Schools' Booklet Indonesia 2019

Contents

1. Study area and research objectives

Sulawesi and the surrounding smaller islands of the Lesser Sundas and the Moluccas were identified as a unique biogeographic region by the naturalist Alfred Russell Wallace in the late 19th century. These islands are now known as the Wallacea region of Indonesia (defined by the area within the dotted line on the map below), and formed their unique fauna due to their isolation from other landmasses by the deep ocean channels that surround the islands. During past Ice Ages sea levels here dropped by up to 100m. This led to the large 'Greater Sunda' islands to the west (Borneo, Java, Sumatra and Bali) being linked to mainland Asia by land-bridges, and therefore allowing large mammalian fauna to spread throughout this area. However, the deep ocean channel between Borneo and Wallacea remained impassable to large mammals, so few are found in the region. The islands to the east of Wallacea would have been linked to Australasia, and have many species of marsupials and other Australian fauna. Again, the ocean channels between Wallacea and New Guinea were too deep for most mammals to cross. However, birds, reptiles and insects were able to cross the channels, and Wallacea has species of both Asian and Australian origin.

Figure 1. Location of the Wallacea biogeographical region

Sulawesi is the fourth largest island in Indonesia (159,000 km2) and has a high percentage of endemic species (those that occur nowhere else in the world other than in Sulawesi). There are 127 known mammal species in Sulawesi, of which 62% (79 species) are endemic; 700 species of bird (36% endemic); and 74 species of herpetofauna (38% endemic). Despite such high numbers of endemic species in these forests the Wallacea region remains one of the least biologically studied areas in the world, and one of the most likely places to discover vertebrate species that are new to science.

The first week of the expedition is spent in one of the field camps located across Buton Island. The teams will help collect data on the carbon stocks and biodiversity of the forest which are then being used as part of a submission under the Reducing Emissions from Deforestation and forest Degradation (REDD+) scheme for funding the protection of the Buton forests. Lambusango reserve is one of the largest remaining stands of forest on Buton as much of the island has been heavily deforested. Lambusango contains a rare and interesting type of forest known as Limestone Karst Forest, where the forest grows on limestone rock

that was formerly coral reef and has been heavily weathered. As limestone is porous, these forests contain many underground river systems that rise to the surface as streams and springs and disappear underground.

The second week will be run at the Opwall marine research centre on Hoga Island in the Wakatobi Marine National Park. The Hoga Island research programme is led by the Coral Reef Research Unit at Essex University and has an outstanding publication record. Over the last seventeen seasons 77 peer reviewed articles have been published in academic journals. The site is the location of a Darwin Initiative-funded conservation management programme which is successfully developing a sustainable reef fishery.

Figure 2. Important locations.

2. Week 1 itinerary

The students on site will complete six days of training and research. These are divided into two half days of jungle skills training, one full day of forest habitat surveys and three days of learning about biodiversity monitoring techniques and assisting our field scientists. There are two forest camps that the students could be located in. Students working in the south of the island will pass through Labundo village on their first and final nights. Students will arrive in Labundo on Sunday evening and will then be shown to their accommodation. That evening there will be introductory lectures on health and safety, and site orientation. The students will also prepare to trek to camp the following day.
Students working in the North Buton camps will travel from Bau Bau to Ereke by car on the Sunday, where they will stay in a hotel. That evening there will be introductory lectures on health and safety, and site orientation. The students will also prepare to trek to camp the following day.

All school groups will follow the example timetable below; Table 1 shows an example timetable – please note that the students will work in smaller groups for the field practicals. The students should complete

each of the activities listed but the timing of the sessions may vary depending upon factors such as weather conditions and fitness of the students.

Table 1. Example timetable for the forest week. Timetables will vary slightly dependent on your forest camp, group size, and whether the group are taking part in Canopy Access. Note there may be changes depending on fitness of students, weather conditions or operational issues.

