Technical update report

Subject:	TECHNICAL UPDATE ON *DELIVERABLE* N. 2– MONITORING AND ACTION PLAN FOR *TRACHEMYS SCRIPTA* SCHOEPFF, 1792
proponent:	Puglia Region - Dipartimento Mobilità, Qualità Urbana, Opere Pubbliche, Ecologia e Paesaggio Via Gentile n. 52, 70126 Bari
Realized by:	ERSE *Ecological Research and Services for the Environment* soc. coop. s.t.p. Via Aurelia sud 291, 55 049 Viareggio (LU) – www.erseambiente.it
activities:	Technical report: specific monitoring protocol and relative action plan towards the IAS *Trachemys scripta,* aimed at the "evaluation of the threats to biodiversity caused by the IAS and relative action plan for the protection of biodiversity", inside BEST project- *Addressing joint Agro-and Aqua-Biodiversity pressures Enhancing SuSTainable Rural Development*").

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Premise

The present report aims at realizing a management plan concerning the Invasive Alien Species *Trachemys scripta*, also known as pond slider inside the Nature Reserve of Torre Guaceto. This plan is composed by two sections: a monitoring plan, whose goal is to characterize the spatial and quantitative patterns of the distribution of the species on the territory, and a relative action plan. The latter will be strictly related to the monitoring plan, proposing different management strategies depending on the different outcomes.

Chapter 1. Introduction

Protecting biodiversity is one of the main and most ambitious goals of our times, requiring a strong cooperation among institutions and local managers. Many anthropic factors represent a great menace in this regard, including the introduction of Invasive Alien Species (IAS), which is considered one of the main threats to biodiversity around the world

1.1 The Invasive Alien Species

According to Kolar & Lodge (2001), ecologically speaking a species is defined as invasive when able to quickly spread from the introduction point throughout the territory, becoming abundant and eventually dominant in this new area. This is possible thanks to the following characteristics (Life ASAP Project):

1. Resistance to parasites and diseases
2. Adaptation to different environmental conditions, including highly anthropized ones
3. Higher competitiveness in exploiting the resources, compared to the native species (sometimes producing allelopathic substances)
4. Quick growth
5. Short life cycle
6. High reproductive potential
7. High diffusion capabilities, eventual asexual reproduction
8. Adaptation of the life cycle depending on the invaded environments
9. Consociation with human activities
10. Resistance to predators/competitors in the new area

From a regulatory point of view, IAS are defined as those species threating biodiversity and related ecosystem services (CDB 2000, 2002), with negative impacts on economic activities and human health. It is thus important to distinguish between alien species and invasive species, as a new introduced species may not necessarily be related to a menace for local biodiversity.

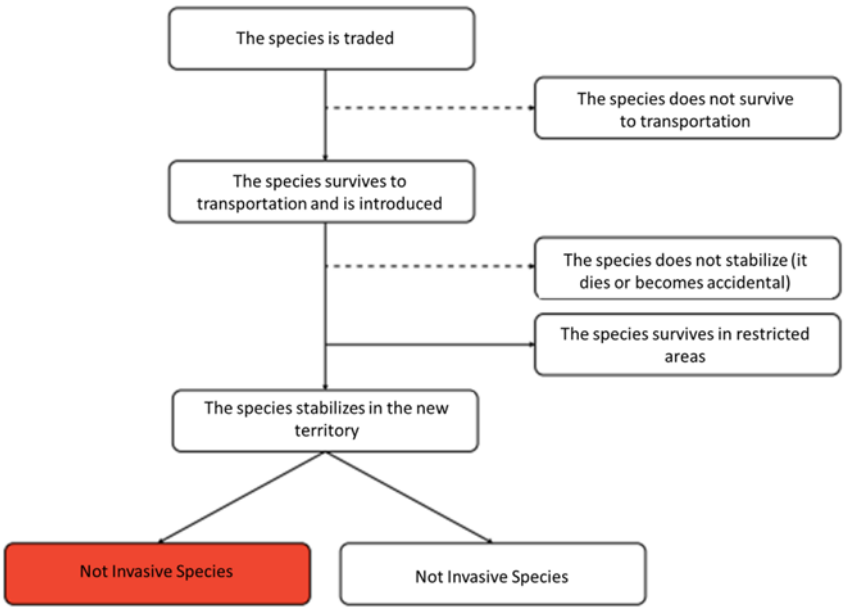

Figure 1: introduction and potential invasion process of an alien species (from lifeasap.eu).

According to the tens rule (Williamson, 1996), around 10% of introduced species survive to the transportation, and 10% of these species stabilize in the new environment. Again, a 10% of these stabilized species may become invasive, giving an overall 0,001% probability of invasion of a new introduced species. Obviously, this "rule" represents an estimation, but still remains a reference point in the study of biological invasions.

1.2 The species *Trachemys scripta* as an invasive species inside the apulian territory and inside the Nature Reserve of Torre Guaceto

The pond slider (*Trachemys scripta* SCHOEPFF, 1792) is a freshwater turtle belonging to the family of emydidae, native to the Mississippi basin. Widely traded during most of the XX century, mainly as a pet and for alimentary purposes (in Southeast Asia), now it is present in many countries of the world. Listed as one of worst 100 IAS around the world and in Europe (Lowe *et al*., 2000; DAISIE project and UE Reg. 1143/2014), thanks to its high ecological adaptive capabilities, *T. scripta* has an omnivorous, generalist diet which allows it to be highly competitive with the native fauna, in particular to the closely related species such as the European pond turtle (*Emys orbicularis*). It is also important to stress out the potential negative effect from a sanitary point of view, being the species a vector for pathogens like salmonellosis. In Italy, its distribution is mainly located in the central/northern part of the peninsula, while it tends to be more scattered in the South.

According to this information, *T. scripta* can be properly considered as an Invasive Alien Species, currently expanding its range in many parts of Italy, including Apulia. It is therefore necessary to put up specific management plans aiming at containing its expansion and its impact on the local biodiversity.

1.2.1 Torre Guaceto Reserve

The main purposes of this plan are the realization of a local containment plan for *Trachemys scripta* inside the Torre Guaceto Reserve, a protected are located inside the Brindisi province and constituted by a Natural Terrestrial Reserve and a Marine Protected Area. This report will produce a monitoring plan to estimate the abundance of the population inside the reserve and a management plan to contain the species, by physically removing the captured individuals (which will be directed through disposal or containment in specific rescue facilities).

Specifically, the Reserve has been chosen as a proper study/containment area thanks to its semi-confined borders and thanks to its high conservational value, being a RAMSAR humid area where the presence of the pond slider constitutes a serious threat to the local biodiversity. In addition, the area is located inside the SPA/SAC Natura 2000 Protected Area IT9140003 “Stagni e Saline di Punta della Contessa”, according to the “Birds Directive” 79/409/CEE and “Habitat Directive” 92/43CEE.

The biological community of the area is therefore particularly sensible to the ingression of exotic species, whose presence in the Reserve is not restricted to the fauna but it also includes invasive plant species like the Port Jackson wattle (*Acacia saligna*) or the common boobialla (*Myoporum insulare*). This is mainly due to its location, close to human activities and close to the sea, factors representing a threat in terms of potential reintroduction of the IAS and thus making eradication efforts more risky.

Table 1: characterization of invasiveness of *Trachemys scripta*.

Invasiveness characteristics	Evaluation
Velocity of dispersal	Dispersive
Tendency of prevalence	Dominant
Level of threat to biodiversity	Highly competitive
Regional distribution	Distributed at a regional level

Chapter 2. Characteristics of the species

2.1 Morphological description

TAXONOMY

Phylum: Chordata
Class: Reptilia
Order: Testudines
Family: Emydidae
Genus: *Trachemys*
Species: *Trachemys scripta*

Figure 2: taxonomical framework of the pond slider, with pictures: individual of red-eared slider (*Trachemys scripta elegans,* on the left) and representation of the three most common subspecies of *T. scripta* on the right, with different patterns in terms of colour and shape of the post-orbital and plastron spots.

The American pond slider (*Trachemys scripta* SCHOEPFF, 1792), is a species of freshwater turtle belonging to the family of emydidae. The adults show sexual dimorphism, the male having a longer, thicker tail, well developed claws and flat shell. The head of both sexes is characterized by post-orbital spots different in shape and colours, which represent diagnostic features for the identification of the different subspecies:

- *Trachemys scripta scripta* (THUMBERG in SCHOEPFF, 1792). Yellow-eared slider, showing two clear yellow spots on the cheek. The shell is dark green in the young individuals, turning almost to black in the adults. The plastron is entirely yellow, and the individuals can reach 15-18 cm in dimensions in males (up to 25 cm in females)

- *Trachemys scripta elegans* (WIED-NEUWIED, 1838). Red-eared slider, showing elongated red mark(s) on the cheek. The shell is dark green in young individuals turning to black in adults, the plastron shows black spots on each scute, surrounded by a wider circle and enlarging in the male, with a specific pattern for each individual. *T. s. elegans* is the largest subspecies, the female reaching up to 40 cm in length.

- *Trachemys scripta troostii* (HOLBROOK, 1836). Cumberland sliders, or Troost's turtle, characterized by yellow/orange narrow marks behind the eyes. The shell is brownish green with yellow spots, oval shaped in the adult. The plastron shows spots on each scute, less vivid compared to *T. s. elegans*. Dimensions are comparable with the yellow-eared slider.

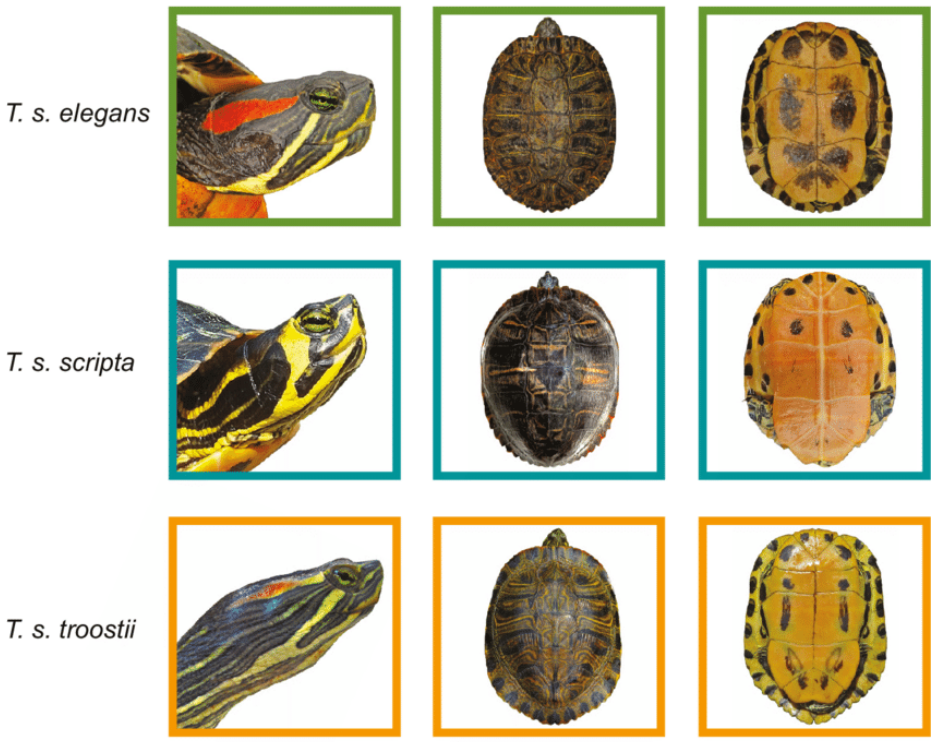

Figure 3: schematic representation of the main diagnostic features to identify the different subspecies of the pond slider.

