



Appendix to Activity Report
Stazione Zoologica Anton Dohrn
2012-2017
List of external grants

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ABBaCo

Restauro Ambientale e Balneabilità del SIN Bagnoli-Coroglio



Summary

Dismissed industrial activities are responsible for persistent environmental degradation, mainly due to long-term accumulation of xenobiotic contaminants in the environment. Such a chronic form of pollution represents a major threat for human health, biodiversity and ecosystem functioning. Necessary environmental remediation practices should however be coupled to restoration plans aiming at revert the degradation trend and give back healthy areas able to provide valuable ecosystem goods and services. Albeit fully integrated into the EU Restoration Agenda, marine environmental restoration is a new challenging issue in ecology, with Italy coordinating MERCES, the first European project in this field. The environmental restoration of Bagnoli-Coroglio Bay is a unique challenge at European level. ABBACO will develop new approaches for the removal and remediation of contaminated sediments and restoration of marine habitats. Actions include: i) identifying the environmental benchmark of the area; ii) assessing its present health status, iii) studying the effects of contaminated sediments on biodiversity and ecosystem functioning (MSFD), iv) assessing the combined effects of multiple stress at a hierarchical level; (v) experimenting innovative methods of transplantation and restoration of key species and habitats, and new biotechnological instruments for the remediation of sediments (bioremediation, bioaugmentation) in degraded habitats. ABBACO will provide novel expertise and stimulate new initiatives within the Blue Economy Agenda. The project results will be achieved by the actions of 6 intermingled work packages (WPs): WP1 Historic overview of the environmental status; WP2 Assessment of contamination and multiple environmental impact; WP3 Effects on biodiversity and ecosystem functioning; WP4 Holistic approach to the study of multiple stress and risk reduction; WP5 Pilot studies of restoration and rehabilitation; WP6 Evaluating the effects of restoration and rehabilitation procedures; WP0 Project management.

What we do

We are coordinator of the project and play a key role in each of the 6 project's WPs.

Partners: **1)** Stazione Zoologica Anton Dohrn, Napoli; **2)** Istituto Superiore di Sanità (ISS); **3)** Istituto Nazionale di Geofisica e Vulcanologia (INGV); **4-5)** Consiglio Nazionale delle Ricerche (CNR-ISAC, CNR IAMC); **6)** Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile (ENEA); **7)** Università Politecnica delle Marche; **8-9)** Università degli Studi di Napoli Federico II (DiB, DICEA); **10)** Università degli Studi della Campania "Luigi Vanvitelli"; **11)** Università degli Studi di Napoli "Parthenope"; **12)** Consorzio Nazionale Interuniversitario per le Scienze del Mare (CoNISMA).

Research Area: Multidisciplinary Science.

Project Lifetime: 8th March 2017 to 7th March 2020.

SZN Role: Coordinator.

Principal Investigators: Luigi Musco, Vincenzo Saggiomo.

People involved: *Researchers:* Bertocci I (WP4 co-leader), Bottaro M, Cardini U, Carotenuto Y, Castellano I, Costantini M, D'Ambra I, Ferrante M, Hochscheid S, Locascio A, Munari M, Pepi M,

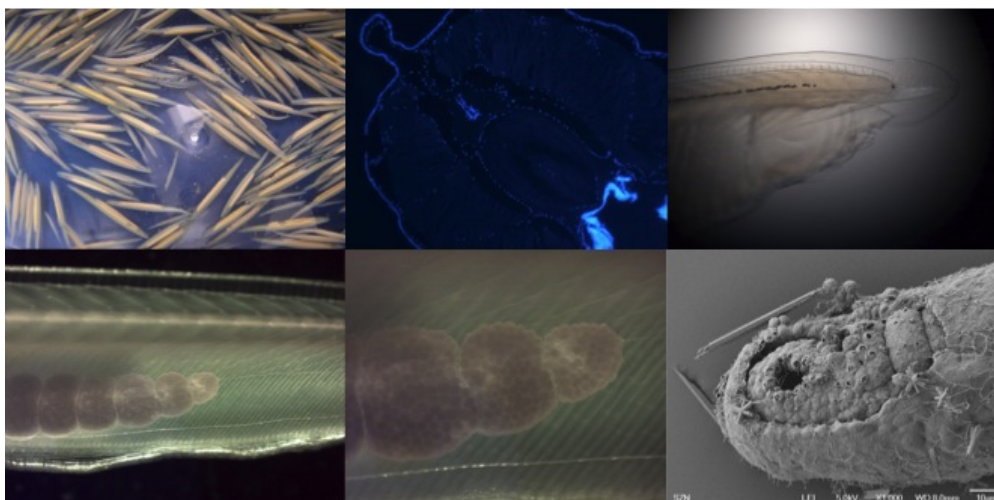
Rastelli E, Ristoratore F, Sansone C, Stefanni S, Zupo V; *Experienced Researchers*: Brunet C, Buia MC, Casotti R, Gambi MC, Iudicone D, Mazzocchi MG, Montresor M, Procaccini G (*WP5 leader*), Romano G, Sordino P, Spagnuolo A, Tosti E (*WP4 co-leader*); *Senior Reserachers*: Palumbo A, Ribera D'Alcalà M, Santella L, Zingone A (*WP3 co-leader*); *Associate Researchers*: Badalamenti F, Vicinanza D, Vega Fernández T (*WP1 leader*); *Technologists*: Conversano F, Margiotta F (*WP3 co-leader*), Patti FP, Sarno D, Terlizzi F, Toscano A, Saggiomo M; *Experienced Technologists*: Cirino P; *Technicians*: Cannavacciuolo M, Di Capua I, Lanzotti G, Passarelli A, Zazo G; *Post doc*: Gallo A, Guglielmo S, Morroni L (many others to be involved soon); *PhD Students*: Dell'Anno F.

Funding Institution: MIUR - Fondo Integrativo Speciale per la Ricerca (determina CIPE - GU n.56 8.3.2017).

Contribution to SZN: €2,000,000 (MIUR contribution) plus €1,700,000 (SZN co-financing contribution).

AmphioxusNOS

Marie Curie Career Integration Grant (FP7-PEOPLE-2011-CIG)



Summary

The main interest of the project is to study the Nitric Oxide Synthase (NOS) family evolution and its regulation during amphioxus development. In the framework of the project, setting-up an amphioxus facility at the SZN was a priority of national interest, representing the first Italian laboratory working with live amphioxus embryos *on demand*.

Since Furchgott, Ignarro and Murad won the Nobel Prize in Medicine or Physiology in 1998 for their breakthrough work on the role of nitric oxide (NO) as a multifunctional signaling molecule, many reports have shown the seemingly limitless range of body functions controlled by this compound. To manipulate the endogenous NO level for therapeutic benefits using NOS gene therapy is essential to understand the physiological and developmental functions of different NOS genes (nNOS, iNOS, eNOS). Due to their extensive conservation over evolutionary time, one would expect greater differences and structural changes in NOS genes than that we have observed (Andreakis 2011), reflecting the very ancient and essential nature of Nitric Oxide biological pathways. Surprisingly, a single molecule, identical in all living animals, can fulfil a huge range of different functions. This suggests that differences in the regulation of NOS enzymes expression are key in explaining their functional diversification, functional novelties and degree of complexity.

What we do

We use as animal model system the cephalochordate amphioxus *Branchiostoma lanceolatum*, from the Gulf of Napoli (Italy) and from Banyuls-sur-Mer (France), with comparative and multidisciplinary approaches in the field of Evolutionary and Developmental Biology (Evo-Devo). The primary aim of this project is to perform a detailed study of the duplicated set of NOS genes during amphioxus development, trying to establish the basic primary NOS roles that are evolutionary conserved in chordates.

Partners: Stazione Zoologica Anton Dohrn, Napoli

Research Area: Organismal Biology

Project Lifetime: August 2011 to July 2015

SZN role: Coordinator

Principal Investigator: Salvatore D'Aniello

People involved: Evgeniya Anishchenko, post-doc; Giovanni Annona, post-doc; Filomena Caccavale, PhD student (SZN-OU)

Funding Institution: European Commission, FP7-PEOPLE-2011-CIG (Grant no. 293871)

Contribution to SZN: € 100.000 (EU contribution)



ASSEMBLE Plus

Association of European Marine Biological Laboratories Expanded

ASSEMBLE

ASSOCIATION OF EUROPEAN MARINE BIOLOGICAL LABORATORIES

Summary

The objectives of ASSEMBLE Plus are to: 1) Enhance transnational access to a set of state-of-the-art marine stations; 2) Improve their service provision, with emphasis on developing novel key enabling technologies and data solutions; 3) Strengthen complementarity and interoperability within the consortium; 4) Lay the logistical and strategic foundations to expand the coverage of EMBRC in both its scope and its geographical distribution and to consolidate its long-term sustainability.

WP NA1 improves user access to marine stations by establishing the policies and procedures needed for regulating, granting and supporting access. **WP NA2** operates the data management and knowledge transfer platform. **WP NA3** promotes TA to potential new user communities from across the life sciences as well as from the private sector. **WP JRA1** Genomics Observatories will foster the application of genomics technologies at LTER sites. Research encompasses populating and verifying databases of taxonomic reference barcodes, harmonization of metabarcoding SOPs across the consortium, and inter-calibration of classical biodiversity data and genomics data (metabarcoding, meta-transcriptomics, etc.). **WP JRA3** Functional Genomics will address demands to establish links between genomic information and phenotypes of marine model species. It will develop functional genomic approaches for marine models. For the generation of Genetically Modified Marine Organisms (GMOs), a reference set of phenotyped - genotyped GMOs, and phenotypic or genotypic data for the functional description of the GMOs will be generated and made available for TA. **WP JRA4** Instrumentation for Marine Biology and Ecology will produce technical benchmarks for cross-consortium implementation of standardized experimental maintenance and rearing systems for marine organisms. **WP TA** Marine stations will provide transnational access to services offered with the aims: i) to attract new users from different disciplines and from different sectors; ii) to test interoperability and complementarity among partners; iii) to develop Key Enabling Technologies; and iv) to attract scientists who aim to increase the Technology Readiness Level (TRL) of their research.

What we do: SZN will offer TA, lead NA1 and contribute to NA3, NA4, JRA1, JRA3 and JRA4.

Partners: **1)** (Coordinator) Université Pierre et Marie Curie (UPMC) France, **2)** National Institute of Biology (NIB) Slovenia, **3)** Royal Netherlands Institute for Sea Research (NIOZ) Netherlands, **4)** University of Helsinki (UH) Finland, **5)** Institute of Oceanology Polish Academy of Sciences (IOPAN) Poland, **6)** University of Gdansk (UG) Poland, **7)** National University of Ireland Galway (NUIG) Ireland, **8)** University of Gothenburg (UGOT) Sweden, **9)** University of the Basque Country (UPV/EHU) Spain, **10)** Hellenic Center for Marine Research (HCMR) Greece, **11)** The Hebrew University of Jerusalem (HUJI) Israel, **12)** Stazione Zoologica Anton Dohrn di Napoli (SZN) Italy (together with third parties ISMAR - Venice and IAMC - Messina, Italy), **13)** University of Bergen (UiB) Norway, **14)** Center for Marine Sciences (CCMAR) Portugal, **15)** Alfred Wegener Institute (AWI) Germany, **16)** Max Planck Institute for Marine Biology (MPIMM) Germany, **17)** Flanders Marine Institute (VLIZ) Belgium, **18)** Scottish Association for Marine Sciences (SAMS) UK, **19)** The University Court of the University of Saint Andrews (USTAN) UK, **20)** Marine Biological

Association of the United Kingdom (MBA) UK, **21**) Natural Environment Research Council (NERC-BAS) UK, **22**) Marine Science Scotland (MSS) UK, **23**) AquaTT (AquaTT) Ireland

Research Area: Marine Biotechnology

Project Lifetime: 01/10/2017 to 30/09/2021

SZN Role: Coordinator of WP Network Activity 1, Involved in Joint Research Activity 1, 3 and 4, and Trans National Access, together with IAMC Messina and ISMAR Venice

Principal Investigators: Wiebe HCF Kooistra, Marco Borra

People involved: *Experienced Researchers:* Arnone MI, Borra, M (*TA*), Brunet C, Carotenuto Y, Casotti R, D'Aniello S, Ferrante M, Iudicone D, Kooistra WHCF (*PIC member, WP NA1 leader, GA member*), Locascio AM, Procaccini G (*WP JRA 4 lead at SZN*), Ristoratore F (*WP JRA 3 lead at SZN*), Sordino P, Zingone A (*WP JRA 1 lead at SZN*), CNR-IAMC: Sprovieri M, Giglio M, Crisafi E; CNR-ISMAR Luna G, Focaccia P, Sclavo M.

Post doc: Balestra C, Di Cioccio D, Marin Guirao L (others to be involved soon)

Funding Institution: EU INFRAIA-01-2016-2017 (Integrating Activities for Advanced Communities)

Contribution to SZN: 1 017 745,25 € (EU contribution), SZN contribution 34 Person Months from FOE

Biodiversitalia

Multitaxa approach to the study of the biodiversity response to climate change in Italy



Summary

The project addresses issues aiming at monitoring, predicting and managing **biodiversity in a range of Italian habitats**. The subproject concerning planktonic protists was conducted at SZN in connection with the EU BIODIVERSA-BioMarkS project. Research consisted of the analysis of the biodiversity of the Protists of the Gulf of Naples through high throughput sequencing (HTS) coupled with DNA metabarcoding, which allow to describe with a very high resolution the microbial diversity and thus to highlight its role in the functioning of the pelagic ecosystem. The objective was to create a morphological, genetic and ecological data set for the diversity of phytoplankton of the long-term MareChiara (LTER-MC) research station in the Gulf of Naples, and to compare it with those obtained at other 8 sites along the European coasts within the BioMarkS project. The aims of the project were subsequently expanded by including additional sampling addressing changes in biodiversity across the seasons.

What we do

We are coordinator of the OU SZN and were responsible of the whole subproject related to planktonic protists. We conducted sampling, DNA extraction and analysis of molecular data along with morphological and environmental variable analysis.

Partners: Stazione Zoologica Anton Dohrn, Napoli; Università di Torino and CNR Firenze.

Research Area: Marine molecular ecology

Project Lifetime: 22-02-2012 to 22-08-2016

SZN Role: Partner

Principal Investigator: Adriana Zingone

People involved: W. Kooistra, M. Montresor, D. Sarno, R. Piredda, postdoc;

Funding Institution: MIUR FIRB (RBAP10A2T4_002)

Contribution to SZN: € 200,200 (MIUR contribution).

BioMedBridges

Building data bridges between biological and medical infrastructures in Europe



Summary

BioMedBridges is a joint effort of twelve biomedical sciences research infrastructures on the ESFRI roadmap. Together, the project partners develop the shared e-infrastructure - the technical bridges - to allow data integration in the biological, medical, translational and clinical domains and thus strengthen biomedical resources in Europe. The project successfully concluded in December 2015, delivering the basis and impetus for its follow-on sister project CORBEL.

What we do

We were partner in BioMedBridges as representative of the EMBRC infrastructure. EMBRC was in the preparatory phase when the proposal was submitted therefore there was no official deliverable assigned to us. We have nevertheless contributed to the project with the following: participation to the technical coordination committee, definition of a use case scenario for the execution of metagenomics analysis pipeline, organization of a workshop and contribution to the computational activity of the project.

Partners: European Molecular Biology Laboratory; University of Oxford; Karolinska Institutet; Science and Technology Facilities Council; Heinrich Heine Universität Düsseldorf; Leibniz-Institut für Molekulare Pharmakologie; Technische Universität München; Stazione Zoologica Anton Dohrn; Erasmus University Medical Center Rotterdam; Technologie- und Methodenplattform für die vernetzte medizinische Forschung e.V.; Helmholtz Zentrum München; Medizinische Universität Graz; Institut national de la santé et de la recherche médicale; University of Copenhagen; University of Helsinki, Institute for Molecular Medicine Finland; European Grid Infrastructure; CSC - IT Center for Science Ltd.; University Medical Center Groningen; Consorzio Interuniversitario di Risonanze Magnetiche di Metalloproteine; Delivery of Advanced Network Technology to Europe; Stichting VU-VUmc; Biobanking and BioMolecular resources Research Infrastructure; Infrafrontier GmbH;

Research Area: Computational sciences

Project Lifetime: January 2012 to December 2015

SZN Role: Partner

Principal Investigator: Remo Sanges

People involved: Wiebe Kooistra

Funding Institution: EU

Contribution to SZN: €11.328,00

CEFA

Coastal Ecosystem Functioning in a changing Antarctic ocean



Summary

Information on the trophodynamics of Antarctic coastal ecosystems (in particular the Ross Sea) is scarce, especially during the spanning period from spring to summer, when the peak of primary production occurs in the sea ice and open waters. To fill this knowledge gap, the present project is focused on the trophic dynamics of Terra Nova Bay (TNB), a site model for the study of the Ross Sea coastal ecosystems. The sympagic, pelagic and benthic trophodynamics at TNB will be analyzed in relation to the evolution of sea ice dynamics and the chemical and physical properties of the water masses by means of traditional and innovative (e.g. AUV, underwater acoustics) sampling/measurement techniques. In particular, we will analyze spatial-temporal variations of primary production, biomass and biodiversity of sympagic and pelagic algal communities, bacteria and zooplankton, pelagic-benthic coupling processes, biomass and biodiversity of benthic communities (including bacteria and meiofauna) and the degradation rates of suspended and sedimentary organic matter. The results will conceivably contribute to the knowledge of the current environmental status and the changes taking place in the Antarctic coastal ecosystems in the light of the ongoing climate change and in relation to the ocean-atmosphere exchange of CO₂ and consequent ocean acidification.

What we do

The tasks of our O.U. provide results of biotic and abiotic analysis in the three different environmental context (sea-ice, sea-water and sediment) at different spatial and temporal scales. We will focus on:

- 1) specific composition of the microalgal communities with light microscopy, TEM and SEM analysis;
- 2) floristic analysis of microalgae found in the sediment traps and in faecal pellets of meso-zooplanktonic target organisms;
- 3) microalgae biodiversity in sea-ice and in the water column through molecular approaches;
- 4) photosynthetic parameters of pelagic and sympagic microalgae using modulated fluorescence techniques;
- 5) inorganic and organic nutrients levels in sea-ice and in the water column;

Partners: Università di Messina; Università Politecnica delle Marche (UNIPM); Università di Napoli Federico II (UNINA); Università degli Studi di Genova (UNIGE); Università degli Studi di Napoli 'Parthenope'; CNR IAMC - Istituto per l'Ambiente Marino Costiero; Istituto Superiore della Sanità

Project Life time: 2012 – 2017

Principal Investigator: Raffaella Casotti

Project Managers: Maria Saggiomo – Francesca Margiotta.

