Draft notes on Biodiversity, resettlement and the long term prospects for small populations on small tropical islands.

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These notes were prepared as a rapid overview based on personal experience and opinion. They were prepared as a briefing document in particular to advise the ongoing review and resettlement feasibility studies. Statistics have not been fully cross-checked or validated, and in many cases may not may not be fully up-to-date. They are meant for briefing purposes only and should not be cited without further verification. They were prepared in some haste and may be incomplete. They also do not represent the views of anyone other than the author.

1. Background

Chagos as increasingly unique place in the planet:

- Has 1.5% of the world's coral reefs (Spalding et al. 2001) including the world's largest coral atoll (this might be contested only in that the Great Chagos Bank is partly submerged, so some definitions might not include it, but it is largely semantics)

- Some of the most unpolluted ocean on the planet (Everaarts et al. 1999; Readman et al. 1999; Sheppard 2005)

- Vast area of shallow water, with miniscule area of land (Sheppard and Seaward 1999).

- Rich biodiversity (Sheppard 1999; Sheppard and Seaward 1999) and some marine endemism (= unique species found no-where else) (Winterbottom et al. 1989; Winterbottom and Anderson 1999)

- Fish communities that remain *relatively* unimpacted by fishing (Mees et al. 1999b; Mees et al. 2000; Spalding 2000; Pearce and Ansell 2002). BUT see context below

- Seabird colonies. Some of the most significant in the entire Indian Ocean

- Endangered species. Turtles, marine mammals and some marine fish are found in sufficient quantity to make it an important stronghold globally.

It is somewhat difficult to communicate the importance of these facts to those not fully aware of the crisis facing the worlds coastal waters and coral reefs, but numerous references and observations point to the fact that coral reefs the world over are in a parlous state from multiple threats (Bryant et al. 1998; Sheppard 2000a; Sheppard 2000b; Sheppard 2000c; Souter et al. 2000; Spalding et al. 2001; Burke et al. 2002; Lindén et al. 2002; Wilkinson 2002; Burke and Maidens 2004; Wilkinson 2004; Souter and Lindén 2005). Even in the most remote locations coral reefs are under siege from target species overfishing, often illegal, while ocean currents are bringing pollutants to all quarters and global warming presents a new threat to all areas. Chagos is not immune, but it is remarkably healthy and in that sense almost unique.

It is important to try and understand that environmentalists concerns to protect these systems, which may sound melodramatic or overly protectionist, arise from the fact that there is no-where else on the planet where there are 50 (currently) uninhabited islands and such a vast area of reefs that, while perhaps not pristine, remains relatively unscathed.

To my mind such concerns should never be read as “anti-resettlement” but that “we can’t afford to mess this up”.

2. Chagos current human uses/impacts

Military base

X,000 people, including military, but dominated by support personnel.
No doubt that this base has had massive impacts on the natural environment, with large-scale building work, including an extraordinarily destructive blasting of reef-flats for the construction of the runway (30 years ago). Ongoing impacts include recreational (and personal consumption) fishing and the impacts of multiple, massive ship anchors on the sea bed of the lagoon. There are strict environmental rules which do offer a surprising degree of protection, including restricted access to most of the eastern part of the atoll; pollution control measures; and some pollution control. Given the size of the base these impacts should probably be considered as relatively low.

Erosion is taking place on some shores, perhaps linked to the damage to the reef flat, but perhaps also linked to coral death and sea level rise (see climate change)

Fisheries

Industrial tuna fishery operates in high seas and divides into purse-seining (largely European vessels) and long-lining (largely east asian). The Indian Ocean tuna fisheries are not yet in decline (unlike much of the Atlantic and Pacific tuna fisheries). These are highly migratory species that are only caught in Chagos waters for part of the year, and the total numbers in Chagos waters is highly variable (Mees et al. 1999a; Pearce 1999; MRAG-Ltd 2001; MRAG-Ltd 2002). The large-scale nature of the movements of these tuna means that it is not possible for a single nation to “manage” stocks. Overfishing elsewhere will harm the industry through the entire Ocean. UK is actively engaged in the Indian Ocean Tuna Commission which attempts to control and manage this industrial fishery. Note that this currently is a high tech industry, with very large, super-expensive vessels which run without any need of terrestrial facilities.

