Lionfish Bycatch in the Florida Keys Commercial Spiny Lobster Fishery

El Pez León Captura Incidental en los Cayos de Florida Langosta Pesca Comercialles

Prises Accidentelles Apparaissant dans les Florida Keys Commercial Langouste Pêche

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ABSTRACT

The emergence of lionfish as a bycatch species in deep water fishing grounds of the commercial spiny lobster fishery indicates a need to extend the efforts to monitor and cull lionfish present to deep water habitats. Catch data was collected from a commercial lobster vessel to determine the geographic distribution, length frequency, catch rates of lionfish, as well as the potential impacts on lobster catch rates. Locations and depths were recorded for each trap sampled; and each organism caught was identified and measured. Lionfish were present in 21.4% of the traps; with mean catch rate of 0.38 fish/trap. Mean catch rates of legal lobsters decrease from 1.82 to 0.59/trap when lionfish are present. Traps provide a low effort/high yield option for culling lionfish in deeper waters that are not targeted by normal removal efforts. While this method could be helpful in reducing lionfish numbers, lionfish presence leads to reduce lobster catch rates, negatively impacting fisher profits.

KEY WORDS: Lionfish, invasive, lobster fishery, bycatch, impacts

INTRODUCTION

As the number lionfish continues to increase in the Western Atlantic Ocean, Caribbean Sea, and Gulf of Mexico, the importance of understanding and quantifying their impact on the ecosystem has become critical. Recent studies in the Western Atlantic and Caribbean indicate that lionfish have the potential to drastically change the landscape of reef systems and coastal habitats. In Florida, lionfish have become a common feature on the Florida Reef Tract and near-shore estuarine habitat after lionfish re-invaded in 2009. Researchers and managers have increased the awareness of affected communities to the negative threat posed by lionfish, and encouraged culling to reduce population size and impacts. Many of these control efforts are focused on removing lionfish with nets and spears in organized kill-derbies or encouraging local divers and snorkelers to cull lionfish during recreational activities. While these efforts can be successful in reducing lionfish densities, they only occur in shallow depths frequented by divers and snorkelers. In recent years, lionfish have become a large proportion of the bycatch in the commercial spiny lobster fishery. Reports of lionfish have risen from tens of lionfish in a single season to thousands. Employing observers on lobster vessels will give researchers an opportunity to quantify lionfish populations in deeper habitats, which are rarely monitored.

METHODS

Two observers surveyed the catch from a single commercial lobster vessel operating on fishing grounds in the Middle Florida Keys during the 2011 - 2012 and 2012 - 2013 fishing seasons. The fishers deployed wooden traps individually in single-file lines in water shallower than 23.5 meters, and with a series of 20 connected wire traps in water deeper than 23. 5 meters ("trawl"). Observers sampled every third trap retrieved from the ocean floor. Following a similar sampling scheme as Matthews et al. (1994), each organism was identified to the species level and measured, with the exception of non-lobster invertebrates which were just identified (e.g. crabs, sponges, shrimp, etc). All lionfish caught, from both sampled and non-sampled traps were held separate from other bycatch species retained by the fishers to obtain counts and total length measurements for all lionfish caught in each trawl. Additionally, an overall count and total poundage of lionfish was recorded for each sampling day.

Spatial interpolation (e.g. kriging, inverse distance weighting, density, etc) will be used to determine if any patterns in distribution are evident for main groups (lobster, lionfish, bycatch fish) caught in the lobster traps. Statistical methods will be employed to quantify reductions in lobster catch as a function of lionfish presence. Estimates of total catch of lionfish from the sampling vessel will be used to estimate total removals for an entire season and compared with those obtained during the 2011/2012 season to determine whether lionfish catches continue to increase in this fishery as reported by a Florida Keys lobster fisherman (Gary Nichols, Personal communication). Lionfish catch rates will be standardized by depth, month, and trap soak time to determine relative abundance. Estimates of relative abundance from the two years of data collection will be used to determine the statistical power of trap observations to detect changes in relative abundance of lionfish. Logistic statistical models implemented in R will be used to test antagonistic relationships between lobster and lionfish on the basis of presence/absence data obtained from the traps.

