

[2011/12]



Operation  
Wallacea

Conservation research through academic partnerships

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Lennkh, Dan Locke-Wheaton, Dr Peter Long, Gerhard Lorist, Andrew Macbeth, Fred Manata, Eduardo Marabuto, Javier Marin, Sinead Marley, Dr Duncan May, Niall McCann, Dr Steve McMellor, Dr Kathy Meakin, Andy Milne, Dedy Muldiana, Ferdie Muller, Tom Mullier, Dan Newman, Paul Nicklen, Klaus Nigge, Dr Joe Nunez-Mino, Paul O'Callaghan, Thomas Peschak, Dr Rob Pickles, Tania Pinero, Dr Roger Poland, Adam Powell, Dr Nancy Priston, Dan Pupius, Marc Rabenandrasana, Dr Bob Reed, Ernesto Reyes, Joel Rice, Joe Riss, James Rosindell, Dr Steve Rossiter, Sonia Rowley, Pelayo Salinas de Leon, Dr James Saunders, Kevin Schafer, Caroline Schiess, Johan Scholtz, Florian Schultz, Simon Segar, Brian Skerry, Dr David Slater, Dr Kathy Slater, Dr Dave Smith, Laura Smith, Andrew Snyder, Dr Martin Speight, Robin Springett, Dr Dave Suggett, Helen Taylor, Dr Raquel Thomas, Hannah Thomas, Roy Toft, Alex Tozer, Nienke van Etten, Pearl Vas, Dr Ben Vivian, Nicole Wakeford, Dr Graham Watkins, Michele Westmorland, Geoff Whiles, Dr Roy Wiles, Dr Olwen Williams, Dr Keith Wilmott, Karim Zalut, Calina Zepeda, Christian Ziegler, Heike Zitzer





## WHAT IS OPERATION WALLACEA?

Operation Wallacea is an organisation funded by tuition fees that runs a series of biological and conservation management research programmes that operate in remote locations across the world. These expeditions are designed with specific wildlife conservation aims in mind - from identifying areas needing protection, through to implementing and assessing conservation management programmes. What is different about Operation Wallacea is that large teams of university academics who are specialists in various aspects of biodiversity or social and economic studies are concentrated at the target study sites giving volunteers the opportunity of working on a range of projects. The surveys result in a large number of publications in peer-reviewed journals each year, have resulted in 30 vertebrate species new to science being discovered, 4 'extinct' species being re-discovered and \$2 million levered from funding agencies to set up best practice management examples at the study sites. These large survey teams of academics and volunteers that are funded independently of normal academic sources have enabled large temporal and spatial biodiversity and socio-economic data sets to be produced, and provide information to help with organising effective conservation management programmes.

In 2011, the expeditions are operating in 10 countries: Indonesia, Honduras, Egypt, Cuba, South Africa, Mozambique, Peru, Madagascar, Guyana, Mexico and new for 2012, Guatemala. In each country, a long-term agreement is signed with a partner organisation (e.g. Honduran Coral Reef Foundation in Honduras, Fund Amazonia in Peru, Wildlife Ecological Investments in South Africa, National Science Foundation in Egypt) and over the course of this agreement it is hoped to achieve a survey and management development programme at each of the sites. Occasionally, a competent local partner organisation is not available. In these cases, Operation Wallacea mentors the formation of a new NGO

formed from local staff who have provided successful input to the expedition surveys (e.g. Lawane Ecotone for the Indonesian forest, Lembaga Alam for the Indonesia marine sites and Expediciones y Servicios Ambientales de Cusuco for the cloud forest site in Honduras).

## GLOBAL RESEARCH AND CONSERVATION MANAGEMENT STRATEGY

The vast majority of science programmes that deliver key research outcomes are characterised by short term funding with restricted aims and bio-geographical ranges. Long-term projects covering large bio-geographical scales and that incorporate more than one ecosystem are rare. The Operation Wallacea programme provides the opportunity to consider science and conservation of key ecosystems from a global perspective. Operation Wallacea is able to draw upon researchers from a wide range of different disciplines and academic institutions to address major issues related to the sustainable management and conservation of some of the world's most diverse but threatened environments.

A global research and conservation strategy has been developed and is applied in 4 stages at each of the sites. This includes an initial assessment of the biological value of the site (stage 1). If the site is accepted into the Opwall programme, an ecosystem monitoring programme is established to determine the direction of change (stage 2). If this reveals a continuing decline, a programme for monitoring socio-economic change in adjacent communities is established to determine how these communities interact with the study site (stage 3). Once these stage 2 and stage 3 data are obtained, funding applications are submitted to establish a best practice example of conservation management and the success of these programmes are then monitored (stage 4). There is obviously





some considerable overlap between these stages. Stage 1 projects can still be running in addition to a stage 4 programme in order to add data to understanding the ecosystem requirements of target species or adding to the overall species lists for previously un-worked taxa.

#### STAGE 1: ASSESSING ECOSYSTEM DIVERSITY AND FUNCTION

The first stage at a new site is to determine the relative biodiversity value of the site to determine whether it is worthy of protection or, if it is already protected, whether it will make a valuable long term study site for the Operation Wallacea research teams. In order to assess the importance of a site, taxonomic groups about which data have been obtained from similar habitats elsewhere in the region are studied, so the relative value of the studied site can be set in context. Examples of this type of survey include the atlas distributional surveys in the St Katherine Protectorate in Egypt and the coral reef surveys in Cuba and Mozambique. However, even after determination of the relative value of a site, additional data on other taxonomic groups are added as different specialists opportunistically join the programmes. Examples of this type of survey include the continuing woody plant surveys of the Cusuco cloud forest National Park in Honduras, the crustacean surveys of the cenotes in Mexico and bird surveys of the Pacaya Samiria National Reserve in Peru, etc. These data add to the species diversity knowledge of the site, but understanding the ecosystem requirements of key species is an equally important element of study. Examples of this type of study are the habitat and behaviour studies of primates such as macaques in Indonesia, and Mantled Howler monkeys in Honduras, various resource partitioning studies of coral reef fish and the causation of patch reef diversity in the Wakatobi Marine National Park in Indonesia. Understanding the connectivity of various ecosystems is another part of this research

theme and is best exemplified by studies of the use of mangrove, seagrass and coral reef habitats by various fish species in the Caribbean and Indo-Pacific.

#### STAGE 2: MONITORING ECOSYSTEM CHANGE

Once a site has been identified as worthy of inclusion as a long term study area for the Operation Wallacea research teams, a monitoring programme for the study site is established so changes in the ecosystems can be assessed. Examples of these studies include the large scale forest structure and faunal studies in the Lambusango forest in Indonesia, the Iwokrama and Surama forests in Guyana and the Cusuco National Park in Honduras as well as the annual surveys of coral, invertebrates and fish on a range of transects in the Wakatobi Marine National Park, Indonesia, Utila, Rio Esteban and Cayos Cochinos Islands in Honduras and Punta Frances MPA in Cuba. These surveys often lead to more detailed studies of aspects of the ecosystem where there appears to be an anthropogenic impact. Examples of these studies include monitoring of artisanal fisheries in the Wakatobi Marine National Park, Indonesia; stable isotope surveys to determine sources of water quality impacts on the reefs of Utila and Cayos Cochinos Islands in Honduras, levels of hunting pressure on large mammals, caiman and river turtles in the Pacaya Samiria Reserve in the Amazon, Peru, etc. Monitoring population levels of keystone species in the ecosystems is also an important element of these monitoring programmes and examples of these studies include the Baird's Tapir surveys in the Cusuco National Park in Honduras, turtle surveys in the Punta Frances Reserve in Cuba and the primate, macaw and dolphin population studies in the Amazon, Peru.

#### STAGE 3: MONITORING SOCIO-ECONOMIC CHANGE

Conservation of the sites included in the Operation Wallacea programme needs the co-operation of adjacent communities and





data on how these communities interact with the study sites. An example of this type of study includes the surveys of landownership and usage in the buffer zone of the Cusuco National Park. Stage 3 studies are launched once the decision has been made that there are sufficient biological data and knowledge about the ecosystems to complete a detailed funding application to support the establishment of a best practice example of conservation management in the study area.

#### STAGE 4: ESTABLISHING AND MONITORING THE EFFECTIVENESS OF CONSERVATION MANAGEMENT PROGRAMMES

The final stage is when international funding is received to establish a best practice conservation management programme. This is directed through the Operation Wallacea Trust (charity number 1078362), which oversees the disbursement of the funds to various in country organisations to implement the management programme. The Operation Wallacea survey programme continues with the biodiversity and socio-economic performance monitoring programme established in stages 2 and 3. Volunteers on this project then have the opportunity to work alongside staff from other international and national organisations involved in the management programme implementation. The Lambusango and Kaledupa survey programmes in Indonesia fall into his category, as does the monitoring programme in the rainforests of the Peruvian Amazon. These surveys also examine the effectiveness of existing conservation management programmes such as the studies being completed in the KwaZulu Natal, Pongola and Welgevonden sites in South Africa.

#### OPTIONS FOR UNIVERSITY STUDENTS

If you are in or have completed university level education and have a good level of English you can join the expeditions in one of two ways:

##### RESEARCH ASSISTANT

Joining as a Research Assistant enables you to individualise your itinerary by choosing to spend a week each on a range of different terrestrial or marine research projects as well as joining relevant training courses. Relatively few people have field experience working alongside real research projects and the Operation Wallacea research programme offers the opportunity to work with a range of academic teams to strengthen your CV (resume) or to help you decide whether tropical field work is of interest for your career. Research Assistants are involved in a wide range of tasks on each research topic and help to gather primary data. In addition, if you are at a North American University you can gain credits towards your degree course by registering your expedition itinerary with St Andrews University in Scotland and if you are at a University outside of North America you can gain credits towards your degree by registering your expedition itinerary with Imperial College London. It is also possible that your own university will award credit for joining as a Research Assistant. Some universities will award their own credit for joining the programme as independent study whilst at others you can register your time as a Research Assistant as an Internship and gain credit that way. You don't have to register for credit though – many students join the expeditions just for the unforgettable international experience in beautiful parts of the World.

##### DISSERTATION OR THESIS STUDENTS

A number of university students use the research programmes as a way of collecting data for their Final Honours year dissertation or Senior Thesis. If you are going as a dissertation/thesis student, you





need to check the full list of topics available in this brochure (all projects numbered 200+). Note that these topic areas are those for which we have academic expertise on site and give an indication of the types of question that could be asked. Once you have an idea of the topic area that interests you the most, you must discuss your proposed research with your University supervisor and gain his/her approval before going ahead with doing your dissertation or thesis. Students from a wide range of UK Universities (Oxford, Cambridge, Nottingham, Sheffield, Aberdeen, Plymouth, etc.) have received Firsts for their dissertations with Operation Wallacea, and indeed more than 80% of dissertation and thesis volunteers achieve either of the two highest grades for their field projects. The reasons for the success are many, including the intrinsic interest of Opwall's study sites, the inspiration most students get from working with enthusiastic scientists in amazing places and the facilities put in place to enable high-quality research. The most successful students are those who prepare well, plan their survey and data gathering thoroughly, and who part complete much of their data analysis and dissertation drafting before leaving.

### **GAINING COURSE CREDIT AS A RESEARCH ASSISTANT**

Some students want to gain course credit for their time on expedition although many students decide simply to go for the experience and to strengthen their resume (CV). If you do want credit though there are two ways of organising it – signing up for an external course or gaining internal course credit.

#### **EXTERNAL COURSE CREDIT**

If you are from a North American University and are going for 4 weeks to the Indonesia, Honduras, South Africa or Peru expeditions,

all options can be used for credit except dive training by signing up for BL3400 Tropical Research and Field Study Module with St Andrews University in Scotland (cost £600). St Andrews will award 20 course credits for the 4 weeks (equivalent of 3 - 4 credits at US universities) and you will receive a graded transcript that can be used towards your GPA.

If you are at a European or Asian University, expeditions to the Indonesia, Honduras, South Africa or Peru research sites with a minimum of 4 weeks of credit bearing options can be taken as a BIOL 2.16 Tropical Field Research Module. Imperial College will award 7.5 European Credit Transfer Scheme (ECTS) credits for the 4 weeks (cost £600) and a graded transcript will be forwarded to your department for inclusion in your overall degree.

For those going on the Egypt expeditions, Nottingham University has organised course credit for those participating in 4 weeks of the mountain desert surveys (£600). Note the Guyana, Cuba and Madagascar research programmes are being submitted to these universities for approval as part of their course credit scheme and may be approved in time for the 2011 season.

In all cases, the credit system works by completion of an approved training course, completion of three weeks of research assistant projects or additional training and submission of a research proposal.

#### **REQUIRED TRAINING COURSES**

This will usually be the first week of the expedition and comprise a week-long course offering training in the specific environment in which you have chosen to do your expedition. Required training courses available are Jungle Training and Neo-tropical Forest Ecology and Caribbean Reef Ecology courses in Honduras, Bush Training and Savannah Ecology in South Africa, Jungle Training and





Wallacea Wildlife and Indo-Pacific Reef Ecology in Indonesia and Amazonia Ecology and Wildlife Conservation in Peru. Course Manuals are available to download that explain the course structure, lectures, practicals and learning outcomes. Twenty percent of the overall marks come from the exam at the end of these courses. Note for the Egypt option, part of the training course is run before the data collection and part after the data collection.

### RESEARCH PROJECTS AND ADDITIONAL TRAINING COURSE

After the required training course, you have to complete 3 weeks of research projects. These can be different projects each week or they can be multiple weeks on the same project. There are also some additional training courses (e.g. DNA analysis option in Honduras and Indonesia, Cultural Experiences in Honduras and Indonesia) and these also count as alternatives to one of the research project weeks. Note however, that dive training does not count as a training course since it is just a skills-based module. Thus if you include dive training on your schedule, you will need to go for 6 weeks so you have time to complete the required training course and the 3 weeks of research or additional courses. This aspect of the course is assessed by the student completing a field diary (20%) and from assessments of performance in the field by each of the leaders of the various research projects or additional training courses (10%).

### RESEARCH PROPOSAL

You will need to submit a 1500 word Research Proposal based on one of the titles from a list provided by the University. The Proposal will require prior reading before going out on site but you are then expected to incorporate first hand field experience into the final essay which needs to be completed within 2 weeks of the expedition end and then submitted to the relevant university. This is worth 50% of the marks awarded.

### BOOKING EXTERNAL COURSE CREDIT

To enrol for credit for BL3400 Tropical Research and Field Study Module with St Andrews, you would just book onto the Opwall expeditions in the normal way and pay your 10% deposit. You then need to arrange a meeting with your Study Abroad Office to discuss what you would like to do and if they have any queries over how the St Andrews course credit applies, email [standrewscredit@opwall.com](mailto:standrewscredit@opwall.com) for clarification so that the credit arrangements for your participation can be put in position. Equally if your academic advisors or Study Abroad departments have questions about the program, please pass on this email address to them and ask them to contact us. Then in January 2011, you will be invoiced for your second 10% deposit by Operation Wallacea. Once this is paid, we pass your contact details through to St Andrews and they will email you a student code for their enrolment website. You then enrol on the St Andrews website and pay the £600 registration fee. This gives you access to the St Andrews electronic library and reading lists to help you prepare for the module as well as the lectures and notes.

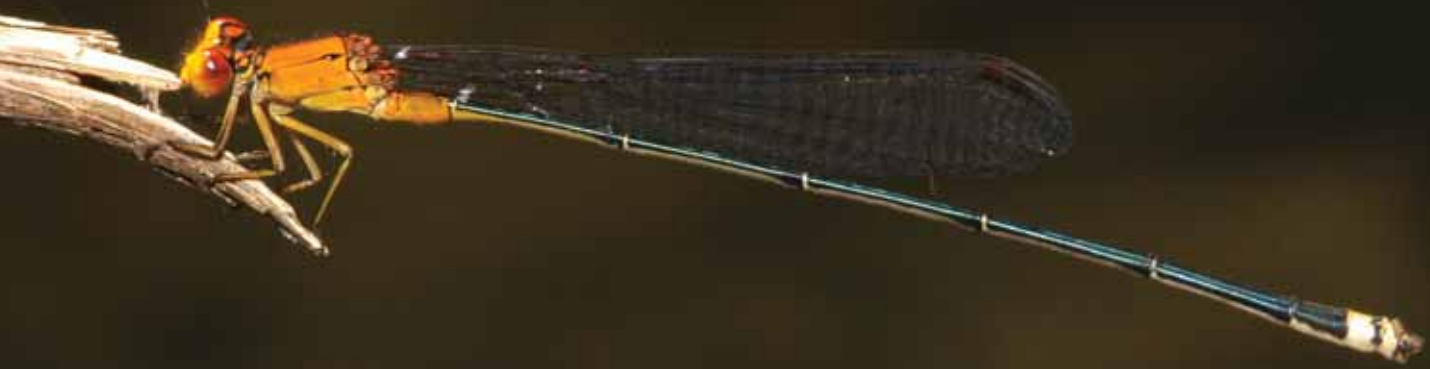
To enrol for credit with Imperial College London for BIOL 2.16 Tropical Field Research Module you follow exactly the same procedure but email [imperialcredit@opwall.com](mailto:imperialcredit@opwall.com). Likewise, with credit from Nottingham University for the Egyptian expeditions, you follow the same procedure but email [nottinghamcredit@opwall.com](mailto:nottinghamcredit@opwall.com).

### INTERNAL COURSE CREDIT

It is sometimes possible to use an Operation Wallacea expedition to gain credits from your own university. This is often done through an independent study or internship program. The amount of credit available will vary depending upon which university you are at and the duration of your expedition. Your university will often require a piece







of work based on your experience to go towards your Independent Studies or Internship; again these vary between institutes but may be in the form of a presentation or short written report.

To organise gaining credit in this way you will have to speak to your academic advisors and often your Study Abroad departments to find out what they can offer. They will usually have forms for you to complete before coming out with us which will need certain details about the expeditions before you can gain the credit. This might be details of time allocation or academic supervision during the expedition, all of which we can happily supply to you if needed. Please note that your university will still charge you the normal fees for their credit on top of the expedition fees you will need to pay.

If you have any questions about gaining credit from your university please email [independentcredit@opwall.com](mailto:independentcredit@opwall.com). Equally if your academic advisors or Study Abroad departments have questions about the programme, please pass on this email address to them and ask them to contact us. It is very important that if you are gaining credit in this way for an expedition you email us in advance so we know you are gaining credits, even if you have no special on site requirements. This will make the awarding of credits much easier and ensure that any provisions you need on site are prepared in advance. If you fail to tell us about any credit you are gaining before an expedition we cannot take any responsibility for problems that may occur on site or when you return to your university.

## HOW TO PREPARE AND COMPLETE A DISSERTATION OR THESIS

### HOW DO I PREPARE WELL BEFORE COMING OUT TO THE SITE?

Once you have selected your preferred topic and booked on to the expedition, you need to go to the Operation Wallacea website ([www.opwall.com](http://www.opwall.com)) and download the suggested reading for that topic. After reading these papers, you need to send a draft project proposal by 1 February 2011 to our Senior Dissertation Advisor ([dissertations@opwall.com](mailto:dissertations@opwall.com)) that contains the following sections:

- a project title
- rationale for the project based on the literature review
- proposed methodology that will be followed
- how the data, if gathered using the proposed methodology, will be analysed
- equipment requirements

At this stage, you also need to talk to your university tutor/advisor to identify who your internal university supervisor for the research project will be. You will then be sent a dissertation assessment form that will need to be signed by your university supervisor. Once we have received this form and the draft research proposal, the Senior Dissertation Advisor and the academic who will be providing your specialist supervision in the field will contact you with comments on the draft and the practicalities of completing the proposed research. Once you have these comments, you can submit the final research proposal to the Opwall Senior Dissertation Advisor, your Opwall field supervisor and your internal university supervisor. This has to be completed before 1 April 2011, otherwise Operation Wallacea has the





right to refuse you the opportunity to complete a dissertation or thesis on site. Having agreed your project plan, you will need to complete a risk assessment for the project. Risk assessments for all generic activities carried out by Operation Wallacea can be obtained from the Opwall website ([www.opwall.com](http://www.opwall.com)) so that you can complete this task for your specific project. Note that this risk assessment should also be submitted to your university before departing for the project.

### HOW WILL I BE SUPERVISED IN THE FIELD?

Once you are on site, an experienced Senior Scientist will be introduced to you. You will meet with your specialist field supervisor as well as the Senior Scientist to discuss your proposed project plan in detail. You will then be asked to draft a timetable for the implementation of the project plan which ensures that data are gathered, any necessary interviews scheduled, background information collected and spare time built into the timetable to allow for problems. During your field work, you will be supervised on a daily basis by your specialist project supervisor, but will also have to report on progress regularly to the Senior Scientist.

### WHAT WILL I BE EXPECTED TO DO ON SITE?

Ensure that you give completion of your dissertation or thesis the highest priority. You will be staying in some of the most beautiful reefs and/or forests in the world and it is important that you don't get distracted. It is best to work hard early on in your stay, complete your research and then if there is spare time at the end, relax. As a minimum, you will need to spend 4 weeks working on your thesis/dissertation topic if it is for an Honours project or 6 weeks if it is for a Masters. Since skills and safety training inevitably takes 1–2 weeks, you will need to stay for 6 weeks for an undergraduate dissertation or thesis, although 8 weeks would be better and is essential for a Masters project. Enter data, analyse results and start drafting sections of your dissertation during your stay. Usually when

you start writing you realise that there is additional information that you need to collect and it is typically not possible to gather this information once you have left site. You will be asked to give a short oral seminar to other students and staff about your research at the end of your stay, and to write a short report. These are very useful parts of the experience, because of both the scientific feedback obtained and the experience of doing them.

### WHAT WILL I BE EXPECTED TO DO WHEN I RETURN TO UNIVERSITY?

Finish writing up your dissertation or thesis as soon as you can. If you leave it for a few months, it is often very difficult to get back into the detail of the project. You must send a hard copy of your dissertation and a copy on disc to Operation Wallacea. The hard copy is photocopied and forwarded to various in-country organisations who are interested in the results of the work in their countries. The disc version is used to publish your report on the Operation Wallacea website. Remember that you are part of a wider project and your results are needed! Please also let the Operation Wallacea office know the marks you get for your dissertation.

### MEDICAL ELECTIVE SCHEME

Operation Wallacea runs a medical elective programme, offering medical students a chance to experience real life, hands on expedition medicine. If you have at least 3 years of clinical experience and are able to take your elective during the period June-August, then you can make an application to join the expedition under this scheme. Applications need to include a curriculum vitae and dates of proposed visit and must be received by **1 March 2011** with successful applicants being informed by **15 March 2011**. In order to find out how to undertake your elective with Operation Wallacea, and





to request an information pack, please contact the Opwall Medical Elective Co-ordinator on [medicalelectives@opwall.com](mailto:medicalelectives@opwall.com). We are currently offering the medical elective scheme in Honduras.

As a medical elective student, you are given training in dive medicine, medical planning for expeditions, tropical infections, envenomation procedures, planning and executing evacuation procedures, and general expedition life. The main aim of the elective is to develop medical skills useful in an expedition environment including supporting our on-site medics, providing first aid cover at each allocated site and briefing incoming volunteers on basic medical issues.

There is also a possibility for you to be able to complete a small medical research project in areas such as public health and working with the indigenous people of the area. You are welcome to participate in the existing social and scientific research programmes at each site, as long as you appreciate that your primary objective is to provide First Aid cover at the site to which you have been allocated.

## OPTIONS FOR HIGH SCHOOL STUDENTS

The various biodiversity surveys being run as part of the Operation Wallacea programme are mostly carried out by university academics and university undergraduates acting as Research Assistants or completing dissertations or Senior Theses. However, there are some tasks that need a much greater amount of manpower than available just from university students. These tasks are being carried out by groups of sixth form students from the UK, and senior High School students in the US and Canada who must be accompanied by their biology, geography or environmental science teachers. The groups, known as General Surveyors, will join the mixed teams of scientists and undergraduates but will undertake their own programmes.

There are two week expeditions available at each of the sites for 16 – 18 year old students and are ideal for those studying biology, geography, environmental courses or interested in conservation. The two week expeditions have slightly different structures in each country and manuals outlining the programme of skills training, academic lectures and practicals to demonstrate the differing types of surveys being undertaken and the field research to be carried out are provided to the students in advance of the expeditions. Training is also given in how to prepare for the expedition and how to fundraise.

The expedition itineraries vary considerably. In Indonesia, Guatemala, Madagascar and Honduras, the first week is spent in lowland or cloud forest and the second week on coral reefs. In Peru, the programme is based for the whole two weeks on research ships on the Amazon whilst in Cuba the project is solely based on reefs. In South Africa, the first week is in one of the game reserve research sites with the second week on reefs, and for a limited number the option of diving the reefs in Mozambique. Guyana is the toughest of all the projects with one week in lowland rainforest followed by a canoe based survey for one week on a river or two weeks helping on a fish survey in the Rupununi wetlands.

## GAINING CREDIT FOR SCHOOLS EXPEDITIONS

Although most school groups join the expeditions solely for the experience and the opportunity to strengthen their university applications, there are a number of ways that credit can be obtained for school expeditions. There is the option to use the expedition experience to complete a Certificate of Personal Effectiveness (CoPE) which in the UK is worth 70 UCAS points. For schools that are AQA registered and are doing the AQA Baccalaureate, there is the





opportunity to use the expedition preparation and completion to complete the Extended Project Qualification. For schools in North America, there is the option of awarding internal credit as well as gaining credit through US universities (please contact US office).

## CoPE

In the UK, the Certificate of Personal Effectiveness is worth 70 UCAS points and therefore can give the holder a significant advantage when applying for certain university places, as well as providing transferable skills that can be invaluable in later life. In order to be eligible to receive the Certificate, you need to be able to demonstrate that you have completed the curriculum which is made up from several "challenges", and need to submit portfolio evidence which proves competence in the following skills:

- Problem Solving
- Communication through Discussion
- Working with Others
- Research
- Oral Presentation
- Improving Own Learning and Performance

There are five basic stages to an Opwall expedition, each of which facilitates completion of different aspects of the Certificate:

## FUNDRAISING FOR YOUR EXPEDITION

In order to raise the funds to go on an Opwall trip, groups of students work together over a 12-18 month period, during which time they plan, organise and run various fundraising events and activities. The Operation Wallacea fundraising coordinator will visit the group to help facilitate the initial discussion. Students will be divided into groups of up to 5 individuals, and will arrange a date for a subsequent meeting,

during which each student will be expected to produce a business plan for their fundraising efforts. This meeting will be attended by an Opwall moderator who will assess the initial fundraising plans and the **Communicating through Discussion** skill through observing discussions within the groups as they plan their activities. A second meeting after the fundraising has got under way will be held to complete assessment of the **Problem Solving** skill.

## PREPARING FOR YOUR EXPEDITION

You will have a presentation from Operation Wallacea staff about how to prepare for the expedition a few months before the expedition starts. After this presentation, you will then need to divide into groups of 5 or 6 who form an expedition working group with responsibility for ensuring all the preparation for each of the group members. The group should decide on how various tasks are assigned and monitored such as completion of information forms, vaccinations, health and insurance issues, ensuring all group members have managed to source the equipment and clothing required for the forest, organised travel and visa arrangements and if there is a marine based week obtained the PADI or BSAC Diver Manuals and completed the theory lessons in advance. An Opwall assessor will then visit to assess progress with this preparation to assess the **Working with Others** skill.

## PLANNING A RESEARCH PROJECT

Your research project needs to be planned in advance of the expedition with background literature research completed on one of the topics which will be provided. You then need to complete background research on the question using a variety of sources (books, internet, magazines, journals, film, etc.). Before 1 May 2011 for 2011 expeditions you then need to submit to Operation Wallacea a 2-3 page report summarising the answer to your research question. The remaining part of the research project is done on site.





### EXPEDITION WEEK 1

During your first week in the field, you will need to talk with the scientists on site about your research question and then produce a final written version of your research report. This needs to be handed in on your return home to complete your **Research** skill. You will also need to prepare and deliver a short presentation about your research project findings. Because computer facilities are limited at these sites, students are encouraged to be creative with their presentations which may include aspects of drama, leaflets, drawings and whiteboards in order to engage the listeners in their presentations. The quality of the **Oral Presentation** skills will be assessed by an Opwall CoPE assessor on site.

### EXPEDITION WEEK 2

The second week of many of the expeditions involves the students completing a dive qualification or a reef ecology training course. On these training courses you need to demonstrate your **Improving Own Learning and Performance** skill by keeping a log of your progress. On those options where the second week does not involve diving (Guyana and Peru), the course at the beginning of these expeditions is used to demonstrate this skill.

Students wanting to register for the CoPE award will need to register with Operation Wallacea and pay a £40 registration fee. Information packs and assessment forms will then be provided and an Opwall trained CoPE assessor will visit the school to explain how the scheme works.

### OPTIONS FOR ACADEMICS

Operation Wallacea has developed themed research programmes at each of the 21 research centres that they use over the university holiday period in Indonesia, Egypt, Mozambique, South Africa, Madagascar, Honduras, Cuba, Guyana, Mexico and Peru. Academics from universities and institutes around the world can come and conduct research into their own specialist interests as part of these programmes. The programmes are funded by undergraduate or Masters students who come to gain hands on research experience. All of the sites are run in conjunction with local communities and organisations who have developed small businesses around the provision of the logistics support for these large annual survey programmes. The research programmes are very much output focused with at least 25 papers being submitted to peer reviewed journals each year.

There are more than 150 academics collaborating on various projects within the research programmes and there are various ways in which additional academics can become involved in the research programmes. You can apply for a Visiting Academic grant to visit one of the sites to assess their suitability to run a long term research project or to take a class for a field visit. Operation Wallacea also part funds PhD studentships (26 to date) and is looking for additional academic collaborations to increase this support. The Opwall research facilities can be used by university class groups outside the June to August periods when the Opwall research programmes are running or class groups can be run with course credit during the Opwall season.





## VISITING ACADEMIC GRANTS

Over the last few years a Visiting Academic Grant programme has been developed that part funds the field costs for academics to visit the Opwall field sites and get first hand experience of the research opportunities in the areas in which the research programmes operate. There are various ways in which the research relationships can be developed:

1. Funding research projects. Operation Wallacea funds the field costs and organises the logistics, counterpart scientists where required by the host country and permits for research projects accepted into the programme. Increasingly, these projects are being developed into PhDs.
2. Opportunity for large-scale temporal or spatial data sets to be obtained. One of the problems of traditional grant aided research is that such grants tend rarely to enable data sets to be gathered over many years. Likewise, geographical comparisons across different countries are often difficult to fund. Both of these aspects can however be funded under the Operation Wallacea programme.
3. Collaborating on large scale funding applications. Operation Wallacea has used the results of the research programmes to lever US\$2 million funding from a range of sources in collaboration with various universities.

To apply for a grant you must be a full time academic at a university and to submit an application before 1 March 2011. The application needs to include a curriculum vitae with publication record and a covering letter explaining the proposed site to visit and the proposed output from the visit (e.g. site for university training course, proposed

research project for inclusion in the overall programme from 2011, grant application, etc.). Full or partial grants will be offered to the successful applicants by 17 March 2011.

## PhD GRANTS

Operation Wallacea runs a yearly grant programme for PhD students. The grants are available to PhD students registered at an academic institution. It is intended to allow that student to come to our sites and conduct their own research projects for 4 to 8 weeks each summer for multiple years if required. The research project must fit within the themed research programme for the site and be between June and August each year.

The outputs for the grant are required to have a conservation application, either through understanding biodiversity, ecological models and theories or research into establishing sustainable industries in local communities. The first year in the field is expected to be spent collecting initial data and working with the academics on site, especially the Senior Scientist to implement the research plan. During this initial expedition, the PhD student will be given a small number of volunteer students to help collect the field data. In subsequent summers, the project is expected to make full use of students to collect data, including 2 or 3 undergraduate thesis/dissertation students.

Applications should be no more than 6 pages and include details of the methodology, a timeframe for research in each year, details of supervision and academic support and a breakdown of any equipment requirements. The project is intended to produce academic and conservation orientated outputs and these should also be included in the application. Resumes of all associated academics should also be included. In addition, Operation Wallacea is willing if the PhD is of major research interest to the site, to co-fund PhD grant





applications to large funding bodies such as Research Councils, in particular acting as the industrial partner in CASE grants. Note significant preference is given to students who have completed their undergraduate or Masters dissertations with Operation Wallacea. The application dates are 31 March 2011 and 30 September 2011.

**CLASS GROUPS**

The Opwall research centres are used for expeditions in the summer months, but most of them are open throughout the rest of the year for independent academic class trips from September to May. The set up of the trips is intended to offer as much flexibility as possible, allowing them to be designed around the requirements of the course. For example, trips can be based at just one site within a country or move around sampling different habitats, including time in both forest and marine systems if required. The trips can be run for any length of time with a simple price structure based on flexibility. Each country has an agreed start and finish point and the costs include all the transfers from this point, food, accommodation, use of facilities, equipment, boats, vehicles, diving if required and safety systems including medical cover.

Academics interested in developing courses utilising these facilities outside the Opwall season may wish to apply for the Visiting Academic scheme. Operation Wallacea has developed a number of written courses with exam material, which are used for training of volunteers joining the main research programmes (Jungle Training and Neo-tropical Forest Ecology and Caribbean Reef Ecology courses in Honduras, Bush Training and Savannah Ecology in South Africa, Jungle Training and Wallacea Wildlife and Indo-Pacific Reef Ecology in Indonesia and Amazonia Ecology and Wildlife Conservation in Peru). These may be utilised as part of the course being developed by the academics but the responsibility for

developing the academic course and delivery of the course will be that of the organising academic.

The other way of running class trips is to run them as part of the existing Operation Wallacea field research programme during the June to August period. Class students can sign up for one of the sites and then do a compulsory course during their first week in the field followed by 1 - 3 weeks working on the various research projects being run from that site. The university has to provide an academic to assess the course provision, mark the scripts from the compulsory training course and to audit the various research projects being carried out by different class students. Doing it this way means there is very little for the academic to prepare in advance and new courses in exciting locations can be added relatively quickly to the range of options available to the students at particular universities.

**PARTICIPATING UNIVERSITIES**

**UK AND EUROPE**

- |             |                         |
|-------------|-------------------------|
| Aberystwyth | Copenhagen              |
| Aberdeen    | Christchurch Canterbury |
| Anglia      | Duchy College, Cornwall |
| Bangor      | Durham                  |
| Bath        | Edinburgh               |
| Bergen      | Essex                   |
| Birmingham  | Glamorgan               |
| Bournemouth | Huddersfield            |
| Brighton    | Hull                    |
| Bristol     | Imperial College        |
| Cambridge   | Kent                    |
| Chester     | Lancaster               |





Leeds  
 Lisbon  
 Liverpool  
 Liverpool John Moores  
 Lueven  
 Lund  
 Lyons  
 Manchester  
 Manchester Metropolitan  
 Napier College  
 Newcastle  
 Northumbria  
 Nottingham  
 Oxford  
 Oxford Brookes  
 Pasante  
 Pavia  
 Perpignan  
 Plymouth  
 Portsmouth  
 Queen Mary College  
 Reading  
 Royal Holloway  
 Sheffield  
 Southampton  
 Sparsholt College  
 St Andrews  
 Sussex

Swansea  
 Trinity College Dublin  
 Tuebingen  
 University College Dublin  
 UEA  
 University College London  
 University of West of England  
 Wurzburg  
 Zurich

### NORTH AMERICA

Auburn  
 Boston  
 Brock  
 Brown  
 Bucknell  
 California  
 Calgary  
 Central Connecticut  
 Central Florida  
 Clark  
 Colorado State  
 Dalhousie  
 Delaware  
 Georgia  
 Harvard  
 Lakehead  
 Laurentian

La Verne  
 Laurentian  
 McMaster  
 Miami Dade  
 Michigan State  
 Monmouth  
 New Brunswick  
 New Hampshire  
 North Carolina  
 NYU  
 Ontario Institute of Technology  
 Oregon State  
 Pennsylvania  
 Princeton  
 Providence College  
 Rutgers  
 Salisbury  
 Scripps Oceanographic Institute  
 Southern Illinois  
 Southern Utah  
 SUNY ESF  
 Texas A & M  
 Toronto  
 UCLA - Santa Barbara  
 UMASS  
 Waterloo  
 West Florida  
 Western Ontario

Western Washington  
 Wilfred Laurier  
 Windsor  
 Wisconsin  
 Woods Hole Institute  
 Yale

### MUSEUMS

Florida Museum of Natural History  
 National Botanic Gardens of Wales  
 National Museums of Scotland  
 Natural History Museum, London  
 Oxford University Museum

### OTHER COUNTRIES

Arthur Rylah Institute  
 FORO Miraflores, Nicaragua  
 Havana  
 James Cook  
 KwaZulu Natal  
 Makassar  
 Murdoch  
 National University of Australia  
 National University of Malaysia  
 Queensland  
 Southern African Wildlife College







Sydney  
 Tasmania  
 Universidad de los Andes  
 University of Indonesia  
 Victoria University of Wellington  
 Witwatersrand

**OTHER INSTITUTIONS**

AmazonEco  
 Bay Islands Conservation Association  
 Bogor Herbarium  
 British Council  
 British Trust for Ornithology  
 California Fish & Game Department  
 Canopy Access  
 Durham Wildlife Trust  
 Egyptian Environmental Affairs Agency  
 Ezemvelu KZN Wildlife  
 FORO Miraflores, Nicaragua  
 Fundacion Pro Aves, Colombia  
 FundAmazonia  
 Global Environment Facility  
 Honduran Coral Reef Foundation  
 ICF, Honduras  
 Indonesian Institute of Sciences

JCA Ltd  
 KZN Ezemvelo  
 Leicestershire Wildlife Trust  
 National Botanic Garden of Wales  
 Peace Parks Foundation  
 Scottish Natural Heritage  
 Smithsonian Tropical Research Institute  
 Southern African Wildlife College  
 UNDP  
 USGS Hawaii Volcano Observatory  
 Wallacea Foundation  
 Wetlands Trust  
 Wildlands Conservation Trust  
 Wildlife and Ecological Investments  
 World Bank  
 Zoos Victoria

**APPROACH TO HEALTH AND SAFETY**

Risk is inherent in everything that we do in life. Without accepting and understanding these risks, we would not be able to do anything at all. The first concern of all activities undertaken as part of Operation Wallacea expeditions is to gain an understanding of the environments we will be working in, and from this to reduce risk to health and safety as far as is possible. All the expeditions provided by Operation Wallacea meet the requirements of BS8848 Specification for the Provision of Visits, Fieldwork, Expeditions and Adventurous Activities outside the UK (self declared). Detailed documents explaining how each of the expeditions comply with the clauses of BS8848 are published on the Operation Wallacea website before the start of the research programmes. Safety auditing is also performed at each of the sites during the research programmes. Reports on the accidents and illnesses that occurred during the expeditions are published on the website.

Operation Wallacea has a seven point health & safety policy which is reproduced below together with short notes on how each of these policy points are implemented in the various countries.

**Provision of relevant health and safety information to all volunteers before they arrive on site**

The website contains information on the immunisations and prophylactic medications required for volunteers going to different countries as well as information on necessary equipment for activities such as trekking, staying in the forest, diving, etc.





## **Ensuring that appropriate qualified and experienced staff are employed on the project and that all field staff and group leaders are trained in the safe operating procedures**

Operational procedures have been prepared for each site and staff have to go through an on-site induction course which includes training in the relevant procedures. Implementation of the procedures is audited on a regular basis by Health & Safety or medical staff on site and non-conformances reported to the relevant staff for corrective actions to be implemented. On the dive training side of the expeditions, all the staff are PADI Dive Instructors or higher (or BSAC in the case of Cuba), whilst all dive support in the water is given by PADI Dive Masters or BSAC Dive Leaders in the case of Cuba. Unlike the PADI or BSAC schemes, which are clearly relevant for the marine side of the project, on the terrestrial sides of the project there are often no directly applicable qualification schemes. This is approached by ensuring the senior staff at each site have extensive relevant experience in relevant skills (e.g. field camp management, jungle training, canopy access, etc.). Bush training and field surveys in South Africa do however, have relevant qualification schemes for guides (FGASA) and for carrying firearms in the field, and senior staff on this project have these qualifications.

## **Identification of the risks associated with activities and locations as well as the development of measures to minimise these risks**

Risk assessments have been produced for each location visited (dive site, forest, bush or desert camp, trek location), activity undertaken (e.g. diving, trekking, etc.) as well as specific research project associated risks. These risk assessments are on the Operation Wallacea website and can be downloaded to help with planning your expedition. Volunteers when they first arrive are required to complete an exercise where they are asked to identify the risks likely to be

encountered at the site and on the various activities and projects they will be doing. This process is designed to get all volunteers thinking about risks and how to reduce them for themselves before they are told of the agreed risk reduction measures.

## **Development and implementation of safe operating procedures for each of the activities undertaken**

Procedures to ensure trekking teams remain in contact with all the members of the group are practised. Sign out/in procedures for all groups leaving terrestrial camps have been put into position and search and recovery procedures prepared for teams missing return and contact deadlines. Additional procedures cover aspects such as safe driving, hygiene, snorkelling and swimming and many other aspects. All diving is carried out in accordance with procedures in accordance with PADI procedures (or BSAC in Cuba) and include limiting diving to two dives a day, maximum depth for survey and training dives of 18m, a maximum 50 minute dive (unless the dive is to 5m or less), a minimum 3 hour surface interval between dives and each diver must return to the surface with at least 50 bar remaining in the tank. All boats have a sign out/sign in procedure and have to carry oxygen and First Aid kits.

## **Ensuring there are adequate communication, medical and evacuation procedures in position**

At all sites and on all transport routes there are multiple methods of communications comprising VHF radios, satellite phones, cell phones and email. It is possible to contact the teams in the field directly from the UK co-ordinating office. A Medical Officer (doctor, accident and emergency nurse or emergency paramedic) is at each main camp. Where the camps are close to US standard hospitals, Emergency First Aid trained staff are used as the Medical Officers, whereas in the sites where access to high standard hospitals is more distant,





doctors with well equipped medical kits are on site. Evacuation plans for Emergency Priority emergency evacuations (normally by air but in some cases in conjunction with overland routes), High Priority (fastest overland route to a hospital) and Medium Priority (most convenient and comfortable overland route) have been developed for each site and are published on the Operation Wallacea website before the start of each expedition. £1 million medical and evacuation insurance cover has been purchased for all participants by Operation Wallacea so that the evacuation co-ordinating company (CEGA), appointed by the insurer, can, with the help of the Medical and Evacuation plans, establish contacts and agree prices in advance with all the hospitals, air ambulances, etc. likely to be used in an emergency. This is done so there are no delays if an incident were to occur.

**Briefing of all volunteers on arrival in the safe operating procedures, and acquainting them with the medical facilities available.**

All volunteers on arrival are given a general health and safety briefing, and additional briefings are given by leaders as the volunteers join new projects or visit new areas.

**Recording all illnesses, accidents, near-misses or incidents which may have a bearing on health and safety and using this information as part of an ongoing refinement of the operating procedures.**

The Medical Officers and First Aiders keep detailed confidential medical records and summary reports on all staff and volunteers, which are used in combination with accident and 'near miss' data reported, in compiling accident and illness reports. These reports are published for each country on the Operation Wallacea website at the end of each season's expeditions. These analyses have been performed on all the expeditions run by Operation Wallacea since 2004 and show that joining an expedition is as safe as going on a sports tour (e.g. football, rugby) or taking part in activities such as skiing.

