Borneo Schools' Booklet 2019

Contents

1. Study area and research objectives....2
2. Week 1 itinerary for Schools at the Forest Camp....4
3. Jungle survival skills....5
4. Week 1 lectures....6
5. Biodiversity practicals....7
6. Forest Structure Measurements....8
7. Learning outcomes from week 1....9
8. Week 2 itinerary....9
9. Indo-Pacific Reef Ecology Course....10
10. PADI Open Water Diver Course....11
11. PADI Open Water Referral Course....12
12. Reef Ecology lectures....14
13. Academic Benefits....16
Relevance of their expedition to the syllabus....17

1. Study area and research objectives

Students will spend 2 weeks in East Kalimantan, (Borneo) in Indonesia. Their first week will be spent in the Lesan Conservation Forest camp. During their week in the forest the students will participate in a Borneo wildlife and conservation course and help with the biodiversity surveys outlined in the terrestrial section below.

After the first week, the group will travel to Derawan Island. At this site, those students medically fit to do so will complete a scuba diving course (PADI Open Water), and all students will complete a marine ecology course. Those students who are already dive trained (or those who do not wish to or are not able to learn to dive) will participate in a more in-depth version of the course, which will include in-water practicals by diving or snorkeling. This marine ecology course consists of two lectures and two in water practicals each day (either diving or snorkelling) enabling participants to identify different fish groups, invertebrates and corals as well as learn marine biological survey techniques.

Groups need to arrange international flights to arrive into Berau before 1200 on the Sunday before the expedition starts. The return flights need to be booked from Berau any time after 14:00hrs on the Saturday after the final day of marine activities on the marine site.

Figure 1. Map of Borneo showing main locations students will stay or transit through

Borneo was once mainly covered in forests but in just the last 40 years over 30% of the remaining forests have been felled. There are a series of biomes within Borneo but the most diverse of these are the lowland rainforests which are the most diverse rainforest habitats in the world with more than 10,000 plant species on Borneo alone. Part of the reason for this exceptional diversity is that during Ice Ages Borneo is connected by land bridges to the mainland of Asia so that species can spread across. These invasions are then separated by long periods of isolation on a large island which leads to further speciation. This high plant

diversity in the lowland forests of Borneo supports some high faunal diversity as well with 380 species of breeding birds and a diversity of mammals ranging from the Slow Loris to Sun Bears.

One of the main drivers of lowland forest destruction has been clear felling in order to develop palm oil plantations. In the province of East Kalimantan much of the lowland forest has been cleared for these plantations but the Berau government has stepped in to preserve 10,000ha of prime lowland forest from being converted. The Lesan protection forest is bordered by the Kelay river and an orangutan rehabilitation release site has been established in the buffer zone. The Lesan forest is nearly completely surrounded by palm oil plantations although there is a narrow forest corridor that links the protected forest to the wider undamaged forests past the palm oil plantations. Operation Wallacea has been invited by the Berau government to help with identifying the fauna of the Lesan forests and to then establish a standardised monitoring protocol that can identify any changes in key taxa over time. The Berau government has identified tourism income as one of the most important parts of the local economy. At the moment this tourism income is almost exclusively focused on the offshore islands and the diving industry, and the Berau government would like to develop the Lesan forest site as a location for tourists to see some of the spectacular wildlife of the Borneo forests. As a result of this objective, one of the outputs from the 2019 surveys will be a photographic guide to the species found in the Lesan forests.

In addition to identifying the faunal diversity of the forest, the Berau government would also like data on the carbon storage value of the protected forest. By protecting the forest from being clear felled the Berau government has foregone the value of the timber and one way of replacing some of this lost income is by payments being made under the REDD+ scheme. This scheme is designed to provide payments to local communities for protecting the carbon value of the forest (and thereby reducing carbon emissions). Preference is given to protecting the carbon value of forests with high nature conservation value when including forests with the REDD+ scheme. So the results of the faunal studies will be combined with theforest structure and carbon levels surveys so that an application can be made for ongoing annual funding to ensure the Lesan forests remain protected for the next 25 years.

