



# Eel status and management in Tunisia

### Venice 28-30 May 2012

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## **Eels and Wetlands**

### 1347wetalnds :

- 370 Natural : lagoons, rivers, sebkha,
- 1077 Artificial : dams, reservoir, channel,
- ...more or less connected to the Mediterranean



## **Eels and Wetlands**

 National Hydraulic plan and Continuous restoration of Natural wetlands, tends to multiply Artificial wetlands and interconnection





### **Eels and Wetlands**

### Anadromous fish Alosa fallax



Last record 1983

### Catadromous fish

Anguilla anguilla



### **Common migratory fishes**

Mugil cephalus

Solea vulgaris

Dicentrachus labrax



# **Eels and wetlands**



Wetlands Types	LAGOONS	SEBKHA	ESTUARY	PETLANDS	SPRING	GARAET	SALINAS	OASES	TIADL ZONE	ISLANDS	WADII	ARTIFICIAL Wetlands
Nbr of wetlands	13	71	5	2	5	31	7	6	4	60	64	1077
<b>Ramsar Sites</b>	5	7	1	2	1	2	2	2	2	2	2	7
Fish species	45	1	22	0	1	1	1	3	30	55	4	11
Eels	***	*	***					*	**	**	**	**

- Eels are **recorded around all the inlands water and marine** water in Tunisia.
- Despite the **lack of fish passes** eels reach most of dams and reservoir through hydraulic structures and interconnections
- Eels are not commonly consumed in Tunisia

## **Eel production and trends**

Eels production during the period : 1995-2010



Eels (T)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Моу	%
Marine	136	196	126	99	120	83	92	79	96	61	103	105	126	207	37	28	106	<b>59</b>
Wetlands	106	80	75	63	86	27	43	123	70	47	65	145	124	95	69	55	80	41
Total	242	276	201	162	206	110	135	202	166	108	168	250	250	302	106	83	186	

## **Eel production and trends**



## **Eel production and trends**



Ghar El Melh Lagoon (natural)







#### *Tunis lagoon (restored)*

Marine area



# **Eels production and trends**

Summary of intermittent and continuous time series data for stocks of European eel: commercial fishery monitoring data in coastal, lagoon and inland habitats

HABITAT TYPE	Country	Location	Data source/type	Years	Temporal trends over data duration t-test or Pearson correlation significance level shown or NS = trend not significant
A. COASTA	L WATERS: FI	SHERY-INDEPENDENT DATA			
11	Tunisia	Tunisia North	Fisheries Authority/Longline bottom set Trammel net , [B]	1995-2008 [T]	Significant over series duration between 1995-2008 and since 1997, p<0.005; <u>Note : significant increase trend since</u> <u>2008</u> .
12	Tunisia	Tunisia East	Fisheries Authority/Longline bottom set Trammel net , [B]	1995-2008[T]	NS over series duration, p<0.005; but significant decline since 2000 to 2006, then less increase since 2007. <i>Note : Increase in CPUE</i>
13	Tunisia	Tunisia South	Fisheries Authority/traditiona I fisheries , Longline bottom set Trammel net , [B]	1995-2008[T]	Significant increase tend over series duration between 1995-2008, p<0.005; <u>Note : significant increase trend since</u> 2008.

# **Eels production and trends**

B. LAGOON	S/TRANSITION	AL WATERS: FISHERY-INDEPEND	ENT DATA		
1	Tunisia	Coastal lagoon Ghar El Melh	Fyke net[B]	1995-2008[T]	Significant increase tend over series duration between 1995-2008, p<0.005. <u>Note : maximum of production in 2007</u>
2	Tunisia	Coastal lagoon Tunis	Fyke net[B]	1995-2010[T]	NS over series duration between 1995- 2010, p<0.005. <u>Note : Record production in 1995 (70533</u> <u>tons).</u>
3	Tunisia	Coastal lagoon Bizerte	Fyke net[B]	1995-2010[T]	NS over series duration between 1995- 2010, p<0.005.
	Tunisia	Coastal Northern lagoons (all lagooner production in the North)	Fyke net[B]	1995-2008[T]	NS over series duration between 1995- 2008, p<0.005and no signal to decline during this series. <u>Note : production exceeding 100</u> <u>tonnes/year in years of 1995, 2002, 2006</u> <u>and 2007.</u>

C. INLAND I	RESHWATER: I	SISHERY-INDEPENDENT DATA			
1	Tunisia	Ichkeul	STL/Fyke net [B]	1995-2010[T]	NS over series duration between 1995- 2010, p<0.005. <u>Note : Record Production in 1995, 2002</u> and (recently 2011)
2	Tunisia	Lebna	Trammel net[B]	1995-2008[V]	-

<sup>a</sup> [N] = numerical or density-based data; <sup>b</sup> [T] = longer-term time series data used in further analyses; <sup>c</sup>[B] = biomass-based data; <sup>d</sup> [V] = intermittent data with variable gaps between surveys.