To facilitate the nomenclature, we will use the term *Trachemys scripta s.l. (sensu latu),* referring to the different subspecies for which the same management protocols are applied. We also provide a quick identification key to identify the pond slider to other freshwater turtles of the family emydidae.

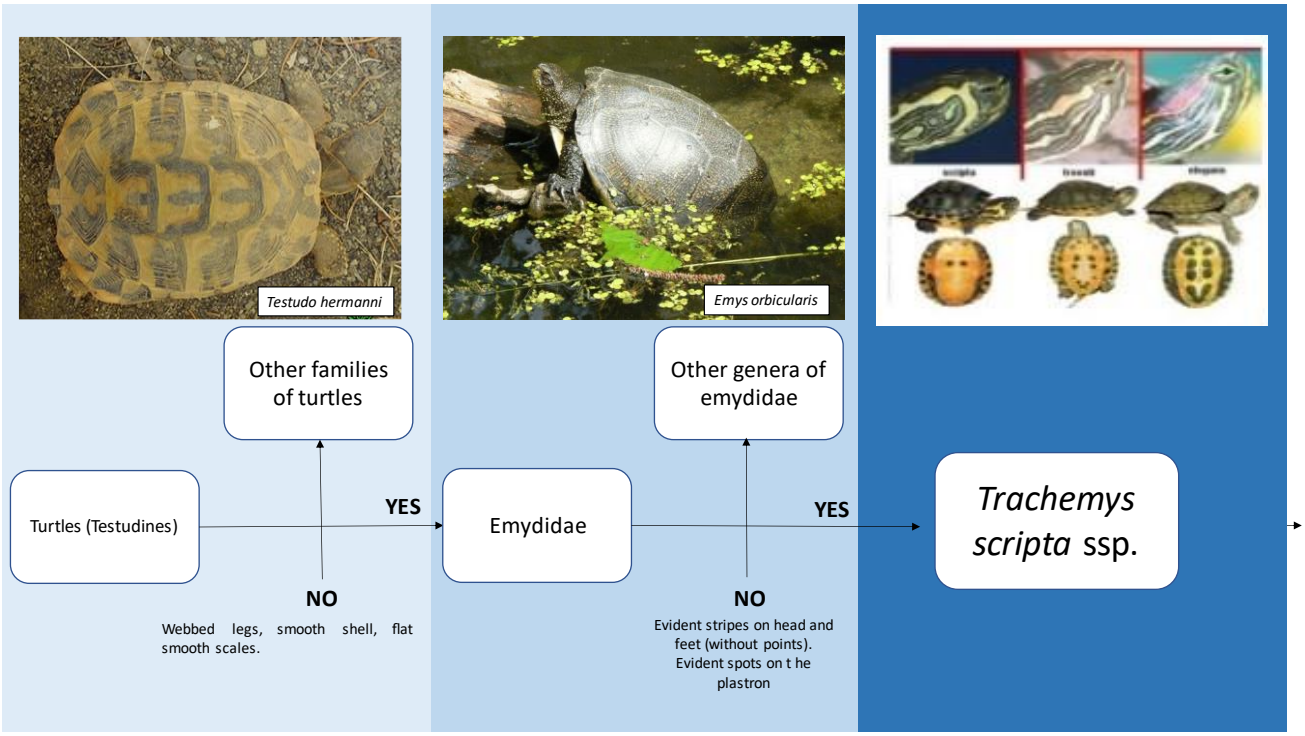

Figure 4: identification key for *Trachemys scripta s.l.* (credits: www.tartapedia.it; www.ente.parcoticino.it; www.asap.it).

2.2 Ecological features

The pond slider is mainly omnivorous, shifting its diet depending on the age (the individuals are more carnivorous in the early life-stage and starts eating plant material when adults). Overall, the species mostly feeds on fishes, molluscs, crustaceans, insects and macrophytes, both algae and flowering plants. Trachemys scripta s.l. is in turn preyed upon by foxes, mustelids, birds (mainly corvids) or snakes.

The species is ecologically flexible, not having specific requirements in terms of habitat choice, and living whereas there are ponds with muddy bottoms, macrophytes and basking sites. These adaptation capabilities make it able to colonize different kinds of habitats, both freshwater or brackish ponds, artificial or natural ones. Concerning temperature, the species requires a range from 10°C to 37°C to feed and reproduce.

2.3 Reproduction and development

Individuals reach sexual maturity on the 3rd, 4th year, and the reproductive season mostly spans from April to October, eventually up to December in optimal conditions. Females dig their nest along the riverbank, laying up to 30 eggs each year. Hatching occurs from 59 to 112 days after, taking longer when temperatures are lower and with an optimum at about 26°C. Similarly, sex determination is temperature-dependant, with higher T generating females. Individuals can live on average up to 20 years in the wild and 40 years in captivity

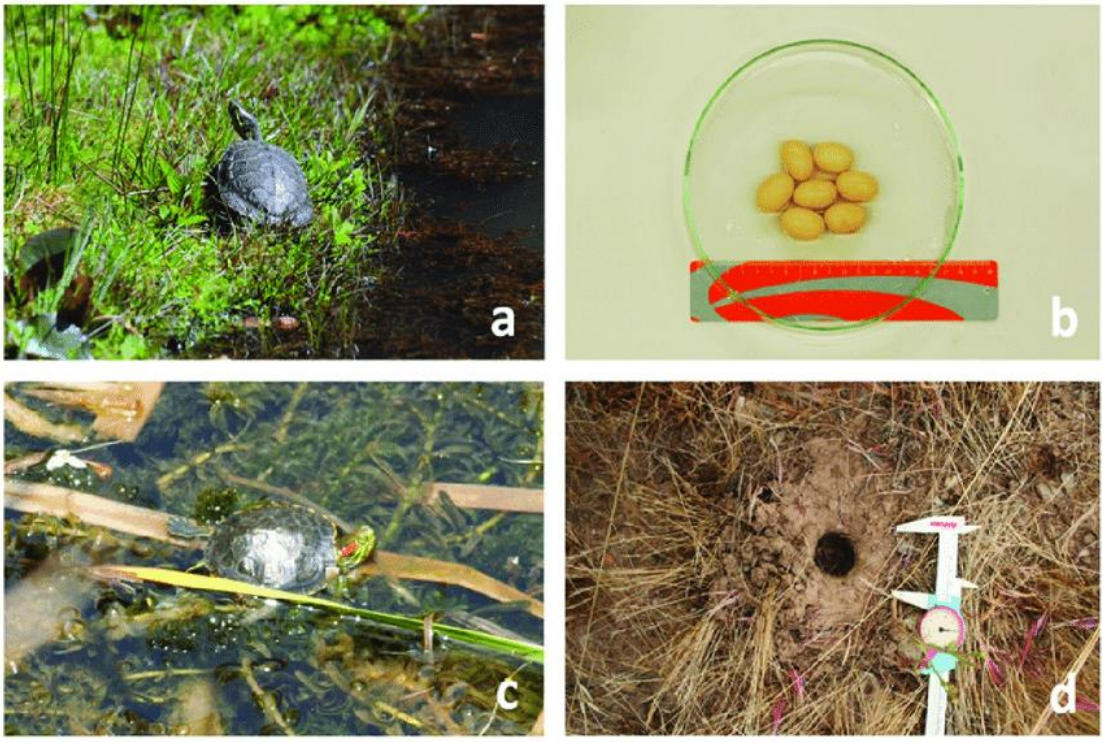

Figure 5: pictures of adult (a), eggs (b), youngster (c) and nest (d) of *Trachemys scripta elegans*. From Gonzalez *et al.*, 2018.

Chapter 3. Distribution and pathways of introduction

3.1 Distribution

Trachemys scripta is native to North America, from Virgina to Mexico, from the Atlantic Ocean to the states of Kansas and Oklahoma. *T. scripta elegans* has the wider distribution, *T. scripta scripta* occupy the most eastern part and *T. scripta troosti* showing a smaller distribution compared to the other ones, up to the rivers of Cumberland and Tennessee.

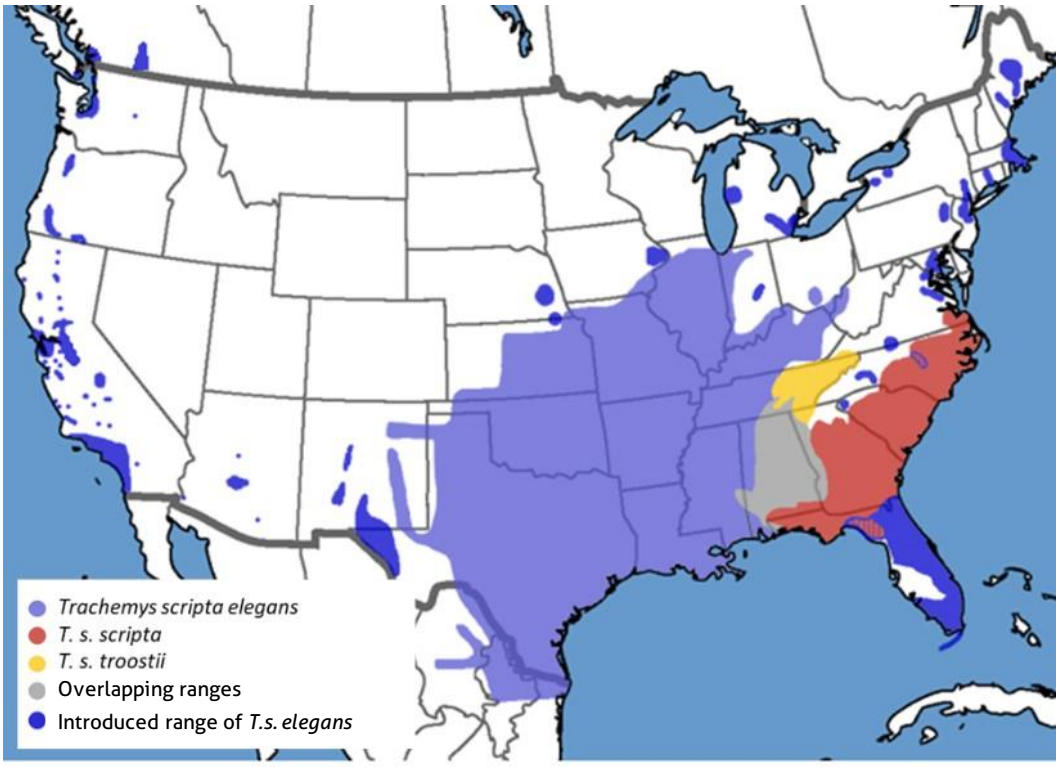

Figure 6: native range of the main subspecies of *Trachemys scripta*. Source: www.californiaherps.com

After the export of the species occurred in the XX century, from the USA, in a few decades the species has been introduced in Europe, Asia, Indonesia, Oceania, South Africa and South America. In Europe the first introductions date back to the 1950s, as a pet, and the first reportings in the wild start from the 1980s, in Germany and Denmark. Nowadays the species is widespread in the whole continent, but it apparently breeds only in those countries where it finds the optimal climatic conditions, like Spain, France and Italy.

