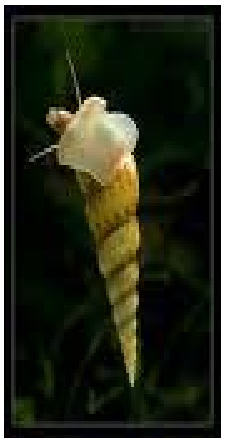
National Invasive Species Strategy for Saint Lucia

Aquatic Ecosystems



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ACRONYMS AND ABBREVIATIONS

BCSU	Biodiversity Conservation and Sustainable Use
CBD	Convention on Biological Diversity
CEHI	Caribbean Environmental Health Institute
CITES	Convention on the International Trade in Endangered Species of Wild Fauna and Flora
CPA	Crop Protection Assistants
CPO	Crop Protection Officer
CRFM	Caribbean Regional Fisheries Mechanism
CZMAC	Coastal Zone Management Advisory Committee
CZMU	Coastal Zone Management Unit
FMP	Fisheries Management Plan
GDP	Gross Domestic product
GMO	Genetically Modified Organisms
IAS	Invasive Alien Species
IPPC	International Plant Protection Convention
LMO	Living Modified Organism
MAFF	Ministry of Agriculture, Forestry and Fisheries
MOH	Ministry of Health
MARPOL	Marine Pollution
NEMAC	National Emergency Management Advisory Committee
NEMO	National Emergency Management Organization
NEMS	National Environmental Management Strategy
NEP	National Environmental Policy
NGO	Non- Government Organization
NHM	National Hazard Mitigation
SDES	Sustainable Development and Environmental Section
NISS	National Invasive Species Strategy
OECS	Organization of Eastern Caribbean States
SDU	Sustainable Development Unit
SLASPA	St. Lucia Air and Sea Ports Authority
SLWMU	St. Lucia Waste Management Unit
SMMA	Soufriere Marine Management Area
SPAW	Specially Protected Areas and Wildlife
SRDF	Soufriere Regional Development Foundation
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environmental Programme
WRMA	Water Resources Management Agency
WRMU	Water Resources Management Unit

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1. Setting the Stage

INTRODUCTION

Invasive Alien Species (IAS) are plants, animals and pathogens that are introduced in a region where they previously did not naturally occur. In most instances the species is non-native but due to favourable environmental conditions, the species has been able to establish itself and compete successfully with local species. Not all alien species are necessarily invasive. A species needs to be able to not only survive in its new location, but also to thrive, which means, it must be able to reproduce and colonize the new habitat. As species establish themselves in new locations they can alter ecological relationships among native species and can affect ecosystem function, economic value of ecosystems, and human health. Consequently, in order to protect native biological diversity in any country, caution must always be taken to monitor the introduction, establishment and spread of non-native species.

One of the key strategies to safeguard against damages caused by IAS is the Prevention of arrival of potentially harmful species into the protected landscape. Past experiences globally have shown that the old saying “prevention is better than a cure” is correct. The costs to prevent introduction have been found to be vastly less costly than the eradication and or mitigation of impacts.

Aquatic Invasive Species

These have had many impacts in the past:

Plants have become weeds that spread from river to river as a result of floods or transfer by birds, humans, boats, fishing gear, boots, and other means. The infesting vegetation clogs river-ways, becoming a nuisance to boats and larger animals such as otters. This infestation can hamper access to water for agriculture, industry, fishing, water sports, construction and tourism.

Invasive plants can also infest coastal areas, spreading across inshore sandy and rocky bottoms, reducing water visibility, over growing reefs, providing habitat for other non-native species. These invasive plants can also attach to boat hulls, fishing gear, nets, fishing pots and traps, becoming a nuisance to boatmen, fishers, recreational divers and tour boat operators. Highly overgrown areas also become unpleasant to swim in or carry out any other type of recreational activity, thus impacting on public use of the sites both for tourism, agriculture, aquaculture, fisheries and public enjoyment.

When fauna invade aquatic systems, the ecological changes can be immediate. Invasive fish may outcompete with residents leading to a loss of a certain species. Invasive vertebrates and invertebrates may also consume plants or other fauna reducing their presence in the ecosystems, thus altering ecological structures and food chains, including predator – prey relationships. Changes caused by invasive fish and other fauna may also lead to changes in the chemical

constitution of the ecosystems, affecting water quality, micro and macro fauna compositions, food webs, and ultimately the resilience of the aquatic system.

Most impacts of IAS in coastal areas occur inshore, often on coral reefs, sea grass areas, and other feeding grounds. An invasive alien may rapidly devastate a reef, consume juvenile fish, plants, sponges, etc, introduce diseases, cause certain species to move away in search of new territory. Invasive invertebrates can also be devastating on marine systems. Encrusting organisms such as barnacles, crabs, snails, sea urchins, can choke reefs, foul boat mechanisms, impact on fish species, become a pathway for the introduction of pathogens, affect mariculture operations such as sea moss farming and if nothing else, be a nuisance to sea bathers.

How may IAS enter aquatic ecosystems in a country? This can occur in several ways and under

- Introduction of exotic or non-native fish, plants, snails and other invertebrates into rivers, lakes, oceans and coasts. Such introductions will have devastating impacts on the aquatic system whether such introductions are accidental and or deliberate.
- Changing environmental conditions within water-bodies enabling changes in ecological balance, allowing certain non-native species to thrive and replace native species.
- Moving boats, fish tackle, floating docks, recreational vehicles from one location to another without adequate de-fouling and or disinfection. Such exchanges can easily lead to transfer of species to new areas. Eggs, spores, larva, can be present in small drops of water and remain viable for several weeks, germinating and continuing the lifecycle once conditions are right. As St. Lucia is an important yacht destination, the use of fish gear in local waters without disinfection, the cleaning of debris from the bottom of the boats whilst inshore and failure to properly isolate from natural systems and destroy through disinfection or heat, the disposing of garbage and other organic waste via the general waste disposal mechanisms, and the permitting of visitors to exercise pets onshore are all pathways that must all be avoided as much as possible.
- Removal of certain predators from water bodies thus enabling the flourishing of non-native species. This last situation can occur when certain IAS either prey on native species at the top of the food chain, or compete with them for food, thus leading to a reduction of complete loss of the populations.

St. Lucia, as part of its commitment to many International Environmental Conventions is in the process of developing a National Invasive Species Strategy that is expected to feed into a much larger Regional Strategy. This report reviews the enabling policies, regulations and structures for effective management of aquatic invasive alien species and identifies areas that are still inadequate for control and management these species.

The following report assesses the current operations and structures in St. Lucia with regards to IAS and compares it against the desired situation, thus identifying the shortfalls and permitting the crafting of actions to increase the capacity needed to more effectively manage IAS in the State.

PROJECT FRAMEWORK

Scope: Review the status of aquatic IAS in St. Lucia, as well as the potential of new species to arrive and threaten aquatic biodiversity in the country. Aquatic systems encompasses fresh and salt water including marine, brackish and freshwater ecosystems such as beaches, bays, wetlands, inland swamps, lakes, rivers, streams, "gullies", drainage canals within the geographic range of the island. Assessments are not limited to alien species. All species that have or have the potential to become invasive whether as a result of introduction into new areas or changes in conditions of an existing environment are considered.

Within this study assess capacities of agencies, Government, non-Government, Community-based, donor and volunteer organizations that are either mandated or permitted to contribute to the monitoring of aquatic IAS and their impacts. Review all national and regional policies, legislative, regulatory and institutional frameworks that facilitate management and control of aquatic IAS. Through a detailed needs analysis, identify shortfalls, inadequacies, inconsistencies and weaknesses in the management framework.

Goal: Develop a draft strategy for the effective management of IAS in aquatic ecosystems in St. Lucia.

Objectives: By September 30, review all national policies, legislative instruments, and institutional structures and assess local capacities and inadequacies that affect St. Lucia's ability to minimize the presence of IAS and their adverse environmental, social, and economic impacts in aquatic ecosystems. Make recommendations for actions that build on, but are not limited to, existing local resources and frameworks.

Indicators: list of relevant policies, legal frameworks and institutions; list of management and other gaps observed, report on strategic plans and milestones proposed to improve management and control.

Strategy: The following CBD Guiding Principles for the Management of IAS will be used to help define the operational frameworks and the resources, capacities and enabling conditions needed to achieve IAS management.

Guiding Principles Towards Management of IAS

Guiding principle 1: Precautionary approach The precautionary approach in principle 1 refers to the Rio Declaration and the preamble of the CBD, which lays down that "... where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat".

Guiding principle 2: Three-stage hierarchical approach A three-stage hierarchical approach to minimize the risk and spread of invasive alien species gives preference to the prevention of their

introduction. In the event of an introduction, early detection and rapid action (e.g. eradication) are recommended. If this fails, the third stage is containment and control.

Guiding principle 3: An ecosystems approach Principle 3 recommends that measures to deal with invasive alien species should, as appropriate, be based on the ecosystem approach. This approach may be described as a strategy to protect complex and dynamic plant, animal and micro-organism communities and their non-living environment, which together interact as functional units, through integrated management of land, water and living resources (CBD, 2000).

Guiding principle 4: The role of states This guiding principle calls for states to recognize that activities within their jurisdiction or under their control, such as intentional and unintentional introductions, may pose risks to other states. Guiding principle 4 stipulates that states should take actions to minimize the spread and impact of invasive alien species. This would include the identification of invasive alien species or species that could become invasive as well as providing information on such species to other states.

Guiding principle 5: Research and Monitoring This guiding principle states that it is important for states to conduct research on and monitoring of invasive alien species in order to increase the knowledge about such species and their status in the country.

Guiding principle 6: Education and public awareness Guiding principle 6 attributes importance to public awareness in the management of invasive alien species. It recommends that states should promote education and public awareness of the causes of invasion and the risks associated with the introduction of alien species. In cases of mitigation measures, such as control or containment programmes, this should be done in a way to involve local communities and appropriate interest groups.

Guiding principle 7: Border control and quarantine measures This guiding principle recommends that states should implement border controls and quarantine measures to minimize the risks of introduction of alien species that are or could become invasive. The quarantine measures should be based on risk assessment, and existing appropriate government bodies should be strengthened as necessary to implement the measures.

Guiding principle 8: Exchange of information Provisions regarding information exchange on alien species are laid down in principle 8. It recommends the development of information systems in regard to relevant biological information on alien species as well as the dissemination of information. Information on import requirements for alien species should be made available to other states.

Guiding principle 9: Cooperation, including capacity building This guiding principle points out that a state's response to minimizing the spread and impact of invasive alien species not only may be applied internally within the country but also may require a bilateral or multilateral approach with other countries**.** Cooperative efforts may include the development of programmes to share information and the establishment of bilateral or multilateral agreements to regulate

trade in certain alien species, as well as cooperation in research and its funding. Capacity-building programmes for states that lack expertise and resources are advocated. Such programmes may involve technology transfer and the development of training programmes.

Guiding principle 10: Intentional introduction Guiding principle 10 provides recommendations regarding the intentional introduction of alien species into countries or into new ecological areas within a country. The principle recommends that such intentional introductions should take place only after they have been evaluated and authorized. A risk assessment should be part of the evaluation and the authorization should be based on the precautionary principle. Furthermore, principle 10 recommends that the burden of proof that a proposed introduction is unlikely to threaten biological diversity should be with the proponent of the introduction or be assigned as appropriate by the recipient state.

Guiding principle 11: Unintentional introduction This guiding principle recommends that every state should have in place provisions to prevent unintentional introductions of invasive alien species. Such provisions could incorporate legislative measures and the establishment or strengthening of institutions. Guiding principle 11 also mentions the most common pathways for unintentional introductions, such as agriculture, forestry, shipping or tourism. It recommends that environmental impact assessments of such activities should consider unintentional introductions of invasive alien species and that risk assessments should be carried out for these pathways, where appropriate.

Guiding principle 12: Mitigation of impacts Guiding principle 12 (as well as the three following guiding principles) deals with the mitigation of impacts once the establishment of an invasive alien species has been detected. Mitigation measures, which should be initiated at the earliest possible date, may include eradication, containment or control programmes that are safe to humans, the environment and agriculture, as well as ethically acceptable to stakeholders. Principle 12 also recommends that, consistent with national policy or legislation, an individual or entity responsible for the introduction of invasive alien species should bear the costs of control measures and biological diversity restoration where their failure to comply with the national laws and regulations is established.

Guiding principle 13: Eradication This guiding principle recommends dealing with the introduction and establishment of invasive alien species by eradication, where feasible. Eradication is best carried out in the early stages of an invasion, and community support is often essential for the success of an eradication campaign.

Guiding principle 14: Containment Containment, or limiting the spread, of alien invasive species may be an appropriate strategy where eradication is not feasible.