People involved: Augusto Passarelli; Fabio Conversano; Gianluca Zazo.

Funding Institutions: Progetto Nazionale di Ricerca in Antartide (PNRA)

COCONET

Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential

Summary

The Project will identify groups of putatively interconnected MPAs in the Mediterranean and the Black Seas, shifting from local (single MPA) to regional (Networks of MPAs) and basin (network of networks) scales. The identification of physical and biological connections with clear the processes that govern patterns of biodiversity distribution. This will enhance policies of effective environmental management, also to ascertain if the existing MPAs are sufficient for ecological networking and to suggest how to design further protection schemes based on effective exchanges between protected areas. The coastal focus will be widened to off shore and deep sea habitats, comprising them in MPAs Networks. Socioeconomic studies will integrate to knowledge-based environmental management aiming at both environmental protection(MPAs) and clean energy production(OFW). Current legislations are crucial to provide guidelines to find legal solutions to problems on the use of maritime space. Two pilot project (one in the Mediterranean Sea and one in the Black Sea) will test in the field the assumptions of theoretical approaches. The Project covers a high number of Countries and involves researchers covering a vast array of subjects, developing a timely holistic approach and integrating the Mediterranean and Black Seas scientific communities through intense collective activities and a strong communication line with stakeholders and the public at large.

What we did

SZN worked as sub-partner of CONISMA and is responsible of assessment of genetic diversity and connectivity within Pilot sites (South Adriatic Sea and Black Sea) in two seagrass species, *Posidonia oceanica* and *Zostera noltei*.

Partners: Stazione Zoologica Anton Dohrn, Napoli and many others

Research Area: Management and Conservation

Project Lifetime: 2012-2015

SZN Role: Sub-contractor

Principal Investigator: Gabriele Procaccini

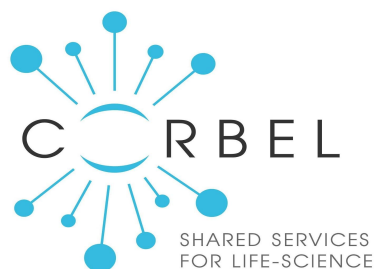
People involved: Marlene Jahnke (PhD)

Funding Institution: EU

Contribution to SZN: €47,506.65

Corbel

Coordinated Research Infrastructures Building Enduring Life-science Services



Summary

CORBEL is an initiative of thirteen new biological and medical research infrastructures (BMS RIs), which together will create a platform for harmonised user access to biological and medical technologies, biological samples and data services required by cutting-edge biomedical research. CORBEL will boost the efficiency, productivity and impact of European biomedical research. Individually, the services offered by the BMS RIs are critical to their own user communities. Collectively, through CORBEL, they will be transformative across the range of life-science disciplines: from generation of knowledge at the bench to patient treatment at the bedside.

What we do

The SZN participate to the WP4 (Community Driven Cross-Infrastructure joint research – Bioscience): Use case 4 (Marine Metazoan Developmental Models for BioMedical research - from predictive integrated databases to functional testing), coordinated by CNRS-Villefrances-sur-Mer (Evelyn Houliston). Within this WP the SZN hired for 18 mo the bioinformatician postdoc Elijah K. Lowe to work at enabling genomics and databases for *Paracentrotus lividus*.

Partners: Altogether, the CORBEL consortium comprises 37 individual partner institutions from 13 ESFRI Biological and Medical Sciences Research Infrastructures (BMS RI). Partners within WP4 are: EMBL-HD, EMBL-EBI, UMCU, ICFO, CRG, BRFAA, HMGU, CIRMMP, CSIC, CNRS, SZN, USTAN, FVB, MDC, VU/VUmc, DKFZ.

Research Area: Research Infrastructure

Project Lifetime: September 2015 to August 2019

SZN Role: Partner

Principal Investigator: Maria I. Arnone

People involved: Elijah K. Lowe; Salvatore D'Aniello; Anna Palumbo; Filomena Ristoratore.

Funding Institution: European Commission Horizon 2020 research and innovation programme. Grant agreement No 654248.

Contribution to SZN: €90.700,00. (EU contribution)

DiaEdit

Development of genetic tools for the establishment of routine genome editing in the marine diatom *Phaeodactylum tricornutum*

Summary

The DiaEdit project, Development of genetic tools for the establishment of routine genome editing in the marine diatom *Phaeodactylum tricornutum*, is part of the initiative “Increasing the Potential of Marine Microeukaryotes as Experimental Model Systems through the Development of Genetic Tools” promoted by the Gordon and Betty Moore Foundation.

The recent development of genetic tools for targeted genome editing of diatoms constitutes a great opportunity for the characterization of molecular processes in these ecologically important algae. Genome editing technologies in diatoms, however, are still in their infancy regarding their routine application. Targeted mutagenesis in diatoms is challenging because of their mostly diploid state and the current lack of efficient homologous recombination.

In this project we propose to enlarge knowledge and tools for genome editing in the molecular model species *Phaeodactylum tricornutum*, an essential requirement to transfer these technologies to other diatoms. We plan to develop and/or validate three different approaches for genome editing: a TALEN-based approach, the utilization of CRISPR/Cas9 and a viral integrase system.

What we do

SZN is involved in Task 4 “Control of nuclease expression”, aimed at the improvement of the specificity of action and expression of the nuclease used to modify the genome. This will be done mainly by identifying promoters that can allow fine control of the nuclease expression. NGS (next generation sequencing) will be used to assess the level of specificity of the chosen system by re-sequencing engineered clones.

Partners: SZN; Université Pierre et Marie Curie Paris, France; University of Konstanz, Germany; Norwegian University of Science and Technology, Norway; Tel Aviv University, Israel; Biological Systems and Biochemical Engineering Laboratory INSA/CNRS, France.

Research Area: Functional Genomics, Marine Biotechnology

Project Lifetime: October 2015 – April 2018

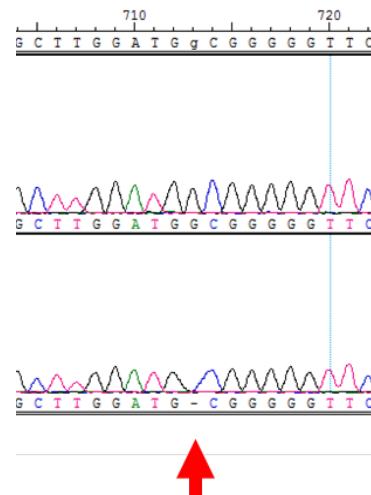
SZN role: Partner

SZN Principal Investigator: Mariella Ferrante

People involved: Monia T. Russo, Senior Post-doc

Funding Institutions: The Marine Microbiology Initiative funded by the Gordon and Betty Moore Foundation (USA).

Contribution to SZN: 80.876,28 USD (71.979,89 EUR)



EMBRIC

European Marine Biological Research Infrastructure Cluster to promote the Blue Bio-Economy



Summary

The objective of EMBRIC is to build a cluster of RIs, which foster innovation in marine biotechnologies. The project focuses on (i) discovery and development of marine natural products, (ii) marker-assisted selection in aquaculture, and (iii) coherent chains of high quality services for access to biological, analytical and data resources by connecting cognate ESFRI and other RIs (EMBRIC, MIRRI, EU-OPENSOURCE, ELIXIR, AQUAEXCEL, RISIS). The Joint Development Activities (WPs 6-8) will assess service interoperability in the research workflows, develop novel enabling technologies, and increase Technology Readiness Levels in their respective domains. Transnational Access (WP10) is offered to the user community. Projects mobilize at least two of the RIs in the cluster.

What we do: SZN leads WP7 “Microalgae for blue biotechnological applications”, to demonstrate that linking complementary expertise in biology, analytical chemistry and genetic engineering at multiple RIs can provide the blue biotechnology industry with high-performance strains from across the diversity of microalgae. This involves proof of concept that 1) strains from across microalgal diversity constitute a rich resource of natural products for commercial exploitation, 2) such strains can be genetically engineered to improve their performance capabilities for commercial exploitation, and 3) selective breeding in microalgae in combination with genotype screening can produce strains with improved performance in commercial applications. SZN specifically contributes to the identification of bioactive compounds from microalgal strains and to the generation of genetically engineered diatom strains. **SZN leads WP10** “Transnational Access To EMBRIC” the SZN manages the translational access, coordinating the scientific, technical and logistic access to the different RIs involved.

Partners: 1) (Coordinator) Université Pierre et Marie Curie – Paris 6 UPMC FR, 2) Centro de Ciencias do Mar do Algarve CCMAR PT, 3) Natural Environmental Research Council NERC UK, 4) The Scottish Association for Marine Science LBG SAMS UK, 5) Stazione Zoologica Anton Dohrn SZN IT, 6) Marine Scotland Science MSS UK, 7) Marine Biological Association of the United Kingdom MBA UK, 8) Forschungsverbund Berlin E.V. FVB DE, 9) Consiglio Nazionale delle Ricerche CNR IT, 10) The University Court of the University of St Andrews USTAN UK, 11) TUNATECH GmbH TUNATECH DE, 12) Xelect Limited Xelect UK, 13) Institut National de la Recherche Agronomique INRA FR, 14) The Arctic University of Norway UiT NO, 15) CAB International CABI UK, 16) Universiteit Gent UGENT BE, 17) Institut Pasteur CRBIP FR, 18) Helmholtz-Zentrum fuer Infektionsforschung GmbH HZI DE, 19) European Molecular Biology Laboratory EMBL DE, 20) Université Paris Est Marne La Vallée UPEM FR, 21) Tel Aviv University TAU IS, 22) Université de Nice Sophia Antipolis UNS FR, 23) SCALPRO AS SCALPRO NO, 24) Leibniz-Institut DSMZ-Deutsche Sammlung von Mikroorganismen & Zellkulturen GmbH DSMZ DE, 25) Hellenic Centre for Marine Research HCMR GR, 26) CNRS / Institut Français de Bioinformatique CNRS/IFB FR, 27) Universitet i Bergen UiB NO.

Research Area: Marine Biotechnology

Project Lifetime: 01/06/2015 – 31/05/2019

SZN Role: WP7 leader, WP10 leader, and Steering Committee member

Principal Investigators: Wiebe HCF Kooistra and Mariella Ferrante

People involved: *Experienced Researchers:* Ferrante M (*WP7 leader*), Ianora A, Kooistra WHCF (*WP10 leader*), Montresor M, Sansone C; *Technicians:* Manfredonia A, Minucci C; *Post doc:* Di Cioccio D, Russo MT, Sabatino V

Funding Institution: European Commission, under the H2020-INFRADEV-4 call

Contribution to SZN: 409 437,50 € (EU contribution)

EMBRC

European Marine Biology Resource Centre preparatory phase 2



Summary

The project had as objectives: 1) to harmonize the access mechanism to the operational EMBRC-ERIC across all the partners, putting tools in place, including host contracts and single point online access platform; 2) to put in place guidelines towards implementation of the Nagoya Protocol, and 3) To focus smart specialization of the regions onto opportunities offered by marine biological resources for blue-biotech innovation.

What we did: SZN established a set of user access contract templates in which the IPR and the % of the FEC of user access to be charged to the user are specified. User contracts terms and conditions specified the necessary measures to be compliant with the Nagoya protocol. SZN organized a WS to decide on a set of contract templates.

Partners: **1)** Centro de Ciencias do Mar Algarve, Faro, Portugal, **2)** UPMC - PARIS 6, Paris, France, **3)** Stazione Zoologica Anton Dohrn, Naples, Italy, **4)** Marine Biological Association of the UK, Plymouth, UK, **5)** Universiteit Gent, Gent, Belgium, **6)** Hellenic Centre for Marine Research Heraklion, Greece, **7)** The Hebrew University of Israel, Jerusalem, Israel, **8)** Universitat de Pais Vasco, Bilbao, Spain, **9)** Universitetet I Bergen, Bergen, Norway, **10)** Instituto do Mar IMAR, Portugal, **11)** Universitat de Vigo, Vigo, Spain, **12)** The University of St. Andrews, St. Andrews, UK, **13)** Conference of the Marine Peripheral Regions, Rennes France, **14)** Helsingin Yliopisto, Helsinki, Finland, **15)** British Antarctic Survey, NERC Cambridge UK, **16)** Vlaams Instituut voor de Zee VLIZ, Ostende, Belgium,

Research Area: Marine Biotechnology

Project Lifetime: 01/10/2015 to 30/09/2016

SZN Role: participation in WP2.

Principal Investigators: Wiebe HCF Kooistra, Marco Borra

People involved:

Experienced Researchers: Kooistra WHCF,

Experienced Technologist: Borra M

Post doc: Di Cioccio

Funding Institution: H2020-INFRADEV-1-2015-2 Proposal ID 689173

Contribution to SZN: 59 000 € (EU contribution)

EMSO MedIT

European Marine Seafloor Observation MEDiterranean ITaly node



Summary

The project concerns the enhancement of research infrastructures for marine environment located in the Convergence Regions Sicily, Campania and Puglia, where the sea is a primary opportunity of development. The project, called EMSO-MedIT is the Italian contribution to the consolidation in the above mentioned regions of the European research infrastructure EMSO, which, within the context of EMSO-MedIT, is in synergy with the other ESFRI coordinated by Italy (KM3NeT and EMBRC) and the Italian initiative for marine research RITMARE.

The actions foreseen will be carried out according to the following objectives:

- 1) enhancement of marine infrastructures and of scientific and technological facilities to strengthen and expand the network for multidisciplinary monitoring of coastal, deep and the water column marine environment;
- 2) networking of all existing and enhanced infrastructures for the transmission in real-time/near-realtime integrating the data from fixed and relocatable observing systems;
- 3) establishment of a mobile system of intervention to be used for monitoring campaigns at sites of strategic interest or in the case of environmental emergencies.

The network of monitoring infrastructures will be further enhanced through the creation of an exchange information system that will enable the sharing of the large amounts of data, providing access to a large community of Italian and foreign users.

Our role: We are partners of the project and in charge of the WP2 "Strengthening of Campania", together with INGV for the Gulf of Pozzuoli. The expansion includes the acquisition of different oceanographic instrumentation, including a WaveGlider, an ROV, and various sensors, but mainly two buoys type elastic beacon to locate in the Gulf of Naples and Gulf of Pozzuoli for the real-time monitoring and data transmission to the control center of physical and biological environmental data. Partners: National Institute of Geophysics and Volcanology (INGV), Anton Dohrn Zoological Station (SZN), National Institute of Nuclear Physics (INFN), the National Research Center (CNR), National Institute for Environmental Protection and Research (ISPRA).

What we do

We are coordinator of the Work Package 2, in charge of development of infrastructure in the Campania Region and members of the Steering Committee.

Partners: Partners: National Institute of Geophysics and Volcanology (INGV), Anton Dohrn Zoological Station (SZN), National Institute of Nuclear Physics (INFN), the National Research Center (CNR), National Institute for Environmental Protection and Research (ISPRA).

Research Area: Ecosystem Assessment.

Project Lifetime: September 2015 to March 2016.

SZN Role: Partner.

Principal Investigator: Raffaella Casotti

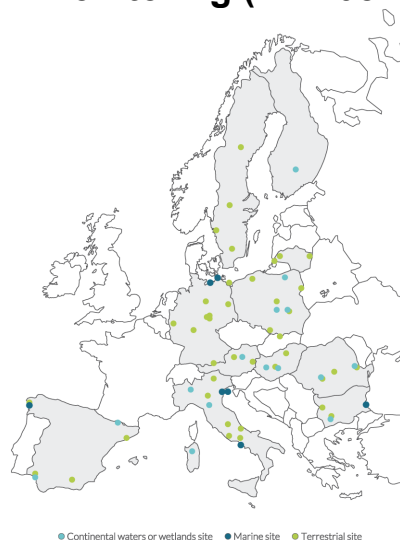
People involved: Fabio Conversano, Augusto Passarelli, Salvatore Orfano, Salvatore Addezio, Mariella Saggiomo, Christophe Brunet, Daniele Iudicone, Francesca Margiotta.

Funding Institution: PON R&C 2007-2013 - PAC Enhancement of public research infrastructures.

Contribution to SZN: €2.006.180,00 (MIUR contribution).

EU-LIFE+ ENVEUROPE

Environmental quality and pressure assessment across Europe: the LTER network as an integrated and shared system for ecosystem monitoring (LIFE08 ENV/IT/000399)



Summary

The main objective of the project is the analysis of the health status of ecosystems and the definition of appropriate environmental quality indicators through a long-term integrated approach across a wide scale and between different domains (terrestrial ecosystems, freshwater, coastal and marine). The EnvEurope project has involved the participation of 11 countries belonging to the LTER-Europe network with the aim to design a scheme for monitoring environmental quality at research sites and identifying a set of common parameters to be acquired within the largest European network of long-term ecological research sites. A further objective was the selection of a list of parameters, indicators and ecological indexes to be used in the analysis, comparison and description of environmental quality at international level.

What we do

We participated to action 5, 'Testing in the Field', with the Long Term Ecological Research site MareChiara (LTER-MC), mainly carrying out four sampling campaigns at LTER-MC. In addition, we collaborated to the creation and population of metadata databases and database (Action 1), harmonization activities concerning the methods and parameters (Action 2), and to the analysis of the historical data series (Action 3).

Partners: We were subcontractor of the CNR-ISMAR, Venice but in fact collaborated with all ENVEUROPE partners with aquatic sites.

