Mortality of Spotted Seatrout, Red Drum, and Black Drum Caught in Gill Nets

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Abstract: In-net mortality of spotted seatrout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellatus*), and black drum (*Pogonias cromis*) caught in gill nets with 7.6, 10.2, 12.7, and 15.2 cm stretch mesh was determined in Texas bays during 1985–87. Spotted seatrout had greatest mortality (74%) followed by red drum (55%) and black drum (28%). For each species, in-net mortality was significantly different among meshes, among bays and between seasons. Among these 3 factors, mesh size was the most important in predicting mortality variation. In-net mortality was generally inversely related to mesh size, was higher in spring than fall, and varied without pattern among bays. Limiting the use of monofilament gill nets would prevent excess mortality of spotted seatrout and red drum caught incidental to targeted black drum.

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Gill nets have been used to harvest finfish in Texas coastal waters since the 1930s (Matlock 1978). Target species have been spotted seatrout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellatus*), and black drum (*Pogonias cromis*). From 1977 to 1981 these species comprised 71% to 73% of the commercial finfish harvest in Texas bays (Osburn et al. 1985). Decreases in spotted seatrout and red drum availability (Hegen 1981) and harvest (McEachron and Green 1982) prompted a ban on the sale of these species in 1981. Commercial effort was then directed toward black drum (Osburn et al. 1985). Even though sale of spotted seatrout and red drum was illegal, these species were still captured in gill nets incidental to targeted black drum (Matlock et al. 1977). In 1988, gill nets were prohibited in Texas coastal waters.

Previous studies have determined mortality of fishes caught by hook and line (Hunsaker et al. 1970, Warner and Johnson 1978, Matlock and Dailey 1981, and Hegen et al. 1982, 1984) and trotlines (Martin et al. 1987); however, studies determining netting mortality are limited. Elam (1971) observed an initial mortality of 90% to 100% in spotted seatrout and 40% in black drum when captured in gill nets.

The present study was conducted to determine in-net mortality of spotted seatrout, red drum, and black drum captured in Texas coastal waters using monofilament gill nets.

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Methods

In-net mortality of spotted seatrout, red drum, and black drum caught in monofilament gill nets was determined from catches of these species in Texas Parks and Wildlife Department (TPWD) routine gill net samples. Gill nets were 183 m long and 1.2 m deep with separate 45.7 m sections of 7.6, 10.2, 12.7, and 15.2 cm stretched mesh tied together. The nets were set perpendicular to shore in ascending mesh size. Nets were used in 8 Texas bay systems (Galveston, East Matagorda, Matagorda, San Antonio, Aransas, Corpus Christi, upper Laguna Madre, and lower Laguna Madre) during 1985–87 and in Sabine Lake during 1986 and 1987. Forty-five sets of gill nets were used in each bay and spring (15 Apr–15 Jun) and fall (15 Sep–15 Nov) season. Sample nets were set within 1 hour of sunset and retrieved within 4 hours of sunrise. Detailed descriptions of gill nets, sample stations, and sample procedures are reported in Rice et al. (1988).

During 1985–87, mortality was determined in TPWD gill nets for 1 year for each species (spotted seatrout, 1985; red drum, 1986; and black drum, 1987), respectively. Mortality was determined by observing individual fish for 10 seconds after each fish was out of water but prior to removal from net. Fish were determined to be dead if there was no movement of gill covers, fins, or mouth during the 10 seconds.

The relationship between mesh, bay, and season on in-net mortality was examined for each fish species separately. SAS procedure CATMOD (SAS 1985) was used to fit, by maximum likelihood, the following logistic regression model (McCullagh and Nelder 1989) to the mortality data:

$$\mathrm{Ln}(P_{dead}/P_{live}) = \mathrm{Mesh}_i + \mathrm{Bay}_j + \mathrm{Season}_k + \mathrm{Mesh}_i \times \mathrm{Bay}_j + \mathrm{Mesh}_i \times \mathrm{Season}_k + \mathrm{Bay}_j \times \mathrm{Season}_k + \mathrm{Mesh}_i \times \mathrm{Bay}_j \times \mathrm{Season}_k$$

Table 2. Results of likelihood ratio (G) test of homogeneity of in-net mortalities of 3 fish species among meshes, among bays, and between seasons. Means followed by the same letter in a column under a species heading are not significantly different ($P = 0.05$).

