CRUISE SUMMARY REPORT

CRUISE Name: BONIFACIO2010-SIC **No:**
enter the unique number, name or acronym assigned to the cruise (or cruise leg, if appropriate).

CRUISE PERIOD start: 23/11/2010 to end : 09/12/2010
PORT OF DEPARTURE (enter name and country) **NAPOLI (ITALY)**
PORT OF RETURN (enter name and country) **NAPOLI (ITALY)**

SHIP Name: R/V URANIA **Call Sign:**
Type of ship: RESEARCH VESSEL
enter the full name and international radio call sign of the ship from which the data were collected, and indicate the type of ship, for example, research ship; ship of opportunity, naval survey vessel; etc.

RESPONSIBLE LABORATORY
enter name and address of the laboratory responsible for coordinating the scientific planning of the cruise

Name: IAMC CNR, U.O.S. ORISTANO
Address: LOC. SA MARDINI snc, TORREGRANDE (OR)
Country: ITALY

CHIEF SCIENTIST(S) Name: DR ALBERTO RIBOTTI (IAMC CNR UOS ORISTANO)
MR MIRENO BORGHINI (ISMAR CNR UOS LA SPEZIA)
enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruise.

OTHER PARTICIPATING LABORATORIES
enter name and address of the participating laboratories, apart the responsible

Name: IAMC CNR, U.O.S. NAPOLI
Address: Calata Porta di Massa, interno porto di Napoli, 80133, Napoli
Country: ITALY

Name: IAMC CNR, U.O.S. CAPO GRANITOLA
Address: Via del Mare 3, 91021 Torretta Granitola - Fraz. di Campobello di Mazara (TP)
Country: ITALY

Name: ISMAR CNR, U.O.S. LA SPEZIA
Address: Forte Santa Teresa, 19036 Pozzuolo di Lerici (SP)
Country: ITALY

Name: Lab. Ecology & Plant Physiology, Dept. Evolut. Biology "Leo Pardi", Firenze University
Address: via P.A. Micheli 1, 50121 Firenze
Country: ITALY

Name: Dip.Te.Ris., Genova University
Address: Via Balbi, 5 - 16126 Genova
Country: ITALY

Name: Stazione Zoologica "Anton Dohrn"
Address: Villa Comunale, 80121 Napoli
Country: ITALY

Name: Parthenope University
Address: Via Amm. F. Acton, 38 - 80133 Napoli
Country: ITALY

Name: ENEA CRAM
Address: Forte Santa Teresa, 19036 Pozzuolo di Lerici (SP)
Country: ITALY

OBJECTIVES AND BRIEF NARRATIVE OF CRUISE:

enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the report data were collected.

Objectives

The cruise has been planned to reach the following objectives:

1. Water masses characteristics and biological structures

Several measurements along key sections localised inside and on the board of the central Mediterranean basin in order to define the main paths of the circulation and the physical-chemical-biological properties (temperature, salinity, dissolved oxygen, nutrients, chlorophyll, phytoplankton, primary production, etc) of the water upper, intermediate and deep central (Sicily Strait) and western (Tyrrhenian sea, Sardinia Channel) Mediterranean water masses. Check of the diffusion of the new deep waters found during several cruises from 2005 to August 2010 in the Sardinia Channel area.

2. Validation of numerical models

Measurements will be used to validate four numerical circulation models implemented at IAMC-CNR in Oristano (SCRM32, SCRM48, WMRM). The three models at IAMC-CNR in Oristano are operational as they give daily forecasts for the following 5 days of the main oceanographic parameters (temperature, salinity, water and surface heat fluxes, currents, waves).

3. Methodological developments

- measurements of velocity profiles by Lowered ADCP;
- periodical maintenance of currentmeters moored in the Sicily Strait and in the Tyrrhenian Sea;
- recover of an Argos drifter in the Tyrrhenian sea.

Brief narrative

The cruise has been strongly influenced by bad weather conditions that has obliged to a re-planning of the activities on-board. Priority has been given to the maintenance of the three moorings, two in the Sicily Strait and the third in the Tyrrhenian sea, all done even if in several days. Second step was the completion of the two main transects, useful also for the validation of the two forecasting systems in the central and western Mediterranean, one in the Sicily Strait and the second between Sicily and Sardinia. Unfortunately it has been possible to acquire data only between Mazara del Vallo (TP) and Cape Bon in (Tunisia) and partially along the second transect (Sicily and Sardinia).

It was not possible to recover the Argos drifter at the end of the cruise as it stopped working at the end of November.

PROJECT (IF APPLICABLE) if the cruise is designated as part of a larger scale cooperative project (or expedition), then enter the name of the project, and of organisation responsible for co-ordinating the project.

The cruise has been organised in the framework of the following projects:

- MyOcean, (European IP);
- SESAME - Southern European Seas: Assessing and Modelling Ecosystem changes (European IP);
- PRIMI - Progetto Pilota Inquinamento Marino da Idrocarburi, financing ASI.

