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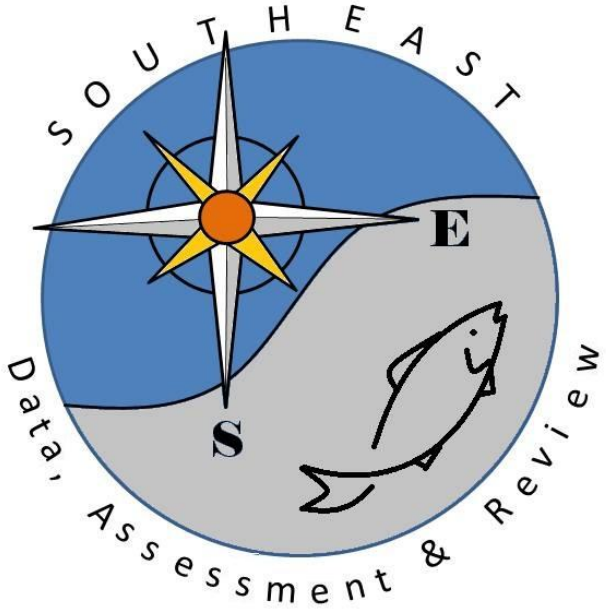
SEDAR31-AW09

11 January 2013



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Introduction

Juvenile red snapper (Lutjanus campechanus) are frequently caught by shrimp trawlers targeting brown shrimp, Penaeus aztecus, or pink shrimp, P. duorarum, in offshore areas of the Gulf of Mexico (Bradley and Bryan 1975). Linton (2012) has estimated the total bycatch of red snapper since 1972 based on effort and bycatch per unit effort statistics gathered by the NMFS. Unfortunately, this time series cannot be extended further back in time for lack of reliable bycatch per unit effort statistics. Moreover, complete effort data are lacking prior to 1960 (J. Nance, pers. comm.). This paper updates the work of Porch and Turner (2004), using several historical references to extend the offshore shrimp effort back to the inception of the fishery.

A brief history of offshore shrimping in the Gulf of Mexico

The first known case where a vessel landed a catch consisting almost entirely of brown shrimp occurred in Texas during the year 1940, however notable catches of brown shrimp did not occur until 1947 when, in the face of a declining white shrimp fishery, several vessels began targeting brown shrimp in deeper water off the Texas coast (Lyles 1951). Initially, brown shrimp did not sell very well, but by 1948 a market was developed and the landings of brown shrimp in Texas increased substantially. Large populations of pink shrimp were also discovered in Florida waters off the Dry Tortugas late in 1949 and by 1950 there was a substantial fishery there as well (Idyll 1957; Joyce and Eldred 1966). In the fall of 1950, large concentrations of brown shrimp were found off the Mississippi Delta in depths of 50 to 100 meters and, by 1951, many trawlers were observed working that area (Springer 1951).

The development of the aforementioned fisheries created a demand for larger, more powerful vessels that could operate efficiently in the deeper offshore areas. This spurred a construction boom producing an average of 325 shrimp trawlers per year for the 1949-53 period and 432 in 1954. After that the construction of new trawlers declined from 168 vessels in 1955 to "almost zero" in 1961 (Captiva 1966). Interestingly, these statistics match up well with the growth in the number of shrimp otter-trawl vessels (boats greater than 5 tons) listed in the operating units section of the Fishery Statistics of the United States[1] (Figure 1). Inasmuch as most of the white shrimp grounds were already over-capitalized (Springer 1951, Lyles, 1951) and few of the vessels built prior to 1950 were adequately equipped to trawl in the deeper offshore waters (Springer 1951), it is reasonable to assume that the statistics on new trawl "vessels" grossly reflects the effort being expended in pursuit of brown and pink shrimp in the offshore areas. Some further justification for this assumption can be found in the rather close agreement between the number of offshore trawlers operating on the Tortugas grounds (the most important offshore grounds in Florida) and the increase in shrimp trawl vessels recorded in the operating units record for Florida during the same period (Figure 2).

