

Supplementary Material: Survey

Please note no skip logic is included in this survey document.

Hello,

We (Phil Karp, Alex Fogg, Fadilah Ali, Holden Harris, PhD, Alli Candelmo, PhD, Kaylin Clements, and Jennifer Solomon, PhD) are a group of researchers and practitioners interested in the invasive lionfish. We are **conducting a research study on the role of public participation and citizen science in lionfish management in the Western Atlantic region.**

We invite you to contribute to this research by completing an online survey on behalf of your organization. Please follow your organization's protocol for participating in surveys and inform them of your participation if necessary. Some questions may require you to consult with other members of your organization. Please note that your organization's name will not be included in our final publication nor will your own name and your responses be reported in aggregate with other organizations' responses. You must be 18 years old or older to participate in this survey. Participation will take approximately 10–15 min. Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participation at any time without penalty.

We will not share your name or personal identifiers, nor that of your organization/agency without your explicit permission. Identifiers might be removed from the identifiable private information and, after such removal, the information could be used for future research studies without additional informed consent from the subject or the organization. While there are no direct benefits to you or your organization for participating, we hope to gain more information about lionfish management in the Western Atlantic region in order to better inform these efforts. There are no known risks from participation in this research. It is not possible to identify all potential risks in research procedures, but we have taken reasonable safeguards to minimize any potential (but unknown) risks.

To indicate your consent to participate in this research and to continue on to the survey, please continue to the next page.

If you have any questions about the research, please contact Jennifer Solomon at jennifer.solomon@colostate.edu or Kaylin Clements at Kaylin.Clements@colostate.edu. If you have any questions about your rights as a volunteer in this research, contact the CSU Internal Research Board at: RICRO_IRB@mail.colostate.edu; 970-491-1553.

Please note: **We recommend using a computer or tablet to take the survey as opposed to a mobile phone.** Do not press the back button on your browser, or you will lose your responses.

1 What is the name of the organization on whose behalf you are participating in this survey?

NOTE: Providing the name *ensures we do not report duplicate survey responses. We will not share the organization name in our publication.* If you are involved in lionfish management with more than one organization, please complete a separate survey for each.

2 In which geographical region(s) has your organization currently or previously been involved in invasive lionfish management?

☐

Caribbean

- ☐ Central America
- ☐ Mediterranean
- ☐ Mexico
- ☐ South America
- ☐ United States–Atlantic
- ☐ United States–Gulf of Mexico

2B You selected Caribbean, Central America, or South America in the previous question. What country or countries within that region(s) has your organization engaged with the lionfish invasion?

- ☐ Anguilla
- ☐ Antigua and Barbuda
- ☐ Aruba
- ☐ Bahamas
- ☐ Barbados
- ☐ Belize
- ☐ Bermuda
- ☐ BES Islands (Bonaire, St. Eustatius, Saba)
- ☐ Brazil
- ☐ British Virgin Islands
- ☐ Cayman Islands
- ☐ Colombia
- ☐ Costa Rica

- ☐ Cuba
- ☐ Curacao
- ☐ Dominica
- ☐ Dominican Republic
- ☐ French Guiana
- ☐ Grenada
- ☐ Guadeloupe
- ☐ Guatemala
- ☐ Guyana
- ☐ Haiti
- ☐ Honduras
- ☐ Jamaica
- ☐ Martinique
- ☐ Montserrat
- ☐ Nicaragua
- ☐ Panama
- ☐ Puerto Rico
- ☐ Saint Barthelemy
- ☐ Saint Martin
- ☐ St. Kitts and Nevis

- ☐ St. Lucia
- ☐ St. Vincent and the Grenadines
- ☐ Suriname
- ☐ Trinidad and Tobago
- ☐ Turks and Caicos Islands
- ☐ U.S. Virgin Islands
- ☐ Venezuela

3 What best describes the type of organization?

- ☐ For profit
- ☐ Non-governmental organization (not-for-profit)
- ☐ Government
- ☐ Other: _____

3B What is your organization's primary sector of involvement?

