

The Impact of Environmental Variability on Fishers' Harvest Decisions in Chile using a Multi-Species Approach

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Introduction

The distribution and abundance of marine resources are changing in response to environmental conditions such as global ocean warming (Poloczanska et al., 2013). Due to climate change, species distribution is expected to change in the future, reducing species availability in some areas but increasing in others. The literature that studies fishermen's responses to either changes in fish availability or policies that restrict access to fisheries (e.g., Stafford, 2018; Vasquez Caballero et al., 2023) has identified that fishers can adopt the following adaptive strategies: (i) fishermen can reduce or reallocate fishing effort, either to another species or to another location (Gonzalez-Mon et al., 2021), (ii) keep following the same strategy, or, (iii) in the worst-case scenario, stop fishing entirely and find alternative employment elsewhere (Powell et al., 2022). Among all those strategies, reallocating fishing efforts to other alternative species might be an effective adaptation strategy to climate change (Young et al., 2018). Diversification of target species has been associated with reducing income variability (e.g., Kasperski & Holland, 2013; Sethi et al., 2014) and increasing resilience to both climate shock (Cline et al., 2017; Fisher et al., 2021) and interannual oceanographic variability (Aguilera et al., 2015; Finkbeiner, 2015).

However, switching between species requires fishers to have the skills, the gear, and the permits to do so (Frawley et al., 2021; Powell et al., 2022). Moreover, even though a fisher may satisfy these requirements, diversification might not be possible (Beaudreau et al., 2019) as it might be constrained depending on port infrastructure, markets, and regulations (Kasperski & Holland, 2013; Powell et al., 2022). Therefore, deciding which adaptation strategy to take is not straightforward and would depend on many factors. Additionally, fishers might respond differently to an analogous situation as they have different goals, skills, and preferences (Jardine et al., 2020; Powell et al., 2022; Zhang & Smith, 2011).

References

Aguilera, S. E., Cole, J., Finkbeiner, E. M., Le Cornu, E., Ban, N. C., Carr, M. H., Cinner, J. E., Crowder, L. B., Gelcich, S., Hicks, C. C., Kittinger, J. N., Martone, R., Malone, D., Pomeroy, C., Starr, R. M., Seram, S., Zuercher, R., & Broad, K. (2015). Managing small-scale commercial fisheries for adaptive

- capacity: Insights from dynamic social-ecological drivers of change in monterey bay. *PLoS One*, 10(3), e0118992.
- Beaudreau, A. H., Ward, E. J., Brenner, R. E., Shelton, A. O., Watson, J. T., Womack, J. C., Anderson, S. C., Haynie, A. C., Marshall, K. N., & Williams, B. C. (2019). Thirty years of change and the future of alaskan fisheries: Shifts in fishing participation and diversification in response to environmental, regulatory and economic pressures. *Fish Fish*, 20(faf.12364), 601–619.
- Cline, T. J., Schindler, D. E., & Hilborn, R. (2017). Fisheries portfolio diversification and turnover buffer alaskan fishing communities from abrupt resource and market changes. *Nat. Commun.*, 8, 14042.
- Finkbeiner, E. M. (2015). The role of diversification in dynamic small-scale fisheries: Lessons from baja california sur, mexico. *Glob. Environ. Change*, 32, 139–152.
- Fisher, M. C., Moore, S. K., Jardine, S. L., Watson, J. R., & Samhouri, J. F. (2021). Climate shock effects and mediation in fisheries. *Proc. Natl. Acad. Sci. U. S. A.*, 118(2).
- Frawley, T. H., Muhling, B. A., Brodie, S., Fisher, M. C., Tommasi, D., Le Fol, G., Hazen, E. L., Stohs, S. S., Finkbeiner, E. M., & Jacox, M. G. (2021). Changes to the structure and function of an albacore fishery reveal shifting social-ecological realities for pacific northwest fishermen. *Fish Fish*, 22(2), 280–297.
- Gonzalez-Mon, B., Bodin, Ö., Lindkvist, E., Frawley, T. H., Giron-Nava, A., Basurto, X., Nenadovic, M., & Schlüter, M. (2021). Spatial diversification as a mechanism to adapt to environmental changes in small-scale fisheries. *Environ. Sci. Policy*, 116, 246–257.
- Jardine, S. L., Fisher, M. C., Moore, S. K., & Samhouri, J. F. (2020). Inequality in the economic impacts from climate shocks in fisheries: The case of harmful algal blooms. *Ecol. Econ.*, 176, 106691.
- Kasperski, S., & Holland, D. S. (2013). Income diversification and risk for fishermen. *Proc. Natl. Acad. Sci. U. S. A.*, 110(6), 2076–2081.
- Poloczanska, E. S., Brown, C. J., Sydeman, W. J., Kiessling, W., Schoeman, D. S., Moore, P. J., Brander, K., Bruno, J. F., Buckley, L. B., Burrows, M. T., Duarte, C. M., Halpern, B. S., Holding, J., Kappel, C. V., O'Connor, M. I., Pandolfi, J. M., Parmesan, C., Schwing, F., Thompson, S. A., & Richardson, A. J. (2013). Global imprint of climate change on marine life. *Nat. Clim. Chang.*, 3(10), 919–925.
- Powell, F., Levine, A., & Ordonez-Gauger, L. (2022). Climate adaptation in the market squid fishery: Fishermen responses to past variability associated with el niño southern oscillation cycles inform our understanding of adaptive capacity in the face of future climate change. *Clim. Change*, 173(1-2), 1.
- Sethi, S. A., Reimer, M., & Knapp, G. (2014). Alaskan fishing community revenues and the stabilizing role of fishing portfolios. *Mar. Policy*, 48, 134–141.
- Stafford, T. M. (2018). Accounting for outside options in discrete choice models: An application to commercial fishing effort. *J. Environ. Econ. Manage.*, 88, 159–179.
- Vasquez Caballero, S., Sylvia, G., & Holland, D. S. (2023). Fishery participation and location choice model: The west coast salmon troll commercial fishery. *Can. J. Fish. Aquat. Sci.*
- Young, T., Fuller, E. C., Provost, M. M., Coleman, K. E., St. Martin, K., McCay, B. J., & Pinsky, M. L. (2018). Adaptation strategies of coastal fishing communities as species shift poleward. *ICES Journal of Marine Science*, 76(1), 93–103.
- Zhang, J., & Smith, M. D. (2011). Heterogeneous response to marine reserve formation: A sorting model approach. *Environ. Resour. Econ.*, 49(3), 311–325.