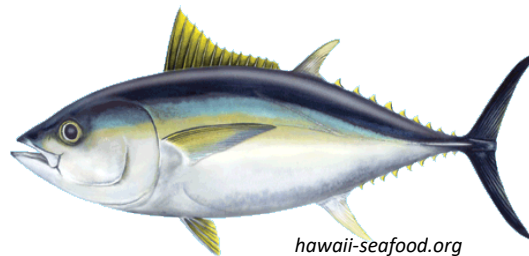


Transition Matrices from AOTTP Bigeye tuna (*Thunnus obesus*)

Benjamin Galuardi^{1,2,*}

Igor Arregui³, Nicolas Goni³, Marina Chifflet³,

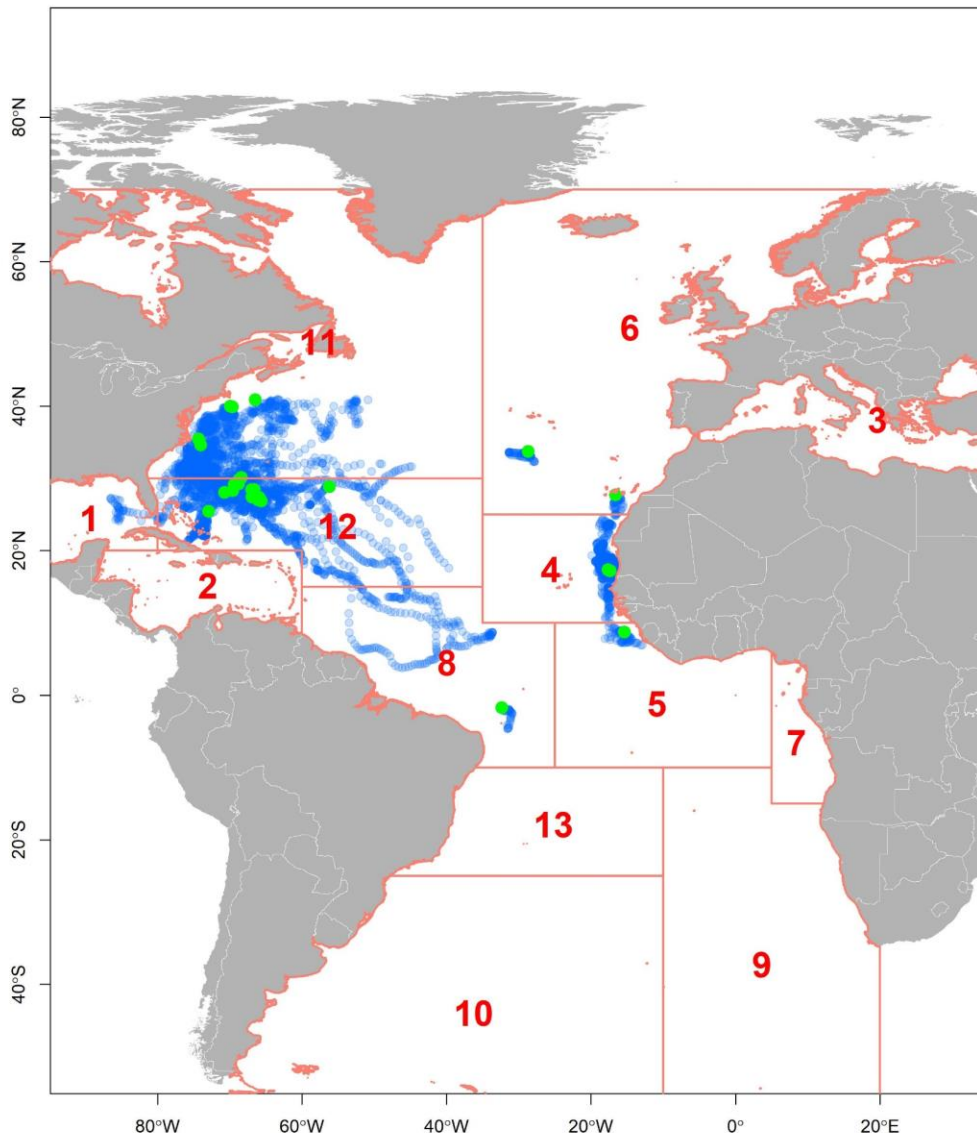
Chi Hin Lam⁴



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2. Greater Atlantic Regional Fisheries Office, NOAA, Gloucester, MA
3. AZTI Technalia, Marine Research division, Pasaia (Gipuzkoa), Spain
4. Large Pelagics Research Center, Gloucester, MA, USA



