Scientific Description

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Deliverable Number D.4.2.2.

Project Acronym	CREW
Project ID Number	10044942
Project Title	Coordinated Wetland management in Italy-Croatia cross border region
Priority Axis	4
Specific objective	3.2
Work Package Number	4
Work Package Title	Implementation of Wetland Contracts
Activity Number	2
Activity Title	Context analysis (each target area)
Partner in Charge	Agency for Occupation and Development in North Barese / Ofantina Area
Partners involved	All partners
Status	Final
Distribution	Public

Notes:

1) D.4.2.2 Scientific description REPORT
The REPORT is the collection and analysis of all the dossiers produced by PPs. Each dossier will collect the available information about target areas (environmental, socio-economic and territorial development aspects) in order to better focus the objectives to be developed in the Wetland Contract implementation actions, to the local challenges and priorities.

2) The template filled in by each PP is inspired by and coordinated with the documentation elaborated in the Project WETNET financed under Interreg MED Cooperation Programme to increase information share, data and opportunities of confrontation.

Authors: UNICAM

REPORT OF SCIENTIFIC DESCRIPTION OF PILOT WETLANDS

(deliverable 4.2.2)

Summary

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A. EXECUTIVE SUMMARY

I. Overview

Wetlands in the cross border area of Italy and Croatia are vulnerable interconnected environments, hugely contributing to biodiversity. Their protection intertwines scientific-environmental aspects and governance concerns.

The CREW project co-financed by the European Regional Development Fund through the Italy - Croatia CBC Programme, aims at ensuring higher coordination between different level of spatial planning and authorities in charge for wetlands management, whilst limiting conflicts between preservation issues and economic activities. The main objective of the Project is to protect the biodiversity in Italian and Croatian coastal wetlands by the implementation of a coordinated methodology for wetlands management (Wetland Contract) in coherence with the ICZM principles.

The **Wetland Contract** tool is a multistage process that starting from the definition of a structured and integrated knowledge base leads to the signature of a formal Agreement and the realization of the activities foreseen in the Action Plan.

In fact, the first stage of the process is the context analysis collection:

→ **4.2.1 "Regulatory framework"**
→ **4.2.2 "Scientific description"**
→ **4.2.3 "Stakeholders' map"**

The **scientific description** collects the available information and diagnosis about the target wetland related to environmental, socio-economic and territorial development aspects. It aims to better focus the objectives to be developed in the Wetland Contract implementation stage to the local challenges and priorities.

The analysis consists in the description of the target wetlands including:

- organizations responsible for their management
- role of the partner in relation to the pilot area
- wetland typology
- values of the pilot wetland including: Environmental heritage, Archaeological heritage, Historical heritage, Architectonical heritage, Ethnological heritage, Landscape heritage
- main threats and impacts for the biodiversity of the pilot wetland and relevance of the impact
- main drivers for promoting a voluntary governance process like a Wetland Contract in the pilot area

- specific objectives and expected results from the Wetland Contract of the pilot area.

The present **Report** is the result of the analysis and systematization of the scientific surveys produced by each partner filling out a template structured by UNICAM to have comparable and preparatory information about both the general scientific knowledge of the pilot areas and the habitats involved, and the threats that have impacts on the pilot wetlands.

II. Findings

The pilot wetlands involved in the CREW project (3 in Croatia and 4 in Italy) are different in surfaces and characteristics: wide lagoons systems, lagoon mouths, river mouths, swamps, ponds, small pools, saltmarshes, reclaimed land with irrigation channels, shallow sandy bays or salt meadows.

All pilot areas are managed by public entities, mainly regional or local administrations and most of the them has a Management Plan in force or under preparation.

Data related to floristic species, vegetation, evolution of vegetal landscape, Hydro-geological resources and Faunistic resources are generally more available for the Italian pilot sites then Croatian.

All pilot wetlands are particularly relevant in terms of biodiversity for what concerns birds and fishes (for breeding, migration and wintering) and includes unique ecosystems in the context of the Adriatic coastal region, in fact there are Sites of Community Importance, Special Protection Areas, Important Bird Area and RAMSAR convention areas.

Wetlands have always had a close influence with human presence due to the great amount of resources they offer and transportation, on the other hand human's influence can have also negative impacts on wetlands biodiversity due to intensive agriculture that causes reduction of riparian vegetation and pollution. Moreover, tourism causes overexploitation of the wetlands endangering their ecosystems. As for the rest of the Adriatic coastal area, Climate changes are observed with the intensification of extreme weather events, increasing overall temperature and decreasing the precipitation (can lead to increased salinization of the wetland) and sea level rise (coastal erosion).

