MedWet

Volume IV

Mediterranean Wetland Inventory: Photointerpretation and Cartographic Conventions

G.C. Zalidis, A.L. Mantzavelas & E.N. Fitoka

THE GOULANDRIS NATURAL HISTORY MUSEUM
GREEK BIOTOPE / WETLAND CENTRE

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ICN
Instituto da Conservação da Natureza

MedWet

Ouranoupoli, Greece

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The presentation of material in this report and the geographical designations employed do not imply the expression of any opinion whatsoever on the part of any of the agencies involved, concerning the legal status of any country, territory or area, or concerning the delimitation of its frontiers or boundaries.

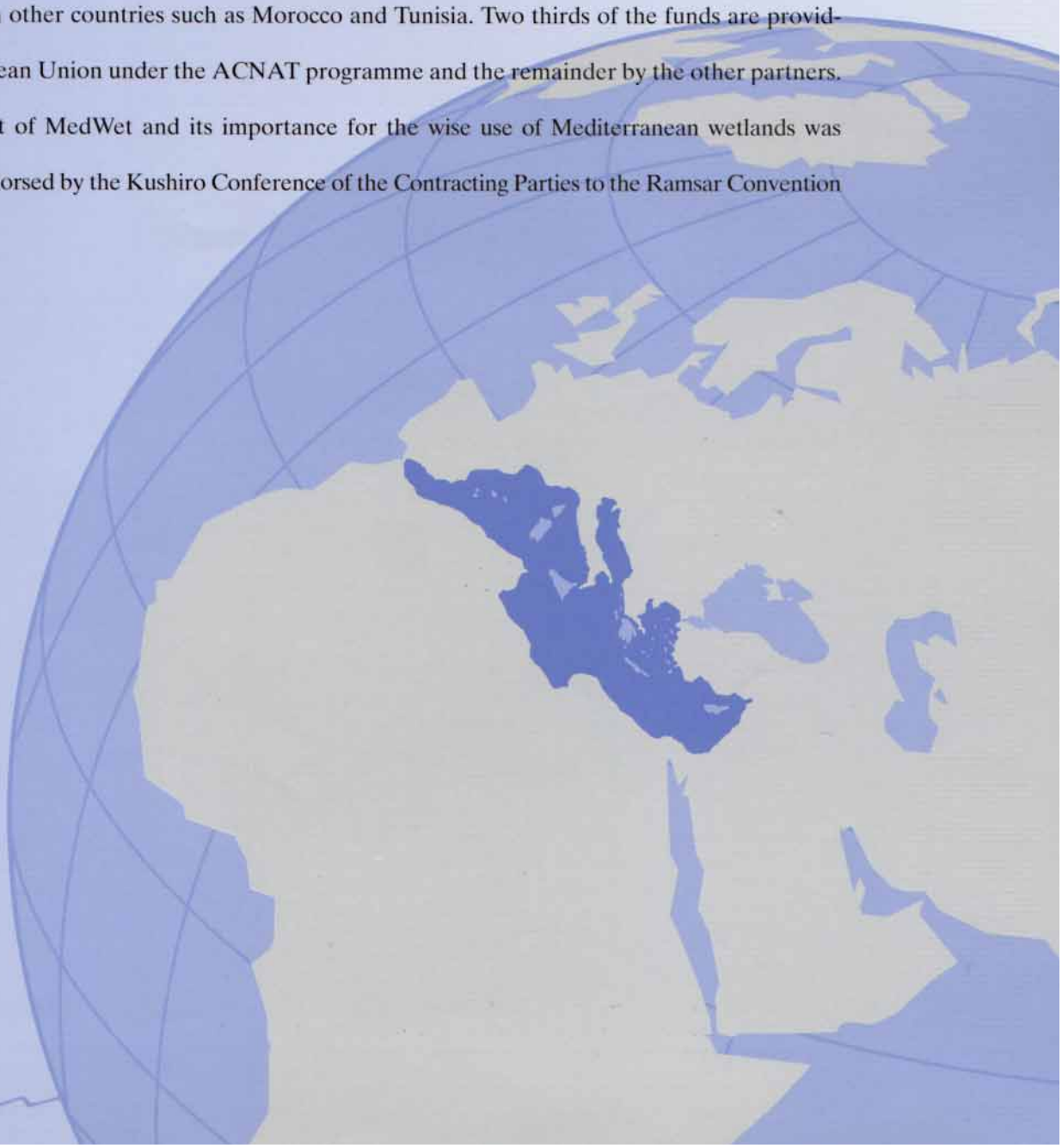
The Medwet Action

The Mediterranean basin is rich in wetlands of great ecological, social and economic value. Yet these important natural assets have been considerably degraded or destroyed, mainly during the 20th century. To stop and reverse this loss, and to ensure the wise use of wetlands throughout the Mediterranean, a concerted long-term collaborative action has been initiated under the name of MedWet.

A three year preparatory project was launched in late 1992 by the European Commission, the Ramsar Convention on Wetlands of International Importance, the governments of France, Italy, Spain, Greece and Portugal, the World Wide Fund for Nature, Wetlands International (former IWRB) and the Station Biologique de la Tour du Valat.

This project focuses on that part of the Mediterranean included within the European Union, with pilot activities in other countries such as Morocco and Tunisia. Two thirds of the funds are provided by the European Union under the ACNAT programme and the remainder by the other partners.

The concept of MedWet and its importance for the wise use of Mediterranean wetlands was unanimously endorsed by the Kushiro Conference of the Contracting Parties to the Ramsar Convention in June 1993.



One of the methodologies developed under the MedWet project concerns Mediterranean wetland inventory. This subproject was undertaken jointly by the Instituto da Conservação da Natureza (ICN) of Portugal and Wetlands International, together with the assistance of a number of other agencies and partners.

The MedWet inventory work aimed to assess the status of existing wetland inventories in the Mediterranean region in order to identify the gaps and review the adequacy of the methods used, and to prepare a standard methodology for carrying out inventories of Mediterranean wetlands.

The MedWet Inventory Methodology includes a Manual for Mediterranean wetland inventory and a suite of publications on separate but linked tools, which allow wetland inventories to be conducted at a number of different levels. The whole methodology can be found in the set of five volumes comprising:

Volume I

Mediterranean Wetland Inventory: A Reference Manual

explains the inventory process and provides a basic introduction to each of the inventory tools.

Volume II

Mediterranean Wetland Inventory: Data Recording

presents the inventory Datasheets and their Guidelines.

Volume III

Mediterranean Wetland Inventory: Habitat Description System

explains the MedWet Habitat Description system and gives guidelines for its application.

Volume IV

Mediterranean Wetland Inventory: Photointerpretation and Cartographic Conventions

describes the MedWet mapping conventions.

Volume V

Mediterranean Wetland Inventory: Database Manual

presents the MedWet inventory Database software and user Manual for data storage (available as a separate publication).

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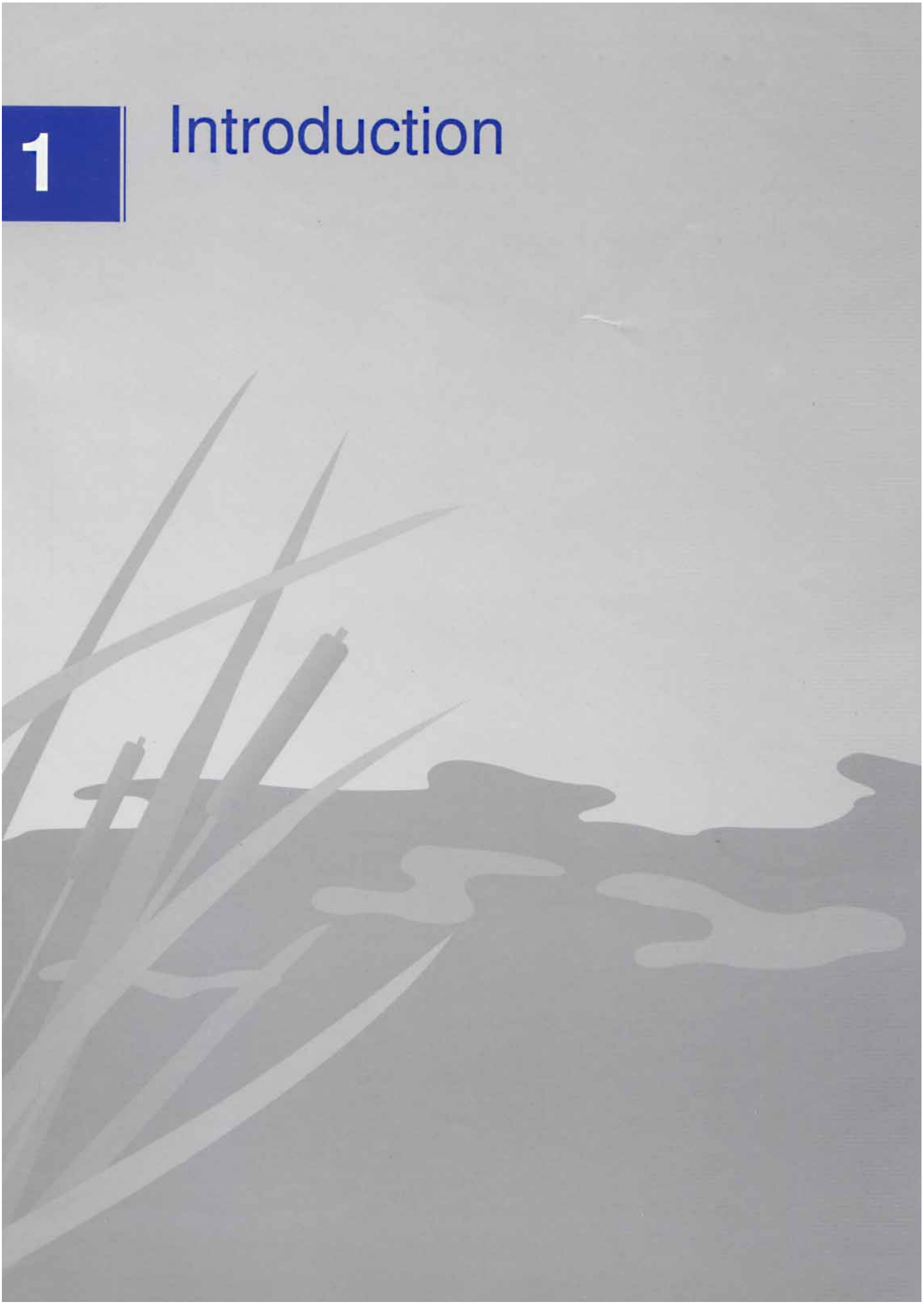
1 Introduction



