



MINISTERO DELL'AMBIENTE  
E DELLA TUTELA DEL TERRITORIO E DEL MARE

**ITALY**

**MINISTRY FOR THE ENVIRONMENT,  
LAND AND SEA**

**General Board for Nature and Sea  
Protection**

# **Monitoring density and abundance of cetaceans in the seas around Italy through aerial surveys for conservation**

**4<sup>th</sup> ACCOBAMS Meeting of the Parties**

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# International framework

Systematic monitoring is essential to inform conservation measures in Marine Protected Areas and to assess cetaceans' population trends

Monitoring programmes are among the priority actions in the Pelagos Sanctuary Management Plan, ACCOBAMS and the Specially Protected Areas and Biodiversity Protocol under the Barcelona Convention, the UN Environment Programme, through its Mediterranean Action Plan and the Scientific Committee of the International Whaling Commission (IWC)

# European framework

EU Habitats Directive: maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of Community interest in need of strict protection.

Monitor these habitats and species and report every six years on whether their conservation status is favourable and on the implementation of measures taken to ensure this.

## National framework

The Italian Ministry of the Environment has started a series of project to assess and monitor abundance and density of cetaceans and other mega fauna in the seas around Italy:

- Pelagos Sanctuary, winter and summer 2009
- Ionian Sea, Gulf of Taranto, spring 2010
- Central Tyrrhenian Sea, summer 2010
- Pelagos Sanctuary, summer 2010
- Sardinia and Corsica Seas, summer 2010
- Southern Tyrrhenian Sea, ongoing

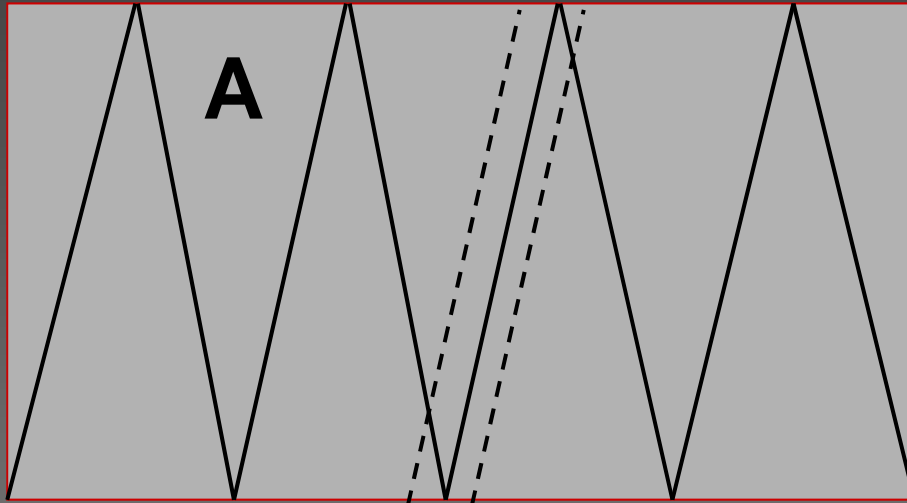
Species / subspecies	Unit	IUCN criterion		Status		Notes	Assessor/s
				Past trend	Present trend		
<b>Killer Whale</b> <i>Orcinus orca</i>	Strait of Gibraltar subpopulation	CR	C2a(i,ii); D	?	↘	Killer Whales in the Mediterranean were not assessed and are included in the "Visitor species" section	Cañadas and de Stephanis
<b>Sperm Whale</b> <i>Physeter macrocephalus</i>	Mediterranean subpopulation	EN	C2a(ii)	↘	↘		Notarbartolo di Sciara, Frantzis, Bearzi and Reeves
<b>Short-beaked Common Dolphin</b> <i>Delphinus delphis</i>	Mediterranean subpopulation	EN	A2abc	↘	↘	Assessed in 2003	Bearzi (2003)
<b>Common Bottlenose Dolphin</b> <i>Tursiops truncatus</i>	Mediterranean subpopulation	VU	A2cde	↘	?		Bearzi and Fortuna
<b>Striped Dolphin</b> <i>Stenella coeruleoalba</i>	Mediterranean subpopulation	VU	A4de	↘	↘		Aguilar
<b>Fin Whale</b> <i>Balaenoptera physalus</i>	Mediterranean subpopulation	DD					Notarbartolo di Sciara and Panigada
<b>Long-finned Pilot Whale</b> <i>Globicephala melas</i>	Mediterranean subpopulation	DD					Cañadas
<b>Risso's Dolphin</b> <i>Grampus griseus</i>	Mediterranean subpopulation	DD					Gaspari and Natoli
<b>Cuvier's Beaked Whale</b> <i>Ziphius cavirostris</i>	Mediterranean subpopulation	DD					Cañadas
<b>Harbour Porpoise</b> <i>Phocoena phocoena relicta</i>	Black Sea subspecies	EN	A1d + A4cde	↘	↘	Interpreted to include the animals in the northern Aegean Sea	Birkun and Frantzis
<b>Short-beaked Common Dolphin</b> <i>Delphinus delphis ponticus</i>	Black Sea subspecies	EN	A1d	↘	?		Birkun
<b>Common Bottlenose Dolphin</b> <i>Tursiops truncatus ponticus</i>	Black Sea subspecies	EN	A2cde	↘	?		Birkun

