Topic 4: Integration of conservation and sustainable livelihoods: Marine, including fisheries

Session Organiser: Dr John Cooper, Chief Research Officer, Avian Demography Unit, Department of Statistical Sciences, University of Cape Town, South Africa, and an Honorary Conservation Officer, Tristan da Cunha

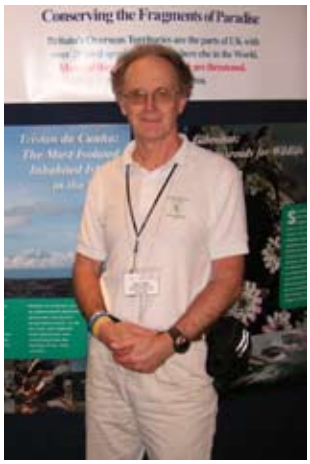
This topic, the integration of conservation and sustainable livelihoods, relating to marine areas including fisheries, explores the complex and challenging nature of this task. The small islands of the UK Overseas Territories and Crown Dependencies have a large area of marine responsibility, so the key question is "How can they be managed and looked after effectively?" The session presentations and discussion explore this huge task.

An introduction by Dr John Cooper (circulated in advance) gives background information and proposes subjects for discussion. Reviews were commissioned on three topics. One of these (By-catch issues in fisheries within UK Overseas Territories and Crown Dependencies Territorial and Exclusive Economic Zone waters) proved too ambitious, but Grant Munro stood in to address by-catch issues in fisheries within UK Overseas Territories focussed on the South Atlantic. Dr Anne Glasspool reviewed development issues in the inshore marine zones of UKOTs/CDs. Dr Mike Brooke's paper (presented by John Cooper in Mike Brooke's absence) examined the role of Marine Protected Areas in improving the conservation status of UKOT/CD territorial and EEZ waters. Grant Munro, Anne Glasspool and John Cooper then formed a panel to lead the discussion, which is summarised after the reviews.

In addition, poster presentations from BVI (Management of Marine Protected Areas and the Marine Conservation Programme), Alderney (EIA and tidal power), Bermuda (Reef Ecosystem assessment and mapping) and Tristan da Cunha (conservation status of the critically threatened Spectacled Petrel) are included in this section.

Introduction by session co-ordinator

Dr John Cooper, Chief Research Officer, Avian Demography Unit, Department of Statistical Sciences, University of Cape Town, South Africa, and an Honorary Conservation Officer, Tristan da Cunha



Cooper, J. 2007. Introduction to Integration of conservation and sustainable livelihoods: Marine, including fisheries. pp 109-111 in *Biodiversity That Matters: a conference on conservation in UK Overseas Territories and other small island communities, Jersey 6th to 12th October 2006* (ed. M. Pienkowski). UK Overseas Territories Conservation Forum, www.ukotcf.org

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Introduction

In 1987, Sara Oldfield published a guide for conservation action in the United Kingdom Dependent Territories (as the UK Overseas Territories were then termed), which she entitled *Fragments of Paradise*. When the total land area of the UK Overseas Territories (UKOTs) and Crown Dependencies

(CDs) are considered, it becomes obvious that one thing they have in common along with their fragmented nature is their small size. The largest (if we exclude British Antarctic Territory), the Falkland Islands, has an area of a little over 12 000 km², and the smallest, including Anguilla, Ascension, Bermuda, Gibraltar and Pitcairn, have land areas of less than 100 km². These are tiny sizes compared to those of continental nations. The United Kingdom has an area of a little over 240 000 km², the United States covers a huge 9.8 million km² and even land-locked Andorra has an area of 468 km². However, when territorial and Exclusive Economic Zone (EEZ) waters are included the situation is somewhat different. EEZ waters usually extend 200 nautical miles offshore and, compared to the land areas of UKOTs and CDs, these marine areas are many sizes larger. This makes, for example, the combined land and sea area of the Falkland Islands larger than that of Belgium – which is not a landlocked country. The 200-nm Maritime Zone encircling South Georgia and the South Sandwich Islands (with a total land area of only 4065 km²) makes for a political entity with a larger area than Switzerland.

The above comparisons would be of little significance if these marine components of UKOTs and CDs were of minimal value or interest. This is not the case, and a number of them are important for economic reasons, such as fisheries (e.g. Falkland Islands, South Georgia), oil exploration (e.g. Falkland Islands) and tourism (e.g. Caribbean UKOTs). Other marine areas, currently without significant economic activity, such as that of Pitcairn, may well harbour resources as yet unexploited or even yet to be discovered, including endemic and threatened species. One thing it may be assumed is that all UKOT and CD marine areas support habitats and biota of great conservation significance, although it is fair to say that all have been relatively little studied. Thus the primary challenge in ensuring sustainable development in UKOT and CD marine areas is how best to integrate the desire for economic development with the conservation of the habitats and species occurring within them.

Format of the discussion session

The following notes outline the initial intentions, subject to modification in the session. The session coordinator (John Cooper) and the three session speakers (Mike Brooke, Anne Glasspool and Grant Munro) will form a panel to lead the discussion. Inputs, preferably with specific examples and recommendations, from the session attendees will be encouraged and a rapporteur will record the salient points of the discussion and any specific recommendations. This record will form part of the Conference Proceedings, and will also link into the conference conclusions.

Subjects for discussion

Ensuring existing and new marine fisheries are managed in a sustainable manner

Matters to address include:

1. Are existing regulations adequate?
2. Is by-catch minimized (are FAO National Plans of Action in place)?
3. Are fisheries and fishery zones adequately patrolled, including against IUU (Illegal, Unregulated and Unreported) fishing?
4. Are resource research programmes adequate?

Ensuring tourism and other development activities are properly managed

Matters to address include:

1. Are existing regulations adequate (pollution, dredging, etc.)?
2. Is income from development activities adequately supporting conservation efforts?

Protecting habitats and species

Matters to address include:

1. Are there lists of threatened marine species with suitable levels of protection defined?
2. Do species action/management/recovery plans exist or are they planned for these threatened species?
3. Are there sufficient Marine Protected Areas in existence or planned (including sea mounts within EEZs)?
4. Are quarantine procedures adequate to protect marine biodiversity (e.g. regulations and inspections pertaining to ballast dumping, hull fouling, mariculture, etc.)?

Making use of international bodies

Matters to address include

1. What can be the value of World Heritage and Ramsar Wetlands of International Importance Conventions, and other conventions (e.g. CBD, CMS, CITES)?
2. Can membership of and inputs to Regional Fisheries Management Organizations (RFMOs) help manage resources?
3. How can the Agreement on the Conservation of Albatrosses and Petrels (ACAP) support species protection?

Resourcing conservation efforts

Matters to address include:

1. Do individual UKOTs and CDs have sufficient resources in the way of funds, infrastructure and qualified personnel to undertake the necessary conservation management activities identified above?
2. If such funds and resources are inadequate how can they best be obtained (training, NGO and private sectors, tourist levies, fishing licenses, UK grants-in-aid (e.g. OTEP), etc.)? (Note that this links into the Resources session.)

NOTES: the above lists only some of the possible areas for discussion and is intended to act as an impetus, and not a prescription. Attendees are encouraged to bring up other issues. It will be most helpful if these could be imparted to a member of the panel prior to the session, to ensure adequate time is made available.

Review 1: By-catch issues in fisheries within UK Overseas Territories in the South Atlantic, with special reference to the Falkland Islands

Grant Munro, Falklands Conservation

Munro, G. 2007. By-catch issues in fisheries within UK Overseas Territories in the South Atlantic, with special reference to the Falkland Islands. pp 112-121 in *Biodiversity That Matters: a conference on conservation in UK Overseas Territories and other small island communities, Jersey 6th to 12th October 2006* (ed. M. Pienkowski). UK Overseas Territories Conservation Forum, www.ukotcf.org

The incidental by-catch and mortality of non-target taxa by a wide range of fishing methods constitutes a critical threat to many vulnerable species including marine mammals (seals and cetaceans), turtles, sharks and seabirds. Many fishing methods are relatively unselective and indiscriminate in the marine species they target. Catches may contain undersize fish and non-commercial fish species, and "high-grading" of catches to optimise the value of restricted quota, all lead to a high level of fisheries discard. This can cause significant impacts to the marine ecosystem and affect prey availability for higher predators. However, the decline of many species, most notably albatrosses, turtles and sharks, and the increase in dedicated observer programmes, have highlighted the significant incidental mortality of non-target taxa through capture, entanglement or collision.

The *Code of Conduct for Responsible Fishing* of the Food and Agriculture Organization of the United Nations' and its associated *International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries* (IPOA-Seabirds) recognise the need to minimise incidental mortality if sustainable fisheries and species biodiversity are to be maintained. However, such assessments require data not only on by-catch but also on the dispersal of impacted species at sea, so as to determine the overlap of foraging ranges with fisheries. The lack of resources in many UK Overseas Territories, coupled with the inability to monitor and control extended maritime zones, mean that little data exist on incidental mortality and may lead to unreported fisheries activities. It has been shown that voluntary reporting significantly underestimates catches and may hide the extent or even existence of by-catch. There is thus an urgent need for data collection from dedicated marine observers to enable risk assessments to be undertaken and subsequent advocacy and mitigation methods to be undertaken and adopted.

In the Southern Ocean, 19 of 21 species of albatrosses are currently classified as globally threatened by the World Conservation Union (IUCN). Population declines are attributed to incidental mortality associated with fisheries activities. Longline, trawl and jig fisheries may all lead to incidental seabird mortality. Thousands of seabirds are killed annually on long lines as they dive on baited hooks during setting, an un-quantified number collide with trawl warps as they forage on discards and yet more may be deliberately targeted as food by jigger crews.

The process from initial identification of the problems, through quantification and mitigation development, is followed from data and experience in the Falkland Islands, South Georgia, Tristan da Cunha and in adjacent areas, such as South African waters and on the Patagonian Shelf, where birds forage. This highlights the problems but also the successes that can be achieved if effective monitoring and mitigation implementation are adopted.

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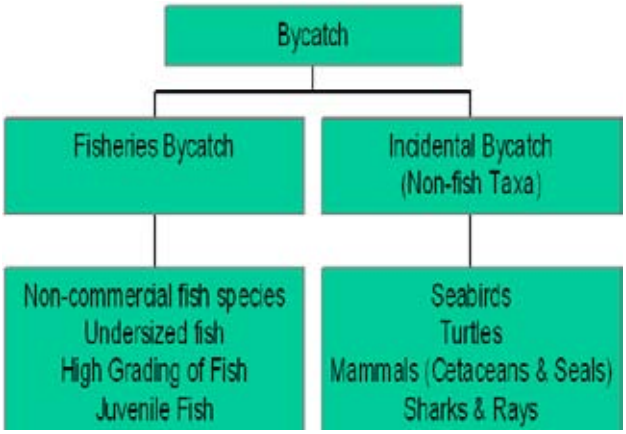
Introduction

Fisheries can have a range of environmental impacts. Obviously all fisheries are extractive. At worst this means, if poorly managed and monitored, stock collapse can occur. This can be disastrous, not only for the environment but also economically for the industry. Thus the importance of precautionary fisheries management has been widely accepted. Fisheries science deals with the stock assessment of commercial species and, to a lesser extent, the discharge of undersize commercial fish and non-commercial fish species that may be caught through unselective fishing gears. These estimates, and further estimates of occurrences such as "high-grading", all aim to keep stock at sustainable levels. Management has even been extended beyond national boundaries to the high seas where Regional Fisheries Management Organisations (RFMOs) attempt to regulate effort.

Until relatively recently little consideration had been given to the capture of non-fish taxa by management authorities as this had little direct economic impact. Only recently, with the increasing promotion of an ecosystem approach to fisheries and campaigns such as emphasizing "dolphin friendly" products in the 1990s and more recently for albatrosses and turtles, has attention turned to the significance of fisheries-related mortality on the populations of other taxa (see figure at top right). The species most affected are typically those that are long lived with a low fecundity or sporadic breeding where even a small increase in adult mortality can lead to long term population declines.

Data from the IUCN Red List of threatened species indicate that seabirds are becoming threatened at a faster rate than other groups. Albatrosses, for example, are now the most threatened family of birds with 19 of 21 species classified as threatened by the World Conservation Union (IUCN) according to BirdLife International's most recent categorizations. Albatrosses may live to over 45 years of age, do not reach reproductive maturity until about 10 years of age, may lay only one egg every other year and form long term breeding pairs. These demographic factors together place them at serious risk to any anthropogenic increase in adult mortality. Similarly, turtles may not breed until over 30 years of age and may only breed every three to eight years. All turtle species are now classified as threatened by the World Conservation Union.



There is a wide range of fisheries techniques and the causes of incidental mortality will differ depending on the fishery and species recorded. The main industrial fisheries may be divided into trawling, longlining and purse-seining/gill-netting; however, within each group there are many sub-divisions. Trawl nets can be demersal (bottom trawling), semi-pelagic, pelagic or pair, all of which have different specification of nets, sweeps and trawl speeds and thus give rise to different interactions. Longlining can be shallow set pelagic, deep-set pelagic, double line bottom (Spanish) or single auto-line bottom and again each gear type can effect different taxa in different ways. Interaction can be exacerbated if the vessel is also discharging processing waste. Whereas comparisons can be drawn between areas, it is still necessary to assess each situation as techniques and species assemblages or even age classes can mean that mortality may be distinct.

Long-lining

Longlining has received the most attention in recent years. This method became much more popular in the late 1980s as vessels moved away from drift/gill nets to target tuna. In itself longlining is one of the least damaging commercial fishing methods, it does not impact heavily on the seabed and cause benthic damage, is selective (relatively) in both the size and species it catches, meaning that undersize fish are not caught, and does not "ghost fish" (abandoned and lost nets continuing to catch fish and other marine species)– so its greatest environmental impact is in the capture of non-target taxa.

Pelagic longlining consists of hooks hanging from a long drifting line suspended from the surface of the sea by a number of floats. The floats maintain the line near the surface and the length of line con-

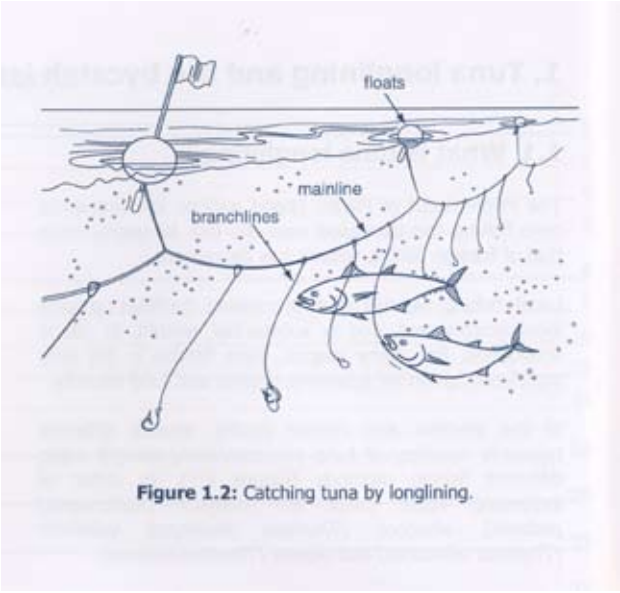


Figure 1.2: Catching tuna by longlining.