The effort expended on the offshore grounds seems to have leveled off during the early sixties when few boats were built. However, another surge in vessel construction began in the mid 1960s in response to increasing market demand (Captiva 1966). This second surge is evident in both in the number of days fished[2] and the number of shrimp trawl vessels (Tables 1 and 2).

Reconstruction of effort trends prior to 1960

In consideration of the above historical account, it appears that the number of shrimp trawl vessels recorded in the operating units data base may be a useful measure of the relative effort exerted by the fleet prior to 1960. Assuming most of the older vessels were not well suited to trawling the deeper offshore waters, the amount of offshore effort may be indexed by the number of shrimp trawl vessels added to the record since 1945 in Texas, 1949 in Florida, and 1950 in the remaining states.

A time series of nominal effort in 24 days fished is typically used to index shrimping effort in the Gulf of Mexico for the years 1960 to the present. In order to creat a continuous tiume series with the same units, the time series based on vessel operating units (O) was rescaled to days fished (D) by use of the scalars p that minimize the squared differences between pO and D during the years when both measures are avaialble (1960-1970):

$$p = \frac{\sum_{i=1960}^{1970} O_i D_i}{\sum_{i=1960}^{1970} D_i D_i}$$

$$D_j = pO_j \left[j = 1945 - 1959 \right]$$

Separate scalings were conducted for vessels based east and west of the Mississippi River. The rescaled series are shown in Figure 3 and Table 2. It is evident that the trends in number of new vessels are quite similar to the trends in effort units for the period 1960-1970, when both types of data are available. Moreover, the trends prior to 1960 agree qualitatively with the historical counts of a rapidly developing fishery that began to level out during the late 1950's. Hence we conclude that the reconstructed time series are reasonable representations of the actual effort trends.

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[1]Fishery Statistics of the United States (1948-1970). U.S. Government printing office, Washington D. C. Produced by the U. S. Fish and Wildlife Service (Bureau of Commercial Fisheries) branch of the U. S. Dept. of the Interior until 1968, then the National Marine Fisheries Service brach of the U.S. Dept. of Commerce).

[2]Number of 24 hour days fished provided by J. Nance, Chief, Fishery Management Branch, Galveston Laboratory, National Marine Fisheries Service, Galveston, Tx.

Acknowledgments

J. Nance provided the observed effort data and provided some helpful advice.

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Table 1. Number of vessels recorded in the operating units file less the number recorded the year before the fishery started.

1945	0	0	0	0	0	0	0	0
1946	20					0	20	20
1947	102					0	102	102
1948	268					0	268	268
1949	433					0	433	433
1950	523			15	234	249	523	772
1951	522	28	28	60	341	429	550	979
1952	589	60	6	59	442	507	649	1156
1953	638	-5	35	65	460	560	633	1193
1954	773	62	-83	58	743	718	835	1553
1955	638	51	-52	73	827	848	689	1537
1956	744	155	156	91	827	1074	899	1973
1957	1057	70	141	109	926	1176	1127	2303
1958	1438	300	129	137	978	1244	1738	2982
1959	1370	487	147	165	1038	1350	1857	3207
1960	1327	534	103	165	828	1096	1861	2957
1961	1347	261	115	130	834	1079	1608	2687
1962	1081	204	119	111	782	1012	1285	2297
1963	1162	561	100	190	806	1096	1723	2819
1964	1193	642	73	173	860	1106	1835	2941
1965	1177	598	77	238	804	1119	1775	2894
1966	1215	641	78	309	845	1232	1856	3088
1967	1481	720	19	340	850	1209	2201	3410
1968	1621	746	154	410	947	1511	2367	3878
1969	1612	801	132	449	891	1472	2413	3885
1970	1529	992	120	391	772	1283	2521	3804

*Springer (1951) reported a minimum of 28 shrimp trawlers operating near the Southwest Pass of the Mississippi River (La) in 1951. Inasmuch as the brown shrimp grounds extend to the SE as well, it is assumed that an equal number of vessels worked in that area as well (Ms). The value of 20 vessels in Texas during 1946 is an arbitrary small number intended to reflect the fact that there were small landings of brown shrimp in that year. Negative numbers probably reflect a decline in the number of vessels fishing inshore for white shrimp that exceeded the increase in vessels fishing offshore for brown shrimp (some moving into more productive areas outside La and Ms, and others being retired). In any case, the offshore fisheries in La and Ms appear to be small compared to those off Tx and Fl, so misrepresenting the dynamics in these areas will have little impact on the regional summaries.

