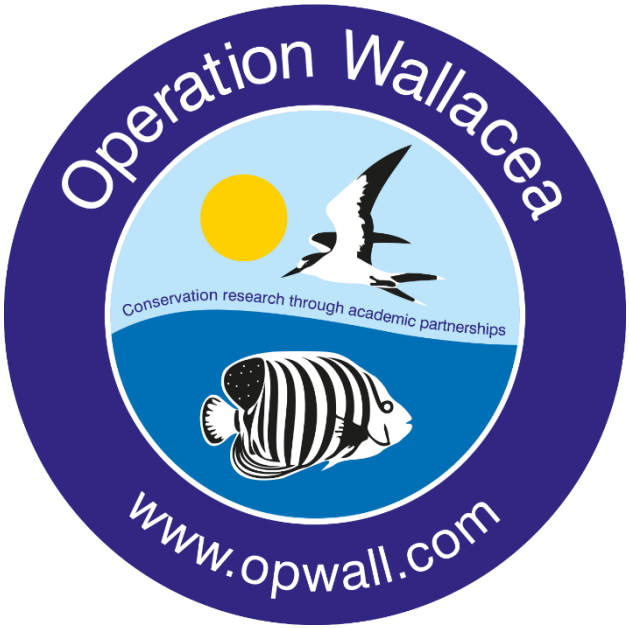

Dominica Schools' Booklet 2019

Contents

1. Study area and research objectives

This is a field-based module, split between three main field sites on the island of Dominica in the Lesser Antilles of the Caribbean. The first week is spent at either 3 Rivers Ecolodge in Rosalie or the Forest WNT centre, situated in the east and the centre of the island respectfully. The second week is spent at Fort Shirley within Cabrits National Park in the north of the island.