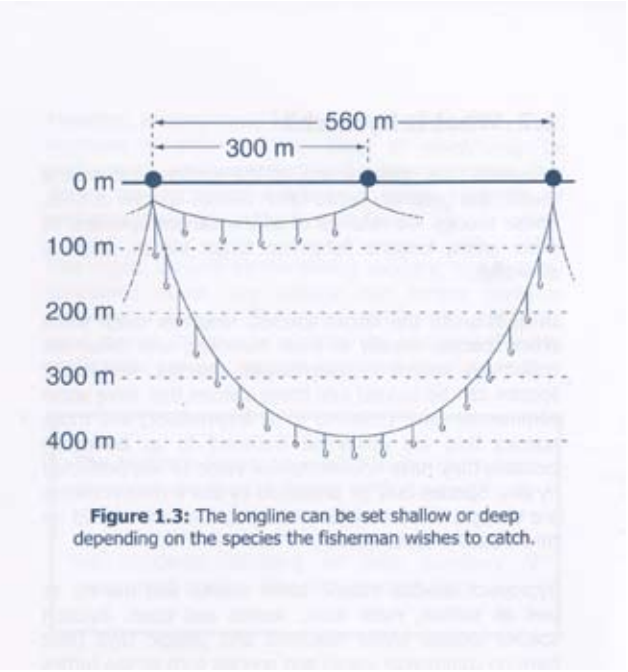


Figure 1.3: The longline can be set shallow or deep depending on the species the fisherman wishes to catch.

necting the floats to the mainline help to determine the fishing depth of the line. The mainline has a number of branch lines or snoods, each with a baited hook. From 300 to 3500 branch lines or hooks may hang along the mainline which extends from 10 to 180 km in length. The shape of the longline and the depth of set will vary depending upon the species that is being targeted. A shallow set, from 35 – 110-m depth would usually target swordfish whilst a deep set 300 – 400m depth would target albacore and bigeyetuna. The lines are usually set and left in the sea for a soak-time of approximately eight hours before being hauled. This is the most common form of longlining in warmer low-latitude fisheries.

Baited hooks are not however just seen as a source of food by fish but also by seabirds, turtles and sharks. Seabirds forage behind boats as the lines are being set and attempt to dive on the baited hooks. In the process they may be caught on the hook and dragged underwater and drowned as the line sinks. This interaction is, however, limited to periods of setting and hauling when the line is within the diving range of seabirds although, given that the line is only lightly weighted, the sink-time of the line behind the vessel can be slow and lead to a large danger area astern.

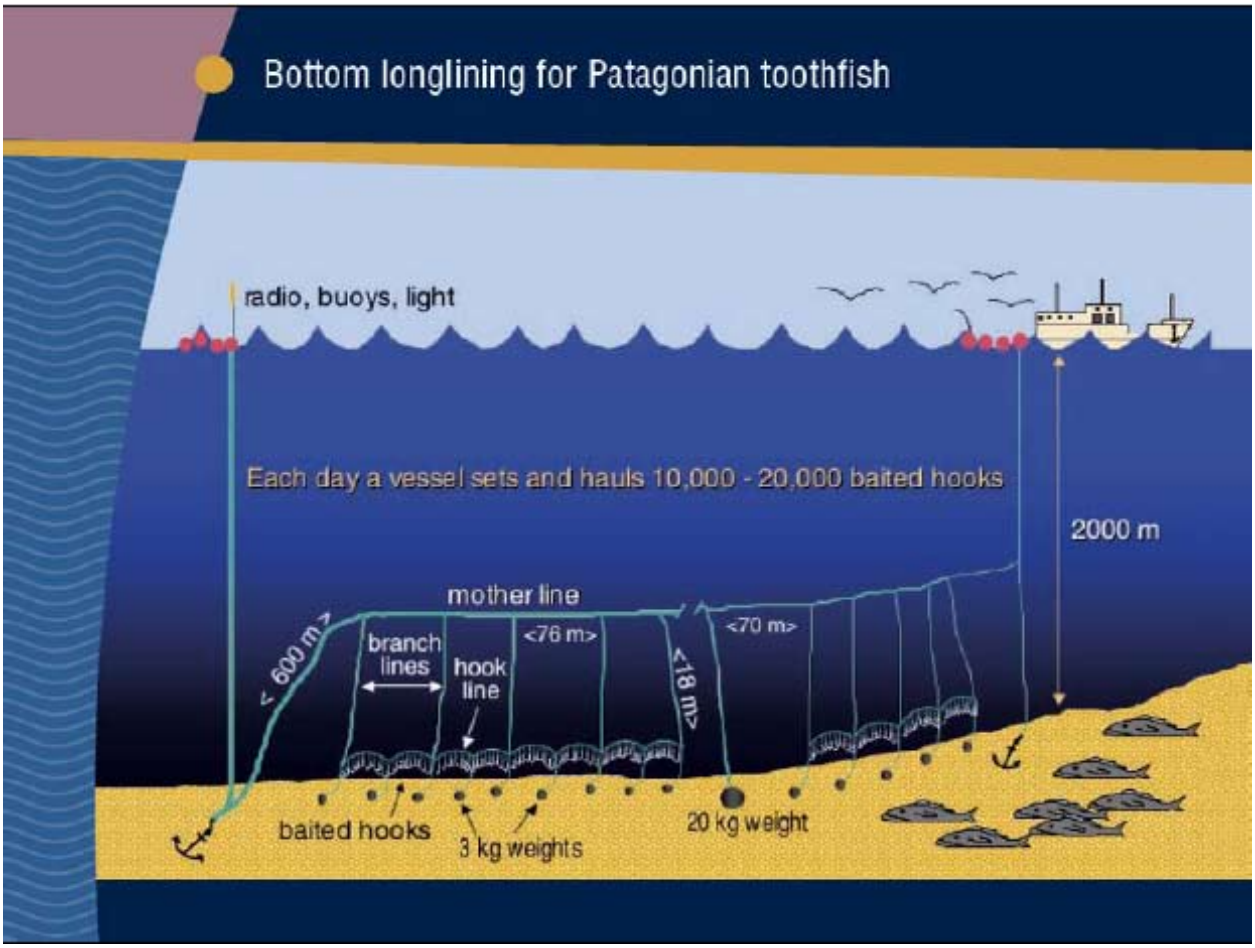
Turtles may be susceptible throughout the time that the line is in the water and bait is on the hook and are particularly susceptible to capture on shallower set longlines used to target swordfish. In limited observer studies conducted in the Azores 237 turtles were captured in 93 sets. This related to an overall average of 2.5 turtles per set (1.7 turtles / 1000 hooks) or 3.8 turtles per set (2.5 turtles / 1000 hooks) with turtles present. When considered along with the statistic that under the management of International Convention for the Conservation of Atlantic Tunas (ICCAT) 30 – 40 million hooks are set annually the catch of turtles may be significant.

Sharks are also at risk through the entire operation and may take both bait and the fish caught on the line. Pelagic sharks such as the tiger, blue, silky, oceanic whitetip, thresher, short-finned mako and hammerhead sharks can all interact with oceanic longline fisheries; other coastal shark species may be susceptible to artisanal fisheries. Sharks are susceptible to overfishing as they grow slowly, mature late and produce only a small number of young. There is concern that some species are at unsustainably low numbers.

Bottom-longlining is weighted and set along the seabed with anchor lines at each end leading up to the surface. Lines can be double lines utilising an extra mother line that floats clear of the seabed or single autolines where hooks come directly off the mainline that lies on the seabed. Generally they are set below the feeding depth of seabirds, turtles and sharks and interaction is limited to the periods of setting and hauling when birds can dive on the hooks.

Trawling

Trawl mortality in relation to seabirds is a relatively newly identified problem and may be as significant as longlining. Mortality can be derived from three sources, collision with the trawl warps,



collision with the net-sonde cable or entanglement or crushing in the net.

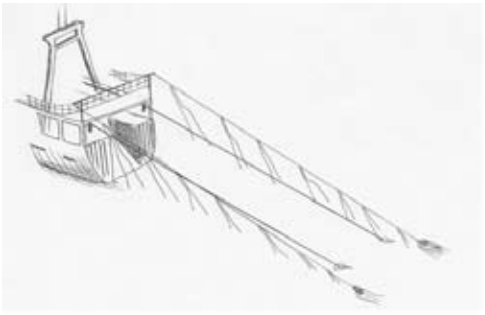
Vessels operating in the Exclusive Economic Zone (EEZ) waters and distant from shore generally process fish onboard and thus discharge processing waste such as guts along with unwanted undersize fish and non-commercial fish species. This waste discharge can attract considerable numbers of birds which forage behind the vessel and this is the primary cause of almost all interactions. The birds foraging on waste discharge are then at risk from the trawl warps as they cut through the water. In the Falklands observers recorded one bird contact every minute during periods of waste discharge. Some of these contacts can lead to damage and injury to the bird that may effect its future survival. A proportion are struck by the cable, when their wings become wrapped around it and, with the forward motion of the vessel and the inclination of the cables, are dragged underwater and drowned. A certain proportion of these birds are recovered from wire splices or shackles farther down the cable where they have become lodged. These constitute the confirmed mortalities.

Collision with the net-sonde cable is similar although, as this cable is higher and extends further behind the vessel, there is a greater susceptibility to aerial collision. However, these cables are not now generally used.

Net-related mortality of seabirds is more generally related to midwater pelagic trawls. These trawls are larger and can extend to the size of a football field. Hauling and setting takes longer during which time the net is floating on the water. Whereas bottom nets have a small mesh size, the larger mesh size of pelagic nets allows seabirds to dive through the net to scavenge fish stuck in the mesh. These birds can then become trapped and drown or alternatively be crushed as the meshes open and close under tension.

By-catch impact assessment

A preliminary review of the range of bycatch species and the level of bycatch within United Kingdom Overseas Territories and Crown Dependencies was conducted by correspondence with governments and relevant NGOs, and by consulting published and unpublished literature. However, from



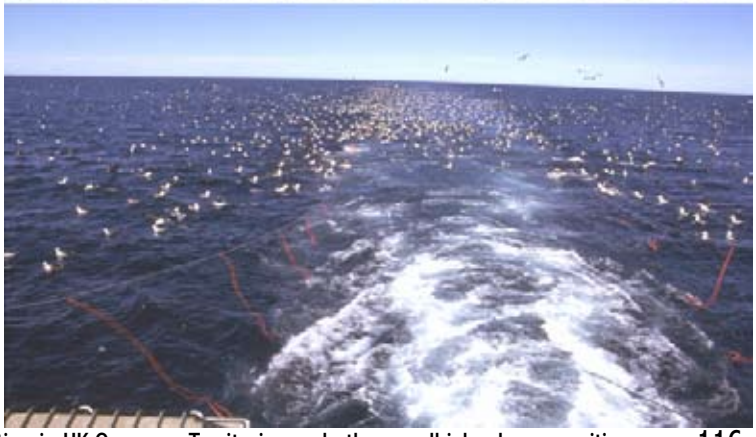
Trawl Warp Cable Strikes

1 contact / minute during periods of offal discharge & processing

1500 confirmed mortalities p.a. in FI

the few responses received it would seem probable that data are lacking in many areas.

A format to address the issue of the incidental catch of seabirds in longline fisheries has been established through the Food and Agriculture Organization of the United Nations' (FAO) *International Plan of Action - Seabirds*. This was initiated in 1997 through the FAO Committee on Fisheries (COFI) and adopted in 1999, and follows such initiatives as the *FAO Code of Conduct for Responsible Fisheries*. The established system is a two-stage process. In the first stage a risk assessment is conducted to determine the extent and nature of a nation's incidental catch of seabirds. If this shows that there may be a potential problem or that data are deficient, a second stage is to commission a National Plan of Action to address problem areas, be this establishing observer protocols to better determine the level of the problem or instigating the adoption of mitigation procedures.



It is obviously impossible to generalise as fisheries and seabird assemblages differ widely. However, some general issues to consider may be:

Is there an established EEZ or fishery and/or does unregulated fishing occur?

The fact that there is no established fishery does not mean that bycatch is not occurring if vessels are using the zone in an unregulated and unreported manner or if there is no ability to monitor the zone. There are instances known and suspected both in the Overseas Territories of Tristan da Cunha and Ascension in the South Atlantic where unregulated fishing has occurred.

Is this fishery managed?

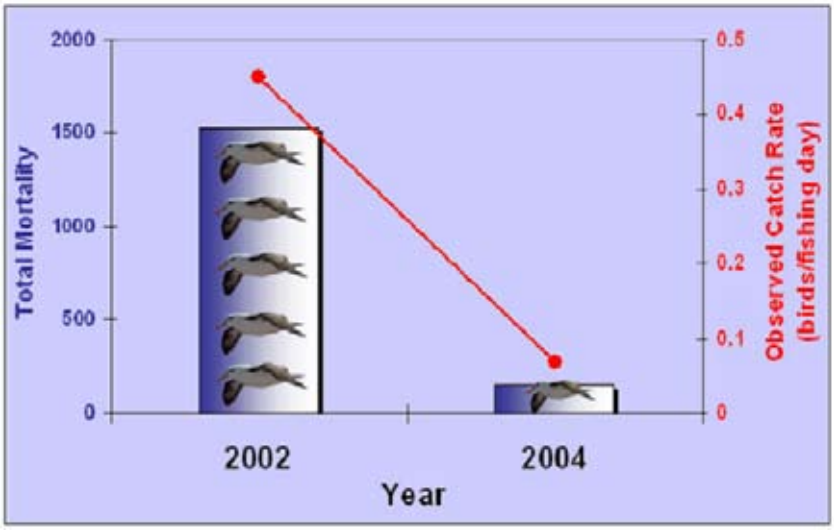
This will provide basic data. What fish species are targeted may suggest what interaction is occurring and confers obligations on the authority for sustainable management of all components of the fishery.

Is the fishery monitored and how? (patrol vessels, in-port inspections, at-sea observers, catch returns, etc.)

How the fishery is monitored will determine the accuracy of available data, whether bycatch is reported and how additional data may be obtained.

Are catches landed in a UK Overseas Territory or do international vessels discharge elsewhere?

This may preclude the verification of catches and



liaison with the fisheries, or even the placing of observers aboard.

Has an assessment of incidental mortality been conducted?

It is important to know the basis of the assessment as voluntary reporting has proved to be very unreliable in the past.

What species assemblages are present and what species have been identified at risk?

The biology, distribution diet and diving ability of species can all suggest if they may interact with fisheries.

Is the biological range of species known and have these been analysed in terms of spatial and temporal overlap with fisheries?

BirdLife International has co-ordinated the pooling of satellite tracking data from many albatross studies. This initiative can be used to determine the potential for where and when interaction can occur by overlaying fishing effort on species distribution.

Have bycatch rates or annual mortality been quantified?

Whereas the most important first step is to quantify the problem, ongoing monitoring is also essential if mitigation is to be adopted.

