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2009/B:15

Simulated archival tagging programme for albacore tuna in the North East Atlantic including an analysis of factors affecting tag recovery



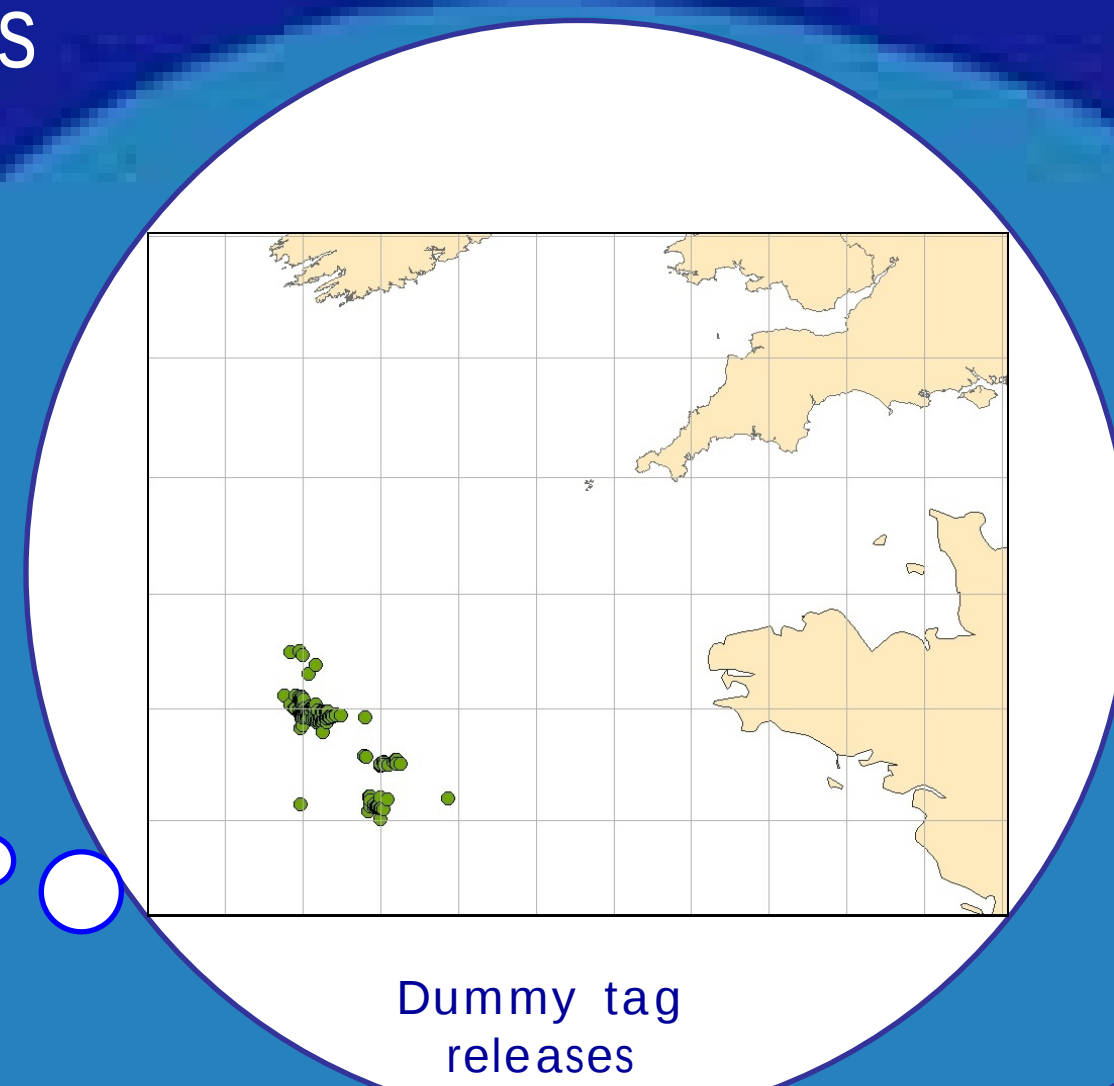
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Introduction

With annual landings worth approximately €60 million, albacore tuna (*Thunnus alalunga*) is a highly commercially important species in the North Atlantic. Stock status has declined in recent years, however, with the latest stock assessment categorising the stock as over-fished. Very little information is available on the behaviour of fish in relation to environmental variables, and evidence of the existence of sub populations within the North Atlantic is increasing. These issues which have major implications for the stock assessment process could be addressed by electronic tagging but no information is available on the survivability of albacore tuna carrying archival tags. This study aimed to assess the physiological capability of juvenile albacore to carry archival tags. Also, an ICCAT conventional tag database was analysed to examine factors at the point of release which affect recovery, which could boost recovery rates in future tagging programmes



Methods

1. Dummy tagging

- 353 releases with dummy tags in 2005 and 2006
- Irish trolling vessels 200 – 300 miles ssw of Ireland
- Dummy tags: epoxy resin, lead shot and fishing line
- €200 reward

2. Factors affecting recovery

- Database of 13 187 conventional releases with 1484 recaptures
- Binary logistic model applied to factors at the time of release unaffected by differences in rewards: Fish length, fishing gear (trolling or baitboat), month, effort
- Model applied to 2 datasets in order to deal with association between fishing gear and effort

$$\theta = \frac{e(\alpha + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_i x_i)}{1 + e(\alpha + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_i x_i)}$$

θ = probability of recapture,
a = the constant of the equation
b = the coefficient of the predictor variables

Dataset 1: Randomly reduced baitboat releases in high effort years to match low effort years (106)

