

Comisión Interamericana del Atún Tropical
Inter-American Tropical Tuna Commission



RISK ANALYSIS FOR YELLOWFIN TUNA: FORMULATION OF HYPOTHESES

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11TH MEETING SCIENTIFIC ADVISORY COMMITTEE San Diego, California (USA)

11-15 May 2020

Postponed until a later date to be determined

Introduction

Issues and sources of uncertainty in former assessment of yellowfin tuna

- Oversensitive to new data (logline index of abundance)
- Longline index based on Japanese CPUE –contraction of the spatial distribution and effort reduction
- Inconsistency between longline and purse-seine indices – not resolve despite extensive research
- In recent years, changes of the size composition towards larger sizes in longline fisheries but also some purse-seine fisheries
- Possibility of stock and spatial structure not captured in the model

2018-2020: Workplan to improve the stock assessments of tropical tuna

- Included external reviews of the YFT and BET assessments
- Both external reviews suggested a variety of alternative models rather than a replacement for base case
- Change from “best assessment” to a risk analysis approach which considers multiple models and explicitly deals with uncertainty

The staff's pragmatic risk analysis approach

Described in Maunder et al. 2020 (SAC-11- INF-F):

- 1. Identify alternative hypotheses ('states of nature') about the population dynamics of the stock that address the main issues in the assessments**
 - **YFT: SAC-11-J**; BET: SAC-11 INF-F
- 2. Implement stock assessment models representing alternative hypotheses**
 - YFT: SAC-11-07; BET: SAC-11-06
- 3. Assign relative weights to each hypothesis (model)**
 - YFT: SAC-11 INF-J; BET: SAC-11 INF-F
- 4. Compute combined probability distributions for management quantities using model relative weights**
 - SAC-11-08

