



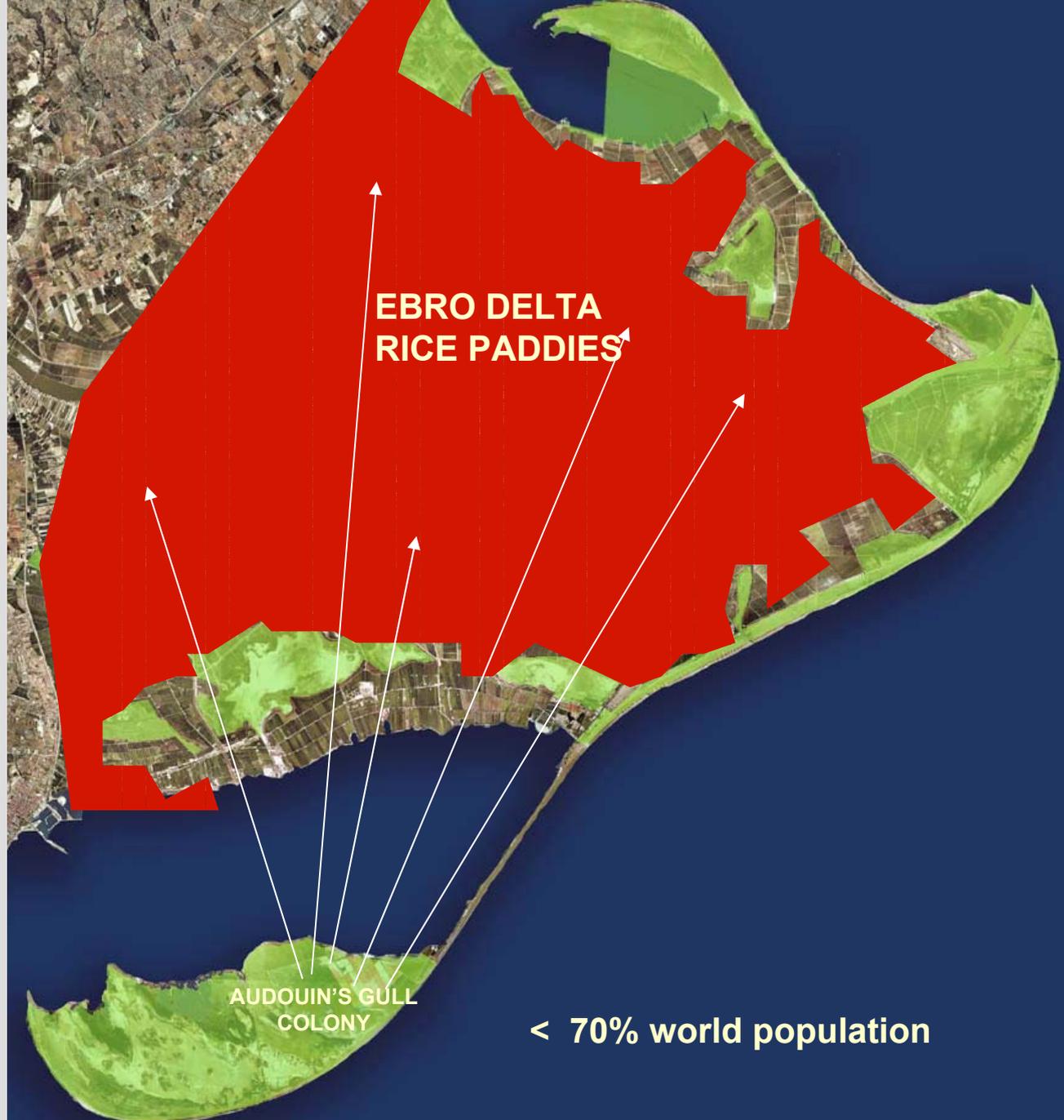
Audouin's Gull (*Larus audouinii*):
from a **pelagic foraging stress** to an
establishment of a **temporary**
terrestrial diet in Ebro delta rice
paddies

 Generalitat de Catalunya
Departament de Medi Ambient
i Habitatge



Survey framework

> LIFE NATURE project of “*Conservation of Audouin’s gull (Larus audouinii) in Catalonia*” LIFE02NAT/E/8612



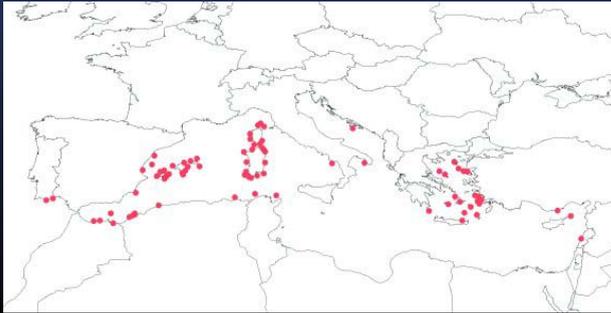
**EBRO DELTA
RICE PADDIES**

**AUDOUIN'S GULL
COLONY**

< 70% world population



The species **Audouin's Gull** and the survey
background



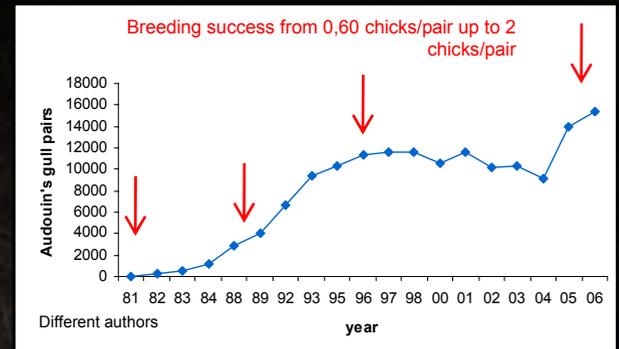
< Endemic species of the Mediterranean basin

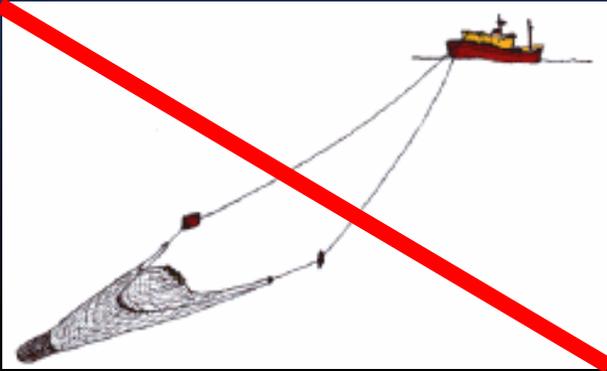
This species remained, during many years, as a pelagic one >



< Availability of fishing discard from the trawlers fisheries

High increase of breeding success of Audouin's gull >





> A fishing moratoria stopping fishing by trawler overlapped with the breeding season

An important decrease in breeding success was recorded >



< Scarcity on food source forced the species to explore new areas

A change in the foraging area was occurring >





< The fishing moratoria was delayed to avoid overlapping

The Audouin's Gull went on taking advantage of the food of rice field habitat >



Vittorio Pedrocchi

In theory, once the previous situation was reestablished it seemed that logically a complete return to optimum feed species should account. But, the return not only not happened but it seems that this alternative food source has become a good source of food.



