Republic of Seychelles

Fifth National Report
to the
Convention on Biological Diversity

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Report prepared by John Nevill, Consultant. E-mail: jnevill@seychelles.net & jnevill@environmentseychelles.com

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Executive Summary

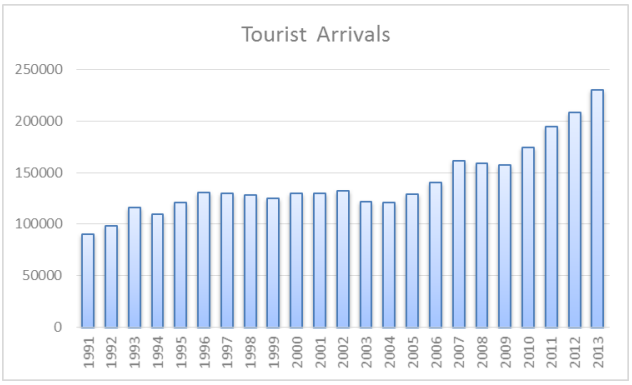
Seychelles' Fifth Report to the Convention on Biological Biodiversity, in line with reporting criteria, builds upon and should be read in conjunction with the preceding Fourth National Report (**GoS 2011**). The report investigates and summarises the salient points of current knowledge on the importance, status and trends of and threats to Seychelles' biodiversity and the measures being undertaken to address these concerns and the gaps in current national implementation of the CBD and its Aichi Biodiversity targets. Seychelles has made extensive commitments to biodiversity conservation not least through the designation of nearly 50% of its landmass as Protected Areas. Indeed great

progress has been made in addressing the priority concerns of the majority of terrestrial ecosystems. On land the primary threat to endemic biodiversity remains the ongoing spread of invasive alien species (IAS). The significant advances Seychelles has made in IAS eradication and management and ecosystem restoration, however, offer hope for the future, though the challenges posed by the difficult terrain and dense vegetation of key areas of endemism still exceed national capacities. In the marine environment much work remains to be done with very worrying trends evident in artisanal fishery catches and clear evidence of fishing down the marine food web giving substantive cause for concern.

Importance of Biodiversity. Seychelles depends on its tourism and fishing industries to support the country's social services and drive its socioeconomic development. Attempts have been made to further diversify the economy with offshore banking and international business zones but tourism and fisheries remain far and away the two main components of the national economy.
Fisheries, both artisanal and industrial, are directly dependent upon the sound management of marine resources, whilst tourism in Seychelles is based upon the aesthetic beauty of the islands with their tropical flora and fauna, white sand beaches and clear blue waters. All of these characteristics are derived from a healthy, clean and productive environment.

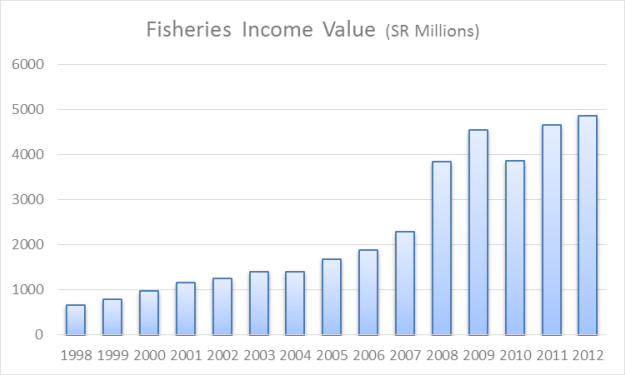
Tourism is the largest sector of the Seychelles economy accounting for 26% of GDP and employing over one third of the country's workforce in 2008. A record total of 230,272 tourists visited the country in 2013.

Tourism Arrivals 1991-2013.



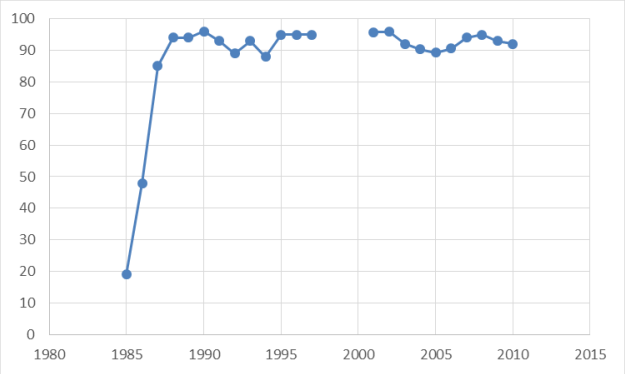
Fishing is a vital economic sector for Seychelles and central to national food security. In 2012 approximately 5,500 people were employed directly or indirectly in the fisheries sector constituting 12% of total formal employment. Fisheries revenue has risen steadily over the last 20 years (see fig below), the revenue upsurge in 2008 being due to the devaluation of the Seychelles rupee.

Fisheries Income 1998-2012.



Fisheries have consistently been the main national earner of foreign exchange. Fisheries are the dominant visible export accounting for an average of 92.6% of visible exports from 1987 to 2010.

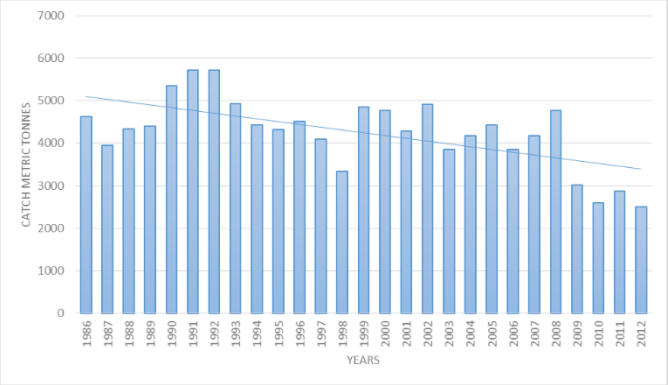
Fisheries as a Percentage of National Exports



The sector faces multiple challenges however as there is significant evidence that the demersal stocks of the Seychelles banks are over fished whilst the regional industrial fishery has yet to effectively address issues of by-catch and illegal, unreported and unregulated fishing.

Status and Trends of Biodiversity. The 4th National report to the CBD (GoS 2011) described at length the status and trends of Seychelles Biodiversity. In the subsequent years (2011-2013 inclusive) there has not been significant change in that overall assessment. Understanding of various aspects of biodiversity and their specific status and trends has progressed however and the salient points are covered in sections 2 and 7 of this report. Of key concern is the decline in artisanal fishery catches since 1991 and the marked decline of certain high value and ecologically important groups within that fishery.

Artisanal Catch 1986-2012



Fishing effort is not yet effectively managed and there is cause for concern in various high value target fisheries such as for the Emperor Red Snapper, Sea cucumber, Groupers and elasmobranchs.

Addressing downward trends in the artisanal fishery is difficult because of the multispecies, multi-gear and patchy resource distribution of the fishery. This coupled with traditional open access fishing rights, numerous landing sites and the limited human and financial resources of the Fishing Authority make the conceptualisation, design and implementation of effective management regimes very problematic. The Seychelles Government and the Seychelles Fishing Authority in partnership with stakeholders have taken substantial steps to address these issues in the last three years as described in **Section 7** of this report.

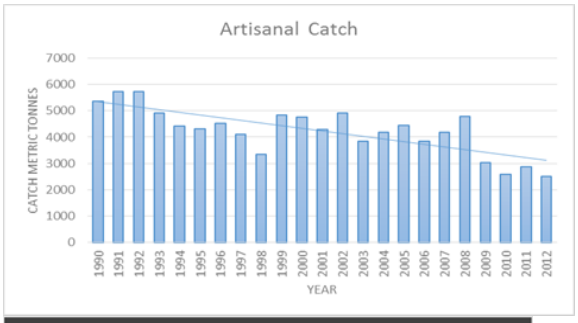
The management of terrestrial biodiversity has been far more successful with stable and even positive trends apparent in some habitat types. The exception is that of lowland inland waters, the most threatened of native habitat types due to historical and ongoing reclamation, drainage, siltation and pollution.

Main Threats to Biodiversity. The key issue affecting terrestrial biodiversity and in particular endemic biodiversity is that of invasive alien species (IAS). This is most relevant on the islands of Mahe and Silhouette whose hills and mountains with altitude above 200m are endemic biodiversity hotspots but where the terrain and dense vegetation make effective IAS management beyond current national resource's and capacity. Lowland wetlands are probably the most threatened habitat type in Seychelles due to the limited land area and the consequent development driven "coastal squeeze" making habitat loss through change in land use the primary threat and ongoing driver of biodiversity loss in this habitat type. The marine and coastal ecosystem is highly diverse and consequently faces a variety threats, the primary and most immediate threat being the unsustainable use of fishery resources. Climate change represents a pervasive threat to all of Seychelles' progress in the conservation and sustainable use of biodiversity and is perhaps constitutes the single greatest medium to long term threat to Seychelles' biodiversity and related socioeconomic well-being.
Knowledge and related data management is a key limiting factor to Seychelles' conservation and sustainable use of biodiversity. The complexity of tropical ecosystems coupled with the classic SIDS human resource constraints make adequate research and effective data management an ongoing challenge; this is particularly true *inter alia* in the domain of environmental economics. Cross-

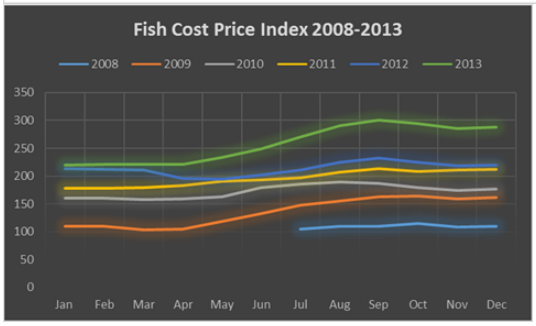
cutting this issue is the pressing need to properly integrate biodiversity data and values throughout the decision-making and development cycles.

Impacts of Negative Changes in Biodiversity. Quantitative and qualitative data are generally lacking in Seychelles regarding the impacts of declines in and degradation of biodiversity and its service provision. Good data is however available for the fishery sector and here biodiversity decline as evidenced by declining catch in the demersal fishery shows a distinct positive correlation with the cost price index for fish and was conserved the main driver of inflation in Seychelles in 2013.

Artisanal Catch 1990-2012



Cost Price Index for Fish 2008-2013



National Biodiversity Strategy and Action Plan (NBSAP). The implementation of the Seychelles NBSAP was reported on in detail in Seychelles previous (fourth) national report to the CBD (GoS 2011). A new NBSAP has recently been drafted and is reviewed here in terms of its contribution to the CBD Strategic Plan and specifically the Aichi Biodiversity Targets. This review shows that the current document does not properly integrate the Aichi Targets into its format, structure or priority actions and a review and re-drafting is consequently recommended.

Implementation of the Convention since 2010. Since 2010 the Seychelles government and stakeholders lead by the Seychelles Fishing Authority have taken significant and substantive steps to address the issues faced in the conservation and sustainable use of marine biodiversity including: the development of a new fisheries bill bringing fisheries governance in line with best current practise, the piloting of a new fisheries co-management model with the artisanal fishers of the second largest island of Praslin, the ongoing development of new monitoring and fishery management regimes - these matters are covered in detail in **Section 7.1** of this document.

Seychelles has customarily addressed the conservation and sustainable use of terrestrial biodiversity through the establishment of protected areas and the

implementation of IAS eradication and control programmes complemented by ecosystem rehabilitation projects and species re-introductions. These approaches have been refined over the last 3 years with: a detailed Key Biodiversity Assessment undertaken in the main granitic islands to provide a new basis for protected area and land use planning, the advancement of IAS management and eradication techniques expanding to new species and pre-emptive approaches realising additional benefits in endangered species conservation these are summarised in section 7.2 and expanded upon in case studies on IAS programmes and special focus sections on Aldabra and threatened endemic bird species.

Part III of the report includes an assessment of Seychelles implementation to date, of the 2020 Aichi Biodiversity Targets in tabulated format finding in most cases an encouraging level achievement and highlighting certain shortcomings such as in environmental economics and the mainstreaming of biodiversity values into national accounting models and highlighting issues as they pertain to lowland inland waters and problems of demersal fisheries stock depletion.

Lessons from Implementation of the CBD. The report concludes with a summary of key lessons learned from the national implementation of the CBD to date:

a). The majority of Seychelles endemic biodiversity resides at altitudes above 200 metres in the hills and mountains of Mahe and Silhouette. The key threat to this biodiversity is IAS but the steep terrain and dense vegetation make effective management of these areas beyond current or envisaged future capacity of the country. Seychelles primary biodiversity sustainable use issues are marine based over tens of thousands of square kilometres of plateau and banks and hundreds of thousands of square miles of ocean making effective management and enforcement of sustainable use plans, policies and measures beyond institutional capacities. These are circumstances that are not likely to change and as such Seychelles will be dependent upon international assistance for its effective implementation of the CBD for the foreseeable future.

b). Conservation objectives have been identified, effectively communicated to stakeholders and the general public and implemented with significant success. Species extinction and its prevention is a message that has been effectively communicated and results have been positive, to date, in many instances.

c). Sustainable Use Objectives however are proving far more difficult to address and in particular in the marine domain and fisheries. The lure of short term financial gain and the traditional open access approach to what is often still perceived as a "free and inexhaustible" resource base are currently proving to be barriers too difficult to surmount. A new approach is required and the Seychelles Government has commenced the international pioneering of the Blue Economy Concept (**GoS 2014a**) most recently culminating in the Blue Economy Summit held in Abu Dhabi in January 2014. With international momentum galvanised focus is now also turning to development of the national governance mechanisms required to establish the Blue Economy nationally as the new economic paradigm. This phase shift in development policy offers hope to negotiate many of the challenges the country faces in terms of the conservation and sustainable use of marine biodiversity. If all goes well the blue economy should form a major component of activities covered in Seychelles 6th national report to the CBD.

d). The mainstreaming of pertinent CBD commitments into national strategic documents, polices and plans remains a key administrative weakness by limiting the national capacity to appropriately prioritise activities, target resources and assess and report upon progress in implementation of the CBD. It is thus very important that the current opportunity to revise the draft NBSAP be utilised to the full.

e). Climate change threatens the national progress realised to date in the conservation and sustainable use of biodiversity and poses perhaps now the single greatest threat to Seychelles' biodiversity and related socioeconomic well-being. Effective international cooperation is more imperative now than ever if the objectives of the CBD are to be realised.

Part I: Biodiversity Status and Trends

1. Importance of Biodiversity

The first European explorers to Seychelles found the islands uninhabited by man and the main islands of the granitic archipelago rich with sources of

water, food and materials with which to revictual and repair their ships. The accounts of the first settlers make clear their total dependence upon the biodiversity resources not only for their subsistence but also as the basis for all economic activity. As the economy developed and evolved through the subsequent decades and centuries other activities were incorporated that were not directly dependent upon the biodiversity resource base. Despite this diversification it was not until the latter half of the 20th century that significant components of economic activity evolved - such as tourism, the broader services industry and some elements of light industry - that were not directly related to utilisation of the biodiversity resource base.

The building of the international airport in 1971 provided the basis for the development of the tourism industry as well as providing access to potential overseas fresh fish markets to the artisanal fishery. In the 1980s, following Seychelles' declaration of its Exclusive Economic Zone (EEZ) and the subsequent development of a tuna canning facility in Port Victoria; the industrial tuna fishery rapidly became a major source of national income.

Today the Seychelles depends on its tourism and fishing industries to support the country's social services and drive its socioeconomic development. Attempts have been made to further diversify the economy with offshore banking and international business zones but tourism and fisheries remain far and away the two main components of the national economy.