Formulation of hypotheses

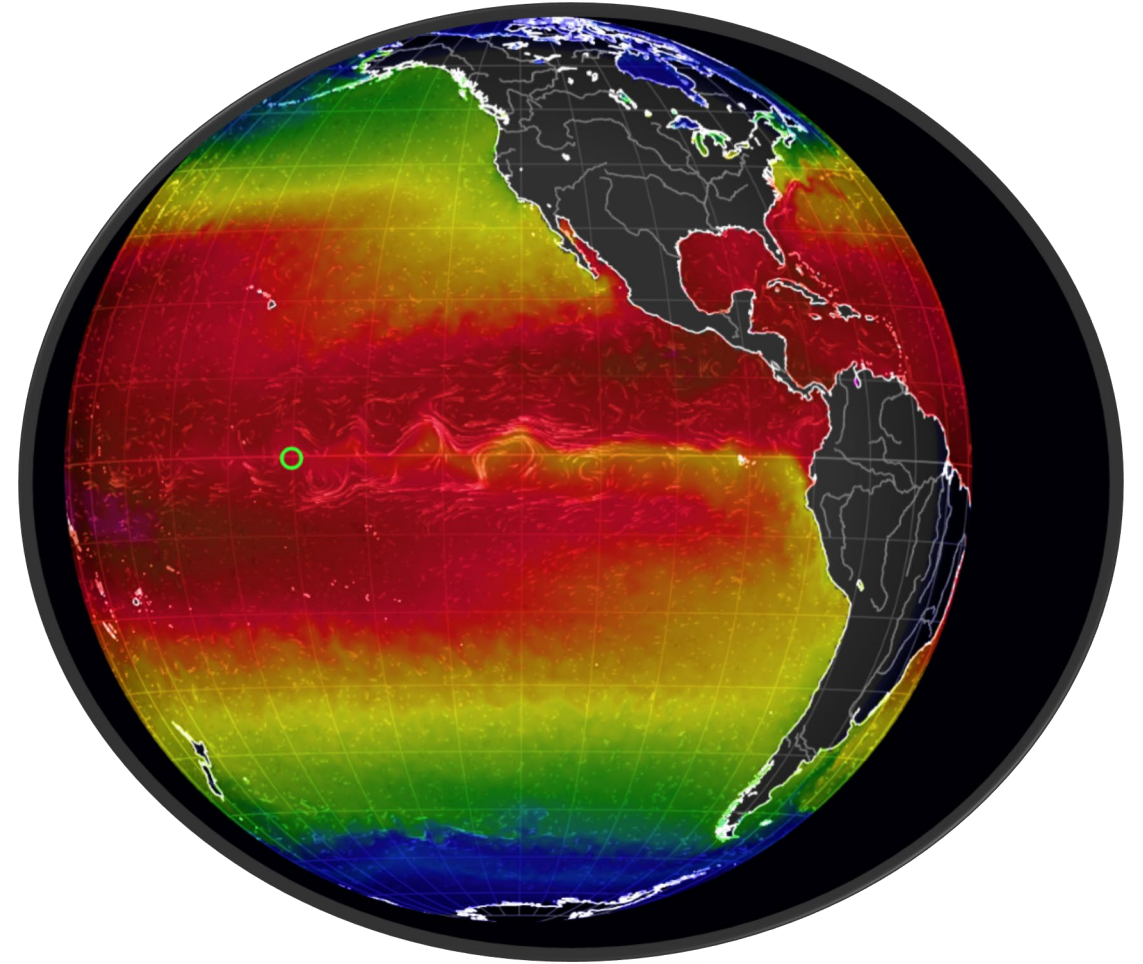
Alternative
states of
nature

Broad hypotheses
(Level 1)

