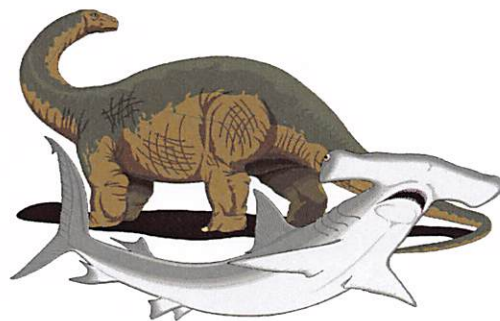


# EXERCISE JURASSIC SHARK 2

Guadalupe & Revillagigedo Islands

19 Oct - 07 Nov 08

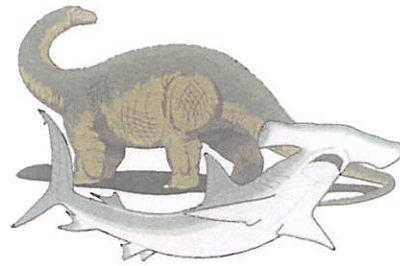


## POST EXERCISE REPORT



[www.jurassic-shark.org.uk](http://www.jurassic-shark.org.uk)

# EXERCISE JURASSIC SHARK 2 GUADALUPE & REVILLAGIGEDO ISLANDS, MEXICO 19 OCT - 07 NOV 08



*"Studying sharks in the wild can be difficult, not so much because they have sharp teeth, but also because they live in rather inaccessible places and often travel vast distances"*

Mark Carwardine, 2002<sup>1</sup>



Project endorsed by

**Royal  
Geographical  
Society**  
with IBG

Advancing geography  
and geographical learning



<sup>1</sup> From: Carwardine, M & Watterson, K., 2002 'The Shark Watcher's Handbook.'



# THE JOINT SERVICES SHARK TAGGING TEAM

*A force for good in marine conservation*

The Joint Services Shark Tagging Team (JSSTT) is a Tri-Service team of divers from the British Armed Forces. The team exists to provide manpower and resources for shark tagging and other marine conservation projects where diving skills are required. JSSTT expeditions operate under the Joint Services Adventurous Training scheme and are nicknamed EXERCISE JURASSIC SHARK. They are open to military and essential scientific personnel only. The team represents PRETOMA (a Costa Rican NGO specialising in shark and turtle conservation) in the UK and is sponsored by Selex Galileo.

The JSSTT has now tagged 35 sharks and placed 6 acoustic receivers in the Eastern Pacific with the aim of building an overall picture of shark movements in the across the Eastern Pacific Tropical Seascape and beyond. The first expedition, EXERCISE JURASSIC SHARK, tagged 15 hammerhead sharks off Cocos Island, Costa Rica in July 2006. The second expedition, EXERCISE JURASSIC SHARK 2, took place in October 2008 and tagged a further 20 sharks (including 10 great white sharks) off Guadalupe and the Revillagigedo Islands (Mexico).



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## **INTRODUCTION**

1. EXERCISE JURASSIC SHARK 2 was a Joint Services expedition to Guadalupe and the Revillagigedo Islands, off the Pacific coast of Mexico and was entirely based on board the live-aboard boat, *Sea Escape*. The aim was to electronically tag great white sharks, scalloped hammerhead sharks (*Sphryna lewini*) and whale sharks. As a military expedition it also aimed to develop the kind of leadership, teamwork, courage and co-operation that is vital to operational capability. Beyond that, EXERCISE JURASSIC SHARK 2 exposed military personnel to a unique conservation project and offered the opportunity to publicise the plight of shark populations in general. The tagging was carried out under the direction of researchers from - The Centro De Investigaciones Biologicas del Noroeste, S.C. (CiB), Mexico and the Centro Interdisciplinario de Ciencias Marinas (CICIMAR). The expedition had 'sponsored' status from the Joint Services Expedition Trust (JSET) and was approved by the Royal Geographical Society. The expedition was given final clearance on 15 September 2008.

## **AIM**

2. The original aim was to electronically tag 10 great white sharks, 10 scalloped hammerhead sharks and 2 whale sharks in order to provide evidence about both their movements and habits. The expedition ultimately tagged 10 great white sharks with radio tags at Guadalupe and 6 scalloped hammerhead sharks, 3 Galapagos sharks and a silver-tip shark in the Revillagigedo Islands. Tissue samples from 2 Giant Manta Rays were also taken. A total of 4 new radio receivers were deployed.

## **RESULTS**

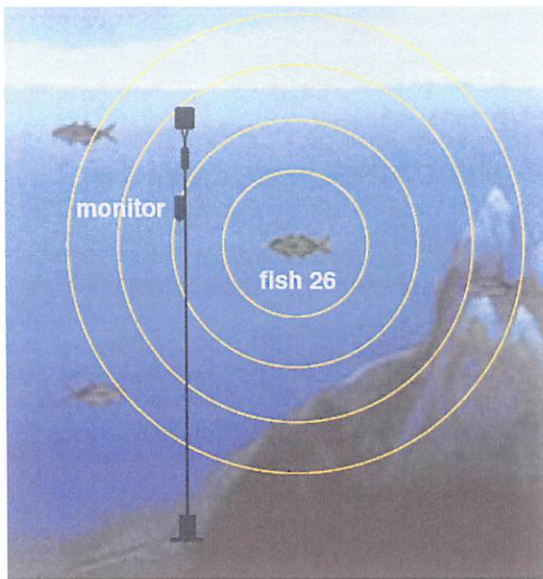
3. This expedition set out to put out tags and receivers for the first time. The receivers will be downloaded by our research partners on subsequent expeditions and data published accordingly. Research data from EXERCISE JURASSIC SHARK (Cocos Island 2006) will be published this year.

## **WHY IS SHARK RESEARCH IMPORTANT?**

4. Sharks are a vital component of marine ecosystems; as apex predators they control their prey populations: stabilising population fluctuations and removing diseased or genetically flawed individuals. Their disappearance can be extremely damaging. Nevertheless, sharks are being subjected to intense fishing pressure as a result of the high demand for shark fins and cartilage. Since many sharks travel long distances, crossing oceans and national boundaries, they are susceptible to the unregulated fishing efforts of multiple nations. Consequently, shark populations have plummeted worldwide to less than 30 percent of their numbers two decades ago. This decline, coupled with the slow reproductive rate of most sharks has meant that there is now considerable concern about the health of shark populations and an urgent need for effective conservation and management.

## METHODOLOGY

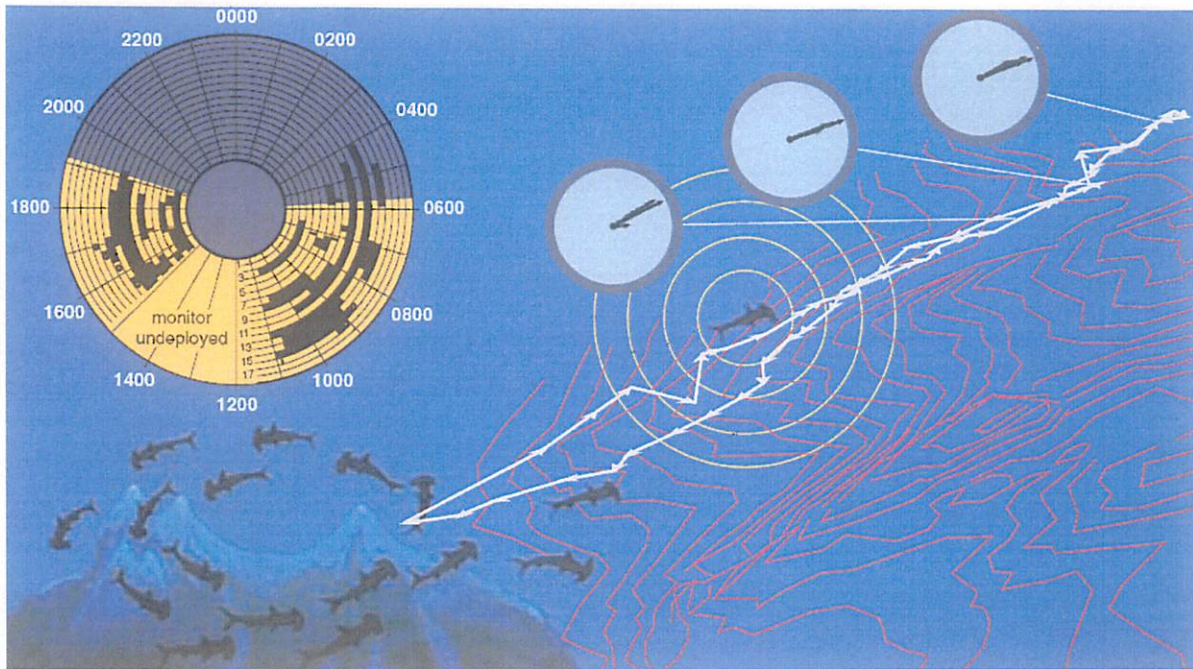
5. The hammerheads, Galapagos and silver-tip sharks were tagged while they are free swimming. Cleaning stations occupied by small yellow Barber Fish (a type of Butterfly Fish) were the key to the team's success. These stations are thought to be the main reason for increased shark activity around the islands. The sharks spend the night feeding in deep water and then come up to the cleaning stations during the day in order to have their parasites removed by these tenacious little fish. Divers wait for the hammerheads to swim into a cleaning station and then move in slowly to tag them using a spear gun. The sharks swim much more slowly and often roll over to one side while waiting to be cleaned. The sharks seemed to enter a trance-like state when they are at the cleaning station and generally reacted by simply swimming away (catching sharks to tag them, while being the traditional method, is very traumatic on the animal, and in some cases causes the shark to die). Closed and semi-closed circuit re-breathers were used by a proportion of the team in order to get as close to the sharks as possible. Great White sharks were tagged from the surface using a pole spear.



6. Besides the tags, the team also deployed two new radio receivers at different sites (Guadalupe, Socorro Island and Roca partida). These record the presence of a radio tag when the shark swims past; logging the comings and goings of a tagged shark as it moves around the island (see diagram below). Of the 15 tagged sharks, 10 were tagged with radio tags and 5 with satellite tags. The satellite tags are designed to read the temperature, depth and approximate location experienced by the shark every 1 to 6 minutes for periods up to 120 days. They then release themselves from the shark and download this information to a satellite. The radio receivers give us information about the sharks in relation to specific sites, whereas the satellite tags will ultimately give us an indication of where they go to feed and breed.

*Above: The radio tag transmits a unique electronic signature that is picked up and logged by the receiver as the shark swims past. Below: Hammerhead sharks at other sites have been found to depart at dusk and return before dawn. They return using the same precise route (as illustrated by the linked arrows). It is thought that they follow geomagnetic signatures (red lines). From: Klimley, A.P., Richert, J.E. and Jorgensen, S. J., 2005 'The Home of Blue Water Fish' American Scientist 93: 42-49.*





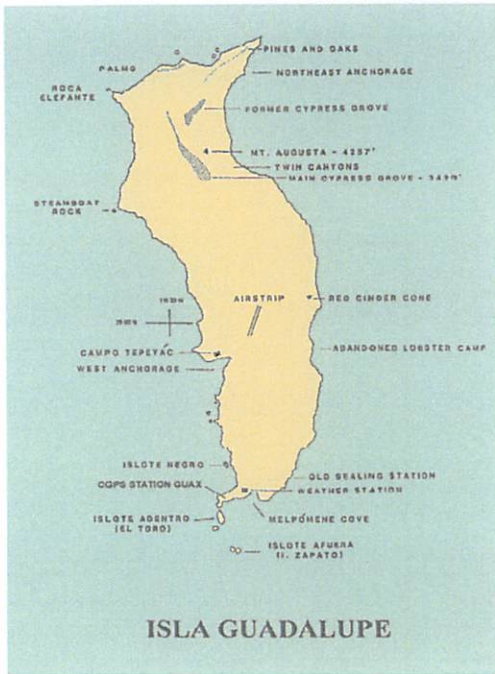
## DIVE LOCATIONS

7. **Guadalupe.** Guadalupe Island, or *Isla Guadalupe* (29.039°N 118.278°W) is a volcanic island located 241 kilometers (150 statute miles) off the west coast of Mexico's Baja California peninsula and some 400 kilometers (250 statute miles) southwest of the city of Ensenada in Baja California state, in the Pacific Ocean. The two other Mexican island groups in the Pacific Ocean that are not on the continental shelf are Revillagigedo Islands and Rocas Alijos.



Above: Guadalupe. Below: Maps of Guadalupe and the Revillagigedo Islands.

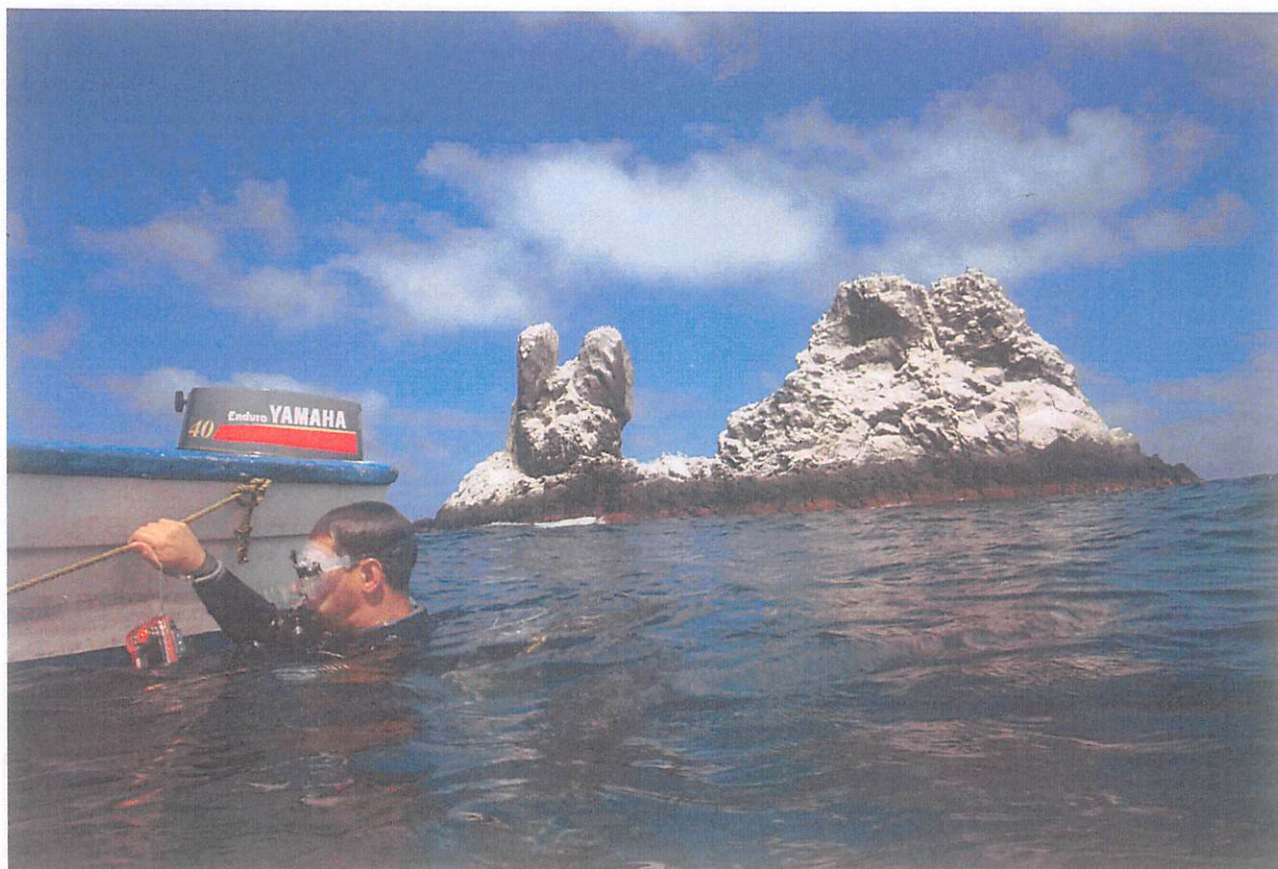




8. **Revillagigedo Islands.** The Revillagigedo Islands (also Revillagigedo Archipelago or Islas Revillagigedo) are a group of four volcanic islands in the Pacific Ocean, known for their unique ecosystem. They have been part of Manzanillo municipality of the Mexican state of Colima since 1861, but are nevertheless under Mexican federal jurisdiction, and lie 386 km southwest of Cabo San Lucas, the southern tip of Baja California peninsula. They are located around 18°49'N 112°46'W. There is a naval station in the south of Socorro Island, with a population of 250 (staff and families). On Clarión, there is a small naval garrison with 9 men. The islands are otherwise uninhabited.

9. **Roca Partida** (Spanish: "Broken Rock") is the smallest of the Revillagigedo Islands. It is uninhabited, with an area of 1.4 Hectares (0.014 km<sup>2</sup>) only. Like the other islands in its group, it is volcanic in origin, but unlike San Benedicto and Socorro which are still active, Roca Partida has eroded to a piece of bare rock, devoid of terrestrial vegetation. It is some 100 m (300 ft) long and about 8 m (25 ft) wide, and rises into two peaks divided by a low-lying area - hence the name. These were some 25 and 34 m (75 and 100 ft) high in 1953 but the higher one appears to have eroded several meters since then (see photo below). No land animals or fresh water occur on Roca Partida.





