The Effects of Fish Trap Mesh Size on Reef Fish Catch off Southeastern Florida

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Introduction

A concern exists that wire fish traps may be too effective and may damage reef fish stocks. Current regulations in the U.S. Gulf of Mexico and South Atlantic Federal waters allow minimum mesh sizes of 1 × 2″, 1.5″ hexagonal, and 1.5 × 1.5″. These mesh sizes retain snapper and grouper that are smaller than the minimum legal size limits and below the minimum size of first sexual maturity (Munro, 1983; Taylor and McMichael, 1983).

Sutherland and Harper (1983) and Taylor and McMichael (1983) reported that 38–50 percent of the fish captured in traps had no direct commercial importance. Noncommercial species and undersized commercial fishes incur injury and mortality from: 1) Attempting to escape from traps, 2) embolisms caused by changes in ambient pressure as traps are lifted to the surface, 3) stress and handling at the surface before release, and 4) predators such as moray eels which enter traps and prey on fishes before the traps are hauled (Sutherland and Harper, 1983; Taylor and McMichael, 1983). Lost traps (ghost traps) which continue to catch fish have also been a concern, although some evidence indicates that lost traps quickly become damaged and ineffective (Sutherland et al., 1983).

Determining the effects of mesh size on fish size and composition is important for fishery management. Adjusting trap mesh size can reduce the chances of overfishing and can optimize fishery resource production by reducing juvenile and bycatch mortality. Here we examine the effects of wire fish trap mesh size on the catch composition and size distribution of reef fishes off southeastern Florida.

The objectives of this research were to: 1) Document the size distribution of individuals and species caught by different mesh sizes, 2) determine the effects of different mesh sizes on catch of target and nontarget fishes, and 3) report the selectivity of meshes so that optimum mesh sizes can be determined for management purposes based on their capacity to reduce bycatch mortality and yet retain marketable fishes.

Previous studies of fish trap mesh selectivity may not be entirely applicable to the trap fishery in southeastern U.S. waters due to differences in species availability, abundance, and size of fish present. This study differs most importantly in that the sampled area had received relatively little trap fishing effort and that more mesh sizes were tested. Fish traps have been illegal in Florida state waters to a distance of 3 n.mi. (5.6 km) from shore since 1980, and in Federal waters at depths less than 100 feet (30 m) since 1983. Most previous studies of mesh selectivity have been conducted in heavily exploited areas outside the continental United States (Olsen et al., 1978; Stevenson and Stuart-Sharkey, 1980; Hartsuijker and Nicholson, 1981; Hartsuijker, 1982; Munro, 1983; Luckhurst and Ward, In press). In these locations detecting differences between meshes would be more difficult because larger individuals were more likely to be absent.

Methods

Field Methods

Fish traps constructed with different sizes of wire mesh were fished in depths of 7–40 m about 5–7 km east of Key Biscayne, Fla. Field studies consisted of two phases: December 1986 to July 1987 and October 1987 to July 1988. The first phase tested eight meshes (five square and three rectangular) measuring 0.5 × 0.5″ (13 × 13 mm), 1.5 × 1.5″ (38 × 38 mm), 1 × 2″ (25 × 51 mm), 2 × 2″ (51 × 51 mm), 2 × 3″ (51 × 76 mm), 3 × 3″

ABSTRACT—Catch and mesh selectivity of wire-meshed fish traps were tested for eleven different mesh sizes ranging from 13 × 13 mm (0.5 × 0.5″) to 76 × 152 mm (3 × 6″). A total of 1,810 fish (757 kg) representing 85 species and 28 families were captured during 330 trap hauls off southeastern Florida from December 1986 to July 1988. Mesh size significantly affected catches. The 1.5″ hexagonal mesh caught the most fish by number, weight, and value. Catches tended to decline as meshes got smaller or larger. Individual fish size increased with larger meshes. Laboratory mesh retention experiments showed relationships between mesh shape and size and individual retention for snapper (Lutjanidae), grouper (Serranidae), jack (Carangidae), porgy (Sparidae), and surgeonfish (Acanthuridae). These relationships may be used to predict the effect of mesh sizes on catch rates. Because mesh size and shape greatly influenced catchability, regulating mesh size may provide a useful basis for managing the commercial trap fishery.

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(76 × 76 mm), 2 × 4″ (51 × 102 mm), and 4 × 4″ (102 × 102 mm). Measurements were from "knot to knot." The second phase added two rectangular and one hexagonal-shaped mesh: 1.5 × 3″ (38 × 76 mm), 3 × 6″ (76 × 152 mm), and 1.5 × 2.3″ (38 × 58 mm), respectively. Mesh sizes are referred to in English units for convenience. The hexagonal mesh is referred to as 1.5″ hexagonal. Mesh size characteristics and measurement conversions appear in Table 1.

All traps used vinyl-coated wire and were rectangular, measuring approximately 61 × 71 × 91 cm (2′ high × 2.3′ wide × 3′ long). Each trap had a single funnel entrance in one end that terminated in a 6 × 46 cm (2.5 × 18″) vertical opening. The top and bottom panels of the traps were constructed of the tested mesh. The side and end panels of all traps were constructed of 1 × 2″ (25 × 51 mm) vinyl-coated wire mesh to present the same silhouette and presumably the same amount of visual attractiveness to fish. This 1 × 2″ mesh was the second to smallest so that its presence did not affect results of other tested meshes. One trap was constructed entirely of 1 × 2″ wire mesh, but had all inside panels lined with the smallest tested mesh, 0.5 × 0.5″ galvanized hardware cloth. The 1 × 2″ mesh was considered the standard mesh based on its wide popularity and usage off southern Florida.

The traps were fished unbaited in trawls (strings) of four traps. Each trawl had traps attached at 50 m intervals to a 250 m groundline with a concrete or steel weight anchoring each end of the groundline. A subsurface or surface buoy was often attached to one end of each groundline to aid in relocation and retrieval. The traps were randomly attached to the groundline to prevent sampling bias and each set was fished under similar conditions of depth and bottom type to avoid confounding effects on mesh size. Soak times averaged 7 days but varied considerably (range 1–19 days) due to weather factors. Lost, stolen, or damaged fish traps were replaced or repaired as needed, and different traps of a given mesh size were rotated into the fishing schedule.

Table 1.—Dimensions of trap meshes used in field studies.

Shape	Width (inches)	Length (inches)	Area (inches)^2	Diagonal (inches)	Width (mm)	Length (mm)	Area (cm^2)	Diagonal (mm)
Square	0.5	0.5	0.25	0.71	12.7	12.7	1.6	18.0
Rectangular	1	2	2	2.24	25.4	50.8	12.9	56.8
Hexagonal	1.5	2.3	2.3	2.32	38.1	58.4	22.3	59.0
Square	1.5	1.5	2.25	2.12	38.1	38.1	14.5	53.9
Rectangular	1.5	3	4.5	3.35	38.1	76.2	29.0	85.2
Square	2	2	4	2.83	50.8	50.8	25.8	71.8
Rectangular	2	3	6	3.61	50.8	76.2	38.7	91.6
Rectangular	2	4	8	4.47	50.8	101.6	51.6	113.6
Square	3	3	9	4.24	76.2	76.2	58.1	107.8
Rectangular	3	6	18	6.71	76.2	152.4	116.1	170.4
Square	4	4	16	5.66	101.6	101.6	103.2	143.7

Table 2.—Summary of fish trap catch and effort data by mesh size and region.

