Egypt Marine Expedition 2016

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1. Introduction

1.1. The Red Sea

The Red Sea is a rich biological hotspot, with over 5,000 species in total (NCS, 2009). While scientifically invaluable, this biodiversity is also economically fruitful, with an estimated worldwide value of over £19 billion pounds per year through tourism (Hicks et al, 2013).

Due to its immensely varied ecosystem, ranging from deep pelagic rifts to mangroves and corals, and its relative isolation from the Indian Ocean, it boasts an almost unparalleled level of biodiversity, providing organisms of all shape and size with crucial sites for nurseries, living/shelter habitat, and feeding grounds. Many of these organisms are economically valuable to the surrounding communities and in turn to the world as a whole, especially as 17% of fish species found in the Red Sea are endemic to the area, as are 6% of corals (Reefcheck, 2010). However the red sea is tremendously understudied.

Fish stocks worldwide are in a state of severe decline, with as many as two thirds of fisheries under collapse. Of 600 fisheries monitored by the Food and Agriculture Organization, 96% of fisheries are currently exploited, with 7% of these fully depleted (FAO, 2004). The Red Sea hosts a number of extremely important fisheries, mainly artisanal and small commercial fisheries, but also many large foreign commercial vessels. From 1988 to 1998, there was a 43% increase in finfishes caught in the Red Sea, and a 215% increase in invertebrates caught (PERGSA, 2002).

Fishing in the red sea is focused on shallow coral reef environments due to ease of access:

“There are some reports of conflict between the artisanal and industrial fisheries and most of the countries have rules which prohibit industrial vessels from working close to the shore. Nevertheless, because of lack of enforcement they are reported often to operate in the shallow inshore waters.” (PERGSA, 2002)

Destructive fishing methods such as trawling and long-line fishing inflict damage indiscriminately, destroying corals and catching anything they come upon. Many times this includes endangered or threatened species such as sharks, turtles, or whales. Turtles are also highly affected by fishing in the Red Sea. Four species are known to be found there, with Green and hawksbill species being common nesters on beaches. Eggs are under threat from the problem of poachers, while those which survive into adults are under vast list of afflictions ranging from irresponsible coastal development to pollution (HEPCA, 2013).

The governing bodies responsible for the health of the Red Sea include the governments of 9 Arabian States and monitored by The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA). This organization works for the better management and protection of the species within the Red Sea, through integrated assessment of the marine environment. PERSGA has produced a State of the Marine Environment Report (SOMAR) in 2006, detailing the development of protected areas, management of species, and methods for furthering the future of the Red Sea.

In the Red Sea, coral reef health is considered generally good, with 20-50% live coral cover, positive ratio of live to dead coral cover as well as high diversity of key and indicator species (Kleypas & Eakin, 2007). Anthropogenic threats such as that of oil spillage from off coast rigs along with, heavy metal accumulations, and both chemical and physical waste from the coastline are all contributing to the degradation of coral reefs and its wonderful life within the red sea, (A. Hasheem, 2007). Climate change is also having an effect on coral reefs, resulting in community shifts affecting communities as a whole (Lindahl, Ohman, & Schelten, 2001; Garpe, Yahya, Lindahl, & Ohman, 2006). With such issues in the red sea, it would seem vital for every effort to be made to improve its quality, not only to keep a continued flow of tourists who help bring in large sums of money, enriching the economy, but to also save what is a productive, breath taking and important ecosystem on Earth.

Green sea turtle seen on the 2015 expedition

1.2. Glasgow University Egypt Marine Expedition

On our most ambitious expedition yet, the University of Glasgow Marine Expedition will be building on years of previous work, using past knowledge and experience to collect novel data and perform new and exciting research. Using a newly designed research lab in El Quesir, the team will be able to carry out necessary tests and examine data, along with field research. Past expeditions have set up connections with researchers and schools in the area, as well as providing the necessary baseline data to embark on these new, ambitious projects. The team will consist of three master's students and seven undergraduate students, all of which are studying in bioscience fields. Together they have designed four projects, one of which will take place in a previously unexplored area to the south of El Quesir, Wadi El Gamal. These projects will not only expand our knowledge of the Red Sea, but will also highlight areas that are in need of further research by examining the success of a protected area and the health of reefs. This will also highlight areas that are in need of further research, opening up new possibilities for future work.

Map showing the town of El Qusier

2. Expedition Aims

2.1. Collaboration

The team will be working in collaboration with contacts from the Egypt Environmental Affairs Agency (EEAA), Society of Environmental Awareness Supporters (SEAS), ROYAA, Hurghada Environmental Protection & Conservation Association (HEPCA), and Keep Quesir Beautiful (KQB). These organizations mainly focus on conservation and environmental issues, and aim to educate and inspire people to care for the environment. These contacts will not only assist with the expedition, but also give us a chance to reach out to the community and share our knowledge and facilitate events such as beach cleanups. Working with these organizations in the past has been rewarding for both the team members and the community, allowing members to get involved in the teaching of children about the ocean.

We will also liaise with The Open Ocean Science Centre (OOSC), an NGO based in Dahab and El Quseir. We will also be arranging transportation through the Pharaoh Dive Club and Roots camp. The OOSC will provide general logistical support, assistance in acquiring the necessary permits from the local authorities, and transport between El Quseir and Wadi El Gamal for the team members carrying out the Marine Protected Area research project. By collaborating with groups like the OOSC, we are able to strengthen the University's reputation as an international research body, while also benefiting from the insider expertise of local people.

2.2. Research

The goal of the 2015 Egypt Expedition is to conduct four research areas (detailed below) that will focus on conservation and the continuation of previous studies. Each project will be designed and carried out by one or two members of the expedition, but all team members will fully understand and be involved in all of the projects. Projects will be carefully planned with the aid of an academic supervisor, who will ensure that each one will meet its goals and will produce high quality research. The expectation is to have most, if not all, of the projects be of publishable quality, and to have them published in a respected journal. This not only benefit the university, but also prepare the expedition members for a future in research, enabling expedition members to make a contribution to the scientific community and increase the repute of the Glasgow University Expedition Society. We aim to report our results by means of our blog, poster presentations, attending seminars and conferences and by compiling a comprehensive report of our findings.

2.3. Public Outreach

The past three expeditions have established many useful connections not only at home, but in Egypt- these connections include NGOs and Universities and, importantly, primary schools. As a team, we recognise the importance of sparking an interest in the natural world among the next generation of biological scientists. Although we will

unfortunately not be able to return to Hillhead Primary as we have in recent years due to the timing of the expedition interviews, we are planning to work with schools in El Quesir. We will work with the children to teach them the importance of the ocean and the conservation of its biodiversity through interactive workshops, as well as engaging in beach clean-ups and snorkeling. These events have been very well received in the past, and have been rewarding for both the schoolchildren and expedition members.

We also will keep in touch with our followers through weekly updates on our website (http://www.gu-egypt-expedition.co.uk/), as well as our popular Facebook page (610 likes) and Twitter. These updates will not only focus on the team and expedition, but also relevant news from the world of marine conservation biology.

3. Research

The following research areas will encompass no fewer than two and no more than four individual projects on coral reef ecosystems. Each study has been developed to suit the research interests of its particular student coordinator, whilst attempting to further develop some of the questions posed during reviews of the results from the Egypt 2015 expedition, and take into account questions arisen from the annual tropical ecology field course undertaken by the University of Glasgow.

3.1 Measuring the success of a no-take zone in marine protected area Wada El Gamal

Introduction:

Marine protected areas, and specifically no-take zones (NTZs), are becoming an increasingly important part of marine conservation, with as many as 5,880 marine reserves around the world today (Bergseth, Russ, & Cinner 2013). There is a wealth of evidence that no-take zones provide both social and biological benefits; not only maintaining and improving ecosystem health but also benefitting the communities that depend on them (Pomeroy et al. 2005, Advani et al. 2015, Rife 2013, Halpern & Warner 2002). Overexploited target species are given an opportunity to recover, as are habitats that may have been destroyed from destructive fishing practices such as trawling or dynamite fishing. Surrounding take zones are also improved due to the migration of fish and larvae from the NTZ, replenishing fish stocks in these fished areas (Ashworth& Ormond 2005). However, NTZs can be rendered ineffective if managed and monitored improperly. A study of 1,306 marine protected areas in 1995 showed that only 31% believed they had reached their management goals (Jameson, Tupper & Ridley 2002), and it is well documented that the majority of marine protected areas are not successful (Pomeroy et al. 2005, Rife et al. 2013). Failure of no take zones is mostly due to insufficient monitoring, poor funding, and lack of compliance from fishermen (Advani et al. 2015).

