

STUDYING DISPLACEMENTS AND SIZE STRUCTURE OF TROPICAL TUNA SPECIES (BIGEYE, SKIPJACK AND YELLOWFIN) BETWEEN THE SENEGALESE EEZ AND ADJACENT WATERS

SCRS/P/2021/XXX

Kamarel Ba, Fambaye Ngom Sow

Centre de Recherches Océanographiques de Dakar-Thiaroye (CRODT)
(Senegal)

Symposium AOTTP, January 12-14 2021

Introduction

- The conventional tag release-recapture database (July 2016 to October 2020) used in this work was built up during the AOTTP program.
- Our presentation aims to study the displacements and size structure of the main tuna species (bigeye BET, skipjack SKJ, yellowfin YFT) between the Senegalese EEZ and the adjacent waters by using all useful information available on the database.
- The information extracted from the database is in a format that allows mapping of the species distribution and migration, in which two areas were defined : inside Senegalese EEZ and outside Senegalese EEZ.

Materials and methods

The minimum distance covered d (in Nm) was calculated by measuring the length of a straight line between the tagging position (re) and the recapture position (rc) (Arrizabalaga et al. 2002) using the following equation :

$$d = \cos^{-1}(\sin(lat_{re}) \times \sin(lat_{rc}) + \cos(lat_{re}) \times \cos(lat_{rc}) \times \cos(lon_{re} - lon_{rc})) \times \frac{R}{1.852}$$

R , the radius of the Earth is estimated at $R = 6378.145$ km.

The azimuth A taken by the fish once released in water was calculated using the formula :

$$A = 2 \times \arctan\left(\frac{y}{\sqrt{x^2 + y^2} + x}\right)$$

$$x = \cos(lat_{re}) \times \sin(lat_{rc}) - \sin(lat_{re}) \times \cos(lat_{rc}) \times \cos(lon_{rc} - lon_{re})$$

$$y = \sin(lon_{rc} - lon_{re}) \times \cos(lat_{rc})$$

Time at liberty corresponds to the difference between tagging and recovery dates; while the swimming speed is the ratio of distance to the time at liberty in hour.

The individuals considered in the analyses were those that exceeded 30 days of liberty and was either tagged or recaptured in the Senegalese EEZ; and statistical analyses were also performed on fish lengths.

Results

112 073 specimens of tropical tunas (YFT = 40 992, BET = 24 089 and SKJ = 46 992) were tagged and recaptured in the Atlantic

Overall, after 30 days of liberty:

YFT: 6042 tagged, 5586 recaptured

BET: 3284 tagged, 3032 recaptured

SKJ: 1837 tagged, 1630 recaptured

Tagged or recaptured in the Senegalese EEZ:

YFT: 659 individuals

BET: 327 individuals

SKJ: 315 individuals

Inside Senegalese EEZ:

YFT: 424 tagged, 368 recaptured

BET: 235 tagged, 165 recaptured

SKJ: 230 tagged, 134 recaptured

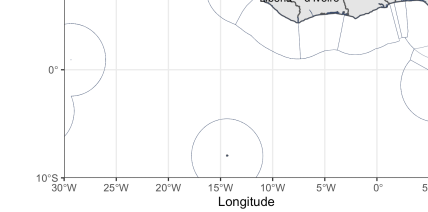
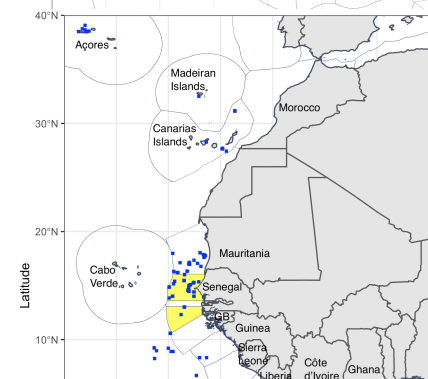
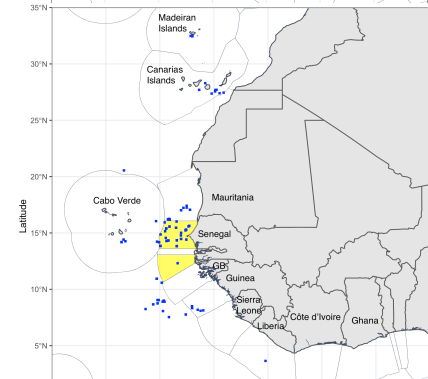
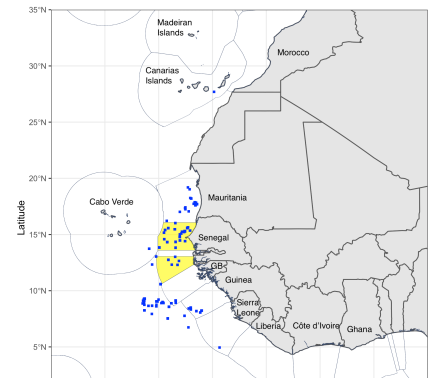
Tagged and recaptured Senegalese EEZ:

YFT: 111 individuals

BET: 55 individuals

SKJ: 36 individuals

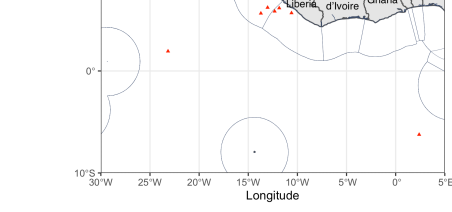
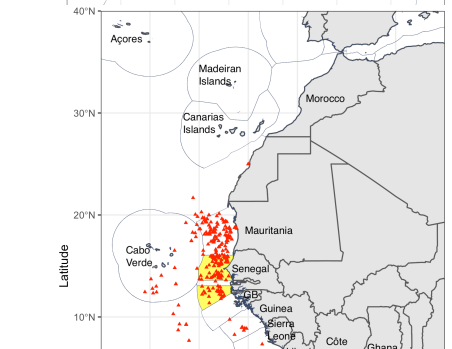
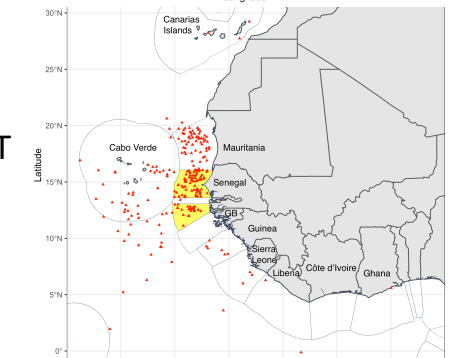
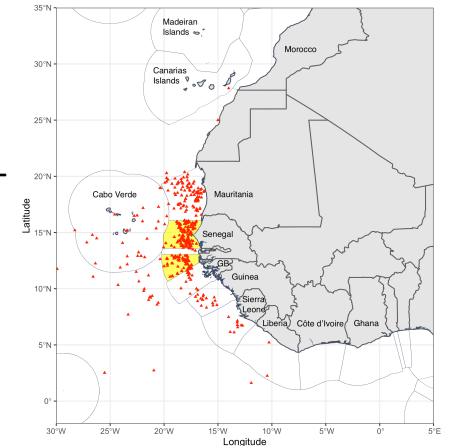
Tag and recapture positions in relation with Senegalese EEZ