Mesh size (inches)	Trap hauls (no.)	Total catch (no.)	Catch per haul (no.)	Total weight (kg)	Mean wt. per haul (kg)	Mean wt. per fish (kg)	Median wt. per fish (kg)	Total species (no.)
0.5 × 0.5″	28	322	11.50	50.46	1.80	0.16	0.08	35
1 × 2″	34	210	6.18	80.65	2.37	0.38	0.21	43
1.5 × 1.5″	30	259	8.63	128.13	4.27	0.50	0.22	41
1.5 Hex″	31	396	12.77	142.24	4.59	0.36	0.20	47
2 × 2″	27	153	5.67	53.98	2.00	0.35	0.24	33
1.5 × 3″	31	213	6.87	84.40	2.69	0.39	0.28	32
2 × 3″	31	76	2.45	73.71	2.38	0.97	0.38	25
2 × 4″	27	78	2.89	59.14	2.19	0.76	0.50	18
3 × 3″	29	67	2.31	40.88	1.41	0.61	0.45	15
4 × 4″	33	19	0.58	25.10	0.76	1.32	1.16	7
3 × 6″	29	17	0.59	18.89	0.65	1.11	0.80	7
Totals	330	1,810		757.58				85

The number of hauls for an adequate sample size was determined according to methods given by Bros and Cowell (1987). Mesh sizes added in phase II were fished more often in phase II to obtain comparable numbers of trap hauls.

Each captured fish was identified, weighed, and measured to the nearest millimeter of fork length. Total length, standard length, body depth, and body width were recorded for many individuals. Where possible, fish were released after measurements were made.

Economic Analysis

The effects of mesh size on the value of catches were analyzed based on voluntarily reported mean wholesale prices for each species by 30 seafood dealers from 6 Florida counties for May 1988 (Economics and Statistics Office, NMFS Southeast Fisheries Center, Miami, Fla., personal commun.). Wholesale price per pound was converted to mean price per gram and multiplied by the weight for each species from a standardized sample of 30 trap hauls per mesh size. Prices were adjusted according to fish size for some species as commonly done in the fishery. We assigned large individuals (> 5 pounds, 2.3 kg) the highest values, medium sizes (2–5 pounds, 0.9–2.3 kg) the lower range of values, and small sizes (< 2 pounds, 0.9 kg) a standard value of $0.50/pound ($1.10/kg).

Mesh Retention Experiments

The largest mesh that would retain a particular fish was determined during laboratory and field trials. Most of the fish used in laboratory studies were captured in fish traps during field studies, although some were obtained from other sources. Fish were tested by gently pushing them through various meshes (beginning with the largest and proceeding to smaller meshes) until they were retained. The hexagonal mesh was not tested because it easily became distorted during testing.

Table 3.—Percent catch composition by family. Families are listed according to decreasing percentages of 1980 weights. Data for 1980 are from the commercial trap fishery in Dade and Broward Counties (Sutherland and Harper, 1983). Data for 1987–88 are from southeastern Florida (Dade County) using 1 × 2" mesh traps only. Sample size: 3,011 kg (5,984 fish) in 1980 and 757 kg (1,810 fish) in 1987–88.

	Weight		Numbers	
Family	1980	1987–88	1980	1987–88
Lutjanidae (snappers)	21.0	5.9	15.2	3.8
Serranidae (groupers)	10.0	21.0	0.9	2.4
Balistidae (leatherjackets)	10.0	17.0	14.8	22.4
Haemulidae (grunts)	9.1	17.0	19.2	31.4
Pomacanthidae (angelfishes)	7.5	3.7	4.7	1.9
Sparidae (porgies)	7.4	0.8	7.8	1.0
Labridae (wrasses)	6.9	1.7	3.2	1.9
Acanthuridae (surgeonfishes)	6.7	6.7	7.6	11.9
Scaridae (parrotfishes)	4.9	3.7	4.3	3.8
Ostraciidae (boxfishes)	3.3	1.1	5.1	1.4
Carangidae (jacks)	3.2	2.5	2.5	2.4
Pricanthidae (bigeyes)	2.2	0.0	3.1	0.0
Diodontidae (porcupinefishes)	1.5	1.6	3.2	3.3
Scorpaenidae (scorpionfishes)	1.4	2.0	1.8	2.4
Muraenidae (morays)	1.3	6.6	0.4	1.4
Holocentridae (squirrelfishes)	1.1	1.3	1.7	2.4

Results

Catches

Fish trap catch and effort data were summarized for field studies (Table 2). A total of 1,810 fish, representing 85 species in 28 families and weighing 757 kg, were captured during 330 trap hauls. The relative percent contribution of various families to total catch was compared with previous data from commercial trap catches for southeastern Florida (Table 3). This comparison reflects only data from 1 × 2" meshed traps, the predominant commercially used trap in 1980. A 1979–80 survey of commercial trap catches off Dade and Broward counties showed that snapper, grouper, triggerfish, and grunts, in decreasing order of abundance, dominated commercial trap catches (Sutherland and Harper, 1983). The 1987–88 catches were dominated by grouper, triggerfish, and grunts, with snapper ranking 6th in weight.

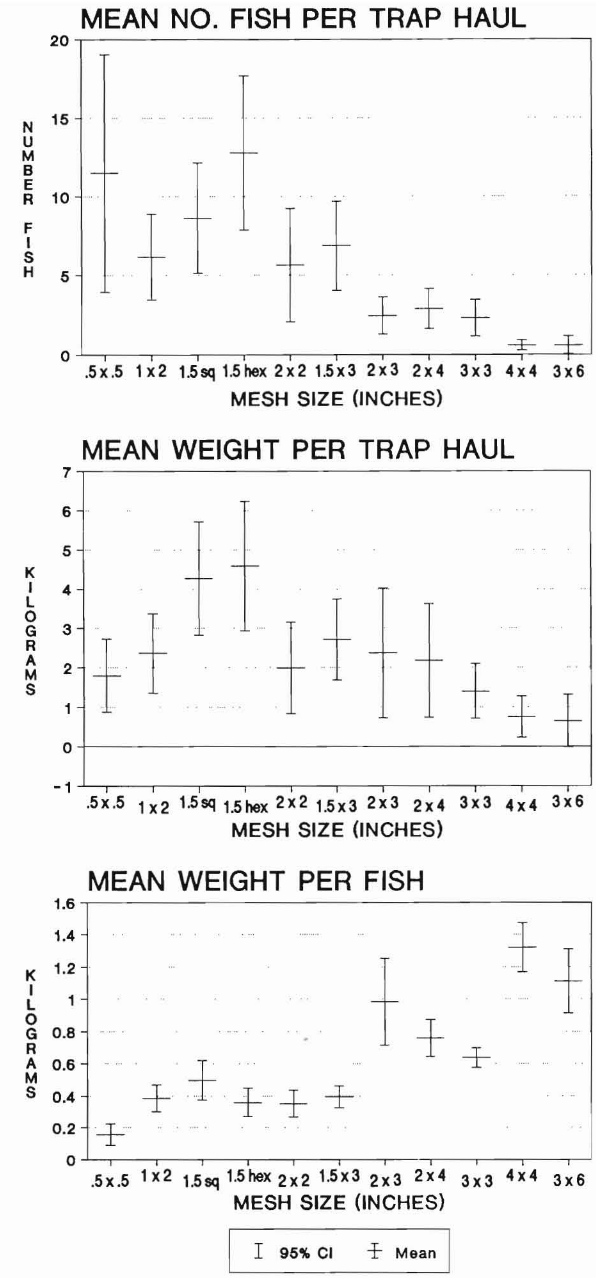

Figure 1.—Effects of mesh size on fish trap catches. Bars show means and 95 percent confidence intervals. Sample sizes are in Table 2.