In order to tackles these criticalities, the main objectives be pursued by the Wetland Contracts are to enhance the economic potential of the wetlands and integrate the maintenance and prosperity of economic activities in equilibrium with the wetlands fragile balance (sustainable tourism and sustainable agriculture) while actively involving stakeholders public and private in the process of decision making and/or management of the area building a new community.

B. REPORT

I. Pilot wetlands ID (template section A.1)

The CREW project has seven pilot areas (3 in Croatia and 4 in Italy):

1. Northern Lagoon of Venice, Veneto, Italy (PP: IUAV)
2. Sentina Natural Regional Reserve, Marche, Italy (PP: City of San Benedetto del Tronto)
3. Marano Lagoon, Friuli Venezia Giulia, Italy (UTI Bassa Riviera Friulana)
4. Neretva river delta, Dubrovnik-Neretva County, Croatia (Public Institution Public Institution for the Management of protected Natural Areas of Dubrovnik-Neretva County)
5. Ornithological Reserve Palud-Palù, Istria, Croatia (Natura Histrica)
6. Malo and Veliko blato, Zadar County, Croatia (Natura Jadera)
7. Ofanto river, Apulia, Italy (Patto dell'Ofanto)

The areas involved are different in size, surfaces and characteristics and are related to regions with different impact in terms of inhabitants bearing the influence of the nearest towns and villages, which have a population of between a few thousands inhabitants to hundreds of thousands of inhabitants. The Italian areas are larger and more populated, in particular the Northern lagoon of Venice (Fig.1).

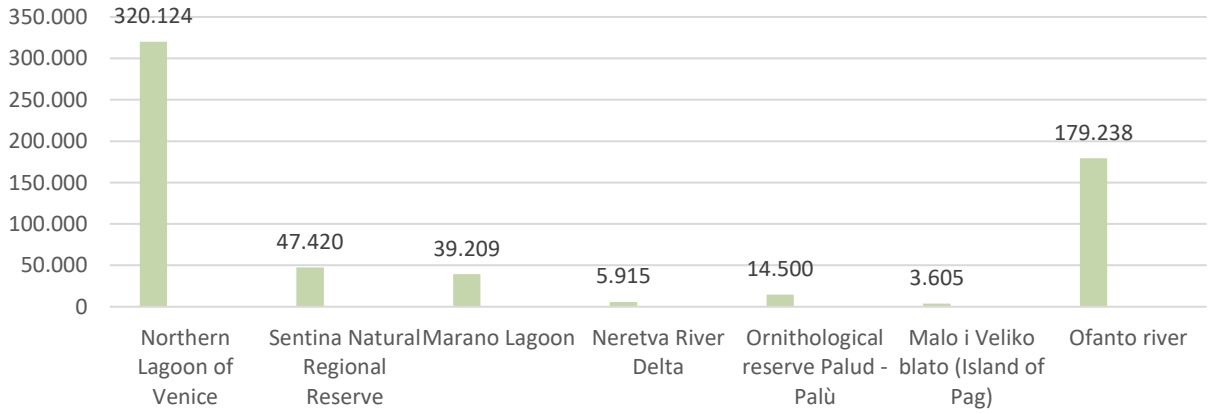

Fig. 1 – Inhabitants.

One aspect that all pilot areas have in common is the type of entity that manages the wetland. Indeed, all of them are managed by public entities, mainly regional or local administrations. The Croatian pilot areas are managed by regional public institutions that are in charge of the management of all the protected natural areas of their County (Dubrovnik, Zadar and Istria). Sentina Natural Reserve and the Northern Lagoon of Venice are managed by Municipalities (Municipality of San Benedetto del Tronto and

Municipality of Venice). Marano Lagoon is managed by the regional authority (Friuli Venezia Giulia) and Ofanto river by the province authority (Barletta Andria Trani).

Most of the areas has a Management Plan of the wetland in force or under preparation except for Ofanto river (Fig.2).

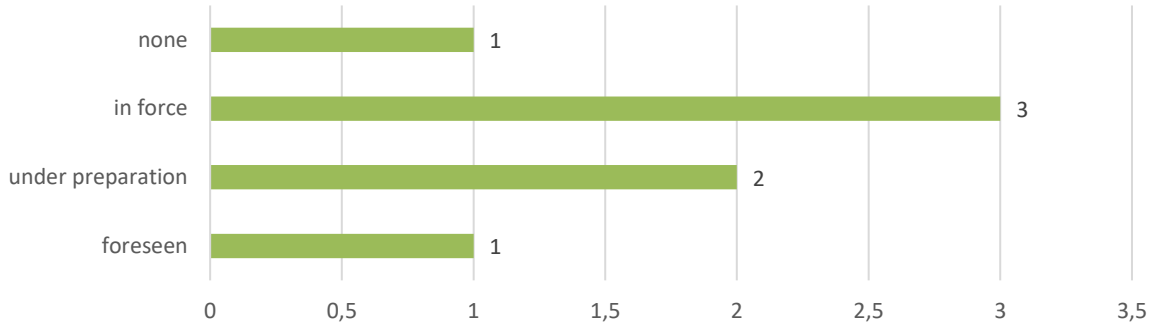

Fig. 2 – Wetland management Plans (none: Ofanto river; In force: Northern lagoon of Venice, Marano Lagoon, Sentina Natural Reserve; Under preparation: Malo i Veliko blato and Neretva river delta; Foreseen: Palud-Palù)