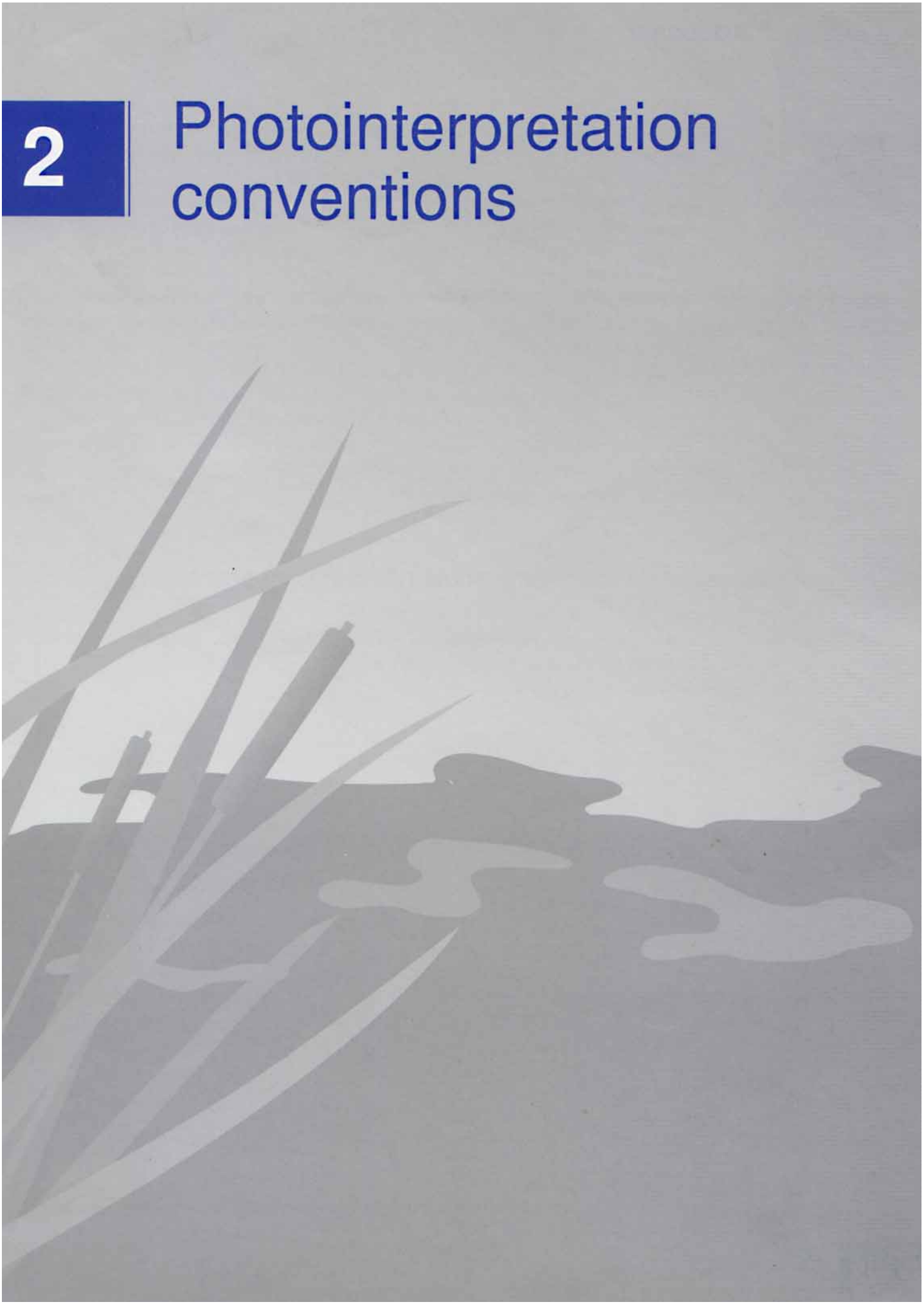
1. Introduction

see
Volume III
Mediterranean Wetland Inventory: Habitat description system

The identification and description of wetland habitats is a prerequisite to effectively manage and monitor Mediterranean wetlands. In chapter 9 of *Mediterranean Wetland Inventory: A Reference Manual* a method is described for mapping wetland habitats based, on a Wetland Habitat Description System using information from aerial photographs coupled with field work.

These Photointerpretation and Cartographic Conventions provide specific guidelines for mapping Mediterranean wetland habitats and a standard protocol to maintain consistency of outputs.

2 Photointerpretation conventions



2. Photointerpretation conventions

Photointerpretation conventions are presented in order to address technical and symbology problems and to ensure a uniform photointerpretation procedure for repeated mapping efforts. The complications which arise when the real world is classified in standard and limited units can be solved by developing photointerpretation conventions.

Conventions for the application of the MedWet Wetland Habitat Description System and for the symbology and drawing techniques are provided in order to furnish the user with a useful tool while following a real mapping procedure, or while just filling the datasheet and only preparing a reconnaissance map. Figures show the techniques that should be followed for delineation of the wetland habitats during the photointerpretation effort. The definitions of all parameters that refer to the Wetland Habitat Description System, as it has been developed by the MedWet subproject on Inventory and Monitoring, are presented in *Mediterranean Wetland Inventory: Habitat description system* (Farinha *et al.* 1996).

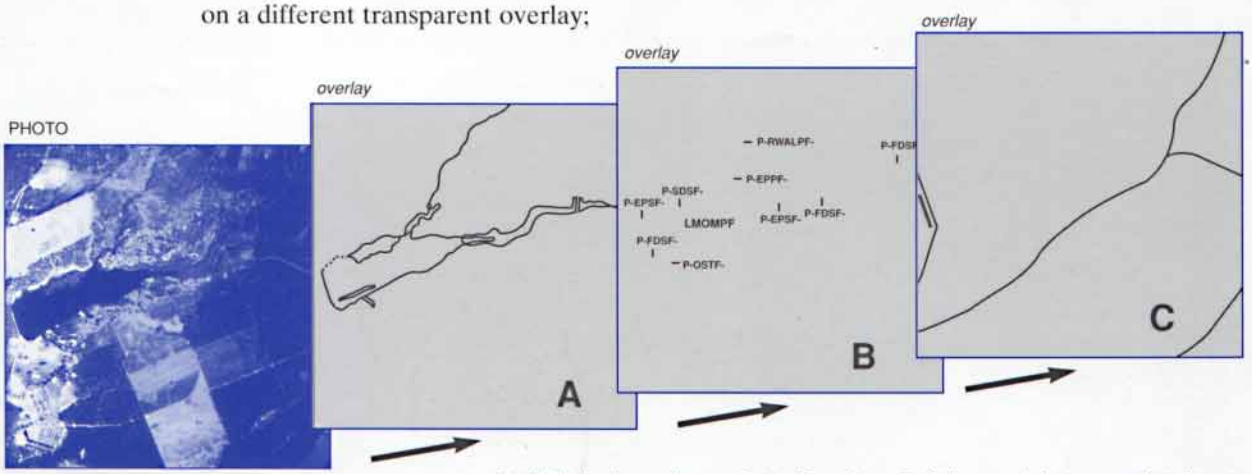
The application of mapping in additional Mediterranean wetland sites will confirm the convention's usefulness and will help to produce several tools to help identify wetlands in the field (e.g. to prepare a list of wetland plants species and to divide them into categories based on a their frequency of occurrence in wetlands and to prepare a list of the nation's soils with actual or high potential for hydric conditions).

Photointerpretation for the photointerpretation procedure

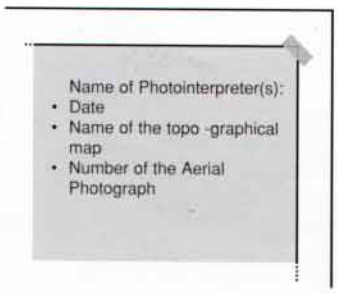
Before starting photointerpretation the interpreter should prepare the photo-overlays and decide on the pen sizes. The following are proposed in order to keep uniformity during the photointerpretation process.

Photo-overlays

- Overlay transparencies are fastened on photos for the wetland habitat delineation. Wetland habitats lying along the outer borders of each photo-overlay set of adjacent photos should be edge-matched;
- Two separate overlays are used: one for the delineation of wetland polygons, lines or points and the other for their associated codes;
- Important anthropogenic features such as roads, trails, animal installations, etc., are delineated on a different transparent overlay;



A - Wetland polygons, lines or points. **B** - codes **C** - Anthropogenic features: roads, trails,...etc.



- In the upper right hand corner of the photoverlays the following information is added: a) photointerpreter's name, b) date of photointerpretation, c) name of the corresponding topographic map, d) number of the aerial photograph.

Pens

- The delineation of wetland habitats is made with pen points with waterproof ink in legible script. When using photos of scale between 1:40,000 and 1:65,000, it is important to use extremely fine pen points (rapidograph 000 size). Fine felt tip pens are acceptable for photo scales near 1:24,000 or larger.

Application of the wetland habitat description system

see
Volume III
Mediterranean Wetland Inventory: Habitat description system

The application of the Wetland Habitat Description System in the photointerpretation procedure requires a good knowledge of the system and of the wetland site to be mapped.

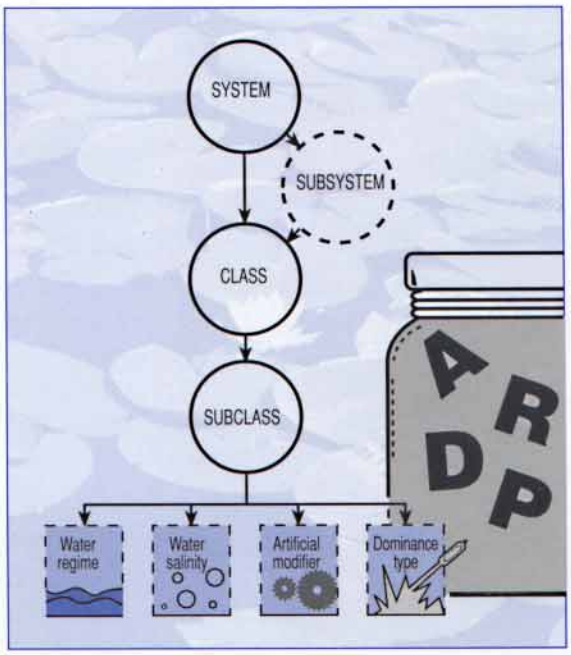
The Wetland Habitat Description System is intended to describe wetlands, arrange them in a system useful to resource managers, furnish units for mapping, and provide uniformity of concepts and terms, while also providing categories of wetlands that can be compared directly to wetland classification systems used in Europe (e.g. CORINE Landcover, Ramsar wetland types).

The Wetland Habitat Description System is constructed in an hierarchical way to meet the following needs:

- combination of different levels of information detail and survey intensity without any loss of data;
- to make use of remotely detectable parameters in the classification process, so that the maximum amount of information may be obtained with a minimum amount of field work;
- to make detailed classification through the use of successive levels, while also making it possible to produce a map of uniform confidence and accuracy; and
- the application to an actual mapping programme.

The Wetland Habitat Description System consists of 5 systems: ***Marine***, ***Estuarine***, ***Riverine***, ***Lacustrine*** *and* ***Palustrine***, which are the highest level of the hierarchy. Only two of them, the Riverine and Lacustrine systems, are subdivided into subsystems. Classes are the third level of the hierarchy and based on substrate material or on life form and there is also one class for the permanently flooded surfaces. The same classes may appear under one or more of the systems or subsystems. Subclasses and dominance types further subdivide the classes. Modifiers for water regime, water salinity and artificiality are applied to the classes or subclasses.

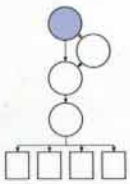
Wetland habitats are assigned to a code that corresponds to the proper System, Subsystem (if exists), Class, Subclass, Water regime, Water salinity and Artificial modifier and Dominance Type. These codes are listed in Appendix.



Each system, subsystem, class, subclass of the MedWet Wetland Habitat Descrip-tion System is represented by a letter. Wetland habitats will be labelled using the code that is compined by the proper letters of each level of the system.

All non-wetland areas on the photos should be labelled using the code (numerical) that correspond to classifiers described in the CORINE LandCover classification system.

Systems



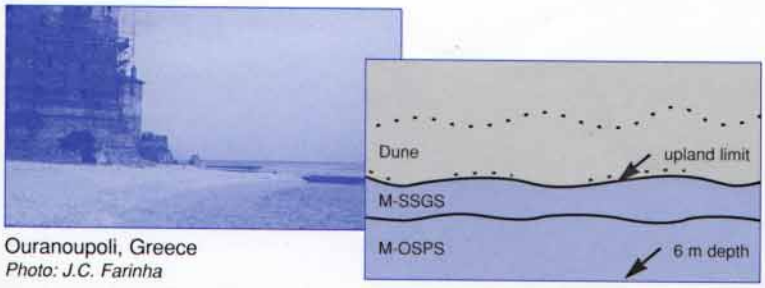
Systems are the highest level of the hierarchy and refer to a complex of wetlands that share the influence of similar hydrological, geomorphological, chemical or biological factors. Here we give a brief description of them, the photointerpretation conventions applied at this level and the letters used for coding the wetland habitats.

M Marine system

The Marine System occurs in a zone bordering the mainland and islands of the Mediterranean region. Marine systems with a very narrow tidal range are divided into a permanently and an irregularly flooded zone, contrary to Marine systems of the Mediterranean region borded by the Atlantic ocean (Portugal, south-western coast of Spain and Morocco) which are characterised by an evident tidal action and divided into a subtidal and an intertidal zone. Salinity exceeds 30 g/l with little or no dilution except outside the mouths of Estuaries. Shallow coastal indentations or bays, gulfs and straits without appreciable freshwater inflow, and coasts with exposed rocky islands that provide the mainland with little or no shelter from wind and waves, are also considered part of the Marine System because they generally support typical marine biota. Common aquatic vegetation along marine shores includes vascular species such as *Zostera nana* and *Ruppia maritima* and algae such as *Ul a* spp. and *Enteromorpha* spp.