In the current study, mean catches ranged from a low of 0.58 fish/haul for a 4 × 4" mesh to 12.77 fish/haul for the 1.5" hexagonal mesh (Tables 2, 4; Fig. 1). With the exception of the 0.5 × 0.5" mesh (which had the second highest average catch in numbers) the average number of fish per haul tended to decline with meshes larger or smaller than 1.5" hexagonal. The total number of species caught in larger mesh traps was considerably less than with smaller mesh (Table 2).

Mean total weight per haul tended to decline with meshes larger or smaller than 1.5" hexagonal, ranging from a low of 0.65 kg for a 3 × 6" mesh to a high of 4.59 kg for the 1.5 " hexagonal mesh (Tables 2, 5; Fig. 1).

Mean weight per fish tended to increase with mesh size, especially for

Table 4.—Weight (g) of fish caught by various meshes off southeastern Florida between December 1986 and July 1988.

	Weight of fish caught (g) by mesh size (inches)[1]											
Species	0.5×0.5	1×2	1.5×1.5	1.5 Hex	2×2	1.5×3	2×3	2×4	3×3	4×4	3×6	Total
Acanthurus behianus	595	1,905	100	2,810	724	1,705	225					8,064
Acanthurus chirurgus	245	1,486	4,553	3,315	7,607	8,330	3,893		6,976			36,405
Acanthurus coeruleus		2,005	5,555	4,791	865	7,039	1,245		2,860			24,360
Aluterus schoepfi		9,766		4,510	475	11,072	4,425	17,206	2,175	4,063	450	54,142
Aluterus scriptus		507	600	675		605						2,387
Anisotremus surinamensis		2,910				1,252			1,020			5,182
Anisotremus virginicus	450	2,019	2,289	5,915	1,505	4,645						16,823
Aulostomus maculatus	200											200
Balistes capriscus			425	970	377	2,057	391					4,220
Balistes vetula									1,482			1,482
Calamus bajonado			475		495		1,220					2,190
Calamus calamus		625			309	970	1,155					3,059
Calamus proridens						765	380	400				1,545
Cantherhines macrocerus					780							780
Cantherhines pullus	99	128	375	680								1,282
Canthidermis sufflamen	145											145
Caranx bartholomaei		675	21,010	16,805	320	6,539		1,425		6,500		53,274
Caranx crysos			975	375		695	784					2,829
Caranx latus	121	900										1,021
Caranx ruber			1,040	380								1,420
Chaetodipterus faber					405					1,955		2,360
Chaetodon capistratus	100	125	500	145	47							917
Chaetodon ocellatus	125	235	1,755	800	669	370						3,954
Chaetodon sedentarius		175		435								610
Chaetodon striatus				50	187							237
Chilomycterus schoepfi							329					329
Dasyatis americana			2,140									2,140
Diodon holocanthus	137	1,326	770	1,025	879	922						5,059
Epinephelus morio		1,685	4,200	3,895	919							10,699
Epinephelus sp.		1,600										1,600
Epinephelus striatus			1,380									1,380
Equetus acuminatus	97		113									210
Ginglyostoma cirratum		3,600	2,920	9,380			13,000					28,900
Gymnothorax funebris	6,500	3,780		2,550	9,240		11,700					33,770
Gymnothorax moringa		1,574										1,574
Haemulon album			415					798				1,213
Haemulon aurolineatum	13,411	200		1,337								14,948
Haemulon carbonarium				250								250
Haemulon flavolineatum	1,750	1,820	3,055	6,765	201							13,591
Haemulon parrai	645		615	2,738	361	1,998	485	400				7,242
Haemulon plumieri	4,861	6,664	5,080	11,718	8,471	3,435						40,229
Haemulon sciurus	387		1,220	3,117								4,724
Halichoeres bivittatus	46											46
Holacanthus bermudensis			1,575	5,860	1,174	1,150		7,176	10,848	3,800	7,480	39,063
Holacanthus ciliaris		400			248	745		540	317			2,250
Holacanthus tricolor	19		740	500	260	250						1,769
Holocentrus ascensionis	210	912	580		196							1,898
Holocentrus rufus		175	1,180	612								1,967
Kyphosus sectatrix				800								800
Lachnolaimus maiximus	4,435	1,340	6,730	3,892	2,979	2,970	450	3,322	2,080	1,400		29,598
Lactophrys bicaudalis				400	120							520
Lactophrys polygonia							111	1,241	510			1,862
Lactophrys quadricornis			300	1,015		3,111	1,896	1,348	580		1,206	9,456
Lactophrys trigonus											591	591
Lactophrys triqueter		900				485	372	207				1,964
Lutjanus analis	1,573	3,020	12,200	6,241		5,545	1,460	11,900	2,700			44,639
Lutjanus apodus				2,660								2,660
Lutjanus cyanopterus						7,250		6,500				13,750
Lutjanus griseus		1,255	1,520	665								3,440
Lutjanus jocu						766						766
Lutjanus synagris		104	2,100	1,723			105					4,032
Monacanthus hispidus	587	3,462	2,291	1,975	2,948	990	1,510		250			14,013
Mulloidichthys martinicus	417											417
Mycteroperca bonaci	7,350			5,800			8,750				7,850	29,750
Mycteroperca microlepis		13,480		4,650								18,130
Ocyurus chrysurus		395	1,375	4,880	1,680							8,330
Pomacanthus arcuatus		980	1,200	3,755	2,765	2,285	1,257	3,565	4,479	5,680		25,966
Pomacanthus paru		1,572						1,293		1,700	810	5,375
Priacanthus arenatus					285		336					621
Prionotus roseus	38											38
Pseudupeneus maculatus	2,041	428		200		255						2,924
Rachycentron canadum		1,450										1,450
Scarus coeruleus				975		2,625						3,600
Scarus taenipterus	585											585
Scorpaena plumieri		1,649	400	270				605			500	3,424
Seriola dumerili				8,500								8,500
Seriola rivoliana		450	282		540	340						1,612
Sparisom chrysopterum	850	2,197	2,008	300	480	1,879						7,714
Sparisoma aurofrenatum	160	200										360
Sparisoma sp.	500											500
Sparisoma viride	350	570	405	1,140	5,467	460	4,520	520	700			14,132
Sphoeroides spengleri	724											724
Sphyraena barracuda	620		31,680				13,710		3,900			49,910
Umbrina coroides	90											90
Urolophus jamaicensis								695				695
Total weight (g)	50,463	80,649	128,126	142,244	53,978	83,505	73,708	59,141	40,875	25,098	18,887	756,674
											Count	85
Number of samples	28	34	30	31	27	31	31	27	29	33	29	

[1]The following five partially decomposed fish were caught in the indicated meshes but were not weighed: *Gymnothorax funebris* (1.5 × 1.5″) *Sparisoma viride* (2 × 3″); *Holacanthus bermudensis, Pomacanthus arcuatus,* and *Sphyraena barracuda* (3 × 3″).

meshes 2 × 3″ and larger (Fig. 1, 2; Table 2). The average weight per fish ranged from a low of 0.16 kg for a 0.5 × 0.5″ mesh to a high of 1.3 kg for the 4 × 4″ mesh. Because the weight/frequency distributions were strongly skewed (Fig. 2), median fish size was also examined. Median size increased with mesh size, ranging from a low of 0.08 kg for a 0.5 × 0.5″ mesh to a maximum of 1.16 kg for a 4 × 4″ mesh (Table 2, Fig. 2). Median weights of fish remained relatively constant (0.20–0.28 kg) for five smaller meshes ranging in size from 1 × 2″ to 1.5 × 3″. Median weights of fish caught in traps with meshes of 2 × 3″ or larger were about two to five times higher (0.38–1.3 kg) than those from the five smallest mesh sizes.