There is very little data available on the state of Red Sea fisheries (FAO 2014), and even less on the status of marine protected area and NTZ Wadi El Gamal. Wadi El Gamal is large (1,600km^2), well funded (€131,750 yearly from a variety of parties) and is both staffed and monitored by an NGO called HEPCA (Hurghada Environmental Protection and Conservation Association) (Samy, Lizaso&Forcada2011). Wadi El Gamal is also sparsely featured in Red Sea conservation literature. Our research would summarize the NTZ's success in this MPA, facilitating comparison to other MPAs in Egypt and abroad, and aiding Egyptian stakeholders in policymaking, development and future conservation work. Extensive literature surrounding no-take zones is vital if we are to critically examine our frameworks for marine biodiversity conservation, and design viable future projects.

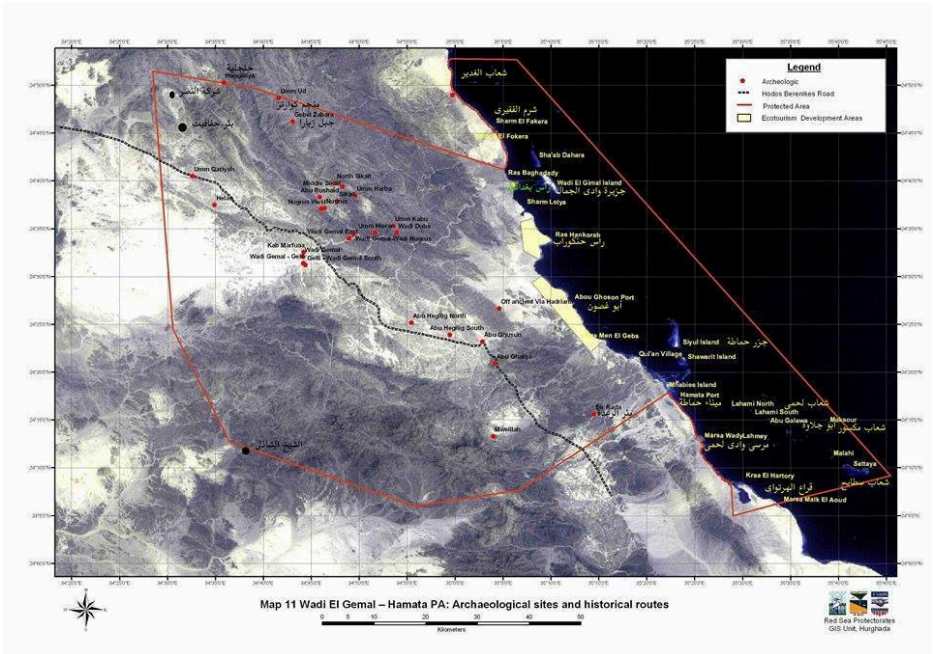
Aims:

This project will adapt and expand upon the research of Advani et al. (2015), investigating whether individual fish size, fish biomass, abundance, and species richness are higher within the no take zone compared to the fishing zones. We will also note the presence of discarded fishing gear, as an indicator of compliance to regulation.

Methodology:

Four researchers will travel by Mini bus provided by Roots Camp and Pharaoh Dive Club to Wadi El Gamal and camp for 5 days at a time, and will then return to El Quesir for 2 to 3 days to refresh supplies, enter data and participate in other project work. The trip will occur a total of 4 times, resulting in a total of 20 days camping in Wadi El Gamal and the surrounding take zones. We will be working with EEAA and local counterparts from ROYAA, SEAS, HEPCA, and Suzanna Aprille Valle.

Three sites will be chosen in no-take zone Wadi El Gamal, along with three sites in each of two neighbouring fishing zones. At all nine sites, two observers will carry out four 25m long belt transects: two at 3m depth- representative of reef crest depth, where herbivorous fish are mostly caught (Advani et al. 2015); and two at 10m depth- or reef slope depth, where predatory fish are mostly caught (ibid). Each site's two transects will be repeated three times, at different hours on two non-consecutive days, to avoid the effect of time of day on the marine community structure. Each observer will be trained to recognize a group of fish families, avoiding pseudoreplication. In total, this will require 54 dives. The dives will occur three times a day over 20 days, which will allow us 60 dives. This will allow us a two-day buffer, in case of injury or illness. With the use of computer software, the stereoscopic cameras will allow fish size to be calculated in order to determine biomass from publicly available length to weight data. To measure species richness and biodiversity, researchers will use the film to identify fish by trophic level and family. Trophic levels observed will consist of: herbivores, omnivores, corallivores, invertivores, and piscivores. Fish families that will be identified are: Epinephelidae, Lutjanidae, Lethrinidae, Chaetodontidae, Pomacanthidae, Scaridae, Acanthuridae, and Siganidae. It is necessary to identify trophic level along with family as lower trophic levels will experience different fishing pressures than higher tropic levels, and will respond differently to no-take zones. Divers will also record instances of discarded fishing gear and compare them between sites. This will be done by photographing the gear, and recording the location and photo number of the gear on a dive slate. Any results will be written into a log book after each dive, and will be entered into an excel spreadsheet upon our return to El Quesir. In a healthy reef system, we would expect to find an increase in large, piscivorous fish due to relief from fishing pressures. Smaller, herbivorous fish that are less commercially important may show little change or even an opposite effect due to increased predation from piscivores (Halpern & Warner 2002, Advani et al. 2015, Ashworth & Ormond 2005). The increase in large piscivorous fish, along with a larger fish population, will also lead to an increase in fish biomass. We would also expect to find lower instances of discarded fishing gear.



A map of Wadi El Gamal National Park

3.2 Investigating the Bold-shy continuum of the Freckled Hawkfish *Paracirrhites Forsteri* in relation to their growth over the past 3 years.

Introduction:

Within the wild there will always be those individuals of any species which show to make more high risk decisions, within their every day behaviour, whilst this may increase their chances of gaining a food source, it may also increase their chances of being predated on. On the other end of the spectrum are the individuals who show no willingness to take risks, and will retreat at the sign of any possible danger. In scientific terms this is commonly referred to as, the bold-shy continuum (Ionone, et al, 2008). The behaviour may vary with the presence of predators against the presence of food which may alter how bold or shy the individual is, this is a common behaviour found in many fish species. Boldness (aggressive) may show to give individuals an advantage when competing for food, mates and territory however this behaviour may increase the chance of being caught by predators (Ruiz-Gomez & Hungtingford, 2012). Shy (non-aggressive) fish in comparison may show higher rate of predator avoidance and thus are less likely to be caught (Ruiz-Gomez & Hungtingford, 2012). Lab studies have indicated a positive correlation with growth in relation to boldness and aggressive behaviour, almost in a positive feedback manner (Stamps & Judy 2007). This makes sense as more aggressive individuals will defend feeding territories with higher success, gaining a more productive feeding ground thus increasing growth rate, however it was also found that in correspondence with this, faster growing fish also indicated an increased level of risky behaviour (Stamps & Judy 2007). This is something which has had little research into as such a study would have to be conducted over a large time span, however as two years of past research is available on *Paracirrhites forsteri*, individuals within this study site, with thanks to previous expeditions in 2014 and 2015, a baseline for such a study is set. Through analysis of data from previous years, re-encountered fish during this investigation can be re-measured and weighed, and their increase in size related to their previously measured degree of boldness, giving an indication of how their degree of boldness has affected their growth and development in the past 2 years. Using GPS coordinates it may also be possible to identify any changes within the individuals' home ranges, over the years, possibly indicating increased boldness.

Commonly found associated with the reefs of the Indo-pacific and particularly common in the Red sea, Egypt, the Freckled Hawkfish *Paracirrhites forsteri* is a tropical, carnivorous fish, known to be very territorial, whilst also being of a sedentary nature (Lieske, Fiedler, & Myres, 2004). The hawkfish species are commonly found among or on branches of coral, where they wait stationary for possible prey species such as smaller fish and crustaceans to pass within range, before they strike. This behaviour also gives these fish an advantageous option to retreat and hide under/within the substrate when startled or under threat from a predator. With the feeding strategy of these fish involving little to no movement until the time of striking their prey, they make an easy species for observational studies such as this one (Cameron, Alwany, & Bailey, 2012).

Aims:

Following on from previous expedition studies it is aimed to identify what variable distances the hawkfish will respond within to an approaching potential predator, whilst also investigating whether the individual size of *P. forsteri* has an influence on individual bold-shy behaviour, however on individuals which are re-encountered from previous years, it is aimed to investigate how their previously identified degree of boldness has impacted their growth. We can also see whether we are more or less likely to find bold or shy hawkfish. Then any disappearances would need to be due to emigration or mortality.