Guiding principle 15: Control In cases where eradication and/or containment have failed, control measures are the last step in efforts to minimize the impact of alien invasive species. Guiding principle 15 recommends that **control measures** focus on reducing the damage caused

by invasive alien species as well as reducing their number. This principle highlights the use of integrated management measures.

AQUATIC INVASIVE ALIEN SPECIES IN ST. LUCIA

Aquatic IAS in Saint Lucia and their current status

Common name	Scientific name	Status
Marine		
Sea turtle virus	*Fibropapillomatosis (FP)*	Present
Mediterranean seasgrass	*Halophila stipulacea*	Invasive in Dominica, Probably recent introduction to St. Lucia: present in Anse La Raye, Marigot and Labrelotte Bays; threat to native seagrasses
Mozambique tilapia	*Oreochromis mossambicus*	Invasive in fresh and brackish water; one of "World's Worst 100 IAS"
Macroalgae (brown, red, and green)	Phaeophyta, Rhodophyta, Chlorophyta	Present; environmental impact poorly documented
Freshwater		
Animals		
Marsh snail	*Biomphalaria glabrata*	Present; host/vector of *Schistosoma mansoni;* eradication failed, impact control by focussed molluscicide treatment following survey
Giant river prawn	*Macrobrachium rosenbergii*	Probably naturalized; introduced for aquaculture form Taiwan; invasiveness unclear
Obscure swamp eel	*Ophisternon aenigmaticum*	Naturalized; native to North America; invasiveness unclear
Mozambique tilapia	*Oreochromis mossambicus*	Invasive in fresh and brackish water; introduced for aquaculture in 1970s
Nile tilapia	*Oreochromis niloticus*	Probably naturalized with ecological impact; introduced for aquaculture in 1970s
Schistosoma parasite	*Schistosoma mansoni*	Present; eradication failed, impact control by focussed molluscicide treatment following survey
Red-eared slider	*Trachemys scripta elegans*	Escaped/released from captivity; May impact native terrapins as well as common prey
Plants		
Calathea	*Calathea lutea*	Large stands at Bexon River; potential threat to riparian habitat
Spiral ginger	*Costus scaber*	Present, potential threat to riparian habitats
Umbrella sedge	*Cyperus difformis*	Invasive of Asian origin; Detected in Cul de Sac swamp in March 2010
Water hyacinth	*Eichhornia crassipes*	Naturalized; one of "World's Worst 100 IAS"; popular ornamental clogs drainage canals
Malaysian trumpet snail	*Melanoides tuberculata*	Apparently introduced to control *Biomphalaria glabrata*; also impacting non-target species

Common name	Scientific name	Status
Woodrose	*Merremia tuberosa*	Expanding into Union River; huge vines; potential threat to riparian systems
Golden Flamboyant	*Peltophorum pterocarpum*	Few specimen in swampy spots and mangroves; potential threat to swamp forest
Java plum	*Syzygium cumini*	Common on Piaye River; potential threat to riparian systems

Pathways for Invasive Species Introduction into Aquatic Ecosystems in St. Lucia

Globalization has vastly increased long-distance travel and commerce, and highly altered waterways. These and other factors have increased the frequency by which non-native plants, animals and pathogens are introduced to new areas, sometimes with costly results. Invasive species can enter important aquatic habitats including riparian zones and wetlands by several common pathways listed below.

Aquaculture Escapes: Non-native shrimp *Macrobrachium rosenbergii* and black and silver tilapia *Oreochromis mossamicus, Oreochromis niloticus*, are examples of non-native aquaculture species that are currently in use in St. Lucia. Of these, at least one, the black tilapia, has proven to be invasive.

Aquaria Releases: Pet Shops There are a number of pet stores in St. Lucia. It is noted that several of these stores import aquarium fish, plants and other organisms to be used in aquaria. Discussion with officers from the Ministry of Agriculture confirm that no regulations exist requiring special disposal or treatment of waters used to transport fish and other imported aquatic "pet" species. Escapes or intentional release of unwanted aquarium fish, turtles, plants, shell fish, corals and sponges can be a source of new non-native species in all parts of the country. The invasive algae Caulerpa, for example, is thought to have been introduced to U.S. waterways after being discarded from aquaria.

Ballast Water: Since almost all foreign goods enter St. Lucia through its seaports, the potential for invasive species impacts on coastal communities is immense.

Boat Hulls, Fishing Gear, Scuba and water sports items: Boat hulls, fishing boots and equipment, diving gear, and other recreational items that are transported among several water bodies have been known to spread invasive species problems to new waters. Some zebra mussels and milfoil have been introduced via these pathways.

Cross-basin Connections: IAS may spread from one location to several as a result of small streams connecting to larger streams and rivers. New connections, possibly as a result of work from the Ministry of Communications and Works, between isolated water bodies have allowed the spread of many invasive species throughout the island.

Disposal of Solid Waste or Wastewater: Seeds, viable roots, larva and other reproductive stages of invasive plants and animals may be easily spread to aquatic ecosystems through wastewater discharge, or leaching from landfills, then spread by water flow to downstream areas, including coastal areas. Waste materials from vegetables, fruits, meats and even fish, that were purchased from other countries, and consumed on board yachts, may contain pathogens. Such materials, if disposed of in regular marina garbage collection bins, can be ready pathways to IAS.

Fish Bait Releases: Discarding unused bait can introduce species into new environments. These new arrivals can alter ecological parameters, thus enabling changes that can either enable the new arrivals themselves to thrive, or other species for whom competitors have been reduced or eliminated.

Illegal Stockings: The placement of species in non-native environments sometimes occurs as persons become interested in aquaculture or simply having a small fish pond on their property. Such introductions can be devastating to other species if the introduced species has the capacity to not only survive but thrive, in the new environment. In St. Lucia, it is suspected that aquarium fish are released into inland ponds in the hope that they may reproduce freely. It is also known that tilapia are often released into weed or mosquito infested ponds and lakes to help manage the infestations.

Intentional Introductions*:* The introduction of non-indigenous species into aquatic ecosystems with few controls on reproduction or distribution. In St. Lucia, this occurs when persons attempt to stock small garden ponds and rivers with species obtained from pet shops, illegal imports, purchases from persons on yachts. Non-indigenous species may also be officially imported into the country for aquaculture and mariculture purposes, for biological control of weeds and other invasive plants. In the 1990s for example, the importation of grass carps into St. Lucia for control of aquatic weeds in ponds was being considered. The fish would consume the weeds and then themselves be sold as fish food. However, further investigation showed that the species had become a serious pest in the United States where it had escaped from the aquaculture ponds and begun to thrive in southern waterways, consuming all vegetation and thus wiping out other species that were less competitive.

Live Food Industry: As St. Lucia's tourism continues to grow, the diversity of restaurants increases. Currently, there are a number of 5 star restaurants that specialize in live food displays. The import of live, exotic seafoods can be a source of entry of micro-organism into the country. Without the proper controls, aquatic IAS can enter the environment via waste water from kitchens and drains when species are cleaned or the aquaria water is changed.

Moving and Depositing Fill in Wetlands: Seeds and viable parts of invasive plants contained in fill material may rapidly colonize the new substrate, which then compete with native species within the wetlands.

Pathogens Spread by Non-natives to Vulnerable Native Species: Non-native species may sometimes host pathogens that do not pose a threat to them. However when the species arrives in a new environment, the pathogens come in contact with other hosts who may not themselves be resistant. The concern for the spread of disease is justified especially in tropical aquatic ecosystems where transmission of pathogens occurs at a high rate.

Science/laboratory Escapes, Disposals or Introductions: Accidental or intentional release of laboratory specimens may introduce some non-native species into aquatic systems.

Seafood Packing and Disposal: Much seafood is packed in seaweed prior to distribution. Because seafood is transported long distances, organisms in packing seaweed may reach new waters as an unintended by-product.

Why are Aquatic IAS of Concern to Saint Lucia?

IAS can seriously impact on the economy (agriculture and fisheries) of a country, especially islands. Invasive species can damage fish stocks, affect public health and safety by changing quality of water for drinking and industry, and, by impacting on our marine resources, harm coastal communities that rely on fishing, and tourism, that relies on beaches for recreation.

Alien species that invade aquatic ecosystems and establish thriving communities, can either destroy native species, or lead to their decline. In altering the diversity of a river, lake or coastal water, IAS can impair public use and enjoyment of waterways, lead to the development of disease either to humans or aquatic wildlife, reduce the resilience of the aquatic systems to floods, climate change, disease infestation, drought. A few examples are described below:

Fisheries IAS are successful primarily because local environmental conditions meet the ecological needs of the species, whilst predators and competitors may be absent or in reduced numbers. Under these conditions, newly arrived species may be able to successfully establish themselves and may also pose a risk to native species as they compete with them for space and food. Where IAS compete in aquatic systems native fish species can be affected. In coastal areas, IAS can have devastating impacts on the local fishery. Non-native fish may compete or prey on local fish, significantly reducing populations and causing a fall in the commercial fish landings. Invasive sea grasses may overrun reefs and other breeding grounds, destroying nursery areas and impairing the production of food. IAS can also lead to changes in predator-prey structures such that species that were once harmless to the commercially important species may become a threat due to increased numbers. Invading weeds may also impair fishing activities as they clog river mouths, impair visibility along the reefs, foul fish pots / traps, and lead to entanglement of fishing lines and other fishing gear. Weeds may also clog the engines of fisheries boats. In 2009, fish landings were reported to be 1,695.33 metric tonnes, valued at EC$21.7 million, 1% of the island's GDP (CRFM). Introduction of IAS into the marine environment is likely to

significantly affect fish production or in the least, increase the cost of fishing as more effort may be required to achieve the same levels of production.

Pathogens: The impact of disease organisms that may lead to a reduction in fish or plant productivity will invariably reduce the economic returns from fishing. Pathogens are likely to attack either the species that comprise the target fishery or they will affect food source or nursery grounds. In some instances predators may be affected but the result is often that new species, which previously did not threaten the fishery, are given the opportunity to increase and replace the former predators. In either event, the arrival of an invasive pathogen into the marine environment is expected to adversely affect fisheries production.

Agriculture Water quality and quantity can readily be impaired by weed infestations in rivers and streams. Such infestations can become a serious problem in dams which supply water to agriculture plots and aquaculture facilities.

Aquaculture This is a growing industry in St. Lucia. Currently there are 45 farms, comprising a total of 9.7 hectares of land under fish and shrimp cultivation. The success of aquaculture ventures relies on the farmer having complete control of the species growing in the pond. The presence of unwanted fish and weeds must be controlled at all times as these will compete with the target crop for space, food and nutrients. Currently the shrimp and fish farmers have to invest significantly to control unwanted weeds and fish that invade the ponds. However current techniques allow them to maintain sufficient control to limit adverse impacts. Introduction of new potential aquaculture pests into St. Lucia's rivers may increase management costs sufficiently to make this struggling industry uneconomic.

Tourism A significant part of St. Lucia's economy is dependent on "beach" tourism. In 2009, from January to December, a total of 278,491 foreign visitors came to the island to enjoy the beaches either for swimming, scuba-diving, or yachting, representing significant economic returns to the country. IAS in the marine ecosystems can be problematic to the tourism industry: Aquatic weeds can release toxins into water leading to the burning of eyes during bathing, the itching of skin and attraction of aquatic ants. Aquatic weeds also make sea bathing uncomfortable and they lead to entanglement of bathers' limbs, trap mud and invertebrates and reduce visibility. In most instances of infestation, sea bathers choose to move elsewhere in such of more pleasant locations for bathing.

Aquatic weeds also infest reefs making them less attractive to scuba-divers and snorkelers as fish and other points of interest become less visible. Swimming is also hampered by the weeds. Eventually, the infesting vegetation impacts on the density and diversity of species on the reef, reducing the overall beauty and attraction of the reef.

The presence of weeds in rivers and streams can also affect the country's local economy by impairing the free flow of rivers and thus affecting the availability and quality of water available for human consumption. The tourism industry is heavily dependent on local water supplies for use in bathrooms, pools and food services.

Invasive fish: The marine ecosystem is a unique balance between fish, marine mammals, invertebrates, encrusting organisms, and aquatic vegetation. The change in this balance to any major extent will lead to an imbalance where one or more species experience changes in abundance at the expense of others. This change in population structure is often first observed along the breeding areas such as reefs and sea grasses, exactly the places where tourists and other sea bathers often visit. If the invading species happens to be a top predator, significant reductions in diversity on St. Lucia's top scuba and snorkel hotspots is likely to occur thus making the island less attractive to visitors.

