Housing Market Capitalization of Freshwater Fisheries: Evidence from Oneida Lake, NY

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Human societies benefit in numerous ways from ecosystem services generated by fish populations, from recreational fishery to biodiversity and ecosystem health. Evaluating the economic values of fishery related ecosystem services would provide critical information for project evaluation and decision making, and serve as an important tool and indicator to engage relevant stakeholders to raise the awareness of the interdependence between nature and people

In this paper, we propose to quantify the economic value of freshwater lake fish species using the hedonic property value method (hereinafter Hedonic). The Hedonic model has been widely used to establish the linkage between water quality and its capitalization effect on the housing market The intuition underlying hedonic model is that property buyers' willingness to pay for environmental amenities, i.e., water quality and fish population would be captured in the housing sales prices (Bishop et al. 2020). Following Weng et al. (2020), our empirical framework identifies the capitalization effect of fish populations on the change in housing price premiums between lake-front and non-lake-front houses in response to fish population changes. Changing in fish populations would bring the biggest impacts to lakefront homeowners due to their year-around access to angling, boating, or visiting. To our knowledge this is the **first study** that utilizes the hedonic method to quantify the economic value of fish species, likely because of scant longitudinal fish population data that is necessary to identify a hedonic model.

There are several rationales to estimate a hedonic model for fish population. First, hedonic model enables us to quantify homeowners' revealed preference towards lake fishery, especially those who live within close vicinity of the resource. This is complementary to the preferences estimated from the travel cost approach, which focus on anglers travelling to specific recreational sites. Second, our approach enables the identification of capitalization effects of changing resources conditions. Relying on the exogenous data of fishing site conditions, our study avoids the classical endogeneity issue in the angler's survey, i.e., quality of fishing site conditions is judged by anglers, which correlates to anglers' willingness to pay. Third, by incorporating time varying fishery and water quality data, we could explore the joint impacts of water quality and fish populations, which would help to identify the driving ecosystem services of freshwater lakes and shed light on the essential management variables of lake management. Last, as indicated in (Kuwayama et al. 2022), the value considered in the hedonic model is more general, it calculates not only the direct amenity loss from water pollution of the lake, but also the loss in value of the recreational opportunity.

We use Oneida Lake in New York State, USA as a case study for exploring relationships between fish abundance and lakefront property values. Oneida Lake nurtures a diverse fish community and has seen a long history of recreational fishery activities. By leveraging a rich dataset of housing transactions of four counties in New York State, annual fish population observations of over 40 fish species, and spatially explicit water quality monitoring data, we are able to capture the spatial and temporal changes of fish population, water quality, and property values spanning nearly three decades (1990-2018). The rich data also enables us to explore several identification issues in hedonic estimation, including the spatial extent of fish population changes, estimation differences between full sample hedonic and repeated sales models, the impacts of water quality indicators in capturing economic values.

Our empirical results suggest a statistically significant capitalization effect for an increase warmwater gamefish, the main attraction for anglers in Oneida Lake. A one-standard-deviation

in the abundance of warmwater gamefish increases housing price by 8.8%. We find statistically negative effect for the abundance of coldwater gamefish, which more likely reflects the competition effect for suitable environments between coldwater and warmwater species. The effect of panfish population is statistically insignificant. Our results suggest that fish abundance generate significant economic values for lakefront homeowners: the aggregated capitalized value for a one-standard-deviation increase in warmwater gamefish amounts to $51.9 million.

This paper makes several contributions to the literature. First, this study quantifies the linkages between fishery population and nearby property values, the first to our knowledge. This complements existing literature on non-market valuation of recreational fishery using survey-based methods. Second, utilizing long-term observations on fish population, our paper provides one of the first estimates on the marginal value of varying fishery resource conditions. These complements existing studies using repeated travel cost surveys, while also offers insights on lake species conservation and management. Lastly, our results are useful in communicating the economic value generated by recreational fishing, especially from homeowners, which could bring significant impact on ecosystem management decisions.

Reference

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