MINISTERIO
DE ECONOMIA Y
COMPETITIVIDAD

**SECRETARÍA DE ESTADO
DE INVESTIGACIÓN DESARROLLO E
INNOVACION**

**DIRECCIÓN GENERAL
DE INVESTIGACIÓN CIENTÍFICA Y
TÉCNICA**

**SUBDIRECCIÓN GENERAL
DE PROYECTOS DE
INVESTIGACIÓN**

SOLICITUD DE BUQUE OCEANOGRÁFICO

PLAN DE CAMPAÑA

DATOS DEL INVESTIGADOR PRINCIPAL:

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DATOS DEL PROYECTO:

Título del proyecto: Biomass and Active Flux in the Bathypelagic Zone

Acrónimo: "**Bathypelagic**"

Jefe de Campaña: Santiago Hernández León

RESUMEN DEL PLAN DE CAMPAÑA (máximo 10 líneas)

Se realizará una campaña oceanográfica entre Las Palmas de Gran Canaria (Islas Canarias) y Reykjavik (Islandia) con el objeto de realizar la primera estimación del flujo activo por parte del zooplancton y micronecton en la zona batipelágica como parte importante de la bomba biológica y del secuestro de carbono (>100 años) en el océano a escala de cuenca oceánica. Se estimará también la exportación de carbono hacia la zona mesopelágica por parte de ambas comunidades. Proponemos una campaña durante el verano de 2018 (junio-septiembre) de 32 días duración que cubra el gradiente de biomasa batipelágica observado (ver proyecto) entre la zona subtropical y polar del Atlántico. El flujo obtenido y su relación con la producción primaria permitirán obtener las relaciones entre ambos y la estima de dichos flujos mediante teledetección.

PLAN DE CAMPAÑA.

The main objective of the Project is to estimate the active flux towards bathypelagic waters (carbon sequestration) with a global perspective. We propose a cruise during summer 2018 covering the subtropical and temperate zones of the Atlantic Ocean (Figure 1). Nine 48 h oceanographic stations will be performed along a transect from the Canary Islands to Reykjavik in Iceland. Oceanographic features will be studied using CTD-rosette casts performed in all the stations, and plankton and micronekton abundances and distribution patterns will be analyzed through samples taken from the neuston to the bathypelagic zone.

Exported at the mesopelagic and sequestered carbon at the bathypelagic zone by active flux will be assessed in zooplankton and micronekton. Knowledge of the sequestration due to the pelagic fauna is a gap in the study of the biological pump in the ocean. Carbon reaching the base of the permanent pycnocline will remain at depth during a long period (>100 years) and the role of zooplankton and micronekton in

sequestering carbon has not been evaluated yet. This project will be the first estimation of these fluxes.

Acoustic data will be recorded along the transect and in all the oceanographic stations, which combined with the information obtained from the Acoustic Zooplankton Fish Profiler (AZFP) and video cameras attached to the rosette sampler will allow a complete acoustic and visual picture of plankton and micronekton layers. The use of different nets (Mocness and Mesopelagos or MOHT) to obtain the ground truth will give an insight into the overall biomass of these communities. Calibration of echosounders will be performed leeward of Gran Canaria Island, a suitable place (calm and deep) for this work.

Two considerations are given to the managers of the oceanographic fleet. Firstly, the cruise should begin in the Canaries in order to avoid sending the equipment and material to a foreign country (bureaucratic and customs problems) or to a mainland port (e.g., Vigo) because it is also a problem to send the lab equipment a month (or two) before, causing problems to the normal functioning of our laboratory (shared with other research groups). Finishing in Iceland, the equipment will be sent to Las Palmas without leaving the harbor, avoiding customs problems with the Canaries. Secondly, the days at sea should not be altered due to the short and minimum number of stations because of the complexity of sampling (48 h at station and long and tedious deployment of nets during day and night). Less stations will decrease the possibility to find relationships between measured parameters and primary production. Remember that a main objective of the project is to provide these relationships in order to evaluate fluxes in the future using remote sensing products (see EXPORTS project).