PRINCIPAL INVESTIGATORS Enter the name and address of the Principal Investigators responsible for the data collected on the cruise and who may be contacted for further information about the data. (The letter assigned below against each Principal Investigator is used on pages 2 and 3, under the column heading 'PI', to identify the data sets for which he/she is responsible)

PI	name	body	address	country	e-mail
A	ALBERTO RIBOTTI	IAMC CNR	ORISTANO	ITALY	alberto.ribotti@cnr.it
B	MIRENO BORGHINI	ISMAR CNR	LA SPEZIA	ITALY	mireno.borghini@sp.ismar.cnr.it

MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

This section should be used for reporting moorings, bottom mounted gear and drifting systems (both surface and deep) deployed and/or recovered during the cruise. Separate entries should be made for each location (only deployment positions need be given for drifting systems). This section may also be used to report data collected at fixed locations which are returned to routinely in order to construct 'long time series'.

LEGENDA: R (recovery) D (deployment)

3370

PI	Date, time	Latitude	Longitude	TYPE	DESCRIPTION
	dd/mm/yyyy, hh:mm	deg – min - N/S	deg – min - E/W	enter code(s) from list on last page.	Identify, as appropriate, the nature of the instrumentation the parameters (to be) measured, the number of instruments and their depths, whether deployed and/or recovered, dates of deployments and/or recovery, and any identifiers given to the site.
B	R: 03/12/2010, 09:00 D: 05/12/2010, 12:32	R: 37 22.836 N D: 37 22.790 N	R: 011 35.636 E D: 011 35.604 E	H10, H11, D01, D06	C01 (previous maintenance 06/2010, bottom depth 57 m): Argos transmitter SMM 2000X (position once at surface) at 78m, SBE37 MicroCat (temperature, conductivity) at 82m, ADCP WH Long Ranger (currents) at 415m, two acoustic releases EdgeTech 8202 at 437m
B	R: 03/12/2010, 12:00 D: 05/12/2010, 14:10	R: 37 17.151 N D: 37 17.116 N	R: 011 29.971 E D: 011 29.948 E	H10, H11, D01, D06	C02 (previous maintenance 06/2010, bottom depth 534 m): Argos transmitter SMM 2000X (position once at surface) at 246m, ADCP NORTEK Continental (currents) at 250m, SBE37 MicroCat (temperature, conductivity) at 300m, ADCP WH Sentinel (currents) at 400m, two acoustic releases EdgeTech 8202 at 498m.
B	R: 07/12/2010, 10:00 D: 07/12/2010, 14:56	R: 39 29.962 N D: 39 29.894	R: 013 28.589 E D: 013 28.568	H10, H11, D01, D06	VECTOR (previous maintenance 08/2010, bottom depth 3410 m): two sediments traps at 1764 and 3360 m, RCM7 currentmeter at 1774 m, SBE39 (temperature) at 2524 m, Nortek ADCP at 3370 m, SBE37 MicroCat (temperature, conductivity) at 3380 m, two acoustic releases, one EdgeTech 8202 and one Ixsea, at 3980 m

