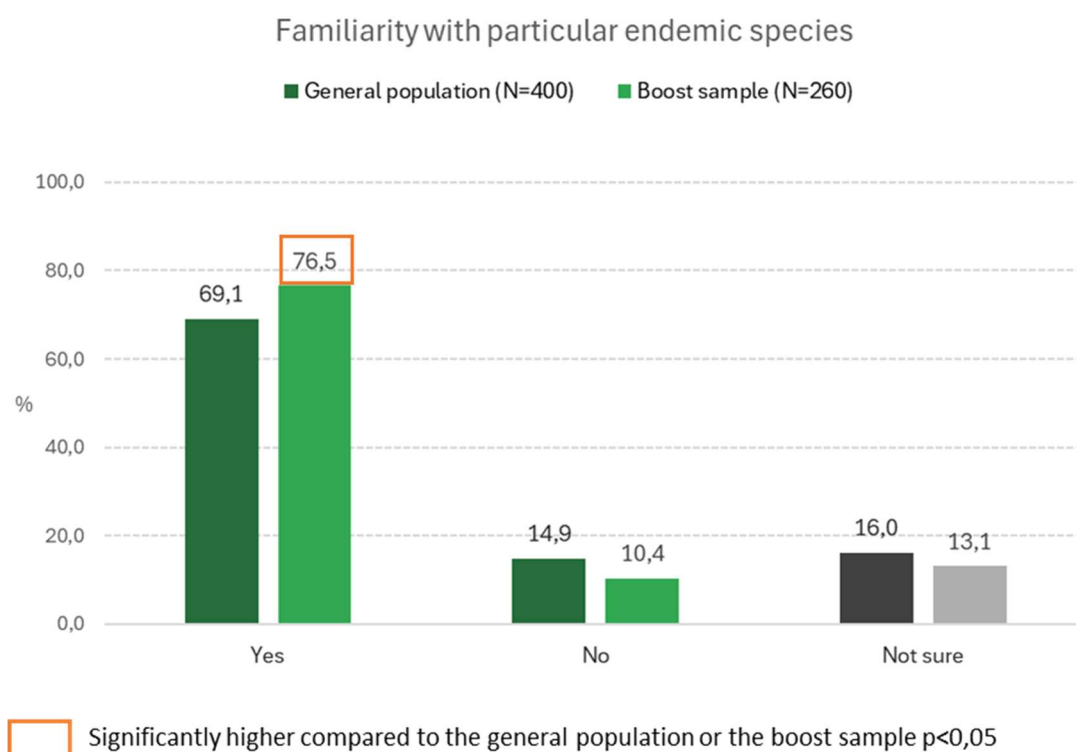


Figure 8 – Familiarity with particular endemic species; Base: all respondents (general population $N = 400$ and boost sample $N = 260$)

Respondents who stated that they know of some endemic species living in the Republic of Croatia were additionally asked to name the specific endemic species they know.

Among respondents who state that they know of some endemic species living in the Republic of Croatia, the most frequently and spontaneously mentioned are the Velebit degenia and the olm (human fish). The Velebit degenia is mentioned by 57% of respondents from the general population and 56% of respondents from Šibenik-Knin and Split-Dalmatia Counties, while the olm is mentioned by 38% of respondents from the general population and 34% of respondents from Šibenik-Knin and Split-Dalmatia Counties. Other endemic species are mentioned to a significantly lesser extent.

Analysis by socio-demographic characteristics shows certain differences among groups of respondents. Respondents older than 45 mention the olm as a known endemic species significantly more often than those younger than 45. Edelweiss is most frequently mentioned by respondents in the 35–44 age group.

On the other hand, respondents younger than 34 and rural residents state to a significantly greater extent that they cannot name any endemic species living in the Republic of Croatia, compared to older respondents and urban residents. In addition, urban residents mention the Velebit degenia significantly more often than rural residents.



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i zelene tranzicije

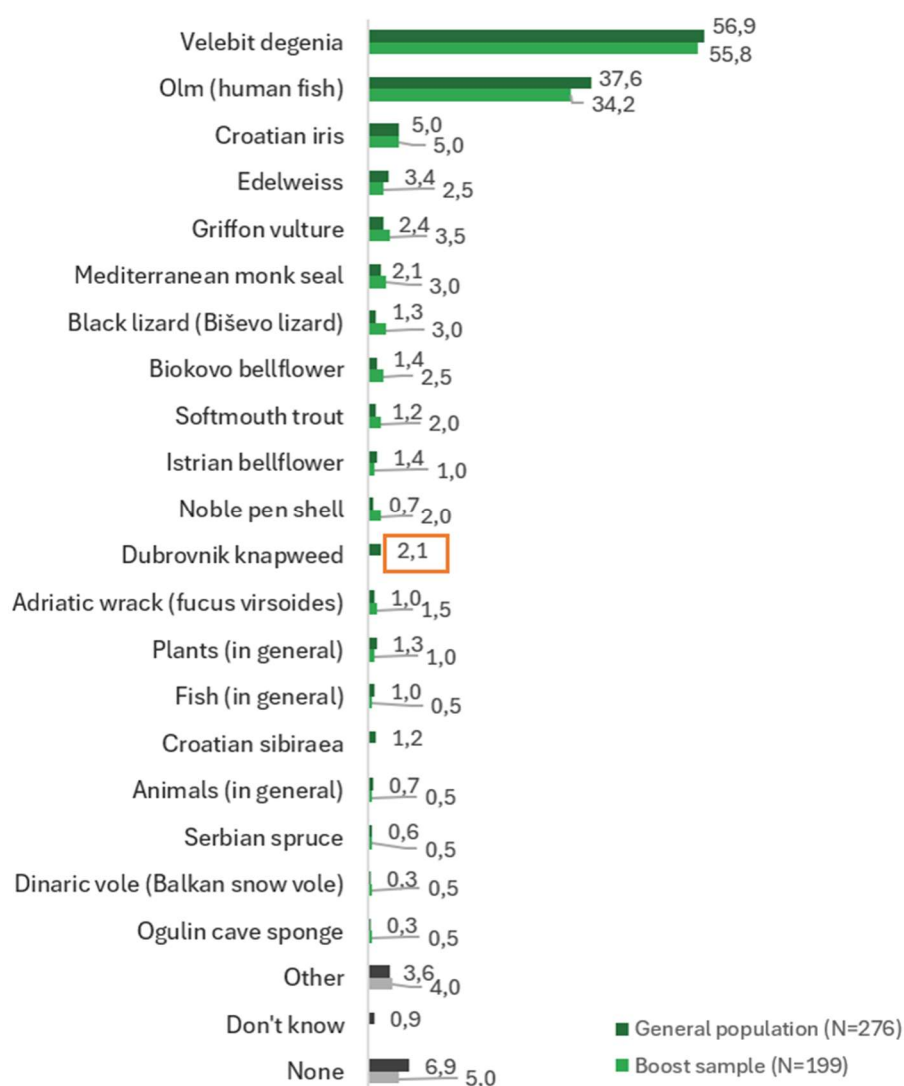


Javna ustanova
reзова Šibensko-kinjske županije
Public Institution
Karuz of Šibenik-Knin County



Familiarity with particular endemic species

Base: respondents who know of some endemic species living in Croatia



 Significantly higher compared to the general population or the boost sample $p < 0,05$

Figure 9 – Familiarity with particular endemic species; Base: respondents who know of some endemic species living in Croatia (general population $N = 276$ and boost sample $N = 199$)

2.4. Invasive alien species

On the question of familiarity with the term invasive alien species, the results show a relatively high level of recognition of this term among Croatian citizens, with 82% of the population of

the Republic of Croatia stating that they are familiar with the term *invasive alien species*, while 18% of respondents state that they are not familiar with it.

Results among residents of Šibenik-Knin and Split-Dalmatia Counties do not differ statistically significantly from the national average. Namely, 79% of respondents from these counties state that they are familiar with the term *invasive alien species*, while 21% are not familiar with the term.

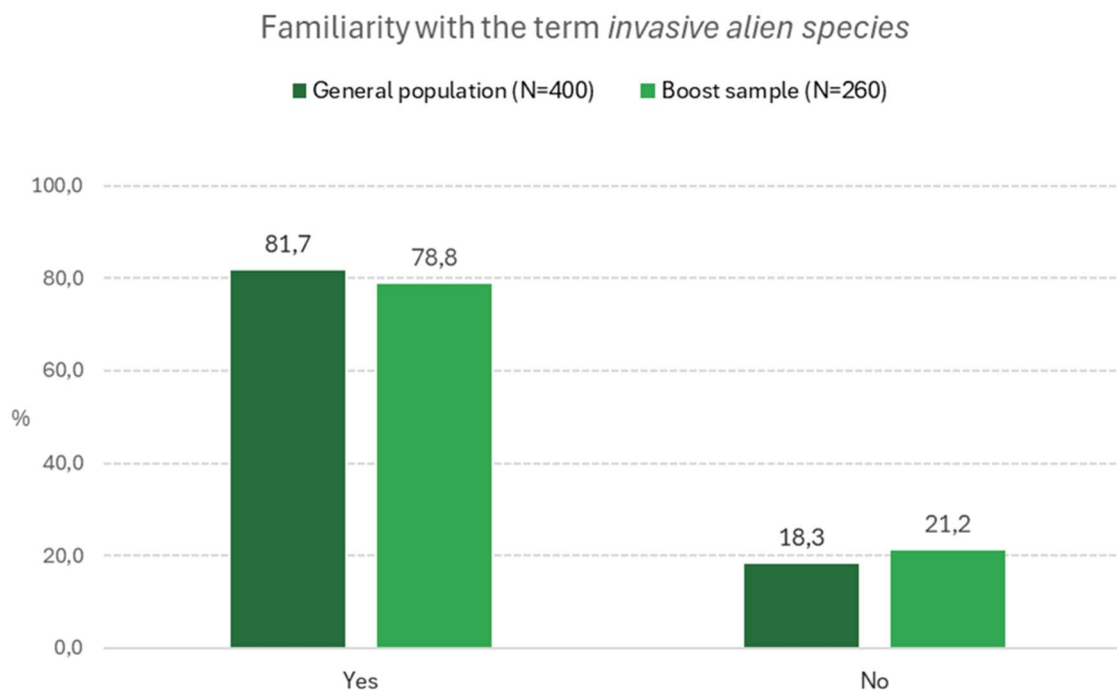


Figure 10 – Familiarity with the term *invasive alien species*; Base: all respondents (general population $N = 400$ and boost sample $N = 260$)

After the spontaneous assessment of familiarity with the term *invasive alien species*, respondents were shown the following definition: *Plant or animal species that have been intentionally or unintentionally introduced outside their natural range are called alien species. Some alien species can successfully establish populations in a new area and spread. If their spread threatens biodiversity, ecosystem services, the economy, or human health, such species are referred to as invasive alien species.* After being presented with the definition, respondents were asked whether they know of any *invasive alien species* living in the Republic of Croatia.

The results show that 44% of Croatian residents state that they know of particular invasive alien species living in Croatia, while 28% of respondents do not know of any such species, and 27% are not sure.

Results among residents of Šibenik-Knin and Split-Dalmatia Counties do not differ significantly from the Croatian average. Among them, 46% state that they know of some invasive alien species living in Croatia, 32% do not know of any, while 22% are not sure.

Looking at socio-demographic characteristics, men, respondents older than 25, and residents of Lika, Kordun, and Banovina state to a significantly greater extent that they know of specific invasive alien species living in the Republic of Croatia, compared to women, the youngest respondents (aged 18 to 24), and residents of other regions.

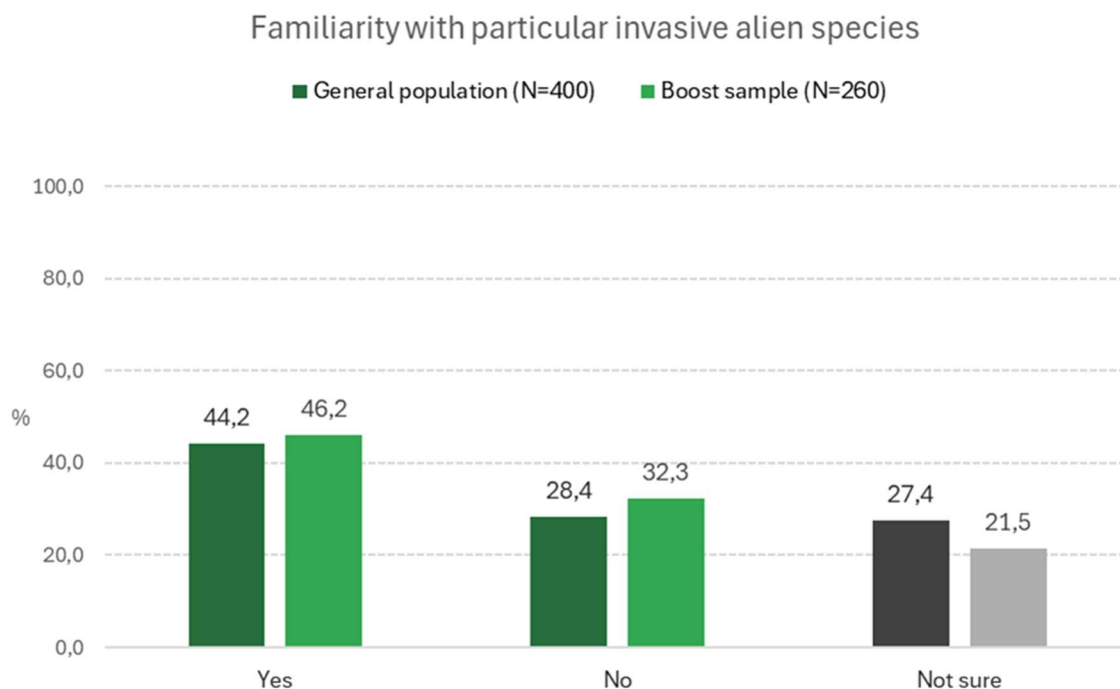


Figure 11 – Familiarity with particular invasive alien species; Base: all respondents (general population N = 400 and boost sample N = 260)

Respondents who stated that they know of some invasive alien species living in the Republic of Croatia were additionally asked to name the specific species they know.