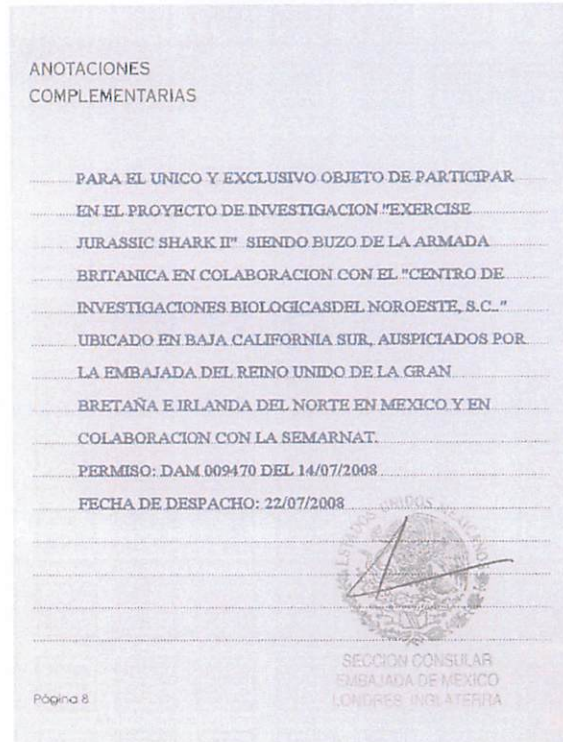
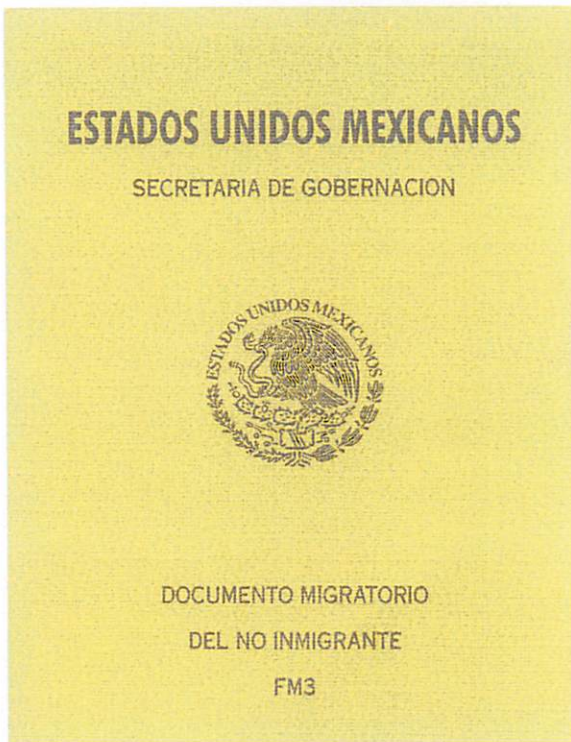
*Above: Roca Partida*

## **JOINT SERVICES EXPEDITIONS TRUST**

10. This expedition enjoyed 'sponsored' status from the Joint Services Expeditions Trust (JSET) and would not have been possible without this key source of both funding and high level approval.

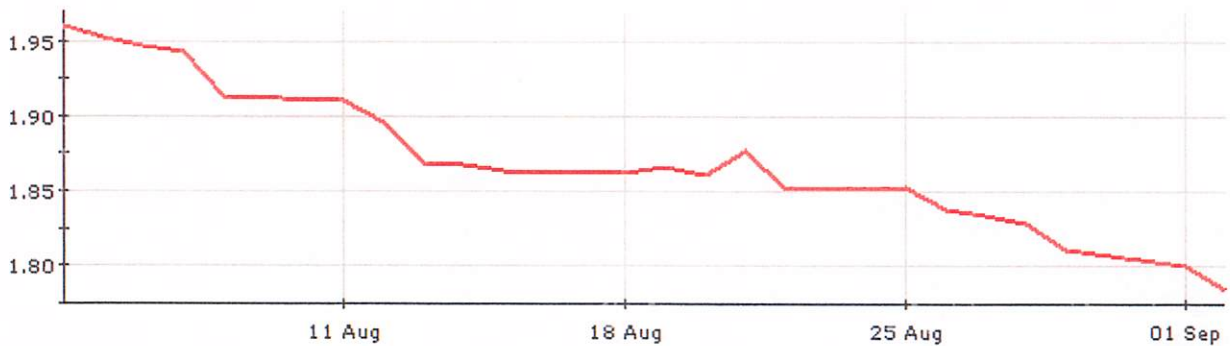
## **EXPEDITION PLANNING**

11. **Visas.** Gaining permission to go to Mexico as a military team proved problematic and required approximately 6 months negotiation to resolve. The JSATFA was submitted in Jan 08 but final authority from the British Defence Attaché in Mexico did not come until 01 Aug 08. Individual expedition members were then required to apply for an individual FM3 visa at the Mexican Embassy in London. Once these were in place final clearance was granted by HQ 4 Div on 15 Sep 09. This late clearance caused significant problems with expedition planning.



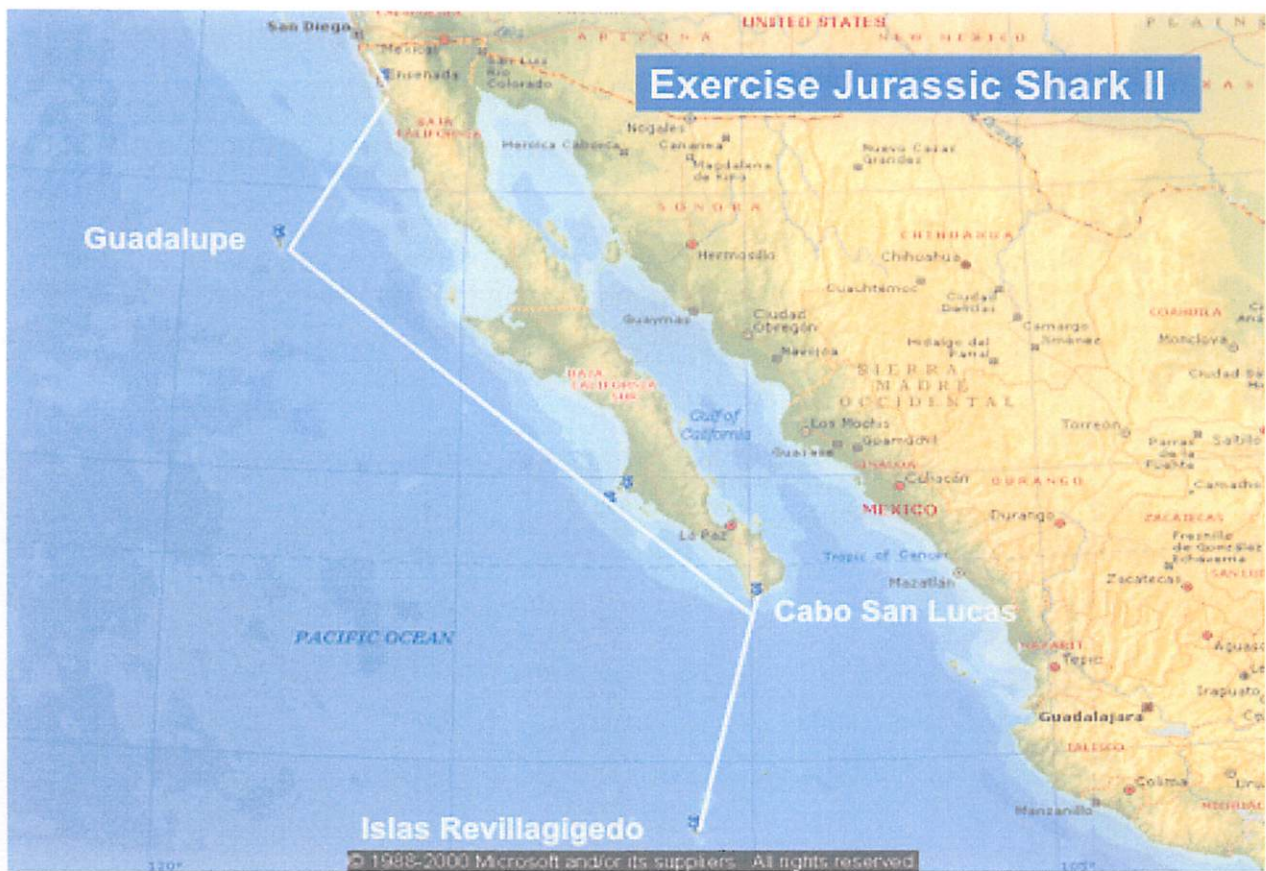
Above: Mexican FM3 Visa

12. **Currency Variations.** Late expedition clearance resulted in late payment for the boat (£60,000). The rapid fall in the exchange rate effectively cost the expedition an additional £5000. This rapid fall is shown by the following graph of US\$ exchange rates at the time.



13. **Itinerary.** The expedition itinerary is at Annex C . A map of the route followed is shown below:





**ADMINISTRATION**

- 14. **Research Permits.** Research permits were held by our sponsors in Mexico.
- 15. **Personnel.** The nominal roll is at Annex A.
- 16. **Flights.** Flights were with Continental Airlines from *Gatwick* North Terminal. Return to *Heathrow* Terminal 4.

- a. **Out.**

19 Oct 08	Gatwick North Terminal to Houston	CO 35	0930 -1405hrs
19 Oct 08	Houston to San Diego	CO 1689	1819 - 1949hrs

- b. **Return.**

06 Nov 08	San Jose del Cabo to Houston	CO 2214	0800 – 1128hrs
06 Nov 08	Houston to London Heathrow T4	CO 18	1835 – 0935hrs (+1 day)

- 17. **Baggage Allowance.** Possession of a NATO travel order increased the total weight that can be carried per person from 46 kg to 64 kg. Continental Airlines policy on applicable baggage allowances is summarised below:

- a. **Standard Allowance.** The standard allowance was 2 bags per person with a maximum weight of 23 kg.
- b. **Military Customers (on Military Orders).** Up to two bags up to a maximum of 32 kg could be carried.
- c. **Diving Equipment.** Continental accepts one dive bag as part of the free baggage allowance. An empty dive cylinder or up to 3 re-breather cylinders is not be included in determining the Free Baggage Allowance and is subject to an excess baggage charge.

18. **MV Sea Escape.** The expedition was Entirely based on the liveaboard boat *MV Sea Escape* (see right).



19. **Documentation.** All personnel were required to be in possession of the following documentation on arrival at Gatwick:

- a. Passport (valid for a minimum of 6 months from 07 Nov 08).
- b. Mexican Visa (FM3).
- c. Completed NATO Travel Order (see Para. 9)
- d. DAN Membership Card.
- e. Military ID card (MOD 90).
- f. Current medical documentation as required by Reference D (See Annex D).
- g. Diving Qualification book (or card).
- h. Proof of Nitrox qualification.
- i. Proof of re-breather qualification (if applicable).
- j. Diving Logbook.
- k. Proof of BSAC membership.



20. **Insurance.** Service personnel taking part in Adventurous Training (AT) are engaged in the course of their normal duties and the MOD accepts vicarious liability for any negligent actions or omissions, which they may commit in the course of those duties. MOD will also provide for medical treatment for personnel whilst on AT including, if necessary, medical evacuation etc. However, there remains a requirement to arrange assistance/CASEVAC/recompression. For this reason alone it was **mandatory** for all expedition members to have **DAN (Europe) insurance** (or an equivalent approved by the Exped Ldr) on this expedition. This applied irrespective of any other travel insurance that might be in place. The cost was **£54** and was arranged on-line at <https://www.daneurope.org/eng/english.htm>.
21. **Spending Money.** The currency was the Peso; however, the US\$ was universally accepted.
22. **CILOR.** Cash in Lieu of Rations (CILOR) was permissible for this expedition. The rate for Mexico was £4.87 per person per day.
23. **Expedition Clothing.** Each member of the team was provided with two expedition shirts and a hat.
24. **Group Equipment:** The following equipment will be taken on behalf of the group:
- a. **Iridium Satellite Telephone and data transmitter/receiver.** Provided by NSSL.
  - b. **EPIRBS/Personal Locator Beacons.** The carriage of satellite EPIRBS was a requirement for the expedition. Four EPIRBS and aluminium dive canisters were signed out from JSSADC.
  - c. **Shark Tags/Spear Guns.** Dr Antoniou was responsible for all scientific equipment (including the spear guns, satellite tags, radio tags, and radio receivers).
25. **Nitrox.** All open circuit and Semi-Closed Circuit Re-Breather diving took place on Nitrox (typically Nitrox 32).
26. **Re-breathers.** The following re-breather equipment was taken on the expedition:
- a. **Draeger Dolphin Re-breathers.** Three Draeger Dolphin Semi-Closed Circuit Re-Breathers (SCCRBs) were made available on the boat for the three team members qualified to use them; however, only one was used. Dr Antoniou also brought his own SCCRБ.
  - b. **Closed Circuit Re-breathers.** Maj Foster and Sgt Thomas took their own Closed Circuit Re-Breathers. Buddy Inspiration Re-Breather cylinders were available onboard *Sea Escape*.
26. **Diving Computers.** A nitrox diving computer was mandatory on this expedition.
27. **Baja Diving and Service.** Baja Diving and Service operate the *Sea Escape*. Their contact details are:
- a. **Tel:** +52 (612) 122-1826 or + 52 (612) 122-7010

b. **E - Mail:** info@clubcantamar.com

28. **Sea Temperatures.** Sea temperatures were:

a. **Guadalupe:** 22 degrees Celsius.

b. **Revillagigedo Islands:** 29 degrees Celsius.

## **DIVING OFFICER'S REPORT**

29. **Introduction.** EXERCISE JURASSIC SHARK diving was conducted in accordance with JSSADR and BSAC Safe Diving Practices. Due to the nature of the diving that would take place it was decided that the minimum qualification level of diver should be BSAC Sports Diver or equivalent PADI level of qualification, and that all divers be nitrox qualified. The expedition consisted of one First Class Divers, eight Advanced Divers, three Dive Leaders, three Sports divers, two PADI OWSI and one PADI Dive Master. Five of the expedition members were qualified SADS.

30. **Pre-Expedition Training Weekend.** A training weekend took place at Fort Bovisand, Plymouth on 23/24 Aug 08. The aim of the training weekend was to introduce team members to each other, check the serviceability of personal equipment and conduct spear gun training. The only absentees were Capt Richard Beck and Maj Mark Foster as well as the expedition scientists; Dr Alex Antoniou, Dr Mauricio Padilla and Miss Deni Macias. The team members had the use of the compressor from JSSADC. No RIB was available from JSSADC due to it just being out of service for repairs. The decision was made to book discovery divers for the weekend for two boat dives on sat and sun paid for by individuals. Before diving commenced all divers documentation was checked which highlighted some misunderstanding with individuals and there subsequent medical centres in relation to the new medical certification (wrong forms used or old medicals now classed as invalid). This resulted in some divers not being allowed to use JSSADC compressor as there medical documents were incorrect, although disappointing at the time it helped ensure that all medical documents would be correct for the actual diving expedition. The first day consisted of a dive in the morning on the Scylla with a maximum depth to twenty five metres.

31. The afternoon dive was on the James Egan Layne followed by speargun lectures and practical loading and unloading of the gun for all. On Sunday morning there was some confusion with timings which subsequently meant that the planned deep dive on the HMS ELK was missed. Three members of the team commenced practical training of spear guns underwater in Fort Bovisand Harbour during which it soon became apparent that reloading of the spear guns underwater would be more demanding than initially anticipated resulting in only Sgt Thomas being able to reload the training speargun. Subsequently it was decided there was no point in other expedition members attempting to reload the gun underwater due to the strength of the rubber bands. Five members carried out a dive on breakwater fort (Max depth sixteen meters) instead. Due to some of the exped having had a relatively shallow dive in the morning it was decide for the training weekend to finish early after the first dive on the Sunday and most of the expedition members left about 1400hrs.



32. **Diving Regulations.** All diving was carried out in accordance with JSSADR. The 30m rule was waived for this expedition (See Annex E ).

33. **Expedition Dives.** Diving during the expedition carried out two complete different diving styles. Initially we successfully carried out surface supplied cage diving with Great White Sharks of Guadalupe Island followed by a successful mixture of open and Semi Closed / Closed Circuit of Socorro islands. Permission had been granted to dive to 40 metres which was required to deploy one of the radio receivers on the islands. Two of the eighteen divers used Semi-Closed Circuit Re- Breathers (SCCRBs), while two used Closed Circuit Re – Breathers (CCRB's) with the remaining fourteen divers using open circuit systems. To help reduce nitrogen overloading all diving was conducted using Nitrox. Each diver analysed their own mixtures which ranged from 30% to 33% for the open circuit divers, and up to 50% for SCCRb divers.

34. **Guadalupe Island.** We successfully carried out 4 days surface supplied cage diving of Guadalupe Island. This involved having 2 self buoyant cages secured at the stern of the boat with a fixed platform leading into the entry point at the top of the cage. Max depth within the cage was 2.1 meters with a max of 4 divers per cage averaging about one hour per dive. Divers dived in waves with a max of 8 divers in the water at any one time. The SADS ensuring that both the expedition doctors were not underwater at the same time The Surface Supplied system consisted of the 2<sup>nd</sup> stage regulator attached to the hose which lead to the compressor bank ensuring a constant flow of Air into the regulator at the ambient pressure. Divers wore their own dive masks and the necessary thermal protection min of 5 – 7 mm full length suits. There was also one opportunity for 2 of the exped members using open circuit to carry out a 13 meter dive within the 2 man deep cage, operated by a hydraulic crane, which went well.

35. **Dive Sites.** A diving summary is at Annex D.

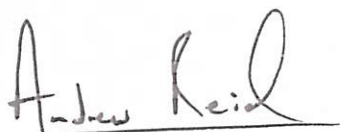
36. **Casualty Evacuation and Recompression.** The key dangers were decompression illness, physical injury (primarily from the use of spear guns, not sharks) and lost divers. The expedition managed the risk of a decompression incident through the use of Nitrox, capping depths/times and imposing mandatory safety stops. Oxygen was freely available on board the boat. Physical injury could be treated on site using our own doctors, medical supplies and satellite telephone. All divers diving within the Revillagigedo area (210-260 miles from land) had a minimum of 2 satellite EPIRB (see Para 25 c) per diver wave. In the unlikely event of a DCI the Nearest chambers were, Socorro Island (Navy Base) attended by Navy personnel, followed by Cabo San Lucas, DAN affiliated and finally Club Cantamar, La Paz, attended by F. Aguilar (our dive operator). The dive operator has an agreement for renting planes from Aereo Calafia, based in San Jose del Cabo Airport (Telephone # 624 1434302). Their plane would land at the Navy Base located on Socorro Island. Evacuation by sea takes 20-25 hours, by air would take about 5-6 hours. On Guadalupe Island (190 Miles from Land) Depth was limited by the shark cage, emergency use of the landing strip on Guadalupe Island (Navy Base) would be permitted. Evacuation by sea takes 18-20 hours to port while evacuation by air would take about 4 hours. Cabo San Lucas Recompression Chamber details are, 24hr emergency line:\* 52 (984) 873 1365 General enquiries: \* 52 (984) 803 1215 VHF Radio: Channel 21 address: 10th av. corner with 28th Street, Playa del Carmen. 77710, Mexico.

## SUMMARY

37. **Financial Summary.** A financial summary is at Annex B .

38. **Shark Biology Course.** The expedition has contributed to the production costs of an on-line shark biology course. It is expected that this will be ultimately be available via the expedition website: [www.jurassic-shark.org.uk](http://www.jurassic-shark.org.uk).

