



**Report of the Lionfish Management Workshop  
at the Gulf and Caribbean Fisheries Institute Meeting  
November 12th, 2015, Panamá**

**Informe del taller para el manejo del Pez león  
en la Conferencia anual del Instituto de Pesquerías del Golfo y el Caribe  
12 de noviembre 2015, Panamá**

**Rapport de l'atelier sur la Gestion du Poisson-lion  
à la Conférence de l'Institut des Pêches du Golfe du Mexique et de la Caraïbe  
12 Novembre 2015, Panama**

\*\*\*

**Purpose of the Workshop / Propósito de este Taller / Objectifs de l'atelier:**

The purpose of this Lionfish Management Workshop (Special Session) was to bring together key managers, including fishermen, who have relevant lessons learnt, local or national strategies successfully implemented and useful tools to share between fishermen, resource managers and decision makers (support the "management decision").

El propósito de este Taller sobre la Gestión de pez león (Sesión Especial) era reunir a los manejadores clave, incluidos los pescadores, que tienen enseñanzas relevantes, las estrategias locales o nacionales que se aplican con éxito y herramientas útiles para compartir entre los pescadores, los administradores de recursos y los tomadores de decisiones (apoyo en la "toma de decisiones").

L'objectif de cet atelier sur la Gestion du Poisson-lion (session extraordinaire) était de réunir les gestionnaires clés, y compris les pêcheurs, qui ont des leçons tirées de l'expérience, des stratégies locales ou nationales, mises en œuvre avec succès et des outils utiles à partager entre les pêcheurs, les gestionnaires des ressources et les décideurs (soutenir la "prise de décision").

**Background – topic :**

Lionfishes (*Pterois volitans* and *P. miles*) are venomous species which are native to Indo-Pacific coral reef ecosystems and adjacent habitats. Through accidental and/or purposeful release into warm Atlantic waters, they have become established as a highly problematic alien species that poses a serious threat to marine ecosystems in the Wider Caribbean region (WCR): they have been shown to reduce biodiversity, are responsible for the decline of ecologically important species, and hinder stock-rebuilding efforts for economically important species.

In January 2010, in recognition of the severity of the lionfish invasion and its impact on coral reefs and local communities in WCR, the 24th General Meeting of the International Coral Reef Initiative (ICRI) agreed to set up an Ad Hoc Committee, known as the Regional Lionfish Committee (RLC), to develop a strategic plan for the control of lionfish in the Wider Caribbean and support dedicated activities (trainings, web portal and list of contacts, promotion of best practices..).

In October 2014 at the 29th ICRI General Meeting, acknowledging that identifying and implementing measures to control the lionfish invasion, while minimizing other harm to marine ecosystems, are desirable, and recognizing the outcomes of the August 2010 ICRI workshop in Cancun as an important step in assembling best management practices as part of a regional strategy, RLC was asked to extend its work to promote several activities. Among these, to raise awareness among the fishery and marine protected area managers on the lionfish threat and the need to develop

effective local response plans, support countries and territories to develop local strategies, based on the regional strategy and work with the ICRI secretariat to disseminate lessons learned to other regions.

In December 2014 at the 8th Meeting of the Contracting Parties to the Protocol Concerning Specially Protected Areas and Wildlife (SPAW), noting increasing lionfish activities undertaken under SPAW subprogramme 2013-2014 and recognizing that the information available on lionfish would need to be compiled and shared among fishermen, resource managers and decision makers, and that the GCFI event is one of the main Caribbean platforms to bring together scientists, fishermen and managers, was approved a new Recommendation:

“Parties and relevant organizations take further action to control the lionfish invasion, in collaboration with other international and regional partners and initiatives, and in particular consider supporting a “lionfish management session” at the 68th GCFI (November, 2015) to promote best management strategies and tools and main lessons learnt”.

### **Presentations during the workshop :**

14 Presentations (best examples) focused on: best management tools and effective methods to promote, management and policy, socio-economic aspects to support decisions, main lessons learnt for control, local and national strategies adopted, possibly other marine invasive with similar patterns in the Caribbean, control deep populations and specific management in Marine Protected Areas and No-Take zones.