CATENA C01

Latit.:
Long.:
Data :
Prof. : 457

Pos : Canale di Sicilia

3 m

Argos SMM 2000X ID 27870

poliestere 14 mm

Galleggiante 1Sintattico +60

-82 m

SBE 37 sn -5

307 m

Kevlar 10 mm

Galleggiante 17" +50

-18

-387 m

5 m Kevlar 10 mm

28 m Kevlar 10 mm

SBE 19 sn -9

-415 m

Galleggiante Sintattico " +150

ADCP WH LONG RANGE

10 m Kevlar 10 mm

Galleggianti 17" +96

10 m Kevlar 10 mm

Sganciatore Edge Tech 8202 -68
sn sn

15 m poliestere 14 mm

5m catena 14 mm -20

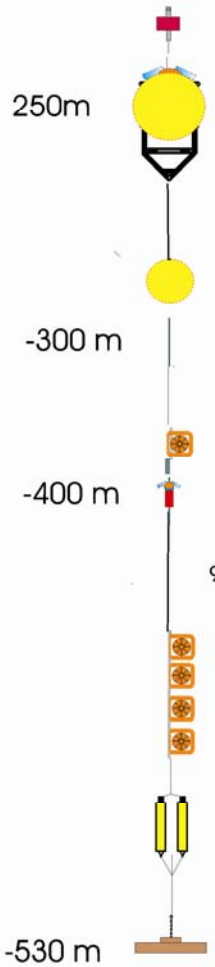
-457 m

700 Kg zavorra

CATENA C02

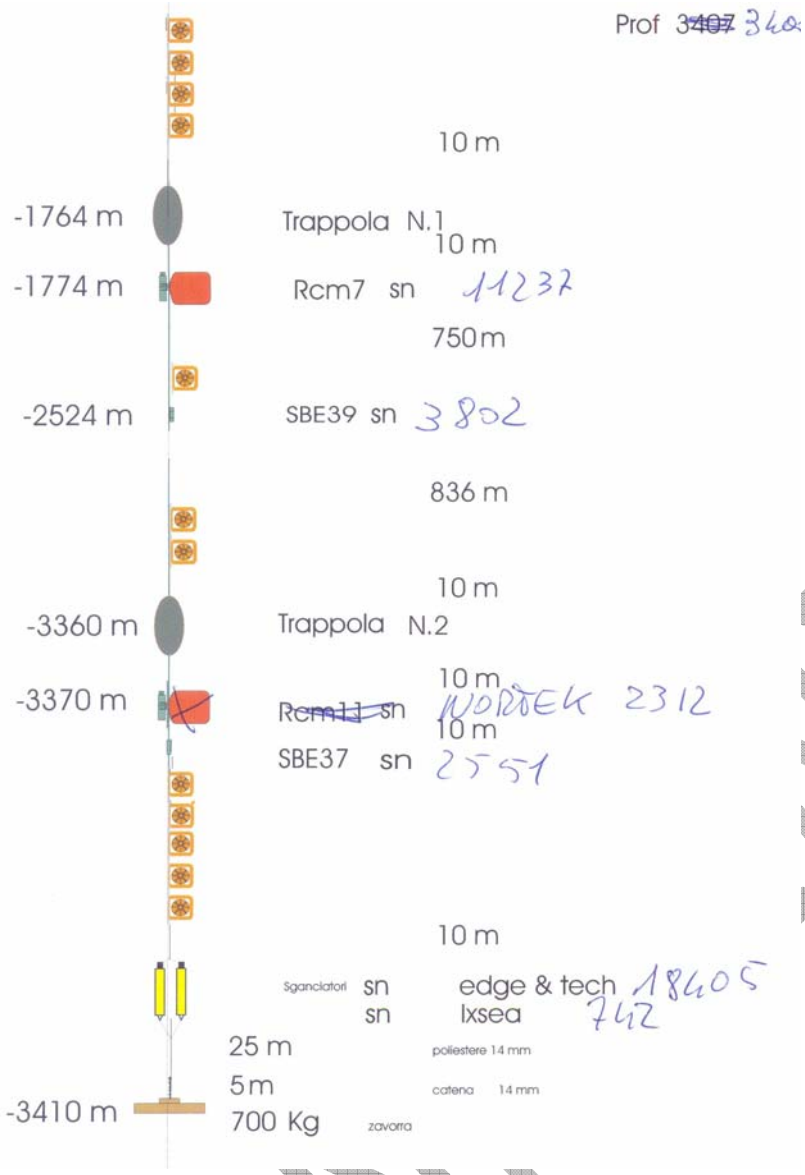
Latit.:
Long.:
Data :
Prof. :

Pos : Canale di Sicilia



	Argos SMM 2000X ID 27870		
3 m			
		Galleggiante 1Sintattico	+150
48m	Kevlar 10 mm		
		Galleggiante 1Sintattico	+60
10 m	Kevlar 10 mm		
	RCM7 sn		-18
			+24
90 m	Kevlar 10 mm		
		Galleggiante 17"	+24
5 m	Kevlar 10 mm		
5 m	SBE 37 sn		-18
	Aquadop sn		-18
95 m	Kevlar 10 mm		
			+96
10 m	Kevlar 10 mm		
		Sganciatore Edge Tech 8202 sn Sn	-68
15 m	poliestere 14 mm		
5m	catena 14 mm		-20
700 Kg	zavorra		

VECTOR



SUMMARY OF MEASUREMENTS AND SAMPLES TAKEN Except for the data already described on page 2 under 'Moorings, Bottom Mounted Gear and Drifting Systems', this section should include a summary of all data collected on the cruise, whether they be measurements (e.g. temperature, salinity values) or samples (e.g. cores, net hauls).
Separate entries should be made for each distinct and coherent set of measurements or samples. Different modes of data collection (e.g. vertical profiles as opposed to underway measurements) should be clearly distinguished, as should measurements/sampling techniques that imply distinctly different accuracy's or spatial/temporal resolutions. Thus, for example, separate entries would be created for i) BT drops, ii) water bottle stations, iii) CTD casts, iv) towed CTD, v) towed undulating CTD profiler, vi) surface water intake measurements, etc.
Each data set entry should start on a new line – it's description may extend over several lines if necessary.
NO, UNITS : for each data set, enter the estimated amount of data collected expressed in terms of the number of 'stations'; miles' of track; 'days' of recording; 'cores' taken; net 'hauls'; balloon 'ascents'; or whatever unit is most appropriate to the data. The amount should be entered under 'NO' and the counting unit should be identified in plain text under 'UNITS'.

Table CTD casts list

Sampling type (responsible institute): N = Nutrients (CNR, UniFi); S = salinity (CNR, UniGe); O = dissolved oxygen (CNR, UniGe); Si = silicium (CNR); M = metals (CNR); C = chlorophyll UniFi); L = light absorption (UniFi); Ss = suspended solids (UniFi); R = radiometer analysis (UNiFi); P = fluorescence and PAR (UniFi)