Among respondents who state that they know of some invasive alien species in the Republic of Croatia, the most frequently and spontaneously mentioned are *Caulerpa* algae, common

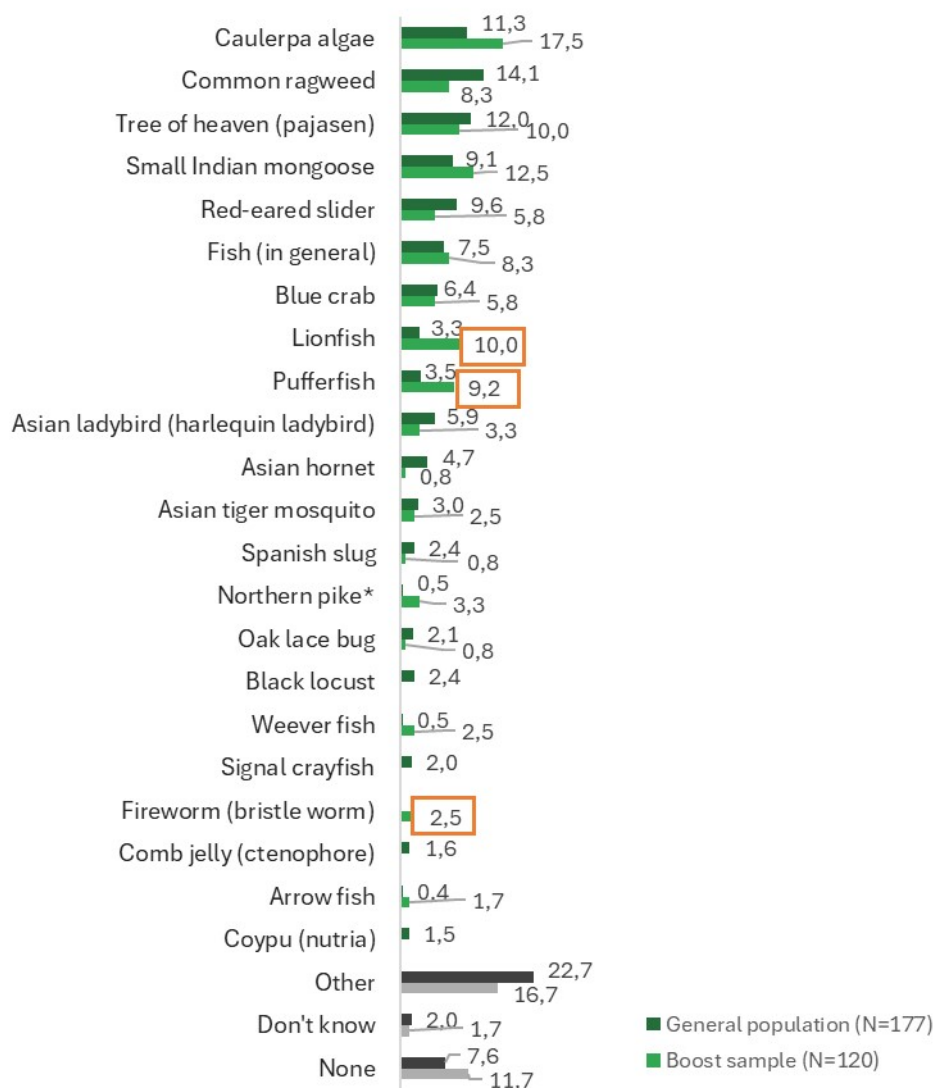
ragweed, tree of heaven, small Indian mongoose, and red-eared slider (turtle). Caulerpa algae is mentioned by 11% of respondents from the general population and 18% of respondents from Šibenik-Knin and Split-Dalmatia Counties, common ragweed by 14% of respondents from the general population and 8% of respondents from Šibenik-Knin and Split-Dalmatia Counties, tree of heaven by 12% of respondents from the general population and 10% of respondents from Šibenik-Knin and Split-Dalmatia Counties, small Indian mongoose by 9% of respondents from the general population and 13% of respondents from Šibenik-Knin and Split-Dalmatia Counties, while red-eared slider is mentioned by 10% of respondents from the general population and 6% of respondents from Šibenik-Knin and Split-Dalmatia Counties. Other invasive alien species were mentioned to a significantly lesser extent.

Statistically significant differences are visible between the two samples observed: residents of Šibenik-Knin and Split-Dalmatia Counties mention lionfish (10% versus 3% at the national level) and pufferfish (9% versus 4%) significantly more often.

In addition, urban residents mention the red-eared slider significantly more often than rural residents.



Familiarity with particular invasive alien species Base: respondents who know of some invasive alien species in Croatia



 Significantly higher compared to the general population or the boost sample $p < 0,05$

Figure 12 – Familiarity with particular invasive alien species; Base: respondents who know of some invasive alien species in Croatia (general population $N = 177$ and boost sample $N = 120$)

* The northern pike is a native species in freshwater ecosystems of the Black Sea basin in Croatia, while in watercourses of the Adriatic basin it is considered an invasive alien species due to its potential negative impact on native fish communities.

When respondents were asked to estimate the current number of alien plant and animal species in the Republic of Croatia, a high proportion of respondents were unable to estimate the number. This response was given by 45% of Croatian citizens and 44% of residents of Šibenik-Knin and Split-Dalmatia Counties.

Among those who did estimate the number of alien species, 21% of Croatian residents believe there are currently between 500 and 1,000 alien plant and animal species in Croatia, 17% estimate between 1,000 and 5,000, 13% believe there are between 5,000 and 10,000, while 4% cite a range of 10,000 to 20,000 species.

Results among respondents from Šibenik-Knin and Split-Dalmatia Counties largely do not differ significantly from the national sample, except for a significantly higher share of respondents giving the correct answer (20% versus 13% at the national level).

Knowledge of the current number of alien plant and animal species in the Republic of Croatia is more pronounced among younger respondents (aged 18–34) and urban residents, while respondents older than 45 state significantly more often that they cannot estimate the number. Furthermore, men more often than women give the incorrect answer “500–1,000“.

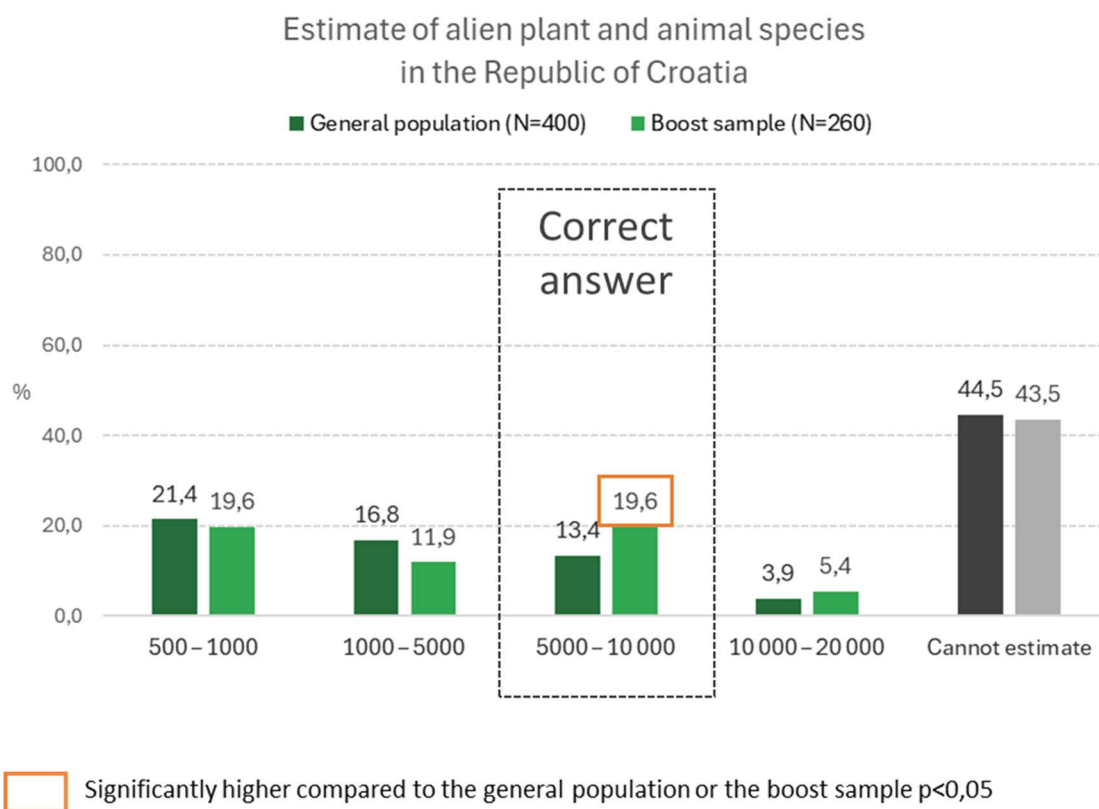


Figure 13 – Estimate of alien plant and animal species in the Republic of Croatia; Base: all respondents (general population N = 400 and boost sample N = 260)

On the question of whether invasive alien species should be removed in order to protect strictly protected and endemic fish species and the biodiversity of freshwater and marine ecosystems, the results show that most citizens support their removal, but under certain conditions.

Thus, 35% of Croatian citizens believe that invasive alien species should always be removed, while 55% believe they should be removed only if necessary for species conservation. On the other hand, 4% of respondents believe they should not be removed.

The views of residents of Šibenik-Knin and Split-Dalmatia Counties do not differ statistically significantly from the national average. Among them, 41% believe invasive alien species should always be removed, 48% believe they should be removed only if necessary for species conservation, while 2% state they should not be removed. In both samples, 8% of respondents are not sure whether such species should be removed.

Looking at settlement type, urban residents are significantly more likely to believe that invasive alien species should always be removed, while rural residents more often state that they should be removed only if necessary for species conservation.

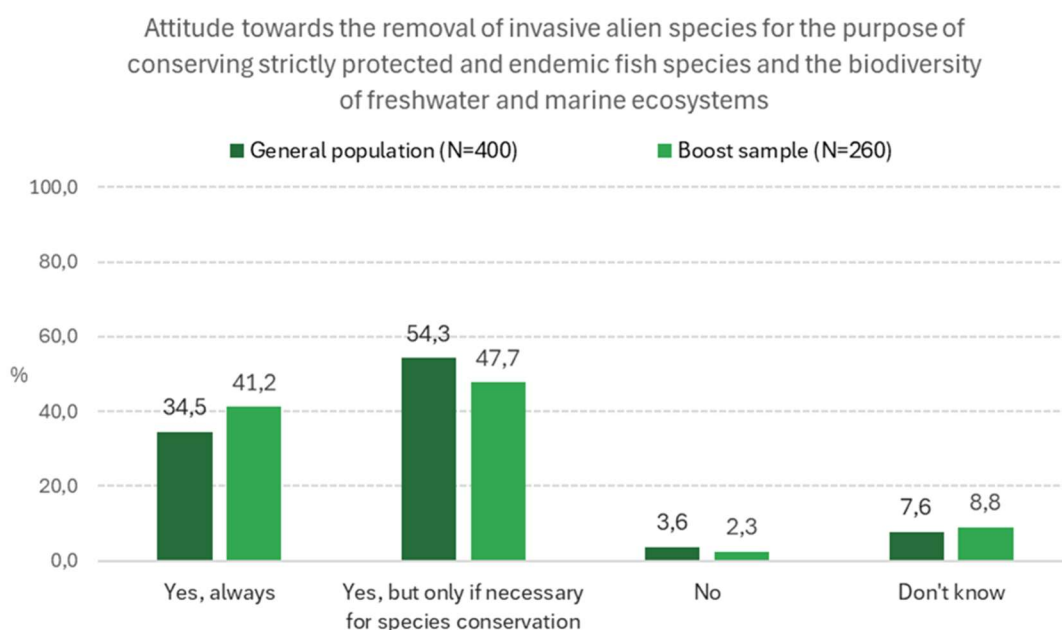


Figure 14 – Attitude towards the removal of invasive alien species for the purpose of conserving strictly protected and endemic fish species and the biodiversity of freshwater and marine ecosystems; Base: all respondents (general population N = 400 and boost sample N = 260)

On the question of whether respondents have noticed alien or invasive alien plant or animal species in watercourses near where they live, most citizens state that they have not noticed such species. Fifteen percent of Croatian residents state that they have noticed them, while 85% have not noticed alien or invasive species in local watercourses.

Results among residents of Šibenik-Knin and Split-Dalmatia Counties do not differ from the national average. Among them, 16% state that they have noticed an alien or invasive plant or animal species in nearby watercourses, while 84% have not.

By socio-demographic characteristics, men, the youngest respondents (aged 18–34), and rural residents state significantly more often that they have noticed alien or invasive alien plant or animal species in watercourses near where they live, compared to women, respondents older than 34, and urban residents.

