

LOUISIANA'S INSHORE SHRIMP FISHERY

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Commercial Shrimper Survey

Data for a description of the inshore fishery became available from a 1979 economic survey of commercial shrimpers. The survey was part of a Sea Grant funded project designed to fill the void of economic information on Louisiana fisheries. Personal interviews of commercial shrimpers were used to acquire catch, effort, cost, investment, and other economic information for calendar 1978. The mixture of boats and vessels using the inshore waters and existence of three inshore management zones (Fig. 1) necessitated a stratified sample design.

The Louisiana Department of Wildlife and Fisheries (LDWF) computer tape of commercial shrimper license sales for 1978 was sorted to identify resident Coast Guard documented vessels as opposed to resident boats (undocumented). Shrimp licensees operating boats were stratified by three zip code groups to simulate three inshore management zones. Mobility and economic information by zone was of interest in choosing the residence stratification. Vessel lengths were arrayed and industry assistance utilized to establish three length groups. Grouping of vessels was based on comparable operating characteristics. Vessel groups were (1) those less than or equal to 50 feet, (2) those from 51-65 feet, and (3) those 66 feet and larger.

The importance of using the tedious process of sorting the computer tape of license sales is exemplified by a previous study. Duffy and Johnson (1979) attempted to stratify the population of shrimpers without access to the original license records. The stratified sampling procedure had to be abandoned in their study to be replaced by a convenience sampling method based on the arrival of boats at the docks. This procedure would necessarily exclude shrimpers using non-traditional marketing methods.

The brown shrimp (*Penaeus aztecus*) and white shrimp (*Penaeus setiferus*) emigrating from Louisiana marshes are harvested by a succession of resource users. Approximately 28,600 shrimp licensees include resident commercial shrimpers, non-resident commercial shrimpers, and licensed sport shrimpers. Two distinct inshore seasons of about 174 days total provide ample access to the shrimp. St. Amant (1980) points out that the large number of users exerting inshore effort affords numerous small boat harvesters good catches of medium and small shrimp. He concludes that the total catch of large, high priced shrimp in the Gulf of Mexico is reduced as a result of the harvest of large numbers of smaller shrimp from the bay system prior to migration offshore. The Louisiana inshore catch trended toward even smaller shrimp between 1973 and 1976 (Table 1). In the period, shrimp in the 51-67 and 68 and smaller count sizes amounted to nearly 92 percent of the inshore catch. This represents an increase in the proportion of the catch in the small count sizes over the 1963-72 period. Table 1 indicates that the higher percentage of small shrimp came primarily from the harvest of small white shrimp.

In neighboring Texas a larger shrimp is preferred. This fact is evident from the high proportion of landings from offshore, a higher weighted average ex-vessel price, and a minimum 65 count (tails) landing law in part of the season.

This disparity in management approaches to a fishery where maximum landings occur when shrimp are harvested at 20-30 count tails (Klima and Parrack 1978) focuses attention on the wisdom of allowing large inshore harvests. An analysis that would indicate whether or not decreased inshore harvests will result in a net gain to society is not available. A prerequisite to such an analysis is a thorough description of the prime candidate for alteration--the Louisiana inshore shrimp fishery.

The budget available for the personal interviews was distributed among the six strata based on the following formula:

$$\frac{n_h}{N} = \frac{(N_h S_h) / C_h}{\sum (N_h S_h / C_h)}$$

where: N = total number of boats and vessel shrimpers

N_h = number of boat and vessel shrimpers in the h^{th} strata

S_h = estimate of standard deviation of the catch per boat or vessel in the h^{th} strata

C_h = predicted cost per interview in the h^{th} strata

n_h = number of boat or vessel shrimpers to be sampled in the h^{th} strata

The mean and standard deviation of catch per boat or vessel was obtained from utilization of the National Marine Fisheries Service catch/effort tapes for the Gulf shrimp fishery. Only those portions of the tape applicable to Louisiana for the 1963-76 period were incorporated in the sample selection. The names of commercial shrimpers from the LDWF license tape were distributed among the six strata and names drawn at random. The personal interviews included 160 boats and 162 vessels.