Start CTD cast Date & Time (UTC)	Station	Lat [° 'N]	Long [° 'E]	Bottom [m]	Activity type
27/11/2010, 16:16	VTM	39° 29.995'	13° 29.969'	3417	S, O, N, Si, M, C, L, Ss
29/11/2010, 11:00	432	37° 44.002'	12° 19.969'	167	S, O, N, Si, M, C, L, Ss
30/11/2010, 09:01	212	38° 02.982	12° 05.500	190	N
30/11/2010, 10:07	213	38° 05.270	11° 57.433	409	S, N
30/11/2010, 11:05	214	38° 07.206	11° 50.777	1143	S, O, N
30/11/2010, 14:10	215	38° 08.742	11° 45.960	1199	S, O, N, Si, M, C, L, Ss, P, R
30/11/2010, 16:19	217	38° 10.851	11° 39.980	762	S, O, N
30/11/2010, 17:56	218	38° 13.924	11° 13.925	228	N, C
30/11/2010, 19:07	219	38° 18.349	11° 25.634	880	
30/11/2010, 20:58	221	38° 26.039	11° 14.777	1130	N, C
02/12/2010, 12:34	432B	37° 43.984'	12° 19.964'	168	
02/12/2010, 14:46	405	37° 38.891'	12° 08.682'	94	N, C, Ss, L, P, R
02/12/2010, 15:52	406	37° 34.873'	12° 00.200'	148	N
02/12/2010, 16:46	433	37° 30.851'	11° 55.361'	105	N, C
02/12/2010, 17:31	438	37° 27.584'	11° 49.714'	74	N
02/12/2010, 18:12	434	37° 24.982'	11° 44.638'	85	N
02/12/2010, 19:02	463	37° 21.944'	11° 39.659'	93	N
02/12/2010, 19:36	451	37° 20.267'	11° 36.022'	538	N, O, S, C
02/12/2010, 20:25	462	37° 18.814'	11° 33.782'	90	N
02/12/2010, 21:05	460	37° 16.740'	11° 29.225'	541	N, O, S, C
02/12/2010, 22:20	436	37° 13.580	11° 23.795	411	N, O, S, C, Si, M
02/12/2010, 23:27	410	37° 10.794'	11° 18.264	246	N, C
07/12/2010, 09:43	VTMb	39° 29.980'	13° 28.583'	3402	S, O, N, C, L, Ss, P, R
07/12/2010, 09:43	51	39° 46.459'	11° 53.231'	3498	S, O, N, Si, M, C, L, Ss, P, R

On-board operations

CTD casts

At all the 24 hydrological stations (with two repetitions) pressure (P), salinity (S), potential temperature (θ) and dissolved oxygen concentration (DO) were measured with a CTD-rosette system consisting of a CTD SBE 911 plus, and a General Oceanics rosette with 24 12-l Niskin Bottles. Temperature measurements were performed with a SBE-3/F thermometer, with a resolution of 10-3 °C, and conductivity measurements were performed with a SBE-4 sensor, with a resolution of 3 x 10-4 S/m. In addition, dissolved oxygen was measured with a SBE-13 sensor (resolution 4.3 μM), and data were checked against Winkler titration. The vertical profiles of all parameters were obtained by sampling the signals at 24 Hz, with the CTD/rosette going down at a speed of 1 m/s. The data were processed on board, and the coarse errors were corrected.

Laboratory: ISMAR CNR, IAMC CNR

Nutrients

Seawater samples for nutrient measurements were collected at different depths, when the system CTD /rosette was going up, according to the vertical profiles of salinity, potential temperature and dissolved oxygen, recorded in real time. Samples of 100 ml of seawater were collected at different depths and immediately filtered through a polycarbonate filter (0.47 μm Ø and pore size 0.4 μm) under slight vacuum. The filtered samples were transferred in 20 ml polyethylene vials and frozen at -20°C. The analysis of inorganic nutrients will be performed in the laboratory on land by the AutoAnalyser AAIII Bran+Luebbe (Grasshoff,1999).

- Not filtered 60 ml bottles and immediately frozen at -20°C (*IAMC CNR, ISMAR CNR*)
- Filtered 100 ml bottles and fixed with HgCl2 (*Firenze University*)

Concentrations of nitrates, orthosilicates and orthophosphates have been then determined in laboratory using an hybrid Brän–Luebbe AutoAnalyzer following the classical methods (Grasshoff et al., 1983) with only a few changes.

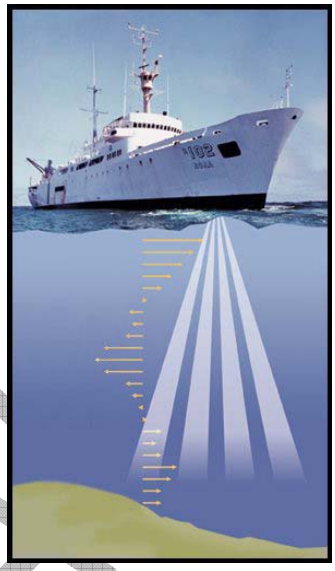
Laboratory: IAMC CNR, ISMAR CNR and Firenze University

LADCP

Two Lowered Acustic Doppler Current Profilers (LADCP) were used to measure velocity profiles. We used two RDI Workhorse 300 kHz ADCP. For data post-processing we used the LDEO LADCP (versione 8.1) software.

Laboratory: ISMAR CNR

Vessel-mounted ADCPs



The hydrographic data set has been integrated with direct current measurements. During the whole campaign two VM-ADCPs (RDI Ocean Surveyor, 75 kHz, and RDI Workhorse, 300 kHz) which operated during the whole campaign, along the whole ship track. The depth range of the two current profilers is about 700 m (OS75) and 150 m (WH300). Data acquisition is carried out using the RDI VMDAS software vers. 1.44. The ADCP data will be submitted to a post-processing with the CODAS3 Software System, which allows to extract data, assign coordinates, edit and correct velocity data. Data will be corrected for errors in the value of sound velocity in water, and misalignment of the instrument with respect to the axis of the ship.

