

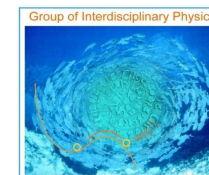


**“Preliminary Analysis On Correlations Between Spatial Distribution Of Chlorophyll-a And Experimental Data Of Biomass On The Sicily Channel (IAMC – CNR – Mazara del Vallo)”**

Docente  
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**Group of Interdisciplinary Physic** in collaboration with **IAMC – CNR – Mazara del Vallo**



- This study is aimed to use a **GIS-Based** system for providing the basis for alternative ways of a **sustainable harvest of efficient fishery resources**.
- The use of remote sensing to provide synoptic measurements of the oceans is becoming increasingly important in **fisheries research** and fishing operations. **Variation in ocean conditions** play **key role** in **natural fluctuations of fish stocks** and in their vulnerability to harvesting [1].
- Information on the changing ocean (**physical, chemical and biological quantities**) is necessary to understand and to eventually **predict the effects of the ocean on fish population**. The evolving capabilities of **satellite sensors** and **data processing technologies** combined with conventional data collection techniques and **GIS modeling** provide a powerful tool towards fish forecasting and thus allowing sustainable management of living marine resources.

- Techniques in the development of fishing grounds have used such oceanographic phenomena as [upwelling areas](#), [temperature fronts](#), [ocean colors](#) and the presence of large amounts of [chlorophyll-a](#) in the water as indicators of areas of fish stock congregations and fish stocks migration. [Sea surface temperature](#) and [salinity](#) and other oceanographic conditions can further assist to develop these areas know as potential fishing zones for forecasting of natural fluctuations of stocks, their congregation and migrations.
- With the advent of satellite a oceanographic study, these oceanographic features such as ocean color, sea surface temperature, [chlorophyll-a concentration](#) can be successfully [mapped in near real time basis](#). This capability coupled with the [knowledge of oceanographic conditions](#) affecting fishery population and historical catch data can lead towards [forecasting of fish populations](#) and their movements. Thus affording the capacity to harvest the fishery resources effectively and equally important on sustainable basis [2].

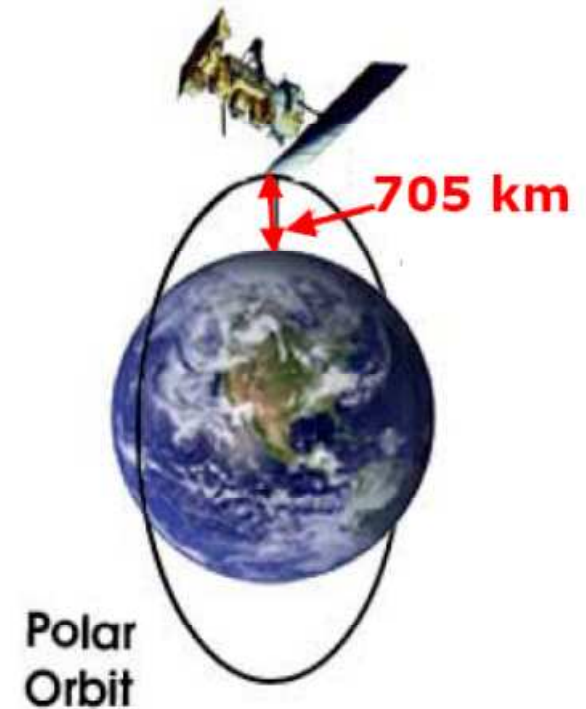
## Something about the MODIS – AQUA:

Launched May 4, 2002

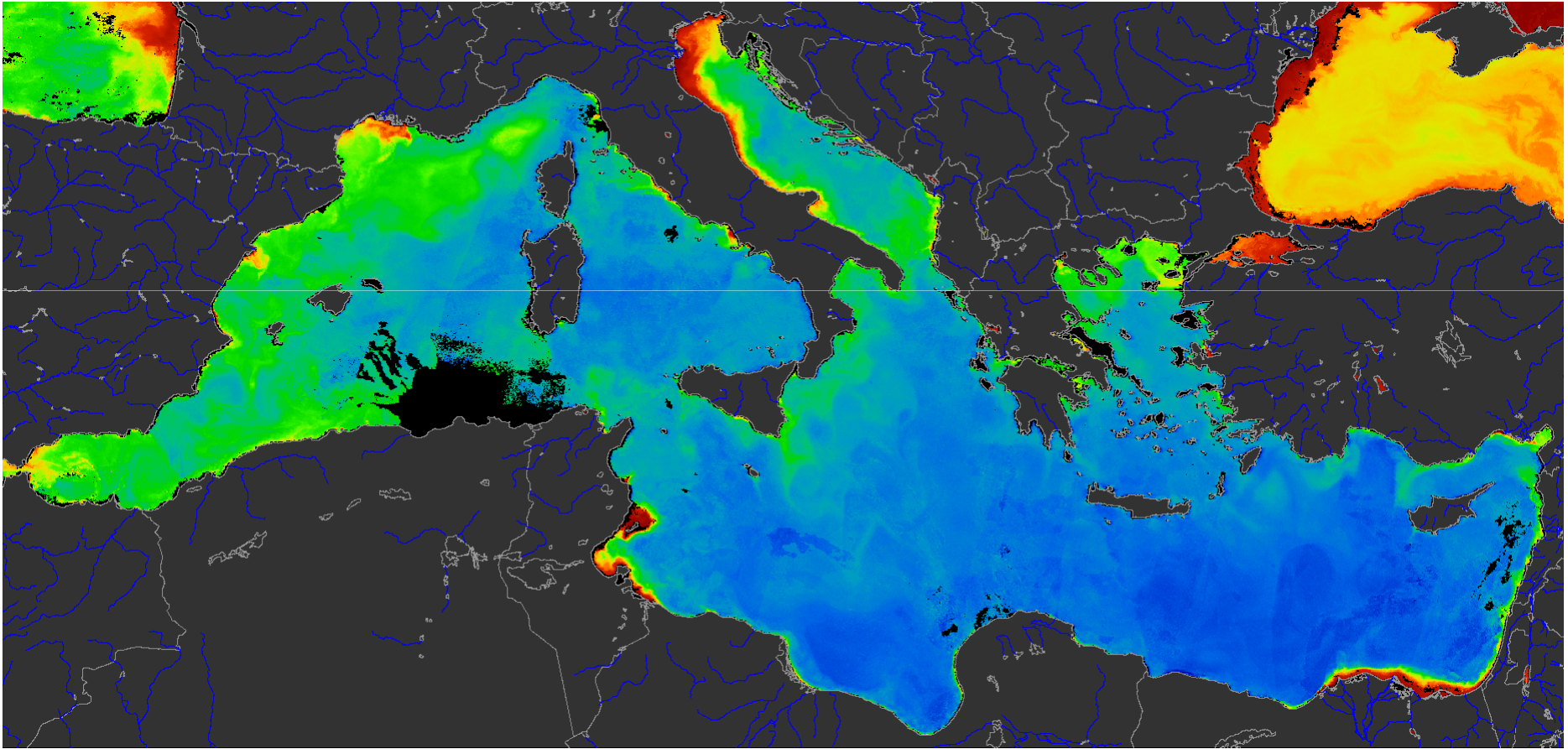
**ALTITUDE: 705 Km (Polar orbiting)**

**Spatial resolution:**

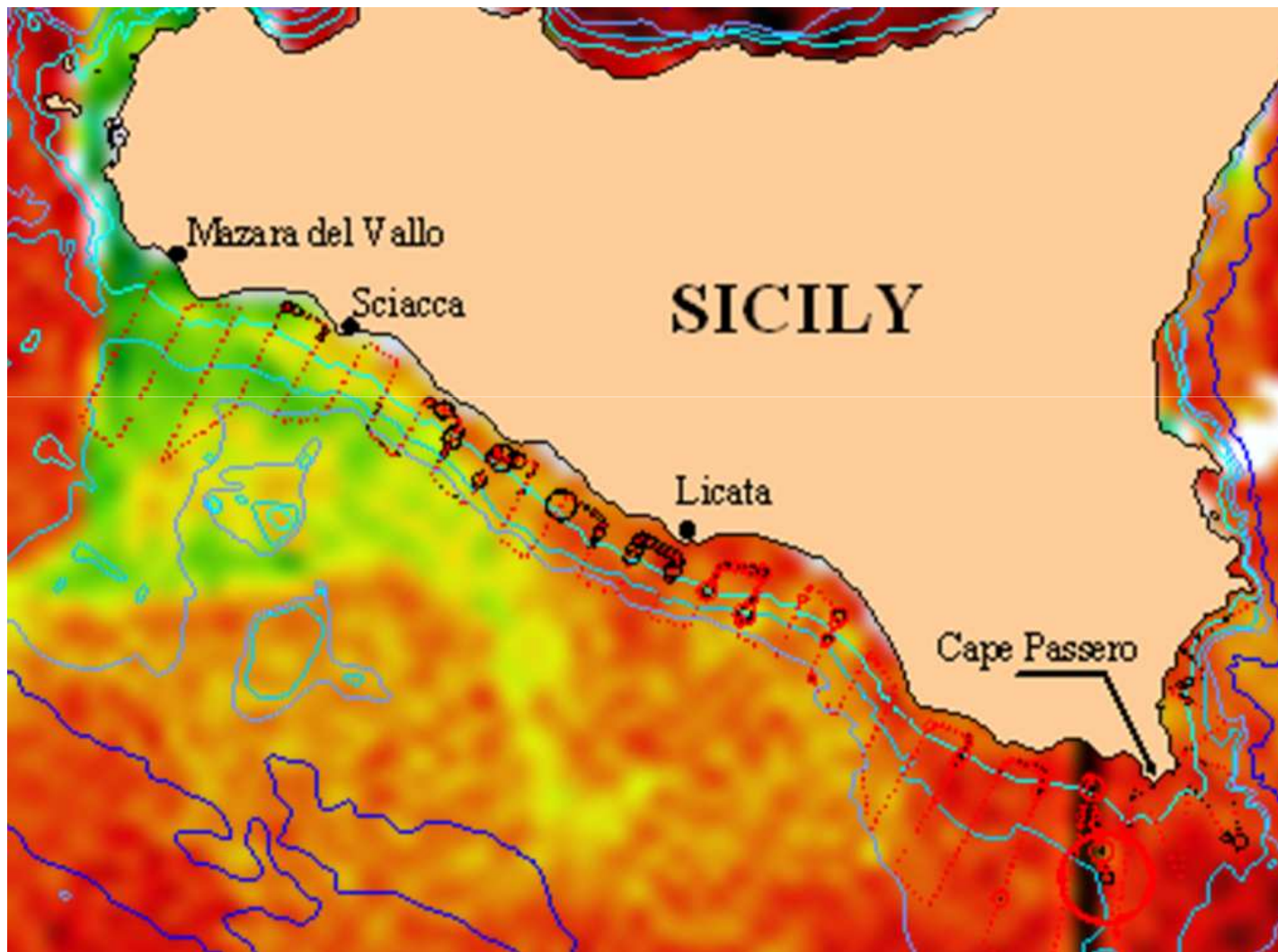
- 250 m
- 500 m
- 1 Km
- 4 Km
- 9 Km



## Some MODIS – AQUA images:



## Some MODIS – AQUA images:



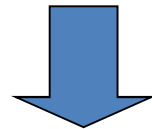
After this quickly explanation, something about the steps used to process satellite data & image available on NASA satellite MODIS-AQUA.

Step 1.

**MODIS – AQUA HDF\_FILE acquirement (from NASA)**

Step 2.

**ANALISYS of HDF\_FILE**

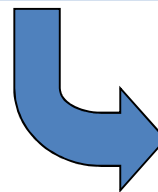


**OCEAN COLORS**

**2.1 Image Analisys (+ 1<sup>oo</sup> processing)**

**2.2 Grid generation & overlapping**

**2.3 Point to Point processing**



**Automatic Processing Software (in progress)**

# OCEAN COLORS

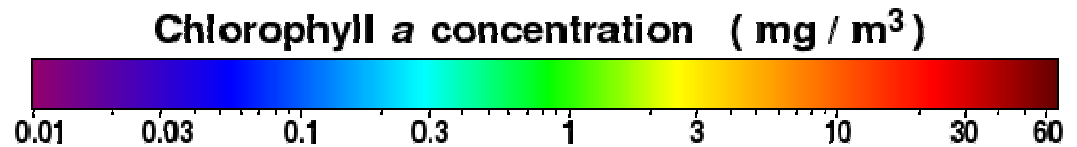
What does it means?

Which the parameters of interest?