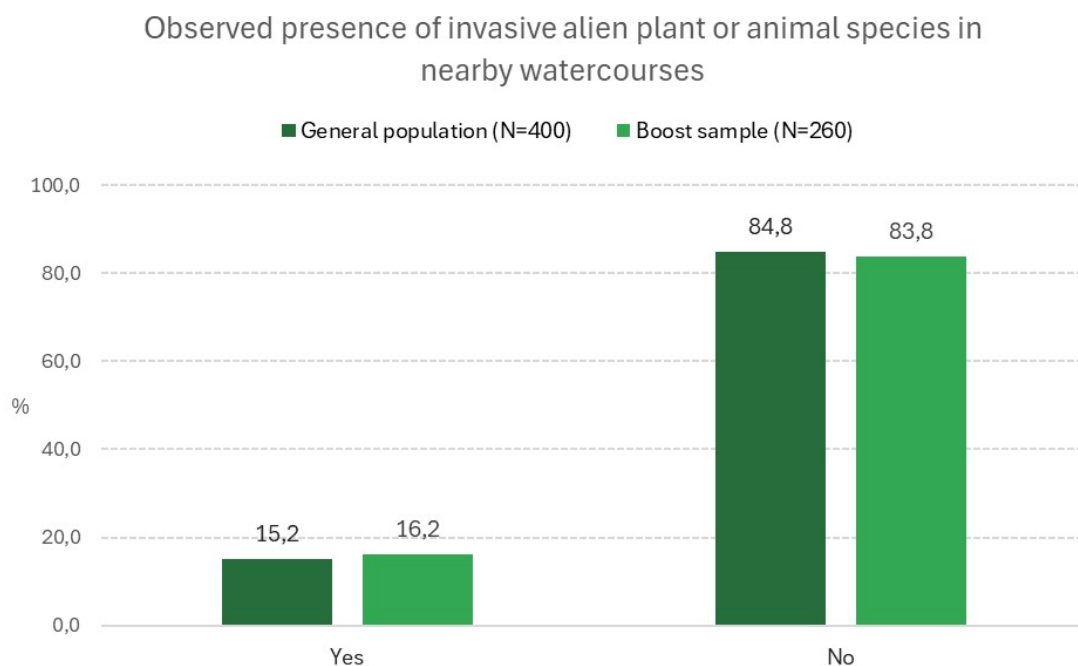


Figure 15 – Observed presence of invasive alien plant or animal species in nearby watercourses; Base: all respondents (general population N = 400 and boost sample N = 260)

After the general questions on invasive alien species, respondents assessed the impact of invasive alien species on native species and habitats. The assessment was conducted on a four-point scale, where a score of 1 indicated “not at all,” 2 “not particularly,” 3 “partially,” and 4 “to a great extent.” Respondents were also offered a “don't know/cannot assess” option, which was not included in the calculation of average values.

In respondents' opinion, invasive alien species have a strong impact across all the aspects listed.

A high level of agreement was recorded with the statement that invasive alien species reproduce rapidly and can outnumber native species, with which 87% of respondents from the general population and 89% of residents of Šibenik-Knin and Split-Dalmatia Counties agree.

A high level of agreement was also recorded with the statement that invasive alien species alter the structure of aquatic communities by reducing the number of certain invertebrates, leading to disruptions in the food web (88% general population and 89% residents of Šibenik-Knin and Split-Dalmatia Counties).

A large proportion of respondents also believe that invasive alien species can be carriers of diseases and parasites to which native species are not adapted (89% general population and 90% residents of Šibenik-Knin and Split-Dalmatia Counties).

An equal share of respondents in both samples (81%) believe that invasive alien species feed on the eggs of other fish species and amphibian larvae. Furthermore, 85% of Croatian citizens believe that invasive alien species most commonly feed on small native fish and their juveniles, while the same view is shared by 83% of respondents from Šibenik-Knin and Split-Dalmatia Counties.

Analysis by socio-demographic characteristics shows that women, to a significantly greater extent than men, believe that invasive alien species alter the structure of aquatic communities, reduce the number of certain invertebrates, and lead to disruptions in the food web, and that they can be carriers of diseases and parasites to which native species are not adapted.

Furthermore, respondents aged 25–34 are significantly less likely than other age groups to believe that invasive alien species feed on the eggs of other fish species and amphibian larvae, reproduce rapidly, and most commonly feed on small native fish and their juveniles.

Attitudes on the impact of invasive alien species on native species and habitats

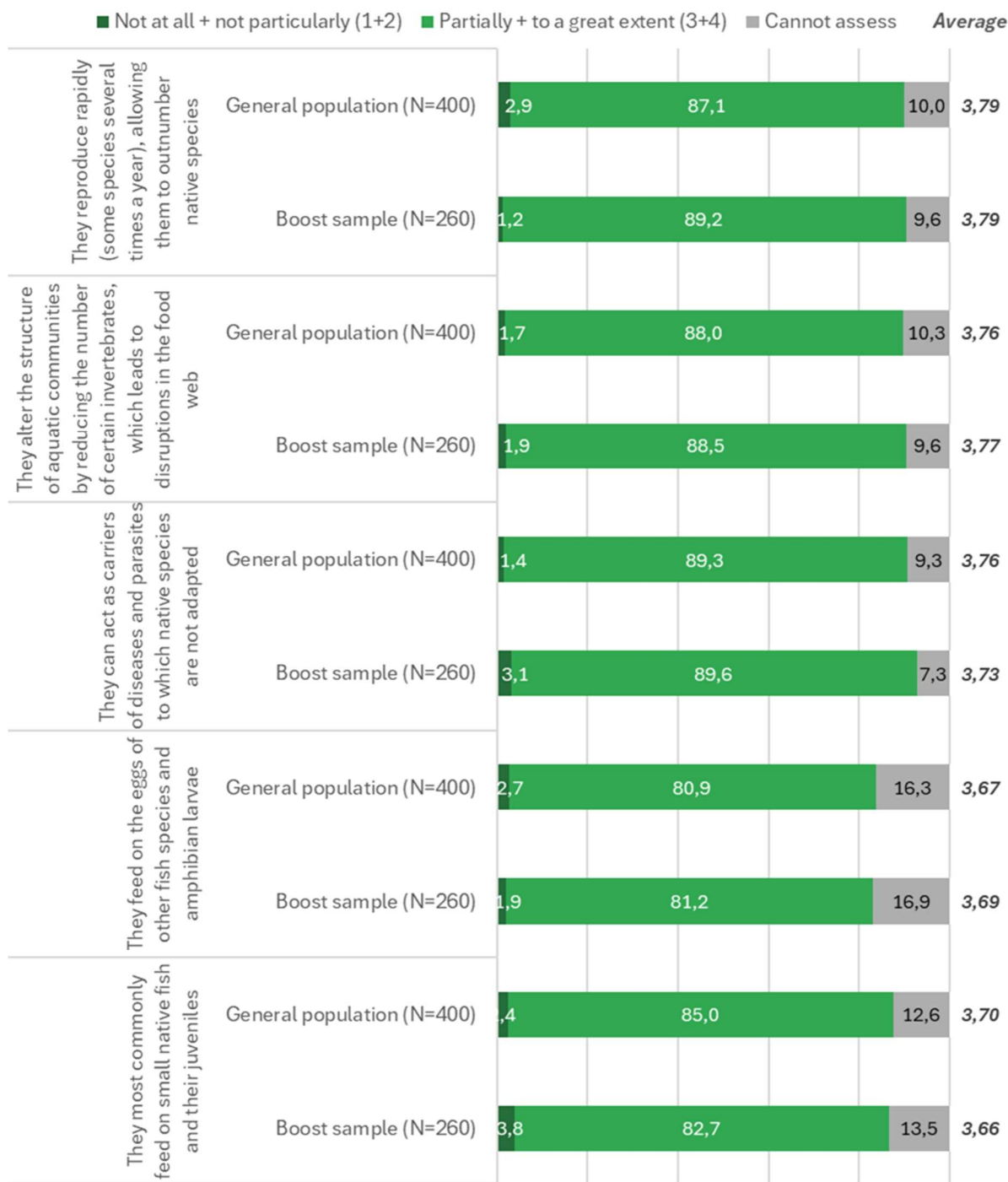


Figure 16 – Attitudes on the impact of invasive alien species on native species and habitats;
Base: all respondents (general population N = 400 and boost sample N = 260)

2.5. Dalmatian minnow (*Phoxinellus dalmaticus*)

Respondents' spontaneous familiarity with the Dalmatian minnow (*Phoxinellus dalmaticus*) was also examined. Respondents were shown a photograph of the species and asked whether they could identify it.

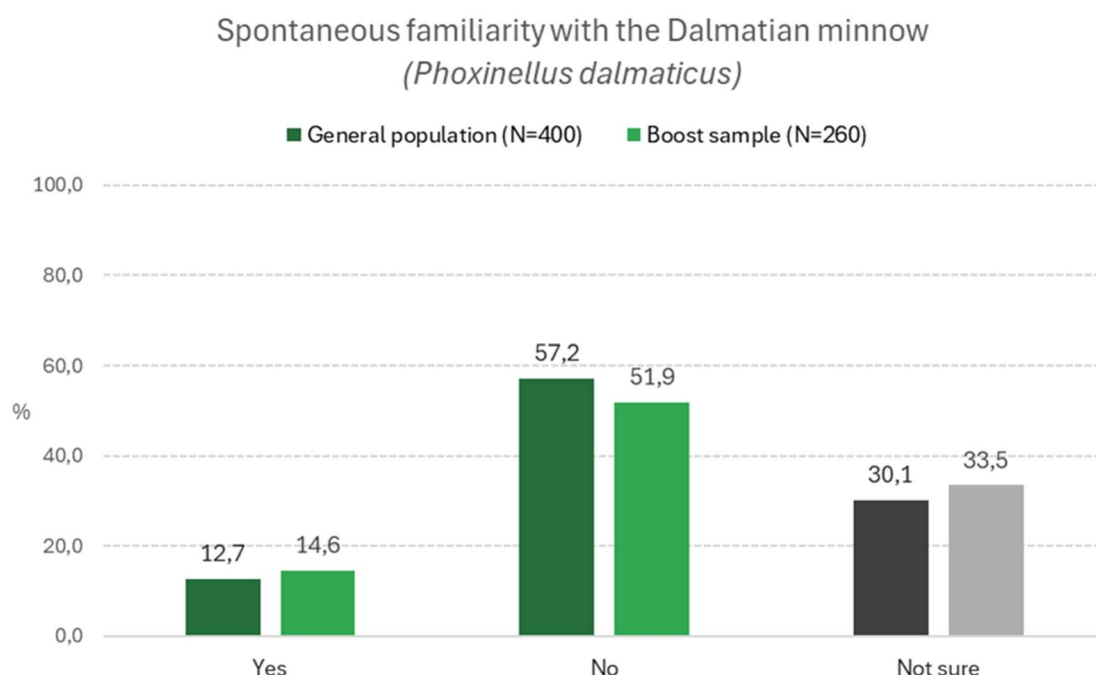


Photo: P. Mustafić (provided by the client)

The results show that spontaneous recognition of the Dalmatian minnow (*Phoxinellus dalmaticus*) is relatively low. At the Croatian level, 13% of residents state that they recognise the Dalmatian minnow, while 57% of respondents state that they do not recognise it, and 30% are not sure whether they recognise the species.

Results among residents of Šibenik-Knin and Split-Dalmatia Counties do not differ significantly from the national average. Among respondents from these counties, 15% state that they recognise the Dalmatian minnow (*Phoxinellus dalmaticus*), 52% state that they do not, while 34% are not sure.

Analysis by socio-demographic characteristics shows certain differences in species recognition. Respondents younger than 34 state to a significantly greater extent that they do not know the species, while respondents older than 34 more often state that they are unsure about recognising it. Furthermore, urban residents are significantly more successful at recognising the species in the photograph compared to rural residents.



*Figure 17 – Spontaneous familiarity with the Dalmatian minnow (*Phoxinellus dalmaticus*); Base: all respondents (general population N = 400 and boost sample N = 260)*

After respondents were shown an additional explanation: *The species shown in the photograph is the Dalmatian minnow (*Phoxinellus dalmaticus*) – an endemic species known for its characteristic interrupted lateral line. The lateral line is short and often discontinuous on the rear part of the body. It is threatened by the introduction of invasive fish species, as well as by human activities that alter its natural habitats*, respondents were again asked whether they had ever heard of the Dalmatian minnow (*Phoxinellus dalmaticus*).

The results of prompted recognition show a somewhat higher level of familiarity with the species compared to spontaneous recognition. After the description was provided, 16% of Croatian residents state that they have heard of the Dalmatian minnow (*Phoxinellus dalmaticus*), with familiarity being particularly pronounced among residents of Šibenik-Knin and Split-Dalmatia Counties, where the share of prompted recognition is significantly higher, at 25%.

Most respondents who stated during the spontaneous assessment that they were not sure which species it was still do not recognise the species even after the additional description, i.e., they confirm that they do not know which fish it is. This response is given by 30% of respondents at the Croatian level compared to 15% following spontaneous recognition, while among residents of Šibenik-Knin and Split-Dalmatia Counties this share is 34% compared to 14%.

