

# **ACTION PLAN FOR SOUTH EUROPEAN NASE (*Protochondrostoma genei*) CONSERVATION**

Version 1.1



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Cover photo:

Adult South European nase (*Protochondrostoma genei*). Author: Jurij Mikuletič.



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## Preface

The South European nase (*Protochondrostoma genei*) (Lasca) is an endemic fish species of the Adriatic Sea basin. The species inhabits watercourses in Slovenia and Italy (Kottelat & Freyhof, 2007; Carossi et al., 2022; Puzzi et al., 2021). Generally, the species is in a poor conservation status. Populations are fragmented and the distribution range has significantly decreased. In marginal areas of the species range, finds are rare and specimen occurrences are sporadic (Bertoli & Pizzul, 2022; Puzzi, 2022; Pliberšek & Tavčar, 2022). Therefore, the species needs attention to assure its survival in the future. The purpose of this Action Plan is to offer unified guidelines for the species conservation management within its entire distribution area. The goal of the plan is support the establishment of local and national action plans with adequate measures for the preservation of the species and improvement of its conservation status. The following are the objectives of the plan:

- To provide touchstone information about the species status
- To provide scientific practices and suggestions for further species management
- To determine priorities in species conservation
- To contribute good practices in knowledge exchange for a wide range of stakeholders

The document was produced in the scope of the LIFE for LASCA project (LIFE16 NAT/SI/000644). It was formed according to European Commission example of the Action Plan for the conservation of the Common Midwife Toad (*Alytes obstetricans*) from the year 2012, since it was formed for the entire species range and the species is under common pressures and threats as Lasca. The Lasca Action Plan was formed with collaboration of scientists in a specific team created for the species and other relevant stakeholders, which collaborated in the five-year period of the project. The project partner, Parco Ticino provided a supporting document, which is attached as a separate document to this action plan (Puzzi et al., 2021). During the project, we carried out 11 scientific councils, mostly on topics analyzing pressures and threats to the species. We met with numerous (N>20) completed and ongoing Life and Interreg Europe projects on the subject of fish conservation. At the end of the project, December 2022, we organized the LIFE for LASCA international congress, where fish scientists from the entire species range presented their work and projects relating to Lasca management and other endangered fish species protected under the Annex II Habitats Directive. Synopsis of the congress are attached as a separate document (LIFE for LASCA International Congress. Book of abstracts and summaries).

In the Action plan are included facts and knowledge from literature and examples of current good practices regarding species management and conservation within its entire geographical distribution range. Taxonomic species description, ecology and distribution are briefly introduced. Emphasis is on the species threats, pressures and conservation status. Towards the end, conservation measures are provided and suggestions are proposed to engage relevant stakeholders. In the conclusion, we foresee the monitoring and review of the plan with updates and modernizations.



## Summary

The South European nase (Lasca) is a small size fish species measuring up to 20 cm in length. Body is slender with small scales. Its main morphological features are inferior mouth, arched lower lip with a cornified pad and 8 ½ branched dorsal fin rays (Kottelat & Freyhof, 2007). Body coloration is silver, ventrally fading to white, dorsally to greenish-grey with a broad dark mid-lateral stripe from head to caudal base, fins often in red coloration. It feeds on aquatic invertebrates, mollusks and epilithic algae. Spawning period is from May to June, when the female deposits adhesive eggs on gravel substrate in a swift current.

Lasca lives in small groups and populates middle and lowland stretches watercourses with fast to moderate flow rates (rheophilic species) (Kottelat & Freyhof, 2007). In these stretches, it commonly shares its habitat with several cyprinid species from genera *Barbus*, *Telestes*, *Phoxinus*, *Alburnus* and *Chondrostoma* (LIFE CON.FLU.PO.). Few smaller populations were also recorded in oligotrophic lakes.

Lasca is an endemic species of the Adriatic Sea basin. It lives in watercourses between Soča/Isonzo river basin in Slovenia and Vomano river basin in Italy. The species was introduced into the Tyrrhenian and Ligurian Sea basins (Kottelat & Freyhof, 2007; Puzzi et al., 2021).

The conservation status of the South European nase is listed under the IUCN as »Least Concern« with a declining trend (Crivelli, 2006). However, the conservation status assessment in the reporting period 2013 – 2018 under Article 17 of the Habitats Directive, the species qualified under the category »U2 - Unfavourable – Bad« with poor trends for the future. It is reported, Lasca permanent population fragments are rare with the most specimens recorded in Po River basin and Tyrrhenian Sea basin, where the species was introduced (Puzzi et al., 2021). The main reason for the population decline is a synergic effect of habitat degradation, loss and fragmentation, as well as presence of allochthonous species (Puzzi et al., 2021; LIFE for LASCA, Bertol & Pizzul, 2022; Carosi et al., 2022). The consequence of these combined affects is fragmentation of populations into metapopulations and the reduction of the species range. On the fringes of its distribution range, the species abundances are so low that viable (meta) populations have practically disappeared. General finds are rare with low numbers of specimens. In the utmost eastern part of the species range, in Slovenia in the Vipava valley (SI3000226), the species disappeared in the recent past (Povž, 1983; Pliberšek et al., 2014; Podgornik et al., 2014). However, during the LIFE for LASCA project, the species was reintroduced into the area in three the most suitable tributaries named Močilnik, Jovšček and Ozlenšček.

