



International Workshop on Ecology, Evolution and Conservation of Diverse and Threatened Ecosystems in the Neotropics (Anfiteatro das Aves, CB, UFRN, Natal, Brazil, 12 – 15 September 2016)

Workshop Programme

Monday 12 September (Morning)

- 8.00 **Angela Maria Paiva Cruz – Rector – UFRN**
Graco Aurélio Câmara de Melo Viana – Director of the Biosciences Center – UFRN
Kharla Costa – Coimbra Representative
Welcome and workshop opening
- 8.30 **Harry olde Venterink – VUB / Carlos Roberto Fonseca – UFRN**
Scientific coordinators of the workshop
Workshop theme, set-up and aims – UFRN point of view
- 9.00 **Harry olde Venterink – VUB**
Species loss, invasion and diversity of plants from a N:P stoichiometry perspective
- 9.30 **Lucíola Santos Lannes – UNESP**
Effects of soil nutrients on native and exotic herbaceous plants in the Brazilian Cerrado
- 10.00 Coffee break
- 10.30 **Leonardo M. Versieux – UFRN**
Ecology, systematics and conservation of Bromeliaceae in Northeastern Brazil
- 11.00 **Fernanda Antunes Carvalho – UFRN**
Systematics, evolution and cybertaxonomy of the Caatinga flora
- 11.30 **Andréia Alves Rezende – UNESP**
Ecological importance and floristic diversity of climbing plants in Brazil

Monday 12 September (Afternoon)

- 12.00 – 14.00 Lunch break (Praiamar Natal Hotel)
- 14.00 – 18.00 Restricted workshop sessions in sub-themes (Praia Mar Hotel)
Brainstorm on questions and objectives for collaborative research
- 20.00 Dinner (Praiamar Natal Hotel)

International Workshop on Ecology, Evolution and Conservation of
Diverse and Threatened Ecosystems in the Neotropics (GCUB / VUB / UFRN)



Tuesday 13 September (Morning)

- 8.30 **Ludwig Triest – VUB**
Perspectives for research on fragmented populations and their survival strategy in agricultural, urban and coastal landscapes
- 9.00 **Rosane Garcia Collevatti – UFG**
Landscape genetics and genomics: the role of contemporary landscape and historical factors in shaping the genetic diversity in Neotropical plants
- 9.30 **Márcio Zikán Cardoso – UFRN**
Integrated approaches to the study of butterfly movement in fragmented habitats
- 10.00 Coffee break
- 10.30 **Carlos Roberto Fonseca – UFRN**
Conservation planning in a megadiverse country
- 11.00 **Gislene Ganade – UFRN**
Restoration of semiarid ecosystems
- 11.30 **Luisa G. Carneiro – UNB**
Direct and indirect effects of soil eutrophication on pollinators and pollination services
- 12.00 **Judith Sitters – VUB**
The diversity of herbivore effects on soil nutrient cycling and plant community composition

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Wednesday 14 September (Morning)

- 8.30 **Marc Kochzius – VUB**
Connectivity of coral reef populations
- 9.00 **Karine Mattos – UFRPE**
Brazilian seagrass: biodiversity and conservation
- 9.30 **Tatiana Silva leite – UFRN**
The Cephalopod project in Brazil and in the world: advances and perspectives
- 10.00 *Coffe-Break*
- 10.30 **Guilherme Ortigara Longo – UFRN**
Trophic interactions in reef ecosystems: from centimeters to latitudes
- 11.00 **Jayme Santangelo – UFRRJ**
How important are small aquatic systems for maintaining biodiversity in inland coastal areas?
- 11.30 **Bram Vanschoenwinkel – VUB**
Looking through the lenses of tropical freshwater microhabitats

Wednesday 14 September (Afternoon)

- 12.00 – 14.00 Lunch break (Praiamar Natal Hotel)
- 14.00 – 18.00 Restricted workshop sessions in sub-themes (Praiamar Natal Hotel)
Brainstorm on questions and objectives for collaborative research
- 20.00 Dinner (Praiamar Natal Hotel)

Thursday 15 September (Day activity)