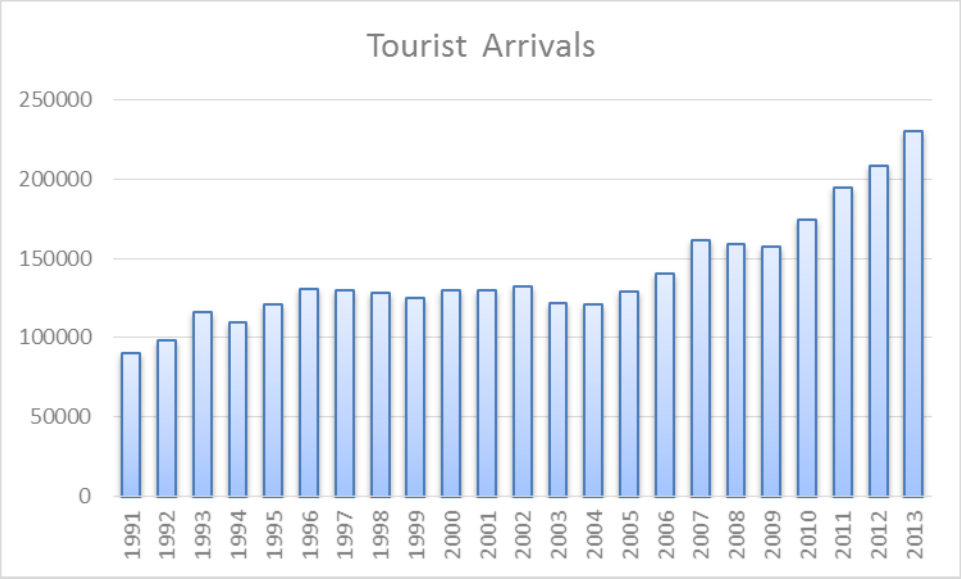
Fisheries, both artisanal and industrial, are directly dependent upon the sound management of marine resources, whilst tourism in Seychelles is based upon the aesthetic beauty of the islands with their tropical flora and fauna, white sand beaches and clear blue waters. All of these characteristics are derived from a healthy, clean and productive environment. Nature-based tourism and ecotourism activities represent the fastest growing component of the international tourism trade and Seychelles has maximised the marketing of its healthy and beautiful environment and endemic species of flora and fauna. The private sector in particular has shown strong recognition of the importance of biodiversity as a key factor in attracting the high revenue clientele it seeks. This has been embodied in the ecological rehabilitation of several islands in the central archipelago with the removal of invasive alien species (IAS) and the (re)introduction of threatened endemic species as part of national conservation programmes in tandem with the marketing of said islands as exclusive hotel ecotourism resorts. This trend seems set to continue in the Amirantes archipelago with several island foundations being registered as a partnership between tourism operations and/or tenants and the Islands Development Company[1] with the objective of supporting and enhancing the environmental and biodiversity management of the islands.

[1] The Islands Development Company is a parastatal organisation whose main role is the sustainable management and development of the outer islands; encompassing tourism and infrastructural development.

1.1. Tourism industry

Tourism is the largest sector of the Seychelles economy accounting for 26% of GDP and employing over one third of the country's workforce in 2008. A record total of 230,272 tourists visited the country in 2013.

Fig. 1 Tourism Arrivals 1991-2013.



Compiled from NBS 2008, 2013a, 2013b

Tourism has proved to be a resilient economic sector which continued to grow despite global impacts from both Gulf Wars and the global economic crisis that commenced in 2008. Despite the ongoing fragility of international money markets and poor economic growth in Seychelles' main tourism markets, visitor numbers soon returned to growth and indeed at an escalated rate. This was likely fostered by the significant devaluation of the Seychelles currency at that time but also coincided with the implementation of a reinvigorated national marketing campaign. Revenue however has not grown at the same rate as visitor numbers reflecting in part the new exchange rate equilibrium.

Environmental and biodiversity attractions form the primary basis for international marketing with Seychelles being in particular renowned for:

- the endemic Coco-de-mer palm (*Lodoicea maldivica*) which amongst various notable characteristics sports the largest seed of any plant in the world,
- the Giant tortoise (*Aldabrachelys gigantea*).

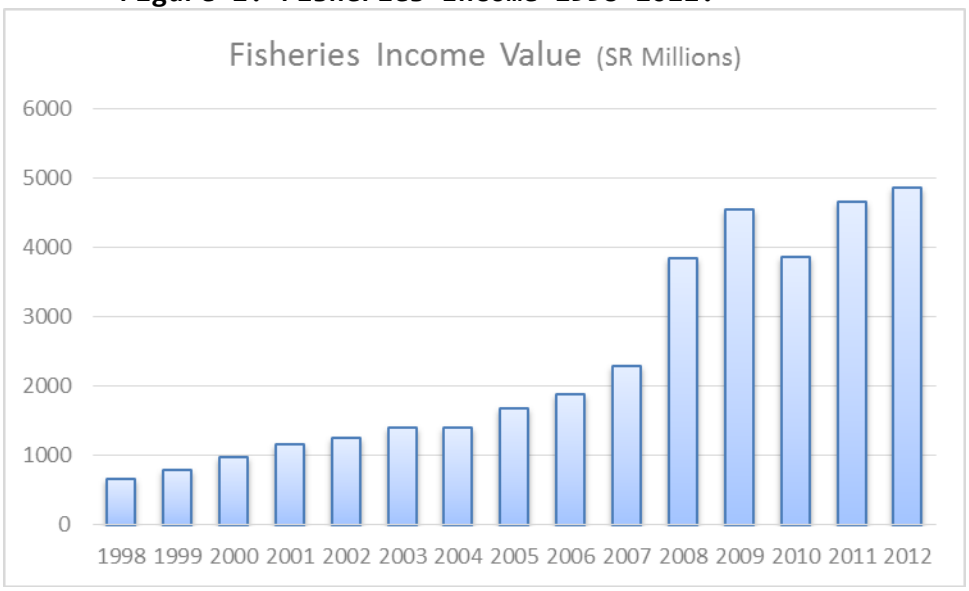
In recent times however other attractions have also come to the fore such as the central archipelago's rare endemic birds, the unique palm forest of Praslin and the rich and diverse attraction of the near shore marine environment with turtles, marine life and including seasonal aggregations of the largest fish in the world, the whale shark (*Rhincodon typus*), developing their own tourism markets.

1.2. Fisheries

Fishing is a vital economic sector for Seychelles and central to national food security. In 2012 approximately 5,500 people were employed directly or indirectly in the fisheries sector constituting 12% of total formal employment. Approximately 70% of the workforce are employed in the industrial tuna fishery and ancillary services, the artisanal fishery constitutes between 1,300-1,400 fishers depending on seasonal variations in activity, the sea cucumber fishing industry employed 150 people in 2011 with another 120 employed in fishery management, administration and research under the auspices of the Seychelles Fishing Authority.

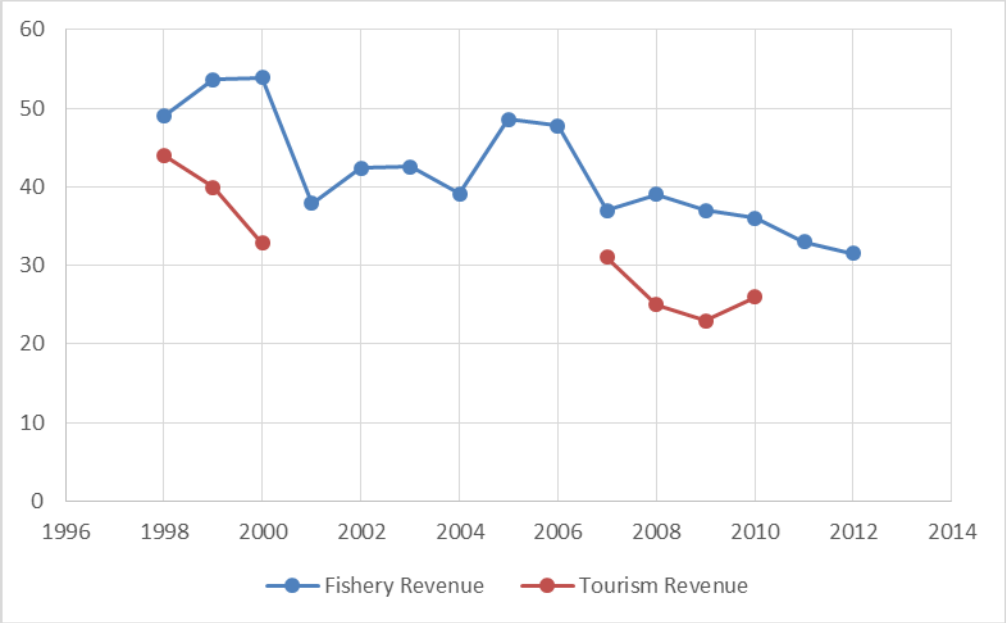
Fisheries revenue has risen steadily over the last 20 years (see **Fig 2**), the revenue upsurge in 2008 being due to the devaluation of the Seychelles rupee.

Figure 2: Fisheries Income 1998-2012.



Fisheries have consistently been the main national earner of foreign exchange (**See fig 3**). Official figures from the Central Bank Annual Report indicate that in 2012, tourism earnings amounted to SR4.247 billion or 27% of current account receipts whilst the earning from fisheries and related activities accounted for 31% of current account receipts (**SFA 2012**).

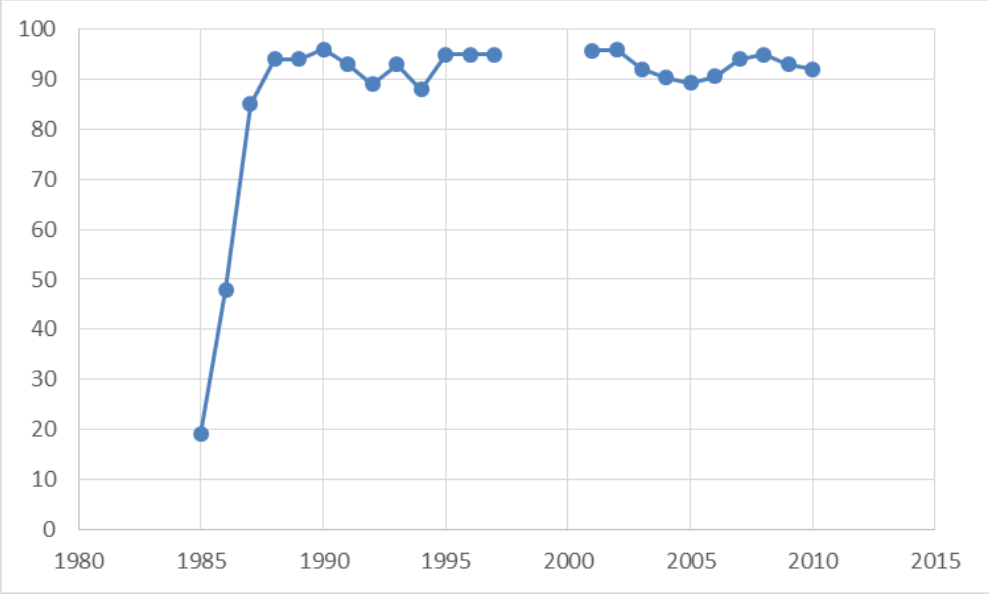
Figure 3: Fisheries and Tourism Revenues as Percentage of Foreign Exchange Income.



(Compiled from various NBS, SFA and CBS Reports)

Fisheries are the dominant visible export accounting for an average of 92.6% of visible exports from 1987 to 2010 (**See fig 4**).

Figure 4: Fisheries as a Percentage of National Exports



(Compiled from various NBS, SFA and CBS Reports)

The sector faces multiple challenges however as there is extensive evidence that the demersal stocks of the Mahé plateau are over fished (**See Section 2.1**) and consequently issues of overcapacity in the domestic fleet need to be addressed. The industrial fishery faces similar problems with the Indian Ocean Tuna Commission clearly lacking the capacity to effectively address issues of by-catch and illegal, unreported and unregulated fishing (IUU)[2]. Data regarding key by-catch species of the fishery, in particular, is chronically deficient and a key barrier to the informed and adaptive management of by-catch issues.

1.3. Biodiversity Values

Biodiversity of course offers more than just direct consumptive use values to the economy and society (**See Table 1**). Key sectors of the Seychelles economy, fisheries and certain aspects of tourism, and their historical predecessors, agriculture and forestry, depend directly upon the consumption of raw biodiversity materials. Human and light-industrial production and consumption also rely indirectly on ecosystem (biodiversity-based) services such as sinks for waste production or provision of water. Non consumptive use is embodied by many tourism activities. Optional values exist in the maintenance of healthy ecosystems to support future use perhaps through applications for endemic genetic information in medicines or food production and the application of biotechnology, or others ways not yet known. Biodiversity has cultural and spiritual values that augment the quality of life and human well-being. Biodiversity also has fundamental intrinsic value as recognised in the preamble of the Convention on Biological Diversity.

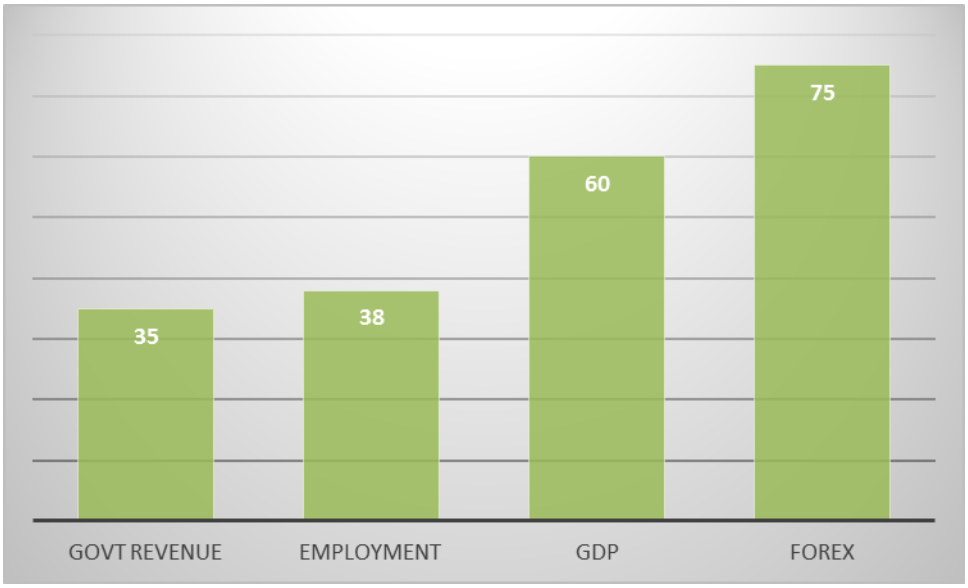
Table 1: Values of Seychelles Biological Resources

Use Values				Non-Use Values
Direct		Indirect	Option	Existence
Consumptive	Non-consumptive			
Biodiversity products that can be consumed directly e.g. Fish, timber, plants and animals	Biodiversity usage that does not necessarily degrade it – particularly true for ecotourism activities such as hiking, bird watching, snorkelling/diving etc...	Ecological service provision such as Water and soil cycle maintenance. Or support of populations with direct consumptive value.	Future value of biodiversity maintained in healthy, diverse, productive state for future, perhaps as yet unknown, consumptive and non-consumptive modes of use.	Intrinsic value. Additional existence values such as cultural, spiritual and bequest values.

[2] Seychelles is a founding country member of the FISH-I Africa partnership launched. This Southeast African partnership to help stop illegal fishing in the Western Indian Ocean was launched in December 2012 and has already yielded notable successes.

Economic assessments of the value of Seychelles' biodiversity are somewhat limited. A basic assessment was undertaken in 1997 (**Emmerton 1997**) as part of the process to develop the first national biodiversity strategy and action plan. Subsequent basic studies have been undertaken on: the socioeconomic impacts of marine ecosystem degradation with a focus on the impacts of the 1998 severe coral bleaching event (**Cesar *et al* 2004**), a travel cost analysis of marine parks **(Mwebaze & MacLeod 2013)** and contingent valuation assessments of two coastal areas on the main island of Mahe (**MCSS 2013 a & b**). The most recent overarching study of the value of biodiversity to the Seychelles' economy **(Murray & Henri 2005)** was undertaken as part of the preparatory process for the development of a GEF full-size project entitled "Mainstreaming biodiversity in production landscapes and sectors". This study calculated that the contribution of biodiversity to the Seychelles economy was very significant (**See Fig 5**), constituting 35% of total Government revenue, providing for 38% of national employment, contributing 60% of gross domestic product and accounting for 75% of foreign currency inflow to the country.

