جامعة محمد الخامس أكدال
Mohammed V –Agdal University

Sustainable Eel Group

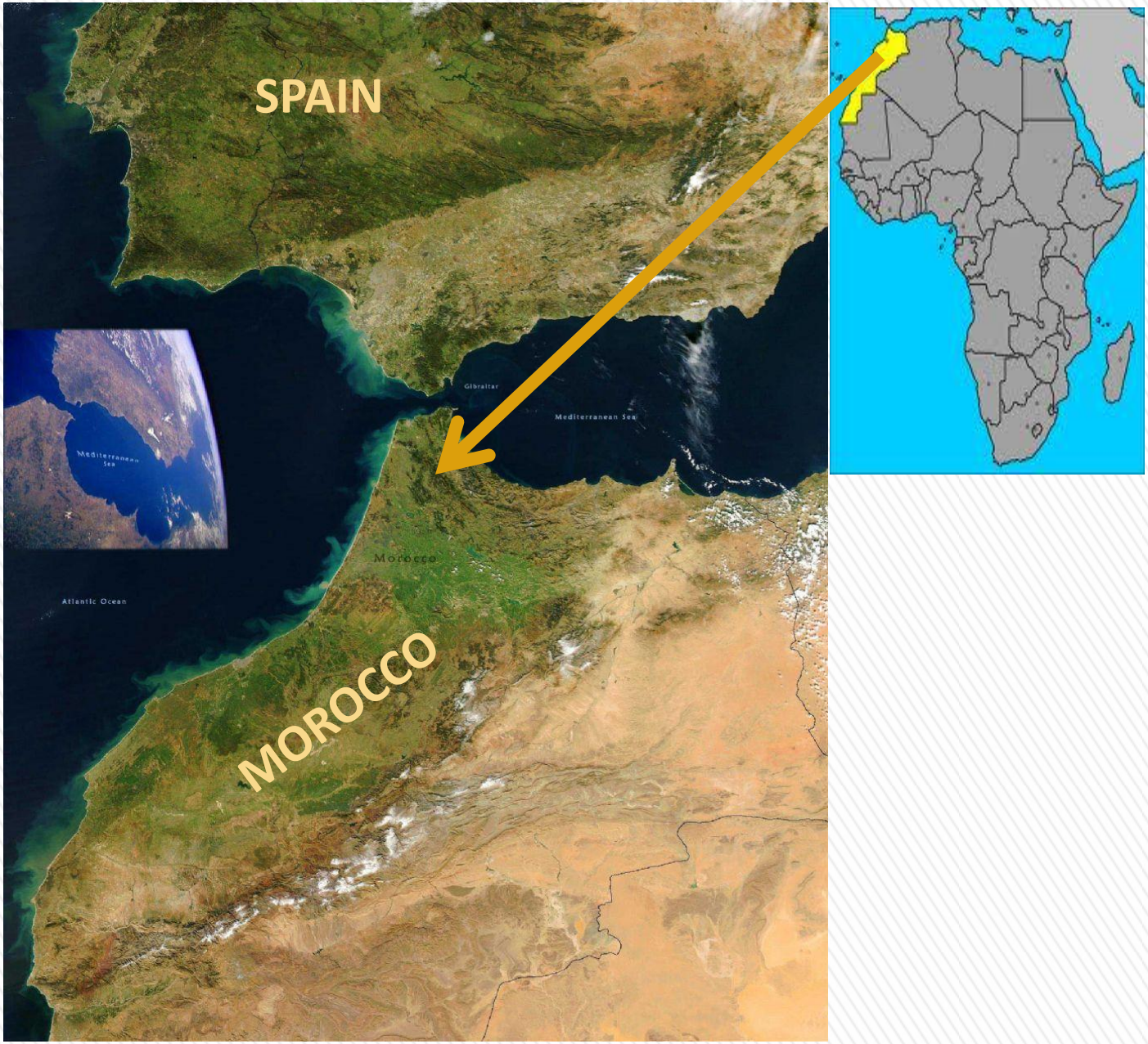
كلية العلوم الرباط
Faculty of Science – Rabat

SUSTAINABLE EEL GROUP CONFERENCE
28th to 30th May 2012 in S. Servolo Island, Venice, Italy

Eel in Moroccan inland water, status of stock and fisheries

Fatima Wariaghli, Mohammed Al Amouri & Ahmed Yahyaoui

Faculty of Science, Mohammed V-Agdal University, B.P. 1014 RP - Rabat, Morocco Tel. / Fax : + 212 5 37 77 54 61
Email: wariaghli_fatima@yahoo.fr/ a.yahyaoui@fsr.ac.ma ;