Day	Activity
Sunday pm	Arrive at accommodation (homestay or hotel) induction and H&S talks and site orientation
Monday am	Trek to forest camp, induction and H&S talks and site orientation. *South camp* - Optional Canopy access course in Labundo before trekking to camp
Monday pm	Jungle skills 1
Monday evening	Lecture 1 – Introduction to Indonesia and Wallacea Field practical – Bats or spotlighting for amphibians
Tuesday am	Canopy access (*North camp - optional*) or Field practical – invertebrates, birds, herpetofauna or megafauna
Tuesday pm	Jungle skills 2
Tuesday evening	Lecture 2 – Plant and insect biodiversity
Wednesday am	Field practical – invertebrates, birds, herpetofauna or megafauna
Wednesday pm	Field practical – invertebrates, herpetofauna or megafauna
Wednesday evening	Lecture 3 – Vertebrate biodiversity Field practical – Bats or spotlighting for amphibians
Thursday am + pm	Habitat survey all day
Thursday evening	Lecture 4 - Impacts and invasives
Friday am	Field practical – invertebrates, birds, herpetofauna or megafauna
Friday pm	Transfer back to Labundo (south only)
Friday evening	Lecture 5 – Conservation in the Wallacea region Social Night
Saturday am	Pack up and feedback Depart to marine site

3. Jungle survival skills

Introduction to life in forest camps, and how to identify and reduce risks throughout the forest. Each group will learn how to live in hammocks and how to select a safe camp site, make fires, shelters, field cooking, etc. During their walks into and out of the camp they will have constant reinforcement of the health and safety messages and identifications of common trees, birds and reptiles encountered.

Learning outcomes:

- Awareness of dangerous plants and animals - from the briefings and demonstrations in the field
- Awareness of disease and health issues working in a tropical rainforest - from the medical briefings and additional information given by the accompanying medic

- Safe working practices in remote locations- this is to do with trekking procedures, river crossings, taking water, hat, sunblock, organising communications etc. gained through lectures and field experience

4. Week 1 lectures

Lecture 1 - Introduction to Indonesia and Wallacea

- Geography, geology and demography
- Alfred Russel Wallace and his Line
- Dispersal and migration between islands, humans, other animals and plants
- Island biogeography theory
- Biodiversity, definitions

Lecture 2 - Plant and insect biodiversity

- Biodiversity "hotspots"
- Wallacea forests etc., natural : rain forests, dry forest &palms
- Wallacea forests etc., cultivated : oil palm, fibre plantations, cacao
- Other flora : orchids & other epiphytes
- Insects : Coleoptera & Lepidoptera
- Plant & animal biodiversity indicators

Lecture 3 – Vertebrate biodiversity

- Numbers of species & endemism in the Wallacea region
- Mammals: marsupials, rodents, ungulates, bats & primates
- Birds: parrots, flowerpeckers, white-eyes & hornbills
- Reptiles: lizards & snakes
- Amphibia: frogs & toads
- Freshwater fish

Lecture 4 - Impacts & invasives

- Climate, global warming & El Niño
- Invasive species: concepts & definitions
- Invasive species examples: frogs, toads and freshwater fish
- Human impacts: hunting & bush meat
- Human impacts: land use change, forestry & agriculture
- Habitat conversion & loss: impacts on plant & animal biodiversity

Lecture 5 - Conservation in the Wallacea region

- Protected Areas (PAs): concepts & theory
- Protected Areas (PAs): reality & failures

- Wallacea conservation examples: villages & households involvement
- Wallacea conservation examples: Lambusango Forest Conservation Project
- Wallacea conservation examples: maleo (megapodes), anoa (buffalo) & macaques

5. Biodiversity practicals

In the forest camps (working in small groups) students will complete the following field practicals:

Wallacean birds

This practical involves an early morning bird point count survey with an ornithologist. The objective will be to learn the principals of the point count survey methodology and to learn how to identify as many species by sight and sound as possible.

Herpetofauna pitlines

The students will be helping with the checking of pitfall traps for amphibians, reptiles and small mammals. The objective will be to learn about standardised pitfall trapping methodologies and identify the common herpetofauna species of the Buton Forests.

Megafauna surveys

This survey involves walking linear forest transects and looking for evidence of occupancy by the Islands megafauna species, most notably Lowland Anoa, Booted Macaque, and Sulawesi Wild Pig. Most of these species are very shy, and are usually detected by their tracks and signs rather than by sight. The objectives of this survey are to learn the basics of patch occupancy methodologies and to learn how to determine the presence of different mammal species by locating and identifying indirect signs.

Invertebrate surveys

This practical starts with a briefing on survey techniques followed by a butterfly survey. These surveys will use transect-based timed Pollard counts to monitor the butterflies of the Buton forests in a systematic manner. The objectives of this survey are to learn the basics of the Pollard count methodology and learn how to identify common butterfly species found in the project area.