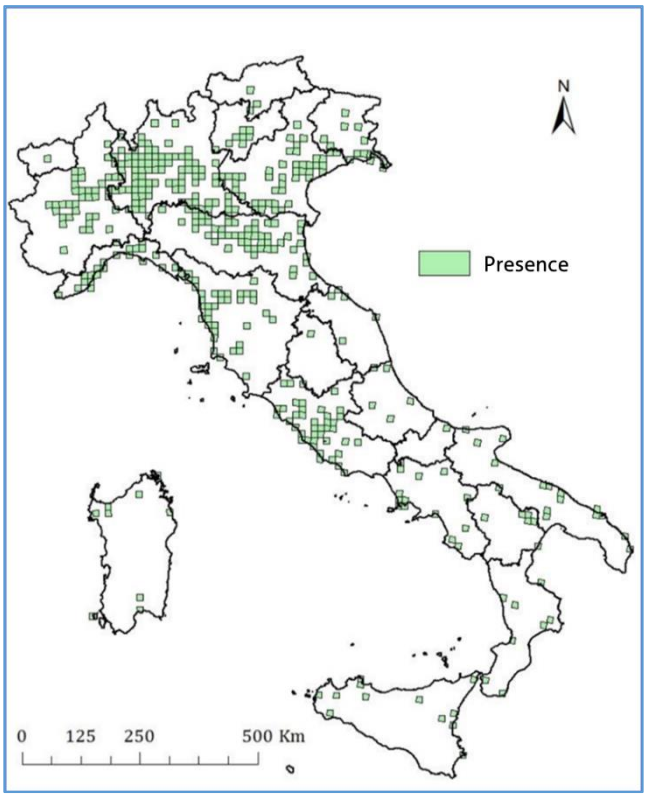

Figure 7 distribution of *Trachemys scripta* in Italy. Grids of 10x10 km. (From ISPRA 2020).

In Italy the first reporting of individuals in the wild dates back to the beginning of the 1970s, in Molise, but only in the 1980s the species has been reported frequently and subjected to management actions.

Concerning the regional distribution, the distribution of *Trachemys scripta s.l.* appears to be well extended, present in every province and well documented by scientific papers and private/institutional reportings (including dedicated databases such as Mapreacter ISPRA or iNaturalist).

Thanks to the specific survey conducted by Puglia Region in collaboration with con ERSE soc. coop. s.t.p., concerning the distribution of IAS in the protected areas of the Region, the species has been reported in the following Protected Areas:

- Torre Guaceto Reserve
- Regional Natural Park “Bosco e Paludi di Rauccio”
- Regional Natural Park “Mar Piccolo”
- Regional Natural Park “Porto Selvaggio e Palude del Capitano”
- Regional Natural Reserve “Litorale Tarantino Orientale”

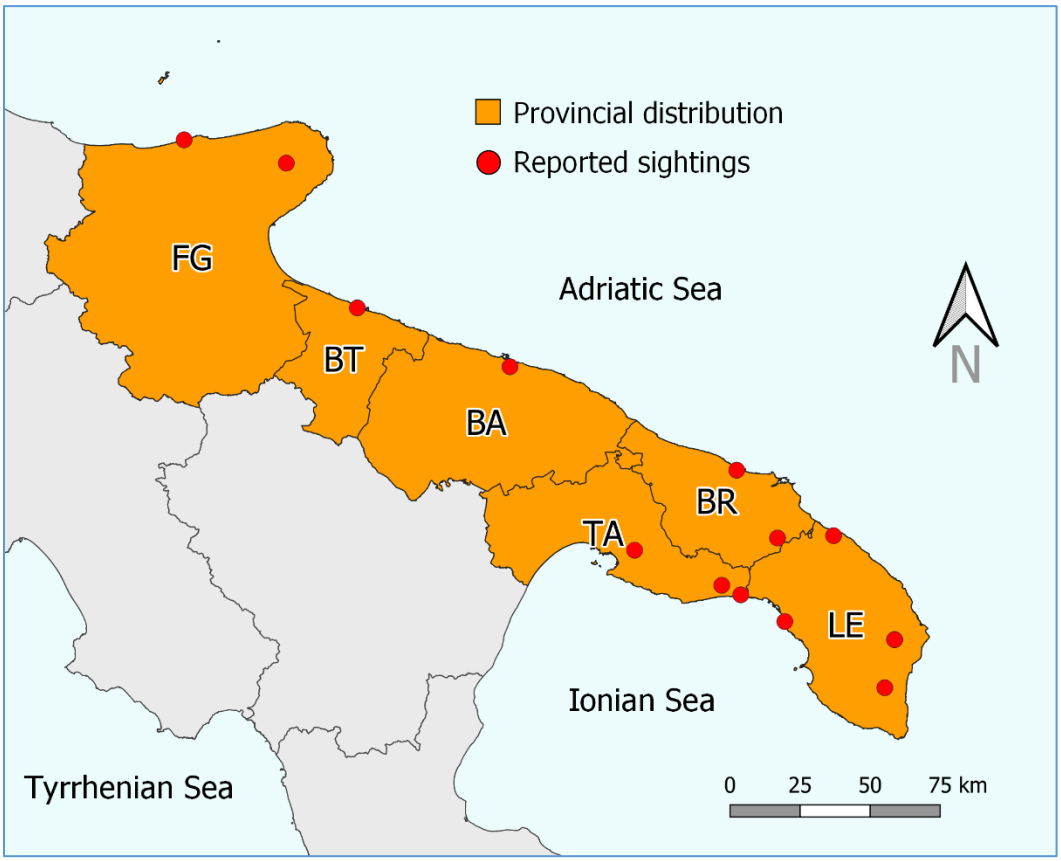

Figure 8: regional distribution of the pond slider *Trachemys scripta.* Provinces where the distribution has been documented are shown in orange. Punctual sightings are shown in red, reported by online databases (Mapreacter ISPRA, iNaturalist), scientific literature and the aforementioned survey on Protected Areas (in green). It is in any case likely that the species is present in other areas not shown in the map.

3.2 Pathways of introduction

The human being is the most important vector for this species, because of its wide trade during the last decades mostly as a pet. Starting from the 1950s, many individuals have been exported from the USA, reaching a number of 1-2 million animals in the 1980s and 3-4 million in the 1990s.

In addition, the accidental or intentional release from private citizens represent a serious factor for the dispersal of individuals in the wild, where they can adapt and live for many years, even if not reproducing, due to its long lifespan.

Chapter 4. Impacts

4.1 Ecological impact

Trachemys scripta is considered to be a highly adaptative species from an ecological point of view, capable of settling in a new environment and altering the local biological community. In its native range, the pond slider plays a key role in the trophic net of the humid areas it lives in, interacting with different species, both of flora and fauna. The younger individuals are mostly carnivorous, feeding on fishes, amphibians, insects and other invertebrates, while adults have a more omnivorous diet, feeding on macrophytes too. In the introduced range, the species may negatively alter the local aquatic cenosis, being a strong competitor for resources and a direct predator towards many species. This ecological advantage is eased by its early sexual maturity, its high fecundity and its bigger dimensions, which allow it to compete not only for food but also for nesting and basking sites.

In our territory, the most threatened species is represented by the European pond turtles (*Emys orbicularis* in the Italian peninsula and *Emys trinacris* in Sicily), which shows a wide overlap in terms of ecological niche with *Trachemys scripta*. The invasive species in fact competes both directly, occupying the best basking sites, and indirectly, feeding on the shared resources and thanks to its better thermoregulating capabilities, which makes it more active at lower temperatures. This competitiveness appears to be more intense in disturbed areas, with more limited resources.

Another threat posed by *T. scripta* is caused by the potential transmission of pathogens towards other species, as the pond slider can be a vector of different kind of parasites like helminths (digenea trematodes and monogeneans) and nematodes, causing high mortality in the autochthonous hosts.

Concerning the phytocenosis, there are no studies about the impact caused by *T. scripta* in Europe, thus requiring monitoring this eventual threat, especially in valuable naturistic environments.

4.2 Sanitary impact

Trachemys scripta may be vector of pathogens towards the human being such as *Arizona* sp. and *Salmonella* sp., particularly *Salmonella enterica* and *S. java.* In the USA and in Canada many cases are reported of direct transmission from the pond slider. Nevertheless, these cases are related to the contact between the animals and the human being in case of captivity, thus excluding the possibility of transmission from individuals in the wild from which there is no direct contact. It is in any case necessary to pay much attention to this eventuality, during the manipulation steps of the plan.

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Chapter 5. Regulatory aspects

The cornerstone of European legislation, and subsequently the Italian and Regional legislation, is Regulation (EU) n. 1143/2014 of the European Parliament and the Council, of 22 October 2014, laying down provisions to prevent and manage the introduction and spread of invasive alien species. It requires, inter alia, the rapid eradication or control of those species by the Member States.

This decree introduces the prohibition of "introduction, transport, detention (even in confinement), exchange, breeding, reproduction, trade and release into the environment" of the species, for public and private subjects (including individual citizens), and requires eradication, where possible, and control or containment of populations of naturally occurring invasive alien species to prevent further dissemination and mitigate adverse impacts on biodiversity. MiTE (Ministero della Transizione Ecologica) may grant derogations from the prohibitions, subject to authorisation, to botanical and zoological gardens, research institutes and other entities carrying out research or conservation activities ex situ. In exceptional cases, derogation shall be granted on grounds of overriding public interest, including those of an economic or social nature. No derogation shall be granted for trade and release into the environment of species listed in the relative Annexes.

The allochthonous species to which the aforementioned regulations apply were subsequently identified through the establishment of lists of invasive alien species of Union relevance or IAS (Invasive Alien Species), through the Implementing Regulation (EU) of 13 July 2016, Commission Implementing Regulation (EU) 2017/1263 of 12 July 2016, Commission Implementing Regulation (EU) 2019/1262 of 25 July 2016.

Italian legislation transposes Regulation (EU) No. 1143/2014 of the European Parliament and of the Council by means of Legislative Decree 230/2017 of 15 December 2017. The measure establishes rules to prevent, minimize and mitigate the adverse effects on biodiversity caused by the introduction and spread, both deliberate and accidental, of invasive alien species within the European Union, and to minimise and mitigate the impact that these species may have on human health or the economy in Italy. The Ministry of the Environment and the Protection of the Territory and the Sea has moreover published two decrees directly connected to the D.Lgs. 230/2017, that is the Ministerial Decree of 6 March 2020, that regulates the institution and the compilation of the register of the exotic species, and the Ministerial Decree of 29 April 2021, which regulates tariffs for activities provided for by Legislative Decree no. 230/2017.

The Apulia Region, in addition to the provisions of Community and Italian legislation on the problem of alien species, establishes a regional coordination table for the control of invasive alien species, through the Decree 815/2019, of 2 May 2019.