Eel in Morocco

Introduction

Eel (*Anguilla* has a long

concerns all

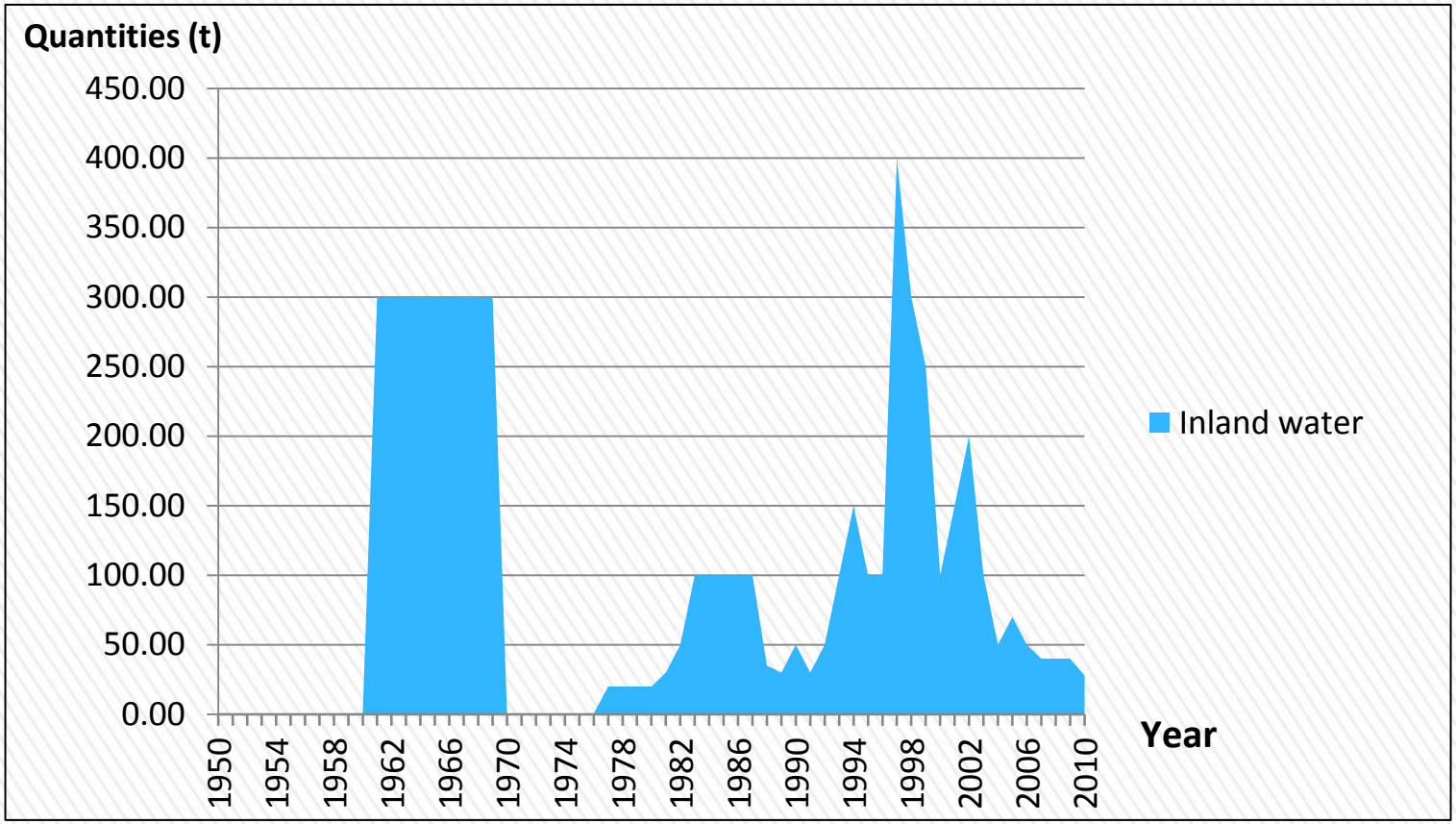
- glass eel,
- yellow eel
- migratory s

Silver eel

Because glass eel has a high economical value, a strong illegal activity is going on.

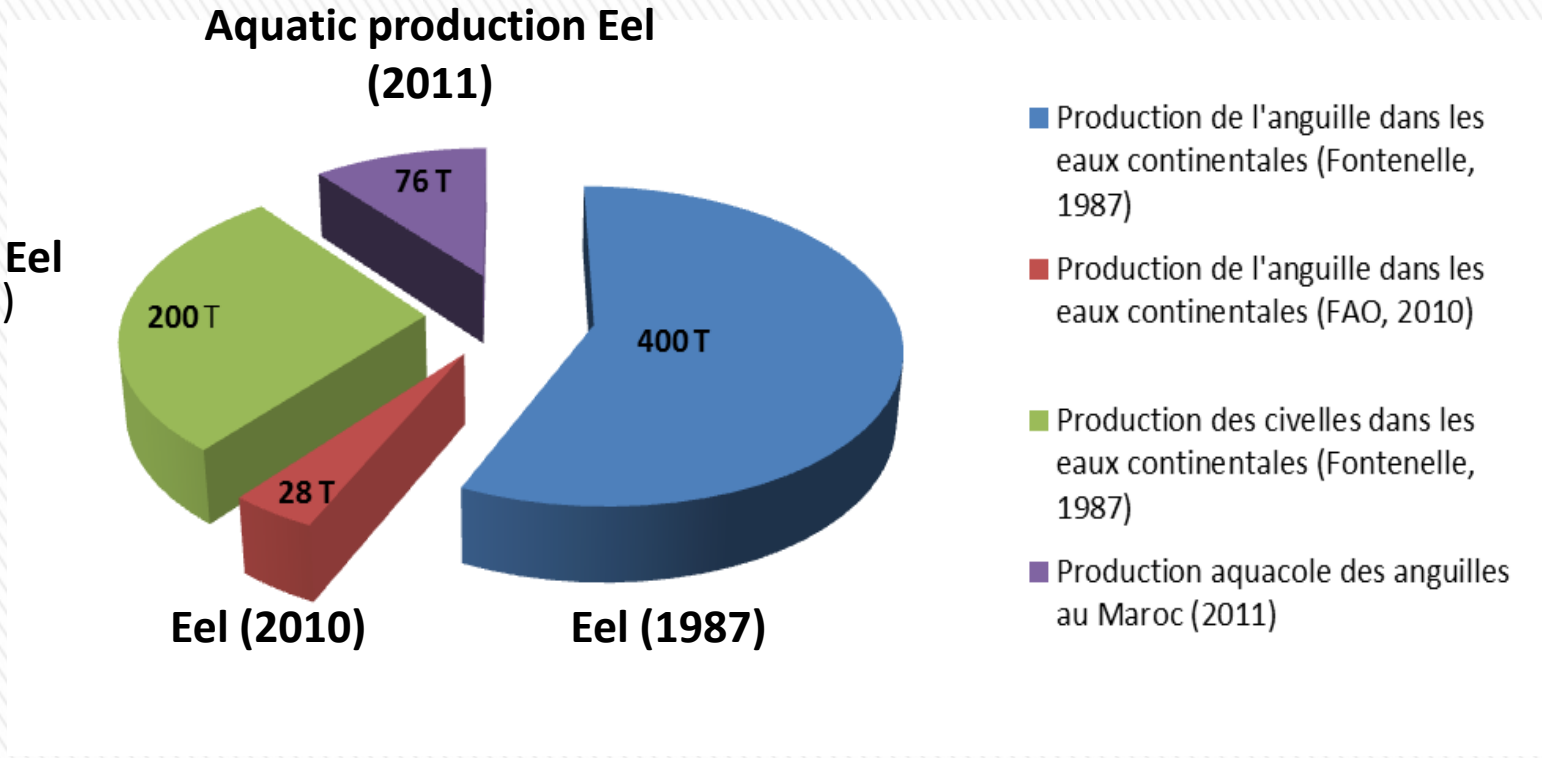
- Stocks of European eel (*Anguilla anguilla*) have declined continuously and steadily since 1980 and continue to drop.

- In Morocco, the peak of catch capture was reached in 1997, 17 years later then Europe.



Capture production of eel in Inland waters Morocco

(FishStat Plus v. 2.32, FAO)



Production of eel and glass eel in inland water

Legislation

- On March 17th, 2011 the committee meeting of fishing in inland waters of Morocco has set urgent measures (changing the close seasons, reducing the quota of eel fishing, controlling the aquaculture companies of eels…) which will improve the management and the conservation of eels.

- The exploitation of glass eels may only be allowed to the establishment of eel aquaculture, whom realized the breeding infrastructural under the license authorization.

- These institutions must obligatory obtain an authorization as exporter.

- Eels don't coming from approved establishments and do not have been previously weaned are banned for export.

Legislation

Fishing quotas of glass eel and eel from leased fishing sites 2011-2012

SITE	Allowable catch for glass eels (kg)	Allowable catch for eel (tons)
Sebou river	2000	22
Drader river	150	2
Loukkos river	350	4
Total	2500	28

In the order released by authorities, “fishing quota” signifies: the maximum quantity of catches effectuated at a given site. The quantity was determined by the MHCOWFDC following consensus of CITES’s national scientific authorities. The fishing quota is the mass of live weight measured in tons or kilograms.