This workshop was built in close conjunction with the Lionfish Science Symposium (scheduled at the same GCFI) and complementarities was the rule.

SPAW RAC, UNEP and TE ME UM sponsored this session, also supported by UNEP CEP (Recommendation at SPAW COP8) and ICRI (29<sup>th</sup> ICRI meeting).

The coordination and facilitation of the workshop was provided by members of the Regional Lionfish Committee (RLC, an Ad-Hoc Committee from ICRI): Franck Gourdin , SPAW-RAC Senior Project Coordinator /ICRI RLC Co-Head, Ruben Torres, REEF CHECK DR Director /ICRI RLC Member, and Jean-Philippe Maréchal, lionfish focal point for the FWI, ICRI RLC member.

N°	Name	Position	Abstract's title
1	<b>Alfonso Aguilar Perera</b>	MEXICO	Proposal of a management plan for the lionfish, <i>Pterois volitans</i> , in the Parque Nacional Arrecife Alacranes in the northern Yucatan Peninsula, Mexico.
2	<b>Jennifer Chapman</b>	for MARFUND	Creating a Strategy for the control of the Lionfish in the Mesoamerican Reef.
3	<b>Marc L. Fruitema</b>	BELIZE	Reframing the invasion : Belize's approach to Lionfish Control.
4	<b>Andrew Sellers</b>	PANAMA	Potential for introduction of the invasive lionfish, <i>Pterois volitans</i> , in the Tropical Eastern Pacific across the Isthmus of Panama.
5	<b>Philip Karp</b>	USA	Incentivising lionfish removals through development of markets for jewellery: preliminary experiences from Belize, the Bahamas and St. Vincent and the Grenadines.
6	<b>Jennifer Chapman</b>	BELIZE	Lionfish Control in Areas inaccessible to fishers : counting and culling with the help of conservation volunteers.
7	<b>Fadilah Ali</b>	UK	Lionfish management on small islands. Lessons learnt from Anguilla, Bonaire and Curaçao. Gestion du poisson-lion sur les petites îles.
8	<b>Nacor Bolanos</b>	COLOMBIA	Management of the Colombian government in the first seven years of invasion of lionfish in the country: achievements, difficulties and challenges.
9	<b>Denise Chin</b>	JAMAICA	Managing Lionfish in Jamaica.
10	<b>Bradley Johnson</b>	CAYMAN ISLANDS	Lionfish Control and Management in the Cayman Islands : seven years on, lessons learned.
11	<b>Nicolas Diaz</b>	GUADELOUPE FWI	Return of positive experience of the involvement of professional fishermen in the fight against the invasion of Lionfish in the archipelago of Guadeloupe (FWI).
12	<b>Joanna M. Pitt</b>	BERMUDA	A lionfish trap for use in Bermuda, with potential applications elsewhere. *Trap Poster
13	<b>Vassilis Tsigourakos</b>	UNEP-REMPEITC	"Regional cooperation in the Wider Caribbean for reducing the transfer of harmful aquatic organisms and pathogens in ship's ballast water."

N°	Name	Position	Abstract's title
14	<b>Paulo Roberto Bertuol</b>	BONAIRE NETHERLANDS	Using the dive industry as a tool for successful Lionfish Management in Bonaire.

You'll find those 14 presentations (pdf files) with their respective abstracts at:  
<http://www.car-spaw-rac.org/?68th-GCFI-conference,656>

14 presentaciones (mejores ejemplos) se centraron en: mejores herramientas de gestión y promoción de métodos de control eficaces, manejo y políticas, aspectos socioeconómicos para el apoyo de las decisiones, principales lecciones aprendidas para el control, estrategias locales y nacionales adoptadas, otras posibles especies marinas invasoras con patrones similares en el Caribe, control de las poblaciones en aguas profundas y manejo específico en Áreas Marinas Protegidas y Zonas de No Pesca.

