



Schools' Booklet Peru 2025

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## 1. Study area and research objectives

The Amazon rainforest represents the largest rainforest on Earth and encompasses seven million km<sup>2</sup> across nine South American countries (Brazil, Peru, Colombia, Venezuela, Ecuador, Bolivia, Guyana, Suriname and French Guiana). Amazonian biodiversity is reportedly higher than anywhere else in the world and contains approximately 2.5 million insect species, 40,000 plant species, 3,000 fish species, 1,294 bird species, 427 mammal species, and 807 species of herpetofauna (reptiles and amphibians).

The study site of the Operation Wallacea surveys is an area of seasonally flooded forest that connects the Pacaya-Samira National Reserve and the Tamshiyacu-Tahuayo Community Reserve. These reserves span over 20,000 km<sup>2</sup> of tropical rainforest and teem with aquatic and terrestrial life. The surveys will be conducted from a site on the banks of the Lower Yarapa river, which is a 50 km long channel that originates in the Ucayali river (which itself borders the Pacaya Samira Reserve) and discharges into the Rio Amazonas (River Amazon). The flooded forests (várzea) of this landscape are particularly susceptible to global climate change which appears to be increasing the frequency of extreme flooding events and low water periods. During the height of the annual floods, much of the várzea area is flooded, but this can be as high as 98% in extreme flooding events, confining land-based mammals (agouti, deer, peccaries, armadillos and tapir) to small areas of land and thereby significantly impacting their population levels. In times of extreme low water, fish populations and their associated predators (dolphins, river birds and caimans) are under stress. The datasets managed by Fund Amazonia for this landscape, which is based on the annual surveys completed by the Opwall teams and others, are the most extensive in any of the Peruvian reserves and is showing the impact of global climate change on a range of taxa and on the livelihoods of indigenous people. This information is being used to make management decisions for the reserves and policy decisions for conserving the Peruvian Amazon including hunting quotas for the indigenous communities (see <https://fundamazonia.org/peccary-pelt-certification.html>).



Figure 1. Location of the survey site

## 2. Itinerary

The students will be based on research ships in the Tamshiyacu-Tahuayo Reserve for the whole two-week period. During this time, the students will be rotating around the various research projects to gain experience and will have a series of lectures and discussion sessions on Amazonian Wildlife and Conservation.

Students will have the opportunity to take part in numerous research projects over the week including terrestrial transects for large mammals and game birds, macaw point counts, dolphin and turtle transects (note the turtle element of these surveys depends on water levels), caiman population surveys, habitat surveys, wading bird surveys, fish population surveys, fishing bat surveys, amphibian surveys and butterfly surveys. Students will be split into groups of 6 – 8 people depending on the activity and will have the opportunity to rotate around the different projects over the course of their time on site. Each student will be expected to join one of the mornings and one of the afternoon or evening activities and to participate in data entry. In addition, there will be some lectures with discussion topics/activities delivered during the first two days of the expedition and at times of day when there are no field practicals running.

Please be aware, the specific surveys students undertake on-site will vary depending on water levels and weather conditions. The list below gives an indication as to some of the surveys students will take part in. Some years we have visiting academics and external scientists who will carry out additional surveys not listed below e.g. entomological surveys.

Table 1. Example itinerary within a rotational timetable for those in Tamshiyacu-Tahuayo. Note there may be changes depending on the total number of groups according to the number of students, fitness of students, weather conditions, water levels or operational requirements. Every evening after dinner the groups will debrief on the sightings of the day and other important aspects of the expedition.