The research objectives for the first year of the Borneo project can therefore be summarised as:

- To quantify the storage value of the Lesan forests from a series of forest structure quadrats
- To complete species listing and photographs of butterflies, dragonflies and beetles
- To complete a report on the diversity of birds in the forest from point count and mist net surveys and to identify the likelihood of each species being seen on a 5 point scale.
- To complete a report on the diversity of reptiles and amphibians and to identify the likelihood of each species being seen on a 5 point scale.
- To complete a report on the non primate mammals present in the forest from camera trap and small mammal trapping surveys, plus mist netting for bats and to identify the likelihood of each species being seen on a 5 point scale.
- To collect data on habitat usage by the various primate species present and to identify on a 5 point scale, the likelihood of each species being seen.
- To produce a photographic guide to the species likely to be encountered on a visit to the Lesan forests.

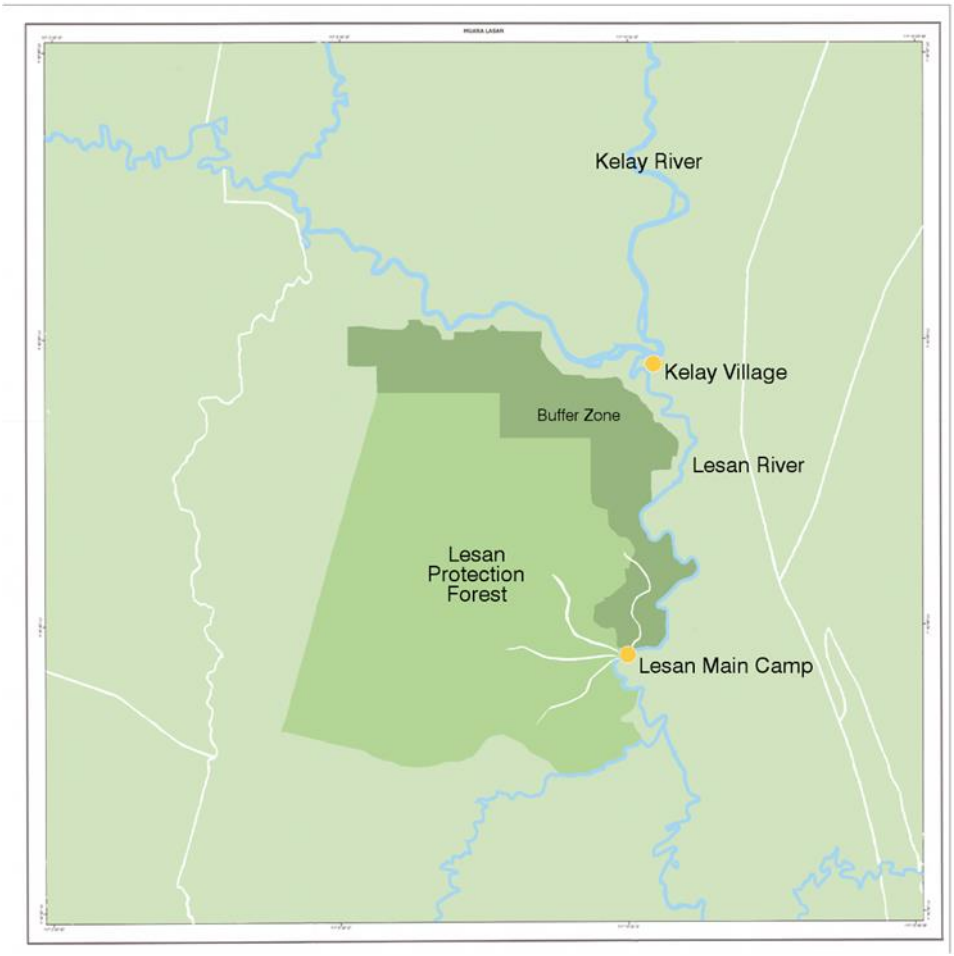

Figure 2. Forest camp and transects

2. Week 1 itinerary for Schools at the Forest Camp

On arrival at Berau airport the groups will be taken by minibus to the village of Lesan Dyak (2.5 hours), with a stop for lunch along the way, at the Centre for Orangutan Protection (COP). The groups will spend their first night in local homestays in the village, where they will receive introductory and health and safety talks, before travelling to the forest camp the following morning. To get to camp they will take a 45min long boat ride down the Kelay river (see figure 2). During the course of the week the students will receive lectures each day as part of the Borneo wildlife and conservation series which is a summary of the last 10 years' of published papers on Borneo biodiversity and conservation and weaved into a series of stories that will help the students understand more about the ecology of Borneo.

