Osa peninsula, situated on the south west coast of Costa Rica, was the location chosen by our Frontier forest research team to conduct their studies. Adding to the datasets of previous research work, a range of animals continued to be surveyed this phase including primates, small mammals, turtles and amphibians. In addition, a new exciting butterfly and odonata project has been established. This new preliminary study aims to investigate the biodiversity and abundance of these invertebrates as umbrella species representing both aquatic and terrestrial assemblages.

For the first time, the team has captured exciting new photos of the river otter (Lontra longicaudis). Camera traps were set up along both the Piro and the Quebrada Coyunda rivers to investigate otter populations in the area. The team continued to track signs and collect scats to be combined with dietary analysis in the near future. These photos have provided useful information regarding identification of individual otters and determination of their ranges. Furthermore, it will act as a baseline to improve our understanding of these small mammals behaviour and help to monitor their activities in their natural habitat.

On the Turtle monitoring program, the team continued to go out for morning and night patrols along the Pejeperro and Piro beaches. Data collected was related to hatchling success, predation levels, location of the nesting site and health of individuals. The research results show that the most occupied beach was the Pejeperro, while the abundant species was the Pacific Green (Chelonia mydas agassizi). A conservation strategy will be established on upcoming phases to ensure eggs and nests are well protected from predation and poaching.

Overall, this phase continued to provide useful information on species biodiversity and abundance in the Osa Peninsula area. Data collected added to our long term monitoring program, providing comparative sets and information on a temporal scale.
Fiji Marine Frontier was invited onto the idyllic island of Gau by the Lomani Gau committee (guardians of the island) to help maintain their precious marine resources. We've been surveying the coral reefs, seagrass beds and mangrove forests since 2006.

Madagascar Forest Located on Nosy Be, Frontier is carrying out vital exploratory research, seeking out important forest fragments which may harbour populations of endangered lemurs, birds and chameleons, and instigating community forest programmes.

Madagascar Marine In beautiful Nosy Be, Madagascar Marine are surveying to assess the health of the local marine environment. Particularly important to our research are the relationships between coral reefs, mangroves and seagrass.

Tanzania Savannah It has been twenty three years since Frontier first started carrying out terrestrial research in Tanzania. Now located in the Kilombero Valley, an internationally important wetland, we monitor large mammal movements between the valley and nearby Selous National Park.

Tanzania Marine Having moved back to Mafia Island, which became a protected marine park in 1995 thanks to Frontier’s pioneering work, we are monitoring the effectiveness of the reserve, and have been asked by the government to carry out more survey work on currently unprotected coral reefs with the aim of extending the park.

Cambodia Forest Frontier is rightly proud of being the first organisation of our kind to be invited into Cambodia to carry out conservation research. Our studies in the dense forests of the Kulen-Promtep Wildlife Sanctuary are finding new species and formulating vital management strategies.

Costa Rica Rainforest This project combines crucial rainforest conservation with community initiatives to help understand the impact of climate change on the environment and its wildlife.

RECENT PUBLICATIONS


Cambodia currently has the world’s third fastest rate of deforestation. In the Oddar Meanchey Province where Frontiers Cambodia Forest Project (CBF) is located, there is a deforestation rate of 2.1% per year. Frontiers CBF is currently in its fifth phase working in the Kulen-Promtep Wildlife Sanctuary, an area no other NGO has surveyed before, allowing for exciting and unique discoveries contributing directly to Cambodian conservation.

Five specific projects took place during phase five: 1) Effects of human disturbance on small mammals and herpetofauna diversity and abundance were assessed. Overall species richness and diversity is relatively low in the area. This can be attributed to the amount of disturbance in the sanctuary. 2) Butterfly, bird and amphibian surveys were continued in order to build a species list for the area. A total of 84 bird species were observed, 51 of which were new to Frontiers research. 169 butterflies were identified, adding significantly to the confirmed species list of the area. 3) A local socio-economic survey of conservation attitudes was also carried out. Respondents were asked questions to gauge their awareness of the sanctuary and threats to conservation. Generally, attitudes were neutral or opposed to conservation. Alarmingly only 22.2% of respondents were aware that the forest is protected as a wildlife sanctuary. 4) Camera traps and track and scat surveys were implemented - Large mammals appear to have a relatively low abundance in the Kulen-Promtep Wildlife Sanctuary. Survey methods indicated that several vulnerable or endangered species are still found within the sanctuary. These species include the gaur (Bos gaurus), classified as ‘vulnerable’. A single gaur was captured by a camera trap at night, suggesting a shift to nocturnal behaviour in the area, a possible response to human disturbances. While no direct sightings were recorded, the endangered pileated gibbon (Hylobates pileatus) could be heard calling in the forest. Encouragingly, 48 images of the vulnerable Northern Pig Tailed Macaque (Macaca leonina) were also captured at different site locations around the sanctuary. Poor evidence of endangered and naturally rare species exists within the sanctuary.