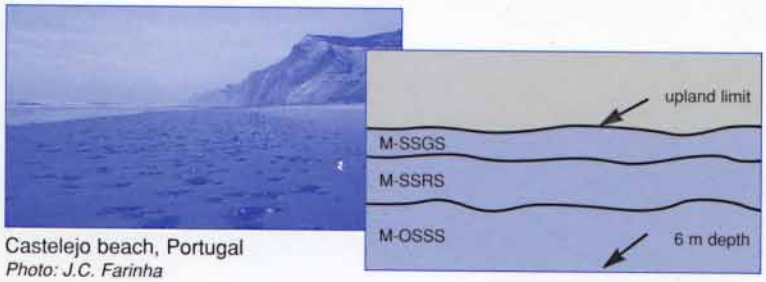
The seaward limit of the Marine System is defined by the 6 meter depth at low tide line; this line should be drawn by reference to Hydrological Service Maps.

The landward limit of the Marine System is defined:



Ouranoupoli, Greece
Photo: J.C. Farinha

On coastlines with weak tides:
the Marine system is bounded by the upland (dune systems)including the associated splash zone and the upper irregularly flooded area of the beach (extreme high water due to meteorological factors).



Castelejo beach, Portugal
Photo: J.C. Farinha

On coastlines with an evident tidal action:
the Marine system is bounded by the landward limit of tidal inundation (extreme high water of spring tides or annual storm surges), including the splash zone from breaking waves.

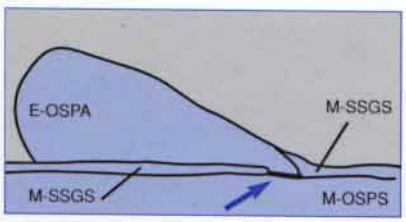
The Marine system is bounded by the seaward limit of Estuarine systems; this limit is usually determined:

- by the presence of wetland emergents, trees or shrubs.
- by an imaginary line closing the mouth of a river, bay or sound, or lagoon opening.

Estuarine system

The Estuarine System occurs shoreward of the Marine System and is sheltered from high-energy wave action. Estuarine habitats include estuaries, lagoons, salt marshes along the outer edge of deltas or bordering the estuaries in areas with an evident intertidal zone, and depressions behind dune systems that are occasionally inundated with brackish or saline waters during storm surges. A large portion of the Estuarine System consists of marshes dominated by halophytic vegetation such as *Salicornia* and *Juncus maritimus*. Exposed mud flats that are non-vegetated or dominated by algal speeies are also common. Lagoons commonly support submerged vegetation such as *Zostera* sp. or *Ruppia maritima* and *Enteromorpha* sp.

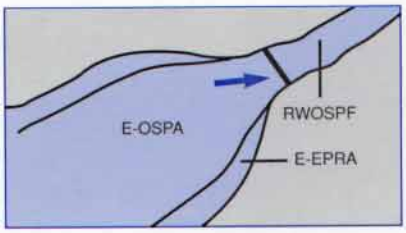
In regions with weak tides the Estuarine System is bounded:



- on the landward side by habitats that are not inundated by the sea
- on the seaward limit of emergent (halophytic) vegetation where this vegetation borders the Marine System
- by an imaginary line closing the lagoon opening or the mouth of a bay or sound. This line should not split polygons in the mouths of bays into two systems.

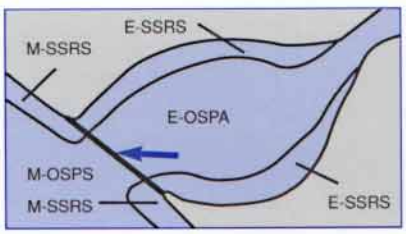
In regions with an evident tidal action the Estuarine System is bounded:

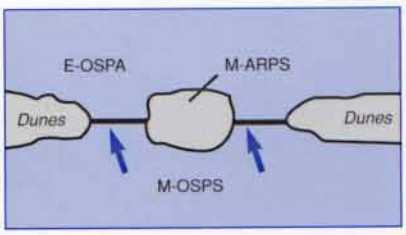
- at the upstream end where marine-derived salts measure less than 0.5 g/l during the period of average annual low flow. This is the Estuarine-Riverine boundary (→) and is formed by the tidal Riverine subsystem;



This border can often be judged by identifying the upstream limit of salt tolerant vegetation, observable by aerial photographs, the tidal Riverine system characterized by freshwater (water salinity < 0,5 g/l).

- by an imaginary line closing the mouth of a river, bay or sound;





In the absence of salinity data, the Marine-Estuarine boundary should be indicated by a straight line drawn across the mouth of a bay, river, sound. This line should not split polygons in the mouths of bays into two systems.

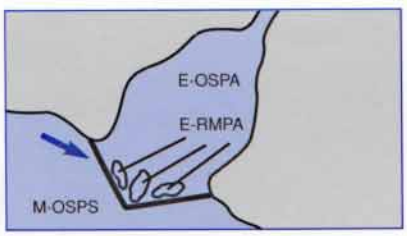
Habitats (such as rocky, sandy, and muddy non-vegetaed areas) that are narrow and continuous with upland and stretch from Marine areas to Estuarine areas must be divided into separate systems.

If the mouth of an Estuarine River has been extended into the Marine system by a parallel breakwater, the seaward limit of the breakwater forms the Estuarine-Marine boundary.

- by the seaward limit of wetland emergent shrubs or trees where they are not included by a the above imaginary lines.

Other factors used to describe the Estuarine-Marine boundary (→) are:

- the seaward limit of Mollusc Reefs;
- occurring outside of the line closing the mouth of a river, bay, or sound. Bottom contour bathymetric) maps may be of some use in delineating the Marine-Estuarine in these instances.



The Estuarine system is defined in terms of salinity and tidal influence:

- if tidal influence is only partially obstructed by weirs or tide (flap) gates or if tidal flux is accomplished by an underground connection, the area should be classified as Estuarine.
- If an area has been completely cut off from tidal action either naturally or artificially then the area regardless of its location or salinity would then fall in the Lacustrine or Palustrine Systems.

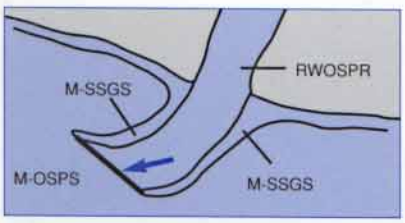
Salina di Tripani (industrial salina), Sicily, Italy
Photo: A.De Faveri

R Riverine system

The Riverine system includes all wetlands and deepwater habitats contained within a channel, excluding wetlands dominated by trees, shrubs, or persistent emergents. Riverine channels may be tidal, but sea-derived salinity is less than 0.5 g/l. The Riverine system includes water surfaces, non-vegetated surfaces, aquatic vegetation, and non-persistent emergents that annually, colonize shoreline surfaces (e.g. sand bars) or grow in slow flowing shallows. Water may flow continuously or only intermittently in riverine channels. Gradients range from high in mountainous areas to very low near estuaries. In high gradient streams, substrates are typically gravel and cobble. In low gradient channels, the substrate consists mainly of mud and sand. Aquatic vegetation such as *Najas* and *Potamogeton* are most common in low gradient riverine areas. Upland islands or islands of palustrine wetlands *(e.g. Salix* shrubs*)* may occur in riverine channels, but are not part of the Riverine System.

The Riverine System is bounded on the landward side by:

- non-wetland
- channel bank including natural and man-made levées
- wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens
- in braided streams, the system is bounded by the banks forming the outer limits of the depression within which the braiding occurs.



In regions with weak tides the Riverine System is bounded at the downstream end:

- by an imaginary line which is the extension of the Marine shoreline across the mouth of the river. Sea-derived salinity can excess 0.5 g/l.

In regions with an evident tidal action the Riverine System terminates at the downstream end:

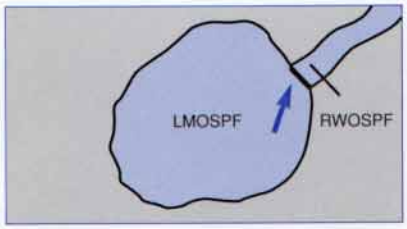
- where the concentration of marine derived salts exceeds 0.5g/l during the periods of annual average flow;

Mira river, Portugal
Photo: J.C. Farinha

The Riverine System terminates:

- where the channel enters a natural or artificial lake

the Ri erine-Lacustrine boundary (⟶) is formed by the extension of the Lacustrine shoreline across the mouth of the ri er.



The Riverine System terminates at the upstream end:

- where tributary streams of the first order originate or where the channel leaves a lake.

Some common features can be part of the Riverine system matching the following conditions:

Rivers with dams and associated locks:

that impound water sufficient to change the ecological character of the river are considered Lakes upstream to a point where the pool elevation or hydrological data indicate the extent of impoundment or where the ecological character of the channel assumes riverine characteristics.

Springs discharging into a riverine channel:

are considered part of the Riverine System; If springs are isolated then they are considered as Palustrine.

Drainage channels:

belong to the Riverine system unless they are invaded by reed beds; in this case they belong to the Palustrine system.

L

Lacustrine system

The lacustrine system includes permanently flooded lakes and reservoirs and intermittent lakes. The total area exceeds 8 ha and the associated exposed or shallow shore are aquatic bed or non-persistent emergents. Rooted vascular, Floating-leaved, or free floating aquatic vegetation (Floating vascular) occurs in many Lacustrine areas, common species include *Nuphar lutea, Potamogeton filifonnis*, and *Myriophyllum spicatum*. Lake shorelines that are intermittently exposed may be non-vegetated or colonized by annual grasses and forbs. Other non-persistent emergents such as *Sparganium erectum* and *Eleocharis palustris* often grow in shallow water zones.

The Lacustrine System is bounded by:

- upland
- wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichen

Lacustrine systems formed by damming a river channel are confined by the contour approximating the normal spillway elevation or summer pool elevation, except where Palustrine wetlands extend lakeward of that boundary.

Dam of Lake Kerkini, Greece
Photo: J.C. Farinha

P Palustrine system

The Palustrine system includes the greatest variety of wetand habitats of all the systems. Typical Palustrine systems include: *Juncus meadows*, *Phragmites australis* marshes, *Typha* stands, flooded riparian shrub and forested areas, and ponds. Palustrine wetland habitats may be situated shoreward of lakes, adjacent to river channels, inland of estuaries, in isolated basins, or on slopes. They may also occur as islands in lakes or rivers.

All water bodies visible on aerial photography that are less than 8 ha in size are considered to be Palustrine System unless depth information is available, or unless an active wave-formed or bedrock shoreline feature is visible.

The Palustrine System is bounded by:

- non-wetland
- the other Systems.

Some common features can be part of the Palustrine system matching the following conditions:

Sidi-Moussa, Morocco
Photo: J.C. Farinha

Coastal areas

that are brackish from residual salinity or from sub-surface seepage are considered Palustrine. Inundation by tides or from surges would be required in order for these areas to be classified as Estuarine.

Oxbow lakes

are placed in the Palustrine System.

Alcochete, Tejo estuary, Portugal
Photo: H. Costa

Salines

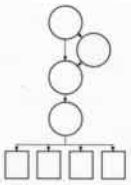
are considered Palustrine wetland habitats. In cases where the marine water enters the saline by natural forces (inundation by tides or storm surges) they are considered Estuarine wetland habitats.

Gambia, Sado estuary, Portugal
Photo: J.C. Farinha

Drainage channels

invaded by reed beds are considered Palustrine and are delineated as linear wetlands; photointerpretation is limited to identification and delineation up to drainage channels of the third order; mapping them however depends on map scale, i.e. on large scale maps third order drainage channels are mapped as well.

Subsystems



Subsystems are more specific subdivisions and are based on an energetic description. Definitions are given in *Mediterranean Wetland Inventory. Habitat Description System* (Farinha *et al.*). Here we give only the letters that are used for coding the wetland habitats.

The **Marine**, **Estuarine** and **Palustrine** systems have no Subsystems.

R The **Riverine System** in areas with weak tidal action comprises 4 Subsystems:

W **Lower Perennial**

U **Upper Perennial**

I **Intermittent**

T **Tidal** To be used only in areas with evident tidal action.