The effect of mesh size on individual weight was determined using a one-way analysis of variance on log-transformed data. The null hypothesis of no difference between mesh sizes was rejected ($F = 84.50$; df = 10, 1794; $p < 0.05$). An a posteriori least-significant difference test (LSD test) compared all possible pairs of mean weights by mesh size. Forty-five of the 55 paired mean weights differed significantly ($p < 0.05$, LSD test) by mesh size (Table 6). The ten paired catches that did not differ significantly tended to be for adjacent mesh size.

Economics

The value of catches was examined based on market categories (Tables 7, 8). Primary commercial species had the highest market value and included snappers (Lutjanidae), groupers (Serranidae), and hogfish, *Lachnolaimus maximus*. Secondary commercial species had about half the market value of primary commercial species and included grunts (Haemulidae), porgies (Sparidae), triggerfishes (Balistidae), and some jacks, *Seriola* sp. Other species had limited or no market value. Primary commercial species were the major component of total value for most meshes although the relative contribution varied considerably (Fig. 3).

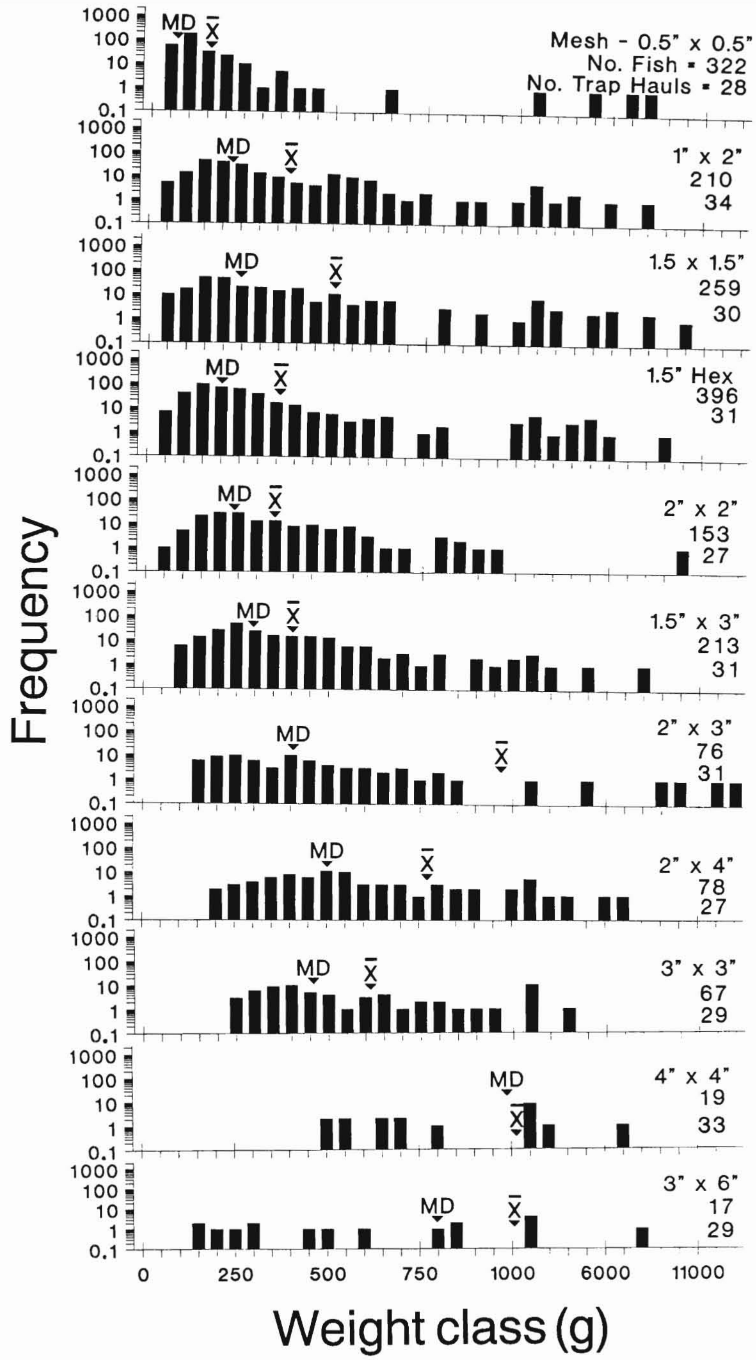

Figure 2.—Weight-frequency of trapped fish by mesh size. Fish weighing less than 1,000 g were grouped into 50 g intervals. Fish weighing more than 1,000 g were grouped into 1,000 g intervals. X̄ is mean weight, MD is median weight.

The estimated commercial wholesale value, based on a standardized sample of 30 trap hauls per mesh, ranged from $0.41/haul for the 4 × 4″ mesh to $5.42/haul for the 1.5″ hexagonal mesh (Fig. 3). Catch value, although variable, tended to decrease for meshes smaller and larger than the 1.5″ hexagonal mesh and was roughly correlated to total numbers and weight per haul (Fig. 4).

Table 5.—Species and number of fish trapped by mesh size off southeastern Florida between December 1986 and July 1988.