W	Baitboat releases	Trolling releases	Total effort index (days)
Year			
1983		277	5 304
1984		192	5 932
1985		139	5 307
1986	106	103	6 290
1988		489	12 882
1989	2 969	40	14 679
1990	4 515	57	13 088
1991	4 113	187	12 265

Dataset 2: Restricted to years 1988 - 1991

Binary logistic regression

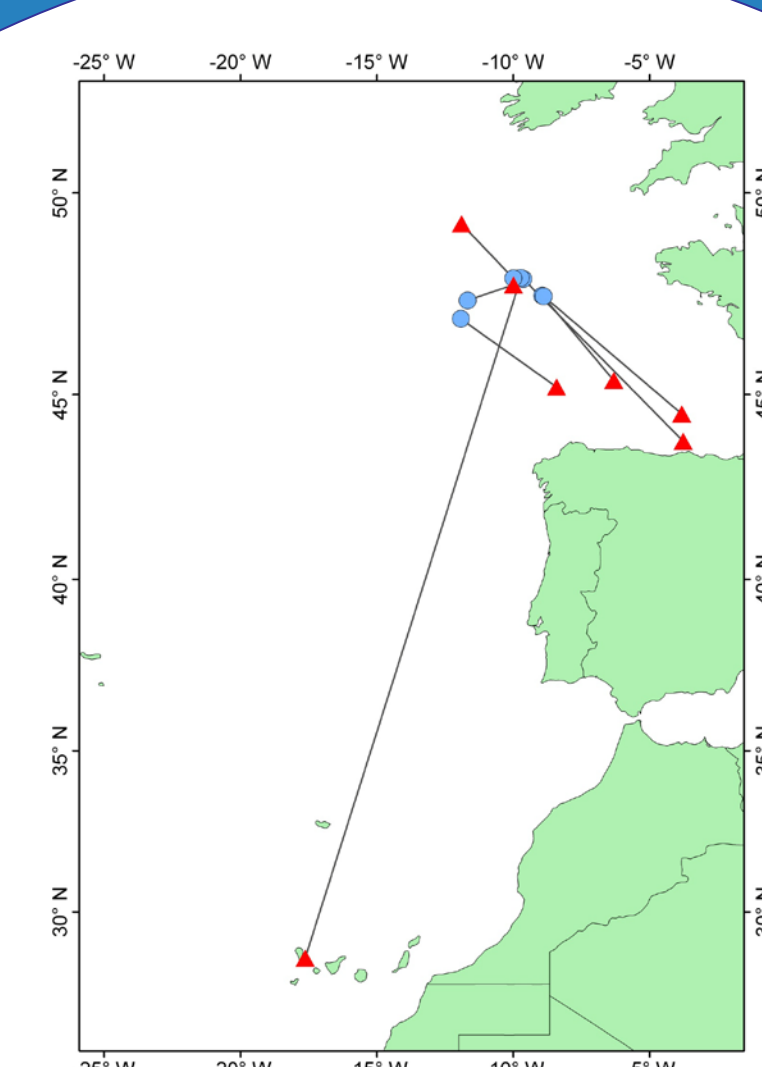
Reference Parameter	Estimate	S.E.	Z	P-value	Odds Ratio	95% bounds Lower	Upper	AIC
Dataset 1								
Constant	-3.7	0.51	-7.22	<0.001				686.3
Effort (High)	-0.59	0.23	-2.56	0.01	0.55	0.35	0.87	683.2
Bait Boat	1.12	0.52	2.16	0.031	3.05	1.11	8.42	678.8
Dataset 2								
Constant	-2.9	0.13	-23	<0.001				3477.6
<55cm	-0.97	0.16	-5.93	<0.001	0.38	0.27	0.52	3449.6
55cm – 64cm	-0.52	0.14	-3.61	<0.001	0.59	0.45	0.79	
75cm – 84cm	-0.72	0.28	-2.52	0.012	0.49	0.28	0.85	
>84cm	-0.65	0.53	-1.23	0.218	0.52	0.19	1.47	
Bait Boat	1.03	0.15	6.67	<0.001	2.79	2.07	3.78	3415.5

Dataset 1: Gear and effort significant, Fish twice as likely to be captured in high effort years

Dataset 2: Gear and fish size significant, Fish in 65 – 74 cm length class caught by trolling highest probability of recapture

Results

Dummy tag recaptures



- 9 fish recaptured – 2.5% recovery rate
- 8 out of 9 fish > mean size of all fish when released
- Mean period of liberty 545 days
- Mean straight line distance travelled 859 km
- Mean growth rate of 8.07 mm month⁻¹

Conclusions

- Despite higher rewards, a lower recapture rate was observed for dummy archival tagged fish (2.5%) compared to conventional tagged fish (7%) tagged under similar conditions (troll caught, high effort years).
- The times at liberty, distances travelled and growth of recaptured dummy archival tagged fish were comparable to conventional tagged fish. This suggests that for fish which survive the implantable tagging technique, impacts on behaviour and physiology are no greater than conventional tagging
- Fish length and gear type were significant factors in the model which can be experimentally controlled. A 5% recovery rate is predicted if fish of 65 – 74 cm FL caught by trolling are tagged in future programmes.
- Tagging fish of 65 – 74cm FL (age 2 &3) is appropriate for advancing knowledge of sub populations of juvenile fish. Recaptures of age 2 -5 fish will provide a reasonable size range for analysis of behaviour in relation to environmental variables. Exclusion of larger fish in future archival tagging programmes would be justified by the increased probability of recapture and cost effectiveness of tagging smaller fish.

Acknowledgements: This work was funded by the Irish and Basque Governments and part-financed by the European Union under the Irish National Development Plan 2000-2006 through the Supporting Measures in the Fisheries Sector.

