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Potential Dissertation Topics

Please note that the following project ideas are being provided only as a guide to the possible research topics which could be conducted with Frontier on a selection of our conservation and research projects. All the research projects proposed below will need to be discussed in detail with our scientists in the field and London HQ. Establishing whether a project is feasible will depend on a variety of factors; including the area of expertise of the current field staff, the conditions in the field, and possible logistical and financial limitations.

Some projects are more suitable for short undergraduate dissertations, while others are more complicated, require a longer commitment and are thus more appropriate for MSc or PhD research theses. However, please note that most projects require a minimum commitment of at least ten weeks in order to allow for the collection of enough data. When incorporating a dissertation or thesis please note that we offer the following discounts for students:

BSc 10%
MSc 20%
PhD 50%

If you are interested in any of the following ideas, please contact the Research and Development Department for more information (research@frontier.ac.uk). We are also happy to discuss any other project ideas generated by interested students.

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Tanzania Marine

- **After fifteen years of protection, how has the Mafia Island Marine Park influenced fish biodiversity and abundance?**

  The Mafia Island Marine Park is Africa's largest multi-user marine protected area. It was established in 1995 based on data collected by Frontier-Tanzania between 1989 and 1994. The chance to draw comparisons between current surveys and the historical data provides an almost unique opportunity to study the effects of long term marine protection on fish biodiversity and abundance. This comparison will allow assessing the long term effectiveness of marine protected areas in tropical waters not only for protecting - or even enhancing - fish biodiversity, but also to increase fishery yields for the local communities who depend upon the marine resources for their living.

- **A comparison between the benthic cover and invertebrate biodiversity today and in 1995 when the Marine Park was first created**

  Mafia Island Marine Park was established in 1995 based on data collected by Frontier between 1989 and 1994. It is Africa's first and largest multi-user marine protected area. The team's relocation inside the marine park will allow comparisons to be drawn between current surveys and the historical data. This is a rare opportunity to study the effects of long-term marine protection on the benthos and the associated invertebrate communities. A special focus will be assessment of which coral genera have benefited the most from the protection (if any). This comparison will allow assessment of the long term effectiveness of marine protected areas with regards to the benthos - especially corals - and the invertebrate communities.

- **Can low levels of fishing promote species diversity on coral reefs?**

  When fishing levels are low, larger fish are often preferentially extracted. This study will compare species diversity and abundance on reefs which experience different levels of fishing to examine whether low levels of fishing can promote the diversity of fish and/or coral species via the mechanism of predator release.

- **Sedimentation of fringing coral reef habitats: an assessment of causes and effects on biodiversity.**

  Tanzania's coral reefs are under increasing threat from terrestrial sediment inputs, mainly caused by extensive deforestation. Alongside water and surface sediment sampling, sediment traps to analyse sub-surface sediment could be placed in locations close to Frontier's regular underwater survey sites. Investigating the input history and spatial extent of terrestrial sediment would establish a historical baseline record of sedimentation. This data would increase understanding of the impacts of sedimentation on the health of nearby coral reefs, by correlating the sedimentation results with the underwater survey results such as the benthic cover. Ultimately, this study will help to determine the level of threat from increased sedimentation for the island's coral reefs.

- **An investigation of what motivates the choice of the 'cleaning stations' set up by the cleaning wrasse *Labroides dimidiatus* and which trophic groups are preferential users.**

  This species is the best known of cleaner fish found on coral reefs in the Indian Ocean. Cleaner fish feed by removing dead skin and parasites from the scales of other fish in a mutually beneficial relationship. They maintain 'cleaning stations', where other fish congregate and try to

attract the attention of the cleaner fish. While some research has been done on the relationship between cleaning wrasses and their clients, little is know about what makes a cleaning station a desirable site. It might be linked to the topography of the reef, benthic communities or reef fish assemblages. This knowledge is important as destructive fishing practices might change the shape and features of the reefs and thereby threaten the cleaning wrasse populations. In addition, it will be interesting to study if specific trophic groups are preferentially cleaned by the wrasse and the reasons behind this preference.

