

Comparison of Texas Recreational Reef Fish and Non-reef Fish Anglers

Tom Wagner, *Texas Parks and Wildlife Department, Coastal Fisheries Branch, 100 Navigation Circle, Rockport, TX 78382*

Hal Osburn, *Texas Parks and Wildlife Department, Coastal Fisheries Branch, 4200 Smith School Road, Austin, TX 78744*

Gary Matlock, *National Marine Fisheries Service, Long Beach Federal Building, 501 West Ocean Blvd, Suite 4200, Long Beach, CA 90802*

Abstract: Social and economic data comparing reef fish and non-reef fish anglers from Texas Parks and Wildlife Department's routine on-site creel intercept surveys and annual statewide mail survey were summarized. Reef fish anglers differ significantly from non-reef fish anglers in that they report being more consumptive-oriented in their fishing motivations, spending less per trip and less on durable goods, and rate themselves lower in their fishing skills compared to their peers. Both user groups support catch and release areas while opposing saltwater stocking, although reef fish anglers indicate less support for size limits and gear restrictions as management tools. This study indicates that reef fish and non-reef fish anglers should be considered independently by fishery managers contemplating regulatory changes affecting these fisheries. Additional work is needed to determine whether there are more distinguishable subgroups within the reef fish and non-reef fish angler groups.

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Over 350,000 finfish were harvested by private-boat recreational anglers during a 3-year interval from 1987 through 1990 from Gulf of Mexico waters off the Texas coast (Campbell et al. 1991). This included approximately 150,000 red snapper (*Lutjanus campechanus*) and 50,000 king mackerel (*Scomberomorus cavalla*). The Texas Parks and Wildlife Department (TPWD) has collected social and economic data from recreational reef fish anglers during on-site creel surveys since May 1987 and from annual mail surveys since 1986 (Riechers et al. 1991).

The objective of this report is to compare the social and economic characteristics of Texas recreational reef fish anglers with those of other user groups.

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The Gulf of Mexico Fishery Management Council (GMFMC) implemented a Reef Fish Fishery Management Plan (FMP) in November 1984 which introduced regulations designed to rebuild declining reef fish stocks in the Gulf of Mexico. Amendment No. 1 to this plan (GMFMC 1989) recommended that social and economic aspects of the reef fish fishery be evaluated for purposes of allocation to different user groups. Amendment No. 3 to this plan (GMFMC 1991) further identified the need to determine user group opinions regarding regulatory alternatives and to document motivations and satisfaction within the recreational fishery as social and economic research needs.

Ditton (1981) emphasized the importance to fishery managers of understanding species preference, sources of satisfaction, and economic value placed on fishing by reef fish anglers. Recent studies have focused attention on the social and economic characteristics of recreational king mackerel anglers (Stoll et al. 1989) and tournament billfish anglers (Fisher and Ditton 1992). Falk et al. (1989) noted that studies of saltwater anglers and their fishing patterns have usually been organized on an aggregate angler basis, making it difficult to relate them to managerially important subgroups.

Methods

This study utilized data from 2 different TPWD sources: a creel survey conducted at sport-boat access sites along the Texas coast (on-site survey), and an annual mail survey of licensed saltwater anglers in Texas (statewide mail survey). Details of sampling design, data collection, and other procedural aspects are contained in Campbell et al. (1991) and in Ditton et al. (1994) and Hunt et al. (1994), respectively. Methodology for each survey type is briefly described separately; results are presented together.

On-Site Survey

TPWD has conducted interviews of private sport-boat fishermen in Texas marine waters since 1974, with social and economic questions incorporated into the monitoring program in May 1987 (Green et al. 1991). Anglers were interviewed from 1000 to 1800 hours at randomly selected boat ramps on randomly selected days as they completed their fishing trips. Their landings were inspected to determine the number and size of each species kept. Boat-access sites within each of the 8 major bay systems in Texas were selected randomly in proportion to relative fishing pressure estimates for the previous 3 years.

Angler responses to the social and economic questions collected from 15 May

1987 through 21 February 1990 were used to compare reef fish anglers with anglers landing other species. During this interval >2,800 on-site surveys were conducted resulting in >20,000 angler interviews. Data collected subsequent to this interval were not included to avoid bias caused by implementation of federal reef fish regulations (excluding the 13-inch minimum size limit on red snapper).

