

Landings, effort and socio-economics of a small scale commercial fishery in The Bahamas

Nicolle M. Cushion¹ and Kathleen Sullivan-Sealey^{1,2}

¹ University of Miami Department of Biology, Coral Gables, FL USA and ² Marine and Environmental Studies Institute, College of The Bahamas, Nassau, N.P., Bahamas

Abstract

The Bahamas has one largest export fisheries in the Caribbean in landings and sales of finfish, conch and spiny lobster. Most fishing takes place on shallow banks throughout the archipelago (approximately 117,000 km²; 45,000 mi²). The fisheries of the Bahamas are comprised of a unique composition of fishermen and markets; however the status of many fish stocks is not known. This study outlines some of the basic characteristics of a small scale commercial fishery (finfish) on New Providence, the country's most populous island. Evaluating landing composition and socio-economic information from small scale reef fisheries over time is critical for understanding the: a) variability and abundance of landings, b) value of the fishery, and the c) influence that the harvesting may have on the targeted reefs. Landing abundance surveys of finfish and interviews from the Montagu Ramp fish market were used to: 1) estimate monthly landing abundances, 2) detect seasonal changes in landing composition, and 3) profile effort and socioeconomic aspects of the fishery. Profiles determined over thirty fishermen contribute to the fishery and gillnets and spearing are the most common styles of fishing. Landings are dominated by two families, Lutjanidae (snappers) and Serranidae (groupers and hinds), and the most abundant catch species were lane (*Lutjanis synagris*), Nassau grouper (*Epinephelus striatus*) and yellowtail snapper (*Ocyurus chrysurus*), respectively. However, this is a multi-species fishery and a diversity of other families are also targeted including, Haemulidae (grunts and margates), Carangidae (jacks) and Sphyraenidae (barracuda), Balistidae (triggerfish), and Labridae (wrasse).

Key Words: The Bahamas, small-scale fishery, fishing landings, fishery socio-economics