A Survey of Commercial Licensees

The survey conducted in February and March of 1979 yielded information on calendar 1978 shrimping operations. Only the data associated with inshore shrimping is discussed in the article. The discussion

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includes all boat shrimper responses and some vessel responses. The latter refers to the vessel respondents that shrimped inshore during a portion of 1978.

Commercial User Characteristics

The population of approximately 13,800 commercial boat shrimpers (Roberts and Sass 1979) includes a wide range of user groups. Pre-survey consultations with knowledgeable resource managers, shrimp buyers, and shrimpers identified the need to differentiate between user groups. A recommendation was made that an accurate description of the inshore shrimp fishery would require defining and recording the differences between "full" and "part-time" shrimpers. Pesson (1974) also noted the large number of part-time shrimpers. Consequently, the boat shrimpers were questioned about their income earning activities during the inshore seasons.

The responses were organized in two groups. Eighty-nine percent stated that they did not shrimp full-time. The remaining eleven percent shrimped full-time during the 1978 seasons. Therefore, a large group of the commercially licensed boat shrimpers are clearly part-time shrimpers. The 89 percentage points attributable to the part-time group is composed of licensees; with jobs (78 percentage points), who were retired (10 percentage points), and who were students (1 point). The identification of licensees as part-time shrimpers does not intimate a lesser status or role in utilization of the shrimp resource. Part-timers view the fishery as a supplemental source of income to job or retirement earnings. A distinction between user groups is justifiable in that the groups may use boats with widely differing capabilities, exert varied effort, view the shrimp fishery differently, and participate at different levels in the management process. With this knowledge and personal experience with shrimper organizations in Louisiana, the authors hypothesize that part-time boat shrimpers do not actively participate in shrimp management deliberations.

The characteristics of boats and the effort exerted were analyzed to determine if additional differences between the two groups existed. Full-time shrimpers being dependent on shrimping for the primary source of income would be expected to operate larger, more valuable boats. The information in Figure 1 verifies that the distinction between shrimpers based on income identifies two groups with differing attributes. Larger, more powerful boats are operated by the full-time shrimpers. The result is that the average boat operated by full-time shrimpers had a 1978 market value four times higher than that of a part-time shrimper. The histograms in Figures 1, 2, and 3 identify the typical part-time shrimper as an operator of a small fiberglass outboard powered hull. Such units are the typical pleasure boats available from boat dealers. Consequently, the use of the boats by part-timers may not be restricted to shrimping. The histograms add further credibility to the method used in the survey of distinguishing among commercially licensed boat shrimpers.

An estimate of total investment in the boat fleet was obtained by weighting the market values of Table 2 and the proportion of full and part-time shrimpers. Total investment in the boat fleet was approximately \$86 million prior to the 1979 season. The part-timers may own and utilize their boats for purposes other than commercial shrimping.

Consequently, the \$62 million portion of total investment attributable to these boats will inflate the total investment estimate an unknown amount.

Shrimping Effort

Insight to the use of investment for shrimping between the groups was gained through comparison of fishing effort. The approximately 13,800 commercial boat shrimpers utilize either or both of two gear types. The survey included questions on gear types, sizes, and effort. Responses of full and part-time shrimpers were expanded to the entire population for the two gear types: butterfly nets and trawls. The butterfly or wing nets are fished from rigid rectangular frames mounted perpendicularly on boats, barges or platforms. These nets, as opposed to trawls, are fished primarily at night in the upper part of the water column.

Expansion of the survey data to the population yielded the trip and effort data in Table 3. Part-time shrimpers were estimated in total to have made three times as many trips as the full-time group. The shorter length of trips by part-time shrimpers was the cause of their share of total 24 hour effort days to be only 50 percent. However, note that 12,122 of the 17,203 butterfly effort days were attributable to the part-time group. Among the reasons for this is the suitability of the gear to night use when part-timers are off their job.