- ☐ Marine Protection/Conservation
- ☐ Higher Education
- ☐ Public Education/Advocacy
- ☐ Fishery
- ☐ Seafood Distribution
- ☐ Culinary
- ☐ Tourism
- ☐ Other: _____

4 What best describes your role in the organization you specified?

- ☐ Director

- ☐ Senior scientist
- ☐ Program manager
- ☐ Researcher
- ☐ Student
- ☐ Communication/Outreach coordinator
- ☐ Scientist
- ☐ Volunteer
- ☐ Biologist
- ☐ Protected area officer
- ☐ Tourism officer
- ☐ Conservation officer
- ☐ Other: _____

The following two questions ask what types of approaches your organization has implemented 1. *directly* and 2. *indirectly*. By *directly*, we mean your organization has been the entity implementing the activity on the ground. By *indirectly* we mean your organization has not implemented the activity on the ground but has supported it or been involved in some way.

5 Which of these approaches has your organization directly implemented for lionfish management? Note: A * indicates to hover over the word for a definition.

- ☐ Organized culling/removal*
- ☐ Tournaments/Derbies*
- ☐ Culling by recreational fishers*
- ☐ Training
- ☐ Data collection
- ☐ Public education, outreach, or awareness raising
- ☐ Workshops/Seminars

- ☐ Networking
- ☐ Knowledge management*
- ☐ Voluntourism*
- ☐ Adventure/Ecotourism
- ☐ Volunteer program
- ☐ Permitting or licensing
- ☐ Gear testing (traps, rovers, spears, etc.)
- ☐ Promoting lionfish market development—Working with fishers
- ☐ Promoting lionfish market development—Working with restaurants or seafood markets/supermarkets
- ☐ Promoting lionfish market development—Working with wholesalers
- ☐ Promoting lionfish market development—Working with fishmongers
- ☐ Promoting lionfish market development—Lionfish jewelry
- ☐ Promoting consumption of lionfish
- ☐ Other (if chosen, please enter a word or phrase to describe your organization's other approach) _____

6 What types of approaches has your organization indirectly supported for lionfish management?

Note: A * indicates to hover over the word for a definition.

- ☐ Organized culling/removal*
- ☐ Tournaments/Derbies*
- ☐ Culling by recreational fishers*
- ☐ Training

- ☐ Data collection
- ☐ Public education, outreach, or awareness raising
- ☐ Workshops/Consultations
- ☐ Networking
- ☐ Knowledge management*
- ☐ Voluntourism*
- ☐ Adventure/Ecotourism
- ☐ Volunteer program
- ☐ Permitting or licensing
- ☐ Gear testing (traps, rovers, spears, etc.)
- ☐ Promoting lionfish market development—Working with fishers
- ☐ Promoting lionfish market development—Working with restaurants
- ☐ Promoting lionfish market development—Working with wholesalers
- ☐ Promoting lionfish market development—Working with fishmongers/seafood sellers
- ☐ Promoting lionfish market development—Lionfish jewelry
- ☐ Promoting consumption of lionfish
- ☐ Other _____

7 What type(s) of data has your organization collected? Please check all that apply.

- ☐ Gear testing (e.g., lionfish traps, rovers)
- ☐ Public knowledge, attitudes, or perceptions of lionfish

- ☐ Volunteer engagement (number of volunteers, hours worked, etc.)
- ☐ Economic impact of lionfish
- ☐ Lionfish market (ex: willingness to pay, consumer characteristics)
- ☐ Lionfish abundance or density
- ☐ Number of lionfish removed
- ☐ Number of lionfish observed (but not necessarily removed)
- ☐ Lionfish size in length (standard length/total length)
- ☐ Lionfish size in weight
- ☐ Presence of eggs in females
- ☐ Sex of lionfish
- ☐ Sexual maturity of lionfish
- ☐ Removal effort: Total number of divers
- ☐ Removal effort: Dive times conducting removal
- ☐ Catch Per Unit Effort
- ☐ Depth of lionfish
- ☐ General location (e.g., name of area or region)
- ☐ Specific location of lionfish (e.g., GPS coordinates, dive site)
- ☐ Type of habitat (ex: sand, artificial reef, coral, etc.)
- ☐ Stomach contents
- ☐ Other: _____

8 How has the data been shared? Please check all that apply:

- ☐ Maintain database
- ☐ Reports to government agencies
- ☐ Report to NGOs
- ☐ Report internally to guide management
- ☐ Report externally to guide management
- ☐ Report to guide policy development
- ☐ Report to partner organizations
- ☐ Publish in scientific journals
- ☐ Communicate to the local community directly (e.g., public meetings)
- ☐ Phone or computer apps
- ☐ News outlets
- ☐ Website
- ☐ Social media
- ☐ Conferences
- ☐ Other: _____