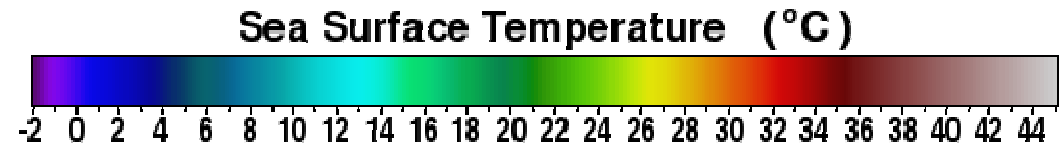
A lot of data available

Our studies:

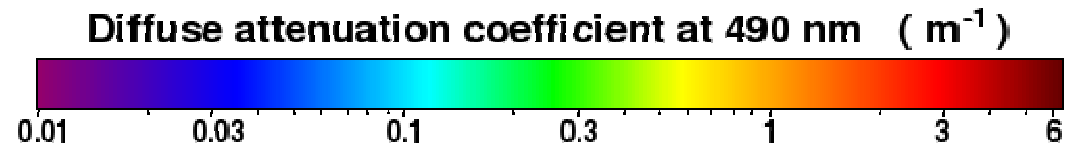
CHLOROPHYLL - a



SST



K - 490



Fluorescence (in progress)



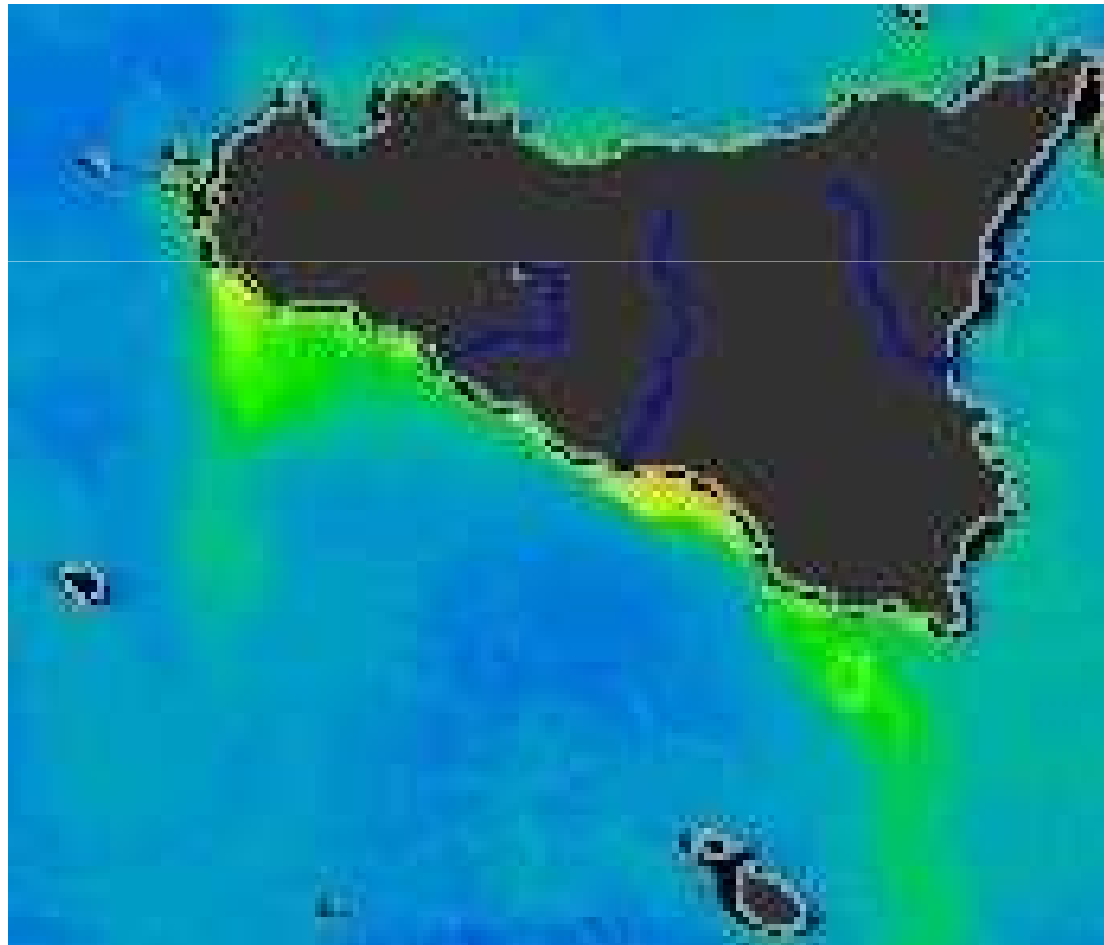


Our studies centered on relationship between *chlorophyll-a* and *fish density*

## The studies

In this example the image is obtained by Empirical chlorophyll algorithm for preliminary validation of the mediterranean region (based on NASA HDF file )

## 2.1 Image Analysis (+ 1<sup>st</sup> processing)



## The studies

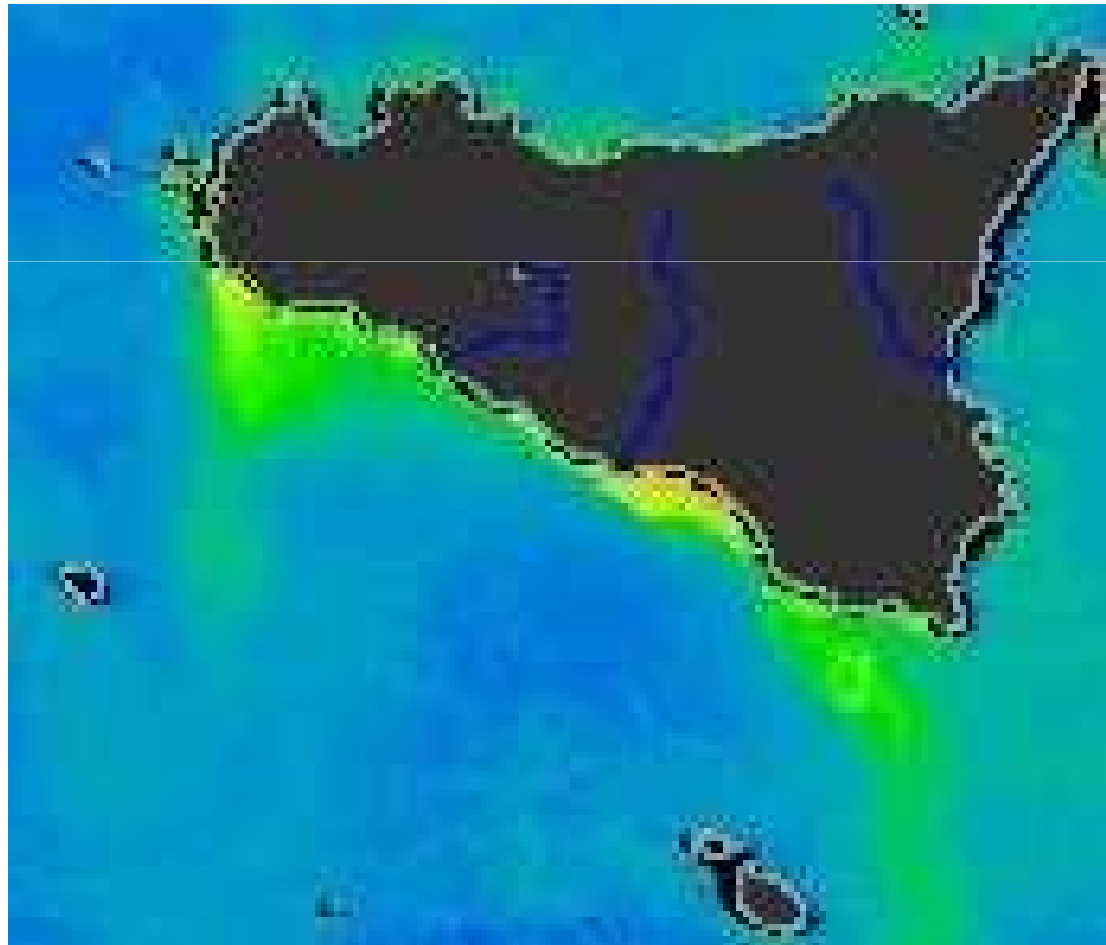
Step 2 is based on the two process:

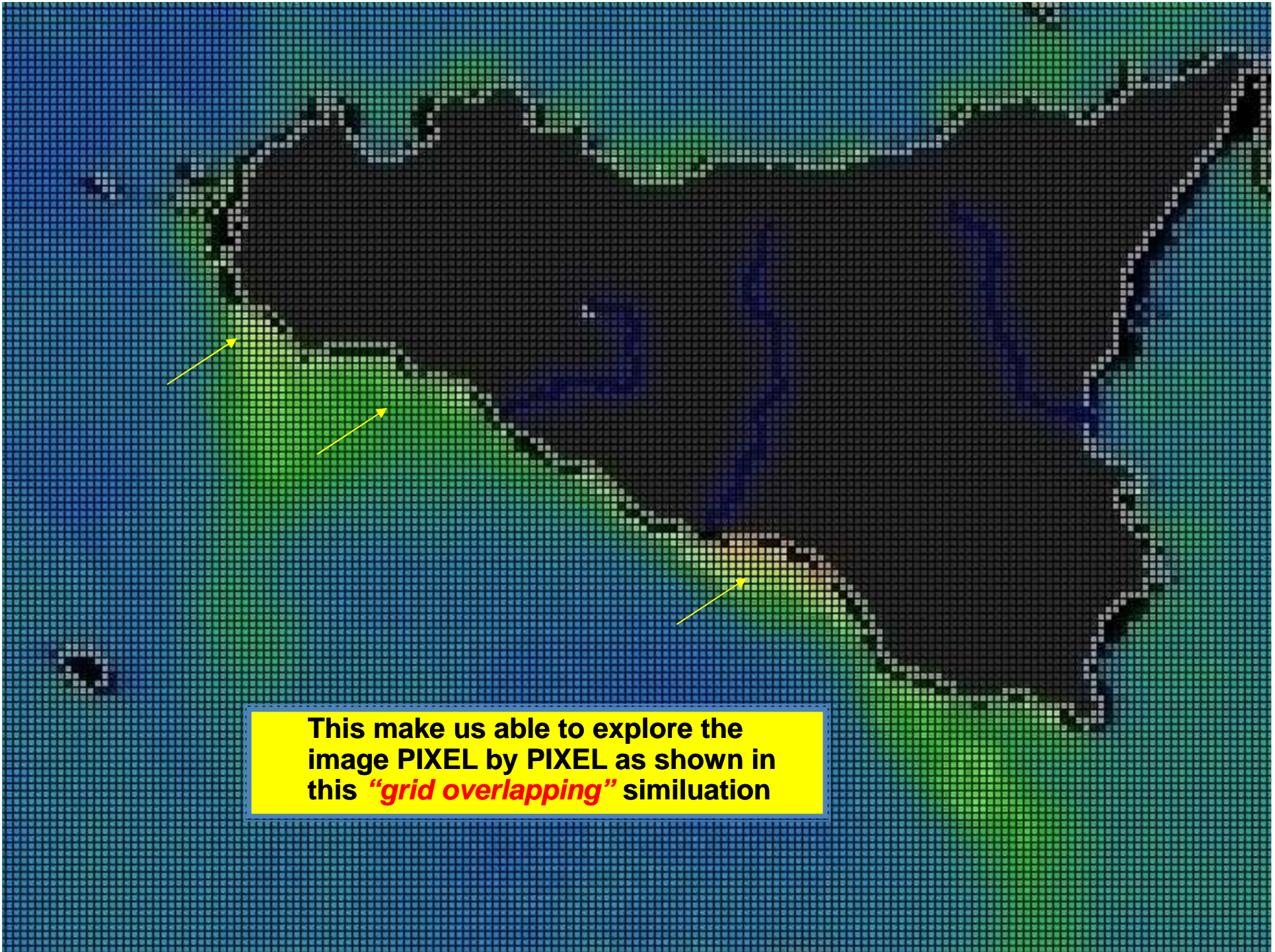
***“Grid generation”***

***“Grid Overlapping”***

Starting by the image processed as explained in step 1

## 2.2 Grid generation & overlapping

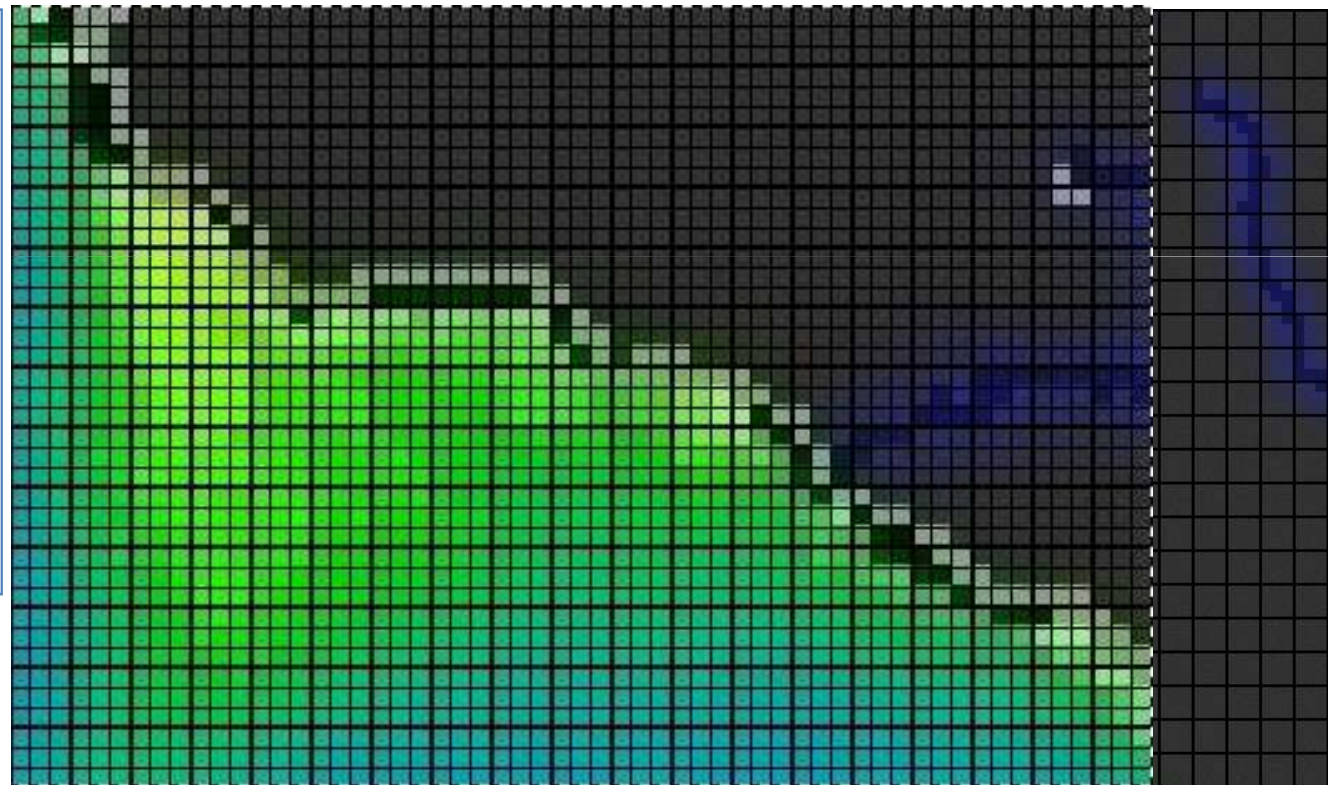




This make us able to explore the image PIXEL by PIXEL as shown in this "grid overlapping" similation