The key: the Red Swamp crayfish
(Procambarus clarkii)

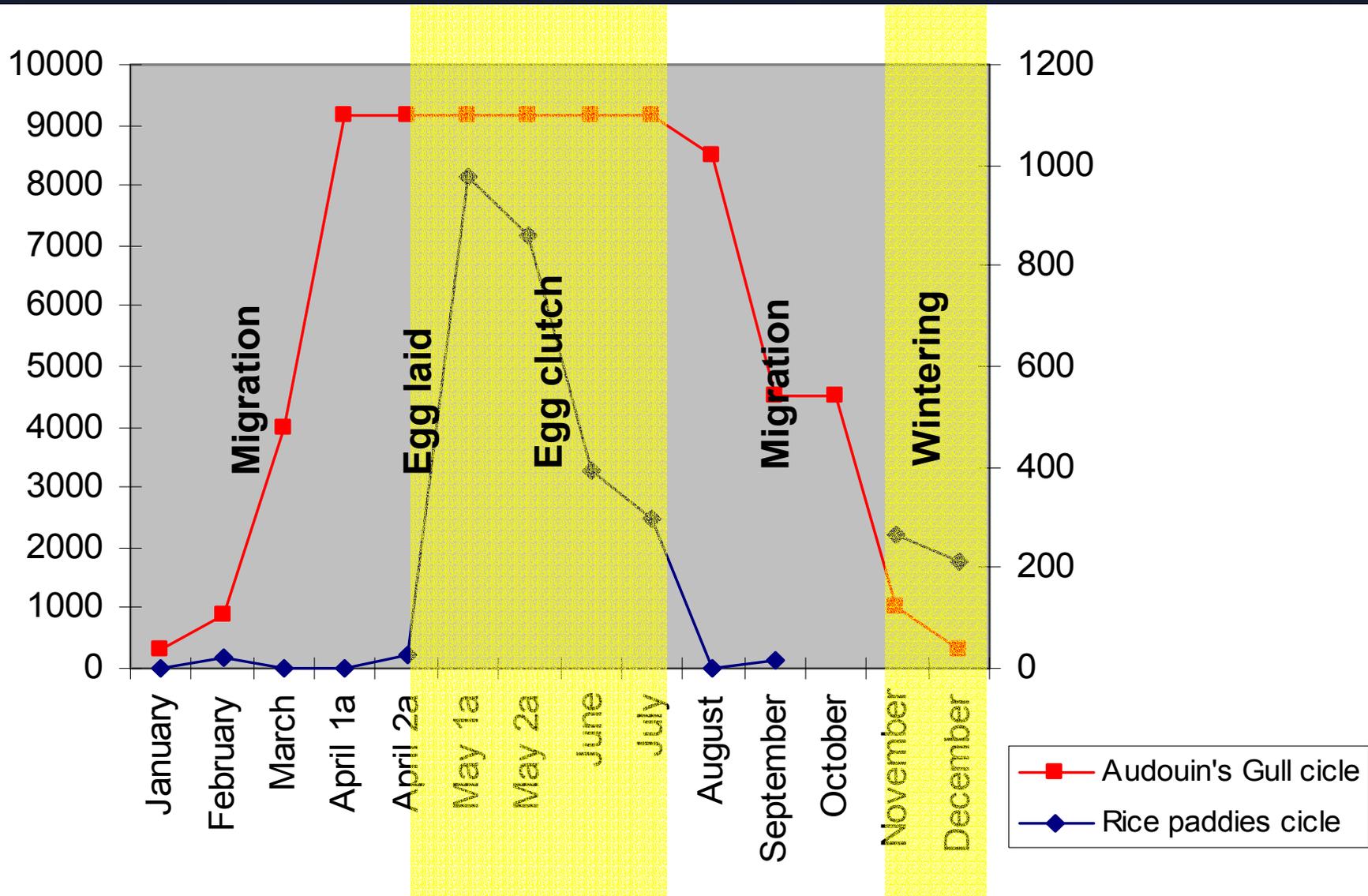
> This species was introduced in Ebro delta in 1979

> Nowadays there is a high availability of this prey in rice fields

> When there wasn't fishing activity the Red swamp Crayfish represented 2-13% of the diet of Audouin's gull (Gonzalez_Solis, 1997)



Audouin's Gull biological cycle / Rice paddies cycle



So, is this behaviour a respond to stress periods as moratoriums or has become a new temporary continental feeding resource?



Methodology

A Line transect in vehicle: 78 km; 20-40km/h

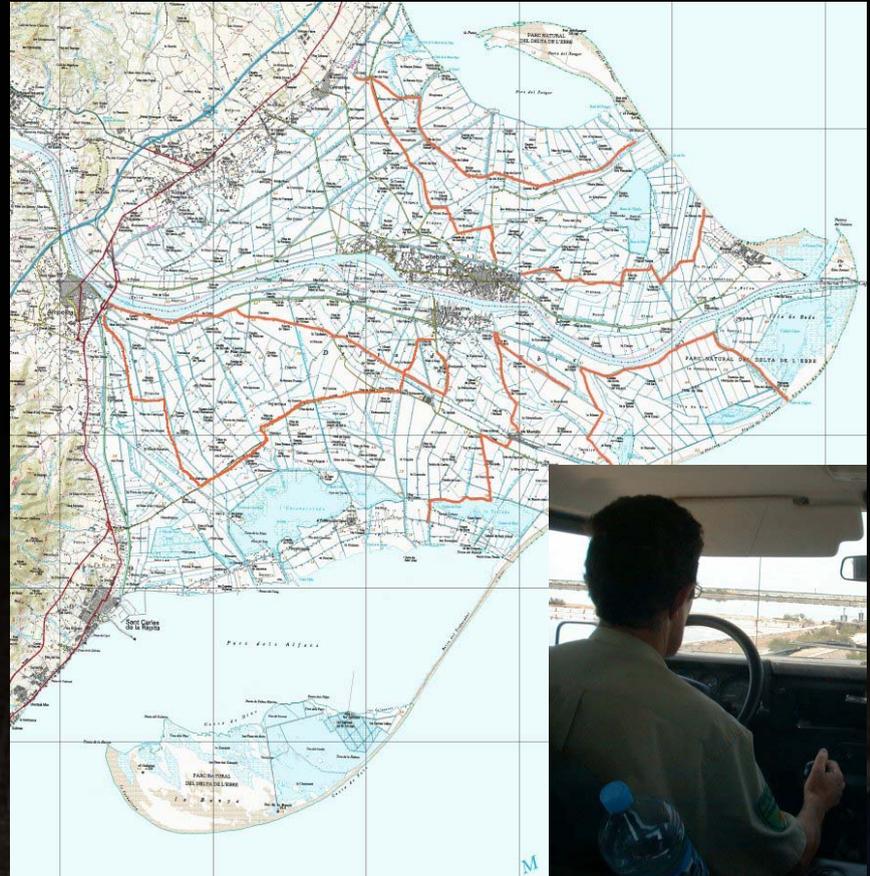
> To estimate Audouin's gull population in rice paddies

> To analyse relation between rice paddy cycle (dry, moisted, flooded, or grow rice) and the behaviour of gulls.