Trachemys scripta is defined as an Invasive Alien Species of Union Concern, defined by the regulation UE 1143/2014, and it is listed in the worst 100 most invasive species globally, according to the "*Invasive Species Specialist Group*" (ISSG) of IUCN.

Chapter 6. Monitoring plan

Considering the regulatory aspects of the European Union, monitoring appears to be a key tool to determine the status of the species, by individuating the essential parameters to determine its presence, distribution, abundance, habitats and future trends.

Data must be collected through standardized methodologies, and these must be combined with information collected through previous monitoring campaigns, scientific literature, sightings, and so on. This chapter will then focus on the monitoring techniques required to reach the aforementioned goals.

6.1 Data collection

Collecting the data through bibliography represents a crucial step, as a high-quality information allows to correctly set up the monitoring protocol, together with regards to the techniques and the time scale. This information itself cannot substitute the direct data collection on the field, but it can optimize the sampling effort, with a positive impact on the economy of the project.

The information is collected from three sources:

- Scientific papers
- *on-line databases*
- Protected area manager survey.

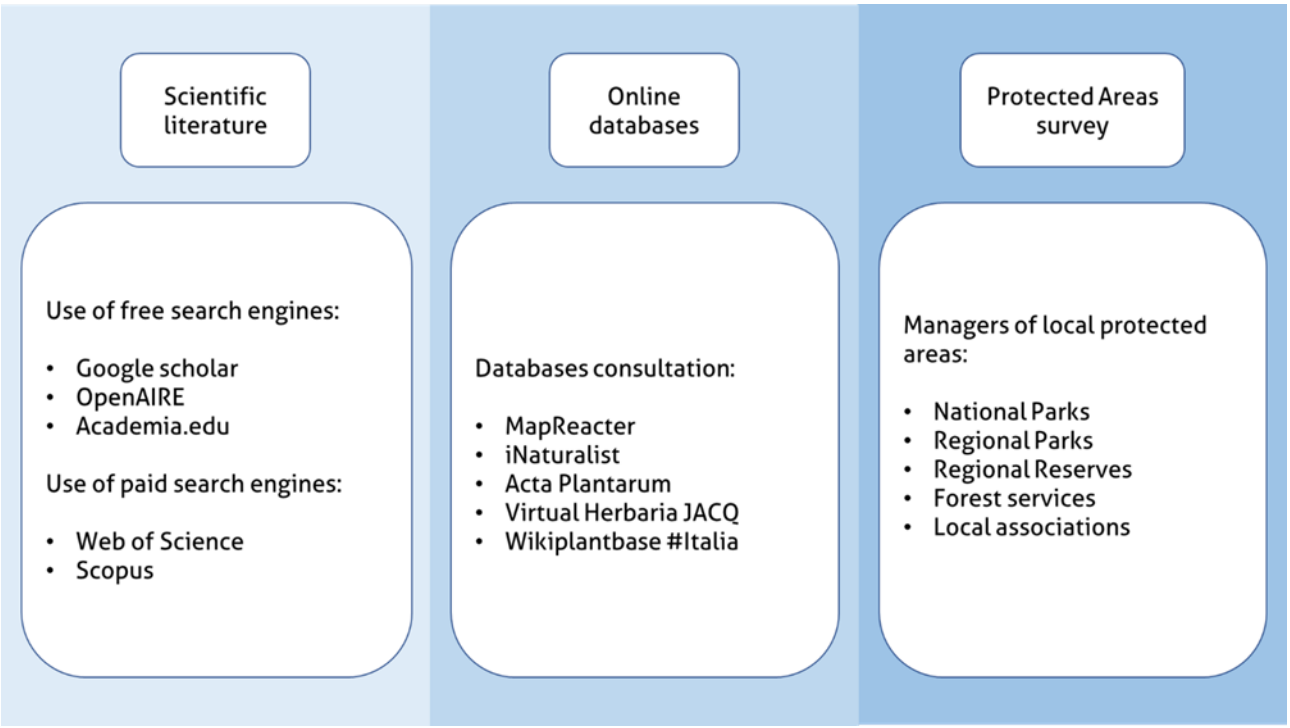

Figure 9: diagram of the sources of the data.

6.1.1 Scientific literature

This source is represented by highly specific scientific journals or technical/informative material, with a major attention to the most authoritative papers (high-impact periodicals, subjected to peer-review; local journals, with high attention to the small-scale patterns). This source may give us information about distribution and abundance of the species. For the present project dedicated search engines have been consulted, as for example *Google Scholar, OpenAIRE, Academia.edu, Web of Science, Scopus.*

6.1.2 Consultation of online databases

This source is represented by online data collectors, like for geographical information (from which we can determine part of the spatial distribution of a species). There may be some biases due to the upload of incomplete/wrong data, especially by people participating to citizen science projects; specific databases periodically review by experts or technical staff. This tool has the advantage of being continuously updated, avoiding the usual gap between the writing of scientific papers and their publication.

For the present project two main databases have been used: *Mapreacter* from ISPRA and *iNaturalist.*

6.1.3 Surveys

Many projects rely on the contribution of citizen science protocols, by gathering information from citizens or stakeholders. For the present project, a specific survey has been proposed to the managers of the local protected areas concerning the presence and distribution of IAS (available at the end of the document, appendix A, produced by Puglia Region and ERSE soc. coop. s.t.p.). This tool aimed at evaluating the critical points about the impacts of these species on the habitats and on the other species, together with gathering information on existing projects for this issue.

6.2 Description of the monitoring plan

This chapter defines the specific modalities for carrying out the *Trachemys scripta* Monitoring Plan within the Torre Guaceto Reserve, specifically at the Torre Guaceto State Nature Reserve, where the populations of American marsh turtles are concentrated.

Numerous protocols for monitoring turtles are known in the literature, using different techniques both indirect and direct. Below are two of the most widely used techniques, suitable for the purposes of this Plan.

6.2.1 Indirect monitoring method. The Visual Encounter Survey

Among the most accredited indirect monitoring techniques we can propose the Visual Encounter Survey, a widely used protocol in the field of herpetology and based on the observation and counting of individuals along transepts or in known areas. This technique, not needing the direct capture of the individuals, needs areas from which there is a good visibility of the banks and/or of the basking sites. Each individual should be counted, distinguished, when possible, if male or female and the subspecific distinction must be identified. The counts should be repeated with at least 3 sessions per site, and the observation period should be for a maximum of 20 minutes/man. The monitoring sessions will be carried out avoiding the windy days, with rain and with abundant cloud cover.

6.2.2 Indirect monitoring method. Capture through nets

As for monitoring protocols based on the direct capture of individuals, in the literature different *ad hoc* techniques for the pond slider have been developed in many different contexts. Many of these techniques have been built within LIFE projects, such as LIFE09 NAT/ES/000529 "LIFE *Trachemys*" in Spain, LIFE12 NAT/IT/000395 "Life *Emys*" in Liguria, the LIFE14 IPE IT 018GESTIRE2020 project in Lombardy or the LIFE14 NAT/IT/000809 project on the Sile River, in Veneto.

Within the mentioned projects, the main traps adopted in natural and semi-natural contexts have been the following:

- Double-entrance hoop nets,
- Basking traps,
- Floating bait pots.

DOUBLE-ENTRANCE HOOP NETS

Suitable for aquatic environments with not excessive depth and with high concentrations of turtles. The trap consists of a double inlet pot tied to a metal guide, with meshes of 2x2 cm. The nets should be placed in mid-water, if the depth exceeds the meter, or deposited on the bottom, always allowing part of the net to be positioned outside the water, to avoid drowning of the captured animals. The location will be entrusted to experienced technical personnel, and the traps need a daily check or at most every two days. As bait, you can place inside the pots a perforated bottle containing rotting fish.

Figure 10: Double-entrance hoop nets. Source: Life Gestire 2020.

BASKING TRAPS

Suitable for the central areas of the basins, or in areas with a low concentration of areas for thermoregulation, the floating basking traps exploit the need for turtles to carry out thermoregulation, offering floating platforms positioned above a basket net from which individuals cannot climb. Freshwater turtles, in fact, tend to climb along the ramps and sliding forward they fall inside the trap. Traps should also be checked on a daily basis or at most every two days.

Figure 11: atoll traps, or crucibles. Source: Life Gestire 2020.

FLOATING POTS WITH TRIGGERS

An alternative to basking traps, which are more difficult to find on the market, is represented by floating trigger cages, which are based on attracting animals inside the nets by placing baits inside them. The advantage over basking traps is guaranteed if there are many natural basking areas for the animals, or in any case, it is difficult to make them unusable. These traps, however, should be placed in shaded areas and should be checked daily if not twice a day, at least on warmer days.

Figure 12 Floating pots with triggers. Source: Sancho Alcayde *et al.*, 2015.

Regarding some general considerations, for all the capture methods listed above the catch period for *Trachemys scripta s.l.* includes almost the entire active season, from April to October. In the case of capturing non-target individuals, each specimen shall be promptly released into the wild. As for the individuals of *Trachemys scripta s.l.* the turtles must be temporarily held by the technicians responsible for the capture until they are handed over to the authorised detention centre.

The CPUE (Catch Per Unit Effort), an indirect measure of the abundance of target species, whose simplicity of analysis makes it suitable to the application of this protocol even by non-specialists, will be used to assess the effectiveness of catches, applicable for *T. scripta* with the following formula:

CPUE = n° of captured individuals/n of nets/catch time

6.2.3 Identification of monitoring sites

The first phase of the monitoring protocol consists in the identification of the water basins present within the investigation area related to the ecology of the species, both in areas where the presence of *Trachemys scripta s.l.* has already been reported and in areas where it is suspected of being present. As a first step, therefore, it will be necessary to identify the suitable sites for the subsequent monitoring phases, represented by the presence of water in a more or less stable way during the year and that may offer foraging and/or nesting areas by the species.

For each of the identified sites, it will be necessary to identify the points for the positioning of the fishing equipment and, in this regard, it will be important to choose sites where there are no short- and medium-term anthropogenic interventions, in order to be able to repeat the monitoring actions over the years and have a set of reliable data.

Specifically, two main categories of areas are identified, subject to differentiated monitoring protocols:

- "A" SITES: sites for which a path is available close to the basin and from which potential basking areas are visible. For these sites we will proceed through the creation of linear transects along which the monitoring protocol will be carried out through the Visual Encounter Survey (VES), according to the methods specified in par. 6.2.1.
- B SITES: Sites for which access to basin is technically complex and for which potential basking areas are not readily identifiable. For these sites, the identification of net deposition sites (hoop nets in the presence of basins with shallow waters and basking traps in the presence of areas with average water depth and with little presence of areas for thermoregulation), and we will proceed through the protocol of direct monitoring with capture with the nets.

In this regard, we provide a map showing the location of the main water basins of the Torre Guaceto Reserve, including the table with the corresponding coordinates, in view of the fact that this monitoring plan is designed for this area. The water bodies identified should be inspected and divided into categories in accordance with the above-mentioned modalities.