9 In which of the following has your organization engaged members of the public? Please check all that apply.

- ☐ Organized culling/removal*
- ☐ Tournaments/Derbies*
- ☐ Culling by recreational fishers*
- ☐ Training

- ☐ Data collection
- ☐ Public education, outreach, or awareness raising
- ☐ Workshops/Seminars
- ☐ Networking
- ☐ Knowledge management*
- ☐ Voluntourism*
- ☐ Adventure/Ecotourism
- ☐ Volunteer program
- ☐ Permitting or licensing
- ☐ Gear testing (traps, rovers, spears, etc.)
- ☐ Promoting lionfish market development—Working with fishers
- ☐ Promoting lionfish market development—Working with restaurants or seafood markets/supermarkets
- ☐ Promoting lionfish market development—Working with wholesalers
- ☐ Promoting lionfish market development—Working with fishmongers
- ☐ Promoting lionfish market development—Lionfish jewelry
- ☐ Promoting consumption of lionfish
- ☐ Other (if chosen, please enter a word or phrase to describe your organization's other approach) _____

10 Which of these approaches has been the most widely used by your organization?

- ☐ Organized culling/removal*
- ☐ Tournaments/Derbies*

- ☐ Culling by recreational fishers*
- ☐ Training
- ☐ Data collection
- ☐ Public education, outreach, or awareness raising
- ☐ Workshops/Seminars
- ☐ Networking
- ☐ Knowledge management*
- ☐ Voluntourism*
- ☐ Adventure/Ecotourism
- ☐ Volunteer program
- ☐ Permitting or licensing
- ☐ Gear testing (traps, rovers, spears, etc.)
- ☐ Promoting lionfish market development—Working with fishers
- ☐ Promoting lionfish market development—Working with restaurants or seafood markets/supermarkets
- ☐ Promoting lionfish market development—Working with wholesalers
- ☐ Promoting lionfish market development—Working with fishmongers
- ☐ Promoting lionfish market development—Lionfish jewelry
- ☐ Promoting consumption of lionfish
- ☐ Other (if chosen, please enter a word or phrase to describe your organization's other approach) _____

11A The next questions are related to your organization's involvement in and application of scientific research: **Has your organization's lionfish data contributed to a peer-reviewed scientific publication?**

- ☐ Yes
- ☐ No
- ☐ Don't know

11B **Has your organization's lionfish data been used to inform management?**

- ☐ Yes
- ☐ No
- ☐ Don't know

11C **Has your organization's lionfish data contributed to government agency research?**

- ☐ Yes
- ☐ No
- ☐ Don't know

11D **Has your organization's lionfish data been used to inform policy?**

- ☐ Yes
- ☐ No
- ☐ Don't know

11E **Does your organization collaborate with scientists? If so, scientists from which sectors? Please check all that apply:**

- ☐ None
- ☐ Government
- ☐ Academic
- ☐ Private industry
- ☐ Non-governmental

☐ Other _____

11D How important is research in your organization's lionfish work?

- ☐ Not at all important
- ☐ Low importance
- ☐ Slightly important
- ☐ Neutral
- ☐ Moderately important
- ☐ Very important
- ☐ Extremely important

12 Based on your organization's experience, which of its approaches to lionfish management appears to have been most impactful to helping control the lionfish invasion? Please rank up to six approaches in the boxes below with 1 being the most impactful, 2 s most, and 3 third most. You can drag up to 2 items into each box.

- ☐ Organized culling/removal*
- ☐ Tournaments/Derbies*
- ☐ Culling by recreational fishers*
- ☐ Training
- ☐ Data collection
- ☐ Public education, outreach, or awareness raising
- ☐ Workshops/Seminars
- ☐ Networking
- ☐ Knowledge management*
- ☐ Voluntourism*
- ☐ Adventure/Ecotourism

- ☐ Volunteer program
- ☐ Permitting or licensing
- ☐ Gear testing (traps, rovers, spears, etc.)
- ☐ Promoting lionfish market development—Working with fishers
- ☐ Promoting lionfish market development—Working with restaurants or seafood markets/supermarkets
- ☐ Promoting lionfish market development—Working with wholesalers
- ☐ Promoting lionfish market development—Working with fishmongers
- ☐ Promoting lionfish market development—Lionfish jewelry
- ☐ Promoting consumption of lionfish
- ☐ Other (if chosen, please enter a word or phrase to describe your organization's other approach) _____

12A Based on your organization's experience, why do these approaches appear to have been most impactful to lionfish control?