Topographic maps or other hydrological data should be used as the primary data source in determining if the riverine channel is a perennial or intermittent stream. Perennial streams are indicated by a continuous line on topographic maps, whereas intermittent streams are shown by a dashed line.

L The **Lacustrine System** comprises two Subsystems:

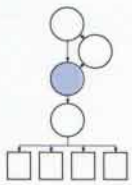
M **Limnetic**

L **Littoral**

Aquatic Beds are considered to be in the Littoral Subsystem unless depth information is available and indicates other System. Aquatic Beds and Non-persistent emergents that are contiguous with Lacustrine System are considered to be Lacustrine regardless of their size.

The boundary between the Limnetic and Littoral Subsystems is the depth of 2 meters.

Classes



Classes describe the general appearance of the habitat in terms of dominant life forms, or provide a description of the substrate for non-vegetated wetland. They are easily recognizable during field surveys and from aerial photographs. Here are described the photointerpretation conventions that are applied at this level and the letters of each class that are used for coding the wetland habitats.

Wetland habitats are classified by the type of life form if vegetation covers 30% or more of the substrate using the classes:

A **Aquatic bed** **M** **Moss/Lichen** **E** **Emergent**

U **Scrub/Shrub** **F** **Forested**

Wetland habitats are classified by the physiography and composition of the substrate if the vegetation covers less than 30% using the class:

S **Non-vegetated**

Ridge-like or mound-like structures formed by the colonization and growth of sedentary invertebrates are classified as:

R **Reef**

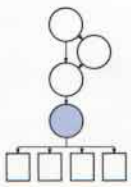
All water surfaces with a vegetative cover less than 30%. are classified as:

O **Water Surface**

Some conventions are defined to ensure a correct interpretation of the classes included in the Wetland Habitat System:

- When trees or shrubs alone cover less than 30% of an area, but in combination cover 30% or more, the wetland habitat is assigned to the class Scrub/shrub.
- When trees and shrubs cover less than 30% of the area but the total vegetation cover is 30% or greater, the wetland habitat is assigned to the appropriate class for the predominant life form below the shrub layer.
- Mixed wetland habitats such as Emergent/Aquatic bed, Emergent/Non-vegetated and Aquatic bed/Water surface are classified according to the predominant ecological phenomena with the most persistence in terms of time.
- Wetland habitats are classified according to their state at maximum vegetation development in an average year and at the average low water level. This simply means that, where possible, maximum vegetative summer growth should be classified rather than spring high-water condition.
- A Non-vegetated seasonally flooded area is classified as "water surface" if the duration of flooding lasts more than half of the growing season or as "non-vegetated" if the duration of flooding lasts less than half of the growing season.
- The class of Aquatic bed, especially the subclass "free floating", is very difficult to map because of its frequent change of location over time. This class is delineated by taking into consideration parameters such as temperature, water depth and wind conditions rather than direct identification based on vegetation.
- Wetland habitats contained within the intermittent subsystem of the Riverine system and all channels of the Estuarine system or of the Tidal subsystem of the Riverine system which are completely exposed at low tide are classified as "non-vegetated".

Subclasses



The Subclasses describe more detailed differences between the habitats. The subclasses of A-Aquatic bed, M-Moss/Lichen, E-Emergent, U-Scrub/Shrub, and F-Forest describe the predominant life form; the subclasses of S-Non-vegetated and O-Water Surface give finer distinctions in substrate material; and R-Reef subclass describe the type of organism that formed the reef. Here are described the photointerpretation conventions that are applied at this level and the letters of each class that are used for coding the wetland habitats.

O **Water Surface:**

R	Rock	C	Cobbles/gravel	S	Sand
M	Mud	O	Organic	G	Gypsum
A	Salt crust	K	Unknown bottom		

S **Non-vegetated:**

R	Rock	C	Cobble/gravel	S	Sand
M	Mud	O	Organic	G	Gypsum
A	Salt crust	V	Vegetated Pioneer		

A **Aquatic Bed:**

A	Algal
M	Aquatic Moss
R	Rooted Vascular
L	Floating- leaved
F	Floating Vascular
Z	Unknown Submergent
X	Unknown Surface

R **Reef:**

M	Mollusc	W	Worm	C	Coral

M **Moss-Lichen:**

M	Moss	L	Lichen

E **Emergent:**

P	Persistent	N	Non-persistent

U **Scrub/Shrub:**

D	Deciduous	E	Evergreen	A	Dead

F **Forest:**

D Deciduous E Evergreen A Dead

Sometimes it is impossible to specify correctly the subclass representing the wetland habitat unit to be mapped. For those cases, and only for photointerpretation and cartographic purposes, three categories are considered:

K **Unknown bottom**

Designation was created for cases that the substrate composition beneath the surface water can not be identified by aerial photographs.

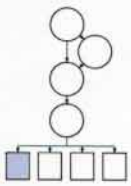
Z **Unknown Submergent**

Designation was created for cases where submergent vegetation is visible on the aerial photographs but cannot be identified as Algal, Aquatic Moss or Rooted Vascular.

X **Unknown Surface**

Designation was created for cases where surface vegetation is visible on the aerial photographs but cannot be identified as Algal, Aquatic Moss, Rooted Vascular, Floating-leaved or Floating Vascular.

Water Regime Modifiers



Precise descriptions of hydrological characteristics require detailed knowledge on the duration and timing of surface inundation, both seasonally and long-term, as well as an understanding of groundwater fluctuations. Since such information is seldom available, the water regimes listed below constitute generalized categories.

Water regimes are grouped in two major groups:

- Marine and Estuarine systems the water regimes are defined in terms of tidal cycles or of storm surge influences.
- In Riverine, Lacustrine and Palustrine systems

  Definitions of the water regime modifiers are given in *Mediterranean Wetland Inventory. Habitat Description System (*Farinha *et al* 1996*)*. Here are applied the letters of each class used for coding the wetland habitats.

M E ***For Marine and Estuarine Systems:***

P Permanently flooded.

This is used for the areas where the very narrow tidal range does not permit the differentiation of an intertidal zone. For this reason the water surfaces of these Systems are classified as Permanently flooded rather than Subtidal.

S Subtidal

A Irregularly exposed

R *Regularly flooded.*
Typical regularly flooded areas include tidal mud flats and the seaward fringes of salt marshes. In Marine and Estuarine Systems with weak tides it also includes seaward areas usually covered with water but occasionally exposed during wind or G-Irregularly flooded spring tides.

G *Irregularly flooded.*
The irregular flooding may be due to normal oceanic tidal cycles(e.g. spring tides) or storm surges. Typical irregularly flooded areas include salt marshes above the zone of daily flooding, and the upper zone of Marine and Estuarine beaches.

U *Saturated.*
This applies in the Estuarine System to areas where wetness is primarily due to capillary rise.

R **L** **P** ***For Riverine, Lacustrine and Palustrine Systems:***

P *Permanently flooded*

L *Semi-permanently flooded*

S *Seasonally flooded*

T *Temporarily flooded*

I *Intermittently flooded*

U *Saturated*

In tidally influenced parts of Riverine and Palustrine systems:

F *Permanently flooded-tidal*

Y *Semi-permanently flooded-tidal*

R *Regularly flooded*

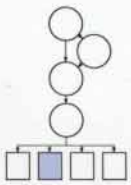
E *Seasonally flooded-tidal*

M *Temporarily flooded-tidal*

In articially flooded areas:

A *Artificially flooded.*
This water regime is used only when it is artificial and unknown.

Water Salinity Modifiers



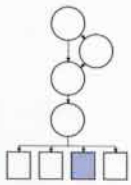
Water salinity description is an essential part of the Wetland Habitat Description System, even though its accurate characterization is quite difficult, both because of problems with measurements and because values tend to vary with changes in the season, weather, time of day, and other factors.

Differences in salinity are reflected in the species composition of plants and animals. Salinity also has important implications for the use and management of wetlands related to irrigation agriculture, grazing, and drinking water.

Wetland water salinity is defined by five classes expressed in grams of salt per litre:

	Coastal modifiers		Inland modifiers	Salinity (g/l)
F	F-Fresh	F	F-Fresh	<0.5
O	O-Oligohaline			0.5-5.0
M	M-Mesohaline			5.0-18
P	P-Polyhaline			18.0-30.0
B	B-Mixohaline	X	X-Mixosaline	0.5-30.0
S	S-Euhaline	E	E-Eusaline	30.0-40.0
H	H-Hyperhaline	Y	Y-Hypersaline	>40.0

Artificial Modifiers



Many wetlands are man-made, and many natural ones have been modified to some degree by the activities of man. Artificial modifiers are used to describe modified and created wetland environments. When used, they are represented by the 6th digit of the wetland habitat code for Marine, Estuarine and Palustrine Systems or by the 7th digit for Riverine and Lacustrine Systems. Definitions of artificial modifiers are given in *Mediterranean Wetland In entory. Habitat Description System (*Farinha *et al).* Here are given the letters used for coding wetland habitats.

F	**Farmed**	intermittent lake bottom, transitional zones from agriculture to wetland especially in drained areas of deltas, etc.
A	**Artificial substrate**	jetties and breakwaters are examples of Non-vegeated Artificial shores.
S	**Spoil**	deposition of spoil materials
E	**Excavated**	canals, ditches, earth tanks (stock) and farm ponds, excavation pits.
D	**Diked/Impounded**	dams, man-made barriers
P	**Partially Drained/Ditched**	this is used to indicate extensive ditch networks in wetlands where due to extreme number and narrow width of the ditches, individual delineation is not possible.

Some mixed Artificial Modifiers can be used. However, mixing should be limited to the following modifiers:

B *Farmed-Dyked/Impounded*

C *Artificial-Excavated*

G *Artificial-Dyked/Impounded*

H *Artificial-Excavated-Dyked/Impounded*

J *Spoil-Excavated*

L *Spoil-Dyked/Impounded*

M *Spoil-Excavated-Dyked/Impounded*

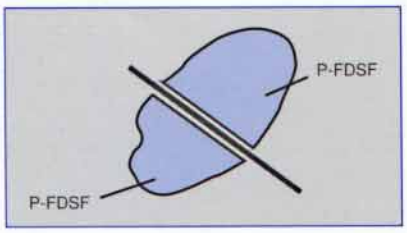
N *Excavated-Dyked/Impounded*

Photointerpretation conventions for symbology and drawing techniques

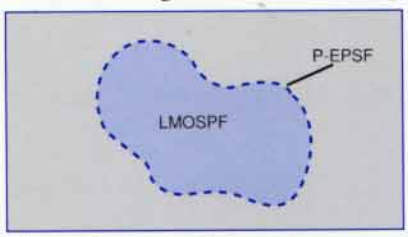
The wetland habitats that are identified during photointerpretation are delineated as polygons, lines or dots according to their size. Conventions for symbology and drawing techniques have been developed in order to ensure constancy and uniformity throughout the Mediterranean region.

Polygons

- Wetland habitat delineation results in a set of polygons providing that they exceed the minimum mapping units.
- If a primary or secondary road bisects a wetland then the wetland habitat is separated in two polygons. Narrow raised road, fills and embankments which bisect wetlands do not have to be delineated as upland dividers.



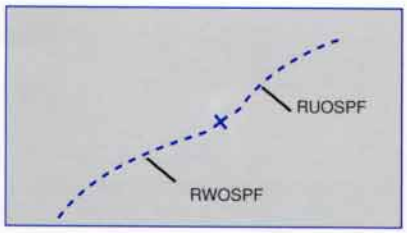
- A dashed line can be used to form the edge of a polygon where a narrow band of vegetation occurs along the edge of a river or lake. A dashed line is often used, to indicate shores in marine and estuarine systems where the zone of shore is too narrow to form a polygon.

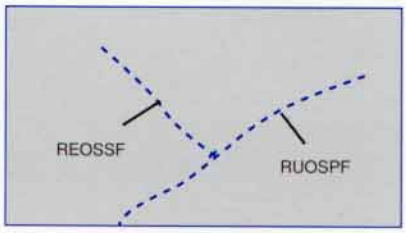


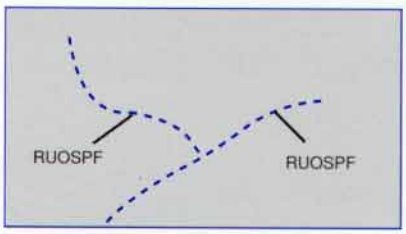
- Labels for polygons should be placed within the polygon, if space permits. If the label is placed outside the polygon, the lead line shall enter the wetland.
- Lead lines without arrows are used for labelling polygons when space does not permit to place the label within the polygon.