Este taller se llevó a cabo en estrecha colaboración con el Simposio Científico sobre el pez león (en esta misma reunión anual del GCFI) y se buscó la complementariedad entre ambas.

SPAW RAC, el PNUMA y TE ME UM patrocinaron esta sesión, también sostenida por el PNUMA PAC (Recomendación a la COP8 de SPAW) y ICRI (29ª Conferencia del ICRI).

La coordinación y facilitación del taller fueron proporcionadas por miembros del Comité Regional Pez León (RLC en inglés, un Comité Ad-Hoc de ICRI): Franck Gourdin, Senior Project Coordinador para el CAR-SPAW / ICRI RLC Co-Head, Rubén Torres, Reef Check DR Director / miembro del grupo RLC/ICRI, y Jean -Philippe Marechal, punto focal pez león para las Antillas franceses y miembro del grupo RLC/ICRI.

Usted encontrará los 14 presentaciones (archivos pdf) con sus respectivos resúmenes con este vínculo:  
<http://www.car-spaw-rac.org/?Taller-para-el-manejo-del-Pez-leon,660>

14 présentations (meilleurs exemples) ont notamment mis l'accent sur les meilleurs outils de gestion et les méthodes efficaces à promouvoir, la gestion et la politique, les aspects socio-économiques pour appuyer les décisions, les principaux enseignements tirés de l'expérience pour le contrôle, les stratégies locales et nationales adoptées, les possibles similitudes avec d'autres espèces envahissantes marines ayant des fonctionnements similaires, le contrôle des populations profondes et la gestion spécifique dans les aires marines protégées et les zones interdites à la pêche.

Cet atelier a été conduit en étroite collaboration avec le Symposium scientifique sur le poisson lion (organisé lors du même GCFI) et la complémentarité fut la règle.

Le CAR-SPAW, le PNUMA et TE ME UM soutenaient financièrement cet atelier, et suivant les recommandations du PNUMA PEC (lors de la 8e COP de SPAW) et de l'ICRI (29e Conférence).

La coordination et la facilitation de l'atelier étaient assurées par des membres du Comité régional Poisson Lion (RLC en anglais, un comité ad hoc de l'ICRI): Franck Gourdin, coordonnateur Senior de projets au CAR-SPAW, Ruben Torres, Directeur de Reef Check RD et Jean-Philippe Maréchal, point focal poisson-lion pour les Antilles françaises.

Vous retrouverez sur ce lien les 14 présentations (format pdf) avec leurs résumés respectifs:  
<http://www.car-spaw-rac.org/?Atelier-sur-la-Gestion-du-Poisson,659>

### **Discussion and recommendations:**

Those presentations were followed by a lively discussion with all the participants in order to make recommendations for better management of the lionfish in the Caribbean, and following several main objectives listed below.

The discussion then continued electronically with all after the workshop to complete this report.

Esas presentaciones fueron seguidas de una discusión animada con todos los participantes con el fin de hacer recomendaciones para una mejor gestión del pez león en el Gran Caribe y siguiendo objetivos más específicos. La discusión continuó con todo el grupo después del taller electrónicamente para preparar este informe técnico.

Ces présentations ont été suivies d'une discussion animée avec tous les participants afin de faire des recommandations pour une meilleure gestion du poisson-lion dans la grande région Caraïbe et en suivant certains objectifs spécifiques.

La discussion a ensuite continué avec le groupe après l'atelier de façon électronique pour préparer ce rapport technique.

## **Final objective 1: Best management tools and effective methods to promote**

**Objetivo final 1: Las mejores herramientas de gestión y métodos eficaces para promover**

**Objectif final 1: Les meilleurs outils de gestion et les méthodes efficaces à promouvoir,**

### **Context:**

Every islands and continental countries in the Caribbean and beyond are under the threat of the invasive lionfish. Solutions and strategies have been implemented to control lionfish populations, following principally the recommendations of the Regional Strategy developed by the Regional Lionfish Committee/ICRI adapted to local situation/context.

