



**TNA PROJECT REPORT**  
**1<sup>st</sup> Call of Proposals**  
**12 January – 3 April, 2012**

**A) General Information**

<b>Proposal reference number<sup>(1)</sup></b>	CALL_1_8
<b>Project Acronym (ID)<sup>(2)</sup></b>	GABS
<b>Title of the project<sup>(3)</sup></b>	Deep Glider Acquisitions between Balears and Sardinia
<b>Host Research Infrastructure<sup>(4)</sup></b>	IMEDEA-CSIC
<b>Starting date - End date<sup>(5)</sup></b>	Pre-mission 23/10/2012 - 30/10/2012 1 <sup>st</sup> leg: 31/01/2013 – 16/03/2013 (glider mission) 18/03/2013 - 22/03/2013 (user group at facility in Mallorca) 2 <sup>nd</sup> leg 15/10/2013 - 29/11/2013 (glider mission)
<b>Name of Principal Investigator<sup>(6)</sup></b>	Alberto Ribotti
<b>Home Laboratory</b>	IAMC CNR UOS ORISTANO, loc. Sa Mardini, 09170 Oristano (Italy)
<b>E-mail address</b>	alberto.ribotti@cnr.it
<b>Telephone</b>	+39.0783.229137-229015
<b>Additional users<sup>(7)</sup></b>	Antonio Olita Leopoldo Fazioli Roberto Sorgente

**B) Project objectives (max. 250 words)<sup>(8)</sup>**

The proposed research aimed to identify the physical properties of the surface and intermediate water masses between the Balearic Islands and Sardinia. Objectives are, updated from the original proposal:

- i) study the seasonal variability of the physical properties of surface and intermediate water masses between the Algerian and the Provençal sub-basins;
- ii) assess the transport of water, salt and heat through the section and
- iii) validate the operational hydrodynamic numerical model of the western Mediterranean implemented at IAMC CNR UOS Oristano (<http://www.seaforecast.cnr.it/en/fl/wmed.php>) through the use of in-situ and satellite data.
- iv) investigate mechanisms of spring bloom triggering over a frontal area.

**C) Main achievements and difficulties encountered (max. 250 words)<sup>(9)</sup>**

The main scientific achievement has been to understand the phytoplankton spring bloom onset by a density front. Additionally, a second achievement has been the possibility to work and, consequently, know the colleagues at IMEDEA. This will probably bring to future stricter collaborations between two laboratories located in two opposite sites of the Western Mediterranean. Then achievements regarded the possibility of acquiring oceanographic data during particularly strong Mistral/Sirocco wind events and compare this with different sea/wind conditions. Secondly it was impressive to have data on the area several times in a year avoiding expensive cruises.

Difficulties in the early mission from October 2012 were solved in the January 2013 mission (during the first mission battery problems obliged to immediately recover the instrument).

**D) Dissemination of the results<sup>(10)</sup>**

Data are available at the IMEDEA-CSIC gliders database. The following scientific paper was already published: Olita A., S. Sparnocchia, S. Cusi, L. Fazioli, R. Sorgente, J. Tintoré, and A. Ribotti, (2013), Observations of phytoplankton spring bloom onset triggered by a density front in NW Mediterranean, *Ocean Sci. Discuss.*, 10, 5, 1559-1580 (under review on *Ocean Science*)  
 Another paper encompassing also the second mission and focusing on seasonal variability of intermediate waters over the slope region of Sardinian sea is presently in preparation.

**E) Use of the Infrastructure/Installation** <sup>(11)</sup>

	In situ	By remote
<b>Nr. of Users involved</b>	2	4
<b>Access units (days/months/etc)</b>	day	day
<b>In situ stay day / Remote Access duration</b>	4 days	88 days + 8 pre-mission

**F) User project scientific field**

<b>Main field</b> <sup>(12)</sup>	Earth Sciences & Environment
<b>Scientific description</b> <sup>(13)</sup>	Marine Science/Oceanography

**H) Technical and Scientific preliminary Outcomes (max. 2 pages)** <sup>(14)</sup>

Technically the instrument was, after a detailed description during the first visit at IMEDEA-CSIC in Mallorca, fully managed by the infrastructure giving all details of each mission status to the user by email or dedicated website.

The first mission (October 2012) was stopped after a couple of days due to technical (battery) problems. It was a week long but data have been acquired close to the coast of the Mallorca island and will be available as those from the following missions. This mission was later initiated as a second mission (January- March 2013) and was scientifically very interesting. During the return phase the glider encountered very strong Mistral event between Sardinia and Minorca. A comparison of changes occurred at physical and biological level have been described in the paper Olita et al. 2013 (see above point D). Here below the abstract:

*“Phytoplankton bloom in NW Mediterranean sea is a seasonal event that mainly occurs in a limited area (Gulf of Lyon and Provençal basin) where this phenomenon is promoted by a cyclonic circulation, strong wind-driven mixing and subsequent spring restratification. At the southern boundary of this area a density front (North Balearic Front) separating denser waters from the lighter Modified Atlantic Waters reservoir at south is suspected to trigger weaker and earlier (late winter) blooms by (a) enhanced pumping of nutrients into the euphotic layer and (b) promoting an early restratification of the water column (by frontal instabilities). A multisensor glider round trip, equipped with CTD and fluorometer, crossing the frontal area in February–March 2013, allowed to observe the bloom triggering after the decrease of intense wind-driven turbulent convection and mixing. Satellite imagery supports and confirms in-situ observations. It was shown that frontal activity has a relevant role in the promotion and acceleration of the dynamical restratification, with a consequent biological response in terms of primary production. Restratification is necessary preconditioning factor for bloom triggering in frontal area, net of other involved mechanism promoting the bloom as the enhanced biological pump. So, like for high-latitude fronts (Taylor and Ferrari, 2011a), also for this mid-latitude oligotrophic region front seems to promote new production by dynamically enhanced restratification inhibiting mixing. Finally, we argued that Sverdrup's Critical Depth criterion seems to apply in the northern well-mixed area, where the zeroing of heat fluxes (and related turbulent convection) does not correspond to a prompt onset of the bloom (which appeared 1 month later).”*

The third and last mission (October-November 2013), again between Balearic Islands and Sardinia has just concluded. Chlorophyll doesn't show any bloom, as expected, while the presence of a Deep Chlorophyll Maximum (DCM) was clearly present at about 50m depth. Oxygen concentration is higher than during the previous mission (February 2013) and its distribution in the water column is quite different. This mission shows a peak (mean) of about 7.5 ml/l at 50 m depth then remaining

higher than usual also at higher depths, while in the previous mission the peak (mean) was of 5.6 ml/l just on the surface. A complete analysis of the data will be realized in the next months. During the glider mission, fluorometer, oxygen and salinity sensors should have been validated with CTDs and water samples from the Italian CNR Urania vessel oceanographic instrumentation. Unfortunately this was not possible due to bad sea conditions that changed plans.

All metadata and raw data will be available within the first months of 2014 from the SOCIB-IMEDEA database. SOCIB-IMEDEA is also NODC.