Nocturnal amphibian surveys

This practical will involve spotlight surveys of river systems after dark with a herpetologist to monitor frog communities and opportunistically sighted reptiles. Species encountered will be identified and the main identification features explained. Students participating in this survey will learn sweep-transect methodologies, distance sampling methods, and how to identify the common amphibian species found in the Buton forests.

Bat surveys

This practical is subject to availability. It will involve working with a bat scientist in the evening to set and empty harp traps and/or mist nets. The captured bats will be identified and the main identification features explained. Students participating in this survey will learn capture-mark-recapture methodologies as well as familiarity with the common bat species found on the Island.

Learning objectives:

1. Be able to identify 10 local bird species by sight and sound.
2. Describe how to identify different reptile families
3. Be able to identify five species of reptile and amphibian found in Sulawesi
4. Learn how to identify large mammal species from their tracks and signs
5. Learn how to conduct butterfly Pollard counts
6. Identify five species of bats found in Sulawesi
7. Be able to describe the differences between harp and mist net trapping for bats

Canopy Access

This training course is optional and is an additional cost. Students will learn how to ascend into the canopy with Canopy Access Ltd.

6. Research contribution

The major research contribution of schools students on Buton has been their efforts towards our forest habitat surveys. Since Operation Wallacea began working with groups of school students on Buton in 2007, their crucial contributions in this area have allowed us to gather large-scale forest vegetation structure data sets which form the foundations of our ongoing REDD+ funding application. These data have also been analyzed to produce two publications which are in the latter stages of completion. The first of these publications is a study of the accuracy of the school groups' work on Buton. Notably, the value of volunteers for collecting data on tropical forest vegetation structure has not previously been published. By comparing the plots surveyed by the students under the leadership of the local and Western experts to the plots surveyed purely by the experts, strengths and weaknesses of the students' surveys have been identified. This paper provides robust statistical support to the value of the students as surveyors and has enabled areas of weakness within the students' surveys to be targeted for improvement. The second paper presently in preparation for publication, which uses the 2008 and 2009 datasets, is an assessment of the small-scale selective logging by the local community that occurs within the area of forest which runs between the road and the Lapago field camp in the South of the island. This paper seeks to answer the question of whether there is a relationship between accessibility and the degree of small-scale selective timber harvesting in this forest. In addition these data are being used as part of a study of zonation patterns of tree species on using Bayesian statistical analyses – a robust method of interrogating data that provides conclusions often regarded as more secure than frequentist analyses (such as the commonly used t-test).

The surveys will be managed by Barnabas Harrison and Dr Melinda Laidlaw, assisted by local Indonesian staff who have an intimate knowledge of the trees of Buton. The habitat surveys are an incredibly important part of the students' time on Buton and whilst the other parts of the programme can be missed if the students do not wish to participate this is the one element of the programme that must be completed by all participating students. The vegetation structure research project looks set to provide answers to many under-studied questions.

In 2019 the surveys are being used for two main purposes – to quantify the carbon storage value of the forest as part of the ongoing REDD+ funding application for the Buton forests and to continue the study of the effect of forest structure and disturbance levels around the biodiversity study sites being used for the study of other taxa (butterflies, herpetofauna, birds and megafauna).

Students will use a verified methodology and spend one full day collecting data. Sample size needs to be of sufficient size to ensure main forest characteristics such as tree basal area can be assessed within each sample. Data from forest surveys on different sample sizes on Buton has indicated that 50m x50m squares is the minimum size for accurately assessing basal area (a 'cross-section' of a tree's trunk) and other forest characteristics.

The survey teams will be divided into four groups, each under the supervision of an expert, and all students should have a chance to work with each group during the survey. Firstly, the team will use two 100 m surveying tapes and compasses to mark out the perimeter of the 50 m x 50 m quadrat and then divide it into the smaller twenty-five quadrats using ropes.

Group 1 will take the GPS coordinates of the four corners of the 50 m x 50 m plot using a GPS unit. The group will also take a canopy photo in each of the sub plots that will later be analysed to determine canopy cover, and therefore a measurement of light hitting the forest floor. This group will also make a basic profile of the plot, taking 17 angle measurements around the perimeter of the plot.

Group 2 will obtain data on the vegetation structure of the survey plots. A 3 m long vegetation touch-test pole will be used to quantify the density of the understory at 100 points spatially arranged with 4 samples within each sub plot.

Group 3 will collect data on the trees throughout the plot. For each tree over 15.7cm in circumference at chest height, the local guide will identify the species and the circumference will be measured. This will allow us to calculate the biomass of each tree.