39. **Overall Summary.** This was an extremely ambitious expedition, which ultimately proved to be a remarkable success: A total of 20 Sharks were tagged and four radio receivers were deployed. This was an expedition that was defined by the scientific project whilst successfully integrating real adventure. The whole team were fully engaged in the work and the degree of problem solving and level of adventurous activity was significantly enhanced by the need to deploy a considerable amount of scientific equipment within an incredibly short space of time.



AJ REID  
Major  
Expedition Leader

### Annexes:

- A. Nominal Roll.
- B. Financial Summary
- C. Expedition Timetable
- D. Diving Summary
- E. Dispensation to Dive Deeper Than 30m.
- F. Diving Locations
- G. Re-Breather Report
- H. Scientific Report
- I. List of Tagged Sharks
- J. Species Identified
- K. Shark Conservation
- L. Medical Officer's Report
- M. Expedition Diary (Blog)
- N. Press Release
- O. Bibliography



**ANNEX A TO  
ITG/20/3602  
DATED 31 MAY 09**

**EXERCISE JURASSIC SHARK – NOMINAL ROLL**

Ser	Rank	Name	Unit	Qualifications	Service	Remarks
1	Maj	Andrew Reid	HQ ITG (Upavon)	<b>SADS</b>	Army	Expedition Leader
2	Maj	Mark Foster	AMD H/S (Birmingham)	<b>SADS</b>	Army	
3	Capt	Kelly Frowen	ATC (Pirbright)	Dive Leader	Army	Expedition Doctor
4	Capt	Richard Beck	Jersey Fd Sqn RE (Jersey)	Advanced Diver	Army	
5	WO2	Roger Godfrey	ATC (Pirbright)	PADI OWSI	Army	
6	SSgt	Johnny Anderson	BRAT (York)	Advanced Diver	Army	
7	Sgt	Mark Jones	7 RHA	Dive Leader	Army	
8	Cpl	Tim Gort	3 RSME (Minley)	Advanced Diver	Army	
9	LCpl	Kelvin Prett	CVHQ REME (Bordon)	Advanced Diver	Army	Webmaster
10	Flt Lt	Matthew Palmer	RAF Lossiemouth	Advanced Diver	RAF	
11	Plt Offr	Matthew Skulskyj	RAF Coningsby	Dive Leader	RAF	
12	Cpl	Matt Wood	RAF Coningsby	Sports Diver	RAF	
13	Lt	Roger Jameson	Royal Danish Naval Air Sqn	Sports Diver	RN	
14	Sgt	Gareth Thomas	539 ASRM	<b>SADS</b>	RN	
15	Cpl	John Corbett	45 CDO RM	<b>SADS</b>	RN	
16	Mr	Guy Hagg	Defence Estates	Sports Diver	Civilian	
17	Dr	Alex Antoniou	SRI	PADI OWSI	Civilian	Hammerhead Scientist
18	Miss	Dení Ramírez Macías	CIBNOR	PADI OWD	Civilian	Whale Shark Scientist
19	Dr	Edgar Mauricio Hoyos Padilla	CICIMAR	PADI Master	Civilian	Great White Shark Scientist

**OUTLINE EXPEDITION TIMETABLE**

Oct 19	0930hrs - Depart London Gatwick North Terminal (CO 35) Fly to San Diego (SAN) via Houston (Continental Airlines) Overland travel to Ensenada (2 hours) Overnight on <i>Sea Escape</i>
Oct 20	Depart from Ensenada to Guadalupe (190 nautical miles)
Oct 21	Arrival at Guadalupe, first day of diving
Oct 22	Second day of diving
Oct 23	Third day of diving
Oct 24	Fourth day diving Departure to Thetis Bank (420 nautical miles)
Oct 25	Full day travelling south
Oct 26	Full day travelling south Arrival at Cabo San Lucas (Fuel, supplies)
Oct 27	Day in Cabo San Lucas
Oct 28	Departure to San Benedicto Island (340 miles) Full day travelling south
Oct 29	Arrival at San Benedicto First day of diving
Oct 30	Second day of diving - San Benedicto. Overnight travel to Socorro Island
Oct 31	Third day of diving – Socorro Island
Nov 01	Fourth day of diving – Roca Partida
Nov 02	Fifth day of diving – Roca Partida
Nov 03	Sixth day of diving – Roca Partida
Nov 04	Seventh day of diving – Roca Partida. Departure for Cabo San Lucas (SJD)
Nov 05	Travel to Cabo San Lucas
Nov 06	Fly at 0800hrs via Houston (Continental Airlines)
Nov 07	0935hrs – arrive London Heathrow Terminal 4



**FINANCIAL SUMMARY**

**EXPENDITURE**

<b>Item</b>	<b>Unit Amount</b>	<b>Amount</b>
International Travel	£742	£11,874
Dive Boat Charter	\$105,600.00	£60,000
Field equipment ( <i>Tags/Receivers</i> )	\$13,420.00	£7,497
Tagging Supplies and Rope	\$1,400.00	£782
National Park Fees	\$26.00	£116
Port Fees	\$52.00	£232
Shirts		£1,148
E-Learning Package	\$1,700.00	£1,133
Re-Breathers	\$825.00	£461
Stickers		£190
Scientist - Flights	\$130.00	£73
Insurance	£54.00	£864
Mexican Visas	£55.00	£880
Website		£100
<b>TOTAL</b>		<b>85250</b>

**INCOME**

Personal Contributions	£24,519
Joint Services Expedition Trust	£12,000
Selex Galileo	£10,000
British Sub-Aqua Club Jubilee Trust	£3,000
ATG(A)	£5,000
HQ 4 Div Adventurous Training Funds	£2,250
PADI Project Aware	£1,133
Berlin Infantry Brigade Memorial Trust Fund	£1,000
Army Cash In Lieu of Rations (CILOR)	£877
RAF Cash In Lieu of Rations (CILOR)	£263
RN Cash In Lieu of Rations (CILOR)	£277
ASADA	£450
Army Sports Lottery	£3,200
Royal Air Force Sports Lottery	£972
Royal Navy Sports Lottery	£1,200
Defence Sports and Recreation Association	£700
Royal Air Force Central Funds	£1,749
RAF Coningsby	£2,100
RAF Lossiemouth	£650
Royal Air Force Special Project Grant	£4,000

Royal Air Force Flights	£2,211
Royal Navy Adventurous Training Funds	£2,415
2 Bde	£500
ISS Medicare	£500
Adjutant General's Corps	£250
Fund-Raising	£764
Ulysses Trust	£500
Royal Engineers	£500
3 RSME Regt	£125
57 Trg Sqn RE	£100
Royal Mons Regiment	£100
Jersey Fd Sqn	£25
Royal Logistic Corps	£125
RAMC	£200
Royal Marines	£300
Fleet Command CSMF and UIF	£150
Royal Horse Artillery Association	£150
49 Bde (TBC)	£200
Royal Artillery Institute	£200
ATC (P)	£200
Upavon Garrison PRI	£50
Mrs Rita Hagg	£50
Building Society Interest	£255
Frome Women's Institute	£40
<b>TOTAL</b>	<b>£85250</b>



ANNEX DTO  
 ITG/20/3602  
 DATED 31 MAY 09

**DIVING SUMMARY – GUADALUPE (CAGE DIVING)**

NAME	QUAL	DAY 1				DAY 2			DAY 3		DAY 4			TOTAL TIME (MINS)	MAX DEPTH
		DIVE 1	DIVE 2	DIVE 3	DIVE 4	DIVE 1	DIVE 2	DIVE 3	DIVE 1	DIVE 2	DIVE 1	DIVE 2	DIVE 3		
Maj Andy Reid	SADS	54	60	50	4	48	46	0	44	83	80	61	0	526	2
Maj Mark Foster	SADS	70	63	0	0	61	0	0	58	58	65	62	0	437	2
Capt Kelly Frowen	DL	57	62	0	0	69	57	0	50	0	57	0	0	352	2
Capt Richard Beck	AD	42	47	0	0	51	67	0	52	0	67	0	0	326	2
WO2 Roger Godfrey	OWSI	52	40	0	0	56	60	0	60	58	59	59	63	444	2
SSgt Jonny Anderson	AD	51	61	0	0	71	118	0	197	87	89	60	0	734	2
Sgt Mark Jones	DL	51	62	0	0	59	48	0	71	86	86	63	0	526	2
Cpl Tim Gort	SADS	46	54	0	0	64	72	0	22	0	51	0	0	309	2
LCpl Kelvin Prevett	AD	70	47	0	0	70	68	0	57	53	0	0	0	365	2
Flt Lt Matthew Palmer	AD	60	40	11	0	64	0	0	89	86	58	0	0	408	2
Pit Offr Matt Skulskiy	DL	56	56	0	0	55	62	100	55	53	60	0	0	497	2
Cpl Matt Wood	SD	54	40	0	0	55	61	100	85	81	65	0	0	541	2
Lt Roger Jameson	SD	47	41	0	0	86	0	0	79	0	109	0	0	362	2
Sgt Gareth Thomas	SADS	75	56	0	0	114	110	0	130	92	62	65	0	704	2
Cpl John Corbett	SADS	59	49	0	0	57	82	47	61	0	48	0	0	403	2
Mr Guy Hagg	SD	61	35	0	0	57	57	59	53	60	26	72	0	480	2
Dr Alex Antoniou	OWSI	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Miss Deni Ramirez Macias	AOW	80	0	0	0	65	0	0	43	48	0	0	0	236	2

**DIVE SUMMARY – REVILLAGIGEDO ISLANDS**

NAME	QUAL	DAY 5	DAY 6			DAY 7			DAY 8		
		DIVE 1	DIVE 1	DIVE 2	DIVE 3	DIVE 1	DIVE 2	DIVE 3	DIVE 1	DIVE 2	DIVE 3
Maj Andy Reid	SADS	38	45	59	60	61	60	45	57	61	60
Maj Mark Foster	SADS	62	78	67	81	73	64	50	50	91	0
Capt Kelly Frowen	DL	21	31	33	40	38	39	44	42	39	0
Capt Richard Beck	AD	29	27	39	38	39	39	44	36	43	46
WO2 Roger Godfrey	OWSI	38	46	39	41	32	40	31	32	34	38
SSgt Jonny Anderson	AD	43	34	38	42	48	45	34	42	39	38
Sgt Mark Jones	DL	43	33	38	41	45	33	38	36	43	47
Cpl Tim Gort	SADS	38	44	32	36	48	49	43	53	0	0
LCpl Kelvin Prevett	AD	45	45	56	60	66	60	45	53	55	53
Flt Lt Matthew Palmer	AD	45	45	41	45	48	49	43	53	61	53
Plt Offr Matt Skulskiy	DL	47	46	44	60	52	48	40	57	61	60
Cpl Matt Wood	SD	47	46	48	60	53	48	42	53	61	60
Lt Roger Jameson	SD	38	33	32	41	47	46	34	29	39	38
Sgt Gareth Thomas	SADS	63	78	67	81	73	64	0	50	91	0
Cpl John Corbett	SADS	21	31	29	41	45	33	37	29	0	0
Mr Guy Hagg	SD	29	27	39	37	32	40	31	32	34	0
Dr Alex Antoniou	OWSI	32	46	41	54	62	44	50	46	50	59
Miss Deni Ramirez Macias	AOW	32	46	41	49	58	42	50	45	50	59



**DIVING SUMMARY – REVILLAGIGEDO ISLANDS (CONTINUED)**

NAME	QUAL	DAY 9			DAY 10			DAY 11			TOTAL TIME (MINS)	MAX DEPTH
		DIVE 1	DIVE 2	DIVE 3	DIVE 1	DIVE 2	DIVE 3	DIVE 1	DIVE 2	DIVE 3		
Maj Andy Reid	SADS	60	60	30	62	60	60	61	59	0	998	30
Maj Mark Foster	SADS	92	82	67	60	85	71	127	120	0	1320	40
Capt Kelly Frowen	DL	48	36	37	47	60	60	60	51	0	726	31.8
Capt Richard Beck	AD	52	40	53	54	50	60	60	60	53	862	30.3
WO2 Roger Godfrey	OWSI	38	29	42	45	40	39	38	0	29	671	28.6
SSgt Jonny Anderson	AD	49	35	52	54	50	60	60	60	56	879	30.1
Sgt Mark Jones	DL	48	36	31	47	60	60	60	51	54	844	31
Cpl Tim Gort	SADS	35	0	0	43	36	36	43	36	0	572	32
LCpl Kelvin Prevett	AD	60	60	30	59	59	60	60	60	0	986	30
Flt Lt Matthew Palmer	AD	52	40	53	59	59	60	60	60	0	926	30
Plt Offr Matt Skulskyj	DL	40	33	0	60	45	39	50	0	62	844	40
Cpl Matt Wood	SD	40	32	0	61	60	60	60	59	0	890	39.2
Lt Roger Jameson	SD	48	35	51	60	45	39	50	0	62	767	30
Sgt Gareth Thomas	SADS	92	82	67	0	0	0	129	120	60	1117	30
Cpl John Corbett	SADS	35	33	0	43	36	36	43	36	0	528	32
Mr Guy Hagg	SD	38	29	42	45	40	39	37	0	29	600	29.5
Dr Alex Antoniou	OWSI	57	32	46	76	88	70	45	60	60	1018	132 ft
Miss Deni Ramirez Macias	AOW	56	33	0	76	52	56	43	60	53	901	33.4

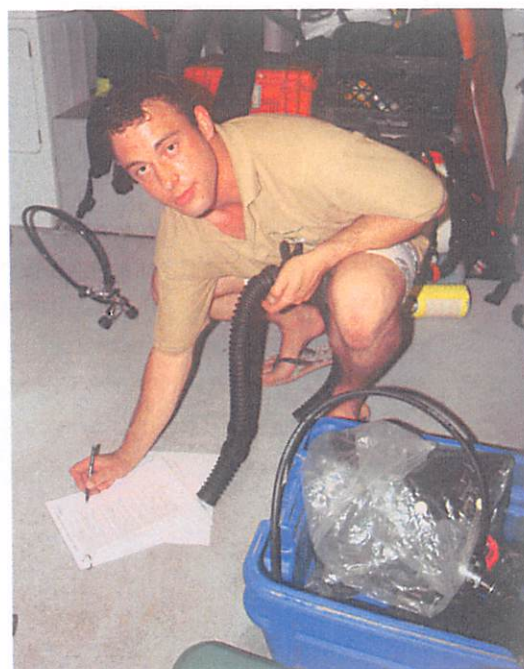
ours. The only difference was that he had an O<sub>2</sub> analyzer fitted, which gave him his PO<sub>2</sub> level at all times. In addition, he had a 5 litre cylinder fitted to give him extra bottom time. With over 200 hours use on the Dräger SCCR, his experience proved invaluable.

4. **Baja Diving & Service.** Baja Diving & Service provided the Dräger SCCRs, Inspiration cylinders for Sgt Thomas, bailouts for both CCR's & the Soda Lime (scrubber). These were waiting for us on Mon 27 Nov at Puerto San Carlos on our return from Guadalupe.

5. **Training & Qualifications.** The following certifications were held by the 6 suitably qualified expedition members:

a. **CCR.** Maj Foster had an International Association of Nitrox & Technical Divers (IANTD) CCR certification with over 11 hours experience. Sgt Thomas had a Technical Diving International (TDI) CCR certification with over 50 hours experience.

b. **SCCR.** As mentioned in Para 3b, Dr Antoniou had a TDI SCCR Instructor certification with over 200 hours of experience. Maj Reid, Cpl Corbett & Cpl Gort all obtained their TDI CCR certification at Joint Services Sub-Aqua Diving Centre (JSSADC), Fort Bovisand. Due to a recent lack of practice from all the SCCR users, Cpl Gort produced a user guide for each qualified member from his course notes. Each user guide contained a Dolphin Re-Breather Dive Planning Checklist, Assembly Check Sheet, Equivalent Air Depth Tables, CNS & UPTD Calculator Sheets & Calculation Sheets with all the formulas. All these were issued from JSSADC on the SCCR course. In addition Cpl Corbett had a copy of "An Introduction to Semi-Closed Circuit Rebreathers" issued by TDI.



*Cpl Gort using the Assembly Check Sheet whilst assembling his re-breather*

6. **Planning.** All the planning for the CCR's & SCCR's was carried out in accordance with JSSADR & the manufacturers guidelines.

a. **CCR.** All the dives were planned with the computer planning software incorporated within the re-breather with the set point at 1.3 PO<sub>2</sub>. In addition both divers carried a 7 litre bailout (filled with air; 21%) during the dives.

b. **SCCR.** Following a letter written from JSSADC (Reference A) after EXERCISE JURASSIC SHARK, all planning was carried out using the set Nitrox mixes as laid out in manufacturer's guidelines. The planning sheets mentioned in Para 5 were used to do this. The maximum operating depth (MOD) of the dive was governed by the Nitrox mix in the cylinder & the dive time by the Nitrox mix in the bag. The VO<sub>2</sub> planning rates used were 1.5 for diving & 2.5 for worst case scenario.





**FLEET COMMAND**

Ministry of Defence  
Superintendent of Diving  
Fleet Diving Headquarters  
Bridge Building, Horsea Island,  
PORTSMOUTH PO6 4TT



Telephone: 023 9222 4148 (Admin)  
Military: 93832 4148  
NavyNet: FDS-HQ-REGISTRY-AO  
Email: fdhqregistry@a.dii.mod.uk

EXERCISE JURASSIC SHARK 2  
Initial Training Group  
Trenchard Lines  
Upavon  
PEWSEY, Wilts, SN9 6BE  
September 08

Reference: 258/10/1

Date: 01

**DISPENSATION TO DIVE DEEPER THAN 30 METRES**

References:

- A. Recreational diving projects Approved Code of Practice.
- B. Joint Service Sub-Aqua Diving Regulations dated 1 Apr 08.

1. Thank you very much for your letter dated the 15 August 08 in respect of Exercise Jurassic Shark 2, 19 Oct – 07 Nov 08. I have visited your web site which is of great interest and your previous Expedition tagging sharks appeared a great success.
2. In your letter you are requesting to waive regulation 19.e. of Reference B, which as you know is establishing the whereabouts of the nearest recompression chamber and other rescue services, but primarily confirming their availability before diving takes place. From your letter you have indicated that from your experience availability is not guaranteed.
3. In addition, you have stated that the remote location of the Expedition puts you significantly greater than 4 hours travelling time from a civilian recompression chamber. Reference B (Regulation 38) states sufficient gas (oxygen) is available for transfer of a casualty to the Emergency Services. One of your reasons for practical mitigation is oxygen is freely available on the boat - but would it support two divers (buddy pair with same profile) travelling to this compression chamber (if on line of course) for anything up to 24 hours?
4. The regulations in Reference B. have been written to incorporate those found in Reference A. Regulation 65 of Reference A. states 'the diving contractor has a responsibility to ensure the provision of facilities so that a diver can be recompressed in an emergency,

should this be necessary'. Unfortunately the information provided in your letter does not give enough confidence that your 'Emergency Assistance Plan' (EAP) is robust enough for the MOD Diving Inspectorate to waive Regulation 19.e. of Reference B.