Most of the pilot wetlands are defined as marine coastal areas except for Malo and Veliko blato that are inland wetlands but since they are located on the Island of Pag they have a close relation to the coastal area. Ofanto river, Sentina Natural Reserve and Neretva river delta include also a part of the upstream river (Ofanto river, Tronto river and Neretva river) as these areas are located at the end or near (Sentina Natural Reserve) the watercourse.

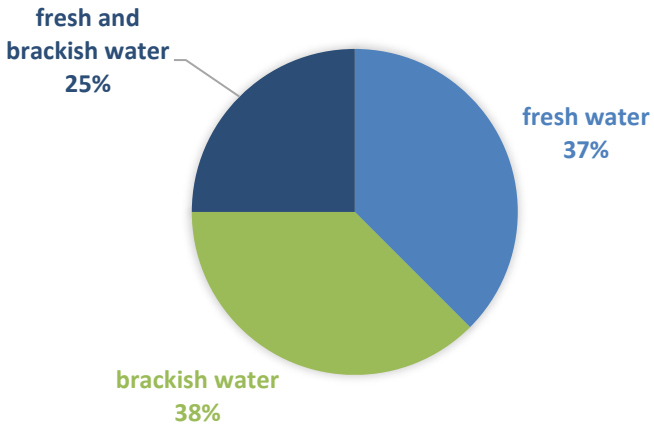

Fig. 3 – Dominant salinity (fresh water: Neretva, Veliko, ofanto; brackish water: Venezia, Marano, Palud; fresh and brackish water: Sentina, Malo blato).

Regarding the dominant salinity, three of the areas have brackish water (Northern Lagoon of Venice, Marano lagoon, Palud-Palù), three areas have fresh water (Neretva river delta, Veliko blato and Ofanto river) while Sentina Natural Reserve and Malo blato have both fresh and brackish water (Fig. 3).

Most of the areas registered a permanent presence of water (Northern Lagoon of Venice, Marano Lagoon, Palud-Palù, Veliko blato, Ofanto river) while Malo blato seasonal, Neretva river delta temporary and Sentina Natural Reserve permanent, seasonal and temporary since the wetland system includes several pools with different features (Fig. 4). It is worth to mention that Marano Lagoon and Northern Lagoon of Venice and Palud-Palù have similar characteristics (brackish and permanent) as well as Ofanto river and Veliko blato (fresh water and permanent).

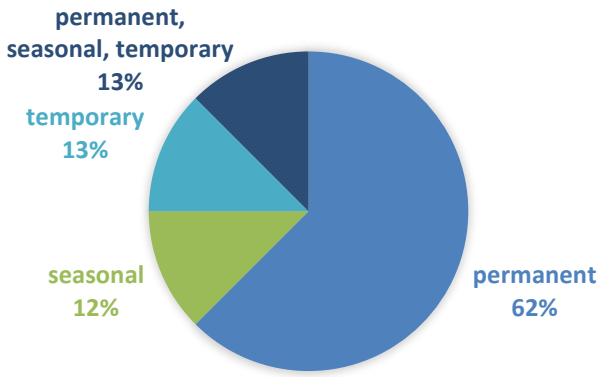

Fig. 4 – Presence of water (permanent: Northern Lagoon of Venice, Marano Lagoon, Palud-Palù, Veliko blato, Ofanto river; seasonal: Malo blato; temporary: Neretva river delta; Permanent, seasonal and temporary: Sentina Natural Reserve).

II. Scientific background (template section A.2)

Floristic Species

From the point of view of data relating to floristic species, all areas already have available studies but only three have maps (Northern Lagoon of Venice, Sentina Natural Reserve, Veliko and Valo blato), and only Sentina Natural Reserve has a monitoring plan in force since 2008 while Neretva river delta is in the process of its preparation. The data are generally recent but of medium or low quality with the exception of the Sentina Natural Reserve (high and up-to-date).