Esfuerzo de pesca y socio-economía de pesquería artesanal de las Bahamas

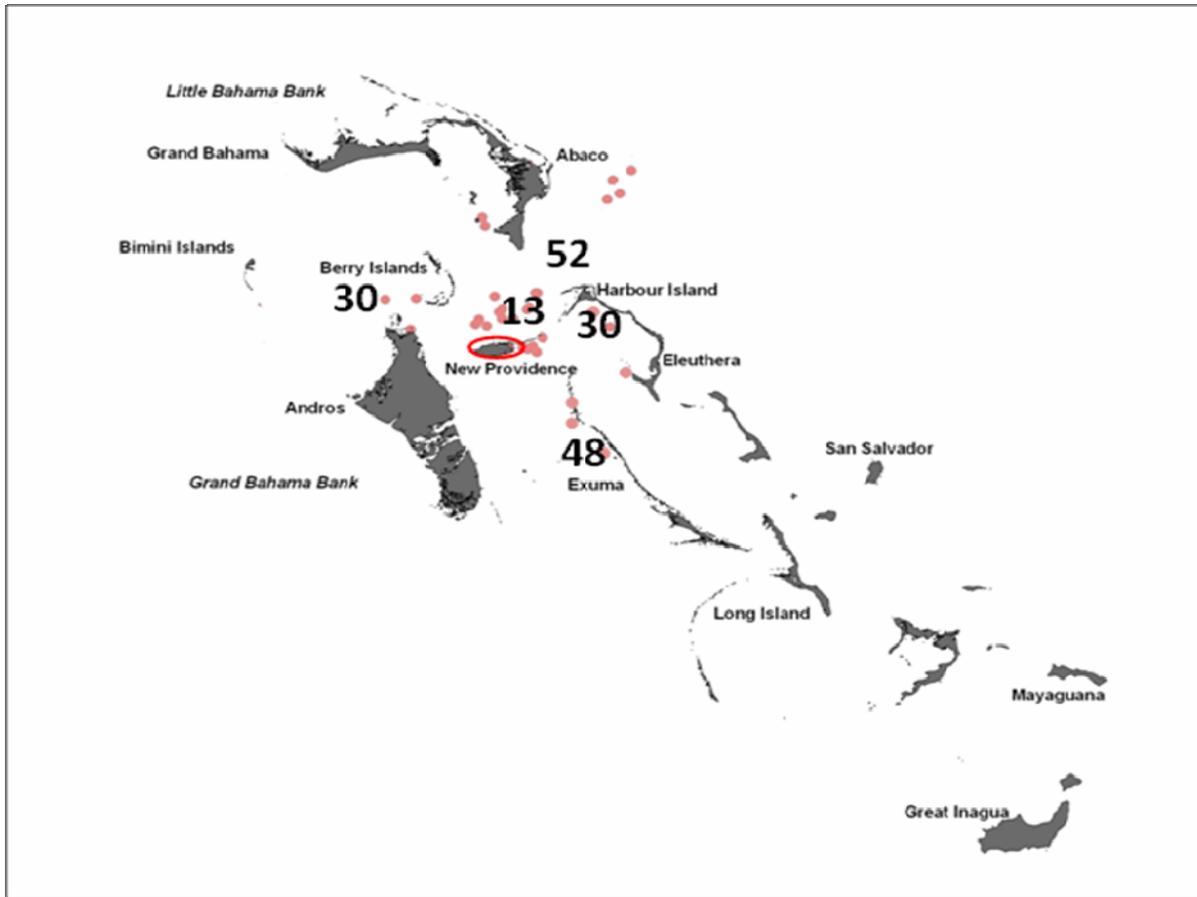
Las Bahamas tienen una de las industrias pesqueras más grandes de la parte de habla inglesa del Caribe, rivalizando a Cuba en la pesca y ventas de peces, conchas y langostas. Las pesquerías de las Bahamas están compuestas por una composición única de pescadores y mercados. La mayoría de la pesca sucede a lo largo de archipiélago (aproximadamente 45,000 millas cuadradas). Sin embargo, el estatus de muchas pesquerías no es claro. Este estudio destaca muchas de las características básicas de una pesquería artesanal en New Providence, la isla más poblada del país. La evaluación de la composición de la pesca y la información socio-económica de las pesquerías de arrecife a lo largo del tiempo es crítico para entender: a) la variabilidad y abundancia de pesca, b) el valor de la pesquería, y c) la potencial producción y el impacto que la cosecha podría tener en los arrecifes blanco. Censos de abundancia de peces y entrevistas en el Mercado Montague Ramp fueron usados para: 1) estimar la abundancia de pesca mensual, 2) detectar los cambios estacionales en la composición de pesca, 3) evaluar el estado trófico de la pesca y 4) esfuerzo del perfil y aspectos socioeconómicos de la pesquería. Los perfiles determinaron que más de treinta pescadores contribuyeron a la pesquería y que el uso de redes y lanzas son estilos comunes de pesca. La pesca es dominada por tres tipos de asociaciones tróficas: carnívoros, invertebrados móviles y herbívoros. La pesca está correlacionada con la reproducción estacional y dominada por dos familias Lutjanidae y Serranidae, pero una diversidad de otras familias también son pescadas incluyendo a Balistidae, Labridae, y Carangidae.