In addition to the voluntary IPOA-Seabirds, the International Agreement on the Conservation of Albatrosses and Petrels (ACAP, www.acap.aq,) is a binding agreement that addresses all issues concerning the conservation of albatrosses. This Agreement was ratified in 2004 and incurs certain obligations on signatories, which may be range states or the flag states of vessels, to monitor, conserve and reduce threats both at sea and ashore. This agreement was made under the auspices of the Convention on Migratory Species (CMS). The CMS is also applicable to turtles and to some other oceanic species, including fish and mammals that cross international frontiers. However, although a number of regional agreements have been negotiated, such as the Memorandum of Understanding (MOU) on the Conservation Measures for the Marine Turtles of the Atlantic Coast of Africa, MOU on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia. There is however as yet no global agreement such as ACAP for turtles (or for that matter, sharks), although CMS itself obliges Contracting Parties to give some protection, in theory at least.

In order to assess correctly the impact of fisheries it is necessary to obtain impartial and dedicated observer coverage understanding the nature of the problem. Voluntary recording by the vessels is highly unreliable, either due to deliberate misreporting or through the fact that no one person onboard is specifically tasked to record such occurrences. Catches are usually back-calculated from processed catch, and no accurate record of bycatch either fish or other is generally recorded. Similarly, seabird interaction with the trawl warps is not visible from the bridge of the vessels, or even the trawl deck in many cases, and may not be noticed.

In Tristan da Cunha in the 2003/04 longline season, 13 Great Shearwaters were recorded killed in 2.08 million hooks (0.006 birds/1000 hooks) from fisheries logbooks. However, two observer trips covering 1.09 million hooks recorded 655 birds or 0.601 birds/1000 hooks – a hundred times more than had been recorded by the fleet voluntarily!

Fisheries observers are tasked with recording fisheries data for stock management and are required to spend the majority of their time in the factory and cannot therefore record bycatch interactions accurately – although a reduced observer protocol is better than no data. In the Falklands the finfish and squid fisheries were established 20 years ago,

although not until the last three years were dedicated observers placed on trawlers, since when no seabird mortality has been recorded. The story is not all "doom and gloom"; there have been significant steps forward in some areas with dramatic declines in mortality rates where assessment has taken place and mitigation been adopted. Some of the most notable have been in relation to the reduction of albatross mortalities in the south-west Atlantic.

The Falkland Islands are the world stronghold of the black-browed albatross, with approximately 65% of the world population or 371 000 breeding pairs. However, populations have been declining at 1% a year and in five years the population has decreased by 19,000 pairs. As a result of such declines the species has been categorized as Endangered by IUCN. Satellite tracking has shown that, whereas juveniles and non-breeding adults utilise the whole of the Patagonian Shelf as far north as Brazil, during the breeding cycle adults are almost wholly confined to Falkland Island waters, so whereas international initiatives are required to address the whole problem, advances in the Falklands can also result in positive outcomes.

The problem of longline mortality has been recognised since the inception of the Falklands commercial fishery in 1994, with mitigation first being investigated the next year. It was not until 2000 that an independent assessment was made by dedicated seabird observers, initially by Falklands Conservation and then by the Falkland Islands Government (FIG). The FIG programme is continuing and this ongoing monitoring has ensured that mortality has continued to fall. Mortality has fallen a 100-fold from when the fishery was established and fourfold since independent monitoring commenced, as highlighted below.

Incidental Mortality in the Falklands longline fishery:

Year	Albatross Mortality / 1000 Hooks
1995 Summer	0.53
1995 Winter	0.13
2000/01	0.02 (134 birds)
2001/02	0.011 (80 birds)
2002/03	0.005 (45 birds)

At-sea observations on-board trawl fishing vessels at sea commenced the following year (2002/03) and highlighted a problem of seabird mortality in the trawl fishery. Black-browed albatrosses attracted to the vessels through the discharge of onboard processing waste are struck by the trawl warps as they foraged behind the vessels. Some birds are caught by the wing and dragged underwater and drowned. A proportion of these are recovered onboard at hauling and count as a confirmed mortality. An unidentified number may be lost from the warp or may be struck on the surface to float free. Over 750 hours were spent observing trawl operations and yielded an estimate a trawl related mortality of 1500 Black-browed albatrosses a year.

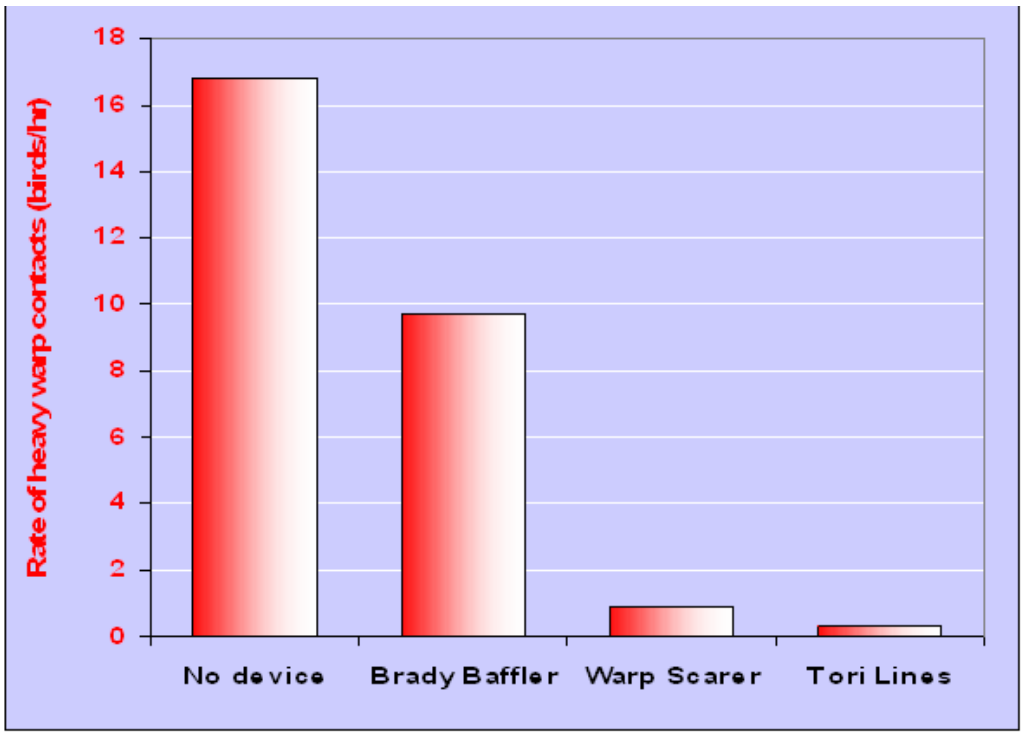
Management and mitigation

During 2003/04 trials were conducted of a variety of mitigation measures. A simple bird-scaring line towed behind the vessel (costing under UK£100) was shown to be the most effective measure and reduced bird collisions from one bird strike/minute to one bird strike/hour during periods of offal discharge. The success of these lines in trials led to the lines being made obligatory under licence conditions across the Falklands finfish fleet from July 2004. At-sea observations since then to monitor the success of the fleet-wide adoption has shown a 90% reduction in confirmed seabird mortality to 169 birds a year across the finfish fleet

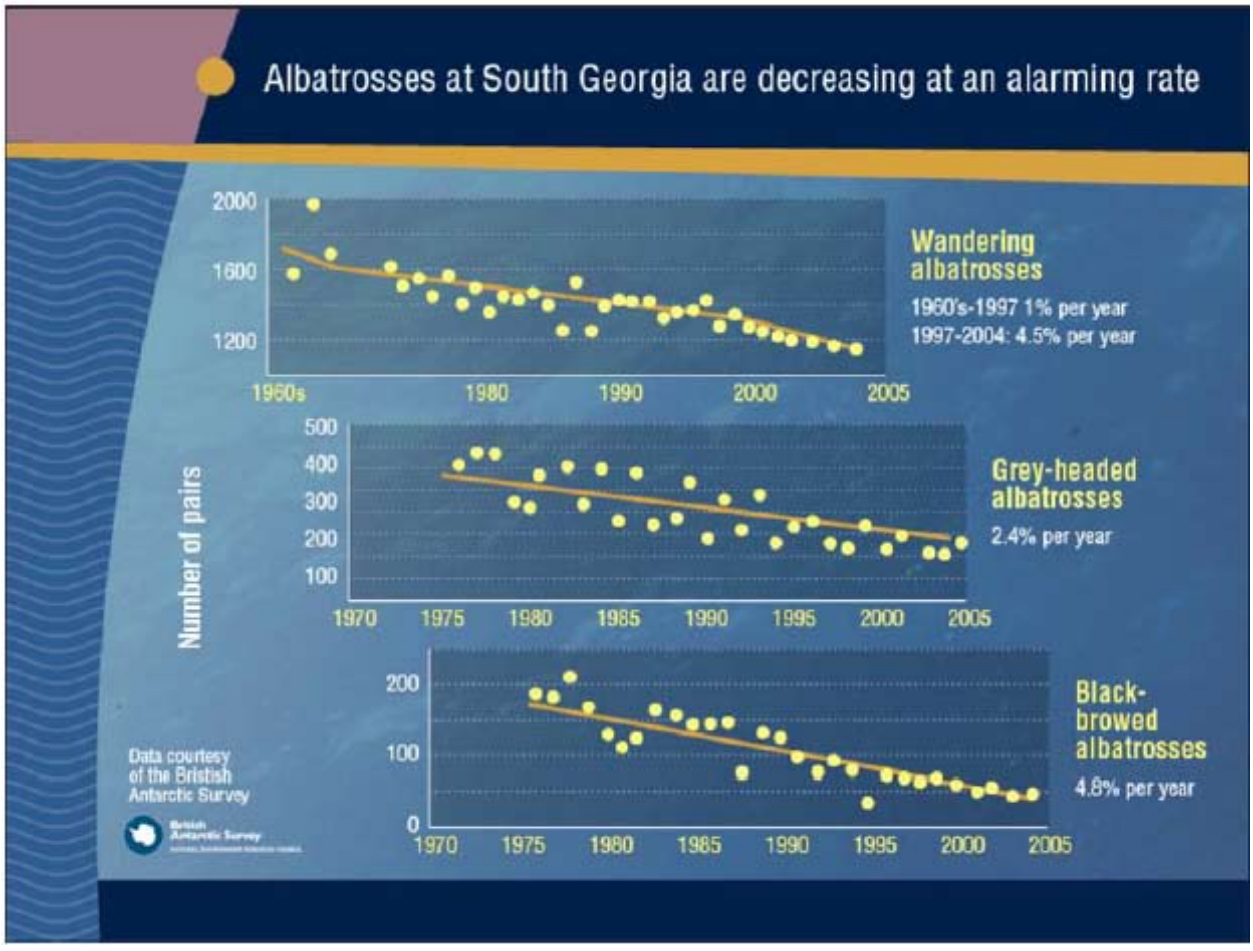
During this time Falklands Conservation was contracted by the UK's Royal Society for the Protection of Birds to formulate a National Plan of Action - Seabirds. Separate plans of action were prepared for the longline fishery, trawl fishery and jig fishery and, following an 18-month consultation phase with the fishing industry, these plans were adopted by FIG Executive Council in March 2004. The Falkland Islands thus became the first UK Overseas Territory to have adopted action plans for all forms of fishing conducted within its waters. This coincided with the United Kingdom's adoption of ACAP in March 2004.

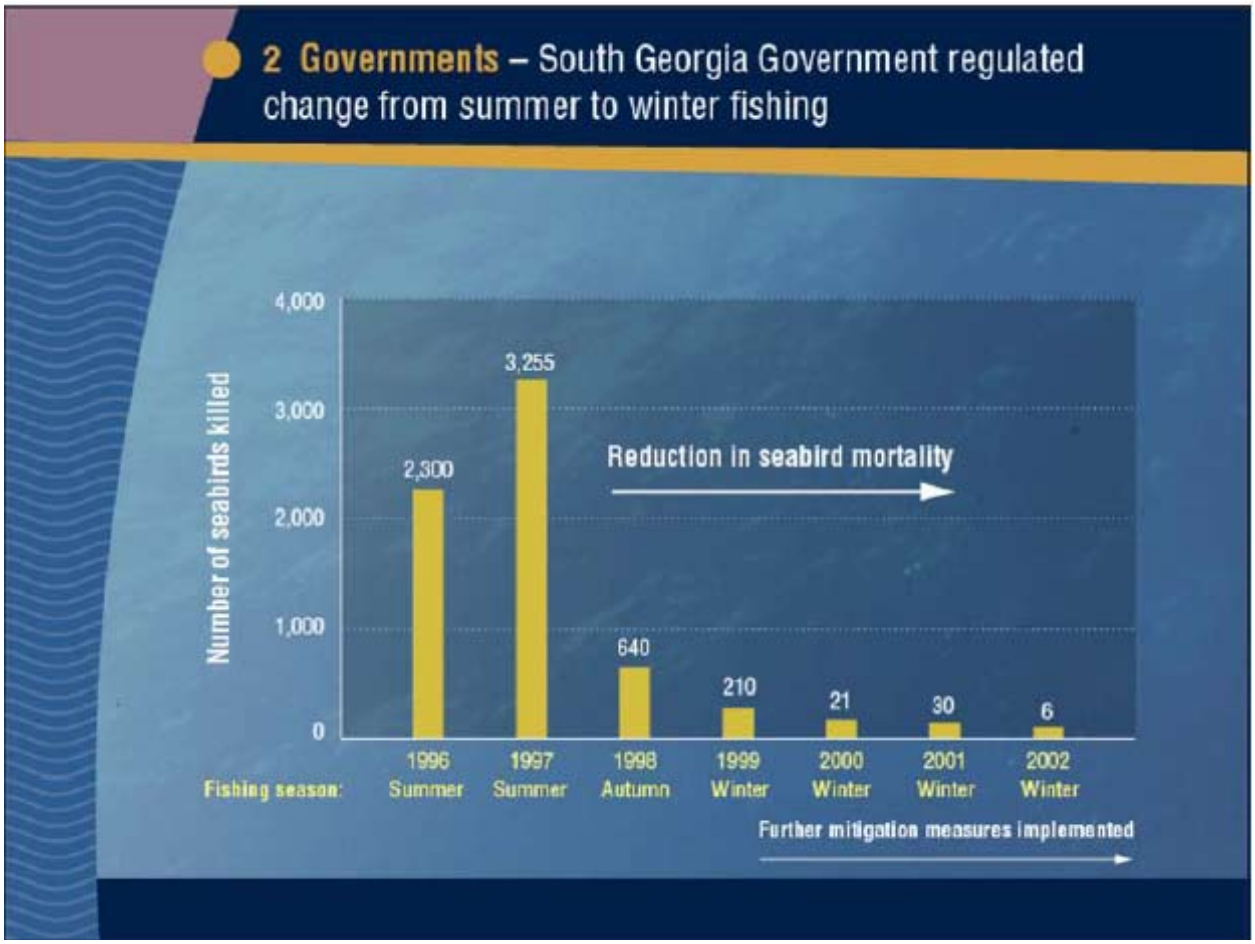
Arguably the best example of a managed fishery adopting a suite of mitigation measures is exemplified by the Convention for the Conservation of the Antarctic Marine Living Resources (CCAMLR) and the proactive stance of the Government of South Georgia and the South Sandwich Islands. South Georgia is of critical importance for a number of albatross species, including wandering, black-browed and grey-headed. All species are in decline with wandering albatross currently decreasing at 4.5% a year.