Public Health Amongst St. Lucia' better known invasive species is Schistosoma parasite, *Schistosoma mansoni,* which is responsible for the disease Schistosomiasis, better known as bilhazia. Schistosomiasis is caused by parasitic flatworms, called schistosomes. *Schistosoma mansoni, Schistosoma japonicum,* and *Schistosoma haematobium* cause illness in humans. The worms live in fresh water in the tropics. To infect humans, the worms must first infect and mature in freshwater snails, which are their "intermediate hosts." Work to eradicate this parasite in St. Lucia has been ongoing for more than 20 years. Bilhazia is reported to be no longer a serious problem in the country, but this is only after years of effort to eradicate the disease causing snails.

Aquatic plants and animals can also become a health risk if they carry pathogenic microbes, or if they secrete toxins or other chemicals that threaten human health. Predator fish that invade river systems and multiply may also threaten the lives of users. Another well known health threat attributed to invasive aquatic species is dengue fever or xxx. This life threatening viral disease is caused by the *Aedes Aegypti* mosquito, a species believed to have originated in Africa but which has become widespread throughout all tropical regions. This aquatic invasive has caused hundreds of deaths worldwide and has lead to the expense of millions of dollars to treat the sickness, halt infections and epidemics and to eradicate it.

RecreationRiver bathing, beach picnics, sport fishing are popular recreation activities in St. Lucia. These activities can be affected as a result of IAS.

2. Assessment of St. Lucia's Capacity to Manage IAS

STRATEGIES AND FRAMEWORKS

FOR EFFECTIVE IAS MANAGEMENT FOR AQUATIC ECOSYSTEMS

It is recommended that any National Invasive Species Strategy (NISS) should encompass 4 programme elements or pillars:

1. **Prevention of Introduction**
2. **Early Detection And Rapid Response**
3. **Eradication And Or Containment**
4. **Impact Mitigation**

Under each pillar, certain key elements are expected to be in place for the management of IAS.

In general, for effective **Prevention** the following, defined and or enabled under national and regional policies and regulations and or institutional frameworks are expected to be in place:

- Regulated imports of non-native fauna and flora.
- Inspectors at all sea and air ports who are equipped with information on species and relevant items approved and banned from entry into the country, are familiar with IAS issues and current alerts, trained in species identification, and quarantine procedures.
- Information materials on IAS threats, and mechanisms to mitigate impacts, posted at all ports.
- Agencies mandated to implement laws pertaining to monitoring imports at air and sea ports.
- Management of ballast water from ships
- Regulations requiring the cleaning of boats and fishing gear and the disposal of materials that are removed during the cleaning process.
- Regulations stipulating the careful collection and disinfection of fouling and encrusting organisms from the hull, keel, fishing gear, and anchors of ships.
- Prevention of the dumping of garbage and sewerage from yachts and other pleasure craft into coastal waters.
- Treatment of all waste materials from yachts and other craft to ensure destruction of possible infesting organisms, prior to disposal in public landfills.
- Information on IAS publicly displayed at all air and sea ports in order to garner support and compliance to rules, from travelers, fishers, importers and the general public.
- A national IAS focal point and regional information exchange system.
- Mechanisms enabling the efficient and regular exchange of information between all relevant stakeholders.
- An electronic database for the uploading of information by focal points in the various agencies.

- Regulation and monitoring of the importation of exotic fish, plants, snails and reptiles for the aquarium and horticultural trades.
- In-depth risk analyses regularly undertaken prior to importation of exotic fish, shrimp and fish food, for aquaculture.
- A precautionary approach taken towards the importation of non-native aquaculture species.
- The importation and exportation of wild species of flora and fauna only via risk assessment and with relevant trade permits, including CITES, Health, etc.
- Emergency response plans in place defining procedures to address deliberate and or accidental introduction of aquatic IAS.
- Port and harbour management as it relates to water quality.
- Legislation requiring port and harbour development plans to incorporate appropriate waste disposal facilities.
- Waste disposal facilities at major sea ports such as Rodney Bay Marina.

For effective **Early Detection and Rapid Response** the following, defined and or enabled under national and regional policies and regulations and or institutional frameworks, are proposed:

- Enabled stakeholder monitoring and reporting via television and radio.
- Comprehensive water quality monitoring programmes.
- Local dive operators include an "unknown species" category in their dive log books and provide the Dept. of Fisheries with this data as soon as possible.
- Information materials on local aquatic species available in schools, and other public places, to increase student familiarity with local biodiversity.
- Information on popular aquatic IAS developed and in circulation via popular media.
- Environmental Education programmes in schools, which incorporate the teaching of aquatic species conservation, from primary to tertiary levels.
- IAS hotlines at the Ministry of Agriculture and Ministry of Health.
- Television and radio programs on early detection of IAS of current concern.
- Improved capacity of laboratory services to conduct water quality analysis, micro biological assessments, and other relevant aquatic surveys.
- Guidelines including a check list for the public with regards to actions to be taken when IAS are detected.

For effective **Mitigation of Impacts, Eradication and Containment,** the following, defined and or enabled under national and regional policies and regulations and or institutional frameworks are proposed:

- Effective and comprehensive legislative and institutional frameworks for hazard mitigation.
- Strengthened capacity of water monitoring and resource regulatory agencies.

- Improved capacity of the Dept. Of Fisheries to monitor and conduct research at critical off-shore sites including fragile coral reefs, commercially important sea grass beds, turtle nesting beaches, marine reserves, dive sites, mangrove areas and fishing grounds.
- Maintained and enhanced coastal and fresh water resources and ecosystems, ensuring resilience and compliance with all relevant national, regional and international standards.
- Empowered local community groups, institutions and individuals to undertake hazard mitigation measures.
- One or more national and regional invasive species task forces with a special arm or unit trained to address threats to aquatic ecosystems.
- Incorporation of hazard mitigation measures in all public and private sector inland water and coastal zone development planning initiatives and programme budgets.
- Routine research which help establish baselines, eradication procedures, monitoring programmes, and criteria to assess degree of success.
- National participation at regional symposia or workshops geared towards identifying, testing and evaluating technologies for eradication and or containment of aquatic IAS.
- Enabled building of capacity in local and regional bodies (Ministries of Health, Fisheries and Forestry; CEHI) to commence eradication procedures.
- Regional initiatives designed to strengthen scientific knowledge on eradication of IAS and their impacts.
- Environmental agreements that outline actions to address water-borne invasive species threats to ecosystems.
- Training within tertiary education institutions to advance scientific research related to aquatic ecosystem management.
- Protection of wetlands, critical mangrove, sea grass, coral reefs and watersheds from unsustainable exploitation.
- Rehabilitation and restoration of declining or damaged coral reefs, mangroves areas, waterfalls, watersheds, river mouths, wetlands, bays, seagrass beds, fishing grounds.

NATIONAL POLICIES, LEGAL AND INSTITUTIONAL FRAMEWORKS

Whilst the previous section presents a “wish-list” of the instruments and structures that should be in place to effectively manage aquatic IAS in St. Lucia, the following presents the current situation, the various legal and institutional mechanisms that serve as management opportunities and enabling conditions. In this way, gaps, inconsistencies, and conflicts in relation to aquatic IAS management can be determined and addressed within a NISS (National Invasive Species Strategy).

National Policies and Agreements

There are a number of policies that are relevant to this stage in the management of IAS. These policies include:

Agriculture Policy In pursuit of its agricultural diversification goals, the Government of St Lucia in 2002 identified a number of targets and measures including a 10 % reduction in the food trade deficit by 2005; increasing the consumption of local production, non-banana agricultural exports; expanding agro industry; and a 20% increased utilization of locally-produced agricultural commodities by the tourism sector. Further, in 2003 the Government of St Lucia refined its agricultural policy within the Agricultural Policy Framework proposed for the OECS. The measures reflected a three-pronged strategy: (i) Enhancing resource competitiveness of the banana industry (ii) Developing a diversified agricultural sector and (iii) Catalyzing the socio-economic transformation of the rural communities. In this regard, a comprehensive list of strategies was formulated to help foster growth and modernization of the agricultural sector. These included:

- Identification and development of alternative sources of income generating activities
- Reduction of the dependence on a single crop for foreign exchange earnings
- Exploration and exploitation of niche markets for non-traditional products
- Optimization of employment opportunities in the sector
- Increase in private-sector investment in agricultural sector activities
- Development of a sector with a dynamic and proactive agricultural trade system
- Improvement of agriculture-related infrastructure
- Generation, adaptation and transfer of appropriate agricultural technologies
- Development of measures to improve natural resource management***.

Biodiversity Policy In short, this focuses on the protection of the island's biological diversity. According the National Biodiversity Strategy and Action Plan of St. Lucia 2000, the vision for the future of St. Lucia's biological diversity includes the following e*l*ements: (those relecvant to IAS Management are marked ***)

- The status of biological resources is known, the people of St. Lucia and visitors to the island are all aware of the value and importance of these resources, and respect for biodiversity is integrated within the nation's culture;***
- Governmental agencies, non-governmental organizations, the private sector and communities are conscious, active and responsible participants in the management of biodiversity, and the concerns for the management of biodiversity are taken into account within policy-making processes at all levels;***
- The integrity of the country's biological diversity is maintained and, whenever possible, restored;***
- Biodiversity contributes optimally, through sustainable uses, to the social, economic and cultural development of the country, and to the physical**,** spiritual, and psychological well-being of all its people;***
- National, regional and international efforts aimed at conserving biological diversity are consistent, mutually-supportive, and effective.***

Coastal Zone Management Policy The objectives of this policy are to:

- Maintain the integrity and productivity of the coastal zone and resources therein.
- Optimize the contribution of the coastal zone to social and economic development through the sustainable use of resources and the equitable sharing of benefits.
- Harmonize uses of the coastal zone and provide a framework for the management and resolution of resource use conflicts.

Education Policy This was developed in 2008. The goal of this policy is to guide the development and administration of national environmental education in Saint Lucia so that all Saint Lucians are equipped with the knowledge and skills required to contribute meaningfully to the sound environmental management and sustainable development of Saint Lucia. There are a number of priorities described within the policy document. Amongst these are several that are relevant to the management of IAS:

- Place environmental education high on agenda of key and other agencies
- Integrate environmental education skills into broad skills base of the country
- Make public agencies more aware of their role in environmental education
- Make environmental education more accessible to key agencies and the rest of the general public.

Fisheries Policy The Fisheries sector is one that will most likely be impacted by aquatic IAS**.** This is true not only from the point of view of the ecosystem impacts but also, and to an equally important extent, as a result of economic, social and cultural consequences. A review of the Draft Revised Fisheries Management Plan (awaiting endorsement), indicates that the overall objectives for the sector are a reflection of this. Fisheries policy currently gives priority not only to the protection of the industry but also to the protection of the resource base on which the industry relies. Hence, whilst IAS are not given specific attention within the draft management plan, it is noted (***) that proposed management priorities strongly overlap with those relevant to IAS management in the marine ecosystem:

The general objectives under the draft fisheries management plan are:

- develop the fishing industry in terms of modernization of fisheries infrastructure, fishing vessels and the use of improved fishing gear and methods;
- promote self sufficiency through increased marine and aquaculture production;***
- advance the social and economic status of fishers and their families;*** and
- improve the nutrition of the nation through the provision of increased volumes of fish.

Specific fisheries management objectives are to:

- maintain or restore populations of marine species,***
- preserve rare or fragile ecosystems and habitats and other ecologically sensitive areas, especially coral reef ecosystems, estuaries, mangroves, sea grass beds, and other spawning and nursery areas;***
- protect and restore endangered marine and freshwater species;***
- promote selective fishing gear and practices and prevent the use of destructive gear and methods;
- factor traditional knowledge and interests of coastal communities and artisanal fisheries into fisheries management;
- ensure effective monitoring and enforcement of fishing and other marine resource uses;
- promote relevant scientific research;***
- take into account traditional knowledge and interests of local communities, small-scale artisanal fisheries and indigenous people in development and management.
- develop and increase the potential of living marine resources to meet human nutritional needs, as well as social, cultural, economic and development goals in a manner that would ensure sustainable use of the resources.***
- ensure effective monitoring and enforcement with respect to fishing and other aquatic resource uses***
- ensure integrated planning and a collaborative approach in terms of policies for the sector, fisheries and coastal zone management;*** and
- cooperate with other nations in the management of shared, straddling and highly migratory stocks.***

National Climate Change Adaptation Policy The Aim of this policy is to foster and guide a national process of addressing the short, medium and long term effects of climate change in a co-ordinated, holistic and participatory manner in order to ensure that, to the greatest extent possible, the quality of life of the people of St. Lucia, and opportunities for sustainable development are not compromised. Climate change events can significantly impact marine and freshwater ecosystems. Some potential impacts include changes in reef biodiversity as a result of increased water temperatures, changes in predator-prey structures as certain species are affected in different ways altering the ecological balance; changes in water quality as chemical composition of gases and other minerals are altered, and as a result of all these changes, shifts in population densities of the fauna and flora that live in or are associated with these ecosystems. An important consideration therefore is that as a result of climate change events many species may either increase or decrease their capacity to thrive and compete for food and space. Climate change impacts are therefore important considerations when conducting risk assessments, and identifying eradication, impact mitigation and containment protocols for aquatic IAS.