Group 4 will examine disturbance and regeneration patterns throughout the plot. Within each 10 m x 10 m quadrat, the number of saplings in a 5 m x 5m quadrat will be counted. A sapling is defined >1.5 m in height and <15.7cm in circumference. Within this quadrat a 2 m x 2m quadrat will be positioned and the number of tree seedlings within it will be counted. A seedling is defined as <1.5 m in height and with a woody stem. For each 10 m x 10 m quadrat the number and circumference of any cut stumps will be recorded

7. Week 2 itinerary

The students will complete six days of training and research in marine science arriving at their marine site on the Saturday evening or Sunday morning (travel dependent) and leaving the following Saturday morning to start their journey back to their home country. The travel itinerary to Hoga will depend on your forest camp location and the weather, and therefore cannot be fully confirmed until a few days before travel. Option 1 will take the ferry from Ereke to Wanci (4 hours) where you will overnight and get a morning ferry to Hoga the next day (2 hours) arriving around 10am. Option 2 will be to take a car to Kamaru (5 hours drive from Ereke), then a ferry from Kamaru to Hoga (5 hours). These examples are based on timings from the North forest camp. Schools travelling from the south camp to Hoga will be more likely to use option 2, which reduces the drive time to Kamaru from 5 hours to 1 hour.

Your six days on Hoga are divided according to the dive options selected for the week; Indo-Pacific Reef Ecology Course (with the practicals done either by diving or snorkeling), PADI Open Water, or Dive Referral (see sections 8 – 11 below). Students will be occupied in the evenings through a series of science talks, documentary viewings and discussions/activities relative to the Coral Reef Ecology Course.

8. Coral Reef Ecology Course

Table 2 shows an example timetable of the activities that students undertaking the Indo-Pacific Coral Reef Ecology Course will complete over the week. The contents of the timetable are comprehensive but the timing of the sessions will vary for each group. The practical element of the reef ecology course can be completed by either diving or snorkeling. If students are already qualified divers by the time they arrive on site, they will be required to complete a compulsory check dive with a PADI Professional at the start of the course. The Indo-Pacific Coral Reef Ecology Course is designed specifically for students aged 16-18rs in mind. It covers a range of topics suitable to support A-Level biology and geography students, IB Biology and ESS over a range of different syllabuses. Lectures will be supported by in-water practicals. In addition to the lectures, a discussion/activity element will be sure to engage the students into the science and get them thinking themselves of the importance of the study topic.

Table 2. Indicative timetable for those taking the Reef Ecology Course. Note there may be changes depending on fitness of students, weather conditions or operational problems.

Day	Schedule for reef ecology students
Sunday am	Arrive marine site, welcome and house allocations
Sunday pm	Health and safety briefings Dive documentation
Sunday eve	Lecture - Science on Hoga
Monday am	Lecture 1: An Introduction to Coral Reefs Dive/snorkel practical 1 – check dive/skin diver course (snorkelers)
Monday pm	Lecture 2: The Blue Planet Dive/snorkel practical 2 – coral and algal identification skills
Monday eve	Dive Logs/Science Activity/Coral Reef Ecology Taxonomy Skills Session
Tuesday am	Lecture 3: The Diversity of Coral Reefs I Snorkel practical 3 – snorkel in mangroves
Tuesday pm	Lecture 4: Conservation of Coral Reefs Snorkel practical 4 – snorkel seagrass beds / invertebrate identification skills
Tuesday evening	Dive Logs/Science Activity/Coral Reef Ecology Taxonomy Skills Session
Wednesday am	Lecture 5: The Diversity of Coral Reefs II Dive/snorkel practical 5 – fish identification skills
Wednesday pm	Lecture 6: Mangroves, Seagrasses & FADs Dive/snorkel practical 6 – quadrat and transect survey
Wednesday evening	Dive Logs/Science Activity/Coral Reef Ecology Taxonomy Skills Session
Thursday am	Lecture 7: The Diversity of Coral Reefs III Dive/snorkel practical 7 – quadrat and transect survey
Thursday pm	Lecture 8: How to Survey a Coral Reef Dive/snorkel practical 8 – fun dive
Friday am	One of the following: Fun dive/catch up dive/Kaledupa visit
Friday pm	Social night
Saturday am	Depart marine site

9. PADI Open Water Diver Course

This course consists of three different elements of learning; dive theory (knowledge development), confined water dives and open water dives. Each component plays its own role in the students' development to meet the performance requirements and objectives they need to become a qualified diver.

