

2006 Lionfish Cruise Logs

Lionfish Research Mission 2006

Dates: **July 27 – Aug 4 2006**

Platform: [NOAA Ship Nancy Foster](#)

The Indo-Pacific lionfish (*Pterois volitans/miles* complex) is native to the tropical and subtropical regions of the southwest Pacific, the Indian Ocean and the Red Sea. Lionfish were first reported by recreational SCUBA divers off the coast of North Carolina in 2000. They are primarily located in water depths from 100 to 260 ft (Figure 1, the map). Now in its third year, our research will expand on previous studies documenting a wide range distribution of lionfish with high abundances, comparable to many native species.

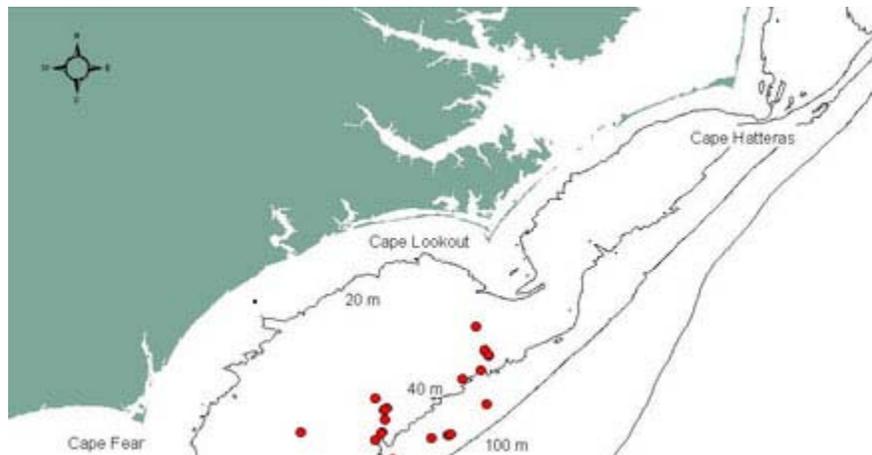


Fig 1. Red dots depict survey locations from 2004 and 2005 lionfish were found at 95% of these locations both years.

Abundance data from previous surveys serve as baseline estimates for determining population growth and geographic distribution of this species. We will determine if lionfish populations are increasing off the coast of North Carolina. This will establish a foundation for determining the impact of lionfish on native fish and invertebrate communities. We can accomplish this, in part, by expanding our native species surveys to include all native fishes, especially tropicals. We hope to identify those species that may be potential prey of lionfish which, when combined with dietary analysis lionfish, should allow assessment of an important ecological impact of lionfish introduction. In addition, a better understanding of lionfish reproductive potential and seasonality is a necessary component of this research. This information will allow researchers to assess the potential impact of the lionfish on native communities.

Lionfish have been found primarily in water depths greater than 100 ft off the coast of North Carolina where the warm Gulf Stream waters moderate bottom water temperatures year round. We have placed temperature sensors all along the seafloor to monitor seasonal bottom water temperatures to better understand the role of temperature in limiting lionfish distributions.

This year's activities include efforts to:

- Conduct visual and video transect surveys to quantify lionfish and native fish species including tropical fish and likely prey of lionfish. This will be done on SCUBA at locations within Onslow Bay (Figure 1). (Dive Operations)
- Collect live lionfish for reproduction and life history studies
- Deploy and retrieve temperature sensors and submerged buoys. (Dive Operations)
- Conduct multi-beam sonar transects to map and identify potential lionfish habitat off the coast of North Carolina.
- Conduct plankton tows for presence of lionfish larvae



Divers



Lionfish and lobsters

Day 1: 7-27-2006 Departure

Personnel

- Paula Whitfield: NOAA Principal Investigator
- Doug Kesling: NURC - UNCW Dive Operations Supervisor, diver
- Christine Addison: NOAA research diver
- Brian Degan: NOAA research diver
- Jay Styron: NURC – UNCW Dive Operations and diver
- Wilson Freshwater: UNCW research diver
- Jennifer Dorton: UNCW- CORMP research diver
- James Morris: NOAA research scientist
- Barry King: technical assistant
- Norbert Wu: underwater cinematographer
- Curtis Callaway: photographer/cinematographer
- Betsy Crowfoot: field producer/writer

NOAA Ship *Nancy Foster* departed the Port of Morehead City at 9 am. Our first destination was a natural hard bottom location 35 miles due south of Beaufort Inlet. We plan to complete three dives to conduct visual fish surveys of both native species and lionfish. Divers will also collect lionfish specimens to examine diet, reproduction, genetics, age, and growth. This information is needed to understand how lionfish are affecting the coastal marine ecosystem.