Figure 5: Percentage Biodiversity Contribution to the Seychelles Economy



(From: Murray & Henri 2005)

No assessment has been undertaken of the cultural and spiritual value of Seychelles biodiversity, though culturally it would appear to be unquestionably high. Social activities revolve around the coast and the interface of land and sea. The leisure time of the vast majority of Seychellois is coastally oriented and based upon activities such as fishing, swimming, water sports, beach games and socialising (picnics, barbecues, family fun days and dances) including national events such as the annual Regatta. This entrenches the environment, natural outdoors experience and interests as a unifying bond at the core of the nation's cultural identity

centred upon a close interaction and affinity with nature and the natural world. This is prominently reflected in Seychellois musical and visual arts.

The cultural importance of such interaction has become more prominent in recent years with former communal areas being lost or open access to them restricted – beach access in particular is a growing problem. Broader concerns about the existence value of biodiversity have recently manifested in widespread public objections to the proposed development of the last physically intact mountain to coastline catchment and watershed system, with associated wetlands and important turtle rookeries, on the main island of Mahe.

Successive stakeholder biodiversity/environment strategic planning processes have identified the lack/absence of trained environmental economists in the country and the need to mainstream environmental evaluation into the decision-making process. Despite this the action plans to establish domestic environmental economics capacity have not been realised and as such this shortcoming is still in need of redress.

2. Changes in Status and Trends of Biodiversity

Seychelles' Fourth National Report to the CBD, submitted in March 2011, included a lengthy assessment of the status and trends of the country's biodiversity. In the three years since that report, as one might expect, there have been no major changes in said status and trends. Trends that were in general negative at that time remain so today and likewise with the habitat types and species that were considered stable or exhibiting positive trends.

There has however been significant progress made in the understanding of the status of elements of Seychelles' biodiversity both terrestrially and marine through targeted, management oriented research, particularly in the domain of fisheries and terrestrially in terms of the assessment of Key Biodiversity Areas. There have also been some excellent direct management interventions that have yielded rapid benefits in terms of the status of certain threatened biodiversity. The broader issues will be covered in synthesis here and some of the specific notable findings and interventions are elaborated upon in case studies in **Section 7** of this report.

2.1. Marine Biodiversity

The marine and coastal biodiversity of Seychelles has been fundamental to socioeconomic development since human colonisation in the late 18th century. Man's early resource exploitation saw the demise of certain key mega fauna

from the marine and coastal ecosystem, notably the salt water crocodile and two species of seal, and the dramatic decline of others such as sharks and marine turtle populations. Since the 1950s these declines have continued and spread down the food chain to mesoconsumers. Both the "fishing down" of the food chain and the lowering of the catch trophic index are notorious portents of declining resources, reduced revenue and degradation of broader ecosystem function and service provision. Urgent action is needed in the form of a significant restructuring of fishery governance and management approaches to address these negative trends. A key precursor to informed action is improved gathering, management and analysis of data on species, habitats and ecosystems. Significant targeted progress has been made in these regards in the last three years and is expanded upon in **Section 7**.

Table 2: Marine Biodiversity Overview

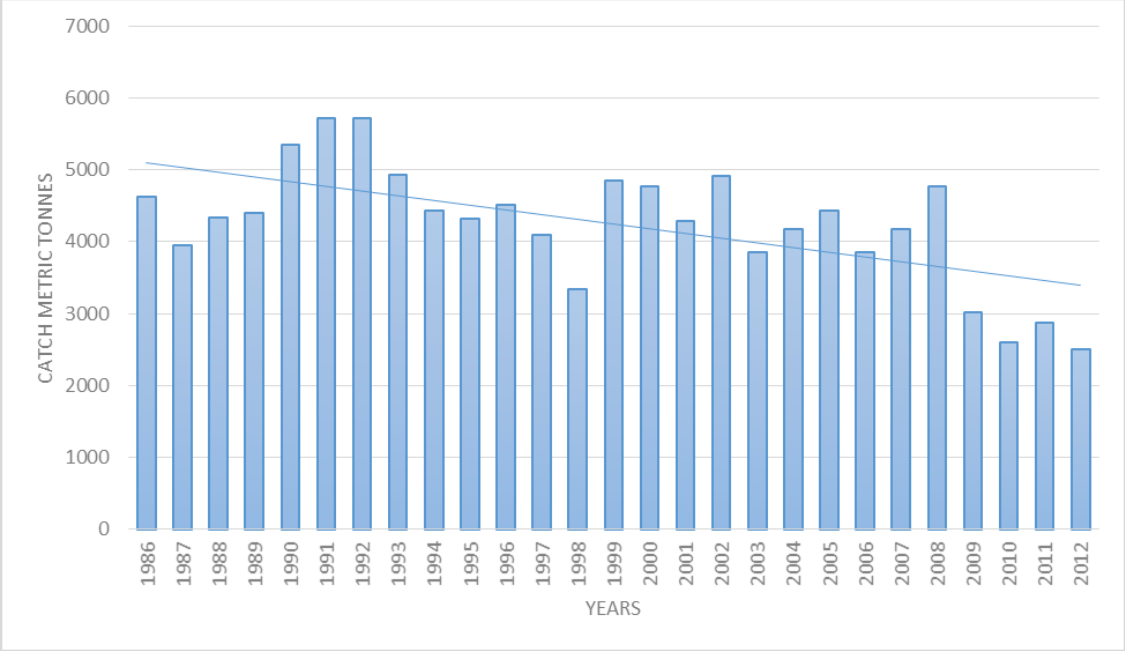
Taxonomic Group	Species	Notes
Macroalgae	approx. 330	Rich species composition at most islands. Domination of red and green algae and poor development of brown algae around the coral islands. Occurs in high density in nutrient rich waters such as off Port Victoria and certain seabird colony islands. Commercially exploitable stocks of Sargassum and Gracilaria have been recorded around the granitic islands (**Kalugina-Gutnik *et al* 1992**).
Alismatales (Sea grasses)	8 species	Commercially exploitable stocks of sea grass (*Thalassodendron ciliatum*) with biomass of 1-4 kg/m^2 have been recorded in the coral islands (**Kalugina-Gutnik *et al* 1992**).
Porifera (Sponges)	➢ 350	351 species recorded (**Van Soest 1994**). Populations around the granitics are more diverse 135 sp exclusive to the granitics, 95 exclusive to the Amirantes and 121 sp shared. 14 species to date have been confirmed as endemic:
Anthozoa Sea Anemones	55 species	Species data not available.
Scleratinian corals	➢ 200	Diversity much greater around the coral than the granite islands. Includes at least 39 species of free living scleratinians (**Latypov 2007**). At least 34 species are classified as Vulnerable or endangered under IUCN criteria.
Octocorallian corals	➢ 70	
Molluscs Gastropods	500	**(Jarret 2000)**
Bivalves	➢ 100	**(Jarret 2000)**
Crustacea Shrimps	➢ 165	At least 5 endemic species: *Eupontonia noctalba, Jocaste platysoma, Periclimenaeus manihinei, Periclimenes compressus, Periclimenes difficilis* (**Bruce 1971, Fransen 1994**).
Macrura		Fishery managed by periodic closures to allow

(Lobster & crayfish) Palinuridae Scyllaridae	 4 3	stocks to recover. (**Bautil 1991**). *Panulirus penicillatus, P. longipes, P. versicolor* and *P. ornatus* *Thenus orientalis, Parribacus antarticus, Scyllarides elisabethae*
Echinoderms Crinoids	 10	 (**Sloan *et al* 1979**)
Asteroidea	32	
Ophiuroidea	44	**(Clark 1980)**
Echinoidea	33	
Holothuroidea (Sea cucumbers)	43	43 species recorded (**Clark 1984, Conand 2008**). More than 20 commercial species have been identified in Seychelles waters, with some 15 currently making up the fishery with 6 species constituting the vast bulk of the catch (**See Case Study 1**)
Fish Osteichthyes	➢ 1,150	More than 400 of these species are coral reef associated species. Some 150 species makes up the artisanal fishery several of which are threatened. Endemism is low considered to be at about 1%.
Chondrichthyes Selachii (sharks) Batoidea (rays) Rhinobatidae (Guitarfish)	79 (60) (16) (3)	A review of species undertaken for this report suggests there are 79 confirmed species of Chondrichthyan in Seychelles waters 60 shark, 16 ray and 3 guitarfish species. Of the 71 species that have been identified to species level 30 are considered threatened (i.e. Vulnerable or Endangered), 15 species are Data Deficient and 1 species has not been evaluated. (See **Sections 2.2c** & **7.1** for further details).
Chelonii	5	The critically endangered Hawksbill turtle (*Eretmochelys imbricata)* and the endangered Green turtle (*Chelonia mydas)* nest in Seychelles though much reduced from historical numbers. The critically endangered Leatherback (*Dermochelys coriacea),* the endangered *Loggerhead* (*Caretta caretta)* and the Vulnerable Olive Ridley turtle (*Lepidochelys olivacea)* utilise Seychelles waters but do not nest there.
Mammals Cetaceans Sirenia	 27 1	Including the Endangered Sei, Blue and Fin Whales (*Balaenoptera borealis*, *B. musculus* & *B.physalus*), and the Vulnerable Sperm Whale (*Physeter macrocephalus*) and eight species of dolphin. There is a small but apparently increasing population (approx. 20-25) of the Dugong (Dugong dugong) at Aldabra atoll. **(Kiska *et al* 2009, Dalebout *et al* 2014).**

It has been recognised since the late 1980s that the inshore demersal fishing grounds around the central archipelago were over-exploited (**Lablache *et al* 1988**). The strategic response to this was to encourage exploitation of the outer banks of the Mahe plateau which was assessed to have scope for further exploitation (**e.g. Kunzel *et al* 1983**). The 1998 national inshore fisheries management strategy (**Mees *et al* 1998**) maintained this assumption but, noting that the catch had declined since 1991, cautioned that the outer banks of the Mahe plateau may have been sequentially depleted by the expanding geographic action of the fleet through time, giving the impression of sustainably maintained catch rates, and that if this was indeed the case, a fundamental change in fisheries management tactics may be necessary.

Another 15 years on, 1991 does appear to have marked a peak in the artisanal fishery with a steady trend of decline in catch since that time (**See Fig 6**).

Figure 6: Artisanal Catch

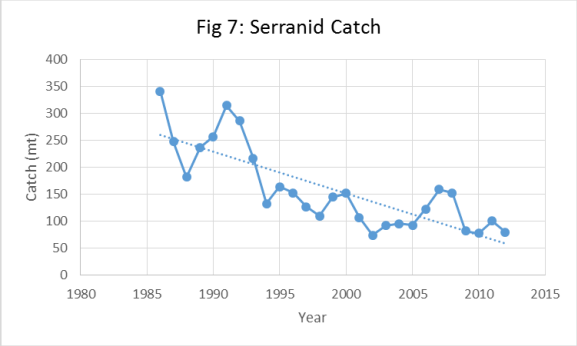


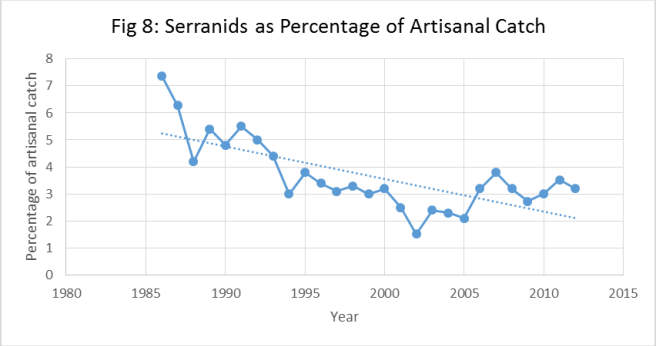
[Compiled from SFA Technical Reports 1986-2009 and Annual Reports 1986-2012][3].

Trends in various guilds of the fishery also give rise for concern; not surprisingly, due to life history traits and high commercial value, this is most evident in the Serranids (**See Fig 7**) which have not only declined in total catch but also as a proportion of the overall artisanal catch (**See Fig 8**). The recent small increase in catch of Serranids apparently reflects the targeting of large groupers in the more distant and less fished, but also much smaller, Amirantes plateau which is unlikely to be able to sustain such

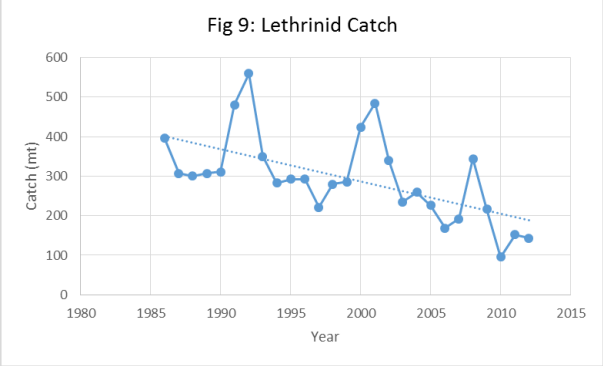
[3] It is important to note that the additional drop in catch from 2009 may also reflect the impacts of piracy on the range of activity of the artisanal fleet.

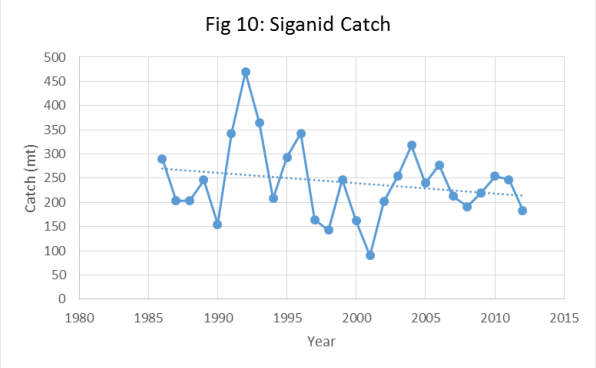
catches for long. Declining trends are also apparent however in the Lethrinid catch (**See Fig 9**) and to a much lesser degree in the Siganid trap fishery (**See Fig 10**).





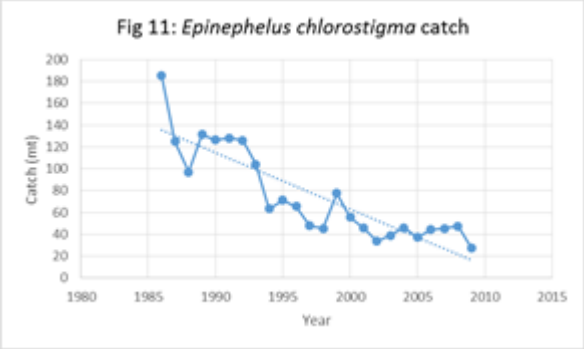
[Figs 7 & 8: Developed from SFA Technical Reports 1986-2009 and Annual Reports 1986-2012]

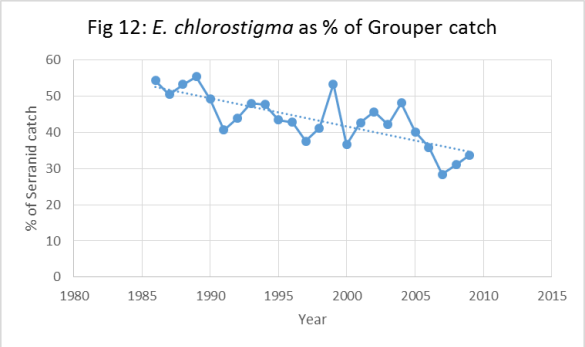




[Figs 9 & 10: Developed from SFA Technical Reports 1986-2009 and Annual Reports 1986-2012].

Of further concern is the decline of the most common grouper the Brown marbled grouper (*Epinephelus chlorostigma*), known locally as "Makonde" not only in terms of catch (**See Fig 11**) but also as a component of the overall grouper catch. The Makonde is a smaller faster growing species, making it more resilient to fishing pressure in terms of life-cycle characteristics than larger serranids, and by far the most abundant making it a very important component of the artisanal catch. It would appear however that targeted fishing pressure on it is such that it is being depleted faster than the overall Serranid fishery (**See Fig 12**).