National Environmental Policy (NEP) and National Environmental Management Strategy (NEMS) National Environment Policy (NEP) and National Environmental Management Strategy

of Saint Lucia (NEMS). The development of these documents were approved by the Cabinet of Ministers in St. Lucia in 2004, with the aim of improving environmental management and policy frameworks for the island. These documents are also produced as part of Saint Lucia's obligation to the St. George's Declaration of Principles for Environmental Sustainability in the OECS. The NEP sets out a broad framework for environmental management establishing links with all other relevant policies. It is hoped that the NEP will guide the development of comprehensive environmental legislation for the island. The NEMS defines specific actions and mechanisms which will enable the implementation of the NEP.

National Hazard Mitigation Policy Hazard analysis and experience have confirmed that Saint Lucia is at risk from natural, technological (man-made) and "slow onset" hazards. Some of the natural disasters given consideration include hurricanes, flooding, landslides, seismic and volcanic activity. The man-made hazards noted are dam collapse, explosions, oil and hazardous material spills, mass casualty, civil unrest, fires and information and communication technology disruptions. Additionally, the island is considered to be at risk to "*slow on-set"* hazards that include droughts, plagues, and the predicted effects of global climate change.

The following guiding principles are listed as being fundamental in underpinning the Hazard Mitigation Policy:

- Hazard risk management integrated in development planning
- Minimizing risks to the environment***
- Fostering stakeholder participation, collaboration and integrity***
- Promoting public awareness and capacity building***
- Making available hazard information and data***
- Recognizing that hazard mitigation is an investment in sustainable development***

National Health Policy The main objective of the National Health Policy of the Ministry of Health (MOH) for June 1993 to July 2003 was to maintain and upgrade the number of human resources present and future. Currently, the National Health Policy covers health personnel, revenue collection, technology use, population growth, vulnerable and at-risk groups, substance abuse, workers' health, environmental issues, HIV/AIDS, community participation.

Organization of the health sector: Various departments within the MOH are responsible for the implementation of health programs such as health education, environmental health, preventive services, hospital and curative services.

Quality of the environmental: The monitoring of water quality is the responsibility of the Environmental Health Branch. The Pesticide Control Board is responsible for the registration and licensing of pesticides. The Ministry of Planning is response for physical development and the environment.

Organization and function of health care services of populations: The Environmental Health Branch is a department within the MOH responsible for the delivery of environmental health services including food and water safety, vector control and sanitation services. The Water and Sewerage Authority is responsible for the collection, storage and distribution of potable water.

Tourism Policy There is a draft National Tourism Policy (2003). One of the main objectives in this policy is to establish tourism as a strategic economic development priority by ensuring it receives primary consideration when allocating financial, technical and physical resources. Its ultimate goal is to ensure benefits generated by tourism are as widely distributed as possible throughout the nation and among local communities (Ministry of Tourism 2003: p. 5).

Relevant International Conventions, Agreements and Protocols

There are a number of environmental conventions that address the prevention of introduction of IAS. Specific actions are defined which address risk analyses, pathways, border control, regulate international movement of biological organisms, monitoring and protection of vulnerable populations and ecosystems, communications and education towards public awareness to alter activities that are in conflict with IAS control.

St. Lucia is signatory to a number of these Conventions including:

- ✓ Cartegena Convention
- ✓ Cartegena Protocol on Bio-safety
- ✓ CBD, Convention on Biological Diversity;
- ✓ CITES, the Convention on the International Trade in Endangered Species of Wild Fauna and Flora
- ✓ Cartegena Convention, Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region; including the Protocol on Specially Protected Areas and Wildlife, SPAW
- ✓ UNCLOS, Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea Relating to the Conservation and Management of Straddling Stocks and Highly Migratory Fish Stocks; St. Lucia ratified this Convention in 1985.
- ✓ MARPOL Protocol (not yet signed but proposed), or International Convention for the Prevention of Marine Pollution from Ships.

Cartagena Convention The 1987 Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region – known as the Cartagena Convention – is the only legally binding environmental treaty for governing marine debris in the Wider Caribbean. The Convention is supplemented by the Oil Spills Protocol, the SPAW Protocol and the LBS Protocol. The Convention and its Protocols constitute a legal commitment by participating governments to protect, develop, and manage their common waters individually or jointly. It requires adopting measures to prevent, reduce, and control pollution from ships, dumping, seabed activities, land-based activities, and airborne pollution. Ratified by 20 countries, the Convention governs the marine environments of the Gulf of Mexico, the Caribbean Sea, and certain areas of the Atlantic Ocean (UNEP, 2005).

The objective of the SPAW Protocol, which entered into force on 18 June 2000, is to protect rare and fragile ecosystems and habitats, thereby protecting the endangered and threatened species residing therein. The Caribbean Regional Co-ordinating Unit pursues this objective by assisting with the establishment and proper management of protected areas, by promoting sustainable management (and use) of species to prevent their endangerment and by providing assistance to the governments of the region in conserving their coastal ecosystems.

Cartagena Protocol on Biosafety The Biosafety Protocol protects biological diversity from impacts of genetically modified or living modified organisms. Such species are the products of modern biotechnology and may pose serious risks to local species. The protocol encourages countries to take the precautionary principle with regards to determining whether or not to permit the import of certain LMOs or GMOs. Where there is insufficient evidence that a genetically altered organism may not be harmful to other species a country has the right to take actions to safeguard natural populations. St. Lucia ratified this protocol in 2005.

Convention on Biological Diversity Simply put, the goal is the protection of biological diversity. 2010 goal: Achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth.

This Biodiversity Convention is an international, legally binding treaty which strives towards:

1. conservation of biological diversity;
2. sustainable use of its components; and
3. fair and equitable sharing of benefits arising from genetic resources

The convention gives significant attention to mechanisms that ensure sustainable development. It covers management of globally endangered species, biosafety issues, it promotes local community involvement in conservation and information sharing via production of national reports. The Convention on Biological Diversity and its members (there are 191 Parties, as of October 2008) recognize that there is an urgent need to address the impact of invasive alien species. Article 8(h) of the CBD states that, "Each contracting Party shall, as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species". The CBD sets global priorities, guidelines, collects information and helps to coordinate international action on invasive alien species. The CBD has adopted guidance on prevention, introduction and mitigation of impacts of alien species that threaten ecosystems, habitats or species, which can be accessed on the CBD website (Decision VI 23). The website also provides further information on invasive species and relevant decisions of the Conference of the Parties to the CBD.

Convention on the International Trade in Endangered Species of Wild Fauna and Flora CITES works by subjecting international trade of selected species to certain controls. The species covered by CITES are species considered to be at risk of extinction as a result of international

trade. Often these species are not native to the destination countries and so requiring CITES trade permits does enable some restricted access to be placed on a selected group of flora and fauna.

Whilst this convention is not designed to monitor and manage invasive alien species, it does require the issuing of special import and export permits for species listed in its Appendices, and which are being moved from one country to the next. Recognizing that international trade is the primary pathway for movement of alien species into new areas, and that, as a result of such entries, species may become invasive, CITES has made provisions in its articles to address IAS:

CONSIDERING that alien species can pose significant threats to biodiversity, and that species of fauna and flora in commercial trade are likely to be introduced to new habitat as a result of international trade;
RECALLING Decisions 10.54, 10.76 and 10.86 adopted by the Conference of the Parties at its 10th meeting (Harare, 1997);
THE CONFERENCE OF THE PARTIES TO THE CONVENTION RECOMMENDS that the Parties:
a) consider the problems of invasive species when developing national legislation and regulations that deal with the trade in live animals or plants;
b) consult with the Management Authority of a proposed country of import, when possible and when applicable, when considering exports of potentially invasive species, to determine whether there are domestic measures regulating such imports; and
c) consider the opportunities for synergy between CITES and the Convention on Biological Diversity (CBD) and explore appropriate cooperation and collaboration between the two Conventions on the issue of introductions of alien species that are potentially invasive.

The International Plant Protection Convention (IPPC) This is an international plant health agreement, established in 1952, that aims to protect cultivated and wild plants by preventing the introduction and spread of pests. The IPPC allows countries to analyze risks to their national plant resources and to use science-based measures to safeguard their cultivated and wild plants. By protecting plant resources from pests and diseases, the IPPC helps:

- protect farmers from economically devastating pest and disease outbreaks;
- protect the environment from loss of species diversity;***
- protect ecosystems from loss of viability and function as a result of pest invasions***;
- protect industries and consumers from the costs of pest control or eradication.***

Contracting parties to the IPPC share the same goal: *to protect the world's cultivated and natural plant resources from the spread and introduction of plant pests while minimizing interference with the international movement of goods and people.*

The IPPC also provides information exchange related to import and export requirements, *pest status* and regulated pest lists provided by each member country.

The MARPOL Protocol The entire convention deals with the effort to prevent harmful aquatic organisms from being transferred through ballast water and sediments. This is the main international convention that covers and sets out protocols to manage and control marine pollution from ships, including the release of oil, chemicals, harmful substances, sewage and garbage. Under this protocol, the release of ballast water from ships in territorial waters is specifically addressed. St. Lucia, if and or when it becomes a party to the convention is required to undertake measures to ensure the provision of facilities at ports and terminals for the reception of garbage. More than 50% of St. Lucia's imports arrive on ships. These ships often need to fill their ballasts tanks with water to help balance the ship when travelling below maximum capacity. Micro- and macro-organisms, both plants and animals, can easily be transported from one region to the next via ballast water, creating opportunities for the introduction of IAS.

The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes. Those of relevance to IAS are marked by ***.

Annex I	Regulations for the Prevention of Pollution by Oil
Annex II	Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk
Annex III	Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form***
Annex IV	Prevention of Pollution by Sewage from Ships***
Annex V	Prevention of Pollution by Garbage from Ships***
Annex VI	Prevention of Air Pollution from Ships (entry into force 19 May 2005)***

States Parties must accept Annexes I and II, but the other Annexes are voluntary. With regards to aquatic IAS, Annexes IV and VI are relevant. Parties must prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments. The parties may take more stringent measures with respect to the prevention, reduction or elimination of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments, consistent with international law.***

The United Nations Convention on the Law of the Sea (UNCLOS) This comprises 320 articles and nine annexes, governing all aspects of ocean space, such as delimitation, environmental control, marine scientific research, economic and commercial activities, transfer of technology and the settlement of disputes relating to ocean matters. Article 196 (1) of the Convention states that: *"States shall take all measures necessary to prevent, reduce and control pollution of the marine environment resulting from the use of technologies under their jurisdiction or control, or the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes thereto."*

Part XII of the Convention (articles 192 - 237) addresses Protection and Preservation of the Marine Environment and gives basic obligations to prevent, reduce and control pollution from

land-based sources; pollution from sea-bed activities subject to national jurisdiction; pollution from activities in the Area; pollution by dumping; pollution from vessels; and pollution from or through the atmosphere (articles 207 - 212). These specific articles provide an important foundation for support of IAS control. In meeting its obligations under UNCLOS, St. Lucia can significantly monitor and manage the introduction of foreign matter into its territorial waters.

Legal Instruments: National Laws and Regulations

Animals (Disease and Importation) Ordinance (Amendment) Act (1994) This Act is implemented by the Veterinary Services of the Ministry of Agriculture, Forestry and Fisheries and controls the movement of animals including fish, birds, bovine, canine, equine etc from areas infested with notifiable diseases to non-infested areas.

Biodiversity Conservation and Sustainable Use (BCSU) Bill 2008 This bill represents the national legislative framework towards the implementation of the Convention on Biological Diversity. The bill will also enable the national action towards the conservation and sustainable use of biological resources and other conservation related matters.

Of all the sections of this legislation, Part III is of most significance to the management and control of IAS. This section provides the framework for the management of biological resources. It is divided into four divisions. This Part of the Bill seeks to give effect to Articles 6-11 of the Convention on Biological Diversity. In Division 1, clauses 14-16 provide for the preparation and implementation of a national biodiversity policy, strategy and plan of action. Under Division 2, by virtue of Clause 17, the Minister has the power to publish a list of species that are endangered, may become endangered or which need to be controlled to meet conservation objectives. Clause 18 provides for the preparation of a recovery plan for each species listed under Clause 17. The Minister by virtue of Clause 19 may also publish a list of activities that are prohibited from being carried out in respect of any species listed under Clause 17. Clauses 20 -22 prohibit a person from taking a listed species, from importing or voluntarily introducing non-indigenous species into native ecosystems or re-introducing indigenous and threatened species into an ecosystem unless that person is the holder of a valid permit issued by the designated officer. Offences and penalties are created in respect of contraventions of Clauses 20-22.