Key words: Las pesquerías de las Bahamas, pesquería artesanal, el valor de la pesquería, abundancia de pesca

Introduction

The fishing industry of The Bahamas is important both socially and economically to the country, as Bahamians depend on marine resources for food and employment. The industry is comprised of a unique composition of fishermen and markets. The labour force employed in the fisheries industry was approximated at 9300 persons in a 1995 census, with 95% being fishermen and the remainder employed in processing or distribution (Buchan 2000). Documented export finfish landings for 1998 totalled 444,335 kgs (3,184,214 lbs) for grouper and snappers combined and were valued at \$5,825,962 USD. Independently, Nassau grouper (*Epinephelus striatus*) landings totalled 510,662 kgs (1,125,817 lbs) valuing \$2,674,401 USD, making it one of the largest in the Caribbean (Buchan 2000). Most fishing takes place on shallow banks throughout the archipelago and major fishing grounds include Great and Little Bahama Banks, the Cay Sal Bank and the Crooked Island and Acklins Island Bank (Buchan 2000) (Figure 1).

Figure 1. Map of the Commonwealth of The Bahamas. Sampling location (Montagu ramp, New Providence), fishing sites frequented by fishermen using Montagu ramp and approximate nautical miles to fishing sites from Montagu ramp are highlighted. (Map GIS files courtesy of NCORE.)



While commercial export fisheries account for the majority of the industry; there are notable small-scale commercial fisheries within the country. (“Small-scale commercial fisheries” for this study are defined as fisheries targeting national markets that harvest less than 5000 kgs (~10000 lbs) daily. Small-scale commercial fisheries in Nassau contribute products for local restaurants and residential consumption.) Throughout the Caribbean similar small-scale fisheries have been shown to be important and warrant monitoring because they target reef fish, often intensively, yet contribute to small island economies (Koslow *et al.* 1994, Hawkins and Roberts 2004). However, assessment of the small-scale commercial fisheries throughout The Bahamas is limited because government resources are focused on regulation and management of the larger-scale export fishing industry. Accordingly, the purpose of study is to document the finfish landing abundances, fisher effort and economics at Montagu ramp, a fish market on New Providence. New Providence is the most populous island; with over 70% of the population residing there. Montagu ramp is a public boat launch on north-east shore of New Providence where small-scale fishermen have distributed fish for over thirty-five years and is one of the main areas on New Providence where the local population purchases seafood.

Materials and Methods

Study Site

The country of The Bahamas is an archipelago in the tropical West Atlantic. The archipelago (including Turks and Caicos) consists of 1,700 islands and cays, thirty of which are permanently settled throughout the Bahamas and the land area totals

approximately 13,860 km² (Buchan 2000, Sullivan-Sealey *et al.* 2002). The northern and central islands are located on two vast carbonate platforms averaging 8 m in depth. The Little Bahamas Bank is located in the northern Bahamas while the Great Bahamas Bank begins approximately 100 km south, extending to the south and south-east. Shallow water banks are also found adjacent to the southeastern islands. These banks provide about 117000 km² (45,000 mi²) of reef fishing habitat (Figure 1) (Buchan 2000).

Interviews and Surveys

Monthly interviews and landing abundance surveys were conducted over 4 to 5 days at Montagu ramp from May-October 2007. Interviews and surveys were conducted from 1400 to 1900 to coincide with the return of the fishermen to the ramp for sales. Fishermen interviews documented the hours/days spent fishing, number of fishers per boat, gear employed and the landing location. Observers recorded finfish to the species level and the abundance of each species. Landings were photo documented for reference. Evidence of potential spawning was documented by photographing mature gonads while fish were processed. Daily records were also taken to document the number of ancillary workers (e.g. fish cleaners and concession) and landings sold by independent (non-fishermen) sellers. Price and profit interviews and estimations were made.

Data analysis

Interview data were used to calculate the average number of fishermen who sell from Montagu ramp, the main gear types employed, the average number of hours spent fishing per day, the average number of fishermen per boat, and the primary locations harvested and related nautical miles per trip. A time raising factor was used to conservatively extrapolated surveys to average twenty days of fishing per month (e.g. if four days of surveys were conducted, landing abundances were multiplied by five) (see Stamatopoulos (2002) for complete method.) The five most abundantly caught species and the percent contribution per family was calculated from the monthly landing averages. Independent analyses were performed for Nassau grouper, because it is a protected species in The Bahamas.

