**Title**: **Microalgae as circular ingredients to reduce the carbon footprint in aquaculture feeds** (SSD BIO/01)

**Research project:**
The present research project entitled "**Microalgae as circular ingredients to reduce the carbon footprint in aquaculture feeds**" belongs to the CN Biodiversity Spoke2 Activity3 "Action 3.1 Circular feeds for carbon neutrality" – PNNR Project

This specific project is aimed to assess and valorise the nutritional potential of innovative feed ingredients characterized by low/zero carbon footprint and derived by circular value chains (i.e. microalgae) to formulate, produce and demonstrate innovative C neutral feeds for aquaculture.

**Activity plan:**

The candidate will work within the Algal Biology research group (AlgoLab) of the Department of Biological, Geological and Environmental Sciences (BiGeA), in Ravenna, under the supervision of Dr. Laura Pezzolesi.
The objective of this research grant is to contribute to the study of microalgal biomass as feedstock for increasing the quality of aquaculture feed. The fishery sector is expanding rapidly, requiring the development of alternative sustainable components and the exploration of new sources of environmentally friendly and nutrient-rich feed ingredients. Microalgal biomass has the potential to support the growth of fish aquaculture. The advantage of using microalgae in industrial sectors (e.g., food, feed, nutraceuticals) consists in the possibility to design bioprocesses where $CO_2$ is consumed without the requirement of commercial $CO_2$ or costly organic substrates as sugars, which oxidation in heterotrophic organisms lead to $CO_2$ release. However, there are some drawbacks that limit the exploitation of microalgal potential, namely the low cell densities and the moderate growth rates. The concept of "Algal biorefinery" has increased the potential exploitation of this biomass and the development of a viable microalgae-based economy. Microalgae biomasses provide a pool of high-values compounds, such as essential amino acids, valuable lipids, vitamins, and pigments, making them suitable as nutritional supplements in livestock feed formulations, potentially replacing fish meal and fish oil in aquaculture. Due to low input costs, low carbon footprint, wastewater treatment benefits, and carbon credits from industrial $CO_2$ conversion, microalgae-based feeds have the potential to provide significant economic benefits. However, several challenges must be addressed before microalgal biomass and bioproducts may be used as fish feeds, including heavy metal bioaccumulation and poor algal biomass digestion. In fact, a critical aspect of the aquafeed formulation is the digestibility, as a highly digestible feed reduces production costs, feed waste, and the risk of eutrophication. Knowledge on biochemical composition is essential due to the limited and diverse information on nutritional value, which derived from the variable composition of the different algal strains and their plasticity in modulating their composition based on the cultivation system.
The use of algal extracts and algae mixes represents a fundamental achievement for aquaculture activities due to the need to use cheap sources potentially convertible in good biomass availability. Nowadays, this is still a tight bottleneck in the culture management of fish and invertebrate species. For this reason, the study and production of algae that could supplement or substitute the zooplankton feeds could be of extreme importance to reduce the biomass destruction of fish to be utilized for feed and therefore the ultimate impact on the environment.

The Candidate will select and cultivate microalgal and cyanobacterial strains to produce biomass optimized in its biochemical composition to obtain more than one high added-value metabolite, in view of the potential use of the algal biomass as alternative ingredient in aquaculture feed and also in other industrial sectors. The Candidate will start working with available organisms in the algobank of the Lab but will also isolate local strains and new algal strains if possible. The algal biomass obtained will be optimized and characterized using the algal biorefinery approach. Proximate composition of the innovative ingredients will be analyzed, with particular attention to the lipid profile (fatty acids profile, PUFA content, pigments), as well as the protein content. The extraction of the algal biomass will be performed using sustainable and environmentally friendly solvents.

The project will consist of:

- Literature review on the use of microalgae and cyanobacteria in aquaculture
- Cultivation of microalgal and/or cyanobacteria strains under different conditions to promote the optimization of the target metabolites (e.g., fatty acids, antioxidants)
- Isolation of new promising strains and their characterization
- Evaluation of the application of the algal biorefinery concept, to simultaneously obtain ingredients for feed and other metabolites exploitable in a different industrial sector
- Final report

**Required Skills:**

Applicants should:

- Proven experience in the field of microalgal and/or cyanobacterial cultivation
- Proven experience in microalgal or cyanobacterial strains' isolation
- Proven experience in the extraction and characterization of algal biomass through spectrophotometric or chemical analyses (e.g. GC/MS)
- Proven experience in molecular biology for strain identification
- Proven experience in writing scientific reports or articles
- Good knowledge of spoken and written English