CITES Management Act (in draft) This legislation is not yet passed but it is designed to enable effective implementation of the CITES Convention in St. Lucia. As such, it gives priority to the monitoring and regulation of all importation and exportation of wild flora and fauna. The draft legislation requires the acquisition of relevant permits CITES and national trade permits prior to transboundary movement of animals and plants. The draft Act also restricts movement, into the country, of species that are believed to be potentially harmful to local biological diversity. Under the Act the Minister of Agriculture has power to implement stricter controls than those required under the Convention. The Minister can therefore control not only the movement of species listed on the CITES Appendices but any others that may be considered a threat to biological diversity as a result of trade.

Control of Importation of Live Fish Act 1952 The Control of Importation of Live Fish Act prohibits the importation of non-indigenous fish species without a license and makes provisions for penalties and destruction of fish.

Disaster Management Act No. 30 of 2006 (replaced the Disaster Preparedness and Response Act, No. 13, 2000) This provides for a more effective organization of the mitigation of, preparedness for, response to and recovery from emergencies and disasters. Under this Act the Director of the National Emergency Management Organization, NEMO, shall, in consultation with the National Emergency Management Advisory Committee, NEMAC, prepare a National Emergency and Disaster Response Plan to be approved by the Minister. The National Emergency and Disaster Response Plan shall include procedures for mitigation of, response to and recovery from emergencies and disasters by public officers, Ministries and Departments of Government, statutory bodies, local government units, and persons or organization volunteer or are required by law to perform functions related to the mitigation of, preparedness for response to and recovery from emergencies and disaster in Saint Lucia.

This piece of legislation can be important in the case of an outbreak of disease as a result of marine and or freshwater borne pathogens, including those associated with aquatic worms, snails, insects.

Under the existing regulations, the National Disaster Response Plan shall include --

- Procedures related to disaster preparedness and response of public officers, Ministries and Departments of Government, statutory bodies, local government units, and persons or organizations who volunteer or are required by law to perform functions related to the mitigation of, preparedness for, response to and recovery from emergencies and disasters in Saint Lucia.
- Procedures for coordinating the national disaster response plan and its implementation Procedures for informing persons in Saint Lucia and elsewhere of the existence of a threatened disaster alert or the existence of a disaster emergency;
- Procedures for preparing and maintaining inventories of services, systems and supplies for the mitigation of, preparedness for, response to and recovery from emergencies and disasters during a threatened disaster alert or the existence of a disaster emergency;
- Procedures for mobilizing services and systems for the mitigation of, preparedness for, response to and recovery from emergencies and disasters during a threatened disaster alert

The Director of NEMO shall consult the National Emergency Management Advisory Committee in the preparation of the National Disaster Response Plan.

Other Plans:

- Hazard Mitigation Plan
- Hurricane Response Plan
- Earthquake Response Plan
- Volcanic Eruption Response Plan
- Oil Spill Contingency Plan
- Stress Management Response Plan
- Emergency Shelter
- Medical Waste and other Bio-Hazardous Wastes Management Response
- Relief Distribution
- Telecommunication
- Transportation Plan
- Evacuation Procedures
- Maritime Search and Rescue
- Emergency Response Plan for the Homeless
- National Influenza Plan

Education Act No. 41 of 1999 Mission Statement: To provide equity of access, increased opportunity and quality service in the areas of education, human resource development, youth and sports for the continuous development of the people of St Lucia.

Priorities

1. Establishing a service orientation to the essential clients served by the Ministry: the school, youth groups, sports persons, public and private sector, NGOs;
2. Strengthening the human resource capacity of the Ministry in order to effectively realize its mission;
3. Provision of increased access to basic, continuing and higher education, to youth services and sporting opportunities;
4. Ensuring quality improvement in educational provision, human resource management, youth and sports programming.

Major Goals/Objectives

(1) Articulate, formulate, implement and administer education policies geared towards human resource development in Saint Lucia;

(2) Ensure access and deliver quality education to all students from early childhood to adult levels;

(3) Ensure effective staff management and utilization for efficient operation of the education system;

(4) Develop, review and modify curriculum materials to respond to socio-economic and technological changes in the society;

(5) Establish and administer minimum standards examinations to evaluate instructional programmes;

(6) Encourage and foster appreciation and pride for our national and cultural values and norms.

Fisheries Act, No. 10 of 1984 and Fisheries Regulations No. 9 of 1994

These are general regulations that apply to Fishing in St. Lucia. Those that are likely to contribute to management and control of IAS have been listed with ***.

- It is illegal for a non-national to fish in Saint Lucia waters without a permit from the Department of Fisheries.
- It is illegal to conduct any marine research in Saint Lucia without permission from the Department of Fisheries.
- It is required that all fishing vessels be registered and licensed with the Department of Fisheries.
- These vessels should have their registration number clearly printed in the dimensions stipulated by the Department of Fisheries.
- Vessels wishing to carry out sport or recreational fishing in St. Lucia waters need to apply for permission from the Department of Fisheries***.
- Anyone wishing to set up a Scuba dive facility in Saint Lucia needs to apply for a permit from the Department of Fisheries.
- Any non-national wishing to dive in St. Lucian waters, needs to do so through a local dive operation, that is, it is illegal for a non-national to dive without a licensed dive leader.
- Anyone wishing to set up a fish-processing establishment in Saint Lucia needs to apply for a license from the Department of Fisheries.
- If someone wishes to export or import fish they need to apply for permission from the Department of Fisheries. ***
- It is illegal to harm, give, receive from any one, or at any time have, expose for sale sell or buy: Undersized lobsters (carapace length less than 9.5 cm); Lobsters carrying eggs; Molting lobsters, that is lobsters changing their skin (Note: Lobsters are very soft to the touch when molting).
- It is illegal to spear fish lobsters.
- It is illegal to remove eggs from lobsters.
- The open season for the lobster fishery extends from 01st September to 30th April of each year. It illegal, therefore, to fish for lobster before or after this time.
- In 1996 a moratorium was declared for the turtles and all their products. That is, it is illegal to fish, sell, own, receive or buy turtle or turtle products.
- It is illegal to take from Saint Lucia waters, sell, own, receive or buy any coral, sponges or marine algae.
- It is illegal to fish for sea urchins without a permit from the Department of Fisheries. It is illegal to hunt for whales/dolphins in enclosed bays and harbors.

- It is illegal to fish for juvenile conch, (conch without a flared lip). If you need to take conch or its products out of Saint Lucia, contact the Department of Fisheries for the relevant permit.
- It is illegal to take from Saint Lucia's rivers, sell, receive or buy freshwater shrimp, locally known as "river crayfish".
- It is illegal to disturb fishing activities. However, if a fish "pot" or other type of fishing gear is observed in a marine reserve or any other illegal fishing activity is noted, please contact and inform the Department of Fisheries.
- It is illegal to use a spear gun without permission from the Department of Fisheries. Please note that spear fishing is reserved for local commercial fishermen, that is recreational spear fishing is illegal.
- It is illegal for someone or a company to put any poison or other pollutant into rivers or the marine waters of Saint Lucia. ***
- Some areas have been declared marine reserves to protect fish nursery and spawning grounds. In order to enter such an area, one needs to get permission from the Dept of Fisheries. In the case of Soufriere, permission can be sought from the Soufriere Marine Management Area Office. ***
- Any person who contravenes or fails to comply with any of these regulations shall be liable to a fine up to five thousand dollars***

Note: All these laws are designed to protect Saint Lucia's marine environment and to ensure that these resources are always available for present and future generations.

Forest laws *The Wildlife Protection Act No. 9 of 1980*

This Act is under the control of the Forestry Department of the Ministry of Agriculture, Forestry and Fisheries and provides for the protection, conservation and management of wildlife in St. Lucia. Under this Act it is illegal to:-

- Hunt, capture, buy, sell import/export, or keep captive any wildlife unless authorized by the Forestry and Land Department.
- Attempt to trade in anyway whatsoever eggs, young, or any part belonging to wildlife and protected wildlife.
- Destroy or damage nest of protected wildlife.
- All Forest Officers are Wildlife Protection Officers and, therefore, are empowered to enforce the provisions under the Wildlife Protection Act. All offences committed under this Act carry a maximum penalty of one year imprisonment or maximum fine of EC $5,000.00 on summary conviction.

The Forest, Soil and Water Conservation Ordinance 1946 / 1983

Under this ordinance it is illegal to:-

- Enter a Forest Reserve or Protected Forest without the expressed permission of the Forestry Department.
- To injure, cut, fell, convert, remove, or harvest any tree or parts) thereof unless granted approved permission by the Forestry Department on Forest Reserves and in Protected Forest.
- Occupy Forest Reserves and Protected Forest for cultivation, Squatting, pasturing livestock and other activities.
- Be in possession, or operate chainsaw(s), axe(s), without the permission of the Forestry Department.
- The Ordinance (Amended Act) also makes provisions for random search and seizure by Forest Officers.

Plant Protection Act #21 of 1988 Plant pests are regulated under this Act which is implemented by the Crop Protection and Quarantine Unit of the Ministry of Agriculture, Forestry and Fisheries. It controls the entry and spread of exotic pests and diseases into St. Lucia. Whilst management of IAS are not specifically addressed, it does place significant regulations on the entry of plants into the country, and in so doing helps contribute to prevention and early detection of invasive species. The Plant Protection Board was established under this Act to advise on matters pertaining to plant health and quarantine. This Unit is assisted by the Customs and Excise Department, the Agriculture Extension Division and other agricultural institutions.

Public Health Act 1975 This Act falls under the administration of the Environment and Public Health Sections of the Ministry of Health. The Act provides for the control of disease causing organisms or vectors. In this manner the Act enables actions for prevention of introduction of IAS. There are specific regulations that are relevant to IAS although at no time is the management and control of IAS specifically mentioned. The following specifically enable actions for border control, risk analysis and waste management at air and sea ports.

The Act makes provisions for the:

- prevention, treatment, limitation and suppression of disease;***
- institution of measures for ensuring the purity of the water supply;***
- management of sewers and sewage disposal works;***
- collection, removal and sanitary disposal of rubbish, night soil and other offensive matter;***
- control and destruction of mosquitoes termites and other insects, rodents and other vermin;***
- inspection and maintaining of sanitary conditions of beaches and swimming pools in the interest of the public health.***

Shipping (Marine Pollution) Act 1994 Currently, SLASPA operates under the Shipping (Marine Pollution) Act 1994. The main purpose of this Act is to provide the State with powers and

jurisdiction towards the prevention of marine pollution and other related issues. The Act seeks to do this through the adoption of several international marine pollution conventions. The legislation provides for the powers, jurisdiction and responsibilities of the (Country) Maritime Administration with regard to the prevention of marine pollution under UNCLOS. **Part III - Intervention On The High Seas** details the Administration's powers and duties with regard to the prevention of marine pollution under the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties. **Part IV - Dumping Waste At Sea***** makes provision for the Maritime Administration's powers and duties with regard to waste disposal at sea under the Convention of the Prevention of Pollution by Dumping of Wastes and Other Matter 1996. **Part V - Prevention Of Pollution From Ships***** details the Administration's jurisdiction, powers, obligations and duties with regard to the prevention of marine pollution under the International Convention for the Prevention of Pollution from Ships (1973) as amended by the Protocol of 1978 (MARPOL 73/78).

Under No. 11 of this Act, a Maritime Affairs Unit has been established and is responsible for licensing ships and the management of marine pollution. There is also a Maritime Areas ACT, Chapter 1.16, which also addresses management of the marine environment.

Waste Management Act No. 8 of 2004 The key function of this legislation is to provide for the management of waste in conformity with best environmental practices and to provide for matters incidental thereto.

The law requires a national emergency plan in conformity with the requirements of the National Disaster Preparedness Plan under the Disaster Preparedness Act No. 13 of 2000 or any enactment replacing it. The plan will establish standards, requirements and procedures for the management of all waste, including the generation, handling, storage, treatment, transport and disposal of all types of waste, requirements and procedures for monitoring and enforcement standards for the construction or operation of waste management facilities or equipment; outline measures for effective training of staff involved in solid waste management and effective public education and awareness regarding solid waste management.

The National Waste Management Strategy shall, amongst other things, establish standards and procedures to be implemented in the identification of methods by which hazardous and bio-medical wastes and other specified classes of solid waste substances are to be managed; identify methods by which solid waste is to be transported in such a way that it does not present a threat to human health, safety or the environment; establish standards and procedures for the location of waste disposal sites and plants. Finally, the Waste Management Act shall, amongst other things, establish standards and procedures for the safe removal, and disposal of litter; classify, for the purpose of waste management, premises from which waste is generated; classify, for the purposes of disposal and treatment, different types of waste; establish targets for the reduction of waste to be achieved and commencement dates.