Laboratory: ISMAR CNR

Measurements with photoprobe Idronaut and spectral-radiometer LI-COR LI-1800UW

A spectro-radiometer LI-COR LI-1800UW has been used to measure the spectral downward irradiance and to compute optical properties as the spectral attenuation coefficient (Kd) and the spectral reflectance. Spectral downward irradiance (350-750 nm, resolution 1 nm) have been measured at 5, 10, 25, 50 and 75 m. A measure of upward irradiance has been done only at 5 m to compute the spectral reflectance in the field. Two measurements of spectral surface irradiance have been done. For technical reasons photoprobe idronaut that measures the vertical profiles of downward, upward and scalar irradiance, cannot be used.

Particulate light absorption analysis

4 l of seawater samples have been filtered on glass-fiber filter GF/F Whatman (∅ 25 mm) frozen at –20 °C for particulate light absorption analysis. On land analysis will be done by means of spectroradiometer LICOR LI-1800UW equipped with an integrating sphere. Measurements before and after pigment extraction in methanol could discriminate phytoplankton absorption spectra from the detritus ones.

Laboratory: Firenze University

Measurement of bio-optical parameters using the PUV Biospherical 510B profiler

Measurements of PAR (Photosynthetic Active Radiation), UV-A (380 nm) and UV-B (305 nm), and natural fluorescence of chlorophyll *a* have been done by means of a PUV Biospherical 510B profiler. The probe is equipped by 2 optical sensors which measure PAR, UV-A and B at the sea surface and underwater until 80 m, respectively. Besides it is equipped with temperature, pressure and natural fluorescence sensors. The software allows to compute other parameters as the vertical attenuation coefficient (Kd), chlorophyll *a* concentration, and the primary production. The vertical profile of PAR can be used to determine the depth of the euphotic zone (1% of the surface sunlight).

Laboratory: Firenze University

Chlorophyll

Seawater samples have been acquired to study relationships between apparent and inherent optical properties of the Mediterranean sea waters and the different taxonomical composition of the phytoplankton assemblages. They have been collected at different depths according to the real time vertical profiles of fluorescence, salinity, potential temperature and dissolved oxygen with the CTD. The following activities have been carried on board: **Estimate of liposoluble pigments concentration:** 4 l of seawater have been filtered on Whatman GF/F filters (∅ 47mm) and stored at -20 °C. Following, measurement on acetonic extract of filters will be carried out by means of:

- spectrophotometric analysis for chlorophaeopigments (chl *a* chl *b* chl *c* and phaeopigments) (Jeffrey and Humprey, 1975; Lorenzen, 1967);
- spectrofluorimetric analysis for chlorophyll *a* and phaeopigments (Holm-Hansen *et al.*, 1965);
- HPLC pigments analysis .with a RP-C8 column based system (Barlow et al., 1997).

Phytoplankton microscopic analysis: 500 ml of seawater fixed with 20 ml of 37 % formaldehyde have been stored in dark polyethylene bottles. The analysis will be performed with invertoscopes after sedimentation of a subsample of appropriate volume. **Fluorescence measurements:** fluorescence has been measured on water samples by Water PAM (Pulse Amplitude Modulation) fluorometer realized at different depths from the surface to over 100 m. At each depth Yield was measured. It is a useful parameter that measures the efficiency of photosystem and it is calculated as: $Y = (F_m - F_0) / F_m$

In order to make these measurements, 35 mL of sea water were included into a specific measuring chamber of the Water PAM equipped with an emitter and a detector. Fluorescence was measured at the end of a period of dark adaptation of 3 minutes. Blu measuring light, applied with pulses of 5 μs and a frequency of 18Hz, leads to a minimum fluorescence (F_0), followed to a saturation pulse, applied between measuring light pulses, with flash of 22 μs and a frequency of 20 Hz, inducing maximal fluorescence(F_m). Where light measurements were realized (see above) along the water column four photosynthesis – irradiance curves for superficial sample and four photosynthesis – irradiance curves for deep (25 m) sample have been calculated and expressed as ETR (Electron Transport Rate): ETR = Y * PAR

The parameter F_0 and F_m were measured in dark conditions and in presence of increasing actinic light (from 0 to 950 $\mu Em^{-2}s^{-1}$). The measurements were made at the end of a period of dark adaptation of 3 minutes and the samples were acclimatized for 20 seconds at each step of PAR.

Laboratory: Firenze University

Suspended particulate analysis
4 l seawater samples collected at different depths have been filtered on previously ignited and weighted glass fiber Whatman GF/F filters (∅ 47mm), rinsed with pure water and stored at -20 °C.

Laboratory: Firenze University

CDOM analysis: 250 mL of filtered seawater have been fixed with NaN_3 and stored in brown glass bottles for spectrophotometric determination.

Laboratory: Firenze University

Isotopic analysis of dissolved and biogenic silica and Trace Metals (TM) analysis on filtered seawater samples
Seawater samples were collected for TMs analysis, Si isotope measurements and seawater analysis. ***TMs analysis:*** samples for trace metals were collected in 1L polyethylene pre-cleaned bottles and then filtered through 47 mm, 0.4 µm pore size, polycarbonate membrane filters. Samples, for total dissolved trace metal analysis, were acidified to a pH ~2 with suprapur HNO_3 and stored at room temperature. These samples, filtered and acidified, were returned to its original bottle contained within a plastic bag, while the polycarbonate membrane filters were kept at T= -20 °C. ***Si Isotopic measurements:*** samples for Si analysis were collected in 1l polyethylene pre-cleaned bottles; in particular 2 l of seawater was immediately filtered (0.4 µm; Nuclepore PC membrane) to separate bSiO2 from DSi. The membrane was dried at 50 °C in an oven, and the filtrate was stored at room temperature.