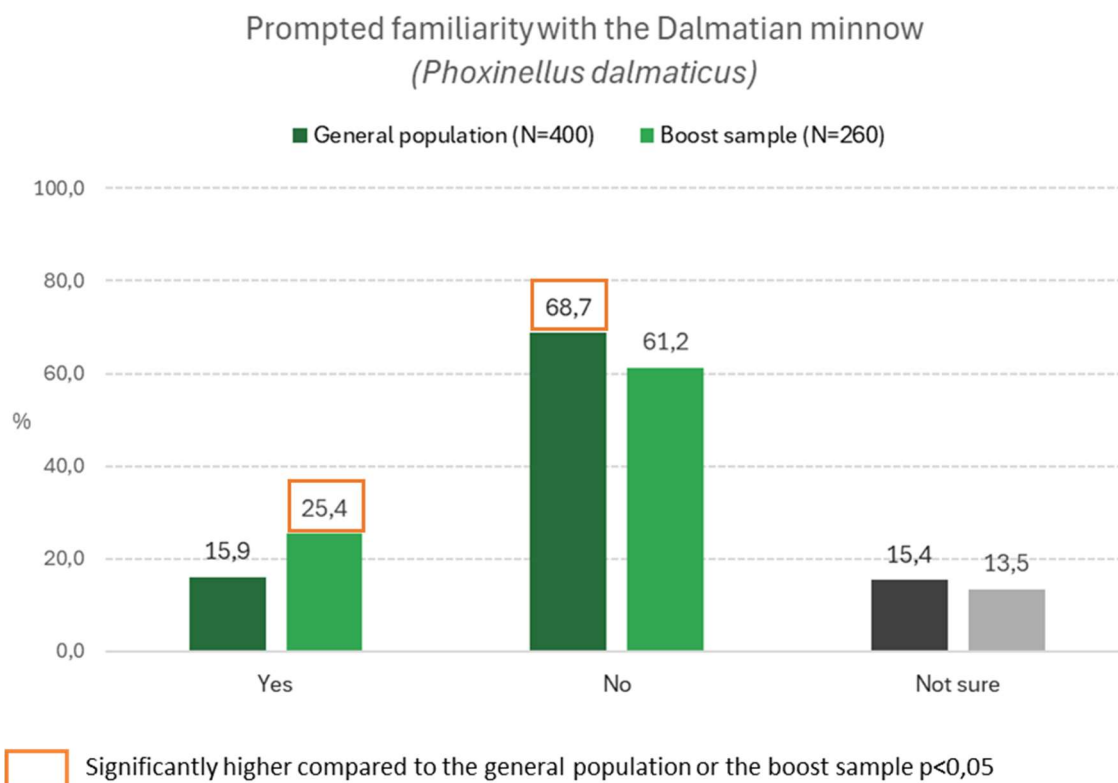


Figure 18 – Prompted familiarity with the Dalmatian minnow (*Phoxinellus dalmaticus*);
 Base: all respondents (general population $N = 400$ and boost sample $N = 260$)

On the question of whether they know in which rivers the Dalmatian minnow (*Phoxinellus dalmaticus*) can be found, the largest share of respondents did not know the answer. Thus, 59% of Croatian citizens state that they do not know in which rivers this species lives.

Of the response options offered, 3% of respondents believe the Dalmatian minnow (*Phoxinellus dalmaticus*) lives in the Danube, Sava, and Drava, while 6% cite the Korana, Kupa, and Mrežnica. The correct answer — that the Dalmatian minnow (*Phoxinellus dalmaticus*) can be found in the Čikola, Vrba, and Krka — is given by 32% of respondents.

Results among residents of Šibenik-Knin and Split-Dalmatia Counties are very similar to the national average. Among them, 5% cite the Danube, Sava, and Drava, 9% the Korana, Kupa, and Mrežnica, while 29% correctly identify the Čikola, Vrba, and Krka as habitats of the Dalmatian minnow (*Phoxinellus dalmaticus*).

Looking at socio-demographic characteristics, men give the correct answer (Čikola, Vrba, and Krka) significantly more often than women. On the other hand, the youngest respondents (aged 18–24) cite the incorrect answer of Danube, Drava, and Sava significantly more often than other age groups.

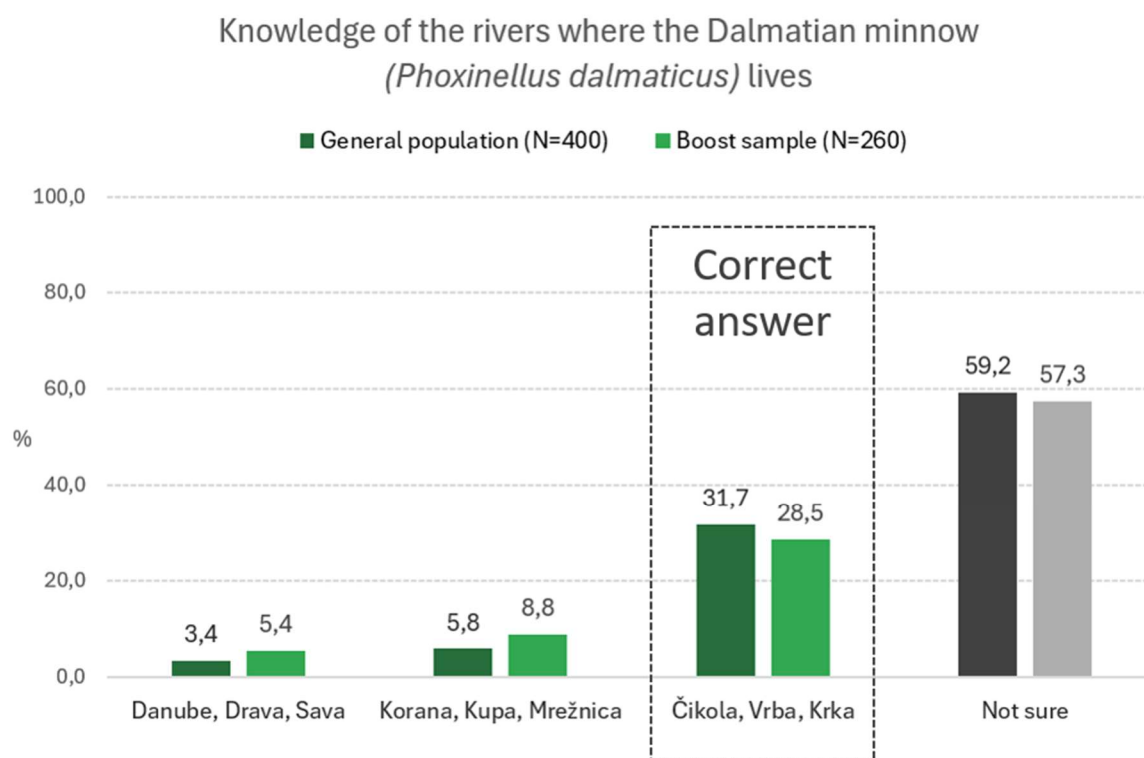


Figure 19 – Knowledge of the rivers where the Dalmatian minnow (*Phoxinellus dalmaticus*) lives – prompted; Base: all respondents (general population $N = 400$ and boost sample $N = 260$)

2.6. Eastern mosquitofish (*Gambusia holbrooki*)

As with the Dalmatian minnow (*Phoxinellus dalmaticus*), respondents' spontaneous familiarity with the eastern mosquitofish (*Gambusia holbrooki*) was examined. Respondents were shown a photograph of the species and asked whether they could identify which fish species it was.



Photo: P. Mustafić (provided by the client)

The results show that spontaneous recognition of the eastern mosquitofish (*Gambusia holbrooki*) is very low. At the Croatian level, 9% of citizens recognise which species it is, while 60% of respondents state that they do not recognise the species, and 31% are not sure.

Results among residents of Šibenik-Knin and Split-Dalmatia Counties are nearly identical to the national average and do not differ statistically significantly. Among respondents from these counties, 11% spontaneously recognise the eastern mosquitofish (*Gambusia holbrooki*), 57% do not know which species it is, while 32% are not sure.

Looking at socio-demographic characteristics, men and residents of Zagreb recognise the fish species in the photograph to a significantly lesser extent compared to women and residents of other regions.

Spontaneous familiarity with the eastern mosquitofish (*Gambusia holbrooki*) is very low. Only 9% of respondents from the general population state that they have heard of this fish species, while 60% state that they have not, and 31% are not sure whether they have previously heard of the eastern mosquitofish (*Gambusia holbrooki*).

Results among residents of Šibenik-Knin and Split-Dalmatia Counties are very similar to the national average, with 11% of respondents stating that they are familiar with the eastern mosquitofish (*Gambusia holbrooki*), 57% stating that they are not, while 32% are not sure whether they have previously heard of this species.

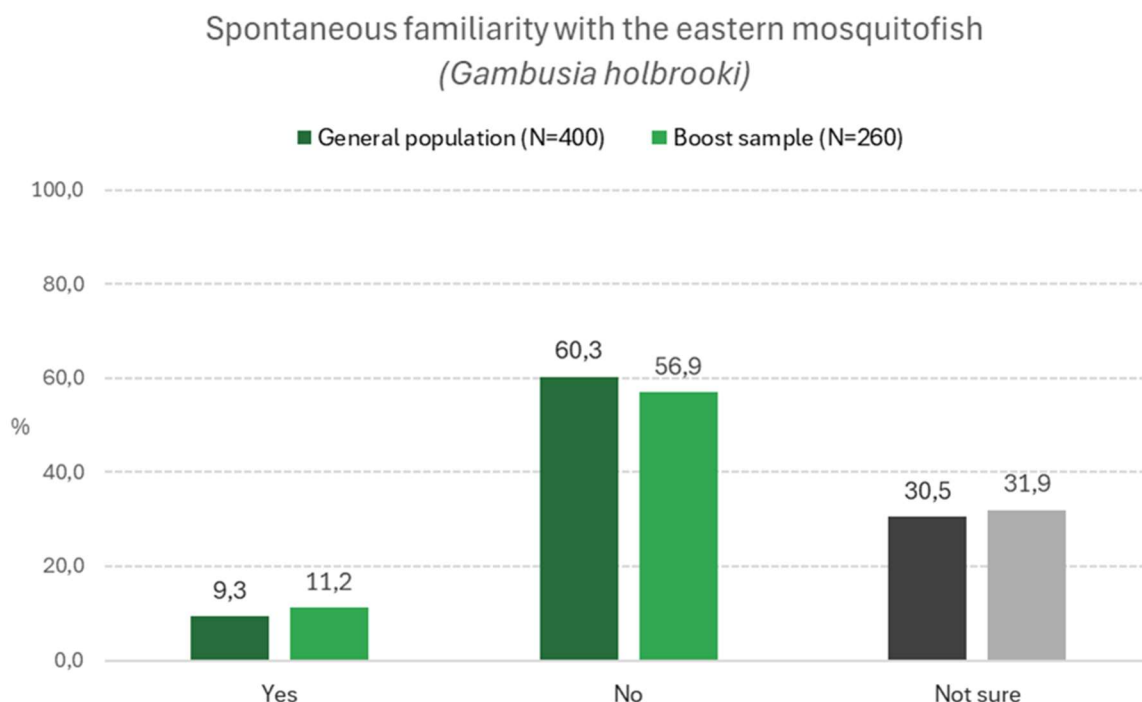


Figure 20 – Spontaneous familiarity with the eastern mosquitofish (*Gambusia holbrooki*);
 Base: all respondents (general population N = 400 and boost sample N = 260)

After respondents were shown an additional explanation — *The species shown in the photograph is the eastern mosquitofish (*Gambusia holbrooki*) – an invasive alien fish species included on the European Union list of invasive alien species of Union concern. It can be recognised by its characteristic almost transparent fins, while the dorsal and caudal fins have several rows of black spots. In areas where mosquitofish are abundant, competition for food and habitat occurs with native species, primarily due to their highly aggressive feeding behaviour. They cause a decline in the abundance of native invertebrate species. They also attack and bite the fins of other fish, exposing them to disease. Due to their negative impact on native species, they are considered one of the 100 most dangerous invasive alien species in the world* — respondents were asked whether, based on this description, they had ever heard of the eastern mosquitofish (*Gambusia holbrooki*).

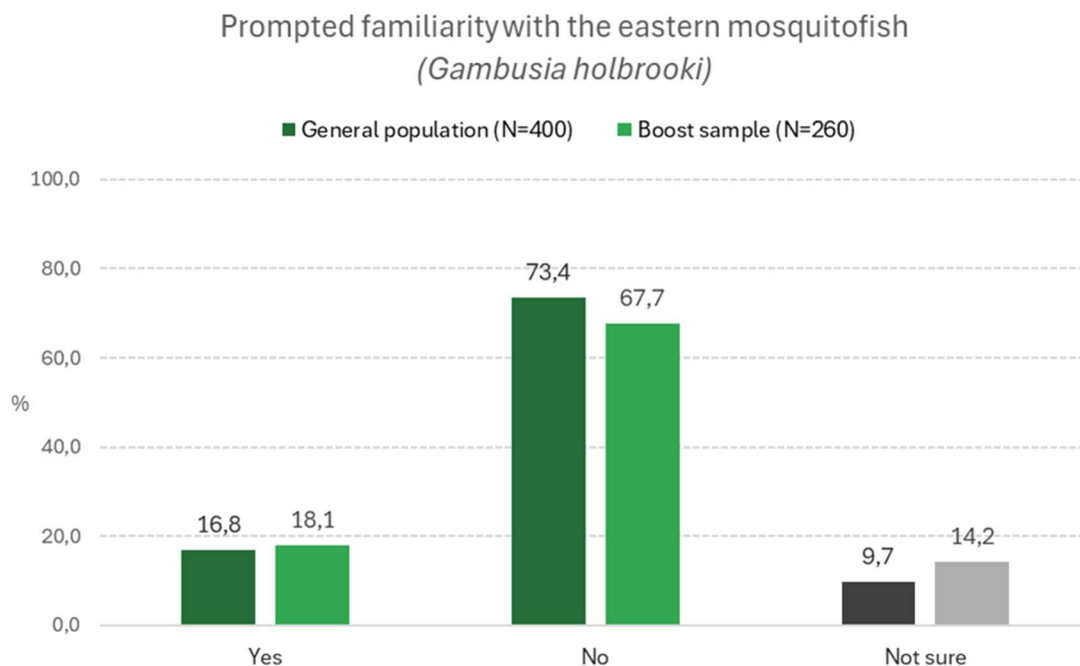


Figure 21 – Prompted familiarity with the eastern mosquitofish (*Gambusia holbrooki*);
 Base: all respondents (general population N = 400 and boost sample N = 260)

On the question of whether they know in which rivers the eastern mosquitofish (*Gambusia holbrooki*) can be found, the results show a low level of familiarity with the species' habitat. The majority of respondents, 74% of Croatian citizens, do not know the answer to this question.