Research Area: Plankton ecology

Project Lifetime: January 2012 to December 2014

SZN Role: External Assistant

Principal Investigator: Adriana Zingone

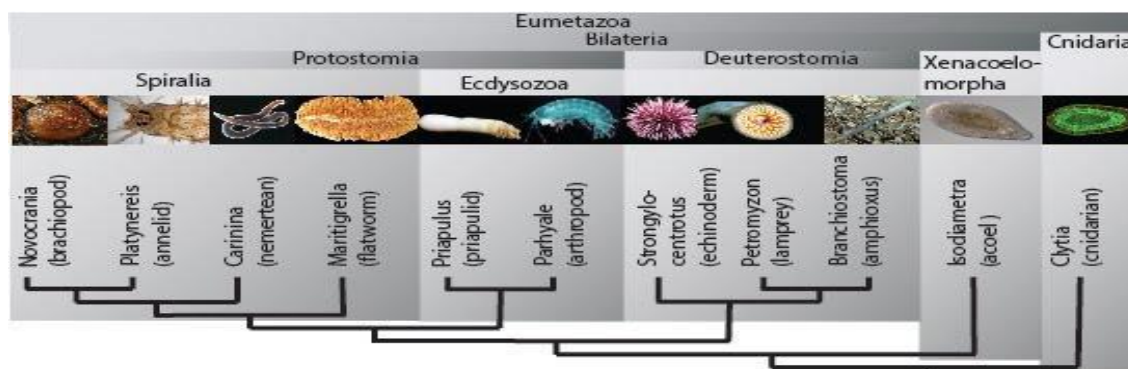
People involved: Diana Sarno, Maria Grazia Mazzocchi, Francesca Margiotta, Cristina Tortora, postdoc, Antonella Costanzo, postdoc.

Funding Institution: CNR through EU Life+ grant.

Contribution to SZN: € 72,600 (CNR contribution).

EvoCELL

Animal evolution from a cell type perspective: multidisciplinary training in single-cell genomics, evo-devo and in science outreach



Summary

The aim of EvoCELL is to lay the foundation for a new branch of evo-devo focussing on cell types. We will study fundamental questions in animal evolution and development - eg. how new cell types arise in evolution, how many are in common between different animal groups and how many unique cell types have evolved in different animal lineages- using a new technology, single cell sequencing, which we will for the first time employ outside of lab models to sample the great diversity of animal phyla. EvoCELL will train a new generation of multidisciplinary scientists skilled in exploring the vast breadth of animal differentiation. We will jointly sample data from all major animal lineages, richly represented in the biodiversity of European waters, and develop new tools for comparative analyses, through which we will together pioneer three branches of cell evo-devo: evolution of stem cells; emergence of animal life cycles, and the stunning diversity of neural cell types. Through their excellent interdisciplinary and intersectoral training, from single-cell biology and palaeontology to bioinformatics and public outreach, our graduates will be in prime positions to assume leadership roles in academia, industry, and science outreach.

What we do

We are one of ten partners and are contributing to WP1, Whole-animal single-cell transcriptome data for marine species, WP4, Origin and evolution of neural cell types and tissues, WP5, training and courses and WP6, Outreach.

Partners: European Molecular Biology Laboratory, Heidelberg - DE; Stazione Zoologica Anton Dohrn, Napoli – IT; Uppsala University, Uppsala – SE; University of Heidelberg, Heidelberg – DE; University of Exeter, Exeter - UK; University College London, London – UK; Sars International Center for Marine Molecular Biology, Bergen – NO; Centre National de la Recherche Scientifique, Villefranches sur mer, Lion - FR; Non-academic partners: Museum für Naturkunde, Berlin – DE; Genomix4Life, Salerno - IT

Research Area: Organismal Biology

Project Lifetime: January 2018 to December 2022

SZN Role: Partner

Principal Investigator: Maria I. Arnone

People involved: 2 ESRs to be hired

Funding Institution: European Commission, Horizon 2020 Call for Proposal: H2020-MSCA-ITN-2017. Grant Agreement no. 766053.

Contribution to SZN: €344081,76 (EU contribution)



ExPO

Exploring the biotechnological Potential of marine Organisms

Summary

Recent technological advances allow now faster isolation of bioactive molecules and more efficient and easier access to marine resources, reinforcing the interest for the exploration of marine environments, especially in order to find solutions for contemporary health issues related to aging, changes in lifestyle and food habits. Additionally, the implementation of cutting-edge platforms for high throughput screening and the advancement in cultivation and molecular biology techniques are allowing finer resolution for finding competent chemicals and pertinent molecular targets.

The Expo project aims to an innovative and sustainable exploitation of marine natural products for applications in the food, nutraceutical, cosmetic and pharmaceutical industries. To avoid over-exploitation of marine ecosystems and achieve sustainable production of bio-active substances, methods of cultivation in closed systems for macro and microorganisms of biotechnological interest will be adopted.

What we do

SZN is involved in all the 7 WPs in which the project is organized.

The selection of organisms (WP1) will be guided by ecological and biological knowledge in order to increase the success rate in identifying new bioactive molecules, focusing on organisms from harsh environments and/or with traits that suggest the presence of chemical defenses. The project will focus on three main application areas: biomedical, nutraceutical and cosmeceutical. The screening activities will cover biological tests carried out on animal and cellular models specifically selected to identify potential anti-tumor, anti-inflammatory, antibiotic and antioxidant bioactivity (WP3, 4 and 5).

To avoid over-exploitation of marine ecosystems and achieve sustainable production of bio-active substances, methods of cultivation in closed systems for macro and microorganisms of biotechnological interest will be adopted and/or developed (WP6). The project will also promote laboratory strategies to increase the yield of bioactive compounds (WP6).

Partners: Istituto di Scienze Neurologiche (ISN)-CNR; Istituto di Scienze delle Produzioni Alimentari (IPA)-CNR; Istituto di Biochimica delle Proteine (ICB)-CNR; Dipartimento di Biochimica Biofisica e Patologia Generale Seconda Università di Napoli (SUN); Dipartimento di Farmacia Università di Napoli Federico II (UNINA).

Research Area: Marine Biotechnology

Project Lifetime: 2017 –2019

SZN Role: Coordinator

Principal Investigators: Giovanna Romano, Pasquale De Luca, Laura Nunez Pons

People involved: 26 Researchers from the 3 Departments are involved in different WP of the projects

Funding Institution: MIUR (Ministero Istruzione, Università e Ricerca)

Contribution to SZN: € 501.188,00

Food&Health

(Premiali MIUR 2015)

Summary

The proposal "Food&Health" (Ci&Sa) aims at improving and developing the Italian food system by finding proper and efficient solutions to meet new and increasing food needs and to address food safety/sustainability problems.

Relevant changes are being observed in the society: healthier habits and life styles produce emerging requests for food safety assurance, food quality, and healthy diets preventing or assisting in the therapies of human diseases. On the other hand, an increasing number of feeding disorders are observed worldwide (including in Italy), and diseases arising from incorrect diets and/or low quality foods assumptions is also increasing. Diet diseases yearly cause death of about two millions of people at global level, according to the World Health Organization.

This problem is complex and worldwide recognized, as highlighted by the European Commission attention in the current framework program Horizon 2020, and by the World Expo Milan 2015 theme (EXPO 2015: "Feeding the planet"). Ci&Sa will address the need of providing better food quality, food safety, and food security with an interdisciplinary and innovative series of research.

Specifically, the project aims at assuring a perspective for healthy, safe and quality food, at any scale (local to global), addressing dietary needs, especially by the population affected by nutrition disorders, and by diseases related to diet.

What we do

Functional foods from microalgae, which can be used directly as food additives (omega 3-6-9, carotenoids, vitamins and proteins), Our aim is the implementation of isolation and maintenance of microalgae for potential biotechnological applications, through large scale microalgae cultivation in photobioreactors.

Coordinator: CNR (National Council of Research)

Partners: Istituto Nazionale di Ricerca Metrologica (INRIM); Stazione Zoologica Anton Dohrn (SZN); Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS); Università degli Studi di Salerno.

Research Area: Biotechnology; Functional Foods

SZN role: Partner

Principal Investigators: Christophe Brunet, Maria Costantini, Adrianna Ianora

Project Lifetime: 01/01/2015- 31/12/2016

Funding Institutions: MIUR (Ministero Istruzione, Università e Ricerca)

Contribution to SZN: 360.595 €

GyPSy

A forward genetic screen in the marine planktonic diatom *Pseudo-nitzschia multistriata*



Summary

This research project is a Marie Curie Career Integration Grant (CIG). The project focuses on a marine diatom, a unicellular alga called *Pseudo-nitzschia multistriata*. Diatoms carry out one fifth of the photosynthesis on Earth and are essential to aquatic ecosystems. An improved knowledge of diatom biology is crucial for understanding the basis of their ecological success, for predicting their capability to adapt to a rapidly changing environment, and for industrial exploitation of their biological properties. We plan to use this species as a genetic model system to study the function of algal genes involved in important processes such as lipid biosynthesis. This will be achieved by the generation of mutant clones. An important part of this project is the sequencing of the genome of this alga in collaboration with The Genome Analysis Centre in Norwich, UK. The final goal of the project is to consolidate a new model organism to explore the molecular mechanisms underlying the biology of diatoms. Ultimately, we want to generate information that will allow a better comprehension of the data and observations that will come from the sea.

What we do

The scope of this project is to generate a collection of stable mutants for diatoms through random chemical mutagenesis. Specifically, we want to isolate mutants with altered production of fatty acids, oxylipins and domoic acid, both to characterise the molecular pathways involved and to obtain clones of potential interest to industry. We have selected the species *Pseudo-nitzschia multistriata* for our studies because of its ecological relevance in Mediterranean ecosystems and because of its controllable life cycle with known sexual stages. As an important step to this study we plan to exploit new sequencing technologies to sequence the genome of the selected diatom, this will allow to undertake positional cloning once mutants have been isolated and will represent per se a valuable resource.

Partners: TGAC, The Genome Analysis Centre, currently called Earlham Institute, UK

Research Area: Functional Genomics, Genetics

Project Lifetime: September 2011 – August 2015

SZN role: Principal Investigator

SZN Principal Investigator: Mariella Ferrante

People involved: Marina Montresor, Remo Sanges (staff scientists) Valeria Di Dato, Swaraj Basu, (Post-docs), Shrikant Patil (PhD student)

Funding Institutions: Marie Curie Career Integration Grant, FP7-PEOPLE-2011-CIG

Contribution to SZN: € 100.000

HEATGRASS

Tolerance to HEAT stress induced by climate change in the seaGRASS *Posidonia oceanica*

Summary

Climate change is increasing in the frequency and intensity of extreme heat events during European summers. Heat waves are enhancing the water thermal stratification in the Mediterranean Sea with dramatic consequences for coastal ecosystems. As a consequence of these heat waves, it has recently been predicted that *Posidonia oceanica* meadows could be functionally extinct by the middle of this century. However, there no exist evidences of this cause-effect relationship and almost nothing is known about the tolerance capacity of this seagrass species to warming. There is, therefore, an urgent need to determine the resilience and acclimation capacity of the species for the conservation of these valuable ecosystems, the functions, and the services they provide. The general objective of this research is to find out how sporadic extreme heat events will affect *P. oceanica* meadows, and to forecast how they will respond under the effects of climate change along the European Mediterranean coasts. To this end, the present project will be based on mesocosm experimentation and will combine novel transcriptomic and ecophysiological approaches for a comparative analysis of plants from contrasting thermal regimes. The main specific objectives are: i) to determine and analyse on an integrated approach the stress responses and tolerance mechanisms of *P. oceanica* over the course and recovery period of a simulated heat wave, ii) to identify specific genes associated with the tolerance and resilience of the species to heat stress, iii) to compare whether genotypes from thermally contrasting depths of a population differ in their tolerance and resilience to warming, and iv) to compare whether populations from thermally contrasting localities differ in their tolerance and resilience to warming. Findings will represent a substantial and novel contribution to the capacity of the species to adapt to global warming particularly useful to adopt decisions in management and conservation policies

What we do

Project coordinator and host organization.

Partners: Stazione Zoologica Anton Dohrn, Napoli.

Research Area: Plant ecophysiology and stress response.

Project Lifetime: 2015-2016.

SZN Role: Project coordinator and host organization.

Principal Investigator: Gabriele Procaccini.

People involved: Lazaro Marin Guirao (Post-Doc).

Funding Institution: EU, FP7-PEOPLE-2013-IEF

Contribution to SZN: €249,242.80

HighGrass

High-CO₂ effects on seagrass photosynthetic ecophysiology

Summary

The atmospheric concentration of CO₂ has been steeply increasing since the beginning of the industrial era. The oceans are responsible for taking up around 25% of the anthropogenic CO₂ emitted into the atmosphere, but in this process the seawater chemistry is being altered, with the increase of total dissolved inorganic carbon (Ci) and the decrease of pH. At present, very little is known on the potential effects that these changes may have on seagrass biology and ecology, despite the fact that these plants are among the world's most productive marine ecosystems, with a very high ecological and economical importance (Costanza et al. 1997). A major impact is likely to occur at the photosynthetic carbon acquisition level. On the current state of the art, major uncertainties still persist concerning the operation of the fundamental processes of light harvesting and carbon acquisition in seagrasses. Much of these gaps are related to the fact that, although seagrasses are angiosperms, some of the physiological mechanisms and pathways of light harvesting and carbon acquisition are not identical to those found in their terrestrial counterparts, neither to those used by macroalgae inhabiting similar aquatic environments. Therefore, a comprehensive understanding of the operation of these mechanisms is a pre-requisite for further research aiming to predict the effects of a high-CO₂ environment on seagrass physiology, productivity, distribution and ecosystem function. While it is commonly assumed that seagrass photosynthetic rates will respond positively to a high-CO₂ scenario (Hellblom et al. 2001), the few published studies on this subject are not consensual, showing diverse responses and lacking physiological insights and explanations for the observed results. On the other hand, studies conducted in natural CO₂ vents revealed that seagrasses have adapted to live under permanently high CO₂ levels (Hall-Spencer et al. 2008) and are able to exploit CO₂ of volcanic origin (Vizzini et al. 2010). Nevertheless, little information is still available on the effects of more diffuse and stable release of hydrothermal CO₂ on seagrass productivity.

The first step in our research will be to solve critical knowledge gaps regarding the operation of the fundamental physiological processes of light harvesting and carbon acquisition in seagrasses. The next step will be to determine, in controlled mesocosm conditions, the short and long-term effects of high CO₂ exposure on the operation of these two processes. Finally, we shall investigate how seagrasses growing in the vicinity of natural CO₂ venting sites have adapted to long-lasting high CO₂ conditions, under both high- and low-light regimes. To address this sequential set of objectives, we shall use an innovative combination of ecophysiological tools, coupled to genomics and proteomics techniques in a multilevel approach, from genes to the whole-plant level.

What we do

SZN took care of the genetic characterization of seagrass species in situ and in mesocosms experiment and of the assessment of gene expression in situ and controlled conditions.

Partners: Stazione Zoologica Anton Dohrn, Napoli, University of Algarve, Portugal

Research Area: Plant ecophysiology and stress response

Project Lifetime: 2013-2014

SZN Role: Affiliate center

Principal Investigator: Gabriele Procaccini

People involved: Miriam Ruocco (PhD)

Funding Institution: Ministerio da Ciencia, Tecnologia e Ensino Superior – Portugal

Contribution to SZN: €45,000.00

“High CO₂ Seas” and “Future4Oceans”

Ischia CO₂ vents as natural laboratories to assess the impacts of OA on marine biodiversity and species adaptation



Summary

OA is predicted to have profound impacts on marine ecosystems has the potential to alter the ocean, its habitats, food webs and marine life. Studies from different CO₂ vent systems distributed worldwide report impacts on the community of temperate and sub-tropical ecosystems. Corresponding to this pH drop, these systems share dramatic decrease in diversity and biomass of marine species as well as in the production and resistance of biomineralized skeletons. Studies using the shallow volcanic CO₂ vents near Castello Aragonese on the island of Ischia (Italy), the CO₂ first vent system studied in the world, have generated key insights on the effects of OA on marine ecosystems. Recently, various new vent systems have been discovered along the coast of Ischia across depths of 3-48 m. These new CO₂ vent's sites span a variety of different habitats such as *Posidonia oceanica* seagrass meadows, gravel and sandy bottoms, semi-dark caves, and coralligenous outcrops, the latter characterized by high coverage of calcifying organisms that are particularly vulnerable to OA. These habitats are hotspots of Mediterranean marine biodiversity and represent an exceptional natural heritage of the Mediterranean seascape. These new CO₂ vents studied within *High-CO₂ Seas* project place Ischia at the forefront of natural laboratories for OA studies, as the only locations known to date where CO₂ vents span a variety of habitat types, allowing us to investigate and report how a suite of ecosystem types responds to acidification. *High-CO₂ Seas* project will assess how marine diversity responds to ocean acidification, including functional responses (functional traits), as proxy of functional roles, such as growth forms, solitary versus colonial species, reproductive modes, seasonality, size ranges, feeding characteristics, presence of calcareous skeletons.

The coral *Astroides calycularis* is a long-lived species with SW distribution in the Mediterranean Sea. It is considered to be vulnerable on the IUCN red list. This species does not host photosynthetic microalgal symbionts. Interestingly, there is one population of the coral *A. calycularis* that naturally occurs in one of the new discovered CO₂ vent systems. The site is a semi-submerged cave named Magician's Cave (Grotta del Mago). It seems that the corals do well with yearly reproduction in this cave affected by the CO₂-rich water bubbles. Within the *High CO₂ Seas* we will test the degree of genetic adaptation (natural selection that occurs within a population) and acclimation (which occurs in individuals) of the coral by performing reciprocal transplant experiments in the field. We will analyze the response to OA by analyzing growth, physiology, skeletal characteristics and use of gene expression profiling approaches. This area of research is crucial to better understand and predict the potential of corals to survive and adapt to the rapid global climate changes that our planet is facing.

High-CO₂ Seas will use virtual reality to teach the changes in diversity associated with ocean acidification. Virtual reality exhibitions to the public will be performed in different museums and aquariums in France and Italy.

What we do

We were coordinator of the project and as operating unit SZN performed all the field work connected with the characterization of the new vent's sites and control areas off the coast of Ischia, and with transplant experiments. See web site at <http://highco2seas.com>

Partners: Stazione Zoologica Anton Dohrn, Napoli (Villa Dohrn-Benthic Ecology Center, Ischia); Hopkins Marine Station, Stanford University (Ca, USA); University of California at Santa Cruz (Ca, USA); EPHE-CRIOBE University of Perpignan (France), Institute d'Océanographie de Villefranche (France), Istituto Nazionale di Oceanografia e Geofisica Sperimentale (OGS) Trieste; Università di Bologna.