Vegetation

From the point of view of vegetation data, all areas already have available studies except for Neretva river delta. Only four areas have a vegetation map (Marano, Venice, Sentina and Veliko and Malo blato) while all areas, except for Neretva river delta, have habitat maps. Only Northern Lagoon of Venice has a

vegetation monitoring plan under implementation (developed within the projects: LIFE SeResto Project and LIFE LAGOON REFRESH Project) while Sentina Natural Reserve and Neretva river delta are in the process of its preparation. The data are generally recent (except Sentina Natural Reserve where the studies on vegetation and habitat were conducted in 2009) and of medium quality (except Marano Lagoon and Northern Lagoon of Venice which reported high quality data).

In general, the pilot wetlands share halophilous and psammophilous vegetation types, most of which are considered habitats of community importance sensu 92/43/EEC Directive.

The habitats reported in the pilot areas are listed below. Some of them (identified by an asterisk) are priority habitats.

1. Coastal and halophytic habitats
    1.1 Open sea and tidal areas
        1110 - Sandbanks which are slightly covered by sea water all the time
        *1150 - Coastal lagoons
        1170 - Reefs
    1.2. Sea cliffs and shingle or stony beaches
        1210 - Annual vegetation of drift lines;
    1.3. Atlantic and continental salt marshes and salt meadows
        1310 - *Salicornia* and other annuals colonizing mud and sand
    1.4. Mediterranean and thermo-Atlantic saltmarshes and salt meadows
        1410 - Mediterranean salt meadows (*Juncetalia maritimi*)
        1420 - Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetiea fruticosi*)
    1.5. Salt and gypsum inland steppes
        *1510 - Salt steppes (*Limonetalia*)
2. Coastal sand dunes and inland dunes
    2.1. Sea dunes of the Atlantic, North Sea and Baltic coasts
        2110 - Mediterranean embryonic dunes
        *2130 - Fixed coastal dunes with herbaceous vegetation (grey dunes)
    2.2. Sea dunes of the Mediterranean coast
        2230 - *Malcolmietalia* dune grasslands
        *2270 - Wooded dunes with *Pinus pinea* and *Pinus pinaster* (2270)

The four priority habitats are indicated in the northern Lagoon of Venice. Sentina Regional Nature Reserve reported the occurrence of habitats 1110, 1150, 1170, 1210, 1310, 1410, 1420, 2120 and 2230.

The ornithological reserve Palud – Palù includes habitats 1150, 1210, and 1410. In the Neretva estuary, there are halophytic meadows of the *Salicornietum herbaceae* association, which may be referred to

habitat of community importance. *Juncetum maritimo-acuti* association, recorded in the Neretva River delta and the area of Malo blato and Veliko blato, can be ascribed to the habitat 1410.
Some pilot wetlands include other habitats with hydrophytic, helophytic, marshy and humid meadow, grassland and woody riparian vegetation types. The area of Malo blato and Veliko blato is mainly covered by halophylous vegetation of the rare *Junco-Scorzoneretum candollei* association, *Scirpo-Phragmitetum*, *Scirpetum maritimi*, *Schoeno-Plantaginetum maritimi*, and *Ononidi-Brometum condensati*.
In Neretva river delta, *Scirpo-Phragmitetum* is the dominant helophytic association, while *Myriophyllo-Nupharetum* and *Nymphoidetum peltatae* are the most common hydrophytic communities.
Ofanto River is characterized by riparian communities of the *Populion albae* and *Salicion albae* alliances, subjected to a marked dynamism.

Evolution of vegetal landscape

It is reported a lack of data related to Evolution of vegetal landscape, in fact only four pilot areas already have studies (Northern Lagoon of Venice, Palud-Palù, Veliko and Malo blato, Ofanto river). Indeed, only Ofanto river has a map, while only Northern Lagoon of Venice and Neretva river delta reported data relating to an evolution of vegetation monitoring plan (respectively under implementation with the LIFE VIMINE Project and under preparation). The data are generally scarce since few partners have any and when available are old of low quality, except for the ones related to Northern Lagoon of Venice (medium and recent).

Hydro-geological resources

From the point of view of data relating to Hydro-geological resources all areas already have available studies and most of them have cartography (except for Sentina Natural Reserve and Palud-Palù). Only two partners have Hydro-geological monitoring plan in force (Marano Lagoon and Northern Lagoon of Venice) and only three have Quality of Water monitoring plan in force (Marano Lagoon, Northern Lagoon of Venice and Neretva river delta) while Palud-Palù is in the process of its preparation. The data are generally of high quality and up-to-date except for the ones related to Palud-Palù (low and old) and Veliko and Malo blato (medium and old).

Faunistic resources

From the point of view of data relating to Faunistic resources, all areas already have available studies, in particular about:

- Entomo-fauna: Marano Lagoon, Northern Lagoon of Venice, Sentina Natural Reserve, Palud-Palù;
- Ichthyo-fauna: Marano Lagoon, Northern Lagoon of Venice, Sentina Natural Reserve, Palud-Palù, Neretva river delta, Veliko and Malo blato;
- Avi-fauna: Marano Lagoon, Northern Lagoon of Venice, Sentina Natural Reserve, Palud-Palù, Veliko and Malo blato, Ofanto river;

- Mammal-fauna: Marano Lagoon, Northern Lagoon of Venice, Neretva river delta, Sentina Natural Reserve, Palud-Palù, Ofanto river.