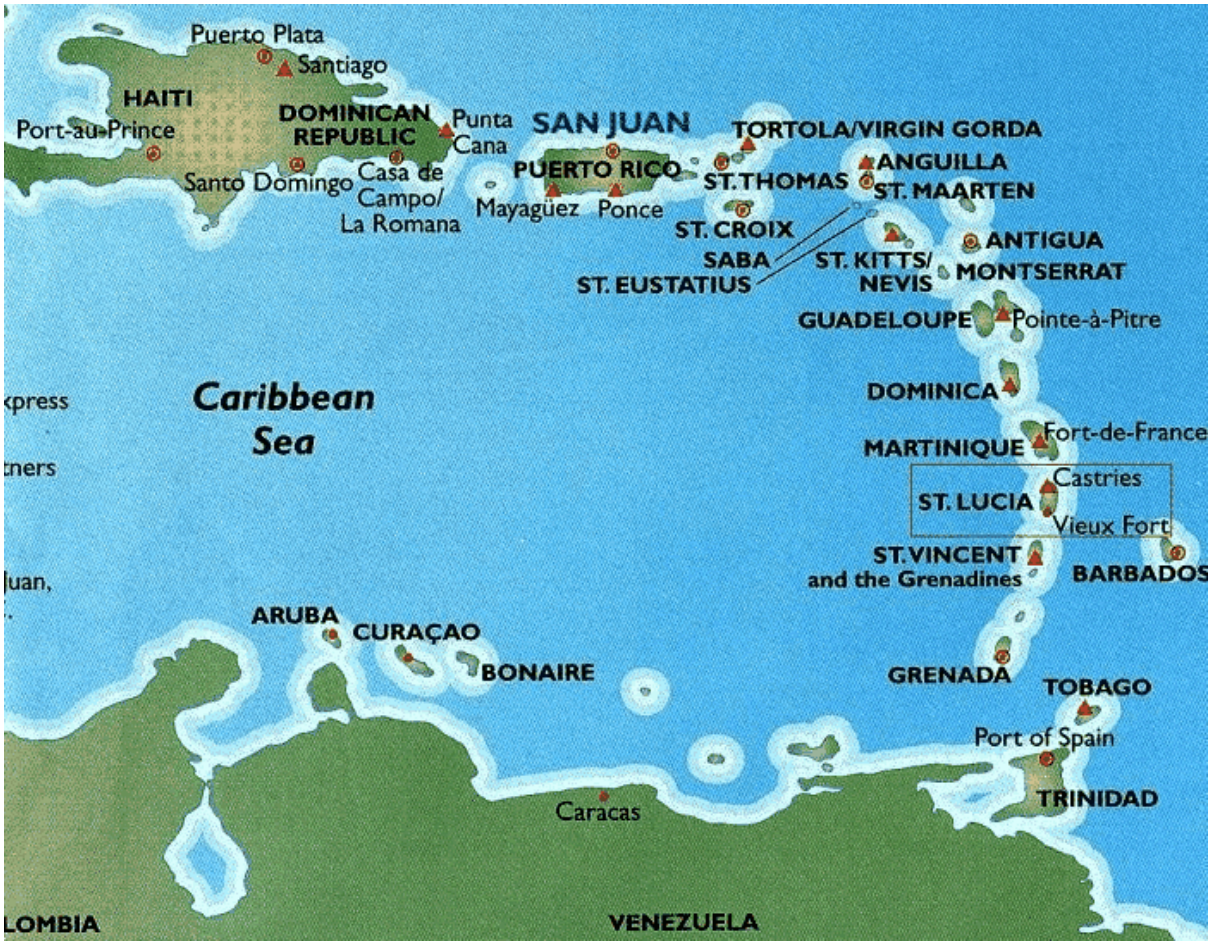

Figure 1. Map of Caribbean showing location of Dominica

The Lesser Antilles run from the Virgin Islands (St Thomas, Tortola etc) and more or less coincide with the outer edge of the Caribbean plate. Many of the islands were formed as a result of the subduction of oceanic crust of the South American Plate under the Caribbean Plate. This process is ongoing and is responsible not only for many of the islands, but also for volcanic and earthquake activity in the region.

The islands of the Lesser Antilles are divided into three groups. The two main groups are the Windward Islands in the south and the Leeward Islands in the north. The Windward Islands are called such because they were more windward to sailing ships arriving in the New World than the Leeward Islands, given that the prevailing trade winds blow east to west. The trans-Atlantic currents and winds that provided the fastest route across the ocean brought these ships to the rough dividing line between the Windward and Leeward Islands. Dominica is at the southern end of the Leeward Islands and Martinique at the northern end of the Windward chain and the straights between these two islands were important in previous centuries when sail boats connected Europe and the Americas.

The Caribbean region is a Biodiversity Hotspot and thus significantly contributes to world biodiversity (Myers et al 2000). Having just 0.15% of the Earth's surface, the Caribbean hosts 2.3% of the global original primary vegetation and 2.9% of the world's vertebrates (Myers et al 2000). In the rich flora of the Caribbean region 7000 endemic species have been estimated, although only 11.3% of the Caribbean primary vegetation remains.