12B Are there any approaches that your organization has used in the past and chosen to stop? Please check all that apply.

- ☐ No, there are no approaches our organization has used and chosen to stop
- ☐ Organized culling/removal
- ☐ Tournaments/Derbies
- ☐ Culling by recreational fishers
- ☐ Training

- ☐ Data collection
- ☐ Public education, outreach, or awareness raising
- ☐ Workshops/Consultations
- ☐ Networking
- ☐ Knowledge management
- ☐ Voluntourism
- ☐ Adventure/Ecotourism
- ☐ Volunteer program
- ☐ Permitting or licensing
- ☐ Gear testing (e.g., lionfish traps, rovers)
- ☐ Promoting lionfish market development—Working with fishers
- ☐ Promoting lionfish market development—Working with restaurants
- ☐ Promoting lionfish market development—Working with wholesalers
- ☐ Promoting lionfish market development—Working with fishmongers/seafood sellers
- ☐ Promoting lionfish market development—Lionfish jewelry
- ☐ Promoting consumption of lionfish
- ☐ Other _____

12C Why did your organization choose to stop using the(se) approach(es)?

Based on your organization's experiences prior to the COVID-19 pandemic, please rate your level of agreement with the following statements:

13A The lionfish population is less of a problem since lionfish management efforts have been implemented in the area(s) where we've worked.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Somewhat disagree
- ☐ Neither agree nor disagree
- ☐ Somewhat agree
- ☐ Agree
- ☐ Strongly agree

13B Our organization's lionfish management efforts have been successful in controlling the lionfish invasion in the area(s) where we've worked.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Somewhat disagree
- ☐ Neither agree nor disagree
- ☐ Somewhat agree
- ☐ Agree
- ☐ Strongly agree

13C The lionfish population has decreased in the area(s) where we've worked since the lionfish invasion started.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Somewhat disagree
- ☐ Neither agree nor disagree
- ☐ Somewhat agree

- ☐ Agree
- ☐ Strongly agree

13D Decreases in lionfish abundance in this area are primarily due to natural processes.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Somewhat disagree
- ☐ Neither agree nor disagree
- ☐ Somewhat agree
- ☐ Agree
- ☐ Strongly agree

13E Decreases in lionfish abundance in this area are primarily due to management efforts.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Somewhat disagree
- ☐ Neither agree nor disagree
- ☐ Somewhat agree
- ☐ Agree
- ☐ Strongly agree

14 Which of the following characterizes how participants engage in your organization's lionfish-related activities? Please check all that apply. Participants...

- ☐ contribute to data collection
- ☐ help analyze data
- ☐ help analyze samples
- ☐ help disseminate results

- ☐ help design the study
- ☐ help interpret the data
- ☐ help draw conclusions
- ☐ participate in defining the questions
- ☐ participate in developing the hypotheses
- ☐ participate in discussion of results
- ☐ participate in answering new questions
- ☐ other _____
- ☐ None of these

14A In which types of participation does your organization engage participants most? Please rank up to six types of participation in the boxes below with 1 being the type of participation that occurs most often, 2 s most, and 3 third most. You can drag up to 2 items into each box.

- ☐ contribute to data collection
- ☐ help analyze data
- ☐ help analyze samples
- ☐ help disseminate results
- ☐ help design the study
- ☐ help interpret the data
- ☐ help draw conclusions
- ☐ participate in defining the questions
- ☐ participate in developing the hypotheses
- ☐ participate in discussion of results

- ☐ participate in answering new questions
- ☐ other _____
- ☐ None of these

15 Do any of your organization's lionfish programs/activities involve citizen science? In this case, we are defining citizen science as volunteers and/or members of the public engaging in activities that generate information for research or management purposes. Note: sometimes "citizen science" is used interchangeably with "community science".

- ☐ Yes
- ☐ No

16 In which of the following has your organization engaged citizen scientists? Please check all that apply.

- ☐ Organized culling/removal*
- ☐ Tournaments/Derbies*
- ☐ Culling by recreational fishers*
- ☐ Training
- ☐ Data collection
- ☐ Public education, outreach, or awareness raising
- ☐ Workshops/Seminars
- ☐ Networking
- ☐ Knowledge management*
- ☐ Voluntourism*
- ☐ Adventure/Ecotourism
- ☐ Volunteer program
- ☐ Permitting or licensing