Don’t have any decent statistics on the income for the fishery and UK government is usually cagey about supplying this, but it was apparent at the recent CCT symposium that the income is not highly lucrative, and is highly variable. Income is probably under £1million per annum, and the bulk of this is spent on running costs for the management agency which provides monitoring and the support vessel (Marine Resources Assessment Group).

Mauritian inshore fishery – operates on outer atolls – licenses available for up to six largeish “motherships” which arrive with a number of small dories that head out for hook and line fishing usually for grouper and snapper on deeper reef slopes. Not highly lucrative and recent years have seen little or no uptake of available licences (Mees et al. 1999b; Spalding 2000). This is again managed by MRAG. They are able to place certain restrictions and regulations on the fishery – often inevitably in a reactive manner (e.g.

shark fishing was banned after a season of high shark capture using specialized lines; certain fish spawning sites have been closed to future fishing after a season of catches). Theoretically there is a Mauritian-British Fisheries working group who plan policy and direction for these fisheries although I believe that at the present time this is somewhat dysfunctional.

Recreational fishery – primarily out of DG. Equivalent in many ways to similar fisheries in tourist areas throughout the world with critical targets being larger predators both over the reefs (grouper, snapper, shark) and in offshore waters (billfish and tuna). Some concerns that this fishery may not be 100% sustainable, but present studies largely inadequate. There is some tag and release, and an improving level of reporting by fisheries operators (at least for boat and floating platform fisheries).

Illegal fishery – likely some illegal elements to the tuna fishery (e.g. shark-finning) which go unobserved, but major illegal activities appear to be a mostly Sri Lankan inshore fishery which has particularly targeted sharks and more recently sea cucumbers (beche de mer). Both stocks appear to have been significantly impacted (Anderson et al. 1998; Spalding 2004; Spalding 2006). Seems likely that yacht based fisheries in northern atolls also undertake some illegal fishing (sharks and possibly occasional turtles, as well as regular capture of the terrestrial coconut crab).

Yachts

The only legal “tourists”. Numbers have increased year on year and visitors mostly stay in Salomon Atoll with small numbers in Peros Banhos. Probably relatively low impact but not zero. Concerns about impacts of both anchor damage and sewage release in the relatively enclosed waters of Salomon. There is some fishing and some (illegal) take of coconut crabs. They are not permitted to visit the nature reserve areas and it seems unlikely that they anchor in such areas. Efforts to reduce impacts have recently included a restriction on the length of total stay, an increase in the anchorage fee, and the designation of anchorage zones to reduce the geographic spread of the highly destructive impacts of anchors and anchor chains on the sea bed and corals.

FCO permitted a single formal organized tour in 2005 which consisted of 10 passengers on a 10-day visit to northern Atolls.

Scientists

Most science visits have been formal and government approved, but sporadic, with major expeditions mounted perhaps decadally. The FCO supports a Chief Conservation Advisor who undertakes an annual visit to the islands.

Marine Protected Areas

A small number of MPAs have already been established, including no-take fishing areas (no fishing whatsoever is permitted, although politics required that the Mauritian inshore fishery be excluded from this legislation), and including an internationally recognised Ramsar site.

Pressure continues from NGOs for the designation of much wider areas or perhaps even the entire archipelago as Ramsar site or as a World Heritage. UK Govt has resisted the latter because of misplaced concerns about the political implications and sensitivities of the military base (WWF-US commissioned a review of this in the 90s and there were no problems with maintaining military security). UK government also maintains that it is not able to apply these conventions beyond the territorial waters (3 nautical miles from land) although there are legal precedents from many other countries of MPAs extending right out to the edges of the 200nm zone.

MPAs should not be seen in any way as a barrier to resettlement, but rather as an integral part of any sustainable management for a coastal/reef/archipelagic nation. There are innumerable examples of the efficacy of such protection in ensuring better fish catches and long-term sustainability (Roberts et al. 2001; Gell and Roberts 2003; Halpern 2003; Balmford et al. 2004; UNEP 2004; Leslie 2005; Roberts et al. 2006; Jones 2007). As mentioned many NGOs are now using people from reef communities as the best teachers to pass these messages to people in other reef communities

3. Thoughts on resettlement

Challenges

Remoteness

Away from Diego surely one of the biggest concerns for resettlement will be access. Much will depend on access to the military base. Assuming this not allowed then options are for a runway or port access. Islands are so remote that they would require a LARGE runway to take international flights (small planes I believe would not have sufficient fuel capacity to make the trip from Seychelles or Maldives) and then associated infrastructure (fuel, power station).

