

RECREATIONAL CATCHES OF FOUR SPECIES OF GROUPERS IN THE CAROLINA HEADBOAT FISHERY

by

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ABSTRACT

A recreational fishery for semitropical reef fishes has developed over the past 12 years off the North Carolina and South Carolina coasts. About 30 headboats fishing from coastal cities transport anglers to the fishing grounds daily for a fee. The faster vessels regularly fish selected locations on the edge of the Continental Shelf 40 to 50 miles offshore while the slower ones fish coral patches and rocky outcroppings closer inshore. A large part of the catch is composed of four species of grouper: scamp, *Mycteroperca phenax*; gag, *Mycteroperca microlepis*; speckled hind, *Epinephelus drummondhayi*; and snowy grouper, *Epinephelus niveatus*. Catch and effort statistics indicate that these species can become quickly depleted from fishing sites by continued heavy fishing pressure. Their abundance on fishing sites in the area has generally remained high, however, because vessel captains try to spread fishing effort in order not to deplete any one site. Restocking of depleted sites is slow.

INTRODUCTION

On the outer Continental Shelf of North Carolina and South Carolina at depths of 15 to 100 fm, rocky outcroppings, steep cliffs, and warm waters from the Gulf Stream provide ideal habitat for a community of reef fishes typical of Caribbean oceanic banks. Recreational fishing for these fishes has developed rapidly in the past decade, mainly from headboats¹ based at ports in North Carolina and South Carolina. On the average, fishermen catch about 10 fish totaling 30 lb daily. Each year since 1972, over 50,000 angler days² have produced over 1.3 million pounds of fish, mainly of smaller species weighing 1 to 6 lb — red porgy (*Pagrus pagrus*), white grunt (*Haemulon plumieri*), and vermilion snapper (*Rhomboplites aurorubens*). Much of the thrill for fishermen, however, comes from catching large groupers that may weigh over 300 lb.

Grouper, a term applied to members of several genera of the sea bass family Serranidae, are found in tropical oceans worldwide, but members of only two genera, *Mycteroperca* and *Epinephelus* are found off the Carolinas. Of the 12 species occurring in catches, only four, the scamp, *Mycteroperca phenax*; the gag, *Mycteroperca microlepis*; the speckled hind, *Epinephelus drummondhayi*; and the snowy grouper, *Epinephelus niveatus* are caught in sizeable numbers. In this paper we discuss our tentative conclusions about the vulnerability of these four species to exploitation, on the basis of recreational catches for 1972-74, and our knowledge of vessel fishing activities.

COLLECTION OF DATA

Headboat crews recorded daily the number of anglers aboard, the locations fished, and the number of each species caught. We achieved about 50% coverage of all headboat trips for June, July, and August 1972 to 1974, and less than 25% in spring and fall when fishing was more sporadic and when many mates worked only part-time. For vessels having incomplete daily records we estimated the monthly catch of each species by multiplying the observed catch per angler day³ of each species by the total angler days for the month, which were taken from vessel booking records. We weighed fish at dockside and multiplied the mean weight of each species by the total number caught to estimate total weight.

To facilitate the estimation and presentation of catch and effort data we divided the fishing area from Cape Hatteras through South Carolina into four districts: Cape Hatteras, Cape Lookout, Cape Fear, and Cape Romain. Cape Hatteras vessels fished in the northern part of Raleigh Bay, Cape Lookout vessels in the southern part of Raleigh Bay and the northern half of Onslow Bay, Cape Fear vessels in southern Onslow Bay and the northern third of Long Bay, and Cape Romain vessels from southern Long Bay to Savannah, Georgia. Within each of the four districts we designated inshore (10-25 fm) and offshore (25-100 fm) subdistricts (e.g., Cape Fear, offshore). We designated each of the

¹ Headboats are those where anglers pay for passage on a per person (thus per "head") basis.

² An angler day is a unit of fishing effort representing one rod and reel angler in the headboat fishery for one day.