AOTTP Bigeye Electronic Tag data



33 tags (WC, MTI , Lotek archival)

2017-2020

W. Africa, Caribbean, Brazil, U.S., Azores

Days at liberty

Mean: 135

Max: 367 (3 MTI X-tags)

Total length:

Range: 98-168 cm

Mean: 141 cm



SatTagSim

- **R package** (<https://github.com/galuardi/SatTagSim/>)
- **Movement matrix derivation from electronic tags**
- **Alleviate movement estimation issues in spatially explicit models (operational, assessment etc.)**
 - Kerr et al. 2016 (CJFAS), 2017 (ICCAT), Morse et al. 2020 (IJMS)
- **Filling spatiotemporal data gaps using movement models that are informed by the available data**

$$\alpha_i = \alpha_{i-1} + c_i + \eta_i; i = 1, \dots, t_k$$

$$c_i = \begin{pmatrix} u \\ v \end{pmatrix}$$

$$\eta_i = N \sim (0, Q_i)$$

$$Q_i = \begin{pmatrix} 2D_t & 0 \\ 0 & 2D_t \end{pmatrix}$$



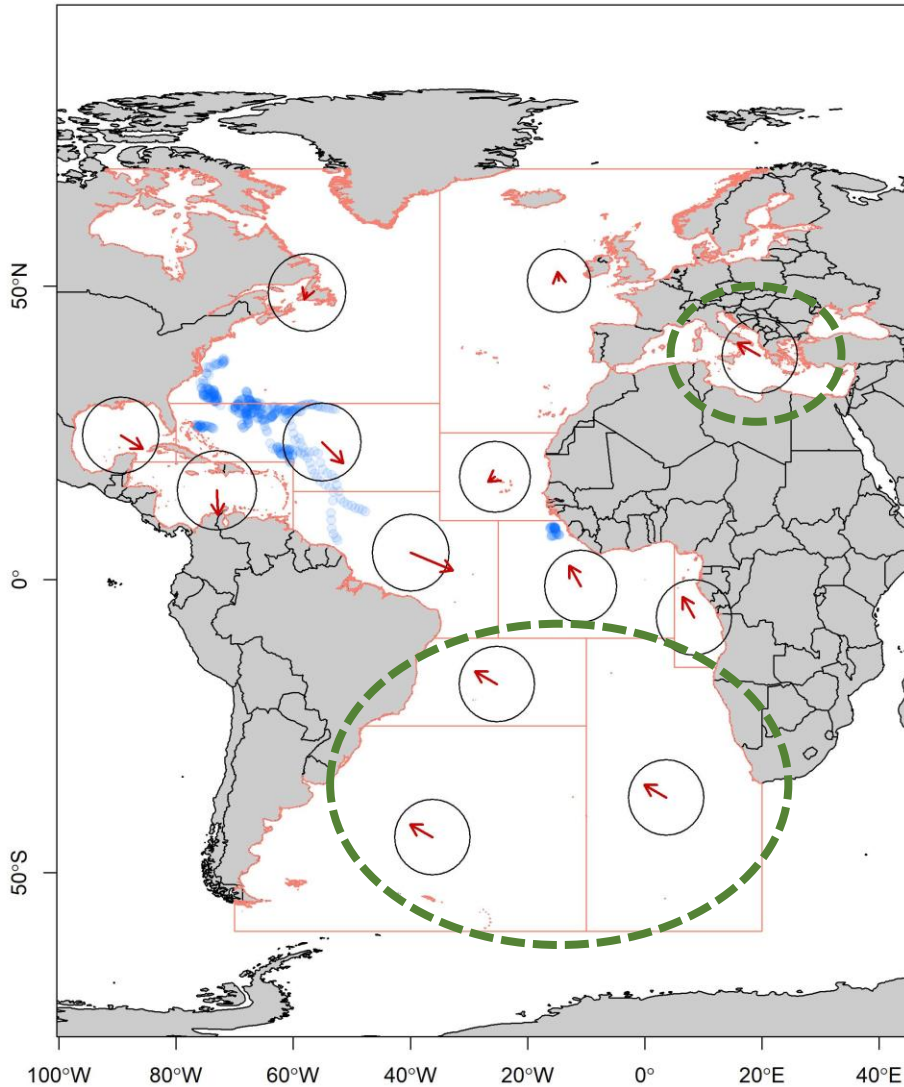
