Spearfishing as a potential threat to fishery sustainability in Jamaica: a survey of 23 fishing beaches

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Abstract: Spearfishing was becoming an increasingly important economic activity in the Caribbean as a result of socioeconomic factors related to underemployment and the low capital outlay for equipment. For a year (2011) we surveyed spearfishing in 23 Jamaican beaches. Spearfishing has expanded from approximately 1% of fishers in 1991 to about 10% in 2011. The fishery is larger than expected and probably produced 4 000tons per year. Though reef fishes dominated catches, other resources such as lobsters, conch and octopus were regularly taken. Many small juvenile fishes were observed in catches well below their adult or optimum sizes. A total of 58% of spear-fishers reported they would have significant difficulty finding alternative employment if spearfishing was banned. Spearfishers reported exploiting the entire island shelf and also nearly all the offshore banks, especially Pedro Bank. Night spearfishing was common and targeted sleeping reef fishes. The activity is banned and should be enforced. Our recommendations include: register all spearfishers, actively manage spearfishing, a partial ban for part of the year and a ban on using scuba and hookah gear for spearfishing. Rev. Biol. Trop. 62 (Suppl. 3): 141-149. Epub 2014 September 01.

Key words: Spearfishing, overfishing, management, reef fishery resources, Jamaica.

Jamaica is the third largest island within the Greater Antilles and is situated near the center of the southwestern Caribbean Sea. It lies in the path of the northeasterly trade winds where speeds often exceed 15ms^{-1} and choppy waters are common. Seas are generally calmer between October and February (Aiken, 1993; Munro, 1983). Westerly currents from 0.5-1 kt occur in the vicinity of the island for most of the year with minimal to no tidal effects (Aiken, 1993), although currents over Pedro Bank can reverse at ebb tide (Munro, 1983).

The island shelf and a number of offshore banks constitute the fishing grounds for marine fisheries of Jamaica which are almost all artisanal. Fisheries produce about 12 000tons annually and are conducted by at least 15 000 active (but possibly as many as 20 000) fishers (Aiken, 2008). Most of the seafloor on the island shelf is sea-grass and soft corals over sand and limestone bedrock. Coralline growth is usually concentrated around the shelf edges (Aiken, 1993; Halcrow, 1998). The southern shelf is much larger and wider than the northern shelf, with a maximum distance from the mainland of 24km. The shelf consists of mostly small patches of corals, gorgonians and seaweeds mixed with sandy patches and large reefs on the eastern side. The north shelf is much narrower; with a maximum distance from the mainland of 1.6km (Fig. 1). Fringing reefs with a few gaps (which are virtually continuous with the sill reef) characterize the north shelf. The largest banks that are utilized as fishing grounds are Pedro Bank and Morant Bank. These banks rise abruptly from deeper than 500m to form submerged plateaus with depths averaging between 20-30m (CFRAMP, 2000).

The fishing techniques used in the Jamaican reef fishery are diverse. The most prominent fishing gears are fish traps, beach seine, and tangle and gill nets; followed by hand

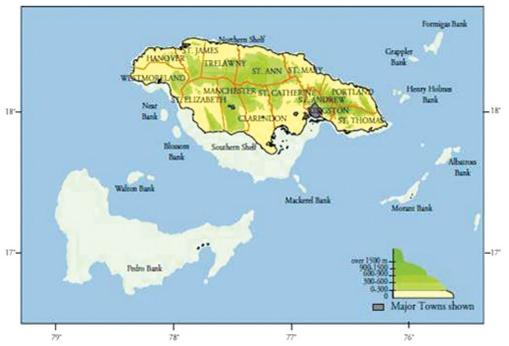

Fig. 1. Major fishing areas of Jamaica. The island shelf consisting of the very narrow northern and much wider southern portions, small nearshore banks, and offshore areas including Pedro Bank (bottom left) and Morant Bank (center right) (Map data from NRCA data unit in CFRAMP, 2000).