Research Area: Marine biology and ecology

Project Lifetime: December 2016- June 2019

SZN Role: Coordinator

Principal Investigator: Teixido N., Gambi M.C.

People involved: A. Palumbo, M. Munari

Funding Institution: TOTAL Foundation (France) and Marie Curie Global fellowship

Contribution to SZN: €77.500,00 (TOTAL Foundation) + €96.000,00 (Future4Oceans; Marie Curie Global fellowship; salary Teixido N.)

InTenSE

INtelligent operating devices for inTEgrated eNvironmental SERVICES



Summary

The purpose of the "Industrial Research and Experimental Development" project, which is the subject of this proposal, is to carry out activities aimed at the development of advanced integrated systems for the management, monitoring, control and automation of specific operations, mainly but not exclusively in aquatic environments, and in particular:

- Industrial research aimed at the innovation of products suitable for the creation of "smart environments" and support for the innovation of processes linked to production facilities and monitoring and control infrastructures;
- Experimental development of intelligent integrated systems, advanced computer technologies (hardware components (HWs) and software (SW)) and demonstrators of intelligent micro-environments and macro-environments aimed at aquaculture production facilities (indoor and outdoor) and related monitoring and control infrastructures.
- Investigations, studies and analyses aimed at evaluating, improving and demonstrating the potential of these integrated systems for the purpose of scientific research - through the creation of medium and large scale monitoring networks - and aquaculture through the production of intelligent systems of control and implementation appropriate to the automation of standard processes.

What we do

In particular, we are aiming at building a stack of innovative technologies, products and services capable of implementing the Internet of Things and Internet of Everything as an enabling technology for the development of intelligent sensors and actuators whose integration and cooperation enables the creation of intelligent micro-environments and macro-environments, whose integration and cooperation allows for intelligent structures and infrastructures to be used for the purposes of hydrobiological and aquaculture research. It also wants to demonstrate how the Internet of things evolved systems (IOTes) can implement "IT Nodes (IOTes Things) capable of interacting and cooperating on the network as Operators able to perform assignments, even dynamically variable, based on an "Operating Contract or Service Agreement" in relation to "Owned Skills or Published Services" within Production Processes or "Integrated and Distributed Services".

Partners: Stazione Zoologica Anton Dohrn, Napoli; AeT snc. EIDES srl

Research Area: *tecnologie dell'informazione e della comunicazione*

Project Lifetime: January 2018-December 2020

SZN Role: Partner

Principal Investigator: Valerio Zupo

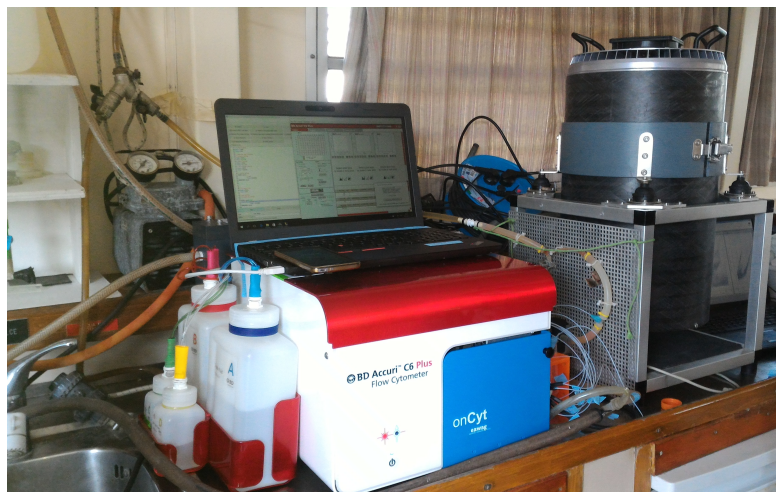
People involved: Sandra Hochsheid, Mirko Mutalipassi (OU PhD), Maria Costantini, Maurizio Lorenti, Vincenzo Rando

Funding Institution: Ministero Sviluppo Economico

Contribution to SZN: € 980.000 (MISE, of which about 480.000 SZN)

IRMA

Implementation and Remote connection of a platform for the real-time Monitoring of MARine microbes



Summary

This project proposes to implement and further develop an automated module to be coupled to a submersible flow cytometer for the counting of marine heterotrophic bacteria.

Detection and quantification of marine bacteria is an essential task to estimate the microbial contribution to biogeochemical cycles, to total carbon and the possible influence of episodic events such as organic matter peaks from accidental discharges or exceptional river outflows. Flow cytometry, based on the analysis of cells flowing in a liquid stream, is a fast, reliable and highly reproducible method of cell detection and counting based upon optical properties such as scatter and fluorescence. It can also be used for the continuous monitoring attached to a buoy and acquiring at high sampling frequency. However, bacteria need a staining step to be analysed and are not included in the commercially available modules.

This project aims at filling this gap by collaborating with the swiss water agency eawag, where a prototype of programmable, automated staining module has been developed and connected to a commercial flow cytometer for the real time assessment of bacterial concentrations. The prototype has now been used for mapping surface bacterial concentrations on board ships and provides a unique system for early warning of environmental risks in coastal areas. Perspectives are to adapt the system to work continuously on floating buoys and to remotely transmit the data onshore.

What we do

We are coordinator of the project and Operating Unit SZN and will perform all manipulations and analyses at sea as well as all data analyses.

Partners: Stazione Zoologica Anton Dohrn, Napoli; INGV Napoli, Mediterranean Institute of Oceanography, Marseille, France.

Research Area: Ecosystem Assessment.

Project Lifetime: January 2015 to June 2017.

SZN Role: Coordinator.

Principal Investigator: Raffaella Casotti.

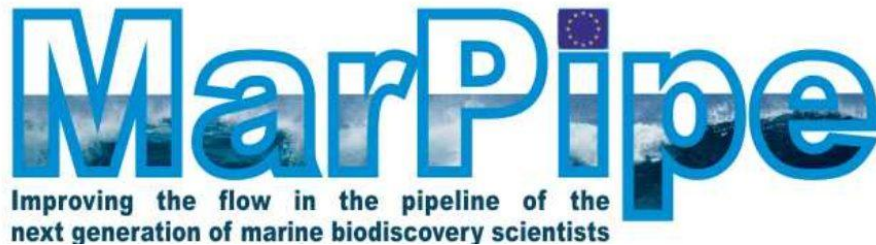
People involved: Cecilia Balestra, postdoc; Thomas Lefort, postdoc; Mark Van Dijk, postdoc.

Funding Institution: MIUR Progetti Premiali (DM 943/2013).

Contribution to SZN: €388.101,00 (MIUR contribution).

MarPipe

Improving the flow in the pipeline of the next generation of marine
biodiscovery scientists



Summary

MarPipe is a consortium of 11 partners (IBP-CNR, SZN, UiT, UNIABDN, GEOMAR, KULeuven, UCC, eCOAST, MEDINA, MicroDish, Italtotec) which will train 11 PhDs in marine drug-discovery, providing these researchers with unique skills toward becoming world leaders in this research field and to advance their careers in academia or industry. Marine organisms have the capacity to produce a variety of biologically potent natural products, including antibiotic and anticancer compounds. MarPipe aims at further development of antimicrobial and anticancer lead compounds originating from a previous EU project (PharmaSea), and will also explore the bioactivity of deep-sea samples (5000 m) collected during the recent Eurofleet-2 project in the sub-Antarctic (PharmaDeep). The PhD students will thus be involved in all phases of the drug discovery pipeline, from isolation of new microbial strains to pre-clinical development of lead compounds.

What we do

SZN has hired the PhD student (Open University) Kevin Martinez working for the MarPipe project. He started his PhD on the 1st July 2017. The topic of his thesis is Drug discovery from marine microalgae and, in particular, on anticancer compounds.

Partners: SZN, BP-CNR, UiT, UNIABDN, GEOMAR, KULeuven, UCC, eCOAST, MEDINA, MicroDish, Italtotec

Research Area: Marine Biotechnology

Project Lifetime: 1st November 2016-31st October 2020

SZN Role: Participant

Principal Investigator: Adrianna Ianora

People involved: Giovanna Romano, Experienced Researcher; Kevin Martinez, PhD Student

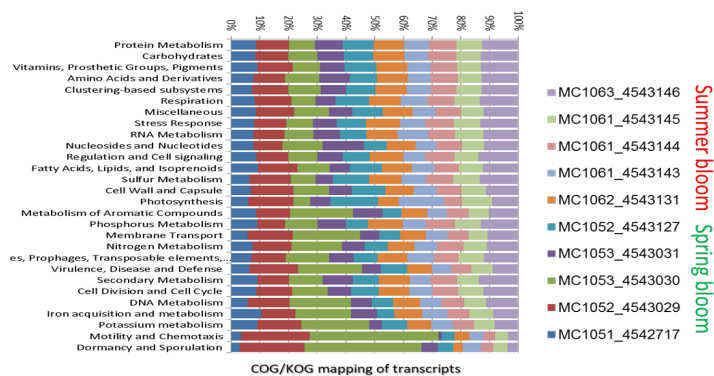
Funding Institution: Marie Curie ITN H2020 (Project ID: 721421)

Contribution to SZN: 258.061,32 €



MetaTRAc

METATRAnsCriptomics of a waxing and waning plankton bloom in the Gulf of Naples



Summary

Rapid development of high throughput sequencing technologies permits assessment of gene expression of natural microbial assemblages. In this project we have conducted a first metatranscriptomic investigation on the composition and functional variations of phytoplankton blooms in the Gulf of Naples in the course of the different phases of their development, addressing the following questions: “What are the species present?”, “What are they doing?” and “How do they change over the bloom?”. To this end, we have gathered an RNA database obtained with *next generation* sequencing techniques from samples collected at the Long Term Ecological Research MareChiara (LTER-MC). In addition, a case study has been developed with the comparative study of the transcriptomes of two *Leptocylindrus* species.

What we do

We have been coordinator of the project and Operating Unit SZN and have performed the sample collection, the RNA extraction and quality check and a first analysis of the meta-transcriptomic data. In addition, we have analysed transcriptomic data for two congeneric diatoms for which we have described the whole flagellar dataset.

Partners: Stazione Zoologica Anton Dohrn, Napoli; European Molecular Biology Laboratory (EMBL) Heidelberg

Research Area: Molecular ecology and diatom transcriptomics

Project Lifetime: 01-01-2013 al 01-12-2014

SZN Role: Coordinator

Principal Investigator: A. Zingone, R. Sanges

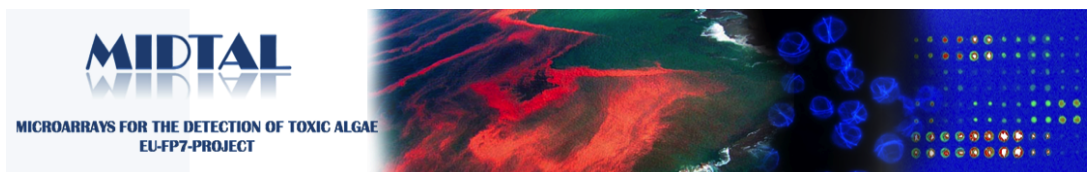
People involved: M.I. Ferrante, D. Nanjappa (post-doc), M. Montresor, W. Kooistra, D. Sarno.

Funding Institution: MIUR Progetti Premiali (DLGS 213/99)

Contribution to SZN: € 168,300 (MIUR contribution)

MIDTAL

Microarrays for the Detection of Toxic ALgae



Summary

Microalgae in marine waters regularly cause «harmful algal blooms», which threaten public health and cause economic damage to fisheries and tourism. Monitoring for these algae is time consuming and morphology in LM may be insufficient to give definitive species and toxin attribution. Molecular methods offer rapid means of both species detection using their rRNA genes as the target. Microarrays were at project start the state of the art technology in molecular biology for the processing of bulk samples for detection of target RNA/DNA sequences. The purpose of MIDTAL was to provide new rapid tools for the identification of toxic algae and their toxins so that monitoring agencies can comply with ECC directive 91/1491/CEE.

What we did

Partners developed an array (phylochip) with 163 probes covering the harmful algal species of EU interest. The array was validated using PCR and microscopy-based cell counts. SZN's role was to test and optimize a series of probes for the detection of European *Pseudo-nitzschia* species (many of which cause amnesic shellfish poisoning; ASP). We enumerated samples from the LTER site MareCiara in the GoN, and maintained cultures of local *Alexandrium* and *Pseudo-nitzschia* for constructing calibration curves and signal standardization in WP2. We processed samples for microarray analysis for WP 3 for field validation.

Partners: 1) Stazione Zoologica Anton Dohrn, Italy, 2) Linne Universitetet, Kalmar, Sweden, 3) Instituto Espanol de Oceanografia, Vigo, Spain, 4) National University of Ireland, Galway, Ireland, 5) Universitet i Oslo, Oslo, Norway, 6) The University of Westminster, London, UK, 7) DHI Forening, Denmark, 8) Instituto Tecnoloxico para o Control Domedio Marino de Galicia – INTECMAR, Vigo, Spain, 9) The University of Rhode Island, USA, 10) Queen's University of Belfast, Belfast, UK

Research Area: Environmental Protection

Project Lifetime: From 2008-09-01 to 2012-05-31, closed project

SZN Role: WP2 coordinator

Principal Investigator: Wiebe H.C.F. Kooistra

People involved:

Experienced Researchers: Montresor M, Zingone A

Experienced Technologists: Biffali E, De Luca P, Sarno D

Technicians: Cannavacciuolo M, Minucci C, Passarelli A, Zazo G

Post doc: Barra L, Ruggiero V

Funding Institution: EU FP7-ENVIRONMENT, Project ID: 201724

Contribution to SZN: € 316 078. (EU) plus €103 050 (SZN co-financing)

MO.DO - Model Organisms



Network of Excellence – MO.DO – MODEL ORGANISM

MODEL ORGANISMS IN BIOMEDICAL RESEARCH

Summary

MO.DO project, an acronym for Model Organisms, is a project funded under the POR Campania (Fondo Europeo Sviluppo Regionale – Programma Operativo Regionale 2007-2013, Campania) and implemented through an agreement Academies belonging to Campania region (Università degli studi di Napoli Federico II, Seconda Università degli studi di Napoli, Università degli studi di Salerno, Università degli Studi del Sannio) Governmental Research Institutes (Stazione Zoologica Anton Dohrn, CNR – Istituto di Genetica e Biofisica, CEINGE, BioGEM scrl) and SMEs (InBios srl, BioUniverSa srl, Aterra Bioscience, MomoLine srl, Unlimited Software srl.). The project was implemented within Health and Biotechnology intervention scheme of the POR.

The project's activities have been aimed at exploring the biological aspects of 'model species' in order to assess their potential for pharmaceutical, biotechnological and environmental industries. Research activities on different organisms allow the identification of the fundamental biological mechanisms governing these species and the discovery of the biological and physiological bases of diseases, as well as the development of new technologies for improving the quality of life and interaction between humans and the environment. The project also provided the ground of developing ad hoc training activities aimed at fostering the higher education and specialization of young generations in fields related with the Project. Dissemination of results was facilitated to link the scientific outcomes with public audience, facilitating extra-regional collaborations, and facilitating the interaction with industrial and companies context to stimulate future investments.

What we did

The activities carried out at the SZN can be summarized as follows:

1. expanding the plethora of "model organisms" with the inclusion of marine organisms belonging to Polychaeta, Echinoidea, Ascidiacea, and Cephalopoda.
2. evaluation of adaptive responses (biological and eco-physiological) to environmental stress in relation to global climate change;
3. extending knowledge on the evolution and development of the digestive tract and its functioning;
4. studying the dynamics that regulate the microbial-immune-intestinal interaction;
5. understanding biological mechanisms underlying thyroid precursor during evolution;
6. development of processes, protocols and procedures to maximize the welfare of species for research purposes following the Directive 2010/63 / EU
7. special training for increasing knowledge and enhancing the ability to conduct advanced research on model organisms.

For all the objectives, the SZN has focused in understanding the SMEs needs to better foster a culture of collaboration between researchers and potential industrial outcomes.

Partners: Università degli studi di Napoli Federico II, Seconda Università degli studi di Napoli, Università degli studi di Salerno, Università degli Studi del Sannio, Stazione Zoologica Anton Dohrn, CNR – Istituto di Genetica e Biofisica, CEINGE, BioGEM scarl, InBios srl, BioUniverSa srl, Aterra Bioscience, MomoLine srl, Unlimited Software srl.

Research Area: Genetics, genomics, bioinformatics and systems biology; Neurosciences and neural disorders; Evolutionary, population and environmental biology; Pharmaceutical and environmental Biotechnology; Biomedical research.

Project Lifetime: November 2011 to November 2014

SZN Role: Coordinator of Training and Dissemination; Partner

Principal Investigator: Graziano Fiorito

SZN Scientists involved: Maria Ina Arnone, Maria Cristina Gambi, Maria Rosaria Pinto, Antonietta Spagnuolo.

People involved: Piero Amodio, Carmen Andrikou, Rossella Annunziata, Claudia Campagnano, Alexia Massa Gallucci, Mariagrazia Lepore, Daniela Melillo, Lenina Natale, Maria Salzano, Ivana Zucchetti.

Funding Institution: Regione Campania (P.O.R. Campania F.S.E 2007/2013)

Contribution to SZN: € 310.197,53

ModRes

New model organisms for the scientific research: culture, ecology, physiology and genomic characterization



Summary

The introduction of new model species may be crucial to permit the comparison of biological processes over a range of organisms, to disclose their evolutionary mechanisms, and to expand our comprehension of biological processes by answering specific questions. Mediterranean marine invertebrates are an excellent source of new model species and, according to the PTA 2015-2017 of Stazione Zoologica, our institute is keen to producing an enriched catalogue of models deriving from the Bay of Naples and able to expand the scientific research towards new ambitious objectives.

We propose to generate a list of candidate organisms and test their performances in various fields of ecological, physiological, genetic, biotechnological research. Each candidate species will be first studied for its biological properties (spatial and bathymetric distribution, life cycle, reproductive processes, sexual behaviour, asexual reproduction, etc.), physiological features (resistance to the culture conditions, ability to be reared in automatized continuous systems, etc.), and ecological peculiarities (seasonal dynamics, relationships with other organisms, role in the food webs, etc.). Some of the species could be characterized by the production of secondary metabolites useful for nutraceutical or medical purposes, or be characterized by specific physiological properties having biotechnological importance.