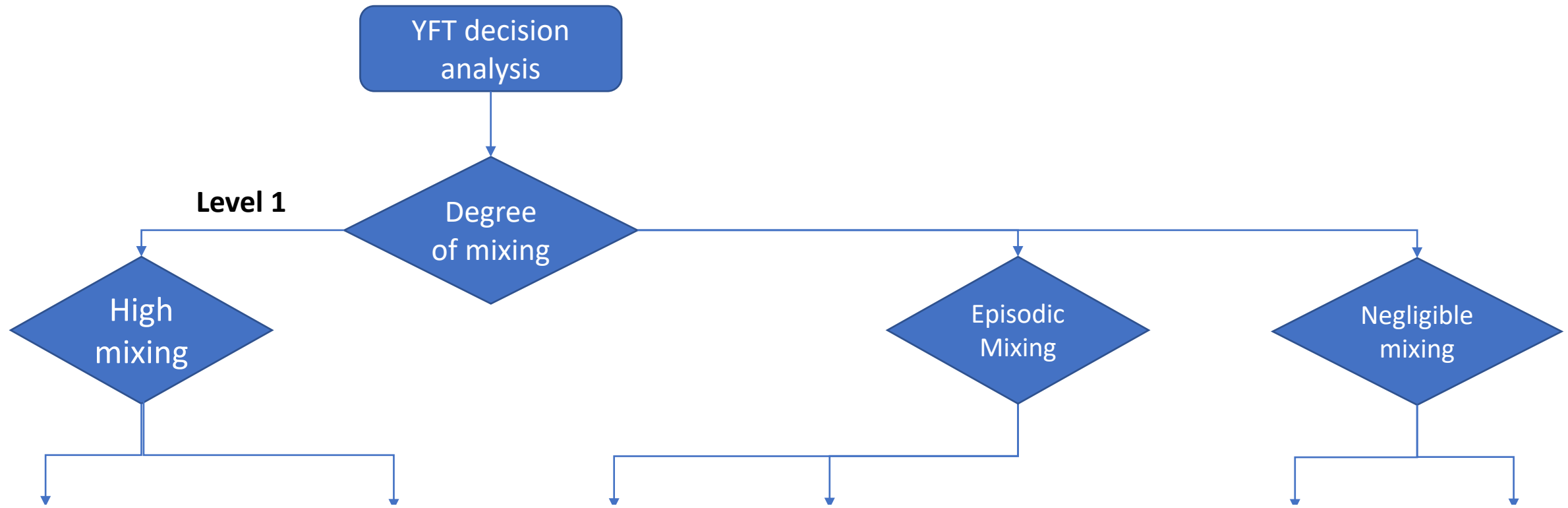


Formulation of hypotheses: yellowfin tuna

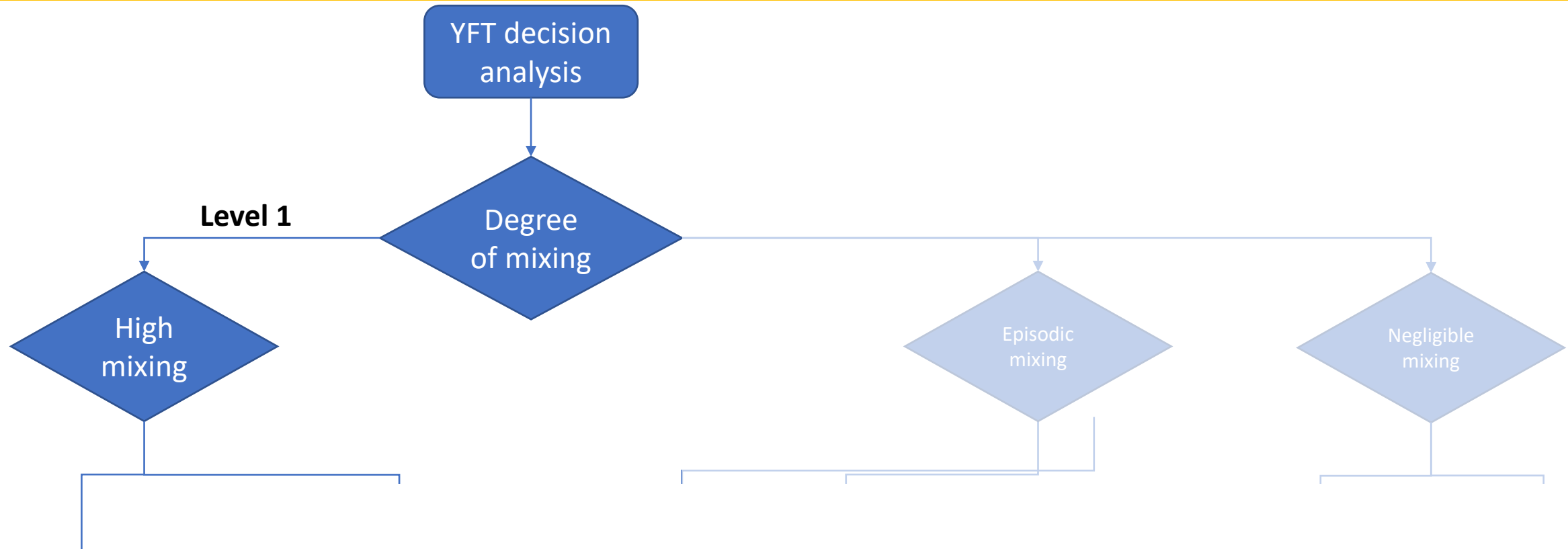
How much does the
population mix?



Formulation of hypotheses: yellowfin tuna



Formulation of hypotheses: yellowfin tuna



Pragmatic approach