Camera trapping is a rapidly expanding method, revolutionising our understanding into some of the world’s most elusive species. Photographic evidence of rarely encountered individuals is invaluable in the pursuit of an intimate insight into the lives, abundances and behaviour of globally endangered species.

Initially, the first reported camera traps were implemented as far back as the 1890’s through the use of trip wires and flash bulbs. Over 30 years later the world of science began utilising cameras to survey large animal species, but early attempts were often defective due to technological difficulties. Advancements in photographic technology have however substantially improved the dependability of camera traps as a method in research science. Infrared triggers have now been developed, and as a consequence an explosion of camera trapping in wildlife research has arisen.

Over the last decade an abundance of species thought to be on the edge of existence have been confirmed across the globe thanks to camera trapping techniques. This year, photos of the critically endangered Amur leopard were captured in Hunchun Amur Tiger National Nature Reserve, China. Remarkable footage has also provided an intimate look into the elusive cross river gorilla in Cameroon. Recent discoveries have also been made in North-East India in a park believed to be deserted by large mammals. Bengal tigers (Panthera tigris tigris), and Asian elephants (Elephas maximus) were astonishingly photographed within the forest, posing questions for the further protection of the area.

Frontier has also been part of this revolution, and camera traps have been an important instrument for wildlife research on a range of field projects. Projects in Cambodia, and Costa Rica, have benefited from camera devices to gain an understanding of large mammal biodiversity. In the past few research phases, Frontier research teams in Cambodia have captured exciting images of three vulnerable species: the sun bear (Ursus malayanus), the northern pig-tailed macaque (Macaca leonine), and gaur (Bos gaurus). One near threatened species has also been photographed – The Asian golden cat (Catopuma temminicki). The presence of these species is encouraging, and was only possible through camera technology. The impending threats on the forests however pose a great pressure on the survival of these creatures. The more exposure these animals gain the greater chance our research teams will have in the mission to protect these habitats.

The ongoing potential for camera traps is extensive and their future use in science is extremely valuable. New innovative ideas are driving camera trapping to new levels - from the canopies of trees to underwater marine worlds. Future possibilities may even permit the use of microscopic cameras to gain an insight into minute species. Photographic pioneers have achieved a method which not only captures magnificent pictures, but also provides a vital tool for conservationists in the quest to protect biodiversity in areas which are at threat.
Frontiers Marine Research Project on the island of Gau in Fiji (FJM) has recently relocated to a new site location at Muana. The new site is located in the District of Navukailagi and 3 reef areas are currently being surveyed. When comparing this current phase with previous survey sites in the Sawaieke District, it is clear that all three new sites in the Navukailagi District have yielded higher numbers of fish and invertebrates, greater levels of diversity, higher levels of hard coral cover and lower levels or algal cover, and therefore higher levels of extrapolated reef resilience.

During the latest project phase, FJM focused on establishing itself at the new Muana camp. New dive sites for training and surveying were explored, relations with the new host villages were established and work was resumed surveying the Navukailagi District after a break of four years. Crown-of-thorn starfish (Acanthaster planci) populations continue to increase on Gau Island, and the seriousness of the implications for coral reef health due to crown-of-thorn outbreaks should not be underestimated. Nine crown-of-thorn starfish were observed at one of the three new sites.

Butterflyfish (Chaetodontidae)

The butterflyfish are a group of conspicuous tropical marine fish of the family Chaetodontidae. These beautiful fish are much admired by divers, eco-tourists and scientists alike; however, for some species of butterflyfish, their strong dependency on certain species of coral has put them increasingly under threat as coral reef loss becomes an ever more urgent problem. Butterflyfish are found mostly on the reefs of the Atlantic, Indian and Pacific Oceans and there are approximately 120 species in 10 genera. Through-out the Info-Pacific, butterflyfish are an important component of reef monitoring programmes at national, regional and international levels. Due to their ease of identification, relative ease of censuring, broad geographic range, longevity and high degree of site attachment, the butterflyfish is an extremely apt research subject.