Fig. 1. Principales zonas de pesca en Jamaica. La plataforma de la isla consiste de partes muy estrechas al norte y mucho mas amplias al sur, pequeños bancos cercanos a la costa, y las zonas de alta mar, incluyendo el Banco de Pedro (parte inferior izquierda) y el Banco de Morant (centro-derecha) (Datos del mapa son de la unidad de datos NRCA en CFRAMP, 2000).

lines, spearfishing, and some use of illegal explosives. Fishing vessels are mainly small, open, non-motorized wooden canoes (95% of all vessels), with some use of larger, 27 foot motorized fiberglass open canoes (Aiken, 2008; Sary, 2001). The main fisheries resources utilized in Jamaica are coral reef fishes, spiny lobsters, conch, small coastal pelagic finfish and large offshore pelagic finfish. All are targeted by spearfishers (Aiken, 2008).

Spearfishing is defined in this study as "the catching or taking of a fish through the instrumentality of a hand or mechanically propelled, single or multi-pronged spear or lance, barbed or barbless, operated by a person swimming at or below the surface of the water" (FWC, 2011). Types of spearfishing include free diving with snorkel, SCUBA, or hooka.

Munro (1983) noted that spearfishing was becoming an increasingly important economic activity in the Caribbean as a result of socio-economic factors related to underemployment and the low capital outlay for equipment. Spearfishing appeared to be attractive as it offered income earning capacity to otherwise unskilled or impoverished individuals. According to Munro, spearfishing was also attractive in terms of its effect on the natural resources and their management as spearfishing tended to target the oldest, largest and least productive members of the fish community, leaving the younger and more productive members and promoting conservation of the stock (Munro, 1983). He gave an example of the benefits of spearfishing in Belize, stating that about 67% of the production of spiny lobsters at that time was derived from spearfishing and that the spearfishing community appeared to be one of the most prosperous population sectors.

Despite Munro's observations of the benefits of spearfishing in Caribbean countries, some studies have also shown that spearfishing has been implicated in the local extinction of some species. An example is the Goliath grouper (*Epinephelus itajara*) on the Caribbean island of Bonaire (Roberts, 2007). The previous Jamaican study showed that spearfishing accounted for a major portion of the country's annual fisheries production (Passley, 2009; Passley, Aiken & Perry, 2010). That study focused on regular fishermen at beaches around the island and obtained data on the amount, size and type of fish caught, where fishing was most frequently carried out, and how much the fishermen depended on their spearfishing activities. Results showed that spearfishing was much more widely used in Jamaica than expected. The unexpected results from the Passley (2009) study led to the initiation of a second follow-up spearfishing study (the present paper) of commercial spearfishing in Jamaica to confirm the earlier conclusions and to assist the Fisheries Advisory Board in managing commercial spearfishing. Data gathered from this and the previous study were analyzed with the following objectives: 1) to determine the current status of spearfishing in Jamaica, its commercial value, and its contribution to annual fisheries production; 2) to compare the current status of commercial spearfishing in Jamaica with results from the previous study (Passley, 2009; Passley et al.,

2010); 3) to determine effective steps that may be taken to conserve the resources of Jamaica's island shelf and determine if commercial spearfishing can continue under regulations, and 4) to conduct a literature Review on commercial spearfishing worldwide.

MATERIALS AND METHODS

Study sites: Survey trips were made to 23 preselected fishing beaches known to have spear-fishers present by the Fisheries Division of the Ministry of Fishing and Agriculture in Jamaica (Fig. 2).

Fig. 2. Fishing beaches visited in Jamaica: 1. Negril Beach, 2. Orange Bay, Hanover 4. Lucea, 5. Sandy Bay, 6. Hopewell, 7. Spring Garden, 8. Whitehouse Beach, St. James 9. Success, 10. Grange Pen, 11. Falmouth Fishing Village, 12. Braco, 13. Rio Bueno, 14. Old Folly, 15. Discovery Bay, 16. Runaway Bay, 17. Swallow Hole, 18. Salem, 19. Priory, 20. St. Ann's Bay, 21. Mammee Bay, 22. White River, 23. Oracabessa, 24. Pagee, 25. Robins Bay, 26. Breakfast Gap, 27. Annotto Bay, 28. Castle Garden, 29. Dover, 30. Buff Bay, 31. Orange Bay, 32. Hope Bay, 33. St. Margaret's Bay, 34. Bryan's Bay. 35. Norwich, 36. Prospect/Port Antonio, 37. Drapers, 38. Fairy Hill, 39. Blue Hole, 40. Preistman's River, 41. Boston Beach, 42. Long Bay, 43. Manchioneal, 44. Innes Bay, 45. Hector's Bay, 46. Holland Bay, 47. Dalvey, 48. Rocky Point, St. Thomas, 49. Port Morant, 50. Leith Hall, 51. Lyssons Beach, 52. Morant Bay, 53. Yallahs, 54. Bull Bay (7 miles), 55. Port Henderson, 56. Hellshire, 57. Old Harbour Bay, 58. Welcome Beach, 59. Barmouth/Portland Cottage, 60. Rocky Point, Clarendon, 61. Alligator Pond, 62. Black River, 63. Long Acre, 64. Whitehouse, Westmoreland, 65. St. Ann's Beach, 66. Smithfield, 67. St. Mary's Beach. Satellite image from Google Earth 2012 ©.

