Written evidence submitted by the Turks and Caicos Reef Fund (TCRF)

The Turks and Caicos Reef Fund (TCRF) is a non-profit organization (NPO), registered in the Turks and Caicos Islands (TCI). TCRF is the country’s only environmental NPO, with a stated mission: to help preserve and protect the natural environment of the TCI. TCRF works with the TCI Government’s Department of Environment and Coastal Resources (DECR) to implement conservation projects, which would otherwise not be possible due to limited government resources. We are pleased to provide our comments on the impacts of invasive alien species (IAS) in TCI. Our discussion describes TCI’s IAS threats, followed by a discussion based on the Terms of Reference (TOR).

Marine Ecosystems

Marine ecosystems in TCI are among the best preserved in the UK Overseas Territories; however, climate change, globalization and poorly controlled land-based activities are resulting in threats by IAS. TCI’s current threats to marine biodiversity by IAS include lionfish *Pterois miles/volitan* and recently identified stony coral tissue loss disease (SCTLD). The causes of SCTLD are currently unknown, but it is likely due to an introduced or novel organism.

**Lionfish**

Lionfish within the tropical western Atlantic pose threats due to their voracious appetites, rapid growth rate and fecundity. First observed in TCI in 2006, the population has grown unabated.

Lionfish can consume prey that are up to half their length (which can be up to 18” long), and an adult lionfish of average size consumes 13 gm of prey per day (Green et al., 2011). Analyses of the stomach contents of lionfish indicate that the diet consisted of 15% crustaceans and 85% finfish (fishbase.org). Thus, many commercially important species form the lionfish’s diet. A single lionfish on a coral head can reduce biomass on that site by nearly 80% in just 5 weeks, significantly reducing species diversity (Albins & Hixon, 2008). Such findings have widespread implications not only for TCI’s commercial fisheries industry but also for tourism activities, such as diving, sport fishing and snorkeling, upon which TCI’s largest industry, tourism, is based (Brough & Sartori, 2015).

Herbivorous fish (e.g. parrotfish *Scaridae spp.*) are important to maintaining a healthy reef system by controlling algal overgrowth. Without these herbivores, algae rapidly outcompetes coral populations. Associated impacts include decreased biodiversity, reduced resistance to climate change and ecosystem collapse (Mumby, Hastings, & Edwards, 2007).

Lionfish reach maturity approximately two years after birth, after which they spawn approximately every four days. This spawning frequency equates to an
annual fecundity of over two million eggs (Morris & Whitfield, 2009). The fertilized eggs float and can drift with the currents up to 25 days before settling on a new location, resulting in widespread and rapid distribution across the tropical western Atlantic.

Although there is no way to completely exterminate the species in the region, regular culling of lionfish at strategic sites can reduce numbers and size (Frazer, Jacoby, Edwards, Barry, & Manfrino, 2012).

TCI currently has limited policy, means or capacity for combatting invasive lionfish. No management plan to control them has been developed, and DECR, are critically understaffed and do not have the necessary equipment to control them. A small project funded by the FCO in 2013 supported six DECR staff and local volunteers in PADI lionfish certification training. JNCC has provided support over the years in providing public awareness and training. Sporadic “lionfish tournaments” have also taken place. However, these efforts have not translated into any change in the lionfish baseline in TCI, nor have they progressed into meaningful control policy and action. Currently, the only consistent control effort is the occasional spearing or netting of lionfish by local dive operators and fishing by a few local fisherfolk for personal consumption.

SCTLD
SCTLD is a newly discovered, lethal disease, which affects at least 20 species of stony corals, *Scleractinia spp*. The disease first appeared off the Florida coast in 2014. The cause of the disease is currently unknown; however, wherever it occurs, high mortality results. Since its discovery, the disease has spread to other parts of the Caribbean. Recently, possible infection was reported off South Caicos by the School for Field Studies. Until more is known about the disease, it is difficult to assess potential threats to TCI; however, as the disease progresses rapidly, its possible introduction into TCI could result in catastrophic coral reef losses within relatively short timeframes (see http://www.agrra.org/coral-disease-outbreak/).

Terrestrial Ecosystems

IAS threats to terrestrial habitats and species include introduced grazing (donkeys, horses and cattle) and predatory (cats, dogs, rats and mice) mammals, invertebrate pests and a variety of floral species. Each of the above threats is discussed in the following sections.