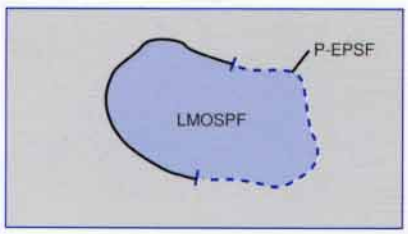
Linears

- All linear wetlands are indicated by a dashed line if they are as wide as the pen width. They are drawn only when space permits reasonable labelling.
- Any classification change along a linear wetland shall be indicated by a short solid line drawn perpendicularly across a dash along the linear. A short solid line should also be drawn across the end of a linear wetland where the linear forms part of a polygon border. When two separate linears intersect, the dashes must connect at the intersection.

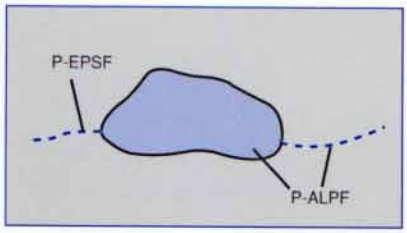


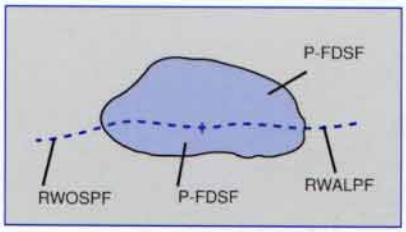


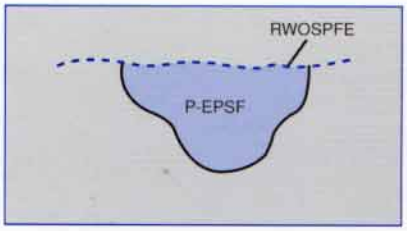




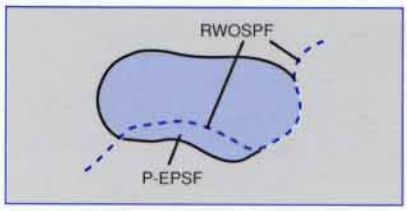
- Where a linear enters, passes through, or forms one side of a polygon, the dashed portion of the linear must connect to or bisect the polygon border.







- Linear wetlands should be considered secondary in priority to larger wetlands which can be delineated as polygons, to avoid unnecessary detail. Linear wetlands take priority if they form boundaries between wetland and upland and only when experts or local agencies believe that their contribution is essential to the representation of the wetland site.
- All dashed line segments and polygons formed by intersecting lines must be labelled.

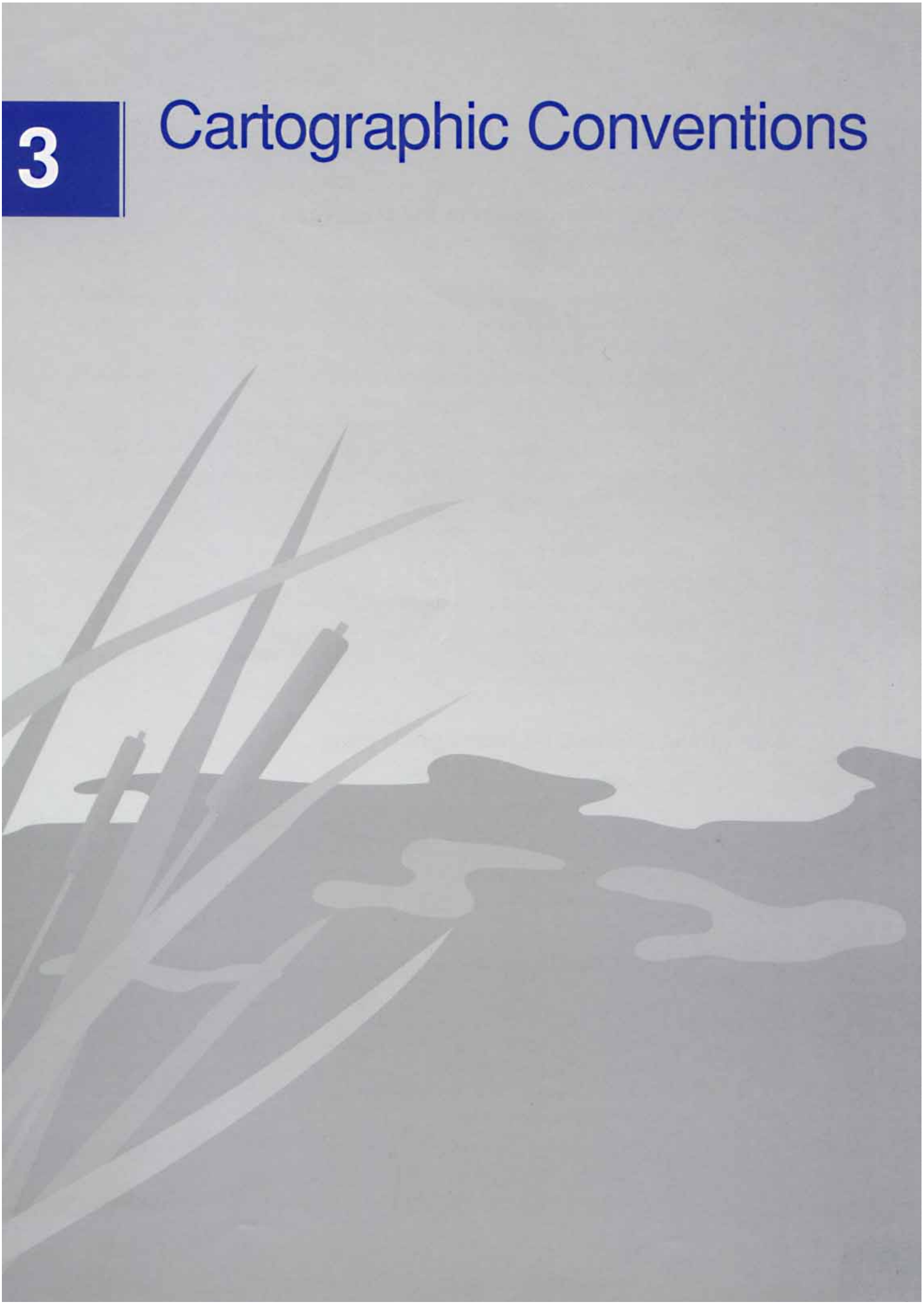


- Lead lines without arrows should be used when labelling linear wetland habitats.

Dots

- Dot wetland habitats give information only for the location of the habitat but no information is given about the length or the diameter of it.
- Lead lines with arrows should be used when labelling dot wetland habitats. Arrows are omitted in complex areas.

3 Cartographic Conventions



Cartographic conventions

Cartographic conventions are defined in order to maintain constancy in cartographic presentation of the wetland habitat maps throughout the Mediterranean region.

Transferring the information to the base map

The information from the final photointerpretation is transferred to the corresponding topographic map to be planimetrically corrected. The transferring can be done either manually by photogrammetric instruments or automated by computers (Karteris 1990).

In the Greek pilot study the programmetric instrument Zoom Transfer Scope was used for such transferring. Four or more anthropogenic (e.g. road intersections and buildings) and where necessary natural (e.g. shorelines) features visible on the aerial photograph and also present in the base map are traced, along with the polygons, to provide horizontal control for the photography. The polygons are compiled on the base map with the Zoom Transfer Scope, which allows for scaling and correction of distortions.

Other photogrammetric equipment, such as the aerial sketch-master or radial-planimetric plotter, can be used for this process. These give less accurate cartographic results than the Zoom Transfer Scope.

If there is no access to such equipment then direct tracing of the identified and delineated wetland habitats from the aerial photography mosaic to the base map is carried out; the photography and base map should be of the same scale. This can be done when there are no evident photo-distortions.

Scale of wetland habitat description map

Map scale defines the relationship between a known unit of measure on a map and the same unit of measure on the ground. The scale of 1:25,000 is proposed as adequate to depict information about the wetland habitats. The minimum mapping unit on the map is 2x2 mm which is equal to an area of 0.25 ha.

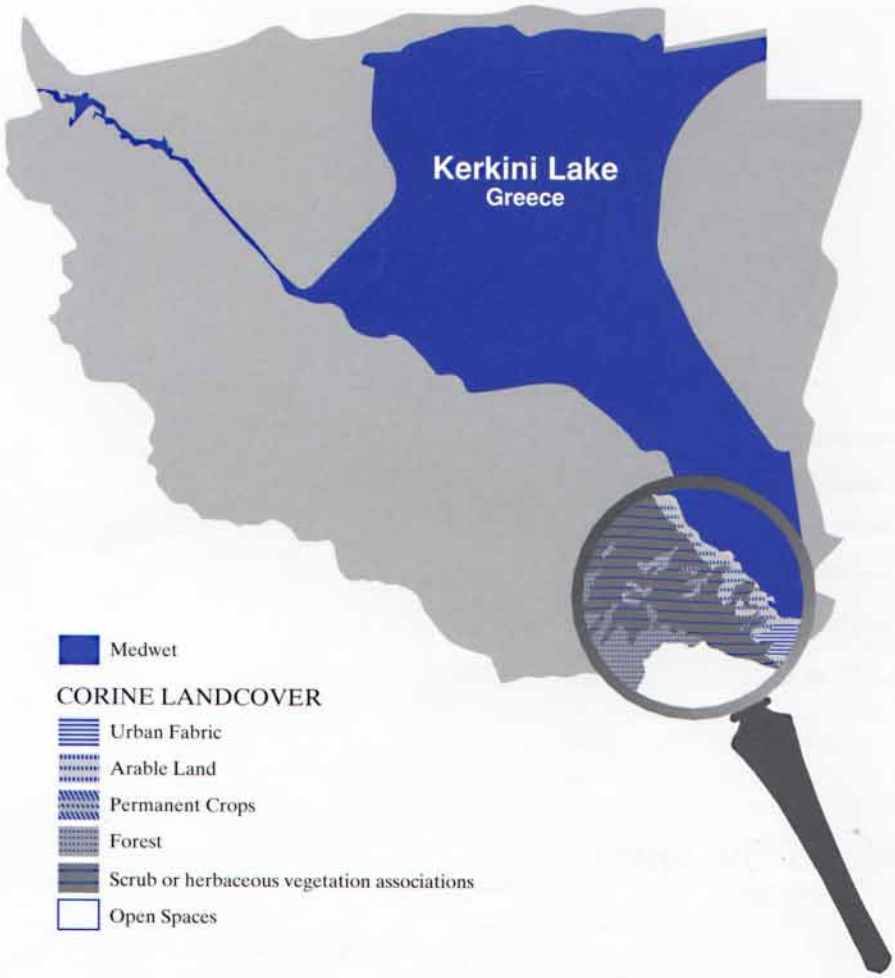
Borders of the mapped area

The borders of the mapped area were proposed to fit with the cartographic output of the CORINE LandCover project (1:100,000 scale). The methodology for mapping wetland habitats is implemented in the units that have been classified by the CORINE LandCover classification system as 'wetlands' and 'water bodies'.

A peripheral zone is also enclosed in the borders of the mapped area so that the outer edge of the wetland site can be examined and mapped more precisely.

The borders of the mapped area are defined by various characteristics: (1) the wetland habitat

description map is limited by artificial structures such as roads, rail bridges, dams, etc.; and (2) in the absence of the above they are limited by an arbitrary line traced 5 to 10 km from the limits which have been defined by the CORINE LandCover project. These borders are not considered as the wetland site limits and their choice is not based on any ecological criteria. The only reason is the depiction of the borders between the outer wetland habitat units and the upland limits, and the depiction of transitional zones between wetlands and upland.



Presentation of wetland habitats

Types of lines

- Polygon wetland habitats (provided that they exceed the minimum mapping unit) are traced by solid uniform lines;
- Linear wetlands are those which are too narrow to be shown as polygons and they are as wide as the pen width. They are traced by dashed lines;

- Different types of dashed lines indicate different classes;
- Either linear or polygon wetland habitats that have not been identified on the aerial photographs or by Global Positioning System (GPS) during the field work, but they have been traced in an approximate manner, are drawn by a dashed line in a different colour (blue).