At Frontiers Marine Research Project in Fiji, the butterflyfish is one of the top most recorded fish species at the three different reef sites currently under observation. Studies show that butterflyfish assemblages may in fact be a good proxy of richness of an entire reef. On Gau Island, where Frontier’s Fiji Marine Research Project is based, populations of butterflyfish correlate well with reef health indicators, such as general fish abundance, richness and hard coral cover. Despite high amounts of butterflyfish recordings, populations seem to be starkly following decreases in live coral availability. This decline occurred following an outbreak of crown-of-thorns starfish (Acanthaster planci), which preys on corals by extruding its stomach onto the coral and releasing digestive enzymes that allow the starfish to absorb nutrients from liquefied coral tissue.

The coral A. hyacinthus is one of the only food sources of the Chevron butterflyfish (Chaetodon trifascialis) and it is highly vulnerable to crown-of-thorns starfish attacks. Once this species of coral disappears from a reef, the butterflyfish are not far behind. Outbreaks of crown-of-thorns starfish are thought to be triggered by humans releasing excess nutrients onto reefs as sediment, fertilizer or sewage or by removal of predators by subsistence fishery (as is the most likely case on Gau Island). As abundance and diversity of butterflyfish correlate well with hard coral cover, butterflyfish consequently appear to be a key indicator for reef health and resilience.
This phase the Tanzania Savannah team have been further contributing to the conservation of large mammal populations in the Kilombero Valley, Morogoro region. The area is located between Selous-Mikumi and the Udzungwas Mountains – two biodiversity hotspots. The Kilombero Valley is acknowledged as a prosperous expanse of forest land and therefore human encroachment for agriculture is ever increasing. Monitoring large mammal populations are thus essential for the future safeguarding of species.

The research team on Mafia Island continue to conduct monitoring of key commercial fish species and benthic composition in both protected and non-protected areas of Mafia Island Marine Park. Visually the reefs in the Core Zone appear to be extremely healthy, as reflected by the fish abundance surveys. Interestingly, data recorded for one ‘specified use’ site in particular indicates that percentages of branching, folioid, laminar, and columnar corals have decreased considerably compared to previous phases, while percentages of submassive corals have increased, thus still maintaining a healthy reef status. Surveys also show higher levels of invertebrates outside the protected areas of the bay, compared to those sites within.

Frontier’s Hippopotamus project continues to make progress. This project seeks to investigate the resident population of *Hippopotamus amphibius*, which remains relatively elusive; few scientific studies have been conducted on them, and population numbers are estimated at 20–40 individuals. The project increases its focus on informing the public through newly designed posters, which focus on both tourists and on the local community. Posters are produced both in English and Swahili, recognising the need to inform and encourage local tourists of the biodiversity on the island, and involve the local residents. Local villages have also been encouraged to become a part of the on-going hippo ecotourism work, which will hopefully raise necessary funds to protect crops that may otherwise be damaged by hippos.

During May, the Frontier Tanzania team completed their first successful awareness raising day on Mafia Island at the Utende Primary School. This fun and educating day was organised to make pupils and teachers more aware of marine creatures and the importance of research and conservation. The second awareness day was at Kitomondo Secondary School where a fantastic play was performed on whale sharks and many other fun activities.

Whale sharks on Mafia Island are popular with tourists, with several whale shark safari tours operating in the area. With the possibility that whale sharks around the island are under threat due to fisheries, tourist and boat interactions, studies commenced at the beginning of the year to obtain scientific data on the whale shark population through collaboration with whale shark tour operators and the District Council. This work has continued over the last phase, and workshops have begun in order to train all stakeholders in the surveying techniques required to acquire scientifically viable data. Additionally, meetings to establish a patrol boat which will serve to protect the whale sharks have taken place.
*Frontier - Madagascar Marine Research Programme*

Laura Burton, Biodiversity and Conservation Intern

Scuba diving is essential work for Frontier-Fiji. The Frontier Madagascar Marine team have been conducting further research on ocean reefs surrounding the island of Nosy Be, Madagascar. This phase has seen a continuation of vital baseline survey protocols (BSP), which have produced valuable knowledge on the diversity and abundance of fish and invertebrate species, as well as benthic composition of coral reefs. The island is a popular dive destination, however reef surveying and scientific investigation is notably lacking, and thus the team have endeavoured to fill this niche and are heavily contributing to the understanding of long term reef health.

