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Bio-economic model of spatial fishery management in developing countries

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Introduction and objectives

- There are spatial dimensions to natural resource abundance.
- Sound management of spatial aspects is required for response diversity & ecosystem resilience.
- Objective: build a bio-economic model to analyze spatial interaction between domestic (i.e. inshore) fisheries and fleets from DWFNs (i.e. offshore) under UN Convention on the Law of the Sea (UNCLOS).

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The Model in Brief-I

- Basic framework
  - No harvest offshore

- An extension of the basic framework
  - Harvest offshore (under iso-perimetric constraint)
  - Offshore fisheries problem

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Some selected results

- Result One: Optimum steady state stock in inshore

$$d^* = \frac{1}{2} r$$

- Result Two: Spatial fisheries management policies:
  - *Landing tax for Natural Marine Reserve Offshore*

$$\tau^* = \begin{cases} 1 \\ \left(dp - pr + \sigma_2 r\right)\left(pd - pr\right)^{-1} \end{cases}$$

  - *Landing tax for Sustainable fisheries Offshore*

$$\tau^* = \frac{\sigma_1 dh_1^*}{px_1^{**2}\left(\delta - r + 2rx_1^{**}\right)\left(2rx_2^{**} + \delta + d - r\right)}$$

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An illustration

- EEZ of Ghana

- Granger causality tests on 3 commercial species:

- Round sardinella – causality from offshore
- Flat Sardinella – causality from offshore
- Chub mackerel – bi-directional causality

- Back-of-envelope computation of optimum landing tax: about16%.

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Conclusion

- Spatial externalities exist under the UNCLOS.
- The landing tax that internalizes the spatial externality depends on biological factors as well as socio-economic factors.