Organization and operation of the marine ornamental fish and invertebrate export fishery in Puerto Rico

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Abstract: This fishery was examined utilizing public records, stakeholder interviews, and operational site visits to describe the fishery for the Puerto Rico Coral Reef Advisory Committee as a first step toward development of policies for the effective management of these natural resources. The fishery is not large, including fewer than 20 licensed fishers operating primarily on the west end of the island. Only three operators export product, with the remaining fishers providing specimens to the exporters based upon customer orders. Most collection of coral reef species occurs over hard rubble zones mixed with relic reef structures and rock, or on the sides and frontal areas of active reefs. Other species are collected from among mangrove prop root zones, tidal flats, and seagrass beds. Collections are made using simple barrier and dip nets for fish and motile invertebrates such as shrimp. Invertebrates such as crabs, starfish, and sea cucumbers are commonly collected by overturning small rocks, gathering the specimens, and then replacing the rocks in their original positions. Specimens are carried to the boat and transferred to individual cup holders to maximize survival. Although statements concerning former use of chemicals to assist capture were noted, no evidence of current chemical use was observed. Specimens are held in re-circulating seawater systems onshore until collections are aggregated and shipped. The fishery strives to operate with mortality of <1%, as mortalities of >3% are described as unacceptable to customers. More than 100 fish species are collected in this fishery, but the top ten species account for >70% of the total numbers and >60% of the total value of the fishery, with a single species, *Gramma loreto* (Royal Gramma), comprising >40% of the numbers. More than 100 species of invertebrates are collected, but this fishery is also dominated by a handful of species, including anemones, hermit crabs, turbo snails, serpent starfish, and feather duster polychaetes.

Key words: ornamentals, marine ornamentals, coral reef fisheries, reef management, Caribbean fisheries, sustainable fisheries management.

Management of the marine ornamentals fishery in Puerto Rico is contentious, suffering from poor communications between regulators and fishers, confrontation in the legal system and otherwise, and lack of communication among stakeholders (Hardin and LeGore, in press). These problems are exacerbated by a serious lack of information about the fishery, rendering effective management difficult at best. The Puerto Rico Coral Reef Advisory Committee (CRAC) and Department of Natural and Environmental Resources (DNER) have responded by initiating a three-phased program leading to improved management of these important resources. Phase I, characterization of the fishery, has been conducted and forms the basis for this paper. Phase II will consist of a 2-year evaluation of the populations and biology of major species exploited by this fishery, and will be followed by Phase III, development of management policy recommendations based upon the foregoing efforts.

MATERIALS AND METHODS

Efforts to characterize Puerto Rico's fisheries for marine ornamentals were restricted to the export fishery, which collects wild organisms and ships them to off-island customers. Resources were not available to characterize the domestic commercial or recreational fisheries for these organisms, as these fisheries are informal and undocumented, rendering data acquisition inefficient and difficult.

Meetings and interviews were conducted from June through September, 2002 with full- and part-time fishers, airport rangers who control and inspect export shipments, dive tour operators, pet shop operators, academicians, government resource managers, representatives of relevant NGOs, researchers and other experts. Beyond characterization of the fishery itself, the identification and clarification of conflicts – perceived or real – among diverse users of the local fisheries and habitats was of great interest. Great effort was expended to provide opportunities for stakeholders to discuss such issues.

In addition to meetings and interviews, several opportunities were made available for observing specimen collecting procedures in the field, and observing specimen handling procedures and holding facilities.

The primary source of information on the quantity and value of marine ornamental exports was the invoice documentation prepared for each shipment. These *pro forma* invoices are prepared by the exporter providing the species and numbers of specimens being shipped. Rangers stationed at the shipping airports verify this information by visual inspection. Copies of these invoices are filed by the Rangers, and are eventually collected for data compilation by the Fisheries Statistics Program of the DNER. The DNER's initial efforts at statistical analysis of resulting data were hampered by ambiguities over common species names used in the invoices (D. Matos-Caraballo, pers. com.). This issue was addressed in cooperation with the University of Puerto Rico Sea Grant Program, such that data concerning 1998-2000 fish exports are considered reasonably reliable (Ojeda-Serrano *et al.* 2001, E. Ojeda-Serrano *et al.,* unpublished). These data were supplemented by export records for the first five months of year 2002, which were provided by the exporters themselves.