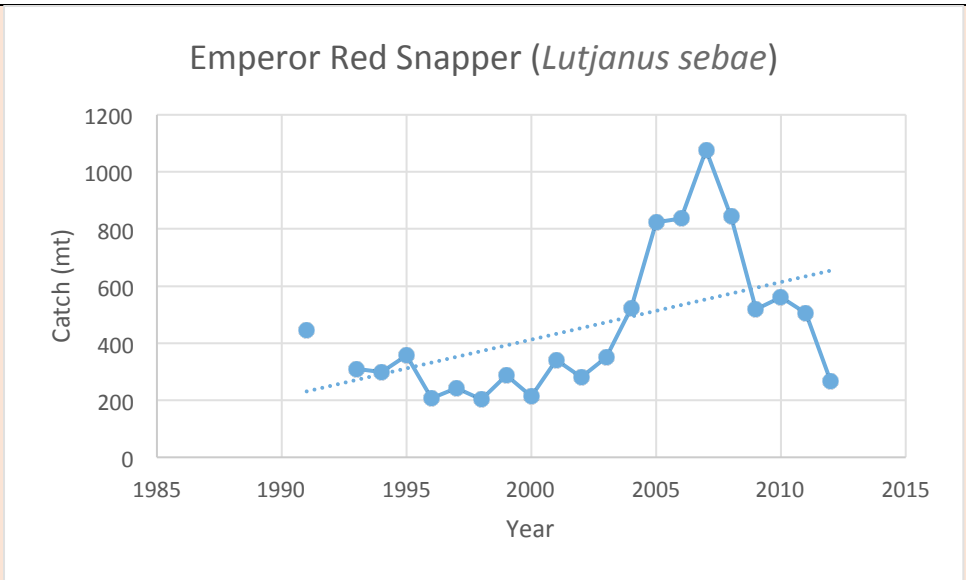




[Figs 11 & 12: Developed from SFA Technical reports 1986-2009 and Annual Reports 1986-2012].

One segment of the artisanal fishery that has shown a strong positive trend is the Emperor red snapper (*Lutjanus sebae*) but unfortunately, in light of the findings of previous studies this also gives rise to concern that the resource is being unsustainably exploited due to its high and rising commodity value.

Focus on the Emperor Red Snapper (*Lutjanus sebae*) Fishery
Figure 13: Emperor Red Snapper catch



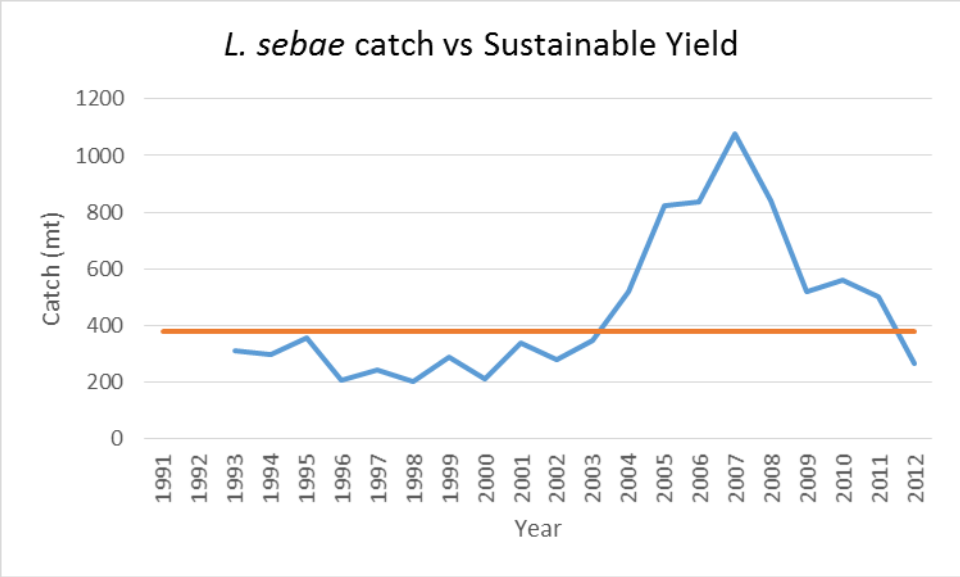
(Developed from SFA Technical reports 1991-2012)

The Life history characteristics of *Lutjanus sebae*, long lifespan, slow growth rate and late age at sexual maturity make it vulnerable to overfishing. A previous study (**Grandcourt *et al* 2008**) undertook a retrospective, 1977-2006, stock assessment of *Lutjanus sebae* that found the fish became vulnerable to the fishing gear of the hand line fishery at a mean age of 3.1 years significantly before the mean age of sexual maturity of 9 years and that as a consequence immature fish made up more than 50% of the catch. This leaves the population vulnerable to unsustainable recruitment overfishing. The study found that in most years the fishery was close to the recruitment overfishing threshold and likely surpassed it in 1990 and 2004. The paper concluded that the dramatic increase in recent yields is cause for significant concern and further evidence that management of the fishery requires urgent attention. **Figure 13** above shows that catch increased significantly again the next year before falling dramatically in 2009. The impacts of piracy on fishing activity, from 2008 onwards, complicate assessment of the scenario as do, with *L. sebae* being a coral reef species, potential lag effects on fish recruitment caused by the 1998 severe coral bleaching event (**Graham *et al* 2007**) but the downward trend continued in 2011 and 2012, and in light of the parameters set above and in particular the potential lag effects of recruitment overfishing there is legitimate concern that that the standing stock for the species has been significantly undermined.

This concern is amplified when the catch figures are see in light of a previous *L. sebae* stock assessment on the Seychelles plateau (**Lablache & Carrara 1988**). Using length cohort analysis the biomass of *L. sebae* on the offshore banks of the Seychelles plateau was estimated at 2,360 metric tonnes (or 0.36 mt/km2) producing an estimated sustainable annual yield of 380 mt (**See fig. 14**). There are admittedly shortcomings with these estimates not least the limited, 2-year, dataset upon which it is based. Offshore banks have always been considered the primary

demersal fishing grounds, and *L. sebae* as the single most important commercially exploited demersal species is known to be caught mainly offshore on these banks. *L. sebae* is also caught in the coastal trap fishery and has been found in lower abundance on the sand bottom central areas of the plateau. Recent VMS (vessel monitoring system) data indicate much more fishing activity in the central plateau than had previously been thought, meaning the standing biomass and yield of the fishery need reassessment. Nevertheless, without other information and in light of significant increases in catch from 2001 the 380 mt guideline is a good precautionary measure for sustainability (**fig 14 below**) and provides significant cause for concern

Figure 14: Catch versus Sustainable Yield Estimate.



Series 1: Catch Series 2: Estimated Sustainable Yield

(Developed from SFA Technical reports 1991-2012 and **Lablache & Carrara 1988**)

There is strong evidence therefore to show that Emperor red snapper (*Lutjanus sebae*) is over-exploited in Seychelles and to date there is no management/recovery plan in place for the species or measures to reduce the fishing pressure upon it. These problems are recognised internationally with the Blue Ocean Institutes' sustainable seafood choices programme allotting a score of just 2.05 and an amber warning code to the Seychelles Emperor red snapper fishery (**BOI 2014**).

Addressing downward trends in the artisanal fishery, however, is difficult because of the multispecies, multi-gear and patchy resource distribution of the fishery. This coupled with traditional open access fishing rights, the numerous landing and sale sites throughout the islands, the independent nature of artisanal fishers and the limited human and financial resources of the Fishing Authority make the conceptualisation, design and implementation of effective management regimes very problematic.

Sound, representative data collection is key to the development of sustainable management regimes and a review and updating of management modalities is required if the demersal component of the artisanal fishery is to be placed on a sustainable footing. The Seychelles Government and the Seychelles Fishing Authority in partnership with stakeholders have taken substantial steps to address these issues in the last three years as described in **Section 7**.

Another high value commodity fishery that has been shown to be prone to overfishing and collapse throughout the tropics is that of the sea cucumber, this has received significant attention in Seychelles but is nevertheless showing many of the classic warning signs of unsustainable exploitation see the case study below.

Case Study 1: The Seychelles Sea Cucumber Fishery

The Sea Cucumber Fishery is a high value commodity fishery which has come to the fore nationally in the last 17-18 years. Sea cucumber has been gathered and prepared for export in Seychelles since the late 19th century. The scale of the fishery however was always limited with annual exports of dried product rarely exceeding 10 tonnes. Sea cucumbers were collected from shallow lagoon waters and reef flats at low tides by skin divers or fishers on foot respectively. In the late 1990's the fishery experienced rapid development due to the growing demand and higher prices for dried sea cucumber on the international market (**Aumeeruddy & Payet 2004, Aumeeruddy & Conand 2007**). Near shore and shallow water stocks were rapidly depleted leading the Seychelles Government to regulate the fishery (**GoS 1999**) by initiating a licensing system for fishing and processing sea cucumbers, a quota on the number of fishing licenses allocated each year, and a limit of four divers for each fishing license (**Aumeeruddy & Conand 2007**). The Government also initiated detailed data collection for the fishery and with the help of the FAO undertook a stock assessment in 2004-2005.

43 species of sea cucumber (*Holothuroidea*) have been identified in Seychelles waters to date (see **Table 1** and **Section 2.2.b.** for more information) with more than 20 species having commercial potential. The vast bulk of the current catch however focuses on the six most profitable species (see Table below). Of these species: 3 are classified as Endangered and 2 as Vulnerable under the IUCN red List criteria which reflects their declines globally due to exploitation to supply the international Beche-de-Mer (dried sea cucumber) market. The sixth species known locally as Pentard and the most valuable of all, is a species of Flower teatfish (*Holothuria sp.*) that has not yet been taxonomically classified and therefore has not yet been evaluated under IUCN criteria.

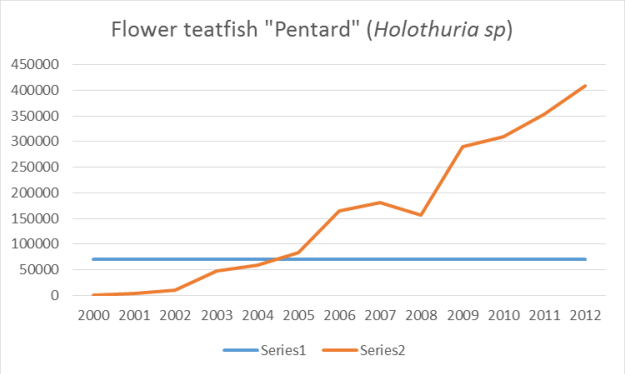
The 2004 stock assessment (**Aumeeruddy *et al* 2005**) identified densities of occurrence of the various species throughut the Seychelles and Amirantes banks and drew conclusions about stock status (see table below) and made recommendations for future Total Allowable Catch (TAC) per species.

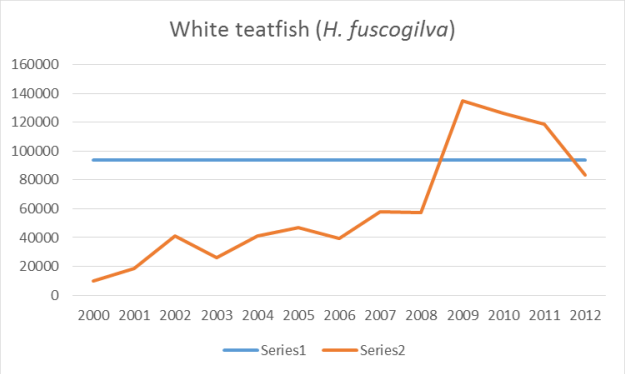
Common name	Scientific name	IUCN Red List status	Status (Aumeeruddy *et al* 2005)	Commercial value (Conand 2008)

"Pentard" Flower teatfish	*Holothuria* sp.	Not Evaluated	Fully exploited	1 High
White teatfish	*Holothuria fuscogilva*	Vulnerable	Fully exploited	1 high
Prickly redfish	*Thelenota ananas*	Endangered	Fully exploited	1 high
Black teatfish	*Holothuria nobilis*	Endangered	Underexploited	1 high
Sandfish	*Holothuria scabra*	Endangered	Overexploited	1 high
Blackfish	*Actinopyga miliaris*	Vulnerable	Underexploited	2 medium

The Sandfish (*H.scabra)* was identified as being already overexploited and heavily depleted and it was recommended that a moratorium be placed on the fishing of this species. Three other species were identified as fully exploited *H. fuscogilva*, *T. ananas* and "Pentard". Aumeeruddy *et al* 2005 also recommened the institution of minimum size limits for the fishery. Unfortunately neither the TACs or size limit measures were applied. In recent years the TACs have been exceeded for 3 high value species (**See Fig. 15 & 16**) and in particular for Pentard which has been the primary catch species for the fishery since 2006.

Figure 15: Pentard Catch vs TAC **Figure 16: *H. fuscogilva* catch vs TAC**

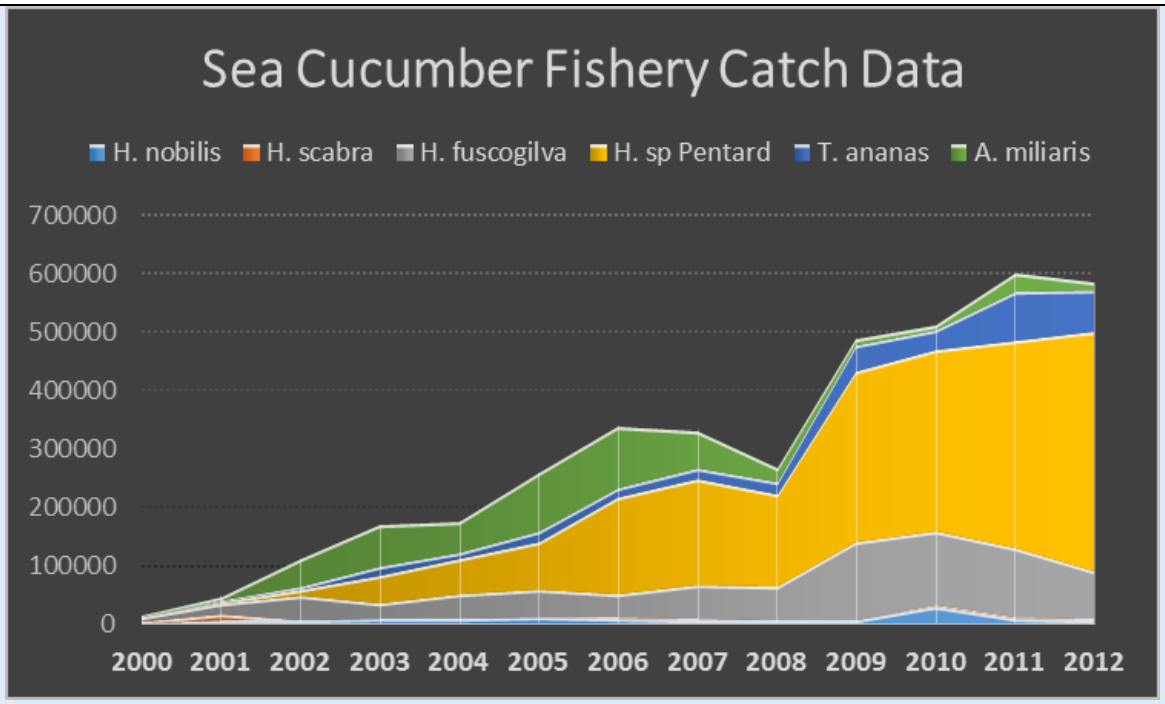




Series 1: Recommended TAC Series 2: Catch.

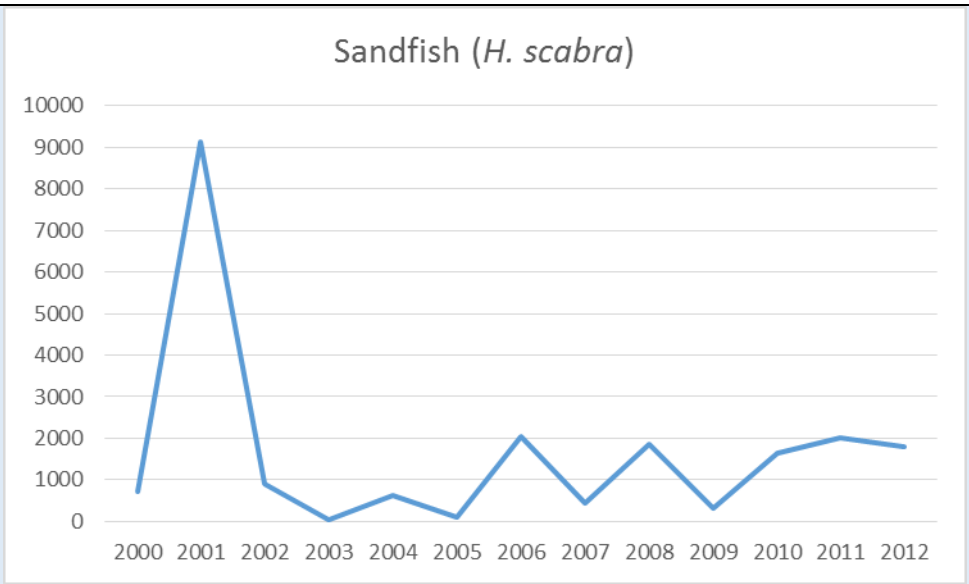
The overall catch for the fishery has continued to rise (**See Fig. 17**) but this is due to the increasing targeted catch of the most valuable species "Pentard" with catches now running at 5 times the recommended TAC.