While most efficient methods for controlling lionfish densities in shallow waters is by involving the dive industry, efforts are decreasing in some situation. In this context, it seems important to create economic incentives to keep the dive centres involved in the control strategy and an open communication plan is settled. Hunter courses and guided dives are proposed in some countries and goodies and equipment have been marketed as lionfish hunting gears, T-shirt, souvenirs etc. Beyond the action of the divers in terms of efficient control of populations, a lionfish based food market has been developed to involve both restaurants and fishermen and increase the demand and the fishing pressure on lionfish population. Both these sectors are key component of control, assumed lionfish meat is suitable for consumption (ciguatera contamination risk). A combined removals strategy joining diver culling, targeted lionfish traps and regular fishing is needed to cover all habitats and seasons.

Jewellery artisanal trade is developing as the demand is increasing in the region. Many questions still arise concerning remote coral reef environment and large areas, marine protected areas, no-take zones, where physical removal of lionfish might need specific administrative framework.

However, management tools and methods would be more efficient if:

- Volunteers are trained properly
- The gap between science and diving operators/business is filled
- Methods are standardised for re-assessment and monitoring
- Biological baseline survey are improved and collaboration strengthened

### **Recommendations:**

- Reduce environmental impact through best management practice (see the “Catfish message”)
- Strengthen monitoring program in order to assess the population changes over time and to measure the impacts of management control actions
- Define guidelines and indicators for general expected results, such as the participation and acceptance of different stakeholders of the local communities
- Promote Citizen science approach to complement resource intensive surveys
- Reinforce collaboration/communication at the community level across the Caribbean region
- Prioritise early detection and rapid response
- Involve the dive industry: different dive training agencies than PADI (the unique that offer LF hunt course until now), in order to have more divers with skills to help the removal efforts.
- Favour the development of markets for lionfish to encourage control.
- Conduct special control events, but maintain regular control and monitoring
- “No fish feeding with lionfish” message - Do not encourage feeding lionfish to predators like sharks/morays etc.

## **Final objective 2: Concrete actions based on regional strategies / plans or sub regional strategies**

**Objetivo final 2: Acciones concretas en base a estrategias o planes regionales o estrategias subregionales**

**Objectif final 2: Actions concrètes fondées sur des stratégies ou des plans régionaux ou stratégies sous-régionales**

### **Context:**

The Caribbean Regional Lionfish strategy was first develop to address regional efforts on invasive lion fish control and management efforts, but also to serve as the regional framework for other sub regional strategies to be guided from, but including adaptation to local characteristics and on going efforts in each sub region.

### **Recommendations:**

- Promote and share regional strategy supporting local managers in influencing local strategies and policy makers
- Regional knowledge sharing and collaboration on lionfish jewellery production techniques, designs, training, and marketing/branding, including development of a “Caribbean Lionfish Jewellery” brand could offer an effective strategy for tapping the high level of identified demand in international markets

- Involve diving industry

**Final objective 3: Strengthening the development of national and local strategies for lionfish control on the basis of the regional RLC strategy**

**Objetivo final 3: Fortalecer el desarrollo de estrategias nacionales y locales para el control del pez león sobre la base de la estrategia regional**

**Objectif final 3: Renforcer le développement de stratégies nationales et locales pour le contrôle du poisson lion sur la base de la stratégie régionale**

**a- Specific objective: Communication – Education**

**objetivo específico : Comunicación - Educación**

**objectif spécifique : Communication – Education**

**Context:**

One of the five objectives of the regional strategy on lionfish is to provide education, information, and outreach mechanisms to generate public support and foster stewardship in invasive lionfish programs. Successful education and outreach (E&O) programs can help shape public perception, enhance constituent involvement, and direct government support and funding. It has been raised that some governments and decision makers do not have a complete picture of the damage that a big population of Lionfish can do. To refine the E&O strategy, several recommendations have been made.