- Assessment centered where the core of the catches are taken

what indices to use?

High mixing

Both indices – observation error hypothesis

Longline index – hypothesis of purse-seine index

not representative

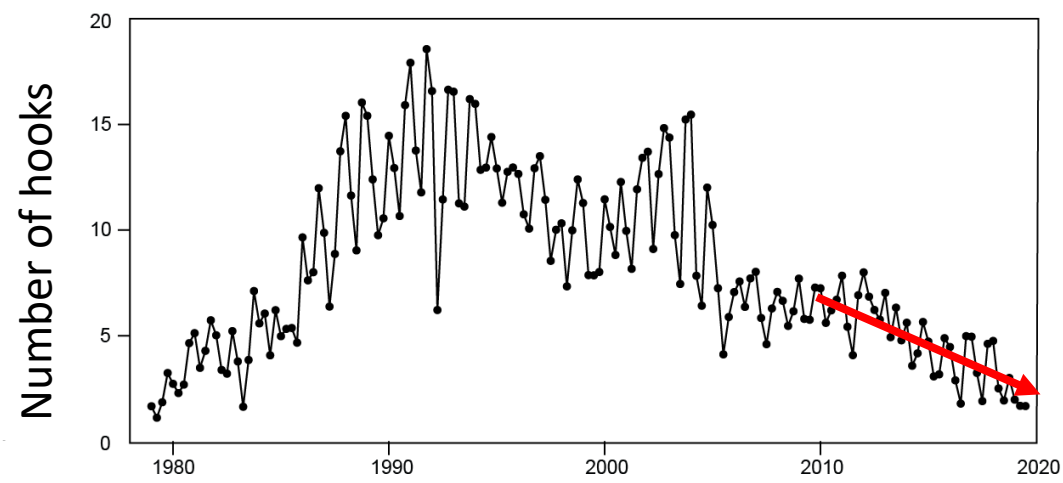
Purse-seine index – hypothesis of longline index