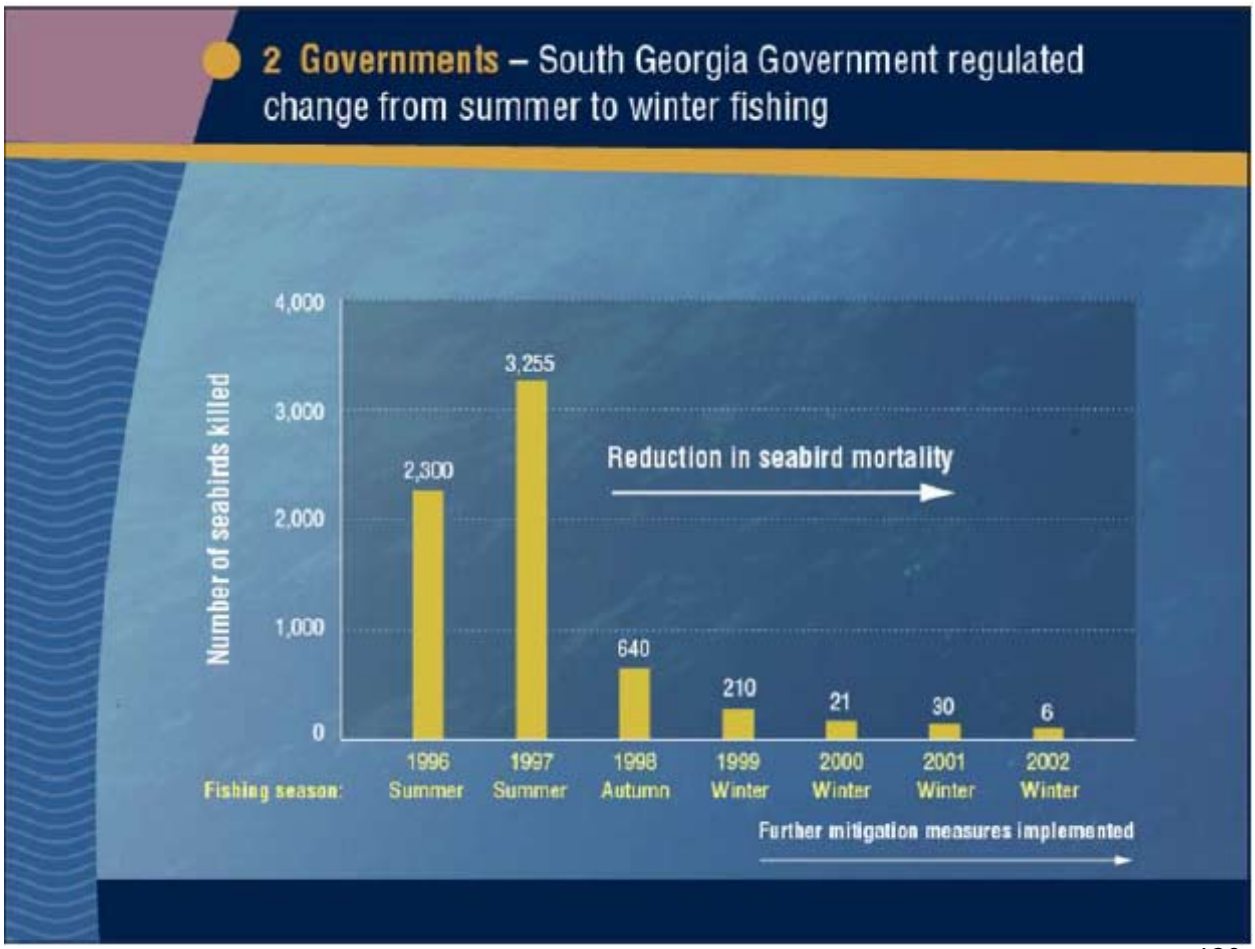
Seabird mortality in the legal fishery around South



Georgia has now been reduced to negligible levels. This has been achieved largely by the development of a specialist group tasked with identifying an appropriate suite of measures to mitigate seabird mortality along with the commitment of the South Georgia Government to implement CCAMLR directives, and at times to apply its own regulations in addition. The CCAMLR Working Group on Incidental Mortality arising from Fishing (WG-IMAF) was established in 1993 and mortality has been reduced from 0.66 birds/1000 hooks in 1993 to 0.0003 birds/1000 hooks in 2003, which represented an annual bycatch of only eight birds by the South Georgia longline fishery. Positive results followed quickly once fishing crews became accustomed to the new mitigation measures . In the first year of adoption, mortality dropped 10-fold from almost 6000 birds a year to 640 birds pa and then dropped to 210,




2 Governments – South Georgia Government regulated change from summer to winter fishing
Number of seabirds killed
4,000
3,000
2,000
1,000
0
2,300
3,255
640
210
21
30
6
Reduction in seabird mortality
Fishing season:
1996 Summer
1997 Summer
1998 Autumn
1999 Winter
2000 Winter
2001 Winter
2002 Winter
Further mitigation measures implemented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2000 Winter
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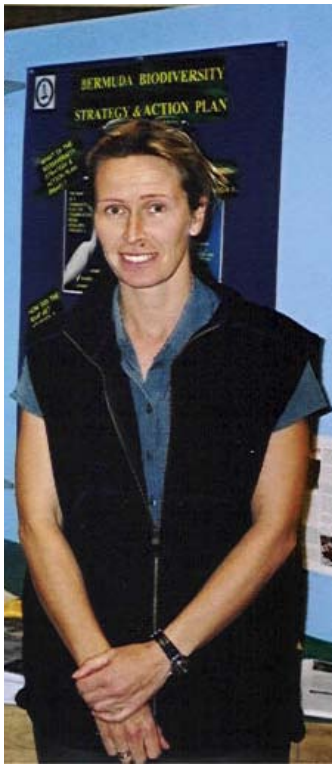
Further mitigation measures implemented

and finally to 21 or less birds a year in subsequent years.

However, this success has been achieved only through patrolling to exclude unregulated fishing and strict enforcement through an observer programme, port inspections and at-sea boardings from fishery-patrol vessels. These activities require considerable investments and resources, that may not always be available in other areas. The issue of seabird mortality in Illegal Unreported and Unregulated (IUU) fisheries is still to be adequately addressed in Tristan waters as, without an all-weather port or an ocean-going fishery-patrol vessel or even reliable telecommunications, it is not possible accurately to monitor fishing activities. The island group is critical for many species including the endemic Tristan albatross, Atlantic yellow-nosed albatross and spectacled petrel. Additionally, two thirds of the world population of sooty albatrosses breed on the islands. Much work has been conducted on terrestrial conservation, management plans and up-grading of legislation from within the Tristan islands but, with limited resources, the protection of the marine environment will be difficult without strong commitment and assistance from external sources.

Review 2: Development issues in the inshore marine zones of UK Overseas Territories and Crown Dependencies

Dr Annie Glasspool, Bermuda Zoological Society



Glasspool, A.F. 2007. Development issues in the inshore marine zones of UK Overseas Territories and Crown Dependencies. pp 122-133 in *Biodiversity That Matters: a conference on conservation in UK Overseas Territories and other small island communities, Jersey 6th to 12th October 2006* (ed. M. Pienkowski). UK Overseas Territories Conservation Forum, www.ukotcf.org

This paper gives a synopsis of the development issues impacting the inshore marine zones of the UK's Overseas Territories and Crown Dependencies, discusses the main trends driving these development issues, considers mitigating factors and presents some of the management actions being taken in various jurisdictions, with a view to stimulating a wider discussion on the subject.

In considering the broad suite of development issues faced by the UK Overseas Territories and Crown Dependencies it is readily apparent that geography has been an underlying factor. Whilst all but two of the jurisdictions (Gibraltar and BAT) share a level of isolation from continental land masses, it is recognised that those in the most remote, and/or physically challenging locations, immediately surrounded by deep ocean and therefore good flushing regimes, have generally been less impacted by development issues (these include the Southern Atlantic territories as well as Pitcairn in the Pacific). In contrast, tropical and sub-tropical Caribbean and Western Atlantic jurisdictions, as well as Jersey, Guernsey, and Gibraltar enjoy pleasant climates and generally safe shallow anchorages within enclosed lagoons or clearly defined harbours and bays which have lower flushing rates. Coupled with abundant (at least historically) and readily accessible natural resources they have therefore always supported much higher population densities and development potential. (BIOT, is an exception, largely protected from development through its isolation).

Across, and within these geographical regions, the emergent marine environmental issues have resulted from a fairly common progressive trend of economic development, which can broadly be described in three phases. Phase 1) is natural resource harvesting; common to some extent in all jurisdictions (except BAT), but in many over-harvesting has decimated local biodiversity, disrupted food chains, impacted water quality, and provided a potential opening for unwelcome introductions. Phase 2) is trade and farming; again practiced in most of the jurisdictions, trade has triggered increased traffic and population influxes with their attendant needs for ameni-

ties. The issues faced include degradation of marine habitats for the construction of larger ports or mariculture activities, dredging of channels for shipping, and increased sewage and solid waste, whilst farming poses run-off issues. Finally, (phase 3)) some jurisdictions are undergoing, or have undergone a metamorphosis into almost exclusively service-based economies (primarily tourism, and now emerging international business). Associated impacts include habitat destruction, loss of biodiversity, loss of water quality and ecological imbalance from the following; hardscaping/destruction of coastal habitats for houses, hotels, docks, moorings, marinas and the associated changes in flushing regimes, increased run-off, sewage, solid waste disposal, light pollution, boating traffic (including cruise ships) leading to noise pollution, groundings, direct collisions with marine life, oil pollution, toxic impacts of anti-fouling paints and wildlife harassment. (Given their impacts, it is perhaps ironic that a primary driving factor behind the emergence of these activities has been the natural beauty and biodiversity richness of the territories!). It is worth noting that most of the Overseas Territories and Crown Dependencies have escaped the impacts of heavy industry although oil exploration is underway in the Falklands. However, a number of jurisdictions have served as strategic military outposts with associated activities causing impacts associated with land reclamation, pollution, waste disposal and noise and light pollution. All jurisdictions face threats from global climate change.

Current management approaches vary significantly, and resource limitations are apparent. The availability of information on development impacts for the various jurisdictions varies according to the amount of research undertaken. This in turn is directly correlated with the level of development and its threats, but is not surprisingly inversely related to the pristine status of a particular jurisdiction's biodiversity! Various international treaties and conventions, coupled with local legislation provide some framework for management directed at specific issues within the territories, but this is often tackled in a piecemeal fashion, development by development. An overarching vision for the forward development of the inshore marine zones of each Overseas Territory and Crown Dependency seems to be critical.

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Background

Given the broad geographical distribution of the UK Overseas Territories and Crown Dependencies, it is not surprising that their shallow inshore waters support a rich diversity of life. From the exotic islands of the Caribbean to the isolated oceanic volcanic seamounts of the western and southern Atlantic and Pacific, or from the vast shallow water reef system of BIOT to the largely ice-covered British Antarctic Territory, these jurisdictions represent examples of some of the most extreme environments, supporting a broad range of habitats and some of the world's rarest and most threatened marine species. For example, almost all species of marine turtle, a flagship group in a number of territories are represented and Green turtles nest on Ascension, Pitcairn, Cyprus Sovereign Base and several of the Caribbean UKOTs (1). Marine mammals, another flagship group, are also found throughout the UKOTs and CDs and species include the endangered Sei, Fin, Blue and Northern Right Whales. BIOT alone boasts 1.4% of the world's coral reefs; coupled with the reefs of the Caribbean, Bermuda and Pitcairn, the UKOTs boast some of the most productive inshore waters in the world, whilst the shallow water fish and corals inhabiting them are recognised biodiversity hotspots (1). Add to these a wealth of other invertebrates, including a suite of lesser known but critically endangered marine cave dwelling crustaceans and the marine biodiversity of the UKOTs and CDs represents a significant proportion of the UK's overall biodiversity.

However, almost without exception these diverse environments are facing increasing threats from human activities. Land reclamation, habitat destruction and hardscaping, over-harvesting, sewage, pollutants, litter and solid waste, introduced species, noise, light and sonar pollution, wildlife harassment, mineral and oil exploration and global climate change are proving to be increasingly persistent threats. Add to this the fact that nearly all these jurisdictions are now economically dependent on the continued health of these natural resources, and resource managers are faced with a daunting task. We should also not forget the cultural and built heritage, notably ship wrecks, which present an interesting study, on the one hand signalling human impact on the other a part of our heritage we seek to protect from further impact.

In considering the broad suite of threats facing the UKOTs and CDs, it is also readily apparent that geography has been an underlying factor shaping the development issues faced in the territories. Whilst all but two (Gibraltar and BAT) share a level of isolation from continental land masses, it is recognised that those in the less accessible and/or physically challenging locations have generally been less impacted by development issues. Those which are also immediately surrounded by deep oceanic waters and good flushing regimes which help to dilute the impacts of pollution events and sedimentation have also fared better. These include the Southern Atlantic territories as well as Pitcairn in the Pacific, ie: south of the Equator.

In contrast, tropical and sub-tropical Caribbean and Western Atlantic jurisdictions, as well as Jersey, Guernsey, and the Channel Islands, the Isle of Man and Gibraltar enjoy pleasant climates and generally safe shallow anchorages within enclosed lagoons or clearly defined harbours and bays. Not surprisingly these jurisdictions have been heavily colonized. Coupled with abundant (at least historically) and readily accessible natural resources these are now some of the most densely populated territories on earth with population densities as high as 1,182

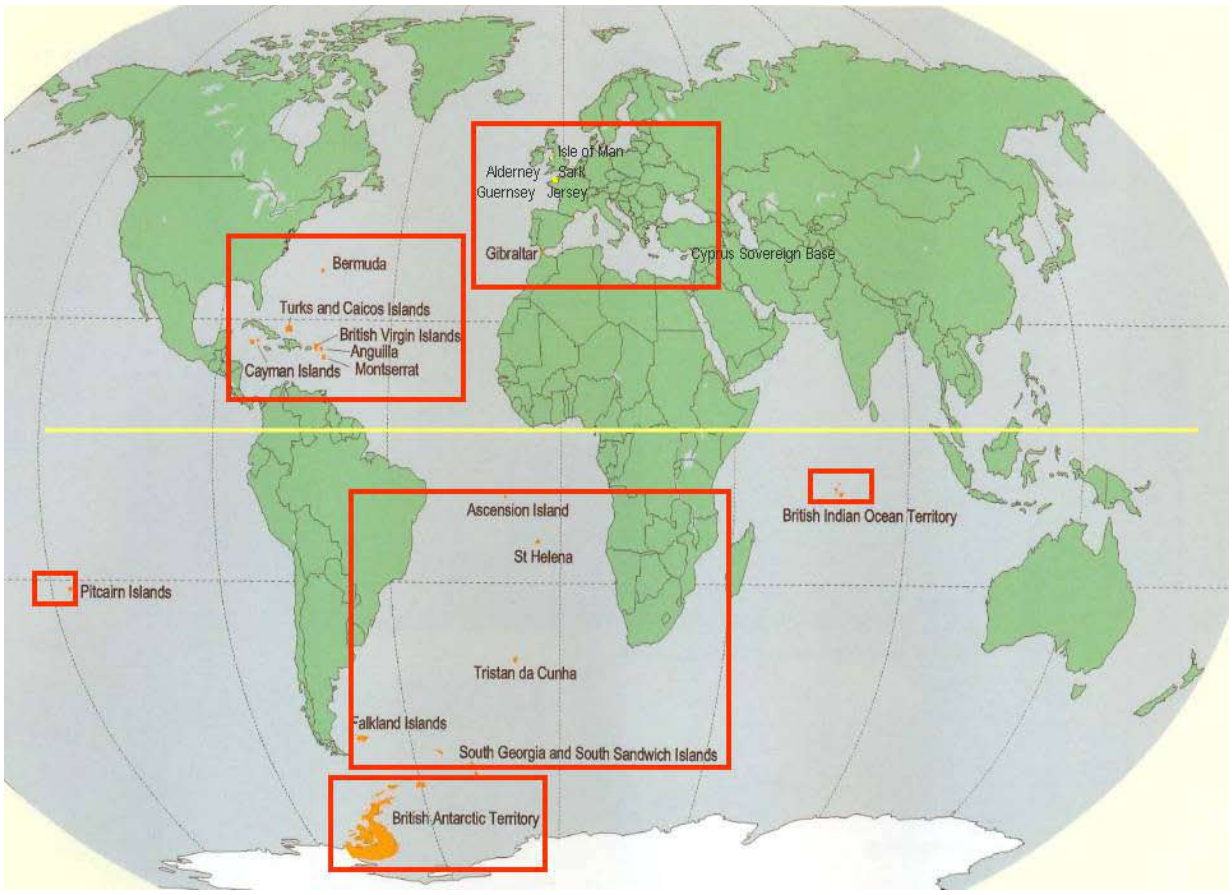

Fig. 1. Diagram to show the main regional groupings of the UK Overseas Territories and Crown Dependencies (adapted from the "Breath of Fresh Air" Resource materials).