	Fish mortality					
	Spotted seatrout		Red drum		Black drum	
Category	Portion dead	*N* Fish	Portion dead	*N* Fish	Portion dead	*N* Fish
Mesh						
7.6 cm	0.77 A	2,127	0.59 A	2,859	0.33 A	549
10.2 cm	0.68 B	1,166	0.59 A	2,725	0.31 A	1,214
12.7 cm	0.76 A	362	0.45 B	1,583	0.28 AB	1,611
15.2 cm	0.69 AB	78	0.46 B	604	0.24 B	1,367
Bay						
Sabine Lake	ND[a]		0.60 AC	502	0.34 AC	228
Galveston	0.70 AB	605	0.53 AB	1,123	0.18 B	470
E. Matagorda	0.78 AB	224	0.53 AB	503	0.19 B	577
Matagorda	0.67 B	415	0.57 AC	1,443	0.25 BC	626
San Antonio	0.74 AB	308	0.60 A	1,015	0.36 A	301
Aransas	0.79 A	314	0.50 B	914	0.23 B	647
C. Christi	0.75 AB	489	0.51 BC	686	0.38 A	398
Upper Laguna	0.79 AB	190	0.54 AB	444	0.33 A	854
Lower Laguna	0.74 AB	1,188	0.57 AB	1,141	0.33 A	640
Season						
Spring	0.75 A	2,250	0.59 A	3,593	0.32 A	2,329
Fall	0.71 B	1,483	0.52 B	4,178	0.25 B	2,412

[a]ND = no data.

in turn would cause faster exhaustion to death due to struggling in net. This may partially contribute to greater spring in-net mortality.

Gill nets are a non-selective passive gear (Hamley 1975). They are an effective gear for harvesting fish, but regulating use to prevent mortality of non-target species is difficult. High in-net mortality, delayed mortality due to infections and injuries from the net, and lack of species selectivity can result in high mortality to non-target species. Fish captured in gill nets are subjected to cuts, gill closure, or body injury (Simmons and Breuer 1976). Elam (1971) found that most surviving fish caught in gill nets and held in ponds for 30 days developed extensive bacterial infections on or around body areas damaged in netting operations; therefore, even higher mortalities are likely after release from gill nets.

High in-net mortality of non-target species would be alleviated if the use of gill nets was limited. Preliminary findings from the present study aided the TPWD in deciding to ban the use of gill nets in all Texas coastal waters effective 1 September 1988.

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A Review of the Potential Environmental Effects of Net Pen Aquaculture in the Northern Gulf of Mexico[1]

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Abstract: This report reviews the environmental and social concerns associated with net pen aquaculture in coastal waters, identifies potentially significant impacts of operations in the northern Gulf of Mexico, and proposes site selection and planning guidelines. There are 5 major areas of potential environmental concern: water quality alterations and their consequences, sedimentation and benthic effects, chemical usage, disease transmission, and escaped fish (exotic species, genetic impacts). Social concerns focus on conflicts between net pen operations and navigation interests, commercial fishermen, recreational users, waterfront property owners, and conservation interests. Environmental impacts are minimized by selecting sites with adequate water exchange and waste assimilation capacity. Zoning to exclude or limit aquaculture (facility size, spacing, materials, feed type, etc.) in waters important to traditional marine resource user groups has been successful in reducing conflicts. This planning effort requires detailed information on physical and chemical processes, biological resources, and patterns of resource use in coastal and marine waters. Until such plans are developed, net pen aquaculture permits should be evaluated on a site specific, case by case basis.

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