Methodology:

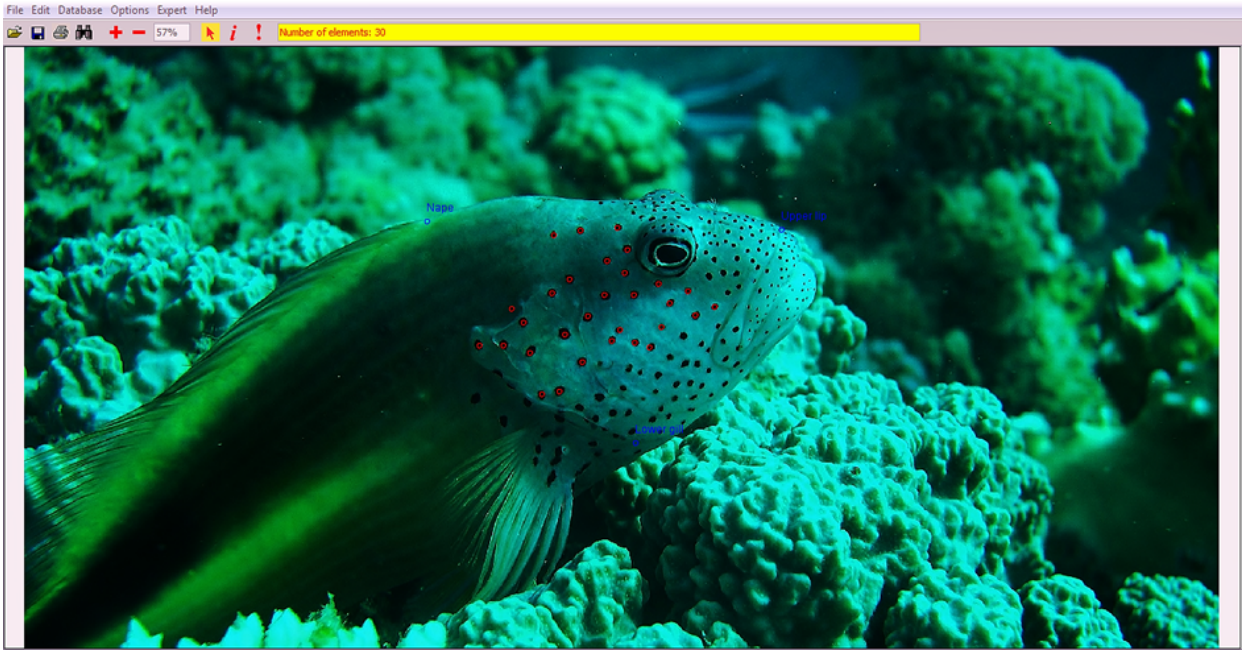
A minimum of two divers and one additional shore cover will be required to collect the data for this project, it will likely encompass three to four shallow dives (15m maximum depth) of up to 45 minutes per day, three days a week on the house reef Abu Sautir (26°06′14″N 34°16′52″E). Using a diver operated stereo video, the divers will work along pre- selected transect lines with the lead diver acting as the spotter whilst also operating the stereo camera. On an encounter with a resting hawkfish the lead diver will approach and begin recording at a distance of 2m (optimum calibration distance) until the fish retreats. Meanwhile the support diver will note the time, depth and video number on a diving slate. Once the recording is complete the support diver will then pass a diving reel with attached surface buoy and GPS tracker to the lead diver who will remain at the position the fish was first spotted. The support diver will then move to the fishes new position and take still photographs of the left and right sides of the individual and record the photo numbers to be used for both geo-tagging and photo ID purposes. The dive sites used in this study will mirror that of previous expedition sites as to increase the likeliness of re-encounters with fish from previous years. Four dive sites will be used, two of which are low level impact of diving; two of which are high level impact dive, as was conducted in 2014.

Each diving day will be followed by a lab based day where write up and data analysis can be undertaken while also allowing ample time for rest and recovery before helping with other projects. Data collection will be completed over six weeks exclusive of a short pilot study. On analysis of the stereo video footage we will be able to estimate the distance the diver was from the hawkfish before the fish retreats and hides amongst the substrate it was resting on. The size (length-weight) of the individual can also be estimated. By using a GPS attached to a surface marker buoy it will be possible to make a map of the coordinates of each individual hawkfish. Compiling this data with the video and photo number along with depth and time for each individual will allow for accurate identification and a rough estimate of home range, along with an indication of their degree of boldness.

Upon completion of each dive, all information will be transferred from diving slates to a field note book before being entered in to an excel spreadsheet. The still photographs

can be analysed with I3S identification software in the field. This will also allow for identification of re-encountered fish individuals between each year. Each analysed photograph will be synced to the GPS tracker allowing for latitudes and longitudes to be recorded and a geo-tagging map to be compiled displaying home ranges for individual fish. All video from the stereo camera will be stored and backed up on two external hard drives ready to be analysed on return to the University with SeaGIS Event Measure software. A calibration exercise will be undertaken before departing and if necessary again on return to allow for accurate measurements of alert and flight distance while also offering size measurements for each individual fish recorded.

Following on from the previous years of study in the 2014 and 2015 projects this project will endeavour to build on the existing data set through the addition of GPS coordinates and structured variation to dive and subsequent encounter time. With a number of individuals identified in the previous years, the chance of re-encountered fish is high, this means that previous data can be compared with the data collected within this project and on analysis will allow for identification of any changes in size and degree of boldness within the individual, over the past 2 years. Due to further refinement to the data collection methods over the years it may also allow for the addition of a other study sites to be used if time and resources will allow.



Freckled Hawk fish, while using I3S Identification software
(Over 57 individuals identified in last 2 years).

3.3 Investigating wave exposure on *Scleractinian* Coral distribution and species diversity in the El Quseir, Red Sea.

Introduction:

Scleractinian Coral, also known as stony or hard corals (Wilkinson, 2008) are the back bone to tropical reefs. Over millennia, this tiny calcium carbonated animal has the potential to create an environment visible from space (Kaiser, et al., 2011). Fundamentally coral reefs support some of the most biodiverse and productive marine environments on the planet. 25% of all marine species inhabit this complex environment despite coral reefs only occupying less than 1% of the global oceans. This condensed concentration of life, labels coral reefs as the 'rainforest of the sea' (Burke, et al., 2011). These ancient biological structures are, however, in decline. Over the past 20 years over 25% of the planet's coral reefs have been lost, with a predicted 60% to be lost by 2024, mainly due to global climate change (Burke, et al., 2011).
Despite their hardy calcium-based skeleton, Scleractinian Corals are in a constant battle between reef developmental processes and the oceanic physical environment. The role of wave exposure is one such process that is well established as a major contributor to coral reef distribution (Sheppard, 1982). Waves directly affect corals distribution via damage, but also indirectly by altering temperature, light intensity, nutrient intake and overall productivity (Dennison & Barnes, 1988) - partly effecting the zonation of corals (Kaiser, et al., 2011). With sea levels predicted to rise by 1 meter within the next century (Hansen, 2007) and with a changing climate, coral reefs bear the brunt of increasing exposure to more and more powerful waves. With this looming threat it is crucial to gain a greater understanding of the effect waves have on coral communities.

Aim:

This study aims to investigate the influence of wave exposure on coral distribution and species richness in and around the El Quseir area.