Species	Number of fish trapped by mesh size (inches)[1]											
	0.5×0.5	1×2	1.5×1.5	1.5 Hex	2×2	1.5×3	2×3	2×4	3×3	4×4	3×6	Total
Acanthurus behianus	3	10	1	15	3	7	1					40
Acanthurus chirurgus	1	6	13	13	21	28	10		17			109
Acanthurus coeruleus		9	18	20	4	31	5		9			96
Aluterus schoepfi		18		10	1	21	8	36	4	6	1	105
Aluterus scriptus		1	1	2		2						6
Anisotremus surinamensis		6				3			1			10
Anisotremus virginicus	1	7	8	25	5	18						64
Aulostomus maculatus	1											1
Balistes capriscus			3	1	2	6	1					13
Balistes vetula									2			2
Calamus bajonado			1		1		2					4
Calamus calamus		2			1	3	4					10
Calamus proridens						2	1	1				4
Cantherhines macrocerus				1								1
Cantherhines pullus	1	1	3	7								12
Canthidermis sufflamen	1											1
Caranx bartholomaei		2	21	9	1	2		2		1		38
Caranx crysos			5	1		2	1					9
Caranx latus	1	2										3
Caranx ruber			3	1								4
Chaetodipterus faber					1					2		3
Chaetodon capistratus	1	3	11	2	1							18
Chaetodon ocellatus	1	3	15	10	6	4						39
Chaetodon sedentarius		1		7								8
Chaetodon striatus				1	2							3
Chilomycterus schoepfi							1					1
Dasyatis americana			1									1
Diodon holocanthus	1	7	4	5	4	6						27
Epinephelus morio		2	3	2	2							9
Epinephelus sp.		1										1
Epinephelus striatus			1									1
Equetus acuminatus	2		1									3
Ginglyostoma cirratum		2	2	2			1					7
Gymnothorax funebris	1	1	1	1	1		1					6
Gymnothorax moringa		2										2
Haemulon album			1						1			2
Haemulon aurolineatum	179	2		15								196
Haemulon carbonarium				1								1
Haemulon flavolineatum	17	15	21	52	1							106
Haemulon parrai	2		2	9	1	7	2	1				24
Haemulon plumieri	38	36	26	64	40	13						217
Haemulon sciurus	3		7	17								27
Halichoeres bivittatus	1											1
Holacanthus bermudensis			3	6	2	1		8	12	3	6	41
Holacanthus ciliaris		1			1	2		1	1			6
Holacanthus tricolor	1		4	2	1	1						9
Holocentrus ascensionis	1	4	2		1							8
Holocentrus rufus		1	7	4								12
Kyphosus sectatrix				1								1
Lachnolaimus maximus	2	4	12	13	6	6	1	4	3	1		52
Lactophrys bicaudalis				1	1							2
Lactophrys polygonia							1	3	2			6
Lactophrys quadricornis			1	4		13	9	5	2		6	40
Lactophrys trigonus											1	1
Lactophrys triqueter		3				1	1	1				6
Lutjanus analis	2	1	6	4		9	2	3	2			29
Lutjanus apodus				10								10
Lutjanus cyanopterus						1		1				2
Lutjanus griseus		4	2	3								9
Lutjanus jocu						1						1
Lutjanus synagris		1	15	9			1					26
Monacanthus hispidus	4	28	14	12	21	8	8		1			96
Mulloidichthys martinicus	2											2
Mycteroperca bonaci	1			1			1				1	4
Mycteroperca microlepis		2		1								3
Ocyurus chrysurus		2	5	21	4							32
Pomacanthus arcuatus		1	2	5	4	4	3	5	8	4		36
Pomacanthus paru		2						2		2	1	7
Priacanthus arenatus					1		1					2
Prionotus roseus	1											1
Pseudupeneus maculatus	15	2		1		1						19
Rachycentron canadum		1										1
Scarus coeruleus				1		4						5
Scarus taenipterus	3											3
Scorpaena plumieri		5	1	1				2			1	10
Seriola dumerili				1								1
Seriola rivoliana		1	1		1	1						4
Sparisom chrysopterum	4	6	5	1	1	4						21
Sparisoma aurofrenatum	3	1										4
Sparisoma sp.	5											5
Sparisoma viride	1	1	1	2	10	1	8	1	1			26
Sphoeroides spengleri	20											20
Sphyraena barracuda	1		5				2		2			10
Umbrina coroides	1											1
Urolophus jamaicensis								1				1
Total number	101	210	259	396	153	213	76	78	67	19	17	1,810
Number of samples	28	34	30	31	27	31	31	27	29	33	29	

[1]The number of species reported differs from Table 4 because some fish were counted but not weighted.

Table 6.—Differences in mean fish weight as a function of mesh size.

Mesh size (inches)	0.5×0.5	1×2	1.5×1.5	1.5 Hex	2×2	1.5×3	2×3	2×4	3×3	4×4	3×6
0.5×0.5											
1×2	*[1]										
1.5×1.5	*	*									
1.5 Hex	*	n[2]	n								
2×2	*	*	n	n							
1.5×3	*	*	*	*	n						
2×3	*	*	*	*	*	*					
2×4	*	*	*	*	*	*	*				
3×3	*	*	*	*	*	*	n	n			
4×4	*	*	*	*	*	*	*	*	*		
3×6	*	*	*	*	*	*	n	n	n	*	

[1]* = significant difference ($p < 0.05$, LSD test).
[2]n = no significant difference ($p > 0.05$).

Table 7.—Wholesale market value, based on voluntary reports by 30 dealers from six Florida counties for May 1988.

Category	Number of dealers reporting	Price ($/lb) Mean	Min.	Max.
Amberjack	13	0.38	0.20	0.50
Angelfish	1	0.15	0.15	0.15
Baitfish	9	0.24	0.05	0.60
Grouper, black	21	2.05	1.40	2.40
Grouper, gag	15	1.96	1.40	2.30
Grouper, Nassau	5	1.65	1.45	2.00
Grouper, red	19	1.63	1.15	2.20
Grouper, scamp	13	2.21	1.70	2.80
Grouper, snowy	8	1.76	1.45	2.20
Grouper, Warsaw	6	1.30	0.90	1.90
Grouper, yellowedge	3	1.83	1.60	2.00
Grouper, yellowfin	4	1.85	1.60	2.00
Grouper, other, mixed	5	1.78	1.65	2.20
Grunts	12	0.36	0.20	0.60
Hogfish	6	1.33	1.00	1.50
Jacks, crevalle	13	0.29	0.20	0.70
Rays	2	0.06	0.05	0.06
Snapper, lane	8	1.04	0.65	1.50
Snapper, mangrove	17	1.44	1.00	2.25
Snapper, mutton	10	1.77	1.50	2.05
Snapper, yellowtail	8	1.86	1.50	2.40
Snapper, other, mixed	4	1.99	1.80	2.10
Triggerfish	8	0.71	0.50	1.05
Porgy (white snapper)	11	0.55	0.30	0.80
Misc. food fish	11	0.29	0.20	0.35

Mesh Retention

A total of 758 fish among 62 species were tested to determine their ability to escape mesh of different sizes. The largest mesh able to retain a fish was determined for the six most common families (Table 9). The size of retained fish for each family was related to mesh size and shape. Because of biological variability, different fish of the same species and length may or may not be retained by a particular mesh. Because area changes exponentially with the liner mesh dimensions, we examined the relative effects of mesh size on numbers, weight, and value per haul based on the area of the mesh opening (Fig. 4).

Table 8.—Value of catches ($) by mesh size and species, standarized for 30 trap hauls.

