

**Problem Chosen**

**A**

**2020  
MCM/ICM  
Summary Sheet**

**Team Control Number**

**# 2010755**

---

**XXX**

**Summary**

## Contents

1	Introduction . . . . .	1
2	Assumption . . . . .	1
3	M1 . . . . .	2
4	M2 . . . . .	2
5	M3 . . . . .	2
6	Strengths and Weaknesses . . . . .	2
6.1	Strengths . . . . .	2
6.2	Weaknesses . . . . .	2
7	A Letter . . . . .	2
8	First appendix . . . . .	3

## 1 Introduction

## 2 Assumption

There are some symbols appear in the model. We show them below:

Table 1: Symbols in Chapter 3

Symbols	Description
$i$	Station variable
$DS_i$	Density of fish( mackerel or herring) at station i ( $kg/km^2$ )
$H_i$	Horizontal opening of trawl at station i ( $km$ )
$TD_i$	Distance of the trawl haul ( $km^2$ )
$C_i$	Catch at station i( $kg$ )
$\lambda_i$	Longitude at station i ( $^{\circ}W$ )
$\phi_i$	Latitude at station i ( $^{\circ}N$ )
$SST_i$	Sea Surface Temperature at station i ( $^{\circ}C$ )
$z_i$	Zooplankton's dry weight at station i ( $kg$ )
$SSB_i$	Spawning-stock biomass at station i
$b_i$	Number of biological species at station i
$y$	Year
$j$	Rectangular number
$t$	Time
$M_j(t)$	State of the $j_{th}$ rectangle at time $t$
$P_{M_w, M_k}$	Transition probability for the State $M_w$ changing into State $M_k$

Table 2: Symbols in Chapter 4

Symbols	Description
$B$	Backshift operator

Table 3: Symbols in Chapter 5 &amp; 6

Symbols	Description
$CPUE_y$	Catch Per Unit Effort in year $y$

### 3 M1

### 4 M2

### 5 M3

## 6 Strengths and Weaknesses

### 6.1 Strengths

### 6.2 Weaknesses

## 7 A Letter

### MEMORANDUM

**TO:** Hook Line and Sinker

**FROM:** Team #2010755

## References

- [1] Olafsdottir, A. H., Utne, K. R., Jacobsen, J. A., Jansen, T., Óskarsson, G. J., Nøttestad, L., ... & Slotte, A. (2019). Geographical expansion of Northeast Atlantic mackerel (*Scomber scombrus*) in the Nordic Seas from 2007 to 2016 was primarily driven by stock size and constrained by low temperatures. *Deep Sea Research Part II: Topical Studies in Oceanography*, 159, 152-168.
- [2] Wu shengnan, Chen xinjun, & liu zhonan. (2019). Prediction model of Japanese mackerel resource abundance in the northwest Pacific based on GAM. *Acta oceanologica sinica*, 41(8), 36-42.
- [3] <http://ecosystemdata.ices.dk/Map/index.aspx?Action=AddLayer&TAXA=6799&YEAR=2017&Grid=-1&Color=random&Type=Count>

- [4] Nøttestad, L., Anthonypillai, V., Tangen, Ø., Høines, A., Utne, K. R., Oskarsson, G. J., ... & Jansen, T. (2016). Cruise report from the International Ecosystem Summer Survey in the Nordic Seas (IESSNS) with M/V M. Ytterstad, M/V Vendla, M/V Tróndur Gøtu, M/V Finnur Fróðland R/V Arni Friðriksson, 1-31.
- [5] Zhang yunquan, zhu yaohui, li cunlu, feng renjie, & ma lu. (2015). Implementation of generalized additive model in R software. *China health statistics*, 32(6), 1073-1075.
- [6] Li dewei, zhang long, wang Yang, & zhu wenbin. (2015). Analysis of the relationship between CPUE and environmental factors in Argentine sliders based on GAM. *Fisheries modernization*, (2015 04), 56-61.
- [7] XiaoXin Han(2009). Research on the Contribution Rates of Three Industries in China Based on Markov Chain. *Cooperative Economy & Science* (15), 24-25.
- [8] Chang, X., Gao, M., Wang, Y., & Hou, X. (2012). Seasonal autoregressive integrated moving average model for precipitation time series. *Journal of Mathematics & Statistics*, 8(4).
- [9] Akaike H. (1987) Factor Analysis and AIC. In: Parzen E., Tanabe K., Kitagawa G. (eds) *Selected Papers of Hirotugu Akaike*. Springer Series in Statistics (Perspectives in Statistics). Springer, New York, NY

# Appendices

## Appendix A First appendix