Methodology:

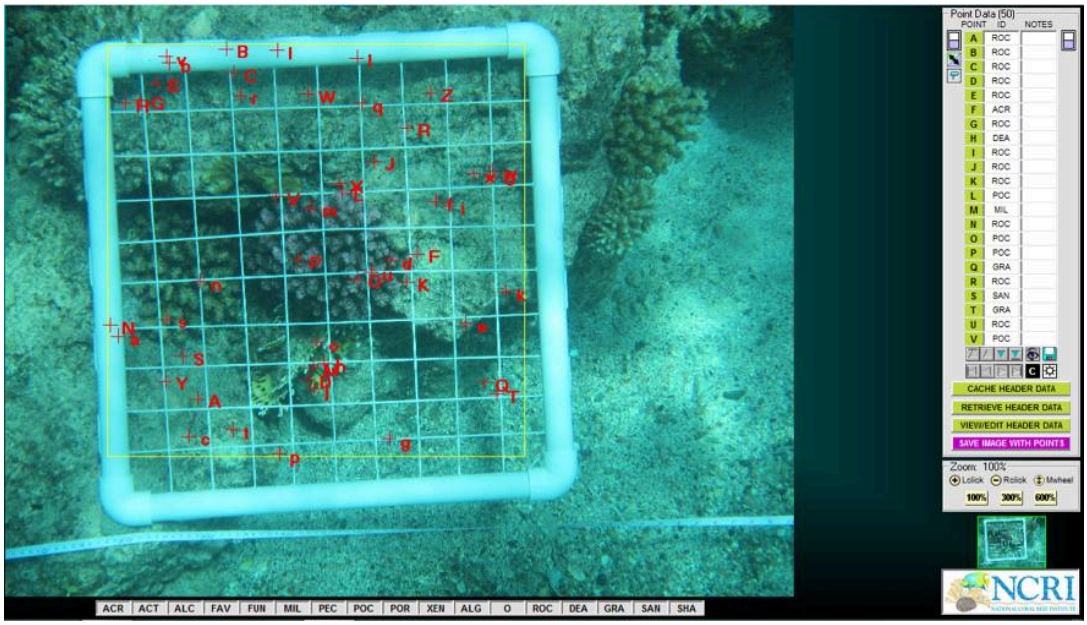
For study area selection, pre-survey dives and snorkels will areas of varying wave exposure around the North and South of the Abu Sautir reef. GPS data logging will be carried out to mark the latitude and longitude of the start and finishing points of each transect, and to be used in accordance to wave exposure, fetch calculations, coral distribution and structural complexity.

A two diver buddy team will set out from the dive entry point and head towards a marked, pre-surveyed 50m site along the reef's crest. 10 short 5m transects will be set out consecutively following the reef crest, with each transect bearing taken with a compass. Each transect will have 4 points at 1m intervals for a $0.5m^2$ quadrate to be placed. Time, depth and temperature at each quadrat will be recorded from a dive computer, with a compass bearing that will be noted on a dive slate and used for wave exposure calculations. Three photographs will then be taken (the best of which will be analysed using CPCe software to calculate coral distribution and relative species abundance).

After the photographs are taken a rugosity measurement (small-scale variations of amplitude in the height of a surface) will be carried out to determine the structural complexity of the reef, as structural complexity often reflects disturbance and stress (Fuad, 2010). Rugosity will be measured by carefully laying a 1m long rope (with 10 knots at 10cm intervals) horizontally across the quadrat at 3 evenly distributed 16cm intervals, following the contours of the reef. The horizontal distance covered by the rope that follows the reefs contours (*d*) is recorded on a dive slate. A rugosity index (C=1-d/l) will be calculated in the lab by comparing the average *d* values for each quadrat to the distance of the fully extended rope (l). This process will be repeated at 3 depths ranges, 0-5m, 10-15m and 10-15m at each 50m site.

The investigation will be carried on both the North and South sides of the reef and will be replicated a minimum of 3 times. Total exposure of a site will be calculated by measuring Wave exposure and Fetch. Wave exposure will be determined by the recorded compass bearings from a set point (quadrats) to obtain an angle of incidence of open water to the next piece of intersecting land. This measurement will work under the presumption that greater the angle the greater the exposure, and will be carried out using compass bearings, OS maps and GPS coordinates and calculated with trigonometry back in the lab.

Fetch (the distance wind blows over open water, generating waves) will be quantified on the reasoning, the longer the distance over which the wind blows without encountering obstructions and the stronger the wind, the larger the waves can develop and therefore the higher the exposure. Under this pretence, daily metrological data of the prevailing North Easterly wind will be recorded and compared with the calculated distance between nearest land to the set point. This data will be used in accordance with the Shore Protection Manual (Engineers, 1984).



Quadrat displaying some *scleractinian* coral diversity, (during analysis of data on previous expedition)

3.4 Quantifying fish community structure at varying depths in Abu Sauatir

Introduction:

Mesophotic Coral Ecosystems (MCEs) are light-dependent ecosystems between 30-150m that are buffered from a number of the human and natural threats that shallower coral ecosystems face, while retaining connectivity to the shallower ecosystems. Due to recent technological advances in marine surveying, our understanding of these MCEs has begun to develop, particularly with respect to changes in fish community composition with depth (Bejarano, Appeldoorn & Nemeth 2014; Bridge et al. 2011; Bryan et al. 2013). One particularly interesting facet of MCEs is their potential to act as refugia for shallow reef fish taxa and a source of larvae- referred to as the 'deep reef refugia hypothesis' (DRRH) (Bongaerts et al. 2010).

Kahng, Copus & Wagner (2014) and Kane, Kosaki & Wagner (2014) described increased depth ranges for shallow taxa and both high diversity and endemism of fish species at MCEs. However, despite their potential ecological importance, MCEs remain an understudied reef habitat (Kahng et al. 2010). As shallow coral reef ecosystems are degraded by direct and indirect anthropogenic influence, it becomes imperative to consider ecosystem management that accounts for the connectivity between shallow and deeper reefs (Bridge et al. 2013).

Surveying marine ecosystems at a range of depths can be a costly and time-consuming endeavour, often requiring extensive scientific diving hours. Alternatively, a variety of drop video camera methods have previously been applied to marine ecological research, providing valuable visual data while circumventing the need for a large number of scientific dives (Easton et al. 2015; Williams & Leach 1999; Willis & Babcock 2000). While camera drops are limited by their fixed visual frame, they provide a sampling method with low impact on fish activities, and footage that can be analysed by computer software and reused by various interested parties (Boom et al. 2014). By dropping a stereo video camera we can use emergent computer software to calculate highly accurate individual fish sizes from the stereoscopic footage, resulting in versatile data to quantify coral reef fish community composition across varying depths.

Intensive or improperly managed SCUBA diving tourism can result in degradation of the coral reef ecosystem (Zakai & Chadwick-Furman 2002), which against the backdrop of a worldwide trend of increasing reef degradation (Pandolfi et al. 2003) highlights the need for fine-scale study of the fish communities at different depths within these imperiled habitats.

The Roots Red Sea camp's house reef, Abu Sauatir (26°06'14"N 34°16'52"E), is a popular dive site among tourists due to its ease of access and biodiversity. However, this site is sparsely mentioned in scientific literature, with no published survey of its fish communities. By studying fish community structure across a range of depths (including MCEs) on the Abu Sauatir coral reef, we will provide useful baseline data for ecosystem management, as well as further context for the future study of MCE fish communities.

Aims:

To quantify and compare coral reef fish community structure at varying depths in the Abu Sautir coral reefs.

Methodology:

Initially, our drop sites will follow the reef contour at Abu Sauatir (26°06'14"N 34°16'52"E), with all drops made in the depth range of 20 to 60 metres. Data collection will be carried out on two days per week, across the six week length of the expedition. On each data collection day we will moor an RIB containing our equipment to a buoy- an anchor will not be used, to avoid structural damage to the reef. A raft will be used to transfer equipment from the shore at Abu Sauatir to the RIB, which is then left with the mooring buoy. Camera drops are then performed from the RIB.

The RIB will be driven by a trained powerboat operator from Pharaoh Dive Club, with full safety equipment onboard and radio contact with the shore. In case of emergency, an expedition team member with a powerboat license will always be present on deck.

One team member will lower the drop video camera rig, while the other uses a GPS tracker to record the GPS coordinates of the drop site. The drop video camera rig consists of an unbaited stereo video camera and depth gauge, rigged with a 2kg weight below and a buoy above, on an 80 metre line. Once this camera has been lowered, a waiting period of two minutes begins, allowing any disturbed seafloor sediment to settle and for fish to acclimatise to the camera's presence if necessary. After this initial two minutes, the camera is left to record for a further five minutes; providing the footage to be analysed. The camera is then retrieved, hauled out onto the deck, and the team proceed in the RIB to the next drop site.

The five minute videos will be reviewed preliminarily after each boat day to identify any immediate problems necessitating drop repeats (based on GPS coordinates), such as an obstructed frame. During days off from data collection, each drop site's footage will be used to identify every fish to the lowest possible taxon, providing the initial fish species count and depth data. Upon returning to Glasgow we will used SeaGIS EventMeasure software to determine individual fish lengths from the stereo video files, from which we can use publicly available length-weight relationship data to estimate community biomass at each drop site.

Time and budget permitting, we can extend this study from the house reef of Abu Sauatir to uncharted reefs in the surrounding area, facilitating comparison between the fish communities at various depths in Abu Sauatir (a recreational dive site) to those in untouched reef systems- with a focus on MCEs.