Figure 17: Sea Cucumber Fishery Catch Data



One of the primary concerns is that the catches may be being maintained by a process of serial depletion where once an area is exhausted of its viable sea cucumber populations the fishing effort moves on to new grounds, giving the impression of sustained catches but atually effecting the systematic depletion of stocks. There is some evidence of this phenomenon in the catch data for the Sandfish (*H. scabra*) which formerly abundant is now scarce and was recommended for a zero TAC in 2005. **Figure 18** below shows the zigzag of the catch for *H. scabra* effectively "bumping along the bottom" which is symptomatic of the process of serial depletion.

Figure 18: *H. scabra* Catch Data



What is apparent from these figures is that the current effort and capacity control measures in place are insuffcient to control species-specific catches. A recent review (**MRAG 2012**) supported this conclusion and recommended the imposition of TACs and minimum size limits in line with the recommendations of **Aumeeruddy *et al* 2005.** In the meantime more data needs to be gathered in particular with regard to size at maturity for the main species to assist in refining future size and TAC limits. The MRAG review also suggested that a temporary moratorium on the catch of Pentard might be advisable in light of the catch being well above recommended levels in recent years.

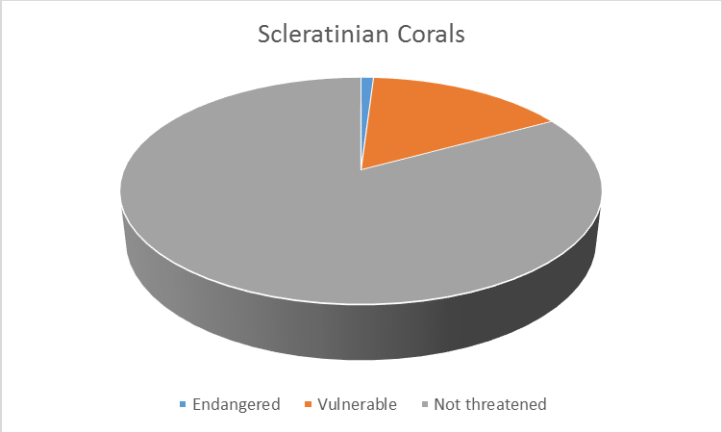
To date however none of the above recommended meaures have been applied and the US$ 7 million per annum fishery (**TRC 2013**), with the livelihoods of some 120 households estimated to be involved in at least one stage of the fishery process (**Marguerite 2005**), is continuing on a business as usual basis.

Author: John Nevill. e-mail: jnevill@seychelles.net

2.2. Threatened Status Analyses

a). Scleratinian corals

Figure 19: Scleratinian Coral Species Threatened Status Analysis

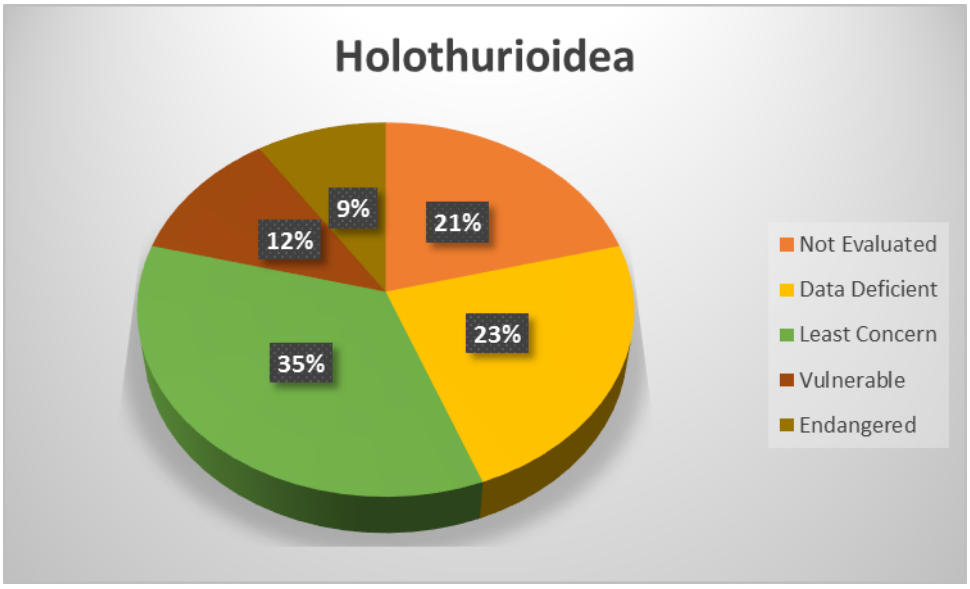


Of the some 200 species of Scleratinian corals identified to date in Seychelles waters 34 are classified as threatened under IUCN criteria – 2 species as endangered and 32

b). Holothurioidea – Sea cucumbers

43 species of Sea cucumber have been recorded in Seychelles waters (**Clark 1984, Condon 2008, MRAG 2012**). Of these 9 have not been evaluated for IUCN Red List status, 10 are Data Deficient, 15 have been classified as Least Concern and 9 species or 21% are considered threatened - 5 being classifed as Vulnerable and 4 as Endangered. For information on the fishery see **Case Study 1.** More than 20 of the locally occurring species have commercial potential, 15 species currently make up the catch, but the vast bulk is composed of just 6 species.

Figure 20: Holothurioidea Species Threatened Status Analysis

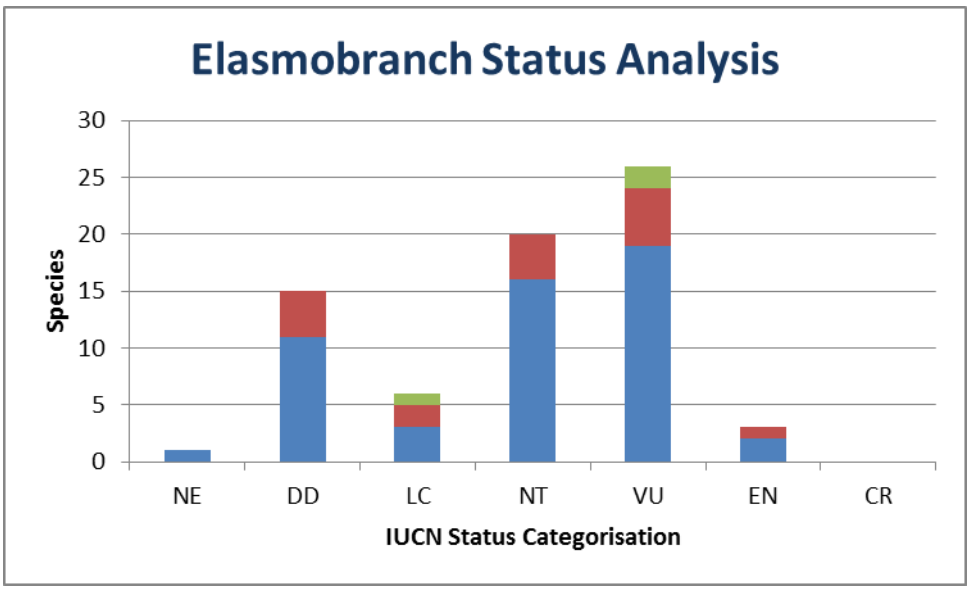


c). Elasmobranchs

71 species of elasmobranch (52 sharks, 16 rays and 3 batoids) have been confirmed to occur and indentified to species level in Seychelles waters. 29 species are considered threatened (26 Vulnerable and 3 Endangered) whilst 16

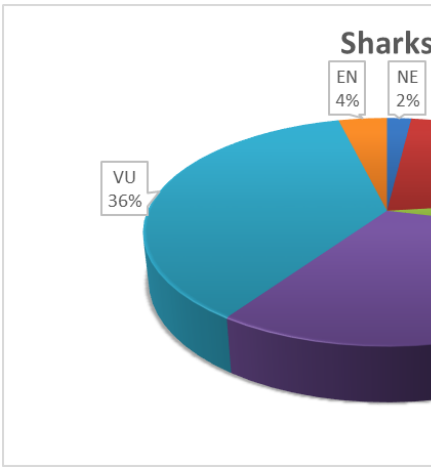
more species are classified as Data deficent or Not Evaluated (**Nevill 2014**). (**See Section 7** for fishery information).

Figure 21: Elasmobranch Species Threatened Status Analysis



Series 1: Sharks Series 2: Rays Series 3: Batoids.

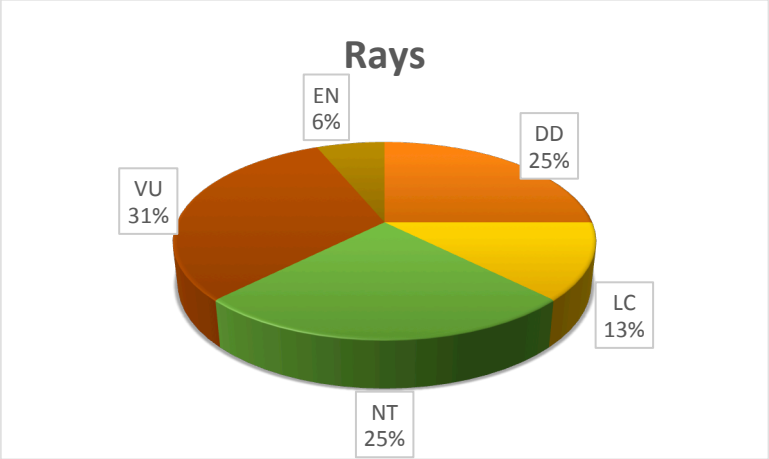
Figure 22: Shark Species Threatened Status Analysis



Of the 52 shark taxa identified to species level: 2 species are classified as endangered, 19 as Vulnerable, meaning 40% of shark species are classified as Threatened under IUCN criteria. 16 species are listed as Near Threatened and 3 as Least Concern 11

Of the 16 species of Ray recorded in Seychelles waters: 1 is endangered, 5 are vulnerable meaning 38% are classified as Threatened. 4 species are listed as Near Threatened, 2 as Least Concern and 4 as Data

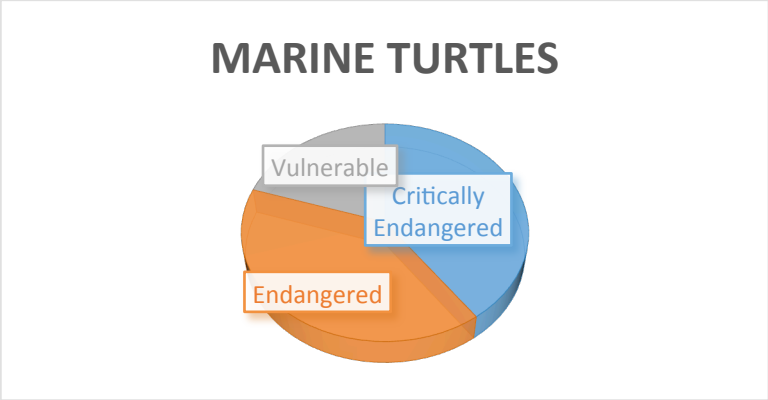
Figure 23: Ray Species Threatened Status Analysis



d). Sea Turtles

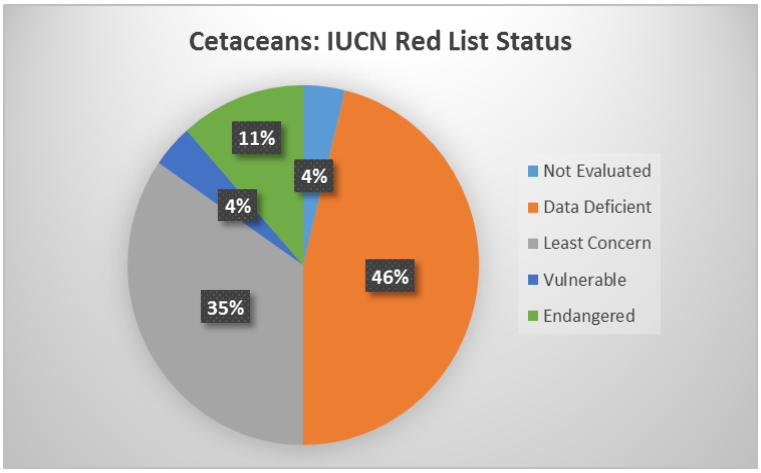
Five species of marine turtle have been recorded in Seychelles waters. Two species, the Green turtle (*Chelonia mydas*) and Hawksbill turtle (*Eretmochelys imbricata*) historically had large breeding colonies in the islands but these were drastically reduced by unsustainable exploitation in the 19th and 20th centuries. All marine turtles were fully proetcted by law in 1994 (**GoS 1994**) but illegal exploitation and ongoing loss of nesting habitat to coastal development and human activity mean that the numbers nesting outside of certain key protected areas continue to decline. Certain protected rookeries have shown excellent recovery in the number of nesting females as covered in Case Study 3 (**Nevill 2011**) of the Seychelles 4th national report to the CBD. The other three species do not nest in Seychelles' territory but two of them the Leatherback (*Dermochelys coriacea*) and the Loggerhead (*Caretta caretta*) must occur/must have occurred quite frequently as they both have local creole names. All five species are classified as threatened on the IUCN redlist: the Hawksbill and Leatherback turtles are Critically Endangered, the Loggerhead and Green turtles are classified as Endangered and the Olive Ridley (*Lepidochelys olivacea*) as Vulnerable.

Figure 24: Marine Turtles Species Threatened Status Analysis



e). Cetaceans

Figure 25: Cetacean Species Threatened Status Analysis

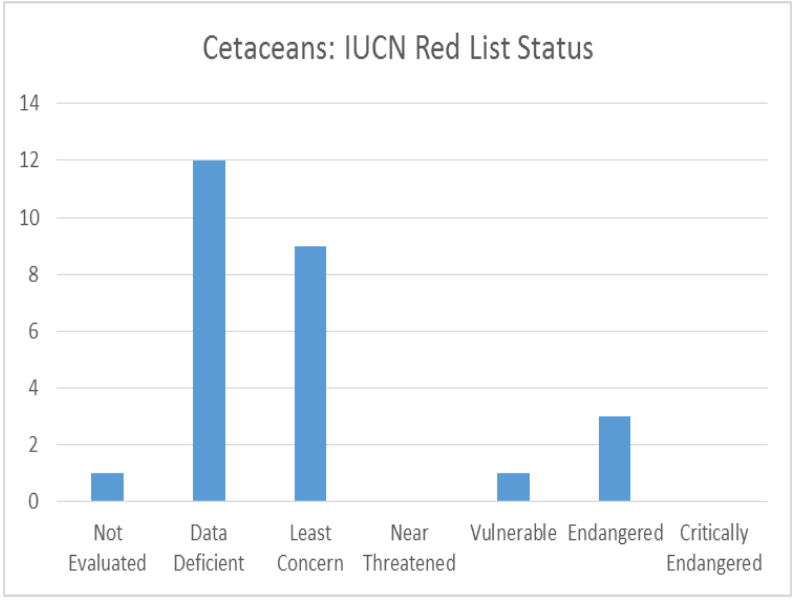


Seychelles was the lead proponent country for the designation of the Indian Ocean Whale Sanctuary declared in 1979. The first sanctuary of its kind, it provides total protection for the great whales comprising all waters north of 55°S from the east coast

In addition all species of marine mammal have received full protection under Seychelles law since 1986 (**GoS 1986**).