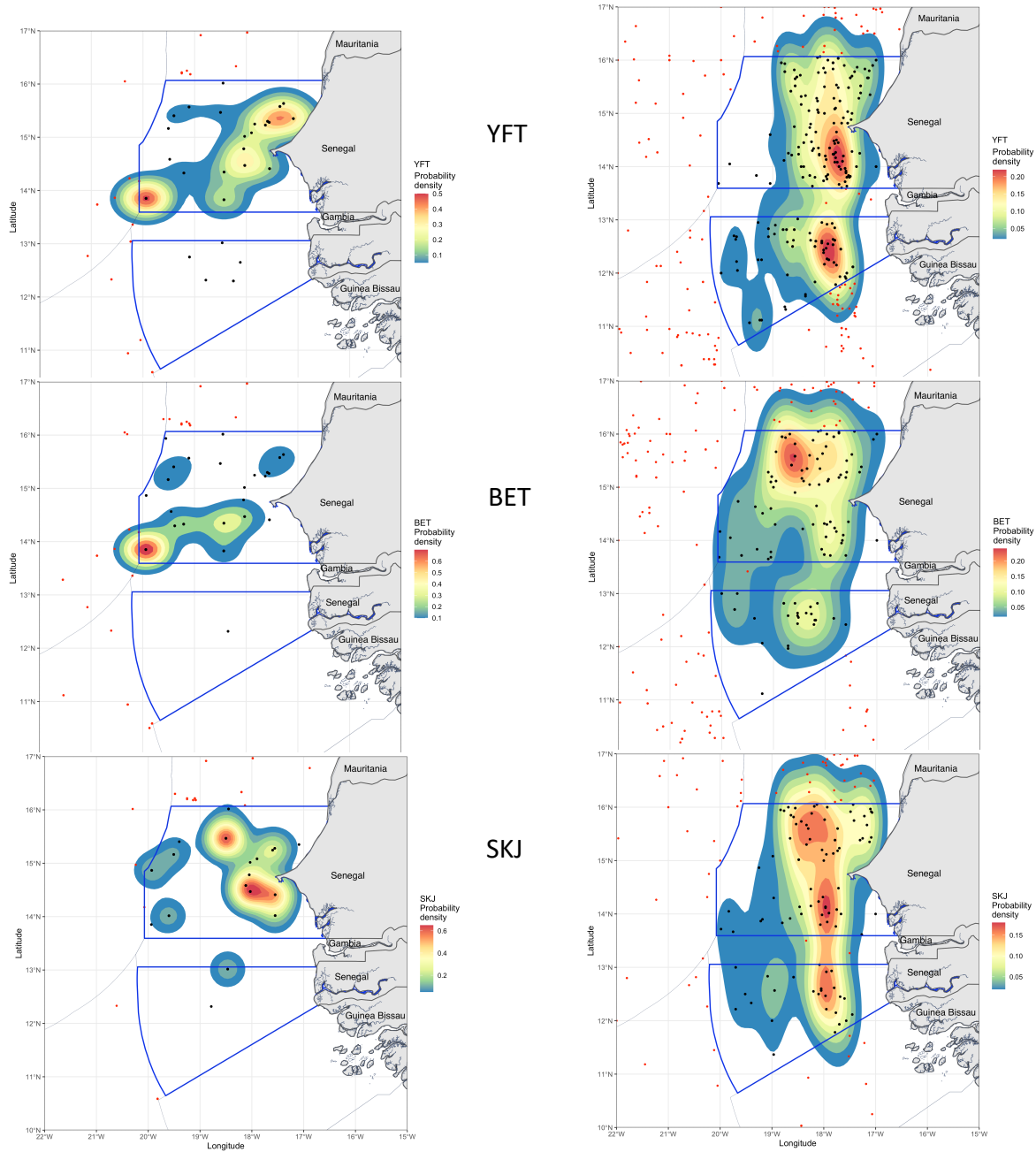
YFT

BET

SKJ

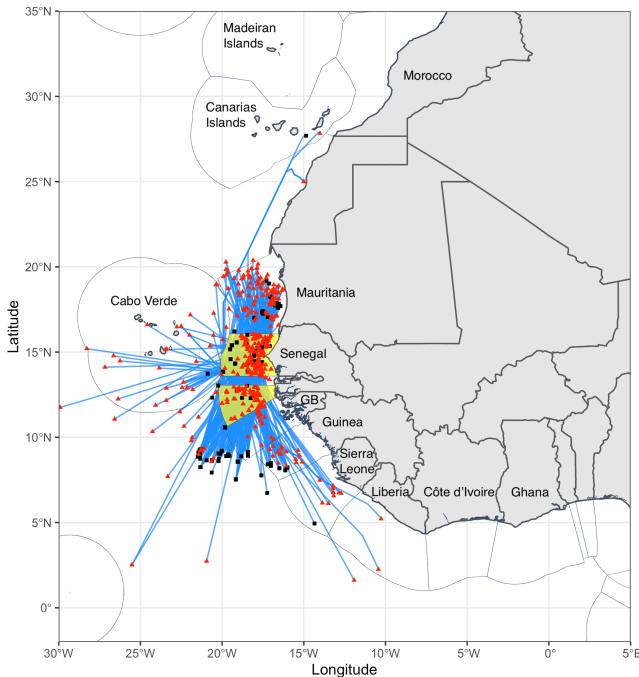


Probability density of tagged (left panel) and recaptured (right panel) specimens inside Senegalese EEZ

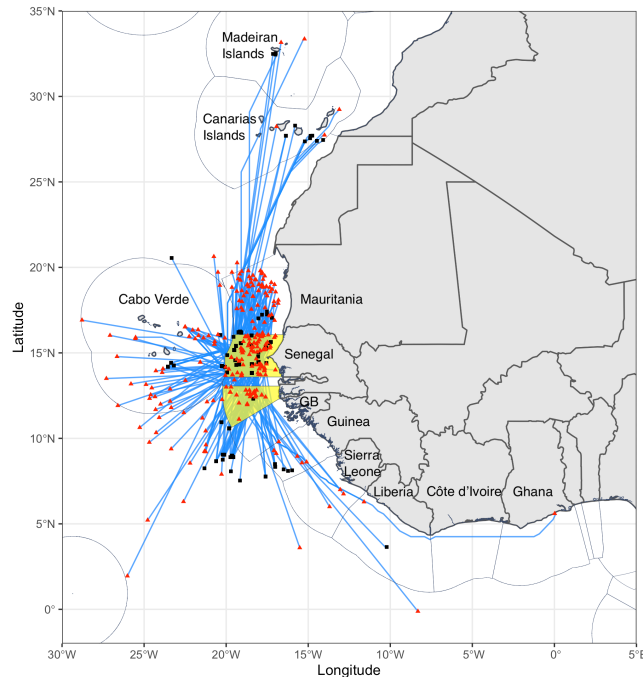


Trajectories and distances (blue lines) covered by tagged (black squared dots) or recaptured (red triangle dots) tropical tunas in the Senegalese EEZ