Only two pilot sites have a faunistic cartography (Marano Lagoon and Northern Lagoon of Venice), while all areas reported knowledge on conservation status (Habitat Directive and Birds Directive) except for Ofanto river. Only Sentina Natural Reserve and Neretva river delta have monitoring plan in force while Veliko and Malo blato are in the process of its preparation. The data are generally of medium quality and recent.

III. Values of the pilot wetlands (template section A.3)

III.a. Environmental Heritage

The **Northern Lagoon of Venice**, that extends from the city of Venice until the lagoon terrestrial limit in the north, covers 220 square km. The depth of the lagoon waterscape varies from few centimetres up to almost ten metres. Different levels of water salinity and the presence of several river mouths, make the lagoon particularly rich in habitats: sandbars, *velme* (vernacular Venetian term, also used in scientific language, that indicate a portion of the lagoon seabed that is shallow but normally submerged, which nevertheless emerges at low tide), swamps, channels, lagoon mouths, sandy dunes, fishing valleys. The priority habitats are: dunes with pioneer herbal vegetation; dune forests with *Pinus pinea* and *Pinus pinaster*; coastal secondary lagoons; salt steppes (Limonetalia). The lagoon is particularly relevant in terms of biodiversity for what concerns birds and fishes, in fact there are Sites of Community Importance, Special Protection Areas, Important Bird Area. Despite the importance of the Venice Lagoon in Mediterranean ecosystems, it is not a RAMSAR area; there is only a small area in the Southern Lagoon of Venice (called Valle Averto), which is not included in the target area.

Sentina Natural Regional Reserve includes unique ecosystems in the context of the central Adriatic coast of Italy. There are 1700 meters of coastline along which there is a small dune system with natural vegetation. The wetland area behind the dunes is extremely heterogeneous, being characterized by small pools of fresh or brackish water, permanent or seasonal. This heterogeneity provides food and shelter to many species of birds, resting here during their long migratory journeys. Another important habitat is represented by the salt steppe, which is particularly rare along the coast and it is characterized by a soil with high salt concentration. Overall, more than 400 plant species and 200 birds are listed in the area. It is a Natura 2000 site (SCI IT5340001) and a Natural Regional Reserve.

Marano Lagoon is located along the northernmost part of the Adriatic Sea and is the north-eastern part of the delta-lagoon system that goes from Ravenna to the Cona island. The lagoon complex can be distinguished in two parts: Marano lagoon and Grado lagoon. This brackish wetland originated as a consequence of the deposits of the Isonzo and Tagliamento rivers, the subsidence phenomena and the

deposit of sands and silts by marine currents. Inside it also flows tributary spring-rivers which contribute to maintain a supply of sediment and fresh water. Located south-west of the town of Marano Lagunare, the mouths of the Stella river represent the only example in the Adriatic of a delta in the lagoon environment. Among the areas above the middle level of the high tides are sandbanks, shorelines and coasts. The salt marshes are emerged areas covered with thick halophilic vegetation, they are located behind the shore cordon, affected by small meandering channels which have variable depth. The shoreline is represented by a series of islands that create the southern boundary of the lagoon with the Adriatic Sea. It is interrupted by natural lagoon mouths that delimit the two islands. The coast that borders the lagoon represents an irregular arc interspersed with inlets where the water courses flow. It is protected by small sandbanks with swampy areas towards the ground. The following protected areas insist on it: Site of Community Importance IT3320037 Lagoon of Marano and Grado; Special Protection Area IT3321003 Lagoon of Marano and Grado; Natural Reserve of the Foci of the Stella; Canal Novo Valley Nature Reserve; Natural Reserve "Riserva Valle Grotari e Vulcan".

Neretva river delta is characterized by wide lagoons, sandflats and saltmarshes. Though a large area of the wetland habitat has been transformed into agricultural lands, due to the branching network of channels, these areas are still important habitats for aquatic birds and a very important ichthyologic area. Reclaimed land is covered by agricultural landscape with many irrigation channels. The Neretva Delta has many lagoons, shallow sandy bays, low sandy shores, sand flats, salt beaches, etc. The delta, lagoons and brackish waters are an exceptionally important habitat which creates room for the intensive growth of fry, which later spend their life cycle in the sea or fresh water. Furthermore, these areas are important for the migration of anadromous and catadromous fish species. Neretva Delta is important for breeding, migration and wintering of almost 200 regularly occurring bird species. With a large number of endemic species and great diversity, the mouth of the Neretva River is one of the most interesting areas of Croatia. The delta is surrounded with karst hills rich with underground water that supplies numerous springs, streams and lakes. More than 80 registered caves and other underground habitats in these karst surroundings are home for rich fauna with many threatened and endemic taxa. The following protected areas insist on it: Ramsar Site, Important Bird Area and Natura 2000 site (SPA HR1000031).