5. To provide some scope for deeper diving and to keep within the spirit of Adventure Training (AT) and your Expedition aims, SofD is prepared to allow 'EXERCISE JURASSIC SHARK 2' to dive to an **Equivalent Air Depth (EAD) of 30 metres** for the duration of the exercise (19 Oct – 07 Nov 08). This dispensation is given as long as the following criteria are met:

- a. No decompression diving is to be planned for the duration of the expedition. Safety stops **MUST** be mandatory on all dives.
- b. All diving to be conducted on Nitrox.
- c. Maximum Operating Depth (MOD) of the Nitrox mix is not to exceed 1.4 Partial Pressure of Oxygen.
- d. Contact is established before the expedition departure and while in 'the field' via satellite telephone with the Institute of Naval Diving Medicine.
- e. Contact with the nearest recompression chamber is made prior to the expedition departure and while in 'the field' via the satellite telephone communication system to confirm the availability of the facility for the duration of the expedition (civilian or military whichever is the shortest sailing time).
- f. All other regulations in Reference B. are to be complied with.

Acknowledgement of these requirements prior to departure would be appreciated.

6. Finally, I would like to thank you again for your letter, and your honest appraisal of the challenge and risks. I wish you and your team a safe and successful expedition and I look forward to an update on your web site on your return.

P Jones  
Cdr RN  
SofD

## DIVE LOCATIONS

### Guadalupe Island

**Depth:** 200+ metres

**Marine life:** Great White Sharks, Yellowfin Tuna, mackerel, California Sea Lions, Northern Elephant Seals, Guadalupe Fur Seal.

**Description:** A visually stunning location with the boat moored in a semicircular bay to the south west of Guadalupe island. Diving was undertaken from a cage, with a surface feed air supply to protect divers from being predated. The sharks were attracted to the cages by floating fish bait and mixture of chopped fish. This also attracted huge number of mackerel and other fish that formed dense shoals under the boat.

The great white sharks were tagged from a small boat using a Hawaiian Sling to place the tag at the base of the dorsal fin. This required quite a considerable amount of skill to place the tag in the correct position.

### San Benedicto – El Canyon “The Canyons”

**Depth:** 25 – 40m

**Marine life:** Silvertip sharks, whitetip reef sharks, jacks, trevallies, a variety of moray eels, crawfish, angel fish, damsel fish, parrot fish, boxfish, various wrasse.

**Description:** Expedition’s first warm-up dive. The background of the volcanic peak of San Benedicto made for a stunning dive location. The dive area was a series of small submerged peaks rising up from a mixed sand and rocky bottom. About 30m from the peaks there was a steep drop off into the deep blue. Visibility was not as good as expected due to a considerable swell which stirred up the sand. A severe swell overnight resulted in many of the team not having a good night’s sleep. A morning dive saw the whole team deployed over several

### San Benedicto – El Boiler “The Boiler”

**Depth:** 2 – 40m+

**Marine life:** Whitetip reef sharks, manta rays, jacks, angel fish, butterfly fish, grunts, damsel fish, crawfish, various wrasse species, moray eels, crown of thorns starfish, snappers, parrotfish.

**Description:** A series of stepped plateau in a linked pinnacle rising to two main peaks to the south west of the main San Benedicto island, varying in depth from 2m descending down to 40+ metres. A strong current running over the top of the pinnacles gave the team an exhilarating dive. All members of the team were fortunate enough to dive with a number of



large manta rays which stayed with the team over a couple of hours. Diving this site resulted in several tissue samples eventually being taken from two manta rays for further analysis of DNA and heavy metal contamination.

### **Revillagigedo – Punta Tosca**

**Depth: 5 – 40m**

**Marine life:** Dolphin, silvertip shark, silky shark, whitetip reef shark, manta ray, scrawled filefish, spotted boxfish, trumpet fish, octopus, Socorro spiny lobster, grunts, snappers, jacks.

**Description:** A series of pinnacles in a semicircular orientation between two small headlands. The pinnacles rise up steeply from a sandy bottom and were subject to a strong surge that swept between the inner and outer reef. The team were visited by a group of extremely friendly dolphins that were happy to play, shooting off away from the group, often breaking the surface before returning back for some more close encounters

### **Revillagigedo – Cabo Pears**

**Depth: 10 – 40m**

**Marine life:** Dolphin, diamond stingray, moray eel, clarion angelfish, guineafowl pufferfish, Mexican hogfish, barberfish, octopus, grunts, snappers, jacks.

**Description:** A finger of reef extending in a south eastern direction from the main island. The steep sides descended into deep water, with the depth of the reef gradually increasing as you got further from land. Halfway along the reef opened out into a sandy area. Due to the strong surge a negative entry was required to get depth quickly and to ensure the team were not caught and swept on to the breaking surf. Hopes were high that the team would see hammerhead and other sharks at this site as a large number of barberfish were found congregating ready to provide a cleaning service, sadly the site did not live up to the potential. However, many other fish made use of the cleaning services the barberfish offered. Once again the team were visited by a group of enthusiastic dolphins that provided some good photo opportunities. During the dive a large amount of netting was seen wrapped around part of the reef. A diver was dispatched to cut away the net from the reef to prevent any wildlife becoming entrapped. Once released the netting was attached to a buoy and sent to the surface for recovery. The team also placed a radio receiver on the reef. This required considerable effort to move the heavy concrete anchor block and place the receiver in a location from where it can be retrieved at some time in the future.

### **Revillagigedo – Roca Partida**

**Depth: 10m – Deep**

**Marine life:** Whale shark, scalloped hammerhead shark, whitetip reef shark, manta ray, dolphin, moray eel, clarion angelfish, guineafowl pufferfish, barberfish, grunts, snappers, jacks

**Description:** A small, solitary, rocky guano coated pinnacle. At last we have come in to contact with hammerheads and whale sharks. The pinnacle has a number of cleaning stations where large numbers of barberfish congregate. A number of hammerheads were seen swimming in the blue but few were approaching close to the cleaning stations. The

rock is surrounded by large schools of fish of many different varieties. Around the sides of the rock there are a number of deep cracks and ledges which provide ideal refuges for morays and whitetip reef sharks. The surface of the pinnacle was encrusted with barnacles and many small cracks and ledges also provided suitable footholds for a variety of sea urchins. The urchins were a constant hazard as the spines penetrate easily through neoprene. A strong surge meant that this was a challenging dive as the surge could move divers 3 – 4 metres up or down the water column. A total of seven scalloped hammerheads, two Galapagos sharks and a silvertip shark were tagged at this site. A radio receiver was deployed in 40m of water on the second day.

## RE-BREATHER REPORT

### INTRODUCTION

1. Of the 19 expedition members on EXERCISE JURASSIC SHARK 2, 6 suitably qualified expedition members were expected to use re-breathers. These were a combination of 4 Semi-Closed Circuit Re-Breathers (SCCRs) & 2 Closed Circuit Re-Breathers (CCRs).

### AIM

2. The aim of having as many re-breather qualified expedition members on EXERCISE JURASSIC SHARK 2 as possible is to maximise the ability to tag sharks. This is due to the relatively bubble free & silent environment that these pieces of equipment produce. This was proven on EXERCISE JURASSIC SHARK when 11 of the 15 tags were deployed by those with either SCCRs or CCRs.

### EXECUTION

3. **Re-breathers.** The re-breathers used for EXERCISE JURASSIC SHARK 2 are as follows:

- a. **CCR.** Maj Foster used his own personal Sentinel CCR manufactured by CCRB. The system including cylinders (minus 7 litre bailout) was brought from the UK. Sgt Thomas used his own personal Inspiration CCR manufactured by AP Valves. The system minus cylinders was brought from the UK.



*Maj Foster & Sgt Thomas with their re-breathers*

- b. **SCCR.** Maj Reid, Cpl Corbett & Cpl Gort planned to use the Dräger SCCR manufactured by AP Valves. These were provided onboard The Sea Escape by Baja Diving & Service at a cost of \$65 per person per day. There was also a box of spare counter lungs, seals, o-rings & dosage devices. In addition, Dr Antoniou (a Dräger SCCR Instructor) provided his own Dräger SCCR. His SCCR was of a similar setup as



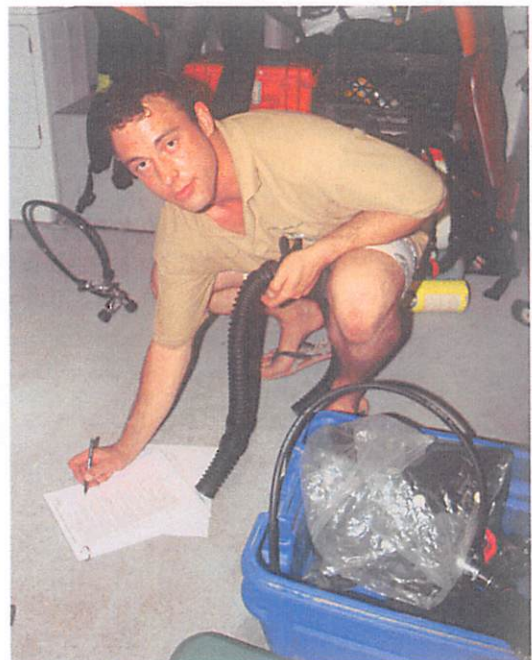
ours. The only difference was that he had an O<sub>2</sub> analyzer fitted, which gave him his PO<sub>2</sub> level at all times. In addition, he had a 5 litre cylinder fitted to give him extra bottom time. With over 200 hours use on the Dräger SCCR, his experience proved invaluable.

4. **Baja Diving & Service.** Baja Diving & Service provided the Dräger SCCRs, Inspiration cylinders for Sgt Thomas, bailouts for both CCR's & the Soda Lime (scrubber). These were waiting for us on Mon 27 Nov at Puerto San Carlos on our return from Guadalupe.

5. **Training & Qualifications.** The following certifications were held by the 6 suitably qualified expedition members:

a. **CCR.** Maj Foster had an International Association of Nitrox & Technical Divers (IANTD) CCR certification with over 11 hours experience. Sgt Thomas had a Technical Diving International (TDI) CCR certification with over 50 hours experience.

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*Cpl Gort using the Assembly Check Sheet whilst assembling his re-breather*

6. **Planning.** All the planning for the CCR's & SCCR's was carried out in accordance with JSSADR & the manufacturers guidelines.

a. **CCR.** All the dives were planned with the computer planning software incorporated within the re-breather with the set point at 1.3 PO<sub>2</sub>. In addition both divers carried a 7 litre bailout (filled with air; 21%) during the dives.

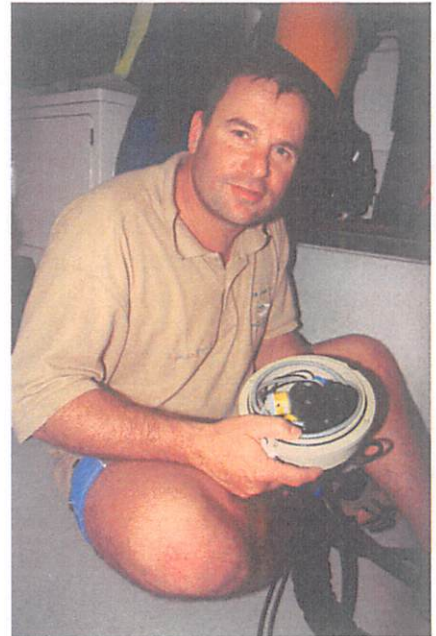
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7. **Equipment problems.** During the exercise there were problems with both the CCRs & SCCRs. These faults are summarised below:

a. **CCR.** No major problems were experienced with the CCRs, although a few problems did occur. These included:

(1) Sgt Thomas had to rebuild his breathing loop due to a hair in a seal. Also, he had a problem whilst calibrating his VR3 to his re-breather, leaving him unable to dive for 24 hours. Another common fault which occurred with the Inspiration is a build-up of condensation on the O<sub>2</sub> cells leading them to miss read.



Sgt Thomas inspects his O<sub>2</sub> cells.

(2) Maj Foster's CCR had corrosion on the connection on the temperature stick therefore he was unable to monitor the temperature in his scrubber canister. The scrubber was routinely changed every 3 hours.

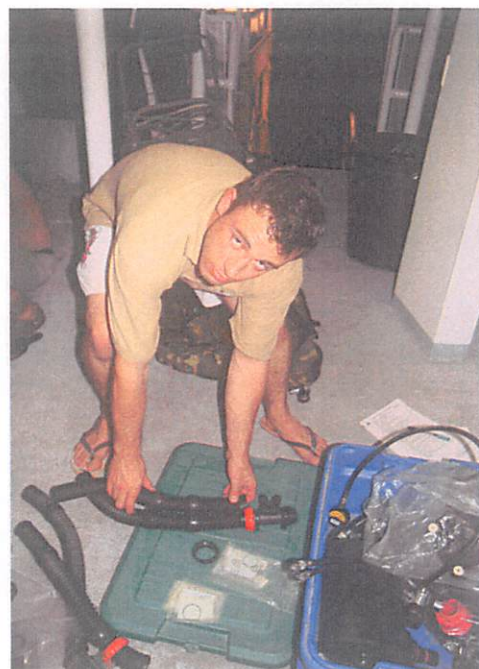
b. **SCCR.** On inspection of the equipment, a number of faults were identified. This resulted in only one fully serviceable SCCR which was used by Maj Reid. Some of the faults included:

(1) All the dosage devices had the 32% nozzle replaced with a blanking cap therefore only leaving the 40, 50 & 60% mixes. The implication of this resulted in a lower MOD compared to if the 32% nozzle had been available.

(2) Two of the four Dräger cylinder provided were not in test & had loose valves. These were isolated & were not used.

(3) Various o-rings were missing on regulators. These were replaced by spares carried within the group & on the boat.

(4) Baja Diving & Service had purchased 3 new wings & casings for the SCCRs before the trip. One case was missing the bailout straps however. Before it could have been used, an alternate method of securing the bailout would have been sought.



Cpl Gort re-building his breathing loop.

(5) Whilst checking the breathing loop on Cpl Gort's re-breather, the one way valves failed to work. The hose was not creating any suction when tested.

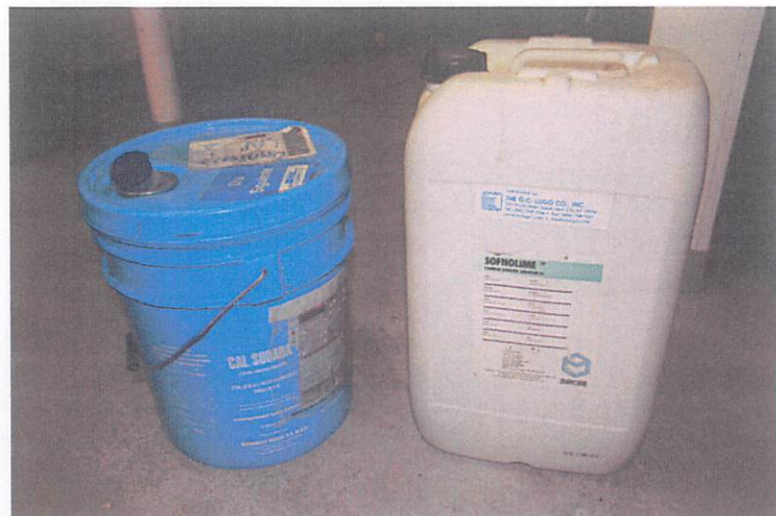


Replacing the valves failed to work. The loop had to be stripped down & rebuilt with new valve seats. This appeared to work. On assembly, when a 2kg weight was placed on the inhalation bag, it soon deflated. On further inspection the air appeared to be leaking from the mouthpiece & Pressure Release Valve (PRV). This was detected by using a method by where the system is lowered into water to detect the leak. This was suggested by an instructor at Baja Diving & Service. Replacing the o-ring on the mouthpiece & tightening the PRV fixed the problem.

(6) Whilst building his re-breather, Cpl Corbett noticed the seal on his scrubber canister was perishing & discharging residue. This made the canister unusable.

(7) Maj Reid's first wing continued to auto inflate underwater. It was replaced with one of the others from a set that wasn't being used. He had no further problems after this.

c. **Scrubber.** The normal weight of Soda Lime required is 2.45kg of 1-2.5mm (8-12 mesh) granule size, preferably 797-Diving Grade 'non-colour indicating'. The Soda Lime provided on board The Sea Escape provided both 8-12 mesh WV (white to violet) & Soda Sorb. This was a courser grain; however, this did not impact on the 3 hour life of the scrubber for the CCRs & the 2 hour life for the SCCRs.



Right: The 2 different types of Soda Lime.

## SUMMARY

8. The use of re-breathers proved valuable on EXERCISE JURASSIC SHARK 2. Five of the ten sharks tagged around Roca Partida, were tagged by re-breather users. The use of more re-breathers may have possibly resulted in more tagged sharks. Although the difficult diving conditions around Roca Partida to some extent negated the benefits of using re-breathers. A recommendation for EXERCISE JURASSIC SHARK 3 would be to source SCCRs from the UK to confirm their quality & reliability. The ideal scenario would be for expedition members on EXERCISE JURASSIC SHARK 3 to attend the CCR course now being run at JSSADC and bring either their own or a military CCR on the expedition.