Sustainable livelihoods.

From an environmental perspective it needs to be borne in mind constantly that the Chagos Archipelago has a tiny land area and sits in very nutrient poor waters – although rich in life there is unlikely to be much space or sufficient net productivity for large-scale or lucrative land- or marine-based commercial activities. Attempts to do to much could be damaging not only for the natural environment, but as importantly for the survival and stability of a returning population.

Climate change – coral bleaching

Corals are highly sensitive to relatively small rises in temperature, exhibiting a stress response known as bleaching. In 1998 a combination of environmental factors caused a mass-bleaching event across much of the Indian Ocean – this was unprecedented in the observed history of coral reefs and there is little evidence that it is even a rare event through the historical record. The majority of informed reef scientists believe that coral

bleaching will become increasing common in the next decades (International Society for Reef 1998; Hoegh-Guldberg 1999). The impacts can be devastating. In Chagos in 1998 80-90% of all corals died (Sheppard et al. 2001; Sheppard et al. 2002). Luckily it appears that the reefs in Chagos are making a good recovery this time, but elsewhere, notably in the granitic islands of the Seychelles there has been little or no recovery (Spencer et al. 2000; Spalding and Jarvis 2002; Souter and Lindén 2005)

Regular bleaching will mean the effective loss of many of the ecosystem services provided by coral reefs, including protection from erosion (Sheppard et al. 2002) and some degree of fisheries productivity (Graham et al. 2007)

One should not state that the coral reefs are doomed. There is some, albeit limited, evidence that corals may have some adaptive potential although consensus is that this appears insufficient for the scale of proposed changes. There is also growing evidence that reefs that remain unimpacted by other human activities may be more robust. But it would be very unwise to assume that reef status will remain stable in the 20-40 year time frame. Much more likely will be more coral death events, increasing in frequency, with decreasing periods of recovery, leading eventually to diminished mean coral cover and subsequent impacts on marine communities (including fish) and on coastal protection.

Climate change – sea level rise

Chagos islands are entirely built by coral reefs. Global sea levels are rising at approximately 2mm per year, and have already risen considerably in the last 50 years (Church et al. 2006; Bindoff et al. 2007; IPCC 2007; McGranahan et al. 2007).

Cross-sectional profiles of the islands show that many are lower in the centre than at the coastal margin, some even at or below sea level (Sheppard 2002). Like all coral islands there is no freshwater on the surface of the land, but freshwater sinks through the limestone and “floats” within the rock structure on top of the salt water that lies underneath – this enables islanders to dig wells to get freshwater and trees to do the same with their roots.

Point here is that sea level rise will again make some islands untenable well before they are actually flooded as water becomes saline and plants die.

Second part of the story is that sea level rise also increases rates of erosion (often modeled on something called Brunn’s rule which may not be very accurate but suggests assuming 1.5m of erosion for every centimeter of rise). This would undoubtedly be greatly exacerbated if the protecting rim of offshore corals were dead and also eroding.

All this can sound horrific and in some places it already is. The Pacific islands of Tuvalu have already had some overwash even in the main island and urban centre and the peoples are already seeking environmental refugee status for the entire nations. Similar situations are already threatening coral island peoples north of Papua New Guinea.

But it is not immediate, and it should be borne in mind that there are thousands of such islands, all populated and likely to remain so for at least some decades, so this is not an immediate argument that can justify no resettlement in the short term. It should be further borne in mind that, with vast expenditure, coral islands can be maintained even if they are actually sinking, as is I believe the case in Key West, Florida.

There is a shocking lack of accurate base-line information on the current coastlines of the Chagos, so it impossible to know whether erosion is occurring, let alone how much, or what is happening to the water table.