> Number and behaviour of Audouin's Gull, yellow legged Gull and Lesser Black-Backed Gull were registered

> In 2007 the distances from the transect to gulls was measured (*Distance sampling*)

> Also
2 transects during night,
1 transect on the weekend

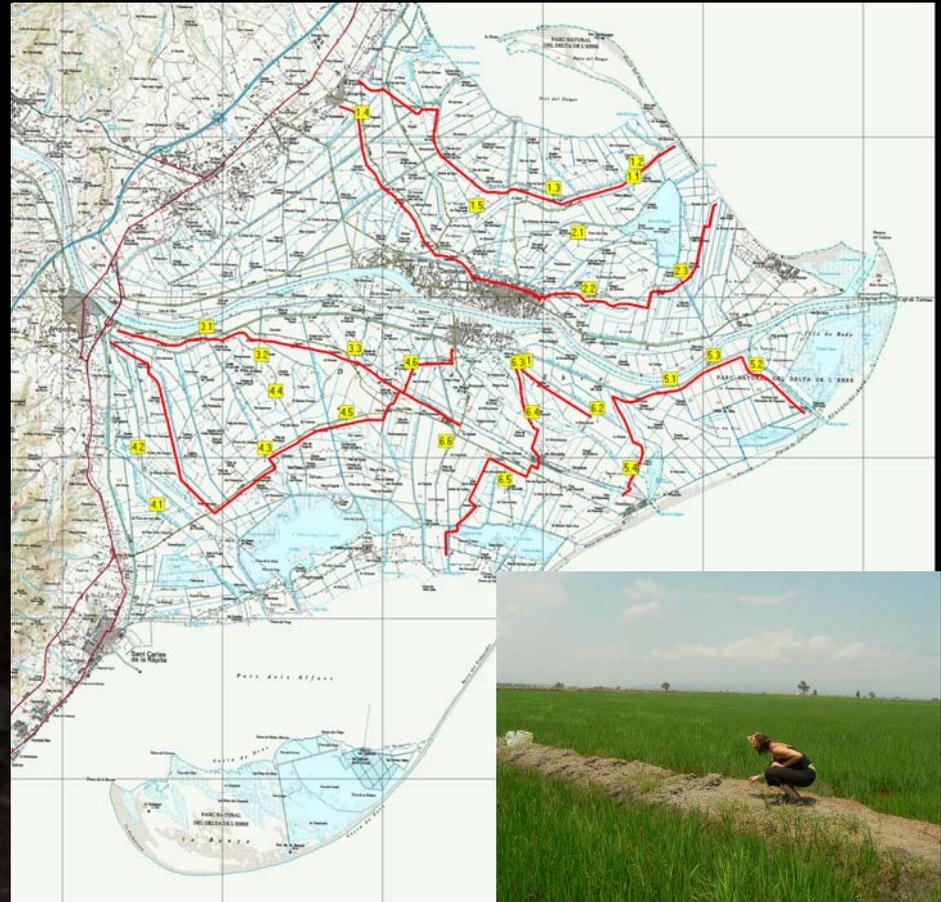


B Line transect rice paddies edge 5 km; 27 itineraries

> To determine relative abundance of Red swamp crayfish in rice paddies

> May and June 2005

> The number of the rests predations of Red Swamp Crayfish were counted



C Diet survey within the colony

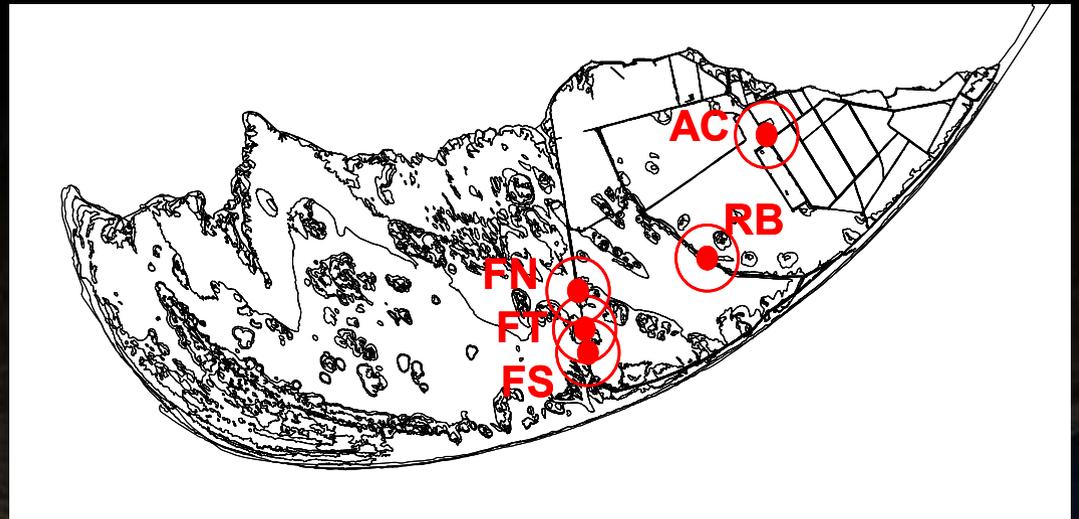
> To determine if consume of Red swamp crayfish was generalised for the whole colony