- 8.00 Restricted Excursion to the Santuário Ecológico de Pipa (Pipa, RN)
Bus leaving from the Praiamar Natal Hotel at 8:00hs
- 14.00 - 15:00 Lunch break at Pipa, RN
- 16:00 Return from Pipa to Natal
- 20.00 Farewell Dinner at Praiamar Natal Hotel



ABSTRACTS *(Alphabetic order)*

Andreia Alves Rezende

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Ecological importance and floristic diversity of climbing plants in Brazil

Climbing plants or simply climbers are synonyms and refer to plants that use other plants or rocks and manmade structures for support. These can be either herbaceous (vines) or woody (lianas). The presence of lianas is one of the main physiognomic characteristics of tropical forests, however the interest by the ecology of lianas has increased in the 90s after the publication of Putz and Mooney (1991), which subsidized the initial comprehension of the importance of lianas for forest dynamics. Lianas contribute in many aspects for forest dynamics, substantially contributing for the general diversity of species in tropical forests but negatively affecting the regeneration of tree species. Brazil has a high diversity of climbing plants (3954 species, 47% endemic) divided in 432 genera and 83 families, but studies are yet scarce. Abundance and biomass of lianas have increased in tropical forests, probably due to evapotranspiration, disturbance and fragmentation increase as a result of changes in land use and atmospheric CO₂ increase. To investigate whether lianas are increasing dominance in Brazil it is important to establish a wide network of permanent plots with standardized protocols in the various Brazilian vegetation types to be monitored in the long term. This would allow studies about the possible mechanisms that control richness, abundance and distribution of climbing plants in Brazil.

Bram Vanschoenwinkel

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Looking through the lenses of tropical freshwater microhabitats

When asked about freshwater in the tropics, most people think about flooding rivers, wetlands and oxbow lakes. However, few would think about aquatic microhabitats that can hold water permanently or periodically. Isolated rocks and mountains such as tepuis can contain cracks and depressions that house unique fauna. In terms of micro-arthropods, few habitats are more diverse than the semi aquatic habitats of moss patches. There is an abundance of freshwater and associated diversity present in the canopy of tropical forests in water filled tree holes and bromeliads. These habitats are widespread and can be extremely abundant, both inside pristine forests as well as on the outskirts of human settlements and even in city centers. More and more researchers are focusing on these understudied systems trying to understand their value for biodiversity conservation, their suitability as model systems in ecology and evolutionary biology, their contribution to ecosystem services as well as the potential dangers associated with disease vectors developing inside. In this talk I will give an overview of the different research lines my research group is currently involved in within this field. I will indicate ongoing projects and collaborations with researchers in Latin America including Brazil and discuss potential future research avenues.

Carlos Roberto Fonseca

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Conservation planning in a megadiverse country

Megadiversity countries have a huge responsibility for the global biodiversity, since they host 70% of the known species. For these countries, a careful conservation planning is quintessential in order to identify pro-active strategies that can in the long run minimize costs. Brazil, which hosts around 10% of the world species, has today one of the largest systematic conservation planning of the world. In this talk I will show the methodology and main results of the process that lead to the recent definition of 288 conservation priority areas in the Caatinga drylands aimed to protect 691 conservation targets. Also, I will show that pro-active conservation opportunities are unevenly distributed among the Brazilian terrestrial biomes and that opportunities are threatened by habitat lost. Finally, based on a successful Amazonian model, it is highlighted that specific financial mechanisms should be created urgently if one wants to make use of such transient conservation opportunities to safeguard the world biodiversity.

Fernanda Antunes Carvalho

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Systematics, evolution and cybertaxonomy of the Caatinga flora

My research focuses on the systematics, evolution and cybertaxonomy of Neotropical plants. Although highly threatened, studies on the evolution of the Caatinga flora are scarce and the information available are still scattered. I aim to investigate the evolutionary patterns shaping the plant biodiversity in the Caatinga by combining dated phylogenies, niche modeling, geological information and precise taxonomic studies to understand the level of susceptibility of different taxonomic groups to environmental changes. However, in order to effectively conserve the biodiversity it is important to gather and make all information on this biome available and more accessible to scientists, policy-makers, and citizens. Thus, for every taxon studied I will make the information available through an "e-flora of the Caatinga" which should include data, images, descriptions, uses, conservation status interactive keys and others.