Proposed as VU in 2010

# Line transect sampling

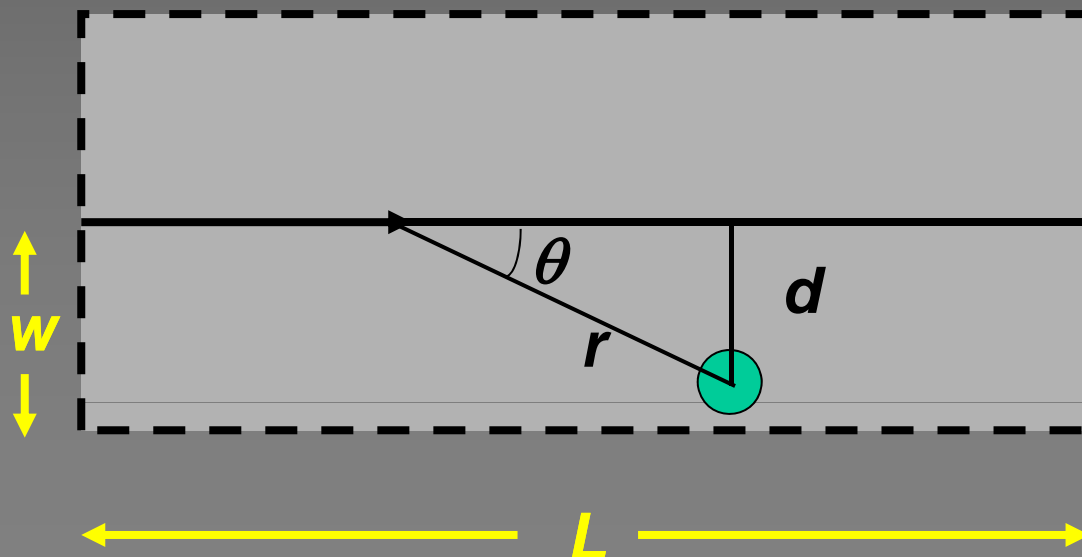
- ✓ Define the area within which abundance is to be estimated
- ✓ Search along pre-determined transect lines for animals
- ✓ When encounter an animal (group of animals):
  - ✓ Identify species
  - ✓ Determine group size
  - ✓ Measure perpendicular distance from animal/group to transect line
- ✓ Continue searching along transect lines
- ✓ Provides estimates of abundance in a defined area in a defined period of time

# Line transect sampling



Cruise tracks designed to sample area representatively

$A$  = size of area



Area searched =  $2wL$

$d$  = perpendicular distance

$R$  = Radial distance

$\theta$  = angle

$d = r \sin(\theta)$



# Estimating $g(0)$

The most critical assumption in line transect methodology is that animals or schools directly on the line are always detected

This assumption may be biased by the

- availability bias (when animals in the track-line are not observed because they are diving). Use diving information.
- perception bias (when the observer fails to detect an animal on the track-line although it is available). Can be  $\sim 1$  with expert observers.

# General issues

- Objectives
- Aerial vs shipboard
- Type of plane
- Track design
- Methods and equipment



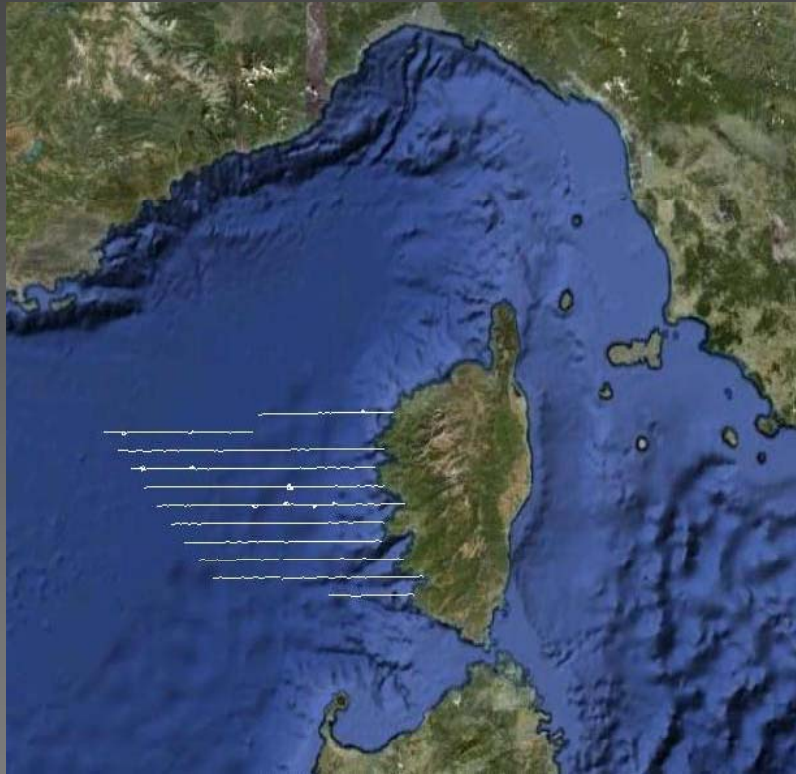
# Is it a ship – or is it a plane?