RESULTS

Fishery Participants: Relative to Puerto Rico's population and amount of available coastal habitat, the export fishery for marine ornamentals is rather small. At the time of this study, there were only 16 permitted collectors on the island, at least two of which were inactive, having left the fishery because of ongoing economic risk imposed by the fishery's uncertain regulatory status. In addition, four new permit applications were in process, which if accepted would bring the official roster to 20 individuals. Feedback from collectors during the interview process provided consistent estimates of 20-25 for the total number of full-time collectors on the island, said to include the permit holders as well as individuals who sell only to the internal markets, and who have not been the focus of management attention to the degree that export fishers have.

In comparison, there are more than 600 licensed collectors of marine ornamentals in the State of Florida (J. O'Hop, pers. com.), and more than 4000 in The Philippines (Barber and Pratt 1998).

The export fishery for marine ornamentals in Puerto Rico is almost entirely restricted to the western side of the island, despite potential for equivalent abundance and types of habitat on the eastern side. Perhaps due to the activity's origin among surfers of the Rincón area, the fishery has historically occurred along the coast from Arecibo in the north to La Parguera in the south. Some collectors report that trap fishermen on the eastern shore commercialize incidental catch of ornamentals (W. McMillan, pers. com.), and that collectors have occasionally been observed near the island of Culebra (E. Hernandez, pers. com.), all presumably for local on-island sale.

Collection Habitats and Methods: Despite the fears of several resource managers and lay stakeholders, the majority of marine ornamental collection in Puerto Rico does not occur over actively growing reefs, primarily due to difficulties imposed to the deployment and use of fragile barrier nets on and near the growing corals. In addition, the primary fishers have made a conscious collective decision to not collect on live reefs in order to avoid political conflict with recreational dive tour operators. Rather, reef-associated fish and invertebrates are most often taken over hard bottom rubble zones mixed with relic reef structures and rock, or from the sides and frontal areas of growing reefs, where surfaces are less complex. In addition to these habitat types, many invertebrates are collected from among mangrove prop root structures, from tidal flats, and from seagrass beds.

Experienced fishers seem to have numerous favorite collecting locations, generally consisting of physical micro-habitats such as clusters of caves, surge channels, ledges, or other structures. Other factors considered in selection of harvest zones are proximity to convenient shore or boat launch points, which minimize transport time and costs in this economically marginal fishery, and shallow depths, which maximize total per dive bottom time available for collection.

Fishers speak of having utilized certain specific locations over a 10-18 year span, rotating among specific sites to allow recovery, variously described as periods of two months to a year, depending upon habitat type and species. Some full time collectors concentrate exclusively on nearshore zones accessible by snorkeling, avoiding the expense of boat maintenance and operation. At least one of these collectors makes extensive use of the rubble-relic reef zone fronting the *malecón* of Aguadilla's main shoreline drive, an area that has been considerably degraded by surface runoff, effluent discharges, and trash disposal.

The primary method observed for collection of marine ornamental fishes was diving with SCUBA gear to maximize bottom time. At depth, a fine monofilament barrier net of approximately 0.6 cm (¼ in) stretch mesh is deployed, located to block likely escape routes. These nets are approximately 1.2 m high and 4.5 m long, with floats on the headline and weights on the footline. With the net deployed, the fisher swims along crevices, ledges and boulders in the vicinity, using a stainless steel pick or bare hands to prod fish out of hiding places for capture in a hand-held dip net. Fish escaping initial capture may then be herded in the direction of the barrier net, where they can be more easily captured with the dip net.

Once captured, the fish are transferred to a holding bag consisting of a perforated plastic bag weighted with a stainless steel hoop at its mouth. At the conclusion of the dive, this holding bag is tied off to the anchor line at depth to allow pressure equalization and prevention of swim bladder injuries to the fish. The depths and durations for this pressure staging vary, depending upon the collecting depth. At a collecting depth of 12-15 m, a 15-min holding time at a 5 m depth was observed. It was said that two such pauses at two different depths are frequently used for deeper collection depths.

Another fisher was observed to conduct all collecting using only snorkeling gear to depths of 9 m or more. This fisher used only a dip net for capturing the fish, a stainless steel prod to encourage fish to leave their hiding places, and a plastic bucket modified to serve as a holding container. His fish collections provide all of his family income. All collections were made by wading from shore using his car as his staging area. He does not own a boat. In approximately 40 minutes, this fisher was observed to collect more than 30 specimens, including Gobies, Tangs, Rock Beauties, Beau Gregories, and Banded Coral Shrimp. He claimed that his normal collecting is more efficient and that he had slowed his actions to more clearly demonstrate his activities to the observers.