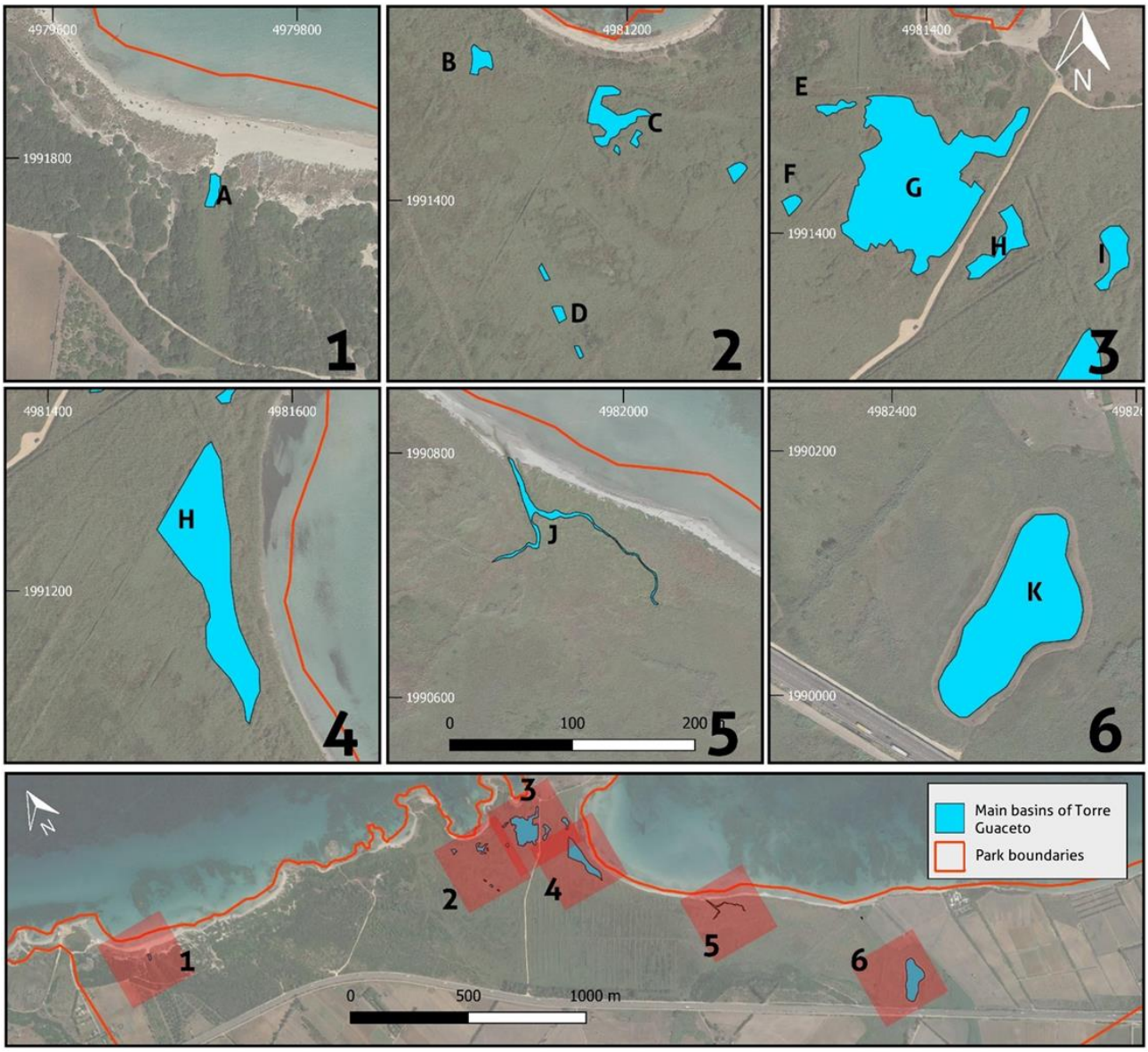

Figure 13: Map representing the main water bodies of the Torre Guaceto Reserve, in which to inspect the presence of *Trachemys scripta*; the relative coordinates are indicated in the table below.

Id water body	Coordinates (WGS 84)
A	40.71933 N 17.77579 E
B	40.71576 N 17.79135 E
C	40.71518 N 17.79256 E
D	40.71384 N 17.79187 E
E	40.71542 N 17.79420 E
F	40.71476 N 17.79370 E
G	40.71476 N 17.79490 E
H	40.71429 N 17.79572 E
I	40.71415 N 17.79679 E
J	40.71256 N 17.79640 E
K	40.70815 N 17.80039 E
L	40.70140 N 17.80640 E

Figure 14: Example of a linear transept for the *Visual Encounter Survey* placed as an example inside the Torre Guaceto Reserve. Image from Google Earth later modified.

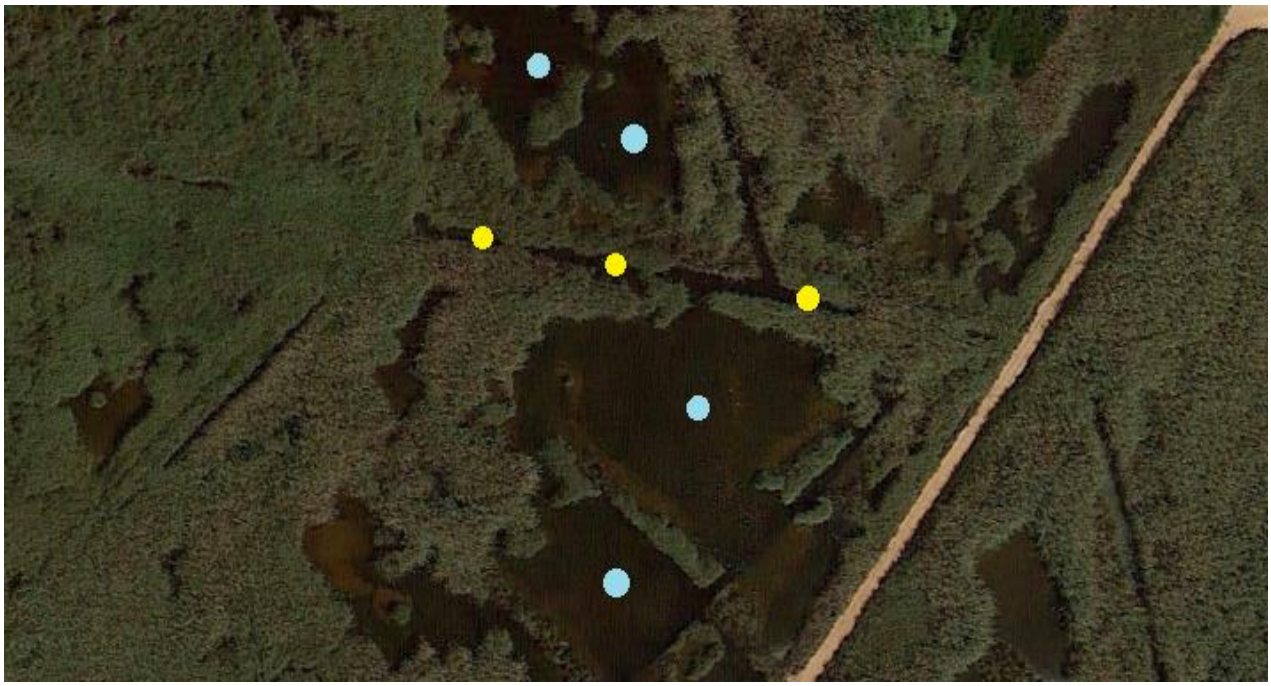

Figure 15: Examples of net-based direct catch monitoring sites, as an example within the Torre Guaceto Reserve. In yellow the spawning sites of the double-lobe pots, in celestial the sites of deposition of the atoll traps. Image from *Google Earth* later modified.

6.2.4 Data collection by survey cards

The identified specimens should be analysed through the compilation of appropriate survey cards, available in the annex.

VISUAL ENCOUNTER SURVEY

For the indirect monitoring technique, the field sheet, available in Annex B, shall contain the following information concerning the test station and the specimens identified:

- Name of the water body
- Date
- Now
- Geographical coordinates and GPS track name
- Locations
- Weather conditions
- **Operator:** operator/s/s name

Biometric parameters of the identified *Trachemys scripta s.l.* specimens:

- **Age:** divided into adults or young
- **Sex:** when possible
- **Activity:** (thermoregulation, coupling, in water, other)

CAPTURES WITH NETS

The captured individuals, once removed from the nets, will be analysed through the collection of biometric data, in addition to the collection of data relating to the station under examination. The sampling form "Direct Capture Monitoring Protocol", available in Annex C, shall contain the following information:

General information (for each trap):

- Name water body
- Site name
- Date
- Now
- Geographical coordinates and GPS track name
- Trap number: sequential det. number of each station
- Locations
- Weather conditions
- Operator: operator/s/s name

Biometric parameters of *Trachemys scripta s.l.* individuals divided by trap:

- Length of carapace
- Width of carapace
- Weight
- Sex
- Photos of individuals: recommendable for the reliability of the data, to be saved in digital format and assigned the ID number of the card

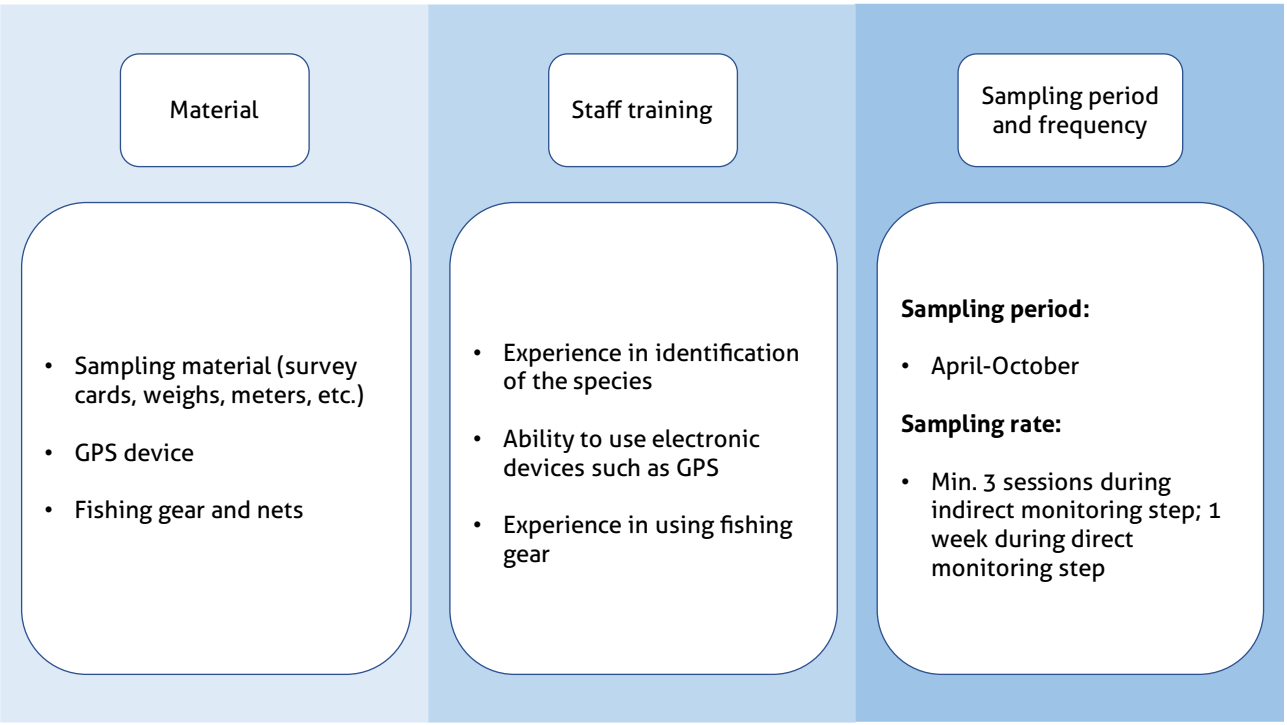

Figure 16: fundamental information for sampling individuals of *Trachemys scripta s.l.*

6.2.5 Mapping of monitoring points via GIS

Spatial mapping is an important phase of data collection, in which the collected information must be standardized in order to be able to be analysed through GIS spatial processing software. Therefore, the data to be collected during the mapping phase, necessary for the production and processing of spatial geometries, are provided:

- Location of monitoring sites: collection of individual linear (in the case of indirect monitoring protocol) or point (in the case of direct monitoring protocol) data representing monitoring sites. It will be sufficient to record the tracks or the GPS point of the site of the transept or of the place of the nets (as illustrated in fig.13 and 14).