**Introduced Mammals**
It has been reported that cats *Felis catus*, may be responsible for as much as 15 percent of all bird, mammal and reptile extinctions globally. They also play a significant role in declining populations of rare, threatened and endangered (RTE) species. Grazing mammals pose threats by altering ecosystem structure
and species compositions through selective herbivory (Courchamp, Chapuis, & Pascal, 2003).

Rats now inhabit the entire land area of TCI, and cats and dogs *Canis familiaris* are widespread (Hilton & Cuthbert, 2010). Since native island birds and reptiles are not adapted to predation, the introduction of predators to TCI has had serious consequences for bird and reptile populations. Sensitive populations, such as the Critically Endangered (CR) TCI rock iguana *Cyclura carinata* have been largely extirpated from islands where IAS predators occur.

On islands where herbivorous mammals have been introduced and naturalised, native floral compositions have been drastically altered. Selective grazing pressures have largely eliminated fleshy, edible species, which have been replaced by native thorny species, such as long-thorn Acacia *Acacia macracantha* and cat’s paw *Pithecellobium unguis-cati*. Grazing AIS are also threatening other vulnerable floral species, such as the Endangered (EN) and endemic TCI Caicos Encyclia *Encyclia caicensis*, and significantly lowering floral species diversities.

A European Union BEST 2.0 project was implemented by the RSPB and the TCNT commenced on Little Water Cay in 2014, a key biodiversity area (KBA) designated for conservation of rock iguana. Preliminary results indicated a significant reduction in rat and cat populations. An important component of the project was capacity building of local stakeholders for invasive mammalian species control. Further efforts are ongoing at Little Water Cay and Ambergris Cay, where significant rock iguana populations are extant, funded by a Round 5 Darwin Plus project.

**Invertebrate Pests**

The IAS invertebrate pine tortoise scale insect *Toumeyella parvicornis* has invaded TCI’s rare Caribbean pine *Pinus caribaea var. bahamensis* habitats on Pine Cay, North Caicos and Middle Caicos (Hamilton, 2006), resulting in widespread mortality. Caicos Pine woodlands provide important habitat for migratory species, including Near-Threatened (NT) Kirtland’s Warblers *Setophaga kirtlandii*, as well as endemic birds, such as the Greater Antillean Bullfinch *Pyrrhulaga violacea* and Cuban Crow *Corvus nasicus*. The decimation of the Caicos Pine woodland ecosystems has led to intense wildfires and gradual habitat changes resulting from the loss of the keystone species. The Caicos Pine Recovery Project (CPRP) was established to restore some impacted sites using a combination of controlled burns, propagation and re-establishment of pines across the historic range. Initial results from the CPRP were promising, with new trees surviving and controlled burning keeping infestations at bay. CPRP was initially funded by the now-defunct government Conservation Fund. Subsequent funding came from OTEP and Darwin Plus schemes. The CPRP is now being
modestly supported by the TCI government; however, funding is limited to the employment of a terrestrial ecologist and labourer, with limited resources for ongoing propagation and habitat restoration. Prospects for the survival of the rare Caicos Pine forests remain uncertain.

**Floral Invasive Species**
Wherever land is cleared or other impacts to terrestrial, coastal and wetland habitats take place, invasive floral species tend to quickly colonize. The species that are most deleterious in TCI include Australian pine *Casuarina* *spp.*, cow bush *Leucaena leucocephala* and white inkberry *Scaevola taccada*. Brazilian pepper *Schinus terebinthifolius* is also recorded in TCI; however, this species does not appear to be naturalizing aggressively.

Australian pine is native to Australia. The seed bank for *C. spp.* is widely distributed in TCI, and these species naturalize along coastlines and disturbed sites. Along coastlines, they rapidly replace existing floral communities via allelochemical leachates that inhibit the growth of floral competitors. In doing so, they completely replace natural vegetation and undermine the structural integrity of dunes, making beaches more prone to sand loss and erosion. Because their wood is brittle and their root structures weak, *C. spp.* are also vulnerable to uprooting and breakage in high winds, making them a significant threat during hurricanes (Wheeler, Taylor, Gaskin, & Purcell, 2011).

In TCI, *C. spp.* infestation is particularly significant along the north shore beaches of North (Horse Stable Beach) and Middle Caicos (Bambara and Wild Cow Run) and sections of East Caicos near and including Joe Grant Cay. Treasure Beach on Providenciales and Governor’s Beach on Grand Turk are also severely impacted.