4. Public outreach

Previous expeditions have been involved in outreach with a school in El Quseir, we will be returning there to teach the kids why the coral reef is so important. We are also aiming to increase our presence on the internet as much as we can through blogs, Facebook and Twitter whilst we are out in Egypt but also before with all the important work we will be doing beforehand.

4.1. Outreach with school

Starting in 2014 the University of Glasgow Egypt expedition began working with the Baladna Language Kindergarten in El Quseir, the 2015 expedition continued this and so will we as the 2016 expedition. The school is in partnership with NGOs Roaya and SEAS, and is heavily involved in environmental projects. The school is also often involved with HEPCA. Through Roaya and SEAS, the school hosts environmental events and classes, teaching children how important the environment is and what they can do to take care of it. They also host 3 day "camps" in collaboration with the Keep Quesir Beautiful (KQB) project, where volunteers spend 3 days in a chosen area cleaning up, adding trash bins, and hanging posters emphasizing the importance of keeping the environment clean. We will also be meeting with the founders of SEAS, Roaya, and KQB Suzanna Aprille Valle and Ali Sayed to plan classes and organize events with the students.

Our aim is to teach the students at the school, from ages 8-18, why the coral reefs so near to them is important and what they can do to aid in their survival. To get to the school we will be travelling to El Quseir with private transport organised by Pharaoh Dive centre.

Whilst visiting, we plan on giving talks about marine ecosystems, their importance and why they need to be conserved. Reduction of marine debris and littering is one important way of conserving corals so this is something we will focus on in our presentations. Rather than giving one talk to the whole school, we will be talking to multiple age groups, this gives us the opportunity to tailor the presentations to make sure it is interesting and appropriate for all ages so we can provide the best learning experience.

Getting the students involved is the key to them learning and absorbing information, so in a workshop we will get them to produce posters on how to conserve coral with the knowledge they have learnt from us. We also plan on taking them out for a beach clean-up trip to show the students how something as simple as picking up litter can help in conservation and how they can all make a difference.

These students could potentially be a future generation of scientists and so drawing their attention to conservation at an early age is a great idea. They will also grow up in the area and by changing their attitude towards coral reefs now, it would hopefully in the long run have an impact on coral conservation in the years to come

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Talk given to Baladna Language School during 2014 expedition

4.2. Online and Social Media

We have a website established from previous expeditions (http://www.gu-egypt-expedition.co.uk/) where we will be doing weekly updates of what we're getting up to and we will also be running a blog on the page. The title cover picture is currently from the 2015 expedition but this will be updated shortly.
Twitter is a great way of spreading news to a wide audience and so we have a twitter page (https://twitter.com/guegypt) with which we post "tweets" about our fundraising efforts and pictures of the events.
Our Facebook page (https://www.facebook.com/GUEgypt2013/) currently has over 600 likes and is gaining more weekly, we will again be posting statuses about events and information that is relevant.

5. Personnel

5.1. Local Counterparts

This year we will be working in close coordination with many local counterparts. One vital contact is Muhammad Negm from the EEAA (Egypt Environmental Affairs Agency). They focus on defining environmental policies, setting priorities and implementing initiatives within a context of sustainable development. Working with this contact will provide us with in depth knowledge of the Red Sea while helping us to manage projects

accordingly. We can also contribute back by allowing them to observe any trends or impacts we find within our own data which may indicate changes within the environment. We will also be working closely with our existing links to the local NGO, both Suzanna Aprille Valle and Ali Sayed, who are also founders of SEAS, ROYAA and KQB. SEAS has the primary focus of bringing awareness to the residents of the Red Sea on environmental issues, while Keep Quseir Beautiful (KQB) a developed community volunteer project has similar aims to organize community cleanups, and support efforts through festivals and various children activities. We feel we can definitely contribute to such aims through our planned outreach projects, especially with Ali and Suzanna being our primary link to the "kindergarden" called the KG which is for children/teens aged 8-18 and local schools. Working along with KG we will engage with the children in beach clean ups, facilitate workshops and promote our research and environmental awareness especially with regards to marine litter in accordance with Suzanna and Ali's own work through SEAS and ROYAA and KQB. In past expeditions we have helped ROYAA through handing out food packages to underprivileged people during Ramadan. They are also known to take food to the Bedouin in Wadi el Gemal during Ramadan, it is likely a plan to get involved could easily be set up, especially with one of our project being conducted within the area of Wadi el Gamal. Ali will also liase with us and help with logistics and provide contacts in Wadi el Gemal as well as helping to make arrangements and provide permissions alongside our EEAA contact Muhammad Negm. With their broad skill set, local knowledge and excellent English, both Ali and Suzanna are important contacts to be in cooperation with. They also have contacts at HEPCA and during the 2014 expedition managed to arrange for two team members to accompany HEPCA members, Suzanna and a PHD researcher on board a live aboard to undertake dolphin surveys for 4 days, something which gave an added bonus to our students, improving their skill set and experience within a completely different field of research. Other notable contacts include Dr. Magdy El-Alwany, one of our contacts at Suez University; she will also be available to ask for advice during the planning stages.

5.2 Academic Advisors

Dr David Bailey is a marine biologist, his research group work in all marine environments from Antarctica to coral reefs, and around Scotland. The main theme is the conservation and management of marine systems and he also has a long-standing interest in deep-water biology.
His work has involved basic studies of the physiological characteristics and behaviour of deep-water fish, but most recently has focused on how fish are distributed and how this has changed overtime. He has helped show how fishing impacts spread deep into the oceans, but also that fish communities in deep-water systems can change quite dramatically due to natural variations in climate.

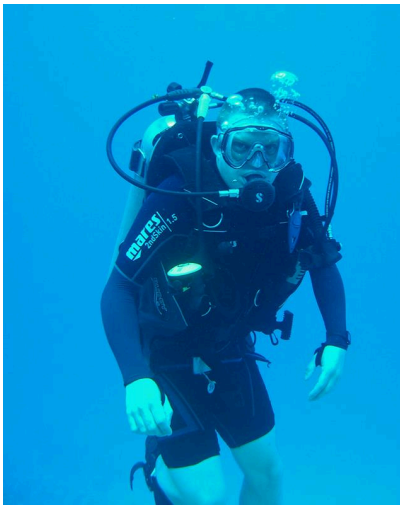
Dr Nicholas A. Kamenos is a senior Lecturer in the School of Geographical and Earth Sciences; School of Life Sciences University of Glasgow.

His primary research focuses on how resources obtained from the ocean have been altered by the synergy between natural and anthropogenic changes and in that respect establishing the extent of global climate change.

The Broad categories of Dr.Kamenos studies fall under four directives: Global Change and Marine Ecosystems; Investigation of the Relationships between Global Change and Marine Ecosystems; The Impacts of Fisheries and the Expected Response of Changing Marine Ecosystems; Climatic and Ecological Proxies for the Holocene Development of Ultra-High Resolution Palaeo-climatic and Palaeo-ecological Proxies for the Holocene Period.

Deborah McNeill is the head of public engagement in STEM (Technology and Science Alliance), which focuses on science outreach in the community by organizing festivals, developing science centres, and hosting career fairs. She has recently been elected to the Exploration Society Council and has a wealth of experience of student lead expeditions from her time as an undergraduate and from advising the previous three Egypt expeditions. For the last five years she has been a demonstrator for Glasgow University's 4th year tropical marine biology field course in Egypt. She is also the dive coordinator for the university sub-aqua club and has extensive diving experience.

5.3 Student advisors



Guy Henderson was a founding member of the 2013 expedition and leader of Egypt 2014 and 2015. This year he has offered to share his knowledge and expertise with the current team. His local knowledge and good working relationship with our local counterparts will ensure a smooth transition while also allowing the team to hit the ground running. Guy is currently in his final year of a marine freshwater biology degree, and is looking forward to joining the team in the field for the first couple of weeks of the expedition to facilitate training and help the team settle in before undertaking pilot studies and refining experimental design.

5.4. Expedition Team Members

The expedition is composed of seven undergraduate students and three postgraduates from the University of Glasgow. All have prior travelling and fieldwork experience, although not all necessarily with the Glasgow Exploration Society. The team from Glasgow will work with Egyptian students and biologists who have local expertise.

Expedition Member: Cassandra Zinkievich (24) 5th MRes Ecology and Environmental Biology
Role: Expedition Team Leader (Researcher & Public outreach)

The Egypt 2016 expedition will be Cassandra's first expedition to Egypt. She has extensive field work experience however, participating in multiple research projects in the Gulf of Mexico studying mangrove health, coral reef studies in the Florida Keys, population surveys and tagging of sharks and cetaceans in South Africa, and shark behaviour projects in Fiji.