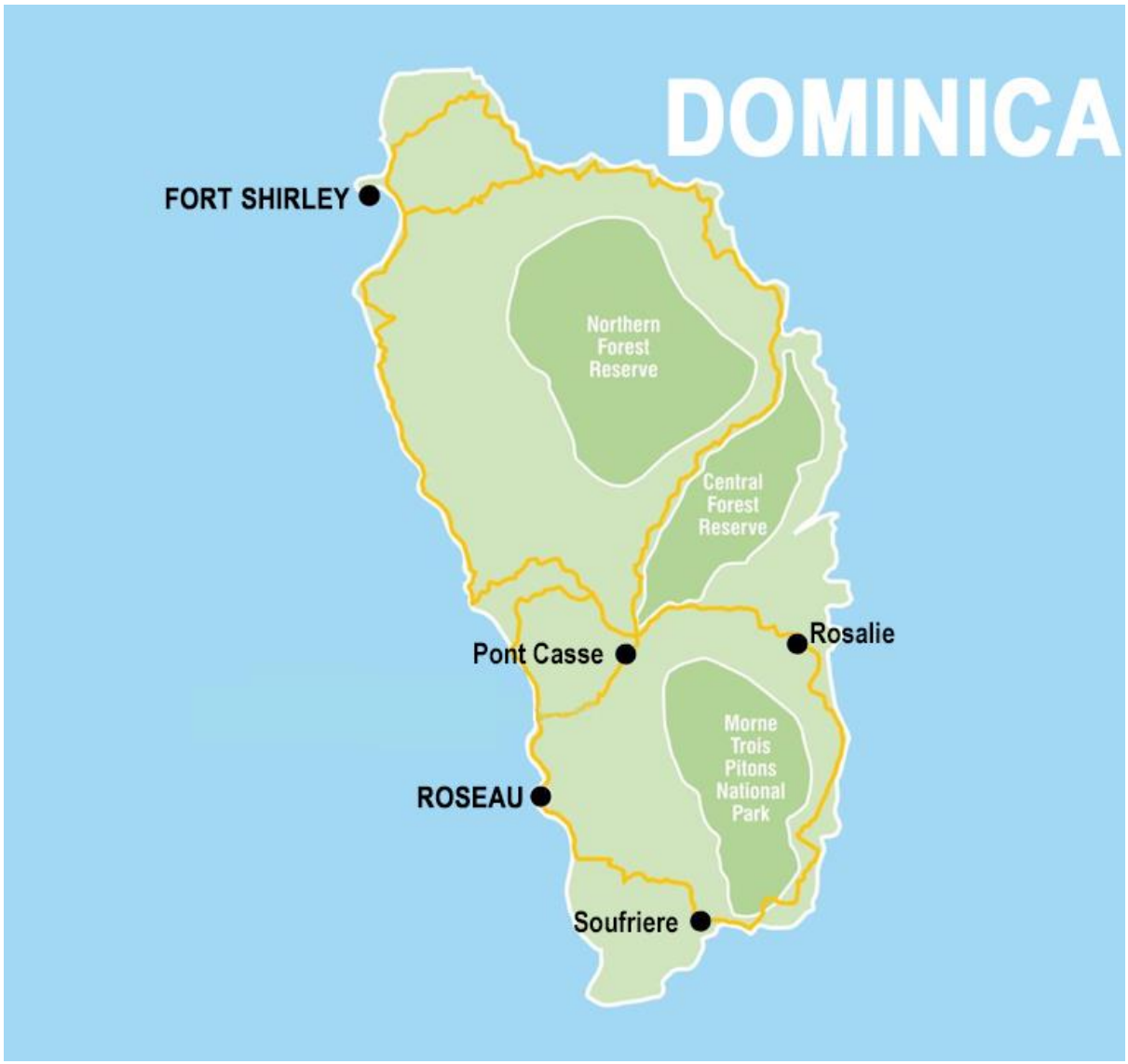

Figure 2. Research locations on Dominica. Week 1 will be spent at a research camp in Rosalie or Pont Casse and week 2 in Fort Shirley.

Dominica is the jewel in the Caribbean crown with the largest stands of primary forests of any island in the Caribbean. The island is volcanic in origin with much of it formed as little as 20,000 – 40,000 years ago. The topography is characterized by very rugged and steep terrain extending above 1500 meters in elevation over much of the country. This deeply fissured terrain has prevented mechanization of forestry and as a result has saved the forests. The cone of MorneDiablotin (1730m) dominates the topography of the northern half of the island whilst a chain of mountains, including MorneTrois Piton (1424 m), extends through the south of the island. The peaks of all these mountains are less than 7 km from the sea. Given its mountainous terrain, the island is blessed with an abundance of water including perennial streams, rivers, lakes and

waterfalls. The rich and diverse natural resource base and mostly unspoiled landscape have led to Dominica being known as the "Nature Island of the Caribbean".

The mountainous nature of the island together with the constant north-easterly winds, results in an annual rainfall of over 7,000 mm on the highest peaks of the central barrier range. The Caribbean coast to their lee is dry compared to the windward coast, and the higher ranges in the north of the island cause the northern part of the leeward coast to be markedly drier than the southern part. This difference is manifested by both an overall reduction in annual rainfall, and an increase in its seasonality. The pattern of rainfall in turn influences the distribution of the main vegetation types.

The vegetation consists of more than 1,000 species of flowering plants and about 60 woody plants and tree species. Dominica contains 52,000 ha of natural forest, woodland and bush. The natural vegetation on the island consists of Swamp Forests, Dry Scrub Land, Littoral Woodland, Deciduous Forest, Rain Forest, Montane Forest, and Elfin Woodland. Total forest acreage accounts for two thirds of the total land area and 20% of the land area has been designated as National Parks.

On September 18th 2017 Dominica was hit by a devastating hurricane. Hurricane Maria hit Dominica at category five speed, with all areas of the island affected. The high winds and rains have had an environmental impact, with early estimates predicted 30% tree loss across the island, with most of the remaining trees losing foliage and branches. The impact on wildlife is currently unknown, so Opwall and it's volunteers now have a unique opportunity to study the recovery of the forest after such a big event, and with data from years previous to Maria for comparison.

The research programme in the forest has four main objectives:

- To record and monitor populations of birds, bats, invertebrates and reptiles. Tracking the recovery and changes in species richness after hurricane Maria.
- To investigate the impact of the invasive Puerto Rican crested anole (*Anolis cristatellus*) on the endemic Dominican anole (*Anolis oculatus*).
- To establish a freshwater biotic index for the rivers and streams on the island in order to assess the health of freshwater environments and monitor possible future change. Evidence for the existence of the invasive, non-native crayfish (*Procambarus clarki*) will also be investigated.
- To investigate the effect of ocean acidification on marine invertebrates.