Fig. 2. Playas de pesca visitas en Jamaica. 1. Playa Negril, 2. Bahía Orange, Hanover, 4. Lucea, 5. Bahía Sandy, 6. Hopewell, 7. Spring Garden, 8. Playa Whitehouse, St. James 9. Success, 10. Grange Pen, 11. Villa de pesca Falmouth, 12. Braco, 13. Rio Bueno, 14. Old Folly, 15. Bahía Discovery, 16. Bahía Runaway, 17. Swallow Hole, 18. Salem, 19. Priory, 20. Bahía St. Ann's, 21. Bahía Mammee, 22. Río White, 23. Oracabessa, 24. Pagee, 25. Bahía Robins, 26. Breakfast Gap, 27. Bahía Annotto, 28. Castle Garden, 29. Dover, 30. Bahía Buff, 31. Bahía Orange, 32. Bahía Hope, 33. Bahía St. Margaret's, 34. Bahía de Bryan. 35. Norwich, 36. Prospect/Port Antonio, 37. Drapers, 38. Fairy Hill, 39. Blue Hole, 40. Río de Preistman, 41. Playa Boston, 42. Bahía Long, 43. Manchioneal, 44. Bahía Innes, 45. Bahía de Hector, 4 6. Bahía Holland, 47. Dalvey, 48. Punta Rocky, St. Thomas, 49. Puerto Morant, 50. Leith Hall, 51. Playa Lyssons, 52. Bahía Morant, 53. Yallahs, 54. Bahía Bull (7 millas), 55. Puerto Henderson, 56. Hellshire, 57. Bahía Old Harbour, 58. Playa Welcome, 59. Barmouth/Portland Cottage, 60. Punta Rocky, Clarendon, 61. Laguna Alligator, 62. Río Black, 63. Long Acre, 64. Whitehouse, Westmoreland, 65. Playa St. Ann, 66. Smithfield, 67. Playa St. Mary. Imagen satelital de Google Earth 2012 ©.

TABLE 1
Main fishing gears reportedly used by 148 spearfishers Islandwide. Four other types of gears were reportedly used by 50% of spearfishers interviewed.

CUADRO 1
Tipos de pesca utilizados principalmente según lo informado por 148 pescadores de arpón en la isla. Según informes, otros cuatro tipos de engranajes fueron utilizados por el 50% de pescadores entrevistados.

Gear used	Percentage of fishers interviewed
Spearfishing only	50
Spearfishing & nets	14
Spearfishing & lines	8
Spearfishing, pots, nets	4
Spearfishing & pots	4
Spearfishing, lines, nets & pots	3
Spearfishing, lines & nets	3
Spearfishing, nets & pots	2
Nets & spearfishing	2
Spearfishing & nets	2
Spearfishing & trawling	1
Spearfishing & 7 other permutations of these gears	1 each

The sites were visited over 9-10 months between January and October 2011. Each trip was made by the researcher and a representative of the Fisheries Division that was well known at the beaches visited. At each site, a questionnaire modified from the original used in the Passley (2009) report was administered to a specified number of spear-fishers. Repeat trips were made when necessary to achieve the desired total sample number. We photographed each spearfisherman interviewed and when available took pictures of spearfishing gear, boats, and catch at the fishing beach. Fifty additional fishing beaches where spearfishing was practiced were also visited to estimate total numbers of spearfishers operating on beaches. Questionnaires were not administered at these additional beaches.