Species	P,S,O	Value ($) by mesh size (inches)											
		0.5×0.5	1×2	1.5×1.5	1.5 Hex	2×2	1.5×3	2×3	2×4	3×3	4×4	3×6	Total
Acanthurus behianus	O	0.41	1.07	0.06	1.74	0.51	1.05	0.14	0	0	0	0	$4.98
Acanthurus chirurgus	O	0.17	0.84	2.91	2.05	5.4	5.15	2.41	0	4.61	0	0	$23.54
Acanthurus coeruleus	O	0	1.13	3.55	2.96	0.61	4.35	0.77	0	1.89	0	0	$15.26
Aluterus schoepfi	O	0	2.85	0	1.44	0.17	3.54	1.41	6.32	0.74	1.22	0.15	$17.84
Aluterus scriptus	O	0	0.15	0.2	0.22	0	0.19	0	0	0	0	0	$0.76
Anisotremus surinamensis	S	0	2.04	0	0	0	0.96	0	0	0.84	0	0	$3.84
Anisotremus virginicus	S	0.38	1.41	1.82	4.54	1.33	3.56	0	0	0	0	0	$13.04
Aulostomus maculatus	O	0.07	0	0	0	0	0	0	0	0	0	0	$0.07
Balistes capriscus	S	0	0	0.66	1.47	0.66	3.11	0.59	0	0	0	0	$6.49
Balistes vetula	S	0	0	0	0	0	0	0	0	2.4	0	0	$2.40
Calamus bajonado	S	0	0	0.58	0	0.67	0	1.43	0	0	0	0	$2.68
Calamus calamus	S	0	0.67	0	0	0.42	1.14	1.35	0	0	0	0	$3.58
Calamus proridens	S	0	0	0	0	0	0.9	0.45	0.54	0	0	0	$1.89
Cantherhines macrocerus	O	0	0	0	0	0.29	0	0	0	0	0	0	$0.29
Cantherhines pullus	O	0.04	0.04	0.12	0.22	0	0	0	0	0	0	0	$0.42
Canthidermis sufflamen	S	0.24	0	0	0	0	0	0	0	0	0	0	$0.24
Caranx bartholomaei	S	0	0.38	13.42	10.39	0.23	4.04	0	1.01	0	3.77	0	$33.24
Caranx crysos	S	0	0	0.62	0.23	0	0.43	0.48	0	0	0	0	$1.76
Caranx latus	O	0.08	0.51	0	0	0	0	0	0	0	0	0	$0.59
Caranx ruber	O	0	0	0.66	0.24	0	0	0	0	0	0	0	$0.90
Chaetodipterus faber	O	0	0	0	0	0.06	0	0	0	0	0.23	0	$0.29
Chaetodon capistratus	O	0.01	0.01	0.07	0.02	0.01	0	0	0	0	0	0	$0.12
Chaetodon ocellatus	O	0.02	0.03	0.23	0.1	0.1	0.05	0	0	0	0	0	$0.53
Chaetodon sedentarius	O	0	0.02	0	0.06	0	0	0	0	0	0	0	$0.08
Chaetodon striatus	O	0	0	0	0.01	0.03	0	0	0	0	0	0	$0.04
Chilomycterus schoepfi	O	0	0	0	0	0	0	0.04	0	0	0	0	$0.04
Dasyatis americana	O	0	0	0.28	0	0	0	0	0	0	0	0	$0.28
Diodon holocanthus	O	0.02	0.15	0.1	0.13	0.13	0.12	0	0	0	0	0	$ 0.65
Epinephelus morio	P	0	0	0	11.47	0	0	0	0	0	0	0	$11.47
E. morio, medium	P	0	1.86	7.59	0	0	0	0	0	0	0	0	$9.45
E. morio, small	P	0	0.41	0	0.52	0.92	0	0	0	0	0	0	$1.85
Epinephelus sp.	P	0	0	0	0	0	0	0	0	0	0	0	$0.00
E. sp., medium	P	0	2.77	0	0	0	0	0	0	0	0	0	$2.77
Epinephelus striatus	P	0	0	5.02	0	0	0	0	0	0	0	0	$5.02
Equetus acuminatus	O	0.01	0	0.01	0	0	0	0	0	0	0	0	$0.02
Ginglyostoma cirratum	O	0	0.42	0.39	1.2	0	0	1.66	0	0	0	0	$3.67
Gymnothorax funebris	O	0.92	0.44	0	0.33	1.36	0	1.5	0	0	0	0	$4.55
Gymnothorax moringa	O	0	0.18	0	0	0	0	0	0	0	0	0	$0.18
Haemulon album	S	0	0	0.33	0	0	0	0	0.7	0	0	0	$1.03
Haemulon aurolineatum	O	11.39	0.14	0	1.03	0	0	0	0	0	0	0	$12.56
Haemulon carbonarium	S	0	0	0	0.19	0	0	0	0	0	0	0	$0.19
Haemulon flavolineatum	S	1.49	1.27	2.42	5.19	0.18	0	0	0	0	0	0	$10.55
Haemulon parrai	S	0.55	0	0.49	2.1	0.32	1.53	0.37	0.35	0	0	0	$5.71
Haemulon plumieri	S	4.13	4.66	4.03	8.99	7.46	2.64	0	0	0	0	0	$31.91
Haemulon sciurus	S	0.33	0	0.97	2.39	0	0	0	0	0	0	0	$3.69
Halichoeres bivittatus	O	0.01	0	0	0	0	0	0	0	0	0	0	$0.01
Holacanthus bermudensis	O	0	0	0.52	1.87	0.43	0.37	0	2.63	3.71	1.14	2.56	$13.23
Holacanthus ciliaris	O	0	0.12	0	0	0.09	0.24	0	0.2	0.11	0	0	$0.76
Holacanthus tricolor	O	0.01	0	0.24	0.16	0.1	0.08	0	0	0	0	0	$0.59
Holocentrus ascensionis	O	0.12	0.43	0.31	0	0.12	0	0	0	0	0	0	$0.98

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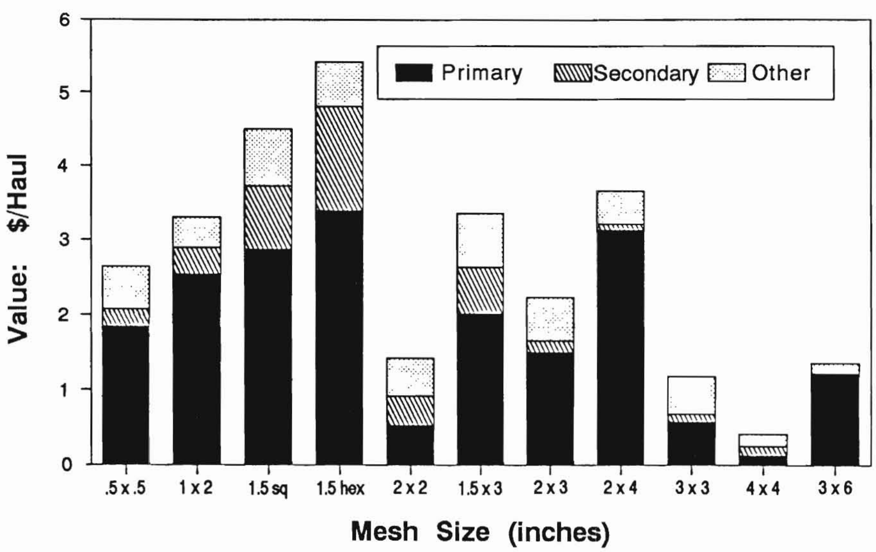

Figure 3.—Relative catch value by mesh size.

Discussion

The ability of a trap to catch fish depends on the availability of fish in the area, the willingness of a fish to enter a trap, and the ability of a fish to escape a trap. In this study, differences in catch between mesh sizes show the willingness of fish to enter traps and their ability to escape based on mesh size. We assume availability of fishes was the same for all mesh sizes tested.

Table 8.—Continued.