not representative

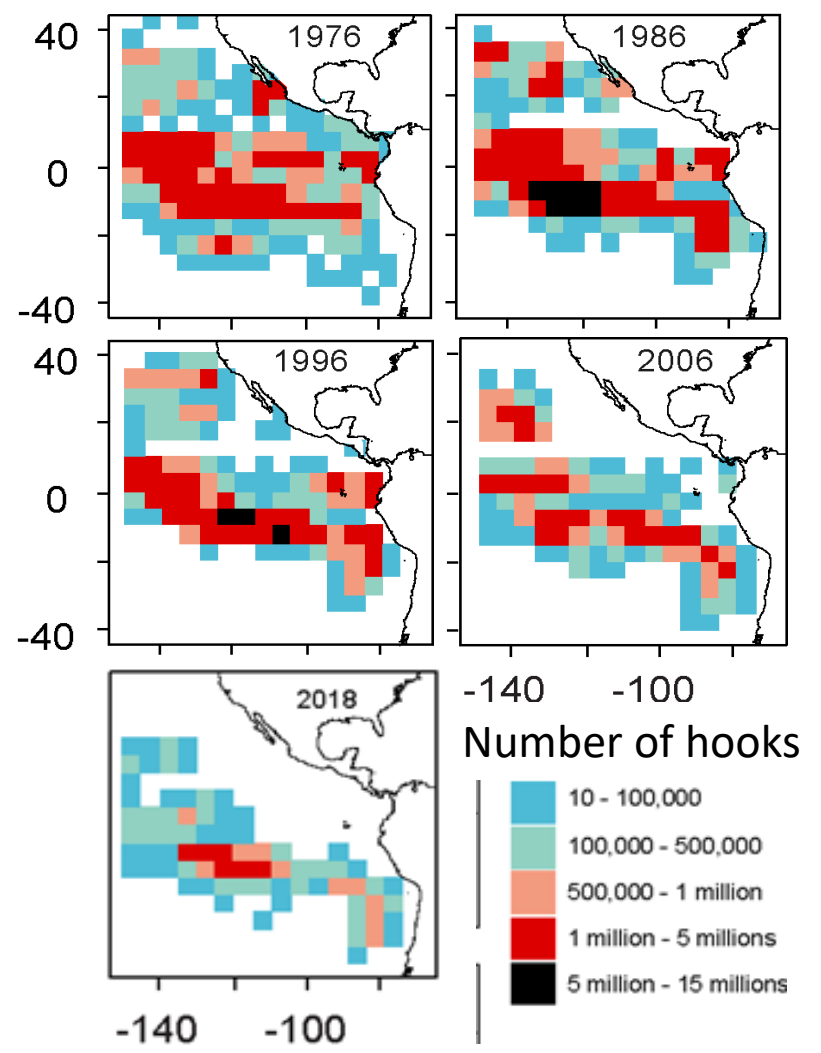


Data for the longline abundance index

Decrease of fishing effort over time

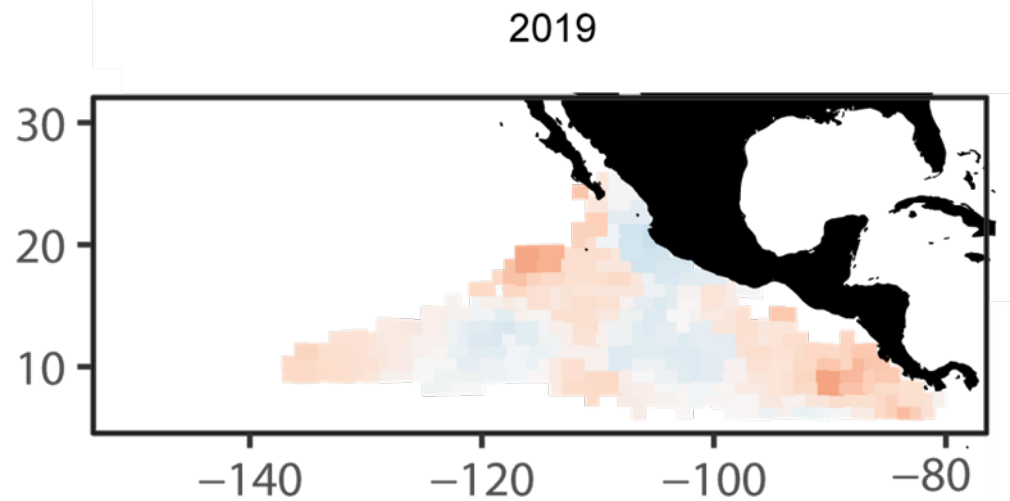


Contraction of the Japanese longline fishery