> 5 spot inside the colony where visited and presence/absence of claws recorded

> Visits between April 10th and June 16th 2005 and 2007

> Pellets were caught and rests of prey which were in the nearby of nests

> Number of nests, number of eggs and number of chicks were counted

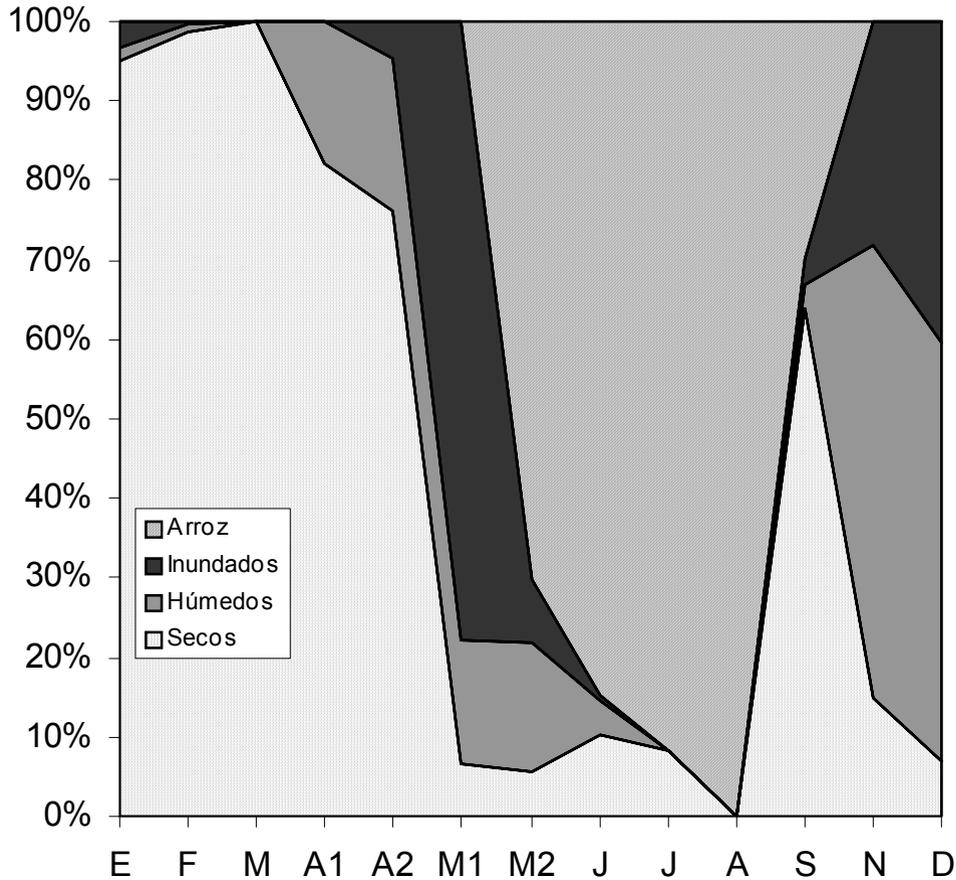




Results

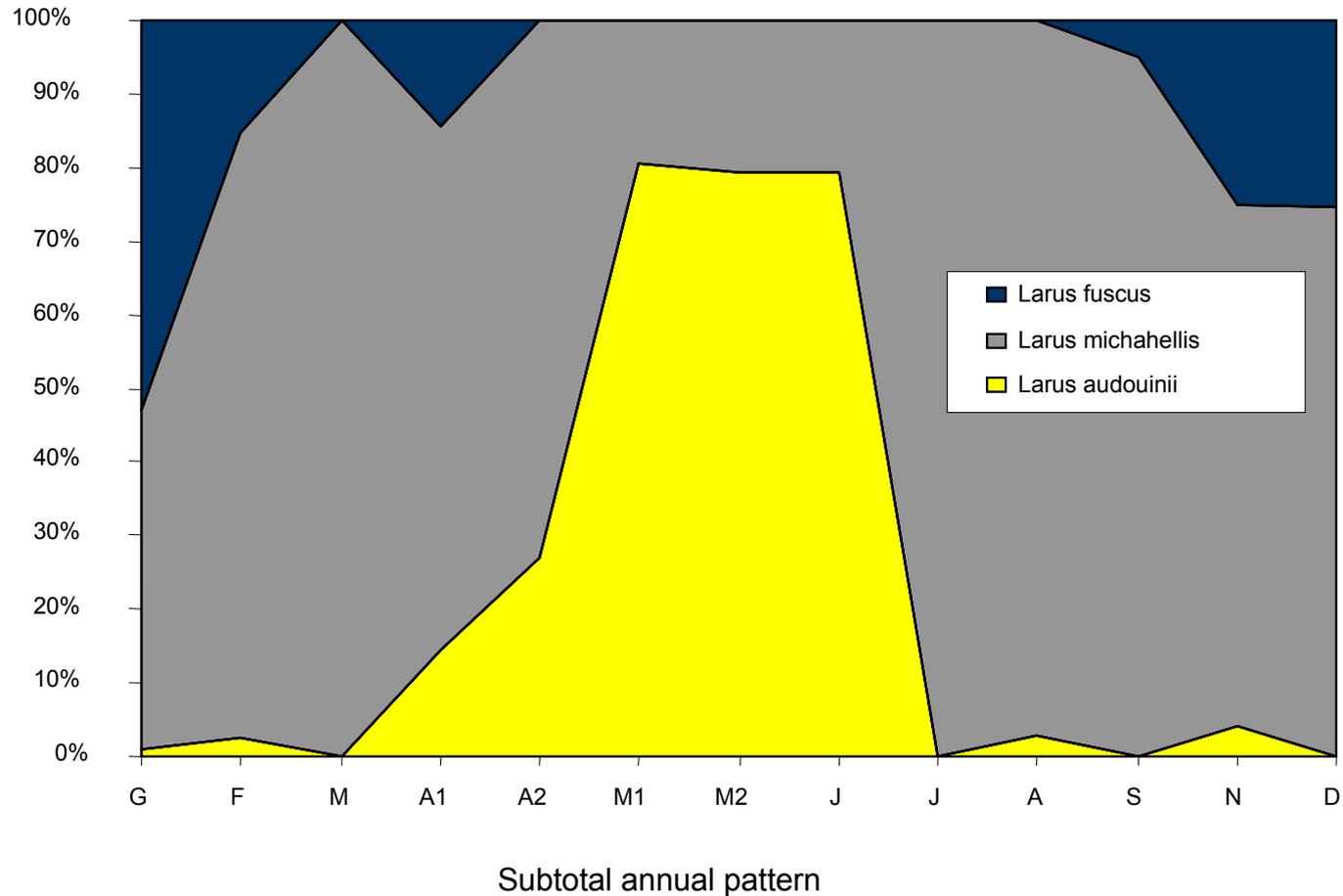
RICE PADDIES PATTERN DURING THE YEAR (2004)

Hemidelta Sur

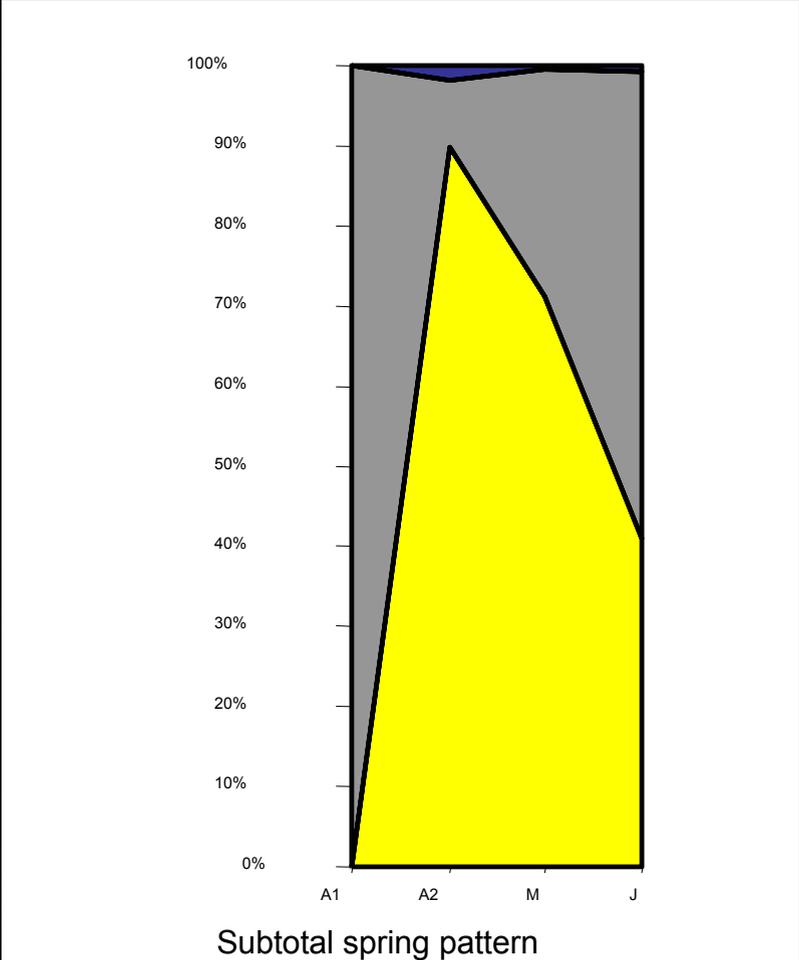


LARGE SEAGULLS RELATIVE PATTERN USE OF RICEFIELDS (2004)

The pattern of frequency was significantly different during the year
 $\chi^2 = 2.533,5; 48g.l.; p < 0,00001$)