Species	P,S,O	0.5×0.5	1×2	1.5×1.5	1.5 Hex	2×2	1.5×3	2×3	2×4	3×3	4×4	3×6	Total
		Value ($) by mesh size (inches)											
Holocentrus rufus	O	0	0.08	0.62	0.31	0	0	0	0	0	0	0	$1.01
Kyphosus sectatrix	O	0	0	0	0.41	0	0	0	0	0	0	0	$0.41
Lachnolaimus maiximus	P	13.92	3.46	19.72	11.03	9.7	8.42	1.27	10.81	6.3	3.73	0	$88.36
Lactophrys bicaudalis	O	0	0	0	0.25	0.08	0	0	0	0	0	0	$0.33
Lactophrys polygonia	O	0	0	0	0	0	0	0.07	0.88	0.34	0	0	$1.29
Lactophrys quadricornis	O	0	0	0.19	0.63	0	1.92	1.17	0.96	0.38	0	0.8	$6.05
Lactophrys trigonus	O	0	0	0	0	0	0	0	0	0	0	0.39	$0.39
Lactophrys triqueter	O	0	0.51	0	0	0	0.3	0.23	0.15	0	0	0	$1.19
Lutjanus analis	P	5.1	10.39	44.41	22.22	0	15.58	5.51	51.55	10.89	0	0	$165.65
L. analis medium	P	0.74	0	1.59	0.67	0	2.5	0	0	0	0	0	$5.50
L. analis, small	P	0	0	0	0	0	0.1	0	0	0	0	0	$0.10
Lutjanus apodus	P	0	0	0	0	0	0	0	0	0	0	0	$0.00
L. apodus, medium	P	0	0	0	1.58	0	0	0	0	0	0	0	$1.58
L. apodus, small	P	0	0	0	2.05	0	0	0	0	0	0	0	$2.05
Lutjanus cyanopterus	P	0	0	0	0	0	30.75	0	31.66	0	0	0	$62.41
Lutjanus griseus	P	0	1.33	3.71	0	0	0	0	0	0	0	0	$5.04
L. griseus, medium	P	0	0.49	0.59	0	0	0	0	0	0	0	0	$1.08
L. griseus, small	P	0	0.34	0	0.55	0	0	0	0	0	0	0	$0.89
Lutjanus jocu	P	0	0	0	0	0	3.25	0	0	0	0	0	$3.25
Lutjanus synagris	P	0	0	0	0	0	0	0	0	0	0	0	$0.00
L. synagris, small	P	0	0.08	1.8	1.43	0	0	0.09	0	0	0	0	$3.40
Monacanthus hispidus	O	0.08	0.4	0.3	0.25	0.43	0.13	0.19	0	0.03	0	0	$1.81
Mulloidichthys martinicu	O	0.29	0	0	0	0	0	0	0	0	0	0	$0.29
Mycteroperca bonaci	P	35.56	0	0	25.35	0	0	38.24	0	0	0	36.67	$135.82
Mycteroperca microlepis	P	0	51.35	0	19.43	0	0	0	0	0	0	0	$70.78
Ocyurus chrysurus	P	0	0	0	0	2.34	0	0	0	0	0	0	$2.34
O. chrysurus, medium	P	0	0	0.7	0.65	2.79	0	0	0	0	0	0	$4.14
O. chrysurus, small	P	0	0.38	1.13	4.77	0	0	0	0	0	0	0	$6.28
Pomacanthus arcuatus	O	0	0.29	0.4	1.2	1.01	0.73	0.4	1.31	1.53	1.71	0	$8.58
Pomacanthus paru	O	0	0.46	0	0	0	0	0	0.47	0	0.51	0.28	$1.72
Priacanthus arenatus	O	0	0	0	0	0.17	0	0.17	0	0	0	0	$0.34
Prionotus roseus	O	0.01	0	0	0	0	0	0	0	0	0	0	$0.01
Pseudupeneus maculatus	O	1.4	0.24	0	0.12	0	0.16	0	0	0	0	0	$ 1.92
Rachycentron canadum	P	0	3.38	0	0	0	0	0	0	0	0	0	$ 3.38
Scarus coeruleus	O	0	0	0	0.6	0	1.62	0	0	0	0	0	$2.22
Scarus taenipterus	O	0.4	0	0	0	0	0	0	0	0	0	0	$0.40
Scorpaena plumieri	O	0	0	0	0	0	0	0	0	0	0	0	$0.00
Seriola dumerili	S	0	0	0	6.89	0	0	0	0	0	0	0	$6.89
Seriola rivoliana	S	0	0.33	0.24	0	0.5	0.28	0	0	0	0	0	$1.35
Sparisom chrysopterum	O	0.58	1.24	1.28	0.19	0.34	1.16	0	0	0	0	0	$4.79
Sparisoma aurofrenatum	O	0.11	0.11	0	0	0	0	0	0	0	0	0	$0.22
Sparisoma sp.	O	0.34	0	0	0	0	0	0	0	0	0	0	$0.34
Sparisoma viride	O	0.24	0.32	0.26	0.7	3.88	0.28	2.79	0.37	0.46	0	0	$9.30
Sphoeroides spengleri	O	0	0	0	0	0	0	0	0	0	0	0	$0.00
Sphyraena barracuda	O	0.22	0	10.47	0	0	0	4.38	0	1.33	0	0	$16.40
Umbrina coroides	O	0.01	0	0	0	0	0	0	0	0	0	0	$0.01
Urolophus jamaicensis	O	0	0	0	0	0	0	0	0.1	0	0	0	$0.10
Total value		$79.40	$99.18	$135.01	$162.54	$42.84	$100.63	$67.11	$110.01	$35.56	$12.31	$40.85	$885.44

[1]Commercial classification: P = primary, S = secondary, O = other.

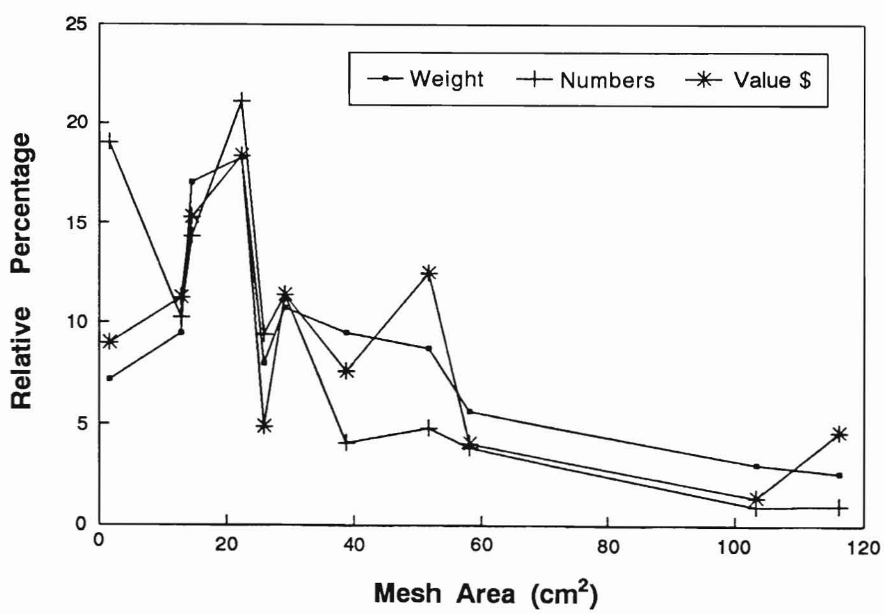

Figure 4.—Relative effects of mesh area on mean total weight, mean total numbers, and mean total value per haul.

Comparing our results to a study of the 1979–80 commercial trap fishery off Dade and Broward Counties (Sutherland and Harper, 1983), we found commercial species comprised 66 percent by weight and 64 percent by number vs. 77 percent by weight and 62 percent by number in 1980. We averaged 2.4 kg and 6.2 fish per haul compared to 5.6 kg and 11.1 fish per haul in the 1980 study. Catches with the 1.5″ hexagonal mesh were more

Table 9.—Fork length (cm) of fishes retained by different trap meshes.

Family and mesh size	Fork Length (cm)																																		Total retained
	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	
Snapper																																				152
1×2″						1			1	6	2	11	24	23	4	2		1																		75
1.5×1.5″									1	4	2	4	7	6	1	3																				28
2×2″											1		2	2	3	6	7	4	1		1															27
2×3″																		1		4	1	1		2	1			1								11
>3×3″																										1	1		3	1	3	1			1	11
Grouper																																				26
1×2″														4																						4
2×2″																2		2	2				1													7
2×3″																1			1	2		2			2	1										9
>3×3″																												2			2		1	1		6
Grunts																																				250
0.5×0.5″			3	5	3	6	6																													23
1×2″						3	13	18	16	12	6	2	2																							72
1.5×1.5″						2	6	12	9	4	2		1																							36
2×2″							3	2	3	11	24	16	7	9	3																					78
2×3″								1		2	5	5	4	6	2	7	3	2	2	1	1															41
Jacks																																				59
1×2″									3	3	2	5	5	2	3	1																				24
1.5×1.5″									6	3	2	5	4	2	2	1																				25
2×2″																	2			3																5
2×3″																	2			3																5
Porgy																																				34
1×2″				1			2	1	3			1																								8
1.5×1.5″				1			1		1			1																								4
1.5×3″											2				1		1																			4
2×3″											2	2	5	1																						10
>3×3″												1		1		2	1	3																		8
Surgeonfish																																				101
1×2″								3	2	4	8	2	3	1		1																				24
1.5×1.5″						1		3	5	7	8	8	8	3	5	4	1																			53
2×2″											2	5	2	1	3	7	1	2																		23
2×3″																1																				1
>3×3″																																				0

similar to those reported during the 1980 study, averaging 4.6 kg and 12.8 individuals per haul. Differences in the present and earlier study partially reflect differences in trap designs, area fished, and method of fishing. In this study we tended to sample in shallower water with smaller traps which may account for the differences in catch data. Other studies have shown that catches are significantly affected by the type of funnel opening, trap size, trap shape, bait and other variables (Luckhurst and Ward, In press).