Regarding the information to be included in the table of attributes of the geometries described above, it will be necessary to record the following data:

- **Scientific name of the species.**
- **Location** (site).
- **Site ID** (e.g. Trachemys 1).
- **Number of traps used**: e.g. 2 traps per site.
- **Year of sampling.**

Table 2: Example of an attribute table for point geometries for *Trachemys scripta s.l.*

ID	Species	Site	ID site	N_traps	Year
1	*Trachemys scripta*	Basin 1	Trachemys 1	2	2022
2	*Trachemys scripta*	Basin 2	Trachemys 5	/	2022

6.3 Possible risks

The captures also expose other non-target species to the catch risk. This threat must be minimised, and for this reason periodic monitoring of the individuals present in the nets is essential, in order to avoid the unnecessary permanence of these species and their possible death.

In the basins inside the Torre Guaceto Reserve, the greatest risk is linked to the autochthonous European pond turtle *Emys orbicularis*, present in the area and categorized as close to the threat by the IUCN.

6.4 Evaluation of monitoring outcomes

The monitoring of *Trachemys scripta s.l.* inside the Torre Guaceto Reserve will have the main purpose of defining the population structure and at the same time to remove the individuals from the basin as the first containment action of the species (for details see the next chapter). The results of this extended monitoring protocol will therefore have the function of defining, from a spatial and temporal point of view, the changes in terms of abundance, age and sex distribution of the American pond slider in the aforementioned basins, providing a case study for the retrieval of crucial information for the application of management interventions, as defined in the next chapter. The protocol should therefore be repeated over the years based on the results of the evaluation phase, in order to obtain a set of reliable and statistically valid data. In particular, the evaluation aims at comparing the results over the years, expressed in CPUE; the observation of a decreasing trend of the variable over time is considered to be positive; on the contrary, a possible increase in the CPUE is considered negative, index of ineffectiveness of the management action. The time scale of the monitoring may be increased and/or the number of seasonal campaigns decreased (e.g. bi-monthly) if the trend of the CPUE variable is stable for at least three consecutive years.

6.5 Time structure of monitoring

The diagram on the following page outlines the time sequence in which monitoring is to be carried out for the purposes described above. The proposed time scale is 36 months, for a total of 3 years: based on the results of the final evaluation phase, it is possible to revise the monitoring plan as specified in the previous paragraph for the years following the one under consideration.

Year 1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	identification of monitoring sites			I campaign (VES + net-capture)								
						Evaluation						
Year 2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				I campaign (VES + net-capture)								
						Evaluation						
Year 3	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				I campaign (VES + net-capture)								
						Evaluation						

Chapter 7. Management plan

7.1 Objective of the management plan

The objective of this management plan is the containment of the American pond slider (*Trachemys scripta s.l.*) population within the basins of the Torre Guaceto Reserve, in which the presence of the species has been confirmed.

Eradication protocols for *T. scripta* are not likely to be applicable even at local level, due to its wide regional distribution and the high risk of subsequent recolonisation due to intentional or accidental releases by individuals that would undermine the success of such actions over time. The present plan will therefore be focused on the management of the species in spatially localized contexts, through containment actions aimed at keeping numerically low the populations of American pond sliders.

7.1.1 Technical characteristics

The management plan will include two main phases for the containment of the population of *T. scripta*: the first will be closely linked to the monitoring phase, while the second, more targeted, will be aimed at the specific containment of individuals within the basins. The monitoring actions, in fact, while representing a phase mainly directed to the study of the trend of the populations of pond sliders in terms of abundance and composition, will also have the purposes to remove the individuals captured in the basins, conceptually overlapping on the containment actions. From a practical point of view, however, the catch effort at this stage is not sufficient of containing the population, and it will be necessary to increase the catch effort and carry out more frequent and numerous campaigns (see par. 7.3).

7.2 Preliminary phase

After the capture and collection of biometric data, specimens of *Trachemys scripta* shall subsequently be retained and removed. The removal through the use of nets is considered in fact one of the most effective techniques for the abatement of the populations of aquatic invertebrates, thanks also to the non-invasive methodology and without side effects for the non-target species if properly conducted. Regarding the disposal of captured individuals, two options could be undertaken:

- **Transfer to special detention centres:** the captured specimens can be delivered to special detention centres, based on the provisions of art. 27, paragraph 4, of Legislative Decree 230/2017.
- **Removal and disposal of carcasses:** in the case of disposal, the carcasses must be removed as required by CE Regulation No. 1069/2009, in compliance with current health and hygiene regulations.

7.3 Containment phase

7.3.1 Direct captures with nets

Similarly to the monitoring phase, the containment phase will involve the direct capture of individuals through nets, as described in par. 6.2.2. The main difference with the first phase will be the sampling effort, which will be intensified by the capture of as many of the target species as possible. The types of traps used will be the following, depending on the context in which they will be applied:

- DOUBLE-ENTRANCE HOOP NETS - Suitable for aquatic environments with not excessive depth and high concentrations of turtles.
- BASKING TRAPS - Indicated for the central areas of the basins, or in areas with a low concentration of zones for thermoregulation.
- FLOATING POTS WITH TRIGGERS- similar in operation to basking traps. The advantage is the lower cost and the greater availability, at the cost of a more frequent control by the operators.

Compared to the capture phase for monitoring purposes of the previous phase, the sampling effort of this phase will see a doubling of the trap density in the basins and an extension of the sampling period throughout the period from April to October, for a total of 7 months (see Parag. 7.3.2 and 7.4 for more details).

7.3.2 Period, working frequency of containment actions and sampling effort

- SAMPLING PERIOD - The sampling period should reflect the peak activity period of the species, from April to October (see par. 6.5 on the monitoring time structure).
- SAMPLING FREQUENCY - The containment protocol with nets should be carried out for a continuous period of 1 week, checking the nets every two days, to be repeated once a month. The containment phase will last a total of 7 months, within which the actions described above will be carried out.
- SAMPLING EFFORT - Regarding the deposition of nets/traps, the catch effort will be doubled compared to the monitoring phase, allocating min. 2 nets for basins with an area of less than 500 square meters, to be increased proportionally with the size of the basin. (e.g. 4 nets if > 500 m^2, 6 nets if > 1000 m^2, etc.).

7.4 Temporal structure of the containment plan

The following diagram shows the time sequence in which the containment campaigns are to be carried out for the purposes described above. The proposed time scale is 36 months, for a total of 3 years: at the end of each year, based on the results of the final evaluation phase of the monitoring plan (winter months: see the relevant paragraph for more details) the need to continue with the containment plan also for the following year should be assessed (see paragraphs below). This schematization represents a structured calendar on a catch frequency on a monthly basis.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year 1	identification of net deposition sites											
				I campaign								
					II campaign							
						III campaign						
							IV campaign					
								V campaign				
									VI campaign			
										VII campaign		
											Evaluation	
Year 2	Evaluation											
				I campaign								
					II campaign							
						III campaign						
							IV campaign					
								V campaign				
									VI campaign			
										VII campaign		
											Evaluation	
Year 3	Evaluation											
				I campaign								
					II campaign							
						III campaign						
							IV campaign					
								V campaign				
									VI campaign			
										VII campaign		
											Evaluation	

Overlapping the monitoring phase with the containment phase, the timing of the activities can be summarized through the following Gantt diagram (in green the containment campaigns, in orange the monitoring campaigns):

Year 1

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Individuations of the sites for the nets											
identification of monitoring sites											
			I campaign								
				II campaign							
			I campaign								
					Evaluation of monitoring results						
					III campaign						
						IV campaign					
							V campaign				
								VI campaign			
									VII campaign		
										Containment phase evaluation	

Year 2

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Containment phase evaluation											
			I campaign								
				II campaign							
			I campaign								
					Evaluation of monitoring results						
					III campaign						
						IV campaign					
							V campaign				
								VI campaign			
									VII campaign		
										Containment phase evaluation	

Year 3

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Containment phase evaluation											
			I campaign								
				II campaign							

				I campaign								
					Evaluation of monitoring results							
					III campaign							
						IV campaign						
							V campaign					
								VI campaign				
									VII campaign			
										Final evaluations		

7.5 Management of captured individuals: transfer to the Centres for the Holding and Disposal of Carcasses

The captured individuals will be given to special detention centres, based on the provisions of art. 27, paragraph four, of Legislative Decree 230/2017. The MATTM has in fact published the "Guidelines for the correct management of invasive alien species of Union relevance kept as pets for non-commercial purposes" (developed with the support of ISPRA and the Italian Herpetological Society) and subsequently communicated through LIFE ASAP (Alonzi et al., 2018) the "Recommendations for the proper detention of pet animals belonging to invasive alien species of Union relevance: the American pond slider *Trachemys scripta*".

Such centres do not require specific authorisations in derogation, since it is established by art.6 of Legislative Decree that the possession of specimens of invasive alien species of Union Concern is prohibited, except where detention takes place in the context of the management or eradication measures, as defined in the Decree. These detention centres should contain tanks, fountains or artificial lakes, which perform the function of safely confining the captured individuals, in order to avoid any risk of escape and to prevent the reproduction of the animals. After having identified these structures and the entities responsible for their management, each Region will have to notify MITE, in order to keep the list of each authorised Centre up to date.

Specifically, the centres placed near natural environments must be completely isolated and fenced, with an underground network for at least 50 cm. Each tank must be built in such a way as to exclude any possibility of escape, through elevated concrete banks that have the double function of preventing the escape of the animals and the deposition of eggs in the soil. As an accessory measure to prevent reproduction (expressly prohibited by law), individuals of both sexes should be kept separate in different tanks, and if this is not possible, the identification of eggs and their rapid removal (where the banks permit such deposition).

For further details on the characteristics of detention centres for exotic turtles, their detection and management, we can also refer to the recommendations drawn up by ISPRA in collaboration with the Italian Herpetological Society in the framework of the LIFE ASAP project (https:///www.lifeasap.eu/file/LifeASAP_Requestions-Trachemysestese.pdf) and the specific documentation produced within the LIFE GESTIRE project (www.naturachevale.it).