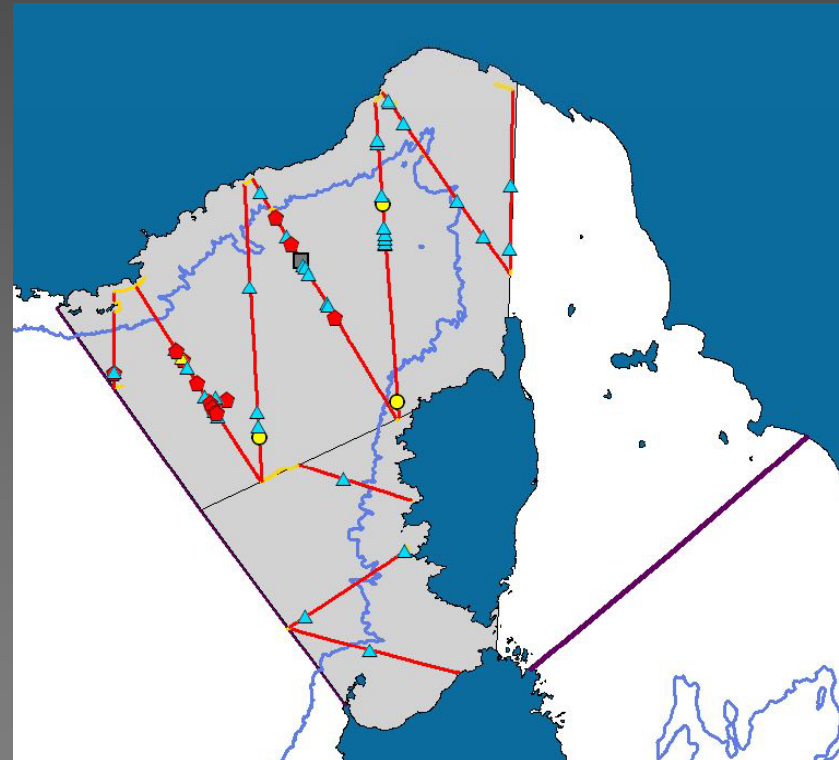
- Coastal waters/coastline
- Species
- Endurance/airport availability
- Prevalent weather conditions
- Equipment
- Sea sickness vs psychology!
- COST!



# Daily effort



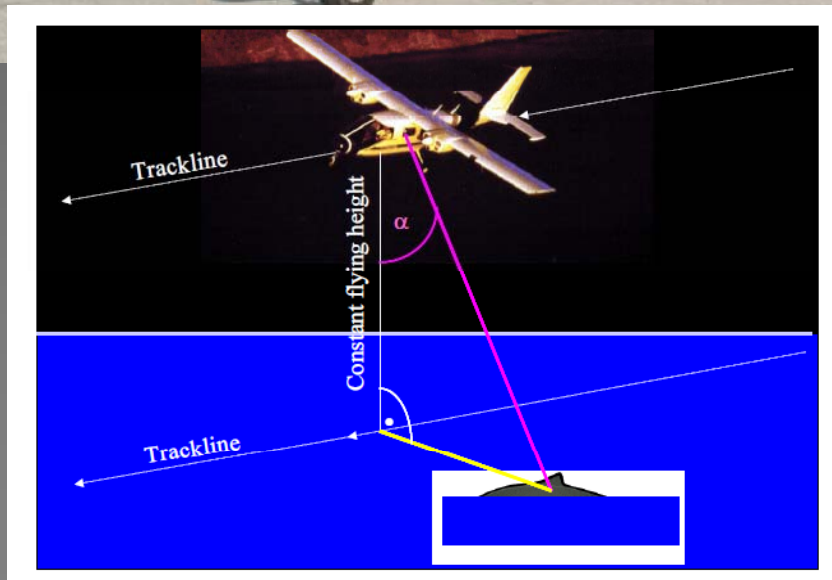
**Airplane**  
**750 nautical miles 1 day**  
**(26/7/09)**



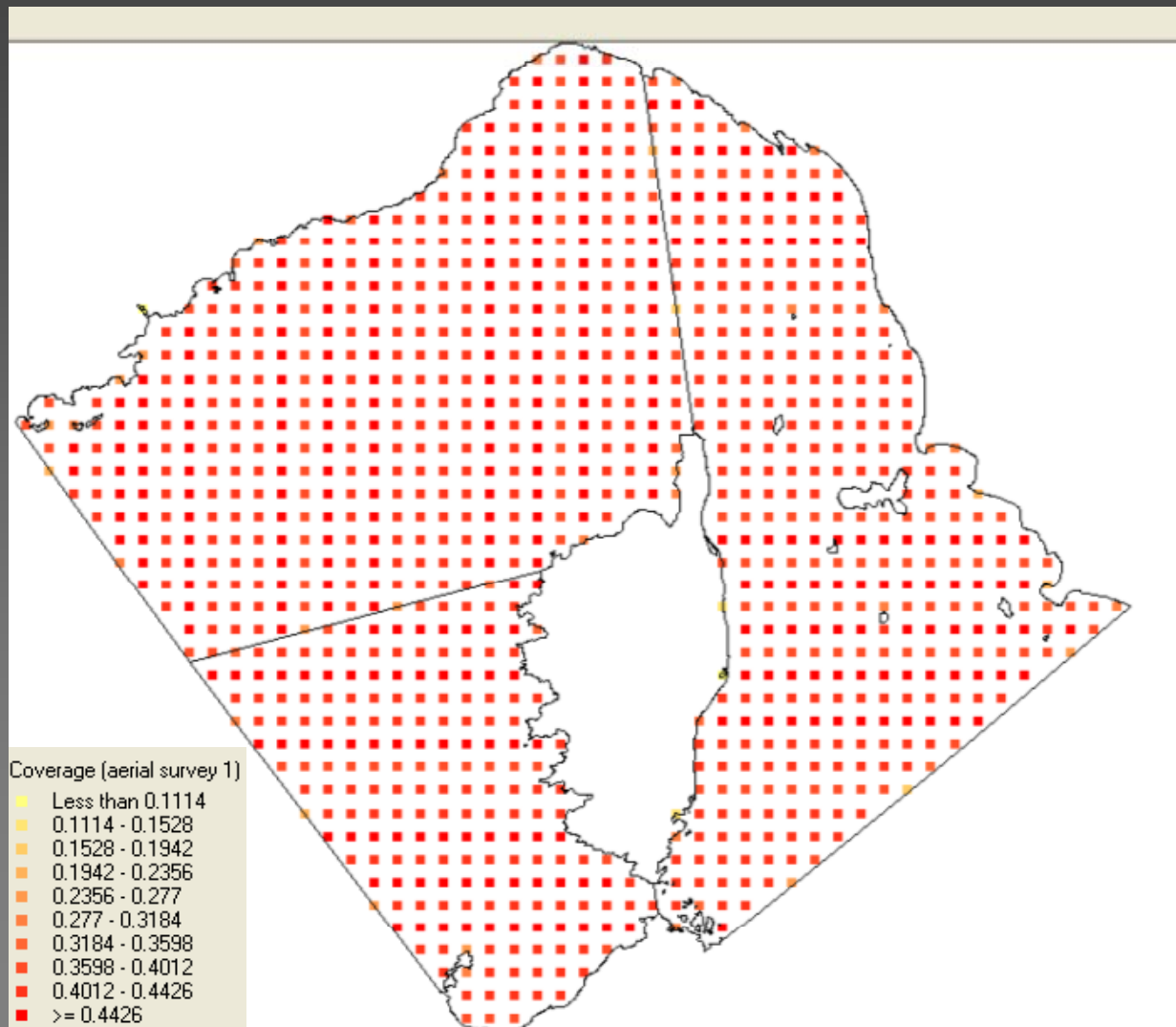
**Ship**  
**677 nautical miles 8 days**  
**(3 – 10/8/08)**