Natural hard bottom and artificial habitats, such as reefs and ship wrecks, along the North Carolina coast have become prime habitats for the venomous Indo-Pacific lionfish. This is one of the most recent marine invasive species to become established (reproducing and dispersing) in the Atlantic Ocean. Until 2000, lionfish were thought to exist only in the Indo-Pacific region. Six years later, they have become common along the coast of North Carolina, in water depths from 100 to 150 ft. Our team has completed training in both deep diving and decompression techniques to allow them to dive to the depths where lionfish are found along this coast.



Brian Degan
Credit: Curtis Callaway

We hope to increase public awareness of the potential consequences of the lionfish invasion and of marine invasive species in general through a collaboration with the Essential Image Source Foundation. They are developing educational outreach products which can be seen at [their website](#). On this cruise, underwater cinematographer Norbert Wu will shoot high definition video footage of habitats off of North Carolina which alongside NOAA researchers to add content to these educational products. In addition, writer/producer Betsy Crowfoot will include [a blog about life on the lionfish cruise](#).

Day 2: 7-28-06

The shipwreck Naeco is our first survey location. In 2000, the Naeco was the location where lionfish were first reported off the coast of North Carolina. Every year since, we have observed increasing abundance of lionfish here.

After dropping down, it wasn't long before lionfish were sighted. They seemed to be everywhere we looked. The first dive team conducted a 50 m visual census survey transect of both lionfish and the native fish community. A 50 m video survey transect was also recorded to compare with the diver visual census results. Cinematographer Norbert Wu tested his high definition video camera on this dive and we compared our digital video camera and his high definition system.



Lionfish photo with
Almaco Jack
Credit: Doug Kesling



Christine Addison
Credit: Doug Kesling

The second dive team was able to collect 30 lionfish in one dive! These specimens will be useful in developing a better understanding of the biology of lionfish in their new Atlantic home. Unfortunately, the seas picked up and our afternoon dives were canceled. We hope for better conditions tomorrow.

Day 3: 7-29-06

Survey Team

- Paula Whitfield
- Christine Addison
- Doug Kesling

Collection Team

- Jay Styron
- Brian Degan
- Wilson Freshwater
- Norbert Wu

Survey dives

Today four dives were completed at an area of low relief live rock approximately 60 miles south of Beaufort Inlet. Although this area did not have the relief of yesterday's wreck dive on the Naeco, the few available crevices and narrow ledges supported a wide variety of fish and other fauna.

A record number of 16 lionfish were counted on one survey transect, which covers an area 50 m long by 10 m wide. The observed lionfish varied in length, suggesting that they came from different spawning events over an extended period of time.

Collection dives

Live specimens of lionfish were collected today. Collecting live lionfish requires a delicate hand and a careful approach. Divers capture the lionfish with aquarium nets and then carefully transfer the fish to a small mesh bag. Due to expansion of the swim bladder* during ascent, fish need to be vented while the divers are at their 20' decompression stop. Divers vent the fish by carefully inserting a hypodermic needle into the swim bladder until air bubbles escape, releasing the pressure of the expanded air. This enables the fish to swim upright once again. We have found that venting the fish in this way increases their survival on the surface. Lionfish were also collected using pole spears. Lionfish collections are needed to understand lionfish reproduction (see Day 2) and other life history characteristics such as age, growth, diet, and genetics.

*The swim bladder is a flexible-walled, gas-filled sac located in the dorsal portion of body cavity. This organ aids in buoyancy control. Most of the swim bladder is not permeable to gases. Gas (typically oxygen) is introduced to (increase buoyancy) and removed from (decrease buoyancy) the bladder via a gas gland. One of the risks to a swim bladder is that if a fish ascends too quickly, the bladder can rupture or burst, killing the fish.