Penpoint widths

- All linework (linears and polygons) is done by the same pen width of 0.25 mm;
- Leaders and labels are drawn by pen width less than <0.25 mm.

Line colour

- All lines have the same colour (black).

Polygon colour

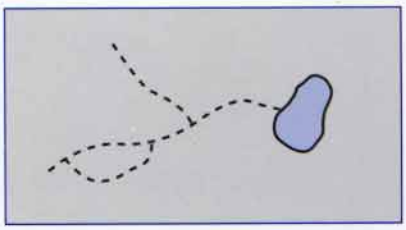
- To enable the rapid extraction of information, the polygons are coloured according to the System level. The colours of choice are:

Blue	for Marine
Magenta	for Estuarine
Aqua	for Riverine
Violet	for Lacustrine
Orange	for Palustrine

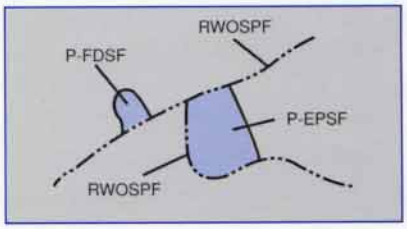
- If possible, the classes are also depicted by a specific shade of the colour that corresponds to the system which is assigned.

Graphical techniques

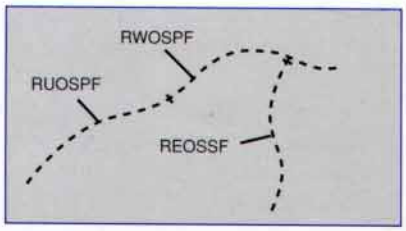
Linear wetlands always adjoin dash to dash, start with a dash and end with a dash.



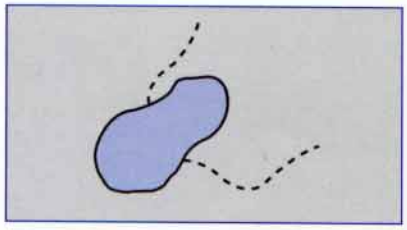
Polygons bordering linears may connect at a dot if the spacing of dots and dashes force it to. This is the only instance when this will happen.



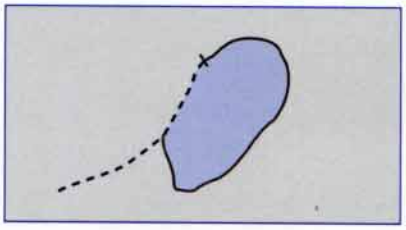
Break lines



Changes of habitat description are indicated by a break line which is made perpendicular to the linear or parallel to the primary linear, whenever possible, and it always goes through the dash. It should also centre across the linear.

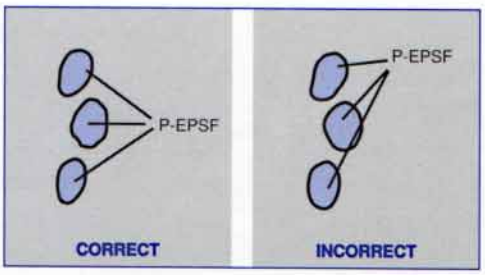


When a linear wetland begins at a polygon, it is not necessary to put a break symbol on thelinear wetland.

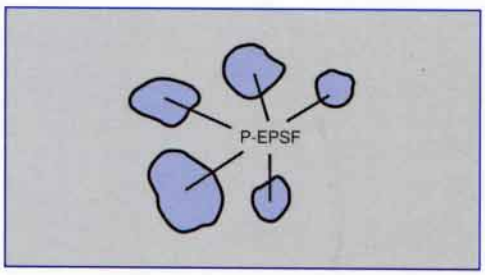


Linears that border along polygons only part of the way must have a break to show where they stop.

Leaders

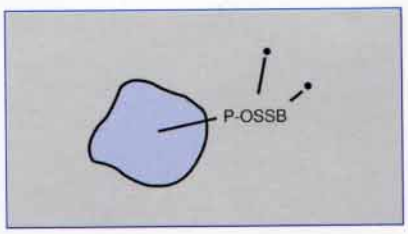


Leaders are drawn with a straight edge no less than 3 mm and no longer than 10 mm. They should never cross labels, breaks or other leader lines. Also, avoid crossing river systems or other polygons, to reach other polygons or river systems.

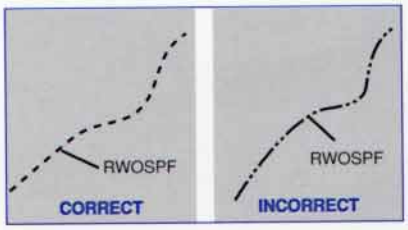


Labels can accommodate more than one leader. Two leaders to a label is considered as optimal, but on congested maps the numbers of leaders may increase.

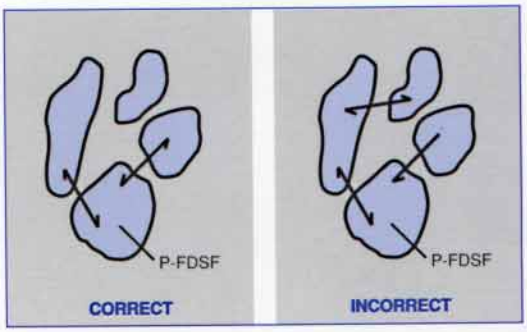
Leaders should always go to a point well inside the perimeter of the polygon. Very small polygons and dots should have their leaders stop just short of touching



Leaders pointing to linear features should always touch the centre of the dash.



Hook leaders may be used to tie together two polygons of the same classification when there is no room to label each separately. Each polygon must be large enough to place the hook inside without the hook touching the wall of the polygon. The length of the hook leader rates between the limits of the length of the normal leaders (3 mm-10 mm). The polygon must be hooked to one that has been labelled.

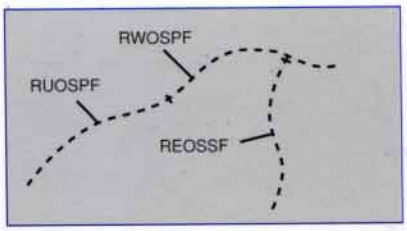


Label placement

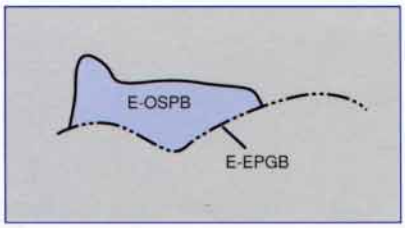
Care should be taken to avoid drawing labels over the features or drawing leaders through rivers or polygons to reach other rivers or polygons.

When large polygons cross a map and are closely intertwined, label these polygons at various points to aid in their identification.

Linear wetland habitats should be labelled more than once if they meander across the map or if they pass through congested areas.



Linears must be labelled on each side of all breaks.



Polygons whose sides are formed by linear wetlands must be labelled as well as the linear wetland.

Labelling of mapping units is performed according to specifications followed during the photointerpretation procedure.

Presentation of non-wetland areas

- The linework, the leaders and labels are done according to the above specifications;
- Non-wetland polygons are shaded using the CORINE LandCover colours;
- Linear upland areas are not included in the wetland habitat map;
- The wetland linework is usually used to define areas of non-wetland areas.

Base map elements

Contours

- Contour lines indicate relief and are shown in brown colour. The objective of representing relief is to portray the heights and shape of the land. The relief is shown for two purposes. First, to present an accurate geometric description of the terrain; and second, to give a picture of the landscape. Trigonometric and height symbols are used as well.

Roads

All roads are drawn as they are depicted on the topographic maps. Those that are not depicted on them are photointerpreted and transferred on the base map from the aerial photographs.

- If primary and secondary roads cross a polygon wetland habitat, then this polygon is divided into two separated polygons which have the same label.
- Improved roads and trails do not divide the polygons.

Urban areas

- Urban areas are photointerpreted only if their borders have been changed since the time of the base map production. Otherwise they are traced as they are depicted on the base map.

Boundaries

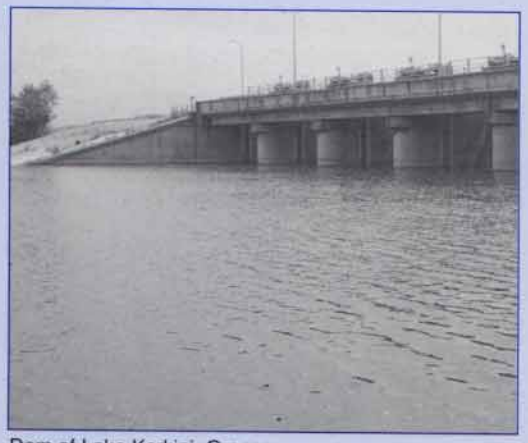
- International and administrative boundaries are depicted in the wetland habitat map as they are depicted in the topographic map.

Map legend

The wetland habitat description map legend should include the following:

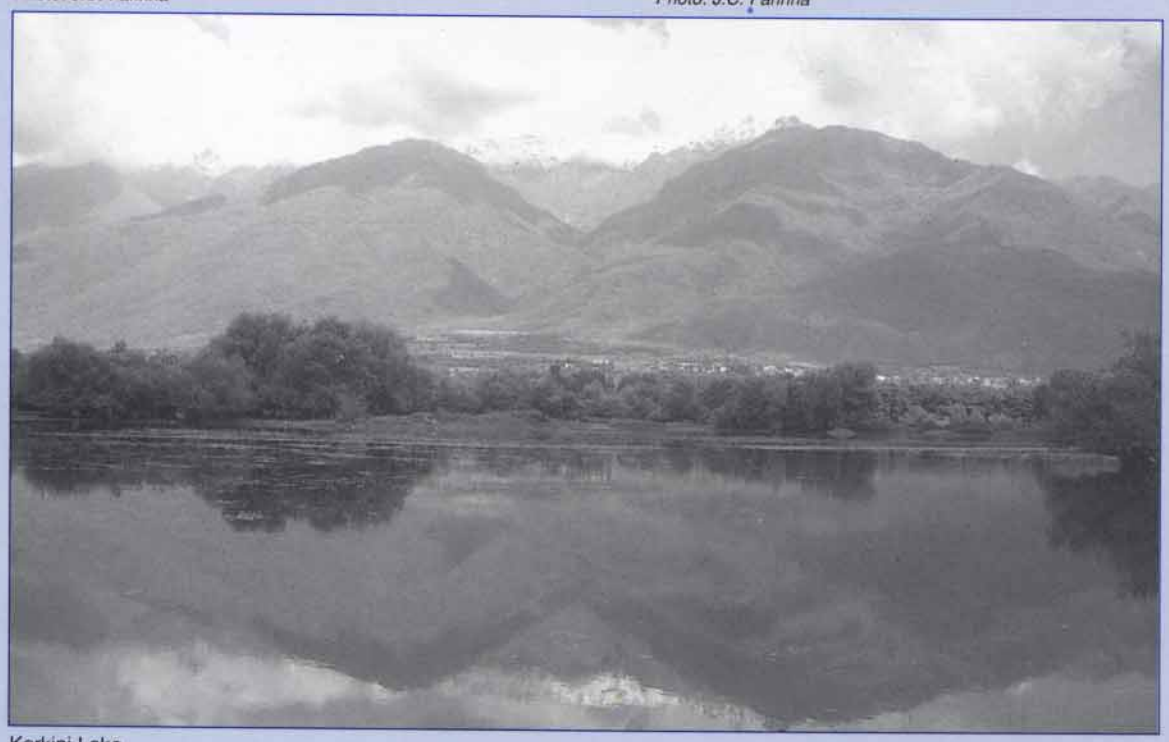
- **Base map legend** → describes the base map elements which are depicted on the Wetland Habitat Description map.
- **Legend for CORINE LandCover** → includes only the upland classification units that are depicted on the wetland habitat map.
- **Symbology example** → an example of wetland habitat units symbology is essential for the translation of the map information.
- **Wetland habitat description system** → every wetland habitat map should depict the wetland habitat description system.
- **Location map** → depicts the location of the wetland site to its catchment area and in the country.
- **Scale bar and scale function**
- **North symbol**
- **Information about** → map projection, name and scale of the topographic base map, scale, date and film type of aerial photographs.