Gislene Ganade

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Restoration of semiarid ecosystems

Programs for restoration of native vegetation cover in drylands have the challenge to overcome harsh conditions and intense plant mortality due to drought. In the Brazilian semiarid tropical forest called Caatinga, restoration programs frequently face as much as 70% mortality of transplants. I will present a series of studies developed by my research group that involve, niche modelling, ecosystem services modelling, and experiments at small and large scale. I will discuss how these studies contribute to the development of new restoration techniques and new strategies for desertification combat in drylands

Guilherme O. Longo

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Trophic interactions in reef ecosystems: from centimeters to latitudes

Trophic interactions are critical to the structure and functioning of ecosystems, altering density and biomass patterns of species across different trophic levels. Human activities have been negatively impacting these interactions, causing drastic changes in ecosystems. Reef habitats, for instance, have suffered a variety of human-related impacts (e.g., overfishing, pollution) leading to loss of biodiversity and critical ecosystem processes, particularly those mediated by trophic interactions. For example, when herbivorous fish and sea urchins were experimentally excluded from coral reefs (overfishing scenario) seaweeds rapidly overgrew corals. The intensity and composition of trophic interactions can be influenced by multiple factors across different spatial scales and have important consequences to ecosystem functioning. For example: at the scale of centimeters, prey nutritional quality or chemical defenses can shape the identity of predators and predation intensity; at the habitat scale (hundreds of meters), different tolerance levels to harsh abiotic conditions can result in predation refuges; at large spatial scales (hundreds of kilometers), temperature can interfere in the predator's metabolic demand and influence its trophic interactions; and at latitudinal scales (thousands of kilometers), these ecological factors meet biogeography, for example with different taxonomic composition. In this talk I will give an overview of our recent efforts on trophic interactions in reef ecosystems of the Western Atlantic and present ongoing collaborations on reef ecology, including several Brazilian Universities, in order to facilitate the establishment of new partnerships in this workshop.

Harry Olde Venterink

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Species loss, invasion and diversity of plants from a N:P stoichiometry perspective

Nutrient enrichment, eutrophication, and alien plant invasions are major causes of vegetation change, including the loss of species from natural plant communities. My research focuses on the importance of the balance (stoichiometry) between nitrogen (N) and phosphorus (P) availabilities for processes controlling plant species coexistence, invasion and extinction. Generally, I aim with answering one or more of the following questions: (1) How do environmental factors and changes influence the balance between C, N and P availabilities?; (2) How does N:P stoichiometry affect the composition of plant communities (e.g., functional groups, biodiversity, endangered species, plant invasions)?; (3) Can patterns in vegetation composition, and interactions between plants and other organism, be explained from their functioning in relation to N:P stoichiometry? In my lecture in Natal, I will focus on questions 2 and 3. I will show field patterns for endangered plants in Eurasian wetlands and endangered and invasive species in the Brazilian Cerrado. I will relate plant traits to N or P limited conditions with examples from dominant grass species under experimental conditions and from endangered and common Eurasian wetland species. I will also present results from experiments with communities of native and invasive plant species, and talk about feedbacks between plants, soil microbes and soil N and P availabilities.

Jayme Santangelo

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How important are small aquatic systems for maintaining biodiversity in inland coastal areas?

Historically, deep and permanent lakes were the core of limnology. Only some decades ago smaller and even temporary lakes were incorporated in aquatic sciences. However, despite the acknowledgement of high scenic and biodiversity values, small aquatic systems are seldom considered in broad conservation strategies and often face multiple pressures. Many coastal areas in Brazil display coastal lakes and associated ponds, which are subjected to huge variations in water volume and salinity. Using zooplankton organisms as a model system in these regions, we are investigating the role of permanent and temporary ponds for maintaining diversity when compared to permanent lakes. Additionally, because ponds usually dry out completely, we also want to understand how organisms recolonise those systems after refilling. Finally, because some lakes and ponds face a temporary salinisation, we wish to understand how salinity affects the ability of different populations to recover. These questions have been addressed by using field sampling, and field and laboratory experiments. We believe future conservation strategies in coastal areas should include small ponds and restore degraded ones.