Table 2. 'Prehistoric' effort series, rescaled to days fished, suggested for use in the red snapper assessment (shaded region). The values for 1960-1970 in the columns to the right are the estimates of nominal effort in days fished (James Nance, pers. comm.).

	predicted		observed	
year	east	west	east	west
1945	0	0		
1946	0	513		
1947	0	2616		
1948	0	6874		
1949	0	11106		
1950	4887	13414		
1951	8419	14106		
1952	9950	16646		
1953	10990	16235		
1954	14091	21416		
1955	16643	17672		
1956	21078	23058		
1957	23080	28905		
1958	24414	44577		
1959	26495	47629		
1960	21510	47731	26006	48766
1961	21176	41242	18865	38925
1962	19861	32958	18008	37865
1963	21510	44192	20208	43916
1964	21706	47064	23991	40067
1965	21961	45526	26023	45918
1966	24179	47603	24374	48133
1967	23727	56452	23133	60584
1968	29654	60709	27254	52614
1969	28889	61889	26580	70265
1970	25180	64659	26193	63463

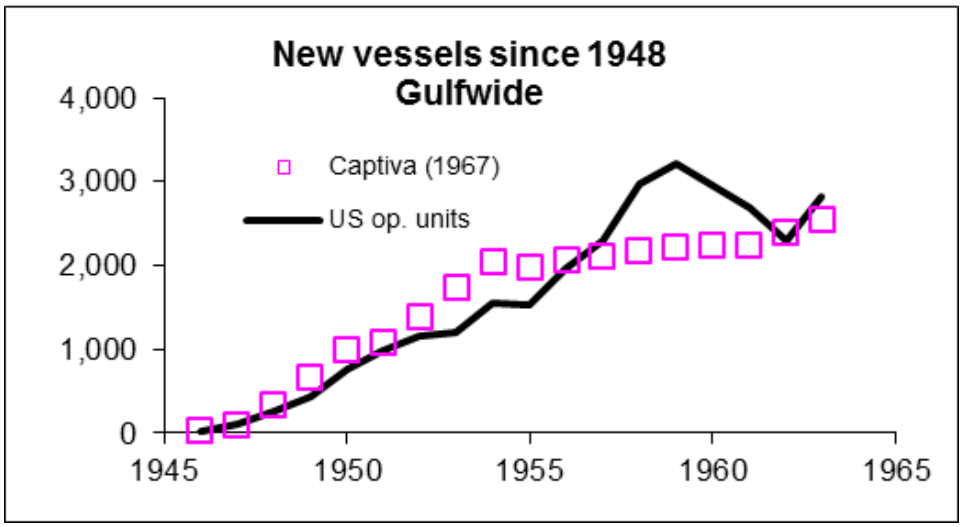

Figure 1. Comparison of the increase in shrimp trawling vessels recorded in the NMFS operating units file since 1948 with an independent estimates of the number of new trawlers produced in the U.S. (Captiva 1966).