What we do

The final goal of this study is obtaining a portfolio of model species from the Bay of Naples, all characterized over a complete set of information about their ecological, genetic and physiological properties, in continuous culture conditions, to be used in the next future for a range of scientific investigations. We will start with *Paracentrotus lividus* and *Ciona intestinalis*, typical models used in our institute.

Partners: Echinoidea snc. Private firm in Procida

Research Area: Organismal Biology

Project Lifetime: June 2017 to June 2018

SZN Role: Coordinator

Principal Investigator: Valerio Zupo

People involved: E. Tosti, M. Costantini, F. Patti, M.C. Buia

Funding Institution: MIUR

Contribution to SZN: € 33.000 (MIUR contribution)

MolEcOC

Approaching inter- and intra-individual variability by molecular ecology for the technology transfer of basic research on marine model organisms (*Octopus vulgaris* and *Caretta caretta*).

Summary

Aim of this project was to contribute to the understanding of factors involved in the biological and functional diversity that account for specific adaptations both at the level of single individuals as well as of entire populations. The *leitmotiv* of the project was a common multidisciplinary approach integrating molecular biology, genetics and functional genomics. We studied: i) biological and evolutionary factors underlying functional specialization of the eight arms of the common octopus, *Octopus vulgaris*, and ii) genetic and environmental factors that induce geographic separation of populations of the loggerhead sea turtle, *Caretta caretta*. To achieve our aims, the project was organized into two sub-proposals: 1. the importance of being eight armed, and 2. environmental effect on life history traits in two sympatric populations of marine turtles in the Mediterranean Sea.

What we did

SZN staff, in charge of both the roles of coordination and operational unit of the project, performed all manipulations and analyses in octopuses and sea turtles and all the bioinformatic analyses and evolutionary studies.

Partners: Stazione Zoologica Anton Dohrn, Napoli; European Molecular Biology Laboratory.

Research Area: Genetics, genomics, bioinformatics and systems biology; Neurosciences and neural disorders; Evolutionary, population and environmental biology

Project Lifetime: December 2012 to December 2013

SZN Role: Coordinator

Principal Investigator: Graziano Fiorito, Sandra Hochscheid, Remo Sanges

People involved: Dr Vladimir Benes, EMBL; Raffaella Bova, Research Assistant; Flegra Bentivegna, Technologist Director; Ilaria Zarrella, Research Fellow.

Funding Institution: MIUR Progetti Premiali (DM 506/12)

Contribution to SZN: €286.328,00 (MIUR contribution)

Monitoring of *Ostreopsis ovata* in Campania



Summary

This project is part of the Integrated Regional Plans of the Health Department of the Regione Campania (2011-2014 and 2015-2019) and aims at protecting human health from risks posed by blooms of the toxic benthic dinoflagellate *Ostreopsis cf. ovata*. The species is widespread along the Campania coasts in summer. Upon an alert launched by Stazione Zoologica, in summer 2007 a group of expert was set up to advice on the risks posed by the toxic blooms and to formulate and carry out a monitoring plan with related actions. SZN participates in the implementation of the plan with a prominent role of transferring knowledge to make the monitoring plan more efficient and to interpret the data obtained from the monitoring.

What we do

We were responsible for the improvement of the knowledge on spatial and temporal distribution of the microalga and of the transfer risks along the trophic network through experiments on animals capable of accumulating toxin. With this aim, we have carried out 8 sampling campaigns in summer from 2007 to 2015, and targeted laboratory studies on animals feeding on the toxic microalga. Since 2015, the plan has been reduced.

Partners: Stazione Zoologica Anton Dohrn, Napoli; Istituto Zooprofilattico per il Mezzogiorno, Dipartimento di Farmacia-Università Federico II e ARPA Campania agency.

Research Area: Microphytobenthos Ecology

Project Lifetime: August 2007 to December 2019

SZN Role: Coordinator OU SZN

Principal Investigator: Adriana Zingone

People involved: V. Saggiomo, M.C. Buia, A. Palumbo, D. Di Cioccio (during his PhD), L. Escalera (postdoc)

Funding Institution: Regione Campania, Health Department

Contribution to SZN: € 525,000 (Regione Campania contribution).

Monitoring of *Posidonia oceanica* meadows



Summary

This project was funded by Regione Campania (POR Campania FSE 2007-2013/POR Campania FSE 2014-2020). It aimed at assessing in the phlegrean area the anthropic pressures and the ecological status of seagrass meadow, one of the most relevant systems in marine coastal waters. In this area, *Posidonia oceanica*, considered as a Biological Quality Element in the WFD 2000/60/EC and as a habitat to be monitored and protected in the MS 2008/56/EC, is monitored since the end of 1960's. and in particular the meadow off Lacco Ameno (LTER_LA) is part of the network LTER-Italy and Europe.

What we do

We quantitatively assessed coastal anthropic pressures, spatial distribution and current health status of *Posidonia oceanica* and *Cymodocea nodosa* meadows around the island of Ischia. With this aim, we have carried out a sampling campaign in summer 2016 by diving and ROV monitoring. The occurrence of the target invasive species *Caulerpa cylindracea* has been also recorded.

Research Area: Benthic Ecology

Project Lifetime: December 2015 to November 2016

Principal Investigator: Maria Cristina Buia

People involved: M.C. Buia, L. Porzio (postdoc), Bruno Iacono and Vincenzo Rando

Funding Institution: Regione Campania

Contribution to SZN: € 23,000 (Regione Campania contribution).

MouZeCLINIC

Empowering an integrated platform for the study of human diseases with great impact by means of system phenotyping of model animals: mouse and zebrafish clinic (MouZeCLINIC)



investiamo nel vostro futuro

Summary

MouZeCLINIC is an infrastructural and training network in biomedicine by means of aquatic and terrestrial model organisms. Through the use of advanced methods of genetic analysis and imaging technologies, MouZeCLINIC aims at performing system phenotyping in zebrafish and mouse models of human diseases. MouZeCLINIC is training a new generation of young researchers by combining the strengths of modern technologies with a real understanding of traditional approaches. The MouZeCLINIC consortium involves two research centers and one academic institution that will provide the MouZeCLINIC fellows with expertise, specialized equipment and training on a wide range of approaches and methodologies incorporated in developmental genetics and translational medicine.

What we do

We are one of the three partners and are contributing by training students, by developing a zebrafish infrastructure and by studying fish models of neuroinflammation, toxicity and metabolism.

Partners: BioGem scarl – Ariano Irpino (Avellino) - IT; Stazione Zoologica Anton Dohrn, Napoli – IT; Università della Magna Graecia – Germaneto (Catanzaro) - IT

Research Area: Organismal Biology

Project Lifetime: January 2012 to July 2015

SZN Role: Partner

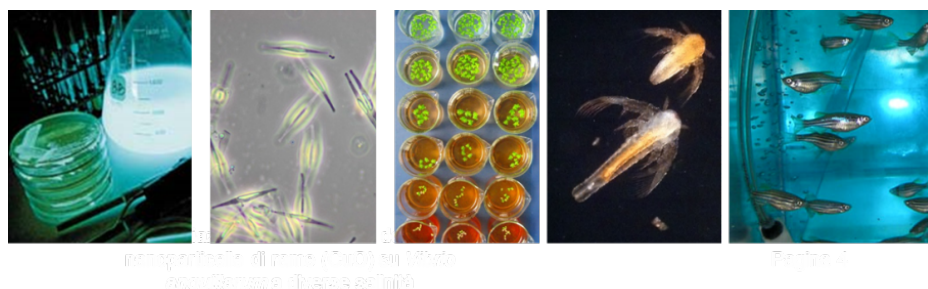
Principal Investigator: Paolo Sordino

Funding Institution: Ministero dell'Istruzione dell'Università e della Ricerca (MIUR): Programma Operativo Nazionale "Ricerca e Competitività" 2007-2013. Grant no. PONa3_00239

Contribution to SZN: Infrastructure € 1.273.424,00 (MIUR contribution). Training € 733.670,00 (MIUR contribution).

NanoBioTech Ambient Project:

development and optimization of ecotoxicological protocols for nanosized materials



Summary

The objective of the NanoBioTech Ambient Project is the development and optimization of protocols to evaluate the ecotoxicity of nanomaterials (NMs, size < 100 nm), with particular attention to marine environment. In fact, the increasing development of nanotechnologies leads to potential release of these emerging contaminants into the environment and their effects are still little studied. Specifically, the research involves the development and/or the adaptation of classic tests on different trophic levels, able to overcome the critical features of "nanotoxicology". Indeed, the intrinsic properties of NMs, whose physical and chemical dynamics are not comparable to those of their micrometric counterparts, make difficult to apply the standard ecotoxicological methods.

This project is born by collaboration between several partners, within the network represented by the Hypatia Research Consortium, which works to create relationships between companies and research organizations.

What we do

The University of Tor Vergata is coordinator of the project NanoBioTech Ambient and collaborates with the Institute for Environmental Protection and Research (ISPRA), the Stazione Zoologica Anton Dohrn (SZN) and the National Research Centre (CNR) for following actions:

- (i) identification/retrieval of metallic NMs of environmental interest;
- (ii) identification/application of analytical methods to evaluate NM behavior, at low concentrations, in complex matrices as seawater;
- (iii) development/application of protocols to assess NM potential toxic effects on different levels of the trophic web and if NM toxicity is salinity-dependent;
- (iv) application of microscopy to observe NM disposition in biological cells/tissues/organisms and possible biological damage.

Research Area: Multidisciplinary Science

Project Lifetime: September 2015 to September 2017

SZN People involved: Elisabetta Tosti (Senior Researcher), Giovanna Benvenuto (Technologist), Alessandra Gallo (Post doc), Franco Iamunno (Technician), Loredana Manfra (Associate Researcher).

Funding Institution: Regione Lazio-Consortio Hypatia (75000 Euros).

NEMO

NExT generation Marine Observatories: Per un approccio integrato allo studio della risposta degli ecosistemi marini alle forzanti antropogeniche e climatiche

Summary

The advancement of knowledge and the development of tools for forecasting and mitigating the effects of global changes on marine ecosystems is a strategic priority for both research organizations and institutions (see European Union Marine Strategy Framework Directive 2008/56) and is a central theme in Horizon 2020. This project aims to fill important gaps in the response of marine communities to anthropic and climatic forcing and to define new and more appropriate conceptual models of biotic interactions needed for more accurate ecological modeling.

The achievement of these objectives will be made possible by a considerable enhancement of the biological component within the Italian Observatory Systems using integrated and complementary approaches based on the analysis of the space-time dynamics of the trophic networks with particular reference to the planktonic component. In this context, a highly multidisciplinary, end-to-end approach will be used, ranging from the study of cellular and molecular metabolic processes, both through specific experiments and by field investigations, the analysis of biological data detected by technologically instrumentation advanced, up to a system modeling that integrates the different types of information. Its feasibility is demonstrated by the experience of Tara Oceans where some of the proponents have contributed significantly and whose ample genomic database will be accessible to the participants.

The result of these highly innovative activities will help to improve the understanding of the biological and ecological responses of marine ecosystems to the anthropic effects as well as to form a new generation of researchers strongly prepared for multidisciplinary work. The great amount of information generated in this project can also have important applicative effects in biotechnology and sensor technology.

What we do

We will do a first year pilot project during which we will use a end-to-end, genomic-enabled protocol to sample the planktonic ecosystem in the Gulf of Naples, building upon the MC-LTER experience. In parallel, we will perform laboratory studies on the plankton functional diversity and develop a eco-bio-geochemical model of the trophic web. Finally, to further integrate all the activities, we will a database that will include the full Tara Oceans holistic database and that will be progressively incremented by the inclusion of new data form the laboratories and from the in situ sampling. The Project has set the basis for the establishment of the G7 working group on Augmented observatories.

Partners: OGS and several international partners

Research Area: Plankton ecology, oceanography

Project Lifetime: January 2016 -

SZN Role: Co-PI with OGS

Principal Investigator: Daniele Iudicone (SZN) and Giuseppe Civitarese (OGS)

People involved: Several researchers from IME, BEOM and RIMAR.

Funding Institution: MIUR

Contribution to SZN: € 610000

Neptune

Multidisciplinary training in evo-devo and neurobiology of marine animal models



Summary

Neptune was a multidisciplinary training network in evo-devo and neurobiology of marine animal models. Through the use of advanced methods of genetic analysis and imaging technologies, Neptune aimed at solving an array of important questions in the evolution, development, neurobiology and ecology of marine invertebrates. Neptune trained a new generation of young researchers by combining the strengths of modern technologies with a real understanding of traditional approaches. The Neptune consortium involved seven academic institutions and one industrial partner that provided Neptune fellows with expertise, specialized equipment and training on a wide range of approaches and methodologies incorporated in evolutionary developmental biology and marine neurobiology.

What we did

We were one of the seven partners and are contributed to the WP "Evolution of sensory systems" by studying photoreceptor evolution in echinoderms and hemichordates (Ambulacraria).

Partners: European Molecular Biology Laboratory, Heidelberg - DE; Stazione Zoologica Anton Dohrn, Napoli – IT; Uppsala University, Uppsala – SE; Max Plank Institute for Developmental Biology, Tübingen – DE; University College London, London – UK; Sars International Center for Marine Molecular Biology, Bergen – NO; Centre National de la Recherche Scientifique, Villefranches sur mer, Lion - FR; Associate industrial partner: ZEISS.

Research Area: Organismal Biology

Project Lifetime: March 2013 to February 2017

SZN Role: Partner

Principal Investigator: Maria I. Arnone

People involved: Alberto Valero-Gracia, PhD student; Monika Mielnicka, ESR

Funding Institution: European Commission, FP7 Call for Proposal: FP7-PEOPLE-2012-ITN. Marie Curie Action - Initial Training Network (ITN). Grant no. 317172

Contribution to SZN: €302.697,45 (EU contribution)



Non-Coding RNA Explosion: Novel Implications in Neurotrophin Biology

Summary

The main focus of the project is the identification of non-coding RNAs (ncRNA) that regulate the expression of Neurotrophins (NT) and NT receptors (NTR). ncRNAs are a novel class of regulatory molecules that have been shown to be involved in almost all biological phenomena, including development and physiology of the nervous system.

Neurotrophins (NT) (BDNF, NGF and NT *sensu stricto*) are growth factors that control development, differentiation, synaptic plasticity and survival of several types of neuronal and glial cells in the embryonic and adult central nervous system and sensory organs. Based on the NT role in development and physiology of the nervous system, the present project aims at extending our knowledge on NTs molecular pathways, with emphasis on their relationships with stress, aging and diseases in evolutionary and comparative perspective.

The project will take advantage of as bioinformatic, molecular, genetic, biochemical and behavioural multidisciplinary approaches, with the aim to acquire new insights on the genetic regulatory networks and on the functions exerted by NT and NT receptors during the correct development and in conditions of thermal, social and nutritional stress. A distinctive feature of this research proposal is the use of three different model systems: cells, mouse and zebrafish.

In summary, the main purpose of the present project is to study the molecular, cellular and behavioural phenotype of NTs and NTRs, with emphasis on the relationships of these molecules with stress, ncRNAs and neurodegenerative diseases (NDs).

We generated a knock-out line in zebrafish through the CRISPR/Cas9 technology for BDNF, one of the most known neurotrophin together NGF, in zebrafish using the CRISPR/Cas9 thecnology to improve our understanding of the role played by NTs during embryonic development and adult brain physiology, with particular attention to the biomedical impact in terms of diagnosis and treatment of neurodegenerative diseases.

What we do

We built a national network, in which the Stazione Zoologica Anton Dohrn of Napoli is the leader Institute, with the aim to merge multidisciplinary approaches and competences to reveal the importance of NT during vertebrate's brain development.

Partners: Stazione Zoologica Anton Dohrn, Napoli (Unit 1); Dipartimento di Biologia e Biotecnologie "Charles Darwin", Università di Roma Sapienza (Unit 2); Dipartimento di Scienze Biologiche, Università di Napoli Federico II (Unit 3); Laboratorio di Bioinformatica, Università del Sannio (Unit 4).

Research Area: Organismal Biology

Project Lifetime: March 2013 to March 2019

SZN role: Coordinator

Principal Investigator: Salvatore D'Aniello

People involved: Ylenia D'Agostino, PhD/post-doc; Annamaria Locascio, Researcher; Filomena Ristoratore, Researcher; Paolo Sordino, Researcher; Antonietta Spagnuolo, Researcher.

Funding Institution: Futuro In Ricerca (FIRB) of Ministero dell'Istruzione, dell'Università e della Ricerca (MIUR). Grant no. RBFR12QW4I.

Contribution to SZN: € 369.443 (MIUR contribution)

Ocean Medicines



Summary

Ocean Medicines is a network of academic, research centres and SMEs across Europe, with proven experience in higher education, training and endowed with state-of-the art scientific and technical expertise and infrastructures. The aim is to establish a network of collaboration and knowledge-exchange between industrial and academic partners to further develop lead compounds from marine microorganisms having anticancer or anti-infective effects that have already been identified by the consortium. To achieve this goal a mobility programme will be set up to prepare a new generation of marine biodiscovery scientists that will be trained on how to isolate compounds from bioactive bacteria/microalgae and take these through to semi-industrial scale-up for further development and toxicity testing at the pre-clinical level. The Ocean Medicines programme also considers commercialization, innovation and entrepreneurship activities including how to start a new business and how to favor an industrial career to seconded researchers. The establishment of this international research network, with its synergistic effects, will significantly contribute to advance all of the involved Institutes/SMEs to the top level in the field of marine drug discovery.

What we do

SZN is involved in WP2 which targets species of bacteria and microalgae that produce bioactive metabolites with anticancer/anti-infective activities; these species will be bulk cultivated under different light/temperature/pH conditions to optimize production of active metabolites. Extracts and fractions will be further screened and chemically analyzed by the other partners.

Partners: Stazione Zoologica Anton Dohrn (Szn), Italy, The University Court Of The University Of Aberdeen (Uniabdn), United Kingdom, Universitetet I Tromsø (Uit), Norway, Fundacion Centro De Excelencia En Investigacion De Medicamentos Innovadores En Andalucia (Medina), Spain, Ecoast, Belgium, Epi-C Srl, Italy, And Sea4us Biotecnologia E Recursos Marinhos Lda, Portugal.