Of the response options offered, 8% of respondents believe the eastern mosquitofish (*Gambusia holbrooki*) lives in the Danube, Sava, and Drava, while 6% cite the Korana, Kupa, and Mrežnica. The correct answer — that the eastern mosquitofish (*Gambusia holbrooki*) lives in the Čikola, Vrba, and Krka — is given by 11% of citizens.

Results among residents of Šibenik-Knin and Split-Dalmatia Counties are very similar to the national sample. Among them, 10% believe the eastern mosquitofish (*Gambusia holbrooki*) lives in the Danube, Sava, and Drava, 10% cite the Korana, Kupa, and Mrežnica, while 8% correctly cite the Čikola, Vrba, and Krka as areas where it lives.

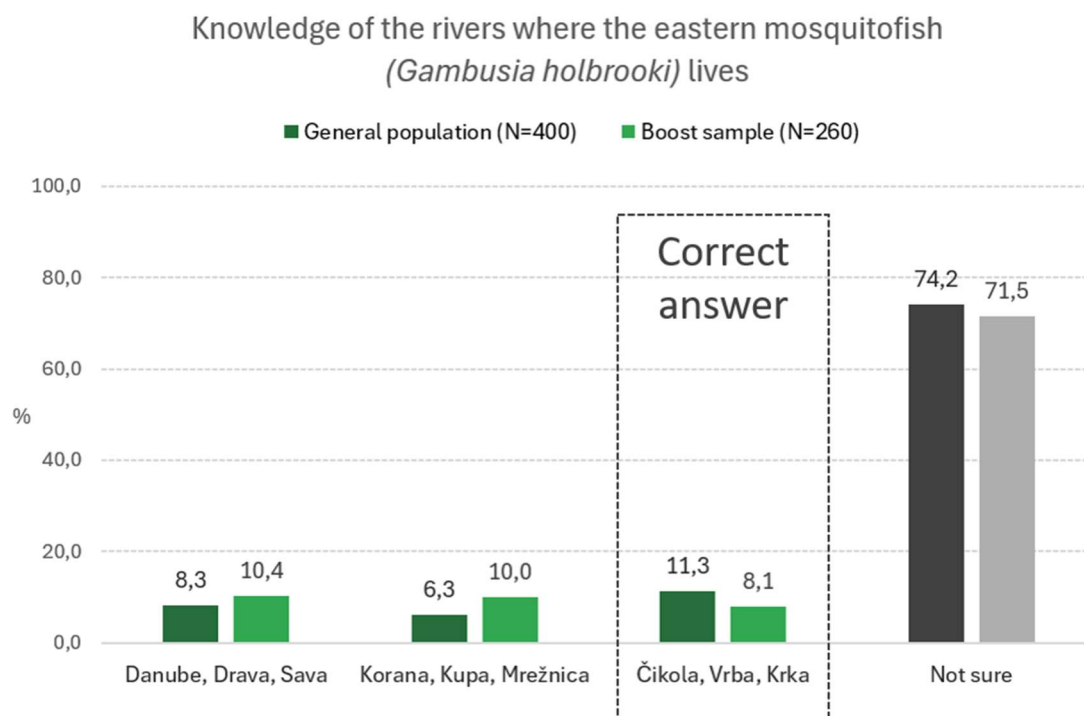


Figure 22 – Knowledge of the rivers where the eastern mosquitofish (*Gambusia holbrooki*) lives; Base: all respondents (general population $N = 400$ and boost sample $N = 260$)

Respondents were further asked to assess which statement is correct when comparing the endemic Dalmatian minnow (*Phoxinellus dalmaticus*) and the invasive alien species eastern mosquitofish (*Gambusia holbrooki*).

The statements offered were:

They differ in many aspects – including adaptability to habitat conditions and visual appearance, such as the shape and appearance of fins, body markings, etc. (correct answer)

They differ only in visual appearance.

There are no differences between the Dalmatian minnow and the eastern mosquitofish.

Don't know / I am not familiar enough to answer.

The results show that slightly more than half of respondents identified the correct answer. Namely, 57% of respondents believe that the Dalmatian minnow (*Phoxinellus dalmaticus*) and the eastern mosquitofish (*Gambusia holbrooki*) differ in many aspects, while 11% believe they

differ only in visual appearance. Furthermore, 4% of respondents state that there are no differences between the two fish species, while 28% were unable to assess the answer.

Results among residents of Šibenik-Knin and Split-Dalmatia Counties are nearly identical to the results for the nationally representative sample. Among them, 60% of respondents believe that the Dalmatian minnow (*Phoxinellus dalmaticus*) and the eastern mosquitofish (*Gambusia holbrooki*) differ in many aspects, 9% state that they differ only in visual appearance, while 5% believe there are no differences between them. The share of those unable to assess the answer is 27%.

Looking at socio-demographic characteristics, rural residents give the correct answer — that the Dalmatian minnow (*Phoxinellus dalmaticus*) and the eastern mosquitofish (*Gambusia holbrooki*) differ in many aspects — significantly more often than urban residents.

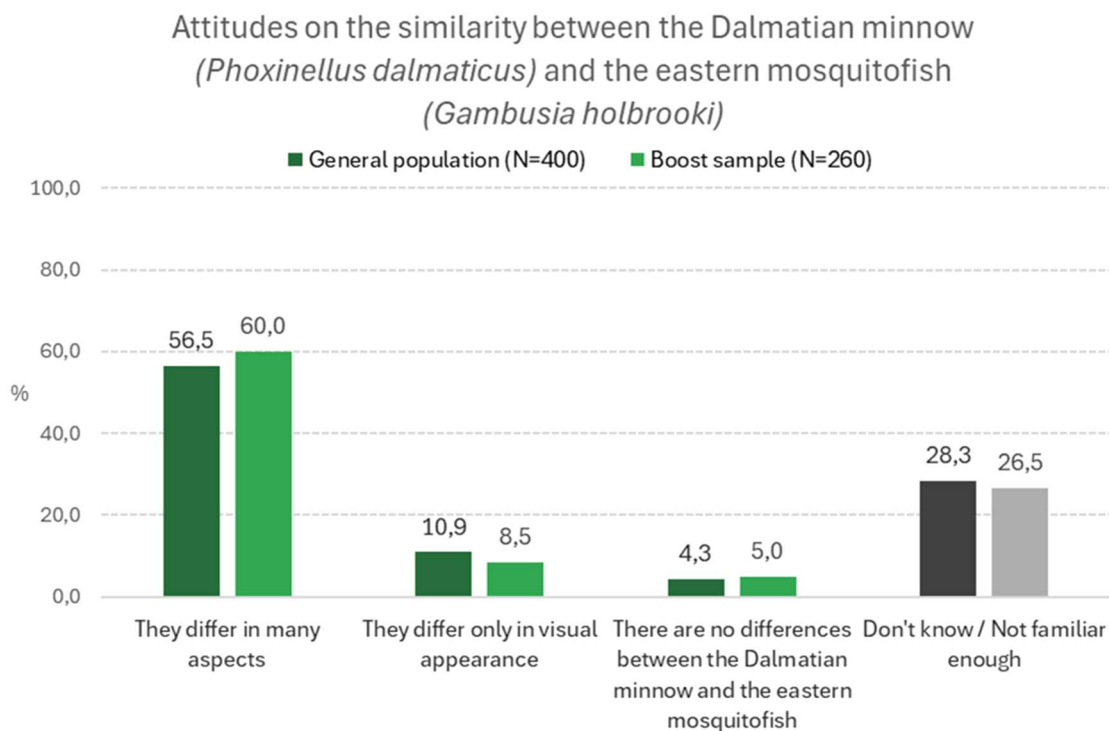


Figure 23 – Attitudes on the similarity between the Dalmatian minnow (*Phoxinellus dalmaticus*) and the eastern mosquitofish (*Gambusia holbrooki*); Base: all respondents (general population $N = 400$ and boost sample $N = 260$)

2.7. *Invasive Species in Croatia* mobile application

On the question of familiarity with the mobile application *Invasive Species in Croatia*, the results show a very low level of spontaneous awareness of the application among citizens. One in ten Croatian citizens (10%) spontaneously state that they are familiar with the application, while 89% of respondents state that they are not familiar with it.

Results among the sample of residents of Šibenik-Knin and Split-Dalmatia Counties are almost identical to the national average and likewise show no significant deviation. Among them, 12% of respondents state that they are familiar with the *Invasive Species in Croatia* application, while 88% are not familiar with it.

Analysis by socio-demographic characteristics shows statistically significant differences among the following groups of respondents: respondents younger than 44, as well as those with completed secondary education and those with higher education, state to a significantly greater extent that they are familiar with the *Invasive Species in Croatia* application, compared to respondents older than 44 and those with a lower level of education.

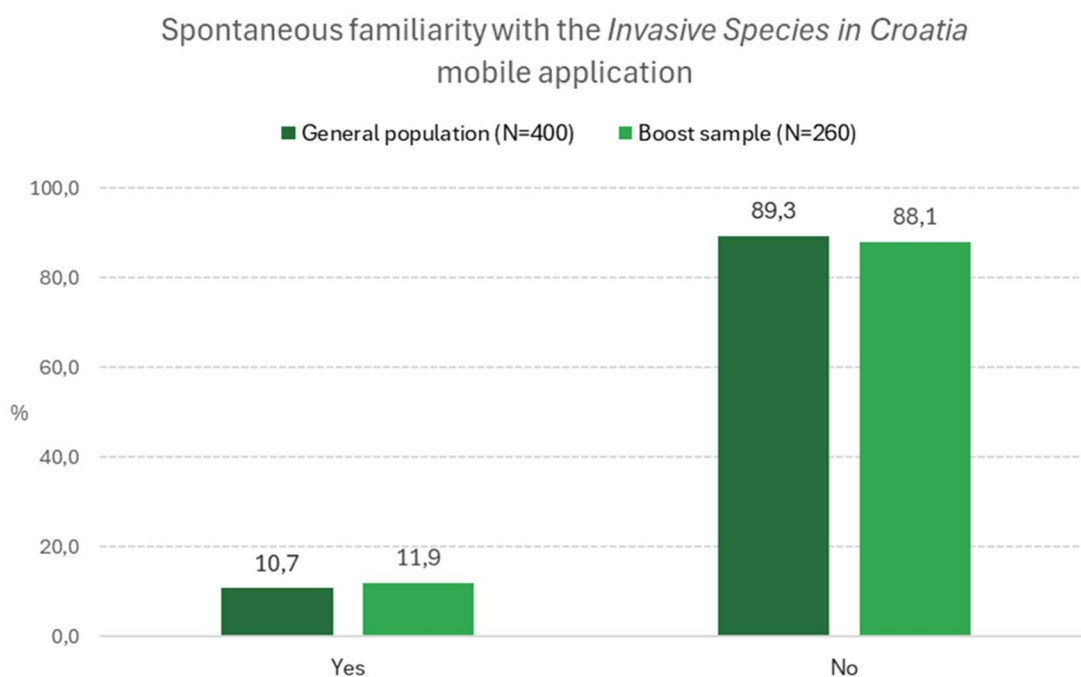


Figure 24 – Spontaneous familiarity with the *Invasive Species in Croatia* mobile application; Base: all respondents (general population N = 400 and boost sample N = 260)

After the spontaneous assessment of familiarity with the Invasive Species in Croatia mobile application, respondents were shown the following explanation: *The Invasive Species in Croatia application enables citizens to report and track sightings of alien and invasive alien species, and to contribute data to national and European databases.* After this description was presented, respondents were again asked whether they were familiar with the application.

The results show that, after the additional explanation, the share of respondents confirming familiarity with the application is even somewhat lower than in the spontaneous assessment. Thus, 8% of respondents from the overall population and 10% of respondents from Šibenik-Knin and Split-Dalmatia Counties state that they are familiar with the application.

At the same time, 85% of Croatian citizens confirm that they still do not know which application is being referred to, while this share among respondents from Šibenik-Knin and Split-Dalmatia Counties is 77%. The remaining respondents state that they are not sure whether they are familiar with the application (7% of the overall population and 13% of respondents from Šibenik-Knin and Split-Dalmatia Counties).