RESULTS

We interviewed a total of 148 spearfishers. The mean age of the spearfishers interviewed on the North Coast was 38±0.5 yrs and 35±0.7 yrs on the South coast. The mean age of all spear-fishers interviewed was 36±0.4 yrs.

The majority of spear-fishers interviewed used spears as their main form of fishing, but some also used hook and line, net, and pot (trap) fishing also (Table 1).

Most (approximately 75%) of the 148 spear-fishers interviewed reported fishing on the island shelf while approximately 25% reported fishing offshore. Among offshore spearfishers, nearly 50% reported fishing Pedro Bank located 160 km southwest of Kingston (Table 2).

This study revealed a new practice of spearfishing at night on reefs. Fully 27% of all spearfishers (29% of south coast and 26% of north coast spearfishers) reported spearfishing at night .

TABLE 2
Reported offshore spearfishing areas by frequency of visit (148 interviews)

CUADRO 2
Zonas informadas de pesca submarina en altamar por frecuencia de visita (148 entrevistas)

Offshore fishing area	Percentage of fishers
Pedro Bank	47.1
Morant Cays	25.5
Formigas Bank	15.7
Colombian Areas	7.8
Grappler Bank	2
Walton Bank	2

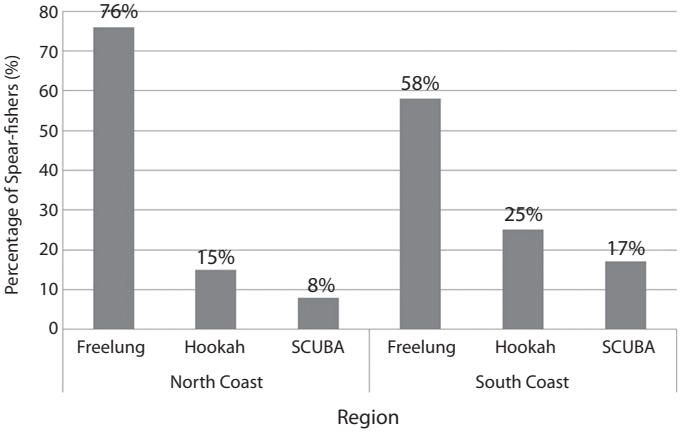

Fig. 3. Distribution of breathing mode used reported by spearfishers by coast. Spearfishing breathing apparatus included hookah, SCUBA, or free-diving ("freelung") while breath holding with snorkel.

Fig. 3. Distribución de modo de respiración utilizado según lo informado por Pescadores de arpón en la costa. Equipo de respiración de pesca submarina incluye hookah, buceo o buceo libre ("freelung"), mientrasse respira con tubo respirador (snorkel).

Spearfishers that reported doing only spearfishing also reported spending an average of 4.4(±0.2) days per week spearfishing Islandwide with slightly more time fishing on the North Coast (4.58±0.1) compared to 4.25 (±0.1) days per week on the South Coast.

Spearfishers interviewed who did only spearfishing (75%) reported that they spent a mean time of 4.5 (±0.16 hours) in the water Islandwide, compared to 4.6 (±0.30) hours on the North Coast and 4.45 (±0.22) hours on the South Coast.

About 75% of all spearfishers reported using commercial spear guns, compared to 25% that used homemade spear guns. More south coast than north coast spearfishers used hookah and scuba gear to spearfish as suggested by Figure 3.

Mean reported daily spearfishing catch islandwide was 18.1±1.8 kg/trip (Fig. 4) were found to be highest on the south coast at 21.3kg/day. Although not a direct objective of the present study, repeated observations of spearfisher catches showed presence of very small and clearly immature reef fishes of several species (Table 1).