For the second week the teams will be based at Fort Shirley in the north of the island where they will complete either their PADI Open Water dive training or a Caribbean Coral Reef Ecology Course.

2. Week 1 itinerary for Schools at the Forest Camp

Groups arrive in Dominica on the Sunday before their expedition officially starts on the Monday morning. The groups head straight to the campsite where they will be completing their first week, so the groups are already on site and ready to start first thing on the Monday morning.

On the first full day of the expedition all the newly arrived groups will spend the day at their research camp and will have orientation lectures as well as the first part of the Caribbean Island Ecology course they will be completing. The first part of the course will describe the Caribbean Biodiversity Hotspot and discuss why it is so important. The students will then go on to learn more about the island of Dominica which

covers 750 km, making it the largest English-speaking Eastern Caribbean island. Dominica's undisturbed forests are the most extensive in the Eastern Caribbean and the following vegetation communities are found:

- Swamp Forests (30 ha) - mainly found near Portsmouth in the North West.
- Littoral Woodland (140 ha) - Windward coast.
- Dry Scrub Land (6,240 ha) - Leeward coast. Many showy flowering species exist including *Sabineacarinalis* (National flower found only on Dominica).
- Deciduous Forest- most developed on the Leeward and Windward side of the island.
- Rain Forests (24,490 ha)
- Montane Rainforests (3,640 ha) - Best developed in the Southern part of Dominica, in MorneTrois Piton National Park.
- Elfin Woodland (170 ha)

At the end of the day the group will be divided into up to 4 teams (depending on overall group size). These teams will spend the next five days rotating around the different research activities, spending either a full or part day in turn on each of the 6 surveys listed below. These options will be interspersed with lectures, talks and practical sessions.

Table 1 – Indicative timetable for the first week. 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	Schedule for reef ecology students
Sunday pm	Arrive at research camp
Monday morning	Welcome talk, health and safety and introduction to Caribbean Island Ecology course
Monday pm	Lectures one and two Survey skill practicals
Tuesday	Herpetofauna surveys
Tuesday evening	Lecture 3
Wednesday am	Volcanology day
Wednesday evening	Invertebrate light trap sampling
Thursday am	Freshwater invertebrate survey – in field
Thursday pm	Freshwater invertebrate survey – processing in camp lab
Thursday evening	Lecture 4
Friday am	Bird mist netting survey
Friday pm	Terrestrial invertebrate survey
Friday evening	Bat mist netting
Saturday am	Marine invertebrate snorkel survey
Saturday pm	Marine invertebrate intertidal survey
Saturday evening	Lecture 6 – round up of weeks activities Social night

Sunday am	Depart for Fort Shirely

Activity 1. Herpetofauna surveys

One day will be spent with the herpetofauna team. The main focus of this team is to investigate the current distribution and competitive interactions between the endemic Dominican Anole *(Anolis oculatus)* and the invasive Puerto Rican Anole *(Anolis cristatellus*). The endemic Dominican Anole has been pushed back by the Puerto Rican anole that was recently introduced to the island, probably in cargo delivered to Roseau, and has then spread rapidly across the island and become invasive. The team will be helping to monitor the spread of this invasive species but, most importantly, will also be investigating to what extent they are competing for the same habitats and thermal environments.

Reptiles, especially small lizards like anoles, require quite specific thermal niches (temperature ranges) in order to maintain their preferred body temperature. If two species are in competition for areas of habitat with the same thermal properties, and are not able to partition that habitat in some other way, then they will be in direct competition with one another, which may result in the exclusion of the least well adapted species. We will be investigating how the two anole species use the available habitats, both spatially and thermally, in order to determine how likely it is that the invasive Puerto Rican Anole could drive the endemic Dominican anole to extinction, or at least reduce its current range and population size.

The team will complete this work by visiting field sites to record data on the two anole species as well as collect habitat and thermal data. Some lizards will then be selected to be brought back to the research centre laboratory where it will be possible to test their 'performance' at a range of different temperatures in order to understand the preferred thermal niche of each species as well as their ability to perform well outside of their preferred thermal 'comfort zone'.