Although the effort days are nearly equal for the two shrimper groups, the effective effort is actually different. Experience levels and gear size were measured in the survey as a means of gaining insight to effective effort differences. Full-time shrimpers pulled trawls averaging 40 feet on the headrope as opposed to 27 feet for the part-time group. The larger trawls were pulled by boats with 50 percent more horsepower (Figure 1). Trawl size and horsepower were shown by Griffin (1976) to be important determinants of a shrimp vessel's effective effort. Therefore, these factors combined with an experience level of 16 years for full-time shrimpers as opposed to 10 years for part-timers indicate a major difference in effective effort between groups. Table 3 should be utilized with this unquantifiable difference in effective effort noted.

Gear Damage

Louisiana inshore waters have hosted oil and gas exploration and development activities for decades. Shrimpers occasionally experience trawl and boat damage as a result of fishing effort in certain areas. The survey of commercially licensed shrimpers included questions to identify the significance of the problem in both Louisiana and federal waters. Hazards similar to that in Figure 4 caused \$1.9 million of damage to trawls and related gear in Louisiana waters (Table 4). Only \$100,000 of the damage estimate was related to the operation of vessels in Louisiana waters. The large number of boat shrimpers was responsible for their share of total damage to be so high. A comparison of the damage estimates for Louisiana and federal waters indicates that the former is a larger problem in the aggregate for resident shrimpers.

The gear damage estimates reflect the actual cost of repair when purchased and only the cost of materials in those instances where repair

labor was not purchased. Repairs completed on board with little or no materials expense were treated as including only uncompensated labor. The repair time in these instances was added to the time lost in freeing nets from obstructions. Thus, the time lost element of Table 4 reflects loss of productive shrimping time. Shrimpers working Louisiana waters experienced triple the time loss of resident operators in federal waters.

Shrimpers succeeded in making the extent of the damage and time loss problems known to the 1979 Louisiana legislature. The legislature passed a gear compensation bill in response. Although similar to the federal contingency fund, the Louisiana law does not permit compensation for the potentially large monetary loss resulting from lost shrimping time. The lost earnings resulting from approximately 102,000 hours of lost shrimping time must be absorbed by the inshore shrimpers.

Commercial Catch of Residents

Catch and landings estimates provide fundamental information on the extent of shrimp resource utilization. The catch is the amount of shrimp caught in a specific area, inshore or offshore. Landings are the total catch, regardless of origin, delivered at a port and sold commercially. Areas offshore Louisiana are subject to fishing effort from vessels of several states (GMFMC 1980). Consequently, a disparity in Louisiana offshore catch and landings can be expected. Due to the small size of inshore boats, their mobility is limited compared to offshore vessels. For this reason the Louisiana inshore catch and landings are thought to be more closely comparable.

The survey of commercially licensed residents revealed that inshore shrimpers landed all of their catch in Louisiana. Landings are synonymous with catch in these circumstances. However, a part of the inshore catch may not be reported in the landing statistics. Duffy and Johnson (1979) reported that the catch of the "smaller" commercial shrimpers with other sources of income and sport shrimpers could produce a substantial unreported catch. The large number of licensees who supplement their income via part-time shrimping was previously discussed. A distinction between users in estimating the inshore commercial catch that recognizes different effort rates (Table 3), boat types (Figures 1-3), and marketing patterns should reflect the situation accurately.

Shrimpers surveyed about their 1978 inshore activities averaged 13,440 and 1,408 pounds of tails for full and part-timers respectively. The catch of commercial inshore shrimpers was then estimated by multiplying the catch averages by the number of shrimpers in the two sub-populations. Survey and license data were used to estimate that 1,244 full-time boat shrimpers worked inshore during 1978. The corresponding figure for part-time boat shrimpers was estimated to be 12,168. The surprising element of the process was that full and part-time boat shrimpers caught essentially the same total amount of shrimp in 1978. Total landings attributable to boats operating inshore was estimated to be 33.8 million pounds of tails. The findings of Duffy and Johnson (1979) are very important in light of the significance of the part-timer's catch. The size of the part-timer's catch and their marketing patterns indicate that the component of the landings estimate attributable to inshore boat shrimpers is definitely underestimated.