**FITNESS LEVELS**

The forest, bush and desert projects in particular require reasonable levels of fitness. The survey work can be physically demanding, and on top of that the working conditions may be hot, humid and/or tiring because of high altitude. We use the following grading of fitness:

Grade level	Definition of fitness and health risk
1	Capable of trekking up mountains over rough ground for 5 hours with a 15kg rucksack and no health problems that would require medical assistance in remote camps.
2	Capable of trekking up mountains over rough ground for 3 hours with a 15kg rucksack and no health problems that would require medical assistance in remote camps.
3	Capable of trekking for up to 2 hours on well defined footpaths with a 15kg rucksack and no health problems that would likely require medical assistance.
4	Lower fitness levels than any of the above definitions or with a medical condition that could reduce ability in the field or require emergency evacuation.

Research Assistants generally have to complete week-long jungle training or bush training courses before joining the main research programmes. Their fitness is assessed during these courses, and advice is offered on appropriate camps or projects. Each leader of General Surveyor groups is asked to grade each member of his/her group into one of the above fitness levels and camps are allocated accordingly. It is possible to split General Surveyor groups into subgroups going to different camps, but a teacher must accompany each subgroup. Marine projects are generally possible with lower levels of fitness (the marine scientists may not agree!), although there are various swim tests required for diving and snorkel based projects. For example, to undertake Open Water Dive training you need to be able to swim 200m unaided.





## OPERATION WALLACEA TRUST

The Operation Wallacea Trust (charity number 1078362) was established in 2000 in the UK in order to support activities that could directly contribute towards the conservation of biodiversity in the areas in which Operation Wallacea is working. The Trust is a UK registered charity, which is entirely independent of Operation Wallacea and is chaired by the Rt. Hon Kenneth Clarke QC MP. The Trustees are drawn from the business sector and senior biodiversity and conservation management academics. Funding to support the admin costs of the Trust in the UK are provided by Operation Wallacea and other donations from the business community. The Trust can therefore ensure that 100% of the funds raised to support overseas projects are actually spent in those countries. See [www.opwalltrust.org](http://www.opwalltrust.org) for more detailed information on each of the projects.

The principle underlying the Trust's approach to projects is that the best way to ensure conservation of forests and reefs is to make sure the communities surrounding the areas to be protected have a financial advantage in ensuring its preservation. Whilst this principle underpins a number of other conservation projects, the unique approach of the Trust is to design systems where contracts are made between communities or individuals to ensure compliance with conservation objectives in exchange for development projects that enable those communities or individuals to develop long-term income sources. Non-compliance by village members in the conservation aspects of the contract will lead to suspension of the investment. There is therefore a direct link between community development and conservation objectives and provides a practical implementation model for the concept of direct payments for conservation.

## KALEDUPA ISLAND REEF FISHERY MANAGEMENT PROJECT

The Operation Wallacea Trust has been funded by the Darwin Initiative to work in collaboration with COREMAP (a World Bank/GEF sustainable fisheries initiative) to develop a best practice example of how a reef fishery could be managed sustainably. There is an urgency to establish a best practice example of coastal fishery management in eastern Indonesia since the reefs are being heavily overfished. The reefs in eastern Indonesia are the most biologically diverse in the World, yet if the over-fishing continues, the reefs may go through a phase shift because of the removal of most of the algal grazing species allowing algae to colonise. This has happened to a number of Caribbean reefs and even to the diverse reefs of Sabah in recent years.

The project on Kaledupa started in May 2007 and introduced a weekly monitoring programme for all fish landed over a 24-hour period once a week in 9 villages around the island. A database has been developed for storage and analysis of the data, which have been collected continuously since July 2007. The data show a continuing decline in the fish stocks on the reefs and can be used to model the effects of various potential byelaws so that decisions on which are the most effective regulations can be made.

A Kaledupa Fisheries Forum comprising representatives from all the villages on the island and chaired by the head of Government for the Wakatobi Islands has been formed. Their first meeting in August 2009 was charged with agreeing fishery management byelaws such as limiting the numbers of fish fences, introducing minimum mesh sizes for gill nets and minimum landing sizes for various species. The fisheries data were modelled to identify potential byelaws, and these data presented so the Forum could make decisions on which were potentially the most effective regulations. The 22 byelaws agreed at the August meeting were then modelled to assess their impact on the fishery.





A database comprising records of 1000+ fishers across the island and their fishing gear has been established. In addition, all motorised boats used for fishing have been registered and individual identification codes painted on each of the boats (more than 550 boats). There is no other area of Indonesia where such a detailed census of fishers has been completed and 100% of reef fishing boats registered.

Implementing registration and community enforcement to ensure only registered fishers are utilising the reefs around Kaledupa, will reduce the overall fishing pressure on the reefs by excluding fishers from other islands. However, this along with Forum agreed fishery regulations is unlikely to be sufficient to reduce fishing pressure to levels where the fish stocks can recover. In order to achieve this, a percentage (to be determined from the results of the fisheries monitoring) of licence holders will be offered small businesses in exchange for surrendering their licences. Thus those that are removed from the fishery will do so voluntarily and only in exchange for businesses that create more income than they would have earned from fishing. Those that remain in the fishery though, then have a licence that is worth at least the value of the businesses for those who did exchange their licences. These remaining licence holders will therefore have a significant asset that they will be allowed to trade amongst other islanders or to use as collateral for raising money from the bank.

There are two business opportunities that the Trust is developing with the Wakatobi Government to provide the income needed to 'buy out' the surplus fishing licences. First, is the development of a plant to process 3000 tonnes per year of the seaweed that is currently being grown in the area but sold at low prices for processing elsewhere. The plant should have an annual turnover in excess of \$6 million as it produces the carrageenan product known as E407a for export to the European Union. Once established, the concept would be to offer shares in the factory to fishers who would surrender their fishing

licences. The Trust project has completed research and developed a carrageenan (the active component of seaweed) extraction process using seawater and Calcium Oxide, which does not infringe any existing patents. The Wakatobi government has constructed the plant and donated 1 ha of land and is offering the use of the building and land to an investor in exchange for a percentage of the shares being offered to fishery licence holders. Once fully implemented, this will provide a mechanism to compensate fishers who come out of the Kaledupa reef fishery as well as a way of increasing the sums paid to all seaweed farmers since they would be getting factory gate prices (i.e. with no middlemen costs).

The second business opportunity is the development of ecotourism for the Wakatobi Islands using homestays. This is the approach that Operation Wallacea has used and the technique is very effective at providing income for the local communities. Thus in 2008 approximately 5% of the entire annual Kaledupa economy came from just the 2 month Operation Wallacea season. The Wakatobi Government has built a 1.7 km runway on the island of Wanci and are subsidising flights making the Wakatobi Islands more accessible and is investing into developing the Operation Wallacea site on Hoga into an International Marine Research Centre as the flagship for a developing ecotourism industry.





## LAMBUSANGO FOREST PROJECT, BUTON ISLAND, SE SULAWESI

The Operation Wallacea Trust was funded by GEF/World Bank to manage a conservation project for the Lambusango forests in Buton Island. The project finished in 2008 and achieved a number of developments that are now being copied elsewhere in Indonesia. For example, the Lambusango Forest Management Forum which was formed to increase transparency and community involvement in forest management and act as a strategic partner to local government for the implementation of good forest governance is now being used as an approach in other parts of Indonesia. The Forum is now being funded by the Buton Government who regard it as an excellent method of stakeholders agreeing regulations to be applied across the forest. The effectiveness of the Lambusango Forest Management project was assessed during and at the end of the project by the Operation Wallacea survey teams. Of the 15 criteria for which there were sufficient data to assess against the performance criteria 14 (93%) met the targets. Operation Wallacea are committed to continue annual monitoring of the Lambusango forests to assess how the forests change post the Trust project.

## ENVIRONMENTAL TRAINING OF GOVERNMENT STAFF IN SE SULAWESI

The Operation Wallacea Trust is administering a World Bank funded project to increase the awareness of government departments in SE Sulawesi to environmental issues. The objective of the project is for rural villages to benefit from better governance and more equitable access to natural resources.

## REDD

The data gathered by the Opwall teams are being used to support an application for funding under the Reducing Emissions of greenhouse

gases from Deforestation and forest degradation in Developing countries (REDD) scheme. This scheme that was outlined at the Copenhagen Climate Change Conference aims to provide a mechanism for tackling the 15% of greenhouse gas emissions caused by deforestation. A total of \$3.5 billion has been pledged by developed countries (Norway, France, Germany, US, etc.) to form a fund to support governments or NGOs to prevent deforestation.

One of the problems with the current carbon credit payment system is that it does not reflect the varying economic pressures on the land. As a result, landowners and communities are wary of locking up their forests for long periods of time because the marginal costs of protecting the forests may change significantly over that period. Moreover, the costs of protecting forests vary enormously based on opportunity costs of alternative land uses. Thus having a standardised international price for carbon sequestration per hectare of land may result in considerable overpayment to landowners/occupiers where the alternative uses are not likely to generate so much income whilst in other cases the payments will be too small to prevent deforestation. Also it is better to concentrate funding at forest blocks under high risk of deforestation - forest blocks on the edge of a continuous stand of protected forest are generally at higher risk than those deep within the core zone.

In addition, the reason governments and multi-nationals are investing in the REDD scheme is not just to prevent deforestation, but the implied benefit this has on biodiversity protection. Yet, in the majority of cases, data on the biodiversity of key taxa in the forests being protected by the proposed REDD payments are not available, so the performance of the REDD payments in protecting biodiversity cannot be assessed. The Cusuco application proposal is to use small scale examples of forest protection where the marginal costs of protecting





the forests can be assessed on an annual basis. Opwall has 4 years worth of biodiversity data for a range of taxa from 150 sites across the Park that can be used to set biodiversity change criteria. Cusuco is an excellent example of cloud forest with a recently discovered tree that is a new genus of tree to science and 16 species of amphibians and reptiles that are Critically Endangered.

The main problem with this model is assessing the marginal value of each 100 ha block of forest without creating collusion between landowners/occupiers to inflate the value. Opwall has been developing some ideas based on the work of environmental economist Paul Ferraro (author of the paper on direct payments for conservation which was the inspiration for both the Lambusango and Kaledupa projects run by the Trust). One Paul Ferraro example had landowners in Java with small farms submitting closed bids in a series of rounds to determine the 50% WTA (Willingness to Accept) value for implementing the conservation measures. In this case, the repeated bidding allowed the farmers to learn from their experience in previous bids and in the final round (which was identified as such) to pitch it at a level where they had a chance of winning. Note only a percentage of the farmers were successful in gaining the funding so there had to be losers to enable this method to work.

The Cusuco example is a lot more complicated and since it is essential to gain protection of the whole forest (not just the forest blocks with the lowest bid prices) the scheme to be used has to be structured differently. The method proposed divides the Park into two parts - the core zone, and buffer zone. Because of illegal clearances in parts of the buffer zone and even in small parts of the edges of the core zone the frontline for conservation is in fact the core zone. The core zone is all government land and is managed by Instituto nacional de Conservacion y desarrollo Forestal (ICF). It is illegal for

surrounding communities to log or hunt in these core zone forests so in theory their opportunity loss cost is zero and we could hardly make payments to communities for not doing something illegal! However in order to enforce this, ICF need to employ rangers and have communication systems and processing systems for prosecuting infringements discovered. The true costs of protecting these forests is therefore the patrolling and enforcement costs and the most cost effective way of doing this, as a top down approach, would be to define the performance criteria needed to appoint an organisation to protect the core zone forests (e.g. they would be paid on success in preventing deforestation and ensuring the various biodiversity parameters agreed were achieved). Payments would be reduced for any loss of forest cover or reduction in the agreed biodiversity performance criteria. These costs could be estimated by requesting sealed bids from a number of organisations.

Once this had been achieved, there would be a twist in the system. Each of the communities with adjacent core zone forest would be asked to bid for how much they would require to ensure the 100ha blocks allocated as their responsibility could be protected to the same performance criteria as for the main bids. Those that bid below the per 100 ha value estimated from the market tender would then be given the responsibility for protecting their adjacent blocks. The costs paid each year would be auctioned and those communities that had bid too high in the first year would be given the opportunity to bid again so that eventually all the communities, as they learn how low they have to make the bid to be successful, would be involved in the protection of their adjacent forest. Doing it this way means that from day 1, the whole of the core zone is protected and that subsequent payments in future years actually go down as the communities accept the need to bid below the central cost value for protection. As soon as the change criteria (percentage change permitted under the





linear spectral unmixing surveys in each 100 ha block and the percentage change permitted in the various biodiversity criteria assessed from the annual Opwall surveys) are agreed the bidding process for the top down policing costs can be put underway. Once the successful bidder is appointed on the basis that they would receive payments from the carbon credit payments, they could then start the process of obtaining sealed bids for management of the forest blocks adjacent to each community. The community bids would have to be made through village co-operatives with 90% plus membership (these are already in existence in some villages) so that, within 6 months, those villages that had these co-operatives and who had successfully bid would be receiving the performance related payments.

The buffer zone however, is a different problem. In the buffer zone, the land ownership seems to be mainly in the hands of a few wealthy landowners but with some small landowners as well. In theory, the land in the buffer zone irrespective of ownership cannot be deforested unless a permit is obtained from ICF. So once again we have a situation where the opportunity loss is technically zero but in practice there are costs of patrolling and enforcement to ensure this happens. This would be tackled in a similar way to the core zone: the bid process for the core zone would also require the costing of patrolling the buffer zone forests. The lowest combined bid for the patrolling of both the core and buffer zone forests would be accepted. Once this price has been established, the owners/occupiers of each 100 ha block would be offered the opportunity to bid to police their own blocks and be paid to do so if their bids were under the costs of the central patrolling system.

## WILDLIFE CONSERVATION PRODUCTS

One of the fastest ways to get additional income into remote rural communities is to use the Fair Trade scheme for marketing their existing products. However, whilst the Fair Trade system has many advantages for increasing incomes in communities in developing countries, the scheme was not developed with any specific conservation benefit in mind. The Rainforest Alliance has developed a similar scheme, which has additional restrictions on how the crops can be grown (non use of herbicides and pesticides). However, even this scheme does not link price to the wider conservation performance of the whole village. Indeed there is one village in the Cusuco National Park buffer zone at the Opwall Honduras site, which has achieved Rainforest Alliance approved prices for its coffee products, yet this village is the one most involved with illegal hunting in the adjacent reserve! To overcome this problem, the Operation Wallacea Trust has trade marked a new scheme called Wildlife Conservation Products, where communities can receive Fair Trade equivalent prices for their commodities only if they have signed one of these conservation agreements. If there is evidence that village members are continuing to hunt or log, the scheme is suspended until the community can exert the necessary pressure to prevent this activity. However, the payment of prices significantly above market rates in these communities provides a strong positive incentive for ensuring 'their' forest is protected.

The main difference between the Wildlife Conservation Products scheme and both Fair Trade and Rainforest Alliance is that the enhanced price is paid not to a producers' co-operative, which







normally comprises only a small percentage of the whole village, but to a village level co-operative that must have 90% membership. The products are bought by the village co-operatives from the local farmers at the normal market rates but are then sold onto the exporter at the enhanced WCP rates, which can produce a village level premium of up to 70% over the farm gate price. Coffee from the villages around the Lambusango and Cusuco sites run by Operation Wallacea were being marketed under the Wicked Jungle Coffee brand in UK universities but there was consistent opposition from Students Unions who are mainly Fair Trade organisations, which prevent them from selling any products that are not Fair Trade registered. Consultation with a range of major UK supermarkets led to the conclusion that the strength of the Fair Trade and Rainforest Alliance brands were so strong that it would take significant investment to create a recognised alternative certification scheme. Sainsburys, the largest distributors of Fair Trade products in the UK, suggested that the way forward would be to develop a new suite of Fair Trade standards – Fair Trade Conservation that encompassed the ideas of certifying communities and their impact on the environment rather than just the producers of particular products. Opwall is, therefore, co-funding a PhD student at Nottingham University to work with Fair Trade and Sainsburys on developing this scheme.





**RESEARCH OBJECTIVES**

Indonesia was the first site established by Operation Wallacea and was selected for two main reasons. Firstly, the forests of the Wallacea region of Indonesia, which comprise the islands of the central part of the archipelago and which are separated from the islands to the east and west by deep ocean channels, are the most endemic rich forests in the World. The deep trenches prevented these islands from being joined to the main continental land masses during the lowered sea levels of the Ice ages. As a result of the long period of isolation, a large number of unique species have evolved. Moreover, the forests of central Indonesia are one of the least studied areas biologically and one of the most likely places to discover vertebrate species new to science. Secondly, there is a triangle of reefs in eastern Indonesia, part of which lies within the Wallacea region that has the highest diversity of coral genera, the proxy commonly used to assess overall diversity of coral reefs.

Operation Wallacea established a research programme in 1995 in the islands off the SE Sulawesi coast, the least visited and most remote part of the Wallacea region. Since that time, annual research programmes have been carried out in the forests of Buton Island and on the reefs of the now Wakatobi Marine National Park. In 1997, after Operation Wallacea presented the first biological survey results and completed political lobbying, the Wakatobi Marine National Park was created covering 1.39 million ha making it the second largest marine protected area in Indonesia.

The results of the forest surveys in central Buton Island, from where 21 vertebrate species new to science have been described, resulted in a \$1 million World Bank/GEF grant being obtained to establish an example of best practice conservation management for a lowland forest. This project finished in 2008 and an assessment of the various

quantifiable conservation targets showed that 90%+ of the targets had been achieved and in many cases significantly exceeded. Since the World Bank/GEF project was completed, Opwall has continued with research in the forests to continue the monitoring data sets and to gather more data on the effects of forest disturbance on the biodiversity of various taxa. The research programme is based in the village of Labundo and is run by an international team of scientists, with logistical support from an Indonesian NGO called Lawana Ecotone formed by local Indonesian staff.

The Lambusango forests in the central part of Buton form the southern end of a continuous tract of forest that continues north through the remainder of the island and at the northern end is protected as the North Buton Nature Reserve. Despite this designation, virtually no data are available on the diversity of this Reserve and Opwall are establishing a field camp to start annual surveys from 2011 onwards. Satellite derived environmental variables (e.g. altitude, slope, aspect), together with data on soil types, geology and rainfall etc. will then be used to determine the factors most influencing the distribution of each of the species recorded from both the north Buton and Lambusango surveys. These correlations can then be used to predict distributions for each of the species across the whole of the Buton forests.

Located in the heart of the Wakatobi Marine National Park next to Kaledupa Island is the Hoga Island Marine Research Station, the most active research facility within this unique bioregion. The Coral Reef Research Unit, comprising marine biologists from both UK and US universities, and based at Essex University, is developing the Hoga Island Marine Research Station as an internationally recognised centre for marine research. The CRRU has developed a



thematic research programme with such research areas as coral reef dynamics, coral reef diversity, fisheries ecology and reef based economics, within which a series of research tasks are completed each year. To date, it has published nearly 50 scientific research papers within top-ranked, peer-reviewed journals and continues to attract international funding to support this research. An Indonesian NGO called Lembaga Alam formed from local Indonesian staff administers the research station.

The level of artisanal fishing on the reefs around Kaledupa is so great that the fishery is on the verge of collapse. A UK government Darwin Initiative grant has been obtained to establish an example of how a sustainable reef fishery can be achieved and this project is ongoing (see Trust pages for details). The Darwin fisheries project is run by the Operation Wallacea Trust and works with a Kaledupan based NGO called Forkani.

## FOREST RESEARCH FACILITIES

### Lambusango Facilities

At the start of their visit, all volunteers working on the Operation Wallacea research programme are based in the village of Labundo where they carry out their initial training. Accommodation is in picturesque local village houses, which are usually wooden or attap (dried coconut leaves) on stilts. You will be invited to village events and to eat with the local people. Each room has a mattress with mosquito net and there is a mandi (bathroom) in or near the house. Staying in Labundo is an ideal way to get to know local people and experience how they live. The Research Centre in Labundo, where scientists working at this site are based, has a computer room with statistical software, scanning and printing facilities. Meals, evening

lectures and briefings take place in the village hall. There is a specially built clinic with a medic permanently on site.

Volunteers working on projects denoted IL are based at Labundo and work on study grids in the nearby forests or stay overnight in tents at the Lapago node camp (a 1.5 hour walk into the forest) in order to work on the study grid there or the forests between Lapago and Labundo. Volunteers working on forest projects denoted IN join teams working at remote node camps across the forests. At each camp, four 3km long transects have been marked and sampling sites established along each. Together these sampling sites at Labundo, Lapago and the node camps span habitats of differing disturbance levels. The node camps are set up with hammocks, tents and communal eating areas. Field toilets are built at each of the camps and shower systems are built into waterfalls on the rivers next to each of the camps. The experience of living and working at these remote forest camps is one that few people forget, and the skills that you will develop, both in terms of fieldwork and forest living, will be invaluable.

### North Buton Facilities

Volunteers working on this project will be based at a field camp on the edge of the North Buton Reserve. The camp is being newly established for the 2011 season and is in a scenic site on the edge of a river with waterfalls and pools and surrounded on three sides by the towering forests of the North Buton Reserve. The camp is accessed by travelling up river on a long boat and then trekking for 1 – 2 hours. Accommodation will be in hammocks or tents and there will be a central building for the lectures and lab work. Field toilets are being constructed and communication will be via satellite phone.





## MARINE RESEARCH FACILITIES

The main Opwall research centre in Indonesia is on Hoga Island in the Wakatobi Marine National Park and this base is used to visit the reefs, seagrass and mangrove areas around Kaledupa Island. The Hoga Marine Research Centre is the largest marine research programme run by Opwall and has the greatest concentration of scientists as well as extensive lab facilities. Hoga Island is in the centre of the Coral Triangle – a triangle of reefs mainly in eastern Indonesia that have the highest diversity worldwide of hard corals. In addition to the main base, a purpose-built research vessel the KM Bintang Sedang, has been commissioned by Operation Wallacea enabling surveys and studies to be undertaken more widely throughout the entire Wakatobi Marine National Park.

A new dive training centre is being constructed in Ereke, North Buton which will be used for dive training courses for General Surveyor groups based in North Buton from 2012 onwards.

### Hoga

All students involved in dive training and marine biology research (coded IH), will be based at the Hoga Island Marine Research Station, located on an idyllic tropical island surrounded by white sandy beaches and pristine coral reefs where much of the marine research is focused. Traditionally built wooden houses serve as accommodation on the island and are complete with their own bathroom and private balcony from which you can enjoy cool evening breezes. The station's main building contains a large, open-air study area, a computer laboratory, email and extensive library facilities. Downstairs it also contains a restaurant area and shop from which refreshments are sold. There are also extensive wet and dry lab facilities on site that have been constructed by the Wakatobi government to assist in the development of the Hoga Research Centre as the principal centre for marine research in the Coral Triangle in eastern Indonesia (triangle of

reefs with the highest diversity of hard corals in the World). In addition there is a lecture theatre where the Coral Reef Ecology course and regular scientific talks are presented. There is a fully operational dive centre where visitors to the research base can rent dive equipment. The base also supports a medical clinic stocking a full range of medical supplies and equipment.

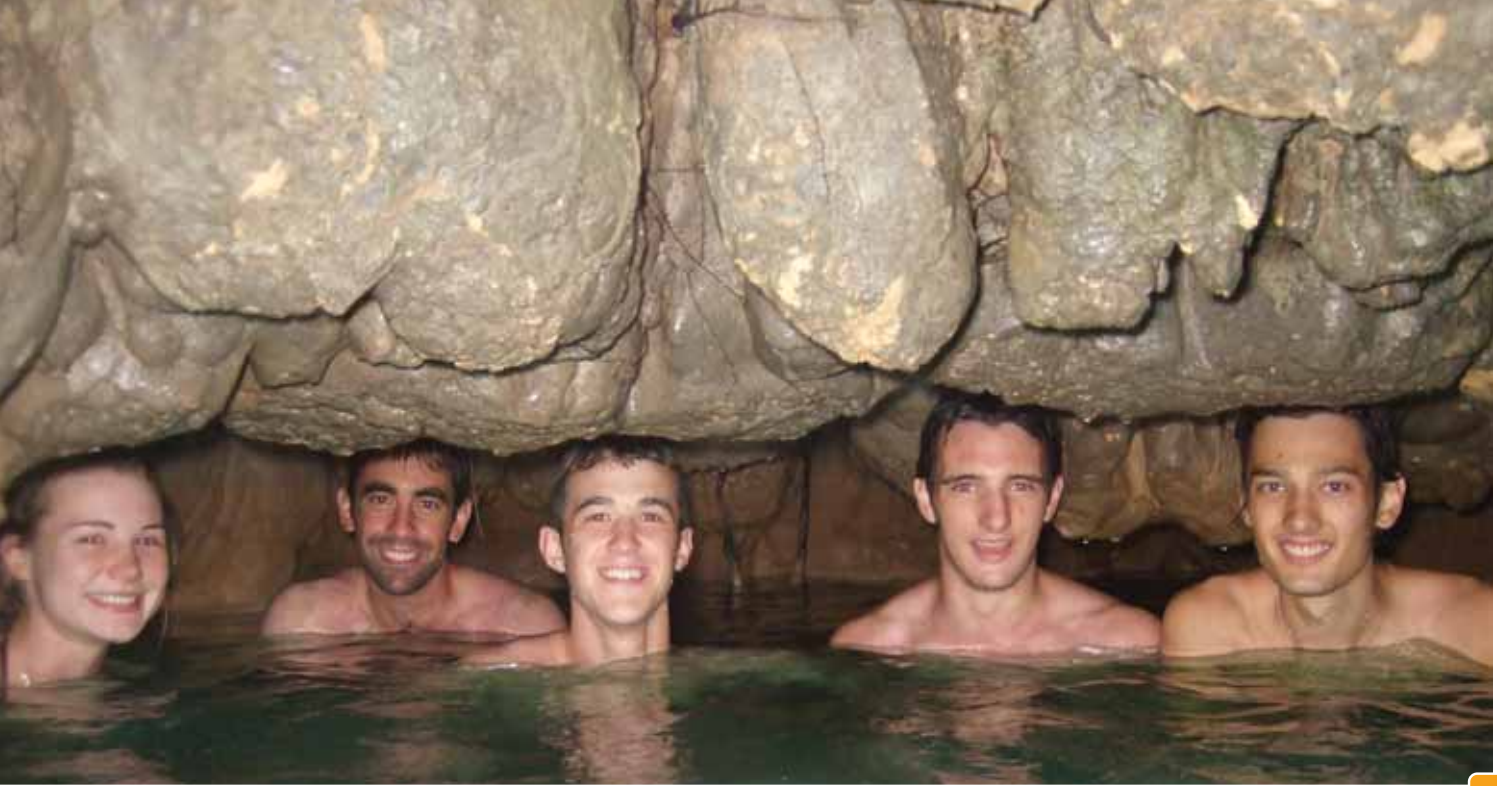
### KM Bintang Sedang

The purpose built, live-aboard dive vessel, KM Bintang Sedang, was built in 2006 and is operated by Operation Wallacea for much of the research season. The vessel is essential to enabling important research to be undertaken across the many islands and atolls scattered throughout the Wakatobi Marine National Park, Indonesia's second largest marine conservation area. The vessel has 12 berths only meaning places are strictly limited. The 26-metre vessel has essential navigation and safety equipment including GPS, depth sounder, satellite telephone and life-raft, and is operated by a highly experienced crew. Time spent on the KM Bintang Sedang is a unique way to contribute towards important research being undertaken within the Wakatobi whilst seeing this unique archipelago that remains largely untouched by the outside world. Projects based on the Bintang Sedang are coded IB.

### Ereke

This new marine training centre is being built on the leeward coast of the Ereke peninsular in North Buton. The centre has a jetty reaching out to the reefs off this sheltered stretch of water making this an ideal location for training courses. Accommodation will be in traditionally built wooden buildings with views out over the bay. There is a fully equipped dive operations centre where students can rent dive equipment. Note this centre is only available in 2012 for General Surveyors working on the North Buton project.





## FOREST TRAINING COURSES

### IN001 JUNGLE TRAINING AND WALLACEA FOREST ECOLOGY

*(Weeks 1, 3 and 5)*

This training course is designed to allow you to acclimatise to the forest environment and give you the field skills to work competently alongside field scientists in the forest. You will be taught practical survival skills, how to live, walk and work safely in the forest, including how to establish a field camp and what potentially dangerous organisms to look out for. The course also contains a series of lectures with practicals to train you in the field survey techniques being used for different taxa and identification of the common species. You will also learn about the ecology of tropical forests and what is so special about the Wallacea forests. You will be spending 3 nights in forest camps with the remaining time based at Labundo. This pre-requisite course is a highlight of the expedition for many volunteers and is where lasting friendships between your co-volunteers, course leaders and local people are built.

### IL002 INDONESIAN CULTURAL EXPERIENCE

*(Weeks 2, 4 and 6)*

This course gives a unique insight into rural Indonesian life and the opportunity to experience what it's like to work in a southeast Asian farm, how to fish in a dugout canoe, learn about medicinal plants, how to plant or harvest rice up to your knees in water in a padi field, and how to prepare Indonesian food. Along with these activities, there will be lectures covering topics that range from Indonesian language (you should be able to speak some Indonesian by the end of the course), Indonesian history and administrative structure.

### CANOPY ACCESS EXPERIENCE

*(Weeks 1 – 8; half-day additional course on top of your normal schedule)*

Canopy Access Limited, the team that helped David Attenborough ascend into the canopy for BBC's Life of Mammals and Planet Earth, are on site to provide access to the canopy for the science teams two days a week. However, for the rest of their time they are available at Labundo to do a half-day demonstration of safe ascent into the canopy. This half-day course which is open to all volunteers costs £80 (approx \$125) and gives students the opportunity to learn how to safely ascend into the canopy. The ascent is done using ascenders (pulley system) with safety ropes and is a unique opportunity to experience wildlife in the canopy. For Research Assistants and Dissertation/Thesis students there is also the opportunity to overnight in a hammock in the canopy so you can see dawn rise over the forest – a truly unforgettable experience. This experience costs £120 which includes the course costs of £80. You do not need to choose the Canopy Access Experience as one of your options – you can do this as an extra experience on site. However, you will need to pre-book either the canopy access or overnight canopy experience courses online [www.canopyaccess.co.uk](http://www.canopyaccess.co.uk).





## MARINE TRAINING COURSES

### IH005 PADI OPEN WATER DIVE TRAINING

*(Weeks 1 – 9)*

This one-week course is a pre-requisite to any diving project. Open Water dive training is free to Operation Wallacea volunteers except for the costs of the PADI registration card and the Open Water Crew Pack, which you need to buy and bring with you. Completion of this course will give you an internationally recognised diving qualification and enable you to join general diving projects accompanied by a Divemaster.

### ADDITIONAL DIVE TRAINING

*(Weeks 1 – 10)*

Additional dive training beyond Open Water level is available and can be fitted around your work on other projects so you don't need to specify the additional courses on your options list. Courses include Advanced Open Water Diver (\$220), Emergency First Response (\$150) or Rescue Diver (\$400 - includes Emergency First Response). Note that these extra courses may not be available at all times, and enrolment may depend on the number of people wanting the training.

### IH006 DIVEMASTER TRAINING

*(Weeks 1 – 10)*

Divemaster training is available free to Operation Wallacea volunteers, with only PADI membership fees and liability insurance costs to pay. Participants will have to set aside four weeks for this course. Before booking this course, you need to be a qualified rescue diver with up to date Emergency First Responder (EFR) training, have a minimum of 60 logged dives, and should contact Operation Wallacea for a detailed list of kit you will need to bring on expedition. Note Divemasters trained with Opwall are offered the opportunity to be

employed as a member of the dive staff team in future years.

Unfortunately, it is not possible to offer work placements in the same year you qualify because of the time passing the course and obtaining your full PADI Divemaster registration and insurance needed.

### IH007 INDO-PACIFIC CORAL REEF ECOLOGY

*(Weeks 1 – 10)*

The Hoga Marine Research Station is ideally situated in the centre of the Coral Triangle, the area with the most biologically diverse coral reefs on the planet. This intensive course involves a series of lectures and in-water practical sessions suited to both divers and snorkelers. The course aims to introduce the key topics of coral reef biology and ecology, and includes a large component that will introduce key species and taxonomic groups. The importance of coral reef ecosystems will also be discussed, along with threats to their continuing survival and management strategies as tools for conservation. Coral reefs cannot be considered in isolation and a healthy reef system is largely dependent on other connected systems. The course will therefore also introduce you to seagrass and mangrove systems. The Indo-Pacific Coral Reef Ecology course will provide you with the knowledge you will need to participate in further Operation Wallacea research activities whilst on Hoga, as well as being a fascinating insight into the functional ecology of coral reefs. Apart from the formal training component, a series of research seminars, lectures of general interest and classes and workshops on other ecological tools will be delivered to you throughout your stay to increase and widen your knowledge base.





#### IH008 WAKATOBI CULTURE, COMMUNITY AND ENVIRONMENT

*(Weeks 1, 3 and 5)*

This course gives a unique insight into rural Indonesian life on remote islands and the opportunity to experience what it's like to work in a local farm, how to fish in a dugout canoe, and how to prepare Indonesian food. Along with these activities, there will be lectures covering topics that range from Indonesian language (you should be able to speak some Indonesian by the end of the course), Indonesian culture and history of the area, as well as introducing you to the marine conservation, development, resource management and eco-tourism issues that are considered significant to the Wakatobi. The course comprises lectures at the Hoga research base and day trips around the island of Kaledupa.

### FOREST RESEARCH ASSISTANT PROJECTS

#### IN101 NODE CAMP BIODIVERSITY MONITORING TEAM

*(Weeks 2 – 8; need to have completed IN001)*

If you join this option you will be based in one of the forest node camps working with a range of scientists. One team is gathering annual monitoring data on the population levels and distribution of two key endemic mammals, the Buton Macaque and Anoa (an endemic dwarf buffalo species on the edge of extinction). This team will be completing very long treks into the heart of the forest, with overnights in fly camps and may be away from the main camp for 2 – 3 days at a time. Volunteers on this aspect of this study need to be prepared for this extreme type of trekking that may include numerous river crossings and even abseiling. The remaining teams are based out of the main node camp. One team is monitoring bird communities from point counts and butterfly communities from transect surveys. Another team is assessing human levels of

extraction in different parts of the forest including rattan, timber and distribution of bees nests exploited for the honey. There is also a team working on the rivers on amphibian demography and a team working on population counts of tarsiers. Most volunteers on this option will spend part of their time on the extreme trek surveys and part of their time on the remaining survey projects based out of the node camp. At the end of each week the node teams will return to Labundo.

#### IL102 LABUNDO BIODIVERSITY MONITORING TEAM

*(Weeks 2 – 8; need to have completed IN001)*

If you join this team you will be based either in the village of Labundo or the field camp at Lapago. There are a number of scientists at these camps who are completing annual monitoring of a range of taxa including the same groups being studied at the node camps. In addition, there are groups working on population densities of Malay Civets, community structure of small mammals and bats and on Buton Macaque behaviour with particular emphasis on the impacts of crop raiding by this species. These surveys have already produced several species new to science, as well as establishing unique data sets on the dynamics of tropical forest vertebrates. Volunteers joining the Research Assistant pool will be helping with a range of activities that include surveys for target groups of invertebrates such as butterflies and fig wasps, setting and emptying pitlines for snakes and lizards, spotlighting for amphibians, harp trapping bats, completing point counts and mist netting for birds, live trapping civets and small mammals, helping with macaque behaviour studies and completing dusk surveys for emerging tarsiers.





## MARINE RESEARCH ASSISTANT PROJECTS

### IH110 USING GIS AND LARGE SCALE BIOTOPE MAPPING TO EXAMINE THE DISTRIBUTION AND CHARACTERISTICS OF SUB-TIDAL, TIDAL AND TERRESTRIAL HABITATS OF HOGA ISLAND

*(Weeks 2 – 10; need to have completed IH007; surveys can be done by snorkeling but if you wish to participate in the dive elements you will also need to be dive trained or have completed IH005)*

During 2010, Operation Wallacea initiated a biotope mapping project that estimated the habitat quality and abundance of key fish and invertebrate taxa on reefs around Kaledupa many of which are not included in the annual change surveys (see IH111). In addition, the project incorporated data collection on the distribution and quality of seagrass, mangrove and terrestrial habitats. Using ARC mapping software and GIS (Geographic Information Systems), an accurate map of the habitats and descriptive data for each area of Hoga Island is being created to enable new arrivals at the Marine Research Centre to quickly identify suitable locations for various studies. The objective of the 2011 surveys is to complete the biotope map for the remaining reefs and associated habitats. Research Assistants on this project will be completing restricted effort manta tow, snorkeling and diving surveys, to estimate approximate coral cover on each stretch of reef, and the abundance and size of key fish groups and invertebrate taxa (e.g. Crown of Thorns Starfish). Seagrass surveys will be completed using snorkel transects, mangroves and terrestrial surveys through trekking based transects and human usage of the island through social surveys.

### IH111 CORAL REEF FISH AND BENTHIC MONITORING

*(Weeks 2 – 10; need to have completed IH007 and be dive trained or have completed IH005)*

The Operation Wallacea Coral Reef Monitoring Programme underpins many of the specific research projects and the results of the repeated annual surveys of 108 transects are fed back to the Government of the Wakatobi to assess annual changes in the reefs. The monitoring programme, which also supports the grant-funded Darwin Project, will continue during 2011 adding to complete the 10th annual survey of these reefs. The surveys are completed along 50m transects with fish community structure assessed from visual surveys using experienced fish biologists. The benthic surveys are completed by underwater video surveys which are then analysed back in the laboratory. In 2011, the stereo video survey approach that was developed by the University of Western Australia and is being used at the other Opwall marine research sites in Cuba, Honduras and Mozambique, will also be used in Indonesia to compare to the results from the surveys completed by the skilled surveyors. Note these data sets from reefs in the Indo-Pacific, Indian Ocean and Caribbean will provide valuable comparative data sets. Research Assistants joining this project will be involved in filming of the transects but will then be expected to work long hours back in the lab completing analysis of the footage.

### IH112 LARGE SCALE SURVEYS OF THE DENSITY, POPULATION STRUCTURE AND ACTIVITY OF THE CORALIVORE STARFISH ACANTHASTER PLANCI

*(Weeks 2 – 10; need to have completed IH007 and be dive trained or have completed IH005)*

The crown of thorns starfish, *Acanthaster planci*, is a highly specialized coralivore. When in high abundance, this multi-armed starfish can devastate coral reef systems. In areas of the Great







Barrier Reef, outbreaks of *A. planci* have decimated huge areas of reefs leading to numerous methods of control and collection. In recent years, the abundance of *A. planci* have seemingly increased and in some areas clear damage has been noted. It is therefore extremely important that a comprehensive study of *A. planci* in the Wakatobi is undertaken to determine its abundance, population structure (using size and number of arms as a proxy), and the extent of coral damage across numerous reef habitats and reef sites. This research will include both diving and snorkeling based activities and examine populations of *A. planci* within large belt transects. A high level of effort is required to gain a true estimate of population size and structure due to the patchy and aggregated distribution patterns of the starfish. This important research is therefore ideal for research assistants who want to help with the assessment and management of reefs of the Wakatobi.

#### IH113 RESEARCH ASSISTANT POOL

*(Weeks 2 – 10; need to have completed IH007; surveys can be done by snorkeling but if you wish to participate in the dive elements you will also need to be dive trained or have completed IH005)*

There are many different marine research and conservation projects running at the Hoga Island Research Centre including diving based projects, snorkeling projects, shallow sub-tidal projects, inter-tidal projects, and research projects focused within the mangrove forests. Research Assistants are always required to help various scientists collect essential data both in the field and at the field centre following field excursions. Research Assistants have the opportunity to gain experience in several different research areas. On arrival at the field base you will be introduced to the range of research projects that are underway and allocated to a scientist whose specific responsibility is to team you up with scientists who need assistance and whose projects match your specific or general interest. Joining the

Research Assistant pool maximises your opportunities to widen your knowledge of marine biology whilst also giving you the opportunity to increase your specialist knowledge in specific areas of research.

#### IB114 REEF CHECK AND MARINE MAMMAL SURVEYS FOR THE WAKATOBI MARINE NATIONAL PARK

*(Weeks 2 – 10; need to be dive trained or have completed IH005 as well as IH007)*

Volunteers joining this project will be based on the live-aboard research vessel, the Bintang Sedang, which over the course of the season will travel around the Wakatobi Marine National Park in order to complete Reef Check and Marine Mammal surveys. Reef Check is a global project that monitors coral reef health across more than 40 countries, and data collected from the Wakatobi will input directly into their global database. In addition, Research Assistants on the Bintang Sedang will conduct a marine mammal census around the Wakatobi. Previous surveys carried out by Operation Wallacea have found that at least nine different species of dolphin and whale frequent the Park and anecdotal evidence suggests that there could be many more. Many sites visited by the Bintang Sedang are extremely remote, and are rarely dived, allowing Research Assistants to observe near pristine coral reef systems. Applicants considering this option should remember that considerable sea travel is involved and the live-aboard research vessel will spend up to a week away from the main base on Hoga as it travels around the Park.





#### IH115 FISHERIES MONITORING WITHIN THE WAKATOBI MARINE NATIONAL PARK

*(Weeks 2 – 10; need to have completed IH007)*

The majority of the near 100,000 residents of the Wakatobi are dependent on marine fish as their major source of protein. Increasing population sizes coupled with increased commercialisation of local fisheries and the recent increased availability of improved technologies have resulted in the over-exploitation of fish stocks. Previous research carried out by Operation Wallacea has provided clear evidence of the decline of fish stocks. From 2007 to 2010, the Darwin Initiative funded a continuous weekly data set of fish catches from various fishing techniques used on the reefs around Kaledupa (fish fences, gill nets, bubu traps, line fishing) to determine monthly patterns of catches. From 2011, this continual data set has been replaced by an annual intensive survey of artisanal catches over the June to August period in the same villages surveyed as part of the Darwin Initiative research programme. The data on catch per unit of effort for the various techniques and the percentage of immature fish of each species being captured by the various techniques are being gathered to compare with previous years and determine whether the fishery is recovering or continuing to decline. Information and data collected will be fed back to government and marine park authorities and will directly aid in the formation of appropriate management strategies and fisheries based regulations. Research Assistants joining the fisheries monitoring team will be directly involved with data collection and data entry and will experience traditional Indonesian fisheries techniques. The project is based on Hoga with day trips out (may be very early mornings depending on tides) to help with monitoring fish catches in coastal Indonesian villages.

#### FOREST DISSERTATION/THESIS TOPICS

The Lambusango forest research programme offers relatively easy access to one of the most endemic rich tropical forests in the Wallacea region of Indonesia. Operation Wallacea science teams have developed expertise in the ecology of these forests over more than a decade and a wide variety of dissertation research areas have been established. All dissertation topics will provide you with an opportunity to collect high quality data to analyse and write up, and will contribute to an understanding of the forests. Some of the topics contribute to the long-term monitoring projects, giving you an established set of methods to employ whilst other topics will require you and your field supervisor to develop methods to answer a novel question. All research topics coded IL will operate from Labundo where the Senior Scientist is based, whilst those denoted IN will require time spent operating from the node camps, albeit with regular returns to the Labundo base.