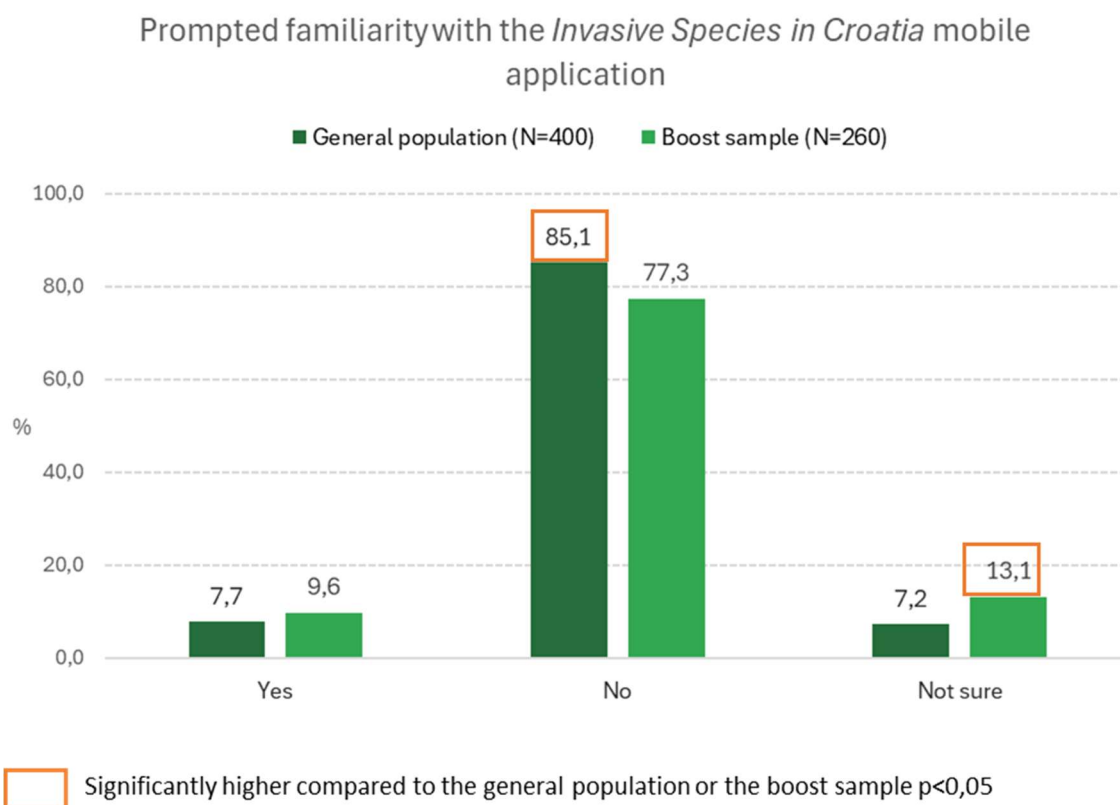


Figure 25 – Prompted familiarity with the *Invasive Species in Croatia* mobile application;
Base: all respondents (general population $N = 400$ and boost sample $N = 260$)

Respondents who stated that they were familiar with the Invasive Species in Croatia application were additionally asked whether they use it.

Among those familiar with the application, 28% of respondents in the overall population state that they use it, while 72% do not. The same ratio was recorded among those familiar with the application from Šibenik-Knin and Split-Dalmatia Counties, where 28% likewise state that they use the application and 72% that they do not.

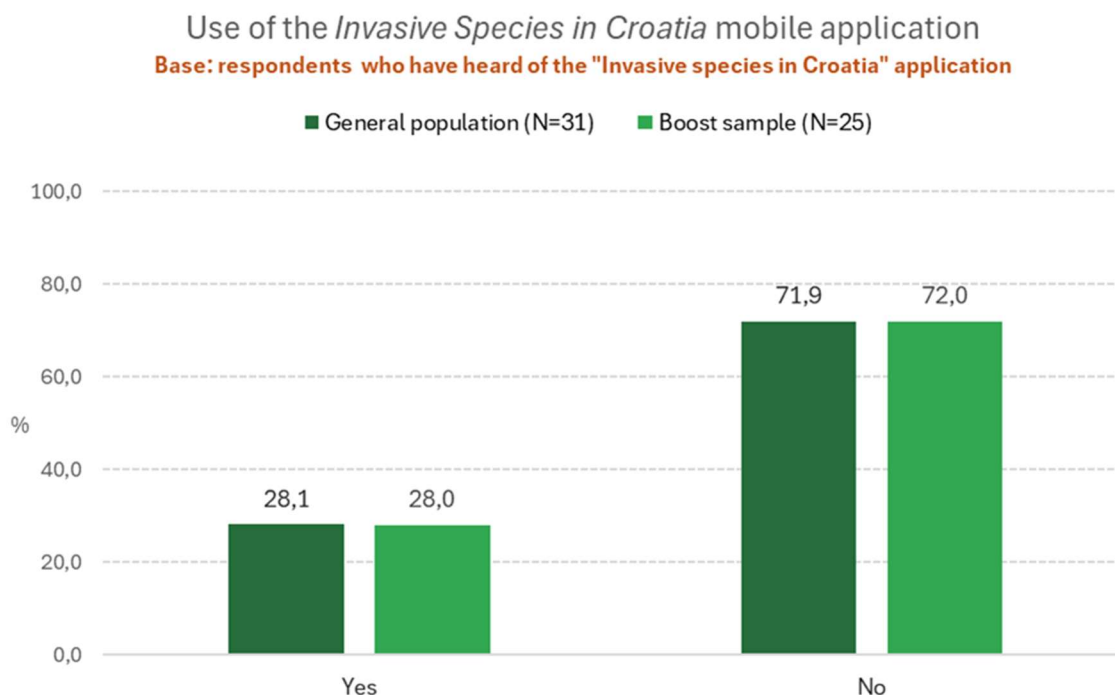


Figure 26 – Use of the Invasive Species in Croatia mobile application; Base: respondents who have heard of the Invasive Species in Croatia mobile application (general population N = 31 and boost sample N = 25)

2.8. Environment

Respondents were asked whether they had noticed changes related to nature during their lifetime (such as the decline and possible extinction of animal and plant species, significant climate changes, etc.) and, if so, whether they believe these changes will affect them personally.

The results show that most Croatian citizens have noticed certain changes in nature, while differing in their assessment of the changes' current and future impact. Nine percent of Croatian citizens state that they have noticed changes related to nature but that these do not affect them

personally. Furthermore, 44% of respondents have noticed changes that do not directly affect their lives but believe they will affect future generations. Every third respondent (33%) states that they have noticed changes that are already affecting their life, while 10% of respondents have not noticed any changes. In addition, 5% of respondents were unable to assess the answer.

The views of residents of Šibenik-Knin and Split-Dalmatia Counties are very similar to the national-level results. Among them, 11% state that they have noticed changes related to nature but that these do not affect them personally, while 46% note that they have noticed changes that do not currently affect their lives but believe they will affect future generations. Furthermore, 31% of respondents state that they have noticed changes that are already affecting their lives, while 8% have not noticed any changes, and 4% don't know.

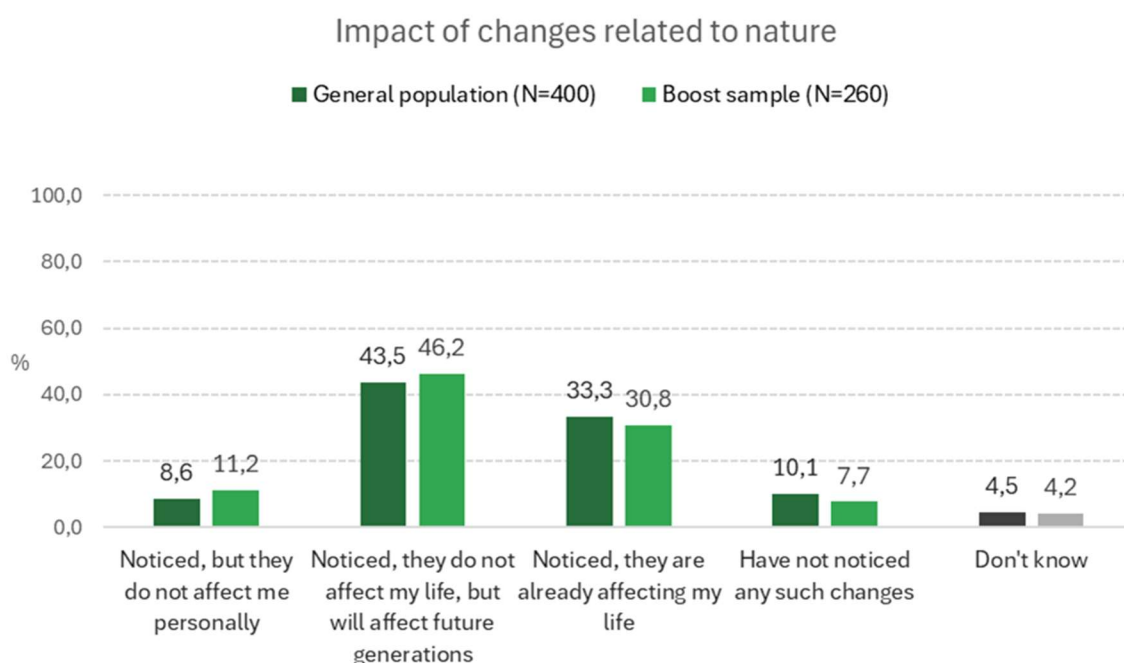


Figure 27 – Impact of changes related to nature; Base: all respondents (general population N = 400 and boost sample N = 260)

Respondents further assessed the importance of various environmental problems. The assessment was conducted on a five-point scale, where a score of 1 indicated “not important at all,” 2 “mostly not important,” 3 “neither important nor unimportant,” 4 “mostly important,” and 5 “very important.”

The results show that respondents perceive nearly all of the environmental problems analysed as mostly or very important.

As above-average important environmental problems, respondents highlight:

- soil, air, and water pollution, considered important by 92% of the overall population and 96% of residents of Šibenik-Knin and Split-Dalmatia Counties;
- extinction of plants and animals, considered important by 90% of the overall population and 94% of residents of Šibenik-Knin and Split-Dalmatia Counties;
- habitat loss, considered important by 90% of the overall population and 92% of residents of Šibenik-Knin and Split-Dalmatia Counties.

Problems assessed by respondents as being at an average level of importance include:

- climate change and extreme weather events, considered important by 86% of the overall population and 90% of residents of Šibenik-Knin and Split-Dalmatia Counties;
- use of biological resources (e.g., exploitation of forests) – 88% of the overall population and 91% of residents of Šibenik-Knin and Split-Dalmatia Counties;
- energy production and consumption and mining (e.g., pollution from fossil fuel combustion, oil spills, thermal pollution, changes in groundwater flows due to mining operations, and solid waste from coal mines) – 87% of the overall population and 90% of residents of Šibenik-Knin and Split-Dalmatia Counties;
- invasive alien species – 84% of the overall population and 89% of residents of Šibenik-Knin and Split-Dalmatia Counties;
- urbanisation (the process of growth in urban populations, the spatial expansion of existing cities and the development of new ones, the spread of urban lifestyles to other urban or rural areas, and the increasing influence of major cities across a country's territory) – 87% of the overall population and 90% of residents of Šibenik-Knin and Split-Dalmatia Counties;
- genetic material and diseases – 83% of the overall population and 89% of residents of Šibenik-Knin and Split-Dalmatia Counties;
- transport and utility infrastructure (e.g., construction of new and expansion of existing roads, construction of water infrastructure for land reclamation/drainage, and construction of irrigation facilities) – 87% of the overall population and 86% of residents of Šibenik-Knin and Split-Dalmatia Counties.



Although still perceived as important, a below-average level of importance relative to the other environmental problems is attributed to the following aspects:

- intensive agricultural production (a farming system characterised by extensive use of machinery for soil cultivation and harvesting, as well as the application of fertilisers and pesticides, resulting in high yields per unit of area) – 83% of the overall population and 84% of residents of Šibenik-Knin and Split-Dalmatia Counties;
- construction of artificial barriers on watercourses – 78% of the overall population and 80% of residents of Šibenik-Knin and Split-Dalmatia Counties;
- human population growth – 73% of the overall population and 74% of residents of Šibenik-Knin and Split-Dalmatia Counties.

A comparison of the two samples shows that residents of Šibenik-Knin and Split-Dalmatia Counties perceive most of the environmental problems analysed as more important than does the overall Croatian population. Soil, air, and water pollution, and the extinction of plants and animals stand out in particular, achieving significantly higher importance scores among residents of these counties than in the national sample.

Analysis by socio-demographic characteristics shows several significant differences. Respondents older than 45 and residents of Zagreb, Lika, Kordun, and Banovina perceive almost all of the environmental problems presented as important to a significantly greater extent compared to those younger than 45 and respondents from other regions.

By gender, one significant difference was observed: women significantly more often than men consider climate change and extreme weather events to be important.

Furthermore, urban residents perceive the extinction of plants and animals as a significantly greater problem compared to rural residents.

