**JOB DESCRIPTION**

**Fonctions :** Post-doctoral position for the study of zooplankton traits from imaging data (M/F)

**Emploi-type :** Post-doctorant

**Catégorie :** A

Les activités qui composent la fiche de poste sont appelées à évoluer en fonction des connaissances du métier et des nécessités de service

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**Presentation of Sorbonne Université**

To transmit knowledge, understand the world, and address the challenges of the 21st century, a new university was born on January 1st, 2018, resulting from the merger between Paris-Sorbonne University and Pierre and Marie Curie University. Sorbonne University is a multidisciplinary, research-intensive institution of global standing. Anchored in the heart of Paris and with a presence in the region, it is committed to the success of its students and strives to address the scientific challenges of the 21st century.

www.sorbonne-universite.fr

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**Presentation of the structure**

The Laboratoire d'Océanographie de Villefranche (LOV ; http://lov.obs-vlfr.fr/) is located close to Nice, on the French Riviera. It belongs to one of the three marine stations of Sorbonne Université. With about 90 permanent staff, the LOV generates and analyses a large quantity of marine data, including imaging, genomic, and satellite data to study the ocean.

The COMPLEx (COMPutational PLAnkton Ecology) team gathers about forty members studying marine plankton by collecting data with quantitative imaging instruments and high throughput genomics that informs advanced numerical analysis methods (modeling, statistics, machine learning). Plankton encompasses all organisms roaming with marine currents. Those organisms are responsible for producing some of the oxygen we breathe, storing the carbon we emit, feeding the fish we eat; plankton is therefore a major building block of Earth’s ecosystem. COMPLEx strongly interacts with the Quantitative Imaging Platform of Villefranche (PIQv; https://sites.google.com/view/piqv), which oversees the operation of the tools that the team develops. Those tools include imaging sensors, such as the Underwater Vision Profiler or the ZooScan, as well as an increase number of software packages to process and control the quality of the data generated by the instruments, sort images taxonomically (https://ecotaxa.obs-vlfr.fr/) or store and distribute data on the abundance of marine snow particles. The team has a long experience of interactions with engineers and computer scientists, in academia and the private sector, to develop these tools.

The recruited person will work within the framework of the ANR PRC TraitZoo project. The objective of the TraitZoo project is to study mesozooplankton communities through their "traits". A functional trait is an individual characteristic that influences the individual's selective value. For zooplankton, relevant traits include size, transparency, presence of appendages (indicators of diet), quantity of reserves, etc. Many of these traits are visible in images of these organisms and can therefore be extracted from images; we have written a review article on the subject: Orenstein EC et al. (2022) Machine learning techniques to characterize functional traits of plankton from image data. Limnology and Oceanography 67:1647–1669. https://doi.org/10.1002/lno.12101

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**Missions and principal activities**

**Mission:** The objective of this postdoctoral position is to realize the potential presented in this article: to exploit a quantitative plankton imaging dataset to extract one or several ecologically relevant traits, possibly through machine learning, and thus explore the functioning of pelagic ecosystems at a finer level than just community composition. Within the TraitZoo consortium, it will also be possible to extrapolate the effect of this trait by including these observations in a biogeochemical model or an individual-based model. The direction of the work will largely depend on the interests of the recruited person, but some avenues
are already being considered:
- Extracting the volume of lipid sacs from Arctic copepods, implementing the method of Maps et al. 2023 (https://doi.org/10.1093/plankt/fbad048) over a series of campaigns spanning several years in northern Canada to better describe the variability and mechanisms involved in this lipid carbon pump, which plays a major role in the functioning of boreal ecosystems.
- Detecting and quantifying cellular extensions in Rhizaria, which are abundant in the California Current, for example, to better estimate their carbon-to-volume ratio. Indeed, it is their effective volume, taking into account cytoplasmic extensions, often fine and visible only in situ, that determines their influence in the ecosystem (for intercepting the downward flux of marine particles or capturing their prey, for example).
- Measuring the distance between individually detected objects in the water column in a globally scaled dataset, thus exploring possible mechanisms of avoidance or association between organisms of different taxa or between organisms and marine snow.

Depending on the chosen approaches, imaging data will be sourced from LOKI, UVP, or ISIIS.

**Principal activities:**
- Assembly and initial exploration of large zooplankton imaging datasets
- Extraction of information from images by conducting manual annotation (with the assistance of dedicated personnel) and potentially implementing and/or developing machine learning algorithms or computer vision techniques
- Quantification of observations, statistical analysis, and extraction of results, potentially extrapolating their ecological influence by including them in a biogeochemical or individual-centered model (in collaboration with other members of the TraitZoo project)
- Discussion of results, writing scientific articles, presentations at conferences, participation in project meetings

**Encadrement :**

No

Nb d’agents encadrés par catégorie : X A ; X B ; X C

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**Experience and skills**

**Cross-disciplinary knowledge required:**
- PhD in biological oceanography, ideally with knowledge of zooplankton ecology
- Data analysis (regression, multivariate analysis)
- Writing and oral presentation of scientific results

**Skills:**
- Proficiency in analyzing large datasets (several hundred thousand rows) through computer programming (preferably R or Python)
- Possibly: knowledge of computer vision image analysis (image processing, edge detection, shape or texture extraction, etc.)
- Possibly: knowledge of deep learning approaches for segmentation or regression.
- Potentially: knowledge in dynamic modeling
- Scientific English (written and oral)

**Abilities:**
- Ability to discuss work in a team, in the laboratory (~45 people, 4 other post-doctorates), and within the project (5 partners, several doctoral students)
- Autonomy in seeking information related to the subject and in formulating scientific hypotheses

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**Exposure to occupational risks, specific working conditions, and regulatory training**

**Exposure to professional risks :**

☒ No

☐ Yes : if yes indicate information regarding physical risks (lifting heavy loads, dangerous machinery, vibrations...), biological risks, chemical risks, ionizing or non-ionizing radiation. If the employee is exposed to hazardous substances including carcinogenic, mutagenic, or reprotoxic (CMR) substances, they must have an Individual Exposure Sheet, which can be downloaded from the intranet section titled “Exposure to Dangerous Products” « Prevention-des-risques-professionnels/fiche-individuelle-d-exposition-aux-agents-chimiques-dangereux ». 
**Other considerations:**
Contract for 15 to 20 months, renewable. Salary between €2900 and €4000 gross monthly depending on experience and initial training.
The laboratory is located in Villefranche-sur-Mer, near Nice, and offers direct access to the Villefranche Bay.

*Conformément à l'annexe de l'arrêté du 18 mars 2013 (NOR : MENH1305559A)*

For more information or to apply (with a CV and a cover letter including a research project), please write to jean-olivier.irisson@imev-mer.fr before March 25th.