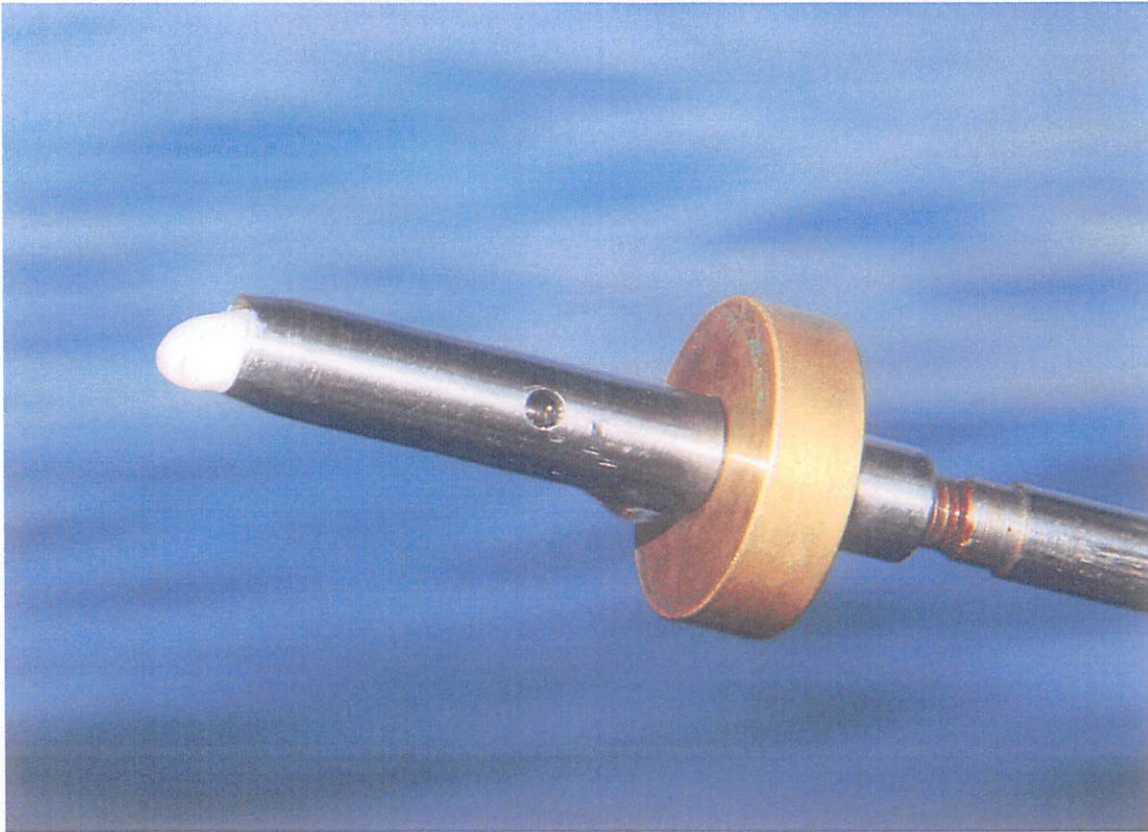
*[Original signed]*

T P GORT  
Cpl  
Expedition Member



## SCIENTIFIC REPORT

- 1. Tagging Equipment.** The equipment discussed below was used to tag hammerhead sharks during the expedition. If an opportunity had been presented to tag a whale shark, the same general equipment would have been used; specific differences have been indicated in the paragraphs below.
- 2. General Arrangement.** Sharks were tagged using a 3-band spear gun, firing a modified spear incorporating a 'tag applicator' tip. The applicator held a stainless steel barb which was attached to the tag; EX JURASSIC SHARK deployed both satellite and radio tags. The radio tags could be detected by either a fixed receiver or a portable hydrophone.
- 3. Spear Guns.** The expedition used two 4D46T 'Magnum' spear guns, manufactured by JBL Enterprises Inc, Orange, California, USA. This model can be disassembled for transport in purpose-made case. The component parts were as follows: a barrel split into 2 pieces, one including the trigger mechanism and the other 3 rubber firing bands; a rubber butt plate; a spear tether, approximately 5m long incorporating a rubber shock absorber and a stainless steel slide to fit over the spear; a spear in 2 parts that screwed together, using PTFE tape for added security. Additionally, a pole spear was used to help increase the possibility of tagging the sharks. The pole spear consists of a pole with the same applicator tip as the other spear guns. A hand held band is used by the tagger to help make the pole spear project forward during the tagging action. To prevent salt-water corrosion, all spear guns and pole spear were rinsed in fresh water after every dive.
- 4. Applicator Tips.** Two sizes of applicator tips were manufactured by a machine shop to specific specifications. The smaller tips were approximately 120mm long, designed to penetrate through the skin and into the muscle just below a hammerhead's dorsal fin; they carried a barb approximately 35mm long. The whale shark's skin was considerably thicker than that of a hammerhead, requiring an applicator tip approximately 200mm long and carrying a barb 45mm long. Consequently, only one firing band was needed to tag hammerhead sharks, whereas all 3 would have been used for a whale shark. It was essential that the barb lodged in the animal's muscle tissue. Had it penetrated just the skin, the shark's natural defence mechanisms would have slowly rejected the barb, just as the human body will slowly force out a splinter in the skin.
- 5. Tissue Sampling.** In addition to the applicator tips, a barbed, hollow needle had also been manufactured for the research, in order to gather tissue samples from whale sharks, great white sharks and manta rays.



*Great white shark tissue sample*

6. **Damage to Tips.** During tagging, experience showed that the applicator tip was bent on almost every use. The degree of bending depended on the angle from which the tagger fired the spear gun and the shark's subsequent reaction. However, straightening the tips induced fatigue and the tip snapped on several occasions. Whilst the Sea Escape mechanic was able to weld the 2 parts together, the repaired tips were not as robust as the originals and repeatedly failed. Therefore, extra applicator tips were purchased to have available to ensure that these were not the limiting factor that prevented the expedition from being able to tag the sharks. There were enough applicator tips to have a ratio of one tip to every 2 tags.

7. **Tags.** The expedition deployed 2 different types of tag: radio tags and satellite tags. Each was crimped to a barb by a piece of 3/32" plastic-coated stainless steel wire; the length of wire was commensurate with the species of shark and the depth of skin penetration required.





*Radio tag ready to deploy using a pole spear*

8. **Satellite Tags.** Three whale sharks were tagged in the Bay of La Paz, with PTT-100 archival pop-up satellite tags (Microwave Telemetry, Columbia, MD). These tags are designed to archive temperature and pressure readings and record time of sunrise and sunset for subsequent geo-location calculation. Tags are rated to withstand 3000psi (2000 m) and have an optional pressure initiated pop-off feature to allow the tag to pop off and start transmitting if it descends below a predetermined depth or remains at a constant depth over a predetermined length of time. The tags that were used in this study had preset attachment intervals of 10 days (one tag), 30 days (three tags), and 120 days (one tag). Sex of the animals was determined from the absence of claspers (the male sexual organs), and total length of the animals was estimated to be 1.8–3.0m. After pop-up, data will be transmitted through the Argos satellite system. ARGOS DCLS earth orbiting satellite system provides autonomous, daily, global locations for monitoring wildlife (Argos 1996). The system consists of two operational TIROS-N satellites in low-Earth (830-870 km), near polar orbits with on-board radio receiver and transmitter units, a series of Earth-based receiver stations, several Earth-based Global Processing Centres (GPCs) and a radio-frequency transmitter (commonly known as Platform Transmitter Terminal or PTT) attached to the host animal.



### Physical Specifications for Pop-Up Tag

Dimensions: L 13.3" x 1.6" dia.

Weight: 65 to 68 grams

Pressure rating: 3000 psi

Antenna: Hard nylon coated flexible stranded marine grade stainless steel, 8.5" (216mm) long.

### General Electrical Specifications

Operating frequency: 401.650 MHz  $\pm$  36 kHz

Modulation Tri Phase PSK:  $\pm$  1.1Rad  $\pm$  0.1Rad

Quiescent current: 3 $\mu$ A

Spurious emissions: -45 dB

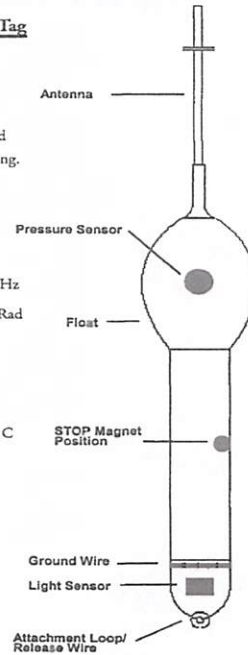
Transmission interval: 45-90 sec.

Operating temperature range: -15 +45 Deg C

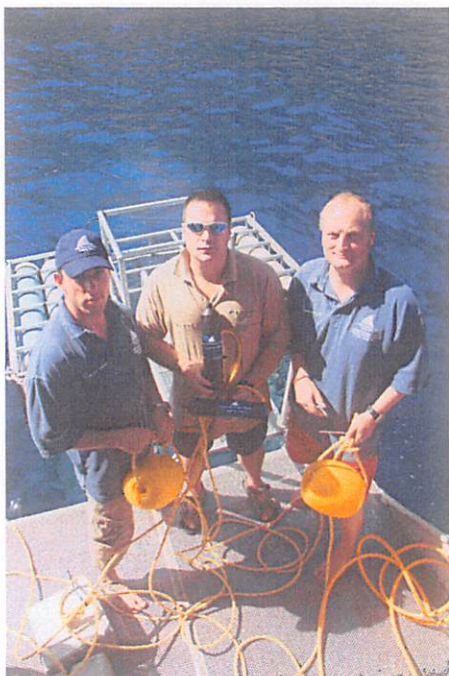
Temperature sensor range: 0 to +35 Deg C

### Sensors

The Archival Pop-Up tag comes complete with sensors to measure temperature, light level, pressure and its own battery voltage.

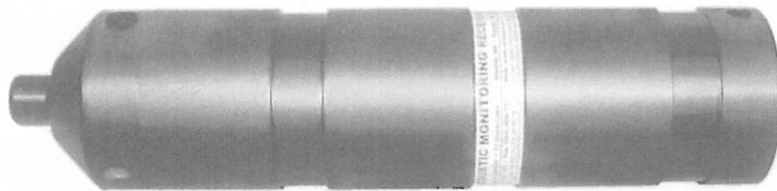


9. **V16 Coded Transmitter.** "Coded mode" V16 tags send acoustic ping trains that are infrequent and random between a pre-specified range. This ping train includes an ID number which permits identification of the specific tag. For applications such as site residency studies and automated monitoring of migrations, coded transmissions are desirable because of significantly increased battery life and the large number of tags that can be used on the same frequency. In this study, the V16 tags were being used to determine the residency of *Sphryna lewini*, the Scalloped Hammerhead Shark.



Left: Radio receivers ready to deploy. Right: Receiver underwater.

10. **VR2W Submersible Receivers.** The VR2W is a submersible, single channel receiver with Bluetooth® wireless technology capable of identifying VEMCO coded transmitters, which in the case for this study are the V16 coded transmitters. After retrieving the VR2W from the water, you can upload data 20 times faster than the VR2 and from up to 7 receivers simultaneously. The VR2W also uses greatly enhanced PC Software. The new VEMCO User Environment (VUE) PC Software for initialization, configuration and data upload from VEMCO receivers allows users to combine data from multiple receivers of varying types into a single integrated database. The VR2W records the identification number and time stamp from acoustic transmitters as a tagged animal travels within receiver range. Depth, temperature and other sensor data can also be collected. After removing your VR2Ws from the water, data is downloaded quickly and easily in the field without opening the case by using your PC with Bluetooth® wireless technology. The VR2W system uses new VUE software that is compatible with Windows XP SP2 operating system. The VR2W consists of a hydrophone, receiver, ID detector, data logging memory, and battery all housed in a submersible case. The VR2W receiver's plastic high pressure case is lightweight and has a depth rating of 500 meters. The VR2W is easily moored or hidden underwater by a diver and can also be set up with an acoustic release system for highly inaccessible locations.



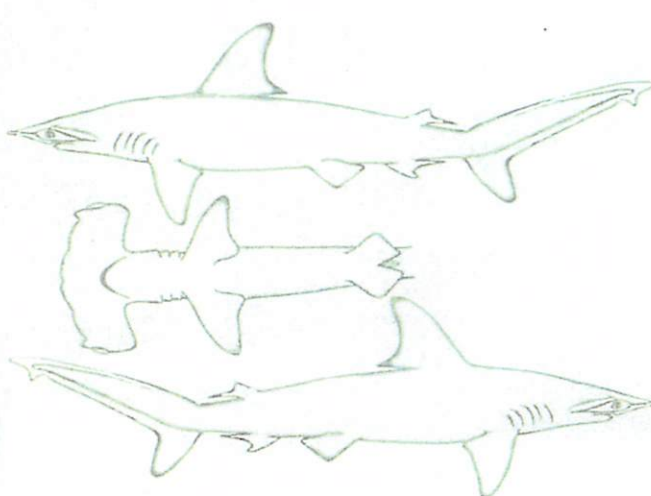
*The VR2W Submersible Receiver.*

11. **Tag Attachment Methodology.** To minimise stress, we deployed tags without catching the animals. Sharks were encountered on specific dive sites where they are known to come to because of "cleaning stations." Here the animals come in close to the site for cleaner fish (barber fish and king angel fish) to make contact who proceed to pick off any parasites on the sharks skin. The tag was driven into the dorsal musculature below the first dorsal fin using a spear gun. The tag used was a JBL Travel Magnum Spear gun. For the satellite tags, the full tag setup consisted of the pop-up satellite tag unit, a monofilament line, and a double barbed stainless steel anchor. The radio tag setup was similar, but instead of using monofilament line, coated stainless steel tethers were used. Custom made tag applicator spear tips were made in order to accommodate the stainless steel anchors. The JBL gun has three rubber bands. This study only required the use of one of the rubber bands, which provided enough power to insert the tag 10 cm into the shark. The tag was attached just below the dorsal fin into the musculature of the shark.

12. **Tag Accounting.** Tags were distributed on a dive by dive basis, this was important because each tag, both radio and satellite, has an on/off switch activated by a small magnet. To activate the tag the magnet must be removed prior to tagging. If the tag was not deployed, it was very important to put the magnet back on the tag to deactivate it hence not wasting any of the battery life giving us maximum data return when the tag was eventually deployed.



13. **Data Collection Forms.** The following forms were used for data collection:

SCALLOPED HAMMERHEAD SHARK STUDY DATA COLLECTION FORM	
Support Vessel: _____ Captain: _____	Country/Island: _____ Date: _____ Time: _____ GPS: _____ Location (Describe surroundings - on surface, on bottom, etc.)  Size of shark: _____ Sex of shark: _____  Notes: (Describe scars & markings. Mark any unusual scars on the sketch below) Attach photo if available.)
<b>SUB-SURFACE DATA</b> Visibility: _____ ft. (measured or estimated) Water Temperature Bottom: _____ Surface: _____  Current Direction: _____ to _____ Strength: _____  Water depth: _____ Depth shark encountered: _____ Swimming direction: _____	
<b>PHOTO/VIDEO</b> U/W Photos by: _____ U/W Video by: _____	<b>TAGGING INFORMATION</b> Visual ID Tag # _____ Tagger: _____ Date: _____ Satellite Tag # _____ Tagger: _____ Date: _____ Radio Tag # _____ Tagger: _____ Date: _____ Tissue Sample# _____ Vial # _____ Date: _____ Name of shark: _____
<b>REPORT COMPLETED BY:</b> Name: _____ Contact Info: _____	<b>BEHAVIOR OF THE SHARK</b>



## WHALE SHARK STUDY DATA COLLECTION FORM

Support Vessel: \_\_\_\_\_

Captain: \_\_\_\_\_

Country/Island: \_\_\_\_\_

Date: \_\_\_\_\_ Time: \_\_\_\_\_

### SURFACE DATA

Air temperature: \_\_\_\_\_

Cloud conditions: \_\_\_\_\_

Wind direction & strength: \_\_\_\_\_

Barometric Pressure: \_\_\_\_\_

GPS: \_\_\_\_\_

Location (Describe surroundings - on surface, on bottom, etc.)

Size of shark: \_\_\_\_\_ Sex of shark: \_\_\_\_\_

Notes: (Describe scars & markings. Mark any unusual pattern or scars on the drawing below. Attach photo if available.)

### SUBSURFACE DATA

Visibility: \_\_\_\_\_ ft.  
(measured or estimated)

Water Temperature  
Bottom: \_\_\_\_\_ Surface: \_\_\_\_\_

Chemistry: \_\_\_\_\_

Current  
Direction: \_\_\_\_\_ to \_\_\_\_\_  
Strength: \_\_\_\_\_

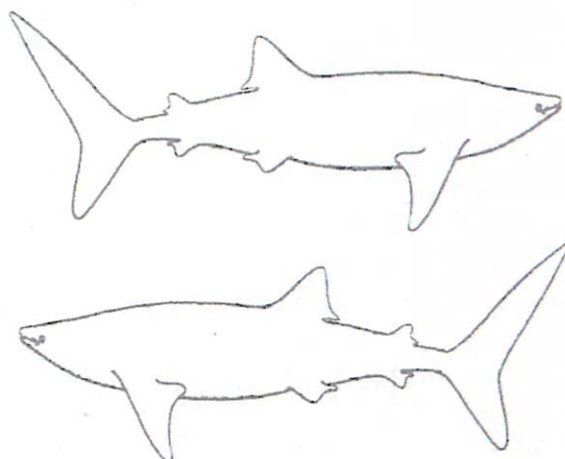
Waves  
Height: \_\_\_\_\_ Strength: \_\_\_\_\_

Water depth: \_\_\_\_\_

Depth shark encountered: \_\_\_\_\_

Swimming direction: \_\_\_\_\_

Environmental conditions: (reef, plankton, schooling fish)



### TAGGING INFORMATION

Visual ID Tag # \_\_\_\_\_ Tagger: \_\_\_\_\_ Date: \_\_\_\_\_

Satellite Tag # \_\_\_\_\_ Tagger: \_\_\_\_\_ Date: \_\_\_\_\_

Tissue Sample# \_\_\_\_\_ Vial # \_\_\_\_\_ Date: \_\_\_\_\_

Name of shark: \_\_\_\_\_

### BEHAVIOR OF THE SHARK

### PHOTO/VIDEO

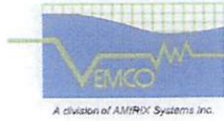
UW Photos by: \_\_\_\_\_

UW Video by: \_\_\_\_\_

**REPORT COMPLETED BRE-  
PORT COMPLETED BY::**

Name: \_\_\_\_\_

14. Cost of Scientific Equipment. The quote for the tags and receivers used on the expedition is shown below:



VEMCO, 211 Horseshoe Lake Drive, Halifax, Nova Scotia, Canada B3S 0B9  
 Phone: +1-902-450-1700 Sales ext 231; Fax: +1-902-450-1704; Web: www.vemco.com

**QUOTATION**

Current Canadian / US Exchange Rate: \$0.975

DATE: 2008-08-28 SALESPERSON: Dana Allen CUSTOMER: QUOTE # AA080823DA  
 Email Address: dalen@vemco.com