The general goal of this action plan is the improvement of the species status in the EU, and allow the South European nase to reach a favorable conservation status. In order to accomplish this goal, further devotion towards the species requirements is needed across its range. Longitudinal river connectivity, reduction and prevention of invasive species are also crucial elements. Control over habitat degradation is especially required on the edges of the species range. We devised a list of proposed actions, which aspire towards the mentioned goal in accordance with the status of the species and threats/pressures involved. Actions are



divided into 7 categories: (1) monitoring and scientific research, (2) repopulation and reinforcement of wild populations, (3) confrontation with habitat degradation, (4) habitat management, protection and improvement, (5) control and reduction of alien species, (6) Action Plan implementation and coordination, (7) public awareness, education and knowledge transfer. Table of actions is in chapter 3.3 on page 20.

### **Action Plan geographical range and target audience.**

Within the European Union, the plan is intended for implementation in Italy and Slovenia. Target audience includes fisheries managers, scientific and nature protection institutions, as well as relevant local public and stakeholders.

## 1 Species biology and status review

### 1.1 Species description

#### Taxonomy

EU species number: 1115

Class:	Actinopterygii
Order:	Cypriniformes
Family:	Cyprinidae
Sub - family:	Leuciscinae
Genus:	Protochondrostoma
Species:	<i>Protochondrostoma genei</i> (Bonaparte, 1839) Former name <i>Chondrostoma genei</i> (Bonaparte, 1841)
Common names	
English:	South European nase, Lasca
Italian:	Lasca
Slovenian:	primorska podust

South European nase or Lasca (picture 1) is the only representative in its genus. The name *Protochondrostoma* derives from the original position of this genus in the group that formerly comprised *Chondrostoma* (Kottelat & Freyhof, 2007).



Picture 1: Lasca adult specimen from Brda in Goriška region, Slovenia.





## Morphology

Lasca is a small slender cyprinid fish species usually measuring up to 200mm in length and weighs approximately 100g. Rare specimens reach 250 – 300mm (LIFE CON.FLU.PO.; Povž et al., 2015). Lasca weight length relationship can be described using the formula  $W = 10 \cdot 5 \cdot TL^{2.96}$  ( $R^2 = 0.98$ ;  $N=709$ ) (LIFE for LASCA). In Slovenia, the largest recorded specimens measured in total length [TL] 190mm (BiosWeb;  $N=655$ ). Initial and localized data regarding Lasca age – length relationship has been reported to be; up to 90mm in the 1<sup>st</sup> year, up to 130mm in the 2<sup>nd</sup> year, up to 150mm in the 3<sup>rd</sup> and up to 160mm in the 4<sup>th</sup> year (LIFE CON.FLU.PO.). Growth rate intensity is dependent on the water temperature and nutrients intake. The body is slim and covered with small scales. Its key morphological features are: inferior mouth, arched “U” shaped lower lip with a thin, but well developed cornified pad, 50-62 lateral line scales and 8 ½ branched dorsal fin rays. Body coloration is silver, ventrally fading to white, dorsally to greenish - grey with usually (sometimes faded in juvenile specimens) pronounced broad dark mid-lateral stripe from head to caudal base; base of pectoral, pelvic, and anal fin are often in red/orange coloration (Kottelat & Freyhof, 2007; LIFE for LASCA). The species can be misidentified with Common nase (*Chondrostoma nasus*) and with the Italian riffle dace (*Telestes muticellus*). Lasca is best distinguished from Common nase by the number of branched dorsal fin rays (Lasca 8½ vs. Common nase 9½). This is especially important when comparing juvenile specimens, since all features are not fully developed and can be sometimes misleading. In comparison with Italian riffle dace, Lasca has an inferior mouth with a cornified pad and the riffle dace has a terminal or sub-terminal mouth and does not have a cornified lower lip.

## 1.2 Ecology and habitat requirements

Lasca lives in small groups and populates middle to lowland stretches of watercourses with fast to moderate flow rates (rheophilic species) (Kottelat & Freyhof, 2007). The species commonly shares its habitat with several cyprinid species from genera Barbus, Telestes, Phoxinus, Alburnus and Chondrostoma (LIFE CON.FLU.PO.). In upper reaches of watercourses, it can also coexist with grayling (*Thymallus* sp.) and marble trout (*Salmo marmoratus*). Few smaller populations were also recorded in oligotrophic lakes. It feeds on aquatic invertebrates, mollusks and epilithic algae.