Please be aware that as a part of the PADI Open Water Course, all students will be required to complete some basic stamina tests on site. Student divers will need to demonstrate that they can comfortably maintain themselves in water too deep in which to stand by completing a 10-minute swim/float without using any swimming aids. Instructors will also have students complete a 200m continuous surface swim or a 300 m swim with mask, fins and snorkel. Table 3 shows an example timetable of the activities that students complete during the PADI Open Water Course. The contents of the timetable are comprehensive but the timing of the sessions will vary for each group.

Table 3. Indicative timetable for those taking the PADI open water diver course. Note there may be changes depending on fitness of students, weather conditions, tides or operational problems.

Day	Activity
Sunday am	Arrive marine site, welcome and house allocations
Sunday pm	Health and safety briefings Dive documentation
Sunday eve	Dive theory
Monday am	Confined water
Monday pm	Confined water / Science Centre visit*
Monday eve	Dive theory
Tuesday am	Confined water
Tuesday pm	Open Water 1
Tuesday evening	Dive theory
Wednesday am	Open water 2
Wednesday pm	Open water3
Wednesday evening	Dive theory exam
Thursday am	Open water 4 & Dive certification
Thursday pm	Lecture – The Future of Coral Reefs Dive/snorkel practical – fun dive
Friday am	One of the following: Fun dive/catch up dive/Kaledupa visit
Friday pm	Social night
Saturday am	Depart marine site

*Science Centre visits for students completing the Open Water Course will be subject to student progress through dive training

10. PADI Open Water Referral Course

For those students who have completed both the dive theory and confined water sessions prior to expedition they can complete their PADI Open Water Referral Course on site. The students will first complete a check

dive with their instructor to demonstrate that they still remember and can confidently perform the necessary skills to progress on to complete their open water dives.

Once referral students have successfully completed the final stages of their PADI Open Water course, they will be able to progress on to the Coral Reef Ecology course. Although there will not be enough time to run the full course, referral students will be able to join at a stage where they can get the chance to learn about the application of survey techniques in the marine environment and how that supports the all-important management of coral reefs. The lectures of the coral reef ecology course are organized so that all referral students and PADI open water students will be able to attend these lectures around their dive training requirements. Table 5 shows an example timetable of the activities that students finishing the PADI Dive Referral Course will complete over the week. The contents of the timetable are comprehensive but the timing of the sessions will vary for each group.

Table 4. Indicative timetable for those taking the PADI open water referral course. Note there may be changes depending on fitness of students, weather conditions, tides or operational problems.

Day	Activity
Sunday am	Arrive marine site, welcome and house allocation
Sunday pm	Health and safety briefings Dive documentation
Sunday eve	Dive theory review
Monday am	Check Dive / Science Centre visit*
Monday pm	Open Water 1 / Science Centre visit*
Monday eve	Dive theory
Tuesday am	Open Water 2
Tuesday pm	Open Water 3
Tuesday evening	Dive theory exam
Wednesday am	Open Water 4 & Certification
Wednesday pm	Lecture – The Diversity of Coral Reefs III Dive practical 1 – quadrat and transect survey
Wednesday evening	Dive Logs/Science Activity/Coral Reef Ecology Taxonomy Skills Session
Thursday am	Lecture – Mangroves and Seagrasses Dive practical 2 – quadrat and transect survey
Thursday pm	Lecture – The Future of Coral Reefs Dive practical 3 – fun dive
Friday am	One of the following: Fun dive/catch up dive/Kaledupa visit
Friday pm	Social night
Saturday am	Depart marine site

*Science Centre visits will be subject to student competency during check dive and availability of scientists

11. Reef Ecology lectures and practicals

Lecture 1: An Introduction to Coral Reefs

- Coral biology; growth, development, feeding and reproduction
- Importance of the symbiotic relationship between corals and photosynthetic microalgae
- What are coral reefs and where are they found?
- Introduction to the Indo-Pacific

Land-based activity: reef zonation activity
In-water activity: check dive/snorkel & PPB

Lecture 2: The Blue Planet

- Quick fire facts to excite students about the marine world
- Who would win in a fight between a great white shark and a killer whale?
- Why is the sea blue and salty?
- Why are whales so important?
- Where did life originate?