Anglers were divided into 2 groups according to area fishing and species landed:

1. Reef anglers ($N = 295$): those parties landing GMFMC-Reef Fish FMP management unit species (GMFMC 1989), as well as non-reef fish species, from the Gulf off Texas, and

2. Non-reef anglers ($N = 936$): those parties landing fish other than reef fish species from the Gulf off Texas.

Reef fish caught in bays and passes were considered incidental rather than targeted, thus bay and pass anglers ($N = 27,838$) were excluded from this comparison. Parties that landed no fish ($N = 9,640$, or 32% of all parties) were excluded from the comparison because it was impossible to categorize them in the above-listed user groups.

Data summarized from on-site surveys included trip cost, post-trip satisfaction, components of motivation, party size, trip length, number of fish landed, number of angling trips per year, gear type, and bait type. Satisfaction and components of motivation responses were rated on an 11-point Likert scale ranging from 0 = "not at all" to 10 = "completely." Chi-square analysis was used to assess differences in distribution of responses to trip satisfaction and components of motivation, and analysis of variance was used to test mean differences in all other variables except gear type and bait type. Significance was accepted at $\alpha = 0.05$, and all analyses were performed using SAS (SAS Inst. Inc. 1985).

Statewide Mail Survey

Pretested mail questionnaires were sent to a random sample of licensed Texas saltwater anglers. This report includes pooled results of surveys mailed from 1986 through 1989 ($N = 23,014$); response rates for this interval ranged from 65% (1989) to 72% (1986). Information was collected on species preference, angler demographics, fishing experience, expenditures, attitudes, motivations, and support of fisheries management efforts. Analysis of variance was used to test mean differences in fishing experience, boat length, and age; while Chi-square analysis was used to assess differences between user groups in distribution of responses to fishing ability, attitudes, motivations, and support of management tools. Significance was accepted at $\alpha = 0.05$, and all analyses were performed using SAS (SAS Inst. Inc. 1985). Detailed survey methodology and minor changes between years are documented in Ditton et al. (In Press) and Hunt et al. (In Press).

Based on responses to first choice of preferred saltwater species, mail survey data were partitioned into 2 categories:

1. Reef anglers ($N = 482$): respondents preferring GMFMC reef fish species, and

2. Non-reef anglers ($N = 747$): respondents preferring Gulf species other than reef fish.

Sample sizes for individual questions varied due to item nonresponse. Anglers listing a bay species (e.g., red drum, spotted seatrout) as first choice were not included in this part of the study.

Results

Overview

Significant differences exist in social and economic characteristics between successful reef and non-reef fish anglers in the Gulf off Texas. Reef anglers are similar to non-reef anglers in that they generally rate non-catch-related items higher than catch-related items as motivations for fishing. However, in contrast to these other anglers, reef anglers place greater importance on catching and keeping fish and less importance on the experience and challenge of fishing itself. In addition, compared to non-reef anglers, reef anglers spend less money per fishing trip and for fishing-related durable goods, rate themselves lower in their fishing skills as compared to peers, and take fewer fishing trips into the Gulf, although their duration of trip is longer and they retain more fish per trip. In general, both groups are satisfied overall with their fishing experiences.

Both groups are supportive of management regulations with stocking being the least popular and catch and release in specific areas being the most popular. In addition, neither group was averse to regulations that prevent them from keeping the fish they caught. However, catch and release fishing is less acceptable to reef anglers than to non-reef anglers, and reef anglers indicate less support for size limits and gear restrictions as management tools.

Species Preference (Mail Survey)

Red snapper (71%) was the preferred species reported by most reef anglers, followed by other snapper (15%), other grouper (8%), and greater amberjack (4%). King mackerel (54%), other sharks (16%), cobia (7%), and dolphin (6%) were the species most often reported by non-reef anglers.

Trip Cost (On-site Survey) and Annual Expenditures (Mail Survey)

Reef anglers reported spending less per trip ($\bar{x} = \$102/\text{trip}$) than did non-reef anglers ($\bar{x} = \$165/\text{trip}$) from the on-site survey. Reef anglers also reported spending less annually ($\bar{x} = \$146$) per angler for durable fishing equipment than did non-reef anglers ($\bar{x} = \$199$) (Table 1).

Satisfaction (Both Surveys)

Reef anglers (\bar{x} trip grade = 6.2) from the on-site survey (0–10 scale) reported similar distributions in trip satisfaction responses as did non-reef anglers ($\bar{x} = 6.4$), as well as did mail survey (1–5 scale) respondents (reef angler $\bar{x} = 3.3$, non-reef angler $\bar{x} = 3.4$).