During the field surveys, the team will also be on the look-out for all other species of herpetofauna and will collect data on them whenever and wherever they are encountered. Two species the team are particularly interested in collecting data on, if encountered, are the Dominican Boa constrictor (*Boa constrictor nebulosa)* and the Cane Toad (*Bufo marinus*). The Dominican Boa constrictor is endemic to the island and Operation Wallacea Scientists are involved in a long-term genetic study throughout the Caribbean and Central America in order to understand its evolutionary relationship to other subspecies in the area. The Cane Toad has recently been introduced to Dominica and it is of concern due to its proven ability to cause problems for native species in other areas where it has become invasive. Understanding the current spread of Cane Toads on the island is, therefore, of critical importance. All sightings of cane toads will be recorded and reported to map the spread and threat of this invasive species.

Students joining this team will typically spend a half day in the field and half day working with the anolis lizards in the laboratory at the research centre.

Activity 2. Freshwater biotic index and assessment of invasive crayfish

The freshwater ecosystems of Dominica are of such importance, not only for their role in sustaining biodiversity, but because of the reliance of the Dominican people on them as their only source of clean drinking water. However, as the island develops there is increased risk of contamination and degradation of these freshwater environments. By developing a freshwater biotic index for the island it is possible to have a standard against which to monitor freshwater ecosystem health and will allow long-term monitoring of the rivers and streams around the island by Operation Wallacea. All sites visited will be characterized for species diversity, abundance, water flow rate and light intensity.

The team are also concerned about reports of an invasive crayfish (*Procambarus clarki*) having been introduced to the island, so it will be a key goal to assess current distribution and impact of this species if it has in fact been introduced and been able to establish itself in Dominica's rivers and streams.
Students joining this team will spend half a day away from the research camp surveying a stretch of river and the other half of the day in the laboratory identifying the species obtained.

Activity 3. Bird surveys

Students will spend one full day joining the ornithology team to record and monitor bird diversity along transects. During the morning, the team will conduct mist net surveys for birds. The team will then head out to complete line transect bird surveys. The hike along the National Trail provides students with the opportunity to experience the island's primary forest while recording species accounts along the way. These data will be used to create a species inventory and record local abundance for those sections of the trail. Data will also be collected opportunistically on other taxa along the way.

Activity 4. Invertebrate surveys

Another day will be spent with the invertebrate team. This team aims to increase the species lists for the island for target taxa. Much of the invertebrate fauna of Dominica is under studied and there are undoubtedly many new species awaiting discovery. For example at the moment Dominica is known to have 361 species of beetles (in 42 families) and of these, 62 species are endemic to the island. The most recent study suggested that the actual numbers of species on Dominica are many times higher than reported. Arachnid diversity is similarly understudied on Dominica and work completed by the Opwall team in 2014 looks likely to have identified some previously unknown species for the island.

The Antillean island chain probably represents the main avenue of natural overwater dispersal via intermediate stepping-stone islands. Beetles and arachnids can be surveyed from sweep net searches, flight intercept traps and pitlines. Typically, the team will spend half a day working out in the field and then half a day in the laboratory at the research camp sorting and identifying the specimens collected.

Activity 5. Volcanology

During this day the students will attend seminars at the research camp given by an experienced volcanologist currently living in Dominica. The students will learn more about the volcanic origin of Dominica and the Lesser Antilles and how it influences everything about Dominica's biodiversity and culture to this day. A particular focus will also be given to geothermal energy production, which is currently a 'hot' topic on Dominica. Geothermal energy production is typically considered a 'green' alternative to burning fossil fuels and would provide cheap, clean energy for the island. However, there are many conservation concerns associated with geothermal energy production which are often overlooked and call into question the environmental impact of geothermal energy for Dominica. The groups will then be taken to visit a site where they can see Dominica's geothermal energy first hand, where sulphurous gases bubble up, heating the water in pools and streams.

Activity 6. Bat Surveys

During the week, each group will spend one evening joining the bat survey team. Students will help check mist nets for bats and help the scientist to identify species. Although students will not be able to handle

bats during this session (due to safety precautions) they will learn a great deal about species identification and bat ecology.

Activity 7. Marine invertebrates

Currently the ambient pH of the sea is 8.1-8.2, but with ocean acidification it is predicted to drop to 7.7 in the next 100 years. Champagne reef in the south of Dominica provides a unique opportunity to look into the future and predict how marine species will survive at a lower pH. Champagne reef is named as such because there are CO2 bubbles coming out of vents in the sea. The CO2 bubbles have lowered the pH thus this site can be used as a natural experiment, one of only four sites like this in the world. Students will snorkel during this survey and complete a number of water sample transects, measure the pH, and collect intertidal invertebrates to look at adaptations to the lower pH. Please note this survey is subject to research permit approval.