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 (usually 6-9 people). 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. The surveys are all run along the 1.2km transects shown in figure 2 (above).

Table 1 – Example timetable for the first week. Note there may be changes to this itinerary depending on group size, fitness of students, weather conditions or operational issues on site and the exact order of activities throughout the week may differ from the proposed timetable below.

Day	Activity
Sunday pm	Arrive in Lesan Dyak, introductory and H&S talks Lecture 1 – Geology, geography and history of the region
Monday am	Travel by longboat to field camp Field practical – invertebrates, herpetofauna or mammals & primates
Monday pm	Field practical – mist netting for birds, or camera trap checking Jungle skills 1
Monday evening	Lecture 2 - Island biogeography & metapopulations, colonisation & extinctions Field practical – Bats, or spotlighting for amphibians
Tuesday am	Field practical – invertebrates, birds, herpetofauna or mammals & primates
Tuesday pm	Field practical – mist netting for birds, or camera trap checking Jungle skills 2
Tuesday evening	Lecture 3 – Plant biodiversity, forest dynamics, succession Field practical – Bats, or spotlighting for amphibians
Wednesday am	Field practical – invertebrates, birds, herpetofauna or mammals & primates
Wednesday pm	Guest lecture or workshop
Wednesday evening	Lecture 4 - Animal biodiversity, food webs Field practical – Bats or spotlighting for amphibians
Thursday am + pm	Forest structure survey all day
Thursday evening	Lecture 5- Humans and rain forests, impacts and harvesting, climate change
Friday am	Field practical – invertebrates, birds, herpetofauna or mammals & primates
Friday pm	Field practical – mist netting for birds, or camera trap checking
Friday evening	Lecture 6 - Conservation and management, limitations and difficulties, examples from the region Pack up and feedback Social Night
Saturday am	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 flora and fauna 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. Geology, geography and history of the region

- Borneo (Kalimantan, Sabah, Sarawak & Brunei)
- Geological origins, relations to wider SE Asia, Wallace's Line
- Ecological zones, mountains, lowlands, swamps & coast
- Land bridges, human colonization & spread, archaeology
- Present day demographics, populations, tribal systems & government

Lecture 2. Island biogeography & metapopulations, colonisation & extinctions

- Background to modern population dynamics
- Theories of island biogeography, colonisation vs extinctions
- Dispersal mechanisms, island shape, size and isolation, species area relationships
- Metapopulation dynamics, habitat fragmentation
- Connectivity and gene flow

Lecture 3. Plant biodiversity, forest dynamics, succession etc

- Definitions of "biodiversity"
- Structure and function of rainforests, why so many species?
- Details of main plant groups (e.g. Dipterocarps, figs, lianas)
- Canopy ecology, abiotic and biotic conditions for "life in the sky"
- Forest succession, gap dynamics and "secondary" vs "primary" structures

Lecture 4. Animal biodiversity, food webs etc

- Animals in rainforest, examples from mammals, birds and insects
- Links between animal species richness and niche diversity
- Mammals on the ground (elephants, deer, pigs) and in the canopy (primates)
- Birds in ecological roles such as seed dispersers and predators
- Insects in rainforests – vertical stratification. Why so many species?

Lecture 5. Humans and rain forests, impacts and harvesting, climate change

- Who lives in rainforests? Indigenous peoples vs incoming commercial exploiters
- Needs of local communities from rainforests including harvesting, hunting and farming
- Unsustainable exploitation; extent of logging and effects on plants and animals
- Primary vs secondary vs clear-felled forests; extinction risks
- Effects of climate on rainforest, El Nino, drought, forest fires

Lecture 6. Conservation and management, limitations and difficulties, examples from the region

- Requirements for successful conservation programs; vital need to include local people
- How to manage rainforest sustainably and integrate it with other crop types e.g.oil palm
- Pressures and advantages of tourism
- Examples of failed and successful conservation projects in Sabah and Kalimantan e.g. Bornean Biodiversity and Ecosystems Conservation (BBEC) Programme

5. Biodiversity practicals

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

Invertebrate surveys

Opportunistic surveys will be performed with an entomologist to identify and record the invertebrates of the Lesan forest. Particular focus will be given to butterflies, dragonflies and beetles. Sweep nets will be used to survey butterflies and dragonflies, whilst standard timed searches will be used to survey beetles species.