**Often it's not important to investigate the entire image but only the R.O.I (Region of interest) as in this example.**

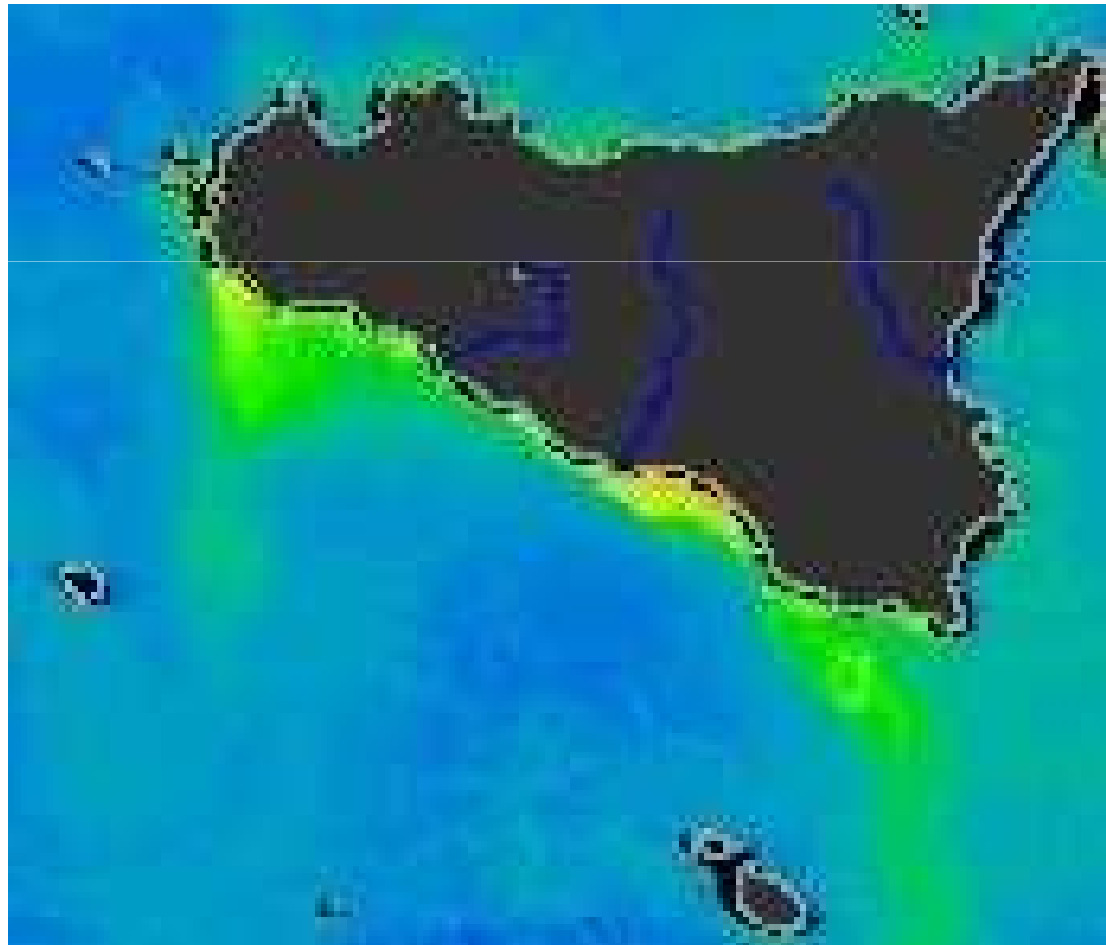
**We can also iterate the process.**



## The studies

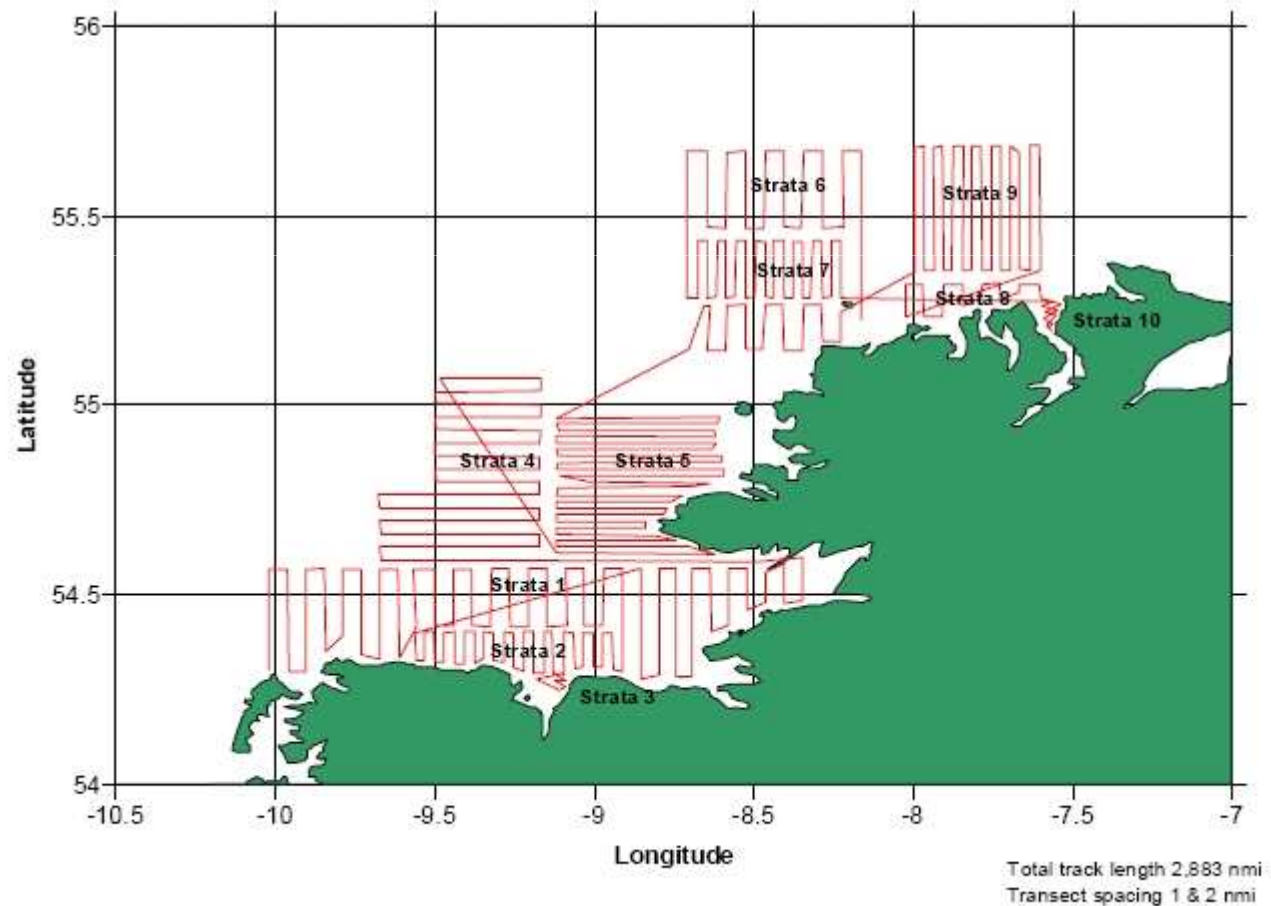
Step 3 is based on matching, and research of **possible correlation** between our “**chlorophyll-a concentration data**” and data acquired during CNR “**in situ**” relevations.

## 2.3 Point to Point processing



It is important to note that studies conducted according to these methods are now a popular *modus operandi* in the field of research of this type.

### I.E. Study on Northwest Sea



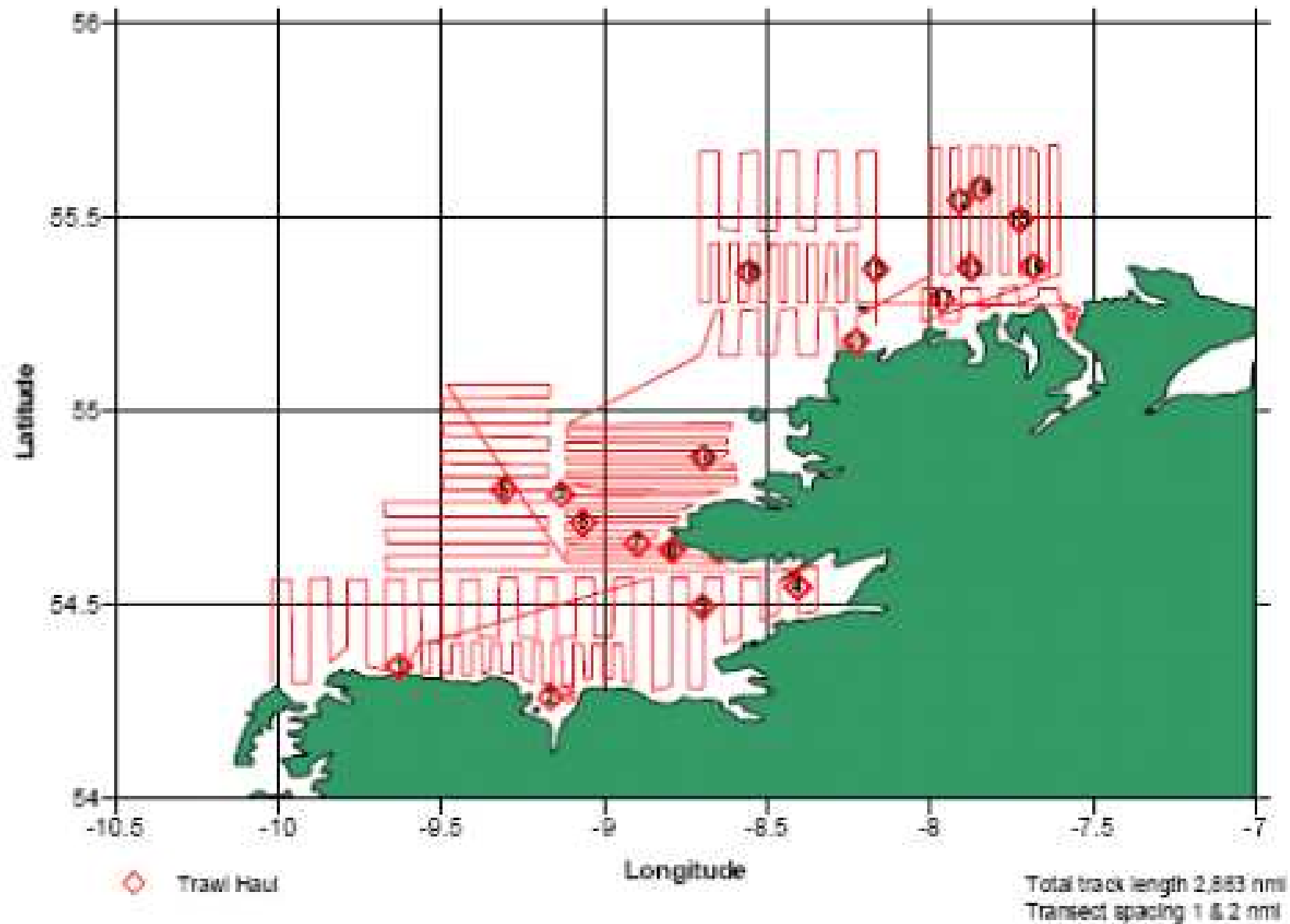
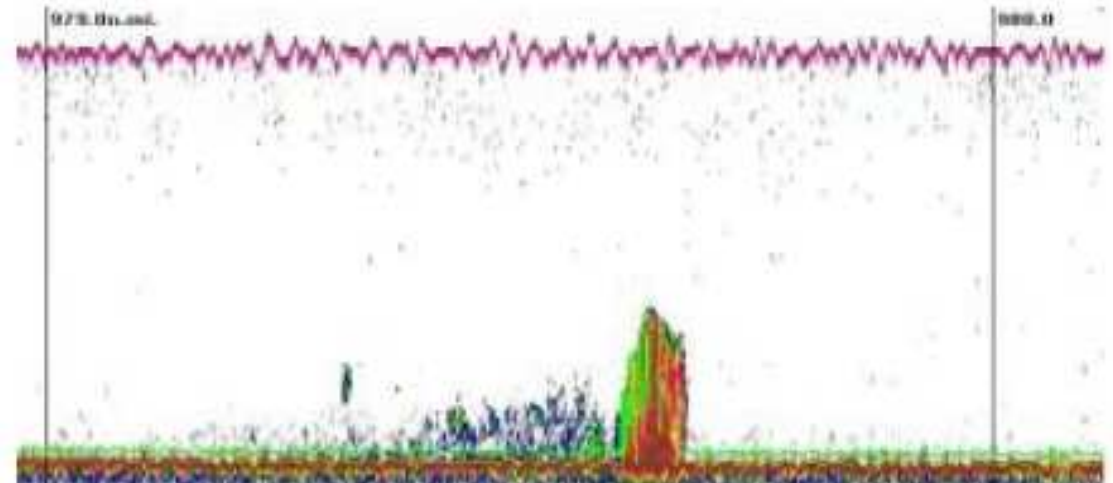
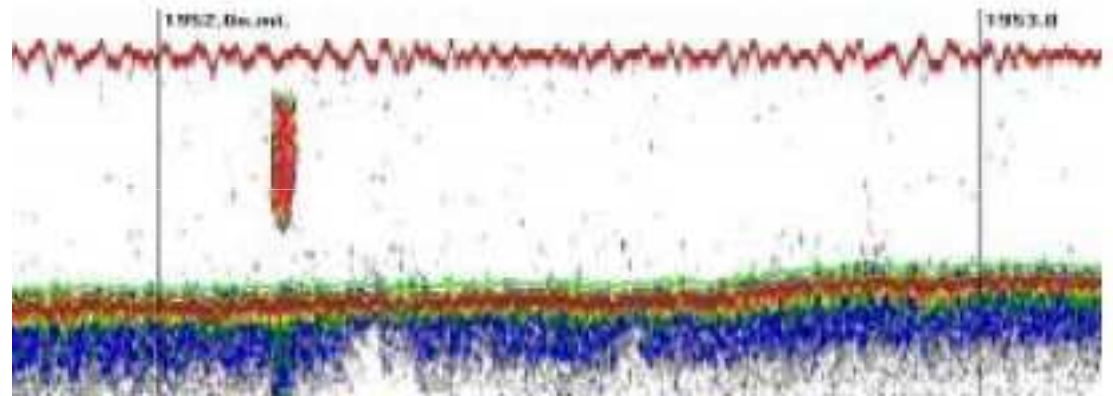
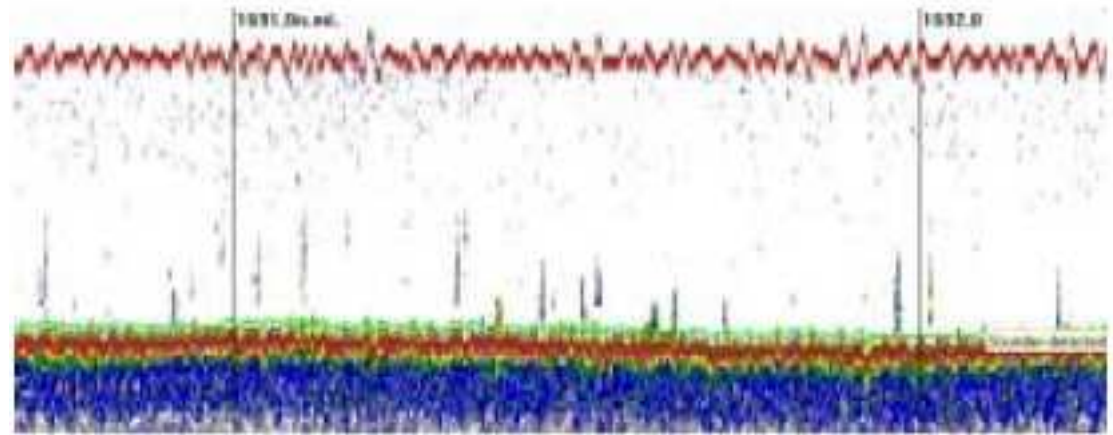