Palud – Palù is a rare habitat type in predominantly karst areas of the Croatian Adriatic coast and wider area of Dinarides. In recent years some bird species which rarely nest in Croatia started to nest here (*Himantopus himantopus, Tadorna tadorna).* There are also ichnofossils (imprints of dinosaur steps) on the coast. Specific habitats for the ornithological reserves include Coastal lagoon, Annual vegetation of drift lines and Mediterranean salt meadows (*Juncetalia maritimi*). It is a Natura 2000 site (SCI HR2001360).

Velo and Malo blato wetlands are depressions with freshwater (in Velo blato) and fresh and brackish water (in Malo blato). Given their altitude above sea (Velo Blato 4m, Malo Blato 0,6) accompanied with

freshwater and brackish water vegetation, these wetlands are one of the most peculiar hydrological oddities on Croatian Mediterranean coast. Widder area of this special ornitlogical reserve is protected SPA area (HR4000004- Velo i Malo blato). Whole island of Pag and wider are is protected as SCI area (HR1000023- North-West Dalmatia and Pag).

Ofanto river is characterized by an exceptional assortment of living species which make it from a naturalistic point of view one of the few important areas of the Puglia region. The presence of mollusc, larvae, insects, unicellular Flora is relevant since they constitute the support of life in the food chain of the mammals, of reptile, amphibians and especially of water birds. Very rich, along the banks, and also the presence of the vegetable kingdom with tall tree species. The wetland, with which it is possible to identify the terminal part of the Ofanto river basin, constitutes a large resting and living area for the wintering of many species of birds during the autumn and spring migrations respectively. The nearby position of the river, facts that the species of birds identified in the area of the Saline, are, the same present in the lower Ofanto. The following Natura 2000 areas are reported: IT9110005, IT9110006, IT9120007, IT9120011, IT9120009, IT9110038, IT9150041.

III.b. Human heritage

Wetlands, in general, have had a close influence with human presence due to the great amount of resources they offer (fishing, hunting, water, salt, pasture, etc.), transportation ("river highway" along which trade were established with its surrounding regions) and refuge.

Due to this variety of resources and environments, in the pilot wetlands is highlighted the human presence since **Bronze and the Iron Ages** (Marano, Neretva, Palud) and then in particular during the **Roman colonization** (Sentina with its ancient city of Castrum truentum located along the Abruzzo region side of Tronto river; Marano lagoon with the colony of Aquileia; Neretva river delta that was once "Colonia Julia Narona" with its numerous temples, winter baths and theatres; and Palud with its "villae rusticae").

It is worth to mention in detail one of the CREW pilot area - **Northern Lagoon of Venice** – that clearly represents a significant example of uninterrupted stratigraphy of almost 10.000 years of human history. Human presence in the area is testified since the Etruscan period and, since then, the coexistence between water and men continued to evolve. Venice, that from the VI Ito the XVIII century evolved from an elective duchy, to a republic to a Signoria, maintained its independence and its domain on the Mediterranean thanks to a strategic geographic position. The lagoon was so important for Venice, that the Republic strongly transformed the hinterland in order to guarantee the delicate balance between land and sea. While the historical centre collected refined palaces, precious churches, and modern factories, the rest of the lagoon also hosted testimonies of different historical moments. The small islands of the

Northern lagoon hosts traditional fisherman huts and boathouses; while the mainland, that represented the defence line during war, hosts military forts and traditional countryside farms. The Northern Lagoon's landscape value is strongly connected to the long history of interdependence between human activities and natural dynamics. The Venice lagoon, in fact, is just apparently a natural landscape: Venetians constantly transformed it in order to maintain channels, lagoon beds, fisheries and terrestrial borders.