At the conclusion of each dive, fish are released from the holding container into a 5-gallon bucket. They are then dip-netted and transferred to individual perforated plastic tubs of approximately 180 cc (6 oz) volume, which

are then placed into a larger plastic transport tub full of seawater. This segregation of individual fish facilitates subsequent handling, and protects individual fish by isolating potentially aggressive species. Seawater in the transport tub is either exchanged frequently or is pump-aerated.

No chemical agents such as quinaldine were observed being used during this study. Although quinaldine is reported as being commonly used for ornamentals collections in Puerto Rico (C. Heberer, unpublished), the export fishery does not utilize this or other chemicals, which are believed to increase mortalities in shipments to customers. Because mortalities of >3% are regarded as unacceptable to customers, any advantage gained on the capture side is offset by the loss of customer goodwill and repeat orders. Likewise, no damage to corals was observed, and no overturning of coral heads or other destructive practices were noted.

Collection of invertebrates is somewhat different, and is usually conducted in depths of 0.5-2.0 m in seagrass and mangrove prop root habitats. Snorkeling gear is used virtually exclusively. Collection equipment consists of a gardener's trowel, a geological hammer, a dip net, and a bait bucket with a spring-closed flap lid.

The most common method of collecting is to turn small rocks and coral pieces over and capture specimens by hand from under the rock. Most of these rocks are <30-40 cm in diameter and all are replaced right-side up after collections are made. The most common specimens collected in this manner include sea cucumbers, emerald crabs, serpent starfish, and brittle starfish. All specimens are placed together into the bait bucket as they are captured.

Of particular interest were the methods for gathering carpet and flower anemones. Both of these species commonly grow on rock surfaces, but none are commonly collected from rock. Rather, specimens growing in sand substrate are selectively collected by inserting the adz-end of the geological hammer into the sand beneath the anemone, and prying it upward to free it from the sand. These anemones are attached beneath the sand to other structures, such as grass roots or rubble, which is then readily removed by hand without injuring the anemone. This practice avoids the tearing of anemone tissue which frequently occurs if they are collected from rock substrate, resulting in unacceptable rates of mortality.

Feather duster worms are also collected selectively, for much the same reason. Specimens growing from cavities in rocks and coral are generally bypassed. Other specimens with tubes attached to the surface of rock or coral are readily and cleanly separated from the substrate by inserting a finger at the interface and scraping the tube free with a fingernail. These specimens are most frequently attached on the lower sides of rocks turned over to find other specimens. No rock substrate is taken, as its export is prohibited.

At the end of collecting the bait buckets are emptied into a 19 l (5 gal) plastic bucket. Specimens are then separated by species into smaller buckets, and smaller or more fragile specimens are isolated in smaller perforated plastic tubs, similar to those used in fish collection, to protect them during transport.

Holding Facilities and Shipping: There are only two significant holding facilities used in this fishery – one for most of the fish and the other for invertebrates. The fish holding facility is operated by the primary exporter, who consolidates collections made by other fishers, who rely on his customer orders to create their markets.

This fish holding facility is comprised of several shallow (<30 cm deep) plastic-lined fiberglass or wooden tanks under a roof of translucent fiberglass, and a re-circulating seawater system. The latter consists of pumps, a column biological filter filled with "Bio Balls," several sand filters, mechanical bag filters, and an ultraviolet light sterilization filter. Water quality is stable, requiring exchange at intervals of only several months. The facility is open on three sides, and is therefore not climate controlled. Specimens are usually not fed because they are usually held in this facility for less than one week before shipping. This avoids fouling of water during shipping, which

frequently leads to unacceptable mortalities, and customers are instructed to feed the fish soon after arrival.

The holding facility for invertebrates is somewhat smaller, but relies in the same basic technology. This re-circulating seawater system consists of several shallow plastic-lined tanks sheltered by a canvas roof, but without walls, so the system is not climate controlled. The system uses a sand filter, a small biological filter with "Bio Balls," and an ultraviolet light sterilization filter. The system is not elegant, but it is effective, and specimens appear to thrive in it.

Once an order is complete, shipments are prepared by placing single specimens in individual plastic bags half filled with seawater, and the headspace inflated with pure oxygen from a compressed gas tank. The sealed bags are placed into insulated 30 x 30 x 45 cm (12 x 12 x 18 in) unsealed cardboard boxes for transport to either the Aguadilla or San Juan airport. Boxes are inspected at the airport by *Vigilantes* (Rangers) and compared against shipping documents provided by the exporter. The boxes are then sealed prior to loading on the aircraft.