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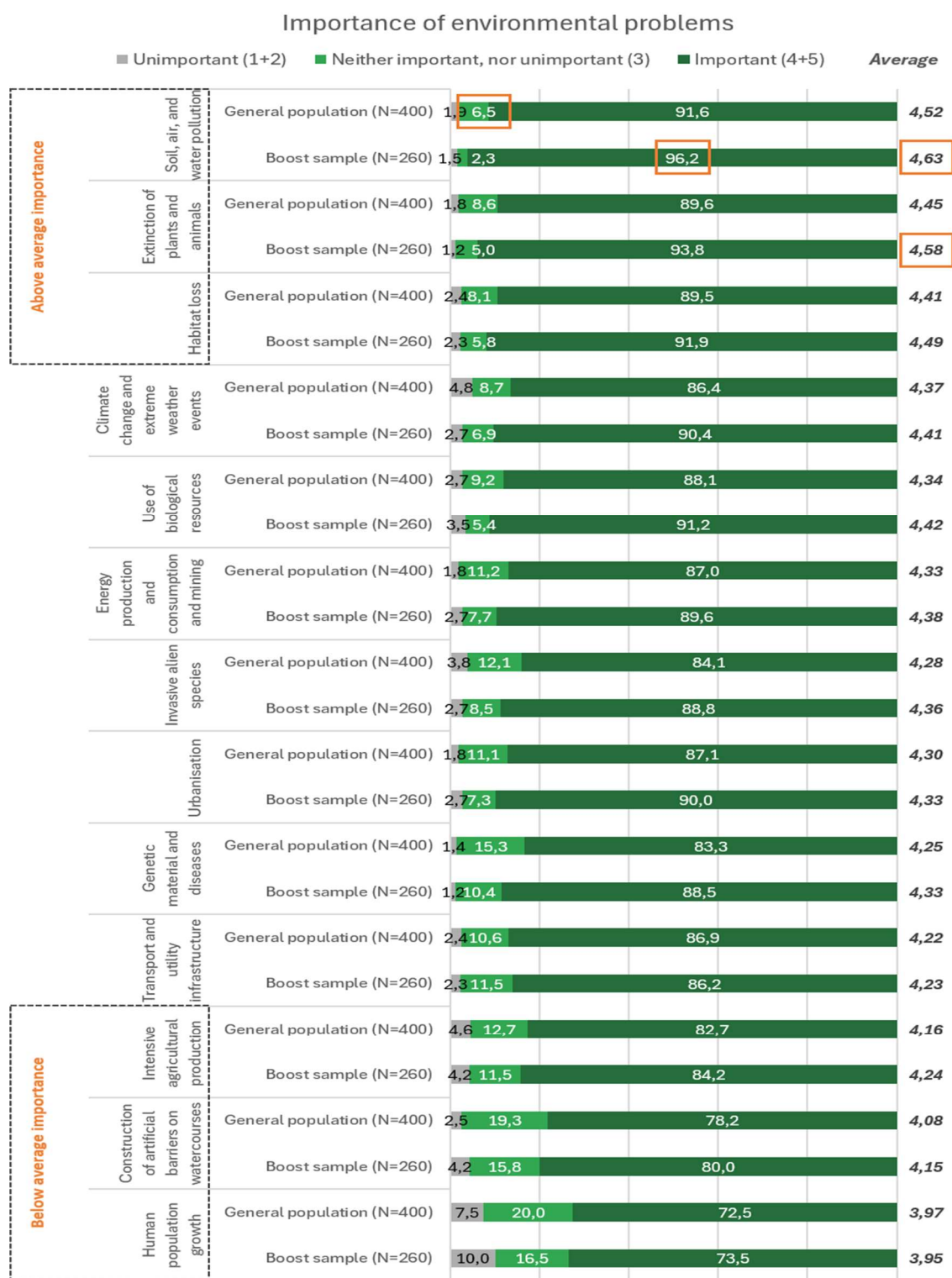


Figure 28 – Importance of environmental problems; Base: all respondents (general population N = 400 and boost sample N = 260)

3. CONCLUSION

Biodiversity

The research results show that the term *biological diversity* is relatively well recognised among Croatian citizens, although more than a third of respondents state that they have heard of it but are not sure exactly what it means. At the same time, citizens very clearly recognise the importance of preserving biodiversity, and consider the problem of the decline and potential extinction of plant and animal species to be serious, especially at the global and European levels. The perceived seriousness decreases as the level of observation moves closer to the personal environment, suggesting a certain psychological distance from the problem.

Citizens identify environmental pollution, the conversion of natural areas, intensive exploitation of natural resources, and climate change as the greatest threats to biodiversity, while invasive alien species and habitat fragmentation are cited somewhat less often as key threats. The results also show that women, urban residents, and residents of certain regions consistently express a higher level of concern for biodiversity conservation than other groups of respondents.

Natura 2000 Ecological Network

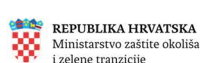
Overall, the research shows that awareness of the importance of biodiversity conservation exists, but there is room for further informing citizens about the concept of biodiversity itself and about certain less-recognised factors threatening it.

Although citizens largely recognise the importance of protected natural areas for nature conservation, the level of familiarity with the Natura 2000 Ecological Network remains relatively low. Almost half of citizens have never heard of Natura 2000, while only a smaller share of respondents state that they know what it represents.

After being presented with the definition, citizens rate the role of protected areas very positively in terms of protecting endangered species, preserving natural resources, and preventing the destruction of valuable habitats. Somewhat less importance is attributed to their contribution to tourism development.

When it comes to the relationship between nature protection and economic development, citizens show a balanced approach. Nearly equal numbers of respondents believe that interventions in protected areas should either be prohibited entirely or permitted only in cases of major public interest with mandatory compensation for damage, while a very small number give priority to economic development at any cost.

Endemic species



The term *endemic species* is very well known among Croatian citizens, and most respondents state that they know at least one endemic species living in Croatia. The Velebit degenia and the olm stand out as the most recognisable Croatian endemic species, while other species are mentioned considerably less often.

Residents of Šibenik-Knin and Split-Dalmatia Counties show a higher level of familiarity with endemic species than the national average. The results also point to differences among particular population groups. Younger respondents and rural residents are more often unable to name a single endemic species.

In general, it can be concluded that citizens are well acquainted with the concept of an endemic species itself, but knowledge of specific Croatian endemic species remains limited to a handful of the best-known examples.

Invasive alien species

Croatian citizens are largely familiar with the term invasive alien species, but knowledge of specific species and their characteristics is considerably weaker. After the term was explained, fewer than half of respondents were able to name an invasive alien species present in Croatia, with common ragweed, Caulerpa algae, tree of heaven, small Indian mongoose, and red-eared slider mentioned most frequently.

At the same time, citizens very clearly recognise the negative consequences of invasive alien species for biodiversity, and a large majority agree that they threaten native species and disrupt natural ecosystems. Most respondents also support their removal, with the prevailing view being that this should be carried out when necessary for the conservation of native and strictly protected species.

On the other hand, the level of specific knowledge remains limited. A large number of citizens are unable to estimate the number of alien species in Croatia, and most have not noticed invasive species in their immediate surroundings. The results show that citizens recognise the problem of invasive alien species at a general level, but there is considerable room to increase practical knowledge of their identification and distribution.

Dalmatian minnow (*Phoxinellus dalmaticus*) and eastern mosquitofish (*Gambusia holbrooki*)

The results show a very low level of familiarity with the Dalmatian minnow among Croatian citizens. Most respondents do not recognise this endemic species, either spontaneously or after being shown the description, although the level of recognition increases slightly after additional information is provided, particularly among residents of Šibenik-Knin and Split-Dalmatia Counties.

Knowledge of the Dalmatian minnow's habitat is likewise limited. More than half of citizens do not know in which rivers this species lives, while only about a third of respondents give the correct answer.

The results clearly show that the Dalmatian minnow remains poorly known to the wider public despite its endemic value and endangered status, and there is a need for more intensive information and outreach efforts to popularise this species through educational and communication activities.

Familiarity with the eastern mosquitofish among Croatian citizens is even lower than familiarity with the Dalmatian minnow. Only a small number of respondents spontaneously recognise this invasive alien species, while a large majority do not know in which Croatian rivers it occurs.

On the other hand, after the explanation was provided, most citizens successfully recognise that the eastern mosquitofish and the Dalmatian minnow differ in several respects, not just in appearance, which shows that short informational messages can significantly contribute to understanding the differences between invasive and endemic species.

The results show that it is necessary to further increase the recognisability of the eastern mosquitofish and other invasive species so that citizens can more easily understand their negative impact on domestic ecosystems.

Invasive species in Croatia mobile application

The *Invasive Species in Croatia* mobile application is almost unknown among citizens. Only about a tenth of respondents state that they are aware of its existence, and even among those who are familiar with it, fewer than a third actually use the application.

The results indicate that the application's potential to engage citizens in monitoring and reporting invasive species is currently underutilised. Given the important role of the application in collecting data on invasive species, the results point to the need for stronger promotion of the application, primarily among younger and digitally active citizens.

Environment

Croatian citizens are largely aware of the changes taking place in nature, and most believe that, if these do not already affect them personally, they will have a significant impact on future generations. Only a small share of respondents state that they have not noticed any changes in the environment.

Among environmental problems, citizens attach the greatest importance to air, soil, and water pollution, the extinction of plant and animal species, and the loss of natural habitats. Climate change, invasive alien species, and the exploitation of natural resources are also considered important challenges, albeit of somewhat lower intensity. Compared with other topics,

respondents attach the least importance to human population growth, the construction of artificial barriers on watercourses, and intensive agriculture.

Residents of Šibenik-Knin and Split-Dalmatia Counties rate most environmental problems as more serious than the national average, while older respondents, women (regarding climate change), and urban residents show a higher level of concern for particular environmental challenges compared to younger respondents, men, and rural residents.

The overall results confirm a high level of citizen awareness of the importance of environmental protection, with nature conservation, pollution, and biodiversity ranking among the most widely recognised social and environmental issues.

4. RECOMMENDATIONS

The research results show that citizens of the Republic of Croatia largely recognise the importance of protecting nature, biodiversity, and the environment, and express a high degree of concern about the threats they face. At the same time, significant gaps were identified in knowledge of certain technical terms, protected areas, specific plant and animal species, and the tools available for engaging citizens in nature conservation. Accordingly, the following activities are recommended:

1. Increase citizens' awareness of key nature-conservation concepts

Although terms such as biodiversity, endemic species, and invasive alien species are relatively well known, the results show that a large number of citizens are not sure of their actual meaning or cannot connect them with specific examples from Croatia.

It is recommended that simple, visually engaging educational content be developed to bring technical terms closer to the general public through everyday examples and local context.

2. Systematically promote the Natura 2000 Ecological Network

The greatest gap between attitudes and knowledge was observed precisely with regard to the Natura 2000 Ecological Network. Although citizens very clearly support nature protection, almost half have never heard of Natura 2000.

It is recommended that a national communication campaign be developed to bring citizens closer to understanding what Natura 2000 is, why it exists, and what benefits it brings to nature conservation, local communities, and quality of life. Particular emphasis is recommended on linking Natura 2000 sites to specific local examples that citizens can recognise.

3. Emphasise the local impact of biodiversity loss

The research shows that citizens rate the seriousness of the biodiversity problem considerably higher at the global level than at the local level. This points to the need for communication that demonstrates that the consequences of biodiversity loss are also occurring in citizens' immediate surroundings.

It is recommended that greater emphasis be placed on local examples of species disappearance, changes in river ecosystems, habitat degradation, and the consequences of invasive alien species, and that responsibility be brought down to the level of local authorities.

4. Popularise Croatian endemic species

Citizens are well acquainted with only a handful of the best-known Croatian endemic species, while knowledge of most other species remains very limited. This applies in particular to the Dalmatian minnow, whose recognition is extremely low even among residents of the areas where it naturally occurs.

It is recommended that dedicated communication activities be developed to present Croatian endemic species as part of the national natural heritage, emphasising their uniqueness and the need for their conservation.

5. Increase practical knowledge of invasive alien species

Citizens recognise that invasive alien species pose a serious threat to nature, but have difficulty identifying them in real-world settings.

It is recommended that simple guides, interactive content, and campaigns be developed to make it easier for citizens to distinguish the most common invasive and native species. Particular attention is recommended for species present in specific regions of Croatia.

6. More actively engage citizens in nature monitoring

The research shows a very low level of awareness of the “Invasive Species in Croatia” mobile application, as well as a very small number of its users.

It is recommended that the visibility of the application be significantly increased through:

- national and local communication campaigns,
- social media,
- schools and universities,
- national parks and nature parks,
- tourist boards,
- fishing and mountaineering associations,

- interpretation centres.

At the same time, it is recommended that campaigns be organised inviting citizens to actively report sightings of invasive alien species, together with additional communication of the concrete benefits of citizen participation in reporting such species through the “Invasive Species in Croatia” application.

7. Develop targeted communication for different groups of citizens

The results show clear differences among particular population groups.

It is recommended that communication be tailored to different target groups:

- younger citizens through digital channels, social media, and short educational video content,
- older citizens through television, radio, and print media,
- rural residents through local communities and agricultural and fishing organisations,
- urban residents through city events, museums, parks, and public gatherings.

8. Build on the existing high level of support for nature protection

One of the most important findings of the research is that citizens largely support nature protection and biodiversity conservation. This level of support represents a strong foundation for implementing the Ministry's future activities.

Communication activities should therefore not be aimed at convincing citizens that nature protection is important, but primarily at increasing citizens' knowledge, understanding, and active engagement in nature conservation.

9. Continue ongoing monitoring of citizens' level of awareness

The results of this research provide a valuable baseline for tracking changes in citizens' knowledge and attitudes.

It is recommended that the research be repeated periodically to assess the effectiveness of the Ministry's communication activities and to track changes in the level of awareness, species recognition, and citizens' willingness to actively participate in nature conservation.