#### IN201 THE ECOLOGY AND EXPLOITATION OF RATTANS

*(Weeks 2 – 8; need to have completed IN001)*

The rattans, climbing palms that are harvested to provide raw material for building furniture and baskets, are the most important non-wood forest product in the Lambusango forests. Research by Operation Wallacea has identified 19 species of rattans in Lambusango alone. There are a number of ways that this topic could be developed. One project could examine the characteristics of soils and forests in which the most frequently encountered of these different species grow in order to assess the key environmental factors that influence rattan distribution and community composition. Another project could estimate the rates of rattan production and exploitation rates in different parts of the forests from re-surveying a series of standardised plots around the various camps from which similar data have been gathered in previous years. Another project could review the various techniques used to assess rattan extraction rates and determine a strategy that could be used by forest rangers to monitor extraction and licence rattan collectors.





### IN202 MAPPING FOREST CHANGE IN SPACE AND TIME

*(Weeks 2 – 8; need to have completed IN001)*

The forests of Lambusango change across the landscape, with some forest on recent limestones, others on much older limestones, sandstones and cherts and others still on ultramafic rocks, one of the rarest forest types in south east Asia. These forests are also changing with encroachment being a problem at points around the edges. One team is carrying out detailed and broad scale mapping of forest characteristics on a variety of geology and at differing stages of degradation and regeneration and use these data to classify Landsat imagery from Lambusango. Various dissertations could be developed around these data sets such as assessing changes in forest cover over time. Additionally, species distributions could be correlated with satellite derived environmental variables to then predict the wider distributions of those species. This topic requires that you have some prior experience of processing remote-sensed imagery as you will have to process your data independently once you get home.

### IN203 MEDICINAL ETHNOBOTANY

*(Weeks 3 – 8; need to have completed IN001 and IL002)*

The people of Buton have a long tradition of using local plants in medicine. One of the Opwall researchers is recording some of this knowledge before it is lost, as modern medicine becomes available. Local people are being interviewed, with the aid of a translator, targeting those with a special knowledge of traditional medicine, particularly the local expert in a village ('dukun'). The objective is to establish which plants are used to treat medical conditions such as cuts, coughs, tiredness, headache, stomach ache, skin ailments, problems of childbirth, mental illness and cancer. Methods used in the preparation of medicines will be recorded. Short walks into the forest and farmland will be made to find the medicinal plants, which will be identified to species – this may involve taking photographs of the plants and visiting Kew Herbarium after the fieldwork is

completed. Comparisons can be made with the published literature on the properties of the species. Efforts will be made to learn the rationale for using particular plants for treating particular ailments. This might not be simply because the plant is known to cure the ailment, using objective standards of proof. This study can be used to develop a series of dissertations looking at questions such as how reliant different communities are on traditional medicine, whether communities are using the same herbal medicines for the same illnesses, how traditional knowledge is being passed on, etc.

### IN204 THE EFFECTS OF FOREST DISTURBANCE ON BUTTERFLY COMMUNITIES

*(Weeks 2 – 8; need to have completed IN001)*

Butterflies are often used as biodiversity indicators – community composition is affected by levels of forest disturbance and openness of the canopy. Operation Wallacea teams are completing annual forest butterfly surveys from pollard walks, sweep netting and fruit baited traps at each of the studied field camps. This survey could be utilised to ask a series of dissertation or thesis questions. For example, one project could study the effects that environmental variables associated with forest disturbance have on butterfly abundance and diversity. Collection of data on habitat structure at these sites would then allow the impact on butterfly communities that forest structure factors have, such as degree of canopy openness, amount of understory vegetation, etc. Alternatively, the effect of height on butterfly community composition could be studied from fruit baited traps set at different heights in the canopy. The effectiveness of the various survey techniques could be examined to determine the effect of time on the effectiveness of pollard walks, how sweep net catches compare with pollard walks and fruit baited traps, how bait type affects catches of butterflies, etc.





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#### IN205 INFLUENCE OF HABITAT STRUCTURE ON HERPETOFAUNAL ASSEMBLAGE COMPOSITION IN SULAWESI

(Weeks 2 – 8; need to have completed IN001)

The general aim of this project is to examine relationships between forest habitat structure and herpetofauna assemblage composition. As part of the above overall research and monitoring project, you will assist the herpetologist in the collection of herpetofauna data at approximately 45 sampling sites stratified into areas with differing levels of forest disturbance. The surveys at each site will be completed using five buckets buried in the ground with a fence running over and connecting each bucket. These pitfall traps will be checked daily. Time-constrained diurnal and nocturnal censuses will also be undertaken at each site and where possible with the help of the canopy access team spotlight surveys of the canopy will be completed for arboreal herpetofauna. These data could be supplemented by taking habitat structural measurements at each site, using standard measurements previously developed and the spatial patterns of assemblage composition and individual species with respect to habitat characteristics determined. This project could focus on either the pitfall data, or ground census data.

#### IN206 LIFE HISTORY AND MORPHOLOGY RESPONSES OF FOREST SCINCID LIZARDS TO FOREST STRUCTURE AND DISTURBANCE

(Weeks 2 – 8; need to have completed IN001)

Changes in forest structure brought about by disturbance potentially influence microclimate of the forest floor. This has implications for activity patterns, resources, predation and competition of forest reptiles. In order to persist in such modified environments, species may respond to these influences with changes in growth rates, morphology and life history. This project will assess variation in morphology and life history traits of three common forest scincid lizards: *Eutrophis rudis*, *Sphenomorphus variegatum* and *Parvoscincus* sp.

As part of the above overall research and monitoring project, students on this project will assist the herpetologist in the collection of herpetofauna data at pitfall sampling sites, measure morphology and life history traits of these species, and examine relationships with habitat structure.

#### IN207 DEMOGRAPHY OF STREAM-BREEDING FROGS ON BUTON: INFLUENCE OF HUNTING.

(Weeks 2 – 8; need to have completed IN001)

Southeast Sulawesi is home to one of the world's largest frogs, *Limnectes grunniens* (individuals over 800 grams have been recorded!). Unlike most frogs, this large species appears to have very few natural predators (e.g. frog-eating snakes, birds and mammals). The only vertebrate predator potentially capable of eating adult *L. grunniens* in forests environs is the Malay Civet. In addition to these natural predators, *L. grunniens* is hunted for human consumption. Previous research on Buton indicates that large frogs in populations subjected to strong hunting pressure are more wary of people than at more remote sites where hunting pressure is presumed to be lower or non-existent. The aim of this project is to get robust data on the population ecology of this species at disturbed and undisturbed population sites. Monitoring transects have been established along streams supporting populations of *Limnectes grunniens* near the research centre of Labundo and the Lapago and Anoa node camps. Populations will be censused at each site, using mark-recapture techniques. Life history, behaviour and microhabitat associations will also be measured. Each site will be sampled on consecutive nights for 5 days, which will then be repeated twice during the season. Spatial and temporal variation in population density, key life history traits and behaviour will be compared between sites and across years. As part of the above study, dissertation students will assist scientists collecting data at each node camp. These data can be used to generate population density estimates and size structures for each site, and relate these to relative human accessibility.





#### IN208 HABITAT ASSOCIATIONS OF BIRD SPECIES AND EFFECTIVENESS OF SURVEY STRATEGIES

*(Weeks 2 – 8; need to have completed IN001)*

There are around 80 species of birds regularly found in the forests of Lambusango; about 60% of these are endemic to the Wallacea region and range from large hornbills to tiny sunbirds. Bird communities are being surveyed as part of the Opwall programme at 24 sites at each camp using 50m fixed-radius circular plot point counts. Each study site is being surveyed three times, with the total number of species detected after three counts being recorded in order to establish patch occupancy rates. Sampling is being conducted each morning between 06:00 – 07:30, this being the period where bird activity and vocalization is greatest, yielding the greatest number of contacts. Point count samples are begun immediately on arrival at each study site, with no 'settling in' period being used. This has been shown to allow the recording of any birds disturbed by the surveyors, thereby increasing the number of contacts made per count. A 10 minute sampling period is used, as counts of this length have a reduced likelihood of multiple contact recording, while still being capable of detecting >80% of bird species present in an area. In addition, mist netting surveys will be completed and point counts conducted in the canopy to compare with ground based point counts. Projects within this topic could concentrate on determining the habitat associations of particular groups (e.g. hornbills, cuckoo shrikes, flowerpeckers, etc.) or could assess how the communities overall change in relation to levels of forest disturbance. Methodological studies could also be included such as comparing the results of analysis of taped calls at the point count sites with those recorded during the actual counts or the effectiveness of mist net surveys versus point counts.

#### IL209 TRAP SELECTIVITY FOR SMALL MAMMAL SURVEYS

*(Weeks 2 – 8; need to have completed IN001)*

Small mammal trapping is being completed at the Labundo and Lapago sites throughout the Opwall season using three different trap sizes. The traps are being set adjacent to pitfall traps. These data are ideal for a dissertation looking at the effect of trap size on small mammal species captured and whether pitlines catch a different proportion of the forest floor small mammal community. Anecdotal information from Borneo suggests that baits such as palm oil nuts may be much more effective than standard peanut butter and rolled oats that have been used as bait in previous years for the Buton programme. Another project could experimentally compare several bait types with respect to trap success.

#### IL210 FACTORS AFFECTING BAT ASSEMBLAGE COMPOSITION

*(Weeks 2 – 8; need to have completed IN001)*

The main focus of the bat research programme is studying the species richness and composition of bat assemblages found inside the forest. These species are adapted to life in dense vegetation and are therefore expected to be especially vulnerable to the effects of logging, rattan extraction and other types of forest disturbance. Potential projects could focus on characterising spatial patterns of different species, or temporal and spatial comparisons of assemblage composition, relating this to habitat structure and levels of human activity.

#### IL211 ECOLOGY OF SULAWESI'S TOP MAMMALIAN PREDATOR

*(Weeks 2 – 8; need to have completed IN001)*

The Malay civet is the principal (possibly the only) mammalian carnivore in the Lambusango Forest. Very little is known about the population dynamics of civets or indeed any other rainforest carnivore, and this project provides an excellent study system to investigate population processes in this ecologically important group.





The project builds on a 7-year data set working on a marked population of civets occupying a 4 km<sup>2</sup> area of forest. So far, more than 110 civets have been tagged, and the project is beginning to build up a unique picture of civet ecology. Dissertation projects can add to this long-term study by repeating annual surveys which involves a 7 – 8 week capture-mark-recapture (CMR) study to estimate population density and to identify which animals are still remaining in the population from previous surveys. Projects could focus on comparing observed population metrics (e.g. density, age structure, average body mass) of Malay civets in the Lambusango forests with those published in studies from elsewhere in their range under different ecological conditions, or even with other similar-sized mammalian carnivores living in contrasting habitats. Project students can also examine elements of civet survival (e.g. what attributes of a civet make it more likely to be found in the population in the following year?) using data from the previous survey season (data includes physical attributes such as age, size, and sex and behavioural attributes such as the number of times it was captured within a season). This project provides experience in how to carry out a CMR study for a small carnivore and how to estimate population density from CMR data using CMR models (e.g. CAPTURE, Jolly-Seber). These are standard tools in wildlife ecology and a must for any budding wildlife biologist.

#### IL212 SLEEPING SITE SELECTIVITY BY THE BUTON TARSIER

*(Weeks 2 – 8; need to have completed IN001)*

Tarsiers live in small groups which emerge from their sleeping sites in trees, tree falls, thickets or holes in the ground at dusk and return at dawn. Previous work on Buton has shown that tarsiers are using sleeping sites, including strangling figs, rock crevices and vine tangles for sleeping sites. By observing tarsiers returning to and emerging from these sites, it is possible to map them, measure group size and assess the key features of sleeping sites. Occurrence of sleep sites will be assessed, using dawn triangulation/

quadrangulation sampling over 0.75 ha plots. Colony sizes will be estimated using dusk sleep site monitoring techniques. Quality and availability of potential roost sites will be evaluated in the vicinity of each plot. This topic could be developed into a series of research questions. For example, how does the quality and availability of sleep sites influence tarsier group size and group density? Alternatively, how is availability of sleep site resources distributed with respect to landscape, habitat variability and human disturbance? Techniques could be explored to assess relative abundance/biomass of invertebrates, perhaps using torch light traps with sticky cards installed adjacent to sleeping sites to yield indices of tarsier food availability at the various sites.

#### IL213 EFFECTS OF FOREST DISTURBANCE ON BUTON MACAQUE BEHAVIOUR

*(Weeks 2 – 8; need to have completed IN001)*

The Buton Macaque is endemic to SE Sulawesi. Of all the known macaque species it is one of the least studied with the only published papers on the behaviour of this species coming from Operation Wallacea field research. There are three semi-habituated troops of macaques used for behavioural research - one in a forest/farm matrix, one in disturbed forest and one in relatively undisturbed forest. One project could examine behavioural responses to disturbance in terms of overall activity budget, feeding behaviour, aggression and ranging. Data could be collected through scan sampling and comparisons made between age and sex classes of monkeys as well as between the troops.

#### IL214 CROP RAIDING AND HUMAN-WILDLIFE CONFLICT IN BUTON MACAQUES

*(Weeks 2 – 8; need to have completed IN001)*

Macaques are important crop pests and troops that live in forest edges frequently enter farmland to raid crops. As part of a long-running study on crop raiding, this topic monitors farms on the forest





edge to record crop losses by monkeys and to characterise the crop-raiding behaviour. Projects could examine questions such as whether some crops are more attractive to the raiding macaques, how macaques raid farms and the impacts of human activity on the farms. This would allow planting regimes to be established to minimise losses and effective methods of deterring the macaques to be developed. Macaques that crop raid come into contact with human environments much more frequently than those in the forest. They may therefore be exposed to different parasites from their forest-dwelling counterparts. These parasites may be detrimental to macaque health, but the macaques themselves may also act as disease reservoirs. Another project could compare intestinal parasite loads from faecal samples of forest and farm macaque troops in order to test the hypothesis that crop-raiding macaques have higher parasite loads than forest troops.

#### IN215 DENSITY AND DISTRIBUTION OF SULAWESI MEGAFUNA

*(Weeks 2 – 8; need to have completed IN001)*

Three of the largest and most charismatic vertebrates that are present in the forests of Buton are endemic species of conservation concern: the anoa, a highly endangered dwarf buffalo, the Buton Macaque, a poorly studied endemic primate and the knobbed hornbill which is often captured for the pet trade. A survey team will assess the abundance of anoa, macaques and hornbills on 3km transect lines at the forest node camps. Various projects could be completed as part of this topic. Anoa distribution could be assessed using patch occupancy analysis and hornbills and macaques through distance sampling. Forest structure could be assessed through standardised sampling at points along the transects and the distribution of the target species related to forest structure and levels of human activity.

## MARINE RESEARCH DISSERTATION/ THESIS TOPICS

The Indonesia marine research programme which is the largest and most integrated marine research programme run by Opwall is divided into four main research themes: coral reefs and climate change, marginality and life in extreme environments, ecological and social resilience and natural resource and conservation management. Each of these main research themes has a series of research activities and within each of the activities are a few suggested research topics. These topics, which are all based on Hoga Island, range through dive based marine biology, intertidal and snorkel based projects, mangrove based studies, behaviour and ecological studies, fisheries management and social science/anthropology topics.

### RESEARCH THEME 1: CORAL REEFS AND CLIMATE CHANGE

*Mechanisms of coral bleaching and thermal tolerance of reef building species*

#### IH220 THE COUPLED EFFECT OF LIGHT AND TEMPERATURE ON THE THERMAL TOLERANCE OF ACROPORIDS

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005 if incorporating a diving element)*

Coral bleaching is a widespread and extensively studied phenomenon, yet many of the underlying mechanisms are still poorly understood. In order to better understand and therefore implement more effective management plans, it is imperative to investigate more in depth the various factors and mechanisms involved in a thermal bleaching response. One of the most important reef building coral genus of the Indo-Pacific is *Acropora* which are generally fast-growing, highly fecund corals that typically invest energy into 'quantity' not 'quality'. One project could investigate the coupled effect of light and temperature on Acroporids collected across environmental gradients (mainly light). The research could determine whether *Acropora*





obtained from shallower environments are more tolerant to thermal stress than conspecifics from deeper habitats. The experimental component of the research is laboratory based but opportunities exist for both diving and snorkeling elements to be included.

#### IH221 THERMAL INDUCED RAPID CORAL MORTALITY

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005 if incorporating a diving element)*

The demise of coral reefs is one of the greatest environmental disasters Mankind is facing with some scientists predicting that 33% of all coral species will be lost within the near future. It has been suggested that corals with a higher skeletal density are able to tolerate thermal stress through numerous mechanisms of acclimation thereby enabling the species to track environmental conditions (a sub-lethal response). However many other, often functionally important, species have limited acclimatory potential and rapidly die off during relatively small changes in temperature (just a few degrees above the long-term monthly average). One project could assess such rapid thermal mortality and compare the responses of a range of species collected from a range of sites to determine possible implications of environmental anomalies (e.g. elevated temperature common during El Niño events) on the biological and physical structure of reef systems. The experimental component of the research is laboratory based but opportunities exist for both diving and snorkeling elements to be included.

#### *Coral acclimation to environmental change*

#### IH222 PHOTOACCLIMATION POTENTIAL OF REEF BUILDING CORALS IN RESPONSE TO SEA LEVEL RISE

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005 if incorporating a diving element)*

The rate of sea level rise is predicted to increase as climate changes with potential implications to reef systems. Changes in sea level

ultimately alter the light climate available for corals to grow and consequently the diversity and productivity they can support. Corals require sunlight to grow but are predicted to 'drown' unless key species are able to grow fast enough to keep up with the rate of sea level rise, or successfully acclimate to altered light climates until they can catch up. As yet, little is known of these fundamental properties for the range of reef building coral architect species that exist throughout the Indo-Pacific. One project could examine the rates and mechanisms of photoacclimation of coral species across natural light gradients and in particular focus on how corals acclimate (or coral communities adapt) to extremes of high and low light intensity. The experimental component of the research is laboratory based but opportunities exist for both diving and snorkeling elements to be included.

#### IH223 THE ECO-PHYSIOLOGY OF CORALS WITHIN HIGH LIGHT ENVIRONMENTS

*(Weeks 2 – 8; need to have completed IH007)*

Understanding how coral communities are regulated by their growth environment is critical for informing how, and to what extent, climate change will ultimately affect reef systems. Examining coral species that persist in present day extreme (or "marginal") reef environments can yield clues as to which species have evolved tolerance and thus should become most dominant under future climate change scenarios. Light availability is fundamental for coral growth; however, too much light can be toxic (and ultimately mimic the affect of thermal stress) and cause corals to bleach. As reefs become warmer, they are also predicted to become clearer; thus, understanding how species have adapted to tolerate light stress is a key issue in environmental and climate change research. One project could identify species most tolerant, as well as the physiological mechanisms that afford tolerance, to high light extremes that exist on reef flats. In particular, studies could focus on species of Acroporidae and Pocilloporidae that are known to occur in reef flats but are typically considered to be the most environmentally sensitive of all reef forming corals. This project is mainly laboratory based but will require sampling from shallow sub-tidal environments.





### Ecological implications of climate change

#### IH224 THE IMPORTANCE OF DIFFERENT CORAL GROWTH FORMS TO OVERALL REEF BIODIVERSITY AND POTENTIAL CONSEQUENCES OF LARGE SCALE CHANGES TO REEF ARCHITECTURE

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005 if incorporating a diving element)*

Corals grow in a variety of forms ranging from smooth boulder-like colonies (termed "massive" growth form) through to highly complex heavily branched colonies. These different growth forms provide different levels of physical complexity (topographic diversity and spatial heterogeneity) and consequently support different levels of biodiversity. Recent research suggests that different growth forms, associated with different rates of growth, have different resilience levels to environmental change. This has led to many scientists suggesting that the physical structure of reefs of the future will be less complex, due to the loss of the architecturally complex but sensitive branching species. One project could assess the relative importance of different coral growth forms in adding to the overall physical complexity of reef systems whilst also identifying the levels of biodiversity different growth forms support. Only through such primary research will it be possible to predict the future form and function of coral reef systems impacted by climate change. This research requires in water activity and is suitable for those interested in diving or snorkeling based research.

### Bioenergetics of temperature change

#### IH225 Q10 RELATIONSHIPS OF FISHES INHABITING HOGA'S INTERTIDAL NURSERY AREAS

*(Weeks 2 – 8; need to have completed IH007)*

What are the effects of temperature change on metabolic responses of juvenile reef fishes from nursery areas surrounding Hoga Island reefs? Tidepools, mangroves and seagrass beds serve as nursery

areas to many important reef fishes. These areas have several characteristics in common: all are tidally influenced and experience rapid, sometimes extreme changes in depth, temperature, salinity and dissolved oxygen. While well adapted for current conditions, some fishes may be extirpated from traditional nursery zones if ocean temperatures increase. Current models predict a 1 – 2°C increase in surface sea temperatures over the coming decades, and it is likely that changes will be more extreme in shallow-water nurseries. A better understanding of how temperature change may affect metabolic responses can aid in identifying critical nursery habitat as well as in identifying species most or least at risk, should climatic conditions change. One project could examine changes to metabolic rates (using oxygen consumption) of key fish species in response to temperature. The research is primarily laboratory based but will also include intertidal based ecological surveys to assess the abundance and distribution patterns of the test species.

#### IH226 TEMPERATURE PREFERENCES OF INTERTIDAL FISHES

*(Weeks 2 – 8; need to have completed IH007)*

How does temperature affect distribution of fishes? Temperature is the overriding factor affecting animal behavior and physiological function. Understanding temperature preference profiles will provide important insights into current as well as potential distribution patterns of terrestrial and aquatic fauna. With the predicted increase in sea surface temperatures and general change in climate, shallow nursery areas such as mangroves and tidepools, as well as some terrestrial environments are likely to experience even greater temperature variations. Animals adapted to survive in these specialized habitats are likely to experience changes in distribution and behavior patterns. A better understanding of the effects of temperature on animal behavior and physiological processes will aid in developing effective conservation and management practices. One project that would be both laboratory and field based (intertidal) could develop thermal





profiles across habitats frequented by key intertidal fish species. The overall thermal strategies of animals living in these habitats will also be examined along with the thermal niche of particular species through the construction of critical thermal polygons, a simple graphical representation of thermal tolerance and acclimation range.

## RESEARCH THEME 2: MARGINALITY AND LIFE IN EXTREME ENVIRONMENTS

*Thermal tolerance of intertidal fish living in two worlds - evaporative water loss adaptations of amphibious terrestrial and intertidal animals*

### IH227 WATER LOSS RESISTANCE OF INTERTIDAL CRABS RELATIVE TO INTERTIDAL DISTRIBUTION AND INUNDATION PERIOD

*(Weeks 2 – 8; need to have completed IH007)*

Does evaporative water loss resistance for intertidal or terrestrial amphibious animals of Hoga Island differ, and are there patterns associated with habitat use? Hoga Island hosts a large and diverse population of terrestrial and intertidal amphibious fauna including six species of crab (*Uca* and *Ocapode* genus). Indeed, virtually every aspect of their life history, behaviour and distribution is dictated by their degree of amphibiousness. Although uniquely suited to exploiting resources on land as well as water, drying during periods of emergence can be a major problem for these animals. Changing land use, habitat loss and shifting climate conditions threaten many of these animals in populated areas, but Hoga offers the opportunity to study amphibious adaptation in a relatively pristine habitat. One project could quantify rates of water loss of the key intertidal crabs of Hoga under controlled laboratory conditions. To contextualize water loss resistance ecological surveys could be conducted to identify distribution patterns of the different species.

### IH228 NOCTURNAL AND DIURNAL EMERGENCE PATTERNS IN AIR-BREATHING MUDSKIPPER AND ROCKSKIPPER FISHES IN RELATION TO RESISTANCE TO EVAPORATIVE WATER LOSS

*(Weeks 2 – 8; need to have completed IH007)*

Mudskippers and Rockskippers are common within the intertidal habitats of Hoga island. Both species are air-breathing and spend prolonged periods out of the water. Such behavior will undoubtedly result in severe desiccation stress but resistance to water-loss has not previously been quantified for these two species. One project could assess water-loss and calculate water-loss resistance under controlled laboratory conditions. Diurnal and nocturnal ecological studies could also be undertaken to determine if cycles in behavior, as well as underlying physiology, reduce the desiccation stress experienced by these species.

### IH229 RESISTANCE OF TROPICAL FROGS TO WATER LOSS AND IMPLICATIONS FOR DISTRIBUTION CHANGES IN THE FACE OF GLOBAL WARMING TRENDS

*(Weeks 2 – 8; need to have completed IH007)*

Terrestrial amphibians (especially anurans) have experienced rapid population declines worldwide, and some have been extirpated across much of their range. A better understanding of their physiological ecology and habitat requirements can provide useful insights into species management, preservation and restoration. Owing to their susceptibility to drying, many amphibians could show marked changes in distribution if current climate change models manifest themselves. One lab based project could quantify the water-loss resistance of tropical frogs common to Hoga island. There are also opportunities to include an ecological component to this research through the detailed investigation of abundance and distribution patterns of the key species.





*Life in the mangroves*

**IH230 EPIFAUNAL DIVERSITY ON MANGROVE PROP-ROOTS**

*(Weeks 2 – 8; need to have completed IH007)*

Does a higher degree of complex root systems have a higher diversity of root fauna, and do epifaunal communities change with shore height/immersion times? Animals such as Oysters, Mussels, Littorina, Sesamid crabs and Sponges are integral to the community structure of mangroves enhancing system diversity. Some of these animals filter the water, and some are important detritivores that process decaying leaf litter. Therefore, many of these species are important in the trophodynamics of mangrove energy pathways. These animals rely on hard surfaces at low tide such as prop roots. If wood harvesting continues, will these animal communities decline? One project could look at the diversity of fauna associated with prop-roots in different mangrove zones and could involve detailed ecological studies within the mangrove followed by sorting and identification at the marine facility.

**IH231 FISH AND INVERTEBRATE ASSEMBLAGES ON NON-REEFAL CORAL COMMUNITIES IN MARGINAL ENVIRONMENTS**

*(Weeks 2 – 8; need to have completed IH007)*

Coral communities that grow beyond the threshold of physico-chemical tolerance of reefal accretion (e.g. low aragonite saturation, high/low temperatures, high/low salinity, highly turbid environments or high light environments) are of high interest to the scientific community as these may inform us of the future of our coral reefs as increasingly reef environments become more marginal. These coral communities are not as diverse as those found on reefs with more optimal conditions, but they are important nonetheless, and have not been studied to the same extent as coral reefs. This research, involving detailed field surveys carried out by snorkeling through the mangroves, aims at increasing our understanding of the total community structure of coral but not reef habitats within these marginal systems. There are opportunities to compare such communities with reef environments through scuba diving.

**IH232 ECO-PHYSIOLOGY OF MANGROVE CORALS**

*(Weeks 2 – 8; need to have completed IH007)*

Mangrove systems are considered to be “marginal” reef environments and are characterized by environmental conditions that are sub-optimal for coral growth. Typically, light and calcium carbonate availability required for growth are low, whilst daily temperature fluctuations, which can inhibit growth, are high. However, corals do exist in mangrove systems thereby demonstrating that some coral species may be adapted to tolerate extreme environmental conditions, and thus could become the major reef formers as reef environments continue to rapidly change. Unfortunately, little is known about community structure (diversity) or the form and function (species diversity, life history strategy, growth rates, mechanisms of tolerance to marginal growth conditions) of the coral species found within mangrove systems. One project could therefore conduct community analyses and physiological examinations of mangrove corals through laboratory experiments and detailed snorkeling based surveys.

*Macroinvertebrates of sedimentary shores*

**IH233 BEHAVIOUR OF SINGLE SPECIES POPULATIONS**

*(Weeks 2 – 8; need to have completed IH007)*

The behaviour of sympatric species of fiddler crab are under study at Ambeua, but the same species also occur in single-species populations, for example of *Uca vocans* on the Ambeuan mudflat, or *U. tetragonon* at the western end of Pantai Pogo (near the village of Furake) and *U. mjoebergi* at the eastern end of the same bay. Investigation of the ecology of such species in allopatry would provide valuable comparative information; i.e. for how long after the tide has receded do they feed?; what are the sizes of their feeding territories?; how much of the feeding period do they actually spend feeding?





**IH234 BEHAVIOUR IN MIXED POPULATIONS OF CRABS**

*(Weeks 2 – 8; need to have completed IH007)*

Both mixed and single-species populations of two species of sentinel crab, *Macrophthalmus convexus* and *M. serenei*, occur, and occur in some numbers, at the top of the low tide sand flat on Pantai Kampoa. The mixed populations raise interesting questions related to potential competition, avoidance of competitive exclusion, etc. For example, do the two species feed at different times?, do the feeding individuals really feed together?, do they interact with each other, and if so is one species always apparently dominant?

**IH235 DISTRIBUTION OF FIDDLER-CRABS WITHIN THE UPPER PANTAI POGO**

*(Weeks 2 – 8; need to have completed IH007)*

Issuing landwards from the eastern end of Pantai Pogo is a high-level reef platform surrounded by mangroves. Several species of fiddler crab occur in the thin layer of soft sediment overlying this platform (probably with burrows extending down through holes in it), but the species present and the extent to which their distributions overlap are not yet known. One project could map the distribution of seemingly co-existing species.

*The biology and ecology of shallow water patch reefs*

**IH236 DAMSELFISH: FACILITATORS OR INHIBITORS**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005 if including a diving element in the research)*

Damselfish range in their behavior and feeding preferences, and through both aggressive as well as passive interactions affect the fish species in proximity to their home range. This can be a positive effect as some damselfish species may act as facilitators for certain fish groups by enhancing food availability through their algal farming techniques, or conversely, negative effects could occur as some damselfish are highly aggressive and/or may actually reduce food

available. Further understanding of these relationships will allow a more comprehensive understanding of fish community dynamics on the reef flat. One project could determine how different damselfish species affect the community structure of fish through a series of ecological surveys and behavioral studies.

**IH237 CORAL REEF PATCH DYNAMICS**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005 if including a diving element in the research)*

How stable are patch reef communities over time? What changes are occurring and over what time scales? What are the responses of fish communities to changes in benthic cover? Coral reefs are dynamic ecosystems and may actually exist in multiple stable states. Permanent transects have been used to successfully document changes in benthic cover, but assessing changes in mobile organisms are more difficult. However, smaller patch reefs or bommies provide a more ideal template to evaluate changes in mobile organisms, as they tend to house a greater number of resident species. One project using snorkel-based ecological surveys of a number of patch reefs of variable size, biological complexity and location within the reef flat – seagrass zone could help describe patch reef dynamics. Patch reefs could be repeatedly visited and variability in fish communities, at different states of the tide and lunar cycle assessed.

**RESEARCH THEME 3: ECOLOGICAL AND SOCIAL RESILIENCE**

*Resilience of mangrove systems*

**IH238 MANGROVE ROOT-TISSUE RE-GENERATION**

*(Weeks 2 – 8; need to have completed IH007)*

Do mangrove woody tissues have the ability to recover when damaged in their dynamic environment? Mangrove habitats are essential for the health of adjacent ecosystems such as sea grass beds and coral reefs; as the mangroves sequester and trap fine sediments within their root systems and for their role as vital nursery grounds for many juvenile crustacean and fish species located within





the complex root systems at high tide. Anthropogenic activities such as mangrove wood harvesting, could be highly damaging but as yet the extent to which mangrove species can recover from such impacts has been little studied. One project could assess the regeneration potential of damaged mangrove root systems. Natural damage to root systems could be assessed at various zones and repeated assessments used to determine the rate at which tissue recovers. Snorkeling may be useful but this project will need only limited in-water activity.

**IH239 DETRIMENTAL IMPACTS UPON MANGROVE FAUNAL COMMUNITY STRUCTURE FACILITATED BY WOOD REMOVAL**

*(Weeks 2 – 8; need to have completed IH007)*

To what extent does the harvesting of mangrove materials reduce the biodiversity of these important ecosystems? The majority of mangrove animals exploit the available hard substrates within these extreme environments. Areas such as mangrove prop roots and in particular large wood detritus (LWD) are a favored habitat for the majority of mangrove fauna. However exploitation of mangrove systems, and removal of both live trees and LWD will inevitably reduce available habitat. Limited information is available on extraction rates (live wood to LWD), natural levels of LWD and consequences of its removal for biodiversity. One project, which would require trekking through mangrove forests could examine the importance of LWD for system biodiversity and evaluate the consequences of its removal.

**IH240 MANGROVE HABITAT COMPLEXITY**

*(Weeks 2 – 8; need to have completed IH007)*

Does a reduction of mangrove habitat complexity result in a reduction of biodiversity? Much tropical research has examined the association between loss of structural complexity and loss of biodiversity, particularly on coral reef systems. Like coral reefs, mangrove forests are also in decline, and their habitat complexity is also under threat

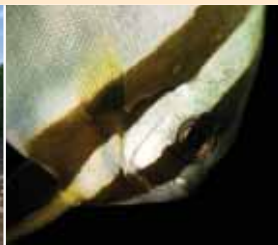
mainly through anthropogenic actions such as wood extraction and land clearance. However, unlike coral reef systems, very little is known about the association between habitat complexity of mangrove systems and associated biodiversity. One project, which would involve trekking through and sampling of the mangrove forest, aims at quantifying mangrove complexity and the association between complexity and species diversity across a range of spatial scales and disturbance levels.

**Trophic structure of reef fish across environmental gradients**

**IH241 RESOURCE UTILIZATION OF REEF FISH ACROSS ENVIRONMENTAL GRADIENTS**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005 if including a diving element in the research)*

As reef habitats become more degraded resident fish species will have to constantly adapt to the changing environment. Arguably it is the species that are most plastic in their behavior that will fare best. One project could use behavior based studies to examine the degree of plasticity that exists between two important, coral dependent butterflyfish species. This research could examine the feeding behaviour (selectivity and feeding type) of two species of corallivore (*Chaetodon baronessa* & *Chaetodon lunulatus*) across reef sites of varying qualities through the use of scuba, snorkeling or a combination of both to determine the extent to which they are able to change the way they utilise resources. To contextualise variation in resource use patterns, behaviour studies will need to be supported by ecological surveys that examine variation in habitat quality and differences in the test species abundance.





#### IH242 FISH PREDATION OF BARREL SPONGES

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

To what extent are barrel sponges predated upon by fish on reefs in the Wakatobi Marine National Park? In polar and temperate regions invertebrates are the primary predators of sponges, however, research in the Caribbean has shown that in the tropics fish can play an important role in determining the distributions of certain sponge species. Preliminary work has shown that barrel sponges (of the genus *Xestospongia*) are predated upon by at least 10 different species of fish in the Wakatobi including a number of species which were not previously known to feed on sponges. One project could determine the number of fish species that feed on barrel sponges, the predation rate of different species, the impacts of predation on sponges and how all these vary with habitat quality and the availability of sponges across the different reef sites. This project will require scuba and will combine detailed behavioural studies with ecological surveys to assess the abundance and physical characteristics of the barrel sponges across reef sites.

#### IH243 ASSOCIATION BETWEEN FISH AND HOST ANEMONES

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005 if including a diving element in the research)*

One of the more conspicuous groups of fish on tropical reefs are the anemone fish. Anemone fish are heavily collected for the aquarium trade and have a mutualistic relationship with their host anemones. However preliminary investigations have shown that this relationship is much more plastic than first thought and may be dependent on the availability of different anemone species across different reef sites with more dominant anemone fish species being more selective than less aggressive species. Further investigations have also shown that some species co-inhabit single host anemones, but what dictates this dual association? Surprisingly little research has been carried out that adequately details the association between fish and anemones and at present it is not possible to identify the key ecological drivers of the partnership. One

project could aim to fully characterise the association between host and fish using snorkeling, scuba or a combination of both.

#### IH244 THE DISTRIBUTION AND SOCIAL STRUCTURE OF ANTHIAS

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

Anthias are a hugely abundant and diverse group of reef fish but surprisingly it is not known whether different species of Anthias occupy different niches or whether they co-exist with limited competition and no niche separation. Anthias live in harems with a dominant male, several lesser males and a large number of females and juveniles. Detailed behaviour based investigations, will provide important insights into the social structure of a model fish group. This research, that is primarily scuba based, will examine the behaviour of two abundant Anthia species (*Pseudanthias dispar* and *P. huchtii*), their fine scale distribution and within-harem interactions across reef sites of differing habitat quality.

#### IH245 THE ABUNDANCE AND DIVERSITY OF REEF HERBIVORES ACROSS ENVIRONMENTAL GRADIENTS

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

The removal of algae from coral reefs is an extremely important functional role and influences successful coral recruitment and coral growth. Herbivores are therefore considered a key functional group whose characteristics (e.g. species and abundance) influence the structure and biodiversity of coral reefs. In reefs of the Caribbean, removal of grazing fish (Parrotfish) following the demise of grazing *Diadema* populations, has resulted in a phase shift from a once coral dominated system to an algal dominated system with major consequences for biodiversity. Within the Indo-Pacific region, there are many more grazing species and consequently a higher degree of functional redundancy. However limited information exists on the relative importance of different herbivores. One project could identify the key grazers of coral reefs of the Wakatobi, and for the key species determine their abundance and biomass, in order to increase understanding of feeding behaviour (e.g. rates) across sites of different habitat quality.





### *Benthic interactions of reef organisms and consequences for biodiversity and reef integrity*

#### **IH246 MORPHOLOGICAL CHANGE AND INTERACTIONS BETWEEN GORGONIANS AND SPONGES**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

What is the incidence level of sponges growing over and within gorgonians and what are the implications for gorgonian morphology? Gorgonian corals and sponges are associated with, and attract a variety of, symbionts and commensals and therefore can enhance coral reef biodiversity. However, little is known about such associations; for example members of the gorgonian genus *Beubryce* are frequently overgrown by an unclassified encrusting sponge. It would appear that affected colonies have marked differences in morphology compared to those unaffected. One project could help increase understanding of the interaction between key gorgonian species and associated sponges through detailed scuba based field investigations to determine the frequency of occurrence, environmental regulation of incidents and implications of the association for growth morphology of the affected gorgonian.

#### **IH247 COMPETITION BETWEEN HARD CORAL SPECIES**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

Reef building corals are often the dominant component of reef systems providing both biological and physical complexity thereby greatly enhancing system biodiversity. Hard corals actively compete against each other for space which is often the limiting factor on crowded reefs of the Indo-Pacific. However relatively little is known about the methods and outcomes of competitive interactions between different coral species and whether environmental conditions (e.g. growth conditions) influences competitive outcomes and coral species dominance. This research aims at increasing the understanding of

competitive interactions between reef building coral species which can be broadly classified in to passive (e.g. over growth) and active (e.g. digestion of neighboring live tissue). One project could produce a typology of interactions and determine competitive outcomes of different coral species interactions across environmental gradients. This research will include extensive field based studies that would be most suitable for scuba divers but may also include simple laboratory experimentation.

#### **IH248 THE ABUNDANCE AND IMPACT OF CORAL BIOERODING INVERTEBRATES ACROSS ENVIRONMENTAL GRADIENTS**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

The growth of a coral reef is dependent on the balance between the process of accretion and erosion. In a healthy system there is generally net growth as those organisms contributing to the physical structure of a reef (e.g. hard corals, coralline algae) are more dominant than abiotic physical erosive forces (e.g. wave energy), anthropogenic destruction (mining, blast finishing and anchor damage) and bioeroding. Many species bioerode corals, either during predation activities (e.g. Parrotfish) or through burrowing activities (e.g. several species of molluscs). One scuba based project could assess levels of erosion by different molluscs species, levels of bioerosion caused by parrotfish and determine which coral species are most affected and whether the impact of bioerosion varies across environmental gradients.





### *The biology and ecology of highly sedimented coral reef systems*

#### **IH249 THE BIOLOGY AND ECOLOGY OF CORAL REEFS IN TURBID AND HIGHLY SEDIMENTED ENVIRONMENTS**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained)*

Under conditions of low light the growth of most coral species decreases, colony morphology changes and the diversity of corals may be reduced. Changes to the species composition of the coral community coupled with differences in colony morphology will have profound effects on associated biodiversity. This research aims at examining the ecology and biology of a turbid and highly sedimented coral reef. One project could include detailed study of environmental conditions coupled with ecological studies of habitat quality (e.g. benthic composition), reef architecture (e.g. colony formations) and associated biodiversity (fish and invertebrates). The research could also analyse previously obtained data so that rates of change in key reef characteristics can be ascertained and change observed within reefs of sub-optimal light conditions compared to rates of change observed in reefs of optimal light conditions.

#### **IH250 REEF BUILDING CORAL MORPHOLOGY ACROSS ENVIRONMENTAL GRADIENTS AND CONSEQUENCES FOR REEF ARCHITECTURE: FROM THE CORALLITE TO THE COLONY**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

Calcification by reef building corals is a light enhanced process. Light quantity and quality will influence rates of calcification and also the morphology of coral colonies. In turn the morphology of colonies influences the architecture of a reef, a factor that directly affects associated biodiversity and productivity. The effects of light can be considered at different spatial scales: the corallite and the colony. This research aims at increasing our understanding of how reduced light, in an impacted reef environment (high turbidity) and with different optical depths (product of light attenuation and depth) influences the

structure and arrangement of corallites and the overall structure of the colony. This research is ideal for scuba divers but could be modified for snorkeling based researchers. The colony formation of a number of species will be examined across environmental gradients and photography with subsequent image analysis software will be used to characterize corallite size, shape and arrangements.

### *Social resilience of marine dependent communities*

#### **IH251 QUANTIFYING THE RESILIENCE OF MARINE DEPENDENT COMMUNITIES TO CLIMATE CHANGE AND RESOURCE DEPLETION**

*(Weeks 2 – 10; need to have completed IH008)*

The traditional Bajo fishing community living on Sampela, a stilt island located 500 metres from the land, has been settled for over 70 years. Before the settlement period families were nomadic, moving between fishing grounds and trade points. Population levels are increasing year on year, with high levels of in and out migration and in recent years there has been an increase in social infrastructure including a new school and medical centre. The community traditionally lived a subsistence existence but due to the arrival of modern fishing techniques, extended access to markets and increasing aspirations, the Bajo fishing effort has increased dramatically. With a decline in fisheries and an increase in living costs the community have developed a number of livelihood strategies, which include a series of strategic livelihood diversifications. The Bajo have had to develop a flexible annual livelihood strategy not only to accommodate seasonal weather patterns, which significantly affect fishing outputs, but also to account for environmental resource use regulations, a marginal location and fluctuations in the market. Projects could be developed to investigate the growth of alternative incomes, including seaweed (Agar) farming and it's potential growth. There is also the possibility to consider external trade relationships in both fish and modern commodities, the popularity of short-term national and international migration, changes in community identity with regard to a change in aspirations, links to land and access to modern commodities. The







processes behind infrastructure development and the success of such projects could also be considered. Interesting projects can be developed by comparing Bajo livelihood strategies to those of the Butonese communities on the main island of Kaledupa.