QUOTATION TO:		SHIP TO:			
Club Centamar 4775 Granby Circle Colorado Springs, CO 80919-3131 Alex Antoniou, Ph.D. tel: 719-540-9119 fax: 719-540-2787		Club Centamar 4775 Granby Circle Colorado Springs, CO 80919-3131 Alex Antoniou, Ph.D. tel: 719-540-9119 fax: 719-540-2787			
ITEM	PRODUCT/DESCRIPTION	QUANTITY ORDERED	CANADIAN UNIT PRICE	CONVERTED US DOLLAR UNIT PRICE	US DOLLAR UNIT TOTAL
1	V16-S4-89KHz-RB4K (hammerhead + white sharks) External PVC Case option ID Codes: To be determined Min & Max delay times: 40 to 120 seconds; nominal 80 seconds Estimated tag life of 626 days  TAGS SHOULD BE DEPLOYED WITHIN 2 YEARS OF DELIVERY.	20	\$390.00	\$380.25	\$7,605.00
2	VR2W Coded Acoustic Receiver (89KHz) with Bluetooth Code Map-110 Lithium Tadiran 5630/F Battery included	4	\$1,410.00	\$1,374.75	\$5,499.00
3	VR2WPC - PC Bluetooth Interface and VUE PC Software Includes Bluetooth USB adapter and two VR2W activation probes VUE PC Software requires Windows XP with SP2	1	\$195.00	\$190.13	\$190.13
4	Dangerous goods handling fee for Lithium batteries	1	\$10.00	\$9.75	\$9.75
REMARKS: Manufactured in Canada Commodity Code: 9015.80 Oceanographic Research Instruments AMIRIX Business Number 892153032		TAX ID No.: 98-0456934 EIN No.: 98-0456934 DUNS No.: 24-342-3589 CAGE CODE (CCR): L3480 ABN: 72728325787		SUBTOTAL: \$13,303.88 FREIGHT: \$270.00 HANDLING: \$0.00 TOTAL: \$13,573.88 CURRENCY: USD	

- NOTE: (1) Freight is an estimate only and will be adjusted on the invoice at time of shipping.  
 (2) Prices do not include any applicable Taxes, Duty, Bank Charges or 3rd party procurement processing fees.  
 (3) Credit cards can be used for orders less than \$5,000.00.  
 (4) Standard delivery for transmitter and receiver orders is 4 to 6 weeks ARO.  
 (5) The TL 5630/F VR2 batteries are shipped as Dangerous Goods.  
 (6) Prices based on Canadian Dollar and converted to US Dollar with current exchange rate.  
 (7) Prices in effect for 30 days after quote date: 28-Aug-08

Original  
 THANK YOU

ANNEX I TO  
ITG/20/3602  
DATED 31 MAY 09

LIST OF TAGGED SHARKS

Ser (a)	Date (b)	Location (c)	Depth (d)	Type of Tag (e)	Species (f)	Sex (g)	Size (h)	Remarks (i)
001	22 Oct 08	Guadalupe	Surface	Radio	Great White	M	4m	Skid #14
002	22 Oct 08	Guadalupe	Surface	Radio	Great White	F	5m	Bumped Chin #20
003	22 Oct 08	Guadalupe	Surface	Radio	Great White	M	4m	Bruce #7
004	22 Oct 08	Guadalupe	Surface	Radio	Great White	?	?	
005	22 Oct 08	Guadalupe	Surface	Radio	Great White	M	4m	Bulls Eye #61
006	23 Oct 08	Guadalupe	Surface	Radio	Great White	?	5 – 6m	Scar on head
007	24 Oct 08	Guadalupe	Surface	Radio	Great White	F	4m	
008	24 Oct 08	Guadalupe	Surface	Radio	Great White	F	1.8	
009	24 Oct 08	Guadalupe	Surface	Radio	Great White	F	4m	
010	24 Oct 08	Guadalupe	Surface	Radio	Great White	F	4m	
011	01 Nov 08	Roca Partida	15m	Radio	Scalloped Hammerhead	F	1.5m	
012	03 Nov 08	Roca Partida	15m	Radio	Galapagos shark	M	2m	
013	03 Nov 08	Roca Partida	15m	Radio	Scalloped Hammerhead	F	1.5m	
014	03 Nov 08	Roca Partida	25m	Radio	Scalloped Hammerhead	?	2.0m	
015	04 Nov 08	Roca Partida	25m	Radio	Scalloped Hammerhead	F	1.5m	



**SPECIES IDENTIFIED**

**SHARK SPECIES IDENTIFIED AROUND GUADALUPE ISLAND**

Ser	Common Name	Scientific Name	Description	Size	Habitat, Behaviour and Biology	Abundance	Team Sighting
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1	Great White Shark	<i>Carcharodon carcharias</i>	Very sharp colour change on flanks from greyish back to white undersides. Black tip underneath pectoral fins, usually a black spot where rear edge joins body. Strong keels on caudal peduncle. Crescent-shaped tail. Large, flat serrated triangular teeth.	Average 3.5 – 5.0m Max ~ 6.0m	From shallow inshore waters to open ocean and oceanic islands, 0 – 1300m. Usually seen around rocky reefs near colonies of prey. Intelligent and inquisitive shark with complex social behaviour. Very effective predator may breach out of water when attacking prey. Highly migratory. Warm blooded,	Rare. Listed as vulnerable.	All great white sharks were seen around Guadalupe.

					maintaining constant high body temperature even in cold water. Litters of two – ten pups are nourished by unfertilised eggs during ~ 12 month gestation at two to three year intervals.		
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**SHARK AND RAY SPECIES IDENTIFIED AROUND THE REVILLAGIGEDO (SOCORRO) ISLANDS**

Ser	Common Name	Scientific Name	Description	Size	Habitat, Behaviour and Biology	Abundance	Team Sighting
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1	Diamond stingray	<i>Dasyatis brevis</i>	Diamond or rhomboid shaped body and short tail. Sting located closer to base of the tail than the tip.	Width to 1.8m	Feeds primarily on crabs		One ray seen at Cabo Pears
2	Manta Ray	<i>Manta birostris</i>	Large ray with dark upper surface and mottled grey /white undersides. Distinctive lobes on the	Average 3 – 4 Max 7m	Very inquisitive species that will approach divers closely, circling	Common.	A number of large rays with attached remoras seen

			side of the head that unfurl to guide plankton into mouth gives this ray the alternative name of "Devil fish"		around and then flaring and looping in close proximity		at San Benedicto
3	Whale Shark	<i>Rhincodon typus</i>	Dark blue-gray to brown with a pattern of large white spots and lines above, fading into white below; three ridges along sides of body. Broad, flat head with small eyes just behind wide, terminal mouth. Unmistakable. Largest of all fishes.	Average 4 – 12 m (13-40 ft) Max 13.7 m (44.5 ft)	Occurs inshore and over deep water, from the surface to at least 240 m (800 ft). Swims with its mouth open feeding on zooplankton, squid and small fish.	Observed at Roca Partida on first few days	Video footage recorded by Maj Mark Foster, Lt (RN) Mark Jameson
4	Galapagos Shark	<i>Carcharhinus galapagensis</i>	Moderately large first dorsal fin begins above inner margin of pectoral fin; tip pointed to somewhat rounded. Body brownish grey above, white below.	0.6 to 3.7 m (2 – 12 ft)	Occurs both close to islands and off shore; from the surface to 50m. Solitary and in small groups and aggregations. Feeds on fishes, squid and octopi. Curious and bold; may closely approach divers repeatedly.	Observed at Roca Partida	Two Galapagos sharks tagged at Roca Partida



					Known to attack divers.		
5	Silvertip Shark	<i>Carcharhinus albimarginatus</i>	Conspicuous white tips and trailing edges of all fins. Stocky body, dark grey above, white below	Average 0.7 m (2-7 ft) Max 3 m (10 ft)	Most often observed along outer reefs and blue water near rocks and pinnacles. Usually solitary or in small groups. Feeds on fishes, including small sharks, eagle rays and octopus. Usually shy; reported attacks on divers when injured fish were present.	Three Silvertip sharks seen on shakedown dive at San Benedicto. Small groups of 3 - 4 individuals seen at Roca Partida	One Silvertip shark tagged at Roca Partida
6	Whitetip Reef Shark	<i>Triaenodon obesus</i>	Conspicuous white tips on first dorsal fin and upper lobe of tail; second dorsal fin and lower lobe of tail sometimes with white tips. A slender shark with a blunt head, grey-brown above shading to whitish below. Extremely short broad snout.	0.6m at birth to over 2m (2 ft - 7ft)	Often observed resting on the bottom on rocky reefs, boulder areas and in caves. Often in groups. Most active at night. Large groups have been observed swimming in place in strong currents. Feeds	Abundant.	The most common shark at San Benedicto Island. Many seen at Roca Partida.

					<p>on small fishes, octopi and crustaceans. Large groups have learned to follow divers at night, opportunistically feeding on prey illuminated by diver's lights. Will approach at close range. Considered harmless, but has bitten divers when harassed.</p>		
7	Silky Shark	<i>Carcharhinus falciformis</i>	Sloping first dorsal fin begins behind rear tips of pectoral fins; tips of fins dusky. Body dark gray to gray brown above, white below.	0.6 to 3.5m (2 -11ft)	<p>Most often observed along outer reef slopes and in blue water near rocks and pinnacles; also in blue water from the surface to 50 m. Solitary and in small groups. Feeds on fishes, squid, and pelagic crabs, yellow fin tuna, rainbow runners,</p>	Occasionally; most often observed in open water or off sea mounts.	Observed at Roca Partida

					bottlenose dolphins and brown boobies. Curious, will make a close pass at divers.		
8	Scalloped Hammerhead Sharks	<i>Sphyrna lewini</i>	Head broad and hammer shaped with anterior notches. First dorsal fin begins above or slightly behind base of pectoral fin. Tips of pectoral fins dusky to black. Body grey-brown above, white below.	Max 4.2 m (14 ft)	Congregates in schools near seamounts and costal islands. Schooling believed to be associated with mating. Feeds primarily on a variety of fishes (sharks, reef fishes, rays, batfish), as well as squid, octopi, shrimp, crabs, and lobsters. Shy and difficult to approach	Common.	Observed at Roca Partida in groups of up to a dozen individuals



## **SHARK CONSERVATION**

### **SHARK TAGGING**

1. All sharks were tagged using a specially adapted spear gun while free swimming. For White Sharks this was typically carried out from the protection of a cage. Whale Sharks can be readily approached by free swimming divers. For Scalloped Hammerhead Sharks divers waited for them to swim alongside a cleaning station and then moved in slowly to tag them using a pole spear or one-band spear gun. Re-breathers were used by a proportion of the team in order to get as close to the sharks as possible. The sharks seem to enter a trance-like state when they are at the cleaning station and react by simply swimming away (catching sharks to tag them, while being the traditional method, is very traumatic on the animal, and in some cases causes the shark to die). This methodology was proven on Exercise Jurassic Shark in 2006 when 15 Scalloped Hammerhead Sharks were tagged. The expedition also deployed 4 radio receivers at different sites around Guadalupe and the Revillagigedo (Socorro) Islands. The aim was to build up complete coverage of the Eastern Pacific thus allowing shark movements to be tracked and corridors to be mapped. Biopsy (tissue) samples were taken from Great White Sharks and Manta Rays using a specially adapted spear gun.

2. All the research permits were obtained from the Direccion General de Vida Silvestre by the Mexican scientific team. It is hoped this project will assist the host country in planning the protection of these sharks and the environment where they live. It will also contribute significantly to shark conservation outside Mexico.

### **GREAT WHITE SHARKS**

3. The (Great) White Shark is a slow-growing and long-lived shark. Additionally, it gives birth to just a few young making it highly vulnerable to over fishing and slow to recover from over exploitation. Because of this, conservationists have been concerned with the vulnerability of the White Shark to possible extinction. It is currently considered a species of concern on the IUCN (World Conservation Union) Red List. The White Shark is CITES III (Convention on International Trade in Endangered Species) listed. Some limited regulations exist in Mexico, but a specific plan of conservation for this species needs to be completed. This expedition will help with research efforts at Guadalupe working in conjunction with local scientists.

4. The White Shark project concentrated on establishing the movements of individual sharks around Guadalupe using both radio and satellite tags. Fundamental questions included:

- Whether different size sharks forage in the study area in the same way?
  - Are they equally active during night and day?
- Do they return on a seasonal and/or annual basis to the same Sea Lion colony?

- Do they search for prey singly or in groups?

Do they converge periodically to scavenge on the remains from a successful predation?

- When do they leave the waters surrounding the island?

## WHALE SHARKS

5. Whale Sharks aggregate around the Revillagigedo Islands; previous observations indicate that these are invariably adult females and pregnant. The presence of pregnant females suggests that Whale Sharks use the deep waters of the southern area of the Gulf of California and Revillagigedo Islands as their primary nursery. Tags can be used to identify local vertical and regional horizontal scale movement of pregnant females around the Revillagigedo Islands. Biopsy samples allow the investigation of the genetic (mitochondrial DNA) population structure for comparison with the results from work being carried out (on juvenile Whale Sharks) at three localities in the nearby Gulf of California.

6. The whale shark aggregates seasonally in different areas of the Gulf of California. The areas are Bahía de Los Angeles off the north central coast of the Baja California Peninsula, Bahía de La Paz off the south eastern coast of the peninsula, *El Bajo* seamount near *Isla Espiritu Santo* (adjacent to Bahía de La Paz), and several seamounts off the southern tip of the peninsula, called Gorda Banks (by Los Cabos). They appear to segregate by size. At the seamounts (*El Bajo* and Gorda Banks) adult females (>9 m) appear to be pregnant. In coastal waters of Bahía de La Paz and Bahía de Los Angeles the aggregations are exclusively juvenile sharks (<9 m).

7. Since 2002 in the Gulf of California photo-ID methods have recognize 100 juveniles and 21 pregnant adults. In the two bays several juveniles have been re-sighted during the same season and when they return the next year. About 30% of the juveniles sighted return to these bays. The juveniles begin to appear in Bahía de Los Angeles in August to feed, with the greatest aggregation in October, after which they leave the bay. Four of these juveniles move to Bahía de La Paz, starting in October with the greatest numbers in November-December. From April through June, pregnant females visit the south of the Gulf of California (*El Bajo* and Gorda Banks), posing the question, "do the sharks use the areas as primary nursery sites?"

8. The genetic analysis of the mitochondria of whale sharks in the Gulf of California, demonstrated that a single population of whale sharks occurs in this area. Information from the photo-ID suggests that juveniles reside within the Gulf of California. In order to determine the residency of these sharks, juveniles from Bahía de La Paz will be tagged with satellite archival pop-up tags during the 2008 season. The absence of adult males suggests that when the whale sharks become adults they migrate to breed. The presence of small juveniles and pregnant females suggest that the southern waters of the Gulf of California are used as a primary nursery for the whale sharks.

9. The study will be extended in 2009 to include the pregnant female sharks in the south of the Gulf of California and in the Revillagigedo Islands. Satellite archival pop-up tags will be used to identify local vertical and regional horizontal scale movements of the pregnant females. The archival pop-up tags collect and record data about depth,

temperatures and light level, which will be used for determining geographic location. This information will help to understanding the pregnant female sharks behaviour found in the Gulf of California.

10. Whale sharks were only found around Roca Partida where the whale sharks were in deeper waters during the first and last day. On the second day the whale sharks were observed on the surface and between 10-20 metres by the divers, but not by those with the tags. On the third day no whale sharks were reported during the dives and it became evident that the oceanographic conditions had changed. These tags were subsequently used on whale sharks from the Gulf of California. Further work is required as follows:

a. In 2008 the satellite tags will be used in the resident juvenile whale sharks from the Gulf of California in order to determine where they go after they leave Bahía de la Paz and to know if they are residents from the Gulf of California.

b. The presence of pregnant females suggested that whale sharks use the deep waters of the southern area of the Gulf of California and Revillagigedo Islands as their primary nursery. Tagging pregnant females from the Gulf of California or from Revillagigedo Island will help to understand if they use the area as a primary nursery. Pregnant females aggregate in el Bajo of Espiritu Santo Island, between April-June, during May of 2009 will be whale shark expedition. Revillagigedo Island will be visited in November of 2009.

## **HAMMERHEAD SHARKS**

11. Scalloped Hammerhead Sharks were tagged off Cocos Island as part of Exercise Jurassic Shark (2006). As a result we now know that Scalloped Hammerhead Sharks migrate between Cocos Island (Costa Rica), the Galapagos Islands and Malpelo (Columbia). This project attempted to establish if the migration of these sharks extends as far as the Revillagigedo Islands using the same methodology. As such this project is effectively an extension of the Eastern Pacific Tropical Seascape (EPTS) initiative, which brings together the islands of the Galapagos, Gorgona, Malpelo, Cocos and Coiba in a single conservation plan. This expedition tested the current assumption that Scalloped Hammerhead Sharks do not migrate out of the area delineated by these islands and could therefore prove vital to their future conservation.

## **OTHER SPECIES**

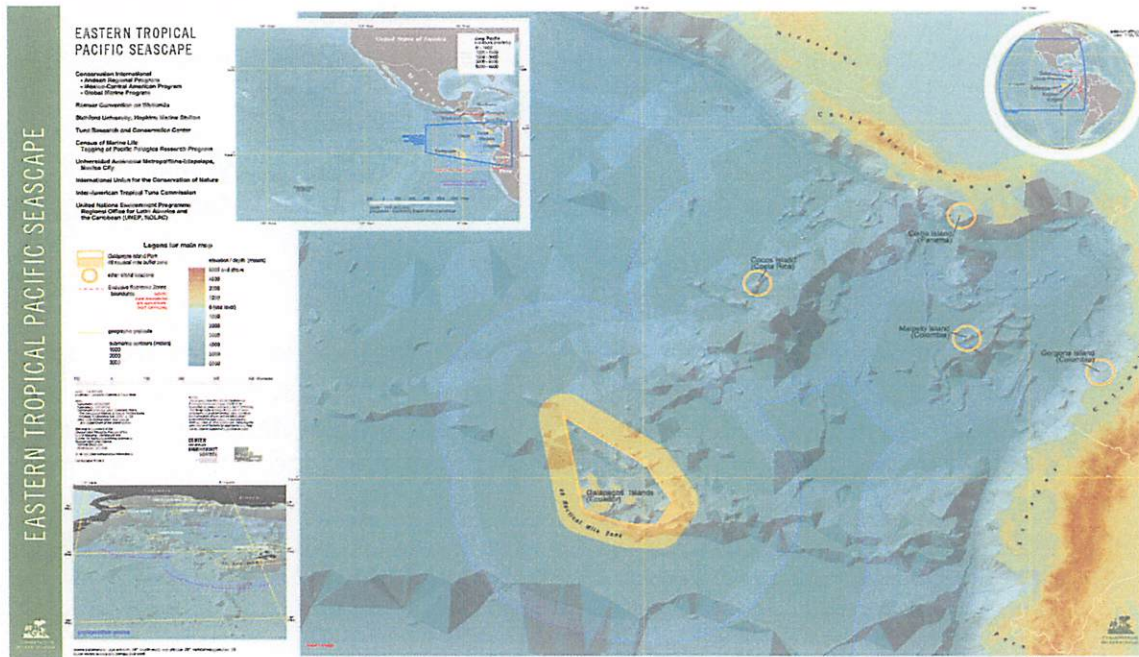
12. Three Galapagos and one silver-tip shark were tagged at Roca Partida. These species were not part of the initial plan but very little is known about the movements of either species and they were tagged simply because the team had the opportunity to do so and it had not been done before.