Size and Value of Fishery: There are apparently only three exporters who routinely ship marine ornamentals off-island, with the remaining full- and part-time fishers commercializing their catch directly to these individuals. The activity of one of these exporters has decreased almost to the point of inactivity. Another is the primary exporter of ornamental fish, who consolidates specimens from multiple fishers to fill customer orders, and the third exporter specializes primarily in invertebrate ornamental species.

Across any given year the exporters typically conduct business with fewer than five purchasers on the mainland United States, with one or two dominant at any particular time. Though informal, these semi-exclusive relationships with the predominant buyers can remain in place for several years, and are treated with paramount importance and respect by the exporters. For example, one exporter's primary buyer reportedly refrained from finding new sources of Caribbean fish during the recent temporary ban on exports, in effect holding a market spot open for that exporter to serve once collection and export were resumed.

The exporters usually collect only to fill specific orders placed by the buyers in North America, and do not generally collect large numbers of specimens on speculation. The exporter in turn places sub- or partial-orders to non-exporting fishers based on the quantity of animals required, specialization in the capture of particular species, or a simple tradition of working together over time. Orders are generally placed at the beginning of the business week, allowing an accumulation of animals to fill the orders over the 3-5 day holding time considered optimal without feeding or investment in more sophisticated holding facilities.

Government export data for 1998-2000 marine ornamental finfish reveal a considerable diversity, including 101 species from 29 families. However, the top 10 of these 101 account for 73% of the total numbers of fish exported, and for 63% of the aggregate value, indicating a disproportionately important role played by these relatively few species (Table 1). The most common export species, the Royal Gramma, accounted for 42% of the total numbers of fish (37 560 of 88 404), and 20% of the total 3-year value ($75 120 of $292 003).

Unit wholesale prices paid to exporters vary according to species, ranging from $30.00 for nurse sharks to $2.00 for a Royal Gramma. It is notable that the top ten highest priced fish contributed only 8% of the total numbers of fish exported, and 26% of the total value of exports (Table 2). Of these top ten highest value species, three (Redtail Trigger, Rock Beauty, French Angel) accounted for 5% of the number of fish exported and 16% of the total value, indicating that the remaining seven species in this high-value list represent a relatively minor proportion of the marine ornamental fishery.

In addition to the 1998-2000 data, additional information on finfish and invertebrates was obtained from the major exporters interviewed during the course of this study. These

TABLE 1
Top ten highest volume species exported over 3-yr period 1998-2000

Rank	Scientific Name	Common Name	Number	Price Each (US$)	% of Catch	Total Value (US$)	% of Value
1	*Gramma loreto*	Royal Gramma	37 560	2.00	42	75 120	26
2	*Opistognathus aurifrons*	Yellowhead Jawfish	8 469	3.50	10	29 641	10
3	*Chromis cyanea*	Blue Chromis	3 548	2.25	4	7 983	3
4	*Ophioblennius atlanticus*	Redlip Blenny	3 414	2.25	4	7 681	3
5	*Holacanthus tricolor*	Rock Beauty	3 157	8.00	4	25 256	9
6	*Gobiosoma multifasciatum*	Greenbanded Goby	2 759	2.25	3	6 207	2
7	*Acanthurus coeruleus*	Blue Tang	2 171	6.00	2	13 026	4
8	Unidentified	Horned Blenny	2 156	3.00	2	6 468	2
9	*Thalassoma bifasciatum*	Bluehead Wrasse	2 109	2.25	2	4 745	2
10	*Centropyge argi*	Pygmy Angelfish	1 802	4.00	2	7 208	2
	Totals		67 145		76	183 337	63
	Totals All Taxa		88 404		100	292 003	100