#### IH252 THE BEHAVIOUR OF CLEANER FISH AND MIMICS - DOES THIS AFFECT THE RESILIENCE OF REEF FISH COMMUNITIES?

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005 if incorporating a diving element)*

The Wakatobi Marine National Park is unusual in that it has three species of cleaner wrasse present on its reefs. The Bluestreak Cleaner Wrasse (*Labroides dimidiatus*) has been well studied but few studies have focused on the behaviour and ecology of the other two cleaner wrasse species: the Blackspot (*Labroides pectoralis*) and Bicolour (*Labroides bicolor*). One project could examine a combination of two or all three species of cleaner wrasse in order to determine differences in distribution, territory size, densities, overlap between species and what affects they have on each other through either direct (aggressive or co-operative) or indirect (competitive) interactions. Research within this area could also examine differences in cleaning behaviour between all 3 species, using focal observations on cleaning stations. This could include: variation in time spent cleaning, visitors to cleaning station and behavioural differences in solicitation and seeking of clients. Two factors have been proposed as the main motivation for clients to seek cleaners. The first is related to relieving the irritation ectoparasites cause to their hosts' skin. The alternative is that clients are seeking cleaners to obtain tactile stimulation. Tactile stimulation is defined as the cleaner fish hovering above the client and touching its dorsal fin area with its pectoral fin, and in particular, pelvic fins. Cleaners have been shown to provide more tactile stimulation to predatory clients compared to non-predatory clients and that tactile stimulation can be used to manipulate the time spent by clients at a cleaning station. One project could determine if cleaners provide more tactile stimulation to 'floaters' (fish that can choose to visit alternative

cleaning stations because of their larger territory size or lack of territorial behaviour) compared to 'residents' (i.e. fish with small territories). Research within this topic could also examine which species and sizes of individuals are most commonly cleaned, whether tactile stimulation increases cleaning duration and also if the other two species of cleaner use tactile stimulation. There is also a fang blenny species which mimics the cleaner fish but instead of cleaning the fish takes the opportunity to bite chunks out of the fish waiting to be cleaned. The presence of this 'cheat' in the system opens up all sorts of possibilities for modeling using game theory.

#### RESEARCH THEME 4: NATURAL RESOURCE AND CONSERVATION MANAGEMENT

##### *The abundance of important fisheries species*

#### IH253 SIZE, DIVERSITY AND ABUNDANCE OF GROUPERS ON CORAL REEFS IN THE WAKATOBI MARINE NATIONAL PARK

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

How has the reopening of the Hoga No Take Area (NTA) to fishing three years ago affected grouper abundance, size and diversity? In 2007 a study was published detailing the effects of the small NTA off Hoga Island indicating that it had a positive effect on grouper size, diversity and abundance. Grouper are a key food species of the region and are highly desirable. The NTA has now been reopened (for 4 years) and the primary aim of this research is to quantify the effects of the reopening of the NTA on grouper populations by examining the abundance and size of key grouper species within the old NTA as compared to outside (horizontal comparisons). Data are available from 2007 and could be compared to that obtained during 2011 both within and outside NTA (vertical comparisons) to determine if the rates of change in the NTA is greater or smaller than sites that have always been fished. This research is only suitable for scuba divers and will include habitat quality surveys as well as fish data collection.





### *Coral Reef Fish larvae recruitment*

#### **IH254 TEMPORAL AND SPATIAL VARIATION IN FISH LARVAE ABUNDANCE AND ASSEMBLAGE STRUCTURE AND CONSEQUENCES FOR NATURAL RESOURCE MANAGEMENT**

*(Weeks 2 – 8; need to have completed IH007)*

Maintenance of fish biodiversity and productivity of reef systems is largely dependent on rates of recruitment as well as mortality. Recruitment is dependent on the abundance of mature adults but also importantly the fish larval community dynamics. Limited studies have focused on spatial and temporal variations in fish larval recruitment with the majority of studies being focused around Australia or the Caribbean. This research will be one of the first detailed investigations into fish larval recruitment within the Coral Triangle. Although for some species, recruitment is seasonal, preliminary investigations have shown that fish larval recruitment is active during the summer expedition season. This research will utilise a dual approach to examine fish larvae abundance around reefs of different environmental qualities. Plankton nets could be used alongside light traps and sampling will occur over different temporal scales ranging from hours to weeks therefore encompassing diurnal, tidal and lunar cycles. This research is primarily laboratory based but will require the researcher to sample throughout the night on several occasions.

### *Causes of coral mortality*

#### **IH255 CAUSES OF AND TEMPORAL AND SPATIAL VARIATION IN, CORAL MORTALITY: CONSEQUENCES FOR CONSERVATION MANAGEMENT**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

There are numerous factors that cause coral mortality ranging from environmental anomalies (e.g. elevated sea temperatures) through to disease. Knowledge of mortality rates is key for conservationists that manage reef systems. This research is therefore extremely important

and is aimed at increasing our understanding of the rates of different mortality factors across different reef systems characterized by different environmental conditions. Specifically research could include detailed investigation of thermal induced bleaching as compared to seasonal sub-lethal bleaching, examine the incidence rates of coral diseases and also examine coralivore activity across several sites of the Wakatobi. Data can be compared to previous year's investigations to determine whether or not mortality rates change across the different sites and whether or not certain causes of mortality are increasing or decreasing. This research can be undertaken by scuba and snorkeling activities and will require detailed ecological surveys, underwater photography and repeated assessment of impacted coral colonies to determine mortality progression rates.

#### **IH256 BASELINE SURVEY OF AN AGGRESSIVE ASCIDIAN ON REEFS IN THE WAKATOBI**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

In recent years an aggressive colonial ascidian (tunicate) has increased in abundance on reefs surrounding Hoga island, particular reefs which are impacted by high sedimentation. This ascidian is unique in that it is able to colonies live coral resulting in colony death. To date no research has been undertaken on this ascidian despite the fact that it is causing significant mortality on reefs of the Indo-Pacific. Research is urgently required to assess the abundance of the ascidian, those corals affected, and how environmental conditions influence its abundance, rates of ascidian colony extension and therefore rates of coral mortality. This research is only suitable for scuba divers and will involve extensive field surveys coupled with repeated measures of colonies affected, across environmental gradients, so that site-specific progression rates can be calculated.





**IH257 COMPARISON BETWEEN METHODS TO ASSESS CORAL REEF HABITAT QUALITY: PHYSICAL AND BIOLOGICAL PROPERTIES**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

Coral reef habitats are one of the best studied marine ecosystems. However methods of assessment, particularly of habitat quality, vary greatly between different organisations and researchers. Different techniques require different researcher experience and different levels of resource; however variations in the techniques used makes it very difficult to reliably compare results across different surveys. Also little is known of the comparative accuracy and precision of the different techniques used. It may be possible for example, to re-allocate efforts to ensure the best research strategy is used when undertaking surveys of reef systems. This research aims at comparing different techniques used to assess habitat quality. The numerous techniques include subjective research observations, large scale manta tows, line intercept techniques with variable intervals ranging from continuous techniques to very coarse 1 m intervals, use of coral quadrats and underwater photography with specialised software (Coral Point Count technique). It is likely that the accuracy of the different techniques used varies across reefs of different habitat quality (e.g. different levels of patchiness). This research will enable the best protocols for use within the Wakatobi to be determined, will identify sources of error and will enable better comparisons of data from this region with numerous others around the world.

**IH258 COMPARISON BETWEEN METHODS TO ASSESS CORAL REEF FISH COMMUNITY STRUCTURE AND THE PRODUCTION OF STANDARDISED PROTOCOLS**

*(Weeks 2 – 8; need to have completed IH007 and be dive trained or have completed IH005)*

As for techniques used to assess habitat quality, methods used to assess the community structure and abundance of fish vary greatly. Techniques range from use of indicator species through to total counts across time and distance restricted belt transects. The different techniques require different levels of resources and expertise but which technique is best suited to be able to detect small rates of change in fish community structure? This research will compare the numerous different methods across reefs of different quality and fish community structure. Effort versus accuracy plots will be produced and a set of protocols developed. The outcomes of this research will enable conservation managers to be most effective with their limited resources whilst ensuring the most accurate level of data is obtained for resources used. Importantly the research will also identify the degree of error and enable us to identify levels of reliability, robustness and confidence limits. This research can be carried out by scuba or snorkeling and will include a number of field research techniques combined with onsite data analysis.

**IH259 CHANGES IN THE KALEDUPA REEF FISHERY OVER THE PERIOD 2007 TO 2011**

*(Weeks 2 – 8; need to have completed IH007)*

Monitoring of fish catch data from 2007 onwards has shown that overfishing by artisanal fishers from Kaledupa has severely depleted fish stocks around the island. This topic is designed to repeat the detailed surveys from 2007 to 2010 of fish landings at 9 villages over an 8 week period. Fishers returning their catches to shore will be intercepted to gather data on the catch techniques used and the effort. The total catch will be photographed spread out on a tarpaulin with a standard rule in the picture, so that the species and lengths of





each (and hence weight) can be measured from image analysis. Using the photo technique ensures that fishers are only momentarily delayed on their way to market. These data can then be used to compare catch per unit effort for each of the main techniques with previous years, and the percentage of immature fish being caught by each technique. The effect of the recent fishery byelaws that are being introduced around the various communities in enabling the fishery to recover can then be assessed. Within this overall topic a series of separate dissertations could be developed concentrating on different fisheries (e.g. fish fences, gill nets, bubu traps, line fishing).

#### IH260 CAN A MARINE VERSION OF THE REDD FUNDING SCHEME BE DEVELOPED?

*(Weeks 2 – 6; need to have completed IH008)*

Protecting forests for their carbon sequestration value by making payments through the REDD scheme is beginning to be introduced in the forestry sector to slow deforestation rates. Is there a way that this type of financial mechanism could be developed and applied to reefs and marine ecosystems? A team from Brown University is examining how such a funding mechanism could be applied to the reefs around Kaledupa and a number of research projects could be developed around this topic.

#### GENERAL SURVEYOR PROJECTS

General Surveyors are needed to help with the biodiversity monitoring and ecosystems research programmes in either the Lambusango forests or North Buton Nature Reserve in SE Sulawesi. The programme comprises a 2-week period on site, with the first week working at the forest site and a second week at the marine site on Hoga Island or for those in 2012 spending their first week at the North Buton site there will be the choice of going to the new Ereke marine site or travelling onto Hoga Island.

##### Lambusango option

The students on this option will travel by vehicle from Bau Bau to the Labundo site (3 hours) and will complete 6 days of training and research in the Lambusango forests. These are divided into 2 days of jungle skills training, 2 days of forest measurements and 2 days of learning about biodiversity monitoring techniques from lectures and practicals. Over the course of the week, each group will spend 2 nights in Lapago field camp in hammocks or tents and for the rest of the time they will be in local houses in Labundo village. The jungle training elements will consist of learning how to live in hammocks how to build natural shelters, make fires, dig latrines, and ensure water is sterilised. Emphasis is placed on the animals and plants that could be dangerous and how to maintain health whilst living in a tropical forest field camp. If the group wants to do the canopy access option then they will be able to do this during this 2 day period. The 2 days on biodiversity monitoring include a series of short lectures about Wallacea wildlife and the survey techniques being used followed by practicals to demonstrate some of these techniques and identify the commoner species. The reason the General Surveyors have been invited to join the biodiversity surveys is to complete forest structure





data collection on the series of standard sample sites being used by the various survey teams. These sites are distributed in areas of forest with differing levels of disturbance and the General Surveyors will be divided into small groups each of which will be completing detailed forest structure measurements in 50m x 50m blocks of forest around the sample sites. After training, General Surveyors will be collecting data on canopy openness, spatial heterogeneity of the sites, size class structure of the larger trees, recruitment of saplings, etc.

**North Buton option**

The students on this option will travel by long boat from Ereke up a river through mangroves and nipa palms (1 hour) and will then trek to the field camp (1 hour). The activities for the group will be the same as for the Lambusango option but the teams are based in the forest camp for the entire week. The biodiversity and forest structure surveys are being carried out in transects that have been installed in the adjacent forest and the science teams on site will be completing butterfly transects surveys, point counts for birds, pitline, timed searches and spotlight surveys for herpetofauna, small mammal trapping and macaque and anoa surveys from transects. The forest structure data gathered by the General Surveyors will be correlated with the distribution of the species recorded. 2011 is the first year that biodiversity surveys will be completed in this forest and there is a good chance that new species records for Buton will be obtained.

**Marine options**

For the second week, students will have the opportunity to complete one of the following:

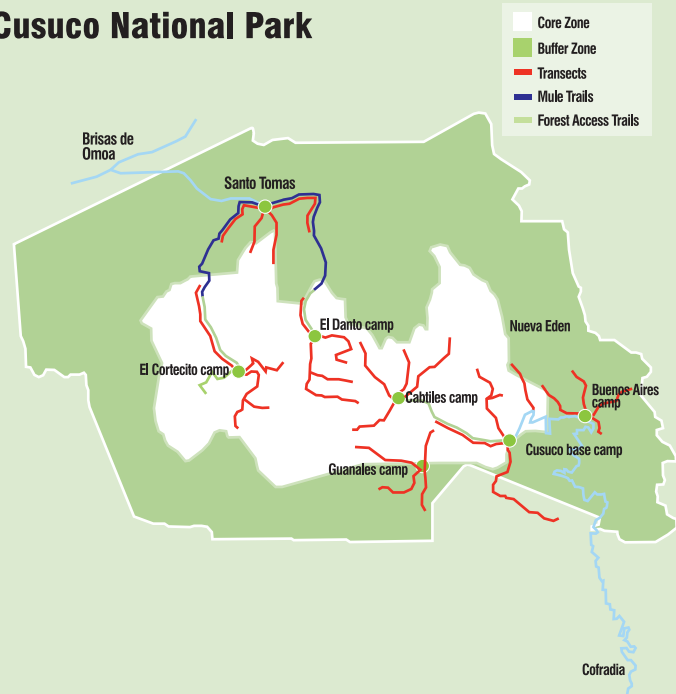
- PADI Scuba Diver training course. This qualification will be achieved in half a week and qualifies the students to dive to 12m with a Divemaster present. The second half of this week would then be spent on a Reef Survey Methodologies course where the students will be learning various reef survey techniques such as line intercept transects, quadrats, manta tow surveys, etc.
- Alternatively, if the student is already dive trained or they don't wish to dive, the option is to do Indo-Pacific reef ecology course. This course consists of lectures and twice daily in-water practicals that can be done either by diving or snorkeling depending on the preference of the student. The course aims to teach the students how to identify the main families of corals, macro-invertebrates and fish and the latter part of the course concentrates on the survey methodologies
- Dive training to PADI Open Water level. This course will last one week and qualifies the student to dive to 18m.

For the groups in the Lambusango forest, the marine week will be completed on Hoga Island in the Wakatobi. Students will return back to Bau Bau by vehicle (3 hours) and then take overnight boats to Wanci (9 hours) and on to Hoga (2 hours) arriving for breakfast. In North Buton, the students will transfer to Hoga by boat from Ereke (7 hours) and on to Hoga (2 hours). In 2012, the groups in North Buton will also have the option of spending their second week at the Ereke Marine site which is a 1 hour trek and 1 hour boat ride from the forest field site.





## Cusuco National Park



### RESEARCH OBJECTIVES

Honduras is Central America's second largest country, and boasts not only a mountainous landscape with dense montane and cloud forest, but also many Caribbean Islands. Despite these advantages, the biodiversity of Honduras has been much less studied than other Central American countries such as Costa Rica, Panama and Belize.

In Honduras, the terrestrial research programme is run in conjunction with a Honduran NGO called ESAC (Expediciones y Servicios Ambientales de Cusuco). The purpose of this science programme is to provide data on socio-economics, forest structure and biodiversity (using indicator groups and population levels of key or threatened species) to assess the performance of the protected-area management. With the advent of funding mechanisms such as REDD (Reducing Emissions of greenhouse gases from Deforestation and forest degradation in Developing countries) these annual biodiversity surveys have taken on an even more important role. The purpose of the REDD funding is to provide a marginal cost advantage for governments and communities to protect their forests rather than allow deforestation, thereby protecting their carbon sequestration value and by implication their biodiversity value. However, since monitoring for the REDD scheme and release of payments is primarily based on regular analysis of satellite imagery to detect deforestation, in theory it is possible for a forest receiving REDD payments to be hunted out without the payments being affected. If this were to happen it would reduce the value of REDD and there would be little benefit to protecting natural forests over plantations – both would conserve carbon but the latter has little benefit in protecting biodiversity. Data sets such as those held on the Cusuco National Park where changes in the diversity of key taxa or population levels of key species can be tracked can be used to set additional biodiversity related criteria for receiving REDD

payments. There are few forests in Honduras that have the level of biodiversity data that has been collected on the Cusuco Park which places Cusuco in a prime position to receive such funding. The data collected to date on Cusuco have demonstrated that the Park contains 6 species of amphibian found only within the Park boundaries and a further 10 species of amphibian in the IUCN threatened category. In addition a new genus of tree (*Hondurodendron*) has recently been described from the Park.

The marine research programme is run in conjunction with the Honduran Coral Reef Foundation (HCRF) for the Cayos Cochinos sites and the Coral View Research Centre and Bay Island Conservation Association (BICA) on Utila and with Grupo de Apoyo al Desarrollo (GAD) on the northern Honduran coast. Surveys are being completed on the reefs around Rio Esteban on the mainland, reefs around Cayos Cochinos Islands which is a Marine Protected Area (MPA) but where there are no mangroves to act as fish nurseries, and reefs and mangroves around Utila.

The main research objective of this programme is to complete reef fish, coral and macro-invertebrate surveys using stereo video for the fish surveys and transect videoing for the benthic surveys on the reefs around Utila, the mainland adjacent to Rio Esteban and the Cayos Cochinos Islands to provide annual monitoring data to inform the various organisations on the effectiveness of the current reef management. In addition, the functioning of the mangroves on Utila as a fish nursery and in sediment stabilisation is being studied from mangroves that range from pristine to severely damaged. There are also unique reptile species found on Utila and the Cayos Cochinos Islands and long term ecological data sets are being gathered on these populations.





## FOREST FACILITIES

Seven camps have been established across the Cusuco National Park, where survey teams are based. From each of these camps, four sampling lines ('transects') radiate out and sampling points are located along them, to ensure that most of the Park is surveyed each year. On the eastern side of the park, 4-wheel drive vehicles can access the main Base Camp by a 2-hour drive from the town of Cofradia. Accommodation at Base Camp is in tents and there are toilets and showers. Terrain around this site is not as steep as some of the other sites. There is a wireless networked computer system at Base Camp, with an internet link, and this is where all the data from the various survey teams are collated. In addition, there are DNA extraction, amplification and visualisation facilities.

From Base Camp, teams can access two core zone fly camps. These are for people who want to experience living deep in the forest, sleeping in hammocks or tents (depending on availability). Guanales is a 2-hour trek from Base Camp and Cantiles is a 4-hour trek. About 1 hour below Base Camp, along the 4-wheel drive track, lies the buffer zone village of Buenos Aires. Accommodation is in local houses at this site, which gives you the chance to experience living in a Honduran mountain community – unforgettable!

On the western side of the park the surveys are co-ordinated from the small mountain village of Santo Tomas. Accommodation at this picturesque site is in tents, and special toilets and showers have been built for use by the survey teams. Santo Tomas is accessed by a 2-hour trek, climbing from sea level to the village. From Santo Tomas two fly camps in the remote western core zone forest can be accessed: both El Danto ("the tapir") and El Cortecito are a 5–6-hour trek from Santo Tomas and accommodation is in hammocks or tents at these camps. Note that the terrain on the western side of the park is steeper than on the east and requires higher fitness levels.

In addition to these montane sites in the National Park, a lowland study site has been established at Manacal, in a series of forest fragments, each with its own troop of Honduran mantled howler monkeys. This privately owned reserve can be easily accessed from Cofradia and is an excellent site to study the behaviour and ecology of the monkeys. Researchers working in Manacal forest are based in a house in Cofradia.

## MARINE RESEARCH FACILITIES

### Utila

The Utila Marine Research Centre is based at Coral View in the southwestern corner of the island. Accommodation is in shared rooms with fans in the Coral View Hotel, away from the main tourism centre and situated between some of the best reefs and the largest mangrove lined lagoon system on the island.

The hotel is run by a local Utilan family and they have built in conjunction with Operation Wallacea, a well equipped dive and environmental monitoring field lab. The Coral View home reef is one of the best on the island and can be accessed from the jetty at Coral View. The research centre has a number of dive boats that can be used to access the remaining reefs which range from being designated as a Marine Protected Area, to those having no protection and with substantial fishing pressure. Utila has extensive remaining stands of mangroves, which range from pristine through various levels of disturbance to severely damaged. This range of mangrove stands therefore makes an ideal study site to assess the effects of differing levels of disturbance on their functionality in sediment stabilization and value as fish nurseries.





### Rio Esteban

This picturesque Garifuna village on the northern Honduran coast has no existing tourism. Operation Wallacea in conjunction with Grupo de Apoyo al Desarrollo (GAD) is helping the local community develop ecotourism income as a replacement for the income lost from not being able to continue fishing the Cayos Cochinos MPA. Accommodation is in local houses with meals taken in a specially built restaurant overlooking the ocean. In 2010, GAD received funding to build a swimming pool and dive centre in the village and some of those completing dive training on Cayo Menor may have the opportunity to complete their theory and pool training whilst based in this community before crossing to Cayo Menor for the open water dives. This gives a great opportunity to experience the wonderful Garifuna hospitality and have an evening of traditional dancing!

### Cayos Cochinos Islands

The Cayos Cochinos Islands are a Marine Protected Area (MPA) and have strictly limited entry to tourists with Cayo Menor being restricted to marine researchers only. The Honduran Coral Reef Foundation runs the Cayos Cochinos Islands on behalf of the Honduran government and development is severely restricted by this NGO in the islands. The Operation Wallacea project is based on a beach of the tiny uninhabited island of Cayo Menor. There is a trail across the island and on the far side are completely empty white sand beaches! Accommodation is in tents on the beach or in shared bunk accommodation in huts. Cayo Menor has a fully equipped marine research centre with diving equipment, speed boats and a dry lab. There is a restaurant high on the hill overlooking the sea where all meals are taken.

## FOREST TRAINING COURSES

### HM001 JUNGLE SURVIVAL AND NEO-TROPICAL FOREST ECOLOGY

*(Weeks 1, 3 and 5)*

This course is a requirement for all Research Assistant and Dissertation volunteers who will be working in any of the forest sites. The course takes one week and comprises a series of lectures and practical exercises to provide an introduction to tropical forest ecology, forest mensuration and biodiversity monitoring techniques. In addition the course teaches participants how to operate safely and healthily in remote forest areas. Activities include cooking in the forest, navigating using compasses and, in the event of becoming separated from companions, how to find food and water in the forest. In addition, training is given on selection of safe camp-sites and how to set up camps with minimal forest disturbance.

### CANOPY ACCESS EXPERIENCE

*(Weeks 1 – 8; half-day additional course within your normal schedule)*

Canopy Access Limited, the team that helped David Attenborough ascend into the canopy for BBC's Life of Mammals and Planet Earth, are on site to provide access to the canopy for the science teams two days a week. However, for the rest of their time they are available at Base Camp or Santo Tomas (both places each week) to do a demonstration of safe ascent into the canopy. Note if you are at one of the fly camps or in Buenos Aires you will still be passing through the sites where the Canopy Access teams will be based. This half-day course which is open to all volunteers costs £80 (approx \$125) and gives students the opportunity to learn how to safely ascend into the







canopy. The ascent is done using ascenders (pulley system) with safety ropes and is a unique opportunity to experience wildlife in the canopy. For Research Assistants and Dissertation/Thesis students there is also the opportunity to overnight in a hammock in the canopy so you can see dawn rise over the forest – a truly unforgettable experience. This experience costs £120 which includes the course costs of £80. You do not need to choose the Canopy Access Experience as one of your options – you can do this as an extra experience on site. However, you will need to pre-book either the canopy access or overnight canopy experience courses online ([www.canopyaccess.co.uk](http://www.canopyaccess.co.uk)).

#### HM002 SPANISH LANGUAGE TRAINING

*(Weeks 1 – 3)*

Those wishing to use the expedition to improve their Spanish can opt for a week of intensive Spanish tuition. The course is a requirement for social science dissertation/Senior Thesis volunteers on either the marine or forest projects unless they already have fluent Spanish. It involves a mixture of taught sessions and more informal learning in a Spanish-speaking environment. Those doing dissertations or theses will be working with supervisors during this week developing their questionnaires and detailed plans for their projects. Accommodation is with local families, and the course therefore offers a good chance to get to know the people and culture. Operation Wallacea runs a course for beginners but also offers courses at more advanced levels.

#### HM003 DNA FIELD SAMPLING COURSE

*(Weeks 2 – 5)*

An important aspect of modern conservation biology is incorporating genetic information (from DNA and RNA) into biodiversity studies. Most molecular biology activities are limited to a sterile lab. However,

this course takes advantage of recent technical developments to combine fieldwork with an on-site field genetics lab. Volunteers on this one-week course work with the biodiversity assessment teams at Base Camp for most of the week, helping with the biodiversity surveys and collecting material for extraction of DNA. During this week, some of this time will be spent working in small groups in the field lab under tuition learning how to extract DNA, amplify it with specific primers using PCR (polymerase chain reaction) and then visualising the results using electrophoresis. DNA extraction will be done via FTA Whatman cards. No prior knowledge is needed.

#### MARINE TRAINING COURSES

##### HU005 UTILA PADI OPEN WATER DIVE TRAINING

*(Weeks 1 – 8)*

##### HE006 RIO ESTEBAN/CAYO MENOR PADI OPEN WATER DIVE TRAINING

*(Weeks 5 – 10)*

##### HC007 CAYO MENOR PADI OPEN WATER DIVE TRAINING

*(Weeks 5 – 10)*

This one-week course is a pre-requisite to any diving project. Open Water dive training is free to Operation Wallacea volunteers except for the costs of the PADI Open Water crew pack and PIC card, which you need to bring with you. Completion of this course will give you an internationally recognised diving qualification and enable you to join general diving projects accompanied by a Divemaster. The course can be done on Utila (HU005), or with the theory and pool training completed at the new dive centre in the picturesque village of Rio Esteban with the last part of the course including the dives on Cayo Menor (HE006). There are limited places available in the Rio Esteban site and any numbers over and above this need to complete their full dive training course on Cayo Menor (HC007).





## HU008 UTILA CARIBBEAN REEF ECOLOGY

*(Weeks 1 – 8)*

## HC009 CAYOS COCHINOS CARIBBEAN REEF ECOLOGY

*(Weeks 5 – 10)*

*(Need to be dive trained if you intend to dive for the practical elements of this course)*

This one-week course is a pre-requisite for joining many of the reef research projects and is free for Operation Wallacea volunteers. The course teaches identification of common genera and species of coral and other macro-invertebrates, identification of the major reef-associated fish families and common species and introduces a variety of methods and practices used for scientific research in the marine environment.

Note the in-water practicals for this course can be done either by diving or by snorkeling only.

## ADDITIONAL DIVE TRAINING

*(Weeks 1 – 8)*

Additional dive training beyond Open Water level is available on Utila and can be fitted around your work on other projects so you don't need to specify the additional courses on your options list. Courses include Advanced Open Water Diver (\$220), Emergency First Response (\$150) or Rescue Diver (\$400 - includes Emergency First Response). Note that these extra courses may not be available at all times, and enrolment may depend on the number of people wanting the training.

## HU010 DIVEMASTER TRAINING

*(Weeks 1 – 8)*

Divemaster training is available free to Operation Wallacea volunteers, with only PADI membership fees and liability insurance costs to pay. Participants will have to set aside four weeks for this course. Before booking this course, you need to be a qualified rescue diver with up to date Emergency First Responder (EFR) training, have a minimum of 60 logged dives, and should contact Operation Wallacea for a detailed list of kit you will need to bring on expedition. Note Divemasters trained with Opwall are offered the opportunity to be employed as a member of the dive staff team in future years. Unfortunately, it is not possible to offer work placements in the same year you qualify because of the time needed from passing the course and obtaining your full PADI Dive Master registration and the insurance needed.

## FOREST RESEARCH ASSISTANT PROJECTS

### HM101 MONITORING BIODIVERSITY CHANGE IN KEY TAXA

*(Weeks 2 – 8; need to have completed HM001)*

Operation Wallacea has established an annual monitoring programme for the Cusuco Park that includes standardised monitoring of habitat and a number of taxa from 150 sites across the Park to assess changes in the structure of the forest and how these changes are impacting on the target taxa (amphibians, reptiles, birds, bats, dung beetles, jewel scarab beetles, *Sphingidae* and *Saturnidae* moths, and bromeliad associated invertebrates). These monitoring data are combined with analysis of satellite imagery to produce an 'Annual State of the Cusuco National Park' report. Volunteers can do multiple weeks of this option, which gives the opportunity to visit camps at different altitudes where the fauna are very different. Although there are a number of research scientists at each camp and it is possible to





work on a range of projects during the week, it is better if you can concentrate on helping the researchers on one taxonomic group for most of your time in order to gain more in-depth understanding and develop specialist skills. If concentrating on one group, you can still join other teams when you are free. Activities include helping to set up and empty invertebrate pitfall traps, flight intercept traps, light traps, searches for tarantulas, performing timed searches with the herpetofauna team, point counts and mist netting with the bird team, forest structure and botany surveys, mist netting with the bat team and working with the genetics team. There is plenty of opportunity to be busy on this option! Note if you want to specialise in bats and learn how to handle the animals you will need a full course of rabies vaccinations before joining the expedition.

#### HM102 LARGE MAMMAL MONITORING

*(Weeks 2 – 8; need to have completed HM001 and have a high level of fitness)*

If you are interested in working with this team then you will need to have a high level of fitness and a lot of stamina. The large mammal monitoring project involves searching the park for signs of large mammals, including tracks, vocalisations and faecal matter. The main focus is on two specific types of mammal. One is Baird's Tapir, classified Endangered by the IUCN. This has a small population in Cusuco National Park that is threatened by hunting. Faecal and other samples are collected for DNA extraction and work on the population genetics of this species is currently under way. The other main focus is on the three primate species found in the park. While mantled howlers appear to be reasonably widespread, the white-faced capuchin and Central American spider monkey continue to persist in the park in small numbers, threatened by hunting and habitat alteration. To date, the team has found evidence of 15 different large

mammal species, including small cats, wild pigs and deer. Multi-season analysis using presence/absence data will help to evaluate population changes in response to hunting, habitat change and management policy. In weeks 1 and 2, a small number of volunteers will be needed each night to help the team attempting to dart a tapir so a daily diary data logger can be fitted.

#### HL103 HOWLER MONKEY ECOLOGY AND BEHAVIOUR

*(Weeks 2 – 8; need to have completed HM001)*

The primate survey teams are based in the lowland Rancho Manacal, outside Cusuco National Park. Here there is a small area of forest where there is a strict protection policy to safeguard primate populations within the property. There are eight different troops of howler monkeys within the forest and the howler monkey population level in Manacal is extremely high in relation to population densities at other sites. This allows intensive, detailed studies of primate behaviour, activity budgets, diet, vocalisation and troop interaction. Research Assistants will be involved in GPS mapping of howler monkey home ranges, habitat assessment, identifying preferred food sources and collection of vocalisation data. Through observation of the monkeys you will gain an understanding of behavioural data collection methods. In addition, you will be able to help the researchers with scan and behavioural sampling of monkey troops.





## HM104 AMPHIBIAN SURVEYS

*(Weeks 2 – 8; need to have completed HM001)*

The single most important reason for the need for effective conservation of the Cusuco National Park is the importance of this cloud forest for amphibians. There are 6 species of amphibians found only in the Cusuco Park comprising two tree frogs (*Plectrohyla exquisita* & *Plectrohyla dasypus*), one bromeliad frog (*Isthmohyla melacaena*), two arboreal salamanders (*Bolitoglossa diaphora* & *Cryptotriton nasalis*) and one ground dwelling salamander (*Oedipina thomasi*). In addition, there are another 10 species that are found in Cusuco but which are endangered under the IUCN categories. Of these, two tree frogs (*Duellmanohyla soralia* & *Bromeliohyla bromeliacea*) have their largest remaining populations in Cusuco, two tree frogs (*Craugastor coffeus* & *Ecinimohyla salvaje*) and one salamander (*Nototriton barbouri*) are known from only one other site other than Cusuco. To add even greater urgency, these small populations are now under threat of infection from amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) which is causing catastrophic amphibian population declines throughout Mesoamerica. Chytrid fungus appears to have reached the Park at least 15 years ago and has caused significant declines in these isolated mountaintop amphibians. Data are urgently needed to identify the distributions of each of the cloud forest amphibian species and the catchments in which each occur. Surveyors on this project will be trekking up rivers to survey frog and salamander species in a range of remote sites to obtain as complete a coverage of the Park as possible. This will involve day time surveys for tadpoles and night time river treks to complete spotlight surveys and to listen for calls. The position of trees with bromeliad frogs calling will be marked and the Canopy Access team organised to climb the trees to recover

bromeliad frogs. All frogs sampled will be swabbed for the presence of chytrid fungus. In addition, genetic samples will be taken for bar coding.

## HM105 DEVELOPING AN AQUATIC BIOTIC WATER QUALITY INDEX

*(Weeks 2 – 8; need to have completed HM001)*

The Cusuco National Park, as with many other cloud forest Parks in Honduras, was declared a Park not because of its biodiversity, but mainly because of its function in protecting river water quality in the headwaters of the catchment. Despite this acknowledged importance in protecting river water quality, there is only a very limited river monitoring programme mainly because Honduras does not have a biological water quality index such as those that are used widely in western Europe and north America. Biotic indices are a cost effective way of assessing water quality since the invertebrate communities present in the river are affected by the levels of pollution and are a reflection of the worst quality conditions that have occurred over the previous weeks, thus identifying whether any episodic pollution events have occurred. In 2009 and 2010, aquatic macro-invertebrate communities were sampled in a range of streams in different catchments to examine the effect of factors such as altitude, stream order, flow rates, habitat, shade, etc., on the communities. This has been input to an initial typological classification of the watercourses based on macro-invertebrates, allowing selection of potential indicators for the development of the index that is being developed. However, many more samples are needed from as wide a range of river systems as possible.





## MARINE RESEARCH ASSISTANT PROJECTS

### HB106 COMPARISON OF THE UTILA, RIO ESTEBAN AND CAYOS COCHINOS REEFS

*(Weeks 2 – 5, Utila; weeks 6 – 7, Rio Esteban; and weeks 8 – 10, Cayos Cochinos; need to have completed HU008 or HC009 and be dive trained)*

Operation Wallacea has been conducting an annual monitoring programme of the reefs around the Cayos Cochinos Islands and Utila for the last few years using the standardised Underwater Visual Census technique. This technique involves trained surveyors counting fish within an imaginary box 2.5m above the transect tape and 2.5m either side. However, this technique has a number of drawbacks: it relies on the surveyor's ability to accurately identify fish encountered, there is no record of the counts other than the documented numbers, and the size of all fish encountered are estimated and are very approximate with errors as high as 50%. In 2010, Operation Wallacea trialed in Mozambique a stereo video system developed by the University of Western Australia. This system allows surveyors to swim along the transects and video the fish encountered. Then in the lab by playing back the two video images on a single computer screen using specialist software, not only can the images be freeze framed to accurately identify all fish encountered, but also size estimation can be done to within 4% error. In addition, there is a digital visual record of the state of the reefs that can be checked in future years. This system is going to be introduced into the Honduran sites from 2011. The stereo video approach is excellent for recording fish communities but a much simpler single video recording technique that was developed at the Opwall Indonesian site is being used to assess benthic cover. A video recording is made at arms' length over replicate 50m transects. Coral cover and community structure of hard and soft

corals are then assessed from analysis of the video footage back in the lab. Volunteers on this project will be helping with laying transects and completing the video records but will also be heavily involved in the analysis of the images in the on-site laboratory.

### HB107 RESEARCH ASSISTANT POOL

*(Weeks 2 – 8, Utila; and weeks 3 – 10, Cayos Cochinos; need to have completed HU008 or HC009)*

There are several different dissertation and thesis level projects ongoing within the Cayos Cochinos and Utila. These projects involve studying a specific element of the marine environment in extensive detail, either through diving, snorkeling or kayaking. Projects include highly detailed benthic surveys, sea urchin and conch distribution and ecology studies, seagrass and mangrove system ecology and several others. All these projects require extensive data collection and research assistants are always needed to help. Research Assistants joining this project can volunteer their time to help with projects they are interested in and will gain valuable insights into the specific research topic they cover.

### HU108 STATE OF THE UTILA MANGROVE FOREST ECOSYSTEM

*(Weeks 2 - 8; need to have completed HU008 or HC009)*

Although Utila still has a series of lagoons and canals surrounded by extensive mangrove systems, these mangroves are rapidly being lost to development and are in various states of damage. Most studies on mangrove systems have compared their function by contrasting areas with and without mangroves. However, as mangroves become increasingly damaged how does this affect their functionality in sediment stabilisation and as a fish nursery? A monitoring programme is being completed annually from replicate samples in mangrove lagoons around the island with varying levels of damage to the trees and organic pollution loadings. Surveys include assessing the effect





on sediment stabilisation from determining water content using a muffle furnace, setting, baiting and emptying fish fry traps, quantifying the health of mangroves from the percentage of stems reaching the sediment and size and abundance of leaves at the end of each branch and assessing how organic pollution loadings affect the epibiont and mobile invertebrate communities in the roots. Research Assistants will use kayaks to paddle around the lagoons and access the mangroves including remote parts of the island inaccessible from the land and this gives you the chance to explore some of the parts of the island that are not normally accessible.

### HC109 BOA, CTENOSAUR AND ANOLE POPULATION MONITORING

*(Weeks 5 – 10)*

One of the main reasons the Cayos Cochinos have protected status is the presence of an endemic pink coloured boa constrictor known as the Hog Island Boa. The snake is found only in the Cayos Cochinos Islands and has been heavily collected in the past for the pet trade. A long term study of the population and their basic biology (feeding, growth rates, habitat selection) is being completed. Volunteers are involved in sweep surveys across the island to help with capturing snakes that are then measured, sexed and have a pit tag injected into them so that re-captures in future years can be used to assess population size, growth and mortality rates. A similar study is also underway with the ctenosaurs with specimens being captured using noose and poles. In addition, during some weeks there are studies of the adaptations of the two anole species found on Cayos Cochinos to changing temperatures using sprint speeds as a proxy for fitness. As a volunteer, you will be involved in all aspects of the project and should expect to be out in the field for between 6-7 hours per day. This is a physically demanding project and you should have a high level of fitness in order to contribute fully.

### FOREST DISSERTATION/THESIS TOPICS

There are a wide range of possible dissertations that can be done within Cusuco National Park. Some of the topic areas involve data collected as part of the general monitoring effort. In such cases (which are indicated below), the data-collection sites and methods are fixed, and the range of possible research questions is therefore limited. However, it also means that the likely sample size of the data collected is large, and that compatible data on a wide range of other taxonomic groups will be available (including information on the vegetation structure, habitat type, altitude, etc.), allowing a variety of research questions to be addressed using the data. Other subject areas, which are not part of the general monitoring effort, allow a much larger range of possible research questions and flexibility in the planning of the work. The main constraints for these projects are logistical (equipment, safety, etc.), so be sure to contact Operation Wallacea with your research ideas well before you come out, to check feasibility and the likely fitness level required. The computers at Base Camp have standard statistical and multivariate software (including R, SPSS version 16, ArcGIS 9.2 and MaxEnt, etc.); some statistical advice is available and there is a small field DNA lab. All research topics coded HM will operate from Base Camp where the Senior Scientist is based, but researchers on these topics will be dispersed around the various forest sites for much of their stay, depending on the requirements of the research project. The HL project is based in the lowland Manacal site and the HS project will be part of a mobile team moving between the mountain villages.





### HM201 BARCODING THE DIVERSITY OF CUSUCO CLOUD FOREST

*(Weeks 2 – 8; need to have completed HM001 and HM003)*

So many taxonomists have worked in the Cusuco Park now as part of the Opwall teams that substantial species lists have been obtained for many taxa. The next stage is to complete genetic barcoding for these species and submit these data to GenBank. This is an ideal project for dissertation students who can isolate and amplify the cytochrome C oxidase subunit I (COI) gene sequence for taxa such as dung beetles, jewel scarab beetles, amphibians, small mammals or bats to determine whether or not the genetic data matches the morphometric data or whether there are previously undescribed species. There are 6 endemic species of amphibian in the Park none of which have been sequenced and there are suspected cryptic species of dung beetle, frog and small mammal that have yet to be fully analysed and described. The project could compare the species identified from the gene sequencing with the morphometric data, potentially describe cryptic species and compare the sequences of species found in Cusuco that have been deposited in public databases. Generally, it will be expected that you collect your samples from at least three camps, and work with the appropriate biodiversity team. Students working on this project will be isolating and amplifying the relevant section of the COI gene and testing that there is viable DNA using agarose electrophoresis. The DNA samples will then be returned to the home institutions on FTA Whatman cards so that sequencing can be done. DNA sequencing cannot be done in the field, and students wanting to do projects of this type will need to ensure that they or their institution can cover the cost of the sequencing (approx \$6 per sample).

### HM202 LANDSCAPE GENETICS OF AMPHIBIAN SPECIES

*(Weeks 2 – 8; need to have completed HM001 and HM003)*

A new field in population genetics, Landscape Genetics, investigates population structure and connectivity in the context of barriers and facilitators within the environment. The detailed satellite imagery and habitat mapping which exists within Cusuco allows a particularly fine-grained analysis of gene flow among populations of species within the park. With the Chytrid fungus widespread within Cusuco, many species of amphibian endemic to cloud forests have suffered declines. Determining how these species move through the landscape and how populations are connected is extremely important for directing conservation effort. Polymorphic microsatellite markers are used to genotype amphibian samples at multiple loci and patterns of gene flow are resolved using software such as BAYESASS and GENELAND. Using least cost movement paths developed using ARC GIS, the correlation between genetic and geographic distance can be investigated and features in the landscape that act as facilitators or barriers can be resolved. Opwall is funding a PhD student to complete the preliminary stage which will involve the development of a library of polymorphic microsatellite loci with which to genotype multiple species of amphibian. This will take place through the cross-species characterisation of existing amphibian loci and if required, the identification of new loci and the development of primers. During this stage, a target of at least 13 loci per species will be resolved with which to conduct population genetic studies. The study will aim to develop a set of loci which are polymorphic in a variety of species, however if this is not possible, a species specific set of loci will be used. The primers will be fluorescently labelled and divided into multiplexes to reduce time and cost in genotyping. Optimisation of the PCR conditions necessary to amplify microsatellite loci in multiplexes





will enable the procedure to then be conducted in the field lab at Base Camp, Cusuco. Note dissertation students doing this project will need access to GENEMAPPER software. The DNA extraction and PCR work can be done in the field lab.

### HM203 THE EFFECT OF ALTITUDE, RAINFALL AND TEMPERATURE ON LEAF STRUCTURE

*(Weeks 4 – 8; need to have completed HM001)*

This project is designed to investigate the factors that affect leaf size, thickness and shape in trees. It is known that these leaf variables change with altitude but the main environmental driving force behind this change has long puzzled ecologists. The forest here allows samples to be taken in areas of quite different rainfall and temperature and so provide a unique opportunity of teasing apart this puzzle. Samples will be collected at a number of different camps using standard techniques to measure leaf area, thickness, shape, dry weight and dry weight per unit area of the samples. It will also be possible to look at stomatal density, the presence of drip-tips, degree of herbivory and a number of other factors which link into the overall question. There are also data available from previous projects that can be used to help gain a bigger picture.

