

## 5.0 RESULTS AND DISCUSSION

### 5.1 Finfish By-Catch Magnitude

Based on the by-catch factors developed from the NMFS MRFSS sport-boat recall data, approximately 1.2 million to 3.5 million fish were caught and released annually in the Galveston Bay system during 1979-1985 (Table 11). For every fish landed, 1.85 other fish were caught and released. Less than 5 percent of the fish reported caught and released were reported as dead (Table 11).

The TPWD estimates of sport-boat finfish landings should be considered as conservative because they do not include night-time private-boat and party boat fishing (Green et al. 1991a). In addition there are sites where sport-boat fishermen can dock, but the TPWD has no access to conduct surveys (e.g., condominiums and private residences). Ferguson and Green (1987) estimated that 25-30 percent of all saltwater sport-boat fishing trips originated from launch sites that the TPWD did not survey. The TPWD currently does not monitor fishing pressure or landings of shore-based fishermen in Texas (e.g., wade/bank, pier and jetty) on a continuous basis. McEachron et al. (1981) reported that these shore-based fishing modes accounted for 33-36 percent of coastwide sport-fishing landings. Therefore, estimates of by-catch based on TPWD sport-boat landings alone should be considered minimum estimates.

Data from the TPWD spotted seatrout tagging study (Table 7) suggest that fishermen specifically targeting spotted seatrout catch and release about one fish for every fish landed (or in the TPWD case, one additional fish for every fish tagged). Spotted seatrout and red drum are among the most sought and landed fish in the southeastern United States (Essig et al. 1991). When asked what species of fish, if any, fishermen were seeking prior to undertaking a fishing trip from Texas' access sites, 50 percent of fishermen indicated they sought spotted seatrout, red drum or a combination of both species (Green et al. 1991a). If it is assumed that recreational fishermen targeting spotted seatrout would retain other desirable species (e.g., red drum) during their fishing trip, then the by-catch of these specialty fishermen would be even lower.

Use of self-reported recall data to direct policy-making, resource allocation, and budget making in the area of recreation and parks management (Chase and Harada 1984) is not uncommon. Self-reported data in the forms of log books have been used in fisheries management to supplement fishery independent data collection (Whitworth et al. in press) and to monitor species under state and federal regulations (TPWD 1981). Past investigations (Phillips 1971, Chase and Godbey 1983) indicate that self-reporting surveys do not accurately reflect true scores and that response errors must be investigated (Chase and Harada 1984). However, they note that obtaining true scores is prohibitively costly. Problems commonly encountered include 'telescoping' in which a fishermen may 'remember' fish boated and released, but which in fact did not occur during the specified fishing trip, and 'prestige bias', where an individual reports a larger number of fish caught than actually occurred because of the 'prestige' of being a 'successful' fishermen. Social desirability of the question was found to be relevant to over or underestimates of recall data (Sudman and Bradburn 1974). Wyner (1980) found that arrest

Table 11. Estimated annual sport-boat by-catch for all finfish species combined for the Galveston Bay system using NMFS MRFSS data and TPWD sport-boat landings data for years 1979-1985.

Year	Estimated landings <sup>1</sup> (x1000 ± 1SE)	Estimated total by-catch <sup>2</sup> (x1000 ± 1SE)	Estimated released alive (x1000 ± 1SE)	Estimated released dead (x1000 ± 1SE)
1979	1357.8 ± 507.6	2511.9 ± 507.6	2376.2 ± 507.6	122.2 ± 507.6
1980	1904.4 ± 499.7	3523.1 ± 499.7	3332.7 ± 499.7	171.4 ± 499.7
1981	947.9 ± 155.9	1753.6 ± 155.9	1658.8 ± 155.9	85.3 ± 155.9
1982	1071.9 ± 129.3	1983.0 ± 129.3	1875.8 ± 129.3	96.5 ± 129.3
1983	808.7 ± 114.0	1494.8 ± 114.0	1415.2 ± 114.0	72.8 ± 114.0
1984	809.2 ± 119.9	1497.0 ± 119.9	1416.1 ± 119.9	72.8 ± 119.9
1985	685.2 ± 88.5	1267.6 ± 88.5	1198.8 ± 88.5	61.7 ± 88.5

1. Data from Campbell et al. (1991).

2. Factors used:

Estimated Total bycatch = Estimated landings x 1.85

Estimated released alive = Estimated landings x 1.75

Estimated released dead = Estimated landings x 0.09

records of a test group of individuals were significantly under-reported because of a tendency to consider the arrest record as socially undesirable, whereas, socially desirable activities (such as catching a lot of fish) will often tend to be overestimated.

Because by-catch occurs during the fishing activity, typical methods such as intercept surveys conducted at the completion of the fishing trip, do not provide verifiable data for estimating the composition and magnitude of the catch. The ability of the individual fishermen to accurately identify the catch to species and the ability of the individuals to accurately recall the number and disposition of the catch can not be assessed using recall methods alone. Hiatt and Worrall (1977) found that for some species (e.g., Pacific bonito) 100 percent of the fishermen who landed the fish (N=331) correctly identified the species, whereas, for other species, only 33 percent of the fish were correctly identified by the fishermen. In addition, it was found that increased frequency of fishing did not improve the fishermen's ability to correctly identify common species. They concluded that it would be desirable to use trained biologists to identify the landings.