- ☐ Gear testing (traps, rovers, spears, etc.)
- ☐ Promoting lionfish market development—Working with fishers
- ☐ Promoting lionfish market development—Working with restaurants or seafood markets/supermarkets
- ☐ Promoting lionfish market development—Working with wholesalers
- ☐ Promoting lionfish market development—Working with fishmongers
- ☐ Promoting lionfish market development—Lionfish jewelry
- ☐ Promoting consumption of lionfish
- ☐ Other (if chosen, please enter a word or phrase to describe your organization's other approach) _____

17 Has your organization facilitated citizen science hands-on activities with lionfish?

- ☐ Yes
- ☐ No

18 Where did the hands-on activity take place?

- ☐ Ocean
- ☐ Boat
- ☐ Dockside/onshore
- ☐ Classroom or lab
- ☐ Other _____

19 Based on your organization's experiences, please rate the level of importance of citizen scientists in the following questions on a scale of Not important to Very important.

20 How important are citizen scientists to your organization's lionfish management efforts?

- ☐ Not at all important
- ☐ Low importance

- ☐ Slightly important
- ☐ Neutral
- ☐ Moderately important
- ☐ Very important
- ☐ Extremely important

21 How important are citizen scientists to your organization's data collection?

- ☐ Not at all important
- ☐ Low importance
- ☐ Slightly important
- ☐ Neutral
- ☐ Moderately important
- ☐ Very important
- ☐ Extremely important

22 How important are citizens scientists to your organization's contribution to scientific findings?

- ☐ Not at all important
- ☐ Low importance
- ☐ Slightly important
- ☐ Neutral
- ☐ Moderately important
- ☐ Very important
- ☐ Extremely important

23 Could your organization do their work on lionfish without citizen scientists?

- ☐ Yes
- ☐ No

24 To what extent has the COVID-19 pandemic changed your approaches to lionfish management?

- ☐ Not at all
- ☐ To a very small extent
- ☐ To a small extent
- ☐ To a moderate extent
- ☐ To a large extent
- ☐ To a very large extent
- ☐ To an extremely large extent

24A To what extent has the COVID-19 pandemic affected your work with engaging citizen scientists in lionfish management?

- ☐ Not at all
- ☐ To a very small extent
- ☐ To a small extent
- ☐ To a moderate extent
- ☐ To a large extent
- ☐ To a very large extent
- ☐ To an extremely large extent

24B Please share what activities have been impacted and if and how your organization has adapted.

25 What limitations does your organization face with regard to lionfish research and/or management? Please rank up to 5 limitations with 1 being the biggest limitation. Lack of...

Drag and drop items in order below

- _____ funding
- _____ staff time or number of staff
- _____ access to data
- _____ local involvement
- _____ local interest
- _____ familiarity of participants with safe handling of lionfish
- _____ skill level of participants

- _____ familiarity of participants with marine science research methods
- _____ duration of participant engagement
- _____ collaboration with local non-governmental organizations
- _____ collaboration with regional/international organizations
- _____ collaboration with local government
- _____ access to software (ex: statistical programs)
- _____ access to gear (ex: boat, dive gear)
- _____ expertise in marine sciences (ex: how to conduct research)
- _____ expertise in social sciences (ex: human behavior, communication)
- _____ Other:

In the future, we intend to create a database of lionfish work being conducted by organizations like yours on a publicly-accessible website with the hopes of providing a platform to share, learn, and connect. Please answer the following questions based on your organization's interest in being included in this database. **If you reply yes to any of the following, we will contact you about the specific content you would like to share and will not release any responses you provided in this survey without your permission.**

25A Would your organization be interested in sharing information about its lionfish work in our database?

- ☐ Yes
- ☐ No

25B Would your organization be interested in sharing lionfish data through our database?

- ☐ Yes
- ☐ No

25C What is the best e-mail address to contact you?

25D Are there other people working in organizations or agencies you know who should receive this survey? If so, please provide their name(s) and/or the name of the organization/agency. Note: We will be translating the survey into Spanish so please do not hesitate to suggest contacts who would prefer to respond in Spanish.

- ☐ Contact 1: _____
- ☐ Contact 2: _____
- ☐ Contact 3: _____
- ☐ Contact 4: _____
- ☐ Contact 5: _____
- ☐ Contact 6: _____
- ☐ Contact 7: _____

☐ Contact 8: _____

☐ Contact 9: _____

☐ Contact 10: _____

26 Thank you for completing this survey. Would you like to receive a copy of the publication and updates about the study?

☐ Yes

☐ No

27 What is the best e-mail address to contact you?