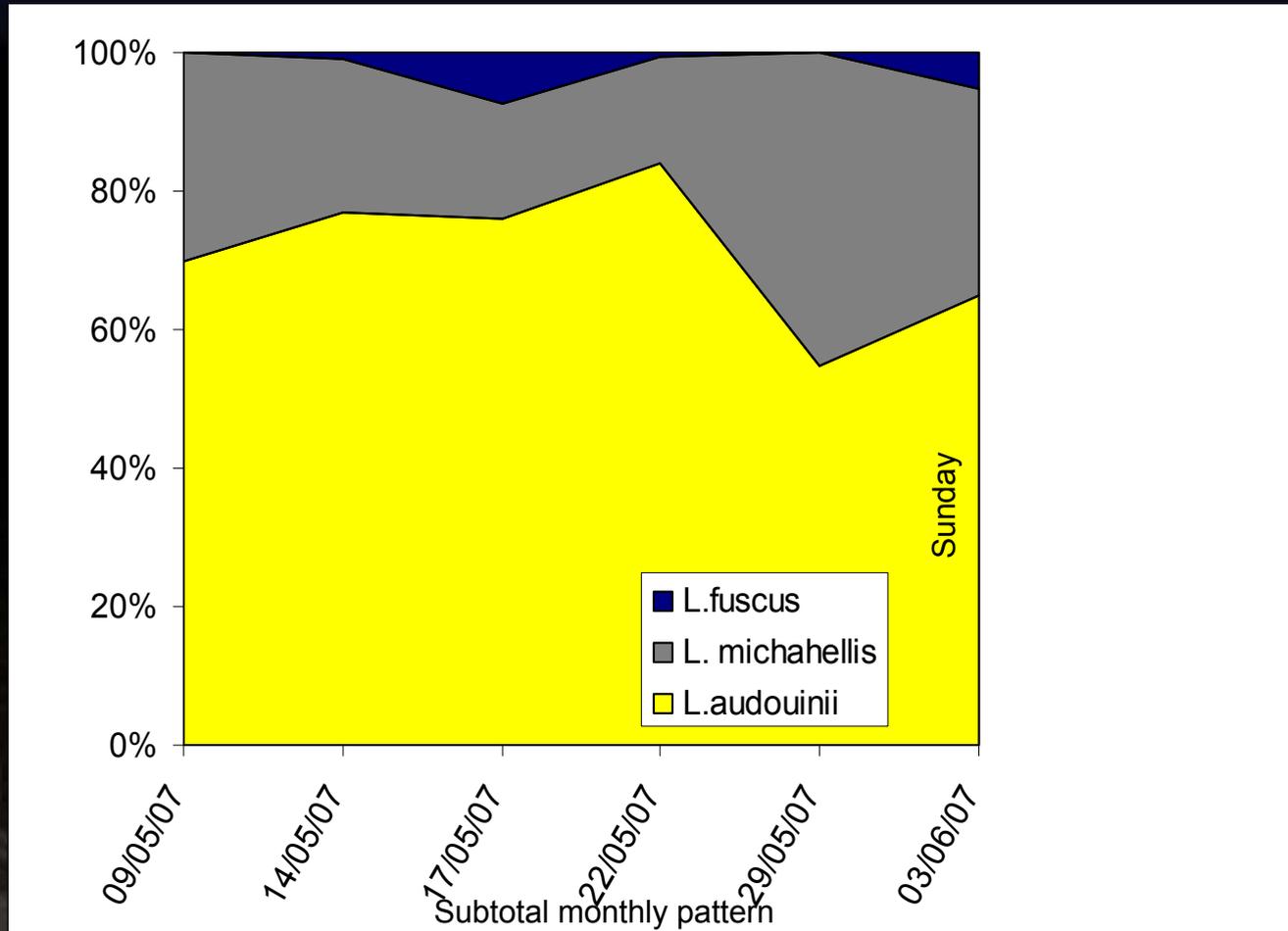


LARGE SEAGULLS RELATIVE PATTERN USE OF RICEFIELDS (2005)



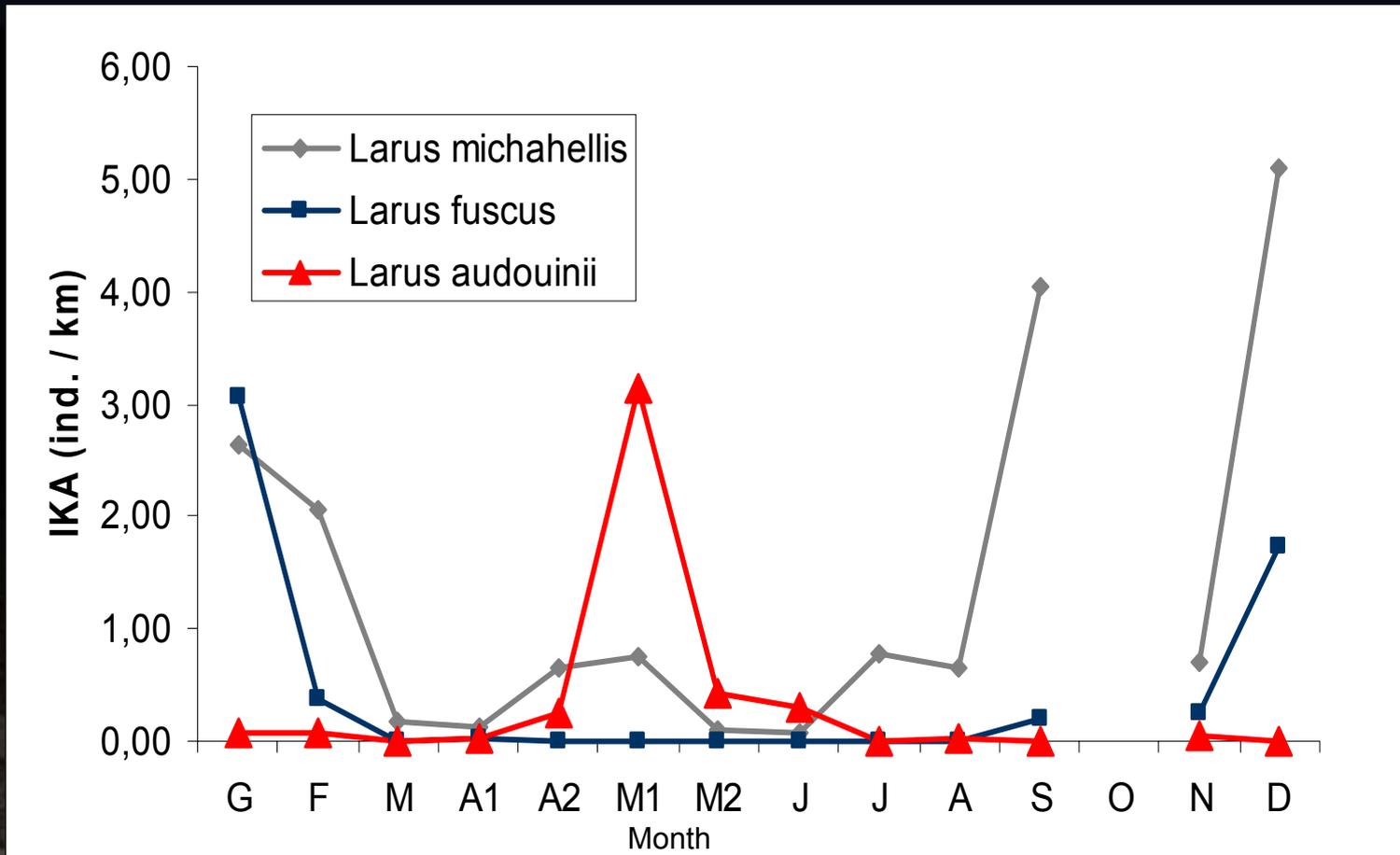
LARGE SEAGULLS RELATIVE PATTERN USE OF RICEFIELDS (2007)

> Any gulls recorded at night!!