³ Catch per angler day is the mean number of fish taken per angler day for time period specified.

approximately 30 headboats (number varied each year) as an inshore or offshore vessel, depending on the depth at which it fished most, and divided the fishing season into five time units: March-May, June, July, August, and September-November. There is little fishing from December through February.

Records of all commercial catches of groupers would have been valuable to our assessment, but they were unavailable. Some commercial vessels come from the east and west coasts of Florida and return there to land their fish, or they land in North Carolina or South Carolina and the catch is immediately trucked to their home port. In both cases the landings are usually attributed to the home port and not to Carolina ports. Landings of the few commercial boats based in the Carolinas are attributed to the home port of the vessel, but all grouper catches are lumped as one species. In North Carolina and South Carolina the total recorded commercial catch of groupers was 18,778 lb in 1972, 99,206 lb in 1973, and 132,132 lb in 1974. By contrast, the total catch of groupers from headboats was 330,068 lb in 1972, 362,359 lb in 1973, and 336,317 lb in 1974. Since the recreational catch is much larger than the recorded commercial catch and the number of headboats much greater than the number of commercial vessels, we believe annual changes in the recreational catch reflect a useful index of stock abundance.

RESULTS AND DISCUSSION

SCAMP

Habitat

Scamp, which live in shallow waters (15-35 fm) and commonly aggregate near rocks, reefs and wrecks, are most common from mid-Onslow Bay (34°10'N) southward and are not caught off Cape Hatteras.

Catch and Catch Per Angler Day

Headboat catches of scamp, the most commonly caught grouper off the Carolinas, were 11,309 (117,154 lb) in 1972, 7,279 (72,025 lb) in 1973, and 11,494 (107,950 lb) in 1974 (Table 1). Total scamp catches were larger in the offshore subdistricts than inshore and they increased southward. Cape Romain offshore catches were largest in 1972 and 1973 and Cape Fear were largest in 1974. Cape Lookout catches were smallest for all three years.

The catches per angler day (CPAD) in offshore subdistricts were smallest in Cape Lookout, as was total catch, and were largest in Cape Fear for all years (Table 2). CPAD values for inshore subdistricts were generally low, which probably indicates only minor availability of scamp in those areas. In 1974 Cape Fear inshore fishermen, however, took scamp at a rate roughly 100 times that of 1972 and five times that of 1973. This remarkable increase probably resulted from increased fishing by inshore vessels at the offshore edge of their normal fishing zone, in response to poor fishing inshore, and not from an increase in scamp abundance.

The catch and catch per angler day for both Cape Lookout offshore and inshore were low because that district is probably too far north to support dense populations. Cape Fear offshore catches were relatively low, despite a high CPAD, because effort was low. Cape Romain offshore catches were large, despite a CPAD somewhat lower than for Cape Fear offshore, because effort was high. Cape Romain offshore effort was at least double that of Cape Fear offshore in the three years studied.

Mean Weights

The annual mean weights of scamp for inshore subdistricts varied little and ranged only from 8.3 (n = 89) pounds for Cape Fear, 1974 to 12.8 (n = 46) pounds for Cape Romain, 1974 (Table 3). Offshore mean weights were only slightly more variable, ranging from 8.1 (n = 183) pounds for Cape Fear in 1973 to 18.2 (n = 5) pounds for Cape Lookout, 1972. Six of nine offshore annual mean weights were between 8 and 10 lb and eight of nine were between 8 and 12 lb. The size of scamp was highly predictable, and neither very large nor very small fish were commonly caught.

Stock Status

The continued stable and relatively high yield suggests that the resident population is being replenished at a stable rate. Commercial fishermen, who occasionally come from as far as the Gulf of Mexico, regard the Carolina Continental Shelf, and especially the Cape Fear area, as good scamp grounds, although the catch could decline rapidly if fishing mortality exceeded the rate of replacement by a large amount. Catch data as well as observations by headboat and commercial handline

fishermen suggest that scamp stocks are, over the area as a whole, large and resilient enough to sustain the fishing effort currently applied.