Land-based activity: presentation briefing
In-water activity: reef zonation & coral growth forms

Lecture 3: The Diversity of Coral Reefs I

- An introduction to taxonomy
- Classifying a green alga
- Classifying a sea cucumber
- Classifying the stoplight parrotfish

Land-based activity: build a fish activity
In-water activity: Fish ID dive/snorkel (practicing hand symbols)

Lecture 4: Conservation of Coral Reefs

- The value of coral reefs
- An introduction to macroalgae
- Competition between macroalgae and hard coral; phase-shifts
- Local threats to coral reefs that stimulate phase-shifts; i. Destructive fishing, ii. Coral mining, iii. Overfishing, iv. Water pollution, v. Coastal development, vi. Disease,
- Potential management solutions

Land-based activity: build a reef & HAS Assessment Score
In-water activity: valuing a coral reef

Lecture 5: The Diversity of Coral Reefs II

- Coral reef food webs
- Fish herbivory
- Invertebrate herbivory
- Filter feeding
- Predation

Land-based activity: invertebrate hunt
In-water activity: Invert ID (key health indicators)

Lecture 6: Mangroves, Seagrasses & FADs

- Mangrove adaptations
- Seagrass adaptations
- Ecosystem services and functions
- Importance of habitat connectivity
- Threats to mangroves and seagrasses

Land-based activity: exploring Bubu traps as a traditional fishing method
In-water activity: artificial reef survey

Lecture 7: The Diversity of Coral Reefs III

- An introduction to behaviour
- Parasitism
- Commensalism
- Symbiosis
- Camouflage
- Fish sensory systems

Land-based activity: beach time & traditional canoes
In-water activity: observing feeding rates

Lecture 8: How to Survey a Coral Reef

- Coral reef assessment techniques and methods of assessment
- Benthic habitat quality, fish and invertebrate sampling

Land-based activity: field transect activity
In-water activity: assessing levels of coral bleaching using PADI's 'Coral Watch' guidelines

12. A-Level exam board table

The following two tables highlight how your Opwall expedition relates to the As and A level syllabuses across all exam boards. The red and blue blocks indicates that the keywords listed are covered on our expedition (through lectures, practical's or in discussion topics) and that these keywords are also within As or A level topics as shown

Topic	Biology	AQA		C	CCEA		C.Int		Ed/Sal		OCR		SQA		WJEC		AP	IB
	Levels: S=AS 2=A2 H =Highers	S	2		S	2	S	2	S	2	S	2	H	AH	S	2		
Evolution, Classification and DNA	Evolution; Speciation; Species; Endemism; Gene pool; Allopatric; Sympatric; Isolation; Variation; Adaptive radiation Adaptation; Wallace; Darwin		◆	◆		◆		◆	◆		◆		◆	◆		◆	◆	◆
	Classification; Taxonomy; Binomial system; Dichotomous Keys	◆		◆	◆			◆	◆	◆	◆			◆	◆			◆
Ecology and Ecosystems	Ecology; Habitat; Niche; Abiotic; Biotic		◆	◆	◆		◆		◆	◆	◆					◆	◆	◆
	Biome; Ecosystems; Rainforests; Deserts; Coral reefs; Mangroves; Marine; Coasts; Hot arid; Semi-arid; Woodland Bush; Tropics; Tropical		◆	◆		◆	◆					◆				◆	◆	◆
	Populations; Competition; Interspecific; Intraspecific; Predator Prey; density dependent; independent: Symbiosis		◆	◆		◆	◆					◆				◆	◆	◆
	Succession; Climax community		◆			◆				◆	◆	◆				◆		◆
	Biodiversity	◆		◆	◆			◆	◆	◆	◆				◆		◆	◆
	Practical work; Field techniques; Ecological sampling; Random sampling; Transects; Capture, mark, release and recapture; Biodiversity indexes; Data handling and; presentation; Quadrats; Statistical testing; Measuring; GIS; Research tools		◆	◆		◆				◆	◆	◆	◆	◆		◆	◆	◆
	Written reports; Research project; Report; Case studies			◆					◆				◆	◆		◆	◆	◆
Agriculture, Human activities, Conservation and Sustainability	Sustainability	◆		◆					◆	◆		◆				◆		
	Agriculture; Agricultural impact; Agricultural exploitation; Cultivation crops; Food production; Sustainable agriculture; Sustainability; Forestry; Timber; Deforestation; Fisheries; Over fishing; Deforestation; Human management; Human effects; Human activities	◆				◆						◆	◆			◆	◆	
	Fair-Trade; Coffee; Rain Forest Alliance; Ecotourism; Tourism; Carbon trading; Greenhouse gas emission control (REDD+)															◆		
	Indicator species; Pollution; Climate change; Global warming Carbon footprint; Fossil fuels		◆	◆		◆				◆	◆		◆				◆	◆
	International conservation; Endangered species; Invasive species; Biological control; Pests; CITES; Ethical, Local; Global	◆	◆	◆		◆		◆			◆	◆	◆			◆		◆
	National Parks; Wildlife reserves							◆										◆
	Environment; Environmental monitoring; Environmental impact; SSSI																	
Behaviour	Animal behaviour; Primate Social behaviour; Courtship; Territory; Co-operative hunting; Herbivores; Grazing	◆		◆	◆			◆				◆	◆	◆		◆	◆	◆