TABLE 2
Top ten highest priced fish species exported over 3-yr. period 1998-2000

Rank	Scientific Name	Common Name	Number	Price Each (US$)	% of Catch	Total Value (US$)	% of Value
1	*Ginglymostoma cirratum*	Nurse Shark	28	30.00	<1	840	<1
2	*Styganobrotula latibricola*	Black Widow	1	25.00	<1	25	<1
3	*Holacanthus ciliaris*	Queen Angel	547	20.00	1	10 940	4
4	*Pomacanthus paru*	French Angel	1 283	16.00	1	20 528	7
5	*Gymnothorax moringa*	Spotted Moray	20	13.00	<1	265	<1
6	*Pomacanthus arcuatus*	Black/Gray Angel	217	12.00	<1	2 604	1
7	Unidentified muraenids	Morays	24	12.00	<1	288	<1
8	*Halichoeres cyanocephalus*	Lightning Wrasse	225	9.00	<1	2 175	1
9	*Holacanthus tricolor*	Rock Beauty	3 157	8.00	4	25 256	9
10	*Xanthichthys ringens*	Redtail Trigger	1 683	8.00	2	13 464	5
	Totals		7 185		8	76 386	26
	Totals All Taxa		88 404		100	292 004	100

data on fish exports indicate a similar pattern of dominance by a handful of species, with Royal Gramma continuing to comprise nearly half of the harvest, and with 8 of the same species again appearing in the 10 most numerous species collected (Table 3).

Although the primary fish exporter concentrates on finfish, he also exports ornamental invertebrate species. Data on these exports indicate a similar preponderance of a handful of species dominating the fishery, with Pink Tip Anemones (*Condylactis gigantea*) comprising nearly half the numbers and half the total value of these exports (Table 4).

Additional data for the first six months of 2002 were obtained from the island's primary invertebrate collector and exporter (Table 5). Once again, the top 10 of 113 species accounted for 68% of the total quantity this individual exported (19 181 specimens of 28 064) and 45% of the total export value (($19 181 of $42 673).

DISCUSSION

Extrapolation of the January-May, 2002 data provided by the major fish exporter to a full year produces a total potential take

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TABLE 3

Top ten highest volume fish species shipped by the major exporter in first five months of 2002

Rank	Species	Common Name	Number	Price Each (US$)	% of Catch	Total Value (US$)	% of Value
1	*Gramma loreto*	Royal Gramma	3 965	1.75	45	6 939	29
2	*Gobiosoma multifasciatum*	Green Banded Goby	672	2.25	8	1 512	6
3	*Chromis cyanea*	Blue Chromis	460	2.25	5	1 035	4
4	*Thalassoma bifasciatum*	Bluehead Wrasse	406	2.25	5	— 914	4
5	*Ophioblennius atlanticus*	Redlip Blenny	388	2.25	4	— 873	4
6	*Myripristis jacobus*	Blackbar Soldier	366	2.25	4	— 824	3
7	*Acanthurus coeruleus*	Blue Tang	264	4.00	3	1 056	4
8	Unidentified	Horned Blenny	215	4.00	2	— 860	4
9	*Halichoeres garnoti* juv	Neon Wrasse	202	2.25	2	— 455	2
10	*Holacanthus tricolor*	Rock Beauty	197	4.00	2	— 788	3
	Totals	these 10 taxa	7 135		80	15 254	64
	Totals all Taxa	71 total taxa	8 899		100	23 756	100

TABLE 4

*Invertebrates shipped by the primary fish exporter during the first five months of 2002**

Rank	Common Name	Number	Price Each (US$)	% of Catch	Total Value (US$)	% of Value
1	Pink Tip Anemone	4 299	1.00	47	4 299	51
2	Blue Legged Hermit	1 640	0.15	18	246	3
3	Emerald Crab	898	1.00	10	898	11
4	Burgundy Star	845	2.00	9	1 690	20
5	Turbo Snails	590	0.15	6	88	1
6	Sea Mat	159	2.50	2	397	5
7	Arrow Crab	93	1.25	1	116	1
8	Red Leg Hermit Crab	90	1.50	1	135	2
9	Brittle Star	87	1.00	1	87	1
10	Harlequin Star	85	1.00	1	85	1
11	Green Star	84	1.00	1	84	1
12	Banded Coral Shrimp	53	2.00	1	106	1
13	Pencil Star	41	1.00	<1	41	<1
14	Flame Scallop	38	1.00	<1	38	<1
15	Red Serpent Star	22	2.00	<1	44	1
16	Feather Star	20	1.25	<1	25	<1
17	Red Pistol Shrimp	12	2.00	<1	24	<1
18	Carpet Anemone	10	2.00	<1	20	<1
19	Rock Anemone	10	2.00	<1	20	<1
20	Hermit Crab	6	1.00	<1	6	<1
21	Lobster Octopus	5	6.00	<1	30	<1
22	Feather Star	4	2.50	<1	10	<1
23	Sand Star	3	1.00	<1	3	<1
24	Scarlet Lady Shrimp	2	3.00	<1	6	<1
	Totals	9 096		100	8 499	100

*Common names from shipping invoices. Scientific corollaries are frequently unclear. Taxonomic clarification is a continuing task.