Figure 2. Cruise track haul positions and hydrographic stations. Northwest herring acoustic survey (ICES Divisions VIaS & VIIb), January 2007.

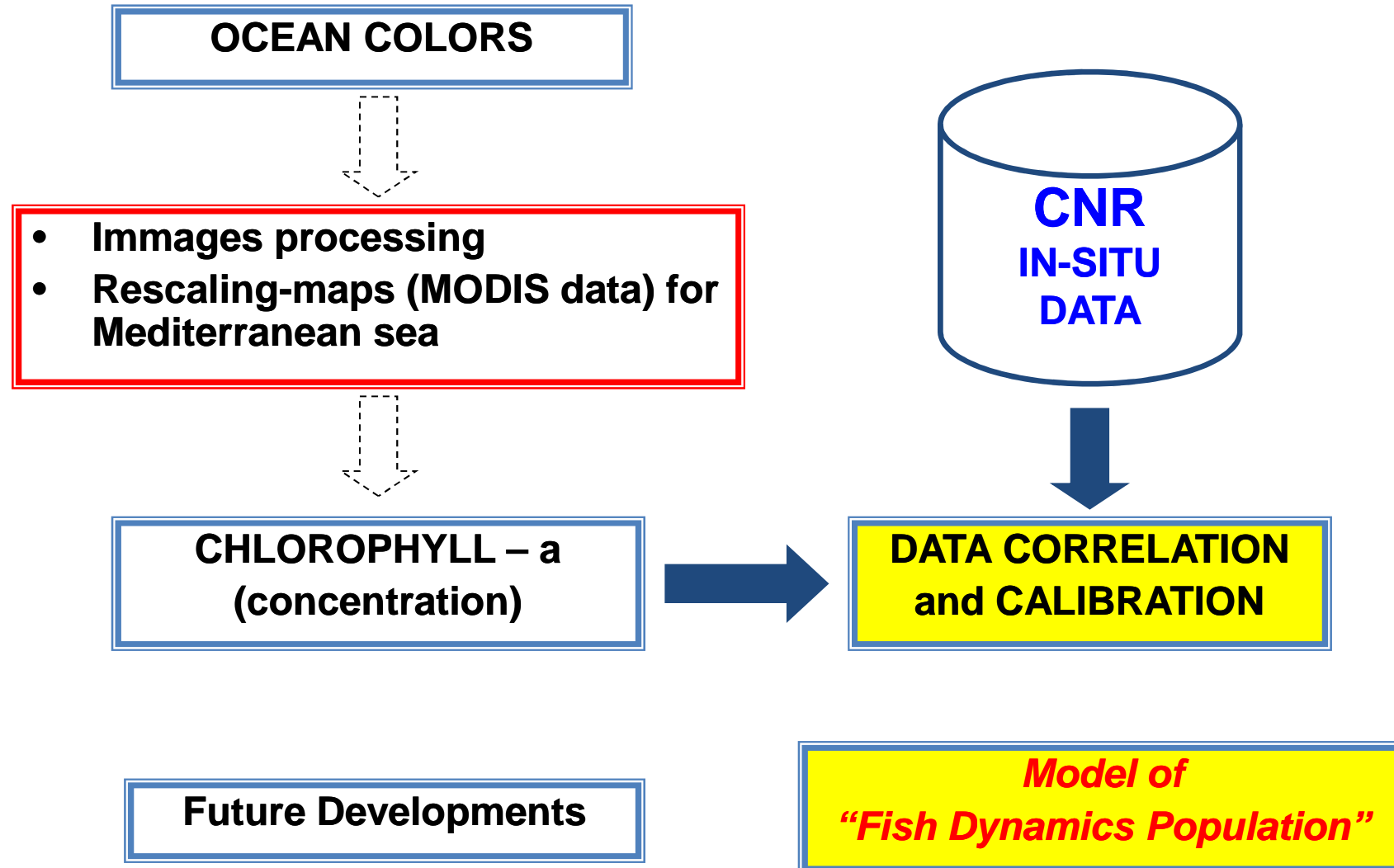
**In these images are shown the echograms of pelagic species recorded during the period of January 2007**

**The echogram are recorded at time intervals (usually 3 per day) and show 3 different situations.**





In the next few slides are shown correlations found between the images detected by MODIS-AQUA during the period 4-15 of July 2002 and the data obtained by the CNR during the IN-SITU campaign in the same period. The logical processing scheme was as follows:.



Our current work.

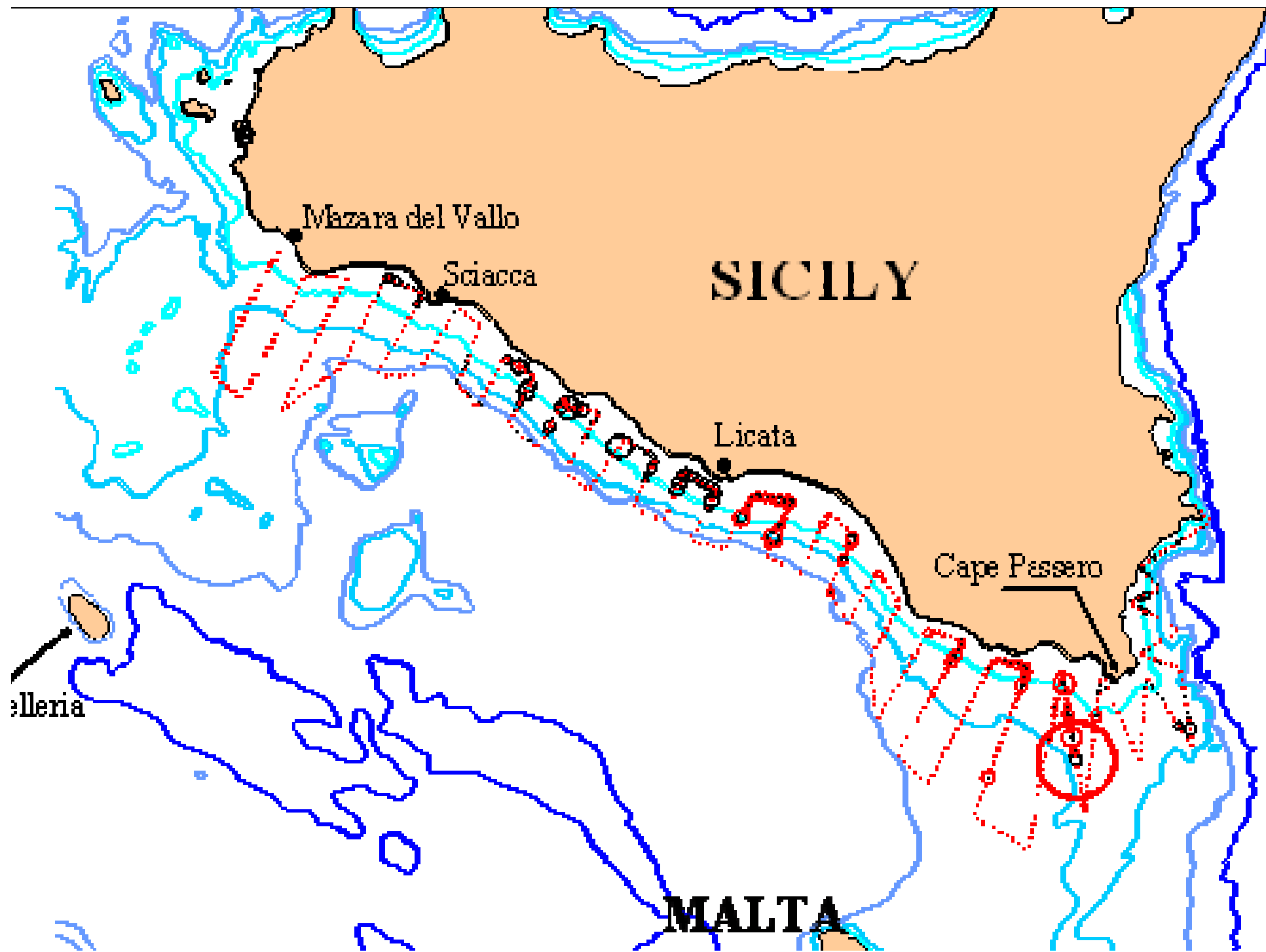
Microsoft Excel - Anchovy and Sardine densities 2002\_chlor (Modificato)

	A	B	C	D	E	F	G
1	Punto	Latitude	Longitude	X	Y	Valore_colore	clorofilla, mg/m <sup>3</sup>
2	1	37,6225	12,57475	4621,794	1257,06	25133	0,289185322
3	2	37,6075	12,56425	4621,542	1257,42	24571	0,268227207
4	3	37,5925	12,55375	4621,29	1257,78	24911	0,280717614
5	4	37,5775	12,54325	4621,038	1258,14	24911	0,280717614
6	5	37,5625	12,53275	4620,786	1258,5	24656	0,271296716
7	6	37,5475	12,52225	4620,534	1258,86	24656	0,271296716