- **Monitoring coral reef recruitment through an investigation of the number of surviving recruits, with a specific focus on damaged reefs**

  Coral recruitment is an essential component of reef resilience, which can be defined as the ability of coral reefs to survive and recover from disturbances, such as dynamite fishing. This destructive fishing practice is still common on Mafia Island and threatens several coral reefs. Not only does it kill target fish and other non-target organisms such as corals, but it also physically damages the reef structure. The process and temporal scale of recovery from this damage is still largely unknown but it is likely to be influenced by the habitat structure and community type. It is therefore crucial to understand the characteristics of this process, in order to predict the coral reef composition of the future. This project aims to look at different habitats, comparing the different substrate types with the survival rates of new coral recruits. The survivorship, growth rate and the causes of coral mortality will be investigated with a specific focus on reefs which have been damaged by dynamite fishing.

- **A study of fiddler crab claw morphology: why do right clawed crabs appear to have a larger claw length in relation to their carapace than left clawed crabs?**

  Fiddler crabs are found in mangroves, salt marshes, and sandy beaches. *Uca chlorophthalmus* is one of six species of fiddler crab found in West Africa. Male fiddler crabs have one greatly enlarged major claw which can make up to 40% of their body mass. This enlarged claw is used both as a weapon in territorial fights and to attract females. If damaged, the minor claw of the crab has the capacity to then grow and replace the major claw, while the other one regenerates in a minor claw. A previous study carried out by Frontier showed that there was no bias towards left or right major claws. However, it seemed that right clawed crabs had a significantly larger claw length in relation to their carapace than left clawed crabs. This study will seek to verify this finding by collecting additional data and, if confirmed, test the hypothesis that a differential competitive advantage between right and left clawed crabs could explain this difference.

Other topics could include:

- A comparison of the number of fishers seen on a patch reef close to Mafia Island, with the abundance of target species on the same reef.
- Reef fish assemblage variation between separate patch reefs within Mafia Island Marine Park.
- Is there any correlation between the level of coral damage and reef fish assemblages, on a patch reef within Mafia Island Marine Park?

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Madagascar Forest

- **A rapid assessment of the herpetological fauna of important forest fragments in Northern Madagascar**

  The northern dry forests of Madagascar are exceedingly important for herpetiles, including a number of endangered chameleon species. Outside of protected areas, many of these species are restricted to ever-dwindling fragments of forest. Frontier is currently working within a network of forest fragments situated between Ankarana NP and Montagne d'Ambre NP, an area that has experienced continual high deforestation rates. It is imperative that these fragments are surveyed while conservation measures can still be implemented to identify which require the most urgent attention. Results will be used to help develop locally-agreed management and community forestry plans.

- **Habitat effects on the distribution and diversity of small mammal fauna in Northern Madagascar**

  Forest fragments in Northern Madagascar suffer differing levels of anthropogenic impacts including resource extraction (e.g. logging) and the introduction of non-native tree species. It is currently unknown which types, and what levels, of habitat degradation have the greatest effect on native small mammal distributions and abundances. Focusing on one particular disturbance type, this project would study how populations of small terrestrial mammals or bats are impacted by differing degrees of degradation.

- **Creation of a detailed map of potentially important forest fragments between two protected areas in Northern Madagascar, using GIS technology**

  Frontier Madagascar Forest camp lies between Montagne d'Ambre National Park to the North and Ankarana Special Reserve to the south. It is located in a secondary dry deciduous forest fragment which is exposed to important anthropological disturbances. The area around the camp is highly degraded and mainly consists of farm lands, deforested grasslands and several small fragments of forest. However, it is possibly of great ecological importance as the remaining forest fragments could be acting as a habitat corridor or refuge for wildlife between the two protected areas. By mapping wildlife habitats, land use and levels of habitat degradation, this project would contribute to our understanding of the importance of the remaining forest fragments for wildlife and provide essential geographic information to work towards their protection.