### HM204 FACTORS AFFECTING FRESHWATER INVERTEBRATE COMMUNITIES

*(Weeks 2 – 8; need to have completed HM001)*

The high-altitude forest reserves in Honduras were initially given legal protection as National Parks in order to protect the water supply downstream. However, water quality monitoring in the San Pedro Sula valley below Cusuco Park is done only via infrequent chemical testing. Chemical monitoring can easily miss intermittent pollution episodes, in

many European countries monitoring of aquatic macro-invertebrate communities is done on a 3-monthly basis to assess water quality. This works well because different species have different tolerances to pollution. The macro-invertebrate communities reflect the worst conditions that have occurred over the previous few months and are therefore useful for picking up episodic pollution events. Over the next 3 years Operation Wallacea is developing a biotic water quality index that can be used for water quality monitoring in the Merendon mountains (which include Cusuco NP), building on pilot work done in 2008. Aquatic macro-invertebrate communities will be sampled and water quality will be assessed in a range of stream orders and habitats, in different catchments all over the park. These data can be used for dissertations/theses to examine the effect of specific factors such as stream order, flow rates, habitat, forest cover, geology, etc. on the invertebrate communities.

### HM205 ECOLOGY OF LEAFCUTTER ANTS

*(Weeks 4 – 8; need to have completed HM001)*

Some colonies of leaf cutter ants have more than a million workers and their massive underground nests house a fungus that the ants actively farm for food. To nurture their fungal crop, the ants must forage for fresh leaf material, which they convert into "mulch" on which the fungus grows. The vast amount of leaf pieces needed to maintain the nest make these ants the dominant "herbivore" in the new world tropics. Understanding how these ants forage and how we can stop them foraging on valuable crop plants is likely to be important for their control. Projects could focus on using ant waste (and component thereof) and trail disruption to control ants and their foraging in the field. The work will involve a mix of observation and manipulation of nests of different sizes and will likely involve night-time work in the forest. Other projects, relating to foraging ecology and behaviour







(especially with respect to parasites and disease) may also be developed.

#### HM206 DIVERSITY AND NICHE SEPARATION IN TARANTULA SPECIES IN CUSUCO PARK

(Weeks 4 – 8; need to have completed HM001)

In general, the arachnofauna (spiders and their allies) of Honduras is very poorly known and there are only 3 described tarantulas from Honduras, two of which *Brachypelma albopilosum* and *Aphonopelma seemanni* were actually described from Costa Rica though seemingly do occur also in Honduras. The third Honduran tarantula, *Mygalarachne brevipes* is the only known endemic, but only exists in our knowledge as a single old museum specimen, collected before 1871 from an unknown location in Honduras. In Costa Rica, there are at least 34 well-described tarantula species in a much smaller geographic area than Honduras (and about 25 more potential tarantula species, several pending description) so it is highly likely that there are many tarantula species still waiting to be discovered in Honduras. Of the 3 species listed from Honduras, one of those (*A. seemanni*) is widely collected in Honduras for the commercial pet-trade market. A key issue is that *A. seemanni* was originally described from Costa Rica, so any trade identification as '*A. seemanni*' may be dubious, and multiple similar species may be being exported under this erroneous name. Such pet-trade collections of Mexican tarantulas in the early 1990s led to the blanket protection of the genus *Brachypelma* under CITES and the trade in Mexican tarantulas has become tightly monitored by national wildlife authorities. The current trade in tarantulas cannot be easily regulated in Honduras yet due to poor current scientific understanding, and lack of even basic biological studies. But, protection is likely to be required, and local-captive breeding of tarantulas for pet-trade export could be a useful

source of revenue. This topic could be developed into a series of different research questions. For example, how many species of tarantulas are present in Cusuco and how do they niche partition? Pitfall traps adjacent to spider burrows could be used to determine prey types and observational data gathered on the area used by each species to collect prey. What differences in prey types exist between tarantula species, and does prey choice vary over lifespan of each species? Are there any signs of parasitic wasps (fm. Pompilidae) preying on tarantulas? Note funding is available to complete genetic bar coding on the Honduran tarantulas so this would make an interesting dissertation topic.

#### HM207 FACTORS AFFECTING DUNG BEETLE AND SPHINGID MOTH COMMUNITIES

(Weeks 2 – 8; need to have completed HM001)

This topic takes advantage of the existing, fixed-method sampling programme of light trapping for sphingid moths and jewel scarab beetles at each of the 28 main sites, and of pit traps for dung beetles at all 150 sites, as well as the taxonomic expertise on site to help with identifications. Students on this project will participate in the main data collection effort. The moth data sets can be analysed by grouping sites with similar altitudes and levels of disturbance and determining the effects of these variables. Data from each of the 150 dung beetle data sets can be analysed in relation to the habitat structure measurements. Given that jewel scarab beetles are extremely attractive and highly valued by collectors, a project using mark-recapture analysis of trapped jewel scarab beetles, to estimate population size and other parameters to inform sustainable exploitation of the beetles, would also be useful. It is also possible to collect morphometric data from dung beetles, which could be used to explore hypotheses relating morphology to habitat structure.





Alternatively, a project could use live trapping of dung beetles to assess how far they travel to their food source, via mark–recapture methods. Dung beetles play a vital role in decomposition in the forest and in seed dispersal and the effectiveness of these roles could be tested using various experimental designs.

### HM208 DEVELOPING STRATEGIES FOR PROTECTING THE THREATENED AMPHIBIAN FAUNA OF THE CUSUCO CLOUD FOREST

*(Weeks 2 – 8; need to have completed HM001)*

The single most important reason for the need for effective conservation of the Cusuco National Park is the importance of this cloud forest for amphibians. There are 6 species of amphibians found only in the Cusuco Park comprising two tree frogs (*Plectrohyla exquisita* & *Plectrohyla dasypus*), one bromeliad frog (*Isthmohyla melacaena*), two arboreal salamanders (*Bolitoglossa diaphora* & *Cryptotriton nasalis*) and one ground dwelling salamander (*Oedipina thomasi*). In addition, there are another 10 species that are found in Cusuco but which are endangered under the IUCN categories. Of these, two tree frogs (*Duellmanohyla soralia* & *Bromeliohyla bromeliacea*) have their largest remaining populations in Cusuco, two tree frogs (*Craugastor coffeus* & *Ecinimohyla salvaje*) and one salamander (*Nototriton barbouri*) are known from only one other site other than Cusuco. To add even greater urgency, these small populations are now under threat of infection from amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) which is causing catastrophic amphibian population declines throughout Mesoamerica. Chytrid fungus appears to have reached the Park at least 15 years ago and has caused significant declines in these isolated mountain top amphibians. Topic scan be developed in a number of directions.

For example, how is chytrid fungus transmitted? Studies are being done to look at air and water dispersal mechanisms and to radiotrack arboreal frogs to see how far they move. Data are urgently required on the population sizes and distributions of each of the cloud forest amphibian species and the catchments in which each occur. This involves trekking up rivers to survey frog and salamander species in a range of remote sites to obtain as complete a coverage of the Park as possible. Day time surveys for tadpoles are supplemented by night time river treks to complete spotlight surveys and to listen for calls. The position of trees with bromeliad frogs calling will be marked and the Canopy Access team organised to climb the trees to recover bromeliad frogs. All frogs sampled will be swabbed for the presence of chytrid fungus. In addition, genetic samples will be taken for bar coding. Another project could complete a bar coding study on these endemic amphibians (see HM201) or look at gene flow between apparently isolated populations (HM202).

### HM209 FACTORS AFFECTING BIRD COMMUNITIES

*(Weeks 2 – 8; need to have completed HM001)*

This topic takes advantage of the existing, fixed-method point count survey work being undertaken for birds at each of the 150 survey sites, as well as the forest structure and other data gathered at each of these sites. In addition, some sites around the park are sampled via mist netting, yielding morphometric measurements and allowing identification of elusive species not sampled by point counts. Experienced ornithologists will help train the dissertation students in the identification of the bird species from both calls and sightings. Aspects of these data sets can then be analysed to study a whole range of impacts on bird communities. For example, selected species can be studied and the data analysed to identify the main environmental variables affecting their distribution. Sites with similar





altitudes and forest types can be grouped to assess the effects of these variables on the bird communities. Similarly, bird communities may be compared between the core and buffer zones of the Park. Or the data could be used to investigate ecological interactions between bird species. A more derived possibility could be to test whether the size of the eye relative to the head size determines the order in which each bird species joins the dawn chorus.

**HM210 BAT MORPHOLOGY AND FACTORS AFFECTING BAT COMMUNITIES**

*(Weeks 2 – 8; need to have completed HM001)*

This topic takes advantage of the existing bat monitoring programme, as well as the taxonomic and bat-handling expertise on site, allowing a wide range of possible projects. For example, previous projects have examined wing morphology and its relationship with habitat affinity or feeding guild: bats living in deep forest environments tend to have different wing shapes compared to those living on the forest edge because manoeuvrability is a key requirement within the forest, whilst on the forest edge speed is more important (to evade predators and catch prey). In 2011, mist nets and sound recording are being used, allowing greater flexibility for projects and the possibility of a methodological comparison. Other potential projects include examination of environmental effects on bat abundance. One such effect that is much debated in the literature is that of the moon: ‘lunar phobia’. This could be studied by simple comparison of bat catches and detection in different phases of the lunar cycle (including using data from past years), both as a community and per species. If bats tend to be caught less during brighter moon conditions then is it because they are foraging less or because they can see the nets better? If you

need to use specialist equipment such as a bat detector (e.g. to compare bat passes with bat captures) then be sure to check its availability with the Opwall office in good time and/or check whether your institution can lend you the equipment.

**HM211 POPULATIONS OF LARGE MAMMAL SPECIES IN CUSUCO NATIONAL PARK**

*(Weeks 2 – 8; need to have completed HM001 and have a high level of fitness)*

Large mammal surveys in Cusuco are focused on the elusive and threatened populations of Baird’s Tapir and the 3 primate species present in the park (howler monkeys, white-faced capuchins, and the central American spider monkey). The survey teams will be taking GPS readings and recording tracks, dung, vocalizations and visual encounters, as well as taking samples of scat and spoor for onsite DNA analysis. This, in combination with the fact that previous years’ data is available to dissertation students, means that a wide range of potential projects and research themes are available in this area. For example students could examine effects of different habitat variables (e.g. altitude, canopy density, disturbance levels) on large mammal populations. Alternatively, faecal samples could be analysed in order to investigate the role of large mammals in seed dispersion within the park.

**HM212 TRAP SELECTIVITY EFFECTS ON ESTIMATES OF SMALL MAMMAL DIVERSITY AND ABUNDANCE**

*(Weeks 2 – 8; need to have completed HM001)*

Estimating the species diversity and abundance of small mammals in Neotropical rainforests using live trapping programmes is fraught with difficulties owing to surveys being labour intensive, many species being elusive and trapping methods being too species specific. This





topic will use a range of traps, setting methods and baits to assess the effect of these variables of capture rate and species diversity within these catches. Ultimately this project will produce a standard methodology for surveying small mammals in Cusuco National Park, that will not only be efficient but will encompass the entire range of small mammal species that inhabit the area.

### HL213 HOWLER MONKEY BEHAVIOUR, HABITAT USE, FEEDING ECOLOGY AND VOCALISATION

*(Weeks 2 – 8; need to have completed HM001)*

Troops of howler monkeys have been habituated in the forest fragments at Rancho Manacal in the lowlands near Cofradia, enabling a wide range of dissertations or senior theses. Average population density for mantled howler monkeys ranges from 30-40 individuals per km<sup>2</sup>, but at Manacal the density is over 200 individuals per km<sup>2</sup>. Such high density is likely to have a significant effect on diet and social behaviour, particularly the loud call vocalizations. Normally howler monkeys maintain 200m-2km between troops (mediated by their loud calls), but at Manacal the troops are adjacent, which is likely to affect the frequency and duration of loud calls in addition to affecting behavioural responses to loud calls heard from neighbouring troops. Howler monkeys are usually described as folivores/frugivores that spend a high percentage of their daily activity budget resting. There are two competing theories of inactivity in howler monkeys: howler monkeys rest in order to digest toxin-loaded mature leaves, or howler monkeys conserve energy to accommodate limited access to high quality food sources (which is especially relevant in disturbed habitats where food availability is low). At Manacal, the howler monkeys have exclusive access to all food sources because their natural competitors (spider monkeys and capuchin monkeys) are unable to survive in these disturbed forest fragments. However, home range size and

access to food is limited by forest fragmentation. Manacal therefore provides an interesting location to investigate the relationships between diet, home range size, population density, food availability and activity budgets.

### HS214 RATES OF DEFORESTATION IN THE BUFFER AND CORE ZONE OF CUSUCO PARK

*(Weeks 2 – 8; need to have completed HM002 and have a high level of fitness)*

To improve the management and prospects for the Park, data are needed on the ownership and use of the land in the buffer and core zones. Satellite data analysis has shown continued encroachment into the forests by farmers in the buffer zone but this tells only part of the story. Data are needed on farm boundaries and ownership, crop usage and income generation so that these data can be used to design incentive schemes that are likely to be effective in protecting the forests. These studies have been completed on approximately 20% of the buffer zone land adjacent to the core zone and in 2010 the survey teams will be visiting a number of previously un-surveyed mountain communities to gather additional data. A series of conservation management dissertations/theses could be developed from this data collection exercise with questions such as the economic benefits of illegal clearances, differing views between communities of the value of protecting the forests and knowledge of existing rules concerning the Park etc. Students working on these projects will be with a mobile team visiting remote mountain communities with translators.





## MARINE ECOLOGY DISSERTATION TOPICS

The following topics are either based at the Utila marine research centre (HU projects) which is equipped to enable environmental processes to be researched and monitored. Other projects are based at the Cayo Menor research centre (HC) or can be done on Utila, Cayo Menor and Rio Esteban as comparison studies between one, two or all three of the Honduran Marine sites (HB). The islands of the Cayos Cochinos and Utila are home to an array of terrestrial habitats and species. Two of the projects are based at the marine research stations but study the terrestrial species on the islands.

### HC221 QUEEN CONCH DISTRIBUTION AND ECOLOGY AROUND THE CAYOS COCHINOS

*(Weeks 5–10; need to have completed HC009 and be dive trained)*

The Queen Conch plays a highly important role in the ecology and economics of the reefs around the Caribbean and the Cayos Cochinos Islands. However, conch are a valuable food product and over-fishing in previous years has severely reduced the populations on the reefs and seagrass beds of the Cayos. The MPA around the islands is designed to prevent the extraction of conch by fishermen and allow the conch population to recover. This project will continue an ongoing monitoring and tagging program studying the population, growth and movement of Queen conch within the MPA from a series of sites that have been surveyed in previous years. Surveys would use the transect surveys to record conch populations, including re-measuring tagged conch from previous years and tagging and measuring new individuals. Data will assess the size class distribution of the species and quantify their recovery within the area. Projects can include more detailed behavioural and movement research by recording positional data of individual conch on a daily basis in a defined study area or look at habitat preference by doing surveys of

the locations in which conch are common. The project could also identify potential levels of sustainable fishing for this species once the population has recovered and how it could be regulated to benefit the local fishing communities.

### HC222 SEA URCHIN POPULATION AND ECOLOGY AROUND THE CAYOS COCHINOS

*(Weeks 5–10; need to have completed HC009)*

Sea Urchins are a vital part of the ecology of Caribbean reefs where they act as one of the main herbivores of benthic algae and help prevent algal density increasing to levels where it can dominate and threaten the coral coverage of the reefs. However, in 1983 an unidentified disease decimated urchin numbers in the Caribbean, with up to 99% mortality in some areas. Urchins are long lived and slow growing so recovery is slow. To ensure the recovery of urchin populations their distribution, population and position within the reef ecosystem needs to be researched. Projects survey urchin populations on the reefs of the Cayos Cochinos, the data from which will be used as part of a long term dataset on urchin density. Data from previous years will be made available so temporal patterns in distribution can be assessed. Additional elements of urchin ecology can be studied including their habitat preference, relationship to other herbivorous species on the reef and the amount of algal coverage in relation to urchin densities. This project is snorkeling based and does not require dive qualification.





## HB223 INFLUENCES ON REEF FISH POPULATIONS OF CONTRASTING REEF SYSTEMS

*(Weeks 2 – 5, Utila; weeks 6 – 7, Rio Esteban and weeks 8 – 10, Cayos Cochinos; need to have completed HU008 or HC009 and be dive trained)*

The reefs around the Cayos Cochinos, Utila and Rio Esteban offer a unique opportunity to study the variety of influences on fish community status. Reef fish populations are subjected to a huge variety of different pressures and variables, both natural and human that dictates their abundance and diversity and many of these variables are little understood. Specific influences that are particularly important in Honduras are those of fishing, coral/algal coverage on reefs and the role of mangrove systems as nursery grounds for juvenile reef fish species. Over fishing has become a significant issue in the area and of particular importance to the artisanal fisheries in the area. Development has led to pollution and disturbance, causing changes in the levels of coral and algal coverage while mangroves are being destroyed to allow coastal development. Fishing on the Cayos Cochinos is prohibited because of the MPA, but is widespread around Utila. Utila has extensive mangrove systems whereas the Cayos Cochinos has none. Rio Esteban is a coastal system rather than an island so has reefs that are subjected to high levels of disturbance. Projects can be designed to study fish species, families or communities on the reefs around one, two or all three of the sites. Conclusions from the projects may identify the importance of the MPA around the Cayos Cochinos or the mangrove nursery grounds on Utila, while links between reef status and fish populations can be addressed across the range of reefs surveyed. Results from all projects can be used to suggest suitable conservation measures around the sites. The data gathered from the stereo video system and the photoquadrats on the various reefs around Utila, Rio Esteban and

Cayos Cochinos will be used for these studies and students developing research questions around this topic will have access to the full data sets from all the reefs.

## HB224 FACTORS INFLUENCING SMALL SCALE COMPETITION BETWEEN CORALS, SPONGES AND ALGAE ON THE REEFS OF UTILA, CAYOS COCHINOS AND RIO ESTEBAN

*(Weeks 2 – 5, Utila; weeks 6 – 7, Rio Esteban and weeks 8 – 10, Cayos Cochinos; need to have completed HU008 or HC009 and be dive trained)*

Corals compete with algae, sponges and other invertebrates for space on the reefs. This topic could map small patches and outcrops of reefs around Utila, the Cayos Cochinos Islands and Rio Esteban and determine the percentage cover and interaction between the various competing organisms. Additional areas of potential research could be based on variables that may influence the balance between competing organisms. These can include biotic variables such as abundance of herbivorous species of fish and invertebrates such as surgeon and parrotfish or urchins that favour coral growth, or damsel fish abundances which "farm" the algae, favouring algal growth. Equally abiotic variables can include; nutrient and sediment conditions in the water, with high nutrients favouring algal growth, and suspended sediments decreasing light penetration, inhibiting both corals and algae. Corals may also be smothered by excess sediment and coral disease may be promoted by high nutrients and sediment. Measurements of coverage will be taken from digital photographs, others e.g. fish abundances will be measured in situ. Correlations can be made at each site between coral and algal abundance and diversity with the biotic and abiotic variables. The sites selected on this project will be studied in future years as part of a monitoring program of growth, recruitment and disease progression of individual corals.





**HB225 SEAGRASS ECOLOGY**

*(Weeks 2 – 5, Utila; weeks 6 – 7, Rio Esteban and weeks 8 – 10, Cayos Cochinos; need to have completed HU008 or HC009 and be dive trained if not snorkeling)*

Utila is surrounded by seagrass beds, but these beds are subjected to a variety of disturbance and pollution from the developing town. Assessing the health of the seagrass beds and their associated macrofauna is vitally important to their survival. Projects will use diving and snorkeling to assess aspects of the health and ecology of the seagrass beds. The undisturbed sea grass beds of Cayos Cochinos provide an excellent comparative site with their pristine seagrass beds. Elements of study can include quantifying macrofauna and algae distribution within the beds and studying the relation this has to environmental variables including indicators of pollution and disturbance. The results of the study will be used to form part of a long term monitoring program of seagrass status around Utila and Cayos Cochinos MPA. Note this project can be done by snorkeling only.

**HU226 SMALL SCALE PATTERNS OF SEDIMENTATION RATE ON CORAL REEFS**

*(Weeks 2 – 8; need to have completed HU008 and be dive trained)*

One of the major stressors on corals is the settlement of suspended sediment on their surfaces. This leads to blocking of light, smothering of the coral mucus surface and increased risk of disease. For this reason sedimentation rate on a reef is considered as highly important in studies of coral reefs, especially with the ever increasing levels of suspended sediment in the marine environment resulting from large and small scale development and deforestation in coastal habitats. Large, generalised patterns of sedimentation are well understood,

however there is little work studying sedimentation patterns within a single reef. The reefs outside the Coral View Research Centre have a natural gradient of sedimentation from the mouth of a local lagoon. Projects can be designed to use a large number of sediment traps on the reef to study patterns of sedimentation. These can then be linked to the topography of the reef, individual corals, benthic structures, sea fans and water currents. The results can be related to the distribution of corals on the reef to assess how important small scale sedimentation patterns are in influencing coral recruitment and distribution.

**HU227 ASSESSING THE IMPACT OF MANGROVE DEGRADATION ON THEIR FUNCTIONALITY**

*(Weeks 2 – 8; need to have completed HU008)*

The island of Utila is dominated by mangrove and wetland systems. These are highly important to the functioning of the entire marine ecosystem on the island through their role in coastal protection and as fish nurseries. However they are being placed under increasing threat from the development on the island, either through direct removal to clear space for construction, or more commonly through partial disturbance and pollution. Many previous studies on mangroves have compared the functioning of healthy systems to areas where mangroves have been completely removed, but little has been done on the impacts of degradation on mangrove systems and its effect on their functioning. This topic allows research to be done on mangroves in four contrasting lagoons. Of these lagoons one is subjected to high levels of organic pollution, while a second is subjected to physical disturbance from dredging and boat traffic, a third contrasting lagoon is relatively untouched and a fourth is part of a marine reserve. These contrasting systems provide an excellent opportunity to study the effects of differing levels of mangrove





disturbance on sediment stability using cores and a muffle furnace to determine bulk densities of sediment. Another option is to compare the epibiont fauna of the mangrove roots to see if these correlate with levels of organic pollution. Estimates of the health of the mangroves can be made from the percentage of shoots that reach the sediment and the abundance and size of leaves on sample branches. This project is ideal for students studying environmental degrees and projects can analyse a variety of environmental measurements and potentially present the data through GIS. However, this topic can also be developed as a biological study by assessing the impact of mangrove degradation on their value as a fish nursery using trapping. On this topic students will be kayaking around the remote mangrove lagoons, exploring and surveying areas of Utila that are rarely if ever seen by other people.

**HC228 CAYOS COCHINOS BOA CONSTRICTOR OR CTENOSAUR ECOLOGY**

*(Weeks 5 – 10)*

This topic can focus on the general ecology of the endemic pink boa including spatial ecology, behavioural ecology, population size estimation, and dietary analysis or on the distribution, population size and morphological diversity of *Ctenosaura melanosterna* using a pole and noose to sample the population. Daily boa visual encounter surveys are conducted across the island and boas are captured by hand. Snakes are measured, fitted with a passive integrated transponder (PIT tag) for permanent identification, and released. Additionally some boas have radio-transmitters surgically implanted so that their precise positions can be determined for up to 3 years after release. Efforts will be split evenly each day between capturing and radio-tracking snakes. Possible dissertation projects could include determining activity ranges (radio-telemetry), population sizes and

mortality rates, sexual dimorphism in head shape, and proximal influences on colour and colour change in boas. Cayo Menor is also the site of a long term study of the ctenosaurs where a large percentage of the population has been captured and marked with PIT tags and each animal has had a painted number on the side. The study has been ongoing for 3 years and short biographies of many of the animals are known (changes in home range, associations with other animals etc). An interesting project would be taking tissue samples of many of the numbered animals and determining familial relationships from genetic analysis, compared to observational data on apparent relationships. The samples would need to be returned to the DNA lab in the Cusuco Park so that the samples could be processed and exported as FTA Whatman cards. Note students doing this topic would need funding to complete the sequencing of each of the samples (approx \$6 per sample) back at their home institution. Other possible dissertation topics include the distribution, population size and morphological diversity of *Ctenosaura melanosterna* on Cayo Menor.

**HB229 THE ECOLOGY AND CONSERVATION OF ANOLIS LIZARDS IN THE CAYOS COCHINOS AND BAY ISLANDS**

*(Weeks 1 – 5, Utila; and weeks 5 – 10, Cayos Cochinos)*

This topic centres on the thermal ecology of lizards in the genus *Anolis* from the Cayos Cochinos and Bay Islands of Honduras. Since the 1960s, temperatures have risen 2.5°C in the Caribbean, and recent evidence has emerged that suggests global warming will affect forest-dwelling lizards that occur in the tropics much more dramatically than it will lizards in other regions of the world. Because three species of forest-dwelling *Anolis* are endemic to the Bay Islands (two out of the three occur on Utila), it is valuable to understand their thermal biology







in order to predict the effects that global warming will have on their survival. Data types that will be collected include: environmental temperature distributions (from copper plated models shaped like lizards), preferred temperatures of individuals, optimal temperatures for sprinting (involving chasing lizards along a race track), upper thermal tolerances, and internal body temperatures. Additional data types include body size, habitat use, and abundance. Data will be used to predict the effects of global warming on lizard communities as temperatures continue to rise in the Caribbean. Lizards will be captured in the field using small nooses attached to fishing poles. Many other potential projects are available studying other elements of Anolis ecology. Projects can be conducted in the Cayos Cochinos, on Utila, or both, and data collected on Roatan and Guanaja will also be available to students.

#### **HB230 DEVELOPMENT OF AN AQUACULTURE BUSINESS WITHIN THE GARIFUNA COMMUNITY TO SUPPLY THE AQUARIST TRADE**

*(Weeks 3 – 5 Utila; weeks 6 – 7, Rio Esteban; and week 8, Cayos Cochinos)*

The value of fish and invertebrates, both freshwater and marine, bound for the aquarium trade has been valued at USD 15 billion annually. The majority of these animals are harvested from the wild by local fishers. As the demand by hobbyists for coveted species rises, local reef communities are overexploited by these fishers who, until recently, were subsistence fishers and only lately have been forced by the lack of economic opportunities to turn to the harvesting of marine ornamentals. The percentage of animals supplied by aquaculture grows each year and culture of ornamentals is the fourth largest aquaculture industry in the US. But as the list of species supplied by aquaculture grows, the need for wild caught specimens decreases,

eliminating the need for fisheries in areas where the loss of income is devastating. Whereas a large impetus behind aquaculturing these animals is safeguarding the environment, the resulting impact on the local economy is not a minor one. The reaction has been a call for the transfer of low-technology culture techniques to local communities as a viable alternative to collection from the wild. This topic involves working alongside an international expert in aquaculture who is examining how aquaculture of reef species could be undertaken in the fishing communities of the northern Honduran coast. The resultant report will identify the proposed system of holding tanks or net pens that will need to be constructed on shore or in a lagoon area. The final part of the report will be concerned with the marketing and shipping possibilities. Working alongside this expert will enable students to develop dissertations on how this business could benefit the Garifuna community and the likely impacts of the business.





## GENERAL SURVEYOR PROJECTS

Operation Wallacea teams have been gathering data sets from 150 sites across the Cusuco National Park on woody plant, dung beetle, moth, amphibian, reptile, bird, small mammal and bat communities. These data are used to monitor changes in biodiversity and abundance of key taxa and are being used by the Park authorities to establish biodiversity performance criteria. The Reducing Emissions from greenhouse gases from Deforestation and forest degradation in Developing countries (REDD) funding mechanism is targeting forests most at risk of deforestation to conserve their carbon sequestration value as well as protect their biodiversity. However, there are very few forests where sufficient biodiversity data are available to demonstrate whether the biodiversity is being protected adequately so the data sets now held by Cusuco puts them at the top of the list of forests to be protected. The data gathered by the students is therefore not just of value for scientific publications but should also be linked to payments to the Park and local communities through the REDD scheme. Whilst some of the data on forest structure can be gathered from satellite imagery, there are some aspects (eg numbers of cut stumps, light penetration as a measure of canopy openness) where only data gathered from foot based surveys can be used. The repeated measurement of these attributes allows changes in the forests over time to be quantified. Such time-consuming measurements on such a large number of remote sites are beyond the resources of most research surveys, but with the help of General Surveyor groups it is proving possible to gather such data on all the Operation Wallacea survey sites in Cusuco National Park. Over the last four years, the general surveyors have completed the first two surveys of all 150 sampling sites and in 2011/12 the target is to complete a third round.

General Surveyors start their first week at Base Camp or Santo Tomas, and will divide their time into 3 x 2 days blocks. One 2 day block concentrates on learning jungle survival skills such as how to navigate through the forests, the dangers likely to be encountered and how to live safely and comfortably in hammock based field camps. There is also the opportunity to do the Canopy Access Experience, for those who would like to get into the tree tops! A second block concentrates on training the students in Neotropical ecology from a series of lectures and practicals where the students have the opportunity to experience mist netting for birds, small mammal trapping, standard searches for herpetofauna, light trapping for moths and jewel scarab beetles and how to complete a forest structure assessment. By the end of this training, students should know how to identify a few of the common mammals, reptiles, amphibians, birds, moths and trees. The remaining 2 day block concentrates on gathering the forest structure data. Note that at least 2 nights will be spent in hammocks in field camps.

In week 2, after the exertions of working in remote forest areas, General Surveyor groups have the opportunity to spend a week learning to dive or doing a reef ecology training course by diving or snorkeling. Groups can choose between Utila or Rio Esteban/Cayo Menor. Utila has the advantage of hotel accommodation, in shared rooms with fans and an on-site swimming pool for the confined-water dive training. Utila is a very comfortable and friendly site with the research centre used by Opwall run by a local family. The Rio Esteban/Cayo Menor option means that the students spend the first part of the week in local Garifuna houses in the picturesque village of Rio Esteban. A new dive centre with swimming pool is being built on the white sands of Rio Esteban and this is where the theory and confined-water training elements of the PADI dive course are taught or the first lectures of the Reef Ecology course given. The group is then





transferred to Cayo Menor in the Cayos Cochinos Marine Protected Area (MPA) for the second part of the week where they do their Open Water dives or finish the reef ecology course. Note for this option if the group arrive having already done the theory and pool training before joining the expedition, then they would transfer straight away to Cayo Menor. There are limited spaces available in Rio Esteban so when these spaces have been filled further groups will have to complete their training on Cayo Menor.

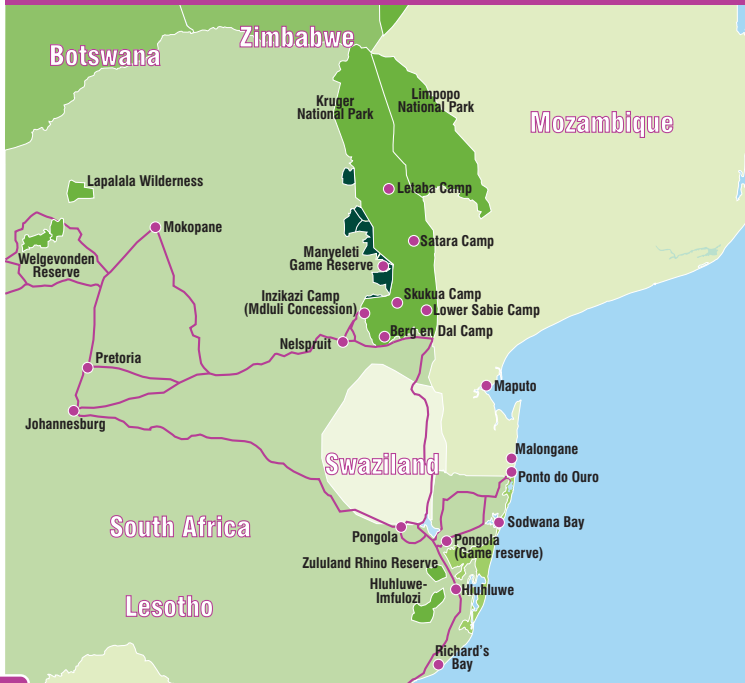
There are three options available to the school groups:

- Dive training to PADI Open Water level
- Reef Ecology Course (this is for previously qualified divers or those who only wish to snorkel)
- Referral dive training and the Reef Ecology Course. If the school completes the theory and confined-water training before they join the Opwall expedition, then on site they can complete the Open Water dives to gain their qualification in three days and spend the rest of their time on the reef ecology course, diving and learning how to identify various reef organisms.

When booking, school groups need to consider the fitness levels of each participant and what each of them would like to do for the marine options. The group should also decide whether to go to Cayo Menor or Utila and identify any preferences they have for forest camps. Having appropriate fitness levels is very important, as lack of fitness seriously limits what you can do in the forest and greatly reduces your enjoyment of the expedition. In general, while different forest camps pose different demands, even the easiest require good levels of fitness.



# SOUTH AFRICA & MOZAMBIQUE



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## RESEARCH OBJECTIVES

The majority of big game areas in South Africa are fenced in order to avoid problems with conflicts between communities and dangerous animals. However this restricts movement of species such as elephant, which can in-turn lead to excessive damage of habitat within the reserve (through confining the elephants, which damage the vegetation as they pass through or browse, to too small an area over a long period of time) and an imbalance within the reserve ecosystem.

A project called the Space for Elephants Initiative in KwaZulu Natal has persuaded a number of private game reserves to drop their fences to create a contiguous area that, when completed, will enable elephants currently confined within fenced reserves in KwaZulu Natal to complete annual migrations along ancient migration routes. There is a long way to go before these routes are completely open but there is tremendous momentum with a number of fences already being dropped. Private reserves constitute over 60% of the protected areas in South Africa, so projects such as this, which encourage cooperation between the reserves through mutually beneficial practices, can be hugely important for conservation management within southern Africa.

Operation Wallacea and our South African partners, WEI, are co-ordinating the research on the impact of the expansion of the elephants on the vegetation and associated diversity of key taxa. There are several reserves in the KwaZulu Natal region that have recently dropped their fences, some of which have never had elephants, some of which have had elephants for a long time. This provides an ideal study location to tease out the impacts of elephant on vegetation and other taxa since there are several areas, with consistent vegetation communities, which have different "elephant histories" in terms of how long each area has had elephants.

The survey has been designed to collect bird data tied to habitat variables from over 50 large sites across the KwaZulu Natal region. These biodiversity survey methods are also incredibly useful for other reserves who want to monitor ecosystem changes due to the impacts of alien species, climate change, elephant damage or fire management practices. The Operation Wallacea teams have established long-term biodiversity monitoring protocols in the sourveld reserve of Welgevonden and, in 2011, will also be working in the nearby reserve of Lapalala, to examine the bird and habitat communities as well as the distribution of large game species across the reserves.

Additionally, this data is being collected in the Mdluli Concession in Kruger National Park, again enabling the Concession managers to observe changes in biodiversity in the area as a result of management actions or other factors. In order to test the usefulness of bird and habitat data as biodiversity indicators, a number of sites around the Mdluli Concession have been selected for year round monitoring of a range of other taxa (invertebrates, amphibians, reptiles, mammals) in addition to the bird and habitat data.

To strengthen the already wide-ranging biodiversity surveys that are being conducted, in 2011 Operation Wallacea will also be surveying the Manyeleti Reserve, situated to the West of Kruger. This Reserve is of particular importance because it extends the Trans-Frontier Conservation Area that links the Limpopo Park in Mozambique and the Kruger Park in South Africa. Adding sites like these to the survey portfolio strengthens the range of habitat types and geographical regions that the survey results can be extrapolated across.

Further management techniques are being examined in the Pongola reserve in KwaZulu Natal, where a number of male elephants have been vasectomised in order to control the elephant populations. The Opwall teams are surveying the make-up and locations of the





elephant herds, and the behaviour of various individuals following this management intervention.

In addition to the terrestrial surveys, a marine team is gathering data on the reefs along the Mozambique coast along the edge of a proposed Trans Frontier Conservation Area (TCFA) between South Africa, Mozambique, and Kenya. This marine team is also working on a project entitled the Great East African Marine Transect that will compare reef fish and coral communities from Sodwana Bay in South Africa to Mombassa in Kenya and, in the 2011 season, will be based in Malongane in Mozambique collecting data for this project.

## RESEARCH FACILITIES

### Greater Kruger sites

Kruger is generally regarded to be the best Park in southern Africa in terms of size, quantity of game and management. Students will be working in one of two sites: the Mdluli Concession or Manyeleti Game Reserve. The Greater Kruger Projects start and finish in the appropriate camps.

The Mdluli Concession is in the south western sector of the Park and students based here will be staying at the Nsikazi Bush Camp. This camp is used as the base for year round surveys on a range of taxa and their habitat associations. The camp is surrounded by an electric fence to deter elephant, rhino and buffalo and accommodation is in dome safari tents with mattresses. Bathroom facilities are in separate toilet and shower blocks. There is a large central mess tent where meals are taken and a separate research tent for lectures and invertebrate identification.

Manyeleti Game Reserve is unfenced to the western boundary of Kruger National Park and the northern boundary of the exclusive Sabi

Sands Game Reserve. Manyeleti covers 23,000 ha and students here will be staying in the Reserve's Main Camp which has single sex dorms with separate ablution blocks. This is our most spacious camp and is situated next to a large dam which is always worth a visit to check for visiting animals. Projects based at the greater Kruger sites are coded SK.

### KwaZulu Natal Sites

Opwall volunteers on Pongola or other KwaZulu Natal (KZN) based projects will complete their bush training elements in one of the many Big Five reserves in the region. Accommodation will be in a basic bush camp which has safari tents, hot and cold water showers, and a central eating area, as well as lecture facilities. The Pongola Reserve where the elephant behaviour projects are based is in a 30,000 ha reserve containing all the normal game species except lion and is an up-market lodge destination. A research camp has been built well away from the lodge with twin bedded accommodation and communal shower and toilet facilities. There is a separate research centre and access to game vehicles and armed guards to complete the elephant surveys. All projects based at Pongola or any other KZN sites are coded SZ.

### Waterberg sites

This project is shared between two sites: Lapalala and Welgevonden Game Reserves. These are two of the larger protected areas within the recently declared UNESCO Waterberg Biosphere. Welgevonden is a leading reserve in sustainable ecotourism and is home to over 50 different mammals, including all of the Big Five plus giraffe, zebra, cheetah and brown hyena. Volunteers will be accommodated at the new research centre within the Reserve. Accommodation is in canvas safari tents with shared ablution facilities. The camp has a central dining and recreation area with a fully equipped kitchen with gas





stove, oven, fridge and freezer. Volunteers will prepare their own meals and are responsible for daily cleaning of the camp. Lapalala was once a wilderness area and was bought in order to protect it from development. It currently has no lion or elephant (one of the reasons why baseline data is so important before these are introduced) but does have many other large game species. The reserve management have helped set up one of South Africa's leading environmental education centres, and are committed to community development schemes in order to incentivise conservation practices. Volunteers will stay in shared en-suite rondavels (a circular kind of chalet or room), and take their meals from the central dining area. Projects based in the Waterberg are coded SW.

#### **Malongane Marine Research Centre**

This Research Centre, which was established in 2009 forms part of an existing dive centre with arguably the best access to reefs in southern Mozambique. Accommodation is in tents with communal toilet and shower facilities and computer facilities have been established. Independent research boat launches have been organised to facilitate the research. Projects based at Malongane are coded MM.

#### **Sodwana Bay Marine Training Centre**

The Sodwana Bay training facilities, which are used for some General Surveyor groups, have been developed within an existing dive centre in northern South Africa close to the Mozambique border and in a picturesque part of the iSimangaliso Wetlands Park. This marine reserve lies adjacent to Africa's southern-most coral reefs. Accommodation will be in tents, situated in a shaded bush camp. There is a toilet and shower block with hot and cold water and there will be pool facilities available for the confined water elements of the Open Water course. The centre is fully equipped with speed boats and diving facilities.

## **TRAINING COURSES**

### **SZ001 BUSHCRAFT TRAINING AND INTRODUCTION TO SAVANNAH ECOLOGY FOR KZN PROJECTS**

*(Weeks 1, 4 and 7)*

### **SK002 BUSHCRAFT TRAINING AND INTRODUCTION TO SAVANNAH ECOLOGY FOR KRUGER PARK PROJECTS**

*(Weeks 1 and 3)*

### **SW003 BUSHCRAFT TRAINING AND INTRODUCTION TO SAVANNAH ECOLOGY FOR WELGEVONDEN PROJECTS**

*(Week 3)*

This course is run in reserves which contain many large and dangerous animals (e.g. rhino, buffalo, hippo, elephant, lion, etc.). One of the objectives of the course is to orientate new volunteers in the African bush and to develop the skills and confidence necessary to participate in the surveys on foot in the reserve. Important rules and etiquette concerning safety procedures on how to conduct yourself in a dangerous game area and what to do if the group walks into dangerous animals such as buffalo, elephant and lion are covered. Training is also given in animal behaviour, how to track animals and to identify safe and danger zones around large game species when encountered and navigation using GPS and other techniques. Identification training is given for large mammals from sightings, spoor (tracks) and scat (droppings), common birds and their calls, major vegetation types and trees. An additional objective of this course is to gain an understanding of savannah ecology and management through a series of lectures on Park management, game management practices, invasive species and other issues relevant to wildlife conservation. A qualified and experienced Trails Guide and Armed Ranger lead each group of participants in the field. The course includes daily field visits together with in-camp lectures and practicals.





**MM004 PADI OPEN WATER DIVE TRAINING**

*(Weeks 3, 5, 7, 8 and 9)*

This one-week dive training course is free to Operation Wallacea Research Assistants or Dissertation students except for the costs of the PADI registration card and the Open Water Crew Pack, which you need to bring with you. The course comprises theory lectures, confined water training skills in a pool and 4 open water dives on the reefs to a maximum depth of 18m. Completion of this course will give you an internationally recognised diving qualification and is an ideal way to wind down after a few weeks in the bush, whilst joining some of the most exciting diving in the Southern Indian Ocean.

**MM005 SOUTHERN INDIAN OCEAN REEF ECOLOGY COURSE**

*(Weeks 3 – 10; need to be dive qualified or have completed MM004 if doing the practicals by diving)*

This course is designed to teach participants how to identify the main species of fish, macro-invertebrates and corals likely to be encountered and concentrates particularly on giving skills in data analysis of the video and photographic footage. The course comprises 8 lectures and practicals each day either by diving or snorkeling or in the computer lab. At the end of the course, you should be able to identify hard and soft corals and sponges to genera level, identify coral growth forms, common macro-invertebrates, most of the common species of reef fish and to complete video and photographic data analysis with a reasonable level of accuracy. In addition, if you are diving for the practicals, then your buoyancy skills should have improved to a level where you should be able to participate in dive based biological surveys.