All spearfishers interviewed reported taking coral reef fish and that parrotfishes (Scaridae) and Grunts (Haemulidae) dominated catches. Table 3 shows a list of the most commonly landed fishes from spearfishing

Parrotfishes and grunts dominated spearfisher catches around the island and is considered an indicator of an overfished reef

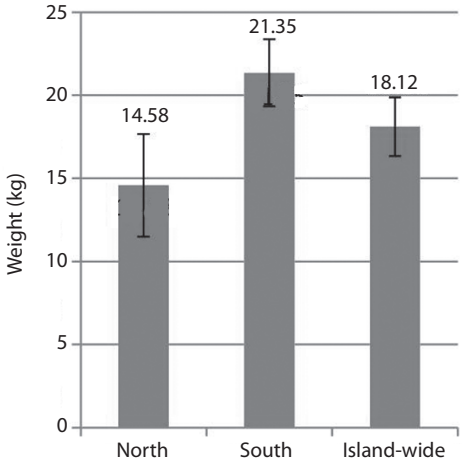

Fig. 4. Reported daily catch rates (kg) by spearfishers by coast and island wide. Numbers show reported average daily catch.

Fig. 4. Tasas diarias de captura(kg) informadas por los pescadores de la costa y en toda la isla. Los numeros muestran el promedio diario de captura.

TABLE 3
Ranking of the eight numerically most abundant fish species caught by spear-fishers by region.

CUADRO 3
Clasificación de las ocho especies de peces más abundantes en las capturas de los pescadores de arpón según la región.

Rank	North Coast (Scientific & common name)	South Coast (Scientific & common name)	Overall (Islandwide)
1	*Sparisoma viride* (stoplight parrot)	*S. aurofrenatum* (redband parrot)	*S. aurofrenatum*
2	*S. aurofrenatum*	*S. viride*	*S. viride*
3	*Acanthurus coeruleus* (tang)	*H. plumieri* (white grunt)	*H. plumieri*
4	*H. sciurus* (bluestripe grunt)	*H. sciurus*	*H. sciurus*
5	*H. flavolineatum* (French grunt)	*A. coeruleus*	*H. flavolineatum*
6	*Lutjanus analis* (Mutton snapper)	*Balistes vetula* (queen trigger)	*L. analis*

fish community (Munro, 1983, Aiken, 1993). *Sparisoma viride*, stoplight parrotfish and *S. aurofrenatum*, redband parrotfish, were the two most numerically abundant reef fish species on Jamaican reefs over the last 10 years (Aiken, personal observation). The present study revealed that spearfishing regularly targeted several other species in addition to coral reef fishes including, i) lobsters (mostly *Panulirus argus*, and some *P. guttatus*), ii) octopus (*Octopus vulgaris*), iii) queen conch (*Strombus gigas*) iv) lionfish (*Pterois volitans* and *P. miles*) and great barracuda (*Sphyraena barracuda*).

A total of 74% of all spearfishers reported fishing year round with no special spearfishing "season". The remaining 26% reported taking a break from spearfishing at some time each year. Spearfishers reported an average of 4.5 hours spent spearfishing per day. Reported perceptions of spearfishers about catch trends are shown in Figure 5. Exactly 64% of spearfishers reported reduced catches on both coasts while approximately 30% reported no change.

Nearly 60% of all interviewed spearfishers expressed the view that they would face unemployment if spearfishing was banned while roughly a quarter reported that they would try another fishing technique for a living.

Mean reported annual income of spearfishers was J$1 992 166.73 (J$480.52/kg * 18.12kg/day *4.4days/week * 52weeks/year = US Exchange Rate = J$100:1 July 2013). Therefore, the mean annual income of spearfishers was the equivalent of US$ 20 000/year. Assuming approximately 1 000 active spearfishers in Jamaica, that total annual production by spearfishers was around 4 145m.

We discovered a new fishing variation involving spear-fishing where a net was used to block off a confined area, then long sticks and

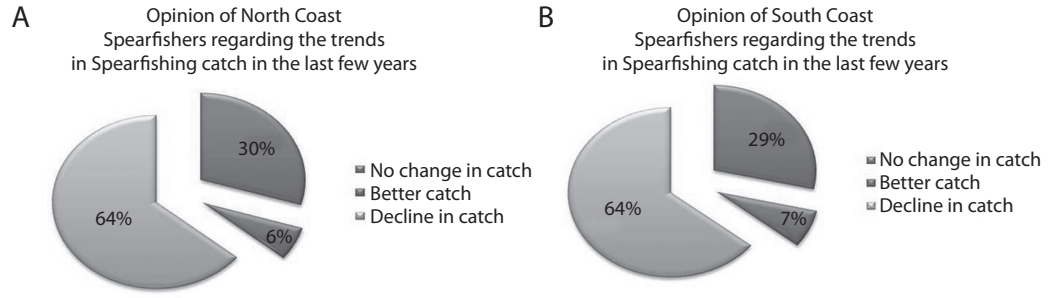

Fig. 5. Reported spearfisher perceptions of catch trends in recent years by coast.
Fig. 5. Percepciones reportadas por los Pescadores de arpón de las tendencias de capturas en los últimas años en la costa.