This has given her experience in valuable skills such as research diving, running a research vessel, fish identification, and data collection. She is looking forward to using these skills in Egypt, as well as gaining further experience that will help her pursue a career in biology. Cassandra is especially excited to work on the research in Wadi El Gamal studying marine protected areas, as she has a special interest in marine conservation. She is a qualified PADI Advanced Open Water Diver, and is looking forward to expanding her diving skills in the upcoming year. She will be undertaking training to become a sports diver, which will teach skills such as rescuing a distressed diver, planning dive trips, and performing basic life support.

Expedition Member: Kyle MacLaren (21) 3rd year Bsc Marine & Freshwater Biology
Role: Expedition Team Leader (researcher & logistics)

The Egypt expedition 2016 will be Kyle's second expedition, after visiting Trinidad for 12 weeks last summer where he helped on a wide variety of research projects involving turtles and frogs. However this will be Kyle's first experience of a marine research expedition, as well as his first experience of leading an expedition. Through the years and particularly on his expedition last year, Kyle has acquired many skills related to field research, team work, and fundraising, which together make him an ideal candidate for leading this year's expedition. As a marine biology student, Kyle is ecstatic to be involved in a marine based expedition, where he hopes to gain much experience

in scientific diving, something which will be sure to link with possible career choices in the future. Having read previous project reports, Kyle is also excited to be leading one of the research projects on the bold- shy continuum in hawkfish, which he hopes to link and expand on from previous years. He also looks forward to working on other projects, gaining experience from each, as well as cooperating with the rest of this year's team, who have linked together well.

Having been a member of an expedition before he has encountered many challenges and learning the qualities and skills he requires to be a cooperative and overall good leader, he knows the role comes with much responsibility and is one filled with many obstacles, but looks forward to the overcoming these with his enthusiastic co leader, who can help share the workload and organization. For Kyle, this expedition will allow him to expand on skills within his scientific career, whilst also giving him a chance to increase both his leadership and team qualities.

Elliot Smith (22) 1st year postgraduate Ecology and Environmental Biology MRes
Role: Researcher & Expedition Treasurer

Egypt expedition 2016 will be Elliot's first research trip to Egypt. Previously he has been on a field trip with the University of Exeter to the Cape Eleuthera Institute in the Bahamas where he learnt skills which will be utilised again in Egypt. As a treasurer of a society for two years during his time with Exeter University, he is an ideal candidate to take the role of treasurer for the expedition. He is looking forward to get the chance to go to El Quesir with a great team of nine other students. He is particularly excited to get the chance to collect data for the project in Wadi El Gemal, a national park with no-take zones which have had very little research done within them. He and the other MRes students will be gathering data on size and abundancy of fish to determine if the no-take zones have had any influence since establishment in 2003. It is an ambitious project but the work is important and currently unknown, making it all the more interesting. Elliot has the qualification of BSAC Ocean Diver, but will progress to Sports Diver before the expedition heads out. He currently has no history of research diving, but is keen to get to Egypt and start gaining the experience which will be very valuable to him in future years to come. Elliot will be the treasurer for the expedition and so will be responsible for handling the money generated through grants and fundraising. Previously working on a committee and taking part in sports such as gig rowing, Elliot works very well in a team and will put in his full effort and do what he can for the other expedition members.

Expedition Member: Georgia Dyer 3rd Year BSc Physiology
Role: Secretary and Fundraising co-ordinator

From a scientific background and a keen interest in marine and aquatic ecosystems, Georgia is thrilled with the prospect of undertaking 6 weeks of research and conservation techniques in El Quseir. Having previously held roles as chair of the senior council and house captain and currently an Honours class representative, affiliated member of the Physiological Society and training for the brain injury association Headway; Georgia has the skills necessary to make her an ideal secretary and key member of the Egypt 2015 team.

Having carried out previous voluntary work in an orphanage in Sri Lanka and lived with a Sinhalese family, Georgia has experienced living and working in a country hugely different from her own. A keen traveller, she relishes the opportunity to experience a new place and culture. Equally, from previous travels she knows of the various issues that can arise unexpectedly; however, is confident in the team's ability to cooperate, support one another, and overcome any challenges faced. Georgia's main interests lie in outdoor activities such as skiing and rock climbing; as well as having climbed mountains in Scotland, Mount Sri Pada in Sri Lanka and the Urubamba Valley in Peru. From mountains to marine, scuba diving is something she has always wanted to do, and she is thrilled with the opportunity to progress through the qualifications and gain some invaluable scientific diving experience whilst in Egypt.

Georgia has been involved with a lot of fundraising previously, particularly from volunteering in a local youth centre and organising school events. Fundraising is what makes this expedition possible and as fundraising co-ordinator Georgia recognises the amount of fundraising that will be organised, and innovative ideas needed for which. Georgia is particularly excited about working in such a small team on the various research projects and learning to dive- opening up the aquatic world for discovery.

Expedition Member: Leo Jhaveri, Year 1 BSc Hons Zoology
Role: Dive Officer and research assistant

As Leo's first expedition with the university and formal research trip he is thrilled to be part of Egypt Expedition 2016. He looks forward to gaining hand-on research experience and learning and sharing knowledge from more experienced team members and others we will be collaborating with on site. Leo is extremely grateful for having this opportunity offered to him this early in his career. Leo pays good attention

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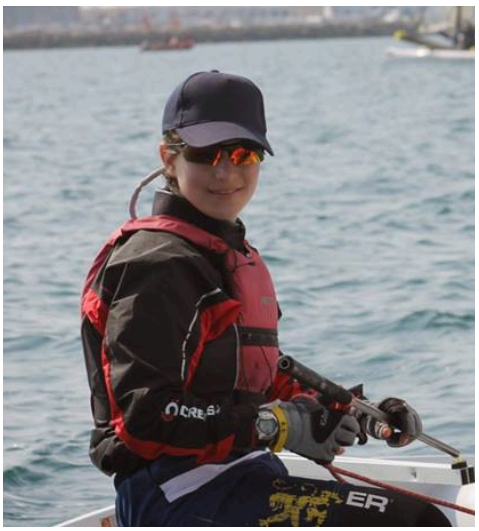
to accuracy and detail in all that he encounters. Previous projects, courses, and work have provided him with well developed collaborative and teaching skills, as well as, the importance of personal commitment and joint efforts.
As dive officer, he will be in charge of overseeing dive safety of the group. Having correctly functioning dive equipment and practicing safe diving is essential for the success of the expedition. With over 7 years of diving in a wide range of conditions, experience of teaching the sport while working at a dive center, and familiarity with general dive center/shop procedures, Leo is well prepared to fulfill this role. He is thrilled to be allowed to combine his dive knowledge to effective scientific use. Fundraising and other tasks in preparation will also be tasks for Leo prior to the trip. Leo aims with enthusiasm for a career in conservation biology of high sensitivity species and ecosystems, both terrestrial and marine.

Expedition Member: Kristopher Carrigan, Year 3 Marine & Freshwater Biology
Role: Researcher and small grant applications

The 2016 Egypt expedition will be Kris's 1st adventure into professional marine biology. Ever since Kris first witnessed a BBC documentary The Blue Planet when he was 4, his interest in the oceans was sparked. When he was 7, the drive to be a part of something aspiring and to shine light on the great unknown of our oceans has been his dream. That spark has fundamentally led Kris to study marine and freshwater biology. The ability and possibility to travel the world in search of answers of the oceans depths to him is the Holy Grail, and that possibility has shaped Kris by creating a thirst for adventure.
During his years of studying, he has developed a fascination for coral, in particularly the relation coral has for the tropical marine environment habitat. Therefore during the expedition, Kris will conduct research into this area. The responsibility and experience of conducting a research project, along with the opportunity to contribute to science is an experience of a life time that will help develop the skills and techniques needed for his career in marine science.

Rachel Mawer (17) 1st Year Bsc Marine and Freshwater Biology Student
Role: Public Outreach and Media



The 2016 Egypt expedition will be Rachel's first research trip and she is very excited to be able to have this opportunity. She is looking forward to gaining valuable experience on this trip and being able to learn from the more experienced team members.
As a keen sailor since she was 7, Rachel has a lot of experience with working on and near the water

which she hopes will come in useful during the expedition. Furthermore, it has provided her with many useful skills and attributes such as being able to work well in a team, determination and motivation, and being able to quickly analyse data on the spot.
Having her RYA Powerboat level 2 qualification means that there is the possibility of diving in other parts of the reef that have been too far away for previous expeditions to reach.
Rachel recently gained her PADI open water course and is hoping to expand upon that before the expedition, as she is looking forwards to the prospect of scientific diving and hopes to take full advantage of this opportunity.
In terms of her role within the team, Rachel will be promoting the expedition on social media by posting updates and information regarding fundraising.
Rachel has been interested in marine life since she was young and she is hoping that this expedition will put her in good stead for the future.