As for the Apulia Region, following the Resolution of the Regional Council of 4 August 2020 n. 1247 and in compliance with the provisions of art. 27 paragraph 5 of D.Lgs. 230 of 15.12.2017 containing provisions for the management of

invasive alien species, the local Rescue Centre for the Reception of Homeotherm Wildlife (CRAS Salento) located in Calimera (LE) has been identified as the authorised centre for the detention of individuals of *Trachemys scripta*. Before the beginning of the capture operations described in this Plan, it will therefore be necessary to contact this Centre, in order to better coordinate operations and facilitate the management of captured animals.

Alternatively, in the event of impossibility to deliver the captured individuals to the appropriate centres (eventuality that will be properly reported), the euthanasia suppression of the same and the disposal of the carcasses should be used. In the latter case, the carcasses must be removed as required by EC Regulation No. 1069/2009, in compliance with current health and hygiene regulations. The slaughtering of the animals must be carried out by veterinary medical staff specially appointed by the authority responsible for the implementation of the Plan, and it must be carried out through the implementation of techniques aimed at minimising the suffering of animals, agreed on the basis of the expert judgement of the technicians in charge. The Authority must also arrange to contact the special waste disposal companies in the territory, in accordance with the arrangements agreed with them. In particular, arrangements for the most sensitive steps in the disposal of carcasses should be agreed with the local health authorities, such as transport, holding at any temporary storage site and identifying the most appropriate methods of disposal.

Figure 17: Example of the Detention Centre of *Trachemys scripta s.l.* located at the Conero Regional Park. Note the high concrete banks and the external fence

7.6 Personnel employed

The implementation of this management plan requires the presence of an appropriately trained technical and operational staff, who can carry out the functions of coordination, control and performance of activities on the ground.

7.6.1 Coordination team

The first phase will be the technical-operational coordination regarding the organization of work, the timing of activities, the acquisition and management of equipment and support for field activities, both regarding the monitoring plan and the management actions. We recommend a staff of at least 2 people, whose main tasks can be summarized below:

- Planning the detailed calendar of activities.
- Research and organization of personnel involved during the operational phase (see next para.).
- Identification of sampling sites.
- Preparation and retrieval of equipment (nets, baits, field equipment, etc.).
- Data collection and analysis of the monitoring and management phases through capture.

7.6.2 Operations team

In this second phase, the staff involved will have the main task of dealing with the operational phase in the field, both during the monitoring plan and during the management interventions. There should be an adequate number of operators to ensure that monitoring and management actions are carried out in order to cover all the necessary shifts in the planned monitoring and containment campaigns.

The monitoring phase will involve the development of 2 campaigns (April and May) of 7 days each in which indirect (Visual Encounter Survey) and direct (capture through nets) monitoring protocols will be carried out. For the former it will be sufficient to have an operator, who will proceed through the previously identified linear transepts, while for the direct capture operations of individuals it will be necessary to set up a team for each basin composed of at least 2 people, involved in the control of the nets, the capture of individuals, the collection of biometric parameters and the disposal of carcasses.

The containment phase will involve a greater number of capture sites and campaigns, in number of 7, to be carried out monthly from April and June and lasting one week each. For each campaign, it is recommended to set up a team of min. 2 operators, involved in the reconnaissance of the pots, the collection of individuals and biometric parameters, and the disposal of carcasses.

Before the beginning of the operations, the operational team must be adequately trained by the coordination team, whose operators can carry out the activities of both phases provided that these do not overlap.

7.7 Estimates of implementation costs

This paragraph provides estimates of implementation costs, divided by year and by operational phase, which refer to the modalities described in the previous paragraphs. The estimated fees and costs shall include operators' costs, expenses related to the use of vehicles and the cost of the material to be purchased, and shall be based on median values derived from national market analysis; it is therefore likely that they will reveal to be cheaper during the implementation phase of the design, where there will be the acquisition of actual cost estimates formulated by local operators and/ or selected through appropriate administrative procedures (which may include, among the selection criteria, a reduction in the estimated cost base). In addition, the expected costs will be optimised according to the further refining of the monitoring/management plan in the light of the actual territorial conditions at the time of application of the plan (e.g. the possibility of reducing the number of operators and/or exits because of a more easily practicable environmental context than the one estimated in this policy document). In order to facilitate such revisions, the unit cost (day/man, daily expenditure, etc.) is provided for each cost item, which can be used in recalculating the expenditure balance against the new planned effort.

The estimates provided here are to be considered inclusive of all the estimated expenses for the implementation of the Plan, not taking into account any coverage of these by the Managing Authorities, with resources already at their

disposal (internal staff, agreements/contracts with local businesses, economic operations, etc.). These resources may, if necessary, be budgeted as co-financed components of the project, in order to request specific funds to carry out the project.

The costs for the maintenance of the individuals in detention centres are not considered, as we suggest to undertake proper conventions with in order to facilitate the implementation of the management plan.

As for the disposal of carcasses, an estimated cost of € 123.97 over IVA up to 10kg of material, to add 8.50 € /kg for each additional kilogram (source AMP Torre Guaceto).

	Team	Type of work	Operator cost (per day)	Cost per day	Estimated days	Estimated cost
Year 1	coordination team	coordination	500 €	500 €	15	7.500 €
					TOT. TEAM	7.500 €
	operational team	Monitoring phase (VES)	250 €	250 €	1	250 €
	operational team	Monitoring phase (traps)	300 €	300 €	4	1.200 €
	operational team	Containment phase	450 €	450 €	28	12.600 €
	operational team	material cost (VES)	400 €	/	/	400 €
	operational team	material cost (trappole)	15.100 €	/	/	15.100 €
	operational team	material cost (containment)	9.900 €	/	/	9.900 €
					TOT. TEAM	39.450 €
					TOT. ANNUAL	46.950 €
	Team	Type of work	Operator cost (per day)	Cost per day	Estimated days	Estimated cost
Year 2	coordination team	coordination	500 €	500 €	15	7.500 €
					TOT. TEAM	5.000 €
	operational team	Monitoring phase (VES)	250 €	250 €	1	250 €
	operational team	Monitoring phase (traps)	300 €	300 €	4	1.200 €
	operational team	Containment phase	450 €	450 €	28	12.600 €
					TOT. TEAM	14.050 €
					TOT. ANNUAL	19.050 €
	Team	Type of work	Operator cost (per day)	Cost per day	Estimated days	Estimated cost
Year 3	coordination team	coordination	500 €	500 €	15	7.500 €
					TOT. TEAM	10.000 €
	operational team	Monitoring phase (VES)	250 €	250 €	1	250 €
	operational team	Monitoring phase (traps)	300 €	300 €	4	1.200 €
	operational team	Containment phase	450 €	450 €	28	12.600 €
					TOT. TEAM	14.050 €
					TOT. ANNUAL	24.050 €
					TOT. PROJECT	90.050 €

7.8 Possible risks

Similarly to the monitoring phase, the capture operations also exposes other non-target species to the catch risk. This threat must be minimised, and for this reason periodic monitoring of the individuals present in the nets is essential, in order to avoid the unnecessary permanence of these species and their possible death.

In the basins inside the Torre Guaceto Reserve, the greatest risk is linked to the autochthonous European pond turtle *Emys orbicularis*, present in the area and categorized as close to the threat by the IUCN.

7.9 Monitoring of the trend of the interventions and future actions

The management plan, if correctly applied, should keep the number of individuals of *Trachemys scripta s.l.* below guard values, ensuring the existence of a population whose impact is significantly lower or zero than the current situation and preventing its further expansion.

Depending on the outcome of this plan, there are two possible scenarios, summarised below:

- Population abundance has decreased significantly over the years: The catch effort applied for the plan is functional to its objectives and must be maintained as an effective containment strategy to limit the effects of the species on the local ecosystem and biodiversity. Individuals or carcasses must be redirected/disposed of in accordance with current legislation, as described in par. 7.5.
- The population remains constant or even undergoes a demographic increase: the catch effort applied to the plan is not sufficient and is poorly or not significant in its objective of reducing the number of individuals. It will therefore be necessary to increase the catch effort until a significant decrease in the population is observed. Individuals or carcasses must be redirected/disposed of in accordance with current legislation, as described in par. 7.5.

From this point of view, the monitoring phase represents the fundamental tool for studying the trends of the populations of American marsh turtles over the years, to evaluate the effectiveness of containment actions and to calibrate subsequent interventions according to the results obtained.

These actions must be related to prevention and communication strategies described in the next chapter.

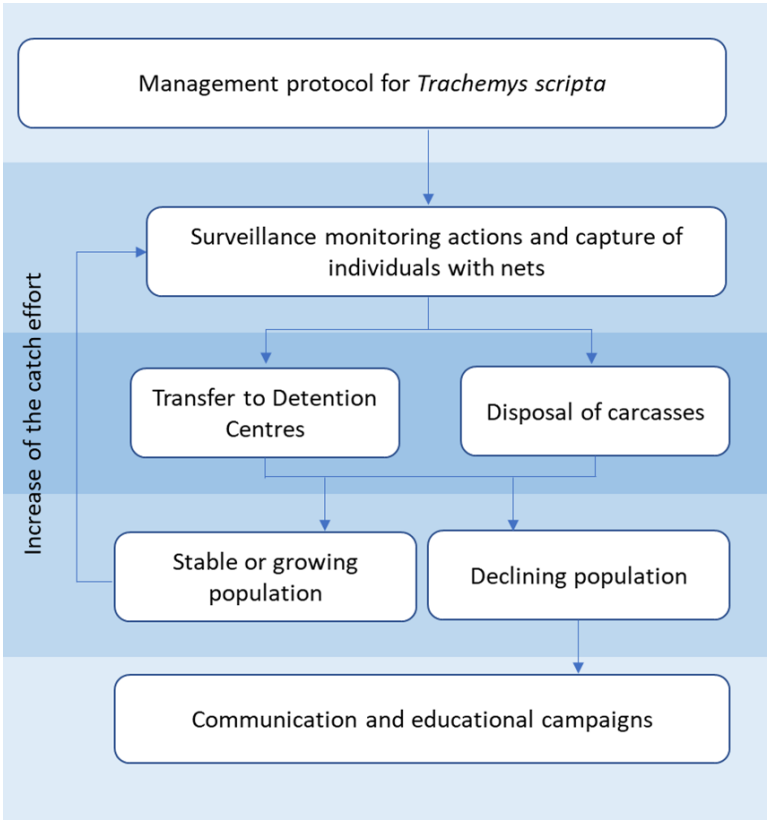

Figure 18: diagram of management actions and future plans.

Chapter 8. Prevention strategies and communication

These chapter contains the main guidelines concerning prevention and communication strategies to adopt for the management of *Trachemys scripta*. The strategy is divided in three steps: Pre-Monitoring plan, Pre-Management plan and post-Management Plan

8.1 Prevention on accidental introductions

The pond slider is listed among the Invasive Alien Species of Union Concern, according to article 6 of D.Lgs 230/2017 which forbids the intentional or negligent introduction, reproduction, cultivation, transportation, purchase, sale, use, trade, detention and release of IAS. In this first step communication is mainly directed towards private citizens and aquarium sellers, which may deal with the species. Also, a proper communication between the local authorities is fundamental, especially directed towards the municipalities, the Region, and the protected areas managers like Torre Guaceto, in order to put up an effective awareness program.