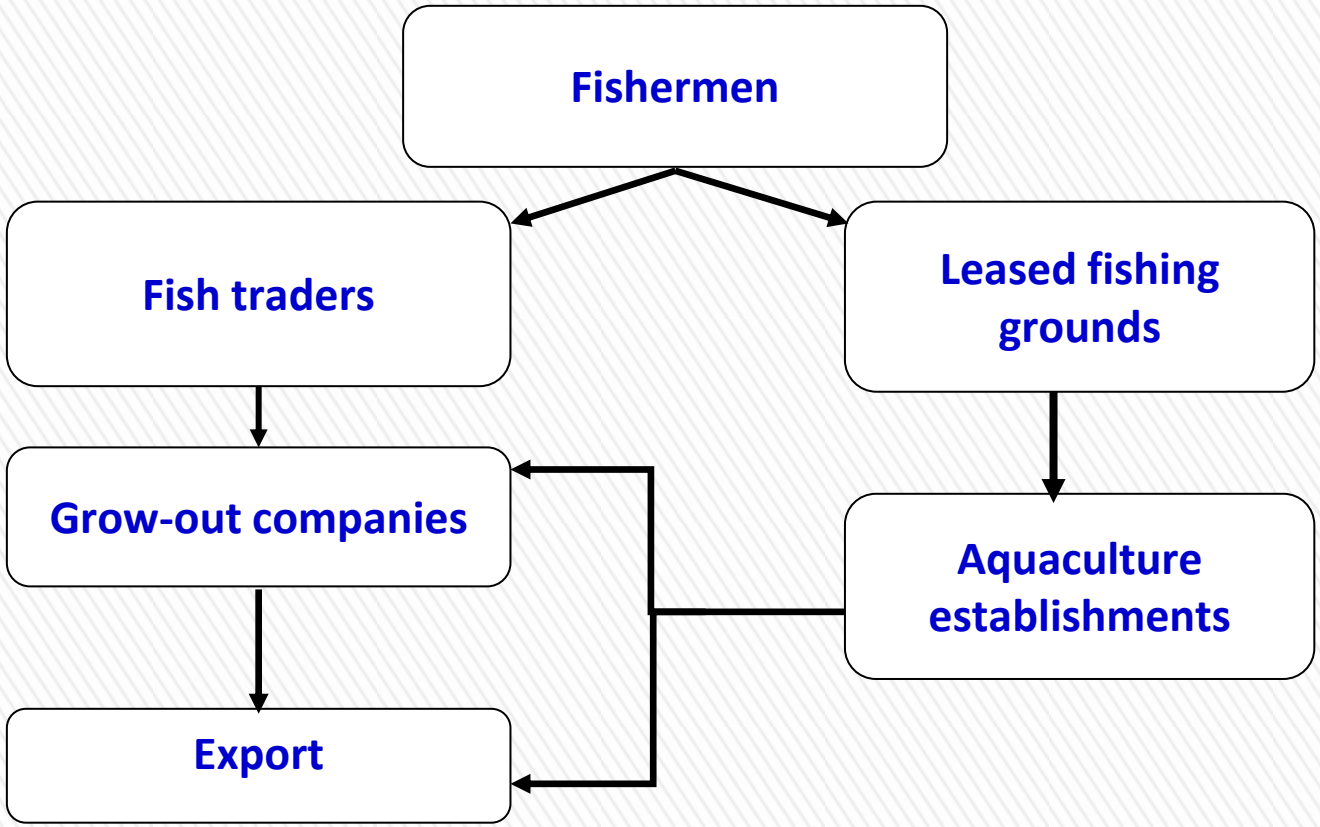
Legislation

Opening and closing dates for eel and glass eel fishing in Morocco

Opening date at sunrise	Closing date at sunset	Number of fish authorized	Observations
March 14, 2010 **November 28, 2010**	May 2, 2010 April 30, 2011	According to the attributed quota	Exploitation, reserved exclusively to leased fishing grounds
March 18, 2011 **December 11, 2011**	June 12, 2011 June 10, 2012	According to the attributed quota	Exploitation reserved exclusively to leased fishing grounds

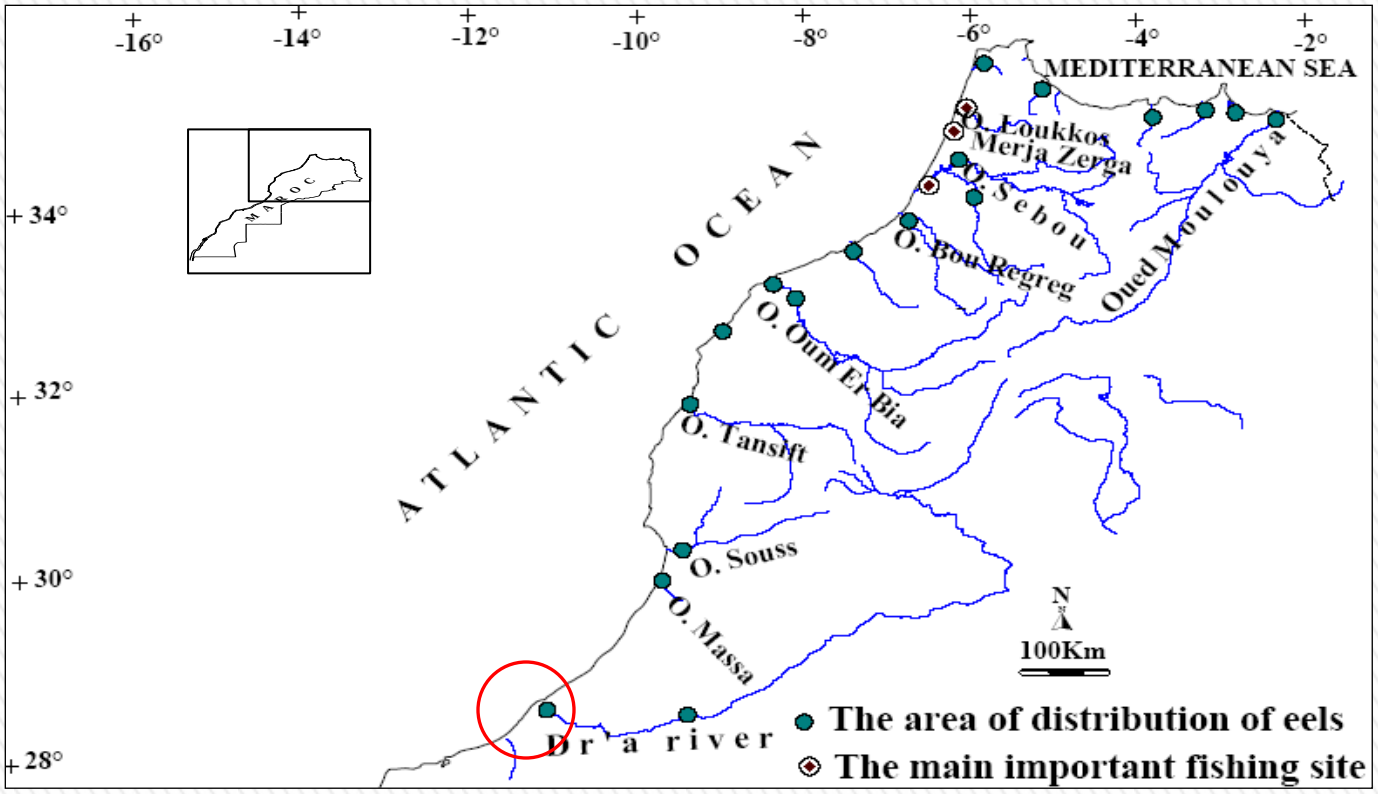
After listing eel in Appendix II of CITES on March 13th 2009, the export and the import of this species for the trade to Europe have to be licensed by morrocan authorities the Moroccan High Commissioner's Office for Waters, Forests and Desert Control (MHCOWFDC) as well as an importation document which must be delivered by the authorities of the country concerned.