Herpetofauna surveys

These surveys will be performed by installing and emptying pitlines (buckets buried into the ground and with leader fences over the top) and from active searches along transects. All reptiles and amphibians encountered will be captured and identified. Note there are venomous species of snake in Borneo so only the herpetologist leading the group and who will have experience of handling venomous snake species will be allowed to catch snakes, even if they are thought to be non venomous. No student is allowed to handle snakes. At night spotlight surveys will be used to look for amphibians and again all species sighted will be captured and identified.

Bird surveys

Bird data will be collected using point counts and mist netting. The point count surveys will be completed between 05:00am and 09:00am. If it is raining heavily or there are strong winds the survey should be cancelled. On all surveys the weather conditions at the time of the point count should be recorded. Point counts of birds (by sight or call) will be conducted at 10 different points along the transect at 300m intervals. No settling down period should be allowed with counts starting immediately. Then over the next 10 minutes for each species the following details should be recorded: species, number of individuals, whether the bird(s) was seen or heard, and the approximate distance of the bird from the observer (recorded at 5m intervals). A minimum of 3 repetitions of each transect in each camp is required to ensure that data collected is representative of the population.

The abundance and diversity of understory birds will also be assessed using mist nets. Mist nets are unable to sample canopy and mid-canopy species adequately, but does allows for quantitatively reliable data to be produced for tropical understory birds, allows for the identification of birds that are shy or seldom vocal, minimises observer bias, and produces results that are easily repeatable. Mist nets surveys will run 5 days per week at each research camp using a suitable existing clearing along one of the sample routes with

enough space to erect three 12m long mist nets 2.5 meter high. The location of this mist net site will be marked and the GPS location recorded.

The opening and closing time of the nets will be recorded each session and nets will be checked every 20 minutes for the duration of the survey. When birds are found in the net, the time of capture will be noted. The birds will be taken out of the net, placed in a cotton bag for holding whilst other birds are being processed. Ringing will be used to control for recaptures. The birds will be weighed (to the nearest gm) and standard morphological measurements taken. The birds will be released close to the net site but far enough away to avoid them being immediately re-trapped.

Primate and mammal surveys

This team will be completing Distance and patch occupancy transects for large mammals. The students will need to move quietly through the forest along the transects and will record the perpendicular distance from the transect to each of the animals sighted. The species and numbers of each will then need to be recorded. If it is primates that are sighted then the group will move towards them and spend a 5-minute period getting a maximum count of the group size. The location of the primates and where possible information on what they are feeding will also be noted.

In addition to the direct sightings of species such as wild pig, deer, primates etc, there will be a number of additional species that cannot be detected by sight but for which signs (footprints, scat, burrows etc) are present. The position of each of these sights will plotted using GPS and the data used for patch occupancy analysis. In addition, camera traps will be deployed at some points within the study area to determine the species and obtain good photographs of them.

The Distance and patch occupancy data sets will be supplemented by a small mammal trapping programme using baited traps with a range of sizes. All traps will be opened in the late evening and checked first thing in the morning. Species captured will be identified and photographed.

Bat surveys

This practical involves working with a bat scientist in the evening to set and empty 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 in the area.

6. Forest Structure Measurements

Assessment of habitat type and level of habitat degradation provides the backbone to biodiversity monitoring programmes and assessment of ecosystem health. In addition, collection of data on the diameter at breast height (dbh) of each tree plus estimating the tree height, enables the amount of carbon stored in the forest to be calculated.

Habitat surveys will be conducted in each of 50m x 50m survey sites to investigate forest structure. On each transect the first plot will be located at 200m, the second at 600m, the third at 1000m, the fourth at 1400m and the fifth at 1800m along the transect line. The number of saplings (trees with circumference $<$15cm and a minimum height of 2 metres) will be counted for each plot. For each tree in the plot with a circumference $>$15cm, the circumference at breast height (which will be converted to DBH), whether the

tree is alive or dead, and the tree species, will be recorded on datasheets. The number of cut stumps in the plot will also be recorded (if any) and the volume of the wood in any fallen trees estimated from the length and the diameter at 1.3m from the base of the tree.