While there is no definitive method of determining the size of the actual commercial inshore landings, the survey results provide sufficient information to develop an approximation for discussion purposes. Resident operators of documented vessels frequently trawl inshore. Their inshore catch estimate must be added to the 33.8 million pounds from boat operators. Personal interviews of 162 shrimp vessel captains revealed that 43 percent harvested shrimp inshore during 1978. Captains operating vessels 66 feet or longer did not trawl inshore. Trawling inshore for the larger vessels is not feasible due to shallow water and a regulation prohibiting double-rig trawling. Thus, the 43 percent of the vessels that harvested shrimp inshore were found to be in the small (<50 ft.) and medium (51-65 ft.) classes. The complex process of expanding the sample estimates to the population of licensees begins with Table 5.

Note that some vessels in the small class shrimped inshore entirely, offshore entirely, and both inshore and offshore. The beneficial aspect of having surveyed captains report their catch by inshore-offshore areas provides a sound foundation for the development of Table 6. Resident vessel captains landed approximately 10.9 million pounds of shrimp tails from inshore waters in 1978.

The combined inshore catch of shrimp from Louisiana resident boat and vessel operations was estimated to be 44.7 million pounds. Shrimp said by survey respondents to be caught inshore were landed in Louisiana. The lack of small boat mobility, limited ice capacity, convenience of Louisiana ports, and presence of part-time shrimpers all support the logic of this conclusion. As reported in Duffy and Johnson (1979) and from personal experience it is certain that, even though residents land their inshore catch in Louisiana, this does not mean the landings are reported. This point is discussed in the Gulf of Mexico Shrimp Management Plan (1980) as follows:

Recreational shrimpers often purchase commercial licenses which permit them to shrimp on a part-time basis and sell all or part of the catch. Most of the shrimp sold go to outlets which are not statistically monitored, so the magnitude of this commercial catch cannot be defined (emphasis added).

Resident Sport Shrimping

A large sport fishery for shrimp occurs in Louisiana waters. Sport shrimpers using 16 foot or smaller trawls are not licensed. They are restricted to a daily catch limit of 100 pounds heads-on per boat. If a sport shrimper desires to pull a larger trawl or exceed the 100 pound limit, a special sport license is available. Neither group of sport shrimpers is allowed to sell shrimp. There were 10,875 sport trawl licenses sold in 1978 (Roberts and Sass 1979). Duffy and Johnson (1979) report that a mail survey of sport shrimpers yielded a catch estimate of 463 pounds of shrimp tails per sport shrimper in 1977. The only other estimate available is found in an undated US Army Corps of Engineers report. The report, cited in the Gulf of Mexico Shrimp Management Plan (1980) as a 1973 report, contains an estimate of 470 pounds of shrimp tails. A sample of pleasure boat registrants was randomly selected by the Corps in order to determine sport shrimping participation. The Corps survey estimated there were 30,000 sport shrimpers. The population of pleasure boat registrants includes both the licensed and unlicensed

sport shrimpers. Duffy's work also failed to differentiate between the two sport groups. Licensed sport shrimpers through use of larger trawls have more fishing power than their unlicensed counterparts. The absence of catch limits on the 10,875 licensed sports is another reason why distinction between the groups is essential to improving sport shrimp catch estimates.

An entry in Table 6 for the sport catch must by necessity reflect a conservative approach. It is known that there were 10,875 licensed sports in 1978. Approximately 3 percent of the licensed sports were assumed not to have shrimped. This figure came from the experience with commercial boat licensees (Table 3). Applying the catch of 463 pounds of tails from Duffy's survey to the sport shrimpers yields an estimate of 4.9 million pounds. Duffy's catch estimate applies to the 1977 inshore season. However, the Louisiana commercial landings reported in Shrimp Statistics (USDC 1980) were comparable for the two years. This comparability makes the use of the 1977 average sport catch in Table 6 a reasonable approach.