**Recommendations:**

- Build education & awareness campaigns on localized socio-cultural languages and values.
- Develop a uniform education strategy for different stakeholder groups. The message should be accurate and avoid scare tactics and extremism
- Outreach information to general public
- Facilitate information to managers adapt the law and regulations
- Sponsor workshops to teach how different groups can have financial benefit of LF can helps to avoid that people just target the LF with big size (ie use to do jewellery can be a good way to use the small ones also)
- Strengthen communication strategies: find the “**right message**” on lionfish control
- Encourage collaboration/communication at the community level across the Caribbean region

**b – Specific objective: Management and policy**

**objetivo específico : La gestión y la política**

**objectif spécifique : La gestion et la politique**

**Context:**

The majority of the countries have recognised the lionfish as an invasive species that can be controlled as domestic policies and legislation frameworks authorise the implementation of national action plans. However, day-to-day management requires new regulations and policies, especially in coastal protected areas. Some countries like Mexico do not even consider lionfish as an invasive species by law.

The regional strategy for the control of invasive lionfish encourages governments to review and amend relevant legislation and, if necessary, develop new regulations and policies to control lionfish.

**Recommendations:**

- Find new regulatory ways through collaboration with resources managers and government agencies to improve lionfish control
- Improve cooperation between countries
- Lionfish control is context specific: create government lionfish task force
- Careful with re-categorisation of lionfish as a marine resource and caution with promotion of invasive species
- Develop an international agreement endorsing the consumption of lionfish
- Aquaria regulations are still necessary to mitigate the imports and exports of lionfish
- Legislation that provides for the issue of special permits, with terms and conditions / restrictions attached, allows flexible management.
- Encourage the formation of partnerships (amongst, Government, NGOs, Environment Agencies, Divers, Fishermen, Tourism Association, Private and Public Sector)
- Strategies need to be adapted to each region.

### **Funding:**

- Getting the support of the private sector can be used to boost public awareness.
- Develop financial incentives for lionfish control

### **c – Specific objective: Socio-economic aspects to support decisions**

**objetivo específico : Aspectos socio-económicos para apoyar las decisiones**

**objectif spécifique : Les aspects socio-économiques pour appuyer les décisions**

#### **Context:**

Fisheries have been included in most local strategies as an efficient way to remove lionfish from the environment. As in most regions, lionfish can be consumed, large communication campaigns have promoted lionfish as a new marine resource for human consumption. However, lionfish has received a “diabolic” image at first due to its danger and manipulation risk, reducing the interest of fishermen in this marine resource. It has been seen as a negative species impacting usual fisheries and was not receiving any attention. In this context, fishermen would not prefer to cooperate because of management issues and other marine resources exploitation. Remote Marine protected areas in the Caribbean can also be difficult to manage, as lionfish need to be frozen as well as other resources like lobsters. In a context of limited funding to support these activities, fishermen can still be hesitant in investing on lionfish. Lionfish is a supplement to on-going fisheries

#### **Recommendations:**

- Standardise methods, assessment tools and instruments for socio economics – fisheries
- Develop fisheries socially responsible and sustainable – Objective: to achieve environmental control of invasion processes
- Promote integrated approach to ensure that socio-economic and environmental benefits are met and sustained in the long term
- Social scientific expertise is required to understand people perception on LF (consumers etc.)
- Create local demand for Lionfish for consumption to provide an incentive for fishermen to catch Lionfish.
- For areas accessible to fishers, remove barriers (laws, private sector, MPAs...) and develop the market to support removal at the target catch rate
- Understanding motivation will assist in reinforcement and retention of those involved.