**RESEARCH ASSISTANT PROJECTS**

**SZ101 BIRD AND HABITAT SURVEY IN KWAZULU NATAL**

*(Weeks 2 – 4)*

**SZ102 BIRD AND HABITAT SURVEY IN KWAZULU NATAL**

*(Weeks 5 – 7)*

**SZ103 BIRD AND HABITAT SURVEY IN KWAZULU NATAL**

*(Weeks 8 – 10)*

*(Need to have completed SZ001 and need to stay on the project for 3 weeks)*

KwaZulu Natal has one of the highest densities of game reserves in the whole of Africa. Although it is encouraging that such a large proportion of the region's land is under conservation, most of the reserves are independently fenced, essentially creating wildlife islands for many of the larger animals. This issue has fueled a multi-organisational movement to try and increase incentives to land owners who drop their fence lines to create larger, continuous conservation areas. Operation Wallacea and their South African partners, WEI, have been asked to provide baseline data to see how the dropping of fence lines will affect habitat and biodiversity. Point counts will be completed for birds and detailed habitat assessments will be completed at 74 sites, each 100m X 100m in size. The point counts will be completed three times at each site (once by each of the three student groups) and diversity can then be correlated to a number of habitat variables, such as dominant woody plant species, spatial heterogeneity, levels of elephant impact, fire damage and veld condition. This survey provides a unique opportunity for volunteers to join small survey teams completing surveys on foot with armed rangers in big game areas. Volunteers need to join the survey for the full 3 weeks and will be part of a small team which will have a game viewing vehicle and be led by





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a bird specialist. A trained, registered and armed guide for leading walking trails will accompany each group. The bird point counts will start as close to dawn as possible and will be finished by mid morning. After a late breakfast the group will then complete a habitat assessment of one of the 100m x 100m survey squares before returning to camp. Students will rotate between long days out in the field on the research projects and days in camp taking part in a course on issues in African Conservation. Students in camp will also have a number of duties including data input and food preparation. The bird and habitat data combined with satellite data should enable bird distributions to be modelled and population sizes estimated, as well as identifying the effects of various management practices.

#### SK104 BIODIVERSITY MONITORING IN KRUGER PARK

*(Weeks 2 – 4; need to have completed SK002)*

Whilst bird surveys in the Waterberg and KZN allow data to be collected to assess the effects of various management practices and to identify temporal trends (e.g. global warming) on this one indicator taxa, it is not possible to use these data to infer that the same changes would necessarily occur with all other taxa unless this assumption is tested. Do fire management practices for example affect the reptile, beetle or ant communities in the same way as they do for birds? This project aims to determine the communities of other taxa in a range of different habitats and with differing levels of elephant damage and recovery from fire management within the Mdluli Concession to determine whether similar trends were occurring with these other taxa as they are for the birds. Volunteers working on this project will be helping to identify ant, beetle, spider and bug communities collected from a range of habitats, installing and checking pitfall lines, undertaking transect surveys for large herbivores and cats, doing bird point counts and completing elephant habitat damage surveys. In

addition, this option has extensive training on conservation management issues in South Africa. Each volunteer will have the opportunity to join at least one of the foot based field activities each day and will be accompanied by experienced armed guards with a stand-by vehicle at all times, since there is a high density of game in this section of Kruger.

#### MM105 ASSESSING REEF STATUS

*(Weeks 4 – 10; need to be dive qualified or completed MM004 and MM005)*

The reefs in southern Mozambique are under increasing pressure from tourism development and growing numbers of artisanal and sport fishers. There are still pristine areas of reef but other areas are clearly beginning to be impacted. Operation Wallacea is running a series of annual surveys that will help identify the relative importance of each of the reef systems for biodiversity conservation and also provide data to quantify changes over time. In order to avoid data quality problems between years, the data are being collected in a way that is independent of the skill of the surveyor, to avoid variation that may mask any underlying trends. Reef fish communities are being recorded from replicate transects on each reef system using a twin video system developed by the University of Western Australia and software which combines the images and enables species identifications and fork lengths to be measured precisely. Coral cover and community structure of hard and soft corals are being assessed using a digital camera photographing replicate randomly positioned 0.25m X 0.25m quadrats on each reef. Volunteers on this project will be diving to help collect these data but will also be spending considerable amounts of time helping with the data analysis in the on-site laboratory. The 2011 programme will repeat the 2009 and 2010 surveys of all the main reefs in the Ponto do Ouro area to identify changes over this period as well as examining the effects of depth on the various communities.







Volunteers joining this project at any time will have the chance to experience some of the most exciting diving available worldwide with sightings of manta rays, sharks, whales and dolphins a possibility, as well as gaining some excellent field skills in reef species data analysis.

### DISSERTATION/THESIS TOPICS

Dissertations can be done as part of existing research programmes in Pongola Reserve, the Waterberg Biosphere and on the Ponto do Ouro reef complex. Some of the topic areas involve data collected as part of the general monitoring effort. In such cases, the data-collection sites and methods are fixed, and the range of possible research questions is therefore limited. However, it also means that the likely sample size of the data collected is large, allowing a variety of research questions to be addressed using the data. Other subject areas, which are not part of the general monitoring effort, allow a much larger range of possible research questions and flexibility in the planning of the work. The main constraints for these projects are logistical (vehicles, safety guard cover, dive launches etc), so be sure to contact Operation Wallacea with your research ideas well before you come out, to check feasibility. In the case of our Waterberg programme, two projects are running concurrently: the bird survey and habitat assessment project, and the large mammal distribution and behaviour monitoring. Although students will spend the majority of their time on the project most associated to their dissertation, time will also be spent on the other. For 2011, a new site at Lapalala has been added to the Waterberg project. With the exception of this new addition, all of the other sites in which Operation Wallacea operate have extensive existing data sets that can be utilised and provide the

basis for much more sophisticated statistical analysis than is possible just on the primary data collected.

Dissertation topics coded SZ will operate from Pongola in KZN, those coded SW will be based in the Waterberg Biosphere Area and those coded MM will be based at the Malongane Research Centre in Mozambique.

#### SZ201 THE EFFECTS OF VASECTOMISING MALE ELEPHANTS ON HERD BEHAVIOUR

*(Weeks 2 – 10; need to have completed SZ001)*

There is a growing need to control elephant populations in South Africa due to the perceived effects that such large populations are having on habitats in confined reserves. It is difficult to find suitable alternative sites for their release; culling is not favoured in many reserves, and so contraception is often the preferred mechanism of control. However, this method itself is not without opposition and there is still a great need for quantitative research into the effects on social behaviour and group dynamics. In 2008, the Disney Corporation funded vasectomies for all the male elephants approaching maturity in the two herds in the Pongola Reserve. The dominant male at the time was not vasectomised, and has now been removed from the herd (as of May 2010). The operation on the largest remaining male was unsuccessful, although he continues to receive GnRH (a hormone regulator which suppresses musth). A second attempt is planned for late 2010, and if successful this will be the first time all the adult and sub-adult males in a reserve have been vasectomised.

During the vasectomies, the animals were fitted with radio collars, and frequent ranging data will have been gathered prior to the start of the 2011 season. In 2009 and 2010, detailed data were collected on





ranging and activity budgets of the males and females and the rates of aggression, friendly interactions, dominance and sexual behaviours observed in males according to group composition (mixed-sex herd, single sex association, single male with females). Dyadic interactions between males were recorded to determine the dominance hierarchy within the males in the population. Each of these behavioural aspects might be expected to change with the vasectomies - in lieu of or replacing GnRH - or with the removal of the dominant male.

Volunteers working on this topic will be in a small group of researchers based in a vehicle with extensive observation times of the elephant herds most days. An identification guide to all the elephants has been developed as well as a family tree showing relationships between each of the animals. This topic could be developed in a number of ways. For example, the ethogram data could be analysed to determine how male and female hierarchies have changed since the vasectomies. Alternatively, the positional data could be used to calculate fixed 50% kernel (estimate of core range) and 95% kernel (estimate of total home range with outliers removed) home range patterns for the two herds and how these have changed over the period since the vasectomies were performed.

#### SW202 FACTORS AFFECTING THE POPULATION SIZE AND DISTRIBUTION OF LARGE MAMMALS IN THE WATERBERG BIOSPHERE

*(Weeks 4 – 10; need to have completed SW003)*

The Waterberg Biosphere area mostly comprises nutritionally poor sourveld grass species which hold a minimal grazing value for herbivores. This results in relatively low carrying capacities of these species which make it difficult to support the population densities demanded by eco-tourist visitors to reserves. As tourism is a massive driver behind the recent boom in land conversion from farmland to

conservation in the region, it is important to understand what other factors are affecting the distribution and abundance of herbivores so that populations can be effectively managed into the future including fertilisation of old farm grasslands within the Reserve. From June to August 2010, herbivore populations were monitored using distance sampling along line transects that incorporate the nine different habitat types of Welgevonden Game Reserve including the artificially fertilised areas. Data were collected on distance to the sighted animals, species, numbers, sex, and age categories along these transects. This will be repeated throughout the 2011 season in Welgevonden and initial data gathered in the Wilderness Reserve of Lapalala. Students on this project will share their time between the two sites, Welgevonden and Lapalala with one group working in Lapalala for weeks 4 – 7 and then Welgevonden for weeks 8 – 10 whilst the other group will do the opposite. The data sets from both sites will be available for all students. These data sets can then be used to assess the importance of habitat type, the proximity to a water source and the distribution of salt licks on the distribution of the various species. Managers of both areas have been experimenting with different fire regimes but with little quantifiable data to support their actions up until now. The data can be used to determine which species prefer newly burned areas and if group composition is affected by the more open areas. The impact of predators on herbivore behaviour is also likely to be a factor and can be elucidated by comparing the data from Welgevonden where lions are present with data from Lapalala where lions are absent. Students working at either of these sites will spend half of their time in the field whilst the other half will be spent in camp doing data entry, attending a lecture series on African Conservation and doing independent work on dissertations.





### SW203 THE EFFECTS OF HABITAT, ELEPHANT DAMAGE AND FIRE MANAGEMENT ON WINTER BIRD COMMUNITIES IN THE WATERBERG BIOSPHERE

*(Weeks 4 – 10; need to have completed SW003)*

Each summer and winter for two years prior to the 2011 season, 40 sites across Welgevonden Game Reserve have been surveyed for bird diversity through point counts. This study will be continued and expanded into Lapalala Game Reserve. Lapalala has different habitat types and, more importantly, currently does not have elephant impacting the vegetation. Both reserves also would like to know what effect fire is having on biodiversity using birds as an indicator group as well as the impact that elephants are having on the Welgevonden bird communities. Three replicates of bird point counts across 40 sites on each reserve will be completed. The habitat assessments will measure spatial heterogeneity, dominant tree and shrub species, levels of elephant impact, evidence of fire damage, and the veld condition. These data can be used to group the sites according to levels of elephant damage, state of recovery from fire damage and habitat type to compare bird communities. Principal Component Analysis can be used to identify the main habitat and environmental features affecting the distribution of the more common bird species. Additionally satellite data for the region and derived environmental data could then be used to determine ranges of the commoner species and estimate population sizes. Students on this project will share their time between the two sites, Welgevonden and Lapalala, with one group working in Lapalala for weeks 4 – 7 and then Welgevonden for weeks 8 – 10 whilst the other group will do the opposite. The data sets from both sites will be available for all students. Students working at either of these sites will spend half of their time in the field whilst the other half will be spent in camp doing data entry, attending a lecture series on African Conservation and independent work on dissertations.

### MM204 COMPARISON OF THE RELATIVE CONSERVATION VALUE OF REEFS IN SOUTHERN MOZAMBIQUE

*(Weeks 4 – 10; need to have completed MM005 and be dive trained or have completed MM004).*

This topic utilises the stereo video data gathered by the Operation Wallacea teams on reefs in southern Mozambique in 2009 and 2010 and which will be repeated in 2011. Software is available in camp to identify each fish species recorded along the stereo video transects and to measure their fork length accurately. There is also software on site, which can be used to accurately record the total area occupied by each coral community on the digital photos. The data set would consist of replicate transects surveyed at different depths on a series of reefs in 2009, 2010 and 2011 and image analysis could be completed for total coral cover, hard and soft coral communities and reef fish communities and size groups to quantify changes that had occurred between the years. The data from this topic could also be analysed to assess the relative effectiveness of utilising different length transects, how coral cover, coral communities or fish communities and size groups change with depth. For those students at universities where completion of their dissertation/thesis outside of term time is not allowed, this topic provides an opportunity to gain experience in conducting fieldwork and a guaranteed data set for later analysis.





#### MM205 THE INFLUENCE OF DEPTH AS A REFUGE FROM FISHING PRESSURE ON REEF FISH COMMUNITIES

*(Weeks 4 – 10; need to have completed MM005 and be dive trained or have completed MM004)*

On coral reefs, the distribution of fish is related to numerous factors such as depth, habitat and fishing. Recently, on coral reefs of Zanzibar, depth was shown by researchers to play an important role as a refuge for fishes against artisanal fishing pressure. On southern Mozambique reefs, artisanal fishing is low to nil, and fishing pressure is largely from the recreational sector. Previous researchers in other parts of Mozambique have suggested that artisanal fishing gear, mainly seine nets, traps, handlines and spear guns, are only able to fish relatively shallow water. In contrast, the recreational fishing gear, mainly handlines, used on southern Mozambique reefs can fish most depths. While it is illegal there to bottom fish on reefs, lost fishing gear from 'snagging' and fish hooks present in the mouths of larger carnivores such as *Epinephelus tukula* (the large Potato Cod) are frequently sighted, indicating that bottom fishing on reefs still occurs. This topic will utilise the stereo-video survey technique to sample the diversity, abundance and length of reef fish at various depths on southern Mozambique reefs. These data can then be used to test the hypothesis that depth will act as a refuge for fish communities where high diversity, abundance and potentially larger fish also occurs on southern Mozambique reefs.

#### MM206 INDICATOR SPECIES OF HARD CORAL COVER ON SOUTHERN MOZAMBIQUE REEFS

*(Weeks 4 – 10; need to have completed MM005 and be dive trained or have completed MM004)*

It has long been shown that proxies can be used to indicate the relative health of other taxa, and on coral reefs the fish family Chaetodontidae (butterflyfish) is often used as an indicator of hard coral cover and health. Chaetodontids are generally obligate coralivores (with some being omnivores) and their diversity and abundance increases with increasing hard coral cover. Nineteen species of chaetodontids are found on southern Mozambique reefs. The first question that can be asked is whether the diversity and abundance of chaetodontids can be correlated with the percentage cover of hard coral. If a correlation can be established, this will allow completion of butterflyfish surveys as a proxy for reef health. A gradient of coral cover can be detected from the reefs adjacent to the camp, towards those further north. Also occurring along this spatial scale is a gradient of human impact from SCUBA diving. Coral damage is well documented on reefs where divers frequent, and in this region most diving occurs around Ponto Malongane and Ponto do Ouro, with diver frequency decreasing towards the north.



## GENERAL SURVEYOR PROGRAMME

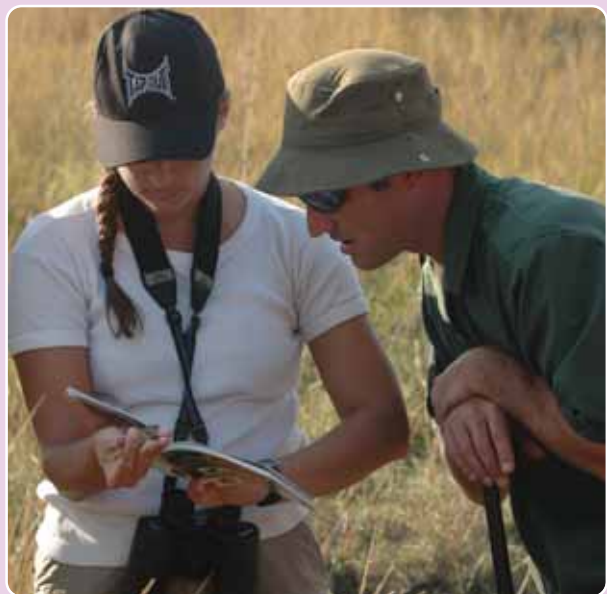
The large-scale survey programmes running in the Kruger Park and in KZN need a lot of survey effort to complete and teams of General Surveyors provide much needed manpower. General Surveyor groups will spend one week in either Kruger or KZN, and a second week in either Sodwana Bay in South Africa (just below the Mozambique border) or (for a limited number) at a camp in southern Mozambique, learning to dive or taking part in a reef ecology course.

The first week of the school's itinerary is divided into 3 days of bush training and 3 days of bird, habitat, and large game surveys. The bush training elements will include lectures and field practicals each day covering walking and working safely in the bush, an introduction to dangerous animals, tracking and interpretation of spoor, and the principles of survival in the bush. After this, the groups will spend 3 days assisting with collecting data on bird and mammal distributions, and on habitat structure throughout the survey areas. Each day half of the time will be spent in the field with the other half in the camp completing lectures and guided discussions on game reserve management, covering issues such as population control, poaching and CITES, and the pros and cons of various management interventions such as fencing and fire management.

For the second week the group will go to either Sodwana Bay in northern KwaZulu Natal, or Malongane in Southern Mozambique. If they choose Sodwana Bay then they will have the following options:

- Dive training to PADI Open Water level
- Reef Ecology course (this is for already qualified divers or those who want to snorkel only)

Alternatively if they choose the Malongane Marine Research Centre then all students can combine learning to dive to PADI Open Water level with marine biology lectures and research dives at the end of the week. This option though requires the school to complete the PADI Open Water theory either from an online training course, or by booking a Dive Instructor to visit the school and train the students in the theory and confined water training before they come out. These options mean that when the group are on site they can complete the Open Water dives to gain their qualification in a shorter time and spend the rest of their time learning about marine biology and trying out the survey techniques being used on the reefs of southern Mozambique.





**RESEARCH OBJECTIVES**

The Amazonian forests of Loreto, Peru are situated in the western Amazon basin and harbour some of the greatest mammalian, avian, floral and fish diversity on Earth. Operation Wallacea is joining a series of projects in this area that have been running since 1984 organised by Fund Amazonia and various conservation groups, universities and government agencies. The vision of these projects is to set up long-term biodiversity conservation using a combination of community-based and protected area strategies. The research and conservation activities use an interdisciplinary approach to find a balance between the needs of the indigenous people and the conservation of the animals and plants.

The objective for the 2011 season is to complete the annual high and low water season monitoring programmes for fish, caimans, turtles, macaws, exploited mammals and birds, dolphins, manatees and primates at the Pacaya Samiria National Reserve. Expeditions 1 – 2 are in the high water season when the forests are flooded, whilst those expeditions from late June to August in the middle of the low water season.

The Pacaya Samiria National Reserve is the largest protected area in Peru spanning over 20,000 km<sup>2</sup> of tropical rainforest and is a truly exceptional wilderness area. Situated deep in the rainforests of the western Amazon basin, at the point where the Amazon River begins its long journey to the Atlantic Ocean, the Pacaya Samiria Reserve teems with aquatic and terrestrial wildlife. The two major rivers that bound the reserve are the Ucayali and Marañón, and they join to form the Amazon proper right at the point where the Reserve begins. The huge floodplains of these majestic rivers have produced the low-lying flooded forests (Igapo) of the Reserve, much of which is accessible on foot during the dry season surveys. The core areas of the Reserve, with no exploitation permitted, are at the most

upstream end. At the downstream end there are communities of Cocama Indians who are involved in reserve management and managing resources in non-core zone areas sustainably.

The Samiria River that runs through the heart of the Pacaya Samiria National Reserve has a particularly large population of river dolphins and is the last remaining refuge for the Amazonian Manatee. Giant River Otters are also returning and every year more are sighted in the rivers, lakes and channels. There are 12 species of primates in the Reserve, many of which are commonly sighted on the terrestrial and aquatic transects. Macaws and wading birds are very abundant, as are the game birds. Peccaries, deer, tapir and capybara are also on the increase and are often spotted during the terrestrial survey work, particularly when the water levels are high.

The Pacaya Samiria National Reserve is working with the local Cocama Indians to guarantee that both the natural and human worlds can co-exist in harmony. Whilst their dress has changed, the Cocama Indians still live as they did centuries ago. They fish and hunt for meat, collect forest fruits and have small slash and burn gardens. They travel in small dug out canoes and live in thatched roofed houses made from trees and palm fronds of the nearby forest. The work that the project is doing is helping to develop management plans that incorporate both the needs of the Cocama people and the conservation of wildlife in the Samiria river basin.

**FOREST RESEARCH FACILITIES**

**Research boats**

The entire research expedition, including accommodation and travel to the field site, will be based onboard one of various research vessels: Clavero, Lobo del Rio, Nutria, Pithecia, and Ayapua. AmazonEco, the Opwall partners in Peru, have restored these historical rubber boom boats. The boats have basic





accommodation with fan-cooled cabins (which can accommodate 2-8 participants in bunk-beds), shared bathrooms and dining areas. There is also limited generator power during the evenings to supply lights to the boat, providing an opportunity for participants to recharge laptops or camera batteries. This makes travel and working in even the most remote part of the Amazon a reasonably comfortable experience. The boats operate in small groups so during the time you are on site you may have to change boats depending on the research schedule.

In addition to the research boat on which you will be living, there are many auxiliary boats (e.g. wooden and aluminium canoes) used to access the various data collection points.

Volunteers are taken by bus to Nauta (2 hours) and join the research ship at this point to cruise for around 24 hours to reach the Pacaya Samiria National Reserve. On some weeks, volunteers take a speed boat from Nauta to the research site (6 hours); and if this is the case, you will spend your first night in Iquitos.

## TRAINING COURSES AND RESEARCH ASSISTANT PROJECTS

### TRAINING COURSES

#### PP001 AMAZONIAN WILDLIFE ECOLOGY AND CONSERVATION COURSE

*(Weeks 5, 7 and 9)*

This course is designed to give you an introduction to Amazonian wildlife, the survey techniques used to assess the diversity of various taxa and conservation management techniques that are producing results in Amazonia. The course consists of a series of lectures and field based practicals and aims to teach you the survey techniques

and main species likely to be encountered in groups such as freshwater fish, amphibians and reptiles, birds, freshwater mammals, exploitation rates of large mammals and birds and primate population. In addition, the course covers a series of examples of conservation management in Amazonia.

### RESEARCH ASSISTANT PROJECTS

#### PP101 BIODIVERSITY MONITORING IN THE PACAYA SAMIRIA NATIONAL RESERVE

*(Weeks 6 – 10; need to have completed PP001)*

Research Assistants on this project will be based on the research ship and will need to be prepared for the hot and humid conditions of the Amazonian rainforest. Whilst some respite can be found on the boat, which provides a comfortable retreat from the tough working conditions, the main reward is the opportunity to see and work with such a huge range of birds and animals, including the larger and rarer animals such as river dolphins, primates and tapirs.

There is a large team of mainly Peruvian researchers based on the research ship with upto nine different research programmes running. Each night, the activities are listed on a whiteboard along with the timings and the number of volunteers needed for the following day to complete various research tasks. Research Assistants signing up for the various projects will help on all the projects over the course of their stay. There is a strong research atmosphere on the boat with teams coming and going at all times of day and night on various research tasks.

Research tasks which require volunteer manpower include: spotlight surveys for caimans and diet studies of this species (which necessitates capture of the caimans through noosing), transect surveys for the abundant Pink and Grey River Dolphins and the substantial populations of manatees at this site, mist netting surveys





of the bird communities utilising the forest understorey, point counts of macaws as indicators of levels of forest disturbance, gill net surveys of fish communities, standardised searching surveys to characterise the amphibian communities, land based transect counts of primates, large mammals and game birds as indicators of levels of exploitation and checking up to 20 camera traps run at a variety of habitats. Later in the season, volunteers will be needed to help with monitoring river turtle nesting sites and habitat selection by the Yellow-spotted River Turtle and with completing transect counts of river birds. In addition to these surveys there are dissertation studies where assistance may also be required.

## DISSERTATION/THESIS TOPICS

All the dissertation topics run from weeks 6 – 10 and require prior completion of PP001 Amazonian ecology and conservation course. Note these are topic areas for which there will be expertise on site to supervise. You will need to complete background reading on the topic (go to [www.opwall.com](http://www.opwall.com) and navigate to the Peru dissertations/thesis page where there will be reading lists for your chosen topic) and then to develop your own dissertation/thesis proposal from within these topic areas.

### PP201 NICHE SEPARATION IN TAMARINS, HOWLER MONKEYS, SQUIRREL MONKEYS AND OTHER PRIMATES

Multiple primate species can be found in rainforest habitats such as the Peruvian Amazon. In order to combat competition associated with several similar species living in close proximity, each species has evolved to occupy a specific niche within the habitat. These adaptations include differences in dietary requirements (frugivorous, folivorous and insectivorous primates), preference for different habitat

types within the forest (e.g. flooded forest, tierra firma forest and palm swamps) and variation in habitat use within the same forest type (e.g. occupying different heights within the forest canopy or variation in activity budgets). Twelve species of primate have been recorded in the Pacaya Samiria National Reserve and this topic examines how the various species separate their niches. Data could be gathered on encounter rates of various species from replicate observations in a range of differing habitats/forest types as a means of investigating habitat preferences. During primate encounters, the troop size, position in the canopy, behaviour and food preferences may also be recorded to further investigate niche separation between primate species. Projects may focus on two or three sympatric species or may investigate niche separation across all primate species in the Reserve.

### PP202 A COMPARISON OF THE LARGE MAMMAL AND PRIMATE FAUNA IN VARIOUS HABITAT TYPES

Transects have been installed through the forest in the Pacaya Samiria National Reserve and these are being surveyed every couple of days during the survey season. In addition, boat based transects are being completed along the edges of the conservation areas and along internal oxbow lakes wherever possible. The Reserve is rich in primate species with 12 species having been recorded (including Red Howler Monkey, Saki Monkey, Tamarin species, etc.) as well as a range of other mammal species (e.g. Giant Armadillo, Tayra, Jaguar, Kinkajou, Giant River Otter, Pink River Dolphin). Visual sightings of species could be recorded along the transects with DISTANCE analysis used to estimate the abundance of the most frequently encountered species. However, signs of other species on the walking transects (eg spoor, scats) could also be recorded and where holes are identified a fibre optic camera used to determine the occupancy of the holes. In addition, sand traps could be set up along each of the walking transects and checked regularly for signs of tracks. The transects run





through different habitat types (varzea or flooded forest which will be mostly dry at the time of sampling, aguajale palm swamp and tierra firma forest) and the usage of these habitat types by various primate and large mammal species can be compared. Patch occupancy and DISTANCE based statistics can be used for this project.

#### PP203 A COMPARISON OF THE BIRD FAUNA IN THE RIVER EDGE, VARZEA, AGUAJALE AND TIERRA FIRMA FOREST TYPES IN PACAYA SAMIRIA

This topic will utilise the existing transects that pass through varzea (flooded forest which will be mostly dry in the July survey season), aguajale palm swamps and tierra firma forests. Point count sites could be installed on the transects to represent the different forest types and replicate point count sites made over the period from 0530 - 0930 hrs each day. At each point, the number of birds seen or heard over a 15 minute period could be recorded with the times of each of the species records noted together with numbers observed. At each site a sound recording of the 15 minute sampling period could be made and analysed for species presence to compare with the observations made from the point count surveys. In addition, in the late afternoon boat point counts could be completed along the edge of rivers and oxbows. This topic will be led by an experienced ornithologist with extensive knowledge of the calls of the 450+ species that may be encountered during the survey. Projects within this topic area are guaranteed large numbers of data points as well as the opportunity to see many of the exotic Amazonian species (e.g. macaws, toucans, kingfishers, etc.).

#### PP204 THE IMPORTANCE OF THE PACAYA SAMIRIA NATIONAL RESERVE FOR WATER BIRDS

One of the main reasons for the designation of the Pacaya Samiria National Reserve is the protection of the extensive water bird populations that utilise the wetlands during the dry season in particular. This topic could complete replicate point counts on a variety of habitats along the river and adjacent wetland areas. At each site, the habitat being used by each of the bird species could be noted (e.g. open water, open water on the river edge, wading in >0.1m water, wading in waters edge to 0.1m, lower shore, upper shore, etc.). These data could then be analysed to estimate populations of herons, egrets, cormorants, screamers, waders, ducks and other water birds utilising the Reserve as well as the habitat preferences of each of the main species.

#### PP205 A COMPARISON OF FISH DIVERSITY IN DIFFERENT HABITATS

This topic could be developed in a number of ways. For example, one project could compare fish communities in a range of habitats in the Reserve, including shoreline edge of oxbow lakes with connections to the main river still remaining, open water areas of oxbow lakes still connected to the main river, edge and open water areas of oxbow lakes not linked to the main river and the main river edge. Sampling could be done using 30m X 3m gill nets with 3 - 4 inch mesh and fished for as close to 1 hour as possible. Large catches of fish can result in piranhas attacking the gill netted fish and on these occasions the net has to be retrieved before the full hour has passed. When this happens, the nets need to be repositioned until constant fishing effort has been achieved. Replicate sites could be chosen to represent these habitat types and multiple one-hour catches made at each of these sites. Projects on fish diversity are guaranteed a large amount of data points.





#### PP206 AMPHIBIAN DIVERSITY AND ABUNDANCE IN PACAYA SAMIRIA

The Pacaya Samiria Reserve contains a large diversity of amphibians. This diversity, however, is not well understood and a detailed survey of the amphibian populations in the three principal forest types in Pacaya Samiria (varzea - flooded forest, altura - terra firme, and palm swamps) would provide vital baseline information. Students could utilise transect surveys, combined with pitline traps for the smaller species, to sample the amphibian diversity throughout Reserve. DISTANCE and other catch per unit effort measurements could then be used to assess the amphibian density.

#### PP207 NICHE SEPARATION IN CAIMAN SPECIES

There are three caiman species (Common, Black and Smooth-fronted) found in the Pacaya Samiria National Reserve. This topic could examine the habitat usage and feeding ecology of the three species to identify how they separate their niches. Spotlight surveys could be completed along the edges of the main river and in a series of oxbow lakes within the forest, some of which are still connected to the main river and some of which are totally separated during the dry season. The species, estimated size and habitat usage of each of the caimans observed during these surveys could be recorded. Animals smaller than 2.5m would be captured by noose wherever possible and more detailed measurements (e.g. length, weight, sex, etc.) recorded from these captured animals. Diet of the captured caimans could be examined by flushing out the contents of the stomach, filtering the regurgitated food and classifying the main constituents. The high abundance of these species and the length of the survey season should ensure a good number of data points for this study.

#### PP208 HABITAT SELECTION AND ECOLOGY OF PINK AND GREY RIVER DOLPHINS

The pink dolphin (*Inia geoffrensis*) and grey dolphin (*Sotalia fluviatilis*) are endemic to the Amazon Rivers and function as indicator species for the general health of aquatic habitats. This topic could examine the health of the aquatic systems in the Peruvian Amazon by evaluating population trends of river dolphins. Dolphins make an excellent indicator species, because they rapidly move out of polluted or degraded habitats, and in turn quickly indicate changes in the condition of aquatic systems. The dolphins are also easy to count and observe, since they frequently surface and are large-bodied and very distinctive. Fixed width transects along rivers, lakes and channels using small boats could be used to determine species, count numbers, determine group size and determine age classes. In addition, hydrophones could be used to help identify the main activities. Comparisons could be made on how the two species of dolphins use the different aquatic habitats.

#### PP209 HABITAT SELECTION AND BREEDING SUCCESS IN RIVER TURTLES IN THE PACAYA SAMIRIA NATIONAL RESERVE

Before designation of the Pacaya Samiria National Reserve there was extensive exploitation of the two largest species of river turtles, with a substantial demand for turtle eggs in Iquitos market. Populations of the Yellow-spotted River Turtle (*Podocnemis unifilis*) and Giant Amazonia River Turtle (*Podocnemis expansa*) at this time were low. However, since effective protection was introduced together with a Head Start programme where eggs of the two species were removed from their wild nests, replanted at guard stations, hatched and released back into the river, the populations have recovered with high numbers of the Yellow-spotted River Turtle present. Since 1996, on average 73,000 Yellow-spotted Turtle hatchlings have been released each year with 16,000 Giant River Amazon turtle hatchlings





also released each year. There is a third, much smaller, unexploited species of turtle - *Podocnemis sextuberculata* and no Head Start programme has been necessary for this species. The effectiveness of the Head Start programme can be judged from historical records of numbers of nest sites of the two large species and by comparing the changes in ratios between the two larger and the smallest species since the Head Start programme was implemented. Projects could also be developed on the nest sites of the three species to determine the main features determining nest site selection (e.g. height above river level, proximity of vegetation, substrate type, etc.) in the three species. The Yellow-spotted River Turtle can be censused by boat surveys using paddles only - outboard engines affect the numbers of turtles seen. Habitat selection by the Yellow-spotted River Turtle could be studied from replicate boat transects of the river as well as in adjacent lakes and sidewaters to determine the preferred habitat of different size groups of this species.



## GENERAL SURVEYOR PROJECTS

The General Surveyor teams are, wherever possible, based on their own ship with separate lecturers and accompanying biologists (depending on group size). General Surveyor groups select one of the 2 week expeditions (A or B in the high water season or starting weeks 1 – 7 in low water season). All the expeditions are in the Pacaya Samiria National Reserve.

The first week on site is spent completing an Amazonian Wildlife and Conservation course. This consists of a series of lectures and field practicals to demonstrate the different survey techniques being used and to learn to identify the common species. In addition, lectures are given on successful conservation initiatives in Amazonia. For the second week, the group joins the surveys and can rotate between the different projects or specialise in one or more projects. A whiteboard system operates with details of each project and their departure time, activity and number of volunteers who can help with the project that day. Projects include transect counts for manatees and river dolphins, gill net surveys for fish, spotlight and noose surveys for caimans, macaw counts and forest transects. Surveyors will have the opportunity to work on a different project each day so by the end of the expedition they will have learned a number of forest biodiversity survey techniques as well as having seen many Amazonian species.





## RESEARCH OBJECTIVES

Cuba is located in the Northern Caribbean, towards the edge of the Gulf of Mexico. The island extends for more than 750 miles and is a mixture of mountain ranges and plains. The southern part of the Isla de la Juventud, the largest island off the coast of Cuba, is an area of significant biodiversity importance. This forested area has been mainly undamaged because it is effectively separated from the rest of the island by mangrove and channels. In order to protect the biodiversity, the whole southern part of the island is now being proposed as a Sustainable Use and Protected Area (APRM) whilst the western end has been designated as the Punta Frances National Park. The Punta Frances National Park contains mangroves, lagoons, semi-deciduous forests and coral reefs, and forms an excellent example of relatively undisturbed and linked Caribbean habitats. Operation Wallacea, the Coral Reef Research Unit at Essex University and the Centre for Marine Research at the University of Havana (CIM-UH) have signed a long-term research collaboration agreement to develop and implement a biodiversity monitoring programme that will provide the data needed to inform conservation management practices across the whole of the southern island APRM.

In 2010, CIM-UH established a Research Centre in the Colony Marina that will act as the base for the surveys, and also as a training centre for Cuban marine biology students. The survey work will be based on research ships operating from the Research Centre and, during 2011, the centre will be equipped with computers and software to complete the analysis of the video data being collected. In 2011, the research objective is to complete fish and benthic surveys of all the reefs of the southern Isla de la Juventud APRM and assess the manatee populations and importance of the beaches for turtle nesting.

The stereo video system being used by Opwall teams in Mozambique, Indonesia and Honduras, and which was developed by the University of Western Australia, is being introduced to Cuba for this first survey. This technique eliminates observer bias, provides a digital record of the status of the reefs and also allows size estimation of fish to within 4% of the true length. A video held 1m above a 50m tape will be used to film the benthos adjacent to the tape and the video data analysed in the lab to identify percentage cover of corals, sponges, algae, etc.

In addition, night time surveys of beaches adjacent to the reef sites being surveyed will be completed to assess their usage as turtle nesting sites. Note: the beach at Punta Frances is continually monitored throughout the breeding season but many of the other beaches in the APRM are too remote for regular monitoring so this survey will help identify their relative importance as turtle breeding sites. In addition, the mangrove channels will be surveyed by direct observation and side scan sonar to assess the manatee populations.





## RESEARCH FACILITIES

### Colony Hotel and Marina

In 2010, the Centre for Marine Research at the University of Havana (CIM-UH) started developing a field research centre at the Colony Marina to be the main base for research on the Southern Isle of Youth APRM (Sustainable Use and Protected Area). By 2011, the research centre will be equipped with computers, and is adjacent to a fully equipped dive centre.

The marina is where the three research boats are based. The manatee and dive boats will be returning to the marina on a nightly basis, but the Felipe Poey research vessel, which is being used as the platform for the reef video and photo surveys, will be moored in the Punta Frances National Park on some nights. All the teams, except those based on the Felipe Poey for 1 or 2 nights, will be operating from the research centre and Colony Marina. The research teams will be staying in the nearby 3-star Colony Hotel which has air conditioned rooms, swimming pools, showers and all the luxuries you would not expect on an Operation Wallacea research expedition! Breakfast and dinner are taken at the hotel with packed lunches provided for the field team

### Felipe Poey Research Ship

The University of Havana research ship, the Felipe Poey (named after a famous ichthyologist) is used as the operating base for the reef surveys and will be away for 2 days (one night) during expeditions 1-5, but will be away for slightly longer periods during expedition 6 so the more distant reefs can be surveyed. The boat has berths both above and below decks, though most people choose to sleep under the stars on the top deck (under a mosquito net).

The Felipe Poey was converted from a fishing boat several years ago and has excellent facilities aboard including a flush toilet and a basic fresh water shower (to be used sparingly to conserve fresh water). There is a fresh water tank which can hold up to 8 tonnes of fresh water at one time. There are also solar panels on board the boat to charge the batteries for radio communication. There is a projector and screen and sitting area on the bottom deck for lectures. The captain's wheel house has state of the art real time navigation systems, GPS systems, echo-sounder and satellite images, all linked to a main computer. There is also a VHF radio for communications with the coastguard and beach monitoring sites.





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## RESEARCH ASSISTANT PROJECTS

The Research Assistant project in Cuba is a single 4 week schedule designed to provide assistance to the Centre for Marine Investigations at the University of Havana who are completing a reef fish and benthic community survey of the reefs of the Southern Isla de la Juventud APRM (sustainable use area). This project is determining use of the beaches in this remote area for turtle nesting and estimating the population size of manatees.

### CP101 REEF FISH, BENTHIC COMMUNITIES, TURTLE BREEDING AND MANATEES IN THE SOUTHERN ISLA DE LA JUVENTUD APRM

*(Expedition 6)*

Volunteers on this project will be mainly based in the Colony Hotel with day trips out on the research boats, except for the time they are working on the more distant reefs when they will be based on the Felipe Poey Research ship for a few nights at a time. Those who are not already dive trained will be spending the first week completing a BSAC Ocean Diver training course. Those already dive trained will be spending part of their first week on the Felipe Poey ship helping with the stereo video transects. During this first week, when staying on the Felipe Poey, the students will be expected to help with the night time patrols of beaches in the Southern Isla de la Juventud APRM for turtle breeding activity. The remaining part of the first week will be based back at the Colony Hotel and helping with the transect, point counts and side scan surveys for manatees.

In week 2, all students will be completing a Caribbean reef ecology course based at the Colony Hotel but with day trips on one of the research ships with in-water practicals to help training in the

identification of the reef fish and coral species likely to be encountered. A major part of this course will concentrate on learning how to analyse the stereo video data.

For weeks 3 and 4, the students will split into 3 groups who will each rotate between the manatee surveys, the reef and turtle surveys and analysis of the video fish and benthic data collected. For the manatee and video data analysis, the groups will be based in the Colony Hotel whilst the reef and turtle group will be based on the Felipe Poey ship.





## GENERAL SURVEYOR PROJECTS

The students will be met at the Colony Hotel on the Isla de Juventud on the Friday start date of the expedition and during their first week will be trained in diving and an introduction to some of the reef fish and corals likely to be encountered. The dive training course will be the BSAC Ocean Diver training course which consists of theory sessions, confined water dives, completed in shallow and sheltered water, and 4 or 5 reef dives to a maximum depth of 18m.

During this course there will be evening lectures on how to identify reef fish and coral species. Those that arrive already dive trained will complete a full Caribbean reef ecology course in this first week with lectures and dive based practicals. Note: those that are not keen on learning to dive will do this course as well, but the in-water practicals will be done by snorkeling. The Caribbean reef ecology course teaches the students about tropical marine ecosystems, as well as learning to identify the main species of fish and corals likely to be encountered. It is possible to complete the theory, and even confined water elements of the BSAC Ocean Diver training course in advance of the expedition (please contact your local Opwall office) so that the dive elements of the course can be completed within the first part of the week and the remaining time can be spent on the Caribbean reef ecology course. During this week, the group will be based at the Colony Hotel, with day trips out on one of the research boats going to the Punta Frances MPA. Lectures will be delivered on the boat and in the evening back at the hotel.

During the second week, the teams will be split into groups of 15 students, each of which will rotate between helping with the manatee surveys (2 days), helping on the video fish and benthic surveys of the reefs including turtle nest monitoring (2 days) and helping with the analysis of the video fish and benthic data (2 days).

During the manatee surveys the students will be living at the Colony Hotel, but working on the manatee research boat helping with the transect and point counts for manatees, collecting environmental data (e.g. water temperature, salinity at different depths, etc.) and assisting with the side scan sonar surveys of the mangrove channels. The groups doing the video surveys of the reefs will be based for 2 days on the Felipe Poey ship. They will be helping complete the stereo video transect surveys for the fish communities and the benthic video surveys. In the evening, the adjacent beaches will be visited using small boats and checked for usage by breeding turtles.

During the 2 days spent on analysis of the video data, the students will once again be based at the Colony Hotel. The group will be required to identify each of the fish on the video by freeze framing and confirming the species, with identification guides where necessary. The length of each of the fish will also need to be measured using the specialised software. The areas covered by corals, sponges, algae and other life forms will be estimated using the line intercept method to analyse the benthic transect video data.



## EGYPT SURVEY LOCATIONS



### RESEARCH OBJECTIVES

In Egypt, Operation Wallacea has a long-term agreement to help the Nature and Science Foundation (NSF) in achieving some of its objectives. The main project run by NSF is to continue the work of BioMap (originally funded by the Italian Co-operation Debt Swap via UNDP), in collating all the biodiversity records for Egypt for a range of taxa from historical travellers reports, museum collections, naturalist records, academic studies, etc. so that these data can be used by the Egyptian Environmental Affairs Agency to manage their National Parks. To date, the project has published identification guides and distribution details for the mammal fauna, butterfly fauna and 3 families of plants. In addition, publications on the reptile fauna, 1 family of wasps and 2 further plant families are close to completion. The project aims to complete the publication of identification guides and distributional details for birds and the remaining 28 families of plants over the next few years.

This detailed study has revealed some significant knowledge gaps for particular areas of the country, which Operation Wallacea is helping to fill with a series of biodiversity surveys. One of the areas where more records are needed is in the mountains of southern Sinai within the St Katherine Protectorate. A sampling grid of 10km x 10km squares has been established to cover southern Sinai and constant sampling effort is being spent in each square. To date, Opwall teams have completed surveys on plants, reptiles, birds, mammals and bats in more than 40% of the squares in the southern Sinai.