Lionfish reproduction studies

Aboard the Nancy Foster, studies on lionfish reproduction continue. We have learned from earlier work that lionfish release multiple batches of eggs per year and are mature at approximately 210 mm total length. Lionfish release their eggs encased in a buoyant gelatinous ball.



Transect photo
Credit: Doug Kesling

Today we collected two lionfish egg balls from a single lionfish using a strip spawning technique. This collection provided new information regarding the number of egg balls each lionfish produces during a spawning event. By counting the eggs in each ball, we obtain estimates of lionfish egg output per spawning event, an important parameter for population modeling.

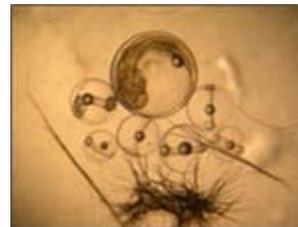
In addition, we are collecting ichthyoplankton using a bongo net. These collections will be sorted to determine if they contain lionfish larvae. By comparison with past ichthyoplankton surveys, these collections will provide insight into the abundance of lionfish larvae in the ichthyoplankton and could be used to gauge the relative increase in lionfish abundance.



Lionfish
Credit: Doug Kesling



James Morris



Fish embryos

Day 4: 7-30-06

Survey Team

- Paula Whitfield
- Doug Kesling
- Christine Addison
- Norbert Wu

Collection Team

- Jay Styron
- Brian Degan
- Wilson Freshwater

The seas and wind finally calmed overnight allowing for a productive day of fish collection and surveying. Four dives were conducted on a live rock area approximately 65 miles southwest of Beaufort Inlet.

Survey and collection dives

The four dive sites were all located along the same rocky ledge, giving us a nice perspective on an extensive area of the ledge. Numerous lionfish were observed on each dive as well as many other tropical fishes including grunts and groupers, and lobsters. Upwelling of colder, nutrient rich waters near the bottom greatly reduced underwater visibility for the divers as well as challenged their thermal tolerance. Over 30 lionfish were collected today.

Topside activities

Dissections revealed that many of the lionfish from the second dive site had recently feasted on juvenile grunts.

A number of hydrated ovaries we also observed during the fish dissection, indicating that these females were likely to spawn within the next 24 hours. We have yet to find a male with milt, a milky substance containing fish sperm, in the testes, which would signify active spawning by males. We'll continue our search tomorrow.



Norbert Wu
Credit: Doug Kesling



Full lionfish
Credit: Curtis W. Calloway



Hydrated ovary
Credit: Curtis W. Calloway

Day 5: 7-31-06

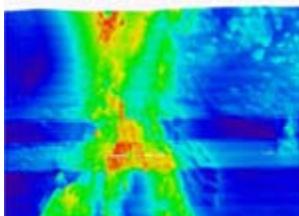
Survey Team

- Paula Whitfield
- Doug Kesling
- Norb Wu
- Christine Addison

Collection Team

- Jay Styron
- Wilson Freshwater
- Brian Degan

During this cruise, we are diving on sites previously sampled on 2004 and 2005 cruises and on new sites selected from high resolution multibeam sonar surveys. Multibeam surveys produce a quick, georectified map of the seafloor with detailed depth information.



Habitat map

In 2005, Geodynamics, Inc. was contracted to multibeam a handful of our sites to aid in site selection and to understand the extent of live rock habitats. The *Nancy Foster* has recently added a multibeam unit and a survey technician to oversee collection of multibeam data. Each evening, after dive operations, we continue to survey additional areas that could yield new



Caribbean lobsters

sites. Not only are these maps critical to increasing our efficiency at locating appropriate sampling locations but they will aid us in designing effective sampling strategies for future experiments. The sites we dove today were chosen from areas previously mapped with this technology.

Day 6: 8-1-06

Survey Team

- Paula Whitfield
- Doug Kesling
- Christine Addison

Collection Team

- Jay Styron
- Wilson Freshwater
- Brian Degan
- Norb Wu

The seas calmed down considerably today, allowing us to transit 75 miles overnight to our furthest site, the 18 Fathom Wreck. This wreck is close to 100 miles from Beaufort Inlet, our port of origin. From this point on we will be working our way closer and closer to home. The first year we visited this site, it had one of the highest densities of lionfish of any site surveyed.