Simulation scheme

- Temporally explicit: Monthly advection/diffusion parameters (u , v , D) derived from electronic tags (Galuardi et al. 2014, 2018)
- Spatially explicit: 13 box ICCAT BET reporting areas
- 6,000 simulated tracks
 - 500 fish/month
 - 4 sim points/month
 - 4 year long tracks
- Distributions and transfer matrices
 - Seasonal
 - Yearly



ADR parameters

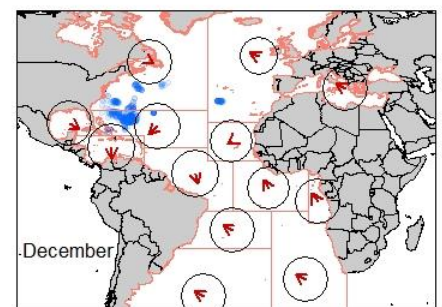
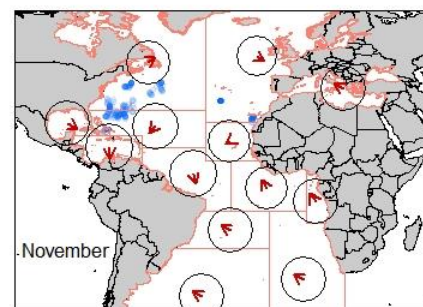
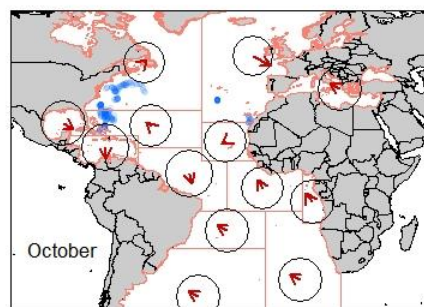
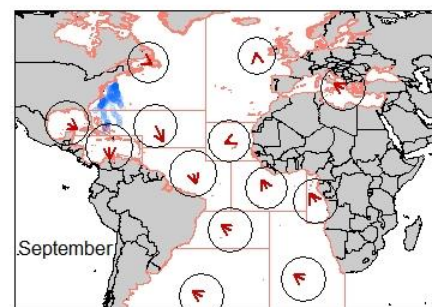
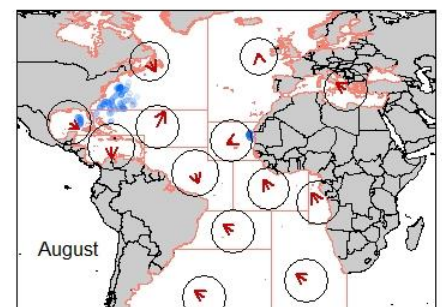
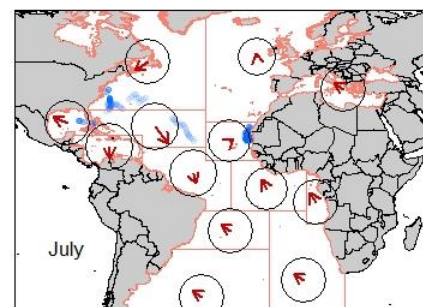
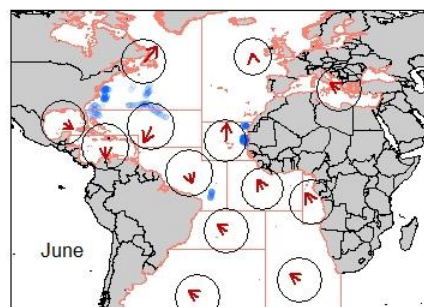
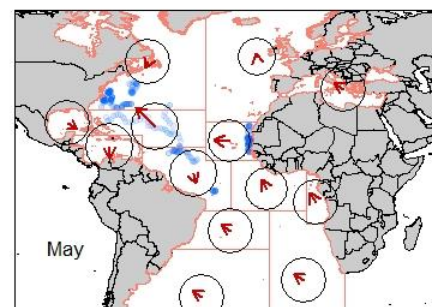
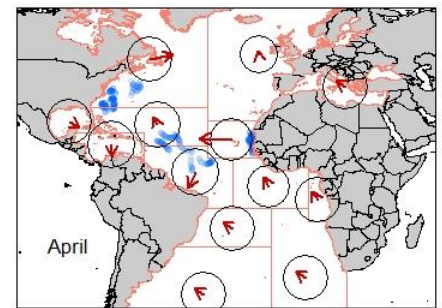
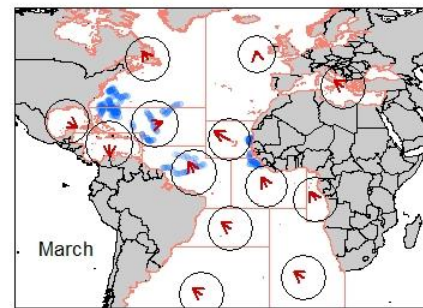
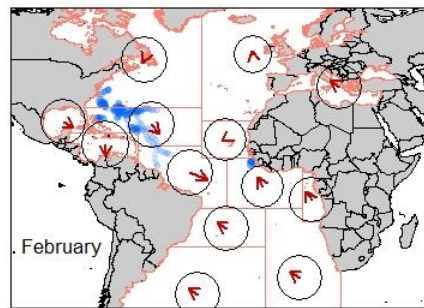
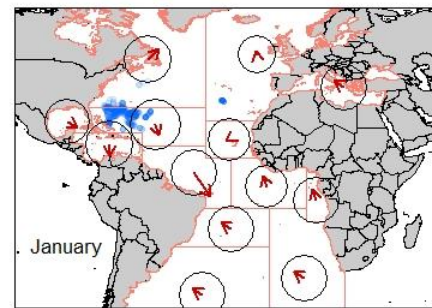
February