## Reproduction

Spawning occurs from May to June, when water temperature reaches ~15 °C. It can also occur in March and April in more Southern parts of its range (LIFE CON.FLU.PO.). Sexual maturity is reached in the third or fourth year of its life (Povž et al., 2015). Sexual dimorphism is evident only during breeding season, when males develop small nuptial tubercles on top of their heads and strong reddish - orange coloration on the base of their fins. On average, a female produces 3000 eggs, but in the first year of maturity <1000 (LIFE for LASCA). The relationship between the number of eggs and the total body length (TL), can be described by the formula  $N_e = 0.05 \cdot TL^{2.2}$  ( $R^2 = 0.84$ ). The smallest mature female (full of mature eggs), which was observed measured only [TL] 86mm. This suggests that Lasca could reach maturity before





the third year. However, for certainty, further investigations should follow. Prior to spawning Lasca migrates in groups in search of faster flowing stretches of a watercourse or its tributaries, where spawning takes place on shallow gravel beds (lithophilic spawner). Female deposits adhesive eggs on to substrate with grain size from 2 – 4 cm (LIFE CON.FLU.PO.; Pellegrino, 2018 a). During the establishment of Lasca breeding in captivity, it was reported that eggs hatch in 5 – 6 days.

## Habitat

Dynamic and non-fragmented medium to small watercourses are crucial for a successful survival of Lasca. Specimens linger in pools and glides, often swiftly moving to shallows and riffles (LIFE for LASCA). The species exhibits a high preference for various types of fish cover, such as undercut banks, roots, large boulders, woody debris and vegetation. During ichthyological surveys, the most fish were recorded hidden under and around these structures. The species was also recorded in lacustrine waterbodies with suitable tributaries for spawning (Puzzi et al., 2021; Pozzi, 2022). Spawning habitat requirements are shallow gravel bottom with a fast to moderate well-oxygenated current (riffles).

Lasca highly prefers watercourse stretches with a large proportion of shade cover (>80%), such as densely covered overhanging riparian vegetation (willows, alders, various shrubs etc.) (LIFE for LASCA). Shade cover prevents water overheating and lessens successful predation from piscivorous birds, other predators and human disturbance. Bank vegetation also creates underwater niches in terms of roots and water breaks, where fish can hide and rest. During habitat surveys, it was measured that Lasca prefers waters where temperature does not exceed 25 °C. During spawning period, from May to June, water temperature gradually raised within the span of 10 - 20 °C.

## 1.3 Distribution, population size and trends

Lasca lives in central and northern Italy and in western Slovenia (picture 2). In accordance reporting data under Article 17. of Habitats Directive, it populates an area of 90.107 km<sup>2</sup> (picture 3; table 1). Populations are fragmented throughout its entire distribution range. The species is very rare in southeastern Italy and in Slovenia (Bertoli & Pizzul, 2022; Pozzi et al., 2021; Carossi et al., 2022; Pliberšek & Tavčar, 2022).

## Italy

In Italy, Lasca populates watercourses in the Adriatic Sea Basin, between Vomano River basin and Isonzo River basin. The distribution area encompasses 90.100 km<sup>2</sup> (picture 3; table 1). The species is endemic in the Po-Veneto district, but it extends its areal to Vomano River basin (Abruzzo) (Kottelat & Freyhof, 2007; Lorenzoni et al., 2010; Pozzi et al., 2021; Carossi et al., 2022). The species has been introduced in Tuscany, Liguria, Umbria and Lazio (Tyrrhenian Sea basin). In Umbria it was found in the middle and upper stretch of the Tiber River and in the downstream stretches of Chiascio, Paglia and Nestore rivers; it has also been recorded in artificial lakes of Corbara, Alviano and Recentino (Lorenzoni et al. 2010). In Lazio, it was found, with fairly structured local populations, in the Fiora, Paglia, Mignone and Marta rivers and, less



frequently, in the Treja, Torbido and Liri rivers (Tancioni and Cataudella 2009; Colombariet al. 2011; Sarrocco et al., 2012). Its introduction into the Tiber River basin dates back to the 1960s and in a short time the species has acclimatized in many watercourses of the hydrographic network and is still expanding its distribution range (Puzzi et al., 2021). Here it seems to have found the ideal conditions for its expansion, as opposed to the original area.

In the area between Vomano River and Po River, Lasca is rare, but some marginal populations remain stable in rivers Tenna, Esino, Metauro, Foglia in Tronto (Marche region) (Puzzi et al., 2021). In the Emilia-Romagna region, there are last permanent populations, which remain preserved in the mountainous area. In the Po River basin, in Lombardy region with main rivers Ticino and Adda, the original reference range of the species, equals to 1,757 km of waterways, which corresponds to 33.5% of the natural regional water network (5,246 km). The current estimated range is equal to 1,175 km, amounting to 27.4% of the aforementioned grid; for 204 km of water courses the current range is not known. The overall assessment of the contraction that has occurred in recent decades amounts to about 25% of the original area, excluding water bodies with an unknown situation. In reality, the current contraction of the species distribution range is much greater, as many populations (River Po, lower course of the Adda and Oglio rivers, Mincio, Mella, Secchia, etc.) indicate by consisting of sporadic and occasional individuals and are therefore close to extinction. Historically there was a source population of considerable size along the Po River, which in spring migrated upstream along the main tributaries for reproductive purposes. Today this source population has in fact disappeared and only residual populations remain, more or less permanent, in the middle course of the tributaries. Considering all of the above, the spatial contraction of Lasca populations is more likely to be 60%.