Today, we conducted several transects to quantify the fish community and to count the number of lionfish. In 2004's fish transect, eight lionfish were counted; today we counted eleven. We also collected 17 lionfish for examination of their life history characteristics. During our two dives, we saw numerous lionfish, spadefish, black sea bass, African pompano and other tropical species. Except for a cold water layer hugging the seafloor near the wreck, this was a great dive.

The conditions on the second dive site, a wreck known as the City of Houston, were much worse. Visibility was reduced to less than 15 feet due to particulates in the water, "marine snow", and high densities of juvenile fish and baitfish. We were able to finish the survey transects and collect a sensor that has been logging bottom water temperature every 30 minutes since August 2005. These temperature data are useful in capturing seasonal changes which increase our understanding of where lionfish can survive and reproduce. Lionfish, die when temperatures drop to 50° F. The temperature logger retrieved from City of Houston reached a winter minimum of 55 ° F, potentially warm enough for year round survival of lionfish.

We have just passed the halfway point now and have examined 16 different locations spread across Onslow Bay, North Carolina. Lionfish were observed at 14 of these locations, with record high densities recorded at three locations. We will see if this trend continues during the final days of our cruise.



Lionfish
(Credit: Doug Kesling)



Temperature sensors
(Credit: Doug Kesling)



School of fish
(Credit: Doug Kesling)

Day 7: 8-2-06

Today we added an additional three fish survey dives and one collection dive to our cruise total. Sea surface conditions continue to improve, although we are keeping an eye on Tropical Storm Chris in the Caribbean. All sites today were on typical North Carolina live rock ledges. The ledges may only rise three feet but they can extend for kilometers, as we found during our multibeam surveys. These extensive ledges provide structure for a variety of fish, such as groupers, snappers, porgies, and many tropicals, as well as lionfish.

The cold, green, nutrient-rich waters on the bottom are beginning to take its toll on the divers. Divers continue to work hard, but they are feeling fatigue earlier than only a few days ago. For now, our weather looks good, enthusiasm is still high, and we'll continue as we have been for our final day and a half.



Lionfish with lobster
(Credit: Doug Kesling,
NURC)

Highlight: Essential Image Source Foundation (EISF) Documentary crew

NOAA researchers have partnered with the EISF (<http://www.eisf.org>) to create outreach products aimed at increasing public awareness about the invasive Indo-Pacific lionfish. It is our goal to warn the medical, diving, and fishing communities about the venomous spines of the lionfish. In addition, we hope to raise public awareness in areas where lionfish have not yet colonized, such as the Gulf of Mexico, Caribbean and Florida Keys. By increasing early public awareness and information, we aim to

decrease the likelihood that will become established in these areas. We have been working topside with writer/field producer Betsy Crowfoot and filmmaker Curtis Callaway and underwater filmmaker Norbert Wu to further this effort.



Norbert Wu – Underwater Filmmaker. (Credit: Doug Kesling, NURC)

Norb, as we know him, has been a professional underwater filmmaker for the past twenty years. When he is not diving with lionfish researchers, he spends time under the ice in the Antarctic and with great white sharks off the Baja Peninsula. On this cruise, in addition to all of the technical dive gear, he has been gathering footage with a high definition video camera. Despite the sheer size of this camera he handles it adeptly, swimming against

unrelenting currents to get the shot.



Norbert Wu topside. (Credit: Christine Addison)

Betsy Crowfoot – writer and field producer

Curtis Callaway - Filmmaker of Callaway Brothers Photography

This dynamic duo, Betsy Crowfoot and Curtis Callaway, were only aboard for the first few days of our cruise, but they managed to be everywhere at once. While Norb collected footage below the surface, Betsy and Curtis were a perpetual flurry of activity, conducting topside interviews of the scientific party and ship's crew and shooting footage of all ship board activities.



(Credit: Christine Addison)

Due to time commitments to their 'real' jobs on Monday afternoon, we said good-bye to Betsy and Curtis during an offshore personnel transfer with the US Coast Guard. We have missed Curtis's camera and Betsy's probing questions following us around ship.

We have been extremely lucky to have such a talented and personable group of filmmakers and journalists aboard. It has been a pleasure to meet them and share our cruise experiences. We thank them for their patience with our camera shyness, our inept modeling, and our instantaneous tongue-tied reflex when the camera was rolling. Their patience and good humor have been appreciated.