IV. Main threats and impacts for the biodiversity of the pilot wetlands (template section A.4)

The main impacts that effect the pilot wetlands intensively depend on the activities that take place in them. The Italian areas are characterized by a high impact of **agriculture** due to an intensive agriculture that uses pesticides, herbicides, fertilizes and high quantity of water, and causes reduction of riparian vegetation. Likewise, **pollution** (mostly due to agriculture or sewage) is an aspect that is repeated as a relevant in all areas. Other significant pressures are those derived from **tourism** sector causing overexploitation of the wetlands (mass tourism during summer season, accommodation facilities and tourist port construction, high level of water demand). Other **human impacts** are registered especially in Croatia related to illegal hunters and poachers. The presence of **invasive species** turns out to be an important impact on Malo and Veliko blato especially related to the golden jackal and wild boars who attack sheep and birds of the wetlands. As for the rest of the Adriatic Region **Climate changes** are observed with the intensification of extreme weather events, increasing overall temperature and decreasing the precipitation (can lead to increased salinization of the wetland) and sea level rise (coastal erosion).

description of the threat		relevance of the impact		
		Low	Medium	High
Agriculture and aquaculture	S-J: intensive agriculture (J: extensive use of olive orchards) M-N: Land reclamation, lowering of the groundwater M: reduction/alteration of lowland and riparian forests M-N: water outlets and deep water withdrawal M-N: embankment and canalization of water courses and drainage network; M-N-J: use of pesticides, herbicides and fertilizers M: zootechnical waste M-N: elimination of the natural elements of the agricultural landscapes M: Intensification of aquaculture activities, alteration of natural morphology within the valley areas	P	N - J	M – O – S - V

Residential & commercial development	O: Housing development and illegal building J: exploitation of a water spring for water supply of inhabitants of the island (tourism high level of demand) M-N: tourism in specific areas of the lagoon led to the proliferation of accommodation facilities, sports facilities, campsites, large parking lots	S		M – O – N – V - J
Energy production & mining	P-O: Quarries N: mega project hydro power, which reduces the inflow of fresh water to the lagoon and thus contributes to the salinization	M - P – S - V	N	O
Transportation & service corridors	O: Power lines M: Commercial, industrial and tourist ports, traffic of commercial and industrial vessels, tourist and industrial settlements N: hub of the roads leading to Dubrovnik and Bosnia and Herzegovina	P – O - S	N	M - V
Land use modification	Abandonment: P: no maintaining of channels and banks J: risk of fire and invasive species expansion N: fire of reed fields lead to a reduction in biodiversity		P – O – N – S - J	M - V
	Intensification: S -P-J: Agriculture J: grazing M: mass tourism	P	N – S - J	M – O - V
Human intrusions & disturbance	P-S: Summer/beaches tourism N-J: tourism M: mass tourism M-N: Agriculture and breeding M: industrial port and industrial settlements N: Illegal kite surfing activities N: illegal land reclamation P - N: Illegal hunting O: Water withdrawal in the riverbed O: Lifting in floodplain areas J: drywalls destroying J: using heavy and noisy mechanization; J: poachers that collect bird eggs or kill/capture birds J-M-N: fishing		O	M – P – N – S – V - J

	M-N: hunting (number of hunters on limited surfaces, killing (by mistake or voluntary) of rare species) O: abusive cultivations			
Natural system modifications	P: eutrophication S: phragmites australis spread N: salt intrusion, reduced inflow of fresh water and reduced sediment deposit N: port works near the lagoon mouths	P	N - S	M – O – V - J
Invasive & other problematic species & genes	P: common ragweed, nutria O: Ailanthus altissima, Robinia pseudoacacia L. S: Trachemys, Mycastor coypus, plant alien species J: Aquatic vegetation species Paspalum paspalodes (Michx.) Scribn., Bidens subalternans DC., Paspalum dilatatum Poir; Animal: golden jackal, wild boars; vegetation species: Alianto and Juniperus M: Nutria, gambusia, golden crucian carp, catfish, sun perch, american marsh tortoise N: invasive plant species: tree of heaven (Ailanthus altissima), black locust (Robinia pseudoacacia), Prickly pear (Opuntia spp), chinaberry (Melia azedarach), hottentot fig (Carpobrotus acinaciformis), bambusa (Bambusa sp. and Phyllostachys sp.), desert false indigo (Amorpha fruticosa) and common ragweed (Ambrosia artemisiifolia) invasive fauna: atlantic Blue Crab (Callinectes sapidus), catfish, small Indian mongoose (Herpestes auropunctatus), the red-eared slider (Trachemys scripta elegans), the pond slider (Trachemys scripta scripta), Ficopomatus enigmaticus, asian date mussel (Arcuatula senhousia), some freshwater fishes, morine fish the bluefish (Pomatomus saltatorix) and the chukar partridge (Alectoris chukar)	P	M – O – N – S - V	J
Pollution	O - P: chemical in agriculture S: water J: sea pollution from sewage, agriculture and sheep breeding N: contaminants in water and soil O: agricultural waste M: Presence of mercury in the lagoon sediment and bio-magnification of mercury through the species		N – S –V - J	M - O

Geological events	M-N: long-term changes due to the sedimentation of the tributary rivers	N - S	M - V	
Climate change & severe weather	S: sea level rise (coastal erosion) J: extreme weather events J: increasing overall temperature and decreasing the precipitation that increase salinization N: often high tide and tidal wave events N: flooding	P	M - N	S – V - J
other	M: Hydraulic setup: Construction of lagoon embankments, maritime works at the lagoon mouths, embankment of stretches of lido, construction of breakwater cliffs, sediment dredging, removal of dredged sediments, dredging and / or rectification of waterways		M	

Tab. 1 - Main threats and impacts for the biodiversity of the pilot wetlands (P: Palud-Palù; J: Veliko and Malo blato; O: Ofanto river; V: Norther Lagoon of Venice; M: Marano lagoon; S: Sentina Natural Reserve; N: Neretva river delta).