# Partenavia P-68



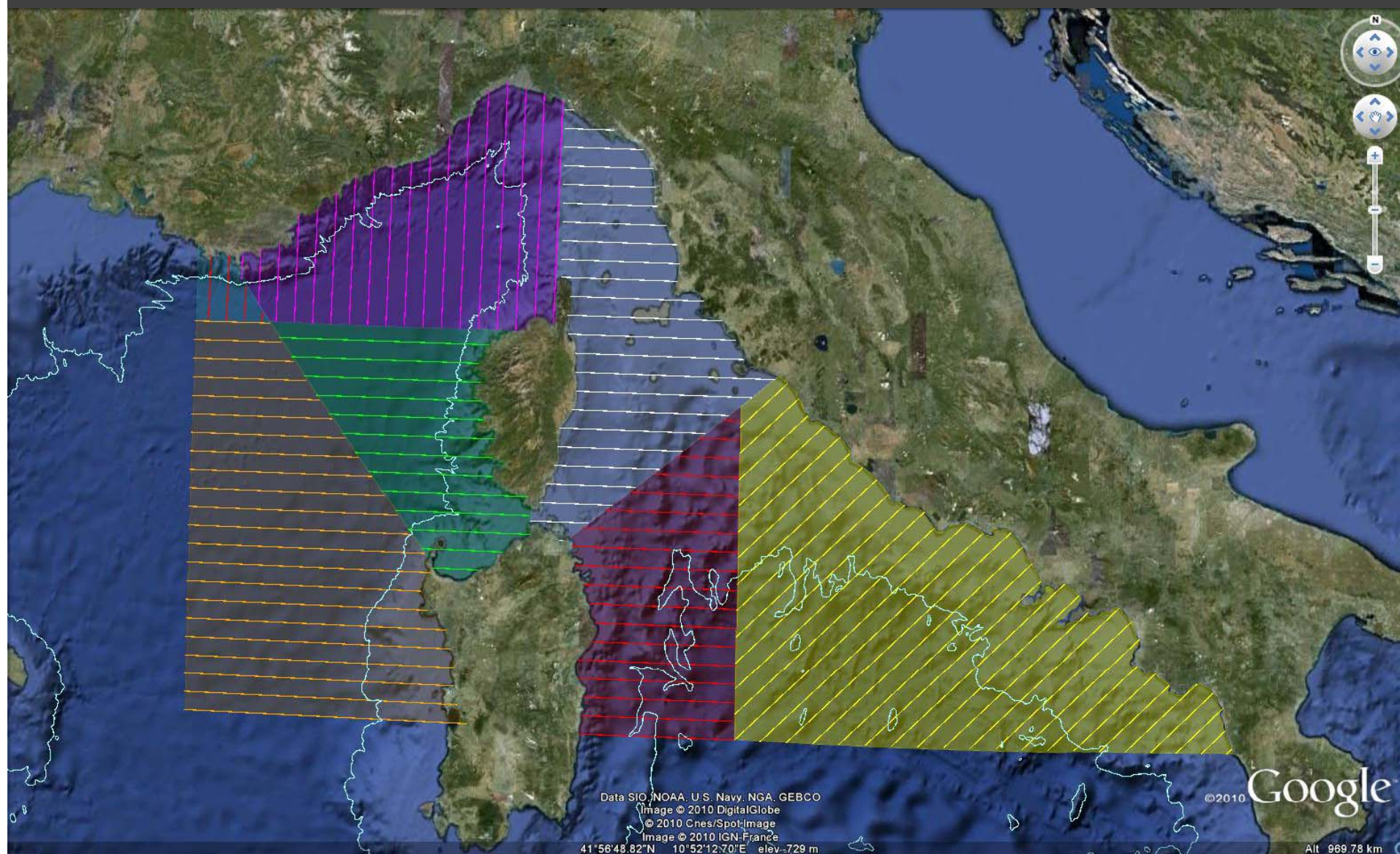
# Equal coverage probability



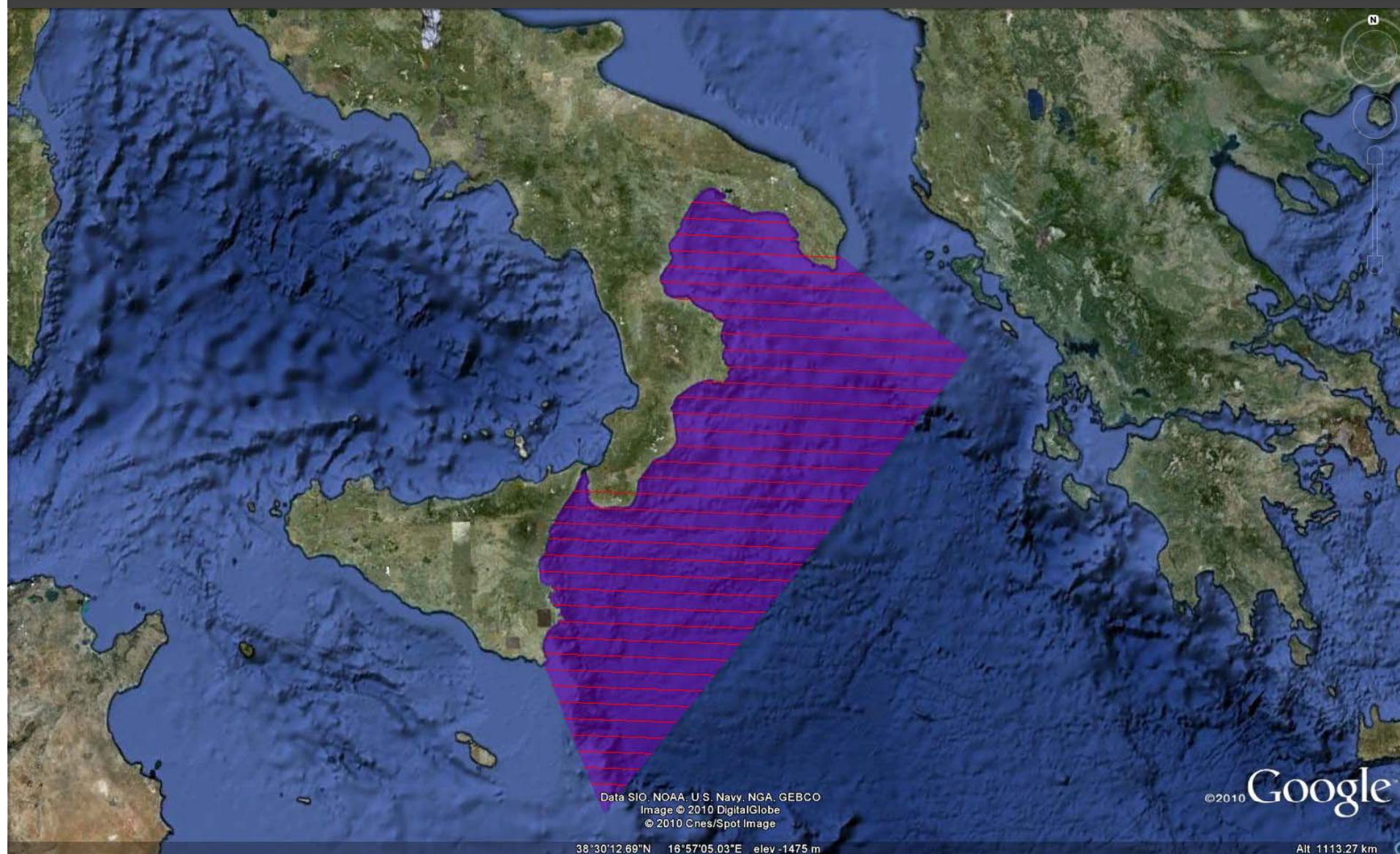
Transects are placed at random using a design where each part of the study area has an equal probability of being surveyed







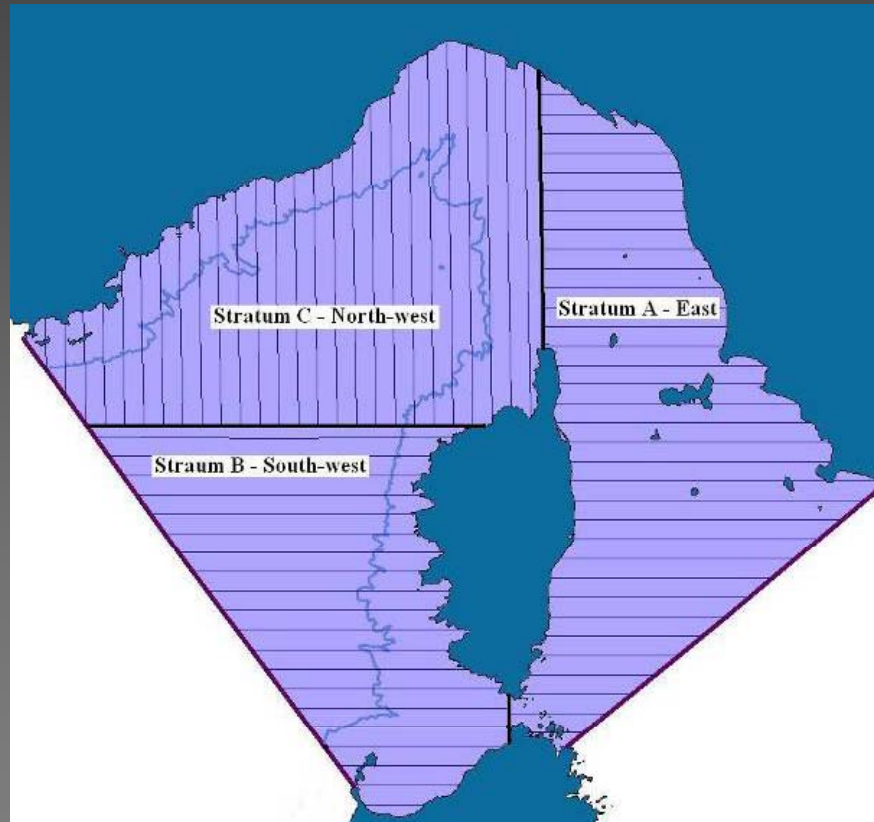








# Case study: the Pelagos Sanctuary



82 transects, spaced 10 km  
between each others  
total of 8,852.56 Km



## Results: winter

131 cetacean sightings in total

striped dolphins ( $n=114$ ), common bottlenose dolphins (7),  
fin whales (1), sperm whales (1), Cuvier's beaked whales (1)