Research Area: Marine biotechnology

Project Lifetime: December 2015 - December 2019

SZN Role: Participant

Principal Investigator: Adrianna Ianora

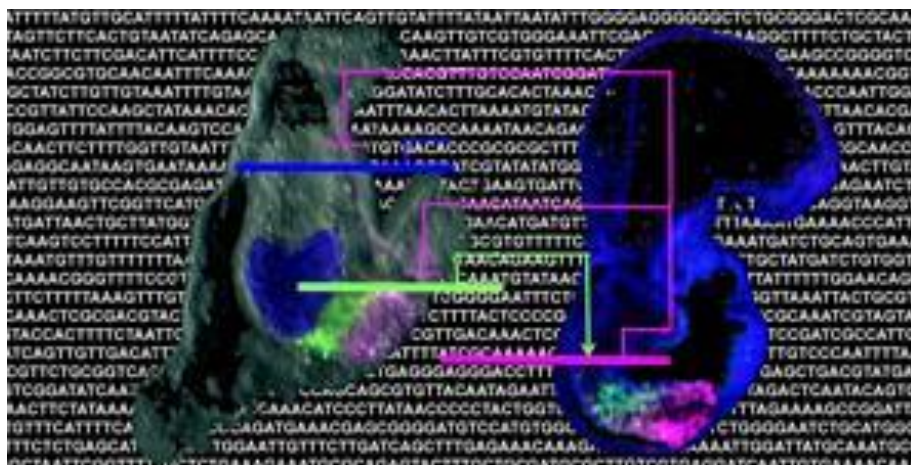
People involved: Giovanna Romano, Experienced Researcher; Chiara Lauritano, Researcher; Clementina Sansone, Researcher; Valeria Di Dato, Postdoc

Funding Institution: European Commission, under the 7th Framework Programme (Project ID: 690944); http://cordis.europa.eu/project/rcn/198834_en.html.

Contribution to SZN: 49.500 €

Pantrac

Gut patterning and PANcreas development in evolution and disease: a TRAnsCriptomic approach



Summary

Many genes that have been shown to cause diseases were originally identified because of their role in embryonic development, but were subsequently shown to be also important in the postnatal control of cell growth and differentiation. This is the case of many transcription factors (TF) among which the ParaHox gene *Xlox*, whose mammalian homolog, *Pdx1*, is well known for its role in specification of the pancreas, and subsequent formation and maintenance of pancreatic beta-cells. *Pdx1* is a causal factor in the development of diabetes, wherein there is a deficiency in insulin production of beta-cells within the pancreas. Moreover, mis-expression of *Pdx1* is commonly seen in intestinal disorders such as Crohn's disease. Here we propose to combine analyses in the highly simple but phylogenetically relevant sea urchin embryo and sea star embryo models with developmentally targeted mouse transcriptome data to characterize regulatory connections that are downstream of the disease-related *Xlox/Pdx1* transcription factor.

What we do

We are coordinator of the project and Operating unit SZN and will perform all manipulations and analyses in sea urchin and sea star embryos and all bioinformatic analyses and evolutionary comparisons.

Partners: Stazione Zoologica Anton Dohrn, Napoli; Laboratorio di Medicina Molecolare e Genomica, Università degli Studi di Salerno.

Research Area: Organismal Biology

Project Lifetime: April 2014 to December 2015

SZN Role: Coordinator

Principal Investigator: Maria I. Arnone

People involved: Rossella Annunziata, postdoc; Claudia Cuomo, PhD student; Elijah Lowe, postdoc

Funding Institution: MIUR Progetti Premiali (DLGS 213/99)

Contribution to SZN: €169.143,00 (MIUR contribution)

PERSEUS

Pressures and impacts in the Gulf of Naples



Summary

This project was part of the 7th FW EU Project PERSEUS (Policy-oriented marine Environmental Research for the Southern European Seas) (2012-2015) aimed at identifying the interacting patterns of natural and human-derived pressures on the Mediterranean and Black Seas, assess their impact on marine ecosystems and, using the objectives and principles of the Marine Strategy Framework Directive as a vehicle, to design an effective and innovative research governance framework based on sound scientific knowledge. The Gulf of Naples was one of the sites selected for the analysis.

What we do

Natural and human-derived pressures were identified in the Gulf of Naples and nearby coastal areas. together with the assessment of their impact on the marine environment. Historical maps of peculiar habitat types (seagrass meadows) were compiled in order to detect a link between their trend and human activity. Data gaps and future research needs to underpin the MSFD implementation were identified for this area.

Partners: 54 from Europe and neighboring countries among which HCMR, CNRS, IFREMER, CSIC, CoNISMa, UPMC, CNR, ENEA, PML, IOLR.

Research Area: Marine Ecology.

Project Lifetime: December 2012 - December 2015.

Principal Investigator: Maurizio Ribera d'Alcalà.

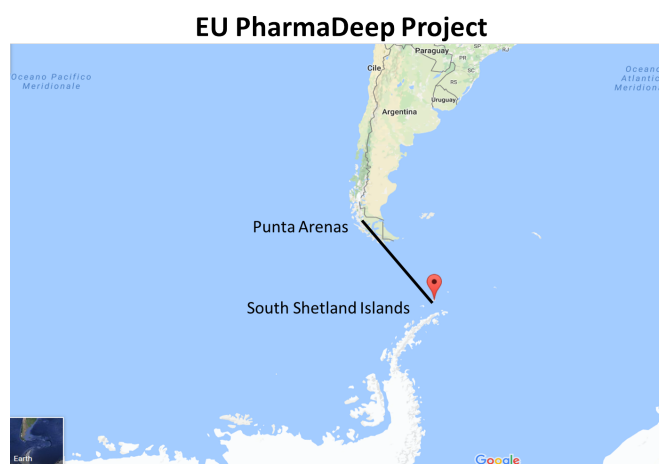
People involved: M.C. Buia, R. Casotti, V. Tornero (Postdoc).

Funding Institution: EU.

Contribution to SZN: € 90.000.

PHARMADEEP

PharmaDEEP: New pharmaceuticals from the deep Antarctic



Summary

PharmaDEEP encompasses multi disciplines, mainly bioprospecting for biotechnology and pharmaceutical applications, with the added value of conventional deep-sea biology and ecology, as well as an astrobiology component. PharmaDeep aimed to collect marine organisms from deep-and-cold-water habitats at the South Shetland Trough (SST), near the Antarctic Peninsula, one of the few cryogenic deep-sea trenches in the world. The PharmaDEEP cruise to the SST on the Spanish BIO Hesperides aimed to sample 5 stations from 2000 to 5200m using a multitude of sampling equipment to primarily sample from deep-and-cold-water habitats in search of unique sources of natural products for the treatment of cancer and infectious diseases, and provide other biological, geological survey and mapping work. The presence of hard substrates and dropstones within this glaciated area did not allow to get samples at each station.

What we do

We were one of the partners, the only one responsible for phytoplankton and zooplankton sampling. We are using the samples for bioactivity screening and gene mining.

Partners: Stazione Zoologica Anton Dohrn, Napoli; IBP-CNR, University of Aberdeen, Universitat de Barcelona, Instituto Español de Oceanografía, BioBridge, University of Chile, Nicolaus Copernicus University, Edinburgh University

Research Area: Marine biotechnology

Project Lifetime: The cruise embarked Punta Arenas (Chile) on the 13th of December and returned to Ushuaia (Argentina) on the 30th of December. The scientific sampling days allocated to PharmaDEEP were 20th-26th of December.

SZN Role: Participant

Principal Investigator: Adrianna Ianora

People involved: Chiara Lauritano, Postdoc; Christian Galasso, PhD student

Funding Institution: European Commission, under the EU EUROFLEETS2 program grant agreement n° 312762.

Contribution to SZN: Reimbursement of travel and cruise expenses

PHARMASEA

Increasing Value and Flow in the Marine Biodiscovery Pipeline



Summary

The EU-FP7 PharmaSea project (<http://www.pharma-sea.eu/>), ended in March 2017, aimed to produce new products for development in three market sectors, health (infection, inflammation, neurodegenerative diseases), personal care and nutrition. Within the project a wide variety of marine microorganisms (mainly bacteria and microalgae) were analyzed, including collections held by some partners and new collections of strains collected in extreme environmental conditions (deep, hot and cold). Overall the Pharmasea project cultivated more than 13,000 microbial strains, dereplicated more than 15,000 extracts, biologically screened more than 130,000 samples and identified about 700 validated bioactive extracts. 90 structural chemical families were identified, of which 17 have new structural features and 5 compound families have novel skeletons. PharmaSea delivered 5 drug lead compounds that have already entered early stage animal studies (for central nervous system diseases).

What we do

SZN cultivated and screened 70 species in 3 culturing conditions for anti-inflammatory and antimicrobial activities and for neurodegenerative diseases. Various species showed activity and chemical partners identified/will identify the compounds responsible for these activities (Lauritano et al., 2016 *Frontiers in Marine Science*, others submitted or in prep). Molecular techniques are also being used to study the transcriptomes of microalgal strains that showed biological activity (Lauritano et al., 2017 *Scientific Reports*). Lauritano et al. (2016) showed that three diatom species, i.e. *Cylindrotheca closterium*, *Odontella mobiliensis* and *Pseudonitzschia pseudodelicatissima*, displayed specific anti-inflammatory activity, the diatom *Skeletonema marinoi* showed anticancer (blocking human melanoma cell proliferation) activity while the diatoms *Leptocylindrus aporus* and *Leptocylindrus danicus* exhibited anti-biofilm activity (against the bacteria *Staphylococcus epidermidis*). The chemical nature of these bioactive compounds is currently under investigation.

Partners: Stazione Zoologica Anton Dohrn, Napoli; SZN, Katholieke Universiteit Leuven, The University Court of the University of Aberdeen, MarBio, eCoast, Biodridge, MEDINA, University college Cork, BIOCUM, CNR, Universidade de Santiago de Compostela, The Royal society of chemistry, C-LECTA GMBH, Denmark's Tekniske Universitet, DEEPTTEK, Advanced chemistry development UK, Wuhan University, Institute of Microbiology Chinese Academy of Sciences, University of the Western Cape, Instituto de Dinamica Celular y Biotecnologia, Asociacion Instituto Nacional de Biodiversidad, Union Internationale pour la conservation de la nature et de ses ressources, University of Waikato, SeaLifePharma.

Research Area: Marine biotechnology

Project Lifetime: October 2012 - March 2017

SZN Role: Participant

Principal Investigator: Adrianna Ianora

People involved: Giovanna Romano, Experienced Researcher; Francesco Esposito, Technologist; Chiara Lauritano, Post-doc; Valeria Di Dato, Post-doc

Funding Institution: European Commission, under the 7th Framework Programme (FP7/2007-2013 under grant agreement n° 312184)

Contribution to SZN: 413.022,4 €

Antigens and Adjuvants for Vaccines and Immunotherapy



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Summary

The therapeutic benefits of a stimulation of the innate immune system are well documented. Many substances of natural origin, including some lipidic or glycolipidic molecules are able to stimulate various cellular components of the innate immune system. Therefore, metabolites of low molecular weight or lipid components of extracts of marine eukaryotic microorganisms may have activating properties of the innate immune cells and act as adjuvants or immune-modulators. The innovative approach proposed in this project is based on a public-private partnership and belongs mainly to Areas of Convergence (Sicily, Calabria and Campania).

The project aims to achieve three important goals: 1. The development of innovative vaccines for bacterial and viral infections 2. The development of new molecules with adjuvant action and the study of the mechanism of action of those already known 3. The development of more effective and safe new viral vectors for the development of new vaccines. The role of the Zoological Station in the project is to identify and cultivate species of marine microalgae that show potential antigen and adjuvant activities.

What we did

The Zoological Station participated in the activity 2.1: "Identification of novel natural compounds with immune-modulatory and adjuvant activity from marine microalgae" and in particular in the RI 2.1.1.: Preparation of extracts and fractions from microalgae, isolation and identification of substances with immune-regulatory properties.

Extracts of marine organisms have already been shown to contain immune-regulatory substances (eg alpha galactosidiceramide that can stimulate NKT cells) and lipids other than those present in humans. This project aims not only to identify new molecules able to interact with the immune system, but also to identify compounds for therapeutic formulations, for example compounds as adjuvants for vaccines. To this end, the group of dr. Ianora prepared pellets of microalgae for the isolation and identification of substances with potentially immune-regulatory activity. The fractions have been assayed by industrial partners (Novartis) for their ability to activate various cells and receptors of the innate immune system. The study was performed in collaboration with IBB-CNR (SZN sub-contractor) who characterized some of active components through the use of NMR techniques.

Leading partner: Novartis Vaccines & Diagnostics srl

Partners: PrimmSrl; BIOGEM s.c.a.r.l.; Okairos; CNR, Dipartimento Scienze della Vita; Stazione Zoologica Anton Dohrn; Università degli Studi di Messina CEINGE Biotecnologie avanzate s.c.a.r.l.; Italsistemi S.r.l.; Altergon Italia; Seconda Università degli Studi di Napoli; Università degli Studi di Napoli Federico II.

Research Area: Health and wellbeing; Biotechnology; Drug Discovery

Project Lifetime: 01/07/2011- 31/05/2015

SZN role: Partner

Principal Investigator: Adrianna Ianora

People involved: Giovanna Romano, Experienced Researcher; Francesco Esposito, Technologist; Valeria Di Dato, Post-doc; Flora Palumbo, Technician; Massimo Perna, Technician; Mariano Amoroso, Technician

Funding Institutions: MIUR - Programma Operativo Nazionale (PON) Ricerca e Competitività 2007-2013.

Contribution to SZN: 944.350,00 €

PON01_02782

New nanotechnological strategies for the development of drugs and diagnostic tools directed to circulating cancer cells (CTC)



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Summary

The presence of circulating tumor cells (CTC) in the blood is associated with an advanced stage of the disease and reduce survival of cancer patients. Knowledge of the characteristics of the CTC is therefore of fundamental importance for many applications of clinical interest. This project aimed at isolating CTC from the blood of patients suffering from epithelial and haematological tumors, to develop protocols for the ex-vivo expansion of these cells and to perform a complete molecular characterization in order to clearly define the mutational and transcriptional profiles. This project also aimed to develop diagnostic kits as well as to identify new molecular targets that may be the target of innovative therapeutic tools for the treatment of these tumors. The project included a phase aiming at identifying molecules with anti-tumor activity against CTC, by screening libraries of compounds, substances and natural peptides including natural products extracted from innovative sources such as marine microalgae.

What we did

SZN has been involved in the following activities:

Activity 6.2 Identification of molecules of natural and / or synthetic origin with possible biological activity on CTC cells.

The main objective of this activity was to provide extracts and fractions from marine cultivable microalgae with anti-tumor properties, and to isolate and characterize these compounds through a screening system based on biological assays of the fractions obtained from crude extracts. Finally, to optimize the production of bioactive compounds of interest through cultivation on a large scale of the producer microorganism(s).

Leading partner: BiogemS.c.ar.l.

Partners: CEINGE; CalMEDSrl; ITALSISTEMI S.r.l.; Areta International S.r.l.; Fondazione Istituto Italiano di Tecnologia, fondazione di diritto privato; Consiglio Nazionale delle Ricerche (CNR); Università degli Studi Magna Graecia di Catanzaro; Stazione Zoologica "A. Dohrn"; Università degli Studi di Milano – Bicocca; I.S.O. Istituto Superiore di Oncologia – Consorzio riconosciuto; Università degli Studi di Napoli "Federico II"

Research Area: Biotechnology; Drug Discovery

Project Lifetime: 01/09/2011- 31/10/2015

SZN role: Partner

Principal Investigator: Adrianna Ianora

People involved: Antonio Miralto, Experienced Consultant (Specialist); Giovanna Romano, Experienced Researcher; Francesco Esposito, Technologist; Raffaella Ummarino, Post-doc; Flora Palumbo, Technician; Massimo Perna, Technician

Funding Institutions: MIUR - Programma Operativo Nazionale (PON) Ricerca e Competitività 2007-2013.

Contribution to SZN: 595.000,00 €

PON01_02093

Study of new technologies and technological platforms for the improvement of production processes of active pharmaceutical ingredients of industrial interest and search for new bioactive molecules from natural sources



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Summary

The overall objective of the project was the study and application of advanced and innovative technologies for the improvement of productive processes of pharmaceutical industry and the search for new molecules with potential pharmacological activity in the anti-infective, anti-cancer and anti-inflammatory field.

The first research line of the project studied the most innovative aspects of technologies of microbiology and genetics of producer strains.

The second research line studied the possibility to identify new products as candidates of potential pharmaceutical interest in the fields of anti-infectives and more generally in cancer and chronic-degenerative diseases connected with ageing, with particular attention to inflammation role. These activities were focused on the search for new substances of pharmacological interest by screening extracts from microorganisms and / or other aquatic organisms and on the characterization of their beneficial and anti-infection properties.

The project aimed at allowing the maintenance of a high scientific and technological concentration of great innovative potential characterized by an organic collaboration between industrial and academic researchers.

What we did

The Zoological Station has been involved in the OR 2.4 – Screening and characterization of extracts from marine organisms. The purpose of this Objective was the identification of new active principles with antimicrobial and / or antitumor and / or protective activity against neurodegeneration and / or aging. To achieve this goal, the Zoological Station focused mainly on the following activities:

- Identification of microalgae species and clones to extract active molecules on the basis of their ecological activity highlighted by previous studies carried out by the group of Dr. Adrianna Ianora. Growth of selected microalgae in 10 liters-carboys and in photobioreactors; collection of microalgal biomass in order to obtain a sufficient amount for the extraction of small molecules.
- Extraction and fractionation of the pellets obtained from species of microalgae grown to SZN, in collaboration with the chemical partner (Institute of Biomolecular Chemistry, ICB-CNR). The active fractions identified by the partners in the project have been processed for the chemical identification by the ICB.

Leading partner: Sanofi-Aventis S.p.A. (Brindisi and Milano);

Partners: Università degli Studi di Bari; Università del Salento; Seconda Università degli Studi di Napoli; Stazione Zoologica "Anton Dohrn", Napoli; Università degli Studi di Salerno.