Laboratory: IAMC CNR

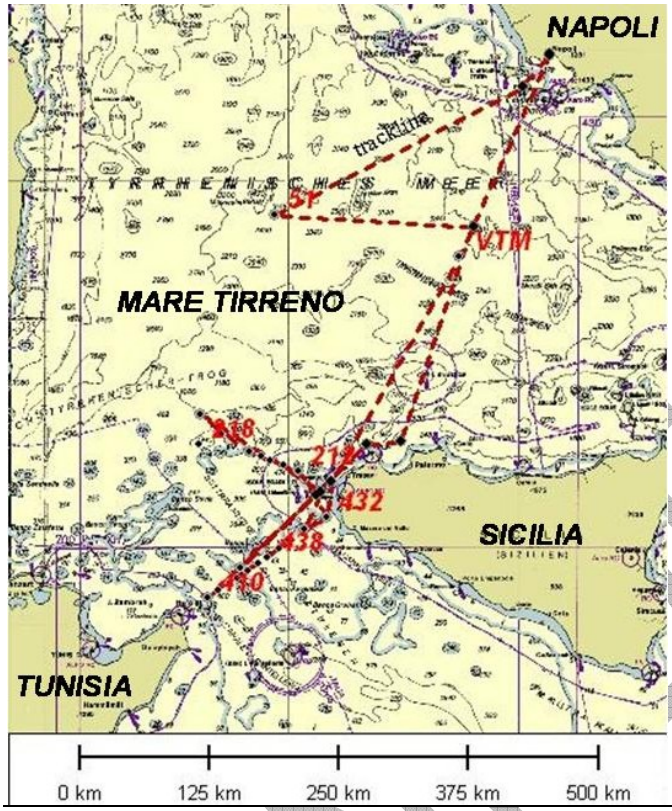
Deep moorings maintenance
Three moorings have been recovered on board, maintained and deployed in the same position.

Laboratory: ISMAR CNR, Parthenope University, SZN, ENEA

TRACK CHART

You are strongly encouraged to submit, with the completed report, an annotated chart illustrating the route followed and the points where measurements were taken.

The geographical limits of the study area are 32.00°N - 40.00°N of latitude and 8°E – 15°E of longitude. Due to bad sea conditions, the expected sampling plan has been partially reorganised (see pictures).



GENERAL OCEAN AREA(S) :

Enter the names of the oceans and/or seas in which data were collected during the cruise - please use commonly recognised names(see, for example, international Hydrography Bureau Special Publication No. 23, iLimts of Oceans and Seas').

TYRRHENIAN SEA
SARDINIA CHANNEL
SICILY CHANNEL

SPECIFIC AREAS

if the cruise activities were concentrated in a specific area(s) of an ocean or sea, then enter a description of the area(s). Such description may include references to local geographic areas, to sea floor features, or to geographic coordinates.

Please insert here the number of each square in which data were collected from the below given chart 143, 179

The Mediterranean sea is a semi-enclosed sea at medium latitudes. Some fundamental processes for the general circulation of the oceans (ex. deep water formation) happen or are given by such sea. The salty waters in the Atlantic, exiting from the Mediterranean, cn influence the water formation processes, the variability and also the equilibrium state of the global thermohaline

circulation, a mechanism by which large amounts of heat are exchanged inside and through the basins. The global thermohaline circulation has a fundamental role in contributing in the stabilization of the climatic system. The Mediterranean circulation, in the western basin, is forced by the wind stress, by the general floating forces generated by the heat and fresh water fluxes at the air-sea interface. The geography of the western Mediterranean is really complex with a really complex deep morphology and a distribution of its coasts, a variety of islands, straits, channels and openings. The exchanges through the different basins depend on the morphology of these straits, channels and openings. Due to a complex topography and geometry and of the high external forcing variability, the response time of the water masses and the spatial and temporal variability scales of the currents are really short than the oceanic ones. The recirculation time of the particles, inside the deep water formations areas, is around a hundreds years at Mediterranean scale, a really short climatic scale if compared with the Atlantic temporal scales of millenniums. The general view that grows up is that of a Mediterranean climatic system always interacting with the atmosphere that stores the information of the changes at the air-sea interface and modifies currents at the abyssal depths. This allows the Mediterranean, and then its western basin, to "react" really quickly to the changes of atmospheric forcing and then to be a "sensor" of the Earth climate. The study of the functioning of marine ecosystems and their response to external forcing is then controversial because really complex. The hydrological characteristics of the different water masses behave differently following depth and geographic position with different modifications in act. In the 30's two different behaviours have been observed, a constant increase in temperature and salinity in the deep and intermediate levels of the western Mediterranean and a more complicated variability of the eastern basin, followed by the climatological transient. What is sure it is then the observation of a phenomenon in the yearly '90s that, due to its dimension and speed, is one of those events characterised by a strong discontinuity: the so called climatological transient. This transient shows as the collapse of a system apparently stable can happen suddenly. In a few years the vertical structure of the basin has been completely modified. The possible reasons of the climatological phenomenon in the eastern basin have been widely described in the specialised literature (Malanotte-Rizzoli et al., 1999; Demirov and Pinardi 2002, Rupolo et al, 2003). This anomaly begun to propagate in the western basin (Schroeder et al., 2006; Schroeder et al., 2007, Schroeder et al., 2008). Actually it is difficult to forecast the effects of such an anomaly in the western Mediterranean even if the long times of run of the intermediate waters in the western basin probably will contribute to absorb it decreasing its effects. Vice versa the occurrence of such a phenomenon has underlined once more as the balances of a complex system can be strongly modified also by small variabilities of one of its components.