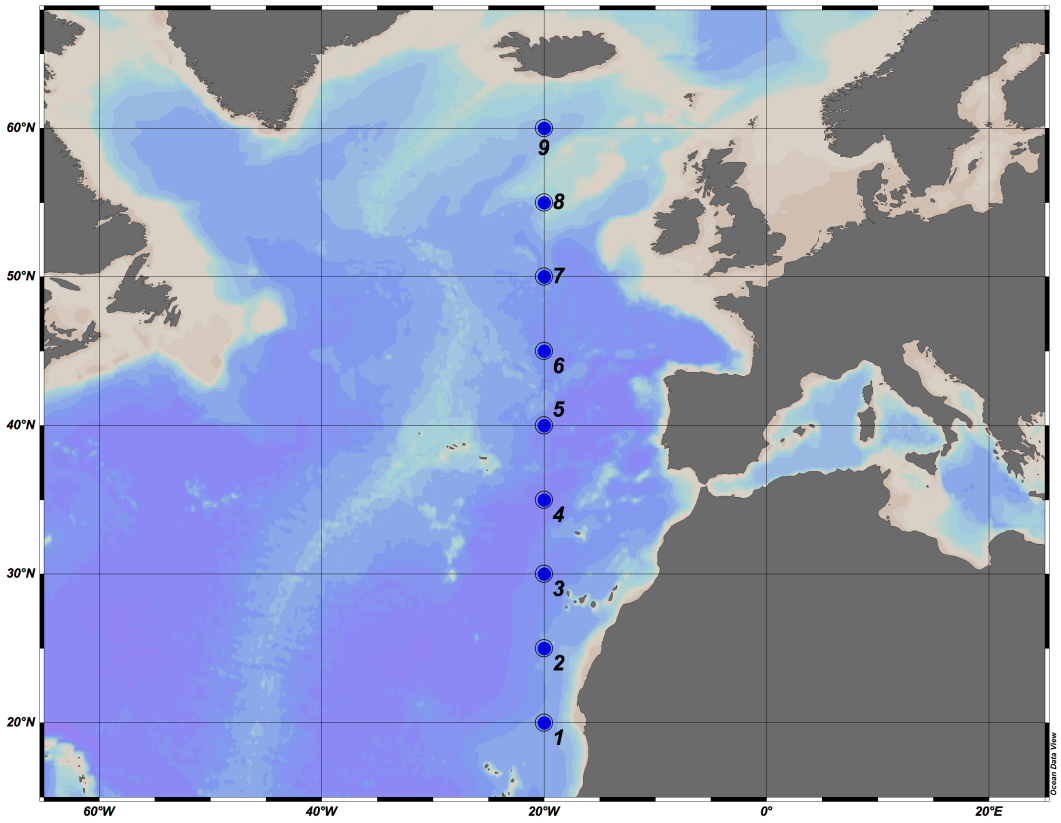

Figure 1. Location of sampling stations. Dots indicate 48 h stations to deploy the sediment trap, rosette sampler equipped with CTD, fluorometer, the Acoustic Zooplankton Fish Profiler, and video system, Mocness and Micronekton nets.

Table 1. Position of oceanographic stations along the Atlantic transect.

Stations	Latitude N	Longitude W	Distance between stations (mn)	Acumulated distance (mn)	Depth (m)
Las Palmas	28	-15	0		
Station 1	20	-20	550	550	3486
Station 2	25	-20	296	846	3846
Station 3	30	-20	296	1142	4718
Station 4	35	-20	297	1439	5054
Station 5	40	-20	298	1737	4843
Station 6	45	-20	299	2036	4024
Station 7	50	-20	300	2336	3987
Station 8	55	-20	300	2636	1948
Station 9	60	-20	300	2936	2097
Reykjavik	64	-22	272	3028	

We will carry out the next sampling:

First day at station. Zooplankton sampling.

Neuston net deployments: A neuston net with a rectangular frame of 100 cm x 30 cm with 0.2 mm mesh size (provided by the project) will be deployed while MOCNESS is at work.

Deployment of a drifting sediment trap: This instrument will be deployed at the start of the oceanographic station to measure the particle flux (POC, PON, and stable isotopes) at the base of the mixed layer (0.5 h for deployment).

Rosette-CTD cast by day: Temperature, salinity, oxygen, and fluorescence will be recorded using a CTD sensor mounted in a rosette sampler equipped with 24 Niskin Bottles (provided by the UTM) from the sea surface to 4000 m depth (~4 h). The rosette will be equipped with the AZFP (38, 125, 200 and 455 KHz) and a video camera equipped with infrared illumination, both allowing a complete full depth acoustic and image profile of organisms. Both profilers provided by the project.

Zooplankton net deployment by day: A 1 m^2 MOCNESS net with 9 nets of 200 μm (provided by the UTM) in the 0-2000 m depth layer (7 h during the day). Hauls will be oblique at a ship speed of ca. 2 knots.

Zooplankton net deployment by night: A 1 m^2 MOCNESS net with 9 nets of 200 μm (provided by the UTM) in the 0-2000 m depth layer (7 h at night). Hauls will be oblique at a ship speed of ca. 2 knots.

Rosette-CTD cast by night: Temperature, salinity, oxygen, and fluorescence will be recorded using a CTD sensor mounted in a rosette sampler equipped with 24 Niskin Bottles (provided by the UTM) from the sea surface to 4000 m depth (~4 h). The rosette will be equipped with the AZFP (38, 125, 200 and 455 KHz) and a video camera

equipped with infrared illumination, both allowing a complete full depth acoustic and image profile of organisms. Both profilers provided by the project.

Acoustic sampling: In order to evaluate the vertical distribution and migration patterns we will use the standard hull mounted echosounders (EK60, provided by the UTM) during all the cruise.

Second day in station. Micronekton sampling.