other scar ing devices were used to strike the water surface in order to make the fish strike the net and become entangled. Those fishes that did not strike the net were speared by swimmers around the net. This method produced very few, if any, escapees.

DISCUSSION

Passley (2009) and Passley et al. (2010) was the first recent study of the state of spearfishing in Jamaica and was considered preliminary in need of supporting data to confirm its findings. It found for example, that 2% of all fishers were found to be spear- fishers as opposed to the 1% in previous estimates (Munro, 1983; Aiken, 1993; Aiken, 2008). About 75% of artisanal spearfishermen in Jamaica used commercially manufactured spearguns and the rest used homemade versions. It was also discovered that spearfishers reported averaging about 4 hour of fishing per day, 5 days a week, which provide an estimated catch of about 3 500 kg/spearfisher/year (Passley, 2009; Passley et al., 2010).

Spearfishing has the potential to be environmentally friendly by being highly selective with no by-catch if participants are educated to target only legally sized fish. However, small fish are continuously being caught and sold in Jamaica, where the reefs are greatly overfished and the fishermen depend on their catch to support their livelihood.

The Jamaica fisheries are considered overfished (Aiken, 1993; Aiken, 2008) based on evidence of observed gradual changes in species composition in catches with time. There has been a great reduction in top carnivorous predatory fish such as the higher-valued snappers and jacks. These species have been replaced by lesser valued herbivorous and omnivorous reef fish such as parrotfishes and doctorfishes (Aiken, 2008). This replacement shows a direct impact of overfishing on reef biodiversity. Other factors affecting the status of fisheries include severe hurricane damage to reefs and the recent introduction to Caribbean waters of the carnivorous lionfish species *Pterois volitan* and *P. miles,* which has no natural predators.

In 2009, a ban was placed on night spearfishing in an attempt to reduce the exploitation of reef fisheries. However, lack of enforcement and an awareness of the ban has somewhat negated its effectiveness. The present study found that night spearfishing was still relatively commonly practiced in 2011 with approximately 27% (nearly one-third) of all spearfishers interviewed reported doing this practice. This violation is one of the most serious conservation and management issues identified in the present study.

The high earnings of the average spearfisher indicates that this occupation is the equivalent to a “middle-class” income for Jamaica (Claremont Kirton, Pers Comm). The estimated annual yield of approximately 4 000t in 2011 is larger than expected and means that spearfishing could be contributing approximately one-third of the total fisheries production of the entire country that was approximately 12 000tons in 2012. This annual production estimate is slightly larger than that 3 500tons estimate for 2009 reported by Passley (2009) and Passley et al. (2010).

Our results showed that many species of coral reef fishes are being removed not only in the day but also at night. This is a serious overall problem for sustainable marine biodiversity. While there is not a problem with the removal of invasive lionfish (*Pterois* sp.), all the other species are removed together, averaging 18.1kg/day. It must be remembered that this sub-sector together with the other activities in the other fishery sub-sectors such as fish trappings, the artisanal and industrial queen conch fisheries, along with spiny lobster harvesting, hook-and-line fishing, and beach seining, comprise a relatively large island fishery. There is therefore tremendous fishing pressure on the already declining fishery resources in Jamaica. This is a serious issue for fisheries management.

Of a total of some 20 000 fishers of all types, spear-fishers now appear to comprise approximately 2 000 or roughly 10%. This

proportion is considerably higher than in earlier estimates of roughly 1% of the total fisher numbers (Munro, 1983; Aiken, 1993; Aiken, 2008). The increase in spearfishing may be due to increases in the cost of gear and maintenance for trap and net fishing as well as the apparent success of spearfishing as suggested by Passley et al. (2010).