Although scamp fishing remains good over the Carolina shelf as a whole, it has become poor on many of the easily accessible rocks and reefs. Our observations suggest that scamp are relatively sedentary and that repopulation of fishing sites is slow. Where headboat competition is low, as in Cape Fear offshore, there are enough fishing sites to maintain a high CPAD. But where competition is more intense, sufficient sites are unavailable to allow time for recovery between fishings, and CPAD declines as it has in Cape Romain offshore since 1972. Cape Romain offshore vessel operators claim that even the 1972 CPAD was much lower than in the early years of that fishery.

GAG

Habitat

The gag is one of the larger groupers (up to 50 lb) caught in the Carolina headboat fishery. Although they are found in water from 2 to 35 fm, the majority are caught between 17 and 30 fm. They commonly occur in aggregations near rocks and reefs but seem especially attracted to wrecks.

Catch and Catch Per Angler Day

The gag was the second most frequently caught grouper and by weight was the most important grouper in the fishery. Anglers landed approximately 7,366 (119,349 lb) in 1972, 10,283 (190,025 lb) in 1973, and 7,679 (145,288 lb) in 1974 (Table 1).

Abundance seemed to be highest in Cape Lookout offshore and lowest in Cape Hatteras offshore. Both catches and the CPAD were large for Cape Lookout offshore, and low for Cape Hatteras offshore, where the CPAD was smaller than for any other offshore subdistrict and only slightly larger than for Cape Romain inshore (Table 2). The low CPAD in the Cape Hatteras district, where fishing effort was relatively light, suggests that Cape Hatteras may be near the northern boundary of the gag's range.

The relative abundance seemed to decrease southward from Cape Lookout, particularly in the inshore subdistricts. The CPAD decreased southward in all years for inshore subdistricts and in 1972 and 1974 for offshore subdistricts. For Cape Romain inshore, the low CPAD was probably due to low abundance of the gag caused by heavy fishing pressure of vessels concentrating in a small area. These vessels did not venture to other fishing sites because they had low maximum speeds. In this subdistrict the CPAD was low at the beginning of the study, therefore suggesting the possibility that exploitation before 1972 was high. For Cape Romain offshore the CPAD has been gradually decreasing, probably in response to fishing effort, which is the highest of all offshore subdistricts.

Mean Weights

Large gag appeared to be more abundant in deep waters (25-30 fm) than in shallower waters. In all districts, the mean weights of gag from offshore were much higher than the mean weights from inshore (Table 3). Mean weights inshore varied from 4.9 ($n = 28$) pounds for Cape Lookout, 1972 to 16.7 ($n = 36$) pounds for Cape Fear, 1974, while mean weights offshore ranged from 17.3 ($n = 27$) pounds for Cape Lookout, 1974 to 25.2 ($n = 40$) pounds for Cape Romain, 1974.

From 1972 to 1974, the mean weights generally increased or remained fairly constant in all districts except Cape Lookout. Cape Lookout inshore mean weights declined from 8.4 ($n = 19$) pounds in 1973 to 2.8 ($n = 9$) pounds in 1974, or 73%, and offshore from 22.7 ($n = 35$) pounds in 1973 to 17.3 ($n = 27$) pounds in 1974, or 24%. The mean weight of gag for Cape Lookout offshore was the lowest of any offshore subdistrict except Cape Hatteras, where catches were small. If high fishing mortality continues in Cape Lookout offshore, existing stocks of adult gag may be drastically reduced there.

In subdistricts where the mean weight increased, it did not increase more than 7 lb or 38%, between any of the 3 years, except for Cape Fear inshore. There the mean weight increased approximately 10 lb or 185% between 1972 and 1974, probably in response to the shift of Cape Fear inshore vessels to deeper fishing grounds.