Time	Activity
Sunday pm	Health and safety briefing
Sunday eve	Caiman survey
Monday am	Large mammal and game bird survey
Monday pm	Community engagement activity Lecture on Amazonian Biogeography and Ecological Census Techniques
Monday eve	Free evening
Tuesday am	Macaws survey
Tuesday pm	Dolphin survey Data entry with scientists and camera trap workshop
Tuesday eve	Boat based floating vegetation amphibian survey
Wednesday am	Butterfly survey
Wednesday pm	Amazonian fish survey Lecture on Conservation Synthesis
Wednesday eve	Fishing bats survey
Thursday am	Wading bird survey
Thursday pm	Community visit

Thursday eve	Sign up board for surveys
Friday am	Amphibian terrestrial transect survey
Friday pm	Wading birds survey
Friday eve	Social evening e.g. Amazon Ecology Quiz
Saturday am	Large mammal camera trap recovery and analysis
Saturday pm	Community engagement activity
Saturday eve	Caiman survey
Sunday am	Macaws survey
Sunday pm	Dolphin survey Data entry with scientists
Sunday eve	Guest lecture
Monday am	Canoe shorebirds
Monday pm	Amazonian fish survey
Monday eve	Social evening e.g. film night
Tuesday am	Guest survey from additional scientist e.g. entomological survey
Tuesday pm	Habitat survey
Tuesday eve	Guest lecture
Wednesday am	Amphibian terrestrial transect survey
Wednesday pm	Wading birds survey Additional lecture
Wednesday eve	Fishing bats survey
Thursday am	Large mammal and game bird survey
Thursday pm	Optional survey signup
Thursday eve	Optional survey signup
Friday am	Feedback forms and debrief. Depart field site.
Friday pm	Return to Iquitos

### 3. Lectures

*Below is an indication of some of the lectures that might be delivered during your time on-site. The number of lectures delivered depends on a number of factors, such as how long you are on-site, the current water levels, and the weather conditions.*

*Lectures 1, 2, 3 and 8 are always covered during students time on-site in order to explain the background to the field site, provide context as to why we are their collecting data, and look towards the future and how we can continue conserving the Amazon and global biodiversity hotspots.*

#### Lecture 1: Amazonian Biogeography

- Formation of the Amazon
  - Lake of Pevas
- Seasons of the flooded forest
- Amazonian River Systems
- Habitats of the Flooded Forests
- The flooded forest and animal adaptations
- People and agriculture of flooded forests
- Terra firme or upland forests
- Wildlife of upland forests
- People and agriculture of upland forests

Discussion topic/Activity – Why are there so many species in the Amazon?

#### Lecture 2: Ecological Census Techniques

- Sampling methods
- Replication
- Mark recapture methods
- Distance Sampling
- Each of the surveys of the expedition, the methods and their importance

Discussion topic/Activity – Discussion on sustainable conservation

#### Lecture 3: Introduction to Biodiversity

- What is biodiversity?
- Different scales of diversity
- What is a species?
- Measuring diversity
- Diversity gradients
- Is biodiversity important?
- Amazonian Biodiversity
- IUCN Red list, biodiversity Hotspots

Discussion topic/Activity – International Year of Biodiversity, 2010.

#### Lecture 4: Neotropical Birds

- Bird diversity
- Large game birds – Curassows, guans, etc
- Humming birds
- Toucans
- Macaws and other parrots

- Ecological interactions
- Conservation issues

Bird identification and survey techniques Discussion topic/Activity – Bird identification task

#### Lecture 5: Herpetofauna

- Herpetofauna diversity
- Amphibians (Caecilians, salamanders, frogs and toads)
- Chytrid Fungus
- Reptiles (Turtles, crocodile, lizards and snakes)
- Snake fang morphology and associated venoms
- Conservation issues
- Survey techniques

Discussion topic/Activity – Which is better: in-situ or ex-situ conservation?

#### Lecture 6: The mammals of the Amazon:

- Comparing neotropical mammals to those of the temperate zones
- Aquatic mammals of the Peruvian Amazon (giant river otters and pink and grey river dolphins)
- Felids and primates of the reserves
- Anteaters, sloths and armadillos
- Forest ungulates
- Feeding ecology
- Population monitoring and methods

Discussion topic/Activity – Camera trap ID test

#### Lecture 7: Amazonian fisheries

- Fisheries Management
- Amazonian Fisheries
- Species richness
- Piranha
- Electric eels
- Arapaima
- Fish survey techniques, gill nets, traps, rotenone, long lines

Discussion topic/Activity – Fish identification quiz

#### Lecture 8: Conservation synthesis

- What is conservation?
- Conservation organisations
- Conservation strategies
- Conservation management strategies in the area

Discussion topic/Activity – Round up of the weeks work and the contributions they will make.