- **Avian diversity in dry deciduous forest fragments in Northern Madagascar and a comparison of species richness between forest edges and interior habitats**

  Previous studies of Frontier in Northern Madagascar have enabled the compilation of a species list of birds inhabiting the area and assessment of their abundance. This project aims to set up more systematic surveys in two different types of habitats: forest edges and interior habitats. This will allow a comparative study of species diversity and abundance between the two kinds of environments. With the dry deciduous forest of Northern Madagascar becoming increasingly fragmented, it is important to understand bird habitat preferences in order to predict what could be the effects of land clearing on different bird species, and which ones are likely to be the most affected. Management plans could then be put in place to try and protect the most vulnerable species.

- **The abundance of introduced small mammals compared to endemic species in habitats showing signs of anthropogenic disturbance**

  Introduced organisms are non-native species which have been brought into an area by humans either intentionally or accidentally. Many cases of introduced species having a damaging effect on the local ecosystems have been documented worldwide. In particular, introduced small mammals have been shown to sometimes lead native species to extinction. For instance in Australia, several native small mammal species have become extinct since Europeans introduced the cat, fox and rabbit to the country. One reason for the potential harm caused by the introduction of small mammals could be that they are better adapted to live alongside humans. Here we aim at a better understanding of the relationships of native and endemic species with human activities. This will lead to a better knowledge of the current threat caused by introduced mammals on Madagascar's many endemic species.

- **Distribution of Crowned Lemur (*Eulemur coronatus*) and Sanford's Brown Lemur (*Eulemur sanfordi*) in forest fragments of Northern Madagascar**

  Lemurs are a primitive family of primates which are endemic to Madagascar and became the symbol of the island. However, poaching is widespread and increasing in Montagne d'Ambre National Park, which is also threatened by bush fires and illegal logging. Crowned Lemurs - despite being relatively abundant in the dry deciduous forests of the northern tip of the island - are classified as 'vulnerable' by the IUCN, and Sanford's Brown Lemur are considered 'endangered' and among the rarest of the brown lemurs . Sanford's Brown Lemur is known to associate with the Crowned Lemur during the wet season when food is more abundant. Both species can be easily identified by their distinctive calls, which can help estimate group densities. The long term aim of this project is to define the distribution of these two species and how their ranges and group densities may vary between the dry and wet seasons.

- **Habitat preferences of different chameleon species in dry deciduous forest fragments south of Montagne d'Ambre National Park**

  Chameleons are a distinctive and highly specialized group of reptiles. They are distinguished by their prehensile feet and tail, their separately mobile and stereoscopic eyes and their long and rapidly extendible tongues. Chameleons typically inhabit a variety of tropical and mountain rainforest habitats. Some species are mostly arboreal and often found in trees, while others are found in smaller bushes, and some smaller species are known to live on the ground under foliage. This project aims to study the habitat preferences of the different chameleon species found in forest fragments south of Montagne d'Ambre National Park.

Other topics could include:

- Forest utilizations by local villagers to the south of Montagne d'Ambre National Park
- Vegetation surveys of disturbed forest fragments South of Montagne d'Ambre National Park

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Madagascar Marine

- **Holothurian abundance and harvesting in the Bay of Antsiranana, northern Madagascar**

  An increasing human population around the shores of the Bay of Antsiranana is leading to ever greater dependence on marine resources for subsistence and trade purposes. The bay provides an excellent opportunity to implement proactive conservation and sustainable development measures before natural resources become too severely depleted. One such possibility is to instigate holothurian (sea cucumber) farming programs, an approach which has previously been successful in other areas of Madagascar and SE Asia. This project will lay down the groundwork for the development of holothurian farming by assessing current population and utilisation levels within the bay.