Opportunities

Military base

Perhaps distasteful, especially to the government, but surely the most straightforward solution would be to allow resident status to those who wanted to stay (would probably require some sort of limitations) and also visitor status for others. Jobs available, and of course full infrastructure in place

Tourism

Will undoubtedly be high on many agendas. There are various points that will worry at least some of the environmental bodies, and maybe some human rights/advocacy groups:
1 – Single or small number of high end luxury hotels (model such as Maldives). Major challenge here is infrastructure. With airstrip plus power supply etc, there would be significant impacts then to at least one or two islands. I can't even begin to imagine the economics. And presumably there would, or should, be the concern about Chagos then becoming something of a private enterprise for a major hotelier, rather than an independent community of Chagossians?
2 – Free-for-all. Could be like the above but messier?
3 – Very low impact eco-tourism. Might work, the place is certainly special enough, but the one public trip that was permitted very nearly folded as they couldn't fill places on the boat. It involved 12 days travel (plane to Seychelles and then boat) for 10 days in Chagos. Low impact lodge type bases could be established, one good model might be Chumbe Island, Zanzibar
4 – More formal servicing or the existing yacht traffic.

Fisheries

Tuna fishery. I doubt that the tuna fishery could provide any sustainable income, and the current system would preclude all but token employment of Chagossians in the fishery. Might be worth investigating the Maldivian fishery which I think may be more locally run. At present it is believed that most or all income covers the patrol vessel and it is extremely unlikely that tuna stocks are going to increase. It should be factored in only as a possible source of variable but low levels of income.

Nearshore export fisheries. A possible option, but please be aware of the complexity of making these work – there are countless failures all around the world showing just how

difficult it is to get it right. As far as I'm aware the live reef fish trade has rarely if ever maintained a constant and stable supply of fish from any reef nation (the typical model is for high prices offered to local fishers who "mine" the local grouper populations until they are no longer of interest to the (East Asian) purchaser who then moves on, leaving an island with no large groupers even for their own consumption). The aquarium trade has potential and I think there are sustainable models from Hawaii and the Philippines and elsewhere (look up the Marine Aquarium Council) – major challenge of needing to air freight the fish!

Aquaculture. Almost all of the attempted models are still experimental, but you would need to do a lot of reading – I don't think sea cucumber (beche-de-mer) is working anywhere yet, but they are still persuing this in New Caledonia and perhaps Solomon Islands. Pearl farming MAY be a going concern in French Polynesia, but I would careful read the small print. There is some seaweed farming in Tanzania and Indonesia, but it is very hard to say how you would make this succeed in such a remote location as Chagos for such a low value product. Same would go for shrimp farming – a farm was established in Seychelles, but I'm sure heavily subsidized. One of the few ways you might try and create a niche would be in certified and sustainable fisheries, working together with a group such as the Marine Stewardship Council – that sort of approach would presumably allow charging of premium prices (to cover problems of transport costs) and might also reduce objections from environmentalists.

Artisanal fisheries. Of course there is enough to support even a relatively large population, but please be aware that the collapse of traditions in Pacific islands has led to hardship and reef fisheries aren't a simple breadbasket. I'm pretty sure, though I've never published on this, that the reason Chagos isn't teeming with turtles is because they were overharvested for 1-200 years. Many small islands have lost important populations of larger species by fishing the breeding aggregations which lead to quite fabulous catches for a few years, but then lead to local or regional extinction as has happened with various grouper species (see Nassau Grouper) across wide tracts of the Caribbean.

Quite a few environmental NGOs are finding that they are re-introducing traditional reef tenure ideas to island peoples who have lost such traditions. They are literally flying in fishermen or village elders to talk to their equivalents in other places/countries and finding this one of the best methods of explaining the value of well-managed reefs and setting aside areas for protection.

Environmental guardians (research, wardens, ecotourism)

The considerable value of the Chagos from an ecological and scientific perspective should not be underestimated. It has been singled out for attention/prioritisation in two of the most recent large global marine assessments, one conducted for the Pew Foundation and the other for The Nature Conservancy. Both remain unpublished, but both organisations are very large and influential, so their interest could potential be converted to funding. A model for this might be Palmyra Atoll in the Pacific, owned and managed by The Nature Conservancy in association with the US government, although here there is no indigenous or local population.

Separately there have also been ongoing proposals to establish a permanent research facility on the islands, modelled perhaps on some of the Great Barrier Reef labs (Lizard, Orpheus, One Tree Islands), or perhaps Aldabra (Seychelles).

Collaboration with NGOs and other governments could provide a means of reducing tensions of tenure (Mauritius and Seychelles both have very active Marine Conservation Societies who have expressed interest in working in Chagos.

In any model the concept of a small resident population, servicing research facilities, monitoring and managing nature reserve areas and perhaps in combination with low-impact tourism and subsistence uses might be both low-coast and actually beneficial. Perhaps a more appropriate means to reduce poaching activities.

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