Estimation of two other aspects of the sport catch would be valuable but data voids would make the estimates of suspect accuracy. One obvious need is for identification of the number of unlicensed sport trawlers. A cautious approach would be to assume sport trawling has followed the trend of other recreational fisheries. Stopping short of identifying a growth rate, it is sufficient to assume that there was no decrease in numbers between 1973 and 1978. This would point to a minimum estimate of 19,000 (i.e., 30,000-10,875) unlicensed sport shrimpers. Catch data on this group is essential to completing the process of describing the inshore fishery. Future surveys of sport shrimpers should emphasize the catch differences between licensed and unlicensed shrimpers. The discard of shrimp by sport shrimpers should also be identified. Sport shrimper's boats do not have the salt or brine tanks used by many commercial shrimpers. The highly saline tanks are used to separate incidental catch from the shrimp. This labor saving process facilitates the retention of many small shrimp suitable for marketing. Sport shrimpers generally do not use the tanks. Consequently, culling of shrimp by hand makes it credible to suspect that sport shrimpers may discard a higher proportion of their catch than their commercial counterparts. Yield surveys of sport shrimpers would be especially beneficial if information on this aspect of the sport fishery was developed soon.

Summary

The percentage of the inshore shrimp catch in the 68 and smaller class increased during 1973-76 as compared to the 1963-72 period. The change in size distribution had its origin in the harvest of small white shrimp (Sass 1979). A higher proportion of the inshore harvest in smaller size classes decreased the proportion of total shrimp value coming from inshore. The conventional concern is with the impact inshore harvest of shrimp has on the offshore harvest and on total value. The data indicate that the 1973-76 change appears to have impacted the inshore shrimper vis-à-vis the offshore trawler. Inshore shrimpers increased their catch of 68 count and smaller shrimp while the proportion of catch in the 51-67 count decreased. A fishery historically dependent on small though marketable shrimp is evidently trending toward smaller shrimp. When available, analysis of post 1976 data would serve to identify the stability of the 1973-76 trend.

The higher proportion of inshore catch occurring in the 68 count and smaller class may result from environmental factors or reflect increased competition for shrimp. Increased numbers of shrimpers could shift a higher proportion of the catch nearer to the opening days of the two inshore seasons. Shrimp will be at their smallest average size during the early part of the season. Consequently, the inshore catch may tend toward a smaller count class simply due to increased numbers of shrimpers working the resource when shrimp density is highest and shrimp size the smallest. This hypothesis is offered not in the light of established fact but as conjecture to guide future investigation. The sizeable growth in commercial and sport shrimper numbers in the years since 1976 is sufficient to cause concern over its impact on size of shrimp harvested. Commercially licensed resident boat shrimpers increased 47 percent from 9,692 to 14,217 in the four year period from 1976-79 (Roberts 1980). Licensed sport shrimpers increased 22 percent from 8,769 to 10,679 in the period. It seems appropriate to question the likelihood of successfully managing the resource to produce even incrementally larger shrimp under these conditions.

Two distinct groups of commercial boat shrimpers were identified via response to survey questions. The designation of shrimpers as full or part-time based on the survey stimulated inquiry as to other ways the groups differ. Differences were noted in boat, motor and trawl sizes, number and length of trips, and catch. The number of 24 hour effort days were estimated for both commercial groups. Part-timers accounted for approximately 50 percent of the 24 hour effort days expended by boats in 1978. This large component of commercial boat effort may in large part go undetected through the conventional practice of estimating effort through dockside interviews of shrimpers. The historical average of days fished for brown and white shrimp in Louisiana inshore waters for 1963-76 was estimated to be 51,365 days (Sass 1979). The high estimate of 65,190 days occurred in 1976. These figures are comparable to the number of trips and 24 hour effort days estimated for the full-time inshore shrimpers in 1978, Table 3. The part-time shrimpers evidently are generally omitted from the dockside procedure used by NMFS to collect effort data. The small fiberglass boats used by part-timers facilitate trailering and operation from boat launches as opposed to commercial docks. This point increases the probability that the catch of part-timers is not identified through the dock-side procedure used by NMFS port samplers in Louisiana.