- **A study of the abundance and distribution of sea urchins in Antsiranana Bay and an assessment of their potential ecological impact**

  Sea urchins are shallow-water echinoderms with soft bodies enclosed in a spherical spiny shell. They are important members of coral reef herbivorous populations and can heavily influence the reef composition. They can have a positive influence by grazing on algae therefore preventing the overgrowth of macroalgae. But if the populations are too large, their aggressive feeding behaviour can damage the coral and lead to the bioerosion of the reef. It is therefore important to collect data on sea urchin densities and species composition. This information will help assess their impact on the health of coral reef system. This study could also include a socioeconomic survey of the sea urchin fishery in the bay.

- **An assessment of the evolution of the fish and/or coral biodiversity levels in the Bay of Antsiranana over the last 5 years**

  The coral reefs of the Bay of Antsiranana, although still in relatively good condition, are under increasing anthropogenic pressure, including overfishing, pollution, increased sedimentation and tourism. Previous socio-economic surveys have shown that local fishermen are aware of a decline in fish abundance and size over the last decade. The Frontier-Madagascar Marine program started carrying out regular underwater biodiversity monitoring surveys in 2005. Thus project aims at establishing a comprehensive assessment of alterations in coral reef species composition on different parts of the reef. In addition, comparing fishery surveys would make it possible to estimate to what extent the biomass and biodiversity of catches in the bay has decreased. This combined study will help determine which areas of the reef are the most threatened and design effective management strategies such as the set up of new marine reserves in the area.

- **An evaluation of the composition and distribution of Nudibranch species in the Bay of Antsiranana**

  Nudibranchs are marine molluscs which belong to the Gastropod class. They have always been very popular with recreational divers due to their colourful appearances. However, knowledge about their biology and ecology is currently limited, and almost inexistent as far as the Bay of Antsiranana is concerned. They have, however, been previously recorded at Order level by the Frontier-Madagascar team. This project aims at establishing quantitative data on the distribution and substratum preferences of the species present, and investigating possible seasonal variations. This study would also allow for a comparison in nudibranchs diversity with the South West of the country (Anakao) where a similar survey has already been carried out by Frontier.

- **Quantifying the extent of coral bleaching in the Bay of Antsiranana and assessing the likely resilience capacity of different coral genera in the face of global warming**

  In the context of global climate change, there is a growing need to assess and monitor the effects of higher sea temperatures on coral reefs. Corals are indeed extremely sensitive to environmental changes and coral bleaching is the most widespread and significant threat to the world's coral reefs. It is therefore important to assess the extent of coral bleaching in the Bay of Antsiranana. Frontier already discovered a high level of coral bleaching within the bay using the Coral Watch method. It would be interesting to study in more detail and identify potentially resistant reefs which may become biodiversity hotspots in the future. Indeed, different species and morphologies of coral exhibit varying degrees of bleaching tolerance. Faster growing, branching species of coral such as Acropora tend to suffer higher bleaching mortalities than slower growing species with massive morphologies. In the long term this study aims to assist the development of effective management strategies for coral reefs in the face of global climate change.

- **Assessing the ecological importance of mangrove stands around the northern area of the Bay of Antsiranana.**

  Mangroves are trees and shrubs that grow in saline coastal habitats in tropical and subtropical regions. In Madagascar they cover vast areas along the coasts and support a very diverse fauna. Many species of animals use this habitat as nesting, roosting and feeding areas, including several species of threatened and endemic Madagascar waterbirds. They also constitute the habitat of many invertebrates such as crabs and shrimps. In addition, they are also an important source of income for the local population. A socio-economic study carried out by Frontier in 2008 showed that mangrove wood is used in building and occasionally as firewood. However, like in most of Madagascar, mangroves are being cut at an alarming rate in the Bay of Antsiranana. It is therefore important to improve our understanding of their ecological importance. This project aims at complementing the socio-economic study carried out in 2008 with biodiversity surveys of the mangroves in order to create a comprehensive management plan together with the local communities.