Marketing of eels in Loukkos, Sebou & Merja Zerga

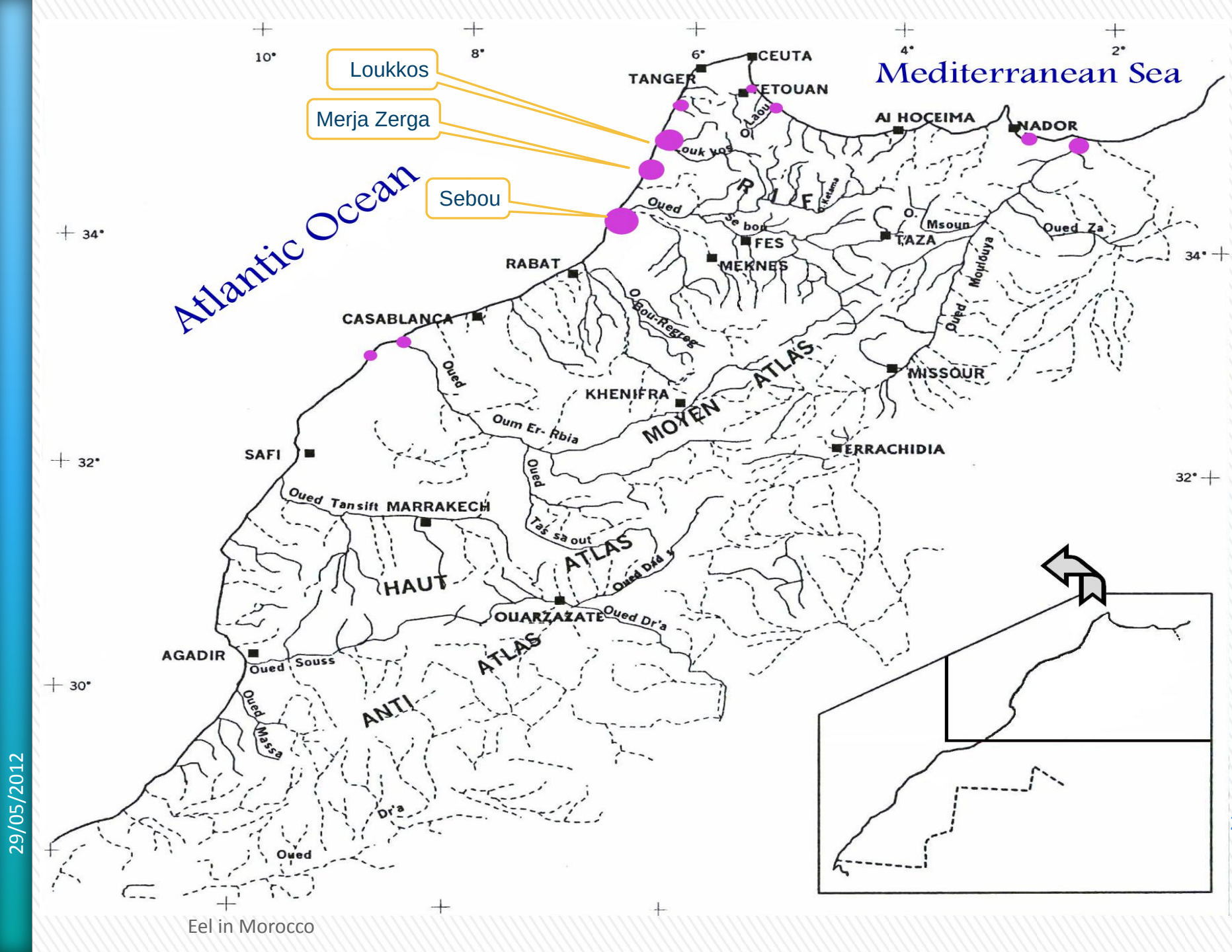


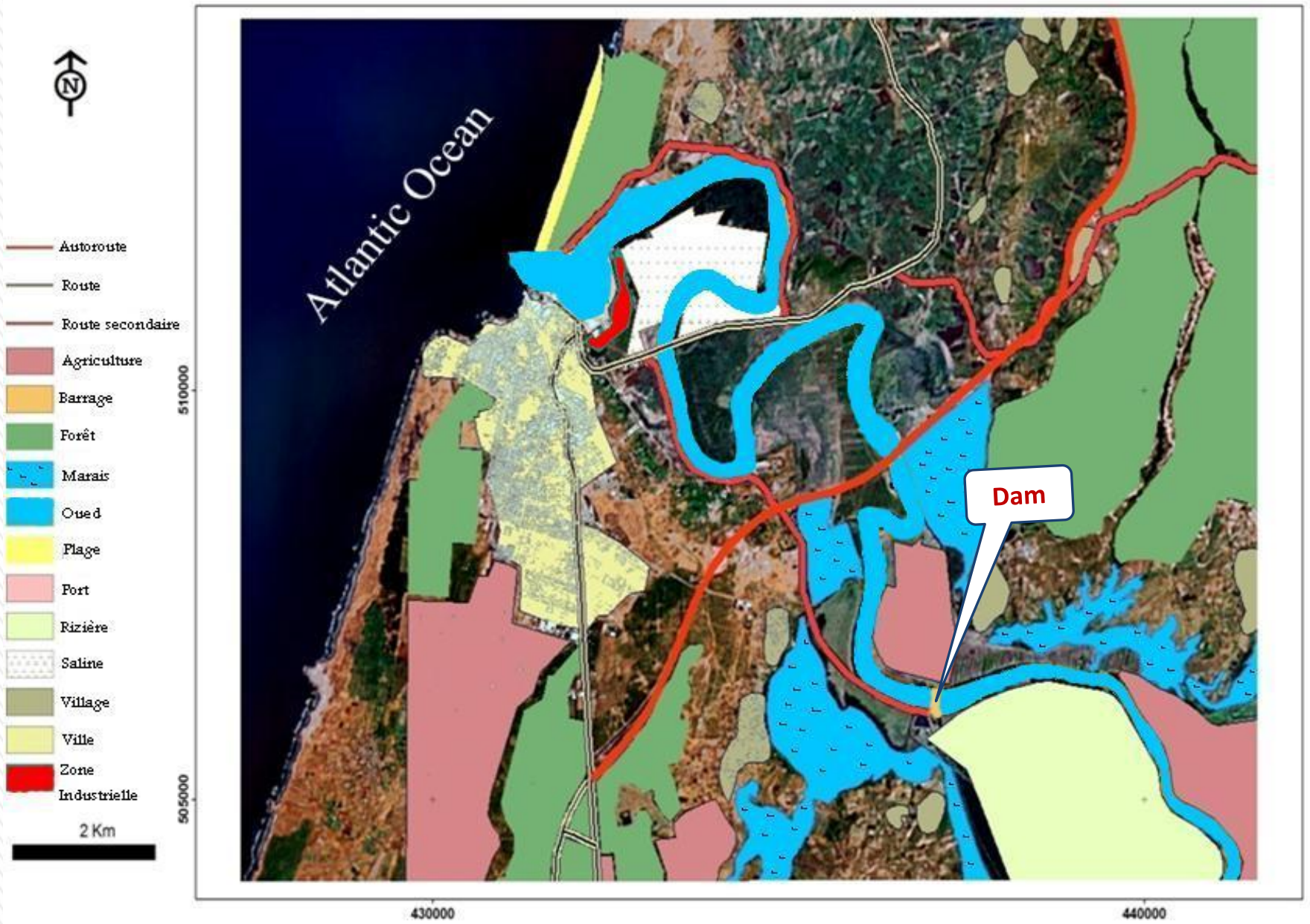
Commercial schema of eel in Morocco

Morocco is the southern limit of eel distribution (28°N at Dr'a river), which means that this species is extremely vulnerable and incurs dangers. In the absence of security measures for protecting eels in Morocco, this fish species could follow a probable disappearance like Moroccan Shad (*Alosa alosa*).