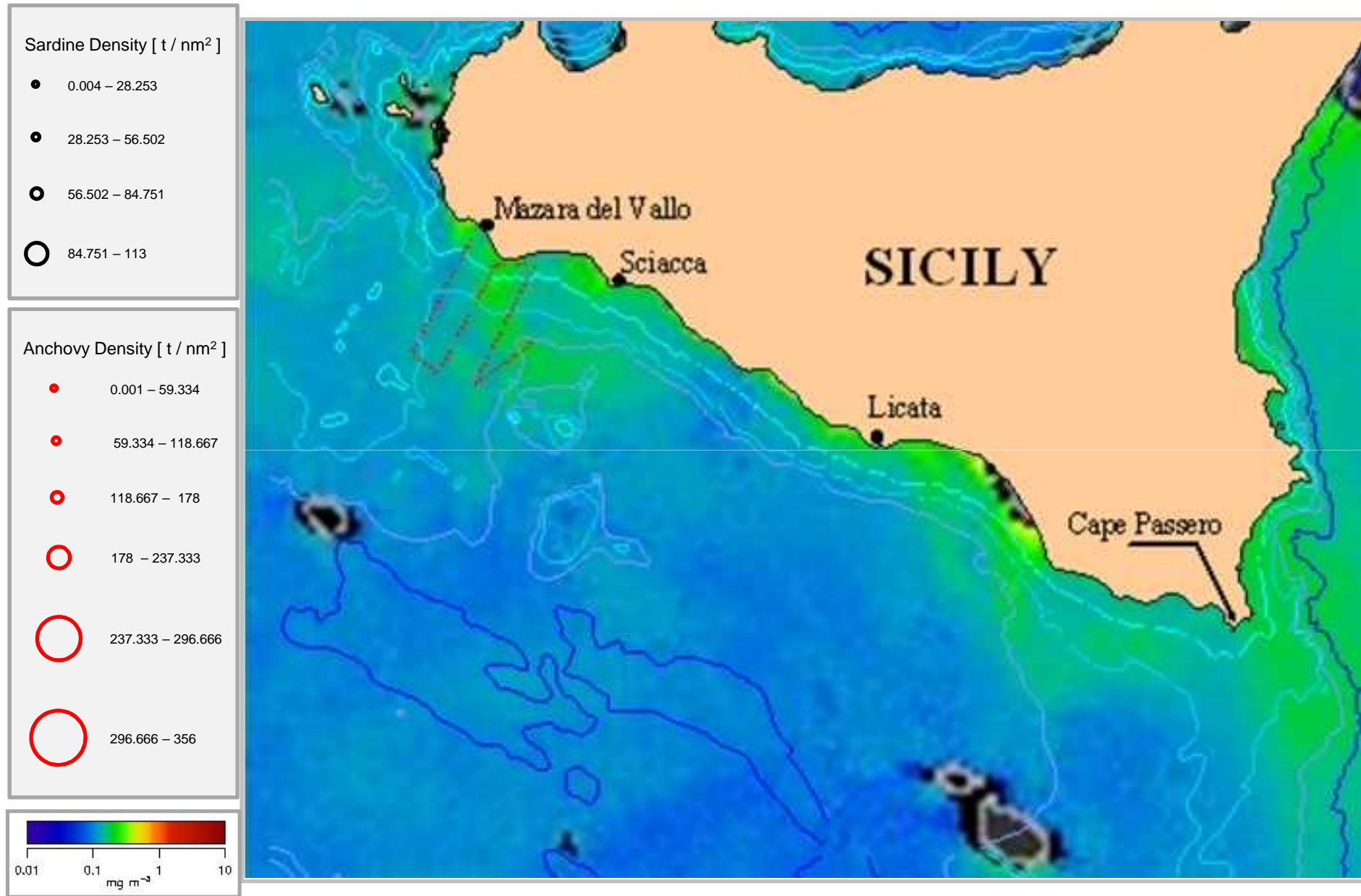






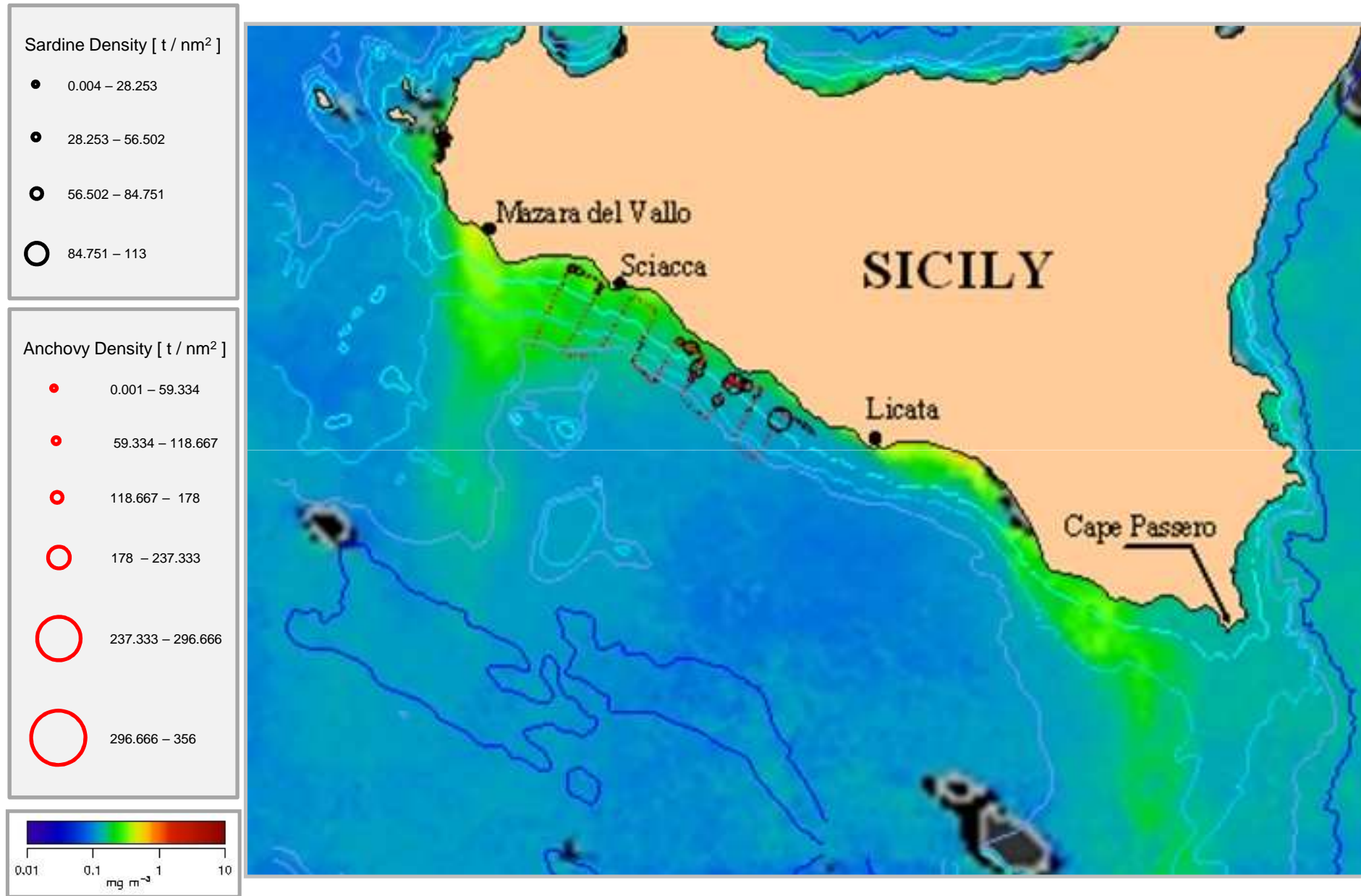


## Relationship between surface chlorophyll-a and fish density



5 July 2002. Anchovy density (red circles) and Sardine density (black circles) along the acoustic survey track.

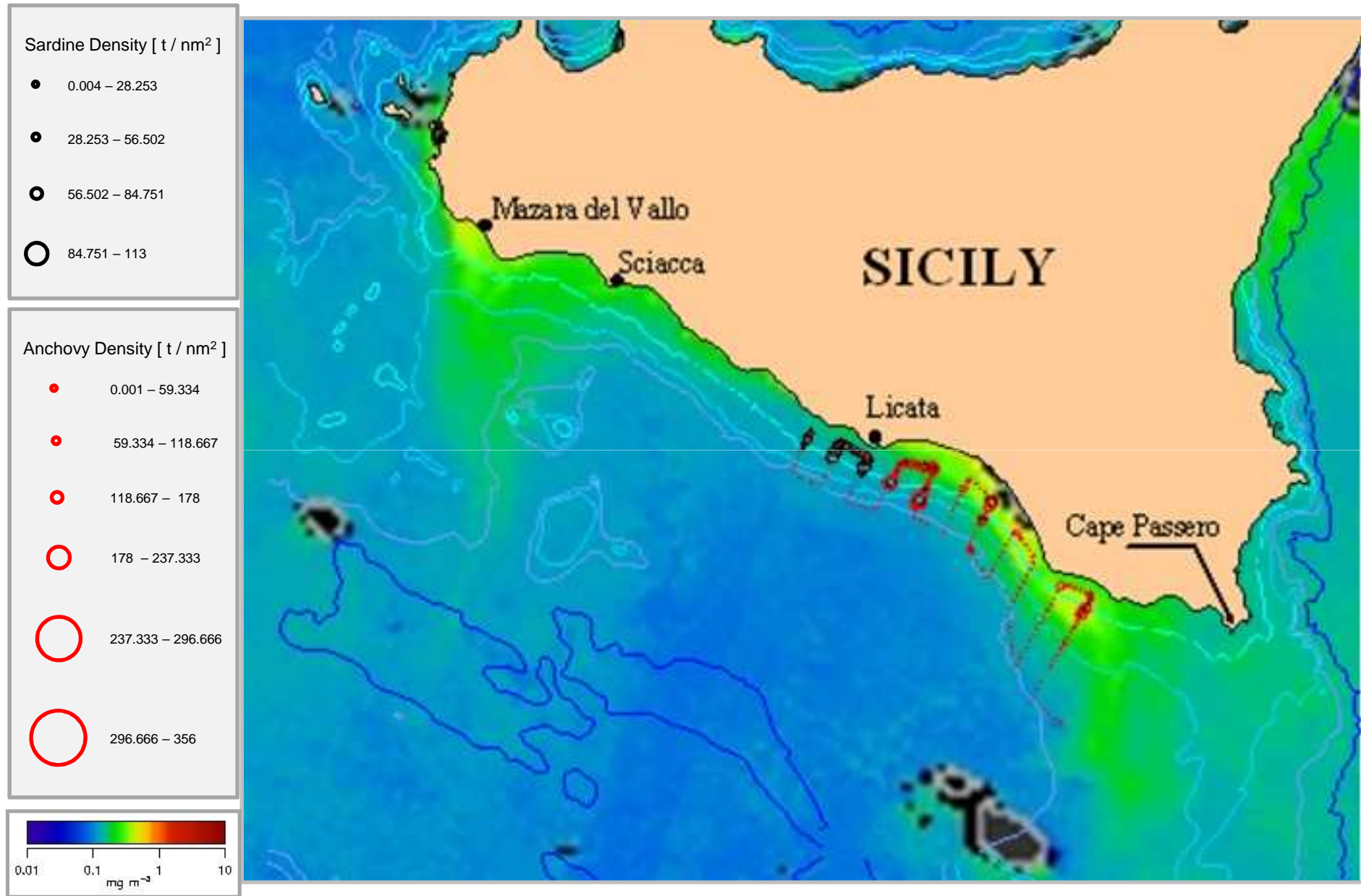
## Relationship between surface chlorophyll-a and fish density