Stock Status

At present levels of fishing effort, it appears that the abundance of gags on the Carolina shelf as a whole is remaining stable. However, should offshore fishing intensity be increased, the deep water stocks might be severely affected and numbers could decline. Although abundance has been declining in the Cape Lookout district, offshore fishing effort has decreased in the first part of the 1975 season to at least half that in 1974, due to a decline in number of vessels. If effort continues at this reduced level, abundance may increase in future years, or at least not decline further.

Table 1. Numbers and pounds of scamp, gag, speckled hind, and snowy grouper caught in the Carolina headboat fishery, by year and subdistrict.

Subdistrict	Scamp						Gag					
	1972		1973		1974		1972		1973		1974	
	No.	lb	No.	lb	No.	lb	No.	lb	No.	lb	No.	lb
Cape Hatteras Offshore	0	0	0	0	0	0	0	0	34	835	8	161
Cape Lookout Inshore	0	0	0	0	0	0	402	1,990	1,048	8,678	793	9,902
Cape Lookout Offshore	401	7,622	664	6,538	299	2,373	4,758	87,340	5,553	120,912	4,216	78,678
Cape Fear Inshore	44	553	355	3,000	1,417	12,327	585	4,271	1,060	9,945	880	16,077
Cape Fear Offshore	1,535	10,841	1,884	15,326	6,366	58,365	456	4,958	591	11,269	835	17,853
Cape Romain Inshore	113	416	a	a	593	7,558	5	112	a	a	158	2,193
Cape Romain Offshore	9,216	97,722	4,376	47,161	2,819	27,327	1,160	20,678	1,997	38,386	789	20,424
TOTAL	11,309	117,154	7,279	72,025	11,494	107,950	7,366	119,349	10,283	190,025	7,679	145,288

^a Data incomplete

Table 2. Catch per angler day, Carolina headboat fishery by species, year and subdistrict.

Subdistrict	Scamp			Cag			Speckled Hind			Snowy Grouper		
	1972	1973	1974	1972	1973	1974	1972	1973	1974	1972	1973	1974
Cape Hatteras												
Offshore	0	0	0	0	0.021	0.007	0	0.242	0.397	0	0.098	0.158
Cape Lookout												
Inshore	0	0	0	0.076	0.134	0.140	0.119	0.029	0	0	0	0
Cape Lookout												
Offshore	0.040	0.050	0.028	0.477	0.416	0.398	0.093	0.090	0.079	0.085	a	a
Cape Fear												
Inshore	0.003	0.042	0.150	0.043	0.125	0.091	0.006	0.021	0.041	0	0	0
Cape Fear												
Offshore	0.816	0.251	1.040	0.242	0.079	0.136	0.496	0.169	0.037	0.011	0	0
Cape Romain												
Inshore	0.022	a	0.015	0.001	a	0.004	0	a	0.017	0	a	0
Cape Romain												
Offshore	0.696	0.210	0.215	0.088	0.096	0.060	0.136	0.255	0.204	0.012	0.031	0.136

^a Data incomplete

Table 3. Mean weight of scamp, gag, speckled hind, and snowy grouper in samples from Carolina headboat fishery catches, by year and subdistrict.

