Evaluating Impacts of the Individual Quota on Fishing Patterns in the Purse Seine Fishery in Japan

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1. Background and Questions

Individual Quota (IQ) has received attention as a method for sustainable fish resources. Under the IQ management, total catch quotas are allocated to fishermen and vessels in advance, which reduces the necessity for fishermen to catch fish earlier than others and alleviates inefficient competition for fishing[1]. Although previous studies found that the IQ management enhanced productivity and fish prices in Japan[2], there is a limited number of studies examining how the composition of fish species caught under the IQ will change.

This study aims to evaluate how the IQ management affects fishing patterns in the context of the purse seine fishery in Japan. The Japan Purse Seiner's Association (JPSA), which comprises large-/medium-scaled firms catching fish in Japan's North Pacific Sea, East China Sea, and Sea of Japan by purse seine, voluntarily started to introduce the IQ management, allocating to its members total allocable catches for both horse mackerel and mackerel in January 2023. This transition to the IQ management allowed members in the JPSA to catch fish at their own pace, which may shift their interest toward other fish species than horse mackerel and mackerel.

2. Data and Method

In cooperation with the JPSA, we collect unique panel data, which provide daily information on amounts of fish caught during 2013-2023. We construct an unbalanced panel data comprising 19 firms with 30 fleets over this period. The sample size is 58,920. We examine whether the transition to the IQ management changes choices of fish species caught by fishermen (horse mackerel, mackerel, sardines, bluefin tunas, and yellowtails). For this purpose, we estimate a firm-/month-level fixed effects probit model with a year trend term below:

$$y^*_{ijd,f} = \alpha_{0,f} + \alpha_{1,f} IQ_d + \alpha_{2,f} \cdot t + \sum_{k=2}^{12} \beta_{k,f}\, month_{k,d} + \sum_j \gamma_{j,f}\, firm_j + \epsilon_{ijd,f}, \quad \cdots (1)$$

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where $y^*_{ijd,f}$ is a latent variable: $y^*_{ijd,f} > 0$ if fishing fleet i of firm j catches fish species f on operating day d, or $y_{ijd,f} = 1$; $y^*_{ijd,f} \leq 0$ if $y_{ijd,f} = 0$.

Table 1: Estimates of average partial effects and p-values in parenthesis ($* \, p < 0.1$; $** \, p < 0.05$; $*** \, p > 0.01$)

	Horse mackerel	Mackerel	Sardines	Bluefin tuna	Yellowtail
IQ_m	-0.04*** (0.00)	-0.04*** (0.00)	0.02*** (0.00)	0.01*** (0.00)	-0.02*** (0.00)

The variable of interest is IQ_d, which is equal to one for days after the IQ management was introduced in January 2023. We add a year trend term t in Equation (1). To control for seasonality within a year, we add $month_{k,d}$, a dummy variable for each month, with January as the baseline. To control for characteristics specific to each firm, we add $firm_j$, a dummy variable which is equal to one for each firm. The error term is denoted by $\epsilon_{ijd,f}$.

３. Results and Discussion

Table 1 displays estimation results of average partial effects of IQ_d. The probabilities of fleet's catching horse mackerel and mackerel significantly decrease after the introduction of the IQ management. In contrast, the probabilities of fleet's catching sardines and bluefin tunas significantly increase after the introduction of the IQ, although fishing fleets become less likely to catch yellowtails. Thus, the IQ management may have driven fishing firms to reducing the intensity of catching fish species covered by the IQ, while increasing their opportunities for catching other fish species such as sardines and bluefin tunas. These results suggest the possibility that the IQ management encourages shifts by fishing firms toward catching fish species that are not managed by the IQ.

References

[1] Kroetz, K., Sanchirico, J.N., Peña-Torres, J., & Novoa, D.C. (2017). "Evaluation of the Chilean jack mackerel ITQ system." *Marine Resource Economics,* 32(2), 217-241.
[2] Tsujita, T., Yagi, N., & Sakai, Y. (2022). "Industry-initiated catch limit management: The case of purse seine fishery in Japan's EEZ waters of the North Pacific Ocean". *Marine Policy*, 140, 105053.