## **EASTERN PACIFIC TROPICAL SEASCAPE INITIATIVE**

13. Four governments – those of Costa Rica, Panama, Colombia and Ecuador – have joined with over 50 partners, including leading conservation and research groups, to launch the first ever attempt to pursue integrated ecosystem management across multiple international political jurisdictions. The EPTS initiative, which is partially funded



by the United Nations Foundation, is part of a broader \$15 million agreement between the Foundation, the Global Conservation Fund at Conservation International (CI) (with funds from the Gordon and Betty Moore Foundation) and the UNESCO World Heritage Centre to conserve current and proposed Natural World Heritage Sites. ETPS aims to establish a functional marine conservation corridor by creating a network of marine protected areas across the 211 million hectare expanse of sea that falls inside the four countries' exclusive economic zones.



Eastern Pacific Tropical Seascapes Initiative (From: Conservation International, 2002).

## GIANT MANTA RAY CONSERVATION GENETICS

14. The giant manta ray (*Manta birostris*) is epipelagic with a circumtropical distribution. This species has a K-selected life history whose characteristics; make them more vulnerable to exploitation, such as large size (6.5 m), slow growth, late maturation (3.5 m), low fecundity (1 or 2 pups), longevity, and most likely small populations. Population declines have been observed in the Philippines, Mexico, Sri Lanka/India, and Indonesia. Although catch data are not available in many of the areas where manta rays are fished, small population size and limited migration increases the risk of local extinction with limited potential for populations to re-establish themselves. Some populations of mantas, like those in the Hawaiian Islands and the Island of Yap have a closed population structure, with high site fidelity and little to no migration away from island groups. Other studies on populations with year-round sightings and high re-sighting rates reveal that a portion of the population is resident while a subset of the population appears to engage in larger migrations. In a few sites, mantas have been well documented to be seasonal.

15. In 2007 the giant manta ray was listed as **Near Threatened** on the IUCN Red List and in the Mexican Red List. To properly manage this species, it is necessary to assess levels of inter- and intra population variation so that management units can be accurately defined. The microsatellite DNA markers are powerful tools for investigating questions concerning population genetic structure and size, gene flow, and migratory

movements within and among different populations. These population parameters are important in addressing the conservation issues relevant to this species. At the moment there are not microsatellites molecular markers for the giant manta ray. The objective is to develop a microsatellite library to isolate microsatellites DNA molecular markers, during the Exercise Jurassic II In Revillagigedo Island we took two tissue sample from a manta which will be used in the develop of microsatellite molecular markers with another 5 tissue samples from Holbox Island.

16. The scientific sponsors for this project were:

a. **White Sharks**

Dr Mauricio Hoyos Padilla  
E-mail: [amuaka@gmail.com](mailto:amuaka@gmail.com)

Dr Felipe Galvan Magana (Adviser)  
E-Mail: [galvan.felipe@gmail.com](mailto:galvan.felipe@gmail.com)

**CENTRO INTERDISCIPLINARIO DE CIENCIAS MARINAS,**

Av. IPN s/n. Col. Playa Palo de Santa Rita

Apartado Postal 592

La Paz,

Baja California Sur,

México.

C.P. 23096.

Phone: (612) 12 25344

Fax: (612) 12 25322

[www.cicimar.ipn.mx](http://www.cicimar.ipn.mx)

[http://biotelemetry.ucdavis.edu/pages/bio\\_hoyos.htm](http://biotelemetry.ucdavis.edu/pages/bio_hoyos.htm)

<http://www.travelistic.com/video/show/5055/Isla-Guadalupe-Conservation-Fund-White-Shark-Research>

b. **Whale Sharks**

Dení Ramírez Macías (PhD Student)  
E-mail: [tiburonballena@gmail.com](mailto:tiburonballena@gmail.com)

Dr Ricardo Vázquez Juárez (Adviser)  
E-mail: [rvazquez04@cibnor.mx](mailto:rvazquez04@cibnor.mx).

**CENTRO DE INVESTIGACIONES BIOLÓGICAS DEL NOROESTE, S.C.**

Mar Bermejo 195.

Col. Playa Palo Santa Rita. C.P. 23090,

P.O. Box 128.

La Paz, Baja California Sur,

México.

Tel: (52)(612)123-84-84

Fax: (52)(612) 125-36-25

<http://www.cibnor.mx>



c. **Hammerhead Sharks.**

Dr Alex Antoniou – Former Director of Field Operations for the Shark Research Institute (SRI).

E-mail: [alex.antoniou@nspf.org](mailto:alex.antoniou@nspf.org)



## MEDICAL OFFICER'S REPORT

- 1. Overview.** The remote location meant that a comprehensive medical kit was put together. Ear infections, gastroenteritis and the usual coughs, colds and lacerations were covered for. Minor surgical instruments, sutures and antibiotics were carried as well as advanced life support equipment, anaphylactic injections and strong analgesia. Morphine (a controlled drug) was carried in a locked box in hand luggage during transportation. The small quantity of controlled drugs, and relatively short length of the expedition meant that a Home Office licence for transportation through UK customs was not required. However a headed letter of authorisation from the local SMO was carried, and this was also translated into Spanish via a notary, at the requirement of the Mexican embassy. There were no problems encountered at customs in the UK, USA or Mexico. The *Sea Escape* also had a fairly comprehensive medical kit including 100% O<sub>2</sub>, although most of the medicine names were in Spanish.
- 2. Seasickness.** The journey to Guadalupe from Ensenada was approximately 36 hrs in the open sea, resulting in a rough crossing and therefore seasickness was a considerable problem as the team was putting together the scientific equipment. There were no problems to/from Cabo San Lucas due to smoother, shorter crossings.
- 3. Vaccinations.** No specific vaccinations or malaria prophylaxis were required for this expedition.
- 4. Sun Protection.** It was very hot and sunny for the majority of the expedition. A few people had minor sunburn during the first day or so which then settled down.
- 5. Medical Problems Encountered.** The medical problems encountered included: seasickness, diarrhoea, sea urchin spines, minor cuts and blisters were treated. One diver had an ankle sprain resulting from rough conditions getting into the RIB, which was treated conservatively. There were no serious illnesses / injuries, and no incidents of decompression illness (DCI).
- 6. Medical Kit.** The medical kit needed to take account of the potential for shark bite and was composed of the following:

## EXPEDITION MEDICAL KIT

ITEM	OUT	IN	Price	Remarks
<b>Analgesia</b>				
Paracetamol 500mg tabs	100	100	1.35	
Aspirin 300mg disp tabs	16	16	0.85	
Ibuprofen 200mg tabs	84	72	1.49	
Diclofenac 50mg tabs	56	56	1.52	

<b>Injectables</b>				
Morphine 10mg/1ml amps	5	5	3.62	Myocardial infarction on risk ass.
Metoclopramide 10mg/2ml amps	5	5	1.34	
Epinephrine 1:1000 1ml amps	5	5	1.48	Anaphylaxis – 0.5mls IM
Hydrocortisone 100mg inj	2	2	2.32	
Chlorphenamine 10mg inj	5	5	7.25	
Giving set	2	2	2.50	Massive haemorrhage
Hartmann's 1000ml IV bag	4	4	6.08	Massive haemorrhage
Lignocaine 1% 20mg/2mls amps	5	5		Local anaesthetic
<b>Antibiotics</b>				
Erythromycin 250mg tabs	56	56	6.16	2 QDS - penicillin-allergic
Flucloxacillin 250mg tabs	56	56	4.12	2 QDS - cellulitis
Ciprofloxacin 250mg tabs	56	28	3.92	1-2 BD - diarrhoea/UTI
Co-amoxiclav 625mg tabs	21	21	11.73	1 TDS - wound inf
Metronidazole 200mg tabs	84	84	2.36	2 TDS - anaerobes
Penicillin VK 250mg tabs	80	80	8.63	2 QDS - tonsillitis
<b>Antiemetics</b>				
Cinnarizine 15mg tabs	100	20	3.75	Sea-sickness – 1 TDS
<b>Primary care</b>				
Dioralyte sachets	20	5	6.26	
Prednisolone 5mg EC tabs	28	28	2.72	
Chlorphenamine 4mg tabs	28	28	0.62	
Glyceryl trinitrate 400mcg spray	1	1	2.27	
Lansoprazole 30mg tabs	7	7	0.98	
Salbutamol 100mcg inhaler	1	1	1.33	
Loperamide 2mg tabs	30	30	0.52	
Loratadine 10mg tabs	60	60	1.72	
Hypo-stop dextrose gel	2	2	5.34	
Chloramphenicol 0.5% eyedrops	2	2	3.10	
Fucidic acid 2% / hydrocortisone 1% cream 30g	1	1	5.30	
Betamethasone 0.1% cream 30g	1	1	1.02	
Suture prolene 4/0	2	2		
Suture prolene 3/0	2	2		
Sofradex ear drops 10mls	12	11	55.92	
Silver sulphadiazine 1% 20g	2	2	6.20	
<b>Resuscitation</b>				
Intercostal chest drain	2	2		Portex ambulatory type
Quikclot	2	2		Massive haemorrhage
Sam splint	2	2		
Trauma shears	1	1		
OP airways	2	2		Sz 2 and sz 3
NP airways	2	2		Sz 6 and sz 7
Bag-valve mask + tubing	1	1		
Vitalograph aspirator	1	1		
Hemcon	2	2		



## EXPEDITION DIARY (BLOG)

### 21 Oct 08 – The Ladies of Guadalupe

We finally arrived at the island of Guadalupe at 0800hrs this morning. As we approached it was clear that this is a special place – towering cliffs shrouded in cloud stood over a clear blue sea. The day was warm and sunny and we could clearly hear the sound of Californian Sea lions calling from the rocky foreshore surrounding the island.

On arrival we called Mauricio (our Great White Shark scientist) on the radio – he answered immediately from his camp on the island and came out to join us on the *Sea Escape*. Before we could tag any sharks we had to deploy the two receivers. This caused a slight problem in that it is inadvisable to dive in open water around the island. Instead we dropped the receivers in 20 metres of water from the boat and ran a line back to the shore so that they could be located and retrieved at a later date.

We were understandably keen to meet the ladies of Guadalupe and getting in the cage to meet them was a high priority. Unfortunately, the ladies proved rather shy and did not appear for some time. When they did, they didn't stay long. Fortunately this changed as the evening came and a couple of the ladies overcame their shyness and approached the cage with something approaching total enthusiasm. Major Reid finally got the picture he had been waiting for when a shark took the bait inches in front of him – causing him to retreat to the interior of the cage fairly rapidly. Today we met 'Shredder', 'Bella' and 'Lucy' but we have yet to identify the others. Lucy was the first to visit us and was clearly identifiable by her chewed-up tail – probably the result of an encounter with another shark. It is possible that one of the sharks was 'Honey' – if so she was being very good today.

Despite the slow start this was a brilliant day and the whole team saw sharks. Tomorrow four of the team will join Mauricio with the aim of starting the tagging. This will be done from the surface whilst the remainder continue with the cage diving.

### 22 Oct 08 – The Waiting Game

Our second day diving at Guadalupe and the key task was to start tagging Great White Sharks. Initially this proved to be an activity requiring considerable patience as the Great Whites appeared to prefer staying deeper where water temperatures were cooler than the 25 degrees Celsius found at the surface. Our first Great White Shark, 'Skid' was tagged before 0900hrs but it took until lunchtime to tag our second: 'Bella'. Bella subsequently returned to the boat to show off her new tag and allow us to photograph it from the surface.

In stark contrast to the morning's work, the afternoon saw two sharks tagged in the space of about 15 minutes followed by a 5<sup>th</sup> about an hour later. This was clearly not the kind of waiting game experienced during the morning. Tagging 5 Great White Sharks was a fantastic achievement, which was carried out by the following team members:

- 'Skid' (male) – tagged by Sgt Thomas.
- 'Bella' (female) – tagged by Flt Lt Matt Palmer.
- Currently Unidentified – tagged by WO1 Roger Godfrey.



- Currently Unidentified – tagged by Capt Richard Beck.
- Currently Unidentified – tagged by Mr Guy Hagg.

Whilst the tagging team were in action the cage diving team were fortunate to witness a Californian Sea Lion literally teasing a Great White Shark – proof that a fit and agile adult Sea Lion has nothing to fear from a Great White Shark. Unfortunately, the pace slowed during the day and the expected flurry of action as dusk approached did not occur. Nevertheless, several members of the team recorded up to 2 hours whilst waiting in the cage just in case!

Maj Andy Reid and Sgt Mark Jones also tried out the 'deep' cage. This is a two-man cage that is lowered to 13 metres - below the surface cages. The cage was circled almost continuously by 2 Great Whites but neither of them came particularly close. Going up and down in something that is operated like a lift was, however, an interesting activity. Tomorrow we hope to deploy the remaining 5 tags.

### **23 Oct 08 – 'Bruce'**

Today was a slow day for Great White Sharks at Guadalupe although this didn't stop SSgt Johnny Anderson from spending an incredible 3 hours underwater on his first dive. Throughout the day the sharks only visited us fleetingly; hardly ever going for the bait. As a result the tagging team only tagged one more shark, bringing the total to six.

'Bruce' was one of the sharks tagged yesterday (previously thought to have been 'Bella'). Despite this potentially negative experience and the humiliation of us getting his sex wrong, he visited the tagging boat several times – providing the opportunity to collect a tissue sample for DNA analysis and photograph the tag *in situ*. Whilst we enjoyed Bruce's company it is notable that no smaller shark would attempt to take the bait while he was around – restricting our opportunities to tag more sharks. The team subsequently watched 'Finding Nemo' in Bruce's honour.

Despite the overall lack of sharks the last dive of the day proved to be something of a highlight with several high quality, but relatively short encounters. This included one encounter when the cage occupants were sent flying after the cage was hit by a massive female shark passing underneath. This shark later turned out to be a new shark – presenting us with the potential opportunity to formally name her on the database held by the Marine Conservation Science Institute (MCSI).

Sgt Gareth Thomas also managed to catch (with his bare hands) a Yellowtail Snapper with a piece of string tied around its tail. Scissors were immediately brought down from the medical kit on the boat and the fish was liberated. Finally, Flt Lt Matthew Palmer was just heading out of the cage after one hour and forty minutes when a Great White took the bait just a few feet behind him – he missed it all.

The day finished with an excellent presentation by Mauricio, our Great White Shark scientist. Tomorrow is our last day with the sharks of Guadalupe before heading south. We can only hope that the sharks overcome their shyness for our last day. There is no doubt that we will miss them.

## **24 Oct 08 – Farewell Guadalupe**

Today was our last day at Guadalupe and conditions were once again absolutely perfect. Despite this the sharks remained relatively shy and the majority of our encounters with these fantastic animals remained relatively short-lived. It seems that watching Great Whites is at least 95% waiting and never more than 5% action. This did not stop Mauricio from eventually deploying all the remaining radio tags with the assistance of the military team. It is anticipated that the tags and receivers deployed by this expedition will shortly be augmented by an additional 3 receivers and 20 radio tags - representing a substantial investment in this particular research project.

Highlights of the day included the presence of a young female Great White who did an initial recce of the area before moving in fast to take the bait. She subsequently returned for a second and third time before finally disappearing – having clearly eaten enough. Some members of the team were also fortunate enough to witness 2 breechings – an extremely rare sight at Guadalupe, which has only been observed three times this year. Unfortunately, the last dive of the day turned out to be the only dive on which not a single shark was seen. Sixty minutes without a sighting is a long time to sit in a cage filled with cold water! Today was also an opportunity to visit some of the Sea Lion and Elephant Seal colonies that surround the island; trips were run concurrently with tagging and diving throughout the day.

We are now back at sea – heading south to the Revillagigedo Islands. On the way we will probably break the journey with an exploratory dive at Thetis Bank (a seamount) and then re-supply at Cabo on the southern tip of Bahia California. The trip to Cabo will take 2.5 days but so far no-one has been seasick. It has been a real privilege to dive with the Great White Sharks but we are now looking forward to the second part of the expedition. The scientific work has been extended to include the tissue sampling of up to 20 Manta Rays and now we just want to get there!

## **25 Oct 08 – It's a long way to .... Cabo**

Now been at sea for 24 hours and the weather has been unbelievably kind to us. The sea is probably as close to being completely flat as the Pacific Ocean ever gets and not a single person has been seasick.

Most of the team spent the day editing photographs from Guadalupe, writing up dives or doing diver training. Both Dive Leader and Advanced Diver lectures were offered to those requiring them. An interesting diversion came when a bird chose to use the boat as resting place. We think it was a Booby.

Tomorrow will be another full day at sea. We have decided not to stop at Thetis Bank in order to maximise our time at the Revillagigedo Islands. This means arriving at Cabo early on Monday morning.

## **27 Oct 08 – Re-Supply in Cabo**

We finally arrived in Cabo at 0730hrs and the task of sorting out the boat commenced. A key task was bringing an engineer on board to fix the compressor, which was only capable of filling to 160Bar – enough for Guadalupe but not the Revillagigedo Islands. Other tasks included removing the shark diving cages, replacing the inflatable (with the shark bite hole - \$9000 worth of boat rendered useless), initial set-up of the hired re-breathers, re-fuelling and, of course, re-supplying with food. All these tasks seemed to

involve considerable logistical and technical problems, which used more and more of our precious time.

Getting the shark cages off the boat was a real issue as we were not allowed to carry them across a public jetty and the port authorities were unhappy about the time the slipway was committed for when they were floated across the harbour and carried out. Once these problems were overcome it became apparent that they were too big to fit on the truck. In the end, one big cage and the smaller deep cage were taken off at night leaving one cage to come off another time. This will probably have to be stored on the top deck.

The long-awaited arrival of the Semi-Closed Circuit Re-Breathers (SCCRBs) and the Soda Lime (carbon dioxide scrubber) was a considerable relief to the six people using re-breathers. However, the SCCR users quickly found that setting up hired equipment of this nature, without any leaks in the system, would not be an easy task. Ultimately these problems were overcome albeit with the promise that some additional parts would be brought down from La Paz (3 hours drive away) overnight.