- **Testing and evaluating the success of various coral propagation methods with the aim of restoring the damaged reefs of the Antsiranana Bay**

  Coral propagation refers to the reproduction of coral and can be artificially achieved through a process called fragmentation. This method was initially designed by aquarium keepers as a cost effective way to have more corals, but is now used more widely, notably to restore damaged coral reefs. Last summer Frontier started carrying out trials of the different coral propagation methods which could be used in the bay to stimulate the propagation of both soft and hard corals (Acropora genus). It is now essential to drive this research project forward by carrying out a more systematic assessment of the efficiency of the different methods and subsequently initiate a coral propagation programme, which will then be constantly monitored.

Other topics could include:

- Sedimentation of fringing reef habitats: an assessment of causes and effects on biodiversity

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Fiji Marine

- **The distribution and mapping of mangroves around Beqa Island and an assessment of their importance for coastal protection in the face of climate change**

  Rising sea levels due to global warming will have a disproportionately large effect on island nations such as Fiji. Mangroves represent natural defences which could do much to mitigate the effects of rising tide lines. However, in many developing countries, mangroves are an important resource *per se* and have been extensively logged. This project will map the extent of mangrove stands around the coasts of Beqa providing information about their current status and recommendations for their continued management.

- **Morphological variations of the coral genus Acropora in relation to the physical characteristics of the reefs around Beqa island**

  Morphological variability is a widespread but poorly understood characteristic of many colonial animals. Corals of the genus Acropora are typically found in shallow reef environments with a high level of light and in relatively turbulent water. They also constitute the habitats of a great variety of reef fishes. Interestingly, depending on the species and location, corals of this genus can grow in different morphological shapes and colours. It can for instance be defined as branching, tabular, plating or encrusting and can vary in colour from blue/green to red/brown. Using transect surveys, this study aims at investigating the hypothesis that these variations are related to the physical characteristics of the reef such as its depth, light level, and water turbulence.

- **The holistic importance of Beqa Island seagrass beds in terms of resource use and conservation.**

  Seagrass beds are extremely valuable habitats, both ecologically and economically. Not only do they constitute important habitats for a diversity of organisms, but they also play an essential role in stabilizing bottom sediments, and act as natural barriers which reduce wave energy and filter coastal waters of nutrients, contaminants and sediments. Seagrass beds are also very important to the local community as they provide the basis of the productivity of many subsistence fisheries. However, because they are located at the interface of land and sea, they are under increasing anthropogenic threat, including sedimentation, eutrophication, human development, beach seine trawling and global climate change. Establishing systematic baseline seagrass surveys would allow assessment of the current status of the seagrass resources on the island and enable the monitoring of changes in their health over time. This would form the first important step in understanding and preserving these valuable habitats.

- **A comparison of fish abundance and diversity between the fringing reef and barrier reef of Beqa Island**

  Local populations in Beqa Island are reliant on coastal resources as a source for food and other products. However, decreasing marine resources is a common concern among Fiji's coastal communities. In general, fishing pressures are higher on the easily accessible fringing reefs in comparison to the barrier reefs. On its eastern coastline, Beqa Island presents a barrier reef relatively close to shore, whereas on the western side of the island it presents both a fringing reef and a long barrier reef situated several miles off shore. This project aims at providing a way of comparing the fish abundance, including those which are commercially important, and the biodiversity levels of the eastern fringing reefs, which have already been surveyed by the

Frontier team, with the western barrier reef. This project will contribute to the long term aim of safeguarding Beqa's coastal resources.

Please note that this project would only be possible if the set up of a satellite camp on the Eastern side of the island proves to be both financially and logistically feasible.