#### **Lionfish target fish traps**

- Develop specific traps and reduce by-catch
- Develop fish traps to catch lionfish in MPAs and other fishery-banned areas.
- Involve the fishery industry in traps design
- Set up regional coordination on traps development: lionfish trap development must be regionally collaborative to complement initiatives already ongoing
- Develop specific fish traps for deep habitat and population

#### **Consumption and ciguatera**

- Message to send: the ciguatera toxin is destroyed by heat and cooking: indeed, uncooked lionfish gives false positive test results (Wilcox and Hixon 2015 Env Biol Fish)
- Education package: incorporate ciguatera in the message

#### **Marketing**

- Development of lionfish jewellery markets can be an effective avenue for increasing landed value of lionfish and incentivizing harvesting
- Lionfish jewellery production has important ancillary benefits, particularly for women communities
- Regional knowledge-sharing, training, production and marketing/branding could offer an effective strategy for tapping international markets

### **d- Specific objective: local and national strategies adopted**

**objetivo específico : Estrategias locales y nacionales adoptadas**

**objectif spécifique : Stratégies locales et nationales adoptées**

**Context:**

Most of the Caribbean countries have adopted the Caribbean strategy developed by the Regional Lionfish Committee/ICRI to launch actions towards the control of local lionfish populations (. The major objectives of this strategy are:

- Facilitate collaboration among governments, reef-reliant industries, civil society, and academia by providing mechanisms for coordination of efforts across political and geographical boundaries,
- Encourage a coordinated research and monitoring agenda
- Encourage governments to review and amend relevant legislation and, if necessary, develop new regulations and policies to control lionfish
- Control invasive lionfish populations using regionally coordinated, effective methods, and
- Provide education, information and outreach mechanisms to generate public support and foster stewardship in invasive lionfish programs.

The implementation of the strategy always starts with community information about lionfish and the need to control their population to limit environmental impacts. Fishermen and divers are the two principal categories targeted.

In the last years, many local and national management and response plans were developed and implemented using the regional strategy as a framework. They're available at: <http://lionfish.gcfi.org/management/management-response-plans>

**Recommendations:**

- Update regularly local and national management and response plans to take into account best lessons learnt and new relevant datas,
- Use existent Ballast water management strategies (eg. Jamaica, Trinidad and Tobago) to also address lion fish control measures.

**Final objective 3 bis: Relevant exchange of experiences between the Caribbean countries on local plans or sub-strategies**

**Objetivo final 3 bis: Intercambio relevante de experiencias entre los países del Caribe en este tema**

**Objectif final 3 bis: L'échange pertinent d'expériences entre les pays des Caraïbes sur cette question**

**Context:**

The Caribbean Regional Lionfish strategy served as the regional framework for other sub regional strategies to be guided from, but including adaptation to local characteristics and on going efforts in each sub region. In this term, local workshops and meetings were implemented in some of the Caribbean and Central America sub regions, combining countries with shared resources and capacities to enhance potential control and management efforts. Each workshop served to review the existing Caribbean Lionfish Strategy, but also local adaptations and measures were consented from local regional key players and stakeholders

**Recommendations:**

- Share their experiences from maritime shipping industries, specially their ballast water management strategy.
- Look to corporate sponsorship to support events/tournaments
- Create a market for all sizes of lion fish.
- Sharing of experiences on production techniques, designs, and market development approaches is important and can help to spur the growth of the market and the spread of innovations
- Citizen scientists can help with monitoring, following the Lionfish Focused Survey (LFS) method.

**Specific Objective 4: Control deep populations and specific management in MPAs and no-take zones**

**objetivo específico 4: Control de las poblaciones de profundidad y de gestión específica en las AMP y zonas de veda**

**objectif spécifique 4: le contrôle des populations profondes, la gestion spécifique dans les AMP et les zones de non-pêche**

**Context:**

The presence of deep lionfish populations is confirmed, but information is sparse and localized. These deep areas are not accessible to actual and usual control and monitoring methods. A major actor for the deep lionfish population control is fisheries but important reflexion must be taken on trap design to limit bycatch and target specifically lionfish. Introduction of traps for lionfish may work in some geographic regions but traps may harm other marine organisms if not

properly used. The control of lionfish population in MPAs is also complicated and must be framed.

### ***Recommendations:***

MPAs:

- Removals of Lionfish in No-Take areas such as MPAs is important but must be monitored.
- Within areas inaccessible to fishers, recreational divers are likely the best mechanism for control, and they can also act as citizen scientists, aiding with gathering information on relative abundance (sighting frequency), and catch per unit effort.
- Lionfish removal within MPAs is ruled by legislation with restriction on tools and personnel allowed to remove lionfish
- Traps may be a cost-effective way of removing lionfish from areas where a consumption fishery is not permitted (e.g. areas with ciguatera risk or environmental contamination) to reduce export of larvae.