Table 1. Mean annual expenditures (\$) on durable fishing equipment reported by anglers responding to TPWD statewide annual mail surveys conducted from 1986 through 1989.

Equipment item	Reef anglers	Non-reef anglers
Rod(s)	50	97
Reel(s)	60	108
Lures, tackle boxes, nets	62	89
Live bait equipment	39	56
Fish attracting light(s)	39	40
Lure color selector	18	47
Vehicle(s)	8,170	10,085
Electronic equipment	437	633
Boating accessories	228	190
Boat(s)	2,965	13,031
Boat motor(s)	1,756	2,081
Boat trailer(s)	398	759
Trailer or camper	991	1,745
Tent, camping equipment	128	129
Other equipment	448	1,495
Total annual ^a	146	199

^aMean total annual expenditures are responses to a separate question, rather than the sum of mean expenditures for each equipment item.

Components of Motivation (On-site Survey)

Both user groups rated non-consumptive aspects of their fishing trips more important than either catching or keeping fish (Table 2). However, catching fish was significantly more important to reef anglers ($\bar{x} = 5.8$) than to non-reef anglers ($\bar{x} = 5.3$). Distribution of responses for "keep the fish you caught" was significantly different, with both groups indicating relatively high importance but with more non-reef anglers indicating very little importance. Although distribution of responses was significantly different, both groups tended to give low importance to "catch and release fish for conservation purposes."

Reasons for Fishing (Mail Survey)

"For relaxation" and "for the fun of catching fish" were the 2 highest rated motivations for fishing by both reef and non-reef anglers (Table 3). Motivations unrelated to catch were ranked higher than were catch or fish size-related reasons by both user groups. However, 8 of 18 motivations showed significantly different response distributions with reef anglers placing less emphasis on the fishing experience and more on the results of the catch; i.e., they rate consumptive motivations higher than they do skill-oriented motivations.

Attitudes About Sport Fishing (Mail Survey)

Responses to various statements about sport fishing indicated that catching and eating fish are important to both user groups (Table 4). On average, however, the

Table 2. Mean values for components of motivation reported by reef, non-reef, and bay anglers from TPWD on-site surveys conducted from 15 May 1987 through 21 February 1990 (Motivation scale range = 0 [not at all] to 10 [completely]). Chi-square analysis used to assess differences in distribution of responses.

Motivation	Reef	Non-reef
Get away from crowds of people	9.6	8.8
Enjoy family and friends	9.5	9.0
Experience unpolluted natural surroundings	8.2	8.3
Do what you want to do	7.9	7.4
Relax	7.2	7.9
Experience good weather	7.1	8.2
Experience adventure and excitement	7.1	6.8
Keep the fish you caught ^a	7.0	7.1
Have a quiet time to think	5.9	6.7
Catch fish ^a	5.8	5.3
Catch and release fish for conservation purposes ^a	4.2	3.0
Did regulations prevent you from keeping the fish you caught	1.2	1.1

^aDistribution of responses between user groups is significantly different ($P < 0.05$).

importance of catching, keeping, and eating fish were rated higher by reef anglers than by non-reef anglers. Distribution of responses was significantly different for 7 of 15 statements.

Support of Management Tools (Mail Survey)

Management tools related to area restrictions for certain species were supported by both reef and non-reef anglers (Table 5). Although both user groups were similar in the ranked order of support for various tools, the distribution of responses was significantly different for 12 of the 15 tools listed. "Stocking fish in saltwater" was not strongly supported by either user group.

Trip Characteristics (On-site Survey)

Both reef and non-reef anglers reported fishing party sizes of about 3 anglers/trip (Table 6). Reef anglers (\bar{x} trip length = 8.8 hours) reported significantly longer

Table 3. Mean values for motivations for fishing reported by reef and non-reef anglers from TPWD annual statewide mail surveys conducted from 1986 through 1989 (Motivation scale range = 1 [not at all important] to 5 [extremely important]). Chi-square analysis used to assess differences in distribution of responses.