Subdistrict	Scamp				Gag				Speckled Hind				Snowy Grouper											
	1972	1973	1974	1974	1972	1973	1974	1974	1972	1973	1974	1974	1972	1973	1974	1974								
	n^a	\bar{W}^b	n	\bar{W}	n	\bar{W}	n	\bar{W}	n	\bar{W}	n	\bar{W}	n	\bar{W}	n	\bar{W}								
Cape Hatteras	0	0	0	0	0	0	0	5	1.5	0	0	0	13	5.2	0	0	2	2.4						
Offshore																								
Cape Lookout	0	0	0	0	28	4.9	19	8.4	9	2.8	0	0	0	0	0	0	0	0						
Inshore																								
Cape Lookout	5	18.2	7	11.4	33	8.2	0	34	22.7	27	17.3	14	8.7	16	8.1	18	9.4	47	11.2	17	8.9	30	6.1	
Offshore																								
Cape Fear	27	12.4	6	11.9	89	8.3	47	6.6	24	8.3	36	16.7	0	0	0	11	4.8	0	0	0	0	0	0	
Inshore																								
Cape Fear	110	9.2	183	8.1	86	9.2	30	18.7	45	21.4	20	20.1	32	10.9	44	8.3	6	5.8	0	0	0	0	0	
Offshore																								
Cape Romain	0	0	0	0	46	12.8	1	3.1	0	0	6	16.3	1	6.8	0	0	5	4.1	0	0	0	0	0	
Inshore																								
Cape Romain	221	9.2	165	10.4	118	9.8	23	22.6	107	18.3	40	25.2	107	8.8	181	7.0	130	8.8	7	19.0	6	20.5	145	11.1
Offshore																								

^a n = number of samples

^b \bar{W} = mean weight in pounds

SPECKLED HIND

Habitat

The speckled hind, also known as strawberry grouper and Kitty Mitchell, is a deep water grouper found near rocky ledges, depressions, and wrecks. It occurs between 15 and 60 fm, but is most abundant from 35-60 fm.

Catch and Catch Per Angler Day

The speckled hind, the third most common grouper in the fishery, is the one most often caught in water from 35 to 60 fm. Headboat anglers landed approximately 4,387 (40,362 lb) in 1972, 8,576 (64,849 lb) in 1973, and 5,296 (42,152 lb) in 1974 (Table 1).

Speckled hind were more abundant in offshore subdistricts, where catches and CPAD were substantially higher than in inshore subdistricts (Table 2). The largest catches were made in Cape Romain offshore, but the highest CPAD's were in Cape Hatteras offshore (1973 and 1974) and Cape Fear offshore (1972).

There was some evidence that high fishing pressure reduces the relative abundance rather quickly. In the Cape Lookout inshore district, where the fishing area was relatively small and easily accessible, the CPAD decreased from .119 in 1972 to zero in 1974. In Cape Hatteras, where fishing effort was relatively low, the CPAD remained relatively high during 1973 and 1974.

Changes in the CPAD may be related to changes in vessel fishing patterns rather than to changes in fish abundance. For Cape Fear inshore, the CPAD increased each year. The increase probably was more the result of inshore vessels fishing farther offshore because of decreasing abundance of fish in shallower waters, than to any increase in speckled hind abundance. Cape Fear vessels normally fishing the offshore district began to concentrate along the inshore edge of it in August 1973, with a resulting decrease in both catch and CPAD of the speckled hind, and an increase in the catch and CPAD of gag and scamp. Where the activities of the vessels remained fairly constant, such as in Cape Romain and Cape Lookout offshore, the CPAD of speckled hind changed little from year to year.

Mean Weights

Speckled hind were generally larger in the offshore districts. Mean weights from inshore subdistricts ranged from 4.1 (n = 5) pounds for Cape Romain, 1974 to 4.8 (n = 11) for Cape Fear, 1974, while the mean weights from offshore subdistricts varied from 5.0 (n = 13) pounds for Cape Hatteras, 1974 to 10.9 (n = 32) for Cape Fear, 1972 (Table 3).

Mean weights remained relatively stable, indicating little change in population structure during the 3 years. In all offshore subdistricts, except Cape Fear, the mean weights did not vary more than 2.0 pounds between any two years. Mean weights for Cape Fear offshore decreased from 10.9 pounds in 1972 to 5.8 in 1974, but the sample size in 1974 included only six fish.

Stock Status

In all subdistricts except Cape Lookout inshore, the speckled hind population seemed to be steady. Because of easy accessibility, stocks in Cape Lookout, Cape Fear, and Cape Romain inshore subdistricts appear to have been heavily exploited. However, speckled hind were most abundant in deep water (35-60 fm), where currents and rough seas prevent easy access. Therefore, we believe that these populations will maintain their yield if fishing effort remains at its present level. In only one subdistrict, Cape Fear offshore, do we feel fishing effort could be increased without abundance declining.