A total of 33% of spearfishers interviewed by Passley in 2009 reported that they had no replacement skills with which to make a living if spearfishing were to be banned. An equal percentage said that they would attempt to find an alternative means of supporting themselves however 10% said that they would then require government assistance.

In other Caribbean countries, spearfishing is strictly regulated or banned completely. In the Bahamas, the Hawaiian sling is the only approved spearfishing device. Gear such as SCUBA gear or air compressors are not allowed for catching fish, conch, crawfish or other marine animals. Spearfishing is further regulated by location whereby spearfishing is not allowed within one mile of the coast of New Providence, within one mile of the south coast of Freeport, Grand Bahamas and within 200 yards of the coast of all the Out Islands. Spearing or taking marine animals by any means is illegal within national sea parks (The Islands of the Bahamas, 2008-2011).

The present study confirmed that the main types of fish and edible marine life landed by spearfishers were those that had a high sale value, such as parrotfish, snapper and lobster. We also confirmed the finding by Passley (2009, 2010), that night diving was a highly productive fishing activity as sleeping fish presented a stationary target and were easily caught. We support enforceing the night diving ban. Again we confirmed findings by Passley et al. (2010) that most spear-fishers carried out other types of fishing, that a high percentage (58% in this study) were decidedly dependent on their spearfishing activities, and that the number of spear-fishers had steadily increased around the island. If spearfishing were banned, 42% of fishers indicated that they would shift into other types of fishing or other non-fishing activities. The overall sentiment perceived in this study was that spear-fishers agreed that their activities were in need of some sort of regulation and management.

CONCLUSIONS & RECOMMENDATIONS

An awareness of the consequences of taking immature reef fishes during commercial spearfishing was perceived in both spearfishing studies to be lacking. Commercial spearfishing, especially with the aid of compressed air, was banned in many countries, either in an attempt to mitigate or prevent overfishing of those countries' marine resources, but in Jamaica. There is a relatively dire situation with all the fishable marine resources of Jamaica and it our opinion that spearfishing as presently practiced in Jamaica is significantly exacerbating the situation with its high level of fishing effort and large catches of many reef species as shown in this paper.

On the basis of findings from the present 2011 data (supported by the 2009 data), we strongly recommend that the government of Jamaica should, with some urgency, consider doing the following:

- Enforce the ban on night diving declared late 2009.
- Enforce strict spearfishing regulations but not completely ban spearfishing. These regulations should include a minimum size of fish landed and a penalty for possession of undersized catch.
- Publicize the danger of depletion by spearfishing with SCUBA and hookah apparatus. Many fishers are unaware, especially to younger divers.
- Register all spearfishers
- Ban spearfishing with SCUBA & Hookah gears.

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RESUMEN

Pesca Submarina: una amenaza potencial para la sostenibilidad de la pesca en Jamaica. Un estudio de la pesca submarina en Jamaica durante el 2011 reveló una pesquería mayor que la esperada, que produce aproximadamente 4000 toneladas por año de todos los tipos de recursos pesqueros. Este nivel de producción esta por encima de lo que se pensaba era una actividad pesquera de pequeña escala. Esta pesquería especializada se ha ampliado aproximadamente en 1% de pescadores a al menos el 10%, en un periodo de 20 años (1991 a 2011). Aunque los peces de coral se dominaran como otros recursos tales como langostas, concha y pulpo. Aunque no era un objetivo del censo se observaron muchos peces juveniles en las capturas con tamaños muy por debajo de su tamaño adulto u óptimo. Un total de 58% pescadores informaron que tendrían dificultad para encontrar otra opción de empleo si la pesca submarina se prohibe. Los pescadores explotan recursos en la plataforma de la isla y también en casi todos los bancos de la costa sobre todo en el Banco de Pedro. Este estudio también muestra que comunmente se práctica la pesca submarina durante la noche con el fin de capturar peces de coral durmiendo. A pesar de que esta actividad es prohibida. Se recomienda que los pescadores se registren y que se regule la actividad. Posibles acciones incluyen considerar la prohibición parcial durante el año o prohibir el uso de equipo de buceo y narguile.

Palabras claves: Pesqueria submarina, sobrepesca, manejo, recursos de arrecifes coralinos, Jamaica

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