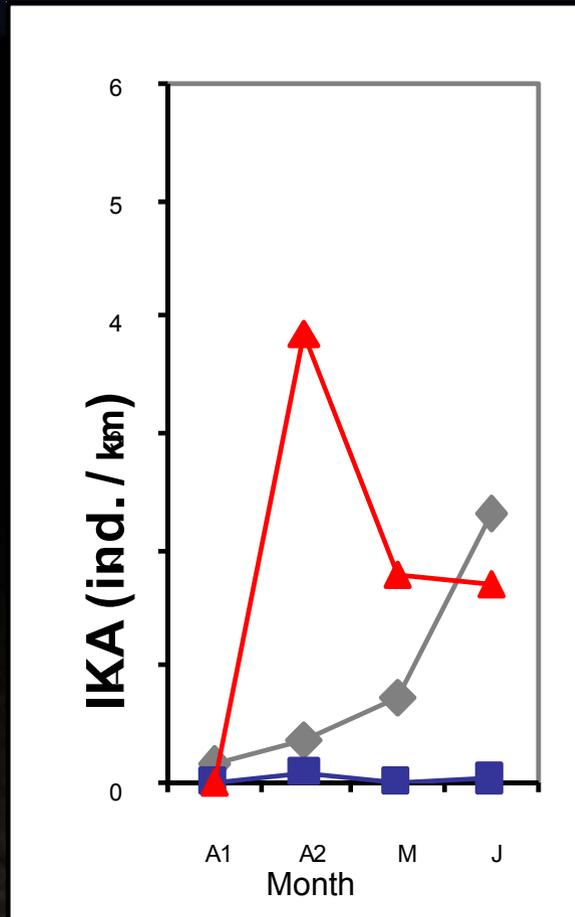
LARGE SEAGULLS ABUNDANCE PATTERN USE OF RICEFIELDS (2004)

In **2004**, relative abundance of Audouin's Gull = 1 ind/km, except in May with **3 ind/km**



LARGE SEAGULLS RELATIVE PATTERN USE OF RICEFIELDS (2005)

In **2005**, relative abundance of Audouin's Gull= 4 ind/km in April and 2 ind/km in June

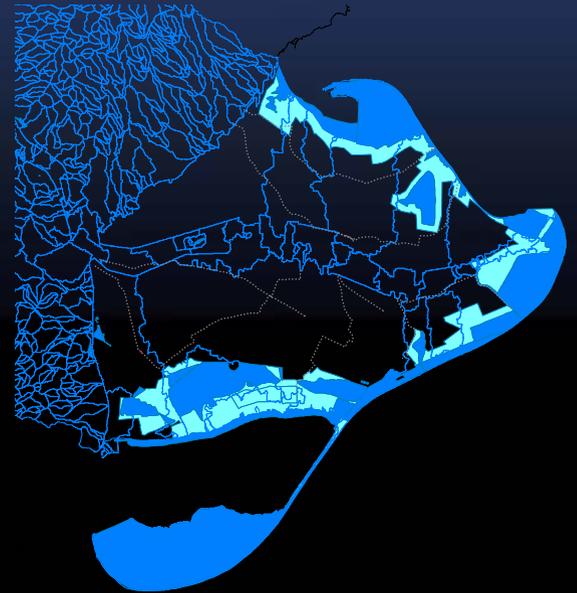


AUDOUIN'S GULL DISTRIBUTION IN 2004



< Wintering
(November-
February)

Territory setting
(March-beginning
April) >



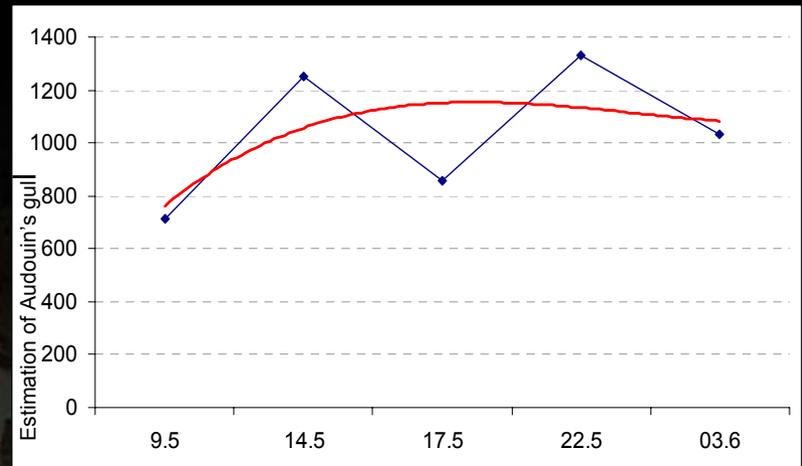
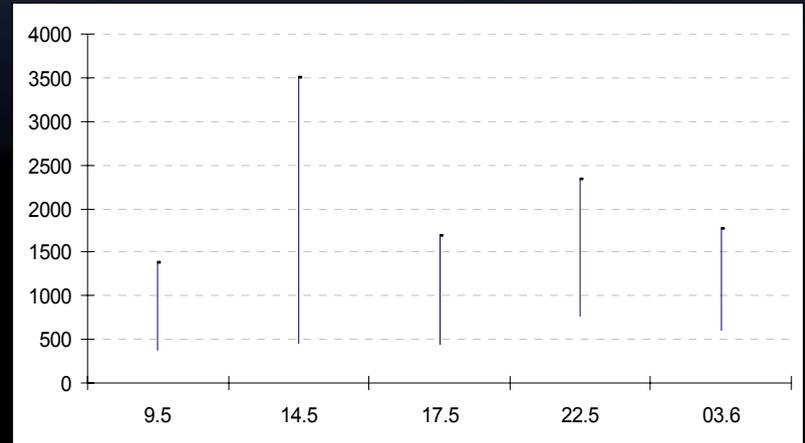
< Prelaying period
and nidification
(Late April-July)

Dispersal
(August-October) >



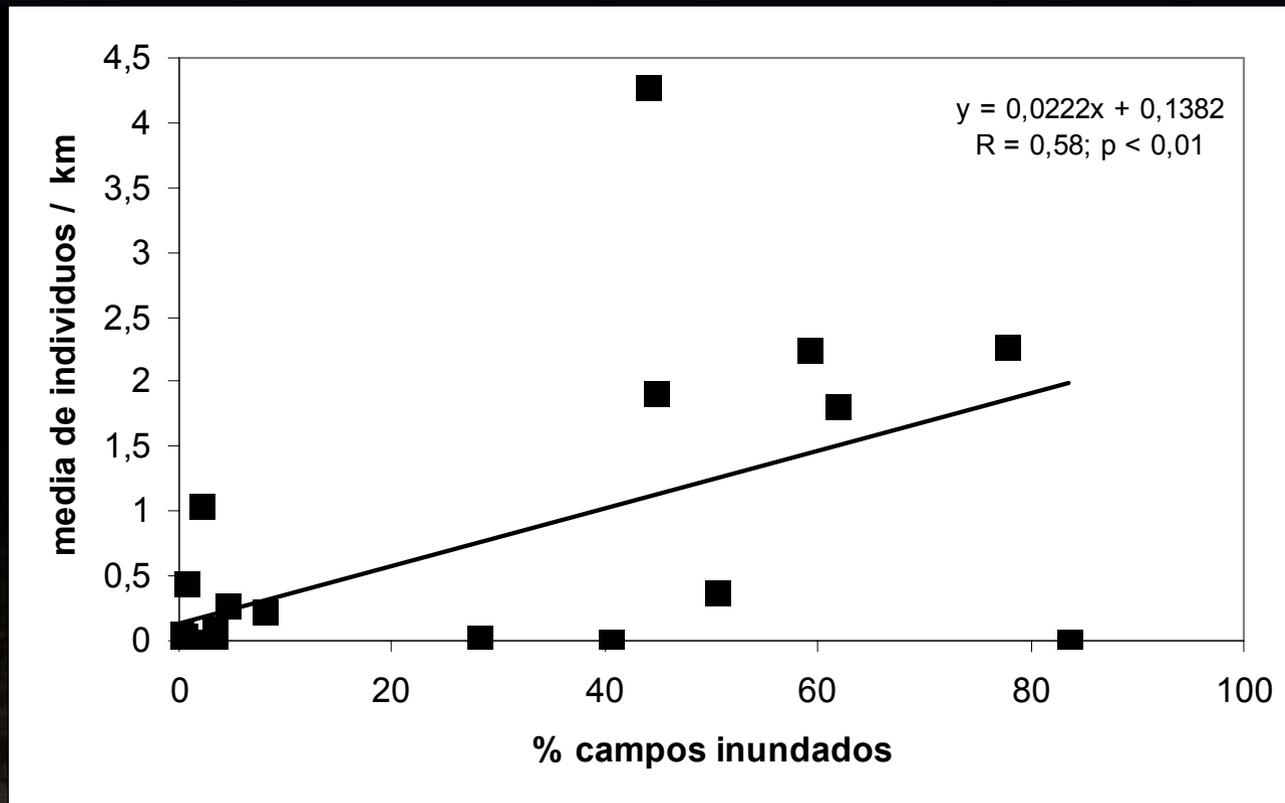
Audouin's Gull population estimation in rice paddies of south delta (*Distance sampling method*)