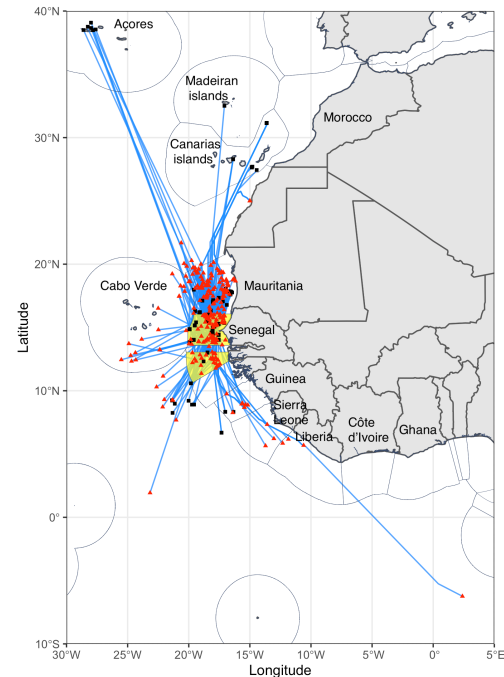
YFT



BET

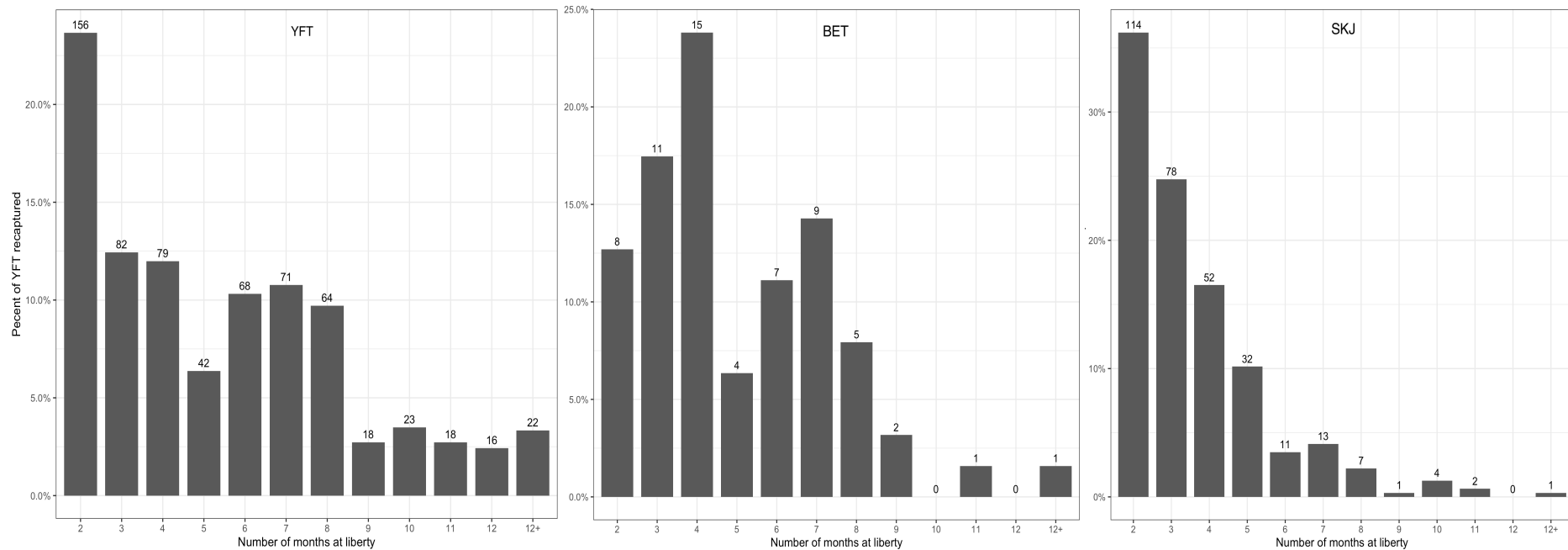


SKJ



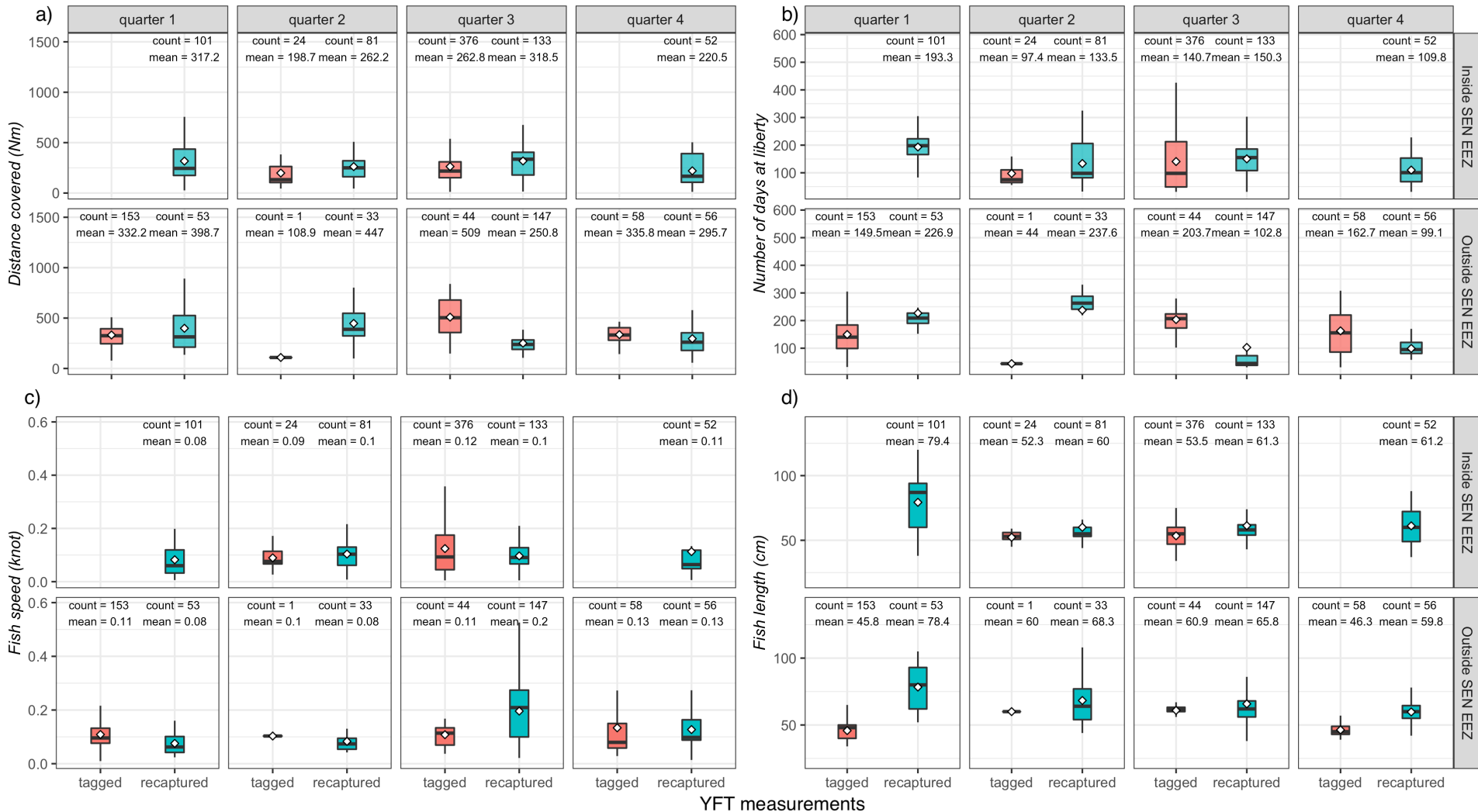
For the three species, the individuals that were either tagged or recaptured in the Senegalese EEZ, swam long distances from north to south and west to east Senegal, vice versa. However, our results didn't demonstrate transatlantic migrations although great distances covered and long time at liberty.