Caribbean Island Ecology Course

Students will complete a Caribbean Island Ecology course whilst staying at the research centre which will describe in more detail the herpetofauna, birds, bats and terrestrial and aquatic invertebrate communities in the Caribbean in general but with particular emphasis on Dominica. Threats to the survival of these species will be described as well as the conservation management initiatives being taken. Lectures will be incorporated into the daily schedule around the research activities, likely being held in the late afternoon prior to the evening meal. Evening seminars will also be held, allowing the Opwall scientists to speak in more detail about their own research projects and interests (not necessarily limited to Dominica).

3. Caribbean Island Ecology lectures

This lecture series gives a review of all of the published ecological research within the Caribbean since 2008. The lectures bring concepts from high school biology into up to date research in the field. Some of these lectures may be given at the marine site.

Lecture 1 : Geography, geology and island ecology

- Geography and biogeography of the region, including Dominica, Barbados, Grenada, Trinidad & Tobago, Guadaloupe, Montserrat, Virgin Islands
- Age, origins and geology of islands in the region
- Principles of island ecology and biogeography (island size, shape, age and isolation
- Mechanisms of dispersal (flying, floating, hitch-hiking) for terrestrial and marine flora and fauna
- History of human dispersal, migrations and recent forced transport around the islands in the Caribbean;

Lecture 2 : Terrestrial biodiversity

- Definitions and limitations of the term “biodiversity”
- Species richness, abundance and distributions of plant species in the region
- Species richness, abundance and distributions of animal species in the region
- Examples from mammals, birds, reptiles, amphibian and insects, in the context of forest type, vertical stratification and management

Lecture 3 : Humans, extinctions and invasions on land

- Influence of human populations on indigenous animals and plants
- Changes in plant communities and vegetation types in historical time
- Modern land use and harvesting, farming and forestry
- Deliberate and accidental introductions, pests and invasives
- Disturbance on land, hurricanes, earthquakes, forest operations

Lecture 4 : Conservation on land

- Should we conserve single species or whole habitats?
- Monitoring of target species for changes in population densities and associated environmental impacts
- Assessing links between impacts and species declines (terrestrial examples)
- Why conservation mainly fails to deliver
- Detailed examples of conservation projects in the eastern Caribbean, terrestrial e.g. US Nature Conservancy Caribbean projects, UN Caribbean Environnent Programme, Caribbean Landscape Conservation Cooperative (CLCC)

Lecture 5 : Marine biodiversity

- Coastal zones and their interactions
- Biology and ecology of major habitats, mangrove forest, sea grass meadows, and coral reefs
- Ecosystem functioning and species coexistence mechanisms in each habitat
- Connectivity processes between the three habitats and importance for coastal zone maintenance
- Mesophotic (deep water) ecology and diversity

Lecture 6 : Human activities and impacts on marine communities, marine conservation

- Disturbance in the sea, hurricanes, diseases (corals and urchins), predation
- Invasives (lionfish), fisheries and aquarium trade
- Global warming, changes in sea temperature, coral bleaching, ocean acidification, sea level
- Marine conservation examples in the eastern Caribbean

4. 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 Caribbean habitats.
- Understand the meaning of Biodiversity and the importance of the area as a biological hotspot.
- Consider how island species may have evolved and spread.
- Understand the importance and use of taxonomy and classification in field research work.
- Use (taxonomic) keys to identify taxa amphibians and reptiles (and understand how different populations are determined from field data.

- Understand the impact of alien/invasive species on island populations.
- Understand the conservation issues relating to geothermal energy production on Dominica.
- Be able to describe the biology of birds and identify common island species.
- Describe and carry out important survey techniques for invertebrate and freshwater fish populations.
- Understand how conservation works with particular reference to Dominica as a case study.
- Consider the impacts of humans on the Caribbean Island chain.
- Have an understanding of the interaction between an organism's physiology and it's ecological function, distribution, behaviour and phylogenetic history.
- Learn how research is carried out to determine the behaviour of sperm whales resident off the Dominican coast (undertaken at the end of week 1 during the transfer to the marine site).

5. Sea mammal research

While travelling from the forest site to the marine site at Fort Shirley, groups will join a whale watching excursion aboard a local catamaran. This will begin in Roseau in the south of Dominica and end in Portsmouth in the north. During the voyage, groups will learn how hydrophones can be used to locate pods of marine mammals, including the sperm whales for which Dominica is famous. There will be the chance to look for these amazing creatures, as well as other marine mammals including dolphins, while the view of Dominica will provide a stunning landscape for any photographers in the group.