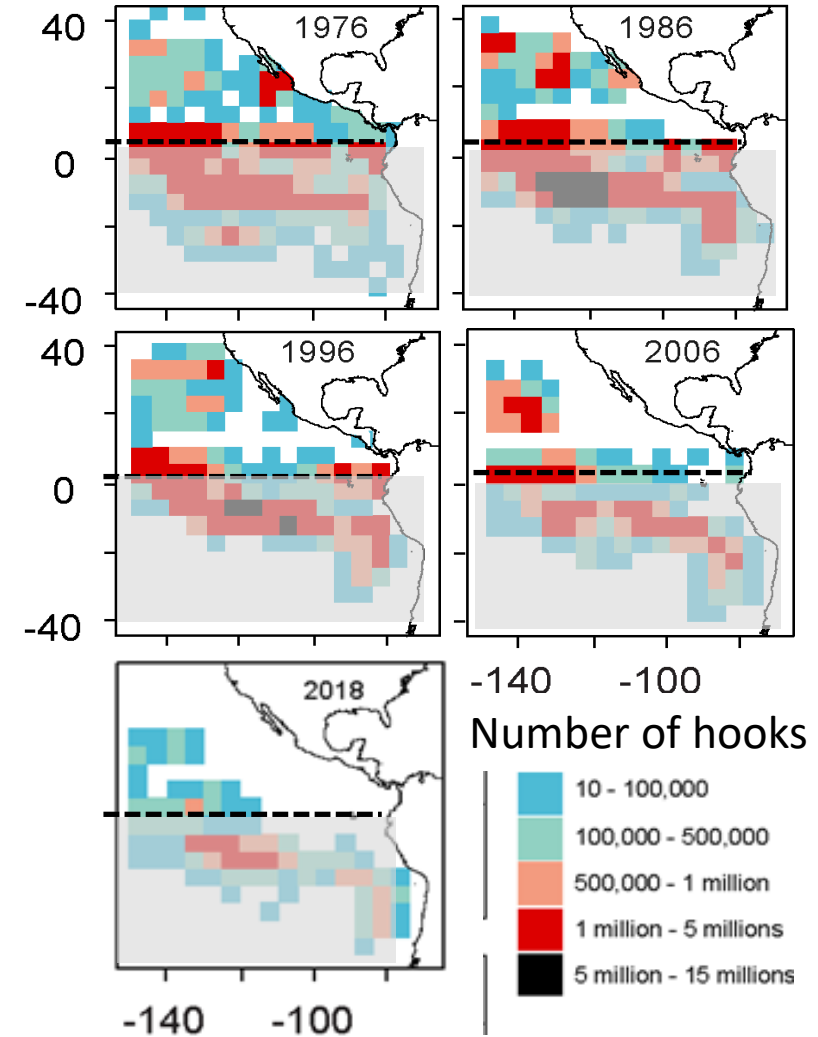


Indices of abundance for yellowfin tuna

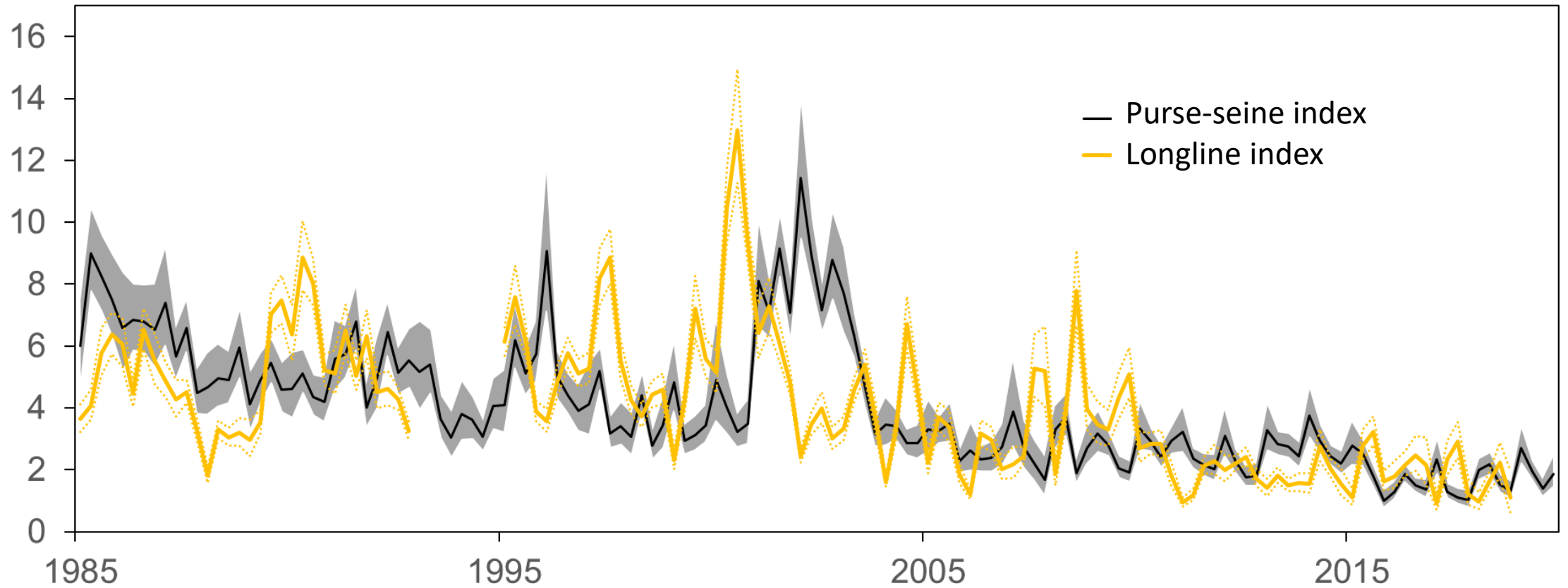
Spatial domain for the purse-seine index



Distribution of the Japanese longline fishery



What index to use?



what indices to use?