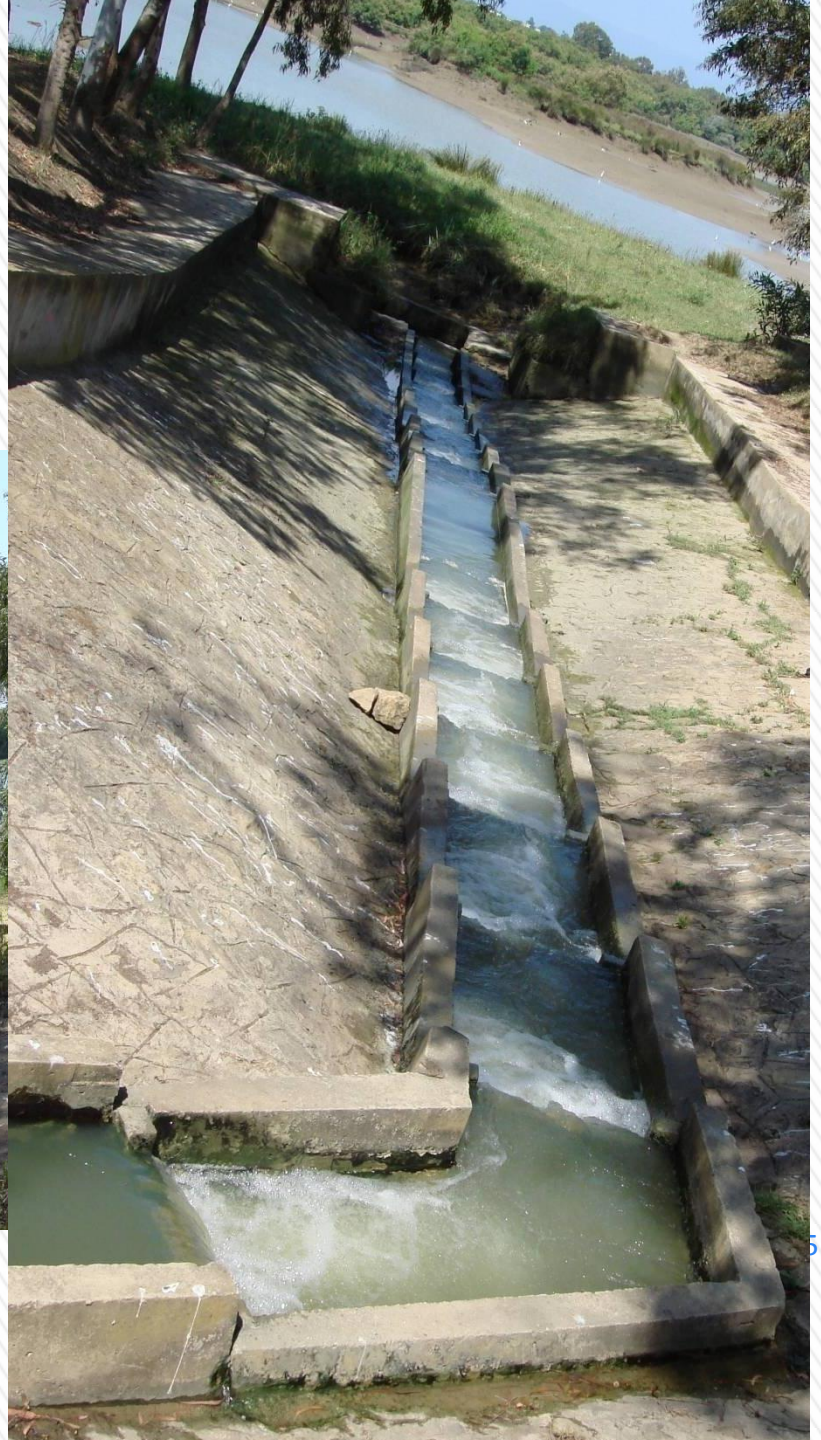
The north Moroccan rivers basins, the area of distribution of eels and fishing sites.


Loukkos
Merja Zerga
Sebou
Atlantic Ocean
Mediterranean Sea
CEUTA
TANGER
TETOUAN
AL HOCEIMA
NADOR
RIF
Oued Sebou
FES
MEKNES
TAZA
Oued Msoun
Oued Za
RABAT
CASABLANCA
Oued Bou-Regreg
Oued Moulouya
MOYEN ATLAS
KHENIFRA
MISSOUR
Oum Er-Rbia
ERRACHIDIA
SAFI
Oued Tansift
MARRAKECH
Oued Tassaout
HAUT ATLAS
Oued Dadès
OUARZAZATE
Oued Dr'a
AGADIR
Oued Souss
ANTI ATLAS
Oued Massa
Dr'a
Oued
10°
8°
6°
4°
2°
34°
32°
30°