6. Week 2 Itinerary

The students will complete five days of training in marine science at Fort Shirley in the Cabrits National Park near the town of Portsmouth, famous as a filming location for Pirates of the Caribbean! Fort Shirley is an archaeological site on which an 18th Century British fort has been partially renovated, and groups will be staying in dormitory style accommodation in an old barracks building with stunning views over the bay. Food will be provided in the fort itself, while there is also a dive centre close by to facilitate the in water activities.

At Fort Shirley the students have the option of completing their PADI Open Water dive qualification (see section 12). If they are already dive trained or don't want to learn to dive then they can do the Caribbean Reef Ecology Course (with the practical's 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 (see section 12) 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, as well as being able to enjoy the beautiful settings of Fort Shirley and the bay.

7. Coral Reef Ecology Course

Table 2 shows an example timetable of the activities that students undertaking the Caribbean 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 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 Professional at the start of the course. The Caribbean Coral Reef Ecology course is designed specifically with 6th form (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 Caribbean Coral 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	Schedule for reef ecology students
Monday am	Dive documentation
Monday pm	Check dive/skin diver course (snorkellers)
Monday evening	Lecture 1 – Introduction to coral reef ecology
Tuesday am	Dive/snorkel practical 1 – Reef structure and topography Lecture 2 – Identification of coral and algal Species
Tuesday pm	Dive/snorkel practical 2 – coral identification skills
Tuesday evening	Lecture 3 – The importance of mangrove and seagrass habitats
Wednesday am	Dive/snorkel practical 3 – algal identification skills Lecture 4 – Identification of ecologically important invertebrate species
Wednesday pm	Dive/snorkel practical 4 – invertebrate identification skills
Wednesday evening	Lecture 5 – Identification of coral reef fish
Thursday am	Dive/snorkel practical 5 – fish identification skills Lecture 6 – How to survey a coral reef
Thursday pm	Dive/snorkel practical 6 – quadrat and transect survey
Thursday evening	Lecture 7 – Global threats to coral reefs
Friday am	Dive/snorkel practical 7 – quadrat and transect survey Lecture 8 – Methods to protect the world's coral reefs
Friday pm	Dive/snorkel practical 8 – fun dive!
Friday evening	Social night
Saturday am	Depart Fort Shirley

Note – a surface interval of 24hrs is mandatory between diving and flying. Therefore, if your group are flying home on Saturday morning you will not be able to dive on Friday. If this is the case, in water activities on Friday will be completed by snorkeling instead. If you are flying on Saturday afternoon then you will be able to dive on Friday morning and snorkel in the afternoon.

Lecture 1. Introduction to Coral Reef Systems

- Why are coral reefs important?
- What are coral reefs and how are they formed?
- Where are coral reefs found?
- Types of coral reefs
- The different zones of a coral reef
- Reefs of Dominica

Activity 1– General feedback session on dive skills and their experience on the reef.

Practical 1 – 'Reef Structure and Topography': Check dive/snorkel – PADI Skin Diver course with DM

Lecture 2. Coral Reef Primary Production

- Competition for space on coral reefs
- Scleractinian (hard) corals as ecosystem architects
- Macroalgae (seaweed) distribution, morphology, and their use of pigments
- What happens when the balance between corals and algae goes wrong?

Activity 2 – Primary Productivity Quiz

Practical 2 – Coral and algal identification skills (DIVING/SNORKELLING)

Lecture 3. The Importance of Coral Reef Fish

- The coral reef food web
- Identification and ecology of common reef fish families
- Common Caribbean fish species
- Feeding guild examples and key species
- Specialists
- Fisheries exploitation

Activity 3 – Fish Quiz

Practical 3 – Fish identification skills (DIVING/SNORKELLING)

Lecture 4. Coral Reef Invertebrates

- What is an invertebrate?
- Taxonomy
- Marine invertebrate feeding ecology
- Common marine invertebrates found on coral reefs
- Case study: The Crown of Thorns Starfish

Activity – Reef Invertebrate Quiz

Practical 4 – Invertebrate identification skills (SNORKELLING)

Lecture 5. How to Survey a Coral Reef

- Why do we survey coral reefs?
- Which method(s) to use?
- Rapid habitat surveys
- Benthic and invertebrate assessment techniques
- Fish assessment techniques

- Measuring abiotic factors
- The use of technology
- The Operation Wallacea reef monitoring program

Activity 5 – Survey Design Challenge

Practical 5 – Underwater survey techniques 1 (DIVING/SNORKELLING)