The opportunity to check our e-mail brought the news that we have two suggestions so far for the name of our female Great White Shark. The first suggestions were: 'Jiji' (from Mrs Lucy Hagg) and 'Maggie' (from Flt Lt Matt Palmer's Mum – Pam). We will draw up a list of potential names and choose the most appropriate when we have confirmation that the shark is ours to name. This particular shark appeared to have some kind of red paint on its body (see picture), which may help guide the selection of an appropriate name. Please keep the suggestions coming.

Finally, Corporal John Corbett's fiancée, Laura Craig, will, no doubt, be overjoyed to see the attached picture of the ultimate gift. His purchase of this rather pathetic (and anatomically incorrect) wooden shark as a gift ensured that he ended up wearing 'the hat' for the next 24 hours. Laura – we are really sorry for spoiling the surprise!

Tomorrow, we will leave Cabo – it is just a question of when.

### **28 Oct 08 – Compressor Problems**

We should have been on our way to the Revillagigedo Islands early this morning but luck was against us and the compressor was still not working. Additional parts were required and these proved to be a long time coming. As a result, the team were left with a situation where the departure time constantly moved to the right leaving us with little choice to sit and wait.

We eventually got underway at 1615hrs – a delay that will cost us most of a day's diving. It will now take another 22 hours to reach the Islands. With a bit of luck the next blog will include details of our first dive. This had got to be the longest transit ever done on a dive boat.

### **29 Oct 08 – Diving at Last**

We spent the morning preparing our diving equipment and the remainder of the scientific equipment. Despite having been travelling for 4 days there seemed to be an amazing amount to do, including setting up the radio receivers and satellite tags, filling cylinders and testing re-breathers. Setting up the receivers is not a simple task – they have to be tested in conjunction with each of the radio tags and reset prior to use. They



then have to be attached to a rope linking a weight and float so that they can be suspended vertically underwater.

We finally arrived at San Benedicto Island at 1430hrs. Almost immediately a dive briefing was held and our shakedown dive was underway at long last. Our plan was to use this dive to recce an appropriate site for one of the radio receivers but not to tag any sharks. This was just as well as the visibility proved to be poor and although we saw three Silver Tip Sharks they did not come close and were, of course, not our target species. At this stage we are naturally wondering whether it will be possible to get close enough to any sharks to be able to tag them. The dive site consisted of a ridge topped with several large pinnacles beyond which the sharks can be found. It is here that we are considering placing one of the receivers. The really good news is the fact that the water temperature is now a balmy 29 degrees. Before diving we carefully placed stickers from our sponsors (Selex Galileo) on our cylinders only to find that the writing came off in contact with water. The cylinders now have a lovely blank white sticker on them. This might prove useful for recording the nitrox mix inside each cylinder.

San Benedicto is an incredible place – consisting of an ancient seabed that that has been thrust up into a dome shape by volcanic activity. This sedimentary rock has subsequently been extensively weathered to produce sharp karst-like gullies. Alongside this are contrasting darker lava flows. Tonight was an amazing sunset, which bathed everything in pink light. It is now dark yet as we write a number of Bottlenose Dolphins are close to the stern of the boat – attracted by the fish that were in turn attracted by the boat's light. Unlike Guadalupe, we are the only boat here.

Tomorrow we will stay at San Benedicto. The expectation being that the current will change direction, bringing in the sharks and, hopefully, better underwater visibility. The dive brief is at 0700hrs.

### **30 Oct 08 – Manta Rays**

During the night the weather changed for the worse. The immediate effect of this was a lack of sleep as the team were constantly woken by the movement of the anchor cable and the boat rolling in the heavy swell. Despite the relatively adverse conditions we dived on the same site as yesterday. Following the anchor cable down we found that it had been effectively tied round several of the massive pinnacles topping the underwater ridge – something that could only be described as a massive Cat's Cradle. Unfortunately, no sharks were seen and it was clearly evident that we had to move on. We also decided that this was not the ideal place to locate a radio receiver given that we have not seen a single Hammerhead Shark.

The next dive took us to a site known as 'The Boiler'. This site consisted of an underwater pinnacle of rock layers that stepped down towards the open ocean. Diving here required pulling yourself down a line as the current crossing the pinnacle was extremely strong. Once down we found much clearer water than that found on the previous dive site and lots of fish. These fish included a prominent cleaning station (marked by Barber Fish – a species of Butterfly Fish) at the seaward end of the rock. However, even the cleaning station did not appear to be inhabited by sharks and we decided not to put a receiver down around San Benedicto. We carried a spear gun and satellite tag just in case we came across a Whale Shark but these were also absent.

The highlight of diving 'The Boiler' was undoubtedly the Manta Rays. We were fortunate to be joined by two of these magnificent animals, providing the opportunity to

collect tissue samples from both. Amazingly, taking these samples did not deter the Mantas from continuing to come really close to the divers; they simply could not have been friendlier.

Tomorrow, we will dive Socorro Island itself whilst we wait for the poor weather to pass (Socorro is a much bigger island with more shelter). We know of two established cleaning stations. Maybe they will be frequented by sharks?

### **31 Oct 08 – Dolphins**

We arrived at Socorro Island before 0700hrs and immediately started preparing to dive a site called Punta Tosca. This site consisted of a knife-like rock ridge known to be frequented by Silky Sharks in particular. This time we saw just one Silver-Tip and one Manta Ray. The highlight was, however, the presence of a small pod of Bottlenose Dolphins. One of the Dolphins left the rest of the pod as soon as it saw divers and proceeded to act as if it wanted to be scratched; repeatedly coming alongside divers, going into a trance like state and falling through the water before returning to the divers. This was a remarkable display from a wild animal that left some of the team in a state of absolute euphoria.

Despite the presence of the Dolphins the almost total absence of sharks meant that we had to move on via a compulsory check-in at the naval base. It was interesting to discover that the Mexican Navy find an average of 5-6 illegal fishing boats per month. These boats fish within the 12 mile protection zone round each of the Revillagigedo Islands and are totally indiscriminate in terms of what they catch; even catching Manta Rays, which are totally protected in all Mexican waters.

The next site (*Cabo Pears*) was known to have a cleaning station and therefore presented our best opportunity yet to find sharks. As a result we entered the water equipped with a spear gun and radio tag just in case. Typically, we did not see a single shark but found two extremely prominent and well populated cleaning stations. This presented a dilemma: do we place a radio receiver here or not? In the end we decided that if sharks were present around the island they would be most likely to visit one of these cleaning stations. We therefore deployed the radio receiver on the third dive of the day. Surface conditions were not good and deploying a 25 kg block of concrete, receiver and float proved a much more difficult task than expected. Nevertheless, Socorro now has its first radio receiver. We just need to tag some sharks to go with it! Remarkably, we had close encounters with Dolphins on all three of today's dives.

Tomorrow we will start diving at the best yet most exposed site in the Revillagigedo Islands: *Roca Partida*. This site is really our last and best chance to find and tag sharks. We will also deploy the last radio receiver here.

### **01 Nov 08 – Sharks!**

Once again our sleep was disrupted by a very rough 6 hour crossing from Socorro Island to Roca Partida. Nevertheless, we arrived to find the sea conditions were fairly good considering this site is nothing more than an 80m long isolated pinnacle of rock in the middle of absolute nowhere. We completed 3 dives over the course of the day and found sharks at long last. The final species list included Silver-Tips, White-Tips, Galapagos Sharks, Silky Sharks, Scalloped Hammerhead Sharks and one Whale Shark. The Hammerhead Sharks were, however, incredibly hard to get close to and the sheer walls of the pinnacle did nothing to help. Despite this Sgt Gareth Thomas

managed to tag our first Scalloped Hammerhead Shark after an hour long wait in the colder, nutrient rich (green) water being forced up by the presence of the pinnacle. Major Mark Foster accompanied him but somehow missed the opportunity to get the all important moment on video. Both divers use closed circuit re-breathers and it is clear that the skittish nature of the Hammerheads will mean that most, if not all of the Hammerhead tagging will be down to re-breather divers.

The Whale Shark was seen at about 40m in the strong current running down the eastern side of the rock. Unfortunately, this meant that we had no chance of being able to tag it although it is re-assuring to know that Whale Sharks are actually here. Roca Partida is a brilliant dive site but it is far from ideal for tagging sharks – sheer walls, colder water, constant swell, currents, variable visibility and (effectively) no bottom conspire with skittish sharks to make tagging difficult to say the least. It was interesting to note that the lack of real estate meant that every single space was packed with life – a dozen Moray Eels in one hole was not unusual.

Our plan is to spend two more days diving here (weather permitting). Tomorrow we will put down the last receiver on a narrow ledge to one side of the cleaning station where today's shark was tagged.

## **02 Nov 08 – Whale Sharks**

Today was both a brilliant day of diving and an intensely frustrating one. There is no doubt that the day was completely stolen by the presence of Whale Sharks and one massive, pregnant, female shark in particular. The trouble was that not one of the divers lucky enough to see these incredible animals was equipped to tag it. Similarly, those equipped to tag Whale Sharks often found themselves in a position where they could easily have tagged a Hammerhead Shark if they had the right spear tip and tag. As a result we collectively experienced numerous potential tagging opportunities but failed to tag a single shark. With just two days left we have got to get this right.

The first dive of the day saw Pilot Officer Matt Skulskyj and Corporal Matt Wood deploying the last radio receiver onto a deep ledge close to where the Hammerhead was tagged yesterday. Once again this proved to be a far from easy task, which we will need to re-visit tomorrow in order to make sure that concrete anchor block is physically tied to an adjacent rock outcrop. As is it is bad weather could result in the receiver going over the edge. Major Andy Reid saw the Hammerhead with the tag in place nearby so we know that the receiver will already be picking up data.

Corporal Tim Gort saw the first Whale Shark of the day whilst acting as diving supervisor on the surface. The remainder of the sightings took place at an average depth of 20 metres. Diving with Whale Sharks is something every diver dreams of and many of the team could hardly believe their luck. The Whale Sharks swim in circles around the rock so we know that if wait in the right place we should be lucky. We just need to get the right kit into the right place at the right time.

Tomorrow we will start diving at 0630hrs. We have a plan to rotate the spear guns and tags throughout the day in the hope that things will work out right at some point. If the weather holds we will stay here to the end of the trip. Roca Partida is an incredible place – constantly shifting currents mean that every single dive is different.



### **03 Nov 08 – Three Tagged Sharks**

Today did not start well. Firstly, Sgt Gareth Thomas, our key shark tagger, was put out of action by a fault on his re-breather, which required him to take 24 hours off diving. Secondly, another boat with 19 divers onboard arrived and, thirdly, the currents changed. No current was encountered on the first dives of the day plus the water was generally much greener. Disappointingly, the Whale Sharks completely disappeared. Despite all this we managed to tag a total of three sharks: Two Hammerheads and a Galapagos Shark.

The diving is now structured to allow the efficient transfer of spear guns and tags between divers. Given that we are diving just one site, that is only 80m long, the dive plan is starting to become more than a little predictable. Most dives are an hour long and consist of swimming around the island looking for places where the sharks might come in close enough to be tagged. Once you are out of sight of the rock you have no choice but to put up a Surface Marker Buoy immediately and surface ASAP – we are, after all, a really long way from anywhere else.

Galapagos Sharks have been tagged in the Galapagos so we now have an opportunity to see if there is any movement between the two populations. The tagging of two more Hammerheads brings the total to three – an incredible achievement considering how difficult it can be to even see them on a dive. Cpl 'Ronnie' Corbett deserves a special mention for repeatedly attempting to tag sharks without any success.

The Roca Partida radio receiver was re-visited on the first dive of the day as it is a slightly deeper dive than the norm. Major Mark Foster secured it to an adjacent rock and reported that a Moray Eel had already taken up residence alongside the concrete block.

Tomorrow is our last day of diving. We plan to dive until the last possible minute – departing once the third dive is finished at approximately 1700hrs. It will then take us about 28 hours to return to Cabo. We can only hope that the Whale Sharks return. Once again the first dive is at 0630hrs.

### **04 Nov 08 – The Last Day of Diving**

Today was a day a mixed fortunes. Most importantly, we managed to deploy all the remaining radio tags. We tagged another 3 Hammerhead Sharks, 2 Galapagos Sharks and a Silver-Tip Shark bringing the total to 6 Hammerheads, 3 Galapagos Sharks and one Silver-Tip Shark (10 sharks). This means that despite all the odds every one of the radio tags has been deployed. This is a truly remarkable achievement that took real teamwork and a considerable amount of patience to achieve (shark tagging is primarily about waiting). One thing is certain: Roca Partida could never be described as an easy site for tagging sharks. Unfortunately, no amount of team work could bring the Whale Sharks back and the 2 satellite tags have therefore yet to be deployed despite the fact that one Whale Shark was seen at depth. Deni, our Whale Shark scientist, will now take charge of the 2 satellite tags and deploy them at the first available opportunity. Guy Hagg deserves a special mention for tagging the Silver-Tip. As far as we know this is the first time this species has ever been tagged.

Shark tagging continued throughout the day despite the fact that the wind picked up progressively throughout the day. This meant that the surge around the rock became increasingly impressive whilst the risk of lost divers (hidden by the swell) increased.

Such increasingly adventurous conditions probably contributed to the fact that Major Andy Reid's camera flooded on the second dive – a rather expensive incident for which he can only hope his wife (Kate) will not give him too hard a time. Fortunately, it is, insured.

With the weather deteriorating, we finally left Roca Partida at 1730hrs. This remote pinnacle of life in the middle of nowhere now has one radio receiver and 10 tagged sharks. Most of us have done a dozen dives at this incredible place. Each dive has been unique and it has certainly been a real privilege to have dived here. We are now on our way back to Cabo – a 28 hour journey. Conditions are not exactly smooth but after almost 3 weeks at sea we all have our sea legs so no one is suffering. Tomorrow will be spent packing and putting together the Post Exercise Report.

### **05 Nov 08 – Endex**

We have spent the day at sea packing, editing photographs and video and writing reports. We expect to reach Cabo San Lucas at about 2200 hours tonight, which doesn't give us much time to get the boat docked etc before we have to go to the airport. We fly at 0800hrs tomorrow morning.

This will be the last blog of the expedition although we expect to post updates from time to time once we return. We are now planning EXERCISE JURASSIC SHARK 3 – this expedition will almost certainly feature a return to hammerhead tagging at Cocos Island and Malpelo in 2010. We will let you know when we have booked the boat.

**ANNEX N TO  
ITG/20/3602  
DATED 31 MAY 09**



## **MEDIA OPERATIONS**

Headquarters 43 (Wessex) Brigade  
Bulford Camp, SALISBURY, Wiltshire SP4 9NY



Telephone 01980 673329 Military 94321 3329  
Fax 01980 672855 Fax 94321 2855  
Email: karen.moseley829@mod.uk

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### **MILITARY PERSONNEL TAG 20 SHARKS IN THE EASTERN PACIFIC**

Sixteen military personnel representing the Army, Navy and RAF have just returned from an ambitious diving expedition to tag endangered sharks around several remote Pacific islands off the west of coast of Mexico. The expedition travelled from Guadalupe to the Revillagigedo Islands from 19 Oct – 07 Nov 2008.

The expedition, called EXERCISE JURASSIC SHARK 2, was the second shark tagging expedition to be conducted by the Joint Services Shark Tagging Team. The aim was to contribute to shark conservation around Guadalupe and the Revillagigedo Islands in the Eastern Pacific by tagging a total of 20 sharks. The expedition set out to tag great white and scalloped hammerhead sharks in order to gather information on their movements. The tags send signals to underwater radio receivers allowing the movements of the sharks to be recorded.

All tagging was carried out whilst the sharks were free swimming as this is the least stressful method for the animal. The expedition started at Guadalupe, west of the Baja California where 10 great white sharks were tagged from the surface under the direction of a locally-based scientist. Sharks were also observed from a cage from where the team photographed a large female shark never before seen at Guadalupe. The team



now have the responsibility of naming this shark on the database of great white sharks found around the island (now 86 individuals).

Four days were spent tagging great whites before the team headed south to the Revillagigedo Islands, a largely uninhabited group of volcanic islands to the south of the Baja California peninsula, where they began the far from easy task of tagging scalloped hammerheads sharks; an exceptionally skittish species. All diving from here onwards was carried out in open water in areas that should have been prime shark habitats. Tragically, the effects of shark fishing meant that hardly any sharks were seen until the team reached an isolated rock outcrop just 80 metres long called Roca Partida. Four man dive teams dived three times per day on a rotational basis in order to optimise the use of the spear guns used for tagging. Strong currents, huge swell, sheer rock walls, extreme depths and the presence of sea urchins made this a difficult site from which to tag sharks. Nevertheless, 6 hammerhead sharks, 3 Galapagos sharks and a silver-tip shark were eventually tagged. Tissue samples were also taken from 2 manta rays for DNA and toxin analysis.

The research work carried out by the expedition took place in co-operation with two Mexican marine research organisations: The Centro De Investigaciones Biologicas del Noroeste, S.C. (CiB), Mexico and the **Centro Interdisciplinario de Ciencias Marinas (CICIMAR)**. **The expedition was sponsored by the Joint Services Expedition Trust and approved** by the Royal Geographical Society. The scientific equipment was purchased with funds from Selex Galileo.

The expedition was led by Major Andy Reid (Army), who explained, "An expedition such as this is all about experiencing controlled exposure to risk with the aim of developing the kind of leadership, teamwork, courage and co-operation that is vital to military operational capability. The expedition also assisted with two important conservation projects, both of which exploit the skills of a Joint Services team to best effect. Sharks are in dramatic decline around the world and this is our chance to make a difference by establishing those parts of the shark's habitat that most need protection."

Corporal Tim Gort (Army), another member of the expedition said, "The expedition has been hugely ambitious and an incredible experience. The rate that sharks are being needlessly killed is unsustainable and most are now endangered. The work we have

done will result in a better understanding of shark movements and help in the development of national and international strategies for their protection.”

**Overall, the expedition succeeded in tagging 20 sharks with radio tags and placed 4 radio receivers. Tissue samples were also taken from great whites and manta rays. Capt Richard Beck (Army) tagged a great white and said, “It is not every day that you are able to tag a 5 metre great white shark; this expedition really brought home to you the value and beauty of sharks.”**

The team hope to build on the success of Jurassic Shark 2 with another expedition in summer 2010.

Further information can be found on the expedition website at [www.jurassic-shark.org.uk](http://www.jurassic-shark.org.uk)

**ENDS**

Further information: Karen Moseley, Army Media Operations South West England, 43 (Wessex) Brigade, Bulford Camp, Wiltshire, Tel: 01980 672946

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