Deep zones:

- Deep areas within MPAs must be explored using technological devices to determine the presence and abundance of lionfish
- To control deep populations a new approach working close to TEK diving industry will be important.
- Data on deep lionfish distributions can be acquired using drop camera survey technologies.
- Traps are a good tool for controlling deep populations but are most effective when there is good information on the local distribution of lionfish.

Traps design:

- To catch lionfish while minimizing impacts on other species, particularly in MPAs, traps should use artificial lures, rather than dead bait, include 4cm wide slots in the corners to allow other fish to escape, and incorporate breakaway panels and sisal door closures to reduce ghost fishing.
- In MPAs work with rules in order to maintain the possibility to catch other spp low and avoid tools that can destroy the reef.
- In no take zones controlled events can be done to maximize the catch under control of the environmental agencies.
- Traps can be a good control tool, but must be adapted to the local fishery and local management goals.

### **Specific Objective 5: Main lessons learned for the control**

**objetivo específico 5: Principales lecciones aprendidas para el control**

**objectif spécifique 5: Principaux enseignements tirés pour le contrôle**

### ***Context:***

Lionfish were introduced in the Caribbean in the mid 80s, but it was only 10 years after, that control and management efforts started to be implemented. Given that lion fish ended up being considered as food items, their population soon started to be controlled, at least in some locations using consumption by humans as the main strategy. Other local strategies, adapted to local management contexts (like MPAs) also started being implemented, all proving of great success as control measures. These are being now replicated in other newly invaded areas, other potential areas to be invaded, and areas of special interests and management such as MPAs.

### ***Recommendations:***

- Working with the local fishing communities is important to increase their knowledge, promote safe handling, and also to get their ideas on how to control Lionfish.
- The immediate response and proper education before arrival of lionfish lays the foundation.
- Success of the strategy is due to the involvement of divers in daily removal of lionfish along with top-down management
- A co-operative effort is required: need partnerships and collaboration
- Understanding lionfish distributions and any seasonal movements is vital for effective control.
- Prioritise areas for control and effective communication about priority control areas is important,
- Each locality will likely require a combination of control mechanisms to remove lionfish from different habitats and at different times of year.
  
- Building up capacity in local diver fishermen is necessary for keeping them engaged on lionfish removal
- Incentives are crucial for effective engagement of volunteers on lionfish removal activities

- An effective control involves different actors to take decision as to remove and create a marketing that support the removal efforts
- Utilise local ‘champions’. Getting a local on board e.g. a fisherman is more likely to encourage success of the strategy as there is more trust
- Market-based approach is best for control
- Creation of markets encourages control: Pairing fishermen/divers with restaurants solves the supply and demand problem often faced
- Developing markets that use lionfish / lionfish parts that are otherwise discarded help overcome perceived/actual opportunity cost
- The entrepreneurship on lionfish’s products (e.g., jewellery, meat) is fine only if awareness of lionfish invasion to the public is effective.
- Schemes to promote Lionfish fisheries and jewellery markets can be complementary and mutually beneficial
- Lionfish fisheries should be promoted as a diversification opportunity for local fishers, rather than encouraging fishers to target only lionfish.
- Educate restaurants and consumers on the issues of supply and demand for LF meat.
- Encourage LF removal tournaments and offer prizes for small LF as well.

### **Specific Objective 6: Other marine invasive species with Similar patterns in the Caribbean**

**objetivo específico 6: Otras especies marinas invasoras con patrones similares en el Caribe**

**objectif spécifique 6: Autres espèces envahissantes marines avec des questionnements similaires dans les Caraïbes**

#### ***Context:***

Over 331 nonindigenous aquatic species have been found in the Gulf Coast Region. They're second only to habitat destruction as the greatest cause of biodiversity loss. The cost to manage this problem in the US for example were estimated at USD137 billion annually.