RESULTS

Observers monitored trap catches over the course of 30 sampling days (Season 1 – 13 days and Season 2 – 17 days) during the two fishing season study period. As expected, spiny lobster dominated the catch, but bycatch species were present in 56.5% of the traps. The five most abundant bycatch species were: littlehead porgies, lionfish, white grunt, scrawled cowfish, and gray triggerfish (Figure 1). There were 3,829 lionfish captured on the days traps were monitored (Season 1 – 1718 and Season 2 – 2111), with 1,383 of those fish seen in the traps that were sampled by observers (Season 1-643 and Season 2 - 740). All other lionfish were collected on sampling days, but not associated with specific trap catch data (geographic position, other species caught, measurements, etc). Lionfish ranged in size from 28 mm to 412 mm total length, with mean total length of 255.3 mm. Mean total length of lionfish increased with depth: < 36.5 meters - 243.9 mm, 36.5 - 45 meters - 255.4 mm, > 45 meters - 266.4 mm.

Lionfish were present in 21.4% of traps (Season 1- 24.7% & Season 2 - 19.2%), but only 11 lionfish were captured in traps (n = 456 traps) set in depths shallower than 23 meters (75 ft). The mean trap catch rate for lionfish was 0.38 lionfish per trap (Season 1 - 0.43 and Season 2 - 0.34), with approximately 300 - 400 traps pulled during each sampling day.

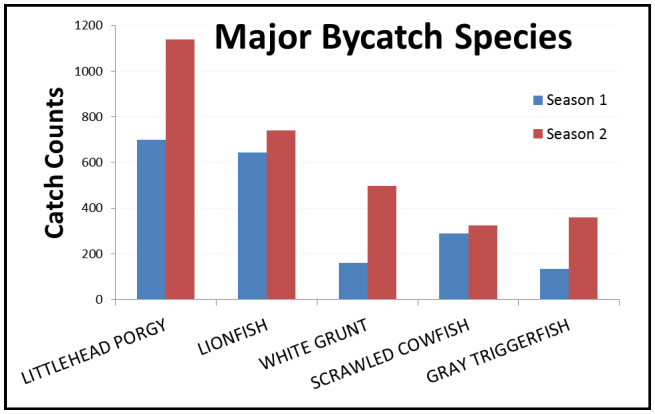

Figure 1. Five most abundant bycatch species captured during the 2-season sampling period.

While lionfish catch rates were comparable at depths greater than 23 meters, lobster and bycatch fish catch rates varied when lionfish were present. The mean catch rate for legal lobsters was 1.11 lobster per trap when considering all traps sampled (Table 1). This catch rate increased to 1.82 legal lobster per trap when calculated for traps with no lionfish present, but decreased to 0.59 legal lobsters per trap when calculated for traps with lionfish present. The mean catch rate for legal lobsters in traps that contained bycatch fish other than lionfish (no lionfish) was found to be 1.00 lobsters /trap, a smaller decline in legal lobsters than seen with lionfish alone.

CONCLUSIONS

While lionfish are often seen by recreational divers and snorkelers in depths shallower than 23 meters, they are rarely seen in lobster traps set in similar depths. While lobster traps were not successful in congregating lionfish in traps at shallower depths, they provide a low effort / high yield method for culling lionfish in deeper habitats that cannot be reached using normal diving removal techniques. The similar mean lionfish catch rates for both seasons may indicate that culling by lobster traps, though yielding large numbers of lionfish, is not sufficient effort to cause declines in deep water lionfish populations . The presence of lionfish in traps may deter lobster entry into traps, as mean legal lobster catch rates declined more with lionfish present than non-lionfish bycatch. Continued monitoring of deep water habitat should be undertaken to determine the density of lionfish in deeper water and to continue to increase efficiency of removals in deep water habitats.

Table 1. Mean catch rate (lobsters/trap) for the above described species composition. Bycatch fish refers to all non-lionfish fish species.

LEGAL LOBSTER CATCH RATES						
	ALL SEASONS		*SEASON 1*		*SEASON 2*	
SPECIES COMPOSITION	**MEAN**	**STD**	**MEAN**	**STD**	**MEAN**	**STD**
All Traps	1.12	1.71	1.29	1.72	1.00	1.69
No Lionfish	1.26	1.83	1.49	1.84	1.11	1.80
Lionfish	0.59	0.98	0.68	1.05	0.51	0.91
Bycatch Fish and No Lionfish	1.00	1.55	1.04	1.45	0.97	1.61
Bycatch Fish and Lionfish	0.47	0.83	0.56	0.94	0.40	0.72
No Bycatch Fish or Lionfish	1.60	2.08	1.97	2.08	1.32	2.04