The temporal analysis of the analysed data does not permits to understand if these oscillations are characteristics of a natural state of the basin or, viceversa, if they represent an anomalous situation.

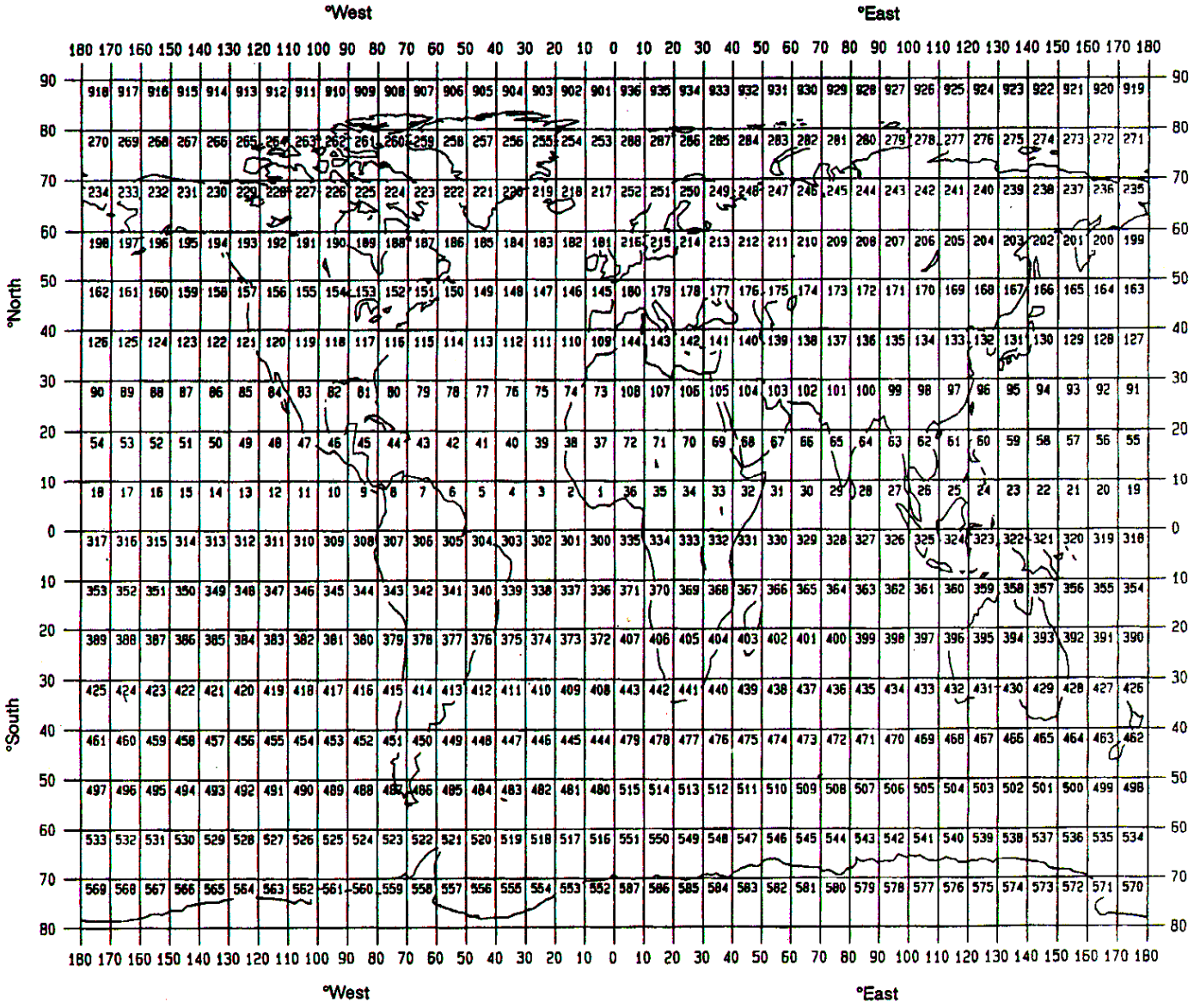
The cruise is part of a strategy for the periodic monitoring of this new hydrodynamic regime in order to evaluate the hydrodynamic and biogeochemical characteristic trends of the waters along the column and their interannual variabilities. For this reason the cruises have been repeated every year. Furthermore the biogeochemical anomalies N/P and the difference between the variables north and south of the basin, with two different hydrodynamic regimes, have been analysed.

Then in the area three regional hydrodynamic numerical models are operative giving a 5-days forecast of the sea state of the central and western Mediterranean updated daily. These cruises are also organised in order to calibrate and validate the circulation models at basin and coastal scales. Comparative studies with in-situ data, from satellite and models outputs will be used to evaluate the interannual variability of the dynamics at basin scale. Furthermore they will be used to study the mechanisms regulating and modulating the Chlorophyll distribution in mesoscale processes.
This cruise is strictly linked with the previous ones Medgoos1-13 (2000-2006), MedOc05, 06 (2005-2006), MedBio (2006), MedCO07 (2007), SESAME-IT4 and MedCO08 (2008), Tyrrhmounts and Sicily09 (2009), Venus1 (2010) where zonal trends of the hydrodynamic and biogeochemical characteristics of the water masses in the western basin.