This survey effort is continuing in 2011 with some of the more remote mountain wadis being surveyed in a series of long treks.

A second Operation Wallacea survey, as part of the biodiversity mapping project with NSF, began in 2010 in the remote western desert that lies west of the Nile and to the border in the south with

Sudan and the west with Libya. Underneath this vast desert area lies water as close to the surface as 2m. The Egyptian government is planning to use this water to irrigate much of this vast area to green the desert and provide a major food source for the country. However, the desert contains some unique species within areas such as the White Desert Protectorate. NSF in conjunction with Operation Wallacea is mounting a second 2-week expedition after a successful expedition in 2010 to survey the biodiversity of oases in the White Desert area from Baharia to Farafala. This 'fishing in the desert' project includes surveys of the fish, amphibians, reptiles and mammals of a series of remote oases as well as surveys of their importance as migrant staging posts for birds.

As well as working in the deserts of southern Sinai and the Western Desert, Operation Wallacea are also running diver and reef ecology training courses in Dahab on the coast. Volunteers can join these courses after participating in the desert surveys.

### RESEARCH FACILITIES

#### SINAI SURVEYS

##### Fox Bedouin Camp, St Katherine

The Fox Bedouin Camp is the main base for the survey of the high mountains of the southern Sinai. The camp is situated on the edge of the town of St Katherine in the heart of the World Heritage part of the Protectorate and consists of a mixture of Bedouin tents and stone built accommodation. Volunteers staying at this camp will be in twin bed rooms with shared bathroom facilities. There is running water with toilets and a shower system on site. There are large colourful tent areas with cushions and carpets where the teams gather round and chat in the evenings. Meals prepared by a team of







Bedouin cooks are taken in these areas on low tables or at a more traditional dining table. A lab for the DNA extraction course and research has been built at the camp, and there is a separate computer room with email facilities on site.

**Mobile Survey Camps, Sinai Mountains**

For 9 days, the teams will be trekking in the high mountains and will be staying in temporary camps set up by the Bedouin support teams. Volunteers at these camps will be sleeping out under the stars in sleeping bags and there are field toilet and washing facilities. The Bedouin prepare all the meals including fresh bread cooked each day. There are 4 x 4 vehicles and/or camels supporting the teams and a Medical Officer working with each team.

**Nature and Science Foundation Marine Training Camp, Dahab**

The marine projects are run from a Bedouin camp in Dahab, in the Gulf of Aqaba. There are open sided tents with colourful carpets and low tables (called *araeshas* in Arabic) where you can relax in the shade and drink tea in between dives and lectures, which will be run from the dive centre which is about 10 minutes walk from the camp. You can access the dive sites by wading into the sea immediately in front of the dive centre – so this is where the confined elements of the dive courses will take place. All food is prepared by the Bedouin team on site. Accommodation is in fan-cooled rooms with shared bathrooms at the camp, which overlooks the Red Sea. There is usually a strong breeze coming off the sea which allows you to enjoy the heat of the Dahab summer without being uncomfortable.

**TRAINING COURSES AND RESEARCH ASSISTANT PROJECTS**

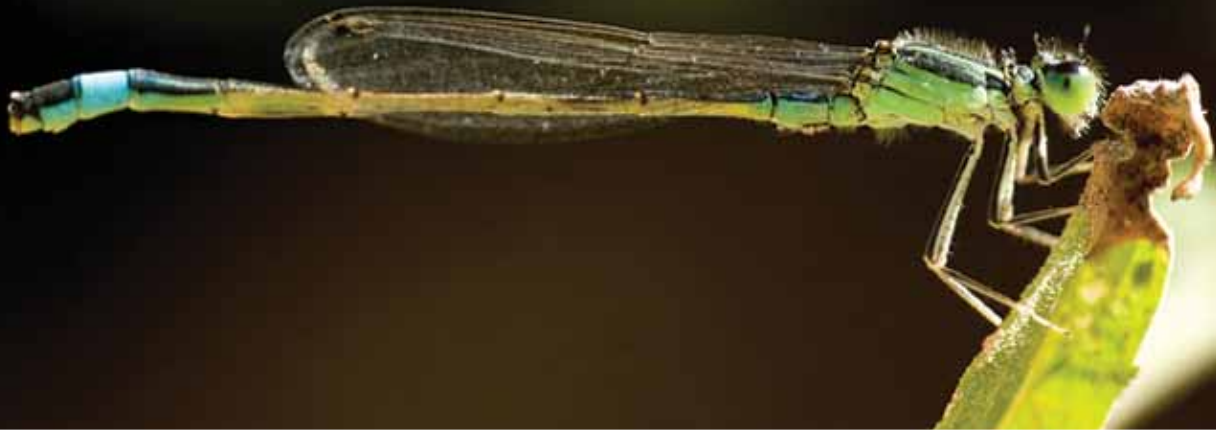
Unlike most of the other sites, the training courses and Research Assistant projects in Egypt are combined into two separate options consisting of either 3 weeks in the Sinai desert and 1 week on the marine side, or 2 weeks spent in the White Desert. The first of these options attracts 20 credits from the University of Nottingham, which can be translated into credits for participants from other universities outside the UK (please email [nottinghamcredit@opwall.com](mailto:nottinghamcredit@opwall.com) for details of how the credits could apply in your university).

**ES101 ST KATHERINE BIODIVERSITY ATLAS PROJECT**

*(Expedition 5)*

The expedition starts after Sunday lunch with short lectures on an introduction to the Sinai followed by field safety and medical talks. Over the next 3 days, there will be a series of lectures on arid region ecology and practicals aimed at training the participants in the identification skills needed and the survey techniques that will be used. On the Thursday, the group will be starting on one of the three 9 day trek routes that have been designed to cover as many as possible of the 10km x 10km squares that still need survey effort. The trek routes will take the group from St Katherine to the Gulf of Aqaba or the Gulf of Suez and it is an amazing opportunity to see some of the most spectacular scenery and wildlife in Egypt. The groups will be living in temporary Bedouin camps around oases and will be surveying in small teams for plants from quadrat surveys, reptiles from standard search times, transect surveys for birds, assessing mammal usage from spoor and scat and mist netting for bats and using bat detectors on mobile night time surveys.





At the end of 9 days in the desert, the teams will return to the Fox Camp for a rest and to help with data entry and mapping the results. On Sunday, the group will be split into those doing different training course options. One option is to do a DNA extraction course using samples collected during the survey (ES002). Volunteers on this course will be trained in the techniques of extracting and purifying the DNA, amplifying it with specific primers using PCR (polymerase chain reaction) and then visualising the results using electrophoresis. A second option is to do a wildlife illustration course (ES003) taught by one of the leading Egyptian wildlife illustrators. A third option is to do a course on how to display biodiversity data spatially using Arc and Erdisi software (ES004). This course also gives an introduction into using environmental data (rainfall, altitude, temperature, soil types, habitat, etc.) to predict distribution of species using GIS techniques.

In the final week, the group move to the NSF Marine Training Center in Dahab where they will spend a week learning to dive (ED005) or, if already qualified or not wishing to dive, will complete a reef ecology course (ED006). The dive course will train students up to PADI Open Water level. This is the internationally recognised entry level qualification for SCUBA diving, and the course consists of theory work, confined water training (conducted just off shore in the shallows) and at least 4 Open Water dives. The reef ecology course (for those already dive trained or those who would prefer to snorkel) consists of daily lectures and in-water practicals (diving or snorkeling). The course is designed to give a comprehensive introduction to the marine ecology of this part of the world – training participants in identification of corals, fish, and invertebrates.

#### EW102 WESTERN DESERT OASIS SURVEY

*(Expedition 6)*

This 2-week expedition involves a small team working with specialist biologists visiting a series of remote oases in the Western Desert. This remote area of desert bounded by the Nile to the east, Sudan to the south and Libya to the west has had little biological survey work completed to date. Yet large parts of this wilderness are due to be converted to agriculture using the large reservoirs of untapped groundwater lying just beneath the desert. Biodiversity surveys are needed and this Operation Wallacea expedition is designed to provide some data to supplement that gathered during the first expedition here in 2010, which aimed to develop a rapid assessment survey technique that would be applied across large parts of the desert in future years.

The teams will be staying in Bedouin camps next to large lakes at Baharia and Farafa and will be using 4x4 vehicles to access remote oases. At each oasis, seine netting will be completed to assess fish and amphibian communities, standardised search times used to assess reptile communities, sweep netting surveys done for butterflies and dragonflies and quadrat surveys to assess the plant communities. Many miles of inhospitable desert isolate many of these oases and it is possible that new species will be discovered in these surveys. In addition, bird surveys will be completed at each oasis both to determine the community structure but also because the surveys are being done at migration time to identify their importance as staging posts for trans-Saharan migrants. During these surveys, there will be time for the group to see the spectacular scenery of the White Desert.

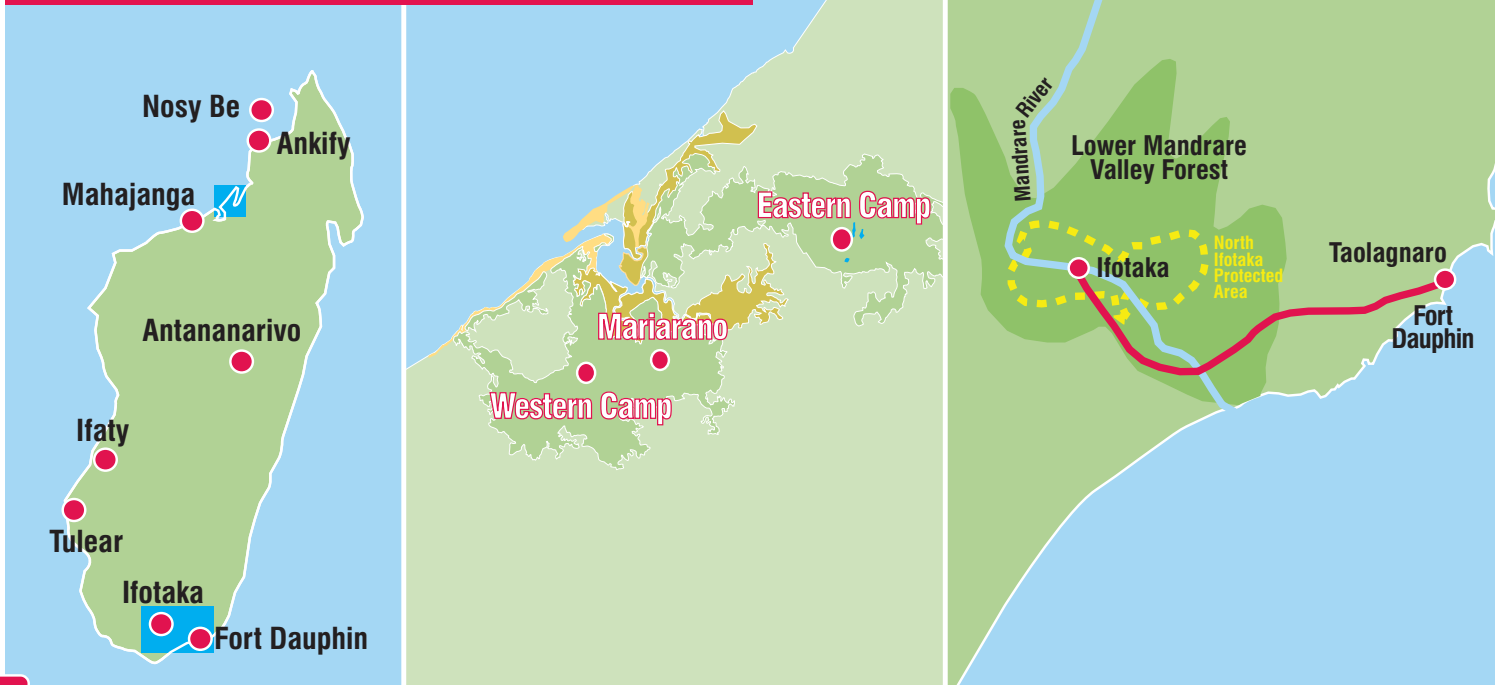


## GENERAL SURVEYOR PROJECT

The St Katherine Protectorate monitoring programme needs a lot of survey effort to complete the atlasing and teams of General Surveyors provide much needed manpower for this. The group will spend the first 3 days at the Fox Camp at St Katherine including trekking up Mount Sinai. There will also be training in how to dress and survive in the desert and the survey techniques that will be used. On the fourth day, the groups will travel out to one of the remote wadis which they will access either in 4x4 vehicles, or by trekking with support from camels to carry the bags and water. For the next 3 days, the group will survey the wadi, sleeping in a temporary Bedouin camp. Because this area of the Sinai is at altitude (1000m to 2000m), the temperature is pleasant in the evenings and mornings, and the group will sleep outside under the stars. During the days, the groups will be completing quadrat surveys for plants, timed searches for reptiles, transect surveys for birds, mist netting for bats, and assessments of mammal populations from spoor and scat. This is an excellent opportunity to see some of the most spectacular scenery and wildlife in Egypt.

Saturday night will be spent back at the Fox Camp de-briefing and relaxing. On the Sunday, the group will be taken to the Nature and Science Foundation Camp at Dahab on the Gulf of Aqaba where they will spend a week undergoing the PADI Open Water course (the entry level qualification for SCUBA diving) or, if already dive qualified, a course in reef ecology. Note that this course consists of a series of lectures and in-water practicals, which can be completed via SCUBA diving or snorkeling; so those students not wishing or not able to dive can still complete the course. The reef ecology course will give participants basic training in the identification of the key groups of fish, coral and invertebrates.





## RESEARCH OBJECTIVES

As well as boasting some of the most spectacular biodiversity in the world (lemurs, tenrecs, baobabs, and over half of all known chameleon species), much of which is endemic, Madagascar has 3 very different forest ecosystem types: dry forest in the north, humid rainforest in the east, and spiny forest in the south. The Operation Wallacea surveys are currently concentrating on dry forests and associated wetlands of Mahamavo in the North, and the spiny forest surrounding Ifotaka in the south, with a view to expanding the research to include humid forest in 2012.

The Mahamavo dry forest ecosystem and adjacent wetlands and the Ifotaka spiny forest system, both have exceptional biodiversity, but much remains to be discovered. Diurnal lemurs include Coquerel's Sifaka *Propithecus coquereli*, Common Brown Lemur *Eulemur fulvus*, Mongoose lemur *Eulemur mongoz*, Lesser Western Bamboo Lemur *Hapalemur griseus*, and in the spiny forest the enigmatic Ring-tailed Lemur *Lemur catta*, with another 3 – 4 species of nocturnal lemurs. Madagascar is the global centre of diversity for chameleons. Several species can be found in Mahamavo including two spectacular large species, *Furcifer oustaleti* and *Furcifer verrucosus*. The wetlands support the critically endangered Madagascar Fish Eagle *Haliaeetus vociferoides*, a flagship species for the area, and Humblot's Heron *Ardea humbloti*, an endangered species. Ifotaka supports populations of Radiated Tortoises as well as the charismatic Ring-tailed Sifaka lemurs and is one of the few areas where the spiny forest trees *Alluaudia ascendens* and *Alluaudia procera* (rare dryland palm) co-exist.

The Mahamavo forest provides livelihoods for several neighbouring communities in terms of agricultural land, fuel and construction wood, as well as some wild food, hunting and medicinal plants. The wetlands in the coastal area support fisheries, which constitute the main resources for coastal communities. However, within this complex,

areas of dry forest have been set aside to provide biodiversity protection. In 2011, the Operation Wallacea teams will be completing a series of transects, covering the main protected forest areas and adjacent habitats. Data will be gathered on forest structure and communities of key taxonomic groups including birds, herpetofauna (chameleons and snakes) small mammals such as tenrecs, rodents, bats and lemurs. The output from this work will be a report submitted to the Madagascar government and will provide a baseline against which changes can be assessed in future years.

The area surrounding Ifotaka is recognised as an international conservation priority due to its high biodiversity and the presence of a number of rare and endemic plants and animals. It is currently protected through a community managed programme funded by WWF. However, there is a desperate need for biological monitoring in order to assess the effectiveness of the existing management programme, and to create a baseline of data to afford comparisons in future years. Operation Wallacea have been asked to design and run this monitoring programme for the "Nord Ifotaka" area in 2011, with a view to roll out the monitoring area to the larger proposed protected area of "Sud Ifotaka" in future years.

In 2011, Operation Wallacea are developing a marine research centre in Madagascar on the small island of Nosy Be, off the North West Coast. In Nosy Be, the reefs around the island are often visited by dive tourists, but so far no standard monitoring protocols have been developed to assess the quality of the reefs in different areas. Operation Wallacea will be developing these protocols so that the impacts of various environmental and industrial factors can be assessed in order to guide best management practice. During this first year, the site will be running dive training whilst the operation and research protocols are established for future years.





## FACILITIES

### Facilities for the North Madagascar options

Expeditions in the North will run from a base camp in Mariarano village, which will be permanently occupied during the field season. Volunteers will travel to Mariarano from Mahajanga by camion-brousse (a small 4x4 lorry equipped with seats like a bus), accompanied by project staff. The journey from Mahajanga to Mariarano takes around 5 hours on a rough road. Volunteers will sleep in tents next to a building converted for use as a field laboratory with computers containing a biodiversity database and office, GIS, and statistics software. There are jungle showers and toilets in the camp. The village is very friendly and living amongst this remote local community and pumping your water from the well is a special experience.

In addition to the camp at Mariarano, two forest camps will also be used – one to the east and one to the west. These camps enable surveys of transects covering the main dry forest areas, marshes, and coastal habitats of Mahamavo. The survey groups will all spend up to one week working from each camp in order to collect data from parts of the forest that would be impossible by trekking from Mariarano. This is an excellent opportunity to get the feel of working and living in a truly remote forest research station. Accommodation will be in tents, and there are very basic shower and toilet facilities. A 4 x 4 vehicle will be maintained at Mariarano for emergency use. There is no mobile phone reception in Mahamavo so emergency communications will be by satellite phone at base camp with radio communications between Mariarano, the two forest camps and teams working in the field.

The marine section of the project will be based on a beach at Morandoka on the island of Nosy Be. This stretch of beach is in a very quiet part of the island, with only a few local houses in the immediate vicinity. Volunteers will be based in tents on the beach. There are flushing toilet and fresh-water showers available, as well as a communal eating area where food will be prepared. There is also a small research centre with computer and lecture facilities.

### Facilities for the South Madagascar options

Expeditions to the spiny forest are run from Ifotaka, which you access by flying to Fort Dauphin and then taking a 5 hour journey into the wilderness. During this journey, you will see the wildlife changing dramatically from the humid forest in the east to the harsh but spectacular spiny forest in the west. When you arrive in the village of Ifotaka you will receive a warm welcome from the local community. You will be staying in a dedicated camp site in the village, which has tents and small huts to sleep in, mandi-style bucket showers, and sit-down toilets. There is also a small education centre with lecture facilities, which will be used for the Malagasy wildlife ecology course. There is also a camp-site based further into the spiny forest which will be used to access some of the more remote survey areas. Here, volunteers will sleep in tents by a river and use basic jungle toilet and shower facilities.





## TRAINING COURSE AND RESEARCH ASSISTANT PROJECTS

There is a single exploratory Research Assistant expedition to the spiny forests of the southwest of Madagascar.

### MS101 SPINY FOREST BIODIVERSITY ASSESSMENT

*(Expedition 9)*

Volunteers will be based in the village camp of Ifotaka, which they will get to after about 5 hours travel on the sandy roads from Fort Dauphin. During their first week, volunteers will complete a Madagascar Wildlife Ecology course which consists of a series of lectures with practicals in the field to demonstrate the different survey techniques and to learn the identification of some of the commoner species. This will give participants an overview of the conservation issues affecting Madagascar and facilitate the development of identification skills and an understanding of Madagascar's unique ecology. The area to the North of Ifotaka will be surveyed mostly using the small pathways through the spiny forest that the locals use when trekking between communities. Four 3km sample routes will be mapped out and these will be used for the faunal and forest structure surveys. The survey work will include early morning forest surveys for birds, small mammals, lemurs, chameleons and other herpetofauna, as well as forest structure assessment surveys, pit-fall trapping for spiders and other invertebrates and botanical sampling during the day. During the evenings, there will be spotlight surveys for the nocturnal lemur species, further herpetofauna surveys and mist netting for birds and bats. Volunteers can rotate between these survey groups throughout their stay in order to develop a wide range of skills.

## DISSERTATION/THESIS TOPICS

Dissertation students in Madagascar will have the option to either spend 5 weeks in the dry forest and then spend a 6th week on the marine site at Morandoka learning to dive (or completing a reef ecology course if they are already dive trained) or will spend all 6 weeks in the forest. The dry forest Madagascar research programme aims to characterise patterns and trends in biodiversity of the forests and wetlands of the Mahamavo region and to devise effective and sustainable strategies for biodiversity conservation, protection of ecosystem services and the resilience of local people's livelihoods. There are several aspects to which undergraduate dissertation/thesis students could contribute by a carefully designed study including constructing species distribution models, evaluating monitoring methods, studying landscape ecology of selected species or the community ecology of selected groups, remote sensing and modeling, and assessment of ecosystem services.

At base camp in Mariarano, there is a library containing field guides and identification materials, common textbooks and the latest specialist books and manuals on field analytical methods, statistics, remote sensing, modeling, social science, etc. This is complemented by a very large collection of interesting papers, including everything ever published on biodiversity and the environment in Madagascar. The Mariarano camp has good computing facilities, comprising a set of networked laptops configured with standard office productivity and graphics software plus specialized software and utilities for statistics, GIS, community ecology, etc. There are also scanners and laser printers. GIS and remote sensing work is supported by large collections of digital spatial data and processed satellite scenes. If you can bring your own laptop (preferably running Windows XP), that would be a benefit as you won't need to share computers for analysis and writing. Students need to join for 6 weeks (expedition 8) and will spend the first few days on site completing an introductory course to Madagascar wildlife ecology.





### MN201 SPECIES DISTRIBUTION MODELING

*(Expedition 8)*

Distribution models allow a set of spatial records for a given species (from our databases) to be integrated with maps of environmental covariates (eg. elevation, climate, land cover) in order to construct and validate a statistical model of the probability that a given species will be found in a particular landscape unit. These models can then be expressed as a habitat suitability map. It will be possible for students in 2011 to join one of the science teams and contribute to collecting field data for lemurs, forest birds, wetland birds, or reptiles and amphibians and then use our entire dataset to make models for a set of species using either GLM or Maxent. Outputs from these studies would be very helpful as the maps produced can feed directly into our systematic conservation planning process and inform the management of the Mahamavo region. High quality maps are also excellent communication tools for explaining the significance of the site to decision makers.

### MN202 EVALUATION OF BIODIVERSITY MONITORING METHODS

*(Expedition 8)*

It is only worthwhile to commit resources to a biodiversity monitoring programme if the methods being used would permit a significant trend of a certain magnitude in an indicator (say, 10% decline) over a specified period (say, over 3 years) to be detected with a desired level of confidence (e.g. 95%). Whether a particular method (e.g. forest bird point counts) will satisfy these criteria depends on the number of sample units, their spatial distribution, the number of sampling occasions on each unit each year, the prevalence in the landscape and detectability of the species of interest, the underlying variance in the state parameter estimated (i.e. density, occupancy, relative abundance), and the level of disaggregation of the indicator. Students with strong statistics skills could use our monitoring data from 2009, 2010, 2011 to undertake a power analysis focused on a

particular group (e.g. birds, lemurs, reptiles and amphibians) and contrasting the indicators derived from GLMM, distance sampling and occupancy models. It would be extremely useful to confirm by power analysis or simulation that our monitoring and data assimilation methods are effective in meeting the aims of the monitoring programme, or to identify ways in which the allocation of effort to occasions or sampling units could be refined.

### MN203 LANDSCAPE ECOLOGY

*(Expedition 8)*

By conducting biodiversity surveys, we build up a knowledge base concerning patterns in the environment. However, in order to make resilient conservation plans for a dynamic future characterised by land cover change, climate change, human population growth and infrastructure development, we need to be able to understand the processes which are affecting the distribution and density of species within the landscape. It would be possible to join the teams conducting field surveys of lemurs, forest birds or reptiles to contribute to data collection, then return to base camp and use our full database linked to our spatial data to infer population processes from patterns of biodiversity. In particular, it would be very useful to test to what extent various species in a particular guild are affected by edge effects and therefore predict the likely consequences for biodiversity of habitat fragmentation in future environmental scenarios.

### MN204 COMMUNITY ECOLOGY

*(Expedition 8)*

Which processes, including habitat and ecological interactions, structure communities of forest birds and reptiles in Mahamavo? In terms of habitat, there is scope for comparison of primary and secondary dry forest and exploration of the effects of gradients in moisture between relatively moist and highly xeric forests. This might





permit the identification of indicator species for particular forest types. Beginning with species co-occurrence matrices and then using more sophisticated methods, it would be possible to test whether ecological interactions within a group may be structuring the community. For example, there are three species of chameleons found in the dry forest: *Furcifer angeli*, *Furcifer pardalis* and *Furcifer oustaleti*. It appears the *F. angeli* is a generalist species whereas the other two species are rarer and may have more specialist habitat requirements or competitive interactions.

#### MN205 REMOTE SENSING AND ENVIRONMENTAL MODELING

(Expedition 8)

Freely available satellite images can enable frequent synoptic observations of whole landscapes. However, it is critical to develop and implement methods that convert this stream of raw data into useful knowledge about the state of the environment. It would be possible for dissertation students to undertake projects on classification methods, change detection, multi-sensor fusion, field evaluation of MODIS products, inversion of the satellite signal to biophysical parameters and hyperspectral remote sensing. Students choosing projects in this area will benefit from considerable on-site technical expertise in processing satellite data, will gain a broad experience of remote sensing methods and become proficient in some advanced techniques. One possible project could involve collecting a field reference dataset using GPS and then making and validating a classifier for temporally coincident moderate resolution multispectral data from Landsat 5, Landsat 7, ALI and ASTER probably using a maximum likelihood approach, but it would be possible to investigate tree-based, Bayesian or object oriented classifiers too. Another project would be to use our existing collections of processed images to evaluate the strengths and weaknesses of a range of change detection methods, including univariate differencing, delta classification and change indices such as the TC disturbance index. In this project it would also be possible to investigate the effects of scale by contrasting results from

Landsat-like sensors with coarser-resolution sensors such as MODIS. This project could make recommendations about the best way to operationally monitor the forest using satellite data in the long term. A third project could take the latest fusion algorithms and use them to develop an effective tool (such as a macro or script) which would allow environmental managers in developing countries to be able to combine the latest 500m MODIS reflectance composite with recent Landsat-like data to frequently produced high-resolution images for monitoring purposes. A lot of derived data products are routinely produced from MODIS data for environmental monitoring purposes, in particular MOD13 vegetation indices, MOD14 fire products and MOD12 change products. However, before these datasets can be routinely used for monitoring in a particular site, it is important to check that the automatic products accurately capture local scale processes. Mahamavo is an ideal test system to investigate the accuracy of these products in relation to field survey data and higher resolution images since local people frequently burn the forest and savannah and the forest extent is highly dynamic, exhibiting complex patterns of forest loss and regeneration.

#### MN206 DEVELOPING MONITORING PROTOCOLS FOR REDD

(Expedition 8)

Climate change mitigation initiatives such as REDD have focused attention on the need to be able to monitor carbon stocks and flows in tropical forests in order to administer schemes which compensate local people for avoided deforestation. Field surveys of forest structure, as conducted by Opwall, are an effective means of gathering this data for small areas. However mapping forest biomass over large areas requires the development of methods for inversion satellite signals to estimate biophysical parameters, such as canopy height or basal area. There are a variety of ways doing this from extremely complex physical models of light scattering to artificial neural networks to very simple regression methods. A







possible project would integrate satellite data (either Landsat, MODIS or MISR) with field data from forest plots and also measurements taken from interpretation of high-resolution commercial imagery (e.g. Quickbird) to develop, refine and validate a statistical model (or a neural network) to take satellite data and generate maps of forest properties such as above-ground woody biomass. A related approach could also be used to develop a method for monitoring suspended sediment concentration in rivers in Madagascar. This is a major environmental problem, as deforestation in the upper parts of catchments allows severe erosion in the rainy season on bare slopes and may provide a second an alternative way of monitoring deforestation rates indirectly. The suspended sediments are deposited in wetlands and on coral reefs and destroy these valuable habitats. You could exploit the boat surveys by the wetland bird team in order to take water samples to estimate sediment concentration and also use a spectroradiometer in order to establish a relationship between sediment concentration and spectra. This would then permit sediment concentration to be estimated in multispectral or hyperspectral satellite images.

### GENERAL SURVEYOR PROJECTS

This 2-week expedition gives students the opportunity to see much of the unique wildlife of Madagascar including lemurs and chameleons and to help with data collection for a biodiversity assessment that is being used to assess the success of conservation management of the Mahamavo forests and associated wetlands. The teams will be based at the Mariarano field camp for the first week and will then travel to the offshore island of Nosy Be for a PADI Open Water dive training or an Indian Ocean reef ecology course in the second week.

During the first week, all volunteers will have daily lectures on Madagascar Wildlife Ecology interspersed around the survey programme. The aim of this course is to give participants an overview of conservation issues affecting Madagascar, develop identification skills and learn much more about the unique wildlife of the island. The survey work will include early morning forest surveys for birds, small mammals, lemurs, chameleons and other herpetofauna, as well as boat-based surveys for wetland birds, forest structure assessment surveys, pit-fall trapping for spiders and other invertebrates, and botanical sampling during the day. During the evenings there will be spotlight surveys for the nocturnal lemur species, further herpetofauna surveys, and mist netting for birds and bats. There are a number of new frog and bat species that have been recently discovered in Madagascar so it is possible that these in-depth surveys in the Mahamavo forests may uncover additional species.

In the second week, the group will travel overland to Ankify (10 hours) and by ferry to Nosy Be. Here the group will have the opportunity to do one of the following options:

- Dive training to PADI Open Water level
- Reef Ecology course (this is for already qualified divers or those who want to snorkel only)
- Referral dive training and the reef ecology course. If the school completes the theory and confined water training in their home country before they come out, on site they can complete the Open Water dives to gain their qualification in three days and spend the rest of their time on the reef ecology course, diving or snorkeling and learning how to identify various reef organisms.





**RESEARCH OBJECTIVES**

The Guiana Shield in South America is a massive granite dome that formed 2 billion years ago and encompasses what is now Guyana, Surinam, French Guiana and parts of Venezuela, Colombia and Brazil. Throughout most of this area there is a low human population density and as a result 2.5 million km<sup>2</sup> of tropical rainforests still remain largely untouched along with extensive savannas and wetlands. The Operation Wallacea expeditions are working in Guyana – an English speaking country with some of the most pristine remaining forests, savannas and wetlands and where sightings of jaguar, tapirs, giant otters, harpy eagles and many other charismatic South American species are common. The expeditions to the interior of Guyana, which involve trekking through undisturbed forests and lengthy river travel in canoes with temporary field camps on the river banks, are not for the faint hearted – this is true South American forest and a real expedition experience.

Operation Wallacea has formed a partnership with the Iwokrama International Centre for Rainforest Conservation and Development that manages one million acres (371,000 ha) of undisturbed forests in the centre of the country. A monitoring programme has been initiated on part of the Reserve but this programme does not cover the core zone forests or those forests surrounding Surama Village on the southern edge of Iwokrama. Guyana is at the forefront of the REDD (Reducing Emissions of greenhouse gases from Deforestation and forest degradation in Developing countries) scheme where payments are being made from governments in developed countries to countries such as Guyana to replace the income foregone by not allowing logging. The intention of this

scheme is not just to retain the carbon value of the forests but also to protect the forest in order to protect the biodiversity. Monitoring of compliance with the REDD scheme primarily relies on analysis of satellite forest coverage; however, if this is the only form of monitoring, the forest could be hunted out and the REDD payments would still happen! Iwokrama and Surama Village want to develop a more rigorous monitoring programme where biodiversity criteria are also included in the performance criteria and the Opwall surveys will provide these data.

The North Rupununi Wetlands, which extend from the Siparuni River to the Kanuku Mountains and from the Essequibo River to the Brazilian border, cover an area of 13,000km<sup>2</sup>. The Rupununi is the land of giants with Giant Otter, Arapaima, Black Caiman, Anaconda, Jaguar, Giant Anteater, Tapir, Harpy Eagle, Giant Water Lily, King Vulture, Toco Toucan and Jabiru Stork, many of which can be seen when travelling down the remote rivers. This wetland ecosystem has one of the most diverse freshwater fish fauna in the World, comprising a number of Rupununi endemics but is also augmented by Amazonian basin species that have managed to cross into the Rupununi basin when the water levels are very high and the two systems are interconnected. The Opwall teams are helping a team of biologists complete netting surveys of the remote river catchments to add to the species list, thereby strengthening the case for their immediate protection.





## FACILITIES

Guyana has one of the least disturbed forest ecosystems in the World. The population of Guyana is less than 1 million people mostly living on the northern coast. The only road to the interior and on into Brazil is a mud track. Visitors arrive at the international airport in Georgetown and then overnight before making the transfer to the Iwokrama Research Centre by bus. After 8 hours, the bus arrives at the mighty Essequibo River and the crossing is done by raft. The Iwokrama Research Centre is just on the other side of the Essequibo whilst for those travelling to Bina Hill there is another 2 hours of travel.

The Iwokrama International Research Centre is well equipped with dormitory accommodation. Meals are taken in the main dining room and there are excellent lecture room facilities. However, time at this centre will be limited with the groups moving rapidly into one of 8 field camps in the forest. In these camps, accommodation will be in hammocks with bashas and integral mosquito nets. There are temporary field toilets and washing will be done in the rivers. In the week spent on the boat based surveys on the Burro Burro River, the teams will be carrying all their supplies with them. Overnight hammock based camps will be made on the river banks each night. Emergency communications will be by satellite phone at the field camp and with the survey boats and a medical officer will travel with each of the groups.

For those going to Bina Hill at the end of the dry season when river levels are at their lowest, accommodation will initially be in shared

rooms at the Bina Hill Training Centre where there are flush toilets and showers. However, for most of the time the group will be mobile and staying in hammocks by the edge of the river. Toilets will be trenches and washing will be in the river. The team will have a satellite phone and a medical officer travelling with them.





## RESEARCH ASSISTANT PROJECTS

Research Assistants will be joining an expedition with a fixed 4-week itinerary that contains training course elements as well as the various research projects for which help will be required. Working on this expedition will give volunteers the opportunity to see a wide range of the Guiana Shield fauna as well as the opportunity to help on establishing an annual biodiversity monitoring programme of key taxa.

### GI101 IWOKRAMA AND SURAMA FOREST BIODIVERSITY SURVEY

*(Expedition 3 in 2011 and 5 in 2012)*

In the first week of the survey, the group will be completing a Jungle Training and Guiana Shield Forest Ecology course. The course is designed to prepare the group for living and working in the forest and to be of practical use in the surveys. Half the week will be spent in forest camps staying in hammocks and learning how to live safely and healthily in the tropical forest. The other part of the course will be a series of lectures on the wildlife and ecology of the fauna and flora likely to be encountered as well as learning how to identify some of the common species.

For two of the next three weeks, the group would be based in one of the 8 field camps to provide sample coverage of the Sustainable Use and Wilderness Areas of Iwokrama and the Surama forests. At each site, four 3km transects radiating out from the camp in different directions will be used for the surveys. Bird point counts will be done over 10 minute periods from dawn to 3 hours after dawn at sites each 300m apart on each of the transects (6 per transect). The herpetofauna surveys would be completed from day and night time searches along each transect. The large mammal and primate surveys would be completed from separate standardised searches along the

transects. The 4 transects will be surveyed in rotation on different days for the birds, herpetofauna and large mammals/primates. In addition, the team will need to gather detailed forest structure data within a 100m x 100m square centered around the point count site.

The bird data gathered from replicate point count data will be grouped by guild to obtain average abundances per guild to iron out some of the annual variation in numbers of individual species. The herpetofauna data gathered from standardised searches on 3km transects (day and night) will identify encounter rates for the most common species as well as adding to the overall species lists for the Park. The large mammal and primate data gathered from standardised surveys will be expressed as encounter rates (direct observations or signs) for each of the main species. Patch occupancy analysis will be used to identify changes in relative abundance of the common species. These data over a period of years combined with the forest structure and satellite data will then be able to track biodiversity changes in the Iwokrama Reserve and Surama forests.

On one of the four weeks, the team will be divided into groups of 5 students and will be travelling in convoy in small boats down the Burro Burro River through the heart of the Iwokrama rainforest to the savannah village of Surama. This is a deep forest experience and the teams will be camping out on the river bank in hammocks and helping the boat drivers and guides porter the boats around rapids and to navigate around fallen trees. The purpose of this trip is to gather standardised data on the water birds and raptors and the large mammals encountered as well as various indicators of human disturbance.



## GENERAL SURVEYOR PROJECTS

### IWOKRAMA/SURAMA FOREST BIODIVERSITY SURVEYS

*(Expeditions 1 and 2 in 2011 and 3 and 4 in 2012)*

This 2-week expedition gives students the opportunity to see much of the exciting wildlife of the Guiana Shield and to help with data collection for a biodiversity assessment survey. The Guyana expedition is the most physically tough of the expeditions organised by Opwall and is not for the faint hearted! The teams will be based at a field camp in the Iwokrama/Surama forests for the first week and will be completing a week long boat survey along the Burro Burro River through the centre of the Iwokrama Forest where there is a realistic chance of encountering jaguar, tapirs, giant river otters and harpy eagles.

In the first week, the volunteers will have 2 days learning jungle survival skills where they will learn how to live in field camps in hammocks, navigation and trekking skills as well as the main dangers from animals and diseases in the forests and rivers and how to reduce those risks. They will also have 2 days of lectures and associated practicals to learn about Guiana Shield forest ecology and how to identify some of the common species. The last 2 days of this first week will be spent helping the science teams with forest structure, bird, amphibian, reptile and large mammal surveys.

For the second week, the team will be divided into groups of approximately 5 students and will be travelling in convoy in small boats down the Burro Burro River through the heart of the Iwokrama rainforest to the village of Surama on the savannahs to the south of Iwokrama. This is a deep forest experience and the teams will be camping out on the river bank in hammocks and helping the boat

drivers and guides porter the boats around rapids and to navigate around fallen trees. The purpose of this trip is to gather standardised data on the water birds and raptors and the large mammals encountered as well as various indicators of human disturbance.

### NORTH RUPUNUNI WETLAND SURVEYS

*(Expeditions 1 and 2 in 2012)*

The teams on these surveys will start at Bina Hill in the centre of the Rupununi wetlands but will then spend the rest of the two weeks travelling by boat to the more remote parts of these wetlands. During this period, the teams will be staying in hammock camps on the river edge. The Opwall teams will be helping biologists with netting surveys to add to the 410 freshwater fish species already described from this ecosystem. This is one of the highest diversities so far recorded but there are still many more undescribed species and completion of this survey adds yet further strength to the case for protecting this relatively pristine wetland ecosystem. This expedition is for those who want to live in remote locations and is a great opportunity to see some of the Rupununi giants including the Arapaima which grows to 3m in length. These fish are obligate air breathers and surface every 10-15 minutes to gulp air. Complete counts of these giants are being completed at the same time as the Opwall teams will be on site with teams of trained surveyors lining the river banks and making direct counts of all the Arapaima surfacing.





## RESEARCH OBJECTIVES

The Amigos de Sian Ka'an (ASK), one of the most successful Mexican wildlife conservation NGOs is celebrating its 40th anniversary in 2011. The main role of ASK in the last few years has been establishing and maintaining the Sian Ka'an Biosphere Reserve in the Yucatan Peninsula of Mexico. This lowland dry forest reserve that preserves some of the best reefs in the Meso-American Barrier Reef is underlain with subterranean rivers carving their way through the limestone and contains innumerable cenotes (areas where the surface of the underground water flows through the rock have collapsed to leave an exposed pool). Research on the crustaceans and fish in these isolated cenotes has already discovered a number of new species to science. For their 40th anniversary, ASK are mounting an expedition with Operation Wallacea, Universidad Autonoma de Mexico and Oxford University to the most remote of these cenotes in the Sian Ka'an Reserve deep within the dry forests to complete freshwater fauna diversity surveys. Most of the cenotes to be visited have yet to be surveyed and the objective is to add to the species list and highlight the importance of the Biosphere Reserve.

In 2012, Operation Wallacea is starting a new project with Mexican and Guatemalan NGOs including ASK to complete annual biodiversity surveys on the Calakmul Biosphere Reserve in Mexico and the Tikal National Park in Guatemala. These contiguous forests that straddle the Mexican and Guatemalan border form one of the largest and least disturbed tracts of forest in Central America and have been designated as the Mayan Forest Biosphere Reserve. The forests encompass the two rival Mayan superpowers with populations of up to 50,000 until around 300AD. The Calakmul pyramids towering over the forests were only re-discovered by air in 1931; so extensive and unvisited is this huge area of forest!

The Mayan forests form the northern end of the Mesoamerican Biological Corridor that is attempting to provide a continuous area of wildlife habitat connecting the Yucatan of Mexico to Panama. With less than half of one percent of the World's land area, Central America contains 7-10% of all biodiversity described, to date making it a biodiversity hotspot. The Mayan forests are classified as dry forest to the north and west and tall, wetter rainforest to the south and east. Preliminary data from camera trapping has indicated that the Mayan forest is one of the remaining strongholds for jaguar and other large mammals such as spider monkeys, howler monkeys and tapir. The Mayan forest are also home to a wide range of reptiles and over 200 bird species. In addition, this stretch of forest contains many hundreds of yet to be excavated Mayan ruins.

The objective of the Opwall survey programme is to provide annual data from 8 camps spread across the forests each with 4 x 3km transects radiating out at 90 degree angles from each camp. Data will be collected on butterflies from fruit traps and pollard walks, dung beetles from pitlines, reptiles from pitlines and standardised searches, birds from point counts and mist netting, small mammals from trapping, bats from mist nets and large mammals including primates from transects and camera trapping. These data will be used to help with applications for REDD (Reducing Emissions of greenhouse gases from Deforestation and forest degradation in Developing countries) funding for the Mayan forests where biodiversity performance criteria are also included in the assessment.

## RESEARCH FACILITIES

In 2011, the only project running will be the cenote survey in the Sian Ka'an Reserve. This will be a small mobile team that will be trekking into the dry forests and camping next to remote cenotes. There will be satellite phone contact.





In 2012 the teams will be working in the spectacular Mayan forests and will be living in hammock camps with jungle showers and trench toilets. These camps will also have satellite phone contact. The marine camp will be in the small remote village of Punta Hierro in the Sian Ka'an Reserve. Accommodation will be in local houses with the offshore reefs accessed by small boats. The objective of establishing the marine base in this village is to help develop a small dive based tourism business for the local community as an alternative income source to fishing the reefs.

## RESEARCH ASSISTANT PROJECTS

### MC101 CENOTE SURVEYS

*(Expedition 1 in 2011)*

In 2011, there will only be one small research project working alongside biologists from the Universities of Mexico and Oxford helping to survey remote cenotes in the Sian Ka'an Reserve. The surveys will be using traps for crustaceans and fish and completing snorkel surveys. Note no cave diving will be done on this expedition. However, this is one of the most remote surveys being completed by Opwall teams in 2011 and you can expect to be in a series of forest camps. It is also the survey in 2011 most likely to discover new species.