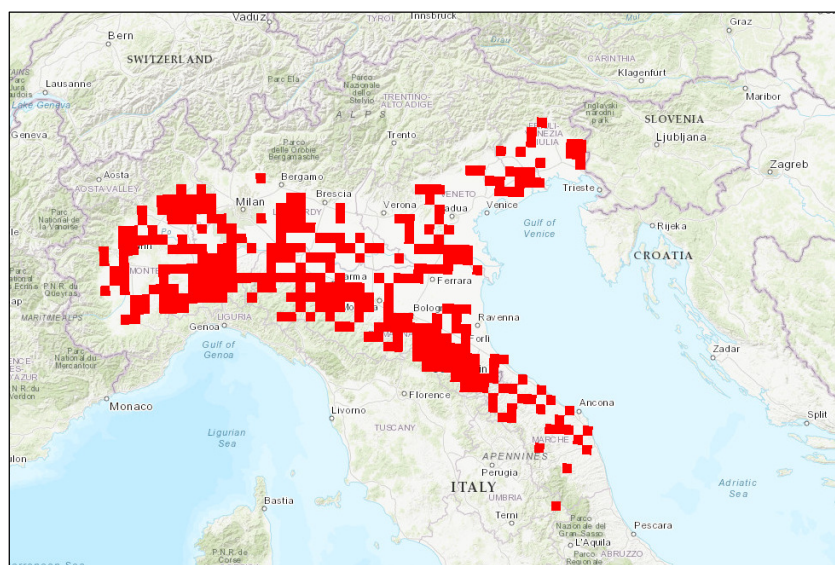
In the northeastern Italy, Lasca is extremely rare and sporadic (Bertoli & Pizzul, 2022). Finds within its range are seldom with low densities and fragmented age classes. The only well-structured population was recently found in the stream Chiarò, a tributary of the stream Corno, which is a part of the Isonzo River basin near the Slovenian border.

## **Slovenia**

In Slovenia Lasca is present in tributaries of the Isonzo (Soča) River. The only original population, barely manage to sustain its self is present in the basin of the stream Reka within the region of Goriška Brda. In this region, the species range cover only 78 km<sup>2</sup> (picture 3; table 1). Here the population is exceptionally small (N<200 specimens) and vulnerable (Pliberšek et al., 2014; Podgornik et al., 2014; Semrajc, 2020; Pliberšek & Tavčar, 2022). Additionally, this small population, due to habitat loss underwent fragmentation and split into two metapopulations, which together inhabit only 6km of streams (BiosWeb; Pliberšek, 2021). In the Vipava River basin, the species disappeared in the past (Povž, 1983; Pliberšek et al., 2014; Podgornik et al., 2014). Recently, after the year 2018, the species is gradually being reintroduced into three Vipava River tributaries: Jovšček, Močilnik and Ozlenšek (LIFE for LASCA). Until the year 2023, there were 136.052 Lasca individuals released into the wild, which originate from the Po river basin in Italy.



Picture 2: Lasca distribution in Europe. Green illustrates the area, where the species occurs naturally. Red illustrates the area, where the species was introduced.



Picture 3: Range of naturally present Lasca populations in Europe. (10 km x10 km squares) for the period 2013-2018. Reporting under the Article 17. of Habitats Directive.

## Population trends

In accordance with the EU species conservation status reporting, Lasca population trends for the period 2013 – 2018 are the following:

- Populations in the Continental biogeographical region are declining in Italy and Slovenia
- Population trends in the Alpine and Mediterranean biogeographical regions are not assessed and/or not known.

Table 1: Lasca range, population size and trends, referenced by reports submitted by EU member states under the 17. Article Habitats Directive for the period 2013-2018.

Member State	Biogeographical region*	Range [km <sup>2</sup> ]	Population size [1kmx1km grids]	Assesment period for the pop. size	Data quality	Population trend**	assessment period of the pop. trend
IT	MED	5.300	N/A	/	/	N/A	/
IT	CON	79.700	4.389-11.079	1999-2018	Based on the extrapolation of limited amount of data	-(D)	2007-2018
IT	ALP	5.100	N/A	/	/	N/A	/
SI	CON	78	5	2013-2018	Complete survey or a statistically robust estimate	-(D)	2007-2018

\*Biogeographical regions (picture 4): CON – Continental, ALP – Alpine and MED – Mediterranean

\*\*population trends: - (D): declining, N/A: not available

Reporting the species population range and size by EU member states is uniform and therefore comparable amongst states (table 1). Range is estimated for the entire distribution area. The majority of the species range is in Italy (>99,8). Data is not available for the population size in the Alpine and Mediterranean biogeographical regions. These two regions cover 13% of the species distribution area, and based on reporting, cover marginal areas of the species occurrence in Italy.





Picture 4: EU Biogeographical regions: green illustrates the Continental biogeographical region, purple illustrates the Alpine biogeographical region, yellow illustrates the Mediterranean biogeographical region and red illustrates the Pannonian biogeographical region (Biogeographical Regions Europe - Map (intl).png from the European Environmental Agency).