Judith Sitters

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The diversity of herbivore effects on soil nutrient cycling and plant community composition

Mammalian herbivores are a major component of many terrestrial ecosystems and they have a strong impact on soil nutrient cycling, thereby impacting plant properties, such as productivity and diversity. Feedbacks between herbivores, plants and soil nutrient cycling have traditionally focused on how herbivores change the quality and quantity of resources entering the soil. However, there is a much wider array of effects including stoichiometric components, trampling-induced soil compaction, and transport of nutrients between habitats. In my talk I will review some of these alternative mechanisms and illustrate the need for a new integrative model of how herbivores affect soil nutrient cycling and availability. Additionally, the large diversity of herbivore species and their different feeding strategies result in large differences in dung quality. I will show that dung of a variety of African and European herbivore species varies widely in nitrogen (N) and phosphorus (P) concentrations, as well as in their ratio (N:P) and ratios with carbon (C:N, C:P). Herbivore dung is an important supplier of nutrients to plants in organic form and I will demonstrate that dung of different herbivore species (i.e., dung type) significantly influenced the diversity and composition of an experimental plant community in mesocosms fertilised with dung of either European bison, cow, horse, fallow deer or rabbit. The effect of dung type on the plant community diversity could be predicted by both the supply level and stoichiometry of N and P in it. The dung type with the most balanced N:P supply (of rabbit) resulted in the highest evenness of the plant community. These studies show that a diversity of herbivore effects influences the relative availabilities of N and P in the soil and hence strongly impacts plant community composition and diversity.

Karine Matos Magalhaes

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Brazilian seagrass: biodiversity and conservation

Seagrass ecosystems are among the most productive coastal ecosystems and provide essential services, especially provisioning services such as biodiversity and functioning as fish nurseries. Most of these services vary in extent and magnitude according to the dominant seagrass species and habitat. Unfortunately, Brazilian seagrass still remains understudied, with gaps of knowledge even in the exact number of species and their distribution along the coast. At the same time, the current conservation status of seagrasses is critical, as these meadows faces several threats with a global rate of ecosystem decline of 7% yr⁻¹, undermining the supply of ecosystem services and affecting subsistence livelihoods. In the presentation, we will give an overview of our current status of knowledge, especially on the north-eastern coast.

Leonardo M. Versieux

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Ecology, systematics and conservation of Bromeliaceae in Northeastern Brazil

I will firstly present our lab's lines of research, which involves a broad spectrum of investigations based on taxa (mainly on tropical families), systematics, evolution, molecular systematics and phylogeography, floristics and economic use of the flora, particularly ornamental families. In the second moment, I will present that the knowledge of Brazilian Bromeliaceae (pineapple family) is progressively improving although many regions are still understudied, as some dry habitats and the Amazonian region and discuss an overview of the advances on the taxonomy and floristics of integrative, unpublished or recently published research, primarily focused on Tillandsioideae: *Alcantarea* and *Vriesea*, as well as Bromelioideae: *Araeococcus* and *Cryptanthus*. Also, a discussion will be provided on the improvement of the floristic knowledge of Bromeliaceae in previously understudied regions, such as the north of the Caatinga biome, specifically the states of Rio Grande do Norte, Ceará, where several new occurrences are being recorded (e.g. *Aechmea muricata*, *Cryptanthus zonatus*, and *Orthophytum disjunctum*); the state of Mato Grosso do Sul (11 genera and 41 spp); the state of Bahia, which has a Flora project underway, with the taxonomic treatment of *Alcantarea* published and *Tillandsia* and *Vriesea* nearly concluded, the treatment of Bromeliaceae for the Flora of Sergipe. These works point toward the need to conduct further field-work and produce Floras, to improve the scientific collections since many species are still poorly understood, and they suggest the necessity to consider establishing centered and institutional living collections and DNA banks in order to take advantage of the material collected by different students in their research. The progress on the taxonomy of *Alcantarea* will also be briefly discussed using recent data on palynology and molecular markers (*A. imperialis* vs. *A. brasiliana*). This genus has been monographed recently and currently comprises nearly 40 species. Additional studies involving species delimitation in *Vriesea*, *Guzmania* and *Mezobromelia* will be discussed using molecular, floral, and anatomical data, indicating the necessity to collaborate at the international level. Opportunities and challenges for new research within the Bromeliaceae in Brazil will also be discussed, highlighting the group's demand for more taxonomic work.