Harry Allard (22) 1 year Ecology and Environmental Biology MRes
Role: Researcher & Scientific Coordinator

Egypt 2016 will be Harry Allard's first expedition to El Quseir, although his past experience of marine scientific research abroad has prepared him extensively for this role in coordinating the research side of the 2016 team's work.

With an extremely talented team of early career scientists and explorers and two highly qualified team leaders, Harry is looking forward to travelling to Egypt to collect data regarding the human attempts to protect marine biodiversity with legislative "marine protected areas", and the impacts of no-take zones upon the local fisheries within these protected areas.

With six different established marine protected areas in the Egyptian Red Sea, all containing no-take zones, Harry hopes to coordinate a major research project in the Wadi el Gemal-Hamata protected area. With this project, Harry hopes to utilise emerging scientific methods, such as the use of stereoscopic cameras, to quantify the effects of a no-take zone on the marine ecosystem, in a well-funded and well-staffed marine protected area. As Harry continues his scientific diving training, he is focused on exhaustive study of the literature surrounding marine protected areas around the world.

As the past study of Egypt's MPAs is lacking, Harry is particularly excited to work alongside other scientists in collecting novel data. This research will both be incredibly beneficial to the team members' careers and our overall understanding of marine resource management, and the effectiveness of marine conservation efforts.

Tinian Kou (17) 3rd Year Bsc Marine and Freshwater Biology Student
Role: Research Assistant and Small grant applications

This will be the first year that Tinian contributes to research projects running in Egypt through the University of Glasgow, but she has much experience. Having done coral reef monitoring at Hoga Island, Indonesia, with Operation Wallace (Opwall) Association during previous summer, she is thrilled to be part of projects within an aquatic ecosystem, and is especially interested in the aspect of anthropogenic impacts on tropical coral reef ecosystems. Since Egypt expedition has run related conservation projects over past few years, this will be a great chance for her to fulfill her interests and improve her scientific skills and knowledge.

Tinian is an open water diver under the qualification of NAUI with some scientific dive training by Opwall. Recently, she has attended the PADI sport dive course to advance, hoping that her skills can assist the team during their work. Apart from marine research, Tinian has experiences in young age education. In the past few years, she voluntarily involved herself in language education in churches and private language centres. These skills could allow her to help in local education, passing what she knows to the younger generation.

As a non-native European speaker, language and culture differences are always the most challenging part for Tinian. However, this does not, and will not, be a reason to stop her moving forward. Being one of the key players in the University's women volleyball team, Tinian has proved that she has an ability to cooperate with others from all over the world. She cannot wait to share her ideas and is looking forward to building great relationship with the whole team.

Expedition Member: Celine Goslinga (18), 1st Year Geography/Business & Management MA (SocSci)
Role: Dive officer and fundraiser co-ordinator

Egypt Expedition 2016

Celine Goslinga, an 18-year-old student from The Netherlands, is very enthusiastic to be involved with the 2016 Egypt Expedition. She is ambitious about traveling, exploration, photography and scuba diving. Unlike most of the other expedition members, she's not study zoology or marine biology. Instead she aspires to work in the field of sustainability and developmental aid. Celine realized this dream when she lived in Bali, Indonesia in 2014, and gained experience collaborating with NGO's and organizing charity events. Being encouraged by her Dive Master mother to give scuba diving a try, Celine has greatly enjoyed it since an early age: descending into open water for the first time on

the exotic British Virgin Island of Jost Van Dyke in 2007. She has been PADI Open Water certified since 2009 and became a Rescue Driver and Emergency First Responder in 2014. During the Egypt expedition Celine will take on the responsibility to look after team mates that are new to scuba diving, by reassuring their nerves and check on the fitness of their equipment as well as looking out for potential hazards and being preparing to intervene when risky situations may still occur.

In preparation of the expedition, Celine will mostly be involved with raising funds, as this is a skill she is eager to practice and develop. And whilst in Egypt, she will have the opportunity to improve techniques for accurate data-collection and field-research. These, she believes, will come in handy later on in her studies. In the mean time, Celine will be contributing to the expedition by documentation of trip through the media of blogging and photography, both of which she has come to be familiar with.

6. Training

In order to ensure the safety of the team and completion of data to a high standard, the team will undergo both dive training and first aid. Two members will be trained in first aid, which will be paid for by expedition funds, and the majority of the team will undergo dive training through the university. The entire team will also be trained to identify fish by family and Latin names, as well as identify coral species.

6.1. Dive Training in Glasgow

Although the majority of the team has diving experience, most of the team will be undertaking training from the Glasgow University Sub-Aqua (Scuba Diving) Club. All three master's students will participate in Sports Diver training through the club, improving not only their diving abilities but also rescue techniques and basic life support. The dive training aims to provide team members with the necessary skills to perform data collection underwater, such as line-transects and quadrats, as well as safely planning dives that require safety stops. The training will also cover both shore and boat dives, as both will occur on the expedition. This will ensure that we can maximise our research in Egypt as we will require less in-situ training, and each member will be confident and comfortable in the water.

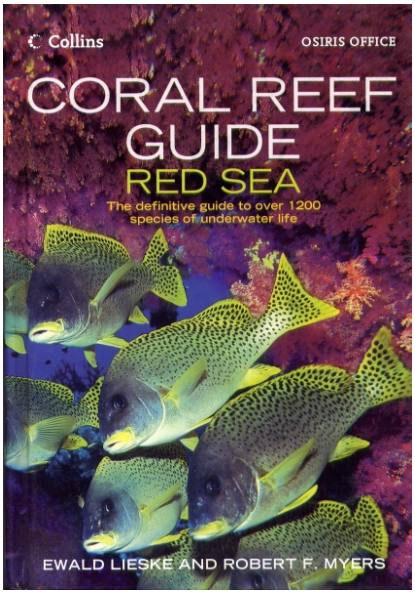
6.2. Dive Training in Egypt

The first week in Egypt will consist of refresher dives, project planning, and training. This will allow members to familiarise themselves with the area, and give them a chance to get accustomed to the diving conditions. There will be five team members with a Sports Diver certification, as well as three open water divers. The remaining members will spent the first week obtaining their open water certification, and will have the option to undertake sports diver qualification if they so please. This will ensure that there will always be qualified divers on hand to assist with the projects, increasing the safety of our dives and allowing all members to participate in dive-heavy projects.

6.3. Marine Theory Classes

In the months prior to departure, the team will participate in marine theory classes, training them to identify fish families, memorize Latin names, and identify coral species. This will be lead by the master's students and team leaders to ensure that all members have a working knowledge of any species they encounter. Members will be required to purchase the Harper Collins "Guide to Reef Fish" book that will also be brought on the

expedition. We will organize monthly quizzes to ensure that all members are keeping up to date with their identification skills.



Harper Collins book front cover

7. Logistics and Planning

7.1 Itinerary, Transport, and Accommodation

The team will travel from Manchester International Airport in early to mid-June (exact dates to be confirmed) to Hurghada via the cheapest flight option available. Once arriving we will travel to El Quseir by private taxi, organised by Roots Camp and Pharaoh Dive Club. This Camp will be the accommodation for the expedition as it has the Pharaoh Dive Centre and Open Ocean Science Centre within the premises; it is close to the dive sites; and it is a cost-effective option if purchased as a 'bed and bench' package including lab hire and local transport. The accommodation will be all inclusive due to the remote location and strenuous nature and long hours of the work undertaken.
Food will be cooked onsite by camp staff and will consist of three meals a day with unlimited soft drinks and water.

Transport to research

Sites which are further away will be organised by the Pharaoh Dive Club. The cost of accommodation, food and travel for all students will be covered by the expedition funds.

The itinerary is as follows:

Week One:
Day 1: Meet local counterparts; discuss expedition organisation and project planning.
Days 2-5: Dive and snorkel training and orientation; visit all dive sites on local reef that will be used in research.
Days 6-7: Carry out pilot study with counterparts; make required amendments to experimental design.
Weeks Two to Five:

Days 1-5: Fieldwork led by project supervisor and counterparts. Work 3-4 days on assigned project and spend 1-2 days assisting on others, to gain full experience of all projects.
Days 6 and 7: One day to account for bad weather, sickness etc. which can otherwise be used to sort and compile data. One day of rest on Sunday.