## 4. Biodiversity practicals

In the study site (working in groups of 6 – 8) students will complete the following field practicals:

Macaw Surveys: 5:30am – 9:00am and 4:00pm – 6:00pm

Point counts are used to monitor macaws. Eight or nine sample points have been identified at each site with each sampling points separated by 500m. Fifteen minutes will be spent at each point with censuses carried out twice a day; in the morning and afternoon. Within the fifteen-minute counts, all macaw species either perched or flying will be noted and the time of observation and distances of the birds from the observer will be estimated where possible. Abundance data for each sample point over the various replicates will be calculated. Identification cards will be available.

Primates, large mammals, and game birds: 7:00am – 12:00pm and 2:00pm – 5:00pm

Transect trails are being used to conduct terrestrial mammal surveys. Distance based survey transects will be completed by the students for these groups along 2 – 3 km trails. Information registered on a census includes day, site, species, number of individuals, and perpendicular distance from the individual to the transect line, habitat, time, distance traveled and weather conditions. The method and theories behind distance sampling will be explained to students and they will be taught how to recognise different species and the main identification features will be explained. Identification sheets will be available.

River Dolphin Transects (includes turtles when river levels are appropriate): 9:30am – 12:00pm and 2:30pm – 5:00pm

Five kilometer transects at each site will be travelled twice daily along the centre of the river using a boat. Information to be collected includes: species, group size, group composition, behaviour (travelling, fishing, playing), time, and any additional observations. During these surveys students will be taught how to record the distribution and behaviour of both pink and grey river dolphins.

A motorized boat will be used to carry out the census. Any dolphins seen coming to the surface for air, swimming with their heads above water or swimming just below the surface of the water (i.e. no deeper than 5 cm) will be recorded with care being taken not to double count any dolphin sightings. Note: when the water levels have dropped enough during our season then the surveys will also include turtles. The method consists of travelling with the current of the river on a boat and registering the number of individuals sighted, either sunbathing or swimming. The censuses are carried out at the same time as dolphin transects, collecting data on the perpendicular distance, the number of individuals, the location of the boat, the activity of the species and any other information deemed relevant. The classification of the microhabitat will be recorded. Students will be taught how to differentiate between the 2-species found in the reserve. Identification cards will be available.

Butterfly surveys: 9:30am – 12:00pm and 2:30pm – 5:00pm

This is a new project using standardised baited catch-and-release traps. Students will learn how to set-up the traps and handle butterflies. The diversity of butterflies along transects and in different forest types will be examined.

Fish Surveys: 9:30am – 12:30pm and 2:30pm – 5:30pm

Students will be able to witness and learn how gill-net surveys are implemented. They will also take part in surveys using fishing lines. Any fish caught will be measured, weighed and identified. Students will learn

how to identify different species using identification guides. The rationale for gill net and line use is to simulate, as closely as possible, the potential pressures of local and commercial fishers, rather than to provide a comprehensive survey of fish diversity.

Habitat surveys: 9:30am – 12:30pm and 2:00pm – 5:00pm

The first part of this survey is to teach the students about the different habitat types found within the reserve, explaining the different flora and how they are used by the local people. The second part is designed to produce quantitative data on the various forest habitats (e.g. size structure and biomass of trees, levels of light penetration and ground vegetation and regeneration rates). 20m x 20m quadrats are set up in the different habitat types and various different measurements within the quadrats are taken using a range of equipment including a canopy scope, clinometer, measuring tape and touch pole.

Wading Bird Surveys: 6:00am – 9:30am and 4:00pm – 6:00pm

One of the main conservation reasons for protecting the Tamshiyacu-Tahuayo Reserve is because of the presence of large wading bird communities that use the local rivers. These populations will be surveyed using 3-5km long boat-based transects. The boat engines will be turned off and the boat allowed to drift down river in the middle of the channel. All waders, ducks, kingfishers and terns will be identified and counted along the transect in divided 500m sections. This survey will depend on water levels and time at research station.