Figure 26: Cetacean Species Threatened Status Analysis

27 taxa of cetacean have been recorded to date in Seychelles waters (**Kiszka *et al* 2009**) (**Dalebout *et al* 2014**). Of the 26 taxa that have been identified to species level (Fig 26): 1 has not been evaluated, 12 are classified as Data Deficient, 9 as Least Concern, 1 as Vulnerable and 3 as



2.3. Terrestrial and Inland Water Biodiversity

For much of the first 180 years of Seychelles human history, limited fishing technology and capacity meant that terrestrial ecosystems bore the brunt of development and production pressure. Giant tortoises were extirpated on many islands to provide meat to revictual ships. The hardwood forests were felled for timber for construction, shipbuilding and as an export commodity. Low-lying forest was subsequently clear felled to make way for coconut plantations whilst higher altitude forests in the main granitic islands were felled to provide fuel for the cinnamon oil distilleries (see Fourth National report for details). The decline of the copra and cinnamon markets, coupled with the rise of tourism and industrial fisheries saw the Seychelles economy shift from its agrarian base changing the pressures of land use. The agricultural (1.9% GDP - **GFM 2014**) and forestry (<0.4% GDP - **Vielle 2001**) sectors are now of very limited significance and in chronic decline in terms of contribution to GDP. As a consequence the area of land under (secondary) forest cover has increased markedly over the last 40 years. Land use pressure now fits the typical Small Island Developing State "coastal squeeze" scenario where the vast majority of infrastructure, human habitation and commercial activities vie for space on the thin coastal strip of land. This has resulted in ever growing pressure on coastal habitats and manifested itself in various phases of coastal reclamation around the three main populated islands. Notable habitat types under pressure include lowland forest and beach crest habitats in the granitic islands but most significantly lowland inland waters which are the most threatened of native habitat types due to historical and ongoing reclamation, drainage, siltation and pollution.

Table 3: Terrestrial and Inland Water Biodiversity Overview

Taxonomic Group	Species	Notes
Fungi	Unknown	Fungal diversity is poorly known in the Seychelles with the predominant focus being on the study of crop and forestry pests. A 2004 survey (**Watling & Seaward 2004**) recorded 17 taxa, mostly macromycetes, all of widespread i.e. regional or pan tropical nature. Some work has been undertaken on ectomycorrhizal fungi with 37 species being identified from just 6 species of tree 30 species associated with just two native species (**Tedersoo 2007, Suvi 2011**). But overall species richness is considered low due to long term isolation and also extensive removal of natural vegetation. 16 species of lichens and lichenicolous fungi have been recorded (**Seaward & Soest 2013**).
Bryophytes	**218**	110 species of moss have been identified (**O'Shea 2006**) and 108 species of liverworts (**Wigginton**

Mosses Liverworts	(110) (108)	**2009**). The bryophyte flora is still insufficiently known with each survey making new discoveries and a mid-90s estimate of 15 endemic species being reduced to 4 and 4 endemic varieties (**Frahm & Ho 2009**) with increasing study in this domain throughout the African region.
Pteridophytes (Ferns & allies)	72	90 species of ferns recorded – 12 endemic, 60 indigenous and 20 probably introduced. (**Awmack 1997, Senterre *et al* 2014**)
Vascular plants	707	136 endemic and 571 indigenous species (plus 913 introduced species) (**Soquet *et al* 2014**).
Diptera (Flies)	589	295 endemic, 294 indigenous (plus 41 introduced). (**Gerlach [ed], 2009**)
Arachnida	347	204 endemic, 128 indigenous, 15 uncertain origin (plus 15 introduced). (**Gerlach & Marusik 2010**)
Myriapoda	76	34 endemic, 34 indigenous, 8 uncertain origin (plus 3 introduced) main diversity and endemism in granitic islands (Aldabra has 6 species only 1 of which is endemic) (**Gerlach & Marusik 2010**)
Coleoptera	825	506 endemic, 319 indigenous, (plus 35 introduced species). Highest diversity found on large granitic islands (Aldabra has 122 species, 40 endemic). **(Gerlach, J. [ed] 2009a).**
Orthopteroidea	162	56 endemic, 106 indigenous (plus 5 introduced) species. Greatest diversity on the large granite islands, Aldabra has 34 species, 11 of which are endemic **(Gerlach & Hass 2008).**
Lepidoptera	546	275 endemic, main diversity on larger granite islands, (Aldabra 57 sp. 20 endemic, Alphonse 46 sp. 35 endemic). The 271 non-endemic taxa include 11 probable introductions. (Plus 6 migrant records) **(Gerlach & Matyot 2006).**
Mollusca (Terrestrial and freshwater snails)	76	69 terrestrial species – 50 endemic, 19 indigenous (plus 8 introduced) (**Gerlach 2006**). 7 freshwater species – 1 endemic, 6 indigenous (plus 5 introduced)
Vertebrata		
Fish	15	15 indigenous species, 2 endemic. (**Gerlach [ed] 2007**) (**Senterre *et al* 2013**) Several introduced species.
Amphibia	11	11 endemic (4 frogs, 7 caecilians), (plus 1 Introduced) species. Scope for further speciation within currently recognised endemic frog species under investigation.
Reptilia snakes	2	Both endemic (plus 1 introduced species).
Lizards	19 species	12 endemic (plus 3 introduced). (**Gerlach [ed] 2007**). Assessment complicated by various endemic subspecies classifications.
Tortoise		1 endemic species the Aldabra giant tortoise (*Aldabrachelys gigantea*). (**Gerlach [ed] 2007**)

Birds Seabirds landbirds	65 (18) (47)	65 species of bird are resident in the seychelles – 18 breeding seabird species, 47 land and water birds of which 13[4] are endemic. (plus 13 introduced species). (**Gerlach [ed] 2007**)
Mammals	6	All indigenous mammals are bats, 4 endemic. (Plus 11 introduced species (**Nevill 2009**))

Research has changed the understanding of the status and trends of terrestrial and inland waters biodiversity over the last three years with some important findings. Perhaps most notable have been the changes in understanding of the status of terrapin species and sub-species in Seychelles. Mitochondrial DNA analysis of the lectotype of *Pelusios seychellensis* has shown that this species, formerly considered an endemic and now extinct species of terrapin, is actually the West African species *Pelusios castaneus*. This finding therefore removes the species from the extinct list and the list of Seychelles endemic fauna. The research undertaken also compiled a sound argument to show that the species was in fact never present in Seychelles but rather its supposed records are a result of mis-labelling of museum specimens **(Stukas *et al* 2013)**. Further research (**Fritz *et al* 2012**) has also lead to a change in status for the, formerly considered, critically endangered endemic subspecies of *Pelusios subniger*. The complete lack of mitochondrial DNA differentiation shows that the Seychelles' *P. subniger* does not represent a genetically distinct sub-species but rather must have been introduced by humans from Southeastern Africa. There consequently remains only one species of terrapin on the Seychelles fauna listing, *Pelusios castanoides,* and this also is now questionable as the weak mitochondrial DNA differentiation identified, rather than evidence of endemism, may well be due to incomplete sampling from the species range in continental Africa. If this is found to be the case then *P. castanoides* would also need to be reclassified as an introduced species.
These findings significantly change our understanding of inland water ecosystems. Terrapins have been the subject of significant conservation research and action over the years including the restoration of wetlands on small islands and the (re)introduction of terrapins. The presence or absence of terrapins has been a significant factor in assessing the conservation value of a wetland. The approach to wetland conservation must be reviewed in light of these findings and *P. subniger* now viewed as an introduced and possibly invasive species rather than a conservation priority, with consideration given to changing its legal status and reversing past island introduction initiatives.

Research is ongoing on a recently discovered new island population of the endangered sooglossid frog (*Sooglossus sechellensis*). Previously thought to occur only on the islands of Mahe and Silhouette a new population was discovered on the island of Praslin in 2009. Subsequent genetic analysis (**Taylor *et al* 2012**) has elucidated the relationship between the three island

[4] This does not include the Aldabra rail (*Dryolimnas (cuvieri) aldabranus*) which has yet to receive mainstream recognition as distinct species but work is in progress to determine this.

populations, suggesting that the Praslin population is most closely related to the *S. sechellensis* from Silhouette and identifies these as two separate clades distinct from the population on Mahe. The study suggests substantial evolutionary divergence between the three populations and indicates that each should be managed as distinct evolutionary significant units for conservation purposes.

Excellent work has been undertaken in the assessment of Key Biodiversity Areas in the central archipelago, under the auspices of the GEF full-size Mainstreaming Biodiversity project, extending our knowledge of the occurrence and distribution of diverse species. Findings included 17 new records for the native flora, amongst which two new species of fern have been described (**Senterre *et al* 2014**), and the rediscovery of 15 species not seen for a century or more (**Senterre *et al* 2013**). At least 4 new species have been added to the list of indigenous fauna including one new species of land/freshwater crab new to science (**Senterre *et al* 2013**).

Inland waters and specifically lowland inland waters, that were classified as the most threatened habitat type in Seychelles in the 4th national report to the CBD, remain a habitat of key concern. The decline of this habitat type due to enhanced drainage (a process that will be escalated following flooding events in 2013 and 2014), reclamation and conversion is ongoing as development continues. Public concern has been raised regarding this ongoing degradation in particular with regard to recent and proposed hotel resort developments on the main island of Mahe.

2.4. Threatened Status Analyses

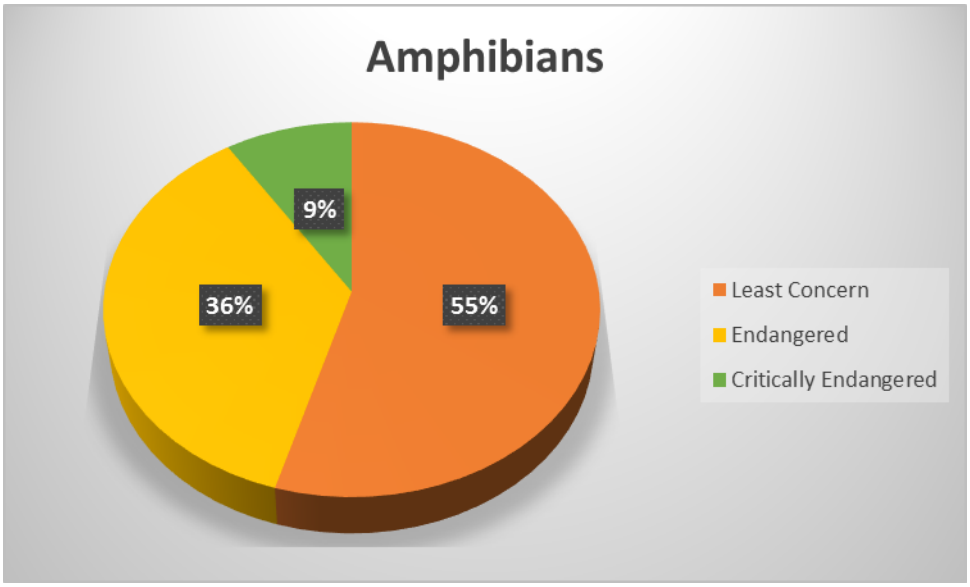
a). Freshwater Fish

15 species considered indigenous have been recorded to date. 5 species, including the 2 endemic species, have not thus far been evaluated for IUCN status whilst the other 10 species are classified as Least Concern.

b). Amphibians

11 indigenous species of amphibian, all endemic, have been recorded to date in Seychelles consisting of 5 frog species and 6 caecilians. 6 species are classified as Least Concern, 4 Endangered and 1 Critically endangered meaning that 45% of Seychelles indigenous amphibians are considered threatened.

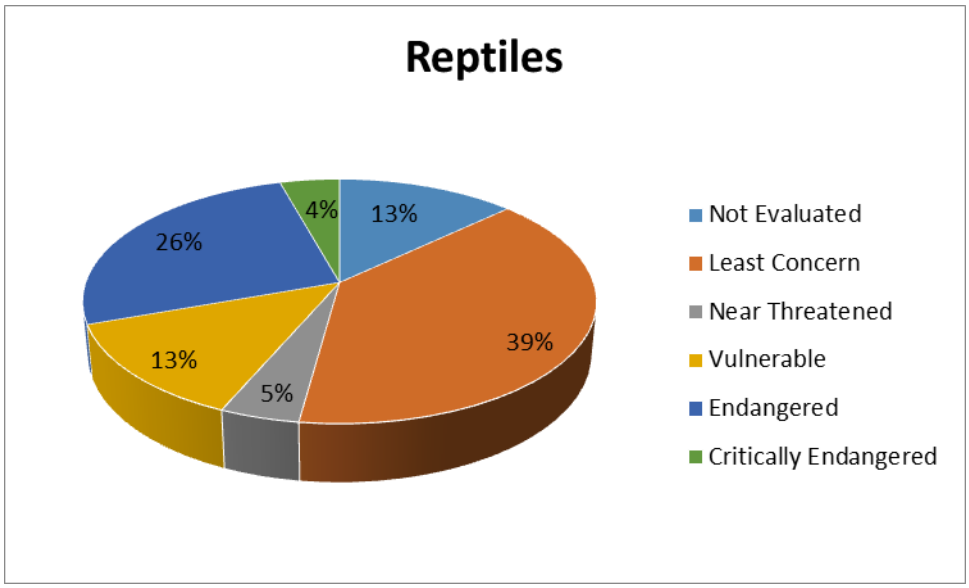
Figure 27: Amphibian Species Threatened Status Analysis



c). Reptiles (Fig 28)

Seychelles has 23 recognised species of indigenous terrestrial reptile – 2 species of snake, 19 species of lizard, 1 species of Giant tortoise and 1 terrapin. There is some debate on these figures in particular due to the status of some lizard taxa currently recognised as endemic sub-species. Previous claims about multiple species of endemic giant tortoise (**Gerlach & Canning 1998**) have not been supported by genetic analyses (**Austin *et al* 2003, Palkovacs *et al* 2003**) and have been strongly questioned by peers (**Frazier 2006, Shah 2003**) as such only one species is recognised here. One terrapin, *Pelusios subniger*, previoulsy considered an endemic sub-species has recently been shown to be an introduced species whilst the other *Pelusios castanoides* may also later prove to be an introduction. Of the 23 species: 3 have not been evaluated, 9 are classifed as Least Concern, 1 as Near Threatened and 10 or 44% as Threatened (3 Vulnerable, 6 Endangered and 1, P. castanoides sub-species, as Critically Endangered).

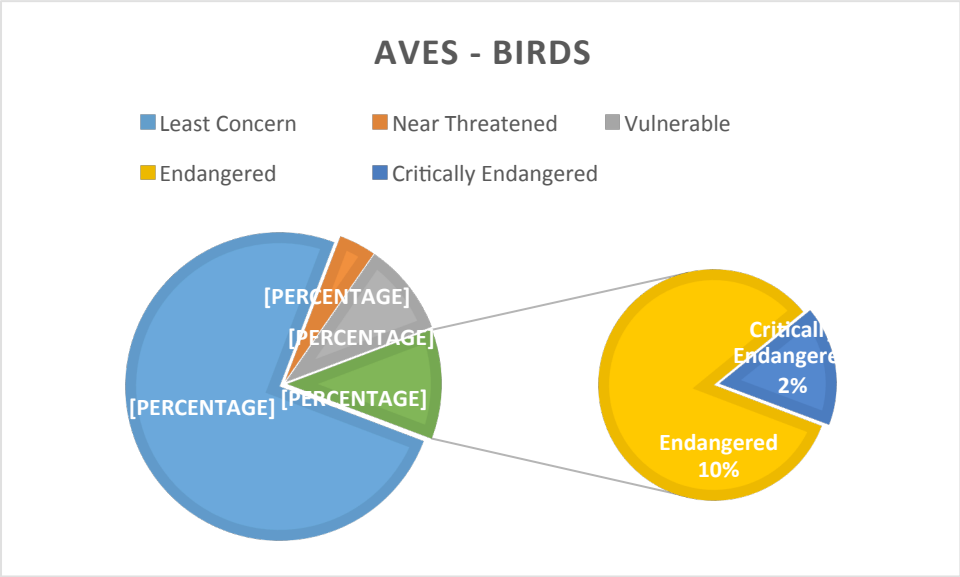
Figure 28: Reptilian Species Threatened Status Analysis



d). Aves – Birds

52 species of bird are considered indigenous to Seychelles – 18 seabirds and 47 landbirds – 14[5] species of which are considered endemic. 13 resident species are introduced . Another 25 species are classified as annual migrants whilst approximately 150 additional species have been recorded as vagrants. Of the 52 indigenous species 39 are classified as Least Concern, 2 as Near Threatened and 11 species, or 21% of bird species, as threatened (including 5 classified as Vulnerable, 5 as Endangered and 1 as Critically Endangered).