It is then advisable to produce informative material in both print and electronic format, to spread through the main communication channels and the social networks, by producing flyers and proper signage and by organizing specific educational events.

8.2 Early detection through sightings

The early detection of an allochthonous species on the territory represents a key resource for defining its distribution range, therefore the citizens may play a crucial role in this direction. Through a specific communication campaign about the main threats of the species and its diagnostic features for a quick identification, private citizens should acquire all the proper tools to sight, recognize and report individuals of *Trachemys scripta* in the area. These sightings will be uploaded on *ad hoc* databases, like iNaturalist, aiming at collecting all the data (and eventually confirming these data). Also, the upload of pictures through mobile phones should be encouraged, in order to better verify the sightings.

Obviously, this early detection protocol must be accessible by technical staff as well, represented by managers of protected areas and Parks, Regional Department personnel, local police, environmental/hunting and fishing associations, etc. These stakeholders could provide a more complete overview of the situation, by creating an information network active on the territory.

Social networks represent in this sense a proper tool for the spreading of the information, by promoting these protocols and by offering the possibility of downloading the specific application to access the databases.

Figure 19: example of informative panel directed to the citizenship (source: LIFE09 NAT/ES/000529 "*Trachemys*").

8.3 Promoting management actions

A proper spreading of the information and communication with all the stakeholders represents a fundamental part in the whole communication process, starting from the promotion of the conducted activities throughout the plan, so that the citizens can develop a proper awareness about the conservation actions. In this phase it is important to communicate the achievements of the management plan. The main final reports directed mainly towards the stakeholders, together with the data collected during the plan, will be then accessible to the whole population, eventually through the organization of final seminars/events.

Specifically, we can individuate some categories of action, each of it addressed to one or more specific targets:

- **Informative seminars**: proper events on conservation of wetlands, their main issues and the threats represented by *Thrachemys scripta* and other IAS. These seminars can be differentiated depending on the different targets, if addressed to citizens, universities or technical staff. Concerning the business sector, communication actions should be targeted as well to pet traders, despite the different opinions and interests.
- **Informative flyers**: some paper informative material will be distributed to the Reserve visitors, aiming at informing the tourists about the presence of *T. scripta,* about its invasiveness and by giving relevant information in case of sightings.
- **Multimedia material and social networks:** a documentary about the plan, the environmental features of the Reserve and the characteristics of *T. scripta* could be produced, showing the importance of conservational management actions and promoting the project throughout the web and via main media channels. Similarly, the use of social networks must be undertaken, in order to reach as many people as possible.
-

- **Informative panels:** proper signage will be placed inside the Reserve, concerning the impact of IAS and containing the main guidelines in case of contact with *T. scripta.*
- **School activities:** schools play a fundamental part in the whole communication process. Workshops, lectures in classroom, school trips and so on may be addressed to the topic of the IAS, in order to inform the young generations and develop a deeper awareness on these issues, focusing on prevention for new introductions on IAS.

Table 3: brief description of the main communication activities discussed in the present chapter.

Activity	*Target*	Frequency	Place
Communication seminars	Citizens, aquarium operators	Half-yearly	Park and Municipalities headquarters of Carovigno and Brindisi, squares and public areas.
Technical seminars	Researchers, environmental technicians	Yearly	Park and Municipalities headquarters, Universities
Meetings with the business sector	Aquarium operators	Yearly	Park and Municipalities headquarters of Carovigno and Brindisi
Informative flyers	Citizens, tourists	Yearly	Information points of the municipalities of Carovigno and Brindisi; Park
Audio-visual documentary	Citizens, tourists, students	Yearly	Park and Municipalities headquarters of Carovigno and Brindisi, cinemas, squares and public areas.
Social networks	Citizens, tourists, students	Weekly	Social networks of the local public institutions involved in the project
Informative panels	Citizens, tourists	First Year	Information centres, touristic areas
School activities	Kids, teenagers, teachers	Yearly, estimating 12h for each classroom	Primary and secondary schools.
Periodical informative report	Aquarium operators, environmental technicians, hunting and fishing associations	Yearly	Social networks of the local public institutions involved in the project; printed copies in the Park facilities.

Chapter 9. Conclusions

The application of the Monitoring Plan and of the Management plan on *Trachemys scripta* inside the Torre Guaceto Reserve, if conducted in accordance with the prescribed protocols, will provide:

- **Determination of the abundance and structure of populations of *Trachemys scripta s.l.*:** the indirect/direct monitoring protocol through visual contact and through capture will allow to determine the abundance and structure of the populations of the pond slider inside the Reserve, together with defining the areas where the presence of the species is more concentrated. The collection of the biometric data will allow to measure age, sex and dimensions of the captured individuals, estimating the parameters for the whole population. The main issue of this step is related to the identification of the best monitoring sites where to place the transects, which will be maintained through the years. The next monitoring steps, in the following years, will provide information about population fluctuations in terms of abundance and composition, giving feedbacks about the capture effort during the containment phase and, more generally, about the effectiveness of the management actions.
- **Physical removal of the individuals during the containment step**: despite the monitoring step is strictly linked with the containment step, the management plan aims primarily at capturing and removing individuals of *T. scripta* inside the Torre Guaceto Reserve. Bycatch episodes must be taken into account, especially concerning the capture of the European pond turtle (*Emys orbicularis*), protected species according to Directive 92/43/CEE "Habitat" and for which the highest care is recommended. We underline how the aims of the present plan, i.e. containment and management of the target species, do not include the complete eradication of the species. Subsequently, it is of fundamental importance to properly conduct the following monitoring phases, distributed through the years.
- **Evaluation of the population health of *Emys orbicularis*:** During the monitoring and management plan, the possibility of capturing individuals of *E. orbicularis* must be taken into account. Once the proper safety measures are undertaken, data collected on the captured individuals will be possibly used as an estimate about the abundance of the populations of the species inside the Reserve. The current plan has, therefore, the secondary objective of monitoring the population status of *Emys orbicularis* and evaluating its trend during the three years of the project.
- **Communication with citizens and stakeholders**: concerning the participation of the non-technical staff, citizenship must be involved in the management of the target species, *Trachemys scripta s.l.*, by raising their awareness on IAS and on the crucial role of the private citizens for their quick identification. As described in par. 8.3, proper informative material will be produced and specific events and seminars will be organized, differentiating the communication depending on the different targets that may have contacts with the species of interest.

The activities are in accordance with the objectives of the action plan, i.e. containment of *t. scripta* inside Torre Guaceto Reserve. Specifically, continuous activities through time, whereas new individuals will be found in the area, are fundamental in order to avoid negative outcomes in the following years. Surveillance monitoring activities and citizenship involvement, properly formed and informed aims at ensuring the effectiveness of the Plan in medium-long terms, through an integrated conservational management plan which will allow to extend, with the proper precautions, the current plan to different species or territories.

Chapter 10. References

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Animal Diversity Web: https://animaldiversity.org/

SERC (Smithsonian Enviromental Research Center): https://serc.si.edu/

California herps: www.californiaherps.com

Ministero della Transizione Ecologica – Specie esotiche invasive: https://www.mite.gov.it/pagina/specie-esotiche-invasive

Life Gestire: https://naturachevale.it/il-progetto/life-gestire-2020/

Ministero della Transizione Ecologica – Progetto Emys: https://pdc.mite.gov.it/it/area/temi/natura-e-biodiversita/progetto-life-emys

Life Csmon: http://www.csmon-life.eu/

Life SIliffe: http://www.lifesiliffe.it/

Academia: https://www.academia.edu/

CABI – Center for Agricolture and Bioscense International: https://www.cabi.org/

Google Scholar: https://scholar.google.com/

iNaturalist https://www.inaturalist.org/

Life Asap https://lifeasap.eu/index.php/it/

Life Proyecto Estany: http://www.consorcidelestany.org/

MapReachter ISPRA – Istituto Superiore per la Protezione e la Ricerca Ambientale: http://geoviewer.nnb.isprambiente.it/

Nobanis – European Network of Invasive Alien Species: https://www.nobanis.org/

Puglia.con – conoscenza condivisa per il governo del territorio: http://sit.puglia.it/

Scopus: https://www.scopus.com/home.uri

Web of Science: https://www.webofknowledge.com

Annex A

The following survey is part of the "BEST Project - Addressing joint Agro- and Aqua-Biodiversity pressures Enhancing SuSTainable Rural Development - Interreg Programme V-A Greece-Italy 2014/2020" (www.interregbest.eu), aiming to elaborate a monitoring protocol for evaluating threats to biodiversity caused by the presence of invasive alien species, together with a dedicated action plan for biodiversity conservation. We need to obtain a simple and clear information from the institutions directly involved in managing local flora and fauna about the most-pressing invasive alien species on the territory, ultimately looking for a monitoring protocol for the management of the 5 priority target species.

We are presently asking you a few minutes of your time to answer the following questions.

Full name

Name of the institution

E-mail contact

Which are the terrestrial plant invasive alien species that cause major threats within your territory/protected area? (Write at least one species up to a maximum of 5, or write "not relevant")

Which are the terrestrial animal invasive alien species that cause major threats within your territory/protected area? (Write at least one species up to a maximum of 5, or write "not relevant")

Which are the aquatic plant invasive alien species that cause major threats within your territory/protected area? (Write at least one species up to a maximum of 5, or write "not relevant")

Which are the aquatic animal invasive alien species that cause major threats within your territory/protected area? (Write at least one species up to a maximum of 5, or write "not relevant")

List the biotic and abiotic features (habitats and ecosystems, vulnerable species/populations) most affected by the species mentioned above.

Define the area where the effects of the alien species take place.

Are there already ongoing monitoring protocols or action plans (eradication/containment) with respect to these species (i.e. LIFE+ Projects)? If available, share the link to the project

Within your territory of competence, are there any prevention programs with respect to future introductions of alien species? If so, which ones? If available, share the link to the program/project

Annex B

Survey card for indirect monitoring of *Trachemys scripta s.l.* through VES (Visual Encounter Survey)

WATER BODY	SITE	DATE	TIME

COORDINATES OF THE TRANSEPT (BEGINNING AND END)	FORECAST

OPERATOR (Name and surname)

CAPTURED INDIVIDUALS							
INDIVIDUALS	AGE (Adult, juvenile)	SEX (male, female, undetermined)	ACITVITY				NOTES
			Thermoregulating	In the water	Mating	other	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
ADDITIONAL NOTES							

Annex C

Survey card for direct monitoring protocol of *Trachemys scripta* s.l. through captures

WATER BODY	SITE	DATE	TIME

COORDINATES OF THE TRANSEPT (BEGINNING AND END)	FORECAST

OPERATOR (Name and surname)

CAPTURED INDIVIDUALS							
ID	AGE (Adult, juvenile)		SEX (male, female, undetermined)	WEIGHT	SHELL LENGTH	SHELL WIDTH	NOTES
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
ADDITIONAL NOTES							