This phase the team has been busy surveying five sites, within a 10nM radius of the Ambala Honko Frontier Research Centre. The five sites vary in size, composition and human disturbance intensities, however all reefs support a rich variety of marine life. Large regions of reef are at present relatively unexplored allowing the team potential scope for the future. Encouraging findings from the team indicate that reef health is positive. Among the 5 sites mean fish counts appeared relatively abundant, ranging between 1736 and 329. In general the species richness between reefs ranged on average from 32 to 21 species. The damselfish (Pomacentridae) was the most prevalent fish species, with the urchin (Diadema setosum), being the most predominant invertebrate. The survey findings are extremely important for the mapping and monitoring of these important coral reefs. The team were also able to successfully assess potential new dive sites close to Nosy Be, which will further help enhance future phases.

Research into two lizard species was also carried out in the hope of identifying what makes the Madagascar girdled lizard (Zonosaurus madagascariensis) a much more adaptable species than its near threatened relative the red-legged girdled lizard (Zonosaurus rufipes). Little differences could be identified but further work in this area offers great potential for the future.

The team has also been busy carrying out exciting research into the behaviour of lemurs, giving us an insight into the lives of these fascinating creatures. Assessment of the vocalisation calls of the vulnerable black lemur (Eulemur macaco) demonstrated habituation to human disturbance. Future investigations into vocalisation calls are an exciting prospect, and the potential for lemur playback calls made by the same groups or different groups of lemurs may provide further knowledge into the behaviour and structure of lemur populations.

Areas with varying levels of deforestation have enabled the team to compare species abundances across different forest coverings. Surveys undertaken by the MGF field team into herpetofauna diversity found 35 species. Site appeared to impact on species diversity; however the level of forest degradation impacted species differently. The team highlighted the potential benefits of forest regeneration for many herpetofaunal communities, however demonstrated that this alone is insufficient for the safeguarding of all species.

The wealth of biodiversity in the Madagascan forests are extremely unique due to the high numbers of endemic species within the region. This phase the MGF team have been further researching vertebrate communities on the island of Nosy Be, and attempting to gain clear insights into the impact of human disturbance on a range of organisms. The colonisation of the area by humans have impacted hugely on the biodiversity of the area, degradation and clearing of forests have consequently had detrimental impacts, and thus the team are conducting integral research.

Initial data was also gained on mangroves in the hope that MGM can expand future work into these ecosystems. Furthermore, the Madagascan field teams have been developing and maintaining positive links and relations with the local community, allowing for integration. Exploration for more reef sites is an exciting prospect for the future, along with the potential for permission to survey in the Nosy Tanikely Marine Reserve.
The Australian government has declared that they are to create the world’s largest network of marine parks to ensure the continued protection of ocean life. This announcement was timed to coincide with the imminent Rio+20 summit – as discussions commenced to discuss a variety of current environmental issues.

Australian Environment Minister, Tony Burke, who announced the proposal after years of planning and consultation, has informed the world that the project is about to bear fruit following one last consultation process. Following the creation of a marine park in the Coral Sea last year, the newly created parks will collectively cover 3.1 million sq. km of ocean whilst restrictions will be placed on fishing and oil and gas exploitation. The creation of 43 new reserves follows warnings issued by UNESCO which state that the Great Barrier Reef, one of 7 natural wonders of the world, was heading towards disaster.

Unprecedented exploitation of natural resources has led to a massive spike in shipping traffic and offshore industries which has had a severe knock on effect on reef health and biodiversity. This network of marine reserves will ensure that Australia’s diverse marine environment, and marine life, remain healthy, productive and resilient. Australia has effectively created a national parks marine estate.

The Wilderness Society called the announcement a first step, however further marine sanctuaries will need to be implemented. This is a sentiment echoed by other environmental groups who are calling for stricter sanctions and a complete ban on commercial fishing in the Coral Sea. However, as is common in such situations, local fishermen are at odds with the environmentalists. They claim that coastal communities would be ruined, thousands of jobs lost and the aquaculture industry seriously impacted. The hundred million dollars offered in compensation by the Australian government will do little to appease their concerns. Some have suggested that these impacts will be devastating. It has been argued however that the design of reserves will minimise the impacts wherever possible.

It is proposed that these reserves will displace around 1-2 percent of the annual wild catch fishery value production in Australia. At present, the world’s largest marine reserve was established around the Chagos Islands and covers 545,000-sq-km area.
DISSERTATION TOPICS

Frontier works in many locations on many research topics, from fish surveys on Tanzanian reefs to tracking sun bears in Cambodia. As a result of this diversity of work, we are able to offer an almost endless list of dissertation projects. This variety means that although our principal dissertation topics are listed below, we are more than happy to discuss new ideas. We also feel that it is important to discuss and develop the project to suit the individual carrying out the research.