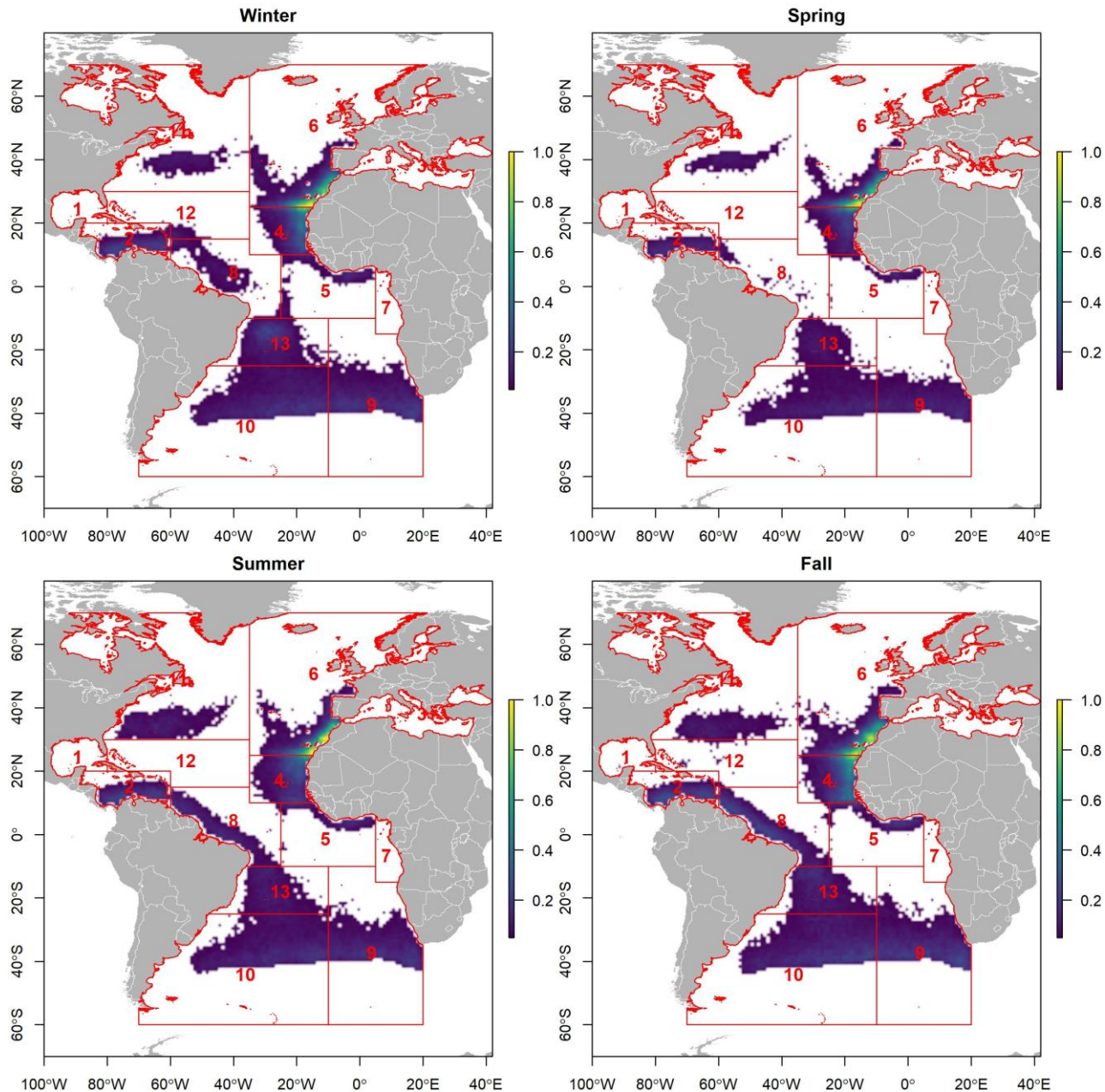
Months/areas without observations use global mean parameters