## 1.4 Threats and pressures

Degradation, fragmentation and loss of habitat, as well as the presence of alien species are the most commonly reported threats and pressures, which caused the decline of Lasca. The decline of populations is in most cases a synergic effect of two or more of the mentioned pressures. For instance, in the Po River basin researchers report a combined effect of habitat fragmentation and alien species presence (Puzzi et al., 2021). On the other hand, in the Vipava River basin synergic effect of habitat loss and degradation, as well as alien species introduction were determined to be the reasons for population decline and disappearance (LIFE for LASCA). Water pollution has also been an emphasized threat within the entire species distribution area, but to a lesser (medium importance) extent (Article 17. of Habitats Directive reporting). In the last decade, more frequent are reports regarding increased predation from piscivorous birds, especially the cormorant (*Phalacrocorax carbo*) (Puzzi et al., 2021; LIFE for LASCA), whose population is increasing (Article 12. of The Birds Directive reporting).

### Fragmentation, degradation, and loss of habitat

#### Habitat fragmentation

The main consequence of the fragmentation of natural habitats is the subdivision of original populations into smaller metapopulations, which are not in contact with each other, each occupying a single or a few areas. This in turn creates negative impacts such as, reduction in



genetic diversity, higher probability of local disappearance and low potential of populating new adequate habitats. Furthermore, fragmentation can lead to the separation of species specific habitats such as, spawning, overwintering and feeding grounds. This increases mortality potential and decreases the population reproduction potential, which can result in disappearances of small local populations.

In the Po River basin, Lasca faces several migration obstacles, in particular in its tributaries, due to the various barriers present that prevent its migration runs (Puzzi et al., 2021). The construction of transversal works on rivers contributed to the contraction of Lasca populations, preventing the species to reach reproductive areas in nursery streams. These obstacles that reduce the connectivity between the main river and its tributaries, can be referred to as partial interruptions. Within the Po River basin, completely isolated populations can be found in the Oglio River upstream of the lake and in the Tidone River (upstream of an artificial reservoir). However, some positive actions have been achieved. Along the Ticino River, from/to the Po River and the Lake Maggiore, Lasca has an opportunity to migrate thanks to the presence of fish ladders at the two dams of Porto della Torre and Panperduto. These fish friendly passages represent the only two existing dams located in the upper part of the river along the corridor Adriatic Sea – Lake Maggiore, towards the lake. Important to point out is that dams change river flows and slow down river or stream velocities. Therefore dam constructions should be prevented if possible, especially to protect rheophilic fish species, such as Lasca (LIFE for LASCA). In case, dam constructions are inevitable and cannot be prevented, at least what humans can do, is implement a functional fish passage.

#### Habitat loss and degradation

Human interventions into waterbodies and peripheral aquatic habitats can be devastating for fish survival, including Lasca. Substantial leveling and widening of riverbeds, unsustainable hydrological river bank regulations, riparian vegetation removal and excessive non regulated water irrigations can lead to Lasca degradation or even loss of habitat. Many of these interventions act synergistically with other threats, such as climate change and presence of alien species, which together can cause a serious threat to the species survival.

Degradation and loss of habitat played a strong role in the disappearance of Lasca in Vipava River (large tributary of the Isonzo River) valley, in Slovenia close to the Italian border. In the second half of the 20<sup>th</sup> Century, man altered the Vipava River in its upper and middle stretches and leveled riverbeds of tributaries in the lower flows of the main river. Many melioration ditches were constructed to increase agricultural surfaces. These interventions, combined with other species threats were fatal for Lasca in this region. Today, the mentioned threats/pressures still exists, but to a lesser extent. In the Goriška Brda Region, where lives the only very small natural Lasca population in Slovenia, extensive hydrological works on a cca. 1km long stretch of the stream Reka in 2018, divided this small population into two parts. These events also caused the loss of the species habitat in this short, but crucial section of the stream (Pliberšek, 2021).



### Alien species presence

Lasca is threatened by the introduction or presence of non-native species, such as Wells catfish (*Silurus glanis*), ide (*Leuciscus idus*), asp (*Aspius aspius*), common nase (*Chondrostoma nasus*), channel catfish (*Ictalurus punctatus*), crucian carp (*Carassius carassius*), common bream (*Abramis brama*) and common roach (*Rutilus rutilus*) (Crivelli, 2006; Puzzi et al., 2021; Povž, 1983; Povž, 1986 a,b). Alien species impact Lasca by predation and competition for food and space. Species like *Silurus glanis*, endanger Lasca by predation (Puzzi et al., 2021). On the other hand, species like the *Chondrostoma nasus*, compete with Lasca for food and space (Povž, 1983; Povž, 1986 a,b).

### Predation from piscivorous birds

Across Europe, the appearance of ichthyophagous has increased in in the last twenty years. Predominantly reported are the following species; Great crested grebe (*Podiceps cristatus*), cormorant (*Phalacrocorax carbo sinensis*) and grey heron (*Ardea cinerea*) (Puzzi et al., 2021; Article 12. of Birds Habitat Directive reporting). This predator increase occurred mainly due the improved habitat protection of the Continental aquatic habitats, which lead to the expansion of overwintering and nesting areas. Rapid and large number of bird returns caused a change in established ecosystem equilibriums, which consequentially resulted in negative impacts on fish populations, which were already threatened by various factors mentioned before. Lasca frequently utilizes shallow niches of watercourses, where it can become an easy prey for piscivorous birds.