Results

Interviews and daily records revealed there are four types of jobs and over fifty persons that regularly work at the Montagu ramp fishery. Over the survey period, 30 fishermen were recorded to fish an average of at least three times a week; seven fish distributors, fifteen fish cleaners and two concessionary workers were also recorded working an average of five days a week (Table 1). Most landings are sold directly by the fishermen upon return to the ramp, although a minority of fishers sell their landings to the distributors. The distributors work almost every day and purchase directly from the Montagu ramp fishermen or from commercial distributors in New Providence. The cost of finfish varied between fish species and by time of year and was based on availability (e.g. several days of bad weather would result in increased prices). The cost for a 4-4.5 kg (~8-10 lbs) Nassau grouper averaged \$USD 35.00; and 3- 4.5 kgs (~7-10 lbs) of *Haemulon sp.*, *Lutjanus sp.*, or *Epinephelus sp.* (hinds) averaged \$USD 13.50. This translates into a range of about \$USD 1.30 / lb for smaller grunts and snappers, up to \$3.75/ lb for grouper or large snappers.

Table 1. The average number of fishers, sellers, cleaners and concessionary workers at Montagu ramp, The Bahamas.

Fishermen interviews and landing surveys showed compressor-based spear and gillnet fishing were the primary methods used by the Montagu Ramp fishermen. The distance travelled from New Providence to fishing sites was estimated to be forty nautical miles (72 kilometres) round trip on average. Distances to accessible fishing were as close as 6.5 nautical miles (12 kilometres) round trip (Rose Island) to as great as 90 nautical miles (~170 kilometres) round trip (Abacos) and trips were weather and target species dependent (Figure 1). The fishermen spent an average of eight hours fishing daily, but this time did not account for post-fishing selling time. There was an evident, financially-viable pattern where no more than four fishermen used the 8 to 10 meter boats with +200 hp outboards to travel to fishing sites and spear fish with compressors.

From May to October 2007, greater than fifty species from a variety of reef fish families were sold at Montagu Ramp. The total number of fish estimated per month were: 8393 (May 2007), 7260 (June 2007), 10280 (July 2007), 9044 (August 2007), 9270 (September 2007), and 10072 (October 2007). Thus yielding a conservative estimate of 54,000 fish landed. The five most abundant species landed overall in the survey period were 1) *Lutjanus synagis* (lane snapper), 2) *E. striatus* (Nassau grouper), 3) *Ocyurus chrysurus* (yellowtail snapper), 4) *Lachnolaimus maximus* (hogfish), and 5) *Haemulon sciurus* (Blue-striped grunt).

Lutjanidae (snapper) landings were the greatest for all months and averaged 58% of the total landings during the six months. The monthly percent of Nassau grouper landings averaged 10%, with June being the lowest (4%) and October being the greatest (13%). The other groupers landed were *Mycteroperca venenosa* (Yellowfin grouper), *M. bonaci* (black grouper) and *M. tigris* (tiger grouper). The hind landings were dominated by *E. guttatus* (red hind). The monthly percent family contribution fluctuated for Haemulidae (grunts), Carangidae (jacks) and Sphyraenidae (barracudas), Balistidae (triggerfishes) and Labridae (hogfish) landings. These fluctuations correlated to spawning periods, where landings increased during respective species spawning periods. (Photographed ripe gonads were used to document spawning potential). Haemulidae landings were mainly comprised of *H. sciurus*, *H. Plumeri* and margates (*Haemulon sp.*). Other important species included *Caranx ruber* (bar jack) and *Sphyraena barracuda* (barracuda). Balistidae landings were almost solely comprised of *Balistes vetula* (queen triggerfish) and Labridae landings were solely *Lachnolaimus maximus* (hogfish) (Figure 2, Table 2).

Figure 2. Monthly percent contribution of families and Nassau grouper landed at Montagu ramp, New Providence (May-October 2007).