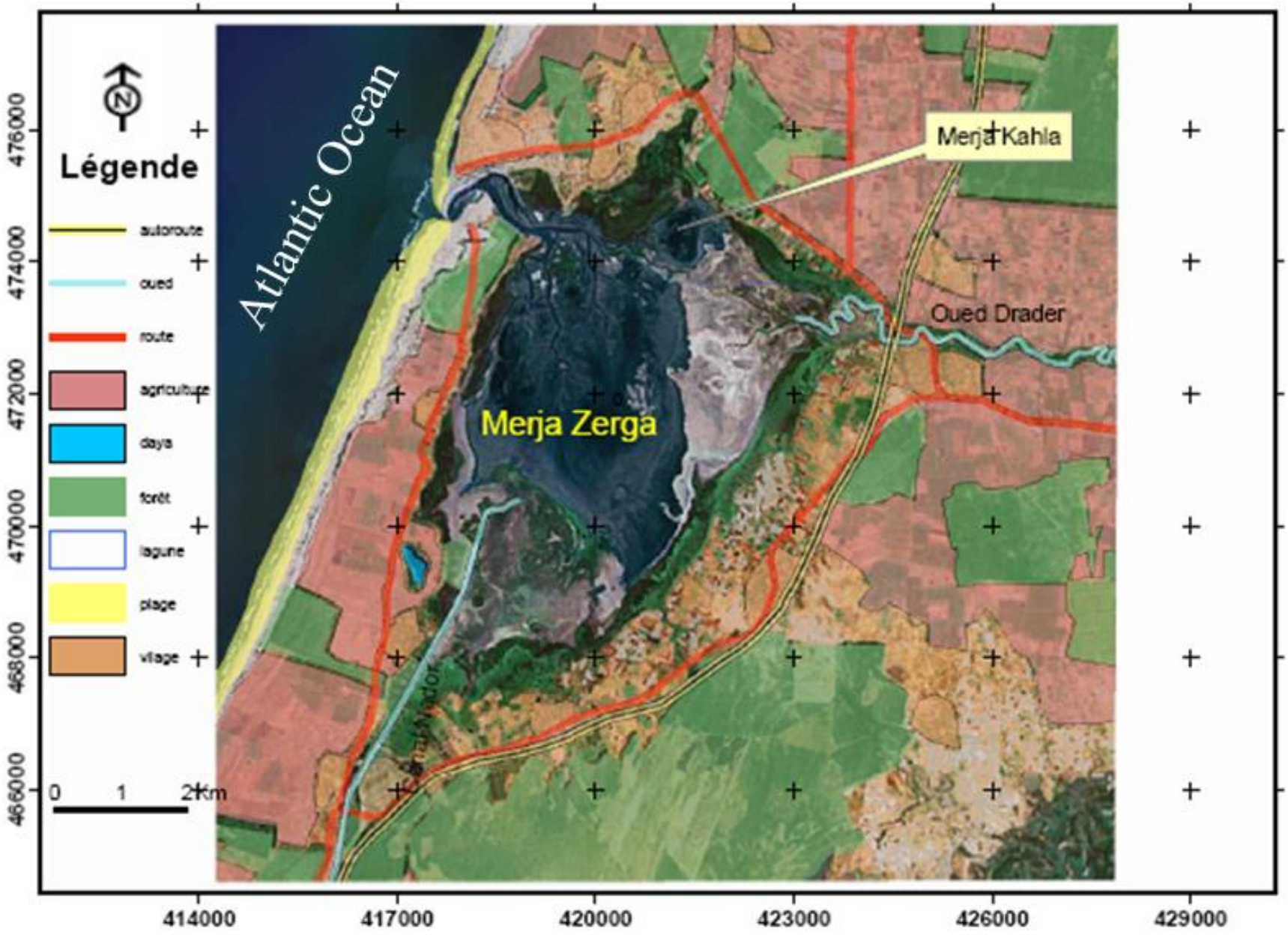
Loukkos Estuary

Eel in Morocco

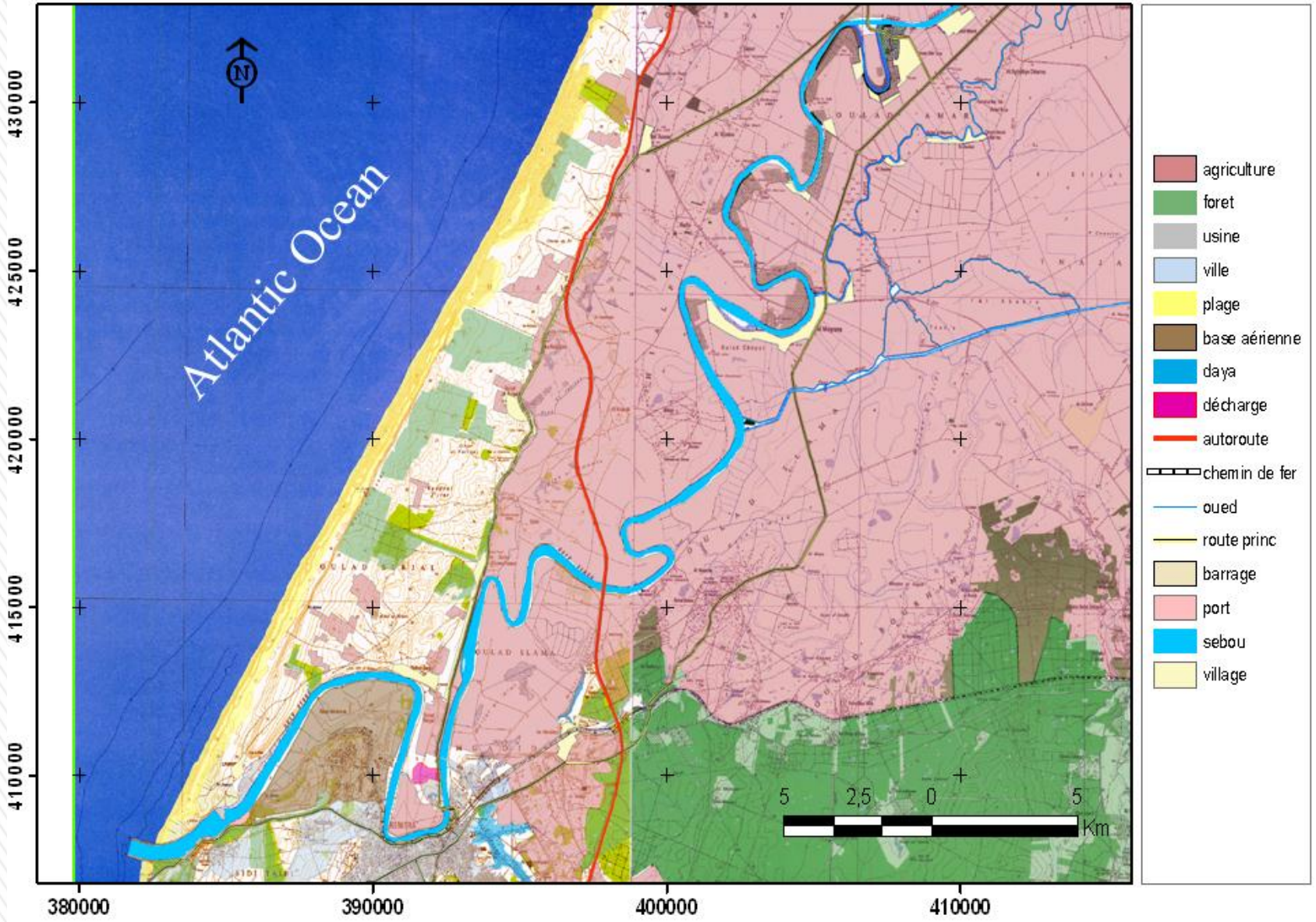


Fish pass

Eel in Morocco



Merja Zerga Lagoon



Sebou Estuary

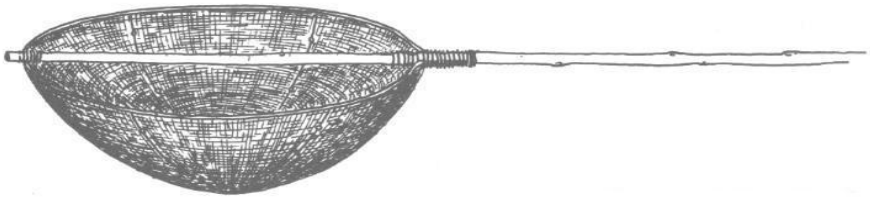
Eel and glass-eel fishing methods

Boat fishing

- Skelitical boats in Sebou and Larache estuaries

- Boat with flat bottom in Merja zerga

Hand dip net



Eel in Morocco

Eel and glass-eel fishing methods

- Fishing instruments vary depending on the characteristics of the site, the main equipment used are fyke nets, hand dip net.