	N	IC 95% Min	Max	n
9.5.2007	714	369	1380	53
14.5.2007	1253	450	3491	81
17.5.2007	856	436	1682	62
22.5.2007	1330	761	2324	71
03.6.2007	1034	604	1770	51



> RELATION BETWEEN PERCENTAGE OF FLOODED RICEFIELDS AND RELATIVE ABUNDANCE OF AUDOUIN'S GULL

> The more flooded the ricepaddies were, the more observations of Audouin's Gull we obtained



> ABUNDANCE OF RED SWAMP CRAYFISH IN RICEFIELDS

1.533,0 ± 1.340,2 Red Swamp crayfish rests/km in the edge of rice paddies

> Distribution of the rests of Red swamp crayfish was heterogeneous: maximum abundance was in the periphery of Ebro delta

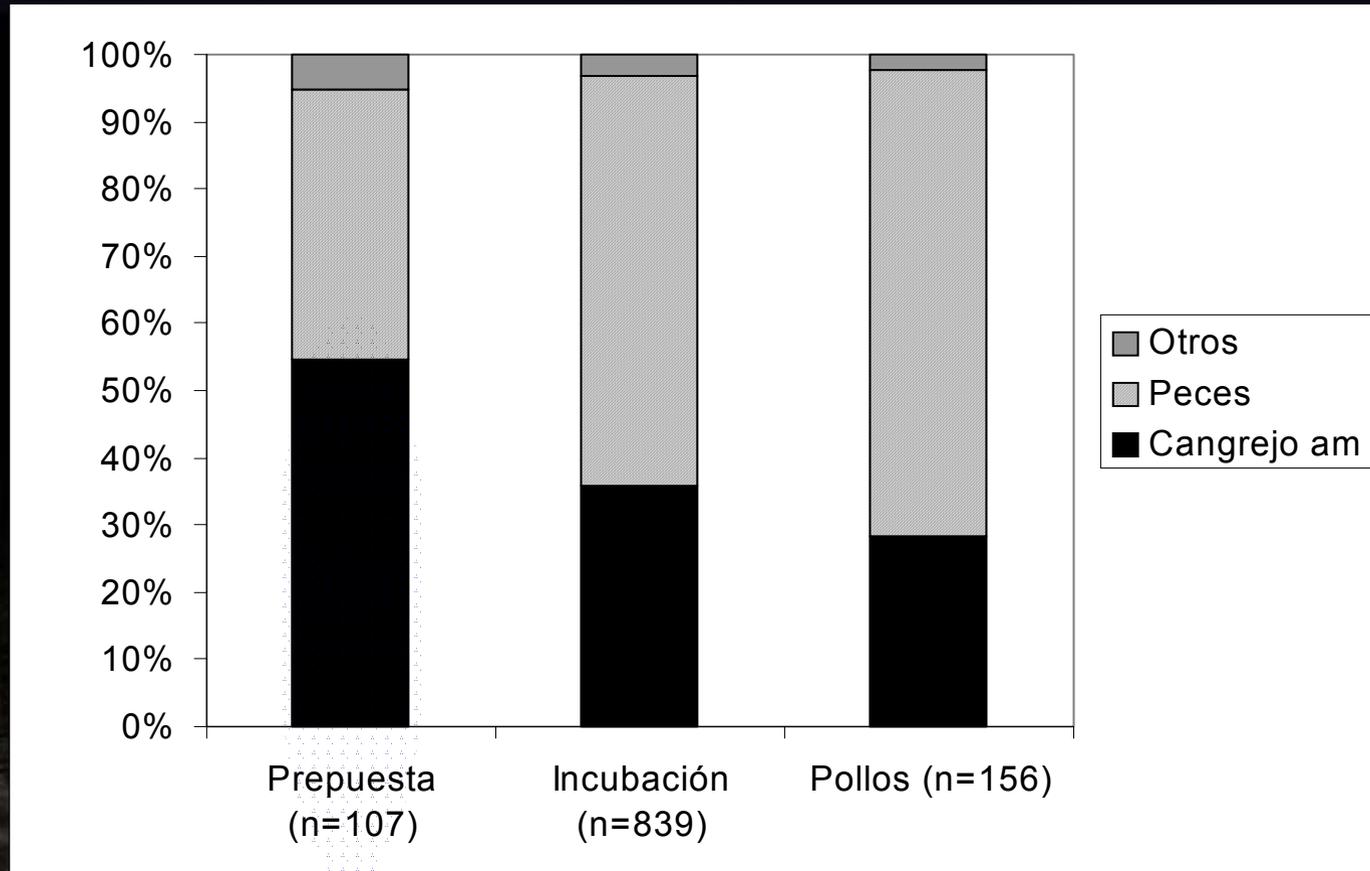
Poisson = 1.327,5; $p < 0,001$



DIET OF AUDOUIN'S GULL INSIDE THE COLONY (2005)