6 July 2002. Anchovy density (red circles) and Sardine density (black circles) along the acoustic survey track.

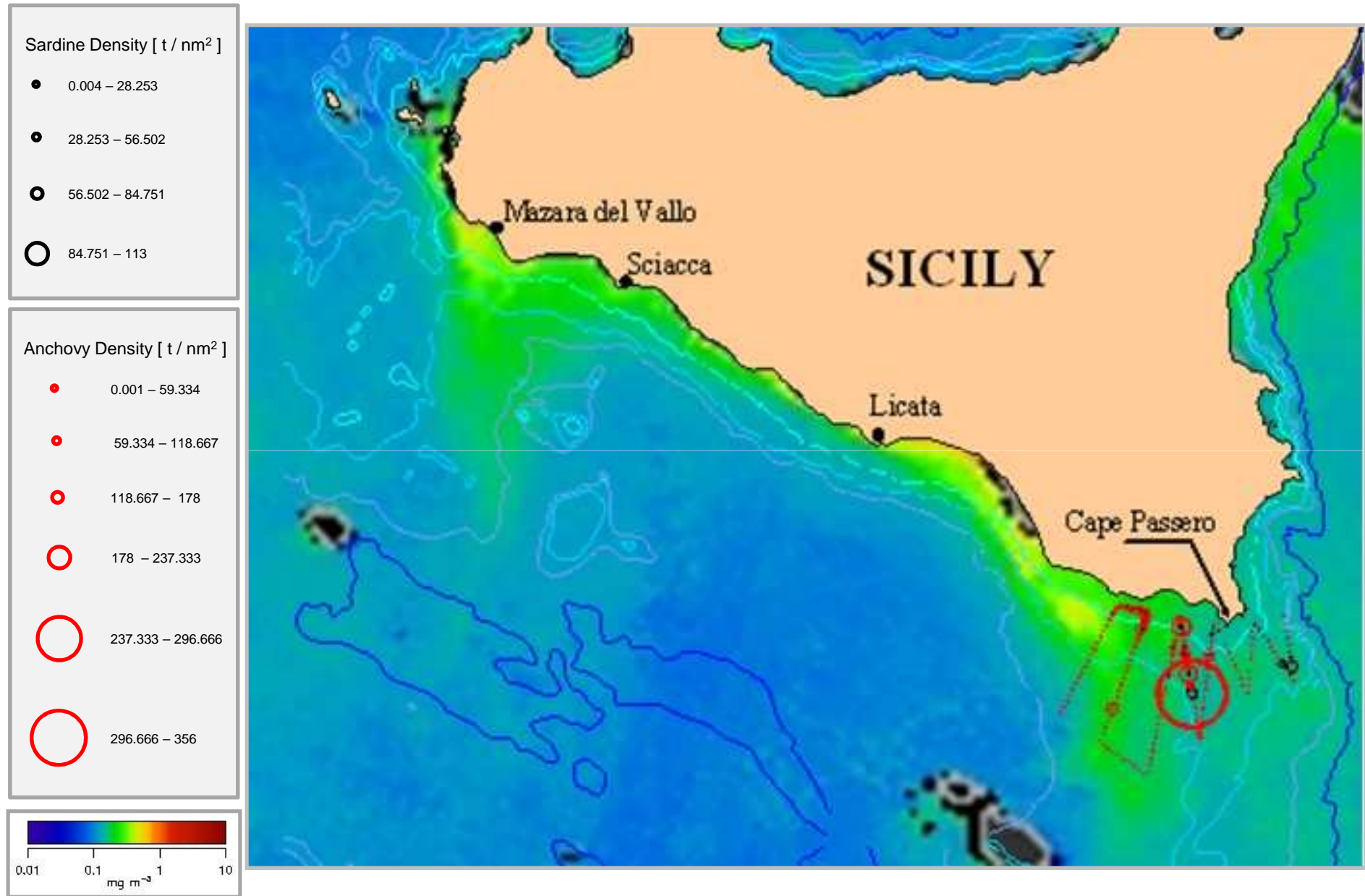


## Relationship between surface chlorophyll-a and fish density



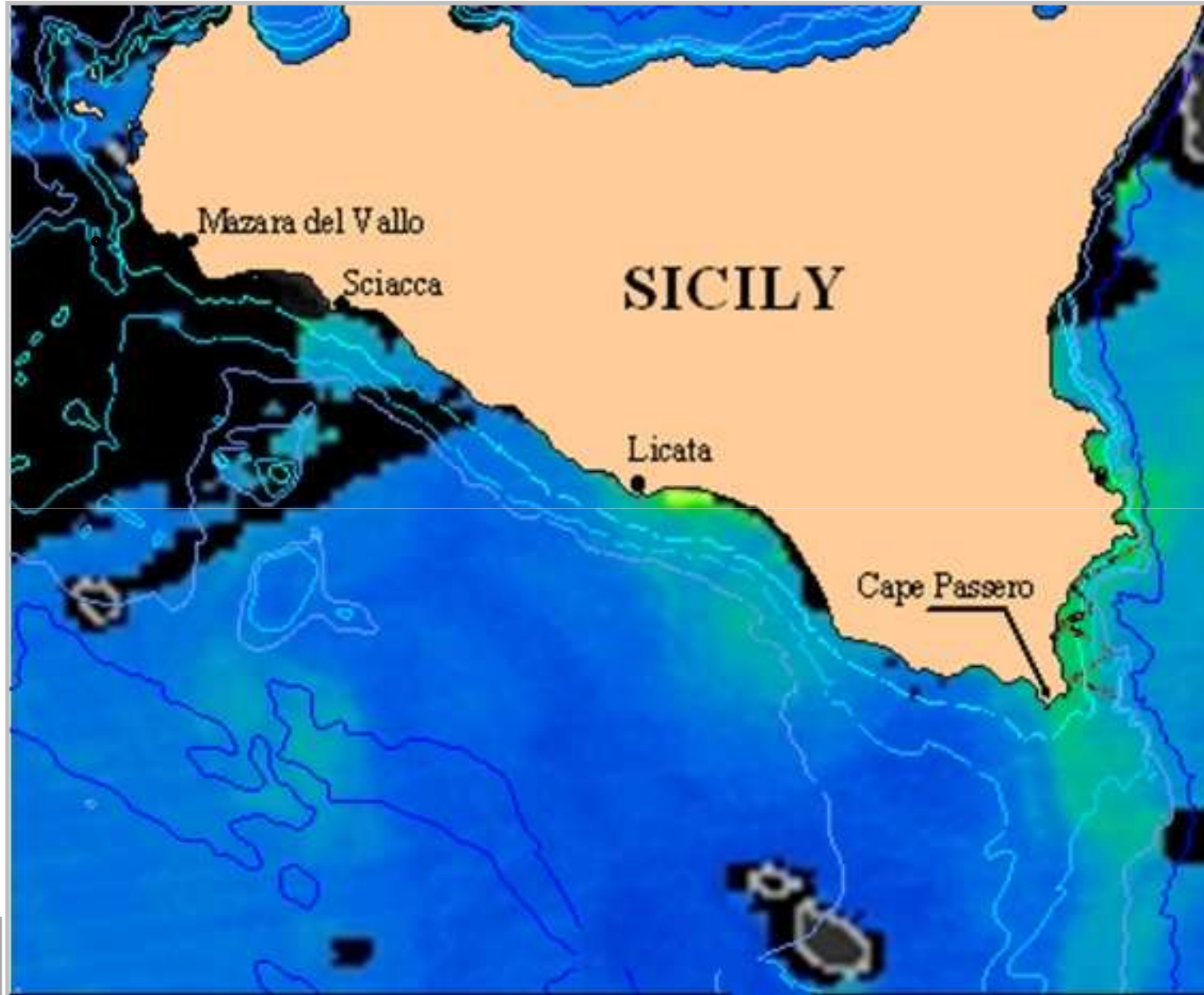
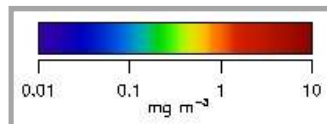
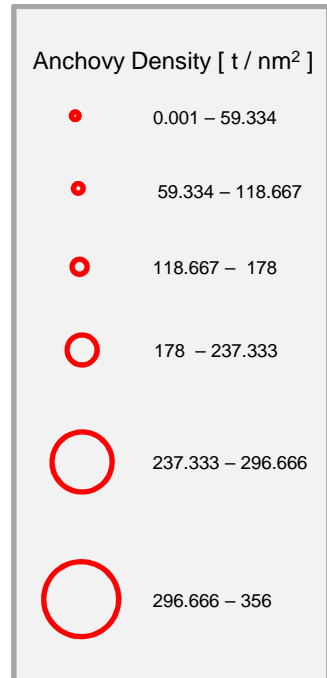
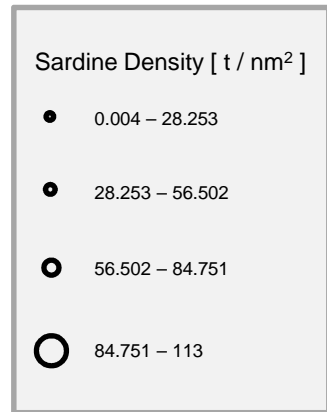
7 July 2002. Anchovy density (red circles) and Sardine density (black circles) along the acoustic survey track.

## Relationship between surface chlorophyll-a and fish density



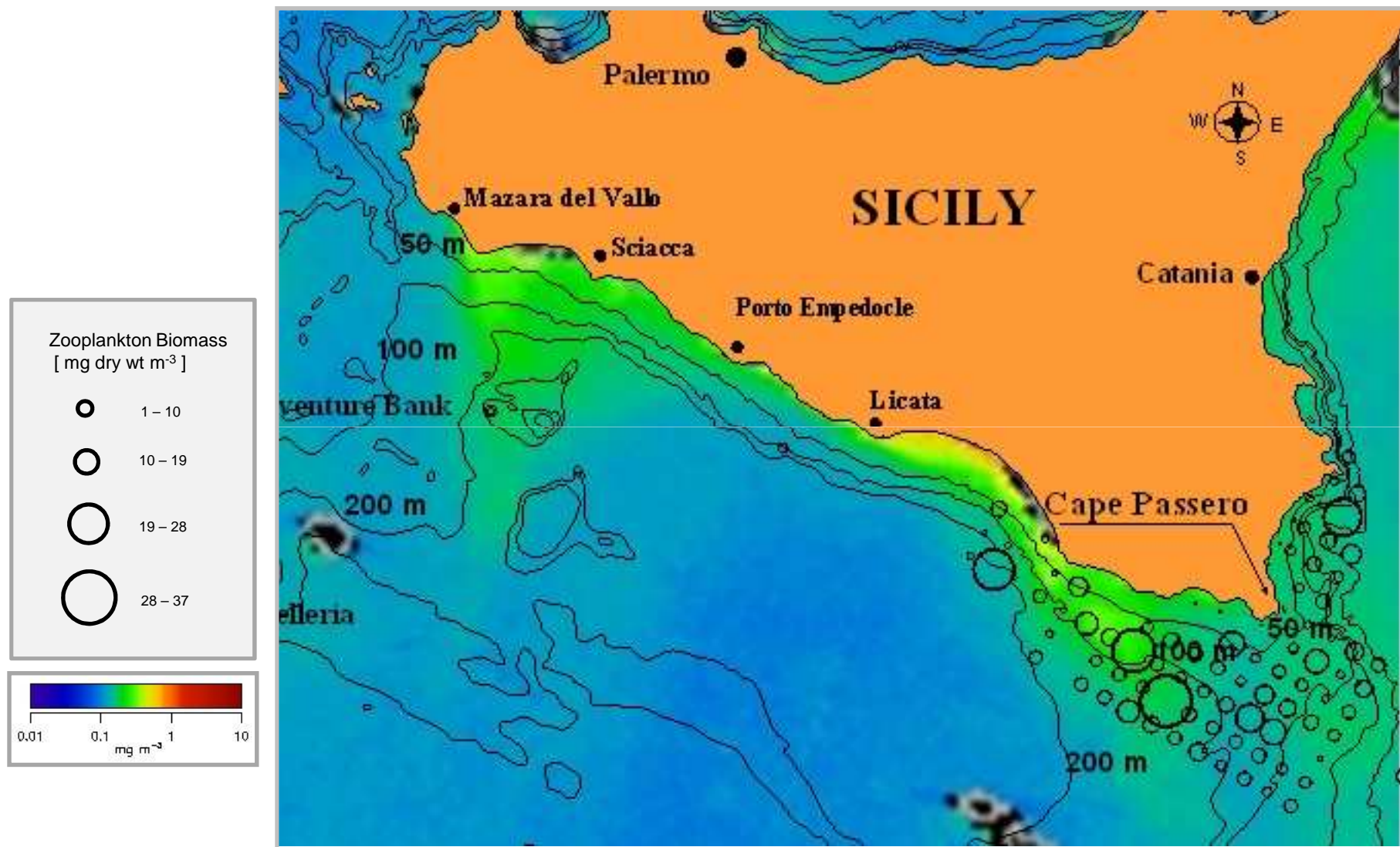
8 July 2002. Anchovy density (red circles) and Sardine density (black circles) along the acoustic survey track.