SNOWY GROUPE

Habitat

Snowy grouper live in deep water (35-100 fm) along the edges of the continental and insular shelves and oceanic banks throughout the Caribbean and along the southeastern United States coast as far north as Cape Hatteras. Dense aggregations containing occasional yellowedge and warsaw groupers and gray tilefish (*Caulolatilus microps*) occur along high, steep submarine cliffs.

Catch and Catch Per Angler Day

Snowy grouper are found mostly in very deep water and therefore were landed entirely by offshore vessels. Cape Fear offshore vessels, which fish in relatively shallow waters (about 25 fm), took only an estimated 23 snowy grouper during the 3 years (Table 1). Headboat anglers landed approximately

1,035 (11,276 lb) in 1972, 792 (12,390 lb) in 1973, and 1,979 (21,970 lb) in 1974. Of the four grouper species considered in this paper, snowy grouper contributed least to the overall catch.

There were great differences in catches from the offshore subdistricts. In 1972 Cape Lookout vessels landed 856 fish and Cape Romain vessels only 158. In 1973 Cape Hatteras vessels, which began to fish in July, landed 156 fish and Cape Romain vessels 636. In 1974 Cape Hatteras vessels landed 186, and Cape Romain vessels 1,791. Although we were unable to estimate Cape Lookout catches for 1973 and 1974, observations by vessel operators and by our port samplers suggest that landings decreased continually from 1972 to 1974.

Changes in the CPAD in most areas probably were related more to changes in habits of vessel operators than to changes in snowy grouper abundance. For instance, Cape Hatteras vessel captains probably became more skillful in locating and capturing snowy grouper as their experience increased. For Cape Romain the increases in the CPAD reflected increased dependence of vessel captains on deep water groupers as scamp fishing deteriorated.

Decreases in the CPAD in Cape Lookout offshore probably reflected decreases in abundance in that area. Snowy grouper were found regularly at only one area within the normal daily cruising range of Cape Lookout. This site is located in 64 fm about 30 miles southeast of Cape Lookout, and consists of a deep notch in the side of a steep cliff at the edge of the Continental Shelf. It is less than 30 feet wide at the bottom, about 150 feet wide at the top, and about two miles long. Although the notch has been producing snowy grouper with regularity for over five years, the small number of fish that such a limited area is able to support could easily become depleted, unless recruitment from other areas was unusually large.

Mean Weights

Mean weights of snowy grouper declined significantly from 1972 to 1974 for both Cape Romain and Cape Lookout offshore (Table 3). In 1972, snowy grouper caught off Cape Lookout averaged 11.2 ($n = 48$), pounds in 1973, 8.9 ($n = 17$) pounds, and in 1974, 6.1 ($n = 30$) pounds. The decline was less regular in Cape Romain. Mean weights for Cape Romain were 19.0 ($n = 7$) pounds in 1972, and 20.5 ($n = 6$) pounds and 11.1 ($n = 145$) pounds for 1973 and 1974.

The decline in mean weight of snowy grouper caught off Cape Lookout correlated with the suspected decrease in CPAD there and was evidence that heavy fishing pressure can alter the size composition of a stock. The decline in mean weights for Cape Romain, while not as severe, also could indicate rapid response of the fished stock to sudden heavy fishing. Cape Romain had the most offshore vessels, five, of any district, all designed along the lines of the fast, seaworthy crewboats used in the offshore oil industry. Since they were approximately equal in capability, no one vessel operator had technological superiority. If one vessel operator found a good fishing site, the others could quickly join him to exert a massive amount of effort in a short time period. It is reasonable to infer that the rapid decline in mean weights and the sudden increase in catches was a reflection of intense fishing pressure on small available stocks.