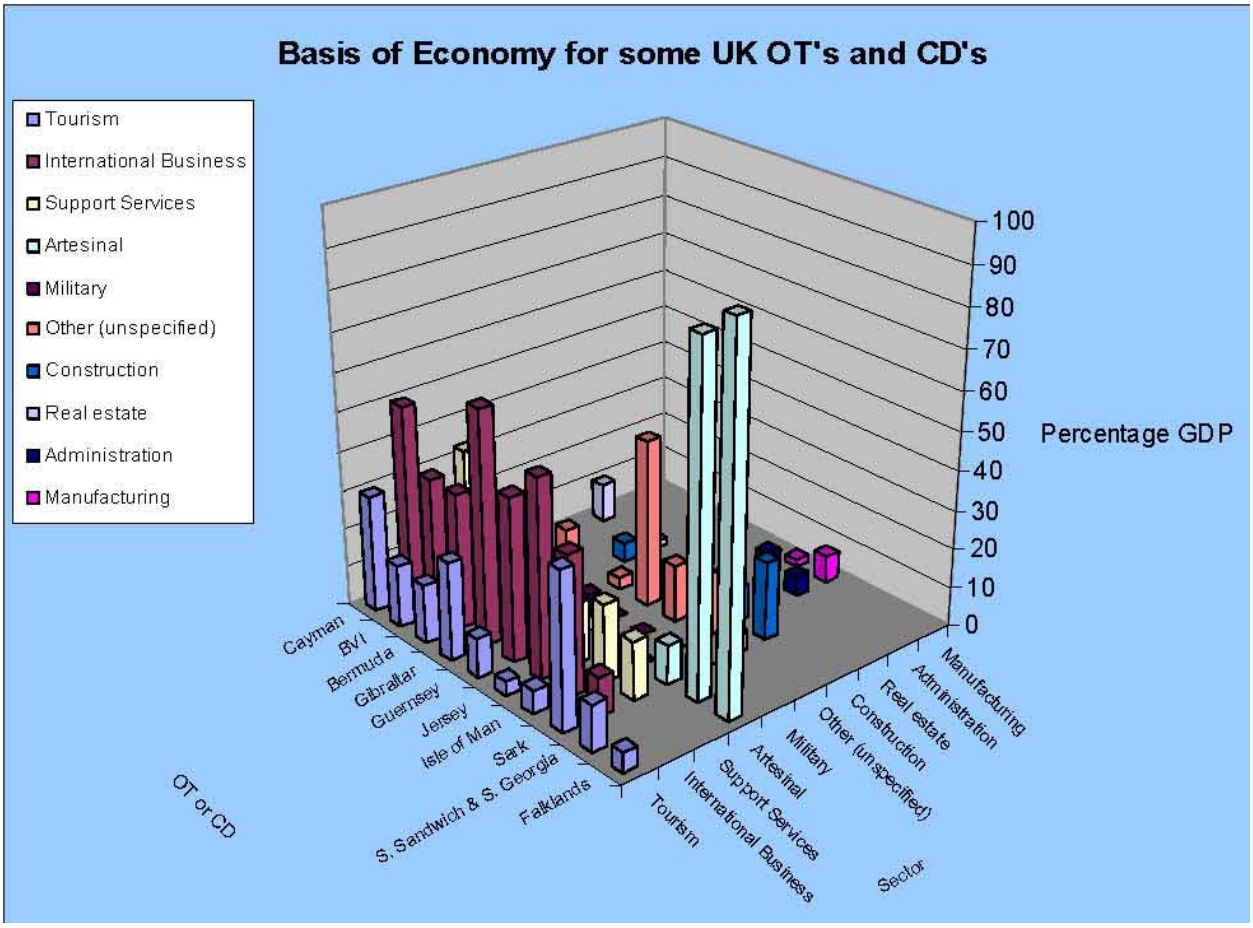

Fig.2. The extent to which service-based industries support the economies of the northern latitude territories.

people per km2 (Bermuda)(2). With inshore waters surrounded by shallow shelves which have lower flushing rates, the effects of over-population are significantly compounded particularly with regards to pollution, run-off and sedimentation. (NB. BIOT is an exception, largely protected from development through its extreme isolation).

It follows that across, and also to some extent within these geographical regions (notably the Car-

UK OT or CD	Over-harvesting	Coastal developme	Land reclamation	Run-off	Oil Pollution	Sewage waste disposal	Dredging	Moorings/ anchors	Cruise ships	boat traffic	Mariculture	Ecotourism	Noise pollution	Light pollution	Sonar pollution	Invasive species	Nursing rates	Lack of awareness	Litter	Lack of polit
Bermuda	5	5	5	2	2	3	3	3	5	3	3	0	1	1	0	?	1	2	5	3	3
British Virgin Islands	5	5	5	5	4	4	3	5	1	3	2	1	1	3	1	2	5	4	4		
Cayman Islands	5	5	5	4	1	3	2	5	1	3	2	1	2	1	1	?	1	3	3		4
Turks and Caicos	2	5	0	0	1	5	5	4	0	3	2	4	1	0	4	0	2	0	1		
Gibraltar	5	5	5	0	4	1	1	5	3	2	3	5	0	5	0	?	5?	0	2		
Guernsey	4	1-5	1-5	1	1	1	1	0	0	0	2	1	0	0	1	1	3	0	3		
Isle of Man	4?	3-4	1	1	2	5	1	5	1	0	3	0	1	3	?	3?	2	0	?		
Jersey	2	3	4	4	1	3	3	2	2	1	3	4	1	1	1	1	3	1	3		
Sark	3	2	0	0	4	1	3	2	0	1	2	0	1	2	2	0	2	0	4		
Cyprus Sovereign Base	2	4	0	2	1	3	0	0	0	0	1	0	0	0	0	0	0	0			
Ascension	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2		
Falklands	3	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	5		
South Georgia	5	0	0	0	1	1	1	0	1	1	1	0	1	1	1	0	0	0	1		
South Sandwich Islands	5	0	0	0	1	1	1	0	1	1	1	0	1	1	1	0	0	0	1		
St. Helena	0	1	1	1	1	5	2-3	5	1	1-4	1	0	1	1	1	0	1	0	2-3	1	
The Tristan da Cunha Islands	3	0	0	0	2	1	0	0	0	0	0	0	0	0	2	0	0	0	0		
British Antarctic Territory	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0			
The Pitcairn Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
British Indian Ocean Territory	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Table 1. Results of questionnaire sent to all UKOTs and CDs identifying threats to their inshore marine zones

ibbean territories) the emergent marine environmental issues have resulted from a fairly common progressive trend of economic development, from colonisation and natural resource exploitation, through to trade and farming, and on to the service-based industries currently driving the economies of the majority of the northern latitude territories as illustrated in Fig. 2.

Discussion of the Threats

If we follow this theme and consider development through a phased approach we can consider the historical and current issues being faced by the territories and the solutions being applied. As a basis for this discussion, a questionnaire was circulated to all the UK Overseas Territories and Crown Dependencies seeking input on the threats to their inshore waters, with a request to try and rank these. *This ranking was undertaken relative to the threats within each territory; no effort was made to compare the threat level between territories.* The ranking scale used was 0 – 5 with 0 representing no threat and 5 representing a serious threat. No effort is made to distinguish between historical and current threats; current management practices in some territories may have alleviated the threat, but the impact may still be felt.

Phase 1: Natural Resource Exploitation

Early colonisation of the UKOTs and CDs was usually driven by the plentiful supply of exploitable resources. In Bermuda for example the literature tells of *"fish so abundant that if a man steppe into the water, they will come around him: so that men were faine to get out for fear of byting"*, and *"great plenty whales which I conceive are very easie to bee killed, for they come so usually and ordinarily to the shore, that wee heard them oftentimes in the night abed"* (3). This abundant supply of natural resources probably applied for most of the territories and was enough of a trigger to encourage ongoing settlement in many. Inevitably though, this resulted in a sweeping depletion of these resources, and in many territories this is still an ongoing threat.

Photo 1. Conch harvesting in Cayman

Photo 2. Accidental turtle capture in fishing net in Bermuda

Table 1 shows that over-harvesting is considered to be especially problematic in some of the Caribbean territories (notably Cayman and the British Virgin Islands), as well as Bermuda, South Georgia and South Sandwich Islands, Gibraltar, Guernsey and the Isle of Man. It is in the tropical and subtropical jurisdictions where overharvesting has the largest impact on the inshore waters (as opposed to open ocean fisheries) and both commercial and subsistence level fishing on the shallow coral reefs has targeted a broad suite of taxonomic groups, including marine turtles, shellfish such as Queen conch *Strombus gigas*, and many of the larger grouper species, driving many to local extirpation and resulting in 'knock-on' impacts to the whole ecosystem; for example the depletion of algae-eating parrotfish can lead to the general demise of the reef by allowing the algae to flourish and "suffocate" the corals. This has been most dramatically seen in Jamaica, where 94% of the coral reef has died, but smaller scale examples likely exist within the UKOTs. As the reef forms the main physical barrier protecting these islands from storms and hurricanes, as well as being pivotal to local economies for tourism activities and food, any knock-on effect can have serious ramifications for the territories.

Solutions:
Most jurisdictions have tackled over-harvesting through a mixed approach of enforcement and public awareness. Restrictions on fishing range from complete protection of a species (for example

marine turtles in most territories) to the establishment of a protected areas system, which may be year round or seasonal during the breeding season. Restricted gear types, bag limits and catch size limits are also in place in most territories for species of concern, whilst licensing of commercial fishermen for certain species and/or gear types, offers the greatest ability to effectively monitor and manage the resources. In Bermuda, the taking of marine turtles below a certain size was prohibited as far back as 1620, although interestingly, this legislation failed through lack of information; unbeknownst at the time, the small turtles being protected did not represent Bermuda's breeding population but rather the juveniles of other populations, whilst the adult turtles which continued to be exploited were Bermuda's breeding population, and were extirpated as a result. This is a classic illustration of the need for informed management!

Public awareness campaigns may also help minimise illegal exploitation by promoting awareness of the penalties for illegal take, however increasingly some territories are noting problems with the expatriate workforce who often fail to familiarise themselves with the local fisheries legislation, and may struggle with language barriers. A lack of resources is a problem in enforcing fisheries regulations in virtually all of the territories.

Other more hands-on solutions for tackling the depletion of local fisheries resources include the implementation of recovery plans, which may include the establishment of hatcheries or grow out facilities targeting threatened and endangered species, eg. Ormers in Jersey; turtles in Cayman; scallops in Bermuda.

International treaties are in place in certain jurisdictions which provide for consideration of the impact of the whole food chain. In Antarctica, the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) adopts an ecosystem approach such that commercial fishing must take into account not only the impact on the target species, but also the impact on predator or prey species. More general treaties and charters in place in many of the territories which call for the protection of threatened species and/or habitats including marine include the Environment Charter, Convention on Biological Diversity, Ramsar Convention, Convention for the Conservation of Antarctic Seals, Convention on the International Trade of Endangered Species, The Bonn Convention, the International Convention on Whaling, The Convention concerning the protection of the World Cultural and Natural Heritage.

Phase II: Trade and Farming

Once successfully colonized, farming became a mainstay and most of the territories established themselves as active trading stations. This development phase has had numerous and far reaching impacts on the shallow water marine zones, most notably (but not exclusively) from the increased shipping. These include:

Habitat Destruction – The challenges of navigating the often complex reef systems surrounding many of the UKOTs and Crown Dependencies are evidenced from the numerous ship groundings that have occurred. Now often considered important from a cultural and tourism perspective, many of these wrecks have left a permanent scar on the reef. For example, the vulnerability of Bermuda's coral reef

Photo 3 & 4. A ship sits on the reef in Bermuda whilst the inset photo shows the total destructive force of such a grounding on the living corals.

system was dramatically demonstrated in 1984, with the grounding of the fully laden super tanker Aguila Azteca on the reefs to the north of Bermuda. Carrying 196,000 tons of heavy Maya crude oil, this tanker could easily have created the largest oil spill in history, were it not for the unseasonably mild weather. However, it is not only the ships themselves, which damage the reefs when grounding but also the blasting that is often employed to salvage them. About 70 ha (173 acres) of shallow outer reef (less than 10 m (33 ft) in depth) have been severely disturbed by groundings in Bermuda, representing about 1% of that reef zone. Long-term monitoring of the Mari Boeing grounding scar, created in 1978, has shown that recovery of the reef is very slow, on the order of 100 years or more (4). Better navigational aids are the most widespread solution to accidental groundings. In Bermuda, the Government petitioned the International Maritime Organisation to declare a 30 mile "Area to be Avoided" by all commercial shipping not calling in to the Island. Additionally, the Government invested in RACON (active radar responding) beacons on the fringing reef to mark navigational hazards.

In addition to groundings, the need for port facilities to be expanded in all jurisdictions to accommodate the increased shipping activity has necessitated significant dredging and modification of the shoreline and shallow waters, resulting in habitat loss. Dredging is listed as a significant threat in all the Caribbean UKOTs as well as the Isle of Man and St Helena.

Increased sedimentation, runoff – In an effort to prevent further groundings, navigational channels crisscross the shallow waters of many of the UKOTs and CDs. Whilst reducing the impact of the groundings, the dredging of such channels has itself resulted in significant habitat destruction, as well as contributing to the sediment loading on the reef. Although the impact of the dredging may be only temporary, the continual movement of ships through these channels creates often constant sediment loading of water on the adjacent reefs. 33% of Caribbean coral reefs are threatened by sedimentation (5), which smothers the corals preventing the light needed for photosynthesis from penetrating. Increased sedimentation may also result from agricultural run-off and soil erosion, which may contribute pollutants in the form of pesticides and cause eutrophication of the inshore waters. Cayman and British Virgin Islands both cite run-off as a significant threat, whilst in Jersey, there is concern about eutrophication resulting from pig farms in nearby France, as well as local potato farming. Aquaculture too has had a significant impact in many of the territories and Cayman has implemented an Aquaculture Development Policy to regulate activities. Licensing of dredging activities is also practiced in several territories.