Lecture 6. The Ecology of Seagrass and Mangroves

- The ecology of tropical seagrass beds
- Seagrass importance and threats
- The ecology of mangroves
- Mangrove importance and threats
- Habitat connectivity

Activity 6–Debate: Hotel Owner versus Conservationist

Practical 6 – Underwater survey techniques 2 (DIVING/SNORKELLING)

Lecture 7. Global Threats to Coral Reefs

- What should a healthy reef be like?
- Anthropogenic impacts on coral reefs (overfishing, pollution, tourism)
- Natural impacts on coral reefs (temperature, storms, disease, acidification)

Activity 7 – Discussion Activity: The Global Aquarium Trade

Practical 7 – Assessing coral reef health (DIVING/SNORKELLING)

Lecture 8. Marine Conservation

- The value of coral reefs (re-visited)
- Top down management (MPAs, zonation, ICZM)
- Bottom up management (ownership, education, community involvement)
- Alternative livelihoods

Activity – Fun Quiz!

Practical 8 – Fun Dive!

8. 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
Sunday pm	Arrive and settle in
Monday am	Dive documentation
Monday pm	Dive theory
Tuesday am	Confined water
Tuesday pm	Confined water
Tuesday evening	Dive theory
Wednesday am	Confined water
Wednesday pm	Open Water 1
Wednesday evening	Dive theory
Thursday am	Open water 2
Thursday pm	Open water 3
Thursday evening	Dive theory exam
Friday am	Open water 4 & Dive certification
Friday pm	Dive/snorkel practical 8 – fun dive! Revision Session
Friday evening	Social night
Saturday am	Depart Fort Shirley

9. 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.

10. Links to University entry

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.

Table 4: 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	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	A H	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	◆		◆	◆			◆	◆	◆	◆			◆	◆			◆
	PCR; Genome sequencing; Genetic fingerprinting; DNA profile		◆	◆	◆					◆		◆	◆			◆	◆	◆
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 5: 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)

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	◆											
	PCR; Genome sequencing; Genetic fingerprinting; DNA profile												
Ecology and Ecosystems	Ecology; Habitat; Niche; Abiotic; Biotic	◆	◆							◆			
	Biome; Ecosystems; Rainforests; Deserts; Coral reefs; Mangroves; Marine; Coasts; Hot arid; Semi-arid; WoodlandBush; 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												

11. Reading and research questions

Many students are now involved in producing Independent Research Projects (IRP) as part of their 2 year educational programme and many hope to carry this out whilst on an Opwall Expedition. If you are an IB school you will be involved in the EE or Extended Essay or if in the UK an EPQ or Extended Project Qualification. Those involved in CoPE will also have a similar task in which they carry out some research. There are many similar projects in most countries.

One of the key features of all of these 'Essays' or 'Projects' is that you have to choose your own research question but it is often difficult to find out exactly what is happening at each Opwall research site. To help in this, we have produced a 'Research' lookup database on the Opwall website – http://opwall.com/epq-research-topic/ but you can also 'download' a more detailed version as an Excel Spreadsheet.

The database lets you find out what is happening at each site and there are links to pdf files and video clips. You can search the 'database' using a variety of filters such as research area and location.

This booklet also contains detailed information on the research projects you will be involved in and this may help you to locate your particular area of interest.

The type of IRP will vary but it is less suitable for individual investigations where you collect your own primary data although in some cases you might be able to get hold of raw data and you will often have the opportunity to help collect some of this data yourself. You will certainly have the opportunity 'on-site' to meet up with the scientists involved which will allow you to get a deeper insight into your research question. Many of you will also have seen the Wallace Resource Library (WRL) which contains many datasets based around the research being carried out and it has been prepared by the actual Opwall scientists involved. It is a very valuable source of ideas with comprehensive datasets to look at and study.
Demo version – http://wallaceresourcelibrary.com

Do also make use of the research library on the OpWall website - http://www.opwall.com

How does it work?

Once you have an idea send an email to schoolresearchprojects@opwall.com with your initial ideas and contact details so that one of the academic staff working with Opwall can contact you to discuss possible research questions. We can also send you further information to help you choose a suitable title for your research site.

Once you have decided on a title you will then be asked to complete a registration form (supplied on request) which we can then forward to the appropriate country manager or scientist. This will then inform those at the research site about what you are hoping to achieve plus for us to give you as much assistance as we can. In some cases we will also be able to provide you with data sets from previous years which some students will find very useful.

Deadlines: Although each school will be operating their own schedule we would like registrations to be competed at least 3 months before their expedition begins although the earlier the better.