> Different diet depending on breeding periods

$\chi^2 = 111,53$; 8 g.l.; $p < 0,00001$



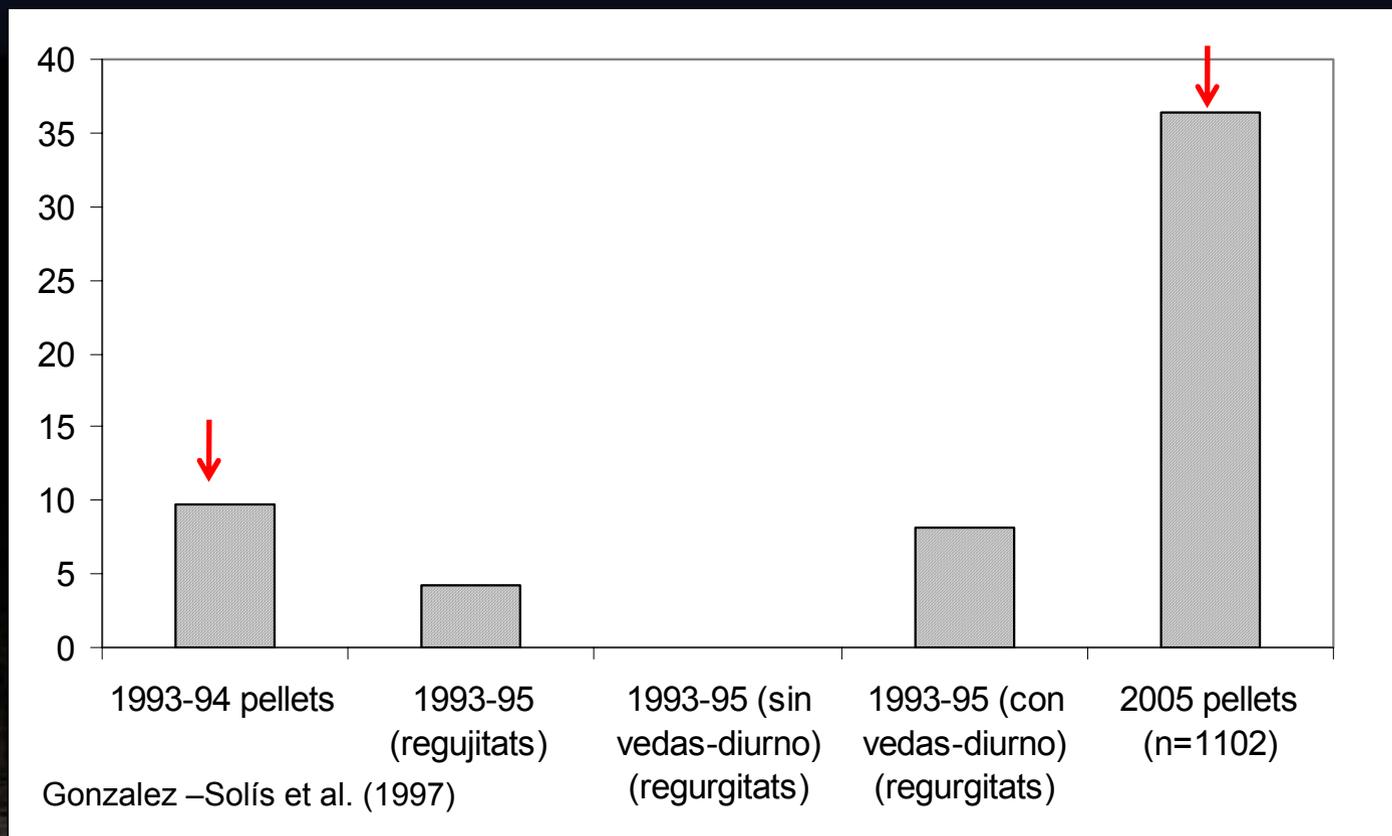
> RED SWAMP CRAYFISH PRESENCE WITHIN THE COLONY

> In 80% nests (n=736) in 2004, and in 93,1% (n=205) in 2005, in the nest surrounding



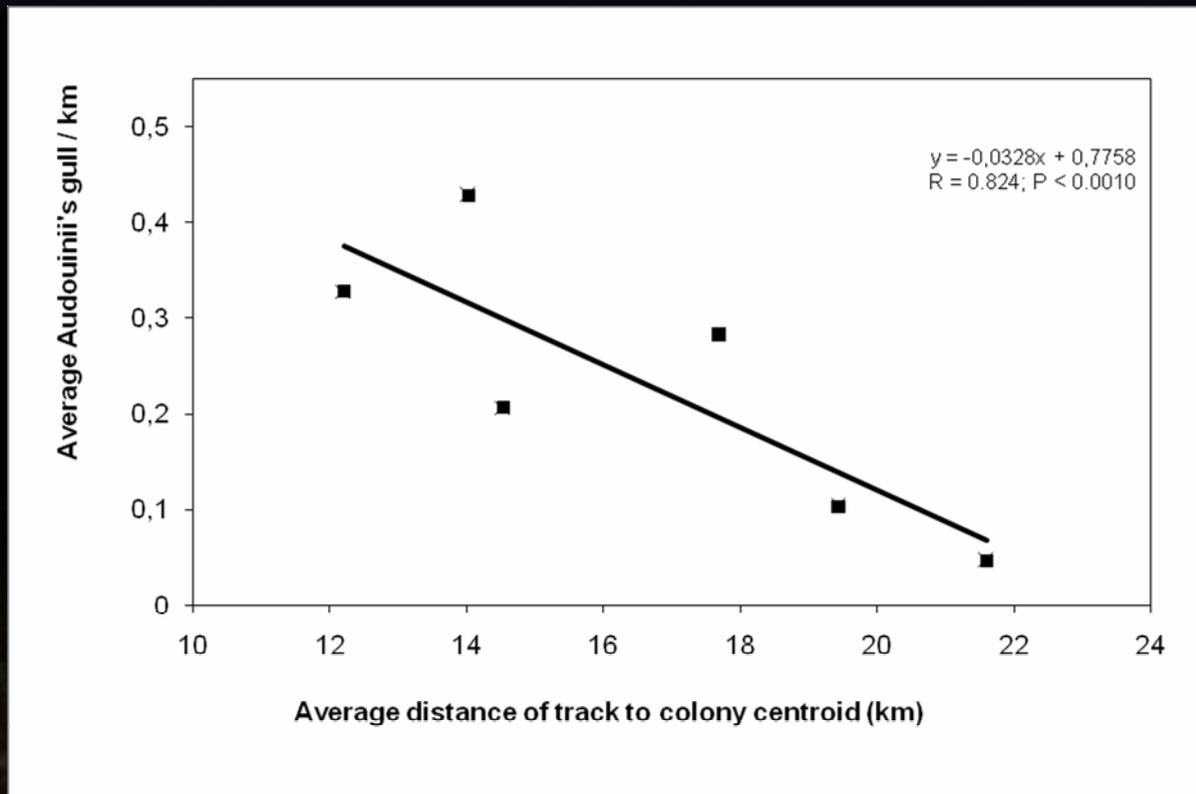
RED SWAMP CRAYFISH PRESENCE IN TERRESTRIAL PREYS

> Increase of Red swamp crayfish in Audouin's gull terrestrial preys



AVERAGE GULL/KM WAS INVERSELY PROPORTIONAL TO DISTANCE OF TRACK TO COLONY

> The furthest the transects were from colony, the less observations of Audouin's Gull we obtained





Discussion

1. Audouin's Gull takes advantage of Red swamp crayfish as soon as the rice paddies are flooded (late April-beginning of May) and this behaviour lasts until the rice plant is grown.
2. The high presence of rests of Red swamp crayfish within the colony shows that this behaviour is widespread within it.
3. The reasons of this behaviour aren't explained yet. Some possible explanations:
 - High abundance of Red Swamp crayfish
 - High increase of number of breeding pairs which should have to exploit new sources of food
 - Progressive learning of young individuals which have been fed with that prey
 - Decrease of fish stocks and discards of fish due to European policy
5. Considering predation of Red swamp crayfish occurs without moratoria it seems this species has become a "competitive" prey

6. Taking into account that the Red swamp crayfish gives less energy, advantages in predateding it instead of fish should happen because of:
 - Shorter distance to feed
 - Constant and high availability (also at the weekends)
 - Less competition with other gulls
7. Different use of the resource from other gulls like Yellow legged Gull and Lesser Black-backed Gull
8. Different use of the rice paddies within breeding season was observed
9. This ecological change could explain the new increase of breeding success of Audouin's Gull population
10. We can affirm that this gull has become temporary a continental one, a behaviour that wasn't recorded before 1981 before it started to breed at La Punta de la Banya
11. Finally, it seems that this feeding habit is overspreading as Lesser Black-backed Gull feds on Red swamp crayfish in Doñana (Chiclana et al.), as well as Audouin's Gull in Albufera ricefields.



Audouin's Gull (*Larus audouinii*): from a pelagic foraging stress to an establishment of a temporary terrestrial diet in Ebro delta rice paddies

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