- **A study of the abundance, size and gender of Grey Reef sharks observed in the Nigali passage (Beqa Island)**

  Grey reef sharks are large predators that hunt either individually or more rarely in groups. They feed primarily on reef fishes but also cephalopods such as squids and octopus. During the day, they usually aggregate in groups of five to twenty individuals near coral reef drops, and then separate in the evening as they start hunting. Despite being perfectly adapted to their environment, grey reef shark populations have declined in many places throughout the world and are classified as Near Threatened on the IUCN Red List, partly because of the continuous degradation of coral reefs from human development. In the Nigali passage, which is a natural break in the outer barrier reef of Beqa, grey reef sharks are regularly observed. However, they are increasingly sighted with fish hooks, lines and training ropes, which suggest that they might be under threat in this area. The aim of the project is therefore to start a systematic monitoring programme of the populations observed in the Nigali passage in order to assess their current status and possibly make management recommendations.

  Please note that due to the relatively distant location of the Nigali reef, this project would only be feasible if additional funding is secured to cover extra fuel costs.

- **An investigation of the competition between macroalgae and coral in shallow reef areas and an assessment of the risk of coral - algal phase shifts (Beqa Island)**

  A phase shift occurs on a coral reef when the coral cover of a substrate is reduced in favour of macroalgal dominance and the reef resilience capacity decreases because of ecological processes and/or environmental factors. The phase shift is usually associated with a perturbation such as coral bleaching, storm damage or outbreaks of a coral-eating species. The new state is generally characterised by a combination of reduced herbivory and nutrient enrichment. The coral reefs of Beqa island, although still in relatively good condition, are currently threatened by a range of anthropological disturbances and coral bleaching has also been observed. This research project aims to investigate the current level of competition between macroalgae and coral in shallow reefs by means of underwater transects. This study will include an assessment of the benthic cover and of the importance of herbivorous species.

- **The influence of water determinands on the variations in fish biodiversity and abundance between reef sites around the island of Beqa**

  Although the reefs of the western coast of Beqa Island are still relatively unspoiled, underwater surveys carried out by the Frontier team have revealed a lower level of fish biodiversity and abundance in the vicinity of coastal villages, particularly Nawaikama. Determinands can be defined as the different physical characteristics of water such as salinity, temperature and dissolved oxygen levels. Some of these determinands have previously been recorded. These data provided some information on occasional thermoclines and haloclines. However, there is a need for a more systematic analysis of the effect of these determinands and to include records of the levels of suspended solids in the water. The analysis of these different determinands will allow a better understanding of their influence on the coral reefs.

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Costa Rica Forest

- **Do nest dimensions and camouflage level influence reproductive success in Olive Ridley turtles?**

  Due to their slow maturation, sea turtles are particularly threatened by a variety of anthropogenic factors such as beach development, longline fishing, egg poaching and pollution of the oceans. In addition, because they are cold blooded and have a temperature-dependent sex determination, climate change is now threatening their populations even further. It is therefore increasingly important to better understand which factors influence sea turtle reproductive success. This project aims at investigating whether there is a correlation between nest depth, width or level of camouflage and reproductive success in this species. In addition, sand temperature measurements will be taken in order to assess the long term effect of global warming on these populations.

- **Monitoring amphibian diversity and abundance in a Costa Rican primary forest**

  Amphibians are a diverse group and are amongst one of the most sensitive to climate change due to their use of small microhabitats and the porous nature of their skin. Declines have already been seen amongst amphibian groups due to reductions in pool sizes, shortened rain fall seasons and increased temperatures increasing disease transmission. Costa Rica has a particularly diverse amphibian fauna, but studies have already shown a decline in some populations. The primary forests where Frontier camp is situated have a range of leaf litter frog species. As these groups lay their eggs in leaf litter, increasing decomposition rates due to increasing temperature can eliminate their breeding habitat to the point that reproduction of an entire species can be threatened. This project aims at gathering amphibian population data by means of survey plots to determine the species composition across an altitudinal gradient. In the long term, the effects of rising temperatures on forest amphibians could be assessed.

