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Market response to a fishery regulation change: Preliminary observations from a Japanese swordfish and blue shark market

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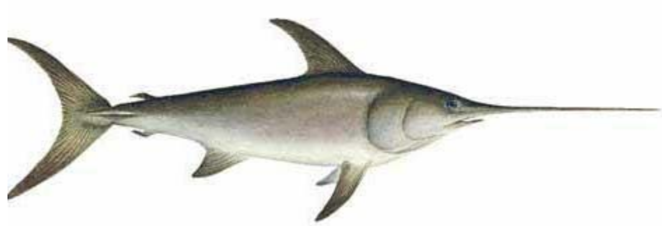

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Introduction

Supply and demand of renewable natural resources are often affected by resource management policy. If the quantity supplied can be affected by resource management, information on how the market could react given such changes is important for policy makers. In a fishery, while regulations on harvest activities have an immediate effect on fishers' behaviour, the responses of the seafood market are usually not straightforward due to substitutable commodities available globally or a displacement of fishing efforts by fishers.

The off-shore longline fishery in Kesen-numa, Japan targets tuna, billfish and shark in a broad area of the North Pacific, which extends from near the coast of Japan to an area close to the international dateline. While there are many species in this fishery, landings of swordfish and blue shark dominate economic activity, making up over 80 % of the total annual revenue. This fact implies that regulations on swordfish and blue shark affect the economic viability of this fishery. Furthermore, their annual landings play significant economic roles in this port since the total annual landings of swordfish and blue shark at Kesen-numa make up 80% and 90% of total Japanese annual landings of these species, respectively.

In 1997, due to the depletion of resources around the islands of Japan, the off-shore longline fishery authorized an expansion to an area west of 180˚ E longitude to west of 160˚ W longitude. Reflecting this expansion, the average days of operation per trip increased from 20 - 30 days to 40 - 45 days. Although it is unclear whether swordfish harvest increased after 1997, landings of blue shark show an upward trend after 1997 (Table 1).

The swordfish and blue shark markets in Kesen-numa do not have competitive commodities which can be used as substitutes. Most landings are consumed or processed within or geographically close to Kesen-numa. Due to these unique characteristics, we can consider these two markets to be a case of a quasi-closed (independent) market, supplied exclusively from the port of Kesen-numa. We can thus consider the amount of supply (landings) and demand from local consumers/processors to be the principal elements that determine the ex-vessel price of these two species at the port of Kesen-numa.

While swordfish products are directed toward human consumption (e.g., sashimi or fillet for steak or other cooking), blue shark products have a variety of uses, all exclusively for processed products. After processing, skins and fins go to a high value food market. Meat from blue shark is processed as surimi. Bone is used for high value medicine and cosmetics. These facts suggest that the market characteristics and consumers of the two fish would be dissimilar.

The fisheries economic literature on the fish market is rich in theoretical insight (e.g.,(Angrist, Graddy, and Imbens 2000; Seung 2008, 87-104) , but provide very little about responses of the fish market upon the fishing regulation changes. Little both theoretical and empirical studies exists for this topics, and empirical work has been hampered by the lack of reliable data and complexity of the fish market structure. Ishimura and Yokawa (2008) described a overview of

The primary purpose of this paper is to exam the effects of regulation change on off-shore longline fishery operations to the swordfish and blue shark markets in the City of Kesen-numa. This paper intends to provide to the result from a first primitive analysis to give a preliminary view of this study. To do so, this study analyzed a time series of prices in swordfish and blue shark markets.

1. Available data

We used landing data at the public fish market at the port of Kesen-numa from 1993 to 2006. Landings and landing values were recorded daily, which we then aggregated to monthly units. The amount of information contained within this data is not substantial, however we intend to use this data set to analyze the market preliminarily before moving to more complex and integrating market analysis with log-book and daily auction data for the off-shore longline fishery.

2. Model specification

One issue in the analysis of time series data is that it is often a result of compounded compounding time trends and seasonality. To address this we first obtained the stationary flow of price to eliminate the effect caused by seasonal change in demand, or seasonal availability of fish. Mathematically an equation detects the time trend expressed as:

(1) $P_t = \beta t + \tilde{P}_t$

where t denotes a deterministic time trend, $\tilde{P}_t$ denotes the price variable at time t, and β denotes the coefficient of the time trend. Secondly, we checked the seasonality effects on price:

(2) $\tilde{P}_t = c + \sum_{i=1}^{12} \alpha_i month_i$

where c and α denote constants and *month* denotes month dummy variables. After examining the effects on time and seasonality independently, we quantified a relationship of price and quantity with seasonal effects:

(3) $\ln(\tilde{P}_t) = \gamma_q \ln(Q_t) + \sum_{i=1}^{12} \delta_i month_i$

where Q_t denotes the quantity of the fish landing at time t, and γ and δ_i denote the coefficients of the quantity and month dummy, respectively. This estimation provides the stationary data.

(4) $P_t' = \ln(P_t - \beta t) + \gamma_j \sum \log D_j$

where D_j denotes the Quantity effect. P_t' denotes the stationary price variable. Next we estimated the effect of fishery regulation change, namely the fishing ground expansion in 1997, by the equation below:

(5) $P' = \overline{\mu} + \lambda D^+$

D^+ denotes fishery regulation changes differentiating before and after 1997. These equations were estimated using ordinary least squares (OLS).