## Relationship between surface chlorophyll-a and fish density



9 July 2002. Anchovy density (red circles) and Sardine density (black circles) along the acoustic survey track.

## Relationship between surface chlorophyll-a and zooplankton biomass



**Satellite  
Remote Sensing**

**Ocean Color**

**MODIS DATA**

**Indicators**

**SST**

**Special  
Phenomena**

**Boundary**

**Upwelling**

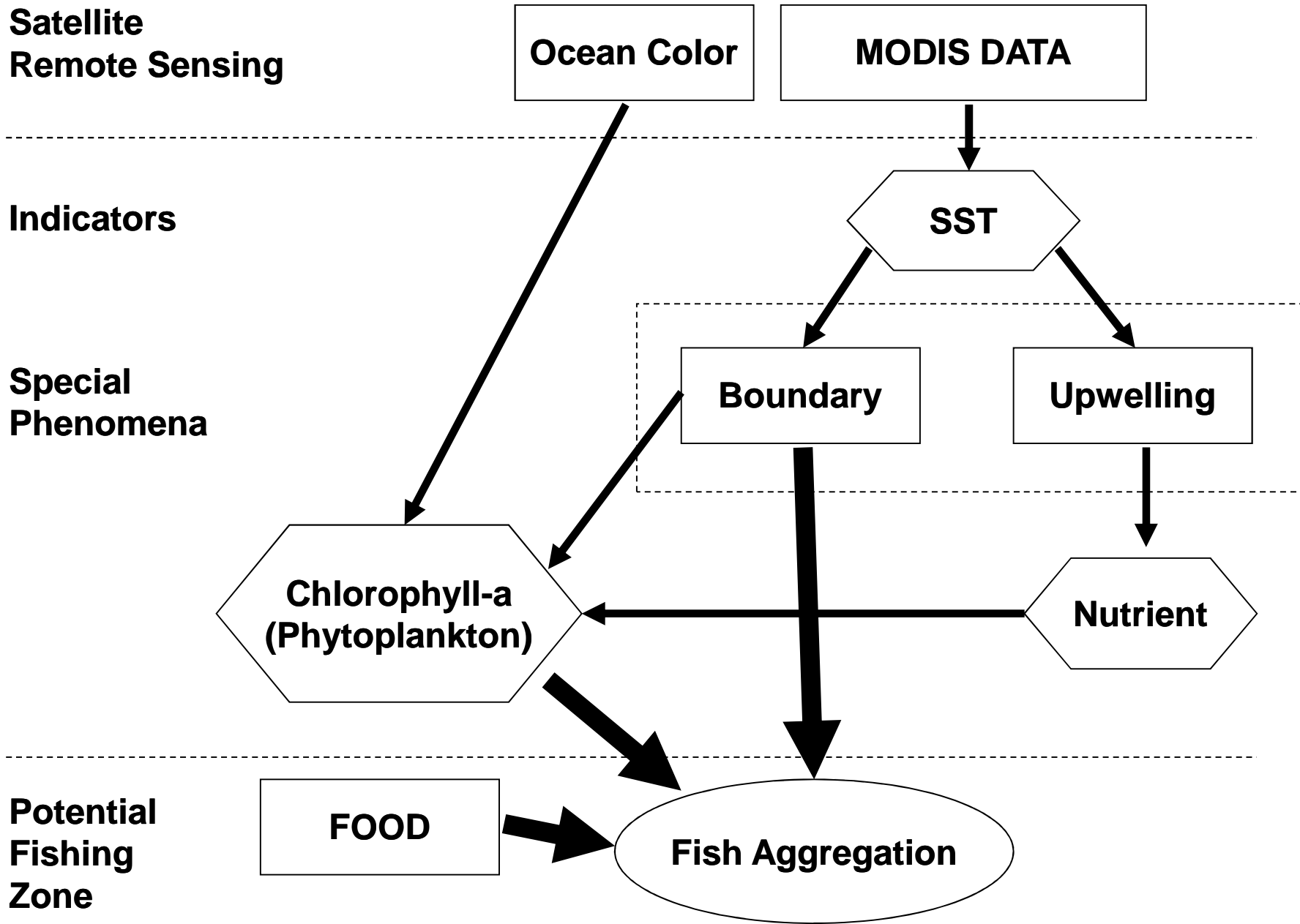
**Chlorophyll-a  
(Phytoplankton)**

**Nutrient**

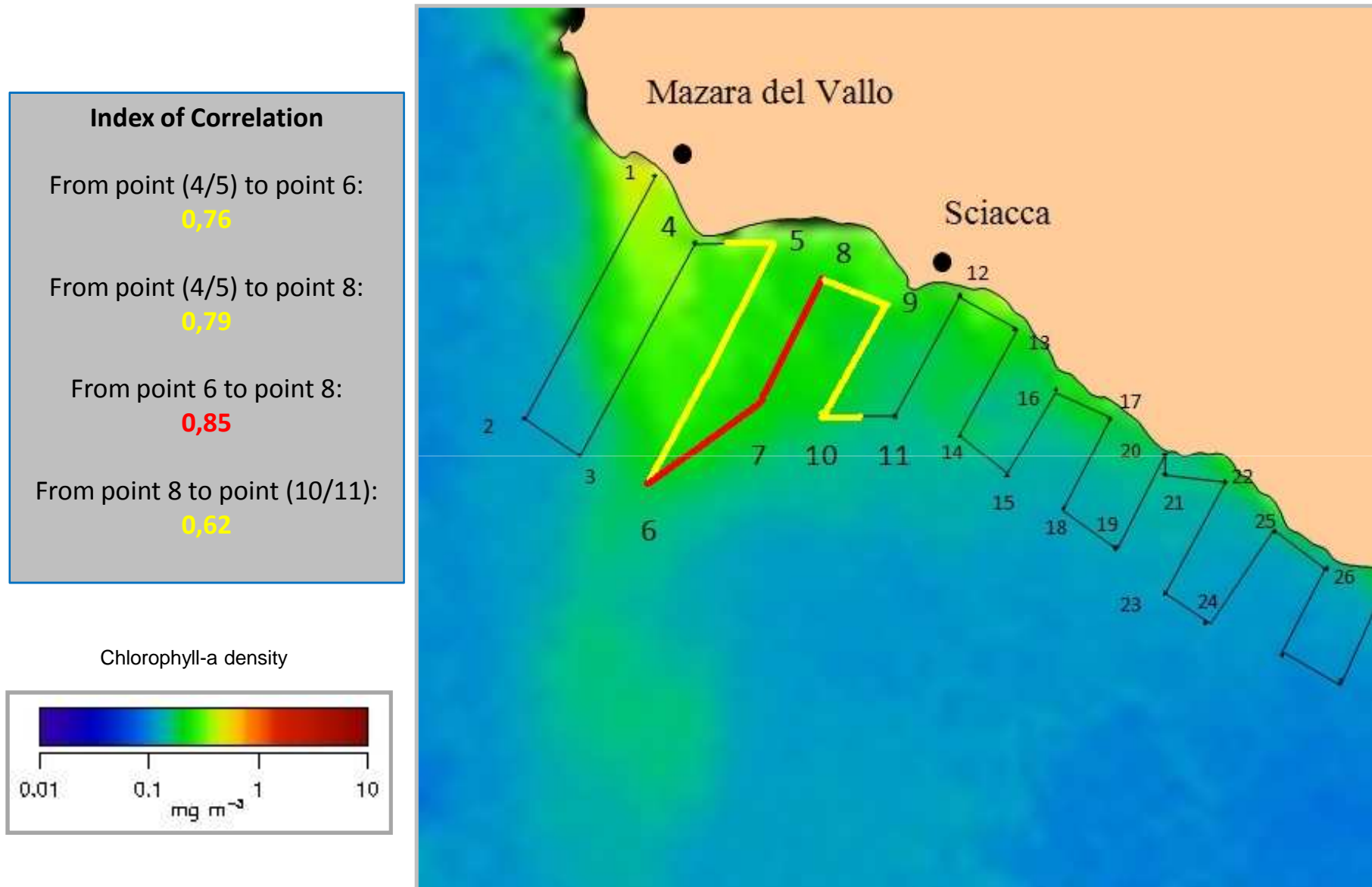
**Potential  
Fishing  
Zone**

**FOOD**

**Fish Aggregation**

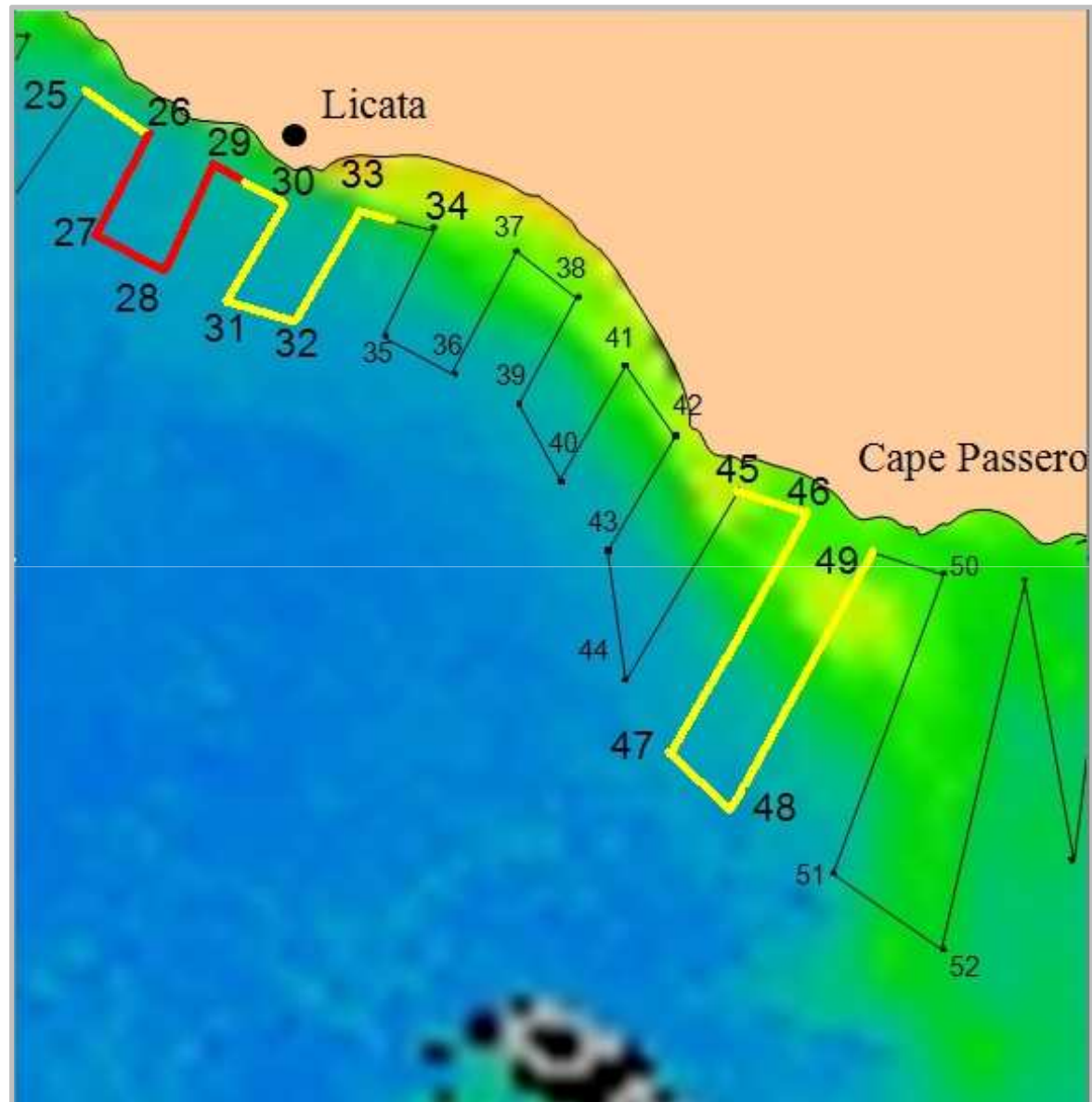
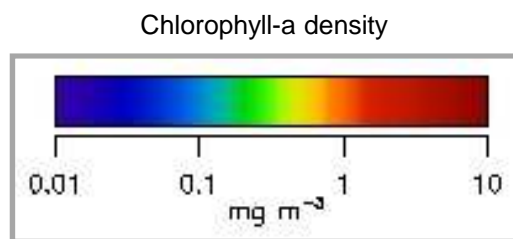
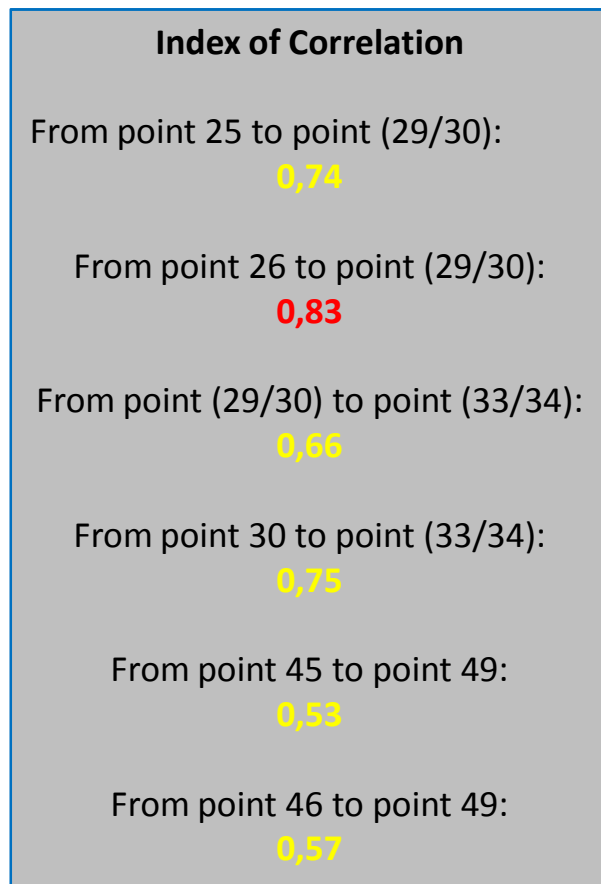


## Correlation between surface chlorophyll-a and All fish density



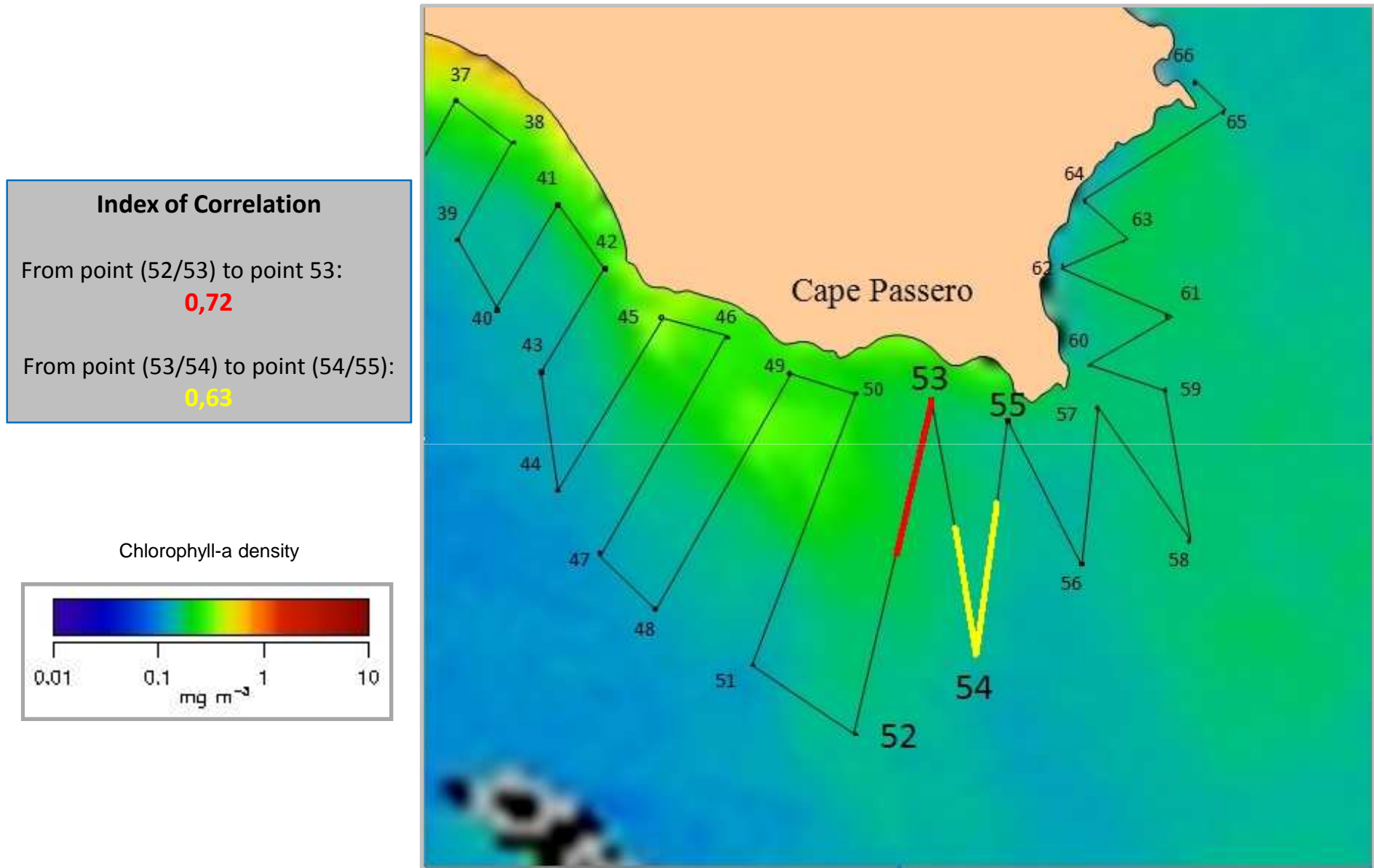
5-6 July 2002. Very large correlation (red line) and large correlation (yellow line) along the acoustic survey track.