Water & Sewage Act No. 14 of 2005 Division 3 Emergencies Section 10-1 Where on the advice of the agency the Minister is satisfied that by reason of an exceptional shortage of rain, or contamination of water, a serious deficiency of supplies of water exists or is threatened, the Minister shall forthwith, by Order published in the Gazette, in at least two newspapers in the general weekly circulation in Saint Lucia and by any other media declare a water-related emergency …

Institutional Framework

This section provides a review of the various agencies responsible for Border Control, Risk Analysis, Documentation, Detection, Rapid Response, Mitigation and Control.

Caribbean Environmental Health Institute (CEHI) CEHI was set up in 1982, as a project, in response to the need seen by the Region's Ministers of Health to address in an organized manner, the environmental health concerns of the people of the English-speaking Caribbean. In 1989 the Institute became a legal entity (with the deposit of the Instrument of Ratification of the CEHI Agreement by Member Governments).

The objectives of CEHI are described below. (Those actions that have relevance to IAS control have been noted ***)

- Provide technical and advisory services to its members in all areas of environmental management, including water supplies, liquid waste and excreta disposal, solid waste management, water resource management, coastal zone management including beach pollution***, air pollution, occupational health, vector control***, agricultural pollution and pesticide control, disaster prevention and preparedness***, natural resource conservation***, environmental institution development*** and socio-economic aspects of environmental management ***
- Prepare and keep inventories of education and training programmes (especially those in related disciplines), regional experts and other related human resources
- Promote and collaborate in the planning and programming of symposia, workshops, and on-the job training in member states***
- Conduct courses, seminars, symposia and other workshops at either the institute or other selected regional institutions ***
- Arrange and accept grants for financing scholarships and fellowships to facilitate the training of nationals of member states***
- Act as a regional reference centre for the collection and dissemination of technical and scientific information, and a focal point for various environmental monitoring networks for the collection and dissemination of environmental data, especially health-related, in the Region***
- Promote and coordinate applied research relevant to the environmental problems of the region as identified by member states ***
- Estimate the provision of engineering, public health laboratory and other related environmental services for member states in accordance with their desires***

- Promote uniformity in professional practices, design, standards and technical methods in programmes formulated for the improvement of environmental health and environmental management; ***and
- Promote activities which assist in implementing the environmental health strategy ***

In pursuit of these objectives, CEHI provides a wide range of environmental and environmental health services and products to both the private and public sector. The member countries of CEHI are Anguilla, Antigua and Barbuda, The Bahamas, Barbados, Belize, British Virgin Islands, Dominica, Grenada, Guyana, Jamaica, Montserrat, St Kitts and Nevis, Saint Lucia, St Vincent and the Grenadines, Trinidad and Tobago and Turks and Caicos.

CEHI is headquartered in Saint Lucia and is headed by an Executive Director. Current assessment of the institution suggests that CEHI may have resources to support mitigation and control of aquatic IAS. However, there is no specific mandate for the institution to give special focus on early detection. Some level of public awareness may be possible under its broader mandate of environmental education. There is no specific officer assigned to address IAS matters. Laboratory services exist but may need to be upgraded depending on the species being targeted. Currently CEHI is equipped with a full service analytical laboratory providing drinking and recreational water analysis, industrial and sewage effluent testing, heavy metal testing and pesticide residue analysis. The target matrices include:

- Water
- Wastewater
- Soil / Sediments
- Fatty food
- Non-fatty food
- Fruits / Vegetables
- Other manufactured products

Coastal Zone Management Unit (CZMU) In January, 2005, the CZM unit was established within the Sustainable Development Section of the Ministry of Physical, Development Environment and Housing. The role of this unit is to:

- Serve as the Secretariat of the Coastal Zone Management Advisory Committee (CZMAC) responsible for, amongst other things, proposing and formulating coastal zone related policies.
- Provide technical input and advice to relevant planning and management agencies on matters pertaining to coastal development and management.
- Collect, manage and disseminate data and other information on coastal resources, issues and processes.
- Create and enhance public awareness of coastal zone management issues and programmes.
- Conduct selected programmes and activities directly relevant to coastal zone management and development.

Ministry of Agriculture: Department of Fisheries The DOF is another important organization in St. Lucia with regards to prevention of entry of marine IAS. In general, the primary role of this organization is to promote self-sufficiency through increased production of Marine and Aquaculture products, and to develop the fishing industry and implement measures to ensure its sustainability.

Management of fisheries in Saint Lucia has undergone significant changes over the past 15 years. The St. Lucian fisheries fleet now consists of 690 vessels operated by 2,319 fishermen, of whom 40 percent operate on a part-time basis. Less than half of the larger vessels are the traditional wooden craft (canoes), with the open fibreglass *pirogue* now the dominant craft within the industry. In addition, a number of small, locally owned and operated longlining vessels (greater than 12 m in length) have recently entered the fleet. The majority of canoes and pirogues are powered by outboard engines. Most of these are in the range of 40 - 115 hp. Longliners have inboard engines. Engine capacity is increasing to reflect changes in vessel carrying capacity.

Inland fisheries: There are no inland fisheries of commercial importance. A traditional fishery for local freshwater shrimp, commonly called "crayfish" remains closed at present due to resource decline. Location and main landing places Fish landings occur at 17 coastal communities, with the largest proportion of the catch being landed at the town of Vieux Fort, the village of Dennery and the town of Gros-Islet. Some of the key priorities for Fisheries are presented below and those which can support IAS management are demarcated ***

- Modernization of the fisheries infrastructure and fishing vessels;
- The use of improved fishing gear and methods;
- Regulation of fishing gear;
- Protection of marine biodiversity;***
- Regulation of other marine based activities so as to mitigate negative impacts on the fishery sector*** and ensure the overall educational advancement of fishers;***
- Development of appropriate fresh water and marine aquaculture programs***

Ministry of Agriculture: Department of Forestry This is the principle agency responsible for managing forest and wildlife resources on the island of St. Lucia. It does so through legislative authority granted by the following statutes: Forest, Soil, and Water Conservation (1964/1983) / Wildlife Protection Act 1980. The objectives of the department and the basic principles of current policy seeks to advance the areas of Forest Reservation (13% of the island), Natural Resource Management*** Utilization, Environmental Education, Wildlife Conservation***, Co-Management, Research, Recreation, Aesthetics, and Forest Extension. Through systematic management and educational interventions, St. Lucia has been able to recognize these multi-dimensional values.

Ministry of Agriculture: Plant Protection Unit This unit falls under the Research Division of the Ministry of Agriculture, Forestry and Fisheries. There staff comprise of a senior crop protection officer (CPO), two (2) crop protection officers and four (4) crop protection assistants (CPA). There are also extension officers who operate in the south and south west of the island. There are 7 ports of entry on the island. Of these, the 2 main ones, located near the capital city, Rodney Bay marina and George FL Charles airport are visited twice daily by CPO's. The other ports are visited for inspection of traded goods on request of the Customs officials. The role of the Plant Protection Officers and Assistants is to inspect plants and plant materials that are being imported or exported. Officers also ensure that all materials entering the island have the required import

permits and phytosanitary certificates. All materials that do not have the correct documents are detained by the Customs for inspection by the CPA.

Ministry of Agriculture: Veterinary Division This Division is especially important in preventing the entry of pathogens associated with the importation of animals. Diseased animals can be a major pathway for IAS entering the country. Waste generated by diseased animals may leach pathogens into the aquatic environment. In St. Lucia, an important border control agency is the Veterinary Division. Veterinary officers have the final say with regards to approval for entry of pets. Officers must work closely with the Customs Office, the Ministry of Trade and Industry who issue import permits, and the Ports Police. In St. Lucia, the veterinary Officer is assigned to the air and sea ports and conducts routine inspections of all animals, including fish. Fish inspections are conducted with assistance from the Department of Fisheries. All animals must be inspected, whether they enter for permanent stay or are in transit.

In general, the following rule applies as observed on an online notification http://www.miasl.org/petguide.doc

Guidelines for Travelers Arriving by Sea

The entry of animals and animal products via yachts/boats represents one of the high risk areas for the introduction of exotic pests and diseases into St. Lucia. The major ports of entry are the Rodney Bay Marina and Marigot Bay. The Veterinary and Livestock Services Division of the Ministry of Agriculture, Forestry and Fisheries would like to inform yachters of the following guidelines when traveling with pets.

Only animals for which a Veterinary Import Permit has been granted will be allowed to leave the vessel. Hence prior to arrival in St. Lucia pet owners with the intentions of leaving the vessel with their pets, will need to apply for an Import Permit. Application forms are available at the Division. Animals without permits shall remain on board the vessel for the entire stay of the vessel at the port of entry.

Ministry of Education Based on the National Education Policy and legislation, the Ministry has defined for itself a programme of operation as follows: The vision: A literate, informed, creative and productive society. The Mission: We seek to optimize and sustain economic development and quality of life by creating a functional individual that is accepting of civic responsibility and empowered to compete in a global environment.

Finally, the Ministry proposes to achieve its targets by *providing quality education for all and fostering an enriched culture through research, legislation, policies, a comprehensive development plan and support services.* The structure of the Ministry of Education is as follows:

- *Organizational/ Institutional Capacity and Management*
- *Rich and Vibrant Arts and Culture*
- *Science, Technology, Information, Research and Communication*

National Emergency Management Advisory Committee There shall be a National Emergency Management Advisory Committee comprising the Prime Minister as ex officio Chairman; a Minister or public officer nominated by the Prime Minister to serve as Chairman in the absence of the Prime Minister from any meeting; such other members as may be nominated by the Prime Minister to represent --
the police force;
the Special Service Unit;
the Fire Service;
the Ministry responsible for public health;
the Ministry responsible for the environment;
the Ministry responsible for public works;
the Ministry responsible for local government;
such other Ministries, Departments of Government and statutory bodies as the Prime Minister thinks fit; such other persons or organizations as the Prime Minister thinks fit who volunteer or are required by law to perform functions related to the mitigation of, preparedness for, response to and recovery from emergencies and disasters in Saint Lucia.

National Emergency Management Organization The role of the National Emergency Management Organisation [NEMO] is to develop, test and implement adequate measures to protect the population of Saint Lucia from the physical, social, environmental and economic effects of both natural and man-made disasters.

Its responsibility is to ensure the efficient functioning of preparedness, prevention, mitigation and response actions.

Sea Ports: Marinas Sea ports can be important pathways for the entry of IAS. Understanding some of the rules and regulations in place at the St. Lucia Marinas is important to developing an image of the effectiveness of the sites in the control of the introduction of invasive species. The following rules were obtained off the internet for the Rodney Bay Marina. Those of specific relevance to IAS management are noted as follows: ***

Marina Rules

Dear Marina Customer:

Welcome to Rodney Bay Marina. To make your stay with us more enjoyable, the following set of guidelines should be followed. These are merely suggested rules of etiquette and regulations to make the Marina and its facilities more enjoyable for all customers. This web site contains details of the various facilities and services available throughout the marina and shopping center complex. Thank you for observing these guidelines.

1. Do not leave garbage on the docks to be picked up. Garbage should be bagged and tied and then properly placed in designated receptacles, or be placed in the garbage truck. Not loosely scattered or abandoned.***

2. Oils and fuels should be disposed of properly at the Boat Yard and not in Marina trash can. Please ask for assistance when disposing of oils, fuels, or chemicals at the Boat Yard. Your concern for the environment helps.

3. Try not to introduce any effluents into the Marina Lagoon. Use holding tanks if possible. This will become a St. Lucian law in the near future.***

4. Do not attempt to turn on your own water and electricity. Please have a dock attendant do it so that you can be properly metered in and out. Using pliers or screwdriver will damage the equipment and you will be charged. It is suggested that you read meters along with our dock attendant to ensure accuracy in your metered charges for utilities.

5. Anyone caught taking water from another yacht's tap shall be responsible for the entire water cost of the metered yacht, Please use your own water.

6. Keep power cords and water hoses in a neat and orderly fashion so that no one will trip in the dark or while carrying objects.

7. Please wash sails on lawn areas where water outlets and drying spaces are available, or do it aboard your yacht.***

8. When marking anchor chains with paint, use paper or cardboard beneath your chain to keep wet paint off the docks and other customers' shoes.

9. When cleaning dinghies, make sure you rinse debris and growth off of the docks when finished.***
10. Lock your boat when leaving it unattended.