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Effects of soil nutrients on native and exotic herbaceous plants in the Brazilian Cerrado

Knowledge on the nature of nutrient limitation in plant communities is important to predict how ecosystems will respond to environmental change and to implement effective restoration plans. Grasslands within the Cerrado domain vary widely in terms of conservation conditions, with invasion by exotic plants and direct destruction being the main agents of degradation of such highly diverse areas. We have been investigating which are the main limiting nutrients for various functional groups (native and alien grasses, and forbs) in Cerrado grasslands. We found that phosphorus stimulates growth of the main exotic invasive grasses, which grow better following direct phosphorus addition and benefit from a biodiversity effect on phosphorus availability in species-rich communities, leading to negative effects on native plants. Contrarily to the common belief that phosphorus is the main limiting nutrient for Cerrado plants, native grasses are limited by a cation or a micronutrient. In this presentation I will talk about fertilization and mesocosm experiments that led to these observations and current efforts we are taking to better understand the role of nutrient limitation in shaping grasslands under different conservation conditions in the Cerrado.

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Perspectives for research on fragmented populations and their survival strategy in agricultural, urban and coastal landscapes

Molecular markers are currently used in population studies for detecting both historical and contemporary gene flow levels. Depending on the scale and problem of the considered area, the approach and methodology can be adapted. At first we will focus on methods used and results obtained for insect-pollinated plants in agricultural landscapes and urban environments where populations are within close vicinity but may lack biological connectivity. Population genetics evidence then is supplemented with mimicking pollinator movements. At such small scales, restoration can be achieved to counteract the potential negative effects of inbreeding and drift. Examples will be given on dimorphic predominantly outcrossing *Primula* species (Primulaceae) that appear to respond differently to fragmentation. Also the local effect of invasive plants on pollinator movements towards native plants will be addressed. In coastal landscapes, fragmentation of seagrass and mangrove habitats can be counteracted through long distance dispersal events. Evidences can be obtained from local fine scaled genetic structure using kinships and estimations of pollen dispersal distances as well as from large scale approaches of isolation-by-distance testing. Examples will be given from a submerged coastal seagrass relative and mangrove trees. Finally, thoughts will be given for discussion about recent methodological approaches and their perspectives.

Luísa G. Carvalho
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Direct and indirect effects of soil eutrophication on pollinators and pollination services

The intensified use of fertilizers in agriculture is one of the main causes of environmental eutrophication, potentially altering pollination services. Such effects might be caused by changes in flower-visitation patterns in the natural habitat patches that supports the crop pollinators, or by direct effects driven by crop floral resources changes. Our ongoing projects combines a synthesis work that evaluates how plant traits regulate flower visitation patterns under different soil nutrient levels, with field experiments in natural habitat and common bean agricultural fields involving different fertilization practices. Data on >2000 flower-visitation networks was gathered from >50 independent studies from 5 continents, covering a diverse range of soil nutrient conditions. This data is used to evaluate if plant functional traits related to nutrient usage (e.g. ability to establish relations with nitrogen fixing organisms) regulate the influence that a given plant has in the pattern of visitation of pollinators. For the field evaluations, we compare flower production, nectar properties and visitation patterns in 28 sites within agricultural fields with different levels of chemical fertilizer input. The results of this study will help predict the consequences of increased nutrient availability for the pollination of different plant species, and help improve management of pollination services for agricultural production.