Research Area: Biotechnology; Drug discovery

SZN role: Partner

Principal Investigator: Adrianna Ianora

People involved: Giovanna Romano, Experienced Researcher; Francesco Esposito, Technologist; Ylenia Carotenuto, Researcher; Clementina Sansone, Researcher TD; Flora Palumbo, Technician; Massimo Perna, Technician; Mario Di Pinto, Technician

Project Lifetime: 01/01/2011- 31/12/2014

Funding Institutions: Programma Operativo Nazionale (PON) Ricerca e Competitività 2007-2013.

Contribution to SZN: 786.250,00

P-ROSE

PLANKTON BIODIVERSITY AND FUNCTIONING OF THE ROSS SEA ECOSYSTEMS IN A CHANGING SOUTHERN OCEAN



Summary

Global temperatures have risen by > 1 °C in the last decades, and more than 75% of the heat excess has been stored in the Southern Ocean (SO). The Ross Sea (RS), characterized by a large ice shelf and a large sea-ice marginal zone, is an important site for deep-water formation and thus, has a large impact on global ocean circulation and climate. Moreover, the RS is one of the most productive areas of the SO and includes a mosaic of functionally different marine subsystems. These characteristics make the RS an ideal zone for investigating the potential effects of climate change on the biological and ecological features of the SO.

Some changes in the physical-chemical characteristics in the RS have already been documented, but, to date, current variations affecting the pelagic food web are mostly unknown. Additionally, the huge amount of information collected during the ROSSMIZE and CLIMA Projects provides a valuable basis for the assessment of major changes that have occurred during the last 20 years in the Ross Sea pelagic food web.

What we do

The activity of the SZN Research unit is aimed at investigating the composition of the phytoplankton assemblages as related to nutrient dynamics.

More in details, we are:

- 1) investigating the dynamics of inorganic nutrients as related to water column stability;
- 2) investigating the N and P inventories, partition and stoichiometry among the different pools (dissolved inorganic, dissolved organic and particulate);
- 3) determining and quantifying the specific composition of the microalgal communities using both traditional and biomolecular methods (light and electronic microscopy, DNA) in different realms and on different spatial and temporal scales;
- 4) isolating strains of the most common eukaryotic species in the phytoplankton. The obtained cultures will be characterized morphologically (LM, SEM), their DNA will be extracted to obtain reference barcodes, their RNA to provide reference transcriptomes.
- 5) analyzing the floristic spectra of the material collected in sediment traps and in faecal pellets of target herbivorous organisms.

Besides the activity in Antarctica, we will be involved in lab experiments on Vit B12 depletion, that will be carried out in Italy on the Antarctic isolated strains. Aims of these experiments are to: i) sequence the transcriptome of the species that will be isolated, ii) identify biochemical pathways, eventually activated or down-regulated, in the experimental condition. The transcriptomes will be analyzed in a bioinformatics way with subsequent experimental validation of the obtained results.

Partners: Università di Messina; Università Politecnica delle Marche (UNIPM); Università di Napoli Federico II (UNINA); Università degli Studi di Genova (UNIGE); Università degli Studi di Napoli 'Parthenope'; CNR IAMC - Istituto per l'Ambiente Marino Costiero

Principal Investigator: Maria Saggiomo

Project Life time: 2016 – 2019

People involved: Francesca Margiotta; Augusto Passarelli; Gianluca Zazo; Francesco Bolinesi; Laura Escalera; Milva Pepi

Funding Institutions: Progetto Nazionale di Ricerca in Antartide (PNRA)

RECCAM

Seagrass Meadows resilience to global warming: an analysis based on responses at ecophysiological, population and ecosystem levels

Summary

Climatic change is supposed to cause significant alterations in the global environment, with clear and specific effects in the oceans. The Mediterranean Sea is an excellent model for the study of such effects on marine ecosystems. Seagrass meadows, and specifically those dominated by *Posidonia oceanica* and *Cymodocea nodosa*, are amongst the most threatened and relevant Mediterranean habitats. This project is aimed at contributing to the understanding of the main response mechanisms of these key habitats to global warming, probably the main component of climate change. To this end, we have focused the problem through three major approaches, relatively unexplored so far but crucial to achieve a proper knowledge of the impacts of temperature rising. First, we will study the physiological tolerance of Mediterranean seagrass species to thermal stress. Second, we will evaluate the influence of warming on herbivorism. Third, we will analyse the interactions between climatic change and other stressors, in particular eutrophication and mechanical disturbances.

What we did

Participant Institution for the genetic characterization of seagrass species in mesocosms experiment and for assessment of gene expression in controlled conditions.

Partners: Stazione Zoologica Anton Dohrn, Napoli; Spanish Oceanographic Institute (IEO), Spain; CSIC-CEAB, Spain

Research Area: Plant ecophysiology and stress response

Project Lifetime: 2014-2016

SZN Role: Affiliate center

Principal Investigator: Gabriele Procaccini

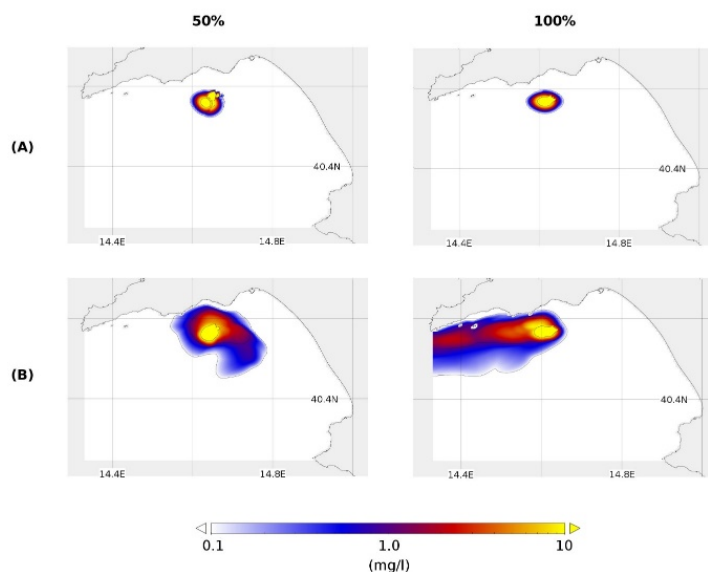
People involved: Lazaro Marin Guirao (Post-Doc); Emanuela Dattolo (Post Doc); Miriam Ruocco (PhD)

Funding Institution: Ministerio de Economía y Competitividad (MINECO) - Spain

Contribution to SZN: €16,000.00

Research Contract AUTORITÀ PORTUALE DI SALERNO-SZN

Characterization of disposal site



Summary

The Authority of Salerno Harbor has planned the dredging of about 4.000 m³ of sediments. The dredged sediments will be deposited in an identified open-sea area.

What we do

We contribute to the characterization of the disposal area by:

- re-analyzing field data acquired during the monitoring carried out in 2004 by SZN, in order to contextualize the observed dynamics of sediment dispersion respect to the marine weather conditions;
- Analyzing the possible criticalities that could alter the composition and abundance of planktonic communities as consequence of fertilization processes;
- performing a numerical simulations aimed at modelling the transport and settling of the dredged material.

Research Area: Environmental monitoring

Principal Investigators: Daniele Iudicone, Francesca Margiotta

Project Lifetime: 2016 – 2017

People involved: Vincenzo Botte, Vincenzo Saggiomo.

Funding Institutions: Autorità Portuale di Salerno

Contribution to SZN: € 38.500,00

Research Contract COMUNE DI POZZUOLI-SZN

Monitoring of Campi Flegrei Lakes



Summary

The project involves, for the Fusaro lake, the restoration of the functionality of the existing connecting mouth between the lake and the sea, in order to regularize the necessary water exchange, thus resulting in a more voluminous hydrodynamic circulation that allows the normalization of mechanisms of environmental recovery of the natural lake habitat.

For the Miseno lake, the project includes the restoration of the functionality of the reclamation systems of the Miseno lake banks by removing the materials which have accumulated. The aim is to improve the exchange of water that is essential to ensure the balance of the ecosystem sea-lake through the removal and disposal of sandy materials transported by waves and accumulated both in the mouths riverbed and in the areas in front of the outlets into the sea.

For the realization of the project, a scientific and technical activity plan is expected to be carried out both during preliminary work and at the completion of the work, essentially consisting of:

- the morphological characterizations of the two lagoons, Fusaro and Miseno, which will be carried out to assess the level of morphological changes in the two lagoons as a result of missed hydrographic maintenance, spills from the surrounding area, removal of sediment, etc
- the preparation of a characterization plan and participation in technical meetings with the Control Board (ARPAC);
- sampling and chemical, physical, microbiological and ecotoxicological characterization of sediment of the estuary and lake areas, the proposal for the fate of sediment to be submitted to the supervisory and monitoring boards during dredging;
- environmental monitoring for the assessment of the effects of the reopening of the mouths on the hydrological dynamics of the lagoons and assessment of possible changes in the trophic status.

What we do

The tasks of SZN (MEDA) include the environmental monitoring for the assessment of the effects of the reopening of the mouths on the hydrological dynamics of the lagoons and assessment of possible change in the trophic status.

Partners: ARPAC, Università di Napoli Federico II (UNINA).

Research Area: Environmental monitoring

Principal Investigator: Maria Saggiomo

Project Lifetime: 2015 – 2017

People involved: Vincenzo Saggiomo, Adriana Zingone, Francesca Margiotta, Francesco Terlizzi, Augusto Passarelli, Fabio Conversano, Violante Stefanino, Gianluca Zazo Marco Cannavacciuolo.

Funding Institutions: Comune di Bacoli

Contribution to SZN: € 160.000,00

Research Contract ISCHIA GAS-SZN

Monitoring of the effects of a gas pipeline on marine environment



Summary

In 2009 a submarine gas pipeline was deployed between the Ischia Island and the land (Torregaveta). This involved the construction of a pipeline trench, which damaged the *Posidonia oceanica* meadow at Punta S. Pietro - Ischia. The trench dredged through the seagrass bed was back-filled with rubble mounds. The project aims at monitoring the long-term effects of the submarine pipeline on physico-chemical features of sediments, on animal benthic communities and on the ecological status of the *P. oceanica* meadow.

What we do

Sampling activities have to be performed in order to detect:

- changes in the benthonic communities in four different sites located along the pipeline;
- changes of the physical and chemical properties of sediments along the underwater gas pipeline;
- natural recolonization of *Posidonia oceanica* on the covered pipeline and/or the decline of the threatened meadow.

Research Area: Environmental monitoring

Project Lifetime: 2016-2019 (a previous monitoring program was conducted in 2008-2013).

Principal Investigator: Francesca Margiotta.

People involved: Maria Cristina Buia, Marco Cannavacciuolo, Rosanna Guglielmo, Bruno Iacono, Maurizio Lorenti, Augusto Passarelli, Francesco Paolo Patti, Vincenzo Rando, Maria Saggiomo, Gianluca Zazo.

Funding Institutions: Ischia Gas Spa.

Contribution to SZN: € 100.000,00

Research Contract ISPRA-SZN

Marine Strategy Framework Directive (MSFD) - phase 1



Summary

To promote the implementation of the Marine Strategy Framework Directive, **MSFD**, in 2012 the Italian Ministry for Environment (MATTM) identified the Italian National Institute for Environmental Protection and Research, **ISPRA**, as the Public Body responsible for the first phase, consisting of the following activities: i) initial assessment of the current environmental status of the Italian waters and environmental impact of human activities on such waters, ii) definition of the Good Environmental Status (GES) of the waters considered; and iii) definition of a series of environmental targets and corresponding indicators. In turn ISPRA established collaborative projects with several Italian Institutions, including Stazione Zoologica, to collect relevant data and information fulfilling the needs for the Initial Assessment phase of the MSFD.

What we do

The goals for the SZN were to provide technical and scientific support and expertise, as well as data and information needed for the reporting phase. The contribution of the SZN included the participation in working groups, the compilation of Reporting Sheets, the processing of technical content as well as the sharing of data and bibliographic information regarding the GES Descriptors 1) MARINE REPTILES, with data concerning the sea turtles *Caretta caretta*, *Chelonia mydas* and *Dermochelys coriacea*; 2) EXOTIC, NON-INDIGENOUS SPECIES relating to taxa of microalgae, and isopod and tanaidaceae crustaceans; 5) NUTRIENTS AND ORGANIC SUBSTANCE, regarding phytoplankton, chlorophyll and nutrient data and 10) MARINE LITTER, in relation to the assessment of the fitness of the common sea turtle as a species indicative of the presence of marine litter in the Mediterranean.

Partners: Stazione Zoologica Anton Dohrn, Napoli; Italian National Institute for Environmental Protection and Research, **ISPRA**

Research Area: Environmental protection

Project Lifetime: 2013-2014

Principal Investigator: Adriana Zingone

People involved: Francesca Margiotta, Sandra Hochscheid, Maurizio Lorenti

Funding Institution: ISPRA (through MATTM)

Contribution to SZN: € 80,600 (ISPRA contribution).

Research Contract LPA GROUP-SZN

N and P enrichment due to fish farming plants



Summary

The LPA group has planned the doubling of their fish farming plants located in Marina di Casal Velino. The dispersion of Nitrogen and Phosphorus produced by the plants has to be assessed in order to obtain the permits, as expected by current legislation.

What we do

We contribute to assessment of N and P (dissolved and particulate) dispersion in the environment by numerical simulations. The simulations are performed using the circulation model ROMS coupled with a simple nutritional approach of aquaculture waste. Moreover, *in situ* data were acquired in order to validate the simulations.

Research Area: Environmental monitoring

Principal Investigator: Daniele Iudicone

Project Lifetime: 2017

People involved: Vincenzo Botte, Francesca Margiotta, Augusto Passarelli, Maurizio Ribera d'Alcalà, Luciana Sabia, Gianluca Zazo, Adriana Zingone.

Funding Institutions: LPA Group

Contribution to SZN: € 31.000,00

Research Contract TERNA-SZN

Environmental Monitoring in Relation to the Connection of the Campania Islands to the National Power Network. Torre Annunziata – Capri Leg



Summary

The aim of the project is to monitor the marine environment possibly affected by the cable laying and the commissioning of the power line by 150 kV "New SE Capri - Torre A. Center" by the Italian Terna network, the national operator for electricity transmission. The construction of the power line will increase the safety and reliability of electricity supply to the island of Capri, with the objective of minimizing the risk of blackouts especially in summer. This work involves the construction of a 150 kV AC of a total length of 31 km (including 30 submarines and 1 on mainland) which will link the current station of Torre Annunziata with a new power station in Capri.

Environmental monitoring in the area affected by the laying of the cables is designed to control marine ecosystems, highlighting any possible situation of stress or environmental impact derived from the different phases of construction of the plant. In particular, the planned investigations concern:

1. Chemistry and physic of the water column;
2. *Posidonia oceanica* beds;
3. Hard bottom habitat (coralligenous);
4. Macrozoobenthos;
5. Chemical, physical and biological tests of sediments
6. Morphology and bathymetry of the seabed.

Monitoring operations will be conducted according to a precise timetable: i) white phase (pre-construction surveys), ii) phase of the execution of the works and iii) end of installation (about 24 months after the end of the work).

What we do:

We are the partner in charge of the chemical analyses of the water column. In particular, we take care of sampling and subsequent analysis of nutrients (organic and inorganic), phytoplankton biomass (Chlorophyll *a*) and total suspended solids (TSS).

Partners: CoNISMa (Consorzio Nazionale Interuniversitario per le Scienze del Mare), IAMC-CNR (Istituto per l'Ambiente Marino Costiero), CIBM (Centro Interuniversitario di Biologia Marina ed Ecologia Applicata "G. Bacci").

Research Area: Environmental monitoring

SZN Role: Partner

Principal Investigator: Raffaella Casotti

Project Manager: Francesca Margiotta

People involved: Maria Saggiomo, Francesco Terlizzi, Marco Cannavacciuolo, Augusto Passarelli, Violante Stefanino, Gianluca Zazo.

Project Lifetime: Oct 2014 to Dec 2017

Funding Institutions: Terna Rete Italia SpA

Contribution to SZN: 390.000€

RITMARE

The Italian Research for the sea



Summary

RITMARE has been the leading national marine research project for the period 2012-2017; it is coordinated by the National Research Council (CNR) and involves an integrated effort of most of the scientific community working on marine and maritime issues. When the project started, more than 50% of SZN researchers were part of one or two working groups. Considering the size and the structure, RITMARE has been more a framework program with several projects than a single project. It has played an important role at SZN because has either funded or co-funded many research activities, prevalently supporting post-doc salaries. The program has been structured in seven sub-projects, namely, 1. Maritime Technologies, 2. Technologies for Sustainable Fishing, 3. Planning of the Maritime Space in Coastal Waters, 4. Planning of the Deep Marine Environment and the Open Sea, 5. Observation System for the Marine Mediterranean Environment, 6. Research, Training and Dissemination Structures, 7. Interoperable Infrastructure for the Observation Network and Marine Data. SZN is contributing to sub-projects 2 to 6, with a prevalent focus on marine ecology and biology. It is worth noting that approximately 65% of the funds assigned to SZN (see below) have been utilized to support the activities of SZN participants, while the remaining part (overheads and SZN staff salaries) has been invested to support new temporary positions for young scientists not involved in RITMARE.

What we do

Most of the results are synthesized in the reports of the groups. The activities spanned different themes, namely, population genetics of clupeids, biology and ecology of seagrasses, response of benthic ecosystems to acidification, photophysiology of marine phytoplankton, dynamics of bacterial communities in coastal areas, structure of plankton food webs, response of diatoms to microscale turbulence, plankton global biogeography, strategy and design of a new generation of marine observatories. An important contribution has also been the design of a Data Policy of general application.

Partners: CNR, INO-OGS, CoNiSMA, INGV, CINFAI

Research Area: Oceanography, Marine Biology and Ecology

Project Lifetime: January 2013 to December 2018

SZN Role: Partner and Member of the Steering Committee

Principal Investigators: Maria Cristina Buia, Christophe Brunet, Raffaella Casotti, Marco Cinquegrani, Mariella Ferrante, Graziano Fiorito, Daniele Iudicone, Gabriele Procaccini, Maurizio Ribera d'Alcalà, Mena Ristoratore, Remo Sanges, Adriana Zingone.