### Recovery Program: Tunisian management plan

#### Management plan for eels in Tunisia (set on 2009 – 2010) :

- Administrative bodies: APD (Directorate General for Fisheries and Aquaculture), DGF (Directorate General of Forestry representative CITES),
- Technical agencies: GIPP (Interprofessional Group for Fishery Products), CTA (Technical Center of Aquaculture), ANPE (National Agency of Environmental Protection), DGBGTH (General Directorate for Dams and Large Hydraulic Works), APAL (Agency of Protection and Management of the coasts),
- Professional organisms, UTAP (Tunisian Union of Agriculture and Fisheries),
- NGOs , ATSMer: Tunisian Association of Marine Sciences and AAO: Association of Friends of Birds
- Research institutions : INSTM (National Institute of Marine Sciences and Technology) INAT (National Institute for Agricultural sciences).

#### Issues and goals for our country as:

- Help rebuild the specie stock by minimizing direct mortality factors,
- Improve habitats for eels by the conservation of water quality and environment,
- Maintain a sustainable commercial fishing and a clear economic operation,
- Reduce or eliminate illegal fishing and trade,
- Better knowledge of the industry operating, marketing and develop formulas certification and traceability of catches, transportation, export,
- Improve the processes of data collection and monitoring the specie and its habitats

### **Tunisian management plan**

### 1. Implementation of 4 Eels Management Units



### **2.** Inventory and characterization of the potential habitats

Region	Catchement area	hydrosystem	Locality	L (km) S (ha)	dept h (m)	Sal. (psu)	hydrology	Hydraulic works	Sea way	Exploitation	Status
	Medjerda (	O. Bouhertma	Fernana	60 Km		1,4	Permanant	B. Bouhert ma ( 880 ha)	Via Mejerda	Restocking	
	23700 km	O. Medjerda	Testour, Zarga, Mejez El Bab	245 Km		1,9	Permanant	B. Sidi Salem (4300ha)	Via Mejerda	Restocking and fisheries	•
North –ea	<sup>,₂</sup> dont 16 ≈57(	O. Lakhmes	Siliana	12 Km			Temporary	B. Lakhmes (102 ha )		Restocking and fisheries	•
st & M	100 er 2000 hu	Canal Medjerda	Kalaât El Andalous	120 Km		2,6	Permanent	-channel		fisheries	
lejerda	י Tunisie) ז	Lagune Ghar El Melh	Ghar El Melh	3000 ha	0,8	37,8	-	-	Open	fisheries	Ramsar
	Super	Lagune Nord	Tunis	2500 Ha	1,5		-	Gates Bordigue	Open	Concession	
	ficie	Lagune Sud	Tunis	860ha	1,5		-	-gates	open	Reserve	
	en eau	O. Meliane	Bir M'cherga	80 km	1,05	3,0	Permanent	B. Bir M'cherga (2000ha)		Restocking and fisheries	

### **2.** *Inventory and characterization of the potential habitats*

Gradually eels are commonly fished in lagoons than in coastal areas and lesser extend in other wetlands.

The major fisheries zones are the northern lagoons (Bizerte, Ichkeul, Ghar El Melh and Tunis noth) were a specific and target fisheries are deployed. And secondly the fisheries of the Gabès gulf (Kerkenna, El Bibane and Zarat) where they are not specifically targeted.

In terms of area, among 950000 ha of water bodies (without marine area) identified across the 4 Management units, operating sites for eel cover about 124,493 ha. Which represent only 13% compared to all the potential sites of the eels presence Furthermore, it should be noted that among the wetlands surveyed, 35 sites are listed as Ramsar sites.



### 3. Characterization of eels and acquired on their bio-ecology

Interest on Eels in Tunisia began early :

• Since the 20s: ecolgy Heldt (1928), glass eel Heldt and Heldt (1928 and 1929) processing (Heldt, 1931).

• Since the 80s, bio-ecological studies have been carried as Thesis works Said (1981), Sanekli (1981), Chaouch (1981), Romdhane(1985)....

• Scientific cooperation Machta (2001) and Hizem (2003),

• Technical cooperation project FAO and GIPP : Support to development and resource management in European eel: 2004-2007,

• Biological and technical aspects (age, growth, physiology, parasitology, catch, processing and exploitation in lagoons :Tunis North, Ichkeul, Ghar El Melh, Mejerda wadii and Kalaat El Andalus channel, Lachheb (2004), Ben Achiba(2004), Ayari (2006), Zammouri, and Tounsi (2006 and 2007), Ounis (2007) and Mestiri(2009).





### **Eel population structure : Age structure**



### **Eel population characterization**

Ref.	zone	W = f(Lt)	b	R²	Allometric Type
Machta (2001)	Ichkeul lagoon	W=0,0015Lt <sup>3,0301</sup>	3,0301	0,95	isometric
Hizem (2003)	Kalâat El Andalous channel	W=0,0012Lt <sup>3,07</sup>	3,07	0,94	isometric
Attya (2006)	Tunis north lagoon	W=0,0014Lt <sup>3,0378</sup>	3,03	0,91	isometric

length-mass comparison of eels from different water systems in northern Tunisia = isometric

Ref.	zone	K <sub>winter</sub>	<b>K</b> <sub>Spring</sub>
Machta (2001)	Lac Ichkeul	0,164	0,183
Hizem (2003)	Canal de Kalâat El Andalous	0,165	0,14
Attya (2006)	Lac de Tunis	0,156	0,17
Kalai (2008)	Lagune de Ghar El Melh	0,17	0,176

Comparison of seasonal variations in condition factor K of eels from different water systems

### **Eel population characterization**

Linear annual growth: the eel population Tunisian presents a fast growth rate until the age of 3 years (otolths, length cm).