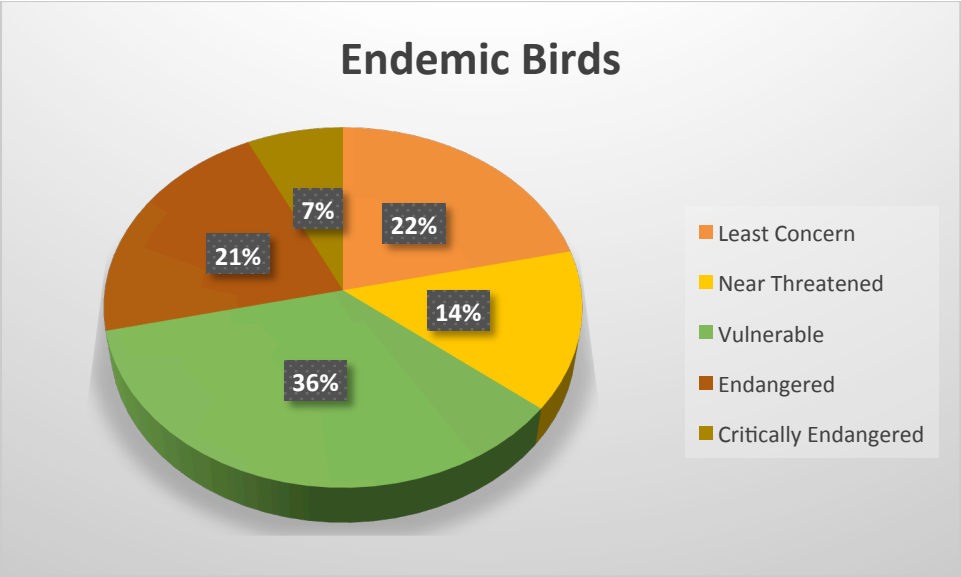
Figure 29: Bird Species Threatened Status Analysis



[5] Including recognition of *Coracopsis barklyi* (**Reuleaux *et al* 2013**) and *Dryolimnas aldabranus* (**Wanless 2003, Wanless & Hockey 2008**) as full species. Several other species are considered to be represented by endemic sub-species in Seychelles.

Consideration of the 14 endemic species gives another perspective. 3 species are considered of Least Concern, 2 Near Threatened and 9 species, or 64% of the endemic species, are considered Threatened – 5 species Vulnerable, 3 species Endangered and 1 species Critically Endangered.

Figure 30: Endemic Bird Species Threatened Status Analysis



These rather gloomy figures however do not reflect the overall improvement in the status of endemic bird species over the last 20 years, where a combination of invasive species eradications, ecosystem rehabilitation and species (re)introductions have seen several species' populations increase and the threatened status of some downgraded[6]. The Critically Endangered Seychelles Paradise Flycatcher (*Terpsiphone corvina*) was reassesed in 2012 following its introduction to Denis island in 2008 and provided both populations are self-sustaining in 2017 it also will be downgraded to Endangered.

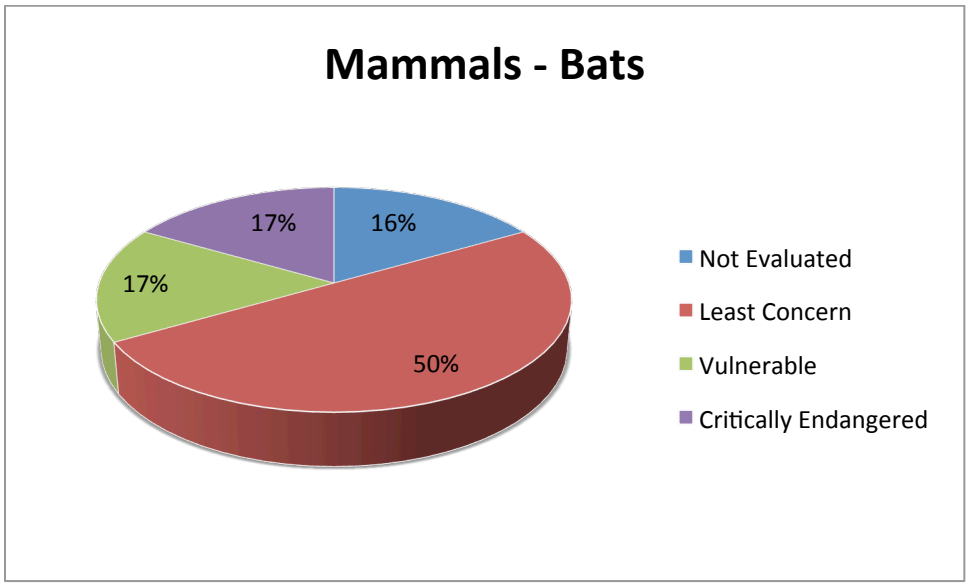
e). Mammals

There are 6 species of indigenous land mammals in Seychelles and they are all bats. 4 of the species are endemic including the recently discovered *Triaenops pauliani* **(Goodman & Ranivo 2008).** 3 of the species are classified as Least Concern, 2 are classified as Threatened – 1 Vulnerable and 1 Critically Endangered. The newly discovered *T. pauliani* has not yet been evaluated but will likely be considered threatened due to its very restricted range on an island of Aldabra atoll. The Seychelles Sheath-tailed bat (*Coleura seychellensis*) is Critically Endangered numbering less than 100 and apparently extirpated now on all but the islands of Mahe and Silhouette. It is one of the world's rarest mammals with the main cause of its demise being

[6] See Case Study 6 (**Nevill 2011**) in Seychelles 4th National Report to the CBD; and see **Section 7.2.2 Table 5** and Case Study 2 in this report, for further details.

degradation of its coastal habitats - including a roosting site degraded by a recent tourism development (**EDGE 2014**).

Figure 31: Mammalian Species Threatened Status Analysis



3. Main Threats to Biodiversity

Seychelles' fourth national report to the CBD recognised that national biodiversity could be described through the lens of three Convention Programmes of work namely: Forest, Inland waters and Marine and coastal biodiversity. The main threats to those ecosystems types and their component habitat categories remain unchanged in the subsequent three years.

3.1. Forest Biodiversity.

The overriding threat to forest biodiversity is the ongoing incursion of Invasive Alien Species. The vast majority of forest cover in Seychelles is secondary and already highly invaded by introduced species which often form the primary canopy species. Status and trends of IAS invasion of forest ecosystems in key biodiversity areas and refuges are not well understood. The current full-size GEF project on Biosecurity has been focusing on the strengthening of controls to prevent introductions of new IAS, with a new focus on eradication and control of IAS to follow in the next CBD reporting period.

A secondary concern is that of forest fire in particular with regard to the threat it poses to dry endemic palm woodland areas.

3.2. Marine and Coastal Biodiversity.

This ecosystem type is highly diverse, and indeed was divided into eight habitat categories in the 4th national report. This diversity in turn means that the categories often face different threats. However the main threat, in terms of biodiversity conservation and socioeconomic wellbeing, is unsustainable use of fishery resources with secondary factors for coastal habitats of habitat loss, through change in land use, and pollution.

Coastal development has greatly reduced natural vegetation cover impacting upon key habitats such as lowland woodlands and beach crest vegetation - including impacting severely upon nesting habitat for endangered turtle species. There is also strong anecdotal evidence to suggest that the land reclamation programme on the east coast of Mahe has destroyed critical habitat causing the collapse of two fisheries: the White-streaked grouper (*Epinephelus ongus)* and the Marbled parrotfish (*Leptoscarus vaigiensis)*. It has likely also had significant impact upon the key shark nursery area for several species, but this is hard to quantify as no pre-reclamation baseline was established.

3.3. Inland Waters Biodiversity.

The extraordinary geographic and evolutionary isolation of the inland waters of Seychelles' granitic islands, surrounded in all directions by a 1000 miles of ocean and separated from continental landmasses for 70 million years, makes them of particular biodiversity interest. Lowland wetlands are probably the most threatened habitat type in Seychelles due to the limited land area and the consequent development driven "coastal squeeze" making habitat loss through change in land use the primary threat and ongoing driver of biodiversity loss in this habitat type. It is estimated that more 90% of the lowland wetland habitats of the central archipelago have been lost in the last 200 years (**Gerlach 2002**).

In addition to the above there are cross-cutting threats to biodiversity and drivers of its degradation primary amongst these is climate change but also it is important to recognise the limitations in national human capacity to research, understand and manage biodiversity optimally.

3.4. Climate Change.

The complexity of ecosystems and the diverse nature of the stresses upon them often makes it difficult to isolate the specific impacts of climate change, it is however without question a contributing and confounding factor to stressors on biodiversity and biodiversity degradation.

For Forest biodiversity, change in ambient temperature and rainfall patterns can affect habitat structure enhancing IAS action, or make species more

stressed and prone to disease, which may have been a factor in the spread of Takamaka wilt disease (**Vielle 1999**). The correlation between weather patterns and forest fire occurrence is of course well understood.

For marine and coastal biodiversity, climate change is a key driver of biodiversity loss the prime example in Seychelles being the extreme coral bleaching event experienced in 1998 that caused 80-90% live coral loss on the Seychelles plateau. This has ongoing ramifications for fish populations and related fisheries (**Graham 2007**). Water temperature likewise affects the movement and distribution of pelagic stocks that have vital economic importance. Water temperature may have other physiological affects upon biodiversity affecting breeding cycles, seasonality and productivity – for example the temperature of incubating turtles' nests is known to influence the sex ratio of offspring.

Climate change fuels more severe weather events such as storm surges and changes prevailing weather patterns effecting the normal seasonal cycles of erosion and accretion both of which can have significant impact upon the physical and biotic components of the coastal environment.

3.5. Knowledge and Data Management.

Limited knowledge and understanding of biodiversity, its status and trends, species ecology and biology, functions and values constitutes a critical threat to conservation and sustainable use as it impedes informed decision-making. For example, lack of species based data in the management of fisheries has been a critical factor limiting the ability to develop effective plans for various components of the artisanal fishery.

Lack of knowledge also undermines the efficacy of environmental impact assessment measures for example in protecting critical habitats from development pressures e.g. the EIA process for the phase 3 east coast reclamation made no reference to the potential loss of key habitats for certain fisheries – the subsequent collapse of fisheries for the White-streaked grouper (*Epinephelus ongus)* and the Marbled parrotfish (*Leptoscarus vaigiensis*) have been directly connected with habitat lost to the reclamation.

3.6. Mainstreaming of Environmental Economics.

There is a significant lack of national capacity in this domain with no qualified practitioners in the country at this time. This shortfall has been noted in previous strategic documents (e.g. first NBSAP and EMPS) but has not been successfully addressed. There is a real concern that the true value of biodiversity is not incorporated into decision making processes and specifically development planning whether it be pertaining to drainage/reclamation of lowland wetlands or in specific species-based cases

such as the hotel developments that impacted key Sheath-tailed bat (*Coleura seychellensis*) and Hawksbill turtle (*Eretmochelys imbricata*) habitats in recent years.

4. Impact of Negative Changes in Biodiversity status

Natural resources have driven economic activity since the first colonisation of the islands. The first colonists in the central archipelago depended to a great extent on the direct exploitation of the island hardwood forests for timber for ship building, ship repair and for export as a raw material. The hardwood forests were in this way rapidly cleared with many species becoming scarce and the Seychelles Ironwood (*Vateriopsis seychellarum*) being driven to near extinction. The only species of its genus the *V. seychellarum,* once a co-dominant canopy species, remains classified as Critically Endangered today with less than 50 mature individuals known. Giant tortoises (*Aldabrachelys gigantea*) were utilised and traded as a source of meat, in particular for revictualling ships due to their hardiness and ability to live without food or water for long periods, and also driven to the brink of extinction being extirpated from the majority of their former range.

The Green (*Chelonia mydas*) and Hawksbill (*Eretmochelys imbricata*) turtles supported significant export industries through the 19th and the better part of the 20th century until populations collapsed and legislation was introduced to protect the remnant populations. The complete protection of marine turtles was instituted by the Wild Animals (Turtles) Protection Regulations 1994 (**GoS 1994**). The shark fishery constituted the main fishery export for the country in the 1950s exporting dried shark meat to East African markets, but this market declined along with the stocks at the end of the decade before winding up in 1964.

In most cases however there is no data or analysis to provide a contemporary costing of the revenue lost by the over exploitation of a particular resource. This holds true today in the artisanal fishery where several species have collapsed (e.g. *Epinephelus tukula, E. ongus, Plectropomus laevis, Carcharhinus melanopterus* & *C. plumbeus*) but their value in a multiple species fishery was not calculated and their place has been taken in the catch by secondary species. The fishing down of the food web by the artisanal fishery is nevertheless a real concern and represents significant loss in revenue.

The removal of key species must also have impacted the ecological balance and components parts of the ecosystem. The removal of the key herbivore, the giant tortoise, and largest predator from, the saltwater crocodile, from terrestrial and inland water systems must have had profound effects on the ecological balance. Likewise the ecological extinction of key predators (seals, crocodiles and sharks) and grazers (green turtles) must have had knock-on the balance of marine and coastal ecosystems. However the other ongoing broader, rapid and near ubiquitous anthropogenic impacts upon the

same systems make it impossible to tease out specific interactions of cause and effect from the "background noise" of disturbance and thus evaluate the costs of decline or loss of specific elements biodiversity from the ecosystems.

There is a counter side to the decline in biodiversity, in some cases rarity imbues and enables the realisation of value that would not be accessible if some species remained common. This is particularly the case for ecotourism where one might argue certain protected areas are profitable and provide employment due to

Cousin Island Special Reserve and the Vallee-de-Mai World Heritage Site

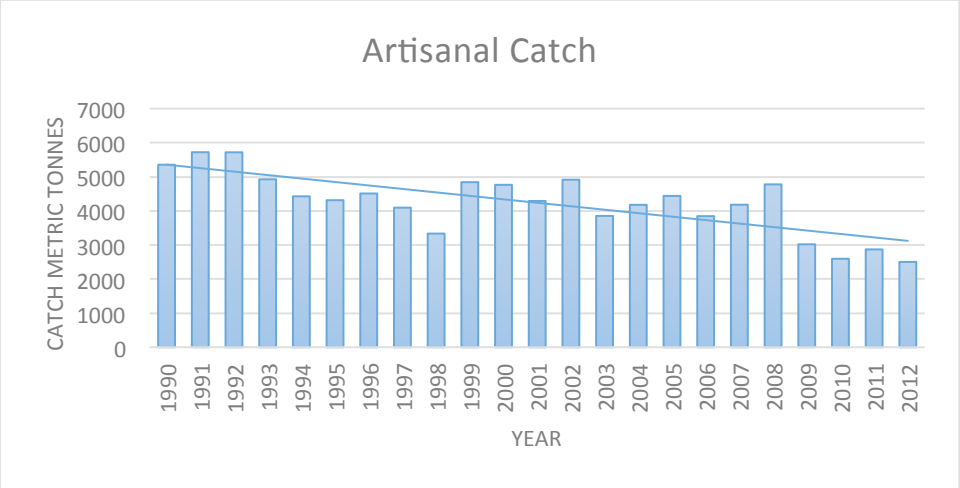
Cousin Special Reserve's allure as a small island adjacent to the second island of Praslin is largely due to its bird populations both seabird colonies and rare endemic species of land bird such as the Seychelles warbler (*Acrocephalus sechellensis*), Seychelles fody (*Foudia sechellarum*) and (re)introduced Seychelles magpie-robin (*Copsychus sechellarum*). Cousin is also, thanks to 45 years of dedicated protection, the largest and most dense nesting colony for the endangered Hawksbill turtle (*Eretmochelys imbricata*) in the Seychelles. This species which nests during the day in Seychelles provides a significant opportunity for island visitors to actually see the animal on land during peak nesting season.