Time at liberty of tagged and recaptured individuals of tropical tunas

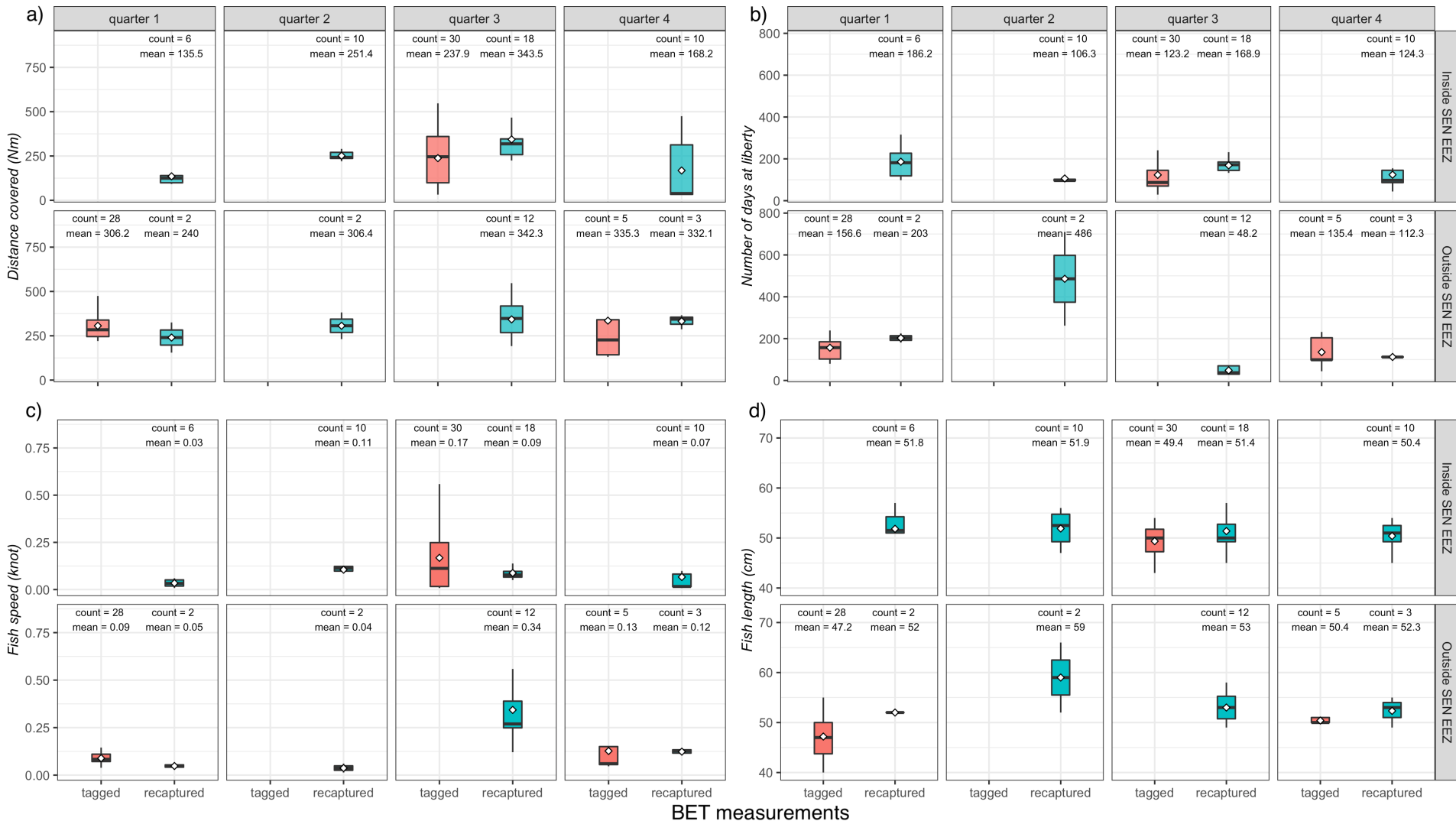


Once tagged, almost all of individuals of each species were recaptured 12 months later except for some, but the number decreases as the time of liberty