Therefore, recall data on the number of fish caught and released by species as provided by sport fishermen, and as obtained in the NMFS MRFSS, might have little validity. Information on the total number of fish caught and released, without regard to species may provide 'interesting' information for use in calculating total by-catch; however, its use for management by species is limited.

Of the more than 500 species of fish known to exist in the waters of the Gulf of Mexico along the coasts of Texas and Louisiana (Hoese and Moore 1977), less than 100 species are typically landed from Texas bays by sport-boat fishermen (Campbell et al. 1991). Currently, the TPWD has enacted size and/or bag restrictions on 23 species which occur in Texas' marine or estuarine waters (TPWD 1991). The majority of these species are sought by sport fishermen. As regulations become more restricted, by-catch increases.

The magnitude of the recreational by-catch becomes important if the fish which are caught and released do not survive. Management regulations which include bag or size limits must assume or determine that enough fish (including those released) will survive to potentially reach spawning size to maintain or enhance current populations or to allow for distribution of the catch among more anglers. Numerous studies to determine the magnitude of hooking mortality have been conducted on marine and freshwater fish (Marnell and Hunsaker 1970, Warner and Johnson 1978, Hulbert and Engstrom-Heg 1980, Payer et al. 1989, Wertheimer et al. 1989, Matlock et al. in press). Some hooking survival studies have incorporated factors such as gear used (i.e., single hook versus treble hook [Payer et al. 1989, Hunsaker et al. 1970, Warner 1979], live bait versus artificial bait [Rutledge and Pritchard 1977, Payer et al. 1989]) as well as mortality associated with handling. Heggen et al. (1982, 1984) found mean mortality ranged from 16 to 38 percent for rod and reel caught spotted seatrout that were held in cages for 7 days after capture. Matlock et al. (in press) determined short-term mortality (i.e., 3 days confinement in holding pens after capture) of rod and reel caught spotted seatrout and red drum and compared differential mortality associated with treble versus single-barb hooks. They determined there

were no differences in mortality between hook types and short-term mortality was approximately 7 percent for spotted seatrout and 4 percent for red drum. The results of both Hegen et al. (1982, 1984) and Matlock et al. (in press) are applicable to the wide ranging variability in handling rod and reel caught fish. Hegen et al. (1984) believe that sport fishermen can contribute to the conservation of a species by learning to carefully handle and release unwanted fish.

## **5.2 Finfish By-Catch Composition**

The composition of reported by-catch species reflect species landed as well as species not landed in the NMFS MRFSS (Table 6). Approximately 50 species of the 86 species reported as landed or released comprised by-catch species only (i.e., no individuals of those species were recorded as landed). The TPWD landings data are comprised of 74 species for 1989-90 (Appendix C, Tables C.1 and C.4). Many of the species listed as by-catch only in the NMFS MRFSS data were landed according to TPWD efforts.

Eight species comprised 93 percent of the total number of fish landed during 1989-1990 according to TPWD intercept surveys (Campbell et al. 1991). Spotted seatrout made up 38 percent of the total landings while sand seatrout, Atlantic croaker, southern flounder, red drum, sheepshead, black drum, and gafftopsail catfish accounted for an additional 55 percent of the landings. Similarly, these frequently caught sport fishes (i.e., the same eight species) comprised approximately 86 percent of all fish landed from Galveston Bay according to the NMFS MRFSS data. These same species accounted for approximately half (48 percent) of all fish reported released alive and 10 percent of all fish reported as released dead (Table 5). In addition, 82 percent of fish reported as disposed of in other ways (filleted, given away, sold, etc.) were these same species (Table 5).

Composition of by-catch can not be accurately determined using recall data, because fishermen, in general, can not accurately identify their catch (Hiatt and Worrall 1977). Studies of by-catch composition must include individuals trained in species identification, or requirements for fishermen to bring their entire catch to such individuals for identification.

## **5.3 Finfish By-Catch Biomass, Seasonality and Geographic Distribution**

It was not possible to examine finfish biomass of by-catch, species specific ratios or seasonal or geographic distribution of recreational by-catch in the Galveston Bay system due to the paucity of data.

## **5.4 Recreational Shellfish By-Catch**

It was not possible to examine or estimate recreational shellfish by-catch for Galveston Bay. However, Cody et al. (1989) speculates that recreational shrimpers along the entire Texas Coast may unintentionally catch 60-100 million finfish per year based on TPWD finfish to shrimp catch ratios (Meador et al. 1988). Given the limited number of recreational shellfish license

holders (Table 8) and current gear and possession restrictions, it is believed that the magnitude of recreational fishermen by-catch is small relative to their commercial counterparts.

Data are lacking on sport-shrimp fishing pressure and composition of associated by-catch. Information on recreational shrimping pressure could be combined with TPWD routine monitoring with otter trawls to produce a minimum estimate for sport shrimp landings and associated by-catch. Estimates would be considered minimum because the TPWD monitoring program utilizes a random sampling technique that does not concentrate effort in areas where shrimp may congregate.