Fishing gears	Local name	Site of used gear
Fyke nets	Quennar	Sebou, Loukkos & Merja Zerga
Glass eel nets	Chebka	Sebou
Hand dip net	Gherbal	Sebou & Loukkos

Fyke nets are mainly used gear in Loukkous , Sebou & Merja Zega

Main characteristics of nets

- **Fyke nets characteristics and trapping periods.**

	Number of boats/fisherman	Length (m)	Mesh (mm)	Fishing period	Duration of traps (years)	Price (DH)
Merja Zerga	36	2	5	**September to May**	3	100 (8.7€)
Loukkos	60	2	5	**October to January**	3	-
Sebou	30	1,5	5	**September to June**	2	70 (6.1€)

Fishing effort

	Number of fishing days/ year	Number of outing/day	Mean period of outing (h)	Number of working hour/year
Merja Zerga	303.67	1	3h 49mn	1159
Loukkos	117	1	3h	351
Sebou	264.45	1.72	1h 24mn	637

Fishing effort

CPUE of eel (Yellow and silver) in Merja Zerga lagoon, in Sebou estuary and in Loukkos estuary (Atlantic sites)

Year	Site	Total catch (Kg)	Total effort (days)*	CPUE (Kg/days)
2003	Merja Zerga	13,500	-	-
	Sebou estuary	420,000	-	-
	Loukkos estuary	-	-	-
2006	Merja Zerga	16,000	304	**52.63**
	Sebou estuary	10,000	264	**37.88**
	Loukkos estuary	200	117	**1.71**
2011	Merja Zerga	2700	304	**8.88**
	Sebou estuary	12,340	264	**46.74**
	Loukkos estuary	120	117	**1.03**

*: The mean number of fishing days per fishing season.

Quantities of glass eels and eels caught in Mediterranean site

Year	Quantities of eels (Kg)	Quantities of glass eels (Kg)
1989	4.6	170
1990	73.3	233
1991 - 1995	-	-
1996	36.6	90
1997	36.15	130
1998	43.6	119
1999	-	-
2000	14	-
2001	167	15
2002	51	20

Production

	Glass eel (tons)		
	Merja Zerga	Sebou	Loukkos
Fontenelle (1987); Sabatié & Fontenelle (2003)	-	**150**	**40**
Al Amouri (2006)	-	**5**	**0.75**
2007	-	**-**	**0.11**
Al Amouri et al (2008)	-	**-**	**0.10**
2009	-	**0.10**	**0.14**
2010		**0.21**	**0.05**
2011		**0.36**	**0.03**

Quantities of eel and glass eel production in Merja Zerga, Loukkos and Sebou

Production

	Eel (tons)		
	Merja Zerga	Sebou	Loukkos
Fontenelle (1987); Sabatié & Fontenelle (2003)	12-15	420	-
Al Amouri (2006)	16	10	0.2
Survey of 2011	2.7	12.34	0.12

Quantities of eel production in Merja Zerga, Loukkos and Sebou

Production

Quantities of glass eel caught in the commercial fishery

Year	Quantity (kg)
2009	240
2010	260
2011	390

Eel Price (DH)

	Fished species		Mean price /Kg (DH)		
			Merja Zerga	Loukkos	Sebou
Eel	***Anguilla anguilla* Linné, 1758**	**Eel (Noun)**	30 (2.6 €)	-	30 (2.6 €)
		Glass eel (Ngoula)	-	150 (13 €)	1200 (104.3 €)

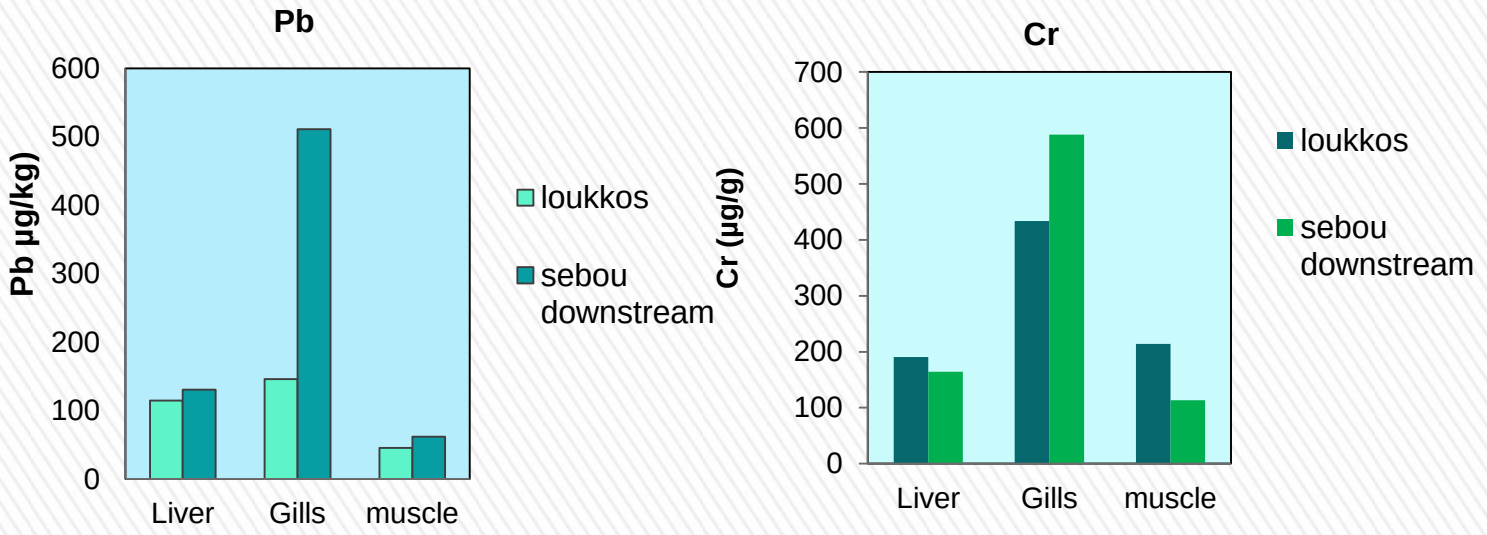
Aquaculture Production

Farm company	Aquastar (Merja Zerga)	Aquagruppen (Sebou)	Noune Maroc (Sebou)	Total
	Production weight (t)	Production weight (t)	Production weight (t)	Production weight (t)
1999-2000	13	13	-	26
2000-2001	12	-	-	12
2001-2002	23	-	-	23
2002-2003	40	-	-	40
2003-2004	-	-	-	-
2004-2005	34.5	10	-	44.5
2005-2006	40	3	-	43
2006-2007	16	3	-	19
2008-2009	13	6	19.5	38.5
2009-2010	-	-	60	60
2010-2011	-	-	76	76

Contaminants

Heavy metals

Assessment of the degree of heavy metal contamination (Pb, Cr) in liver, gills and muscle of eel (*Anguilla anguilla*) inhabiting two ecosystems along the Moroccan Atlantic coast: the Sebou and Loukkos estuaries