Stratum	Size (km <sup>2</sup> )	$k$	$L$ (km)	$Sc$
A	30 907	34	2 932.6	31
B	23 208	20	2 273.5	33
C	34 153	22	2 938.3	47
Total	88 267	76	8 144.4	111

# Results: summer

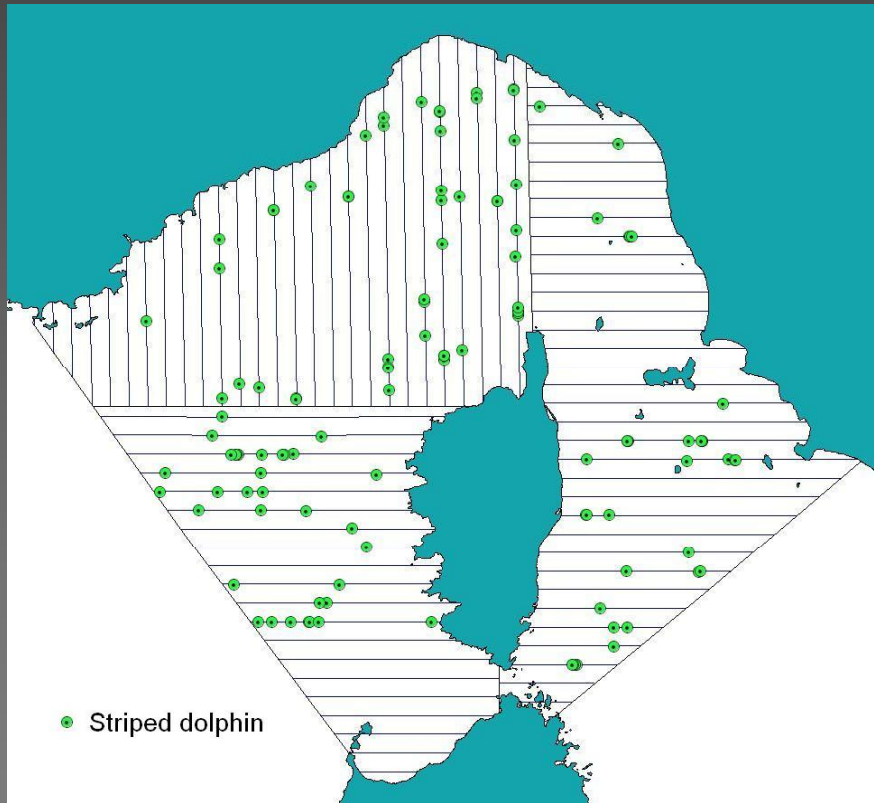
330 cetacean sightings in total

striped dolphins ( $n=280$ ), fin whales (24), common bottlenose dolphins (8), sperm whales (5), Risso's dolphins (4), long finned pilot whales (5), Cuvier's beaked whales (1)

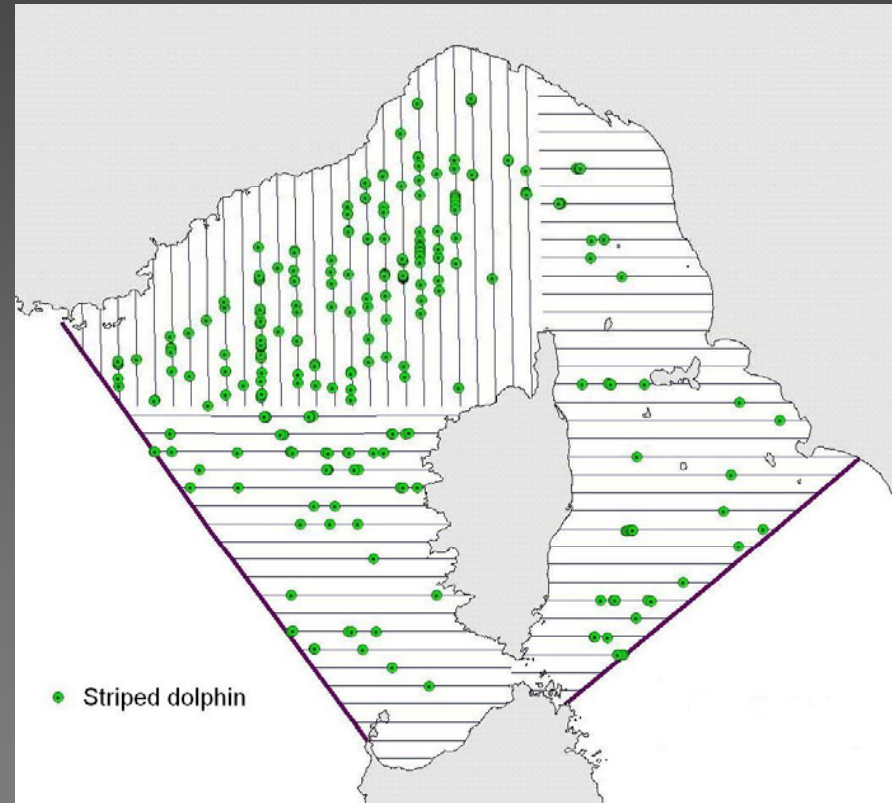
Stratum	Size (km <sup>2</sup> )	$k$	$L$ (km)	$Sc$	$Bp$
A	30 906	34	3 033.3	45	2
B	23 208	20	2 264.8	57	8
C	34 153	25	3 148.9	168	6
Total	88 267	79	8 446.3	270	16