Main hydrodynamic characteristics in the study areas

The central Mediterranean (Sardinia and Sicily channels) is characterised by a really complicated bottom topography directly influencing on the water exchanges between the two Mediterranean basins (eastern and western). In the Sardinia Channel the threshold depth is about 1900 m. This allows the exchange of deep waters in the western Mediterranean. The Sicily Strait is instead characterised by two strict passages with the deepest one of about 520m giving strong limits to the exchanges with the eastern Mediterranean. Over these two thresholds, a wide and shallow area far off Tunisia (Skerki bank) is another obstacle to a direct link between the water masses in the two basins but not for the passage from east to west of LIW (*Levantine Intermediate Water*) and tEMDW (*transitional Eastern Mediterranean Deep Water*).
The Tyrrhenian sea is linked both with the western Mediterranean as the eastern and is an intermediate basin whose southern part is linked to the central Mediterranean through a shallow channel permitting the passage of the LIW and of the tEMDW that, sinking at the entrance of the Tyrrhenian sea, origins the TDW that will move over the WMDW. The Opening Sicily-Sardinia is mainly formed by two channels with a wide intermediate plain. The deepest, in its central part, directly links the Tyrrhenian sea to the Sardinia Channel and to the rest of the western Mediterranean. All the water masses composing the water column from the surface to the bottom pass through it.
Resuming, the study area is a very complex system with an almost sub-tropical climate. Furthermore in the central Mediterranean area is present the widest community of marine mammals and fishes of the whole Mediterranean basin.
Other interesting aspects regard the hydrological properties (temperature and salinity) of the deep and intermediate layers, that show a positive trend for some decades. The reasons of this trend are still unknown.

GEOGRAPHIC COVERAGE - INSERT 'X' IN EACH SQUARE IN WHICH DATA WERE COLLECTED



PARAMETER CODES

METEOROLOGY

M01	Upper air observations
M02	Incident radiation
M05	Occasional standard measurements
M06	Routine standard measurements
M71	Atmospheric chemistry
M90	Other meteorological measurements

PHYSICAL OCEANOGRAPHY

H71	Surface measurements underway (T,S)
H13	Bathythermograph
H09	Water bottle stations
H10	CTD stations
H11	Subsurface measurements underway (T,S)
H72	Thermistor chain
H16	Transparency (eg transmissometer)
H17	Optics (eg underwater light levels)
H73	Geochemical tracers (eg freons)
D01	Current meters
D71	Current profiler (eg ADCP)
D03	Currents measured from ship drift
D04	GEK
D05	Surface drifters/drifting buoys
D06	Neutrally buoyant floats
D09	Sea level (incl. Bottom pressure & inverted echosounder)
D72	Instrumented wave measurements
D90	Other physical oceanographic measurements

CHEMICAL OCEANOGRAPHY

H21	Oxygen
H74	Carbon dioxide
H33	Other dissolved gases
H22	Phosphate
H23	Total - P
H24	Nitrate
H25	Nitrite
H75	Total - N
H76	Ammonia
H26	Silicate
H27	Alkalinity
H28	PH
H30	Trace elements
H31	Radioactivity
H32	Isotopes
H90	Other chemical oceanographic measurements

MARINE CONTAMINANTS/POLLUTION

P01	Suspended matter
P02	Trace metals
P03	Petroleum residues
P04	Chlorinated hydrocarbons
P05	Other dissolved substances
P12	Bottom deposits
P13	Contaminants in organisms
P90	Other contaminant measurements

MARINE BIOLOGY/FISHERIES

B01	Primary productivity
B02	Phytoplankton pigments (eg chlorophyll, fluorescence)
B71	Particulate organic matter (inc POC, PON)
B06	Dissolved organic matter (inc DOC)
B72	Biochemical measurements (eg lipids, amino acids)
B73	Sediment traps
B08	Phytoplankton
B09	Zooplankton
B03	Seston
B10	Neuston
B11	Nekton
B13	Eggs & larvae
B07	Pelagic bacteria/micro-organisms
B16	Benthic bacteria/micro-organisms
B17	Phytobenthos
B18	Zoobenthos
B25	Birds
B26	Mammals & reptiles
B14	Pelagic fish
B19	Demersal fish
B20	Molluscs
B21	Crustaceans
B28	Acoustic reflection on marine organisms
B37	Taggings
B64	Gear research
B65	Exploratory fishing
B90	Other biological/fisheries measurements

MARINE GEOLOGY/GEOPHYSICS

G01	Dredge
G02	Grab
G03	Core - rock
G04	Core - soft bottom
G08	Bottom photography
G71	In-situ seafloor measurement/sampling
G72	Geophysical measurements made at depth
G73	Single-beam echosounding
G74	Multi-beam echosounding
G24	Long/short range side scan sonar
G75	Single channel seismic reflection
G76	Multichannel seismic reflection
G26	Seismic refraction
G27	Gravity measurements
G28	Magnetic measurements
G90	Other geological/geophysical measurements