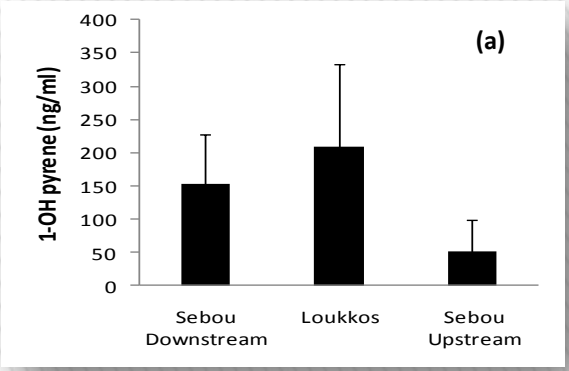


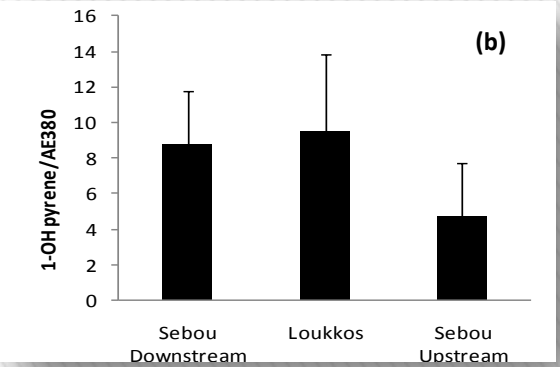
The concentrations of lead and chromium (µg/g wet wt), in liver, gills and muscle of eels

Contaminants

PAH metabolites

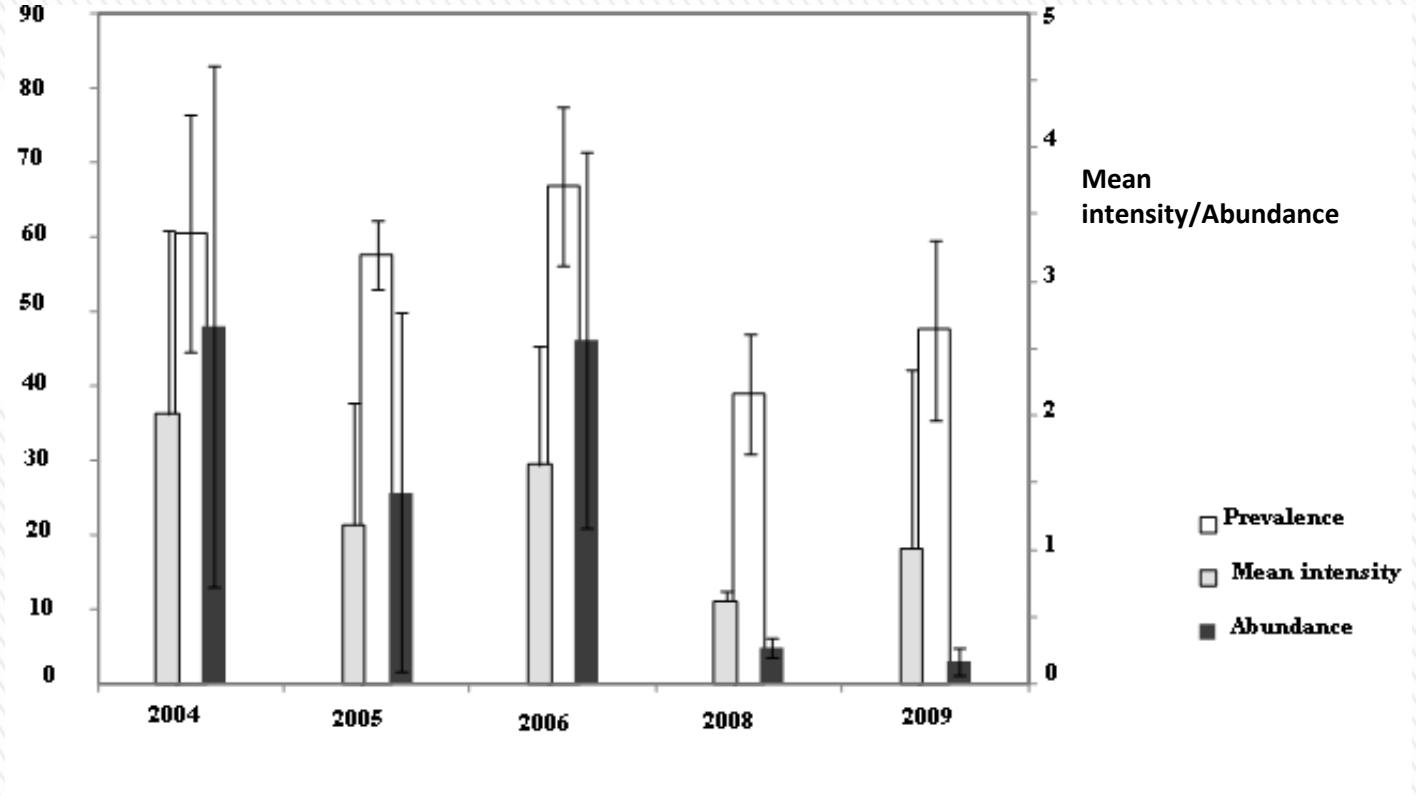
This study investigated in the usefulness of biliary polycyclic aromatic hydrocarbon (PAHs) metabolites of European eel (*Anguilla anguilla*) as bio-indicator of pollution in Moroccan sites. Biliary 1-Hydroxypyrene, 1-Hydroxyphenantrene and 3-hydroxybenzo[a]pyrene metabolites were measured in eel by HPLC analysis with fluorescence detection. Only 1-OH pyrene and 1-OH phynantrene were detected while 3-OH benzo[a]pyrene was not detected. No statistical differences between the sexes and ages for any of the PAH metabolites or biological parameters could be detected.





Mean of the concentration of 1-OH Pyrene concentration (ng/ml) in the bile of Eel. Without normalization (a), after normalization (dividing) of the values for the absorbance at 380 nm (b).

Parasitology



. Prevalence (%), mean intensity ± SD and abundance ± SD of *Anguillicoloïdes crassus* for eels caught in Sebou estuary 2004-2009 (Wariaghli *et al. 2011*

Conclusions & Recommendations

- In Morocco, on the Mediterranean side, the exploitation of eels and glass eels has been stopped since 2005, while on the Atlantic it continues.
- Since the end of the 1990s, eel stocks have been declining at alarming rates.
- The growing fisherman population lacks awareness on the ecological importance of eel and prizes them only for their economical

Conclusions & Recommendations

- The most common causes of eel decline in Morocco may be due to:
- Diseases such as the one caused by the hematophagous parasite, *Anguillicoloïdes crassus*, which was found in Moroccan continental waters in 1990 (EL HILALI *et al*. 1996).

- Illegal fishing (poaching and the use of illicit fishing nets).

- Hydraulic infrastructures such as dams without fish passages, embankments, diversions, pumping from rivers, gravel extracting, etc., all of which deteriorate or destruct eel habitats, especially their growth space.

- Pollution from agricultural, industrial, and domestic activities.

- In addition, commercial fishing activities, such as artificial reproduction and eel farming which are restocked only with wild species in their elver stage, contribute to the species' decline. Eel is of great commercial importance and is probably the only fish to be exploited at all its life cycle stages by man. Due to the increasing amount of eel farming and decreasing populations caused by overfishing, prices have increased along with fishing activity.

THANK YOU FOR YOUR ATTENTION