Table 2. The average percent contribution by family and for Nassau grouper. The monthly percent contributions were averaged for six months (May-October 2007).

Discussion

The Montagu ramp fishery shares similar characteristics to other small-scale commercial reef fisheries (eg. Coblenz 1997, Koslow *et al.* 1994) in that it is economically important locally (some degree of employment for over 50 people), the fishermen fish over a wide area, and fishing effort changes seasonally. On New Providence, Montagu Ramp is one of many locations where fish are landed and sold directly to consumers. The small-scale commercial fishery at Montagu Ramp appears to accommodate the local market by using several gear types, targeting multiple reef fish species and keeping the price of fish relatively constant throughout the survey months. Spear fishermen targeted *Epinephelus sp.*, *B. vetula* and *L. maximus*, which were more costly to fish, but sold at a higher price. Gillnet fishermen harvested primarily Lutjanidae and Haemulidae species, which were less costly to fish, but sold at a lower price (and often larger volume). Fish is already more costly than imported chicken (in Nassau, imported chicken parts sell for \$1.25/ lb compared to the \$1.35/lb for grunts over the summer months in 2007). Local consumers want fresh fish to prepare traditional meals, and can substitute species to accommodate price and availability.

A conservative estimate revealed that over 54,000 fish were landed at Montagu ramp over six months, but these were harvested from many fishing sites throughout the Bahamas (Figure 1). A notable portion of the recorded landings, especially Lutjanidae species, *E. striatus* and deep-water snappers, came from sellers that purchased the fish from large-scale commercial fisheries in New Providence then sold the fish at the Montagu Ramp market. Thus, the total abundances do not solely represent the effort of the Montague-based fishermen, but do represent national landings, and local consumption patterns.

The potential impacts by small-scale commercial fisheries that can lead to changes in the ecology and health of coral reefs structure have been well-documented (e.g. Jennings and Polunin 1996; Hawkins and Roberts 2004; Campbell and Pardede 2006). In many sites throughout the Caribbean, there is strong evidence of over-fishing and “fishing down the food chain” determined by the by the dominance of herbivores and detritivores in the landed species (Pauly *et al.* 1998; Hawkins and Roberts 2004). In The Bahamas, the primary percent contributions by family over the six month survey period were: 58% Lutjanidae, 16% Serranidae, 9% Haemulidae, 5% Balistidae and Carangidae and 2% Labridae. As compared to a larger-scale commercial fishery study by Koslow *et al.* in 1994, the percent contribution by family of The Bahamas was similar to that landed in Belize and differed significantly from landings in Jamaica. Belizean landings of Lujanidae, Serranidae and Haemulidae represented 74%, 11% and 2% of the landings, respectively; while 62% of Jamaican landings were low-value species in the families Scaridae, Sparidae, Labridae, Mullidae, Holocentridae and Acanthuridae (Koslow *et al.* 1994). Thus, the Montagu Ramp and Belizean fisheries represent landings of long-lived, high trophic level species; while Jamaican landings reflect landings reflect short-lived, low trophic level planktivores, herbivores and detritivores fish. Long-term monitoring of Montagu Ramp landings is needed to provide a more complete picture of the total number and species and trophic composition of fishes removed from Bahamian waters.

A notable trend at the Montagu Ramp fish market was the shift in the reef fish species landed from month to month to accommodate the demand for smaller fish, such as snappers and grunts. More information is needed to confirm if the trend is correlated to the fishing of spawning aggregations (all species) as a method of delivering a consistent biomass of fish to the market throughout the year. A similar market study by Rhodes and Tupper (2007) in Pohnpei (Micronesia) documented a trend where fishermen placed additional pressure and increased landings of other families during the seasonal closure on fishing and sale of targeted grouper species. The seasonal closure appeared to place additional pressure on other fish families during the ban periods. Thus, an annual perspective of the Montagu Ramp fishery may provide insights into the influence of the annual seasonal closure on Nassau grouper (~November-February).