increases. Half of tagged individuals has been recaptured after six months of liberty.

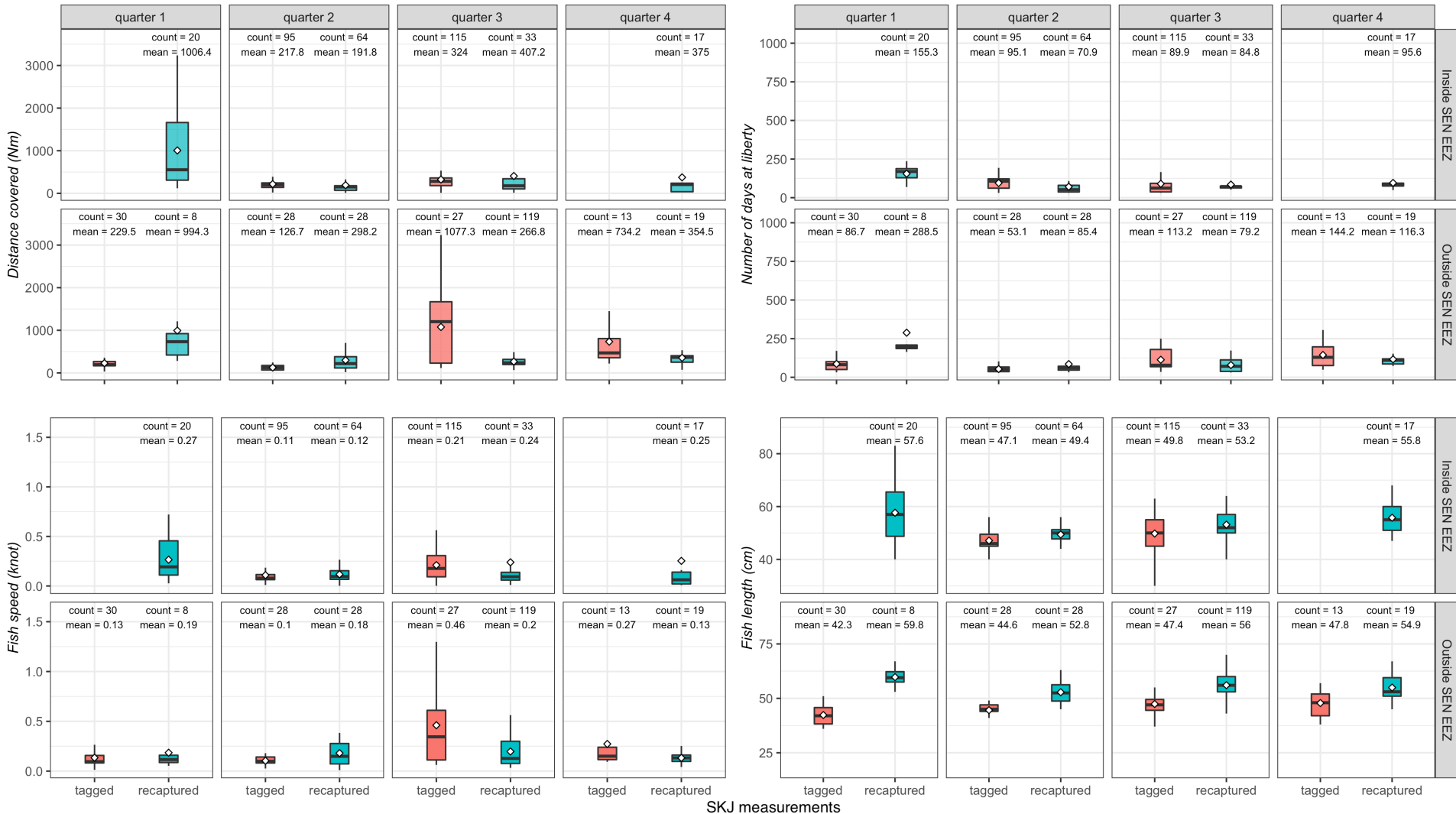
Distance covered (a), Number of days at liberty (b), speed (c) and length (d) of tagged and recaptured YFT inside/outside Senegalese EEZ