Oil and other pollutant - Oil pollution is a daily threat with shipping activity, and is noted as being a significant threat in Gibraltar, Sark and the British Virgin Islands. Oil "fingerprinting" techniques have been successfully employed to trace offenders, whilst oil spill contingency programmes can be activated to contain the spread of oil. Public awareness campaigns to encourage marine service stations and the boating public to adopt more careful fuelling practice have also been tried in some jurisdictions, whilst the Convention on the Prevention of Marine Pollution from Ships had a noticeable effect on reducing contaminant spills across the globe.

Metal-based anti-fouling paints used on boat bottoms are one of the main sources of metal contamination in the marine environment. Many of these paints contain TBT (Tri-butyl tin) which is highly effective as an anti-fouling agent. It has been linked to "imposex" in gastropods, in which the female develops a penis and becomes infertile. There is evidence of imposex in older Harbour Conch in Bermuda (2) although the cause has not been definitely attributed to TBT. This condition may pre-date the local ban on the importation and use of TBT-based paints in 1988. However, TBT is still used on cruise ships and most large ships. Concentrations of TBT in Bermuda's inshore waters are

Photo 5. Female Harbour Conch in Bermuda exhibiting imposex

still elevated despite the ban of anti-fouling paints and additives, as paint chips scraped off boats are often washed into the water and become buried in the sediment. TBT is still widely used in the British Virgin Islands because of concerns about the impact of invasive species on the marine environment.

Ballast water (Invasive species) - Ballast water from visiting ships presents a potential problem in that it provides an avenue for the introduction of invasive alien species (IAS). For many territories, however, ships come laden with goods and then only take on ballast water when they are leaving, having off-loaded their cargo, so that the threat is minimal. Solutions to the inadvertent introduction of IASs through ballast water include restricting dumping of ballast water, public awareness and control/eradication of the invasive species (the most challenging option in the marine environment). However, IAS have shown up; *Sargassum mutans* is a problem in Jersey, whilst the Pacific Lionfish *Pterois volitans* is now resident in Bermuda, its ecological impact as yet unknown. Both the British Virgin Islands and Gibraltar note IAS as presenting a significant threat, whilst they are of concern in the Channel Islands, Isle of Man and Sark

Photo 6. Land reclamation underway in Jersey

Phase III: Service-based Industries

A number of the UK Overseas Territories and Crown Dependencies jurisdictions are undergoing, or have undergone a metamorphosis into almost exclusively service-based economies (primarily tourism, and now emerging international business). Associated impacts include habitat destruction, loss of biodiversity, loss of water quality and ecological imbalance from the following; hard-scaping/destruction of coastal habitats for houses, hotels, docks, moorings, marinas and the associated changes in flushing regimes, increased run-off, sewage, solid waste disposal, light pollution, boating traffic (including cruise ships) leading to noise pollution, groundings, direct collisions with marine life, oil pollution, toxic impacts of anti-fouling paints and wildlife harassment. Some examples are discussed below.

Coastal Development and land reclamation – Coastal development presents one of the most serious threats to the inshore waters of the UKOTs and Crown Dependencies, fuelled by growing tourism and the development of international business. In Jersey, one of Europe's largest land reclamation schemes using recycled glass occurred adjacent to a Ramsar site in 1995 – destroying one of the Island's most diverse reefs. Meanwhile, the Isle of Man is currently faced with the challenge of a land reclamation scheme for their new airport development. In Bermuda the construction of the Air Force Base (the present-day airport) during the 1940s necessitated extensive dredging and land reclamation in Castle Harbour. The construction required the bulldozing of a dozen islands and the dredging of sediments and near shore coral reefs to generate landfill. In all, approximately 24.4 ha of coral reef, 18.2 ha of seagrass beds and 5.7 ha of mangrove habitats were destroyed; the fine silt material that spread over the entirety of St. George's and Castle Harbours choked the coral, permanently altering the marine environment. The new land restricted tidal flow and was insufficient in removing the silt that remains trapped and continually re-suspends to this day (4). The popularity of marinas is also increasing in those jurisdictions catering to service-based industries; whilst these minimise the destructive impacts of moorings (especially on seagrasses where they carve 'halos' into the grass beds) and anchors on both seagrasses and coral reefs, their construction and ongoing operation can be detrimental, particularly as important nursery habitats are typically to be found in the sheltered bays around the shoreline which lend themselves to marinas. Planning zonings are designed to control development activities, and most jurisdictions call for Environmental Impact Assessments on large scale projects (although in many, approval often effectively precedes the EIA). Land reclamation is also recognized as a significant threat in the British Virgin Islands, Cayman, Gibraltar and Guernsey.

Photo 7. Dredging underway in Cayman

Increased sewage – Increasing populations have inevitably led to an increased sewage output. Analyses of ground water in Bermuda for example, indicate that some contaminants, notably nitrates, are attributable to cesspit seepage. However, the amount and rate of contamination to date has been surprisingly low and has not presented a health threat. Meanwhile, some of the larger hotels and the urban developments dispose of sewage effluent through ocean outfalls which do not extend beyond the outer reef-line. Whilst studies have shown no alarming alteration of the reef ecology, probably due to the high levels of dilution, improved levels of treatment and re-use of this effluent are an ultimate objective. Heated water from the incinerator and hyper-saline water from reverse osmosis plants is also pumped into the ocean. Monitoring has shown that such inputs have had little or no effect on the marine environment. In Jersey, however, the sewage treatment works empties into an enclosed bay where plankton blooms have been documented. In other territories, the problems of the increasing sewage load accompanying rapidly expanding population growth is exacerbated by the low flushing rates which persist in many of the sheltered bays and harbours where these developments are occurring. St. Helena noted sewage as a developing problem in one specific location.

Solid waste and dumping of debris – Increased populations and intensive development have also resulted in large volumes of solid waste. This has been addressed through various methods, including land reclamation (in Jersey, solid waste production increases by 3% p.a. and this goes into land fill), incinerators, artificial reefs, cleanups, export, and fines.

Litter/trash - Increased activity in all of the Overseas Territories and Crown Dependencies inevitably led to increased litter. In the marine environment, plastics, ranging in size from large sheets to microscopic pieces, and helium balloons are a major problem. Marine turtles, whales and seabirds are killed each year from ingesting plastics or becoming entangled in fishing gear. Public awareness, fines and coastal cleanups are the most common methods for tackling this problem.

Photo 8. Hawksbill turtle in Bermuda which died after ingesting the jar of plastics shown in the inset.

Tourist-related Impacts – With the expansion of tourism in many of the UKOTs and Crown Dependencies, public awareness of the marine environment has increased significantly, however some aspects of the tourist industry remain unsustainable; coral collection, spear fishing and the trade in endangered species are examples. In most territories, these activities are now prohibited, however other tourist-related impacts include; mooring/anchor damage (managed through protected areas or strategic positioning and the instalment of environmentally-friendly moorings); boat collisions with wildlife (and their habitat (eg. cruise ship groundings), direct wildlife harassment and touching of corals (managed through guidelines for operators and tourists (Bermuda), licensing of operators (Cyprus – turtles), no-go zones and operations restricted to shoreside (eg. Ascen-

Photo 9. Diver touching a coral in Cayman

sion); impacts on animal behaviour (controlled by limiting/prohibiting activity); and loss of historic artefacts (managed though legislation, fines, public awareness, Wrecks Act (Bermuda). Most of these problems arise in the Caribbean UKOTs, Bermuda,

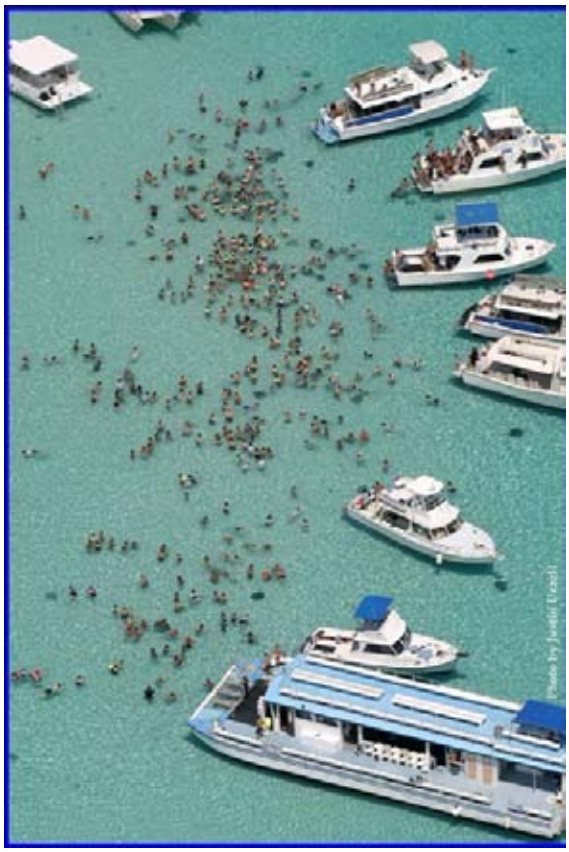

Photo 10. Sting Ray City in Cayman; new guidelines have been implemented to stop handling of the animas, but the animals would appear to have become habituated to the daily provision of food.

the Channel Islands and Gibraltar and Cyprus, but St. Helena also reports concerns.

Light, noise, sonar pollution – Development results in increases of all of these. The impact of light pollution in deterring turtles from nesting has been well documented and the Turks and Caicos noted light pollution as a significant threat. In Gibraltar, noise pollution is deemed a significant threat. In Bermuda, observers note that turtles appear slower to respond to boating traffic perhaps because they are having increasing difficulty in isolating the direction of the threat with the dramatically increased boating traffic. A number of marine mammal strandings have also raised questions about the cause; there has been no documented evidence of sonar pollution but it remains a threat.

Photo 11. A stranded dolphin is assisted in Bermuda's inshore waters

In Bermuda, a recent research request to undertake seismic testing was denied on the grounds that the potential threat to marine life was too great.

Natural Resource Exploitation

In recent years natural resource exploitation has expanded beyond fisheries resources to include bioprospecting for compounds of potential valuable for pharmaceutical purposes. Both Cayman and Bermuda report examples of such exploitation; in both territories there have been past examples of overseas companies collecting specimens without contracts being drawn up with the local Government, thereby contradicting the principles of the CBD which call for appropriate local benefit sharing. Many of the territories are also of interest to the scientific community in general and the ongoing, unmonitored collection of specimens should be of concern for potentially threatened species in some jurisdictions. Licensing of researchers, public awareness and the legal protection of endangered species is part of the solution, and territories are being encouraged to develop policies that consider requests from companies to search and sample on

Photo 12. Sponges are a common target species for pharmaceutical companies looking for compounds of potential value.

Photo 13. Band band disease on Caribbean Coral

a 'case by case' basis. The establishment of Sites of Special Scientific Interest (SSSIs) for example in the British Antarctic Territory allows regulated access for scientific study in accordance with management plans.

Oil prospecting is currently underway in the Falkland Islands, whilst preliminary exploration for minerals has commenced in Bermuda's waters. Still in the exploratory stage, it is too early to determine what impacts these activities might have on local biodiversity, but in both cases these activities are being carefully monitored. The Convention on the Regulation of Antarctic Mineral Resource Activities (CRAMRA) and the more recent Protocol on the Environmental Protection to the Antarctic Treaty of 1991, provides an indefinite prohibition on mineral activities at least for the British Antarctic Territory.

Global Climate Change

Beyond the scope of this summary, global climate change must nevertheless be mentioned given the low lying nature of many of the territories and their dependence on their coastal environments. Impacts already being felt include increased coastal erosion from more frequent and stronger storm activity (eg. hurricanes), changes in species composition (eg. White Bream in Jersey) as well as increased incidence of coral disease such as black, white and yellow band disease, as well as bleaching which in many parts of the world have been linked to global warming. There is ongoing monitoring throughout the Caribbean and Bermuda for the incidence of disease, but little means to mitigate against such threats. Global solutions to develop alternative energy sources are not without their impacts also. For example, in Guernsey there is concern about the efforts to generate hydro electric power, whilst there is concern in Jersey about plutonium pollution from the Cap de la Hague nuclear power station on the French coast.

Conclusions

In conclusion it is apparent that the UK Overseas Territories and Crown Dependencies face mounting pressure in trying to protect their shallow water marine zones from increasing levels of development. As more territories, particularly in the Caribbean and Channel Islands look to expand their role in the international business sector, this development shows no signs of abating. Those jurisdictions which have previously been buffered to some extent by their isolation, but which are now evolving into growing tourism destinations are also starting to witness the potential threats such development may pose. Whilst management practices have been developed to try and mitigate against these threats (and in this, there should be much to be learned from some territories about the successes and failures of various approaches), there are a number of notable stumbling blocks. The key problem expressed by most of the territories seems to be the overall lack of an integrated marine spatial plan. Development activities are being carried out in a 'piecemeal' fashion in the absence of an overall vision. Additionally, there is a general lack of awareness with a feeling that no weight is given to biodiversity in decision-making. Instead, there is a sense that protecting the environment continues to be viewed as a 'cost' to society. Adherence to the principles of the Environment Charter is weak throughout the UKOTs and CDs and a general lack of political will is a clearly voiced concern. Poor communication between scientists and policy-

makers is viewed as another significant problem, whilst often the regulatory framework is inadequate, and there is a need to revamp legislation. A lack of capacity and resources is a common theme throughout the territories, and increased regional cooperation is seen as beneficial.

Maintaining the health and integrity of the shallow marine coastal waters is pivotal to both the economic stability of all of the UK Overseas Territories and Crown Dependencies, as well as the preservation of their rich biodiversity. An overarching vision for the sustainable development of the inshore marine zones of each Overseas Territory and Crown Dependency is essential if these are to be maintained.

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This is Contribution #123, Bermuda Biodiversity Project (BBP), Bermuda Aquarium, Natural History Museum and Zoo.

Review 3: Marine Protected Areas in territorial and EEZ waters of UK Overseas Territories and Crown Dependencies: useful tools in the box?