Motivation	Reef anglers	Non-reef anglers
For relaxation	4.2	4.1
For the fun of catching fish	4.1	4.3
To be outdoors	4.0	4.1
To get away from the regular routine	3.9	4.0
For the experience of the catch ^a	3.8	3.9
To experience unpolluted natural surroundings	3.8	3.9
To experience adventure and excitement	3.7	3.9
For the challenge or sport ^a	3.5	3.7
For family recreation	3.4	3.4
To get away from the demands of other people ^a	3.4	3.6
To be close to the water ^a	3.3	3.5
To be with friends ^a	3.3	3.4
To experience new and different things	3.2	3.3
To obtain fish for eating ^a	3.1	2.8
To develop my skills	2.8	2.9
To obtain a "trophy" fish ^a	2.1	2.3
To test my equipment	2.1	2.2
To win a trophy or a prize ^a	1.5	1.8

^aDistribution of responses between user groups is significantly different ($P < 0.05$).

average trip lengths and caught more fish per person ($\bar{x} = 6.5$) than did non-reef anglers ($\bar{x} = 6.8$ hours and $\bar{x} = 1.9$ fish). Rod and reel was used almost exclusively by all both groups; only 2% of reef anglers used spear guns. Dead fish was the bait type reported most by reef anglers and non-reef anglers, while non-reef anglers also used a substantial proportion of artificial baits.

Angling Characteristics (Mail Survey)

Reef anglers considered themselves significantly less skilled than anglers in general than did non-reef anglers (Table 7). Both reef ($\bar{x} = 15$ years) and non-reef anglers ($\bar{x} = 16$ years) reported similar saltwater fishing experience.

When asked about frequency of fishing by mode (boat or shore/pier) and location (bay or gulf), reef anglers reported significantly fewer days fishing in the bay and Gulf from boats than did non-reef anglers. Boats owned by reef anglers (\bar{x} length = 18 feet) were significantly shorter than those owned by non-reef anglers (\bar{x} length = 21 feet).

Table 4. Mean values for agreement to statements about sport fishing reported by reef and non-reef anglers from TPWD annual statewide mail surveys conducted from 1986 through 1989 (Scale range = 1 [strongly disagree] to 5 [strongly agree]). Chi-square analysis used to assess differences in distribution of responses.

Statement	Reef anglers	Non-reef anglers
I usually eat the fish I catch	4.2	3.9
I like to fish where there are several types of fish to catch	4.1	4.2
The more fish I catch, the happier I am ^a	3.6	3.4
A fishing trip can be successful even if no fish are caught	3.6	3.7
I would rather catch one or two big fish than ten smaller fish ^a	3.4	3.6
The bigger fish I catch, the better the fishing trip	3.3	3.4
A successful fishing trip is one in which many fish are caught	3.1	3.0
I'm just as happy if I release the fish I catch ^a	3.0	3.5
I'm just as happy if I don't keep the fish I catch ^a	3.0	3.5
I like to fish where I know I have a chance to catch a "trophy fish" ^a	3.0	3.4
It doesn't matter to me what type of fish I catch	3.0	3.0
I catch fish for sport and pleasure rather than for food ^a	2.8	3.2
When I go fishing, I'm just as happy if I don't catch a fish	2.7	2.9
I want to keep all the fish I catch ^a	2.6	2.2
I usually give away the fish I catch	2.2	2.4

^aDistribution of responses between user groups is significantly different ($P < 0.05$).

Demographics (Mail Survey)

Responses to questions on age and sex appeared similar between reef anglers (\bar{x} age = 39 years, 82% male) and non-reef anglers (\bar{x} age = 37 years, 87% male). Both user groups were divided evenly between Texas coastal and non-coastal residents with <5% of each residing out-of-state.

Discussion

Our study indicates that reef fish and non-reef fish anglers in the Gulf are both distinct subgroups of all Texas saltwater anglers that should be considered independently by managers. In general, reef anglers are more consumptive and catch oriented and spend less per capita per year on sport fishing than do non-reef anglers. Differentiation between these anglers should allow managers to better

Table 5. Mean values for support of fishery management tools reported by reef and non-reef anglers from TPWD annual statewide mail surveys conducted from 1986 through 1989 (Response scale = 1 [strongly opposed] to 5 [strongly support]). Chi-square analysis used to assess differences in distribution of responses.

Fishery management tool	Reef anglers	Non-reef anglers
A catch and release area for specific saltwater fish ^a	4.1	4.3
Not being allowed to keep certain species of fish in certain areas ^a	4.1	4.2
Releasing fish within a certain length range, but keeping fish above & below this range ^a	3.7	4.1
Not being allowed to keep certain species of fish during certain times of the year ^a	3.5	4.0
Not being allowed to fish in certain restricted areas ^a	3.5	3.6
Prohibiting the use of certain types of bait ^a	3.5	3.6
Keeping fish within a certain length range, but releasing fish above and below this range ^a	3.5	3.5
A voluntary catch and release program	3.4	3.6
Prohibiting the use of certain types of sport fishing gear ^a	3.4	3.5
Being allowed to keep only a certain number of fish you catch in one day (daily bag limit)	3.3	3.5
Releasing fish below a certain length (minimum size limit) ^a	3.1	3.4
A mandatory stamp to retain a specific species ^a	3.1	3.4
Releasing fish above a certain length (maximum size limit) ^a	3.1	3.2
Having certain fishing areas closed during part of the year (closed season) ^a	3.1	3.0
Stocking fish in saltwater	2.7	2.9