Week Six:
Days 1-5: Project work as in previous weeks - 33 research days in the field overall.
Days 6-7: Take inventory of equipment and make preparations for departure and a social gathering with local counterparts before returning to Glasgow or embarking on further travels around Egypt.

Following Weeks:
A report of the preliminary results will be compiled and ready for distribution one month after returning from Egypt.

7.2 Proposed Budget

Expected Income
Personal contribution: (10 x £1,000) £10,000
Personal fundraising: (10 x £300) £3,000
Group fundraising& Small Grants: £5,500
Grants: £10,000
Total: £28,500

Proposed Expenditure

Flights (10 students x £400):	£4,000
Accommodation at El Quesir (6 students x 45 days x £20 + 4 students x 25 days x 20):	£7,400
Accommodation at Wadi El Gamal (4 students x 20 days x 15): (Bed and bench fee, local transports)	£1,200
Daily food and water (10 students x 45 days x 15):	£6,750
Additional transport (rented cars and airport transfers):	£800
Diving equipment (5 students x 3 dive days x 6 weeks x £15):	£1,350
Research diving (6 students x 3 dive days x 4 weeks x £24):	£1,728
Scientific diving equipment (Cameras, GPS, Transect lines, Buoys, Camera mount):	£1,000
First aid kit:	£100
First aid Training:	£200
Pre-expedition costs (T-shirts, fundraising aids, research training etc.):	£900
Post-expedition costs: (Printing and postage of report):	£150
Contingency:	£1,000 approx
Total:	**£26,578**

* We have a large contingency and also hope to negotiate reduced prices with regards to research diving, accommodation and bench fees.

7.3 Safety Considerations/Risk Assessment

Health
All expedition members will have the recommended vaccinations prior to departure, and have been advised by a medical practitioner concerning diseases they may be at risk from in Egypt.

Known Disease Risk Precautions include;
- Diphtheria Vaccination mandatory.
- Hepatitis A/B Vaccinations mandatory.
- HIV/Aids Members will take the usual precautions, avoiding any contact with bodily
  Fluids, they will ensure a clean needle is used if an injection is needed.
- Rabies Vaccination recommended. Doctors/emergency services will be contacted in the event that a member of the team is bitten by an animal.
- Tetanus Vaccination mandatory. Necessary procedures undertaken when cut or scratched to avoid infection.
- Tuberculosis Vaccination mandatory.
- Typhoid Vaccination mandatory. Clean water available at research centre and bottled water used whilst camping and travelling.
- Typhus Areas of poor hygiene with insects and rodents will be avoided.

Nevertheless, this disease is curable with simple antibiotics.

All team members have completed a medical form listing any long term illnesses, medication
required and 'next of kin'/'emergency contact' details. Local hospitals are of a high standard as we are located within a tourist area. Travel to a hospital is relatively easy given our location.
There will be people on hand at all times to transport ill or injured individuals on a stretcher to the nearest road network.

7.4. Hazard and Safety Precautions Undertaken During Fieldwork

Post and Prior to Diving
Tides and weather conditions will be closely inspected before leaving for diving or snorkeling and these activities will only commence if the conditions permit. Any imminent change of conditions which could be considered adverse will result in dives being cancelled and a return to base.

The level of qualification for most students will be open water diver with four of the group qualified stress and rescue divers and one dive leader. The main compensatory measures for this will be depth and dive time restrictions, and that only simple tasks will be carried out.
Diving tasks will be progressive, starting with familiarization and building up to the scientific tasks as individuals develop their skills. Diving equipment used will be in a serviceable state and include an alternative air source (octopus), buoyancy compensator, dive timer (or watch and depth gauge) or dive computer, surface marker

buoy and cutting device. Regulators used must have been serviced within the year, and all equipment will be checked for function prior to diving.

An emergency plan will be in place before diving commences ensuring all team members are aware of how to summon assistance and how to locate medical assistance including hyperbaric medical cover and the provision of oxygen. No work diving may occur until the plan has been written and approved. Before diving, the students must carry out a buddy check. All dives must be logged in writing, including maximum depth, dive time, stops undertaken, environmental conditions and any problems encountered. A copy of these logs must be handed in to the project supervisor on return to Glasgow. All diving must be within the limits described by their diving qualifications.

During Diving

Students will provide shore cover whilst others are diving. Those providing shore cover must be in radio or telephone contact with the shore (confirmed by communications check), and one must be certified to provide First Aid and oxygen. The cover party must have first aid and oxygen administration equipment with them, radio/phone, flares and be aware of the emergency plan.

The maximum number of dives will be three per day if all are to a depth of less than 10m, and two per day if any one dive is greater than 10m. The maximum depth will be 18m (except in order to provide help to another diver in distress). No decompression diving will be permitted, and divers will ascend if their computer shows five minutes no-decompression time. The minimum surface interval will be two hours between dives. There will be no solo diving under any circumstances. A safety stop of two minutes between five and six metres will be carried out at the end of all dives unless unsafe to do so.

Dangerous and/or Venomous Organisms may be encountered (e.g. Lionfish). These animals are rare and will most likely not be encountered. Members will be briefed on the potential dangers posed and encouraged when diving or snorkeling to proceed with caution. Furthermore members will be instructed on how to act in the unlikely event that they encounter such an animal, by slowly swimming away.

Getting Lost

It will be unlikely that any team members will get lost as we will be working in locations near El Quseir. However, work will always be carried out in pairs or larger groups, and on first visiting unfamiliar areas we will work with locals. At least one member will have a mobile phone with the necessary contact numbers on it in the event of becoming lost. Members will also always carry water when leaving camp to avoid potential dehydration and loss of alertness, which may contribute to individuals loosing track of their location.

All team members will be made aware of the locations of the rest of the team at all times, and will be aware of their scheduled activities as well as their expected return times. If team members do not return when expected the remaining team members and staff will be alerted. If team members have still not returned an hour after the expected

time or are not back by dusk (whichever is earlier) a search team will be organised to follow the expected route of return until they meet the individuals in question.

First Aid
Five team members and all supporting staff in El Quseir will be First Aid trained, with some taking part in a first aid course run by Glasgow University Exploration Society. Others have advanced diving-specific qualifications which include similar training. In each team there will always be a field first aid kit with a larger medical kit available at camp.

Evacuation Plan
In the event of an emergency expedition members will perform any necessary first aid while contacting the local emergency services and if necessary, the local police. Other team members, staff and local counterparts will be informed as soon as possible and the necessary procedures taken. As previously mentioned, if the emergency is medical the affected individual will be taken straight to hospital or the doctor either by ambulance or private car. All team members will have full insurance which will cover accidents and emergencies. The British High Commission will be provided with details of names and dates of arrival and departure from the country.

Extreme Hot Weather
To avoid dehydration, we will ensure that all team members carry at least two litres of water with them when in the field. To avoid sun/heat stroke team members will be advised to wear a sun hat and apply high SPF sun cream, especially when travelling by boat. If weather conditions are deemed to be hazardous then appropriate action will be taken.

7.5. Potential Hazards Identified by FCO and Safety Precautions

The FCO currently offer no advice against travel to the Central Red sea coast, with the proposed destination of El Quseir, Hurghada Airport and all in country travel routes falling safely within designated green ‘safe’ areas. Campsites in Wadi El Gamal will be arranged with the Egyptian Environmental Affairs Agency.
To maintain the safety of all team members, pre-approved companies and drivers will be used when travelling to and from the Open Ocean Science Centre and Roots Camp. The centre will provide us with reputable drivers as well as organising larger transport using shuttle buses. This will also help us to avoid any potential accidents. The transportation to and from Wadi El Gamal will be provided and arranged by Ali Sayed of Pharaoh Dive Club to ensure safety.
The political situation will be monitored by expedition leaders and university staff by maintaining close contact with the staff at Roots Camp El Quseir and the Open Ocean Science Centre, as well as regularly checking the FCO website.
Furthermore should any changes to the political situation or the expedition occur this will result in all funding bodies and sponsors being promptly notified, and a change of location investigated further for possible implementation.

FCO travel advice as of 27th November 2014. El Quseir circled in red

Street Crime (Muggings and Thefts)
Members of the team will always travel in group, and will be vigilant with regards to their possessions. They will also be encouraged not to travel at night where this can be avoided. In the unlikely event of encountering crime, team members will be told to not offer any resistance, and will report the incident immediately to local police and insurance companies.

26°06′14″N 34°16′52″E

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