The data requirements of a dissertation are such that the majority of projects will require a minimum ten week participation. Dissertation students are also eligible for the following discounts (subject to conditions):
- BSc 10%
- MSc 20%
- PhD 50%

Cambodia Forest

- What is the potential for resin trees to produce sustainable incomes for local communities?
- Determine the economic value of timber in the forests and examine the potential conservation implications.
- To what degree are non-timber forest products used to supplement income by local people?
- How does human disturbance relate to large mammal abundance?
- Using faecal samples describe the diet of large mammals of the area and investigate whether seeds that have been ingested remain capable of germination.

Costa Rica Forest

- Leaf cutter ant ecology – determine foraging distance, tree selection/leaf preference, overall biomass and scent marking efficiency (which would include some lab work)
- Behavioural study of army ants including troop dynamics, relationship with weather and food competition
- Turtles – the variation of temperature at different sand depths. What are the factors that determine sand temperature and what effect will that have upon the sex of turtle eggs laid in different locations?
- Using turtle nests that are relocated due to bad placement identify the variation in the weight and size of eggs and explore the implications.

Madagascar Forest and Marine

- Lemurs: studies in abundance, habitat preference, diet, social structure.
- Small mammals, amphibians and reptiles: seasonality, abundance and diversity in relation to habitat type and reaction to human disturbance.
- Examine the interplay between local attitudes to natural resource use and conservation goals.
- Examine fishing methods and compare catch for subsistence, artisanal and commercial fisheries.
- Using the example of local fisheries discuss the interplay between local attitude and conservation goals.
- Fish food webs, what is the makeup of the community with respect to diet?
- What fish species use the mangroves as nurseries and in what densities?

Tanzania Savannah and Marine

- The value of marine protected versus unprotected areas to the ecotourism and fishing industry.
- Study the effect of varying soil characteristics such as pH, nutrition level and salinity on plant species.
- Investigate the diet of large mammals, the presence of viable seeds in dung (and thus their potential role in seed dispersal), and estimations of their abundance and species makeup.
- Investigate the importance and role of natural resources – what economic value to natural resources represent?

Fiji Marine

- Assess locally managed marine reserves and the spill over effect in maintaining local fisheries.
- Assess the population ecology of commercially important holothurians.
- What are the effects of anthropogenic activity and surface run-off on the ecology of coral reefs?
- Compare the abundance of damaged or bleached coral to living coral.
- Identify abundance of coral eating fish in relation to coral – what is their overall feeding rate?

If you are interested in conducting research alongside our field scientists then the first step is to contact our research department at research@frontier.ac.uk or phone our London office on +44 (0) 207 613 2422. We can then discuss your interests, what is applicable to your course and what will best contribute to your future career. Armed with this information you can then work with both us and your university supervisor to develop your project. Once you have a clear project idea then it is time to fill out a project proposal form and send it in. All that is left after that is to go and do the research!
Fiji marine Conservation & Diving - The Fijian archipelago lies scattered lazily in the achingly blue waters of the Pacific Ocean, bathed in the radiant South Pacific sunlight. Join our team of volunteer divers and marine scientists and dive alongside dolphins, sharks, manta rays and turtles.

Madagascar marine Conservation & Diving - Visit the home of some of the world’s most spectacular and least explored dive sites.

Madagascar Wildlife Conservation Adventure - Explore some of the world’s most spectacular and least explored wildlife and wilderness as you camp and trek on the extraordinary island of Madagascar.

Cambodia Tropical Forest Conservation & Adventure Project - Explore Cambodia’s uncharted and pristine tropical rainforests and discover a host of exciting wildlife while living as an intrepid explorer in the jungles of Cambodia.

Tanzania marine Conservation & Diving - Dive with your fellow volunteers and conserve pristine coral reefs in the turquoise waters of the Indian Ocean surrounded by turtles, rays and whale sharks.

Tanzania African Wildlife Conservation Adventure - Track and monitor threatened wildlife communities in the open savannas and wooded wildlife corridors in the heart of Tanzania.


**OVERSEAS:**

**TANZANIA:**
Assistant Research Officer (terrestrial and marine)

**MADAGASCAR:**
Assistant Research Officer (terrestrial and marine)

**COSTA RICA:**
Assistant Research Officer (terrestrial)

**FIJI:**
Assistant Research Officer (marine)

**CAMBODIA:**
Assistant Research Officer (terrestrial)

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If you would like the opportunity to join the Frontier team and apply for one of these positions, please email your CV with covering letter explaining your suitability for the role: **staff@frontier.ac.uk**

Further details on Frontier and all the available positions can be found on **www.frontier.ac.uk**