In addition to beach erosion, *C. spp.* poses a threat to TCI’s RTE species populations. The entire eastern coastline of East Bay Cay, which hosts the second largest population of CR *C. carinata carinata* in TCI, has become naturalized with *C. spp.* These new invasive-dominant communities do not provide adequate food for *C. carinata carinata*. The coastal habitats of North, Middle and East Caicos are the primary habitat for endemic and EN *E. caicensis* and *Argythamnia argentea*. Carrying capacity and population numbers for these species may consequently be threatened. Coastlines impacted by *C. spp.* are also reported to inhibit normal nesting activities of CR hawksbill and EN green sea turtles (Doren & Jones, 1997).

No policy or control management plans for *C. spp.* have been enacted to date in TCI. Because of the large scale of the threat, the human and economic resources that currently exist to deal with the problem are grossly inadequate. Without determined and large-scale intervention, it has been determined that *C.*
spp. has the potential to completely replace native coastal vegetation (Cox, 1999).

Cow bush is native to Central America. Due to its ability to survive in dry, oligotrophic soils, it has been able to easily naturalize in upland communities across TCI. It germinates and grows quickly, making it a particularly aggressive invader at disturbed sites. As with C. spp., cow bush has strong allelopathic potential; therefore, once it has naturalized in an area, it can quickly spread into intact floral communities. Because its seeds can persist in soil for several years, it is difficult to eradicate, without ongoing control measures (Kuo, 2003).

Due to limited historical large-scale land use in the Caicos Islands, a significant remnant of intact upland floral communities persist. These terrestrial habitats are the largest in area and best preserved of the territories in the British West Indies, and they contain significant populations of RTE, endemic and other species of interest, including but not limited to EN Swietenia mahagoni, EN Guaiacum sanctum and G. officinale and CR Stenandrium carolinae. Upland habitats also provide valuable biodiversity and ecosystem services, such as regulation of the physical environment, regulation of flows and intellectual, symbolic and experiential cultural values.

In areas that have been invaded, cow bush relative densities can be higher than 75% of total floral species compositions (Lu & Chen, 2002). The threats posed by this species in TCI are therefore grave if left unchecked. Significant impacts are evident on Providenciales, where land clearance has become extensive in recent years. Other islands will be vulnerable as they seek to develop. As with C. spp., no current policy or management plan exists to control cow bush.

White inkberry S. taccada, is a shrub native to the Indo-Pacific and is commonly used in landscaping applications in TCI. Once planted, it rapidly spreads, replacing diverse native vegetation with monocultures (Clubbe, Hamilton, & Corcoran, 2010). In coastal dune communities, S. taccada root structures are not well suited to holding sand in place, and erosion is a common result. Because the greatest spread of S. taccada is via rhizomes, rather than seed in TCI, it can be targeted for successful removal. A ban on the import and propagation of the species, combined with a removal program could eradicate this species from TCI.

Discussion

TCI has limited capacity, policy or management planning for effectively controlling threats from IAS. While some efforts have been made, they have not been sustained once grant funding was completed.
Threats by IAS are expected to be exacerbated by climate change. Lionfish larvae mature more quickly in warm water (Côté & Green, 2012), and decreases in abundance of herbivores on coral reefs, coupled with warming water, will further increase coral reef ecosystem vulnerabilities to bleaching and disease, including SCTLD.

In order to mitigate IAS risks, the following actions are recommended:

- Development of a sustainable funding mechanism for ongoing and dedicated efforts
- Development and ratification of relevant laws and species-specific action and management plans
- Employment of dedicated personnel, as per management plan requirements
- Development and publication of species-specific public education and awareness materials
- Development of alternative uses, such as charcoal manufacturing using C. spp and L leucocephala and commercial fishing of lionfish to encourage harvest. Such programs may be economically self-sustaining, once implemented.

Cost-effective use of resources could be directed towards control of S. taccada, given the potential for eradication. Public awareness campaigns, which can be shared across Overseas Territories (OTs) can also be cost-effective. Overall, however, control of IAS will be costly and will require ongoing and extensive efforts, such efforts should nevertheless be made, given the significant threats posed by inaction.

TCI has benefited from the EU’s BEST program and other sources of EU funding, which have provided a significant source of capital for IAS control in TCI. An EU exit will result in the loss of this critical source of funding. The UK will need to provide alternatives.

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Sources Cited


Kuo, Y.-L. (2003). *Ecological characteristics of three invasive plants (Leucaena leucocephala, Mikania micrantha, and Stachytarpheta urticaefolia) in Southern Taiwan*: Food & Fertilizer Technology Center Taiwan.