Distance covered (a), Number of days at liberty (b), speed (c) and length (d) of tagged and recaptured BET inside/outside Senegalese EEZ

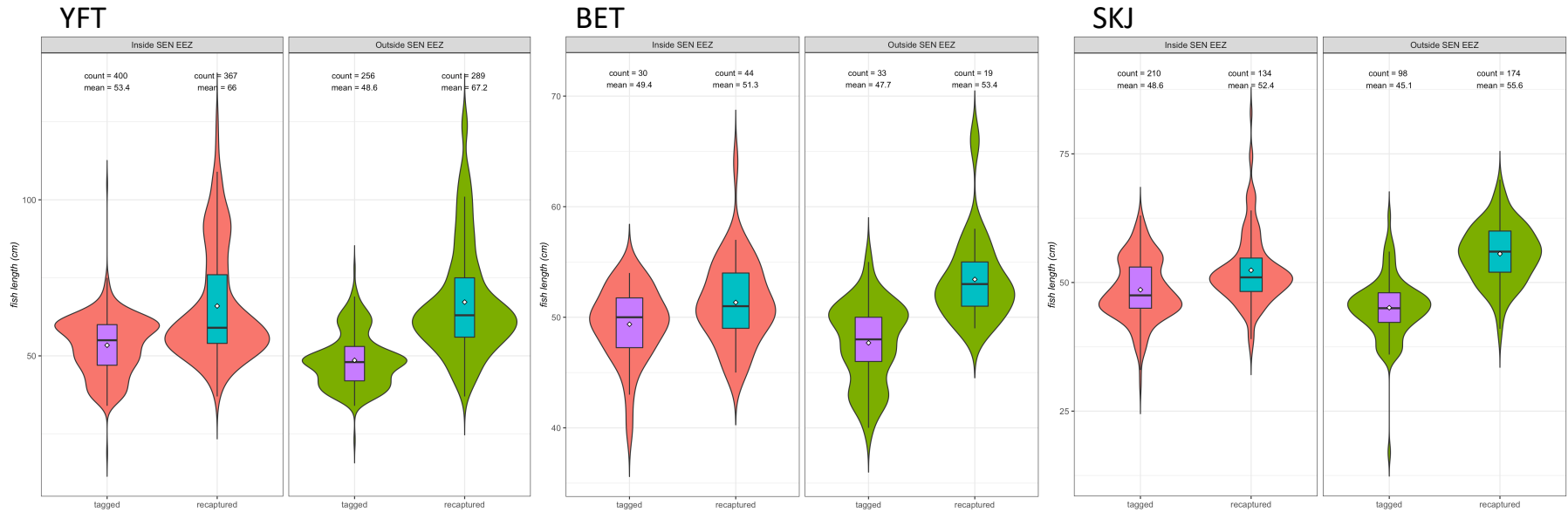


Distance covered (a), Number of days at liberty (b), speed (c) and length (d) of tagged and recaptured SKJ inside/outside Senegalese EEZ



SKJ measurements

Tagged and recaptured fish length by area: inside (salmon color) and outside (lemon green color) the Senegalese EEZ