Management of the shrimp resource throughout its range as attempted by the Gulf of Mexico Fishery Management Council will achieve desired results only with improved information. The growth in number of commercial and sport boat shrimpers and the likelihood that catch and effort of part-timers are inadequately measured are factors that complicate management. These neglected aspects of the inshore shrimp fishery need more emphasis than the Shrimp Management Plan for the Gulf of Mexico (GFMC 1980) recommends in its specification of a statistical reporting system. Management of the size of shrimp at harvest as evidenced by management measure 2 (GFMC 1980) may become more attractive as a means of attempting to increase gross revenue per vessel in the overcapitalized shrimp fishery. Adverse impacts of size management in this example of a resource emigrating from state to federal waters will be distributed among inshore users. Only through focusing statistical resources on these groups will the impact costs and benefits of management measures be better portrayed.

Table 1. Inshore catch of white and brown shrimp expressed as a percent of inshore catch, 1963-76.

	both species %	brown %	white %
	----->68 count-----		
1963-72	63.0	82.4	40.6
1973-76	86.3	95.8	65.3
	-----51-67 count-----		
1963-72	17.1	12.9	21.7
1973-76	5.4	2.5	11.8
	-----<50 count-----		
1963-72	19.9	4.7	37.7
1973-76	8.3	1.7	22.9

Source: (Sass, M.E. 1979).

Table 2. Investment in undocumented commercially licensed shrimp boats, Louisiana, 1979.

	Full-time Operators	Part-time Operators
Purchase price (avg.)	\$ 13,563	\$ 4,375
Market value (avg.)	19,593	5,014
Appreciation (%)	44	15
Total Investment	\$ 24,373,692	\$ 61,010,352

Source: Sea Grant survey of inshore shrimpers.

Table 3. Number of trips and effort of Louisiana shrimpers operating undocumented boats in inshore waters, 1978.

	Trips		24 hr. effort days	
	no.	%	no.	%
Full-time				
butterfly nets	14,691		5,081	
trawling	62,200		59,349	
sub-total	76,891	26	64,430	50
Part-time				
butterfly nets	46,178		12,122	
trawling	172,739		51,822	
sub-total	218,917	74	63,944	50
TOTAL	295,808		128,374	

Source: Sea Grant survey of inshore shrimpers. Expansion to the population from the survey yielded the estimate of 1,244 full-time shrimpers, 12,168 part-time shrimpers and 415 who were licensed but did not shrimp.

Table 4. Estimated gear damage and time lost by Louisiana inshore and offshore shrimpers from underwater obstructions, 1978.

	gear damage (\$)	time lost (hrs.)
inshore waters		
boats	1,848,994	98,999
vessels	95,913	3,466
	<u>1,944,907</u>	<u>102,465</u>
offshore waters		
vessels	1,481,225	36,556

Table 5. Allocation of fishing time to shrimping in inshore waters for three vessel classes, Louisiana, 1978.

Percent of time inshore	0	1-24	25-49	50-100
	---- percent of vessels in time class --			
small	13*	38	--	49
medium	44	26	13	17
large	100	--	--	--
vessel average	60	19	8	13

* Interpreted to mean that 13 percent of the small vessels shrimped offshore exclusively in 1978.

Source: Sea Grant survey of inshore shrimpers.

Table 6. Summary of estimated inshore catch from boat and vessel shrimpers, Louisiana, 1978.

	number of participants	heads-off catch (lbs.)
licensed full-time boats*	1,244	16,719,360
licensed part-time boats*	12,168	17,132,544
licensed vessels*	553	10,940,021
licensed sport†	10,549	<u>4,884,187</u>
		49,676,112

* Results from a 1979 Sea Grant survey of 160 undocumented shrimp boats and 162 vessels operating during 1978.

† The number of licensed sport shrimpers in 1978 (10,875) was obtained from Louisiana Department of Wildlife and Fisheries license records. If 97 percent of the licensees actually shrimped, then there would have been 10,549 sport shrimpers in 1978.

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