Forest structure measurements include understorey vegetation and canopy cover. To measure understorey vegetation, the plot will be bisected to produce the four quadrants. A 3m pole marked in 0.5m segments will be used to record the number of vegetation touches on the pole in each 0.5m segment up to a maximum of 10 touches, every 1m along these bisecting tapes. If one of the positions coincides with a tree then each of the 0.5m segments will be recorded and having vegetation touches. The openness of the canopy will be measured by taking a reading with a canopy scope facing the largest opening in the canopy from the centre of each of the four quadrants and one from the centre of the overall 50m X 50m square. If any of these points is closer than 1m to a tree trunk, then the observation point should be moved slightly so that it is at least 1m from the nearest tree trunk. The perspex square has 25 dots engraved on the square. The observer should look upwards holding the square 20cm from the eye count the number of dots that coincide with gaps in the canopy to give a score out of 25.

7. Learning outcomes from week 1

The students should achieve the following learning outcomes from the fieldwork, practicals, lectures and discussions/activities:

- Be able to define and understand the main Borneo biomes.
- Understand the meaning of biodiversity and the importance of the area as a biological hotspot.
- Consider how Borneo species may have evolved partly by isolation and partly by spreading from the Asian land mass.
- Understand the importance and use of taxonomy and classification in field research work.
- Use (taxonomic) keys to identify taxa such as butterflies and amphibians
- Understand the threats and conservation issues on Borneo
- To understand how and why carbon levels are measured in forests
- To describe and carry out survey techniques for butterflies
- Be able to identify 10 Borneo birds by sight and call
- Be able to identify 10 reptiles and amphibians found on Borneo
- Be able to identify 10 mammals found on Borneo
- To understand how primate species on Borneo separate their niches.

8. Week 2 itinerary

The students will complete six days of training in diving and/or marine ecology at Derawan Dive Resort on Derawan Island. On the Saturday at the end of the forest week the group will travel by long boat (45mins) to Lesan Dyak village and then for 5 hours by bus to Tanjung Batu. From this port the group will take a speedboat (45 minutes) to Derawan island. The students will be staying in 3 – 4 bedded rooms with en suite bathroom facilities. There is a restaurant on site and much of the training will be done on the reefs around the jetty complex.

At Derawan Dive Resort the students have the option of completing their PADI Open Water dive qualification or if they are already dive trained or don't want to learn to dive then they can do the Indo

Pacific reef ecology course (with the practicals done either by diving or snorkelling – see section 10). A third alternative is to complete their theory and confined water practicals before coming out and then just do their 4 open water dives to achieve the PADI Open Water qualification and then move onto the reef ecology course. Students will be occupied in the evenings through a series of science talks, documentary viewings and discussions/activities relative to the ecology course.

On the Saturday morning the group will take an early morning speed boat ride to Tanjung Batu and from there a bus to the airport (2 hours) to arrive by 1200 hrs.

9. Indo-Pacific Reef Ecology Course

Table 2 shows an example timetable of the activities that students undertaking the Indo Pacific 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 snorkelling. 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 Dive Instructor at the start of the course. The Indo Pacific Reef Ecology course is designed specifically with 16 – 18 year old high school students in mind. It covers a range of topics suitable to support A-Level and international equivalent biology and geography students 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 and get them thinking themselves of the importance of the study topic.

Table 2. Indicative timetable for students completing the Indo-Pacific Reef Ecology Course. Note there may be changes to this itinerary depending on fitness of students, weather conditions or operational issues on site and the exact order of activities throughout the week may differ from the proposed timetable below.

Day	Activity
Saturday pm	Arrive marine site, welcome and house allocations, health and safety briefings
Saturday eve	Eve Lecture: Introduction to Opwall and Marine Conservation in Borneo
Sunday am	Dive documentation Lecture 1: An Introduction to Coral Reefs Activity 1: Reef Zonation Activity Dive/Snorkel 1: Check Dive/ Check Snorkel
Sunday pm	Lecture 2: The Blue Planet Activity 2: Briefing on end of week presentations Dive/Snorkel 2: Reef zonation & coral growth forms
Sunday eve	Eve Lecture: Identification of coral reef fish
Monday am	Lecture 3: The Diversity of Coral Reefs I Activity 3: Build a fish activity Dive/Snorkel 3 – Fish ID (hand symbols)
Monday pm	Lecture 4: Conservation of Coral Reefs Activity 4: Build a reef & HAS Assessment Score Dive/Snorkel 4: Valuing a coral reef
Monday eve	Eve Lecture: Identification of ecologically important invertebrates
Tuesday am	Lecture 5: The Diversity of Coral Reefs II Activity 5: Invertebrate hunt Dive/Snorkel 5: Invert ID (key health indicators)