## **1.5 Climate change and possible impacts on Lasca**

Reports on climate change regarding negative impacts on fish are becoming more frequent. Elevated air and consequently water temperatures causes decrease in oxygen saturations in aquatic habitats. With water temperature elevation, simultaneously fish metabolism (ectotherm) also increases, which stimulates a greater demand for oxygen uptake (Holt & Jorgensen, 2015). Therefore, in extreme water temperature conditions, stress comes into effect. This influences disease and host interactions and it impacts seasonal and short term behavioral fish patterns. Fungal diseases are commonly an example of secondary fish infections, which indicate unsuitable live conditions (Bravničar et.al., 1999). Changes in climate can affect migratory fish differently than stationary species, leading to changed distributions of species and crash in fish compositions (Hassan et al., 2020). Water temperature dynamics can also affect sexual maturation of fish gonads, or it can generally affect the growth rate and development of fish and their food. In some species, water temperate can also interact in gender development or act as a trigger for spawning migration runs.

Climate change is also reflected in extreme weather events, which on long term cause radical differences in water regimes and watercourse discharges (Hassan et al., 2020). Frequent and sudden rises in water levels and floods on one side, and prolonged dry periods with overheating on the other side. Human interventions into waterbodies and aquatic habitat networks can even increase these negative impacts. In Slovenia, it was identified that a suitable Lasca habitat, stretches of streams with cleared vegetation and leveled riverbeds were





more prone to droughts than natural well shaded meandering sections with a diverse bottom and banks (LIFE for LASCA). In stream sections, which were open to the sun and flattened, water retracted much faster, especially in extreme droughts of summer 2022. In some parts water disappeared completely, leaving many fish species including Lasca without any survival oasis for survival. Urgent fish rescue measures had to be implemented to minimize mortalities.

In regards with climate change, it would be wise to include the following conservation actions in the future:

- Initiatives in research for improving resistance and susceptibility of fish populations and their habitats to climate change (habitat revitalizations, insuring watercourse connectivity etc.)
- Awareness activities about impacts of climate change (education, awareness events, web sites and various publications) in cooperation with research centers, nature parks and other relevant existing institutions that deal with nature conservation.

## **2 Species conservation and legal status across its geographic range**

### **2.1 International conservation status and protection**

#### **Conservation status**

On the IUCN Red list, Lasca is listed under the category »Least Concern« with »Decreasing« populations trends (Crivelli, 2006). In the description, it is reported that the species is declining at individual locations. The species almost disappeared from middle and low stretches of the Po River, due to the presence of alien species. Elsewhere the species is considered as stable. Status assessment is from the year 2006 and requires an update.

Based on the Article 17. of Habitats Directive reporting for period 2013 - 2018, the species is listed in the category »U2 - Unfavorable – Bad« with poor prospects for the future. Data incorporates the Continental biogeographical region. Species distribution data for Alpine and Mediterranean biogeographical regions is provided, but it is lacking population size data. These two regions cover 13% of the entire species distribution area, and based on reporting, cover marginal areas of the species occurrence in Italy.

#### **Protection**

The species is listed and protected under the Annex II. of The Habitats Directive and under the Annex III. of The Bern Convention.



## 2.2 National and regional conservation and legal status

### Conservation status

On the national level in Italy and Slovenia, the species is listed in the red list in both countries. In Italy, it is categorized under »EN - Endangered«, and in Slovenia it falls under the category »Ex - Extinct«. Slovenian red list was published in the year 2002 and requires an update.

### Protection

In Slovenia, Lasca habitat of the very small original natural population was protected in the Goriška Brda region, with the issued “Order for temporary ban and restriction of Lasca habitat manipulation” (Official Gazette of the Republic of Slovenia No. 47/19 and 103/20).

## 2.3 Existing and recent actions for the species conservation

Various conservation measures for Lasca conservation are being implemented in Italy and Slovenia. Breeding of the species in captivity has been established in Italy and after in Slovenia as well. The offspring serves as genetic backup and as a source for wild population reinforcements in the Po River basin in Italy, and Isonzo (Soča) River basin in Slovenia. Species habitat is being protected through Natura 2000 network. Work on selected projects and initiation of public bodies monitor the species status, research its biology, establish river connectivity, face alien species threats and raise awareness in scientific, common and youth public. The following projects were applied or are still in progress, which directly deal with the conservation of Lasca:

*Requalification of Taro fluvial habitats vital to avifaun (LIFE98 NAT/IT/005138).* With objective to construct a fish pass, primarily for *Barbus plebejus*, *Protochondrostoma genei* and *Leuciscus souffia*, where the passage of the *Silurus glanis* will be unbated.

*Restoration of Bacchiglione springs and habitat of SPA IT3220013 and SCI IT3220040 (LIFE09 NAT/IT/000213).* Revitalization of aquatic and riparian habitats within the Natura 2000 sites of the province Vicenza.

*Restoring connectivity in Po River basin opening migratory route for *Acipenser naccarii*\* and 10 fish species in Annex II (LIFE11 NAT/IT/000188).* Establishment of Lasca breeding in captivity, population reinforcements and improvement of connectivity of migration paths in Po River basin.

*Small fish, small streams, big challenges: conservation of endangered species in tributaries of the upper Po River (LIFE21-NAT-IT-LIFE-Minnow/101074559).* Specific objectives are restoration of longitudinal connectivity of 122 Km, currently fragmented by 16 barriers; Habitat improvement in 13 strategic points; Restocking of the population of five species; Alien species control and reduction in 440 Km in 20 Natura 2000 sites in Piedmont Region, Italy.