^aDistribution of responses between user groups is significantly different ($P < 0.05$).

predict the acceptance and estimate the impacts of a specific regulation change. For example, reducing the bag limit to zero for red snapper should result in a greater proportional displacement of anglers out of that fishery than would the same action for king mackerel or sharks, because those seeking red snapper are more likely to be dissatisfied with a reduction in their ability to take fish home to eat.

Additional work is needed to determine whether there are more distinguishable subgroups within the reef and non-reef angler groups. A single target species approach (Wilde and Ditton 1992) may be warranted to further differentiate between subgroups. Evidence exists, for example, despite differences in survey methodologies, that king mackerel anglers (Stoll et al. 1989) and tournament billfish anglers (Fisher and Ditton 1992) show a lower level of support for area closures than do the current study's non-reef anglers. However, these 2 other studies do

Table 6. Trip characteristics of reef and non-reef anglers from TPWD on-site surveys conducted from 15 May 1987 through 21 February 1990. Analysis of variance was used to assess mean differences of responses.

Characteristic	Reef	Non-reef
Mean party size	3.2	3.1
Mean trip length (hours) ^a	8.8	6.8
Mean <i>N</i> fish/person/trip ^a	6.5	1.9
Mean <i>N</i> saltwater trips/year	21.8	18.7
Mean trip cost (\$)/person	102	165
Gear type used (%)		
Rod and reel	97	99
Spear gun	2	1
Other/combination	1	<1
Bait type used (%)		
Dead fish	38	55
Squid	11	3
Dead fish/squid	19	2
Dead shrimp	5	3
Live shrimp	2	4
Live fish	1	3
Artificial	3	15
Other/combination	21	16

^aMean response between user groups is significantly different ($P < 0.05$); variables 'Gear type used' and 'Bait type used' not analyzed.

collaborate in that their anglers spend more per trip than did reef anglers in this study.

Saltwater anglers in general, which include predominantly bay anglers, spend less per trip (Hiatt et al. 1983, Green et al. 1991) than either angler group in the current study. In fact, TPWD unpublished data indicates that Gulf and bay anglers in Texas may have a wide variety of social, economic, demographic and attitudinal differences that warrant further research. A striking example of the difference between this study's Gulf anglers and other saltwater anglers is the low support for saltwater stocking demonstrated by both reef and non-reef anglers compared to the extremely high approval of stocking reported by all Texas saltwater anglers in Ditton et al. (1994). This may indicate that Gulf anglers are not as devoted as bay anglers and thus see little benefit for themselves in the stocking of bay oriented species. Also of note is the high support by reef anglers for catch and release areas which bodes well for efforts to create marine fishery reserves to protect overfished reef fish stocks (Plan Development Team 1990).

Results of this study can serve as a baseline for comparison with future studies. It should be kept in mind that the on-site survey portion of the study sampled only successful Gulf anglers, although 68% of all angler interviews during the study resulted in successful trips.

Table 7. Responses to questions on fishing ability, saltwater fishing experience, previous year's saltwater fishing by location (bay/Gulf) and mode (boat/shore), boat length, age, sex, and county of residence by reef and non-reef anglers from TPWD annual statewide mail surveys conducted from 1986 through 1989. Analysis of variance was used to assess mean differences of responses.

Angling characteristic	Reef anglers	Non-reef anglers
Fishing ability (%) ^a		
less skilled	38	25
equally skilled	56	56
more skilled	7	18
Mean <i>N</i> years saltwater fishing	15	16
Mean <i>N</i> days fishing in:		
bays from a boat ^a	5	7
bays from shore/piers	5	5
Gulf from a boat ^a	4	8
Gulf from shore/piers	4	6
Mean boat length (feet) ^a	18	21
Mean age (years) ^a	39	37
Gender (% male)	82	87
County of residence (%)		
Texas coastal	48	49
Texas non-coastal	47	48
Out-of-state	5	3

^aDistribution of responses between user groups is significantly different ($P < 0.05$); variables 'gender' and 'county of residence' were not analyzed.

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