Fishing bat surveys: 6:30pm – 7:30pm

This river survey involves travelling along the river for a 1-hour period during dusk recording the number of fishing bats seen flying over the river. The students will also use a batbox (ultrasonic bat detector) to help detect and identify the bats. The purpose of this survey is to use the fishing bats as an indicator of small fish populations.

Night-time amphibian floating meadow surveys: 8:30pm – 11:30pm

This survey will be conducted at night during the period when amphibians are most active. An auxiliary boat is driven into a raft of floating vegetation and students spend 15 minutes searching for amphibians within 2m around the boat. Upon detection, individuals may sometimes be captured and handled carefully, and morphological measurements taken. Amphibian species are used as biological indicators, and the survey identifies species using the floating vegetation as breeding platforms.

Night time caiman surveys: 8:30pm – 11:00pm

This practical will involve spotlight surveys of the river after dark to locate and identify caiman species in order to estimate population size and distributions. Noosing will sometimes be used to capture caimans so as to obtain various morphological measurements, sex and an estimate of age.

## Community Visit

This practical session will introduce the students to the way of life in an indigenous community. The visits may incorporate engagement activities such as small agricultural cultivation or riverine plastic bottle collection with the local families, camera trap sessions with the local children along with other similar activities. The groups may also have the chance to see local houses, buy local handicrafts and maybe even take part in a football game. You might want to bring some small gifts to donate to the school and children.

## 5. Learning objectives

By the end of the expeditions the students should be competent to do the following:

- To explain why the Amazon is so species diverse
- To describe survey methods and their disadvantages for a range of river and forest taxa
- Be able to identify 10 species of Amazonian bird
- Be able to identify 10 species of fish or reptile
- Be able to identify 10 species of mammals found in the forests
- Be able to identify the 3 species of caiman found in the Reserve
- To describe how community based conservation can contribute to saving the Amazon forests

## 6. Research contribution

Conservation strategies must include wildlife monitoring to determine if they actually work and are therefore key elements of any conservation work. The wildlife monitoring conducted by Operation Wallacea in the Tamshiyacu-Tahuayo National Reserve is helping to evaluate the success of conservation strategies in an effort to promote good conservation practices throughout large areas of the Amazon basin. The project has already helped convince the Peruvian and Brazilian governments of the advantages of community based strategies resulting in the recent creation of seven new community based protected areas in the Peruvian Amazon. The wildlife monitoring measures the success of community based strategies for biodiversity conservation and helps convince the government of the importance of these strategies for both the local people and the biodiversity. The impact of climate change is becoming more intense with greater flooding and more intensive droughts. The impacts of these more extreme conditions on wildlife are being monitored by the project and recommendations on how to cope with these changes are being made to the local people, the reserve management and the Peruvian government.

Long-term data sets collected from terrestrial transects are used to determine the impact of hunting on primates and ungulates. River dolphins are used as an indicator species for aquatic systems and macaws as indicators for terrestrial systems. By the long-term assessment of changes in species numbers and behaviour we can evaluate the recovery of both ecosystems. The data collected from caiman surveys allows the recovery of black caiman populations to be determined and ecological interactions between the three species elucidated. River turtle population data are used to determine the success of the Headstarting Conservation Programme (creation and protection of artificial hatcheries) in the Samiria River basin. The fish and fishing bat surveys allow data to be collected on abundance, diversity and age structure of fish species, which are used to determine the impact of local fisheries and the effectiveness of fisheries management.

## 7. Links to A levels

The following table below highlights how your Opwall expedition relates to the AS and A level syllabuses across all exam boards. The red and blue blocks indicate that the keywords listed are covered on our expedition (through lectures, practicals 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	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: 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	APE S	AQA		CCEA		Edex		OCR		WJEC	
				Geography									
				S	2	S	2	S	2	S	2	S	2
	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; 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; G lobal	♦			♦					♦			
	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).

## 8. Reading and research questions

### 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 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](mailto:schoolresearchprojects@opwall.com).

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