*LIFE SAVING LASCA. Urgent measure to conserve nearly extinct species *Protochondrostoma genei* (LIFE16 NAT/SI/000644).* Establishment of Lasca breeding in captivity in Slovenia. Species ecology research and habitat requirements. Repopulation of the Natura 2000 site Dolina Vipave (SI 3000226), including habitat protection and alien species control.

*University of Trieste and Turin, Preliminary study in the stream Chiarò* in the context of the MesoHABSIM Project (Bertoli et al., 2022). Lasca habitat survey and assessment of species threats. Population and species life stages assessments in the Chiarò stream, Isonzo River basin, Italy.

*Lasca *Protochondrostoma genei* (Bonaparte, 1839) conservation status and measures at Apennine area, Italy* (Carossi et al., 2022). Lasca Conservation analysis in the Adriatic Sea basin in central Apennine region in Italy.

## 2.4 Lasca conservation priorities

Conservation priorities are defined on the basis of considering the species main ecological requirements and population status, and are as follows:

- Constant monitoring of Lasca conservation status and trends.
- Population reinforcements in the wild where needed or where the species has disappeared (repopulations).
- Maintaining/establishing captive breeding to provide source of specimens for population reinforcements and probable repopulations.
- Improving river connectivity and creating the connection of migration paths.
- Conservation/enhancement of natural or sustainably and fish - friendly regulated habitats; preserving bank vegetation, stream sinuosity, diverse water dynamics and riverbed structures (ex. spawning gravel beds).
- Control/reduction of alien species and prevention of further introductions.

## 2.5 Gaps in knowledge

Lasca in the last decade was a studied species in terms of its biology and ecology, which contributes to the knowledge regarding the species requirements. However, there are still gaps in knowledge. More research is required about the species conservation status, such as more in detail studies of individual (meta) populations in the Po River basin. To fill the gaps in knowledge, the following priorities regarding future research are proposed:

### Surveys and monitoring

- Detailed population surveys and the species status in its southern and northwestern areas of its entire range.
- Improving knowledge of individual (meta) populations, which have not been thoroughly studied yet.
- Continuing and updating monitoring activities for the species reporting according to the Article 17. of The Habitats Directive.



### **Habitat fragmentation**

- Impacts on habitat and population dynamics of Lasca, connected to concrete examples.

### **Habitat loss and degradation**

- Research in regards with possibilities of habitat revitalizations of waterbodies, which would support Lasca survival in the long run.

### **Alien species**

- Production of alien species distribution range maps within the entire Lasca range in Europe.
- Detailed studies of individual alien species impacts on Lasca.
- Improving and researching techniques, methods, approaches for alien species control and reduction.

### **Pollution**

- Water pollution (different pollutants) impacts on Lasca have not been studied in detail.

## **3 Framework for action**

### **3.1 Purpose**

The purpose of this action plan is the improvement of the Lasca, *Protochondrostoma genei*, conservation status in Europe, with the aspiration that the species reaches a »favorable« conservation status.

### **3.2 Objectives**

In order to achieve the purpose, it is crucial to face threats to the species, which need to be repressed to the point, when their impact becomes negligible. Components of this process are the following objectives:

Objective 1: Wild population reinforcements, to enable development of viable and sustainable populations/metapopulations.

Objective 2: Maintaining a coherent structure and connectivity of metapopulations, with the aim to become viable and sustainable populations across the entire species range.

Objective 3: Monitoring of species threats/pressures, which impact Lasca habitat, especially non sustainable hydrological interventions, which deplete riparian vegetation, riverbed structure and flow dynamics.



Objective 4: Monitoring, reduction and control of alien species, as well as preventing further introductions.

### 3.3 Actions

In order to accomplish the mentioned objectives, we provide a recommended list of actions, taking into account the species threats/pressures in all mentioned regions; central Italy, River Po basin, northeastern Italy and Slovenia. Actions are divided into 7 categories:

- (1) Monitoring and scientific research,
- (2) Wild population reinforcements/repopulations,
- (3) Engaging habitat fragmentation,
- (4) Habitat management and improvement,
- (5) Alien species control and reduction,
- (6) Coordination and execution of the action plan,
- (7) Public awareness, education and knowledge exchange.

Table 1: Recommended list of actions

No.	ACTION	MEMBER STATE	PRIORITY*	TIMELINE**
<b>Monitoring and scientific research</b>				
1	Monitoring on Lasca conservation status and trends.	IT, SI	Urgent	In progress
2	Assessment on Lasca conservation status and trends; where missing.	IT	Low	Long-term
3	Detail studies of individual (meta) populations.	IT	Low	Long-term
4	Research in regards with possibilities of habitat revitalizations of waterbodies, which would support Lasca survival in the long run (including first implementations).	IT, SI	High	Short-term
<b>Wild population reinforcements/repopulations</b>				
5	Map the areas from where the Lasca has disappeared and the areas that need wild reinforcement.	IT, SI	Medium	Long-term
6	Lasca wild reinforcement.	IT, SI	Urgent	In progress
7	Repopulation for well-studied cases.	IT, SI	Low	Long-term
8	Lasca captive breeding.	IT, SI	Urgent	In progress
9	Protection and management of existing populations in the areas where the species is highly threatened.	IT, SI	High	Short-term
10	Conservation/ management of viable populations that can potentially act as source populations.	IT, SI	High	Short-term

\*Priority: Urgent, High, Medium, Low

\*\*Timeline: In progress – is currently being implemented and should continue, Short-term – the action should start within a five years period, Long-term – the action should start within a ten years period.