TABLE 5
Top 10 of 113 invertebrate species shipped by the primary invertebrate fisher in first six months of 2002

Rank	Common Name	Number	Price Each (US$)	% of Catch	Total Value (US$)	% of Value
1	Blue Leg Hermit Crab	7 500	0.25	39	1 875.00	11
2	Pink Tip Anemone	3 600	1.25	19	4 500.00	27
3	Turbo Snail	2 500	1.00	13	2 500.00	15
4	Serpent Star	1 600	1.25	8	2 000.00	12
5	Feather Duster	775	3.50	4	2 712.50	16
6	Rock Anemone	725	1.25	4	— 906.25	5
7	Curly Cue Anemone	650	1.50	3	— 975.00	6
8	Flame Scallop	625	2.00	3	1 250.00	7
9	Zoanthea (Green & Gold)	606	3.00	3	1 818.00	10
10	Fiddler Crab	600	1.00	3	— 600.00	3
	Totals	19 181		100	19 136.75	100

estimate of 21 361 finfish with a potential revenue value of $57 023 for the entire year. If the 1998-2000 data are annualized based on a 30-month period (full years of data for 1998 and 1999, and 6 months in 2000, after which the fishery was closed by resource managers), the entire export fishery is represented by an annual catch of 30 340 fish with a value of $116 801. Comparison of the two annualized estimated indicates that the remaining primary fish exporter's operational volume is equivalent to 70% of the former fishery existing prior to government regulations that temporarily closed the export marine ornamentals fishery (Hardin and LeGore, in press), and 49% of the pre-ban revenue for all fishermen. The present fishery, as well as the former fishery, is clearly dominated by a small number of active individuals. The fishery in Puerto Rico is small, but provides full time occupation for several individuals.

A comparable database for ornamental invertebrates is not yet available for the 1998-2000 period, but extrapolation of the 2002 data submitted by the primary exporters indicate an annualized revenue estimate of $105 743. This figure from only two collectors is comparable to the $116 801 figure for the annualized value of all 1998-2000 fish exports cited above, indicating the potential for a high value fishery for invertebrates.

Interviews conducted with stakeholders in potentially conflicting resource uses such as other fishermen, dive tourism operators, recreational divers, and relevant NGOs revealed few if any real conflicts. The single report of destructive collecting practices was unclear, and cannot be attributed to operators of the marine ornamentals export fishery.

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RESUMEN

Se estudió la pesquería de peces e invertebrados para acuarios, por comisión del Comité Consultor de Arrecifes

Coralinos de Puerto Rico. Se usaron registros públicos, entrevistas con empresarios y pescadores, y visitas a los sitios de operación. La pesquería no es grande: menos de 20 pescadores con licencia que operan principalmente en el extremo occidental de la isla. Únicamente tres exportan el producto, el resto provee especímenes a los exportadores según la demanda. La captura de peces se da principalmente en zonas de escombros coralinos mezclados con restos arrecifales y roca, o en los lados y áreas frontales de arrecifes vivos. Otras especies son recolectadas entre las raíces aéreas de los manglares, zona intermareal y "pastizales" marinos. Se utilizan chinchorros y redes de mano para peces e invertebrados móviles como el camarón. Cangrejos, estrellas y pepinos de mar, así como otros invertebrados, son recogidos comúnmente volcando rocas pequeñas, sacando los individuos y después colocando las rocas en su lugar original. Los especímenes son llevados al bote y se transfieren a envases individuales para aumentar la supervivencia. Aunque existen informes previos de captura con sustancias químicas, no se observó ninguna evidencia en esta ocasión. Los especímenes se dejan en sistemas de recirculación de agua en la costa hasta el día del embarque. La pesquería se esfuerza en mantener índices de mortalidad < 1%, ya que una mortalidad mayor al 3% es inaceptable para los clientes. Aunque se recolecta más de 100 especies de peces, tan solo diez de ellas representan más del 70% de los individuos y más del 60% del valor de esta pesquería. *Gramma loreto* representa más del 40% de la cantidad total. Asimismo, se recolecta más de 100 especies de invertebrados (especialmente anémonas, cangrejos ermitaños, ofiúridos, "caracoles turbo" y poliquetos tubícolas.

Palabras clave: Ornamentales marinos, pesquería de peces de arrecife, manejo de pesquerías, pesquerías del Caribe, manejo de pesca sostenible.

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