Table: Highlighted in Black are topics that you might experience at your research site. Key: C = Cambridge. Pre-U, C.int = Camb. Int. CCEA = N.Ireland; Ed/Sal = Edexcel Salters, S= SQA ; Edex = EdExcel ; IB = International Bacc; AP=Advanced Placement (v. 20/11/14)

Topic	Geography, APES and ESS	IB ESS	APES	AQA		CCEA		Edex		OCR		WJEC	
				Geography									
	Levels: S=AS 2=A2			S	2	S	2	S	2	S	2	S	2
Evolution, Classification and DNA	Evolution; Speciation; Species; Endemism; Gene pool; Allopatric; Sympatric; Isolation; Variation; Adaptive radiation Adaptation; Wallace; Darwin												
	Classification; Taxonomy; Binomial system; Dichotomous Keys	◆											
Ecology and Ecosystems	Ecology; Habitat; Niche; Abiotic; Biotic	◆	◆							◆			
	Biome; Ecosystems; Rainforests; Deserts; Coral reefs; Mangroves; Marine; Coasts; Hot arid; Semi-arid; Woodland Bush; Tropics; Tropical	◆	◆	◆	◆		◆		◆	◆	◆	◆	◆
	Populations; Competition; Interspecific; Intraspecific; Predator Prey; density dependent; independent: Symbiosis	◆	◆										
	Succession; Climax community	◆											
	Biodiversity	◆	◆		◆				◆				
	Practical work; Field techniques; Ecological sampling; Random sampling; Transects; Capture, mark, release and recapture; Biodiversity indexes; Data handling and; presentation; Quadrats; Statistical testing; Measuring; GIS; Research tools	◆	◆		◆	◆		◆		◆	◆	◆	
	Written reports; Research project; Report; Case studies	◆	◆		◆		◆	◆		◆	◆		
Agriculture, Human activities, Conservation and Sustainability	Sustainability	◆	◆		◆		◆			◆	◆		
	Agriculture; Agricultural impact; Agricultural exploitation; Cultivation crops; Food production; Sustainable agriculture; Sustainability; Forestry; Timber; Deforestation; Fisheries; Over fishing; Deforestation; Human management; Human effects; Human activities	◆	◆		◆		◆						
	Fair-Trade, Coffee, Rain Forest Alliance; Ecotourism; Tourism; Carbon trading; Greenhouse gas emission control (REDD+)						◆	◆		◆	◆		◆
	Indicator species; Pollution; Climate change; Global warming Carbon footprint; Fossil fuels	◆	◆				◆	◆		◆			
	International conservation; Endangered species; Invasive species; Biological control; Pests; CITES; Ethical, Local; Global	◆			◆					◆			
	National Parks; Wildlife reserves								◆				
	Environment; Environmental monitoring; Environmental impact; SSSI												
Behaviour	Animal behaviour; Primate Social behaviour; Courtship; Territory; Co-operative hunting; Herbivores; Grazing												

Table: Highlighted in Black are topics that you might experience at your research site. Key: C = Cambridge. Pre-U, C.int = Camb. Int. CCEA = N.Ireland; Ed/Sal = Edexcel Salters, S= SQA ; Edex = EdExcel IB ESS = Env Systems and Societies; APES = Advanced Placement Env. Science (v. 20/11/14)

13. Reading and research questions

In the last few years an increasing number of students joining our research programmes take this opportunity to undertake IRPs. These research projects take many different forms, but what they all have in common is the need to pose and answer a research question. Examples of these include Extended Project Qualification (EPQ), Extended Essay (EE) for IB, as well as many different projects specific to various education systems worldwide.