Wetland Habitat Description of Kerkini Lake



Dam of Lake Kerkini, Greece
Photo: J.C. Farinha

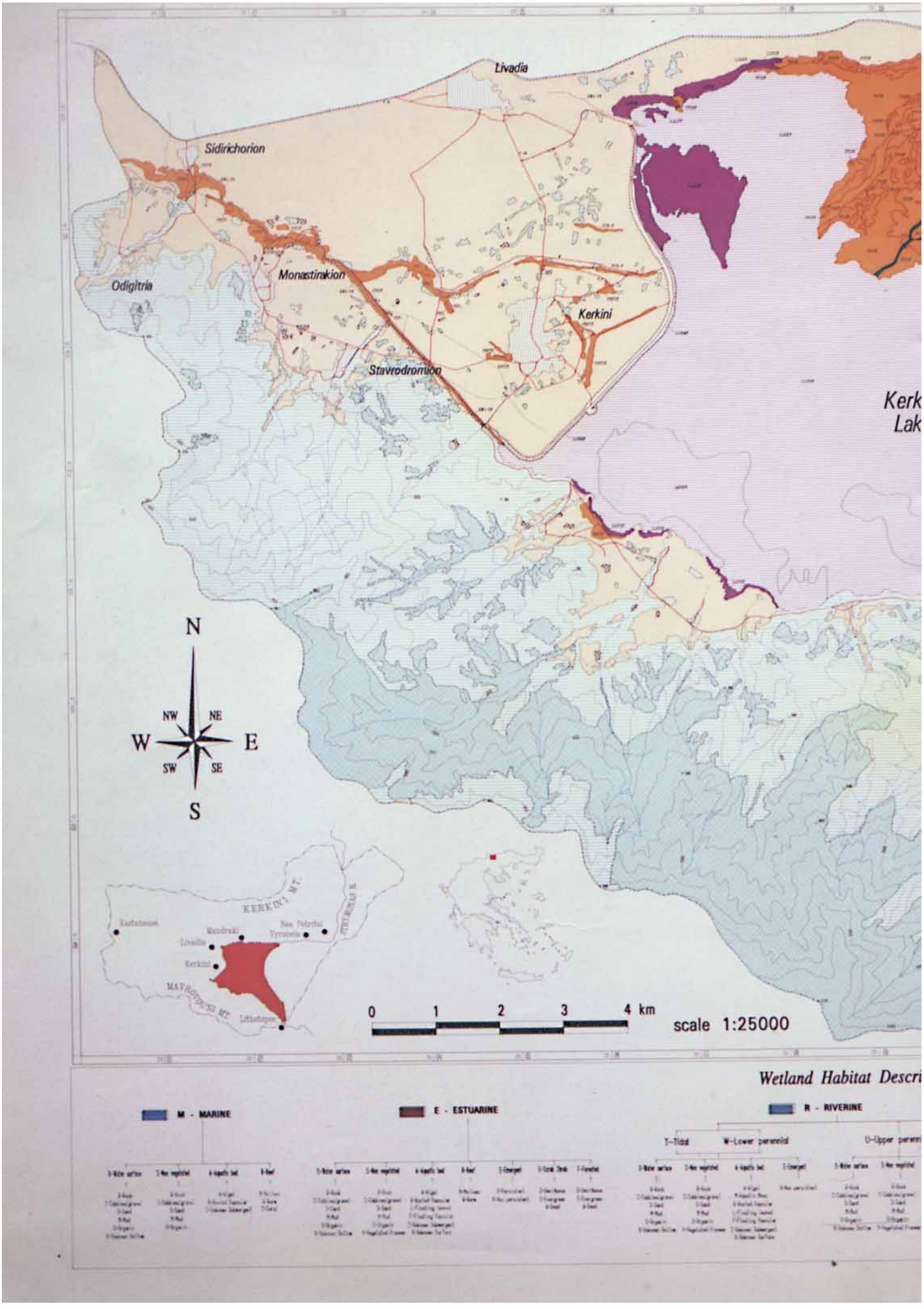
Forested wetland
Photo: J.C. Farinha



Kerkini Lake
Photo: J.C. Farinha

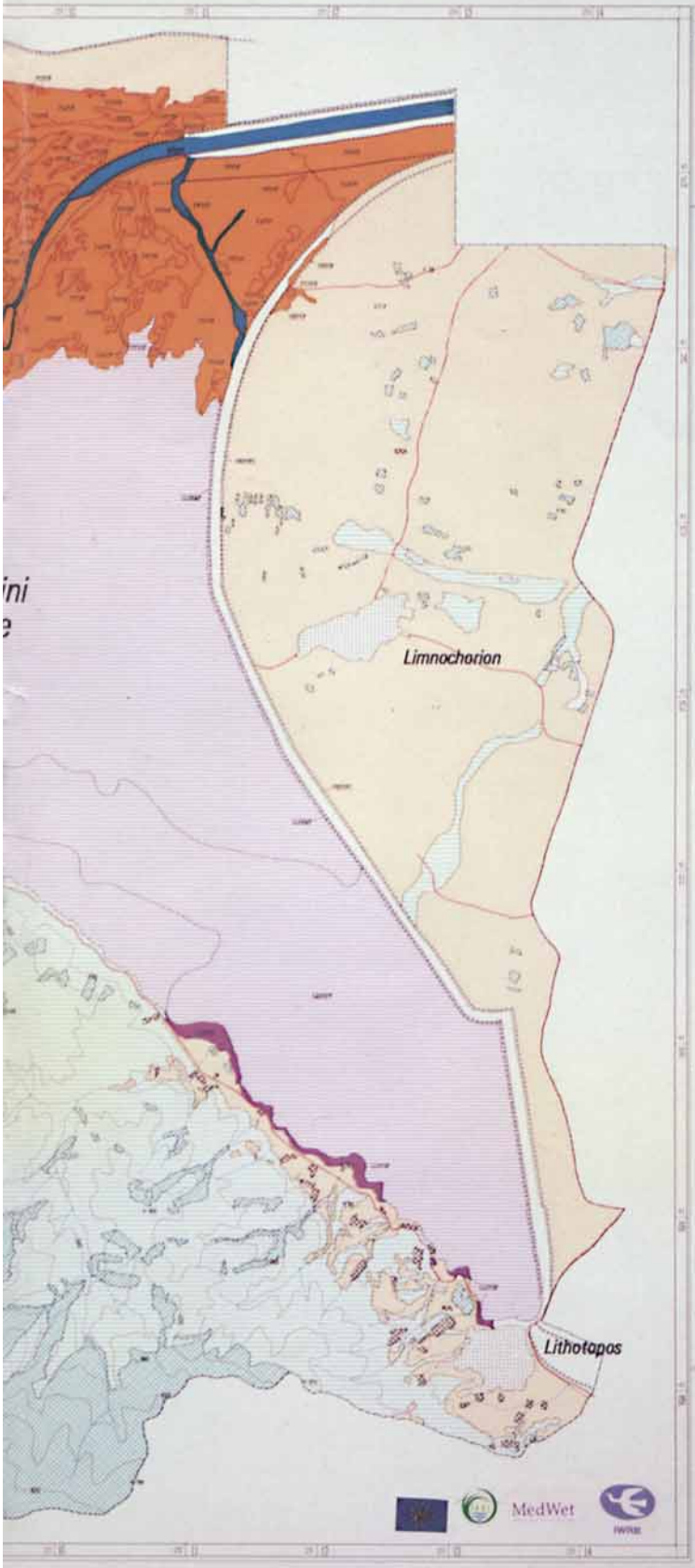
Birdwatching at Kerkini
Photo: J.C. Farinha

White Pelikan *Pelecanus onocrotalus*
Photo: J.C. Farinha


Livadia
Sidirichorion
Odigitria
Monastirakion
Kerkini
Stavrodromion
Kerk
Lak
N
NW
NE
W
E
SW
SE
S
KERKINI MT.
Kastanousa
Livadia
Kerkini
MAVROVOUNI MT.
0
1
2
3
4 km
scale 1:25000
Wetland Habitat Descri
M - MARINE
E - ESTUARINE
R - RIVERINE
T-Tidal
W-Lower perennial
U-Upper perenni

WETLAND HABITAT DESCRIPTION OF KERKINI LAKE

GOULANDRIS NATURAL HISTORY MUSEUM
GREEK BIOTOPE/WETLAND CENTRE (EKBY)



BASE MAP LEGEND

- Roads
- Railroads
- Fill-embankments
- Drainage network
- Contour-lines
- Watershed divide
- External Borderline
- Residential areas
- Trigonometrical points
- Spot-heights

CORINE LAND-COVER

- 1.1 Urban Fabric
- 2.1 Arable land
- 2.2 Permanent Crops
- 3.1 Forest
- 3.2 Scrub and/or herbaceous vegetation associations
- 3.3 Open Spaces

Symbology Example

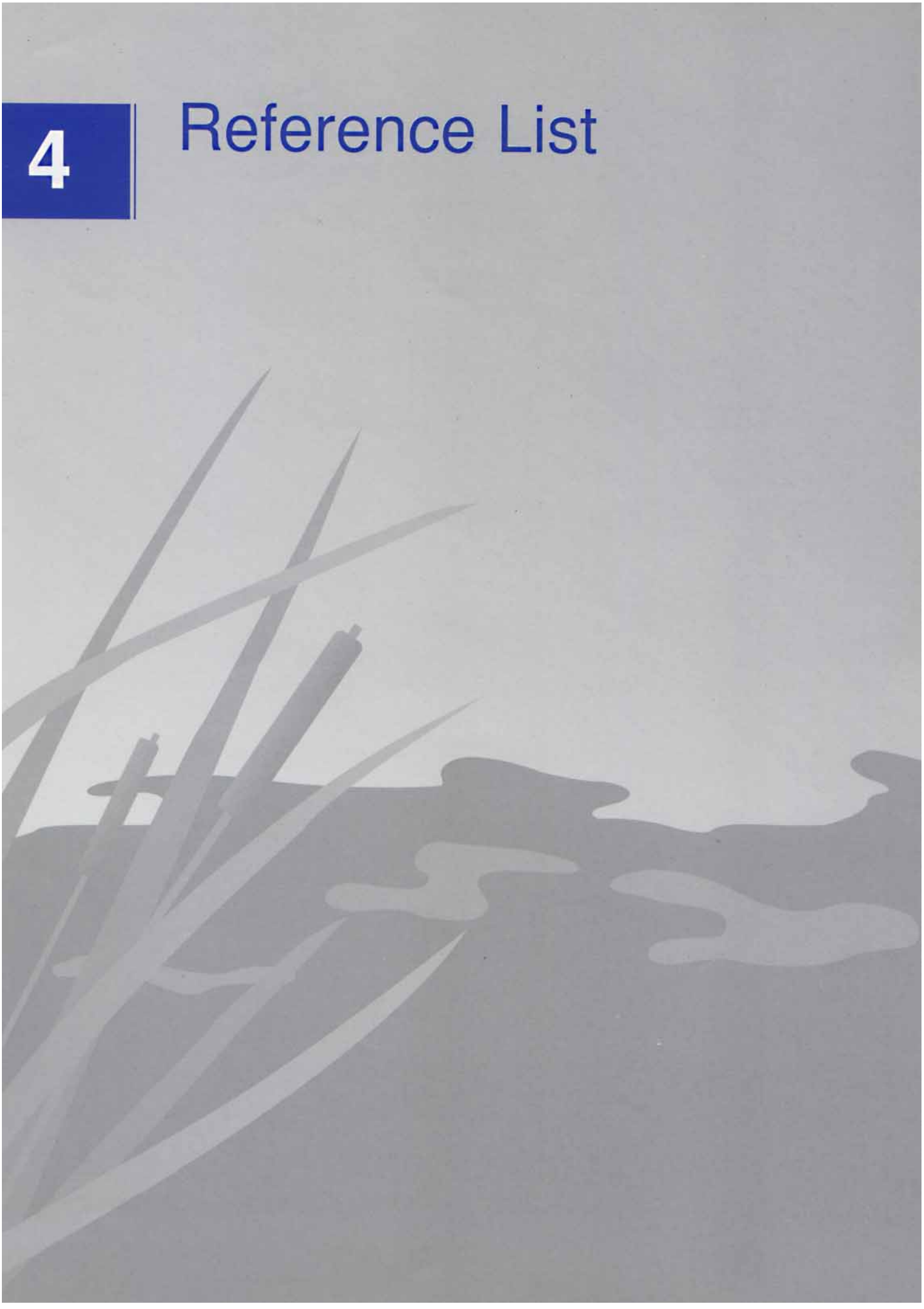
- The map was prepared by stereoscopic interpretation of 1:15000 scale aerial photographs, taken in 1992 and field investigations. The base map was produced by enlarging the 1:50000 topographic map (sheet: Kerkini) of H.A.G.S. The map typically reflects the wetland conditions of the specific year and season that aerial photographs were taken. Identification and classification of wetland habitats based on Wetland Habitat Description developed by MedWet subproject.
- This map is the output of a pilot study carried out in Greece by the Greek Biotope/Wetland Centre (EKBY) in collaboration with IWRB for the MedWet subproject on Inventory and Monitoring. Funds came from the EKBY project (Life contract No 9 91/91/GR/0102) and the MedWet project (Life contract No 843016 (827730)), IWRB contract No WM004. The project was supported by the Greek Ministry of Environment, Physical Planning and Public Works.
- The map processing and plotting was performed by EKBY in cooperation with the Laboratory of Forest Management & Remote Sensing, Dpt. of Forestry & Natural Environment of Aristotelian University of Thessaloniki.
- The Greek Biotope/Wetland Centre (EKBY) was established in 1991, as a result of a proposal to CEC by the Greek Ministry of Environment, Physical Planning and Public Works, under CEC contract Number B91/91 gin/0102 signed by the Commission of European Communities (DG XI) and the Goulandris Natural History Museum.