## Correlation between surface chlorophyll-a and All fish density



7 July 2002. Very large correlation (red line) and large correlation (yellow line) along the acoustic survey track.

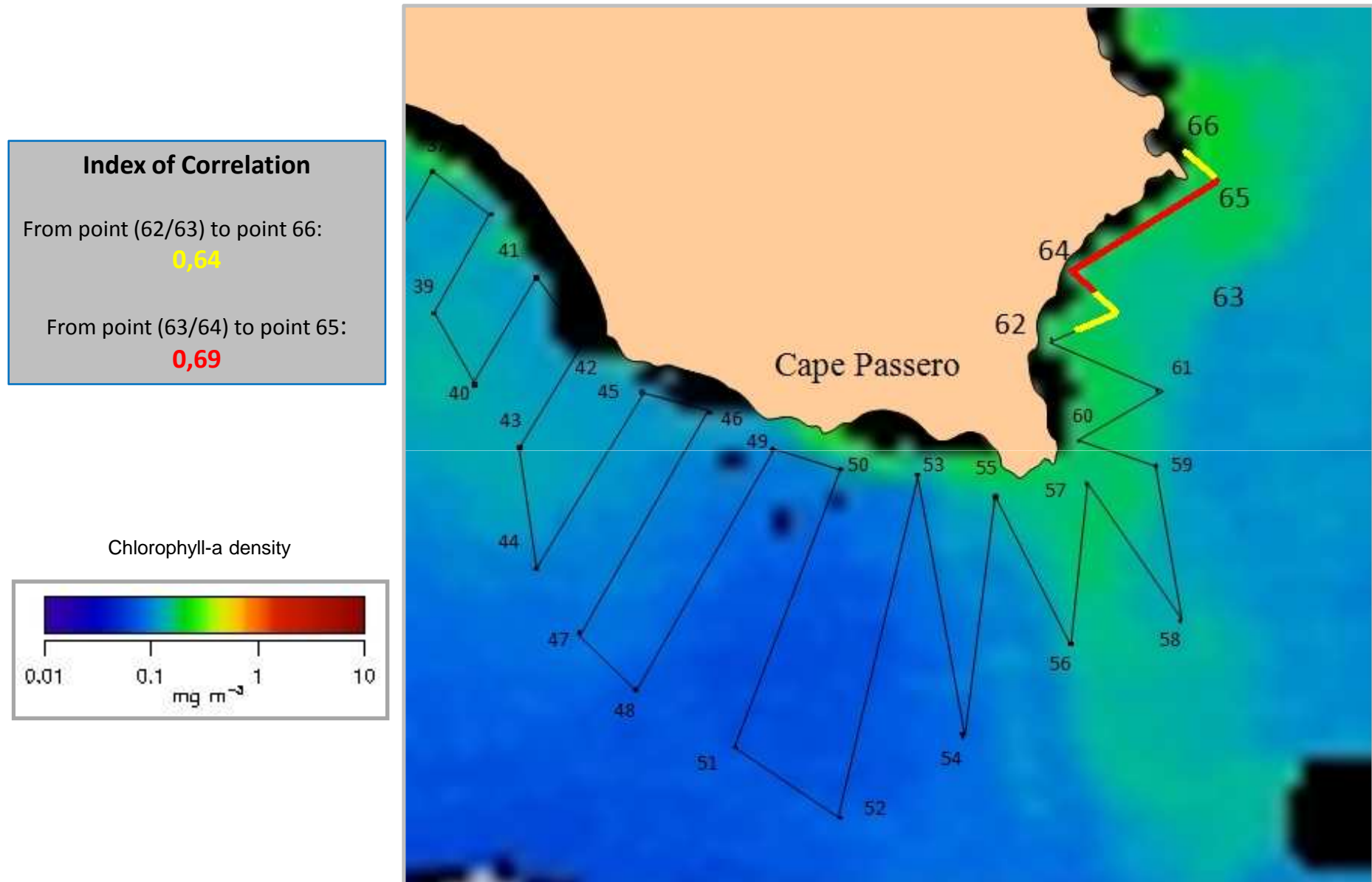
## Correlation between surface chlorophyll-a and All fish density



8 July 2002. Very large correlation (red line) and large correlation (yellow line) along the acoustic survey track.



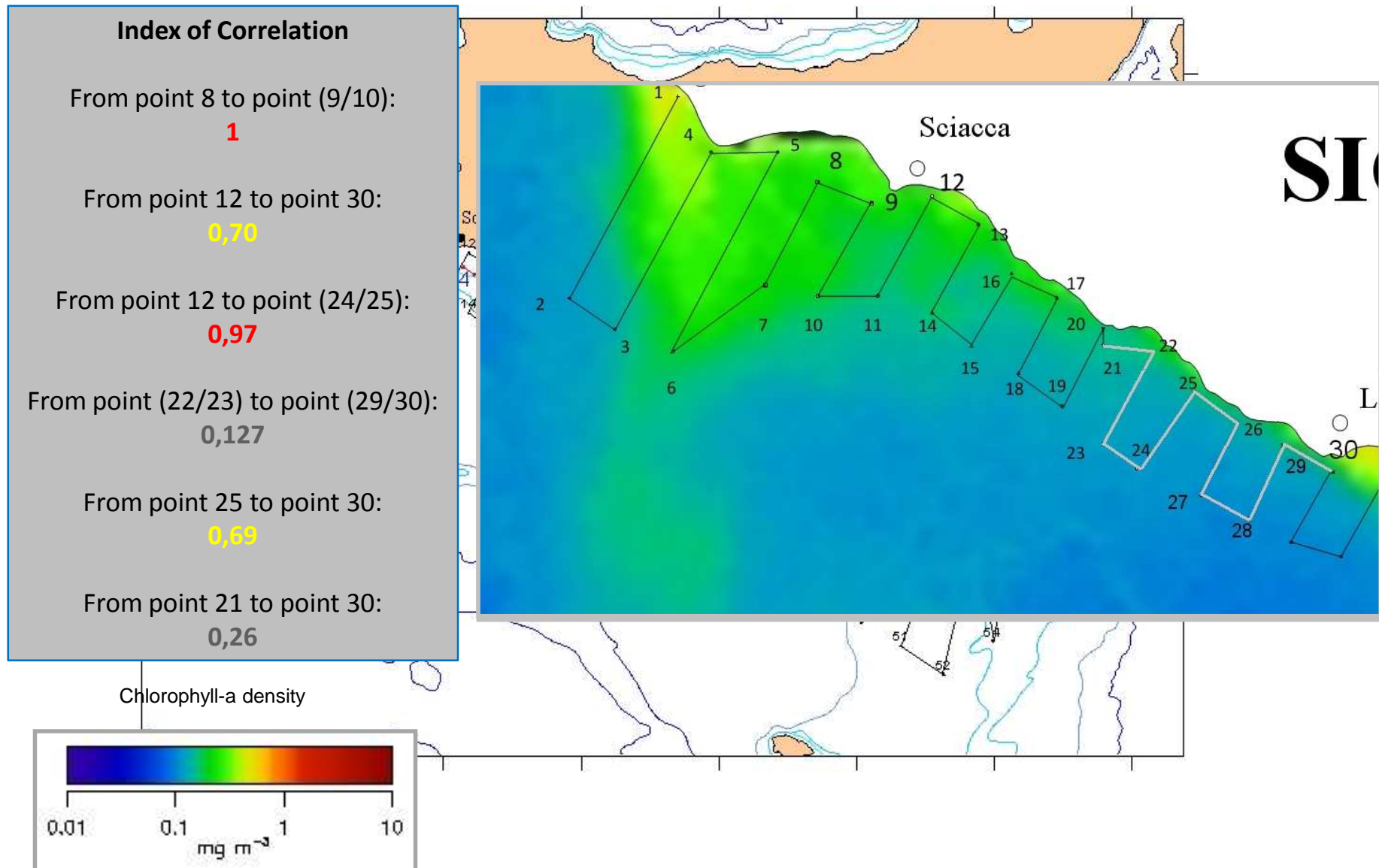
## Correlation between surface chlorophyll-a and All fish density



9 July 2002. Very large correlation (red line) and large correlation (yellow line) along the acoustic survey track.

Work in progress

## Correlation between Density of Anchovy and Density of Sardine Along the acoustic survey track



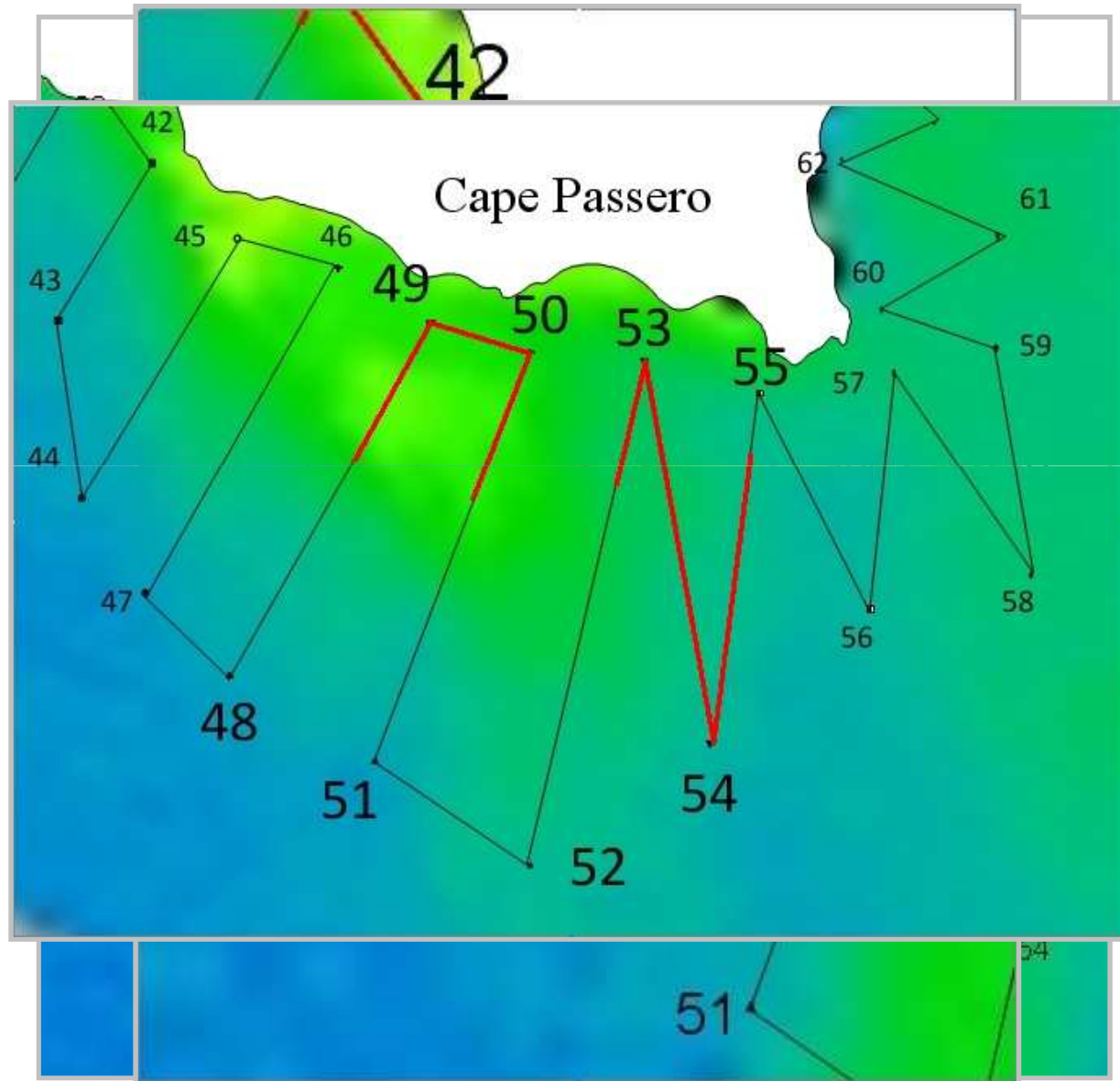
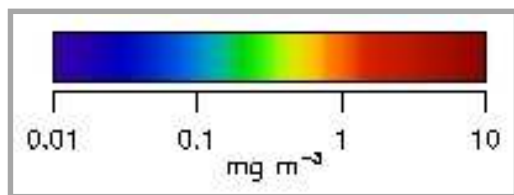
Work in progress  
Correlation between Density of Anchovy and Density of Sardine  
Along the acoustic survey track

**Index of Correlation**  
From point **a** to point **b**:  
**1**

**Index of Correlation**  
From point (48/49) to point (50/51):  
**1**

From point (52/53) to point (54/55):  
**1**

Chlorophyll-a density



## References:

- [1] Anon, 1993, International Workshop on Application of Satellite Remote Sensing for Identifying and Forecasting Potential Fishing Zones in Developing Countries. Organized by Departement of Space, National Remote Sensing Agency (NRSA), Hyderabad and Committee on Science and Technology in Developing Countries of the International Council of Scientific Unions (Costed/ICSU), Madras, Hyderabad, India. 7-11 December 1993.
- [2] Mohd. Ibrahim Mohamed. 1996, Pacific Ocean Remote Sensing Conference, PORSEC 1996, Victoria, B. C.