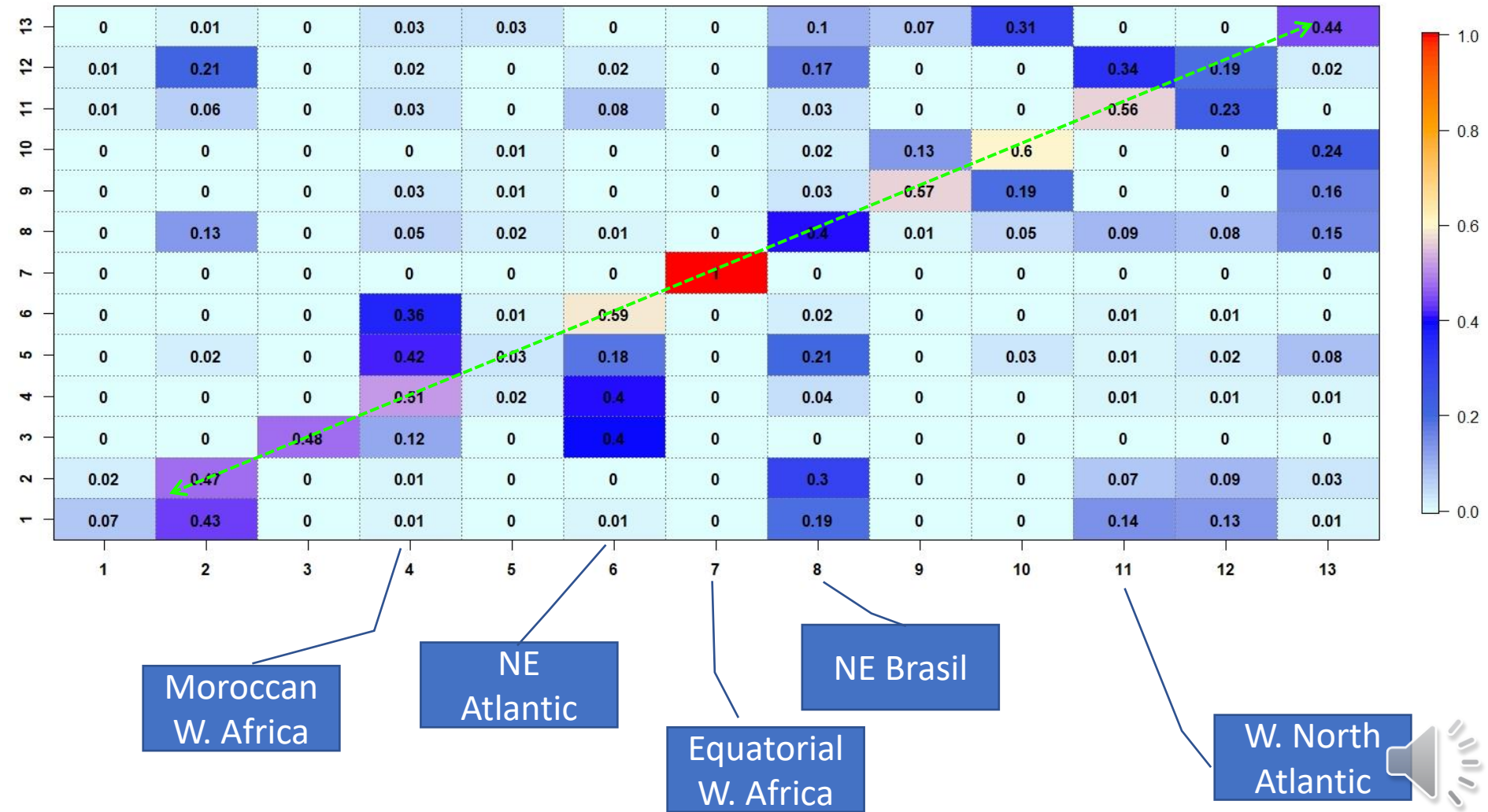
ADR parameters



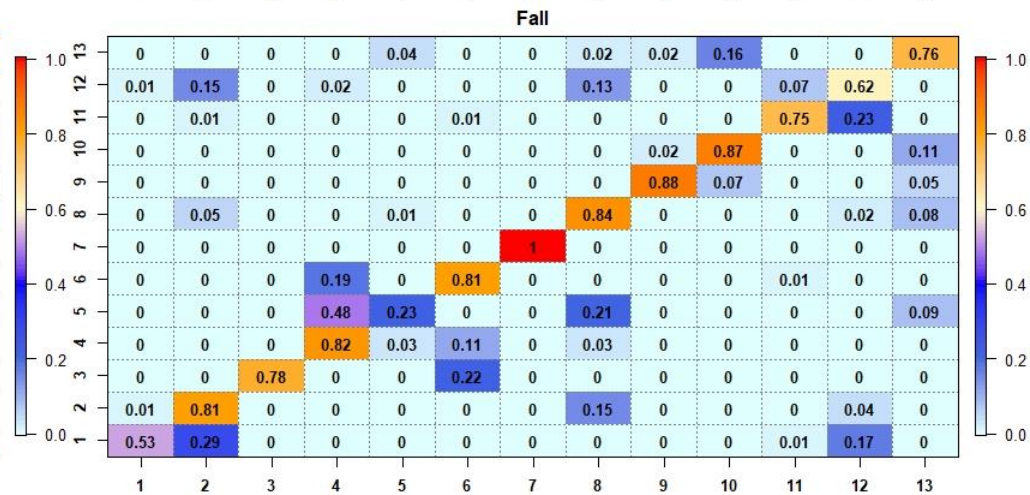
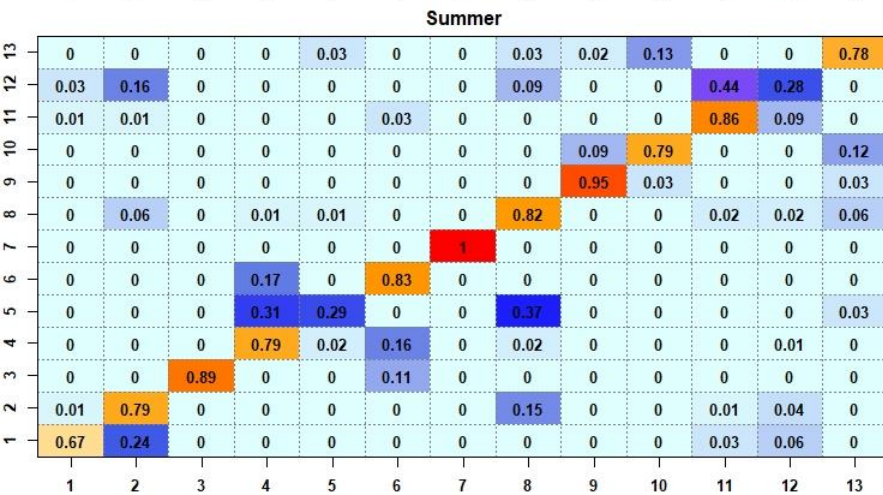
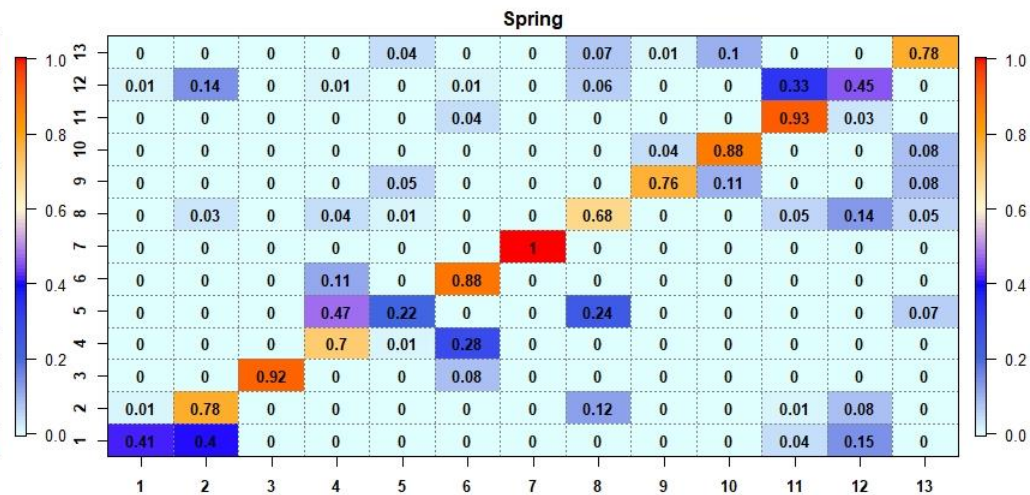
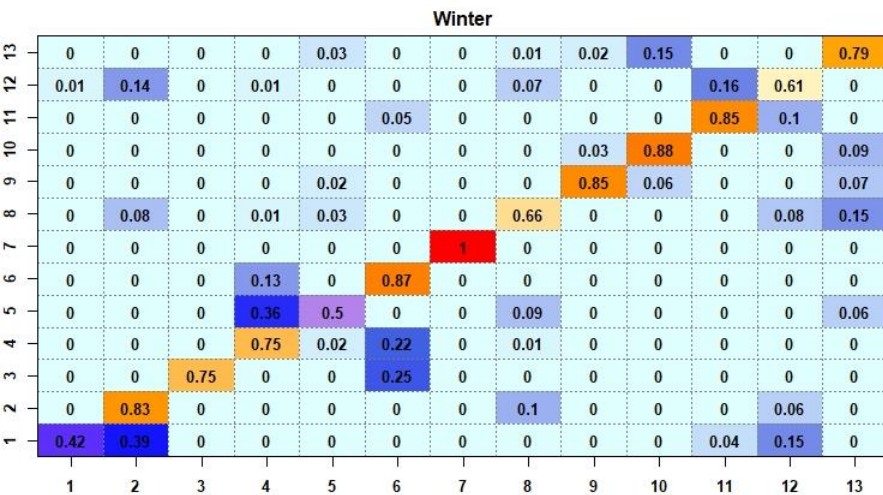
Sim Results: Seasonal



Movement matrix results: Annual



Movement matrix results: Seasonal



Next Steps

- **Results are preliminary!**
- **Results sensitive to input data and amount of stratification**
- **Use tag informed areas**
- **Compare with conventional tag attrition models**
- **AOTTP yellowfin**



Thank you!

AOTTP Tagging participants

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Kerr, L.A., Cadrin, S.X., Secor, D.H., and Taylor, N.G. 2016. Modeling the implications of stock mixing and life history uncertainty of Atlantic bluefin tuna. *Can. J. Fish. Aquat. Sci.* doi:10.1139/cjfas-2016-0067.

Galuardi, B., Cadrin, S.X., Kerr, L., Miller, T.J., and Lutcavage, M. 2014. Using electronic tag data to provide transition matrices for Movement inclusive population models. *ICCAT Col. Vol. Sci. Pap.* **71**(4): 1746–1756.

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