Dr Mike Brooke, Department of Zoology, University of Cambridge, and Chairman UKOTCF Pitcairn WG

Brooke, M. 2007. Marine Protected Areas in territorial and EEZ waters of UK Overseas Territories and Crown Dependencies: useful tools in the box?. pp 134-137 in *Biodiversity That Matters: a conference on conservation in UK Overseas Territories and other small island communities, Jersey 6th to 12th October 2006* (ed. M. Pienkowski). UK Overseas Territories Conservation Forum, www.ukotcf.org

This presentation reviews Marine Protected Areas (MPAs) in the territorial and Exclusive Economic Zone (EEZ) waters of United Kingdom Overseas Territories (UKOTs) and Crown Dependencies. Whereas most territories and dependencies have some sort of protected area(s) lying offshore, many of the areas were established primarily to protect onshore or coastal features, for example sites registered within the international World Heritage and Ramsar Wetlands of International Importance Conventions. In such cases the truly marine component of the reserve is incidental but nevertheless valuable, especially when it extends as far as 12-nautical mile territorial limits. That said, there are MPAs of various status across the UKOTs. I examine the variety of ways by which MPAs have been established and try to identify what features are associated with a MPA achieving its aims, and what features are associated with a lack of success. Based on information supplied from the territories and dependencies, I attempt to identify where new MPAs could most beneficially be designated in the near to medium future. Ensuring the effective protection of offshore MPAs is likely to be major constraint. The Caribbean Overseas Territories that are members of the Organisation of Eastern Caribbean States (OECS) have signed the St Georges Declaration of Principles for Environmental Sustainability in the OECS, and therefore must implement the instruments of the Declaration as well as those of the Overseas Territories Environment Charter. Close scrutiny of both documents has indicated that they are quite similar and there is no philosophy or provision in one that is in discord with the other. Therefore any course of action that will lead to the satisfactory implementation of one will satisfy the execution of the other.

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This talk brings together scattered information provided by a generous network of correspondents on the Marine Protected Areas (MPAs) currently existing in the UK's Overseas Territories and Crown Dependencies, considers their effectiveness, and details where further MPAs could usefully be established.

In the Crown Dependencies there are no reserves which are formal MPAs. However Alderney, Guernsey and Jersey have designated Ramsar sites which include features of considerable marine interest. Since the Ramsar definition of wetlands is broad, "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres", there is evidently scope for using the designation for protecting nearshore marine areas.

In the Caribbean Territories, MPAs are found in Anguilla, in Bermuda in a multiplicity of forms, in the British Virgin Islands, in the Caymans (numbering 26) and in the Turks and Caicos (34). Only Montserrat lacks any MPA or equivalent.

In the 'tropical' Territories, MPAs are absent from the Pitcairns, have been proposed but not designated in Ascension, designated but not adopted in St Helena, and actually established in BIOT and Gibraltar.

Turning to the Southern Oceans, Tristan da Cunha has *de facto* MPAs, since the Gough and Inaccessible Island Nature Reserves have been extended to 12 nautical miles offshore. The Falklands and South Georgia & South Sandwich Islands lack MPAS. The British Antarctic Territory has many, and they will be discussed later in this presentation.

While this brief survey may give the impression that MPAs are effectively members of one species, such an impression would be false. The protected areas actually come in many guises, tailored to local circumstances. This is especially well exemplified by Bermuda where: -

1. The entire 200 mile EEZ is a marine mammal preserve.
2. "Areas to be avoided" are indicated to shipping with the aid of multi-million dollar expenditure on navigational radio beacons.
3. Coral reef preserves have been established to prevent damaging land reclamation.
4. 39 protected areas are designated and provided with permanent mooring buoys (to reduce or eliminate anchor damage). Within the areas, there is no line, spear or lobster fishing.
5. One strict Marine Park exists where this is no mooring, anchoring, or fishing.
6. No fish pots, or spear fishing are permitted within one mile of the shore while there are additional areas where net fishing is prohibited.
7. Seasonally protected areas with specified aims, for example protection of grouper spawning grounds, are gazetted.
8. In sea-grass areas, planning applications are discouraged.
9. Special measures may be taken to protect species of local or global conservation concern.
10. Historic wrecks may or may not be closed to diving.

Clearly this variety of marine conservation measures has been possible only because Bermuda is a populated and prosperous Territory, with resources available to consider carefully what is required to effect useful marine conservation, and then to designate, monitor and enforce. Such luxuries are simply unavailable in many Territories where the marine protection framework is necessarily cruder. This alternative situation is exemplified by BIOT.

In BIOT a Conservation Zone was established in 2003 stretching from the 200 mile limit to within 6 miles of the coast. In practise it remains to be seen what practical effect this designation has. There are additional Strict Nature Reserves centred on Eagle Island and Peros Banhos in the west and north of archipelago, respectively. Finally, the populated island of Diego Garcia contains a Ramsar site in which are Strict Conservation Areas, Restricted Areas and beach walking areas, which together accommodate a variety of uses and users.

A variety of uses - but perhaps not users - is also reflected in the many protection categories created in the Antarctic Treaty area, of which the British Antarctic Territory is an important part. That importance is reflected (table below) in the relatively high numbers of at least some protected area categories that are to be found in the British Antarctic Territory and South Sandwich Islands when viewed as a proportion of all such areas within the Antarctic Treaty region.

Table. Types of Protected Area in the Antarctic Treaty region
N = Number in BAT or SSI/Number in whole treaty area

	Category of protected area	**N**
A	Fully and partially marine Antarctic Specially Protected Areas (ASPAs) of interest to CCAMLR	5/10
B	Antarctic Specially Protected Areas (ASPAs) with a marine component (not requiring CCAMLR approval)	5/6
C	Antarctic Specially Managed Areas (ASMAs)	2/3
D	Multiple-use Planning Areas (MuPAs)	0/1
E	CCAMLR Ecosystem Monitoring Program (CEMP) Protected Areas	0/3
F	Convention for the Conservation of Antarctic Seals (CCAS) Seal Reserves	2/2
G	CCAS Sealing Zones	0/6
H	Marine Protected Areas under proposal	0/2
I	Marine Protected Areas within the CCAMLR Convention Area under national jurisdiction	

It is perhaps no coincidence that the three Territories whose MPA networks I have described in some detail include one that is large (in population terms) and wealthy, and two that largely uninhabited. I would argue that networks can be most read-

ily established either where there is extensive local expertise or where there are (virtually) no people, and therefore no vested interests to resist designation. The problems arise in Territories of modest capacity where resources are sparse and yet there are enough voices and vested interests to make reserve designation contentious.

Given the variety of types of MPA, there is a wealth of reasons why MPAs are designated. However, these reasons can usually be placed within one of three over-arching umbrella categories. These first is that the area is a more or less intact and representative example of some particular type of marine ecosystem. The second is that the protection of the area may have scientific importance, in providing a control to help distinguish between the effects of harvesting and natural ecosystem changes, and in providing an area for study not subject to human interference. The third is the protection of an area or species potentially vulnerable to human activities such as a coral reef or a sea mount. Perhaps surprisingly no correspondent mentioned as a reason for establishment the role that MPAs are known to have in providing a refuge in which numbers of fished species can build up and spill out into the surrounding areas to the benefit of fishermen.

Even well-endowed Territories are likely to face problems policing MPAs. The problem is yet more acute in remote and barely inhabited Territories. Both Territory classes are faced with patrolling a 200-mile EEZ that may cover a sea-area the size of England. In such circumstances, it is evident that enforcement is likely to be difficult or impossible. Even a dedicated fishery protection vessel is barely sufficient. That assumes a vessel is available which, at present, is not the case in most Territories. This situation is unlikely to change given a reluctance of the British Government in London to fund such vessels. Only when a local fishery exists on a scale sufficient to provide license fees adequate to run a protection vessel is there a fair prospect of offshore MPA enforcement. Currently this outcome has been realised only in the Falklands, and South Georgia.

Enforcement of nearshore reserves that are often extensions of onshore reserves is a more attainable aim, and it is one that could be pursued in more UK Overseas Territories.

Despite these difficulties, correspondents mostly reacted positively when asked whether MPAs in their Territories were effective, with, for example, positive impacts on local fisheries reported from Turks and Caicos and Tristan da Cunha. However, Anguilla and British Antarctic Territory reported an absence of evidence and this is likely to be more generally true than indicated. The monitoring protocols needed to establish whether MPAs are or are not effective are simply not in place on an adequate scale. This is not likely to change in the short-term, bearing in mind how difficult it has proven to establish effective monitoring in the mainland UK.

Many Territories and Crown Dependencies reported aspirations to establish further MPAs. These included, from north to south: -

Isle of Man – south coast areas
Jersey – St Ouen's area
Anguilla – Prickly Pear area to provide linkage

The islands of British Indian Ocean Territory shown at the same scale as England and Wales. BIOT's Exclusive Economic Zone (and Conservation Zone) if shown at the same scale would extend well into the Irish and North Seas, the English Channel and Scotland.

between existing PAs
Ascension – but progress constrained by lack of resources
St Helena – offshore stacks but resource shortage as above
Tristan da Cunha – seamounts but uncertain how protection could be enforced
South Georgia – MPAs under consideration
Antarctic Treaty area – high seas MPAs under consideration.

In general, correspondents were positive when reporting their experience with MPAs. However, there is a clear need for establishing more such areas, ensuring that protection is enforced and that the areas are not 'paper parks', and for monitoring whether the MPAs actually achieve the aims for which they were designated.

Acknowledgements

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Discussion following the review presentations

Questions, Answers and General Comments

Bycatch in fisheries

The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) was set up with an ecosystem approach under the Antarctic Treaty. There is a good suite of mitigation measures. Raising awareness of these with other fisheries (Regional Fisheries Management Organisations – RFMOs) is required. The Agreement on the Conservation of Albatrosses and Petrels (ACAP) needs to be used to influence fisheries and mitigation measures. The lead is being taken by the UK in assessing the level of bycatch by ACAP members fishing in the S. Atlantic, and will give an awareness of the scale of the problem and the mitigation measures to be introduced.

The Falkland Islands and South Georgia monitor Exclusive Economic Zones (EEZ) using two fisheries patrol vessels. There is also aerial surveillance and satellite surveillance. Licenced vessels are also monitored via GPS. In addition, there is self-monitoring by licensed fishing vessels.

Satellite tracking relating to ACAP might be of use in the future for tracking illegal fishing vessels.

Reference was made to a UK Defra-led action plan, with the question as to whether other territories were being drawn in, but participants were unaware of this.

There were difficulties in the suggestion of a sharing agreement between Falkland Islands and other South Atlantic islands (e.g. Ascension).

It was noted that blue-dyed fish bait increases fish catch and decreases turtle by-catch. There was an economic saving to the fishery of not catching albatross as a bycatch. Saving albatross from by-catch was not yet reflected in increased population. There were other pressures in other areas, with long-lived individuals with onset of breeding at a late age, and not breeding in every year. There might not be measurable increased recruitment for 10 years. Also, the fisheries in the Falklands represent only a small area of the fisheries that affect albatrosses.

Development issues in inshore marine zones

Concerns were expressed that anti-fouling paint containing TBT was still being used in many places. In BVI it affects conch and makes them infertile. In France and Britain it impacted on dog whelk. Unfortunately new anti-fouling paints are also toxic.

Marine Protected Areas

In some areas, for example the Marshall Islands, fisheries enhancement is the only way in which MPAs can be "sold" as there is no tourism. Therefore protection of seagrasses was promoted for fisheries enhancement to make it acceptable to the public.

Specific discussion relating to subjects proposed in the introductory paper

Ensuring existing and new marine fisheries are managed in a sustainable manner

The Foreign & Commonwealth Office is responsible for EEZs, and also take the lead on CCAMLR. The regulation of long-line fishing in Tristan da Cunha is a massive problem, and UK will miss ACAP targets by far if something is not done. Ascension now has the right to sell its own fishing licences (since 2004) but for Ascension the reply to each of the four questions under this heading in the Introduction is "no". Falklands had received large funding for the start up of their fishery. Would there be any funding for the start-up of the Ascension fishery? It was acknowledged that there was a huge challenge regarding ACAP targets. Work was being done with RFMOs, and also alongside partners such as RSPB and Birdlife, to try to get people on ships to use mitigation measures. Policing was impracticable with current resources.

It was noted that the French authorities were now quite active, using satellites which can scan boats for a signal, and sending policing boats to those fishing without a signal. Why not have extensive collaboration between countries on this? Technicians and officials in Brussels should be lobbied to ensure a vessel monitoring system (VSM) At the Greenland meeting of EU and OCTs, the Falklands representative had spoken about the lack of

EU involvement in policing in the South Atlantic. Members of CCAMLR have to have 100% monitoring.

One thing that was needed now was an immediate point of contact when situations occurred. Illegal fishers have got away in the past in Ascension, even though UK had been informed.

Ensuring tourism and other development activities are properly managed

Aquaculture raises many issues, e.g. breeding alien species, dredging, nitrification, damage to mangroves, fishing to provide food (junk fish) for farmed fish.

Cayman has an aquaculture policy. The legislation has not yet happened, but they do have a draft bill.

This issue was relevant to JNCC and its economic development tools. There was a need to tie dollar values to resources under threat. The information available to date is not specific and very dated. It was hoped that this could be explored with JNCC and assistance given.

One problem was that assessing environmental impact tends to happen at the individual project scale, and ignores the cumulative effect of, for example, 5-10 similar developments in the same area. Concerns were expressed on aggregates and fossil fuel licensing on the sea bed.

There was a clear need for advice and guidance in UKOTs on marine issues. JNCC could help with fisheries, MPAs, environment and impact assessment – including oil and gas. JNCC agreed to discuss further what more they can do to help UKOTs and CDs with their needs.

Is income from development activities adequately supporting conservation efforts? Absolutely not. In BVI development areas were affecting existing MPAs, not supporting them.

Protecting habitats and species

In BVI lots of work had been done but it was very hard to compete with major development projects; small islands have small spaces. The importance of independent NGOs was highlighted in putting pressure on government. An example was given of a territory which did not have effective NGOs because the government did not want them. In this example the government simply decided what it wanted, and what it would do.

BirdLife International have a best practice document available for undertaking risk assessments and plans of action for seabirds. One needs to be produced for turtles.

Making use of international bodies

Some specific examples were discussed.

CITES is moving more towards marine species, and could be the right mechanism to support fishery management. It has teeth, and has closed fisheries down. Gibraltar implements CITES (but leaving most of the work to an NGO), but there was no follow-through. What do you do with the animals which are seized as a result of CITES?

The World Heritage Convention currently has a huge emphasis on sites that are marine or a large percentage of marine environment. Tristan has two islands which form a World Heritage site. The question was "what is the value of these sites?". They highlight the value for tourism, develop a sense of pride in people who live in or near a World Heritage site, and provide emotional tools for engagement. The disadvantages were relatively low, there was paperwork to get registered, and the need for a management plan.

There were issues on islands where people do not feel able to speak out. The question was raised as to whether UKOTCF could raise issues and apply pressure to local bodies and others. Is that what this conference wanted UKOTCF to do? UKOTs should let the Forum know of any such issues to raise in its meetings with FCO and others.

Resourcing conservation efforts

There was unanimous concern over the lack of funds, budgets and a generic capacity problem in UKOTs for environmental work.

Poster: Assessment & Improved Management of New and Existing Marine Protected Areas in the British Virgin Islands

Joseph Smith Abbott, British Virgin Islands National Parks Trust

Smith Abbott, J. 2007. Assessment & Improved Management of New and Existing Marine Protected Areas in the British Virgin Islands. p 140 in *Biodiversity That Matters: a conference on conservation in UK Overseas Territories and other small island communities, Jersey 6th to 12th October 2006* (ed. M. Pienkowski). UK Overseas Territories Conservation Forum, www.ukotcf.org

This OTEP funded project aimed to assess the efficacy of the BVI's existing Marine Conservation Programme (MCP), and develop ways to improve it. The BVI NPT had a proposed system of Marine Protected Areas (MPAs) and wanted to determine (a) whether these areas were representative of all marine habitats within the BVI that required protection, especially habitats of critical importance, (b) how well were the MPAs performing and their effectiveness on the marine environment and stakeholder use through the acquisition of baseline ecological data and, (c) what adaptive management practices were required to ensure the Trust's ability to conserve, manage or restore these key marine habitats? These questions were answered during this two year project conducted in collaboration between the BVI National Parks Trust, Conservation and Fisheries Department, and Dr. Charles Sheppard of the University of Warwick.