Selectivity

A concern of commercial fishermen is that fish will not enter traps with larger sized meshes because these traps are less visually distinctive. We found that commercial species will enter traps with a wide variety of mesh sizes. The walls of all traps were constructed with 1 × 2″ wire mesh so that they presented the same visual silhouette and did not bias catches due to differential attraction. Luckhurst and Ward (In press) noted mesh selectivity could be biased by fish attraction to different trap silhouettes. The darker trap silhouette created by the 0.5 × 0.5″ mesh lining a 1 × 2″ mesh was apparently not more attractive to larger fish than were the other unlined traps which had a standard 1 × 2″ wall mesh. Although the 0.5 × 0.5″ trap had one of the highest catch rates by numbers (11.5 fish/haul), the mean weight/haul (1.8 kg) was similar to those reported for much larger meshes (Fig. 1, Table 2). The high numbers in the 0.5 × 0.5″ mesh are mainly accounted for by many small fishes, such as the tomtate, *Haemulon aurolineatum*, that could escape all larger mesh sizes (Table 4). Other size-related behavioral responses that affect recruitment to traps (Hartsuiker and Nicholson, 1981) should have equally affected catches by different mesh sizes in our study.

Captured fish size was approximately related to trap mesh size (Fig. 2), confirming earlier studies by Olsen et al. (1978), Stevenson and Stuart-Sharkey (1980), and Munro (1983). However, capture of a particular fish was not strictly a linear response to mesh size as measured by either the area of the mesh opening or the longest open dimension. Retention responses for a particular species were influenced by mesh shape as well as the size of the opening (Table 9).

Sutherland et al. (1987) showed that both fish size and body shape were important factors explaining differences in retention by a given mesh size between species. Slender (terete) fishes (e.g., eels, lizardfishes, cobia) of a given length (or weight) were much more likely to escape a particular mesh than were compressed fishes (e.g., angelfishes, triggerfishes, butterflyfishes) or depressed fishes (e.g., stingrays, flatfishes) of the same length. Rounded (fusiform) fishes fell between the two extremes. For example, a surgeonfish with a relatively slender body shape might escape a rectangular mesh but not a square mesh of the same area. A grouper which has a more rounded body shape might be more likely to escape a square mesh than a rectangular mesh. Thus, regulations of mesh size and shape aimed at optimizing one species may greatly affect capture of other species due to differences in body shape.

Total value, total species caught, number of individuals, and mean total weight per haul tended to decline with meshes larger and smaller than the 1.5″ hexagonal mesh (Fig. 4). Two of the minimum mesh sizes currently legally specified (1.5 × 1.5″, and 1.5″ hexagonal) had the greatest percentage contribution to total weight and total value. Mesh sizes 2 × 3″ and larger, especially, tended to catch larger fish but fewer species and individuals. Based on these results, the presently specified legal minimum mesh sizes appear to do little to reduce bycatch.

Catchability

Results show that catchability (the proportion of a population removed by one unit of fishing effort) can be greatly influenced by mesh size and shape. Fewer primary commercial species were caught with the largest mesh sizes. This reduced catch partially reflects the lower availability of large fish that can be retained in large meshes. Also, fish may be less willing to enter large meshed traps, perhaps because fewer retained fish make the trap less attractive.

Economics

Assuming constant effort, a larger mesh size would have immediate effects on total revenue of the trap fishery by lowering catchability. Larger mesh sizes would provide less revenue per trap haul. With larger mesh sizes, more effort (number of hauls) must be expended to obtain total revenue comparable with that of the smaller sized mesh. To achieve the same revenue with larger meshes as obtained with a 1.5″ hexagonal mesh, fishermen would have to increase their number of trap hauls anywhere from 1.5 to 13 times depending on the mesh size (Fig. 3, 4). The number of trap hauls fishermen can make is limited by their skill, manpower, time, and equipment.

The simple economic analysis done here is limited. It does not consider potential future benefits of allowing fish to escape and grow before entering the trap fishery, direct impacts on market prices due to supply, or possible losses to the future fishery from natural mortality. Also, price per pound is highly variable between markets and over time. These considerations are beyond the scope of this study.

Mesh Retention

Laboratory studies show that mesh retention depends on the species and size of the fish tested (Table 9) as well as on the mesh shape and size (Sutherland, et al., 1987; In press). These results do not consider availability in the fished area or willingness to enter traps. Laboratory tests of mesh retention on individual fish show only the physical limitation of fishes to escape a given mesh size. Quite possibly some fish passing though a given mesh in the laboratory would not, or could not, escape under actual field conditions. With these qualifications, Table 9 provides a basis to estimate mesh sizes necessary to allow the escape of fishes of specific sizes for the majority of commercial species. For example, mesh size of 2 × 3″ or larger should allow snapper and grouper less than 30.5 cm (12″) to escape.

Federal regulations in the Gulf of Mexico currently require four (2 × 2″) escape windows in each trap. The effects of escape windows were not specifically investigated in this study due to logistical, fiscal, and time limitations. However, a conservative approximation of their effect can be obtained by extrapolation of the data from 2 × 2″ meshes. In the extreme, the escape windows would make the trap function as 2 × 2″ meshed trap.

Based on our observations of fish behavior it is likely that most fishes able to escape a 2 × 2″ opening will freely swim in and out of the escape window while the trap is resting on the bottom. However, when a trap is pulled, most fishes react by swimming toward the bottom and are unlikely to find the escape window. Thus, injury and mortality from lifting and handling are still likely to occur. These fish would be more likely to escape during lifting if the entire top and bottom panels were made of the desired escape-sized mesh similar to the trap used in the field study.

An advantage of fish traps over bottom longline, trawl, or hook and line fishing is the increased selectivity of fish traps based on mesh size. It is possible to fish traps with meshes that reduce the capture of fish below a minimum size. Hooks are less selective for fish size; small fish can be captured on large hooks. Thus, the mortality and injury associated with lifting smaller fish off the bottom can be reduced or avoided with fish traps more easily than with hooks. Presumably undersized hooked fish still face trauma from handling and embolism even if released.

Summary

This study has described the effects of mesh size on selectivity, retention, catchability, and value of fish trap catches. Mesh size and shape influence trap retention. In this study the most effective mesh sizes for total revenue per haul and total weight were the 1.5 × 1.5″, and 1.5″ hexagonal meshes, two legally specified minimum mesh sizes.

Commercial species will enter a wide variety of mesh sizes. Increasing mesh size reduces catchability and revenue per haul which, within limits, can be compensated for by increasing effort (number of hauls). Adjusting mesh size offers a means for regulating and managing the reef fish fishery. Fish traps with appropriate mesh sizes potentially can reduce bycatch and undersized fish injury and mortality more effectively than similar management measures applied to bottom longline, trawl, and hook and line fisheries.

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