MODIFIERS

WATER REGIME		WATER SALINITY	ARTIFICIALITY
NON TIDAL WATERS	TIDAL WATERS		
F-Permanently Flooded	H-Subtidal	1-Fresh (<0.5 g/l)	A-Artificial Floodplain
G-Intermittently Flooded	J-Irregularly exposed	2-Fresh/Brackish (0.5-5.0 g/l)	C-Canal
H-Seasonally Flooded	K-Regularly Flooded	3-Brackish (5.0-18.0 g/l)	D-Reservoir
J-Temporarily Flooded	L-Irregularly Flooded	4-Brackish/Salt (18.0-30.0 g/l)	E-Wet Pond
U-Intermittently Flooded	U-Saturated	5-Salt (>30.0 g/l)	S-Saline
V-Saturated	F-Permanently Flooded-Tidal	Y-Unknown	X-Mud
Y-Unknown	G-Intermittently Flooded-Tidal		Y-Sand
	H-Seasonally Flooded-Tidal		
	J-Temporarily Flooded-Tidal		
	Y-Unknown		

tion System

4 Reference List



4. Reference List

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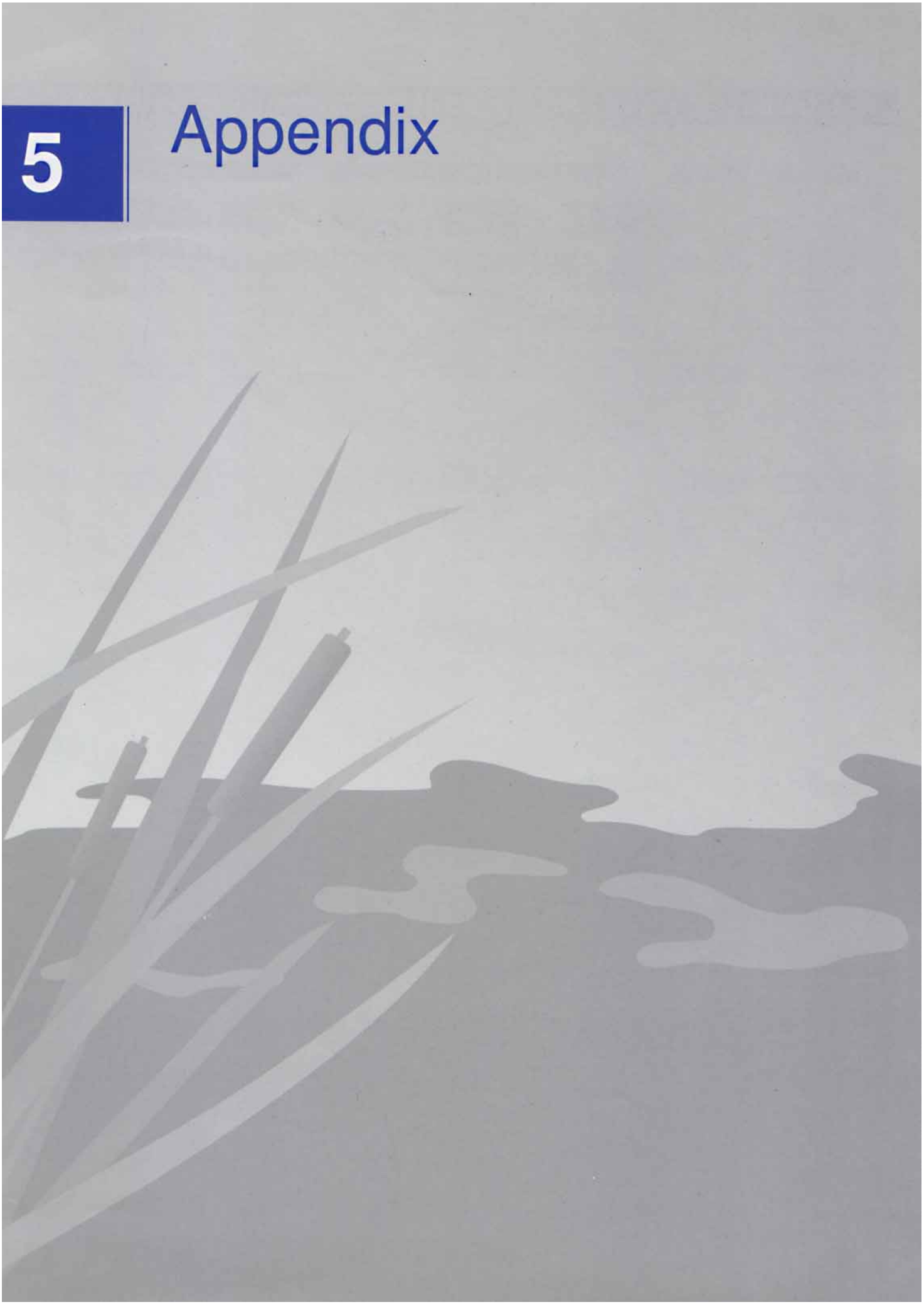
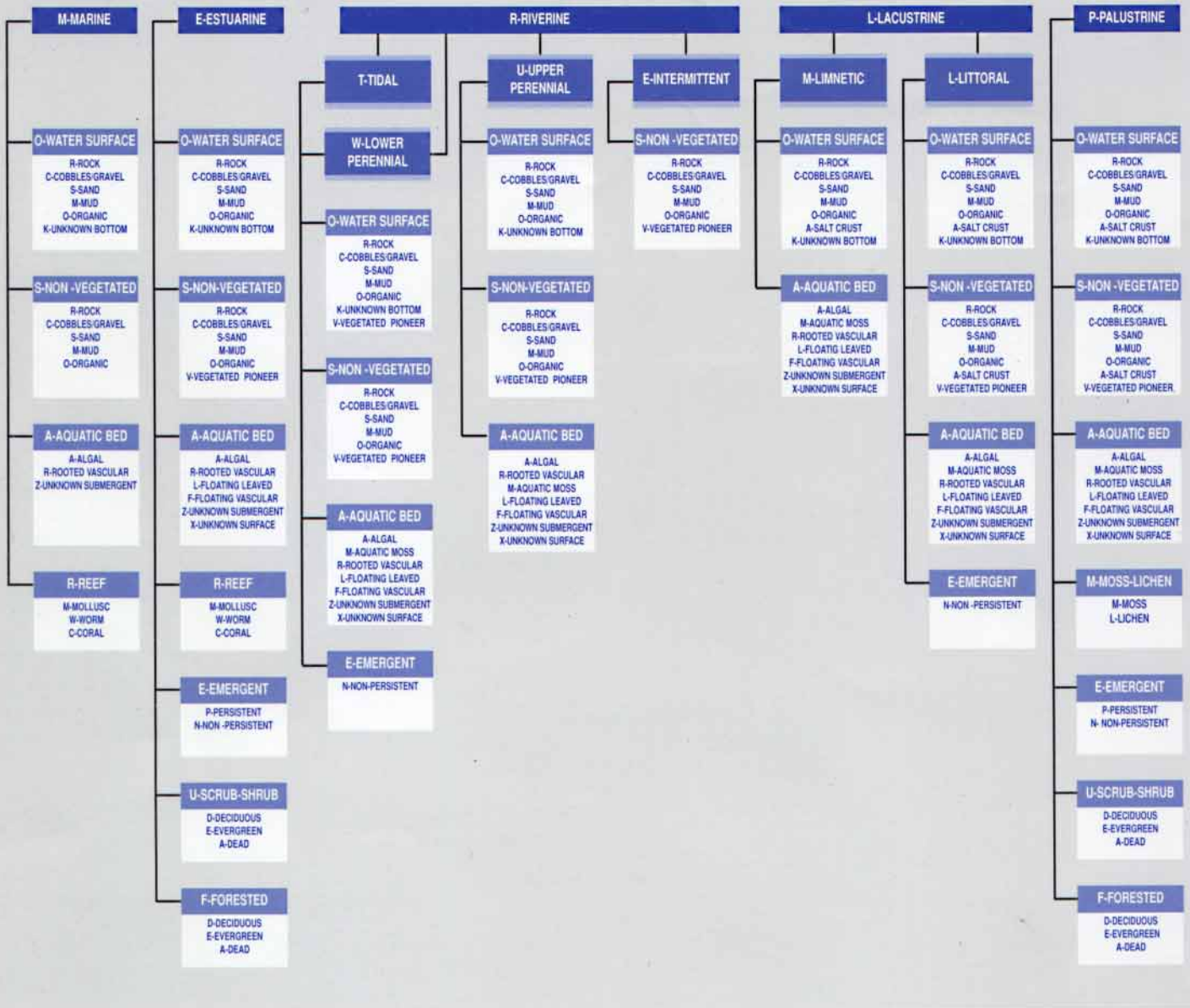
National Wetlands Inventory. 1994. *Manual for Cartographic Conventions.* US Fish and Wildlife Service. St. Petersburg, Florida USA.

5 Appendix



MEDWET WETLAND HABITAT DESCRIPTION SYSTEM



WATER REGIME MODIFIERS

MARINE-ESTUARINE
P-Permanently flooded
S-Subtidal
A-Irregularly exposed
R-Regularly flooded
G-Irregularly flooded
U-Saturated

RIVERINE-LACUSTRINE-PALUSTRINE
P-Permanently flooded
L-Semi-permanently flooded
S-Seasonally flooded
T-Temporarily flooded
I-Intermittently flooded
U-Saturated

TIDAL AREAS OF RIVERINE-PALUSTRINE
F-Permanently flooded-tidal
Y-Semi-permanently flooded-tidal
R-regularly flooded
E-Seasonally flooded-tidal
M-Temporarily flooded-tidal

ARTIFICIALLY FLOODED AREAS
A- Artificially flooded

WATER SALINITY MODIFIERS

COASTAL HALINITY
F - Fresh
O - Oligohaline
M - Mesohaline
P - Polyhaline
B - Mixohaline
S - Euhaline
H - Hyperhaline

INLAND SALINITY
F - Fresh
X - Mixosaline
E - Eusaline
Y - Hypersaline

ARTIFICIAL MODIFIERS

F - Farmed
A - Artificial substrate
S - Spoil
E - Excavated
D - Dicked/Impounded
P - Partially Drained/Ditched
B - Farmed - Diked Impounded
C - Artificial - Excavated
G - Artificial - Diked/Impounded
H - Artificial - Excavated - Diked/Impounded
J - Spoil - Excavated
L - Spoil - Diked/Impounded
M - Spoil - Excavated - Diked/Impounded
N - Excavated - Diked/Impounded

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