No.	ACTION	MEMBER STATE	PRIORITY*	TIMELINE**
<b>Engaging habitat fragmentation</b>				
11	Research Impacts on habitat and population dynamics of Lasca, connected to concrete examples.	IT	Low	Long-term
12	Establishment of river connectivity.	IT	Urgent	In progress
<b>Habitat management and improvement</b>				
13	Research in regards with possibilities of habitat revitalizations of waterbodies, which would support Lasca survival in the long run.	IT, SI	High	Short-term
14	Preparation of guidelines for Lasca habitat revitalization, conservation and management.	IT, SI	High	Long-term
15	Habitat revitalizations of waterbodies.	IT, SI	High	Long-term
16	Habitat conservation and management.	IT, SI	Urgent	In progress
17	Planting of riparian vegetation.	IT, SI	High	Long-term
18	Study water pollution (different pollutants) impacts on Lasca.	IT, SI	Low	Long-term
<b>Alien species control and reduction</b>				
19	Production of alien species distribution range maps within the entire Lasca range in Europe.	IT, SI	Medium	Long-term
20	Detailed studies of individual alien species impacts on Lasca.	IT, SI	Urgent	In progress
21	Improving and researching techniques, methods, approaches for alien species control and reduction.	IT, SI	Urgent	In progress
22	Alien species control and reduction on strategic sites.	IT, SI	Urgent	In progress
<b>Coordination and execution of the action plan</b>				
23	Establishment of EU contact list of experts on Lasca in its entire distribution area that should be able to provide advice to Governments, authorities and relevant stakeholders, and also oversee the practical implementation of the conservation actions recommended in this plan.	IT, SI	High	Short- to Long-term
24	Distribution of this action plan and promote its implementation among EU Member States.	IT, SI	Urgent	Short-term
25	Identify all appropriate funding resources for the activities outline in the Action Plan, ensuring that all relevant organizations, institutions and individuals are aware of such opportunities.	IT, SI	High	Short-term
<b>Public awareness, education and knowledge exchange</b>				
26	Raising awareness about climate change impacts.	IT, SI	Urgent	In progress
27	Raising awareness of alien species introduction consequences.	IT, SI	Urgent	In progress
28	Awareness of the consequences non sustainable hydrological interventions and examples of good practices.	IT, SI	Urgent	In progress
29	Raising awareness biodiversity conservation importance.	IT, SI	Urgent	In progress
30	Raising awareness of possibilities of coexistence of nature and man; strengthen the respect for nature.	IT, SI	Urgent	In progress



### 3.4 Stakeholder participation

Stakeholders are individuals or various groups of people, which directly or indirectly influence the species in positive or negative ways, or the species influence them in the same way. Analysis of stakeholders, incorporates the level of connection of individuals or groups of people with the species. Their interests need to be addressed in terms of their activities, and how these activities influence the species and on what level, when linked to their interests (positive or negative) (Sande et al., 2005). The action plan can be successful only if, stakeholders are included and consulted in the implementation of the plan.

Based on the entire Lasca geographical range (two countries, rivers, tributaries, ect.) and regional differences of proposed measures, the list of stakeholders may be broad. Therefore, it is recommended for the list to be determined on a “case by case” basis. Inevitably, for the success of individual measures, certain other institution will have to be included from sectors, such as nature protection agencies, agriculture, tourism, industry and transportation.

Provided below is a recommended starting list of key stakeholders, which include individuals or groups of people from the following groups:

- Nature conservation (nature protection agencies and/or NGO groups),
- Fisheries (managers, angling associations/clubs),
- Land use (agriculture),
- Water management,
- Scientific societies,
- Local authorities,
- Land owners,
- Common local public.

### 3.5 Monitoring and review

This action plan can be constantly updated on the basis of new relevant research and knowledge, especially for regions where the plan may not be effective. The plan should be updated, at least every ten years after it was published.

### 3.6 Other species that can benefit from the species action plan

With Lasca habitat conservation, habitat of the coexisting species is also simultaneously preserved or protected. For example in Slovenia, in the Reka River basin, the species naturally shares its habitat with native fish species such as the riffle dace (*Telestes muticellus*), arborella (*Alburnus arborella*), barbells (*Barbus plebejus* and *Barbus balcanicus*), chub (*Squalius squalus*), marble trout (*Salmo marmoratus*), Padanina goby (*Padogobius bonelli*) and loach (*Cobitis bilineata*). Additionally, habitat conservation assists other groups of aquatic species or species that utilize adjacent aquatic habitats, such as amphibians, snakes, aquatic invertebrates and plants. Therefore it is logical to emphasize this synergy in conservation of other species, when possible and increase the chances of the action plan success.





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