The Vallee-de-Mai Nature Reserve and UNESCO World (Biodiversity) Heritage site hosts an outstanding example of native palm forest in near pristine condition. The site hosts all 6 species of endemic palm including the famed Coco-de-mer palm (*Lodoicea maldivica*) which produces the largest seed in the world. This forest of endemic palms constitutes a vital

the rarity of the formerly common species they harbour. Cousin Island and Vallee-de-Mai are two of the most prominent and successfully operated protected areas in the country, both provide employment to onsite staff and significant income to the local community through other related service providers (boats, taxis, hire vehicles, tour guides etc…). Both are self-sufficient, and in fact highly profitable, with revenues going to fund additional biodiversity research, conservation and sustainable use initiatives.

There is however one current and quite stark example of the impact of negative change in Biodiversity and that is the economic impact of declining catches in the artisanal fishery. The artisanal fishery is a vitally important economic sector in terms of employment and provision of quality protein to the domestic and tourist population. There is therefore good data available with regard to catch over time and the cost of fish on the domestic market. Artisanal catch rose significantly through the 20th century, reflecting increased effort, improved technologies and the demand from the growing domestic and tourist population. Catches peaked, however, in 1991 and have shown a steady decline in the subsequent years (**See Fig 32**).

Figure 32: Artisanal Catch 1990-2012



The additional decline evident from 2009 may be in part due to the activities of the artisanal fleet being impacted by the threat of piracy.

Figure 33: Mean Fishing Effort 2004-2008 **Figure 34: Fishing Effort 2009**

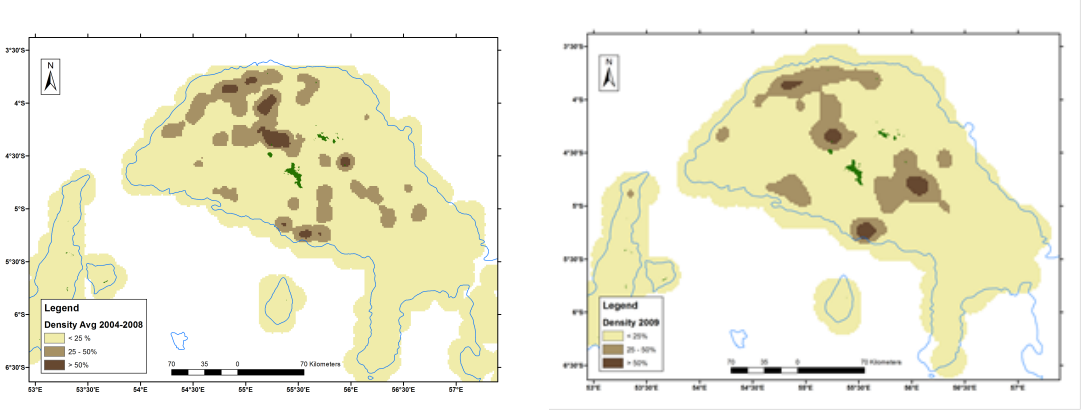


Figure 33 shows the mean density of fishing effort over the Seychelles and Amirantes banks 2004-2008. **Figure 34** shows the displacement of fishing effort in 2009. **Figures 35 & 36** below show the relative productivity of the different fishing areas or Catch Per Unit Effort (CPUE) for 2004-2008 and 2009 respectively – the darker the shade the higher the CPUE. (**Data Courtesy of Seychelles Fishing Authority**)

Figure 35: CPUE 2004-2008

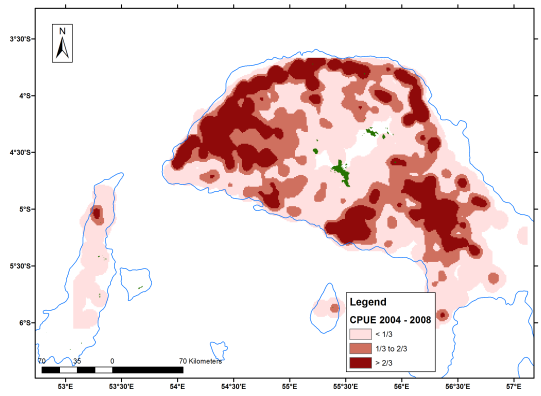
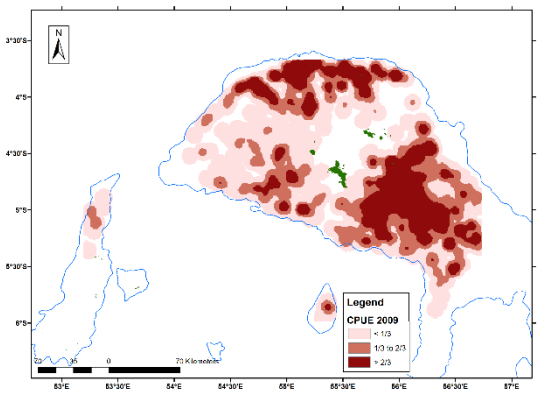


Figure 36: CPUE 2009

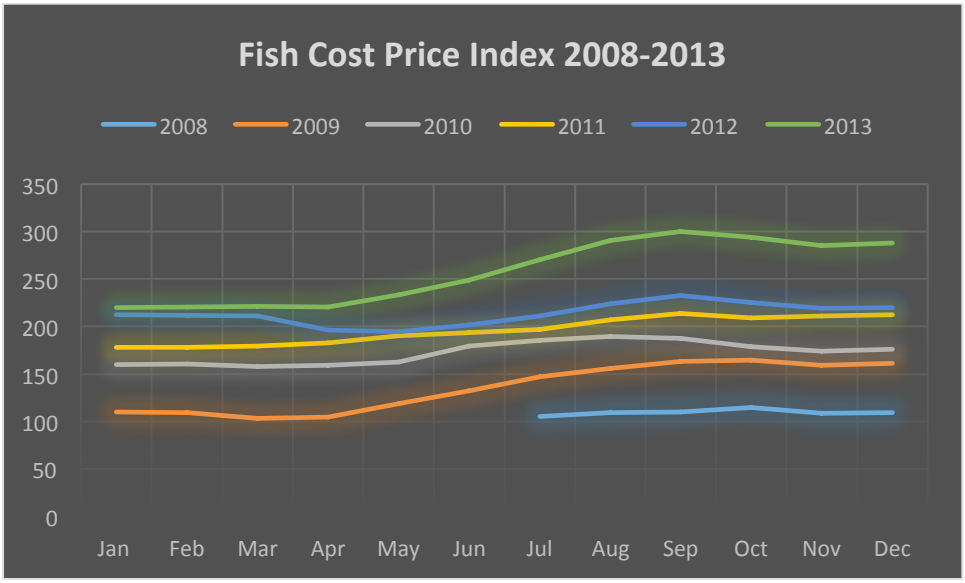


The figures show a partial shift in effort from the north westerly banks where piracy pressure was considered greatest to grounds further south east with a consequent reduction in catch per unit effort.

The 2009 additional drop may also, however, in part reflect the delayed impact of the severe 1998 coral bleaching event predicted by studies that showed recruitment of various reef fish species had been affected and would likely result in subsequent delayed fishery impacts (**Graham *et al* 2007**). It is notable that the trend of decline has continued over the last 4 years of data showing that the overall catch trend is down regardless of area fished.

This decline in catch has fuelled a marked price increase with the Cost Price Index for fish showing a near threefold increase in the last 5 years (**See Fig 37**).

Fig 37: Cost Price Index for Fish 2008-2013



(Compiled from **NSB 2011, 2012 & 2014**).

These figures are complicated by strong fuel prices and growing demand in line with increasing tourism numbers but the correlation between declining artisanal catch and rising fish prices on the local market is sufficiently strong for the Seychelles Fishing Authority to include the following statement in its 2012 Annual Report:

"The artisanal catch in 2012 decreased by 13.0% over the previous year... This indicates a decrease in the amount of fish available for domestic consumption and export, which was reflected in the significant decrease of quantity of fish exported and the rise in the price index of fish in 2012." (**SFA 2012**)

The impact of rising fish prices was such that it was cited as the primary driver of inflation in the national economy for 2013. The 12-month average rate of inflation for 2013 was 4.3% whilst fish prices rose 31% in 2013 compared to 2012 (**CBS 2014**). This therefore shows a very strong correlation between declining fish stocks and the standard of living for Seychellois nationals.

Part II: The National Biodiversity Strategy and Action Plan, its Implementation, and the Mainstreaming of Biodiversity

5. National Biodiversity Targets

National environmental and biodiversity objectives are set out in various national documents and in Presidential declarations.

Article 38 of the Constitution of the third Republic of Seychelles (**GoS 2010**) recognises the right to a safe environment:

> *"The State recognises the right of every person to live in and enjoy a clean, healthy and ecologically balanced environment and with a view to ensuring the effective realization of this right the State undertakes–*
> *(a) to take measures to promote the protection, preservation and improvement of the environment*
> *(b) to ensure a sustainable socio-economic development of Seychelles by a judicious use and management of the resources of Seychelles;*
> *(c) to promote public awareness of the need to protect, preserve and improve the environment. "*

The constitutional text was used as the basis, supplemented by elements of the pre-independence National Parks and Nature Conservancy Act, for the Seychelles Vision for Biodiversity Conservation as embodied in the first Seychelles NBSAP (**Shah *et al* [eds] 1997**):

> *"The Republic of Seychelles recognises the right of every person to live in and enjoy an ecologically sound natural environment and undertakes to take necessary measures to maintain essential ecological services and life support systems, to promote the protection, preservation and in certain cases the improvement of its indigenous biological diversity, and to judiciously use and manage species and ecosystems so as to ensure a sustainable socio-economic development of the country."*

The Seychelles Environmental Management Plan (EMPS) 2000-2010 succeeded the NBSAP as the primary strategic document for Biodiversity management with the NBSAP being updated and reformatted to constitute the Biodiversity, Forestry and Agriculture thematic area and components of the Fisheries and Marine Resources/Processes thematic area. The EMPS constituted the first national strategic document for sustainable development; the Vision for the document states:

> *"At the dawn of the 21st Century it is the vision of the people of Seychelles that this second generation Environment Management Plan, the EMPS 2000-2010, will serve as a flexible, yet robust,*

> *vehicle for continued improvement of proactive environmental management excellence, so that by the year 2010 the Seychelles will be firmly established globally as a committed leader in sustainable development."*

This vision statement was contextualised with a supporting Overall Goal statement:

> *"The overall goal of the EMPS 2000-2010 is: the promotion, coordination and integration of sustainable development programmes that cut across all sectors of society in the Seychelles in order to attain the above mission [sic]."*

These documents guided national biodiversity actions from 1997 to 2010. One shortcoming that has been identified in the documents by various assessments (**Nevill *et al* 2002, GoS 2005, GoS 2005a, TEMATEA 2007, GoS 2011**) however, is the lack of integration of specific CBD targets and pertinent commitments of CBD Programmes of work into the action plans making the targeting of CBD implementation and assessment of progress difficult. There has likewise been a lack of strategic measureable targets in documents – with most targets being confined to technical documents such as species action plans.

Two prominent exceptions to this have been the national objectives pertaining to terrestrial and marine protected areas. Seychelles has a proud history of protected area establishment. Some 47% of Seychelles land area is designated as protected areas for environmental and biodiversity purposes. In 2010 President Michel announced that Seychelles had, as part of its commitment to be a global leader in environmental conservation, set itself the target of protecting more than 50% of its land area. Work is ongoing under the GEF Full-size Protected Areas Project to identify and prioritise areas for inclusion in the expanded terrestrial protected area network.
In the marine domain Seychelles was the first country in East Africa to establish a network of Marine Protected Areas (MPAs). The total area though was too small, at less than 1% of the Seychelles Exclusive Economic Zone (EEZ), to meet biodiversity conservation and sustainable use objectives. Consequently in 2012 Vice-President Faure announced, at the Rio +20 UNCSD, Seychelles' intention to declare, through a debt for adaptation financing mechanism, 30% of its EEZ as protected, half of which will be strict no-take zones. This process is now well under way in partnership with The Nature Conservancy.

Since the conclusion of the EMPS 2000-2010 the Seychelles has been without a functional strategic environmental document. The third generation EMPS 2011-2020 re-named the Seychelles Sustainable Development Strategy (SSDS) (**GoS 2012, Gos 2012a**) was delayed in its development and the document was launched as the SSDS 2012-2020. While

the document has been launched, the three-tiered institutional framework (council, steering committee and secretariat) has yet to be instituted and as such the SSDS is not at the time of writing (April 2014) operational.

A process was undertaken in 2013 to review and update the NBSAP. A document entitled "Seychelles National Biodiversity Strategy and Action Plan to 2020" (**Prescott, J. *et al* [Eds] 2013**) which at the time of writing (April 2014) remains in a late draft form. Remarkably, though the text of this draft recognises the shortcomings of previous strategic documents in not cross-referencing the CBD thematic programmes of work and their pertinent commitments, it also neglects to do so. The Aichi Biodiversity Targets are also not effectively incorporated (see **Section 6** for details) seriously undermining the purpose and functionality of the document.

The draft NBSAP and the SSDS share the same Vision Statement:

> *"To contribute to the realisation of the nation's economic, social and cultural potential through an innovative, knowledge-led approach, being mindful of the need to conserve the integrity of the Seychelles natural environment and heritage for present and future generations."*

6. The New 2014 National Biodiversity Strategy and Action Plan.

The new "Seychelles NBSAP to 2020" is a framework document for Biodiversity management in Seychelles. It is less detailed than its predecessor which set the CBD in the Seychelles context and went so far as to elaborate fully-detailed, budgeted and prioritised projects. The new NBSAP sets out a framework of broad objectives for later elaboration into more detailed projects for stakeholder implementation. The later development of the NBSAP is to be overseen by an NBSAP Implementation Unit to be established under the Ministry of Environment and Energy and "nested" within the proposed SSDS framework. The NBSAP is to be implemented by a proposed stakeholder forum termed "The National Biodiversity Partnership Forum".

Unfortunately, the new NBSAP document lacks sufficient detail and grounding in either the CBD, its thematic programmes or its Strategic Plan 2011-2020 to properly fulfil its intended task.

The NBSAP's strategic goals do not reflect those of CBD Strategic Plan, it does not incorporate the Aichi Targets, either directly or modified

to meet local circumstances[7], and its thematic areas diverge from those of the Convention in ways that are likely to pose additional difficulties in terms of assessing and reporting upon national implementation of the Convention.

The new NBSAP utilises confused terminology by referring, for example, to "freshwater marshes and wetlands" rather than the internationally agreed "inland waters". It even uses the term Genetically Modified Organism (GMO) as opposed to Living Modified Organism (LMO) which is the term legally recognised under the Cartagena Protocol to which Seychelles is party – this is done without explaining whether this reflects a national intent to address the much broader issue of GMOs not currently governed by international law.

Finally the new NBSAP does not provide guidance or criteria on aligning projects with CBD requirements, or identify targets and benchmarks (except in the most generic terms) for subsequent monitoring of implementation, neither does it set out a monitoring programme. Rather all these aspects are left for the proposed Implementation Unit and Stakeholder Forum to determine. Previous assessments of strategic plan implementation in Seychelles (**GoS 2005, GoS 2005a, GoS 2011**), i.e. the first NBSAP and the EMPS 2000-2010, have identified administration/coordination as a key weakness in implementation and hence recommended the proper and explicit integration and cross-referencing of international commitments into national programmes to mitigate this.

Consequently an independent review was undertaken during the final stages of the preparation of this report and it has been decided to revise the NBSAP with particular attention to aligning its format and content with the Aichi Biodiversity Targets, properly integrating these commitments such that the Implementation Unit and Stakeholder Forum will have sound guidance for their later development and elaboration of NBSAP projects. This revision is scheduled to take place in the 3rd quarter of 2014.

[7] An attempt to retrofit the Aichi Targets to the document by appending a cross-referencing matrix fails to bridge the gap as the examination is not complete and cross-references to the thematic area texts as opposed to the Priority Actions identified later which would be much more appropriate for the determination of linkages between the outputs of the NBSAP and the Aichi Targets.