V. Implementation reason-based choices and information availability on voluntary governance process of the Wetland areas (template section A.5)

Regarding voluntary governance, and Wetland Contracts in particular, the Italian and Croatian contexts are very different since only the Italian national regulation recognized this tool and has a well-structured regulatory framework (Environmental Law Legislative Decree 152/2006 art. 68-bis). Indeed, two Italian Partners have already directly experienced voluntary governance and participatory processes in their pilot areas – Marano lagoon (the Laguna 21 process, the Marano and Grado Lagoon Management Plan and ongoing River Contracts) and Ofanto river (the River Contract of the Higher Ofanto integrated into the local development instrument) – while Croatian Partners reported that stakeholders are generally not actively involved in the process of decision making and/or management of the wetlands.

The main objectives report by PP to be pursued by the Wetland Contracts are the following:

- to promote a sustainable use of **water resources**;
- to promote sustainable forms of **tourism** (e.g. develop high quality tourist packages);
- to guarantee the existence and conservation of **traditional activities** (such as fishing and agriculture) that today are under the risk of abandonment;

- to enhance the economic potential of the wetlands and integrate the maintenance and prosperity of **economic activities** in equilibrium with the wetlands fragile balance (balancing the need for further development of local communities and the need to protect natural resources);
- to actively involve **stakeholders** in the process of decision making and/or management of the area building a new **community** linkage amongst local stakeholders.
- to foster closer co-operation of the **public and private stakeholders**;
- to **raise awareness** on wider public (inhabitants of the area and tourists) the importance of the wetlands, possible threats and sharing of information and disseminate water culture (e.g. develop educational packages);
- to guarantee and to enhance the **biodiversity** of the area: increase the conservation status of key animal and plant species; Increase the water quality; reduce the impact of the main threats; reduce water pollution and protect the aquatic environment and the ecosystems connected to it;
- to oppose **salt water intrusion** without obstructing fish migration;
- to reduce and prevent hydraulic risk;
- to implement multidisciplinary integrated **analyses** (integrating the results of the impact of all investigated relevant factors on biodiversity, but also to the local communities) in order to define mitigation methods;
- to implement effective **monitoring** (water quality, water balance and hydraulic dynamics at the scale of the entire wetlands catchment area, minimum vital outflow and sediment management, birds and poaching).

VI. Evaluation of the global knowledge (template section A.6)

Regarding the questions related to a self-evaluation of the level of knowledge it emerges that the Italian areas in general have a higher level and quality of scientific knowledge of the pilot area. With the exception of Neretva river delta which (perhaps because it is an important area and the subject of more studies) has a better level of information compared to the other Croatian areas.

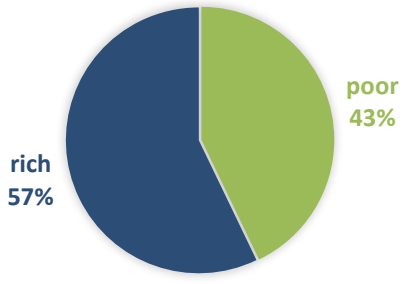

Fig. 5 – How do you evaluate the level of information regarding the target area? (poor: Palud-Palù, Veliko and Malo blato, Ofanto river; rich: Norther Lagoon of Venice, Marano lagoon, Sentina Natural Reserve, Neretva river delta).

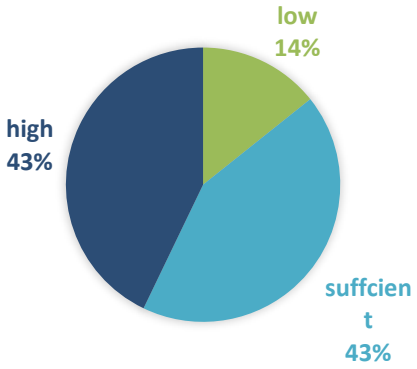

Fig. 6 – How do you evaluate the quality of information regarding the target area? (low: Veliko and Malo blato; sufficient: Neretva river delta, Palud-Palù, Ofanto river; high: Norther Lagoon of Venice, Marano lagoon, Sentina Natural Reserve)