Tuesday pm	Lecture 6: Mangroves, Seagrasses & FADs Activity 6: Exploring DDR's artificial reef Dive/Snorkel 6: – Artificial reef survey
Tuesday eve	Eve Lecture: Guest lecture
Wednesday am	Lecture 7: The Diversity of Coral Reefs III Activity 7: Beach time Dive/Snorkel 7: Feeding rates survey
Wednesday pm	Lecture 8: How to Survey a Coral Reef Activity 8: Field Transect Activity Dive/Snorkel 8: Assessing levels of coral bleaching using PADI's 'Coral Watch Guide'
Wednesday evening	Eve Lecture: The Future of Coral Reefs
Thursday am	Dive/Snorkel 9: Identifying Human Impacts Activity 9: Beach Clean & Snorkel Transect Survey
Thursday pm	Dive/Snorkel 10: Fun Dive/Snorkel
Thursday eve	Eve Lecture: Snorkel Transect Survey Data Analysis Followed by: Quiz Night & Marine Conservation Documentary
Friday am	Activity 10: Turtle Hatchery Programme Turtle Conservation on Derawan Island Beach litter survey & conservation discusssions
Friday pm	Packing Feedback sessions Individual Presentations
Friday eve	Farewell Meal
Saturday am	Depart marine site

10. 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. Indicative timetable for students completing the PADI Open Water Course. Note there may be changes to this itinerary depending on progression through the course, fitness of students, weather conditions or operational issues on site.

Day	Activity
Saturday pm	Arrive marine site, welcome and house allocations, health and safety briefings
Saturday eve	Eve Lecture: Introduction to Opwall and Marine Conservation in Borneo
Sunday am	Dive Documentation Dive Theory

	Confined Water 1
Sunday pm	Dive Theory Confined Water 2
Sunday eve	Eve Lecture: Identification of coral reef fish
Monday am	Dive Theory Confined Water 3
Monday pm	Dive Theory Confined Water 4&5
Monday eve	Eve Lecture: Identification of ecologically important invertebrates
Tuesday am	Dive Theory Open Water 1
Tuesday pm	Dive Theory Open Water 2
Tuesday eve	Eve Lecture: Guest Lecture
Wednesday am	Open water 3 Beach Activities
Wednesday pm	Open water 4 Dive Theory Exam
Wednesday evening	Eve Lecture: The Future of Coral Reefs
Thursday am	Dive 9: Catch up Training dive Activity 9: Beach Clean & Snorkel Transect Survey
Thursday pm	Dive 10: Fun Dive Certification & Logbooks
Thursday eve	Eve Lecture: Snorkel Transect Survey Data Analysis Followed by: Quiz Night & Marine Conservation Documentary
Friday am	Activity 10: Turtle Hatchery Programme Turtle Conservation on Derawan Island Beach litter survey & conservation discusssions
Friday pm	Packing Feedback sessions Individual Presentations
Friday eve	Farewell Meal
Saturday am	Depart marine site

11. 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 management of coral reefs.

Table 4. Indicative timetable for those taking the PADI open water referral course. The contents of the timetable are comprehensive but the timing of the sessions will vary for each group. Note there may be changes depending on fitness of students, weather conditions, tides or operational issues.