11. Lock your dinghies and outboard at night, especially Friday nights.

12. Try to keep excessive noises down after 10 pm, some people do need their rest.

13. Boat repairs being performed at the docks should probably not include grinding and/or power sanding.

14. Barbecue and cooking on the docks is prohibited. Barbecue and cooking should be done on board in suitable equipment and self contained. Any other way is dangerous and frowned upon. Kindly clean up after yourself when finished. Charcoal ash and debris are not to be disposed of into the lagoon.

15. When docking, keep bowsprits and davits over water's edge and not protruding across the docks.

16. If bright deck lights or spot lights are to be used at night, avoid pointing them at nearby boats, especially down or into their cabins.

17. Try to control your pets. Some people do get upset by animals, especially when nature calls on their boat.***

Your co-operation is greatly appreciated. Have a pleasant stay.

It is to be noted here that based on the above notice:

1. Effluents from yachts are allowed to be introduced into the marina.
2. No instructions are given on disposal of animal wastes.
3. Garbage from ships go to special bins but they are then collected by the SLWMU and brought to the landfill like all other garbage.
4. Bottom encrusting organisms on dingies are removed and introduced into the marina without inspection and or disinfection.

Soufriere Marine Management Area The Soufriere Marine Management Area (SMMA) was established in 1994 following an 18-month long process of participatory planning, which resulted in the creation of an institutional and technical framework for the management of the area's coastal resources and the conflicts provoked by the diverse use of these resources. The final agreement on the SMMA was the creation of a marine management area comprising 11 km of coastline and the adjacent marine area, to include marine reserves, fishing priority areas, multiple use areas, recreational areas and yacht moorings. The users include fishers (pot, line and seine), yachtspersons, recreational divers, and the wider community for other recreational purposes. The management institutions include the Department of Fisheries, which, through the Fisheries Act of 1984 is authorized to establish and manage Fishing Priority Areas and Marine Reserves; Soufriere Regional Development Foundation (SRDF) a community-based organization, to which power has been devolved from Government for the purpose, among others, of developing and managing the coastal area of the town; and the Soufriere Marine Management Association (SMMA), which is responsible for coordinating management activities and guiding the formulation of a comprehensive management plan.

St. Lucia Air and Sea Ports Authority (SLASPA)In St. Lucia, the management and control of the release of ballast water from ships is under the control of the St. Lucia Air and Sea Ports Authority, SLASPA, which was established by an Act of Parliament in 1983. The primary role of this organization is to manage air and sea-borne traffic and contribute to the sustainable, social and economic development of Saint Lucia.

SLASPA is responsible for running the island's two principal seaports, Castries and Vieux Fort**,** and the George FL Charles and Hewanorra International Airports**,** as well as the smaller points of entry: Soufriere**,** Marigot and Rodney Bay Marina**.**

Under Shipping Act No. 11, 1994 SLASPA established and houses a Maritime Affairs Unit, for the purpose of the licensing of ships, matters relating to the safety of crew at sea and for matters incidental thereto. At each of the 3 main sea ports and 2 airports, SLASPA has a post from which it monitors the movement of boats entering and leaving the country. SLASPA officials are

responsible for ensuring that all ships comply with the national regulations pertaining to the management of ship-generated waste.

The St. Lucia Solid Waste Management Authority This organization is responsible for coordinating and integrating systems for the collection, treatment and disposal of the island's solid waste. The Authority and the Ministry of Planning have developed a National Solid Waste Disposal strategy plan for St. Lucia. Key components to the management of solid waste in St. Lucia include the following. Those relevant to management of IAS are indicated by ***:

- Improve capacity and effectiveness of domestic solid waste collection and disposal facilities; ***
- Reduce pollution of territorial waters;***
- Improve the collection, treatment and disposal of ship-generated solid wastes;***
- Assist the beneficiary countries in establishing appropriate legal and institutional frameworks to enable effective management and disposal of solid waste;***

Deglos Sanitary Landfill

As leaching of materials from waste into land runoff can severely impact on aquatic ecosystems, landfills can potentially be important pathways for the spread of IAS within the country. In addition, landfills can also become a pathway for the introduction of IAS from untreated materials removed from waste bins from sea ports and originating off pleasure craft.

Considering that solid waste generated by yachts and other ships in St. Lucia eventually ends up at the Delos Landfill, one must enquire "Is the St. Lucia facility effective in preventing contamination of groundwater by solid waste?"

Introduction: The Deglos Sanitary Landfill is an engineered landfill located southeast of Castries between the Deglos Junction to the south and the community of Trois Piton to the north. Operations at the Deglos Sanitary Landfill commenced in March 2003. The landfill occupies approximately nine hectares of land and was designed to allow acceptance of waste for a twenty-year period. The landfill accepts waste from Gros-Islet in the north to Bouton in the south west and Dennery in the east.

The operations of the Deglos Sanitary Landfill

Storm Water Management Area: Storm water management is critical if flooding and the resulting destruction of site property is to be avoided. It consists of the two year ditch, five year ditch, twenty year ditch and balancing pond. *Leachate Collection Area***:** The leachate collection area is located beneath the tipping or working area. It includes underground perforated pipes at the centre and perimeter of the landfill. The system is so designed to allow the extension of the pipes as the landfill extends. The underground pipes are entrenched in granular material and wrapped into geo-membrane material. An additional three feet layer of granular material sits over the entrenched pipes and throughout the base of the tipping area. The underground perforated pipes lead to a sump. At the sump leachate is pumped out and discharged from the

collection area to the treatment area. *Treatment Area*: At the treatment area all leachate undergoes aerobic treatment. Through the process of aeration air is circulated through the leachate to facilitate the breakdown of organic matter, reduce pathogens and transform nutrients. Aeration creates a highly oxygenated environment for bacteria which facilitates treatment. At the end of the treatment process water quality testing is undertaken. If satisfactory, leachate is discharged to the Cul de Sac River. In the event of unsatisfactory results leachate can be re-circulated back into the landfill and treatment is undertaken until results are satisfactory. *Biomedical Waste Management Facility*: All biomedical waste is treated through the process of autoclaving. Autoclaving involves the treatment of waste under high temperature (160 degrees Celsius) and high pressure (6 bars). During the one hour process, waste is treated at high temperature and shredded by the machine. At the end of the operation the treated biomedical waste is disposed of at the landfill in demarcated cells. *Hazardous Waste***:** Hazardous waste is not accepted at the Deglos Sanitary Landfill since hazardous material could cause damage to liners located at the base of the landfill. Additionally, hazardous waste could contaminate groundwater. Producers of hazardous waste are instead encouraged to divert all hazardous waste out of St. Lucia.

The Water Resources Management Agency (WRMA) The Water Resources Management Agency (WRMA) seeks to enable the sustainability of economic growth, human development and the environment by promoting and facilitating the efficient and effective use and management of water resources in Saint Lucia. This was established by the promulgation of the Water and Sewerage Act No. 14 of 2005. It was formalized and became functional three years later towards the end of 2008.

In order to achieve its objective, the WRMA undertakes the monitoring of water quality and quantity, promotion and coordination of research on water issues as they surface, sustenance and provision of assessments of weather, climate and hydrological data, assurance of the accuracy and integrity of primary data on the state of water resources, including maintenance of the recording instruments and finally evaluation of the total economic value of these resources as including watersheds. Specific functions include: (those relevant to management of IAS are indicted ***)

- Consider applications for abstraction licenses and permits for use of water in control areas and permits for waste discharge.
- Promote the sustainability of water resources.***
- Undertake water resources assessment and planning including surveying, monitoring, research and development.***
- Develop watershed management plans and facilitating regulation accordingly.
- Undertake the preparation of water master plans and allocation schemes.***
- Advise the Minister in relation to water control areas and waste control areas.***
- Advise the Minister in relation to water related emergencies.***

GAPS AND INADEQUACIES

On the very positive side: There are several policy, legislative, regulatory and institutional instruments in place that focus on biodiversity conservation, waste water and solid waste management, import control, and disaster management. These structures provide a very strong foundation for the development of a national strategy for the control and management of IAS in aquatic ecosystems in the country. It is only necessary to address a few administrative, legal and institutional gaps under the various management pillars.

Prevention

1. Waste or effluent from yachts is poorly regulated at the sea ports.
2. Fouling and encrusting organisms from boat hulls are inadequately managed. There are no controls to prevent such vectors of disease or IAS from being scraped off hulls and dumped in inshore, or from being transported directly to the local landfill without prior disinfection.
3. Aquarium pet trade inadequately controlled: a) checklist of approved aquarium fish does not exist; b) inspectors at ports inadequately trained to identify fish species being imported; c) no regulations or guidelines in place to govern the disposal of water in which aquarium fish and freshwater turtles are imported; d) improper disposal of waste water from aquarium trade: *staff from two pet stores admitted that water in which aquarium fish and turtles are transported is often untreated and simply emptied down a drain without disinfection;* e) occasionally, there are unintentional introductions during importation: an interview with one pet shop attendant revealed that sometimes "stow-aways", in this case, small snails, are found in their fish imports.
4. Aquarium fish and turtles are often lost by their owners.
5. No regulations exist and no monitoring occurs of the disposal of fecal matter from pets on board yachts.
6. No information on IAS available at sea ports.
7. No regulations in place requiring disinfection of fish tackle from recreation boats from foreign waters to use in local waters.
8. Absence of sanitary facilities for disposal of waste from holding tanks from pleasure craft, at the newly renovated Rodney Bay Marina.

Early Detection and Rapid Response

1. Absence of an IAS lead agency and or hotline where reports may be made by the public.
2. Inadequate information on potential aquatic IAS. (Ideally this information should be circulated to all stakeholders such as interests groups, government agencies and general public).
3. No rapid response disaster preparedness plan for (aquatic) IAS.

Eradication and Containment

In the absence of an IAS disaster response plan for aquatic ecosystems, no guidelines exist for the mobilization of agencies, human resources, tools and technologies. There is also no assessment of agency skills and needs to address eradication and containment of IAS crisis in aquatic ecosystems such as disease outbreaks in freshwater fish, aquatic birds, reptiles and frogs; coral reef die offs, establishment of invasive sea weeds and grasses, changes in fish abundances in rivers and or marine systems as a result of aquaculture or aquarium pet escapes.

Indicators and baselines need to be identified to measure degree of success of eradication and containment.

Impact Mitigation

No disaster plan developed for impacts as a result of IAS in aquatic ecosystems (invasive weeds leading to fish suffocation; water borne infections due to the presence on alien microbes, fouling in coral reefs from invasive weeds or other organisms, presence of invasive sea grasses and weeds that over run local species or affect popular beaches and fish nursery grounds, fouling fish traps, etc.).

Indicators need to be determined to measure degree of success of impact mitigation.

3. Strategic Interventions for IAS Management: Aquatic Ecosystems

A Strategic Plan to address the Management of Aquatic Ecosystems in St. Lucia should build on existing political, legal and institutional frameworks in order to maximize current investments. Only where gaps, inadequacies, inconsistencies are encountered should new investments in management be undertaken.

The following strategic interventions are proposed based on the detailed review conducted in the previous chapter.

STRATEGY 1: PREVENTION

Strategic Objective 1: Minimize all opportunities for entrance of aquatic IAS into St. Lucia.

Strategic Intervention / Actions 1: Manage and control the unintentional and intentional entry of aquatic based invasive species, utilizing principles and regulatory instruments that address pollution from ships, fisheries, importation of aquatic pets and culture organisms, natural marine migrations, and storm events.