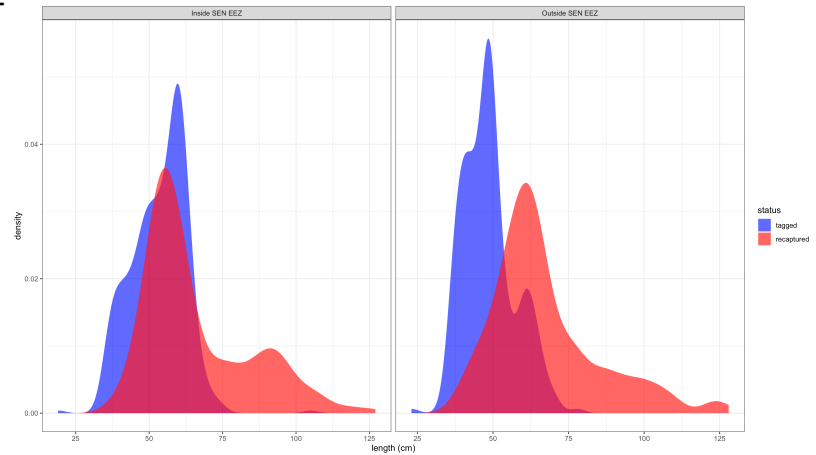


For each species, recaptured individuals were greater in size than those tagged whether inside or outside Senegalese EEZ. Specimens that were tagged outside Senegalese EEZ were smaller in size than those tagged inside; contrarily for the recaptured specimens. However, these differences were not significant ($p > 0.05$)

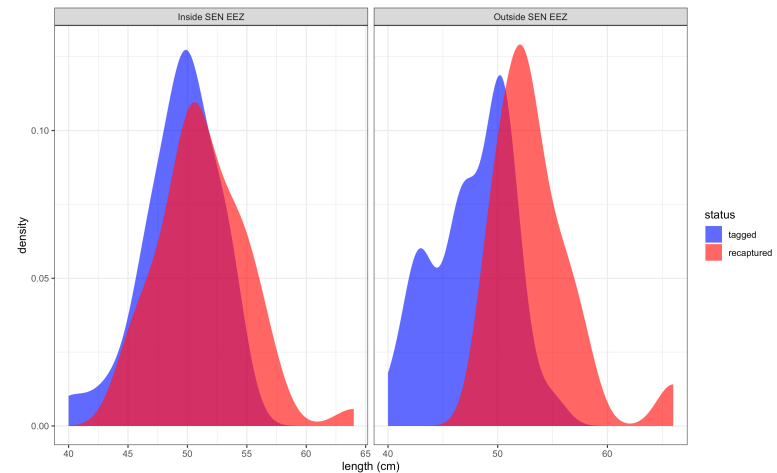
Size structure of tagged (blue) and recaptured (red) individuals inside and outside Senegalese EEZ

- ❖ Statistical tests showed that none of the species length were normally distributed.
- ❖ Non parametric Wilcoxon paired test applied for individuals tagged then recaptured for each species showed that recaptured specimens were significantly greater than those tagged whether inside or outside Senegalese EEZ.
- ❖ Comparison of lengths between areas for the same status (tagged inside vs. tagged outside or recaptured inside vs. recaptured outside) did not result in significant difference in length

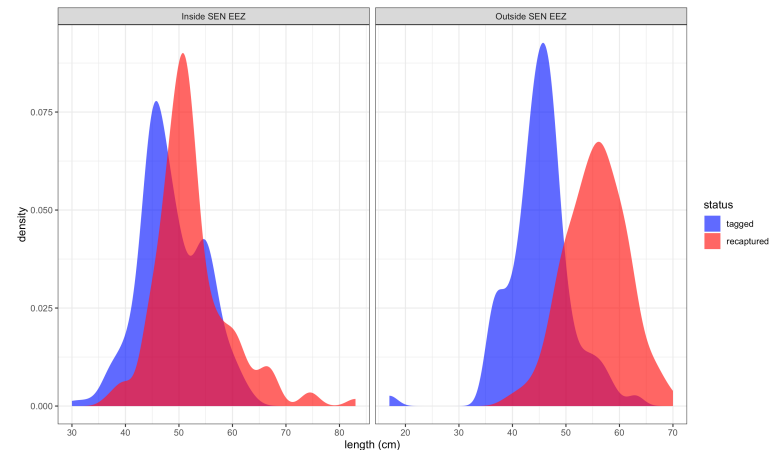
YFT



BET



SKJ



Conclusion

In our presentation, we showed the three main tropical tunas that were either tagged or recaptured in the Senegalese EEZ:

- (1) could stay at liberty for a year,
- (2) travel long distances from North (the Azores, Madeiran or Canarias islands) to South (the Equatorial latitude) and from West (Cabo Verde) to East (Senegalese EEZ),
- (3) the main fish concentration was between Mauritania and Guinea
- (4) obviously, there were no differences in fish length between areas (inside vs. outside), but the recaptured specimens were greater in size than those tagged.

All these results suggest a wider study to better understand tropical tunas behavior (migration and reproduction patterns), growth, abundance, mortality and stocks identity to help fisheries managers to achieve sustainability of these internationally shared resources.