Day	Activity
Saturday pm	Arrive marine site, welcome and house allocations, health and safety briefings
Saturday eve	Eve Lecture: Introduction to Opwall and Marine Conservation in Borneo
Sunday am	Dive documentation Lecture 1: An Introduction to Coral Reefs Activity 1: Reef Zonation Activity Dive 1: Check Dive/Open Water Dive 1
Sunday pm	Lecture 2: The Blue Planet Activity 2: Briefing on end of week presentations Dive 2: Open Water Dive 2
Sunday eve	Eve Lecture: Identification of coral reef fish
Monday am	Lecture 3: The Diversity of Coral Reefs I Activity 3: Build a fish activity Dive 3: Open Water Dive 3
Monday pm	Lecture 4: Conservation of Coral Reefs Activity 4: Build a reef & HAS Assessment Score Dive 4: Open Water Dive 4
Monday eve	Eve Lecture: Identification of ecologically important invertebrates
Tuesday am	Lecture 5: The Diversity of Coral Reefs II Activity 5: Invertebrate hunt Dive/Snorkel 5: Invert ID (key health indicators)
Tuesday pm	Lecture 6: Mangroves, Seagrasses & FADs Activity 6: Exploring DDR's artificial reef Dive/Snorkel 6: – Artificial reef survey
Tuesday eve	Eve Lecture: Guest Lecture
Wednesday am	Lecture 7: The Diversity of Coral Reefs III Activity 7: Beach time and traditional canoes Dive/Snorkel 7: Feeding rates survey
Wednesday pm	Lecture 8: How to Survey a Coral Reef Activity 8: Field Transect Activity Dive/Snorkel 8: Assessing levels of coral bleaching using PADI's 'Coral Watch Guide'
Wednesday evening	Eve Lecture: The Future of Coral Reefs
Thursday am	Dive/Snorkel 9: Identifying Human Impacts Activity 9: Beach Clean & Snorkel Transect Survey
Thursday pm	Dive/Snorkel 10: Fun Dive/Snorkel
Thursday eve	Eve Lecture: Snorkel Transect Survey Data Analysis Followed by: Quiz Night & Marine Conservation Documentary
Friday am	Activity 10: Turtle Hatchery Programme Turtle Conservation on Derawan Island

	Beach litter survey & conservation discusssions
Friday pm	Packing Feedback sessions Individual Presentations
Friday eve	Farewell BBQ and Bonfire
Saturday am	Depart marine site

12. Reef Ecology lectures

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 DDR's artificial reef and its effectiveness
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' guideline

Evening Lectures:

Eve Lecture 1: Introduction to Opwall and Marine Conservation in Borneo

Objectives

- Onsite Scientist talks to students about the history of the Opwall marine research in Indonesia and various marine conservation methods that have been or are being used in this area.

Discussion/Activity/Debate (subjects to be selected based on the groups interests and syllabus)

Eve Lecture 2: Identification of coral reef fish

Objectives

- Fish – families, common characteristics and the evolutionary significance of these characteristics.

Discussion/Activity/Debate (subjects selected based on the groups interests and syllabus)

Eve Lecture 3: Identification of ecologically important invertebrate species

Objectives

- Invertebrates – Learn about families and the most common species (through ID guides as well).

Discussion/Activity/Debate (subjects selected based on the groups interests)

Eve Lecture 4: Guest Lecture

Objectives

- Project Leader talks to students about their research their specialist area to date.

Discussion/Activity/Debate (subjects to be selected based on the groups interests and syllabus)

Eve Lecture 5: The Future of Coral Reefs

Objectives

- CRE Lecturer talks to students about the effects of rising seas surface temperatures, MPAs and bottom-up management.

Discussion/Activity/Debate (subjects selected based on the groups interests)

13. Academic Benefits

Apart from the most obvious values of going on an expedition such as contributing towards conservation, the physical challenge and adventurous travel, the experience can also benefit a student by increasing their chances of gaining entry to university or being successful in a job application and impressing at interview. This can be achieved in many different ways but it will often depend upon which country and educational system a learner is from. Common to most countries the experience will:

- Enhance their understanding of course syllabuses
- Research Qualifications e.g. Extended Essays for IB and UK EPQs
- University Course Credits for US universities
- Creativity, Action and Service (CAS) for IB

- Universities Award from ASDAN

IRPs or Individual Research Projects

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 many education systems worldwide.

We are able to support the dissertation essay style research question; however individual scientific investigations (in which students design and collect their own data) are more difficult to facilitate given the short amount of time students are present on-site.

It is a great 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.

Much of the research they will be able to get involved with is specific to their expedition location. The projects that students will come into contact with range from students helping to collect data through to working and learning alongside the scientists where primary data collection by school students is less practical or more difficult.

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. We have now developed an application system to ensure that the student will be able to realistically undertake such a project, that their choice of topic is appropriate to their expedition site, the science staff 'on-site' are aware of the project and where practical can assist in a constructive way before, during and after their expedition.

For more information visit the Opwall website - http://opwall.com/sixth-form-high-school/independent-research-projects/

Relevance of their expedition to the syllabus

Specific specifications for Biology, Geography and Environmental Studies have been reviewed for over 10 examination boards from around the world to see how relevant a student's expedition experiences will be when related to what they learn in their classroom. The tables below show how this matching works

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												

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