The experience and lessons learnt of the struggle against the lionfish can be used to develop strategies and action plans against other marine invasive species such as the Asian Clam or Tiger Shrimp, and thus anticipate and better control new invasions.

#### ***Recommendations:***

- Create a list for potential invasives to look out for and monitor their presence whilst we are already in the water removing lionfish? E.g. Asian Tiger Shrimp or Humpback Grouper
- Identify possible options in 2016 on behalf of ICRI and UNEP/CEP and natural stakeholders for migrating the Regional Lionfish Committee to a committee that addresses in general, other marine invasive alien species in the Caribbean including pathway vectors and species introduced by ships’ ballast water

\*\*\*

#### **Contact, coordination, review team (RLC Members):**

**Contactos, Coordinación, equipo de revisión (Miembros del grupo RLC):**

**Contact, coordination, équipe de relecture (membres du groupe RLC):**

Franck Gourdin, Senior Project Coordinador SPAW-RAC / RLC ICRI Co-head  
 Franck.gourdin.carspaw@guadeloupe-parcnational.fr

Rubén E. Torres, Reef Check República Dominicana director / ICRI RLC member  
 ruben@reefcheck.org

Jean-Philippe Marechal, lionfish focal point for FWI / ICRI RLC member  
 marechal.jean@gmail.com

\*\*\*

#### **Annexe 1 : useful weblinks**

Weblink on SPAW RAC website with the 14 presentations, abstracts, and Sub-strategies for ECSO and MAR Regions\*

\*(Sub-Strategy for the Control of Lionfish in the Mesoamerican Reef (MAR), Sub-Estrategia Regional para el control del Pez León en el Sistema Arrecifal Mesoamericano (SAM) y Sub-Estrategia para el control de la invasión del pez león en la Ecorregión del Caribe Sur Occidental (ECSO) only available in spanish)  
<http://www.car-spaw-rac.org/?68th-GCFI-conference,656>

Weblink on the lionfish webportal hosted by GCFI: management and response plans  
<http://lionfish.gcfi.org/management>

## **Annexe 2 : list of stakeholders**

(speakers, stakeholders and experts contributing to this report)



We are grateful to the following colleagues for discussions and suggestions that greatly improved this document (no order):

Alfonso Aguilar Perera, Jennifer Chapman, Marc L. Fruitema, Andrew Sellers, Philip Karp, Fadilah Ali, Nacor Bolaños, Denise Chin, Bradley Johnson, Nicolas Diaz, Joanna M. Pitt, Vassilis Tsigourakos, Paulo Roberto Bertuol,

Juan M. Posada, Karen Mac Donald Gayle, Mark Hixon, James Morris, Alejandro Acosta, Bob Glazer, Stephanie Green, Leroy Creswell, Alex Boddanoff, Jacklyn Rivera Wong, Ricardo Gomez Lozano, Nancy Daves,

Sherry Larkins, Chuck Adams, Laura Valderrama Ballesteros, Alex Fogg, Tracy Yandle, Jennifer Sweeney-Tookes, Natalie Miaouslis, Justin Grubich, Elizabeth Taylor, Marion Howard, Friederike Peiffer, Soazig Lemoine, Alli Candelmo, Yazmin Villareal, Juan Claros, Eddy Corey, Mateo Sabido Itza, Carlos Saavedra, David Kling, Donovan Brown, Erin Spencer, Nakita Poon Gong, Rachel Bowman, Andrew Mac Innis, Jennifer Salomon, Tim Noyes, Bernard Castillo, Croy Mac Roy, Meaghan Faletti, Oldemar Del Cid, Stuart Robertson, Oceane Beaufort, Sean Mattson, Pedro Chevalier, Susana Perera, Fabien Védié, María del Carmen Garcia Rivas, Alain Garcia Rodriguez, Marino Eugenio Abrego, Lilliana Piedra Castro, and Kynoch Reale-Munroe.

\*\*\*