Important Milestones	**Primary Policy Instruments**	**Key Laws & Regulations**	**Institutions**	**Gaps/ Challenges Recommendations**
Risk analysis of all imports of fauna, flora, and potential vectors.	Biodiversity Fisheries, Environment, CITES, SPAW, Biosafety Protocol	Customs Act, Plant Protection Act 1988; BCSU Bill 2008	MAFF (Fisheries & Forestry), SMMA;	Insufficient knowledge available on species and impacts./ Develop check list of priority invasive species for regulatory action.
Relevant convention signed and capacity to manage ballast water from ships being acquired.	Cartegena Convention; CBD; MARPOL ; UNCLOS	Shipping (marine pollution) Act 1994	SLASPA is present at all sea ports	Signing of the MARPOL Convention should occur very soon
Release of fouling organisms from boats, scuba gear, fishing tackle regulated	Cartegena Convention; CBD; MARPOL	Shipping (marine pollution) Act 1994; UNCLOS, Fisheries Act 1984 & Regs.1994	SLASPA is present at all sea ports.	No controls in place to prevent introduction of fouling organisms into marinas. / Signing of the MARPOL Convention pending.
Intentional introductions:	CBD, Fisheries, CITES, SPAW,	Plant Protection Act 1988; The	Fisheries Dept.	IAS have been introduced for

Important Milestones	Primary Policy Instruments	Key Laws & Regulations	Institutions	Gaps/ Challenges Recommendations
aquaculture halted.	Biosafety Protocol	Animals (Disease and Importation) Act 1994		aquaculture and agriculture. /National policies on such introductions needed.
Risk analysis to mitigate unintentional introductions: aquaria, live food industry intensified.	Fisheries, Biodiversity, Environment, MARPOL, IPPC	Plant Protection Act 1988; Fisheries Act 1984,Regs.1994	Fisheries Dept. conducts risk assessments and monitors all introductions.	Stricter regulations on import of aquarium fish and invertebrates.
Application of fees and appropriate facilities to manage solid wastes from yachts and cruise ships.	National Waste Management Strategy, MARPOL	Waste Management Act 2004; Shipping Act 1994	SLWMU, SLASPA	Wastes are brought untreated to landfill. / Marinas to disinfect or incinerate wastes from yachts.
Disposal of animal wastes on intransit crafts elaborated and enforced.	Biodiversity policy; public health,	Shipping Act 1994; Waste Management Act 2004; Animal Ordinance Act 1994	Veterinary Division, SWMU, MOH	Waste not treated prior to disposal at landfill. / Introduce stricter measures in the handling of solid wastes (organic matter) from yachts.
Action plan to address floods and natural marine migrations in place.	Coastal Zone, Hazard mitigation	Water and Sewage Act 2005, Fisheries Act 1984 & Regs.1994	NEMO, MOH, Fisheries Dept.	Incorporate potential movement of IS into Flood Management Plans
Risk analyses prior to movement of earth in wetlands obligatory.	Agriculture, Water policy,	Water and Sewage Act 2005	Forestry Dept., CEHI, MOH	Conduct risk analysis prior to land movement.
Communications to travelers on national regulations on IAS prevention widespread.	Biodiversity, Environment, Public health,	Most of the St. Lucia laws make provisions for information sharing.	SLASPA, MAFF, MOH	Little to no information to travelers on aquatic IAS.

STRATEGY 2: EARLY DETECTION AND RAPID RESPONSE

Strategic Objective 2: Increase capacity of all interest groups to identify potential IAS and their impacts. Strengthen capacity of relevant agencies to respond immediately to invasions and their impacts.

Strategic Intervention 2**:** Conduct public awareness and education programmes to raise awareness of aquatic IAS, improve monitoring, research and analytic capacities of laboratories in St. Lucia. Develop guidelines and establish mechanisms to aid responsible citizens in reporting the presence of foreign species and their impacts. Ensure the presence of an IAS Rapid Response Plan involving all relevant agencies. Establish mitigation protocols for all known aquatic IAS in the region and for those likely to become a problem (considered to be high risk.)

Important Milestones	**Primary Policy Instruments**	**Key Laws & Regulations**	**Institutions**	**Gaps/ Challenges Recommendations**
Risk analysis on all reported invasions.	CZM, Fisheries NCCADP, CBD, UNCLOS,	BCSU Bill 2008	CZM Unit, SMMA, Fisheries Dept.	Mandates exist. / Capacities need to be developed. Lead agency to be identified.
Communications: mechanisms for regional exchanges on IAS defined and ongoing.	NHM, Public Health,	Disaster Management Act 2006	NEMO, MOH, MAFF	National communications plan needed/ Lead agency to be identified.
Communications: public awareness programme in place.	Education, CZM, Fisheries, Public Health, IPPC, CBD	Education Act 1999, Fisheries Act 1984 & Regs.1994, BCSU Bill 2008,	MAFF; MOH, Veterinary Division, Plant Propagation, SMMA	Limited information to guide public participation in circulation./ Public generally ignorant of issues. /
IAS focal point defined and functioning.	IPPC, CBD, Biodiversity,	BCSU Bill 2008,	MAFF, MOH	No IAS focal point in any agency. /IAS hotline needed.
Coastal and inland aquatic ecosystems monitored and reports available.	Biodiversity, Fisheries, Coastal Zone, Environment, Hazard mitigation	Fisheries Act 1984 & Regs.1994, Public Health Act 1975,	MOH, Fisheries Dept., CZM	Local capacity for research and response may be inadequate.
Early response	National Hazard	Disaster	NEMO and	IAS Mitigation

Important Milestones	Primary Policy Instruments	Key Laws & Regulations	Institutions	Gaps/ Challenges Recommendations
mechanisms in plan in place.	Disaster Plan	Management Act 2006	other agencies within the NEMAC	Plan should be developed. /IAS hotline established either at MOH or MAFF.

STRATEGY 3: ERADICATION AND OR CONTAINMENT

Strategic Objective 3: Establish mechanisms to enable eradiation and or containment of aquatic IAS in order to safeguard human health, sustain local economies and social structures.

Strategic Intervention 3: Develop an IAS Eradication and Containment Action Plan for Freshwater and Marine Ecosystems based on integration of sound science, human and institutional resources, local infrastructure, and which ensures maintenance of ecosystem functions. Where eradication is not an option, mobilize agencies to implement measures to halt the spread of the pest and mitigate impacts.

Important Milestones	Primary Policy Instruments	Key Laws & Regulations	Institutions	Gaps/ Challenges Recommendations
Species and ecosystems baselines in place	CBD, Biodiversity, Fisheries, CZM, SPAW	Fisheries Act 1984 & Regs.1994,	MAFF, CEHI, SMMA	Develop maps of priority ecosystems and habitats at risk by invasive species
Eradication protocol(s) and actions to evaluate success	CZM, Biodiversity, Fisheries, Health,	Public Health Act 1975, Fisheries Act 1984 & Regs.1994,	NEMO, NEMAC, Fisheries Dept., CEHI, CZM	A management plan to address aquatic IAS and impacts is advised.
Resource mobilization plan for IAS disaster developed	National Hazard Mitigation.	Disaster Management Act 2006	NEMO, NEMAC, Police, Fisheries Dept.; MOH, CZM	Disaster plan for aquatic IAS needs to be developed.
Communications and information exchanges ongoing	National Hazard Mitigation.	Disaster Management Act 2006	NEMO	Implied but not specifically addressed in several other policies and laws.
Regional co-operation agreements in	Biodiversity policy, IPPC,	Implied but not specifically addressed	Implied but not specifically addressed	This will require a single focal point to head the process.

Important Milestones	Primary Policy Instruments	Key Laws & Regulations	Institutions	Gaps/ Challenges Recommendations
place				
Capacity building of response teams ongoing	Biodiversity, IPPC	BCSU Bill 2008	NEMO, Fisheries Dept.	Several agencies are given the mandate to act but lack the necessary resources.
Role of various sectors elaborated	National Hazard Mitigation.	Disaster Management Act 2006	NEMO	A national disaster mitigation committee, headed by NEMO already exists.
Long-term monitoring of impacted sites in place	Fisheries, CZM	BCSU Bill 2008	Fisheries, SDES, CZ unit, Forestry	Specify within hazard mitigation plan for IAS
Eradication often requires significant funds. Funding secured.	National Hazard Mitigation	Disaster Management Act 2006	NEMO	Ensure Aquatic IAS mitigation specified under National priorities.

STRATEGY 4: IMPACT MITIGATION

Strategic Objectives 4: Reduce or eliminate negative impacts on ecosystems, enabling human health, agriculture, fisheries and related economies, social structures and ecological services to return to baseline or improved levels.

Strategic Interventions 4: Identify actions to mitigate ecological, health, social, and economic impacts of potential and existing aquatic IAS in the region. Mitigation programmes must incorporate collaboration with all relevant agencies, both nationally and regionally, and must utilize species and ecosystems information and current biological and behavioural data on the target species. Actions must be supported by reliable scientific research, tested technologies and tools, and should be achievable based on available resources and skills. A monitoring plan must be developed and put into place to ensure that mitigation actions are long term and effectively address all impacts from the IAS.

Important Components of the Strategy	Primary Policy Instruments	Key Laws & Regulations	Institutions	Gaps/ Challenges Recommendations
Species and ecosystems baselines for	CZM, Biodiversity, NEP & NEMS;	Fisheries Regulations 1994, BCSU Bill	Dept. Fisheries, CZM Unit, CEHI,	Legal frameworks in place. However, lead institutions

Important Components of the Strategy	Primary Policy Instruments	Key Laws & Regulations	Institutions	Gaps/ Challenges Recommendations
aquatic systems in place	IPPC	2008	Sustainable Development Unit (SDU), SMMA	need to be identified, and capacities strengthened and or developed.
Maps of priority ecosystems and habitats placed at risk by invasive species available.	CZM, Biodiversity, NEP & NEMS, SPAW, IPPC	Fisheries Regulations 1994, BCSU Bill 2008	Dept. Fisheries, CZM Unit, CEHI, SMMA, Sustainable Development Unit (SDU)	Same as above.
Identification of mitigation plans and implementing institutions defined.	Public Health, NHM, SPAW	Fisheries Regulations 1994, BCSU Bill 2008	MAFF, CEHI, MOH	Same as above.
Capacity building of response teams ongoing.	Biodiversity, CZM, NHM	Disaster Management Act 2006, Public Health,	MOH, Fisheries,	Mechanisms to acquire resources need to be developed and implemented.
Communications plan in place and information exchanges commenced.	Biodiversity, Health, NHM, Fisheries	Disaster Management Act 2006, Public Health Act 1975, Fisheries Act 1984 & Regs. 1994	MOH, NEMO, MAFF	Long term communications to encourage public participation.
Regional co-operation to address common threat ongoing.	Biodiversity, CZM, Fisheries	Disaster Management Act 2006,	MOH, MAFF	Involve regional bodies such as OECS, UNDP, Caricom, FAO
Acquisition of tools and technologies completed.	Fisheries, Biodiversity, NEP, NEMS, CZM, MOH, NHM, SPAW	Disaster Management Act 2006, BCSU Bill 2008	CEHI, MOH, NEMO, SDES, Fisheries	Implied in policies under Fisheries, Health, Disaster Mitigation
Monitoring and evaluation plan approved.	Fisheries, CZM, public health,	BCSU Bill 2008, Public Health Act 1975; Fisheries Act	Fisheries, SDES, CZM unit, Forestry, WRMA	Mitigation results must be measurable.

Important Components of the Strategy	Primary Policy Instruments	Key Laws & Regulations	Institutions	Gaps/ Challenges Recommendations
		1984, Reg. 1994		

RECOMMENDATIONS

1. Put in place a risk analysis protocol on a website to enable all importers and travelers to conduct their own evaluation of risks and consequences of introductions, whether deliberate or accidental.
2. In collaboration with national and regional specialists prepare an IAS species list including “high risk aliens”, “local and vulnerable”, “indicator”, “forbidden for import”, “approved for import”, and circulate to all interest / stakeholder groups.
3. Develop a guidebook for the prevention, eradication, early detection, impact mitigation and control of specific aquatic species (considered to be high risks as invaders and threats to biological diversity), whether present in the country or not.
4. Encourage research on rapid response mechanisms to IAS impacts in aquatic ecosystems.
5. Minimize aquatic IAS introductions through strict monitoring and management of pathways.
6. Develop and make available electronic versions of IAS pathway and impact assessment models to all schools and priority target groups such as pet store owners, horticulturists, aquaculture farmers, sport fishermen.
7. Identify at least two agencies to serve as the lead agencies in the management of IAS. Strengthen the capacity of these agencies to effectively manage their relevant tasks (border control, communications, research, ecosystem monitoring, eradication and impact mitigation).
8. Establish special working groups to assess regulations and procedures governing the importation of “high risk” species or known IAS especially for aquaculture, the pet trade, biological control and horticulture.
9. Make mandatory and acquire tools and technology to support regulations to address effective treatment of ballast water, effluent from yachts, encrusting organisms off ships and pleasure crafts including the hulls, anchors, fish tackles, buoys.
10. Increase agency capacity for species identification.
11. Enhance laboratory services to analyze disease causing and carrying aliens prevalent in aquatic ecosystems.
12. Secure funds to support aquatic IAS management and control, and disaster management.
13. Develop IAS awareness campaign. Target decision makers, school children at all levels, pet shop owners, marine police, dive operators, fish importers, sport or recreational fishers, aquaculture and horticulture farmers.
14. Promote the development of responsible codes of conduct by relevant businesses that impact on aquatic ecosystems.

CONCLUSION

The following summarize the areas where key interventions are necessary.

- Strengthen border controls
- Build Research and Monitoring capacity of key agencies
- Build Human Resources
- Secure adequate funding, especially for eradication and control
- Promote regional cooperation
- Increase information exchange
- Commence data sharing nationally and regionally
- Public awareness and sensitization to garner public support and involvement
- Incorporate IAS management into other national plans and strategies
- Strengthen national, legal and institutional frameworks for management of aquatic IAS
- Develop economic tools and instruments (such as polluter pay principle) to help offset costs of management and control

References