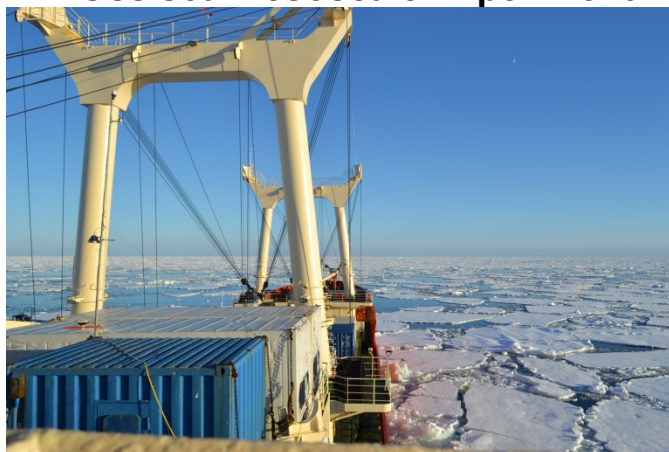
People involved: more than 40 people including post-docs and PhD students have been involved in the program

Funding Institution: MIUR Italian Flagship Project

Contribution to SZN: €4,448,000 Euros (MIUR contribution)

ROME

ROss sea Mesoscale Experiment



Summary

The Ross Sea shelf waters are the most productive waters in the Southern Ocean and may represent a significant but not yet quantified contribution to the oceanic CO₂ sink, mainly linked to the phytoplankton production. Nonetheless, the processes that control the magnitude of the primary production in this region are not well understood. During summer, an observed abundance of macronutrients and scarcity of dissolved iron are consistent with a limitation in phytoplankton growth due to iron lack in the offshore Antarctic waters. Anyway, evidences suggest that iron limitation is important in the highly productive polynyas too. Previous studies indicate that the main potential sources of dissolved iron to surface waters of the Ross Sea are: the intrusions of circumpolar deep water, the resuspension of sediments in near shore areas and on shallow banks, the melting of sea ice and the glacial meltwater from the Ice Shelf. In this context, hydrodynamic transport via mesoscale currents, fronts and eddies facilitate the supply of dissolved iron from these four sources to the surface waters of the Ross Sea polynya.

The main purpose of this research is to provide new insights about the way the complex mesoscale dynamics regulate the iron supply, the primary production and the biogeochemical cycling in the Ross Sea, considering also its key role in the climate context.

General objectives of this research are:

- to acquire physical-biogeochemical data set which could resolve mesoscale phenomena;
- to quantify the impact of mesoscale processes on biogeochemical phenomena;
- to utilize biogeochemical information as a marker for recognizing active mesoscale processes;
- to identify local and remote inputs of iron.

The objectives will be pursued carrying out a series of regional-scale high-resolution transects to characterize the hypothesized iron source regions in the western Ross Sea and to examine selected mesoscale features in detail through mini-process studies.

What we do

In the framework of this project, we investigate: i) the total microalgal biomass distribution and the contribution of different size classes, on different spatial and temporal scales; ii) the photosynthetic pigments as indicators of chemotaxonomic composition and photoprotection processes (by means of HPLC); iii) the degraded pigments as indicators of herbivore grazing activity; iv) the specific composition of the microalgal assemblages by means of optical and electronic microscopy; v) abundance, the biomass and composition of mesozooplankton communities by means of optical microscopy.

Partners; Università di Messina; Università di Napoli Federico II (UNINA); Università degli Studi di Genova (UNIGE); Università degli Studi di Napoli 'Parthenope'.

Project Life time: 2014 – 2017.

Principal Investigators: Maria Saggiomo; Francesca Margiotta

People involved: Augusto Passarelli; Gianluca Zazo; Francesco Bolinesi.

Funding Institutions: Progetto Nazionale di Ricerca in Antartide (PNRA).

Staying Alive

How to microbes help corals survive warming oceans?



Summary

Corals build enormous reefs that support rich marine life and provide people worldwide with coastal protection, food, and income. To do this, corals need symbiotic microalgae and bacteria to provide them food and keep them healthy. When waters get too warm, stressed corals lose these microbes, causing them to turn white (hence the name coral "bleaching"), and often die. However, some bleached corals get their microbes back over time—some may even get better-adapted, stress-tolerant microbes—but we don't know what drives this process. Recent severe bleaching of Hawai'ian reefs gives us an unprecedented opportunity to closely track populations of microbes in individual corals over time to understand how variable recovery rates and long-term survival are mediated at the microbial level.

What we do

We are coordinators of the project and will perform all manipulations and analyses in corals, as well as most of the bioinformatic analyses and ecological interpretations.

Partners: Stazione Zoologica Anton Dohrn, Napoli; University of Hawai'in (USA).

Research Area: Organismal Ecology

Project Lifetime: April 2015 to December 2015

SZN Role: Coordinator

Principal Investigator: Laura Núñez Pons

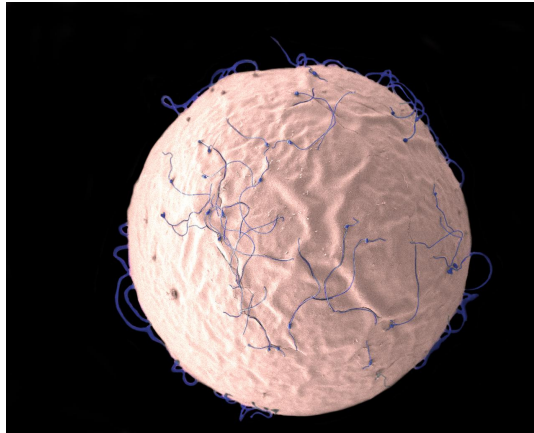
People involved: Dr. Ross Cunning (PostDoc, Raphael Ritson-Williams (PhD)

Funding Institution: Crowdfunding

Contribution to SZN: €4.000,00 (Experiment.com)

StarTregg

Molecular mechanisms controlling fertilization in *Astropecten aranciacus* starfish eggs



Summary

Oocytes of Mediterranean starfish *Astropecten aranciacus* have served as an excellent model system in cellular and developmental biology. Despite their invaluable utilities in studying fertilization, Ca^{2+} signaling, cell cycle, and cytoskeletal controls, the DNA and protein sequence information for this species had been nearly nonexistent. The aim of this project was to assemble *de novo* transcriptome from the RNA-seq data collected from the eggs and early embryos, which are the cell types manifesting the highest RNA sequence complexity. Our interdisciplinary approach combining molecular cell biology and bioinformatics will allow us to develop molecular biological tools (recombinant proteins, RNAi, antibodies, etc.) utilizing the transcriptomic sequence resources, which will facilitate the future studies about the molecular cell signaling mechanisms underlying diverse biological processes.

What we did

This project has been completed with a recent publication (Musacchia et al, 2017, PLoS One 12:e0184090), and the Fastq files of the assembled reads have been deposited in the public domain: ArrayExpress database under the accession number E-MTAB-5679.

Partners: Stazione Zoologica Anton Dohrn, Napoli; GenCore Sequencing Unit, EMBL, Heidelberg, Germany.

Research Area: Reproductive Biology

Project Lifetime: January 2013 to September 2014

SZN Role: Coordinator

Principal Investigator: Luigia Santella

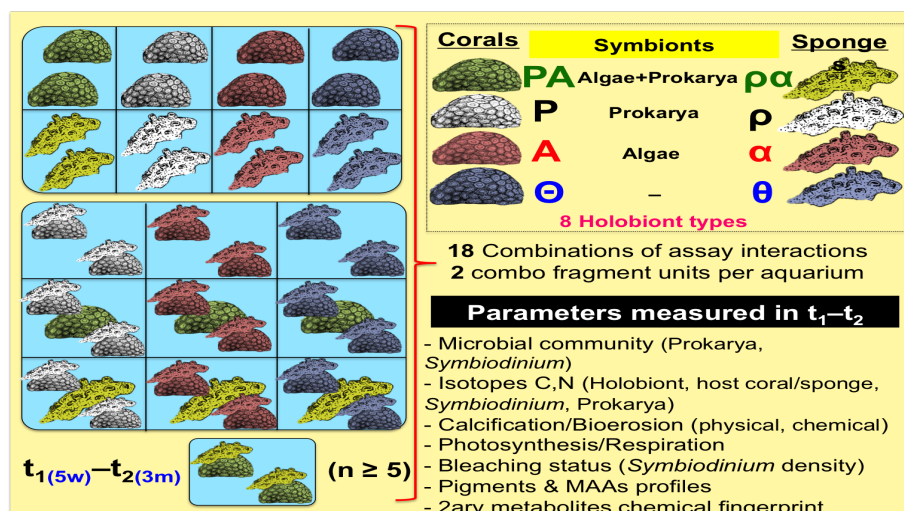
People involved: Remo Sanges, Marco Borra, Elio Biffali, Researchers/Technologist; Francesco Musacchia, Filip Vasilev, Jong Tai Chun, Postdocs.

Funding Institution: MIUR Progetti Premiali (DLGS 213/2009)

Contribution to SZN: €169.258,00 (MIUR contribution)

SymbioRocks

Symbioses on the Rocks': Exploring Microbial and Nutritional Couplings of Coral Reef Architects



Summary

Symbiosis is key for survival and evolution, and this is particularly true in coral reefs. Endosymbionts provide nutrients and bioactive metabolites that confer adaptability and ecological competence to metazoan hosts, permitting niche expansion and environmental resistance. Due to global climate change and other impacts, symbiotic partnerships get disrupted, thereby affecting the stability of whole ecosystems. In the marine realm, sponges and corals are major players in the foundation of benthic frameworks that provide housing to one of the richest biodiversity, the marine reefs. A hypothetical coral-sponge coupling with symbionts performing internal “microbial loops” for nutrient recycling is suspected to be the process closing up this vital circle that nourishes these relevant oligotrophic ecosystems, but the evidence remains ambiguous.

We propose a multidisciplinary study using three key species of hard corals (*Agaricia Tenuifolia*, *Porites porites*, *Siderastrea siderea*), and three specific sponge competitors (*Cliona delitrix*, *C. varians*, *Chondrilla nucula*) as model holobiont systems to address the roles of symbionts in competence and nutritional coupling in Bocas del Toro reefs.

Our main objective is to characterize the microbial community compositions that afford ecological competence to major reef-forming organisms, and determine the contribution of symbionts in nutrition, and metabolite profile.

We plan to expose corals and sponges to combined antibiotic treatments and menthol/light manipulations to create holobionts with modified (distressed) microbiomes (aposymbiotic), mimicking what holobionts experience under environmental stress. Then manipulated and control corals and sponges will be monitored for microbial shifts, isotopic and chemical parameters, aiming to elucidate phenotypic patterns related to healthy microbiome recovery, spatial competition, nutrition and acclimatization.

What we do

We are coordinators of the project and will perform all manipulations and analyses in corals, as well as most of the bioinformatic analyses and ecological interpretations.

Partners: Stazione Zoologica Anton Dohrn, Napoli; Smithsonian Tropical Research Institute (STRI, Panamá).

Research Area: Organismal Ecology

Project Lifetime: September 2016 to December 2017

SZN Role: Coordinator

Principal Investigator: Laura Núñez Pons

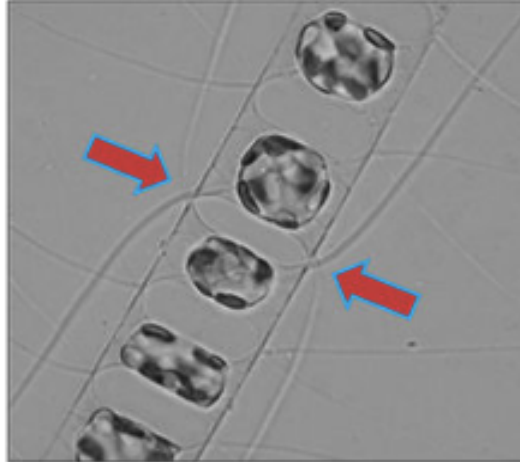
People involved: Andrew Altieri

Funding Institution: GGI - Smithsonian Institute

Contribution to SZN: €14.000,00 (GGI Grants)

“TuPre”

Gene expression changes in response to abiotic and biotic stimuli in diatoms: Turbulence and PRedation CoFound RITMARE Flagship



Summary

Diatoms are a fundamental microalgal phylum that thrives in turbulent environments. Despite several experimental and numerical studies, if and how diatoms may profit from turbulence is still an open question.

Aim of the TuPre project was to study the physiological and transcriptional responses of different species of marine diatoms to changes in turbulence. Could turbulence trigger a response in diatoms when nutrients were in excess and other environmental parameters were kept identical? At the SZN researchers designed and built the TURBOGEN, a turbulence generator prototype based on a vertically oscillating grid system which allows to reproduce natural turbulence in the laboratory. The objectives of the project can thus be summarized as follows: i) identification of diatom species that perceive and respond to micro-turbulence; ii) in the selected species, identification of the genes involved in perception, response, and adaptation to the stimulus. TURBOGEN is potentially usable with any algae species, but experiments can also be designed to introduce multiple levels of the trophic network, such as diatom main predators (copepods, small planktonic crustaceans), allowing to study the changes in gene expression resulting from prey-predatory interactions in turbulence.

What we did

Experiments were carried out with different algal species having different shapes and sizes. We demonstrated that diatoms actively respond to turbulence in non-limiting nutrient conditions. We found a morphological response in three different diatom species, and studied the transcriptional response of *Chaetoceros decipiens* to turbulence, finding an activation of energy storage pathways such as fatty acid biosynthesis. In addition, in experiments lasting 12 days, in turbulence *C. decipiens* continued to take up phosphorus and carbon even when silicon was depleted. Data generated within this study were used also for numerical modelling.

Partners: Stazione Zoologica Anton Dohrn, Napoli

Research Area: Functional genomics

Project Lifetime: September 2014- August 2016

SZN Role: Coordinator

Principal Investigator: A. Amato (M.I. Ferrante supervisor)

People involved: A. Amato (postdoc), G. Dell'Aquila (master student), M.I. Ferrante, D. Iudicone, M. Ribera D'Alcala', R. Sanges, C. Minucci, G. Zurzolo (Administrative).

Funding Institution: RITMARE Flagship Co-Found

Contribution to SZN: 72.000,00 euro (fellowship RITMARE CoFound Bandiera, including A. Amato's salary)

TurtleDives

Comparison of dive behaviour and performance of two marine turtle species inhabiting different environments



Summary

The aim of the project was to monitor the behaviour of green and loggerhead turtles in different geographical areas in order to better understand the environmental effect on behavioural divergence.

To achieve this a number of sub-objectives were investigated, in particular:

- elucidating the movements and habitat utilisation of both Mediterranean loggerhead and Pacific green turtles
- investigating how and to which extent biological-oceanographic features affect movement and dispersal patterns of these two marine turtle species
- determining the difference in behaviour of these two species with respect to their foraging ecology
- establishing the effect of body size on the dive performance of two marine turtle species

The diving behaviour of both species is characterised by similar dive profiles (i.e. the shape of the curve in a time-depth diagram), but the depth utilisation, duration of dives and activity patterns may differ according to the surrounding environmental features and the life stage of the turtles. Such differences were investigated by applying sophisticated telemetry devices (e.g. satellite transmitters, data storage tags ect) to free-ranging turtles in Taiwan and in Italy.

What we did

We were coordinators of the project and Operating unit SZN and performed all manipulations of sea turtles in the Mediterranean and all data analyses and comparisons for both telemetry deployments in Taiwan and Italy.

Partners: Stazione Zoologica Anton Dohrn, Napoli, Italy; National Taiwan Ocean University, Keelung, Taiwan

Research Area: Evolutionary, population and environmental biology

Project Lifetime: March 2010 to February 2012

SZN Role: Partner

Principal Investigator: I-Jiunn Cheng, Flegra Bentivegna

People involved: Sandra Hochscheid, Technologist

Funding Institution: National Science Council Taiwan (NSC-SZN Bilateral Cooperation Program Taiwan/Italy)

Contribution to SZN: no funds were provided directly to the SZN, but indirectly through the Taiwanese Partner, who received 1,024,000 TWD (= 29,098.48€)

“VulnerClima” and “Window to the Future”

New volcanic CO₂ vents provide a glimpse of the potential impacts of ocean acidification



Summary

Ocean acidification (OA), a suite of changes in seawater chemistry associated with increased CO₂ concentrations in the atmosphere, is expected to profoundly alter the diversity and function of marine ecosystems. In recent years, studies using a shallow volcanic CO₂ vent system near the Castello Aragonese on the island of Ischia (Tyrrhenian Sea, Italy) have generated key insights on the direct and indirect effects of OA on the surrounding benthic ecosystems. These natural CO₂ vents locally acidify the seawater by as much as 1.5 pH units below the average ocean pH of 8.1-8.2. Corresponding to this pH drop, the diversity and biomass of marine organisms decrease. Here, we propose to study newly discovered vents along the coast of Ischia across depths of 3-48 m. These sites span a variety of different habitats such as *Posidonia oceanica* seagrass meadows, gravel and sandy bottoms, semi-dark cave habitats and coralligenous outcrops, the latter dominated by calcifying organisms that are particularly vulnerable to OA. These habitats are hotspots of Mediterranean marine biodiversity, but it is unknown how they will be affected by OA. We will carry out SCUBA diving surveys to i) characterize the water chemistry and pH variability and ii) to quantitatively assess community composition and changes at each of the vents sites compared with adjacent control areas. This project will provide new insights regarding OA's effects on a wider range of organisms and community types, thereby enabling generality in our predictions of OA's impacts. Images, videos and results of scientific analyses will provide ample material for outreach products to communicate the anticipated impacts of OA.

What we did

We were coordinator of the project and as operating unit SZN performed all the field work connected with the characterization of the new vent's sites and control areas off the coast of Ischia.

Partners: Stazione Zoologica Anton Dohrn, Napoli (Villa Dohrn-Benthic Ecology Center, Ischia); CEAB-CSIC Blanes (Spain); Hopkins Marine Station, Stanford University (Ca, USA); University of California at Santa Cruz (Ca, USA).

Research Area: Marine biology and ecology

Project Lifetime: December 2015-November 2016

SZN Role: Coordinator

Principal Investigator: Teixido N., Gambi M.C.

People involved: Di Meglio E., master student/volunteer

Funding Institution: National Geographic Society Grant

Contribution to SZN: 19.700,00 USD (National Geographic) + 72.000,00 euro (fellowship Flagship RITMARE CoFound, Teixido N. salary)