We can support a selection of different topics for either essay-based research projects or data-led research projects that are tailored towards what the students will experience on site. It is a fantastic opportunity for a student to witness first-hand many of the aspects of their research question and, in many cases, they will have access to samples of past datasets for their project. Students may also have the opportunity to talk with the actual scientists involved which will give them a convincing 'slant' to the way in which they answer their research question.

For success with IRPs, careful planning is needed by the student and a lot of the work will be done prior to their expedition. They will need close guidance from their school supervisor, and the scientists in the field need to be briefed so that support can be provided where they can. If you or your students are interested in undertaking a research project with us, you should contact schoolresearchprojects@opwall.com.

For more information visit the Opwall website - https://www.opwall.com/schools/educational-benefits/independent-research-project/.

Useful reading:

Malay Archipelago, Alfred Russell Wallace (1850) – available in Kindle format from Amazon for £6-57. The whole text is also available online here: www.papuaweb.org/dlib/bk/wallace/cover.html

Song of the Dodo, David Quammen (1997).Best description of island biogeography

A Naturalists Guide to the Tropics, Marco Lambertini (2000).Best introduction to tropical forests

Coates, Brian J. and Bishop, K. D. - A Guide to the Birds of Wallacea: Sulawesi, the Moluccas and Lesser Sunda (1997). Best bird ID guide for Sulawesi and the surrounding islands, Indonesia.

de Lang, Ruud and Vogel, Gernot - The Snakes of Sulawesi: a Field Guide to the Snakes of Sulawesi with Identification Keys (2005).

SAS Survival Guide Wiseman, J. (1999) Collins GEM. Best overall guide to field survival

Robson, Stuart and Millie, Julian (2004) Instant Indonesian: Everything You Need to Speak Indonesian in 100 Key Words and Phrases.

Research areas and activities being carried out in Indonesia:

Examining the roles of NGOs and government in improving natural resource management in Indonesia.
Bird point count surveys.
Pollard walks for butterflies.
Forest plot measurements to understand the role of disturbance.

Influence of habitat structure on herpetofaunal assemblage composition on Buton Island. Night time frog and reptile transects.
Factors affecting bat assemblage composition in lowland forests of Indonesia.
Density and distribution of Sulawesian megafauna.
Bat netting: evening to set and empty mist nets.
Assessing the impacts of tourism in the Wakatobi Marine Park, Indonesia.
Supporting fisheries management policies in the Wakatobi
Quantifying the resilience of marine dependent communities to climate change and resource depletion in Indonesia.
Environmental impact and feeding habits of the Crown of thorns starfish Acanthasterplanci in a low density population in the Wakatobi, Indonesia.
The importance of different coral growth forms for reef biodiversity in Indonesia.
Physiological adaptations of the unique salt-water frog.
The physical and biological structure of a light-limited coral reef.
Environmental driven variations in reef architecture.
Environmentally driven changes to the primary causes of coral mortality.
Wakatobi Culture, Community and Environment.
The sustainability of fisheries activities within the Wakatobi.
The environmental impact of fish fences within the Wakatobi.
Niche partitioning of Fiddler crabs in biodiverse and highly competitive environments in Indonesia.
Mangrove habitats of the Wakatobi, Indonesia.
Seagrass habitats of the Wakatobi.
Ecology and behaviour of fiddler and sentinel crab populations.
Sponge ecology and coral reef phase shifts in Indonesia.
Competitive interactions between sponges and other reef organisms in Indonesia.
The diversity, distribution and abundance of Nudibranchs in Indonesia.
The role of territorial Damselfish in sculpturing coral reef biodiversity in Indonesia.
Resource utilisation of reef fish across environmental gradients in Indonesia.
The ecology of Anemonefish in Indonesia.
The ecological impact of smothering sponge and ascidians on coral reefs in Indonesia.
The behaviour and functional role of reef fish cleaners in Indonesia.
The abundance and impact of coral bio-eroding invertebrates across environmental gradients in Indonesia.
The ecology and biology of shallow subtidal patch reefs in Indonesia.
Methods of reef assessment and the effect different survey techniques have on estimations of reef fish abundance and functional biomass in Indonesia.
Conservation of herbivore biomass and functional biology of reef systems.
Opwall Coral Reef monitoring programme underpinning scientific research.
The eco-physiology of juvenile reef fish: preparing for future climate change.
Are animals living in extreme environments best equipped to deal with climate change?
Thermal induced rapid coral mortality in Indonesia.