Stock Status

Snowy grouper populations appear to be easily depleted if subjected to sustained and intense fishing, but they are protected to some extent by their remoteness and the difficulty of fishing for them. In the Cape Lookout and Cape Romain areas where snowy grouper were sought intensively, the rapid decrease in mean weights suggested low abundance and low resilience. But over the whole Continental Shelf of North and South Carolina there are probably many small aggregations that are not exploited. The large area of the Continental Shelf, the difficulty of fishing in deep water, and the unpredictable and often strong currents along the shelf edge discourage headboat operators from fishing where snowy groupers are most likely to occur. North Carolina's R/V *Dan Moore* (NC R/V *Dan Moore* Cruise 020) made roller trawl catches of snowy grouper near Cape Fear, yet headboat operators in that district never landed any, preferring instead to fish in shallower waters for scamp and gag. Even in the Cape Hatteras area where the shelf is narrow, the distance to snowy grouper grounds short, and the stocks almost untouched, vessel captains prefer to avoid the vagaries of currents and usually fish shallow wreck sites instead.

It is also probable that stocks exist in deeper water than that regularly fished. For several reasons — gear limitations, line tangling, and angler inexperience — headboats rarely fish in water greater than 80 fm. Since snowy grouper are known to live at depths up to 250 fm (Rivas, 1965), stocks that provide some recruitment probably exist in deeper water.

DISCUSSION AND CONCLUSIONS

Attempting to describe fish stocks from only three years of catch data may seem overambitious, if not presumptuous. Yet we may not be afforded the luxury of collecting a long series of annual data and reflecting cautiously upon it. Stocks in the Carolina headboat fishery could easily become over-exploited, since vessel income depends on attracting fishermen as well as on catching fish. Where fishing is reasonably good and anglers are abundant, headboats increase quickly. Historically, the fish have disappeared almost as quickly as the boats have increased. Off the traditional headboating centers of Tampa Bay and the East Coast of Florida, vessel operators report that catches are only a small amount of what they were a few years ago. Our observations suggest that catches in the Carolina area could quickly decline also. Vessel captains also report great changes in species composition of catches since the first offshore boats began operating about 12 years ago, with the highly prized red snappers becoming increasingly scarce.

None of the stocks seem in immediate danger of depletion, if the entire Carolina shelf is considered. But headboats cannot work over the entire shelf. They are restricted by inlets and by facility locations to certain ports, and by angler demand to a rather inflexible schedule. Strong and unpredictable currents restrict fishing on the shelf edge. Headboat operators, therefore, have only certain segments of the shelf available to them. Because reef fish are highly sedentary, the headboat fishery suffers if fish stocks are depleted on available sites, regardless of whether a species remains abundant over other parts of its range.

Grouper stocks are exploited by both headboats and commercial handline boats. The competition between headboat operators and commercial handline fishermen generates intense controversy because the operating modes of the two groups differ. The highly mobile commercial operator is not restricted by port location or time schedule, and the whole resource is available to him. Therefore, the consequence of depleting any single site is unimportant and he will fish on a site until the fish quit biting or the stock is exhausted. Repopulation of an intensely fished site often takes a year or more before fishing becomes acceptable to a headboat operator, who must depend on the same sites year after year. Since his time on the grounds on any one day is short, a single location may provide fishing indefinitely.

Our assessment would have been impossible had we been restricted to catch data only. In a multispecies fishery where vessel operators can, to a great extent, choose the fish to be sought, the catch per unit effort for any one species can reflect many things other than abundance. Only by combining knowledge obtained from vessel operators, our port samplers, and from our own fishing experience could we interpret the catch statistics meaningfully.

If extension of U. S. jurisdiction over marine fisheries to a limit of 200 miles becomes reality, as now seems likely, one of the critical questions facing fishery managers will be the equitable allocation of our bottom fish resources between commercial and recreational fishermen. This question can be addressed intelligently only if we have factual knowledge of the fishery and of the biology of species that are caught.

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