Marc Kochzius
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Connectivity of coral reef populations

A fundamental question in marine ecology is the connectivity of populations: are they open or closed? Most marine animals of coastal habitats, e.g. coral reefs, are rather sedentary. Adults are strongly site attached and connectivity among populations can only be facilitated by pelagic early life history stages (eggs and/or larvae). In an open population the majority of the offspring will not recruit to the parental population, but will disperse and recruit to other populations. In the contrary, offspring of a closed population will mainly recruit to the parental population, which is also called self-recruitment. A major challenge in studying connectivity among marine populations is to track pelagic early life history stages in the ocean and to estimate the amount of self-recruitment. Population genetic analysis can reveal genetic connectivity on a population level at medium to large scales, while parentage analysis can trace individual offspring of a population at small scale to estimate self-recruitment. Since the open ocean does not show any obvious barriers for dispersal, it was generally assumed that marine populations are open. However, this picture has changed in the last 10 years and studies have shown restricted connectivity in many different coral reef taxa and a substantial amount of self-recruitment in coral reef fish. Connectivity of populations is a key element for resilience, which is the ability of ecosystems to absorb shocks, resist phase-shifts, and regenerate after disturbances. Therefore, the degree of connectivity among populations is crucial for re-colonisation and knowledge about connectivity is important for the management of marine protected areas. The presentation will give an overview of the research conducted in the Indo-Pacific by the marine biology laboratory at the VUB and will discuss how such studies can be implemented to study connectivity and genetic diversity of Brazilian coral reefs.

Márcio Zikán Cardoso

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Integrated approaches to the study of butterfly movement in fragmented habitats

The study of animal movement in fragmented habitats can help us understand and predict faunal responses in fragmented landscapes. Butterflies have been employed as models for study of dispersal and connectivity in fragmented landscapes in temperate regions but few studies have investigated movement in tropical settings. Fragmentation in tropical forests create patches of remnant forests surrounded by matrix of poor quality, selecting for very generalist and open habitat specialists. Most of the studies in tropical fragmentation have tried focused on assessing community responses and have evaluated factors such as fragment size and distance from surrounding patches. Few have sought to evaluate individual and population level responses. In my talk I will describe integrated approaches aimed at understanding simple but fundamental questions in butterfly biology with regards to individual as well as community responses. In order to do so, I will explore two empirical studies. The first evaluated the behavior of *Heliconius* butterflies when flying in matrix habitats and assessed habitat perception. The second study, using a guild of fruit feeding butterflies looked at rates of movement within and across neighboring but dissimilar habitats, using mark recapture data. Additionally, I will also present a conceptual and analytical model on the effect of changes in matrix quality on population diffusion and patch connectivity, using *Heliconius* as the focal species.

Rosane Garcia Collevatti

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Landscape genetics and genomics: the role of contemporary landscape and historical factors in shaping the genetic diversity in Neotropical plants

Patterns in genetic diversity distribution may be the outcome of demographical history and natural selection. However, anthropic disturbs are modifying the landscapes decreasing effective population sizes and genetic diversity. Our goal is to understand the interplay among demographical history, natural selection and contemporary landscape in shaping the genetic diversity distribution in Neotropical trees and palms using population genomics and genetics approaches. In this talk I will give an overview of our current projects and results using landscape genomics and genetics and show that selection may act in few generations modifying adaptative traits and that genetic diversity and differentiation may be differentially affected by historical and contemporary factors.

Tatiana Silva Leite

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The Cephalopod project in Brazil and in the world: advances and perspectives

Shallow-water octopuses are the most intelligent invertebrates and the major predators of mobile species in benthic marine communities. Despite their ecological importance, the diversity and ecology of cephalopods were poorly known in Brazil. The project Cephalopod initiated 15 years ago with a detailed taxonomic investigation on the distribution and abundance of cephalopods species on the coast of Brazil because of the intensification of fishery pressure on these taxa. Since then, research has been focused in understanding the biology, ecology and behavior of cephalopods, especially octopuses. The outcomes of this project have improved our knowledge on the ecology of cephalopods worldwide and have been used to manage fisheries in Brazil. I will present a synthesis of the main findings on the biology and ecology of octopus in Brazil and in collaboration with other countries researchers. I will focus the talk on the biological features, feeding and foraging behavior and defense strategies and show how these information have been applied in fisheries management strategies.