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Poster: The British Virgin Islands Marine Conservation Programme

Nancy K Woodfield Pascoe, British Virgin Islands National Parks Trust

Woodfield Pascoe, N.K. 2007. The British Virgin Islands Marine Conservation Programme. p 141 in *Biodiversity That Matters: a conference on conservation in UK Overseas Territories and other small island communities, Jersey 6th to 12th October 2006* (ed. M. Pienkowski). UK Overseas Territories Conservation Forum, www.ukotcf.org

Marine conservation and management ensure habitat and species survival and provide for adequate fish stocks and enhanced visitor enjoyment, while protecting delicate coral reefs. Through the Marine Conservation Programme, the BVI National Parks Trust has actively conserved coral reef environments from anchor damage by the installation of mooring buoys at popular dive and snorkel sites throughout the BVI. The programme is manned by a staff of six (6) Marine Wardens who are responsible for the maintenance and patrol of these moorings. The programme is administered by a Marine Programme Coordinator, based in the Trust Office. Fees collected for the use of the moorings represent a substantial component of revenue generated by the Trust.

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Poster: Environmental Impact Assessment and Tidal Power; filling the legislative vacuum: A case study from Alderney (Bailiwick of Guernsey)

Roland Gauvain, Alderney Wildlife Trust

Gauvain, R. 2007. Environmental Impact Assessment and Tidal Power; filling the legislative vacuum: A case study from Alderney (Bailiwick of Guernsey). p 142 in *Biodiversity That Matters: a conference on conservation in UK Overseas Territories and other small island communities, Jersey 6th to 12th October 2006* (ed. M. Pienkowski). UK Overseas Territories Conservation Forum, www.ukotcf.org

Alderney's tidal races (the Alderney Race and Swinge) are recognised as being one of the Europe's most powerful tidal resources. With the recent growth in the development of tidal energy devices, and due to the political situation of the island Alderney is the only Island within the British Isles to own and control its own seabed (approximately 90 sq.miles), Alderney finds itself in a unique position.

The poster display will layout the processes taking place within the political, commercial and environmental sectors, which is leading towards the placement of the first tidal devices within Alderney's waters.

- The creation of an independent body to oversee all aspects of tidal power development within Alderney's Waters.
- The establishment of a commercial agreements between State and developer.
- The development of an Environmental Impact Assessment framework, both the establishment of a baseline and longer term environmental scoping and device specific Impact Assessment.
- The creation of a legislative framework.
- The development of monitoring and control processes.

The purpose behind the display is to layout the current tidal power development strategy on Alderney in brief and highlight what might be considered its successes and failures.

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Poster: Bermuda Reef Ecosystem Assessment and Mapping (BREAM) Programme 2006

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Bermuda's coral reef system is particularly significant in that it is the most northerly in the world. Over the past couple of decades, there has been a dramatic decline in the health of coral reef systems globally. Estimates indicate that about 27% of the world's reefs have been degraded beyond recovery and a further 16% are under serious threat. Whilst coral reefs throughout the rest of the Caribbean have suffered dramatic declines in the amount of living coral, Bermuda is one of the few remaining locations with relatively healthy reefs, probably in part due to the fact that our corals are isolated from many of the destructive processes found further south, and because all corals and herbivorous fishes are completely protected across the island. For this reason Bermuda's shallow water marine habitats are not only important locally, but also regionally.

The BREAM project, has been launched in recognition of the fact that there is a need firstly, to support multidisciplinary studies of Bermuda's coral reef complex to eliminate the information gaps; secondly, to properly document and orchestrate data collection, management and sharing in order to promote improved local, regional and international understanding of coral reef systems; thirdly, to integrate the resource managers, the scientific community and the users in the management processes to define common goals and to recognise the significant pressures and conflicts that are placed upon our marine environment; and finally, to promote a range of public awareness programmes, with the goal of encouraging care of our unique coral reef ecosystem.

At present, baseline surveys are being conducted across the entire shallow water marine platform to assess the ecological condition and biodiversity of the reefs. Protocols and a preliminary overview of the findings are presented.

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Introduction

The Bermuda Reef Ecosystem Assessment and Mapping (BREAM) Programme began in 2004, and focuses on the marine aspect of the Bermuda Biodiversity Project.

One of our goals is to collect data on the ecological condition and biodiversity of coral reefs located over the entire Bermuda Seamount, and to continue monitoring these marine communities over an ecologically meaningful length of time.

In the summers of 2004 and 2005 we assessed the ecological condition of the corals, algae and fish at 25 rim reef sites, 35 lagoonal patch reefs and four forereef sites using a modified version of the Atlantic and Gulf Rapid Reef Assessment (AGRRA) and Reef Environmental Education Foundation (REEF) survey protocols.

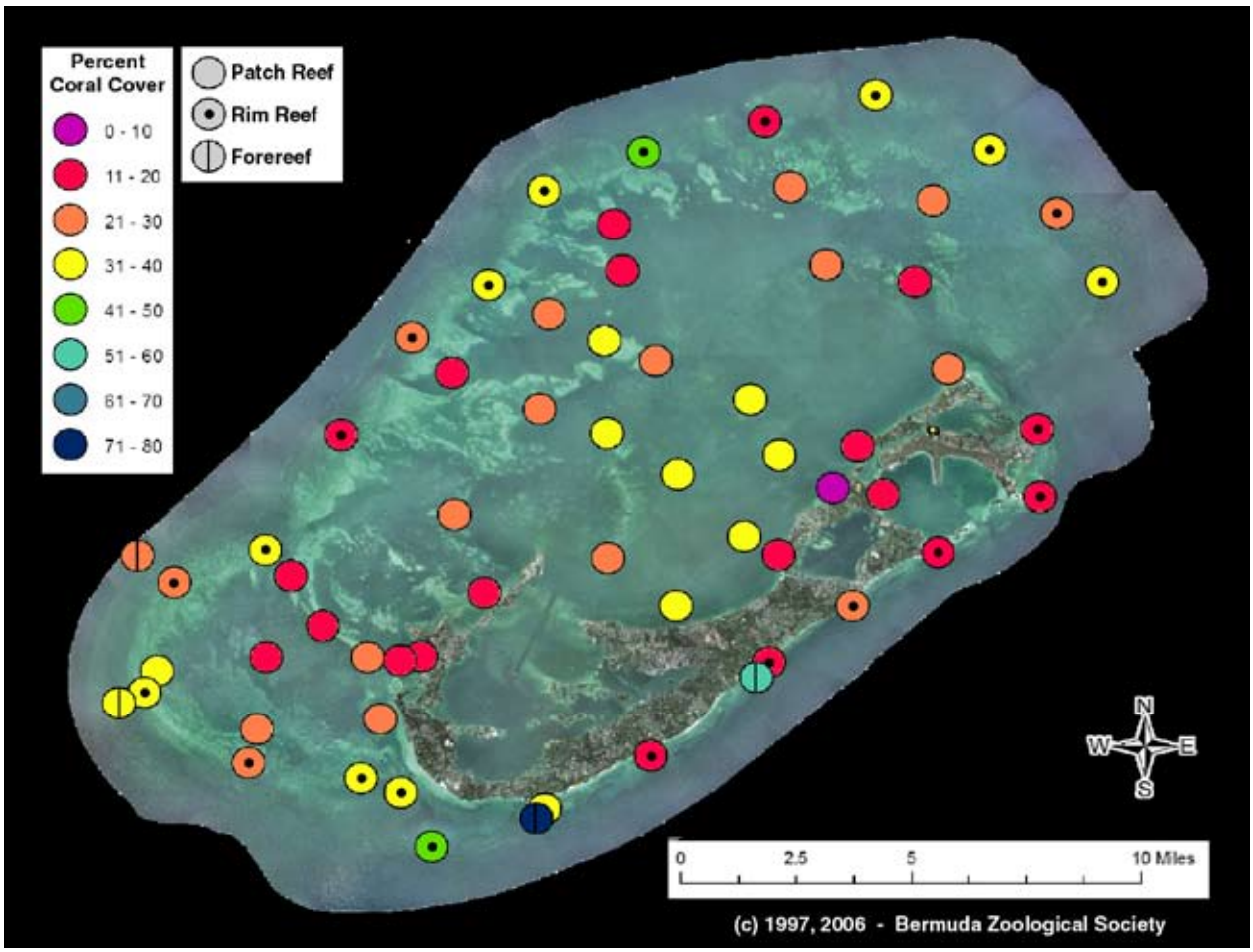

Fig 1. A GIS map showing the location and relative coral cover of patch, rim and forereef reef assemblages across the Bermuda reef platform

Reef Corals

At the 64 sites, team members accounted for a total of 3,658 stony corals, on 297 transects. Coral cover varied from a low of less than 10% to a high of over 75% of the benthic substrate. Fore and rim reefs consisted of almost identical stony coral species assemblages, dominated by *Diploria strigosa* and *Diploria labyrinthiformis*. Species diversity was relatively low both on the rim reef (H' = 1.288) and on the fore reef (H' = 1.215). Families represented on these reefs, in order of abundance, include Diploria, Porites, Montastrea, and Millepora. Lagoonal patch reefs were characterized by the highest species diversity (H' = 2.094) and were dominated by *Porites astreiodes* and *D. strigosa*. This habitat also supported the greatest number of families, including Diploria, Porites, Montastrea, Millepora, Madracis, Oculina and Stephanocoenia.

Reef Fish

Team members recorded a total of 18,510 fish on 1,320 transects. Patch reef assemblages consisted of almost 75% haemulids, with pomacentrids, scarids and acanthurids making up most of the remainder and were less diverse than the other three habitat types (H' = 2.169). Fore and rim reef assemblages were almost identical. The reef fish communities in these habitats were dominated by scarids and acanthurids. The species diversity in these habitats was high (H' = 2.878, H' = 2.816, respectively).

In 2006 we plan to survey additional forereef sites at depths of 10- and 20-m, completely encompassing all reef habitats across the Bermuda platform. The information collected will be used to better guide marine research, resource management and education.

Acknowledgements

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Poster: Assessing the conservation status of the critically threatened Spectacled Petrel

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Hilton. G. 2007. Assessing the conservation status of the critically threatened Spectacled Petrel. pp 145-146 in *Biodiversity That Matters: a conference on conservation in UK Overseas Territories and other small island communities, Jersey 6th to 12th October 2006* (ed. M. Pienkowski). UK Overseas Territories Conservation Forum, www.ukotcf.org

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Project Background

The Spectacled Petrel *Procellaria conspicillata* is 'critically endangered', and, so far as is currently known, endemic to Inaccessible Island in the Tristan da Cunha group. It was given its very high threat status because it was thought to have a small population that was likely to be declining because of high mortality as longline fishing bycatch.

A previous population census in 1999, and an estimate of longline mortality in 2000 were in urgent need of updating, and it was feared that the species might be getting close to extinction. This project attempted to determine the current conservation status of the species.

Spectacled Petrels are large, burrow-nesting seabirds. Their at-sea distribution and ecology are not well understood, though they are known to be among the most abundant birds foraging around fishing vessels off the Brazilian coast.

Activities and Results

Census of the breeding population on Inaccessible Island

A repeat of the 1999 breeding census was conducted during the 2004 breeding season, led by the University of Cape Town. The census involved estimating the number of burrows in all nesting colonies, coupled with intensive counts in a sample of these colonies to determine the proportion of burrows that are missed during estimated counts. The proportion of burrows that were actually occupied by an incubating pair was estimated using a combination of methods; in particular, we determined the call-response to tape-playback of calls at burrow entrances. The number of breeding pairs was derived from the total number of estimated burrows, and the apparent occupancy rate of these burrows.

The census indicated that the population had increased rapidly since 1999. The 2004 population was thought to be around 10,000 breeding pairs, compared to 7,000 breeding pairs in 1999 – an increase of ca. 45%, or 7% per annum. This remarkable result was unexpected and very heartening, but posed new questions: how could the population be increasing so rapidly, in the face of apparently massive adult mortality? We concluded, based on the limited historical data available, that the population has probably been undergoing a sustained recovery since the early twentieth century, when introduced pigs *Sus scrofa* – which were probably catastrophic predators of nesting Spectacled Petrels – died out on the island. Other conditions were so favourable (because the population was well below carrying capacity) that the development of longline mortality did not prevent the increase from continuing. Also, since earlier population censuses probably under-estimated the true population size, the estimated longline mortality was somewhat less severe, in terms of the proportion of the total population killed each year.

Assessment of the current rate of longlining mortality

Observers were placed by Instituto Albatroz on

nine pelagic longline cruises performed from April to December 2005 off Brazil. In total, onboard observers recorded data from 117 longline sets and 115,730 hooks deployed, to estimate current rates of seabird bycatch, fishing locations, catches and bycatch mitigation behaviour.

An extensive review of data on Spectacled Petrel occurrence and seabird bycatch in demersal and pelagic longline fisheries in the Southwest Atlantic Ocean was conducted. A new longline database and GIS system was developed by Instituto Albatroz.

No Spectacled Petrel or other seabird was killed during the observed cruises. It is difficult to interpret these data clearly, because only a small proportion of total longline effort could be covered, and mortality is known to be highly stochastic. Bycatch mitigation measures were not used on these cruises.

Abundance data showed that Spectacled Petrel is the most frequent and abundant species attending vessels. Other common species were Great Shearwater *Puffinus gravis*, White-chinned Petrels *Procellaria conspicillata*, Atlantic Yellow-nosed Albatross *Thalassarche chlororhynchos*, Black-browed Albatross *Thalassarche melanophrys* and great albatrosses *Diomedea* spp. The great majority of these birds is likely to have originated in the UKOTs of Falkland Islands, South Georgia and Tristan da Cunha, indicating the importance of Southwest Atlantic waters for OT's seabird populations.

Assessment of whether there might be another breeding location

Recent sightings of rafting birds off the coast of Tristan da Cunha suggested that there might be a second nesting population on this island. Other islands in the region might conceivably also support undiscovered populations: although the species comes ashore during daylight in the breeding season, so is not hard to detect, it is a winter-nester, and very little fieldwork generally takes place at this time of year.

New searches were conducted on land and from sea in the remoter areas of Tristan da Cunha during winter 2004. In addition, genetic material was taken from 50 breeding birds on Inaccessible Island, and from more than 100 birds caught alive (and released) at longline vessels off Brazil. Microsatellite analysis of the samples was used to examine whether the birds at the longlines were from the same population as the Inaccessible Island breeders. A genetic difference between the Brazil birds and the Inaccessible birds might indicate that there is a second, unknown, breeding population represented among the birds feeding off Brazil.

The searches on Tristan da Cunha did not reveal any Spectacled Petrel colonies, and indeed, other petrel populations on Tristan da Cunha seem now to be only remnants: cats and rats have destroyed the once enormous colonies. The genetic analysis has just been completed, and results are being analysed.