	Ichkeul (Hizem 2003)	Kalâat El Andalous	Lac de Tunis (Attva 2006)	Lagune de Ghar el Melh (Kalaj 2008)
Sex-ratio	0,32	0,8	0,27	0,38

#### Sex ratio (male/female):

Comparing the sex ratio is used to analyze the impact of environment on sex determination of the eel., there is a predominance of females in the lagoon of Ghar El Melh, Tunis and Ichkeul, and male predominance at Kalaat el Andalus channel(0.8).

### **Eel population characterization**

Eels diets :

Qualitative analysis of stomach contents shows the omnivorous behavior : its diet consists of insect larvae and nymphs, crustaceans (amphipods, isopods, copepods, ostracods), molluscs (gastropods and cephalopods), fish (gobies and silversides) and algae. Quantitative analysis has meanwhile shown that fish and shellfish are the preferred prey of the eel.



#### Arrival :

The monitoring of recruitment of elvers showed that the first shipments of glass eels begin from January to July even in August, with a maximum in June. However the colonization depend from year to the second and from a site to an other

in June there are 0 and 6.66% eel elver stage VI a2. In August 50% of eels are stage VIIand there is 0 elver stage VI a2. In July the dominant stage is the stage VI a4representing 56.62% of the catch

#### **Escapement estimation:**

the period of escapement of silver eel in the lagoon of Ghar El Melh and Ichkeul is November-December, during this period we notice a significant drop number of yellow eels and intermediaries,

### 4. Management plan and legal tools

The fishing activities in Tunisia is governed by Law No. 94-13 of January 31, 1994, and the decree of 28 September 1995 and its implementing applications...., which stipulates :

It is prohibited to fish:

1) larvae
2) using firearms;
3) by means of explosives;
4) using toxins or poisons;
5) by means of light except for the capture of fish passage;
6) by disturbing the water bodies
7) by building barriers at the mouths of rivers.

Square mesh for eel fishing (10mm), Triangular mesh for eel fishing (15mm)

**Setting the minimum size of capture to 30 cm:** prohibited to transport, sell, store and process or use as bait, aquatic species for which fishing

# Management plan : what's done

- 1) Establishment of a Steering Committee composed of all representatives departments, institutions and agencies.
- 2) Technical exchange and assistance with Cemagref Bordeaux
- 3) Inventory of tasks, information and data required by each representative and stakeholders in the development of this management plan. Inventory which was inspired by the remarks and recommendations made by the Group of Scientific Experts from the European Union in its review of "Report on the exploitation of eels in Tunisia" dated September 11, 2009, and pieces of information gathered from the Regulation (EC) No 1100/2007 of 18 September 2008 establishing measures for the recovery of European eel;
- 4) Establishing a committee for the coordination and report on the management plan for eels in Tunisia (representatives of the administration (fisheries and environment), scientific and the profession.
- 5) Organization of a scientific seminar on the current status and management of the eel in the Mediterranean (23-24 September 2010 at Salammbo, Tunisia), jointly by the National Institute of Science and Technology of the Sea (INSTM) and the General Fisheries Commission for the Mediterranean (GFCM). This is intended to inspire us experiences of Euro-Mediterranean countries have already developed their management plan for the eel.
- 6) Establishment of a monitoring committee for the implementation of the management plan (representatives of the administration (fishing and environment), scientific research and the profession).

# Management plan : major recommandations

1 New regulation of fishing campaign : 4 months/year one period : Nov- Feb or two period Nov–Dec and March-Apr

2 Enhance connectivity between habitat : Restoring migration routes and eels habitats Expect the operation of the elver passes at Ichkeul Other fish passes are recommended for priority dams (Kalaat Al Andalus, Laaroussia Sidi El Barrak and Lebna).

3 Restocking action for temporary isolated zones.

4 Action to set up eels-reserves of some sites (south part of Tunis lagoon, Korba lagoon, the sebkha of Ariana, the delta of Medjerda river and the downstream parts of the coastal wadis.)

5 Monitoring of Habitat and ecosystems



## Management plan : to be continuoud

- Analysis of current distribution of eels in Tunisia,

- Monitoring and stock assessment of populations by each functional unit,

-Analysis of current distribution of eels in major hydro-systems,
-- Evaluation of biomass, particularly the assessment of future spawning biomass (annual potential) that might escape in each hydro-tracking system,
- Summary Assessment of human pressures (fishing mortality, barriers to hydropower, pollution ...) and environmental pressures (climate change, diseases...).

- Development of business models of population,

- Monitoring the health quality of eel populations with emphasis on contamination by toxic pollutants: heavy metals and PCBs.

# Thank you

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## Management plan : how its planned to works