In summary, the health of fisheries resources in The Bahamas will depend on long-term monitoring of all sectors of the fishing industry (e.g. recreational, tourist, and all scales of commercial fishing). The first six months of the Montagu Ramp study has provided a snapshot of socio-economic and landing patterns. The monitoring of national fisheries resources should include the continued assessment of several small-scale fisheries within the country, with the collection of length and weight data by species for landing biomass estimates.

Acknowledgements

Funding for this project was provided by the Discovery Land Company, Department of Biology, University of Miami, and the College of The Bahamas Marine and Environmental Studies Institute. Field work was accomplished with the assistance of Anastasia Gibson, Elton Joseph, Javano Smith, and Marcian Tucker. We thank The Bahamas Department of Marine Resources for project support. Additionally, we are grateful for logistical support provided by Neil Sealey. Funding to attend the conference was kindly provided by the University of Miami Kriloff Foundation and the Graduate Activity Fee Allocation Committee.

References

- Buchan, K. 2000. The Bahamas. *Marine Pollution Bulletin* Vol. 41, No 1-6, pp. 94-111.
- Campbell, D., Pardede, S. 2006. Reef fish structure and cascading effects in response to artisanal fishing pressure. *Fisheries Research*. Vol 79, Issues 1-2, Pgs 75-83.
- Colblenz, B. Subsistence Consumption of Coral Reef Fish Suggests Non-Sustainable Extraction. 1997. *Conservation Biology*. Vol 11:2 Pp 559-561.
- Hawkins, J., Roberts, C. 2004. The effects of artisanal fishing on Caribbean Coral Reefs. *Conservation Biology*. Vol 18: No 4. Pp. 215-226.
- Jennings, S., Polunin, N.V.C., 1996. Effect of fishing effort and catch rate upon the structure and biomass of Fijian reef fish communities. *Journal of Applied Ecology*. 33, 400-412.
- Koslow, J., Aiken, K., Auil, S., Clementson, A. 1994. Catch and effort analysis of the reef fisheries of Jamaica and Belize. *Fishery Bulletin*. 92: 737-747.
- Pauly, D., Christensen, V., Dalsgaard, J., Froese, R., and Torres, F. 1998. Fishing down marine food webs. *Science* 279: 860-863.
- Rhodes, K, Tupper, M. 2007. A preliminary market-based analysis of the Pohnpei, Micronesia, grouper (Serranidae: Epinephelinae) fishery reveals unsustainable fishing practices. *Coral Reefs*. Vol 26:335-344
- Stamatopoulos, C. 2002. Sample-based fishery surveys: A technical handbook. *FAO Fisheries Technical Paper*. No. 425. Rome, FAO. 132p.
- Sullivan Sealey, K., Brunnick, B., Harzen, S., Luton, C., Nero, V., Flowers, L. 2002. An ecoregional plan for the Bahamian Archipelago. Pgs 227. Taras Oceanographic Foundation, Jupiter, Florida.

Table 1. The average number of fishers, sellers, cleaners and concessionary workers at Montagu ramp, The Bahamas.

	Fishermen	Distributors	Cleaners	Concession
Average days of work per week	3	5	5	5
Approximate #	30	7	15	2

Table 2. The average percent contribution by family and for Nassau grouper. The monthly percent contributions were averaged for six months (May-October 2007).

Family and species	Lutjanidae	Haemulidae	Carangidae & Sphyraenidae	Labridae (Hogfish)	Balistidae (Triggerfish)	Serranidae (Nassau grouper)	Serranidae (Other groupers)	Serranidae (Hinds)
Percent contribution	58	9	5	2	5	10	3	3

Figure 2. Monthly percent contribution of families and Nassau grouper landed at Montagu ramp, New Providence (May-October 2007).