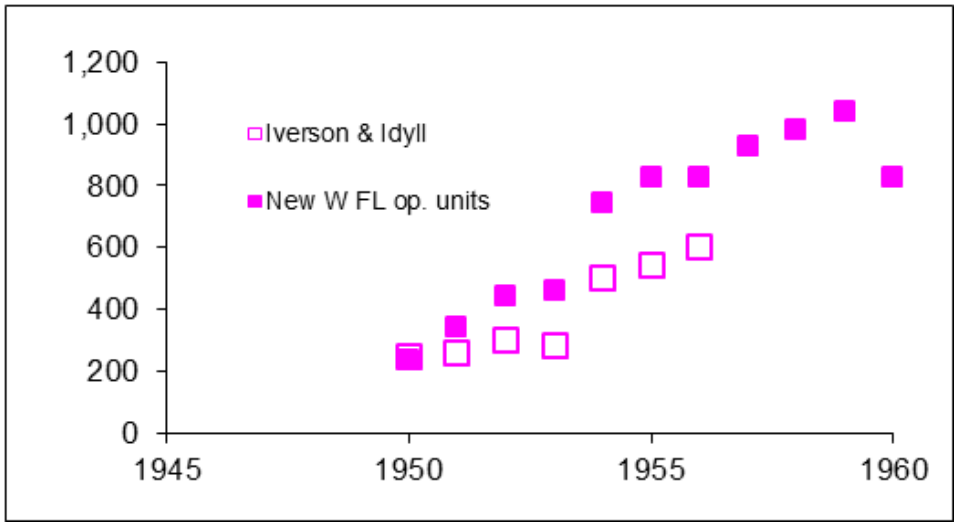

Figure 2 . Comparison of the increase in shrimp trawling vessels recorded in the NMFS operating units file for West Florida since 1949 with an independent estimate of the number of trawlers operating on the Tortugas grounds (Iversen and Idyll 1959). The number for West Florida as a whole would be expected to be somewhat larger than for the Tortugas alone after 1950 owing to the discovery of important new grounds on the Campeche Banks and other minor grounds elsewhere in West Florida.

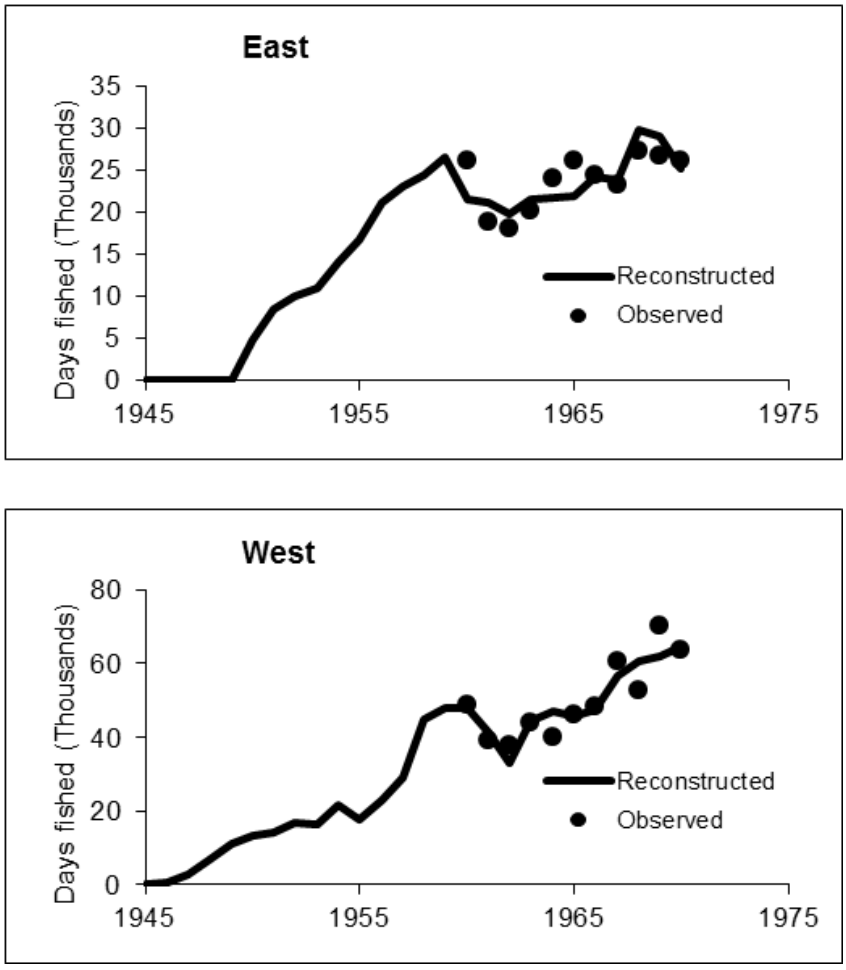

Figure 3. Time series of historical effort reconstructed from the operating unit files in comparison with the nominal estimates of days fished.