Micronekton net deployment by day: A Mesopelagos 15x5 m net or alternatively a 5 m^2 Matsuda-Oozeki-Hu trawl (MOHT), both provided by the project, equipped with 4 and 2 mm mesh size will be deployed in the 0-2000 layer (8 h during the day). Depth strata of each haul will be decided according to the acoustic sound layers.

Recovery of the drifting sediment trap (1 h).

Short rosette-CTD cast: Deployment of the rosette in the 0-200 m layer in order to obtain samples for primary production, microzooplankton grazing experiments and detailed sampling of the epipelagic community (1 h) requiring large volumes of water.

Micronekton net deployment by night: A Mesopelagos 15x5 m net or alternatively a 5 m^2 Matsuda-Oozeki-Hu trawl (MOHT), both provided by the project, equipped with 4 mm mesh size will be deployed in the 0-2000 m layer (8 h at night). Depth strata of each haul will be decided according to the acoustic sound layers.

Neuston net deployment by night: A neuston net with a rectangular frame of 100 cm x 30 cm with 0.2 mm mesh size (provided by the project) will be deployed while MOCNESS is at work.

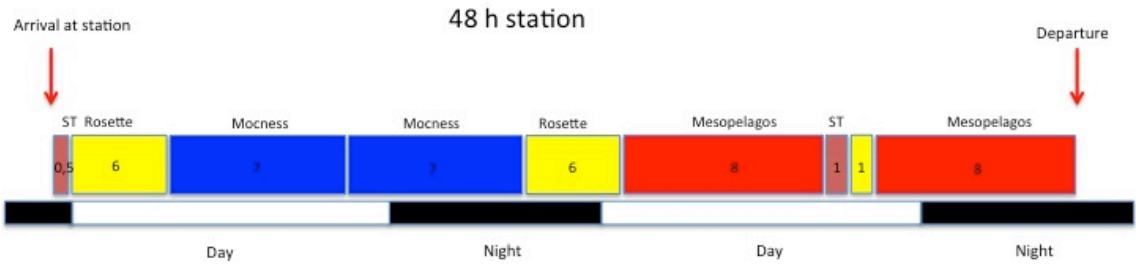

Figure 2. Schematic representation of different deployments to be carried out at station. White and black bars are day and night. NT stands for Neuston net, ST for Sediment trap. Numbers are approximate sampling time for each rosette or net.

Special support of ship crew

All the handling at stations (CTD, nets, sediment traps,…) will require the assistance of the ship crew, especially the nets deployment. This maneuvers are relatively dangerous and should require especial assistance. It is also compulsory the implication of the UTM team in these activities. Although the researchers in charge of all this equipment (senior scientists) have an important experience at sea, supervision by the ship crew is required for safe and security. Electronic, informatics, and acoustic experts from the UTM is also required.

Required equipment

Rosette-CTD seabird 911 plus
ADCP
L-ADCP
MOCNESS net with 9 nets of 200 µm
Kongsberg EK 60 ecosounder at 18, 38, 70, 120 and 200 KHz.
Current profiler Doppler Teledyne ADCP Ocean Surveyor 75 and 150 kHz
Scanmar acoustic communication system
Hydrophones, sensors and electronic Marport

Scintillation counter

2 termosalinographs Sea-Bird SEACAT SBE 21

2 Turner Designs 10AU fluorometers

Portasal Guildline 8410 salinometer

Flow cytometer FACSaria

Espectrofluorometer Perkin Elmer LS55

Espectrophotometer Perkin Elmer Lambda 850

Millipore Milli-Q A10 and Millipore Elix 10 systems

Liquid nitrogen container (2)

Sterero microscope

Winches

Scientific personnel

Dr. S. Hernández León (IP and chief scientist, sediment trap)

Dr. P. Olivar (responsible for micronekton samples)

Dr. M.L. Fernández de Puelles (responsible for zooplankton samples)

Dr. J. Arístegui (dissolved and particulate organic matter and bacterial activity).

Dr. A. Bode (isotopes in zooplankton, micronekton and particulate matter).

Dr. M. Peña (responsible for acoustics).

Dr. I. González Gordillo (micronektonic crustaceans and neuston).

Dr. J. Cabrera (responsible for video system recording and analysis).

Two technicians.

At least 12 scientist to assist sampling and analysis on board.

Required UTM personnel (to be decided by the UTM team).

Reagents and dangerous material

None

Rough weather alternatives

It is important to carry out the main cruise during summer as the probability to find bad weather, especially in the northern stations, is much lower. The cruise in summer will also allow to be successful in the scientific objectives.

El IP contemplará que la información del Plan de Campaña que se incluya en este documento, definirá el contexto máximo de la campaña, en términos de área de trabajo, duración e instrumentación, que se pondrá a su disposición en caso de ser aprobado el proyecto.

NOTA.- El IP/Jefe de Campaña serán, en su caso, responsables de la tramitación inicial de los permisos de trabajo en aguas extranjeras o en zonas protegidas.