„Improving the conservation status of endangered freshwater fish species that are endangered or in unfavourable-bad conservation status in Šibenik-Knin and Split-Dalmatia Counties“

ReFresh Fish LIFE (LIFE24-NAT-HR-101216203)

Final recommendation:

The research results show that there is a high level of awareness in Croatia of the importance of nature conservation, but a moderate-to-low level of specific knowledge in particular areas of nature protection. Future activities of the Ministry should therefore primarily focus on converting citizens' positive attitudes into better understanding and active participation in nature conservation. Particular emphasis is recommended on popularising Croatia's lesser-known natural values, increasing the visibility of the Natura 2000 Ecological Network and the *Invasive Species in Croatia* mobile application, and developing targeted educational and communication activities for different groups of citizens.



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5. APPENDICES

5.1. Appendix 2 – Questionnaire in English

QUESTIONNAIRE

ReFresh Fish LIFE

CAWI, N=600

26-06-067

SCREENING

DEM1 [S] Please indicate your gender

1. Male
2. Female

DEM2 [O] How old are you? *(Please enter your age in years, not your year of birth)* (OPEN END, numeric)

COUNTY [S] Which county do you live in?

1. Zagreb County
2. Krapina-Zagorje County
3. Sisak-Moslavina County
4. Karlovac County
5. Varaždin County
6. Koprivnica-Križevci County
7. Bjelovar-Bilogora County
8. Primorje-Gorski Kotar County
9. Lika-Senj County
10. Virovitica-Podravina County
11. Požega-Slavonia County
12. Brod-Posavina County
13. Zadar County
14. Osijek-Baranja County
15. Šibenik-Knin County
16. Vukovar-Srijem County
17. Split-Dalmatia County



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18. Istria County
19. Dubrovnik-Neretva County
20. Međimurje County
21. City of Zagreb

SIZE [S] What is the population size of the settlement where you live?

1. Up to 2,000 inhabitants
2. 2,001–4,000 inhabitants
3. 4,001–10,000 inhabitants
4. 10,001–40,000 inhabitants
5. 40,001–100,000 inhabitants
6. More than 100,000 inhabitants

BIODIVERSITY

Q1 [S] Are you familiar with the term *biological diversity* or *biodiversity*?

1. I have never heard of it and do not know what it is
2. I have heard of it, but I do not know what it is
3. I have heard of it and know what it is

Q2 [S per row; DO NOT ROTATE] Biodiversity refers to the variety of all living organisms on Earth.

In your opinion, how serious is the problem of the decline and potential extinction of animal and plant species, natural habitats, and ecosystems in each of the following environments?

	1 Not at all serious	2 Not very serious	3 Fairly serious	4 Very serious	5 Don't know / Cannot assess
1 Locally, in the area where you live	1	2	3	4	5
2 In our country (the Republic of Croatia)	1	2	3	4	5
3 In Europe	1	2	3	4	5
4 Global	1	2	3	4	5

Q3 [S per row; ROTATION] In your opinion, to what extent does each of the following threaten biodiversity?

	1 Not at all	2 Not very much	3 Fairly	4 Very much	5 Don't know / Cannot assess
1 Non-native plants and animals in Croatia that have been introduced from other regions or countries	1	2	3	4	5
2 Air, soil, and water pollution (e.g., seas, rivers, lakes)	1	2	3	4	5
3 Human-caused disasters (e.g., oil spills, industrial accidents)	1	2	3	4	5
4 Climate change	1	2	3	4	5
5 Overexploitation of forests, overfishing, conventional intensive agriculture involving pesticide use, and the concreting of waterways	1	2	3	4	5
6 Conversion of natural areas to other uses (e.g., expansion of urban areas)	1	2	3	4	5
7 Fragmentation of natural areas by transport, water, or energy infrastructure (e.g., motorways, hydropower plants, dams on rivers)	1	2	3	4	5

Q4 [S] Have you heard of the Natura 2000 Ecological Network?

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1. I have heard of it and know what it is
2. I have heard of it, but I do not know what it is
3. I have never heard of it

Q5 [S per row] The Natura 2000 ecological network is a network of conservation areas for endangered species and habitats. It includes more than 27,000 protected natural areas across the EU, of which more than 780 are located in Croatia.

How important do you consider such protected natural areas to be for the following?

	1 Not important at all	2 Not very important	3 Fairly important	4 Very important	5 Don't know / Cannot assess
1 Protection of endangered animals and plants	1	2	3	4	5
2 Preserving the role of nature in providing food, clean air, and water	1	2	3	4	5
3 Preventing the destruction of valuable natural areas on land and at sea	1	2	3	4	5
4 Promoting land use practices	1	2	3	4	5



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that do not harm nature					
5 Improving the quality of life of the local population	1	2	3	4	5
6 Tourism development	1	2	3	4	5

Q6 [S] Sometimes economic development results in damage to or destruction of nature in protected areas, such as areas included in the Natura 2000 network. Which of the following statements is closest to your opinion?

1. This should be prohibited because these are our most important natural areas.
2. This is acceptable only for projects of major public interest and if the damage is fully compensated (e.g., through restoration or mitigation measures).
3. This is acceptable because economic development should take priority.
4. Don't know.

Q7 [S] Are you familiar with the term *endemic species*?

1. Yes
2. No

Q8 [S] An endemic species is a species that occurs within a very limited geographic area, for example on an island, a mountain peak, or in a specific river.

Do you know of any endemic species that live in the Republic of Croatia?

1. Yes
2. No
3. Not sure

Q9 (IF Q8 = 1) [O] Which endemic species do you know?

1. _____ [OPEN END, string]
2. None

Q10 [S] Can you identify which species is shown in this photograph?



Dalmatian minnow (Photo: P. Mustafić)

1. Yes
2. No
3. Not sure

Q11 [S] The species shown in the photograph is the Dalmatian minnow (*Phoxinellus dalmaticus*) – an endemic species known for its characteristic interrupted lateral line. The lateral line is short and often discontinuous on the rear part of the body. It is threatened by the introduction of invasive fish species, as well as by human activities that alter its natural habitats.

Have you heard of it?

1. Yes
2. No
3. Not sure

Q12 [S] Do you know in which rivers this species can be found?

1. Danube, Drava, Sava
2. Korana, Kupa, Mrežnica
3. Čikola, Vrba, Krka
4. Not sure

Q13 [S] Are you familiar with the term *invasive alien species*?

1. Yes
2. No

Q14 [S] Plant or animal species that have been intentionally or unintentionally introduced outside their natural range are called alien species. Some alien species can successfully establish populations in a new area and spread. If their spread threatens biodiversity, ecosystem services, the economy, or human health, such species are referred to as invasive alien species.

Do you know of any invasive alien species in the Republic of Croatia?

1. Yes
2. No
3. Not sure

Q15 (IF Q8 = 1) [O] Which invasive alien species do you know?

1. _____ [OPEN END, string]
2. None

Q16 [S] Can you identify which species is shown in this photograph?



Eastern mosquitofish (Photo: P. Mustafić)

1. Yes
2. No
3. Not sure

Q17 [S] The species shown in the photograph is the eastern mosquitofish (*Gambusia holbrooki*) – an invasive alien fish species included on the European Union list of

invasive alien species of Union concern. It can be recognised by its characteristic almost transparent fins, while the dorsal and caudal fins have several rows of black spots.

In areas where mosquitofish populations are abundant, they compete with native species for food and habitat, primarily due to their highly aggressive feeding behaviour. They cause a decline in the abundance of native invertebrate species. They also attack and bite the fins of other fish, making them more vulnerable to diseases. Due to their negative impact on native species, they are considered one of the 100 most dangerous invasive alien species in the world.

Have you heard of it?

1. Yes
2. No
3. Not sure

Q18 [S] you know in which rivers this species can be found?

1. Danube, Drava, Sava
2. Korana, Kupa, Mrežnica
3. Čikola, Vrba, Krka
4. Not sure

Q19 [S] ROTATION, 4 IN SET POSITION] When comparing the endemic Dalmatian minnow and the invasive alien species eastern mosquitofish, which of the following statements do you think is correct?

1. They differ in many aspects – including adaptability to habitat conditions and visual appearance, such as the shape and appearance of fins, body markings, etc.
2. They differ only in visual appearance
3. There are no differences between the Dalmatian minnow and the eastern mosquitofish
4. Don't know / I am not familiar enough to answer

ENVIRONMENT

Q20[S] During your lifetime, have you noticed changes related to nature (such as the decline or possible extinction of animal and plant species, significant climate changes, etc.)? If so, do you think these changes affect you personally?

1. I have noticed these changes, but they do not affect me personally.
2. I have noticed these changes. They do not affect my life, but they will affect future generations.
3. I have noticed these changes, and they are already affecting my life.

4. I have not noticed any such changes.
5. Don't know.

Q21 [S] per row; ROTATION] Prema Vašem mišljenju, koliko su VAŽNI sljedeći okolišni problemi?

	1 Not important at all	2 Mostly not important	3 Neither important nor unimportant	4 Mostly important	5 very important
1 Habitat loss	1	2	3	4	5
2 Extinction of plants and animals	1	2	3	4	5
3 Invasive alien species	1	2	3	4	5
4 Genetic material and diseases	1	2	3	4	5
5 Soil, air, and water pollution	1	2	3	4	5
6 Climate change and extreme weather events	1	2	3	4	5
7 Human population growth	1	2	3	4	5
8 Intensive agricultural production (a farming system characterised by extensive use of machinery for soil cultivation and harvesting, as well as the application of fertilisers and pesticides, resulting	1	2	3	4	5

in high yields per unit of area)					
9 Use of biological resources (e.g., exploitation of forests)	1	2	3	4	5
10 Urbanisation (the process of growth in urban populations, spatial expansion of existing cities and the development of new ones, the spread of urban lifestyles to other urban or rural areas, and the increasing influence of major cities across a country's territory)	1	2	3	4	5
11 Construction of artificial barriers on watercourses	1	2	3	4	5
12 Energy production and consumption and mining (e.g., pollution from fossil fuel combustion, oil spills, thermal pollution, changes in groundwater flows due to mining operations, solid waste from coal mines)	1	2	3	4	5
13 Transport and utility infrastructure	1	2	3	4	5

(e.g., construction of new and expansion of existing roads, construction of water infrastructure for land reclamation/drainage, construction of irrigation facilities)					
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Q22 [S per row; ROTATION] In your opinion, to what extent do the following statements describe the impact of invasive alien species on native species and habitats?

	1 Not at all	2 Not particularly	3 Partially	4 To a great extent	5 Don't know / Cannot assess
1 They feed on the eggs of other fish species and amphibian larvae.	1	2	3	4	5
2 They most commonly feed on small native fish and their juveniles.	1	2	3	4	5
3 They reproduce rapidly (some species several times a year), allowing them to outnumber native species.	1	2	3	4	5

4 They alter the structure of aquatic communities by reducing the number of certain invertebrates, which leads to disruptions in the food web.	1	2	3	4	5
5 They can act as carriers of diseases and parasites to which native species are not adapted.	1	2	3	4	5

Q23 [S] Can you estimate how many alien plant and animal species are currently present in the Republic of Croatia?

1. 500–1,000
2. 1,000–5,000
3. 5,000–10,000
4. 10,000–20,000
5. I cannot estimate.

Q24 [S] It is estimated that around 9,000 alien species are present in the Republic of Croatia, of which approximately 900 are established in the wild.

Do you think invasive alien species should be removed in order to protect strictly protected and endemic fish species, as well as the biodiversity of freshwater and marine ecosystems?

1. Yes, always
2. Yes, but only if it is necessary for species conservation
3. No
4. Don't know

Q25 [S] Have you noticed any alien or invasive alien plant or animal species in rivers, streams, or other watercourses near where you live?

1. Yes
2. No

Q26 [S] Have you heard of the mobile application "*Invasive Species in Croatia*"?

1. Yes
2. N

Q27 The mobile application "*Invasive Species in Croatia*" enables citizens to report and track sightings of alien and invasive alien species, and to contribute data to national and European databases. Are you familiar with this application?

1. Yes
2. No
3. Not sure

Q28 Do you use or have you ever used the mobile application "*Invasive Species in Croatia*"?

SHOW TO THOSE WHO HAVE HEARD OF THE APPLICATION IN Q26.

1. Yes
2. No

DEMO (SVI)

DEM3 [S] What is the highest level of education you have completed?

1. Did not complete primary education (less than 8 years)
2. Completed primary education
3. Completed vocational/industrial secondary school – 3 years (skilled worker / highly skilled worker)
4. Completed grammar school / secondary school (4 years)
5. Completed higher education / university bachelor's degree (2 / 3 years)
6. Completed university / college / master's degree (4 / 5 years)
7. Master of Science degree
8. Doctorate degree (PhD)
9. [DO NOT READ!] I prefer not to say

DEM4. Does your household income come (partly or entirely) from activities in any of the following areas?

MULTIPLE ANSWERS ALLOWED. RANDOMISE.

1. Agriculture and livestock farming
2. Fisheries and aquaculture
3. Forestry
4. Viticulture (grape growing)
5. Hunting
6. Beekeeping
7. Nature conservation
8. Protected area management
9. Tourism (e.g., ecotourism, rural tourism)
10. Water management
11. No, my household income comes from other fields of activity
12. Don't know / Prefer not to answer

5.2. Appendix 2 – Tabular overview of results



KRKA
Nacionalni park
National Park



REPUBLIKA HRVATSKA
Ministarstvo zaštite okoliša
i zelene tranzicije



Javna ustanova
Karuzes Šibensko-kinjske županije
Public Institution
Karuzes of Šibenik-Knin County



FOND ZA ZAŠTITU OKOLIŠA I
ENERGETSKU UČINKOVITOST