- **Sampling ant communities present in primary forests of the Osa peninsula**

  Ants are social insects which belong to the order Hymenoptera, like wasps and bees. Ants diversified after the rise of flowering plants and are now found on all continents except Antarctica. They occupy a wide range of ecological niches and are able to exploit very diverse food resources, either as direct or indirect herbivores, predators and scavengers. They are also relatively easy to sample, making them ideal indicators of habitat quality based on the simple assumption that the more diverse the ant community, the more diverse the habitat. More specific conclusions with respect to habitat quality will possibly also be drawn based on specific indicator species. Bait plates can be placed in different habitats, at different times of day and baited with different baits to give better overview of the ant species present in the area. Generally, bigger and rarer ants will appear after longer periods of time, while more common small species can arrive at the bait minutes after placing. Different habitats will be compared to investigate differences in ant community composition and abundance. Bait types could also be compared for their effectiveness in attracting different species.

- **Avian diversity, abundance and distribution in primary forests of the Osa Peninsula**

  With over 850 recorded bird species, a tenth of the world's avian species are present in Costa Rica. Of those species, seven are endemic and 19 are globally threatened. Most of them are resident species and the remainder are migratory birds who fly in for the winter only. In

particular, some rare bird species which have completely disappeared in some other regions can still be found in some areas of Costa Rica. However, many species still face extinction due to deforestation. On the Osa Peninsula, some of the most frequently sighted birds include turkey vultures, the Scarlet Macaw and various hummingbird species. In order to gain a better knowledge of the birds present in the area, two complementary methods will be used: call counts recording and visual surveys. This study will also focus on determining the presence of endemic and endangered species in the region.

- **An investigation of Nephila spiders foraging behaviour and diet**

  Nephila spiders create impressive webs thanks to their striped legs specialized for weaving, and are sometimes referred to as writing spiders due to occasional zigzag patterns built into their webs. The webs of most Nephila spiders are complex, with a fine meshed sphere suspended in a network of non sticky barrier webs. As long as the orb web is not severely damaged, Nephila often rebuild only a portion of the web. This behaviour is distinct from other spiders that usually replace the entire orb web. In this project, we would like to investigate whether different habitats (forests, meadows, and river beds) and locations (heights of the webs, degree of exposure) influence the success of the spider in terms of the abundance and diversity of its preys; or if the amount of prey is only dependent on the size of the web.

- **Behavioural study of Hermit Crabs after losing their shells**

  Hermit crabs are crustaceans with soft abdomens which are protected from predators by a salvaged empty seashell carried on the crab's back into which the crab can retract. As the hermit crab grows in size, it abandons its old shell to find a larger one. Since suitable intact gastropod shells are sometimes in limited supply, there is often a fierce competition among hermit crabs for shells and hermit crabs are known to lose their shells to other crabs through fights. At this time the crabs are particularly vulnerable to attack, but it is yet unknown how this loss of shell affects the behaviour of land-based hermit crabs. The aim of the survey is to determine the immediate behaviour of hermit crabs upon losing their shells in a natural habitat. This study will be carried out by using manipulative techniques to run observational trials, during which the activity of the crabs will be recorded. The number and type of interactions each crab has with another crab (with and without a shell) will also be studied.

- **Bio-monitoring of streams and rivers using macro-invertebrates as indicators of water quality**

  Using macro-invertebrates to monitor the water quality of streams and rivers hold a number of advantages over chemical monitoring. Indeed, apart from being less costly, macro-invertebrates also give an indication of water quality over a longer period of time than chemical methods. In general, a high diversity among the macro-invertebrate community indicates a high water quality. In addition, specific taxonomic groups can be used as bio-indicators which are characteristic of certain habitat and water quality conditions. The aims of the survey are to i) collect macro-invertebrate samples from various sites of differing gradient, ii) identify macro-invertebrates and locate possible pollution zones, which will be indicated by the presence of pollution tolerant species and absence of pollution sensitive species, and iii) in the event of evidence of pollution, identify potential sources and make appropriate management recommendations.

Other topics could include:

- Butterfly biodiversity within a lowland Costa Rican region

- Testing the common local belief that howler monkey can act as weather forecasters