3. Results

Descriptive statistics for the data are presented in Table 2. We first tested for the significance of time trends in the data. While there was no significant time trend in the price of swordfish, there was in the price of blue shark (Table 3). We thus included a time trend adjustment for the price of blue shark only. We estimated the effects of quantity (landing) changes on price change (Table5). Both swordfish and blue shark prices show significant changes and elasticity with quantity change. The coefficients of quantity change for swordfish and blue shark are -0.41and -0.12, respectively. These suggest that the price of swordfish is more sensitive to quantity changes than the price of blue shark. Finally, we estimated the effect of the 1997 fishery regulation change on price. While there are no significant effects on swordfish, we found some significance for blue shark prices (Table 6).

4. Concluding remarks

Our preliminary results suggest that swordfish and blue shark markets, which are supplied from the off-shore long line fishery, are heterogeneous in character. The price elasticity demonstrates that the swordfish market is sensitive to quantity, while the blue shark market might be affected by seasonality and fishery regulation changes. Further information should be collected and integrated to produce a more detailed overview of the swordfish and blue shark markets in the future.

References

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Table 1: The structural change in Kesen-numa market

	Swordfish	Swordfish	Swordfish	Blue shark	Blue shark	Blue shark	Total	Total
	Landings	Landing value	Unit price	Landings	Landing value	Unit price	Landings	Landing value
Year	MT	1000 USD	USD/MT	MT	1000 USD	USD/MT	MT	1000 USD
1989	6,361	44,600	7,011	10,477	14,415	1,376	131,831	318,981
1990	5,643	44,633	7,909	9,616	18,443	1,918	134,535	350,188
1991	4,102	39,388	9,602	11,123	23,465	2,110	149,044	315,432
1992	5,271	43,969	8,342	11,947	23,221	1,944	131,205	307,545
1993	5,193	40,605	7,819	13,261	22,574	1,702	138,711	276,631
1994	4,949	39,768	8,036	10,140	12,928	1,275	117,874	252,906
1995	4,913	39,267	7,992	10,371	13,249	1,278	123,952	254,331
1996	4,544	40,446	8,901	10,498	14,358	1,368	93,844	250,642
1997	4,728	43,612	9,224	13,128	21,949	1,672	140,657	306,442
1998	4,847	43,238	8,921	13,334	18,874	1,415	107,046	281,582
1999	4,806	38,322	7,974	14,991	21,468	1,432	112,740	290,252
2000	5,285	42,098	7,966	15,680	31,911	2,035	131,547	298,352
2001	4,561	40,359	8,849	15,953	27,399	1,718	128,780	285,686
2002	4,568	39,956	8,747	15,393	25,245	1,640	90,825	243,547
2003	4,400	34,284	7,792	15,250	22,698	1,488	109,067	215,495
2004	4,614	36,723	7,959	13,640	22,338	1,638	89,855	204,798
2005	4,507	38,344	8,508	12,980	23,284	1,794	119,162	217,121
2006	5,150	42,118	8,178	11,369	22,204	1,953	107,127	213,580

Table 2: The described statistics

		mean	std.dev
Swordfish	Price	860.07	120.41
Swordfish	Quantity	395,720	116,402.4
Blue shark	Price	167.99	39.97
Blue shark	Quantity	1,074,866	473,985.5

Table 3: Test for time trend significace

swordfish			blue shark		
parameter	estimate	significance	parameter	estimate	significance
time trend	2.63		Time trend	5.63	**
constant	839.01	**	constant	122.94	**

Table 4: Test for seasonality of the price data

swordfish monthly dummy			blue shark monthly dummy		
parameter	estimate	significance	parameter	estimate	significance
[1]d4	-17.95		d4	-5.34	
d5	-81.5		d5	1.09	
d6	-30.43		d6	-13.92	
d7	-124.51	**	d7	-23.92	*
d8	-138.12	**	d8	-21.84	*
d9	-116.32	**	d9	-26.02	*
d10	-89.97	*	d10	-29.3	**
d11	-134.06	**	d11	-15.82	
d12	-94.4	*	d12	8.44	
d1	-72.41		d1	16.6	
d2	-72.24		d2	12.18	
constant	941.06	**	constant	131.1	**

Table 5: Test for the quantity effect and its seasonality

swordfish			blue shark		
parameter	estimate	significance	parameter	estimate	significance
quantity	-0.41	**	quantity	-0.12	*
D4	-0.01	**	D4	-0.01	
D5	-0.02	**	D5	0	
D6	-0.02	**	D6	0	
D7	-0.03	**	D7	-0.01	
D8	-0.03	**	D8	-0.01	*
D9	-0.03	**	D9	-0.02	**
D10	-0.02	**	D10	-0.02	**
D11	-0.02	**	D11	-0.01	*
D12	-0.01	**	D12	0	
D1	-0.01	**	D1	0	
D2	-0.01	**	D2	0	
constant	12.22	**	constant	6.54	**

Table 6: Test for the significance of regulation dummy

swordfish			blue shark		
parameter	estimate	significance	parameter	estimate	Significance
[1]D+	0.01		D+	0.25	**
constant	6.81	**	constant	4.99	**