# Results: striped dolphins

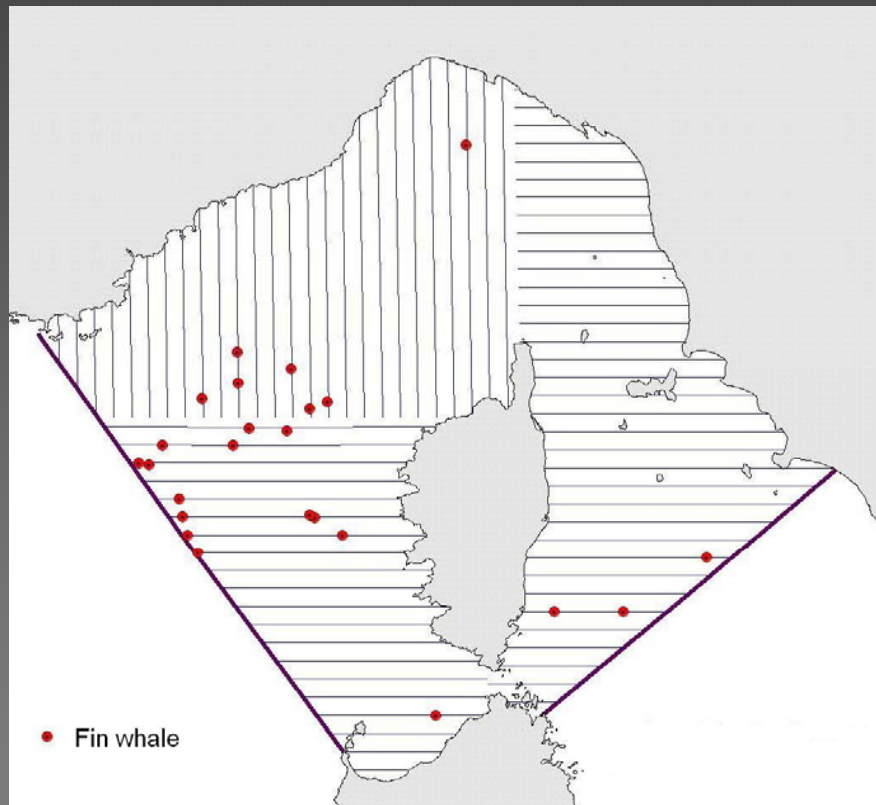


Winter 2009

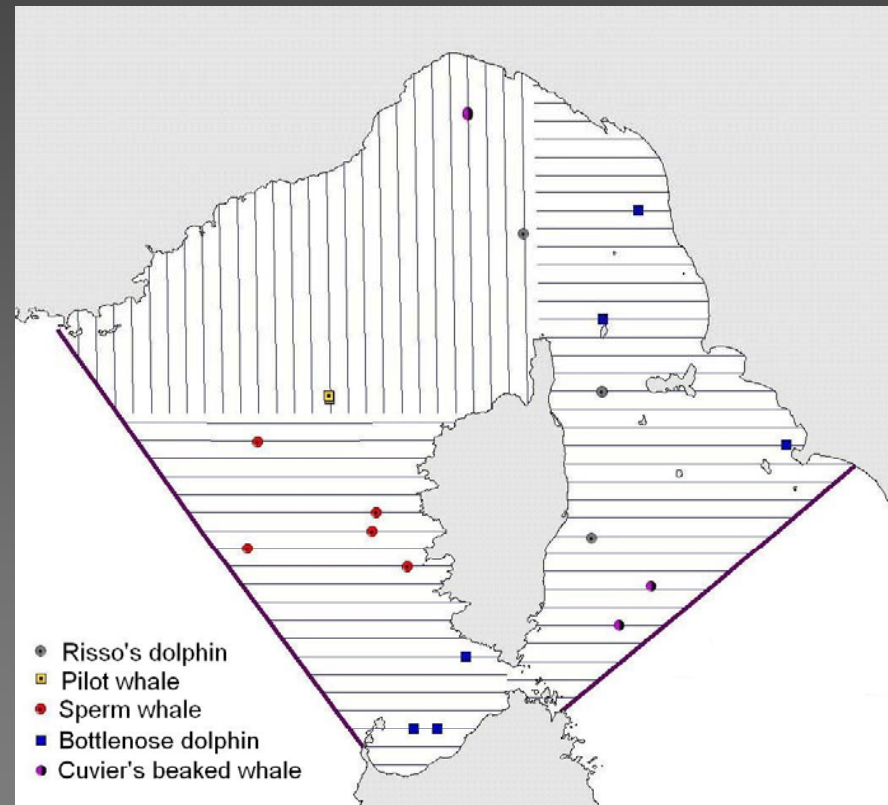


Summer 2009

# Fin whales and other species

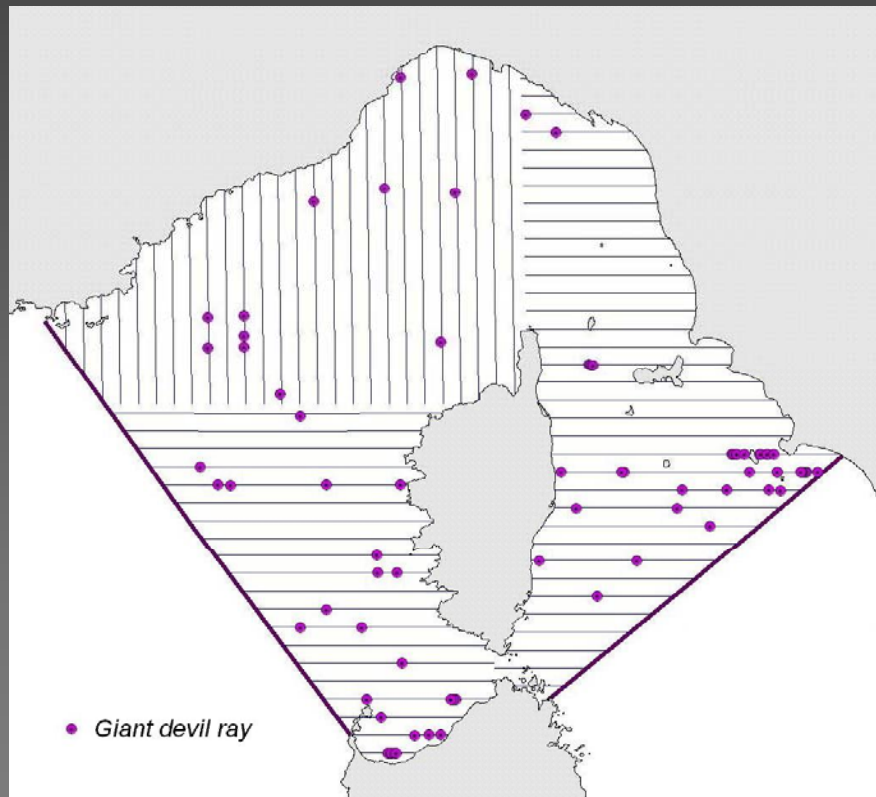


Summer 2009

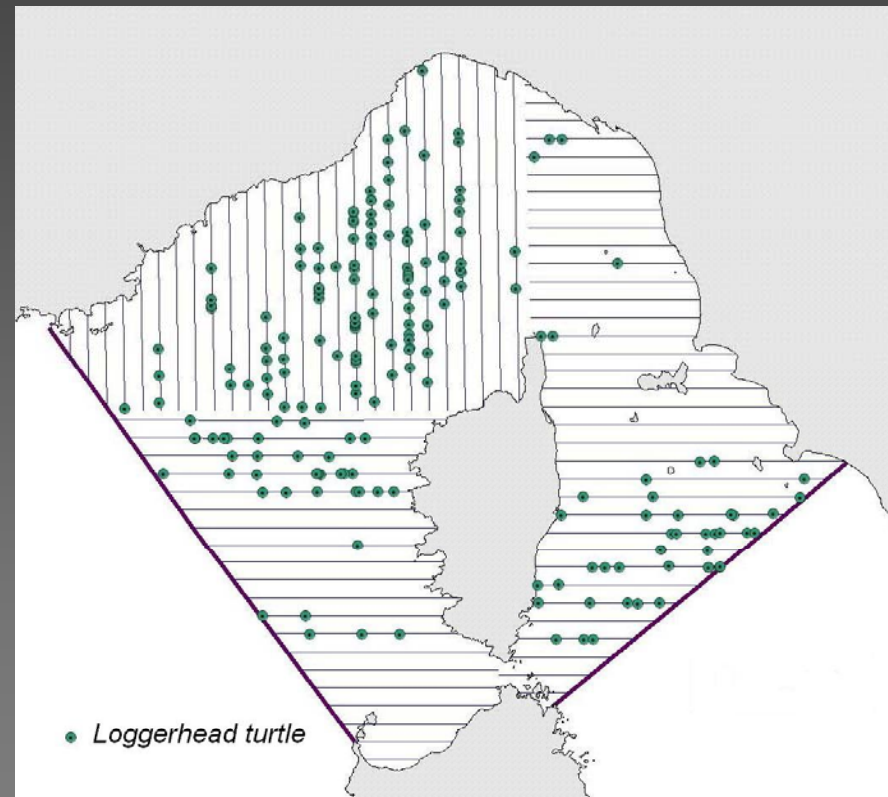


Summer 2009

## Other megafauna



Summer 2009



Summer 2009

# Data analysis

- Dedicated software Distance 6.0 was used;
- both Conventional Distance Sampling (CDS) and Multiple Covariate Distance Sampling (MCDS) was used to estimate striped dolphins abundance.





# Abundance estimates, *Stenella*

## Winter

n/L	%CV(n/L)	D	%CV(D)	N	%CV(N)	95% CI(N)
0.013	14.18	0.218	20.25	19275	20.25	12 972 - 28 641

## Summer

n/L	%CV(n/L)	D	%CV(D)	N	%CV(N)	95% CI(N)
0.031	13.97	0.47	16.04	39363	16.04	23 319 – 55 491

# Abundance estimates, fin whale

Fin whales:  $N=152$  (% CV=29.8; 95% CI 85 - 272)



# Discussion - 1

- This program illustrates the value of aerial surveys for monitoring, particularly in winter when the weather is poorer;
- increase the chance to cover a wide area in great detail, allowing high coverage of the area, with more robust estimates with lower CVs and CIs;
- other megafauna has been observed: loggerhead turtles, giant devil rays and basking sharks listed as endangered or threatened species of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD) within the Barcelona Convention.

## Discussion - 2

- A simple comparison with data from past shipboard surveys suggests an appreciable decrease in presence and density of fin whales in the Pelagos Sanctuary area in the summer;
- variations in density and abundance were detected between winter and summer surveys, with higher numbers in the summer months, when human activities (and potential impact on cetaceans) reach maximum levels;
- fin whales were not sighted during the winter survey, although previous acoustic data indicates some presence;
- robust data after the density estimation obtained in the same region (Forcada et al. 1995).

## In conclusion

- Valuable biological information for the conservation of cetaceans in the Mediterranean Sea;
- abundance of the most common cetacean in the Mediterranean, one of the ACCOBAMS and Pelagos priorities;
- conservation action plans proposed by the IUCN (Reeves et al. 2003);
- inform management measures ( $CV < 35\%$ , Wade and DeMaster 1999);
- the density and distribution data provide valuable baseline information for the proposed basin-wide ACCOBAMS Survey;
- **the method and the expertise developed by Italy during these aerial surveys can be easily exported elsewhere, to promote and facilitate similar effort in other areas.**