## GENERAL SURVEYOR PROJECTS

This 2-week expedition gives students the opportunity to see much of the exciting wildlife of the Central American forests and to help with data collection for a biodiversity assessment survey. The teams will be based at a field camp in the forests that spread across the Mexico/Guatemalan border and form the northern end of the Meso-American Biological Corridor for the first week. They will then spend

a week learning to dive or completing a Caribbean reef ecology course at a site in the Sian Ka'an Reserve at the northern end of the Meso-American Barrier Reef.

In the first week, the volunteers will have 1 day training in jungle survival skills where they will learn how to live in field camps in hammocks, learn navigation and trekking skills as well as about the main dangers from animals and diseases in the forests and how to reduce those risks. They will also have 2 days of lectures and associated practicals to learn about the Mayan Forest Biodiversity and Ecology and how to identify some of the common species. In addition, there will be one day visiting a local Mayan archaeological site and learning about this ancient civilisation.

The last 2 days of this first week will be spent helping the science teams with forest structure surveys, butterfly surveys from fruit traps and transects, dung beetle surveys from pit lines, bird surveys from point counts and mist netting, reptile surveys from standardised searches and pitlines, small mammals from trapping, bat surveys from mist netting and large mammal surveys from camera trapping and transects for signs and sightings of the primates. Note some teams will be in the Guatemala section of the forest whilst others will be in the Mexican part depending on which surveys need to be completed that week.

On the second week, the team will go to Punta Hierro in the southern part of the Sian Ka'an Reserve and will either complete a PADI Open Water dive training course or, if already dive trained or don't want to dive, there will be the option of doing a Caribbean Reef Ecology course with in-water practicals done by diving or snorkeling.



The start point of the expeditions depends on which project you will be doing first. If you are joining the Lambusango forests programme, expeditions start in **Bau Bau on Buton Island in SE Sulawesi on Thursday at 1300hrs**. If you are joining the North Buton programme first, the expeditions start at **Ereke on Buton Island in SE Sulawesi on Thursday at 1300hrs**. If you are joining the marine based programme first, the expeditions start in **Bau Bau on Buton Island in SE Sulawesi on Thursday at 1800hrs**.

The expedition end times vary depending on whether your last week is in the forest or on the marine site. Note all those going to the North Buton site will be finishing in Bau Bau. The finish point for those returning from the marine sites will be in **Bau Bau on Thursday at 0700hrs** whilst for those returning from the Lambusango programme, the finish will be in **Bau Bau on Thursday at 1200hrs**.

In order to ensure that university volunteers have the various training courses available to them, those joining as Research Assistants or Dissertation/Thesis Students can only join the projects in odd numbered weeks (in bold). All these volunteers move between the forest and marine sites on odd-numbered weeks. Thus if you join

for 4 weeks, you need to choose either two options from the forest and two from the marine side or to choose all 4 options from either the marine or forest sides. General Surveyors can join the programme in any week except week 1.

You need to book your international flights to arrive in Indonesia on the Tuesday evening before your expedition at one of the following three entry points: Jakarta, Bali (Denpasar) or Makassar. On the Wednesday night, you will overnight in Kendari and on the Thursday will travel by boat to Bau Bau (for the Lambusango and marine expeditions) or Ereke for the North Buton programme. For UK students, STA ([opwall@statravel.co.uk](mailto:opwall@statravel.co.uk)) have organised package flights through to Kendari with a local travel agent partner to manage the local flights. The STA package includes all your travel to and from the start points of either Bau Bau or Ereke. If you are starting from outside the UK, you need to organise your flights to Jakarta, Bali (Denpasar) or Makassar and your local Opwall office will put you in touch with a local travel agent to organise the rest of your travel. Your return flights from Jakarta, Bali (Denpasar) or Makassar can be arranged from the Friday after your expedition. Note you are responsible for your travel costs up until the start time of the expeditions and from the end point of the expeditions.

## 2011 DATES

EXPEDITION WEEK NUMBER	START DATE IN BAU BAU OR EREKE	FINISH DATE IN BAU BAU
<b>1</b>	<b>Thursday 23 June 2011</b>	Thursday 30 June 2011
2	Thursday 30 June 2011	Thursday 07 July 2011
<b>3</b>	<b>Thursday 07 July 2011</b>	Thursday 14 July 2011
4	Thursday 14 July 2011	Thursday 21 July 2011
<b>5</b>	<b>Thursday 21 July 2011</b>	Thursday 28 July 2011
6	Thursday 28 July 2011	Thursday 04 August 2011
<b>7</b>	<b>Thursday 04 August 2011</b>	Thursday 11 August 2011
8	Thursday 11 August 2011	Thursday 18 August 2011
<b>9</b>	<b>Thursday 18 August 2011</b>	Thursday 25 August 2011
10	Thursday 25 August 2011	Thursday 01 September 2011

## 2011 OPTIONS

	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10
<b>IN001</b> Jungle training and tropical forest ecology										
<b>IL002</b> Indonesian cultural experience										
<b>Canopy Access</b>										
<b>IH005</b> PADI Open Water										
<b>IH006</b> Divemaster training										
<b>IH007</b> Indo-Pacific reef ecology										
<b>IH008</b> Wakatobi culture, community & environment										
<b>IN101</b> Node camp biodiversity monitoring										
<b>IL102</b> Labundo biodiversity monitoring										
<b>IH110</b> Biotope mapping										
<b>IH111</b> Coral reef fish and benthos monitoring										
<b>IH112</b> Crown of Thorns monitoring										
<b>IH113</b> Marine research assistant pool										
<b>IB114</b> Reef check and marine mammal surveys										
<b>IH115</b> Fisheries monitoring										
<b>All forest dissertations</b> except IN203										
<b>IN203</b> Ethnobotany dissertation										
<b>IH220 – IH259</b> Marine research dissertations										
<b>IH251</b> Social resilience dissertation										
<b>IH260</b> REDD funding dissertation										

## 2012 DATES

EXPEDITION WEEK NUMBER	START DATE IN BAU BAU OR EREKE	FINISH DATE IN BAU BAU
1	Thursday 21 June 2012	Thursday 28 June 2012
2	Thursday 28 June 2012	Thursday 05 July 2012
3	Thursday 05 July 2012	Thursday 12 July 2012
4	Thursday 12 July 2012	Thursday 19 July 2012
5	Thursday 19 July 2012	Thursday 26 July 2012
6	Thursday 26 July 2012	Thursday 02 August 2012
7	Thursday 02 August 2012	Thursday 09 August 2012
8	Thursday 09 August 2012	Thursday 16 August 2012
9	Thursday 16 August 2012	Thursday 23 August 2012
10	Thursday 23 August 2012	Thursday 30 August 2012



# HONDURAS DATES AND OPTIONS

Expeditions start in **San Pedro Sula on Wednesday at 0700hrs** (if you are starting in the forest) or **0900hrs** (if you are starting with a marine project) and finish in **San Pedro Sula on Tuesday at 1200hrs**. You will need to book your flight into San Pedro Sula on the Tuesday before the expedition and contact Maya Temple Tours ([dennis@mayatempletours.com](mailto:dennis@mayatempletours.com)) who will arrange for your airport transfer and hotel accommodation for the night. You can book your flight leaving San Pedro Sula anytime after 1400hrs on the Tuesday at the end of the expedition.

In order to ensure that university volunteers have the various training courses available to them, those joining as Research Assistants or Dissertation/Thesis students can only join the project in odd numbered weeks (in bold). All volunteers move between the forest and the marine site on odd numbered weeks. Thus if you join for 4 weeks, you need to choose either two options from the forest and two from the marine side or choose all 4 options from either the marine or the forest side. General Surveyors can join the programme in any week.

## 2011 DATES

EXPEDITION WEEK NUMBER	START DATE IN SAN PEDRO SULA	FINISH DATE IN SAN PEDRO SULA
<b>1</b>	<b>Wednesday 08 June 2011</b>	Tuesday 14 June 2011
2	Wednesday 15 June 2011	Tuesday 21 June 2011
<b>3</b>	<b>Wednesday 22 June 2011</b>	Tuesday 28 June 2011
4	Wednesday 29 June 2011	Tuesday 05 July 2011
<b>5</b>	<b>Wednesday 06 July 2011</b>	Tuesday 12 July 2011
6	Wednesday 13 July 2011	Tuesday 19 July 2011
<b>7</b>	<b>Wednesday 20 July 2011</b>	Tuesday 26 July 2011
8	Wednesday 27 July 2011	Tuesday 02 August 2011
<b>9</b>	<b>Wednesday 03 August 2011</b>	Tuesday 09 August 2011
10	Wednesday 10 August 2011	Tuesday 16 August 2011

## 2011 OPTIONS

	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10
<b>HM001</b> Jungle training & forest ecology										
<b>Canopy Access</b>										
<b>HM002</b> Spanish language training										
<b>HM003</b> DNA field sampling course										
<b>HU005</b> PADI Open Water – Utila										
<b>HE006, HC007</b> PADI Open Water – Rio Esteban and/or Cayo Menor										
<b>HU008</b> Caribbean reef ecology – Utila										
<b>HC009</b> Caribbean reef ecology – Cayo Menor										
<b>HU010</b> Divemaster training – Utila										
<b>HM101</b> Monitoring biodiversity change in Cusuco										
<b>HM102</b> Large mammal monitoring										
<b>HL103</b> Howler Monkey ecology and behaviour										
<b>HM104</b> Amphibian surveys										
<b>HM105</b> Aquatic biotic water quality										
<b>HB106</b> Reef surveys										
<b>HB107</b> Research assistant pool										
<b>HU108</b> Mangrove surveys										
<b>HC109</b> Island reptile monitoring										
<b>HM201, 202, 204, 207, 208, 209, 210, 211, 212, HL213 &amp; HS214</b>										
<b>HM203, 205, 206</b> Forest dissertations										
<b>HC221, 222, 228</b> Marine dissertations										
<b>HB223, 224, 225</b> Marine dissertations										
<b>HU226, 227</b> Marine dissertations										
<b>HB229</b> Anolis dissertation										
<b>HB230</b> Aquaculture dissertation										

## 2012 DATES

EXPEDITION WEEK NUMBER	START DATE IN SAN PEDRO SULA	FINISH DATE IN SAN PEDRO SULA
1	Wednesday 06 June 2012	Tuesday 12 June 2012
2	Wednesday 13 June 2012	Tuesday 19 June 2012
3	Wednesday 20 June 2012	Tuesday 26 June 2012
4	Wednesday 27 June 2012	Tuesday 03 July 2012
5	Wednesday 04 July 2012	Tuesday 10 July 2012
6	Wednesday 11 July 2012	Tuesday 17 July 2012
7	Wednesday 18 July 2012	Tuesday 24 July 2012
8	Wednesday 25 July 2012	Tuesday 31 July 2012
9	Wednesday 01 August 2012	Tuesday 07 August 2012
10	Wednesday 08 August 2012	Tuesday 14 August 2012

# SOUTH AFRICA DATES AND OPTIONS

The expeditions start on a **Saturday at 0800hrs** and finish on a **Friday at 1200hrs**. However, the start locations vary for the different projects. For the Kruger projects, the projects start and finish from the Inzikazi Camp in the Mdluli Concession at Pretoriuskop, whilst the KZN projects start and finish at the Zululand Rhino Reserve near to the town of Mkhuze. The Malongane projects in Mozambique also start from Zululand Rhino Reserve. If you are working on the Kruger or Pongola projects before you join the southern Mozambique projects you will be transferred to the site without needing to return to Zululand Rhino Reserve. The easiest way to get to these start points is to organise your flight to Johannesburg to arrive by 0800hrs on the Friday before your expedition and then contact Wildlife Ecological Investments ([clive@wei.org.za](mailto:clive@wei.org.za)) the NGO that organises the logistics for the research programmes to arrange for your overland return transfers from the airport (7-8 hours) and first night's accommodation. You will be responsible for these costs £195 (approx \$350) before the expedition start time. You can

book your return flights after 2100hrs on the Friday at the end of your expedition.

If you are doing a project in the Waterberg, the start point would be the Research Camp in either Welgevonden or Lapalala (you will know this after submitting your proposal). Transfers from Johannesburg airport to Waterberg, which take approximately 3-4 hours, can be arranged by WEI for £95 (approx \$170).

If you are wanting to combine the Waterberg sites with Mozambique, you will need to return to Johannesburg after and take an overland return transfer to Mozambique.

Note those joining the projects as Research Assistants can only start in weeks 1, 4 or 7 if going to KwaZulu Natal, weeks 1 or 3 if going to Kruger and weeks 3, 5 or 7 if going first to Mozambique. Those doing a dissertation in Pongola can only start in weeks 1 or 4, whilst in the Waterberg they can start only in weeks 3. Those joining as General Surveyors can do so in weeks 3 – 9.

## 2011 DATES

EXPEDITION WEEK NUMBER	START DATE	FINISH DATE
1	<b>Saturday 11 June 2011</b>	Friday 17 June 2011
2	Saturday 18 June 2011	Friday 24 June 2011
3	<b>Saturday 25 June 2011</b>	Friday 01 July 2011
4	Saturday 02 July 2011	Friday 08 July 2011
5	<b>Saturday 09 July 2011</b>	Friday 15 July 2011
6	Saturday 16 July 2011	Friday 22 July 2011
7	<b>Saturday 23 July 2011</b>	Friday 29 July 2011
8	Saturday 30 July 2011	Friday 05 August 2011
9	<b>Saturday 06 August 2011</b>	Friday 12 August 2011
10	Saturday 13 August 2011	Friday 19 August 2011

## 2011 OPTIONS

	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10
<b>SZ001</b> Bush training: KZN										
<b>SK002</b> Bush training: Kruger										
<b>SW003</b> Bush training: Waterberg										
<b>MM004</b> PADI Open Water										
<b>MM005</b> Reef ecology										
<b>SZ101</b> Bird/hab surveys: KZN										
<b>SZ102</b> Bird/hab surveys: KZN										
<b>SZ103</b> Bird/hab surveys: KZN										
<b>SK104</b> Biodiversity monitoring										
<b>MM105</b> Reef surveys										
<b>SZ201</b> Elephant dissertation										
<b>SW202 - 3</b> Waterberg dissertations										
<b>MM204 - 6</b> Reef dissertations										

## 2012 DATES

EXPEDITION WEEK NUMBER	START DATE	FINISH DATE
1	Saturday 09 June 2012	Friday 15 June 2012
2	Saturday 16 June 2012	Friday 22 June 2012
3	Saturday 23 June 2012	Friday 29 June 2012
4	Saturday 30 June 2012	Friday 06 July 2012
5	Saturday 07 July 2012	Friday 13 July 2012
6	Saturday 14 July 2012	Friday 20 July 2012
7	Saturday 21 July 2012	Friday 27 July 2012
8	Saturday 28 July 2012	Friday 03 August 2012
9	Saturday 04 August 2012	Friday 10 August 2012
10	Saturday 11 August 2012	Friday 17 August 2012



# PERU DATES AND OPTIONS

All expeditions start and finish in Iquitos. The expeditions to Pacaya Samiria during the high-water season (in March and April) begin on a **Sunday at 1200hrs** and finish on a **Friday at 2000hrs**. Only 2-week expeditions for General Surveyors are available during this period.

The expeditions to Pacaya Samiria during the low-water season (June to August) also begin on a **Sunday at 1200hrs** and finish on a **Friday at 2000hrs**. Research Assistants can sign on to 2, 4 or 6 week expeditions starting in weeks 5, 7 or 9. Dissertation/Thesis

students need to be onsite for 6 weeks and can only start in week 5. General Surveyors can join in any week.

Most people arrive in Iquitos on the Saturday before the expeditions and then overnight in the beautiful Casa Morey house which belongs to AmazonEco the Opwall partners in Peru. The mansion, situated in the heart of Iquitos, overlooks the Amazon. AmazonEco can organise, pick up from the airport, dinner, bed and breakfast for \$30. Return flights can be booked on the Saturday after expedition end.

## GENERAL SURVEYORS - HIGH-WATER SEASON 2011 DATES

EXPEDITION NUMBER	START DATE IN IQUITOS	FINISH DATE IN IQUITOS
A	Sunday 06 March 2011	Friday 18 March 2011
B	Sunday 20 March 2011	Friday 01 April 2011

## LOW WATER SEASON 2011 DATES

EXPEDITION WEEK NUMBER	START DATE IN IQUITOS	FINISH DATE IN IQUITOS
1	Sunday 19 June 2011	Friday 24 June 2011
2	Sunday 26 June 2011	Friday 01 July 2011
3	Sunday 03 July 2011	Friday 08 July 2011
4	Sunday 10 July 2011	Friday 15 July 2011
<b>5</b>	<b>Sunday 17 July 2011</b>	Friday 22 July 2011
6	Sunday 24 July 2011	Friday 29 July 2011
<b>7</b>	<b>Sunday 31 July 2011</b>	Friday 05 August 2011
8	Sunday 07 August 2011	Friday 12 August 2011
<b>9</b>	<b>Sunday 14 August 2011</b>	Friday 19 August 2011
10	Sunday 21 August 2011	Friday 26 August 2011

## 2011 OPTIONS FOR RESEARCH ASSISTANTS AND DISSERTATION/THESIS STUDENTS

	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10
<b>PP001</b> Introduction to Amazonian Ecology										
<b>PP101</b> Biodiversity Monitoring in Pacaya Samiria										
<b>PP201-209</b> Dissertation topics										

## GENERAL SURVEYORS - HIGH-WATER SEASON 2012 DATES

EXPEDITION NUMBER	START DATE IN IQUITOS	FINISH DATE IN IQUITOS
A	Sunday 04 March 2012	Friday 16 March 2012
B	Sunday 18 March 2012	Friday 30 March 2012

## LOW-WATER SEASON 2012 DATES

EXPEDITION WEEK NUMBER	START DATE IN IQUITOS	FINISH DATE IN IQUITOS
1	Sunday 17 June 2012	Friday 22 June 2012
2	Sunday 24 June 2012	Friday 29 June 2012
3	Sunday 01 July 2012	Friday 06 July 2012
4	Sunday 08 July 2012	Friday 13 July 2012
5	Sunday 15 July 2012	Friday 20 July 2012
6	Sunday 22 July 2012	Friday 27 July 2012
7	Sunday 29 July 2012	Friday 03 August 2012
8	Sunday 05 August 2012	Friday 10 August 2012
9	Sunday 12 August 2012	Friday 17 August 2012
10	Sunday 19 August 2012	Friday 24 August 2012



The expeditions start and finish on a **Friday at 0800hrs at the Colony Hotel, Isla de la Juventud**, and finish on a **Thursday at 1400hrs** at the same location. You need to book your international flights to Havana and then take a Cubana Air flight from Havana to the town of Nueva Gerona on the Isla de la Juventud. Most volunteers are going to be staying at the Colony Hotel on the Thursday night so you may need to arrive in Havana by the Wednesday night before your expedition and overnight there.

On the return journey you would need to organise your flights from Nueva Gerona on the Thursday afternoon and could either overnight in Havana or take an evening flight home from Havana airport.

Once you have your international flights to Havana booked you will need to organise your travel to and from the expedition start and finish points, and for any accommodation needed in Cuba outside the expedition times. These arrangements are most cost effectively made by emailing Ernesto at our Cuban travel agent partners, Quick Viaggi ([quickviaggi@enet.cu](mailto:quickviaggi@enet.cu)). You just need to email your full name, passport number, nationality and arrival and departure flight details, and he will organise your accommodation and transfers to meet your international flights much more cost effectively than arranging it from outside Cuba. Note that General Surveyors can join on a number of dates for a 2-week expedition. Research Assistants have a fixed 4-week itinerary.

## GENERAL SURVEYORS - 2011 DATES

EXPEDITION NUMBER	START DATE ON ISLE OF YOUTH	FINISH DATE ON ISLE OF YOUTH
1	Friday 24 June 2011	Thursday 07 July 2011
2	Friday 01 July 2011	Thursday 14 July 2011
3	Friday 08 July 2011	Thursday 21 July 2011
4	Friday 15 July 2011	Thursday 28 July 2011
5	Friday 22 July 2011	Thursday 04 August 2011

## RESEARCH ASSISTANTS - 2011 DATES

EXPEDITION NUMBER	START DATE ON ISLE OF YOUTH	FINISH DATE ON ISLE OF YOUTH
6	Friday 29 July 2011	Thursday 25 August 2011

## GENERAL SURVEYORS - 2012 DATES

EXPEDITION NUMBER	START DATE ON ISLE OF YOUTH	FINISH DATE ON ISLE OF YOUTH
1	Friday 22 June 2012	Thursday 05 July 2012
2	Friday 29 June 2012	Thursday 12 July 2012
3	Friday 06 July 2012	Thursday 19 July 2012
4	Friday 13 July 2012	Thursday 26 July 2012
5	Friday 20 July 2012	Thursday 02 August 2012



# EGYPT DATES AND OPTIONS

## SINAI EXPEDITIONS (EXPEDITIONS 1 – 5)

The Sinai expeditions to the St Katherine Protectorate start from the town of **St Katherine at 1200hrs on a Sunday** and finish in **Dahab at 0800hrs on Saturday**. The cheapest way to travel is to organise a return flight to Sharm el Sheikh that arrives before 0800hrs on the Sunday and that leaves after 1400hrs on the Saturday. Then contact our Egyptian partners, the Nature and Science Foundation (NSF). They will organise for you to be met at the airport and taken by coach to St Katherine and will also organise your return (cost approx \$50 for the return transfers). If you arrive early they can also organise accommodation for you in a Bedouin camp in Wadi Mandar for approximately \$25 per person dinner and accommodation.

## WHITE DESERT EXPEDITION (EXPEDITION 6)

This expedition which is only available for Research Assistants starts from **Baharia Oasis at 1200hrs on Tuesday** and finish at **Baharia at 1200hrs on Monday**. The cheapest way to get there is to organise a return flight to Cairo that arrives on the Monday and that leaves on Tuesday after expedition end. Then contact NSF and they will organise a return coach trip to Baharia Oasis from the airport for \$60 return. NSF can also organise inexpensive accommodation in Cairo if you arrive before the expedition starts.

### GENERAL SURVEYORS - 2011 DATES

EXPEDITION NUMBER	START DATE IN ST KATHERINE	FINISH DATE IN DAHAB
1	Sunday 10 July 2011	Saturday 23 July 2011
2	Sunday 24 July 2011	Saturday 06 August 2011
3	Sunday 31 July 2011	Saturday 13 August 2011
4	Sunday 07 August 2011	Saturday 20 August 2011

### RESEARCH ASSISTANTS - 2011 DATES SINAI

EXPEDITION NUMBER	START DATE IN ST KATHERINE	FINISH DATE IN DAHAB
5	Sunday 03 July 2011	Saturday 30 July 2011

### RESEARCH ASSISTANTS - 2011 DATES WHITE DESERT

EXPEDITION NUMBER	START DATE IN BAHARIA	FINISH DATE IN BAHARIA
6	Tuesday 16 August 2011	Monday 29 August 2011

### GENERAL SURVEYORS - 2012 DATES

EXPEDITION NUMBER	START DATE IN ST KATHERINE	FINISH DATE IN DAHAB
1	Sunday 08 July 2012	Saturday 21 July 2012
2	Sunday 22 July 2012	Saturday 04 August 2012
3	Sunday 29 July 2012	Saturday 11 August 2012
4	Sunday 05 August 2012	Saturday 18 August 2012



## General Surveyor Expeditions (Expeditions 1 – 7)

General Surveyor expeditions to the North of Madagascar begin at **Mahajanga airport at 1000hrs on the Friday** and finish on the **Thursday at 1000hrs at Nosy Be airport**. The best way to get to and from there is to book your international flights to Antananarivo, landing on the Thursday before your expedition and then an onward flight to Mahajanga on the Friday morning. You will be finishing your expedition at the marine site of Nosy Be and will need to book an internal flight to Antananarivo on the Friday in order to connect with an evening flight out of Antananarivo on the same day, or any flight the following day. It is difficult to quote exact prices for the internal flights but as at the time of writing for a single person booking (not necessarily the same price as groups) the costs are around £350 for the internal Madagascar flights and hotel accommodation prior to the expedition. This can be arranged through DBCAM ([www.dbcam.org](http://www.dbcam.org)) or STA or other international travel agents. It is possible to arrange overland transfers through DBCAM instead of booking flights, but these will be around £250 including accommodation and will mean more than 24 hours in total in converted lorries or buses for the round trip.

## Dissertation/Thesis Expeditions (Expedition 8)

Dissertation/thesis students have a single expedition of 6 weeks when they can work with scientists at the northern Madagascar site. The expeditions begin at **Mahajanga airport at 1000hrs on the Friday** and finish on the **Thursday at 1000hrs at either Nosy Be airport** (for volunteers that are finishing their expedition on the marine site) or at **Mahajanga airport at 1200hrs** (for volunteers that are finishing their expedition in the dry forest). The easiest way to get to the site is to organise your flights to Antananarivo arriving the day before your expedition starts and then internal flights in line with your expedition start/end points. You can do this through DBCAM ([www.dbcam.org](http://www.dbcam.org)) or STA or other international travel agents.

## Research Assistant Expedition (Expedition 9)

The Research Assistant expedition to the south of Madagascar begins from the **airport in Fort Dauphin (Taolagnaro) on a Saturday at 1200hrs** and finishes from the same location on a **Friday at 1000hrs**. The easiest way to get to the site is to organise your flights to Antananarivo arriving the day before your expedition starts (allowing you to connect with an internal flight the following morning) and departing either late on the Friday that your expedition ends (after 5pm) or on the following day. You should organise your internal flights to arrive at Taolagnaro on the morning of your expedition start date, and to depart Taolagnaro on the morning of your expedition end date.

### GENERAL SURVEYORS - 2011 DATES

EXPEDITION NUMBER	START DATE IN MAHAJANGA	FINISH DATE IN NOSY BE
1	Friday 24 June 2011	Thursday 07 July 2011
2	Friday 01 July 2011	Thursday 14 July 2011
3	Friday 08 July 2011	Thursday 21 July 2011
4	Friday 15 July 2011	Thursday 28 July 2011
5	Friday 22 July 2011	Thursday 04 August 2011
6	Friday 29 July 2011	Thursday 11 August 2011
7	Friday 05 August 2011	Thursday 18 August 2011

### DISSERTATION/THESIS STUDENTS - 2011 DATES

EXPEDITION NUMBER	START DATE IN MAHAJANGA	FINISH DATE IN MAHAJANGA
8	Friday 24 June 2011	Thursday 04 August 2011

### RESEARCH ASSISTANTS - 2011 DATES

EXPEDITION NUMBER	START DATE IN FORT DAUPHIN	FINISH DATE IN FORT DAUPHIN
9	Friday 08 July 2011	Thursday 04 August 2011

### GENERAL SURVEYORS - 2012 DATES

EXPEDITION NUMBER	START DATE IN MAHAJANGA/FORT DAUPHIN	FINISH DATE IN NOSY BE/TULEAR
1	Friday 22 June 2012	Thursday 05 July 2012
2	Friday 29 June 2012	Thursday 13 July 2012
3	Friday 06 July 2012	Thursday 19 July 2012
4	Friday 13 July 2012	Thursday 26 July 2012
5	Friday 20 July 2012	Thursday 02 August 2012
6	Friday 27 July 2012	Thursday 09 August 2012
7	Friday 03 August 2012	Thursday 16 August 2012



# GUYANA DATES AND OPTIONS

The expeditions towards the end of the wet season in July and August (expeditions 1 – 3) start on a **Tuesday at 0800hrs** and finish on a **Monday at 1200hrs at the Iwokrama Research Centre.**

The easiest way to get to these start points is to organise your flights to Georgetown and then contact the tourism department at Iwokrama ([tourism@iwokrama.org](mailto:tourism@iwokrama.org)). You need to arrive in Georgetown by 1200hrs on the Monday before your expedition and can fly out on the Tuesday after your expedition. They can arrange overnight

accommodation in Georgetown at the beginning and end of your stay and transfers to and from Bina Hill or Iwokrama. Depending on the numbers travelling together, the total costs is around \$150 for the in-country transfers and accommodation before and after the expeditions. Iwokrama can also organise visits to other parts of Guyana outside the expedition dates. Expeditions 1 and 2 are for General Surveyors only, whilst expedition 3 is for university students only.

## GENERAL SURVEYORS - HIGH WATER SEASON 2011 DATES

EXPEDITION NUMBER	START DATE IN IWOKRAMA	FINISH DATE IN IWOKRAMA
1	Tuesday 05 July 2011	Monday 18 July 2011
2	Tuesday 12 July 2011	Monday 25 July 2011

## RESEARCH ASSISTANTS - HIGH WATER SEASON 2011 DATES

EXPEDITION NUMBER	START DATE IN IWOKRAMA	FINISH DATE IN IWOKRAMA
3	Tuesday 19 July 2011	Monday 15 August 2011

In 2012, the expedition programme is going to be expanded and will be helping with the Rupununi wetland surveys at the end of the dry season when water levels are at their lowest. The expeditions at the end of the dry season in March (expeditions 1 and 2) start on a **Sunday at 0800hrs at Bina Hill Training Institute at Annai** and

finish on a **Saturday at 1000hrs at Bina Hill.** You need to arrive in Georgetown by 1200hrs on the Saturday before your expedition and can fly out on the Sunday after your expedition. Expeditions 1 – 4 are for General Surveyors only, whilst expedition 5 is for Research Assistants only.

## GENERAL SURVEYORS - LOW WATER SEASON 2012 DATES

EXPEDITION NUMBER	START DATE IN IWOKRAMA	FINISH DATE IN IWOKRAMA
1	Sunday 04 March 2012	Saturday 17 March 2012
2	Sunday 18 March 2012	Saturday 31 March 2012

## GENERAL SURVEYORS - HIGH WATER SEASON 2012 DATES

EXPEDITION NUMBER	START DATE IN IWOKRAMA	FINISH DATE IN IWOKRAMA
3	Tuesday 03 July 2012	Monday 16 July 2012
4	Tuesday 10 July 2012	Monday 23 July 2012

## RESEARCH ASSISTANTS - HIGH WATER SEASON 2012 DATES

EXPEDITION NUMBER	START DATE IN IWOKRAMA	FINISH DATE IN IWOKRAMA
5	Tuesday 17 July 2012	Monday 13 August 2012



# MEXICO & GUATEMALA DATES AND OPTIONS

In 2011, there is only one expedition being run in conjunction with the Amigos de Sian Ka'an (ASK) which starts at the **ASK offices in Cancun** (Calle Fuego, 2 Mza 10, SM. 4) on **Monday at 1200hrs** and finishes on **Sunday at 1200hrs** at the same place. You will need to fly into Cancun the morning of the start of expedition and can fly out the evening of the end of expedition.

## 2011 DATES

EXPEDITION NUMBER	START DATE IN CANCUN	FINISH DATE IN CANCUN
1	Monday 20 June 2011	Sunday 17 July 2011

In 2012, the expedition programme is going to be expanded and will be helping with the large scale biodiversity surveys of the Mayan Forests in Mexico and Guatemala. The expeditions start on a **Monday at 1000hrs** and finish on a **Sunday at 1200hrs in Xpuhil**. The easiest way to get to Xpuhil is to organise your international flights to Cancun and then request ASK to organise for your transfer to the start point of the expedition. Assuming it is a group travelling together, the costs are around £75 for the transfer, overnight accommodation and breakfast. You will need to fly into Cancun the Sunday before the start of expedition and can fly out the evening of the end of expedition.

## 2012 DATES

EXPEDITION NUMBER	START DATE IN XPUHIL	FINISH DATE IN XPUHIL
1	Monday 09 July 2012	Sunday 22 July 2012
2	Monday 16 July 2012	Sunday 29 July 2012
3	Monday 23 July 2012	Sunday 05 August 2012
4	Monday 30 July 2012	Sunday 12 August 2012
5	Monday 06 August 2012	Sunday 19 August 2012





## COSTS

The costs of the expeditions are the same for each country as listed below. These costs include all the food, accommodation, £1 million medical and evacuation insurance cover, participation in the survey programme, training courses such as jungle training and forest ecology and dive training to PADI Open Water level and transfers around the projects from the start point to end point of each expedition.

Expedition length	Price in UK £	Price in € Euros	Price in US \$	Price in Can \$
2 weeks	975	1,250	1,650	1,750
4 weeks	1,850	2,400	3,000	3,300
6 weeks	2,500	3,250	4,100	4,500
8 weeks	2,950	3,800	4,900	5,400

*Note you need to pay in the currency of your resident country if that is £ Sterling, Euros, US\$ or Can\$. If it is none of these currencies, you need to pay in US\$.*

The expeditions are nearly all-inclusive but do not include costs of flights and transport to and from the start of each expedition, accommodation before or after the expeditions, any insurance cover needed beyond medical and evacuation cover, costs of additional elective training (e.g. canopy access course, dive training beyond PADI Open Water), dive equipment rental, PIC cards and PADI training manuals, local taxes and Park entry fees.

## FUNDRAISING

When faced with the opportunity of a lifetime, there tends to be only one major factor that holds people back.... expense! Most students who join the expeditions do not have the money needed and therefore have to obtain a percentage from fundraising. Remember you are fundraising to join projects that are successfully conserving important habitats and species as well as increasing income for local communities and this type of activity generally has widespread support amongst people and organisations in the UK and North America.

When you confirm your expedition we will send you a fundraising information pack. There are many ways of raising funds but they generally fall into 6 categories:

- **University Grants:** most US universities in particular have a number of grants available if you are obtaining course credits for joining. Participants will be given a customised sheet listing these substantial sources of income at their own university. There are a few such grants available at UK and Canadian universities but less than in the US.
- **External grants and commercial sponsorship:** in the UK there are hundreds of Trusts and conservation charities that can be approached for support to participate in a real scientific survey programme and lists of these will also be provided. If you have worked at a large company during your holidays, it is worth

approaching them also for support. Business charity groups (e.g. Rotary or Round Table) are also often keen to support this type of activity. Note Operation Wallacea in the US is registered as not-for-profit.

- **Raffles:** in the UK Operation Wallacea has organised a major national raffle with a car as the first prize. Tickets are sold by Opwall volunteers at 70p profit per ticket and the proceeds of the raffle are donated to the Operation Wallacea Trust (charity number 1078362). Selling these tickets at major events (eg sports events, social events, state/county shows, etc.) can result in a substantial income.
- **Fundraising events:** e.g. band nights, restaurant nights, theme parties, conservation dinners, car boot sales, tag sales, etc.
- **Sponsored activities:** e.g. band nights, bag packing, sponsored hikes, abseils, swims, etc. Note in the UK you can collect sponsorship payments through [www.justgiving.com](http://www.justgiving.com) made payable to the Operation Wallacea Trust which is a registered UK charity. The Opwall Trust will then make a grant to you for the equivalent sum of money raised. This mechanism can be used for up to 70% of your total expedition costs (excluding flights). Note Just Giving charges a 5% handling fee so the funds paid by the Trust to your account would be 95% of the sum raised.
- **Working for it:** In the UK, Ireland and Canada at each university an Operation Wallacea fundraising group is formed during the Christmas term and professional help given by the Operation Wallacea fundraising team to the group to plan their fundraising activities. Fundraising targets are normally around £1,000 (US\$ 2,000) per person although there are many examples of students who have raised all the funds needed including the costs of flights. In the US, students booking on for course credit will be directed to a series of grants that are available through their Study Abroad offices and these can cover the entire cost of the expedition. For those students in Europe or Asia that are booking with course credit through Imperial College London, information on possible grants available will be emailed to them.

In UK schools, the fundraising is easier because General Surveyor groups normally have 18 months to raise all the funds needed. There are examples of where large school fundraising groups from disadvantaged areas have raised all the funds needed for the expeditions, flights and all costs for the whole group. Professional fundraising help is also given to the school groups by the Operation Wallacea fundraising team to help them plan their activities.





## FLIGHTS

Once you have booked an expedition with Operation Wallacea, which only requires a 10% payment, the next stage is to book your flights. Normally you get the best deal by booking before January of the year of your expedition. Late bookings usually pay a premium over the early bookings.

### UK AND IRELAND

In the UK and Ireland we would suggest contacting the STA Travel team who have a dedicated Opwall booking service (call 0871 4680668 and speak to the Operation Wallacea team or email [opwall@statravel.co.uk](mailto:opwall@statravel.co.uk)). STA Travel offer group flights at competitive prices negotiated directly with the major airlines specifically for Opwall. It is always worth checking prices with a couple of other travel agencies but in the past STA have generally given the best prices and you can book the flights by paying just a small deposit with the balance due 10 weeks before you fly.

### US

In the US, most people seem to book their flights online with one of the discount providers ([cheapflights.com](http://cheapflights.com), [priceline.com](http://priceline.com), [kayak.com](http://kayak.com)). If this is being done please make sure that your routing is all on one itinerary. If you have separate itineraries and one of the flights is delayed so you miss a connecting flight, you will have to buy a replacement flight. If you book on a single itinerary then the responsibility for replacing the flight is with the travel agent.

### CANADA

In Canada, once you have reserved your expedition with the Operation Wallacea Canada office you need to contact Victor Travel by calling toll free to 1-866-699-0199 or emailing [opwall@cwtvictortravel.ca](mailto:opwall@cwtvictortravel.ca) and they will organise your whole package.

## INSURANCE

We have purchased Medical and Repatriation cover to a value of £1 million on behalf of all our staff and volunteers to ensure that they are correctly covered and that any evacuations are as efficient as possible. The cost of this is met by Operation Wallacea and provided to you free of charge within the overall cost of your expedition. If you want to obtain additional insurance (e.g. to cover loss of personal property, flight cancellations, etc.) then you would need to take out an additional insurance policy.

**EXCLUSIVE DEALS FOR**  
**SCHOOL GROUPS**  
**TEACHERS**  
**STUDENTS**

☎ **0871 4680 668**  
✉ **opwall@statravel.co.uk**

*... Sounds like a plan!*





## RESEARCH ASSISTANTS

"The guides, Opwall reps, biologists and activities were all brilliant. The whole experience was unforgettable".

**Timothy Alsop, Hadlow College, UK (Peru)**

"The project was excellent. I was actually allowed to participate by setting up and checking traps, as well as handling the animals. I felt like a useful member of the team".

**Gabriel Laidlaw-Bale, Mount Alison University, Canada (Indonesia)**

"I have learned a great deal: turned a like of birds into a love – thank you. I especially loved the welcoming atmosphere created by the Opwall staff".

**Chelsea Gatzke, Lakeland College, Canada (Honduras)**

"A great place to be, amazing wildlife, awe-inspiring scenery, terrific guides and wonderful people. Where else would you want to spend your summer!"

**Tristram Moody, University of Cambridge, UK (Peru)**

"Everyone was great, very friendly and easy to get along with, and very knowledgeable and willing to answer questions, not only questions pertaining to the sites' research but also on how to further your career goals in the researching field".

**Ryan Gardiner, Dalhousie University, Canada (Madagascar)**

## THESIS/DISSERTATION STUDENTS

"The sheer abundance of gorgeous species that you see every day, whether you choose a morning, afternoon, or evening expedition, is breath-taking. The Peruvian wildlife is only another fantastic aspect of the expedition experience – meeting other students who are passionate about biology and conservation, experiencing authentic Peruvian cuisine, and living as conservation biologists do only highlights the once-in-a-lifetime experience!"

**Katalin Kun, McMaster University, Canada (Peru)**

"Opwall is fantastic! Best six weeks ever!"

**Kim Townsend-Smyth, UCD, UK (Honduras)**

"I really enjoyed my project; loved living in the forest camp for 2 weeks experiencing the jungle and watching the macaques at close range. I particularly enjoyed meeting so many new people - it's not often you get to meet people with similar interests to you from all over the world!"

**Charlotte Johns, Southampton University, UK (Indonesia)**

"Such a unique experience; I not only came away with more than enough data for my dissertation, having worked alongside leading marine scientists but also spent a summer making friends in a tropical paradise."

**Katie Jones, Oxford University, UK (Indonesia)**

## SCHOOLS

"As with my previous expeditions, the great part is the opportunities for students to see how biology in the field works (and also doesn't work!), but still having fun! The biologists are excellent – informative at just the right level for 6th form students. The manatee project was fantastic! Also, students felt so proud that they had the first confirmed side-scan sonar image and real sighting – excellent stuff!"

**Rebecca Beber, Lead Teacher, Newcastle College, UK (Cuba)**

"I strongly recommend this place to those who want excitement, fun and to learn more about wildlife. The people are amazing and the atmosphere is great. Go! It's a lifetime opportunity!"

**Ashleigh Inniss-During, Harris City Academy, UK (South Africa)**

"The whole experience has been incredibly valuable. The desert experience was very interesting and the reef ecology was fabulous!"

**Ali Cordingley, Staff, South Bromsgrove High School, UK (Egypt)**

"An incredible experience in an amazing location with excellent staff who made the training fun whilst demanding high standards."

**Lauren McEwen, Millfield School, UK (Indonesia)**





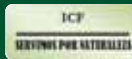
### PARTNERS

We have a number of partners in each country but the principal ones for each country are listed below

**INDONESIA**  
Institut Pertanian  
Bogor



**HONDURAS**  
ICF & Honduran Coral Reef Foundation  
Coral View Dive Centre  
Grupo de Apoyo al Desarrollo



**PERU**  
Fund Amazonia  
Amazon Eco



**SOUTH AFRICA**  
Wildlife and Ecological Investments  
Peace Parks Foundation



**MOZAMBIQUE**  
Reef Divers



**EGYPT**  
Nature and  
Science  
Foundation



**CUBA**  
University  
of Havana



**MADAGASCAR**  
DBCAM



**GUYANA**  
Iwokrama  
International  
Rainforest Centre



**MEXICO**  
Amigos de Sian  
Ka'an



As a member of the Association of Bonded Travel Organisers Trust Limited (ABTOT), Operation Wallacea has provided a Bond to meet the requirements of the Package Travel, Package Holidays and Package Tours Regulations 1992. In the event of the Company's insolvency this Bond provides security for all non flight inclusive packages provided by Operation Wallacea. In the above circumstances, the following will apply:

- a refund of your pre-payments if you have not yet travelled; or
- if you are already on expedition the transport costs back to the start point of the expedition and costs incurred in changing your return tickets plus refund of the percentage of the expedition payment for the cancelled part of the expedition.

**CANADA OFFICE**  
P.O. BOX 43, Whitby, Ontario  
L1N 5R7 CANADA

email. [canada@opwall.com](mailto:canada@opwall.com)  
tel. +1 (905) 231-2095

**UK HEAD OFFICE**  
Wallace House, Old Bolingbroke,  
Lincolnshire PE23 4EX UNITED KINGDOM

email. [info@opwall.com](mailto:info@opwall.com)  
tel. +44 (0)1790 763194

**US OFFICE**  
P.O. Box 461, Point Pleasant  
NJ 08742 USA

email. [usa@opwall.com](mailto:usa@opwall.com)  
tel. +1 (973) 920-0487

**IMPORTANT NOTE:** The details of the expedition programmes described in this brochure are correct at the time of going to print. However, note that you will be joining a real scientific expedition and that on occasions the work carried out on individual projects will differ from that described in order to respond to scientific priorities.

Please keep checking our website [www.opwall.com](http://www.opwall.com) for the most up-to-date information about the expeditions.