High mixing

Both indices – observation error hypothesis

Longline index – hypothesis of purse-seine index

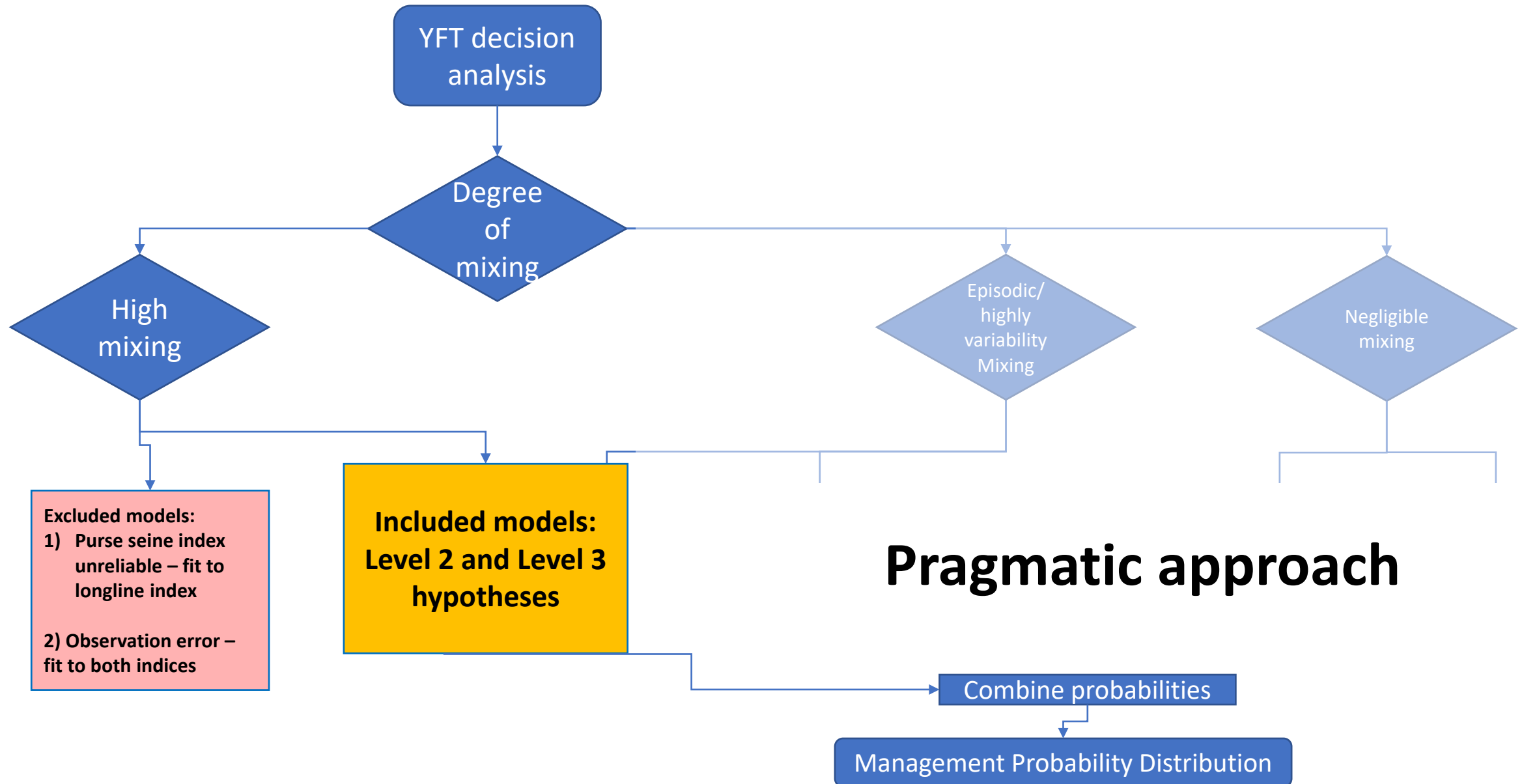
not representative

Purse-seine index – hypothesis of longline

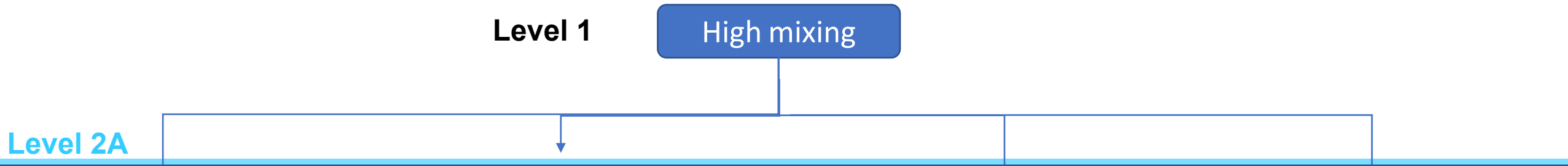
index not representative



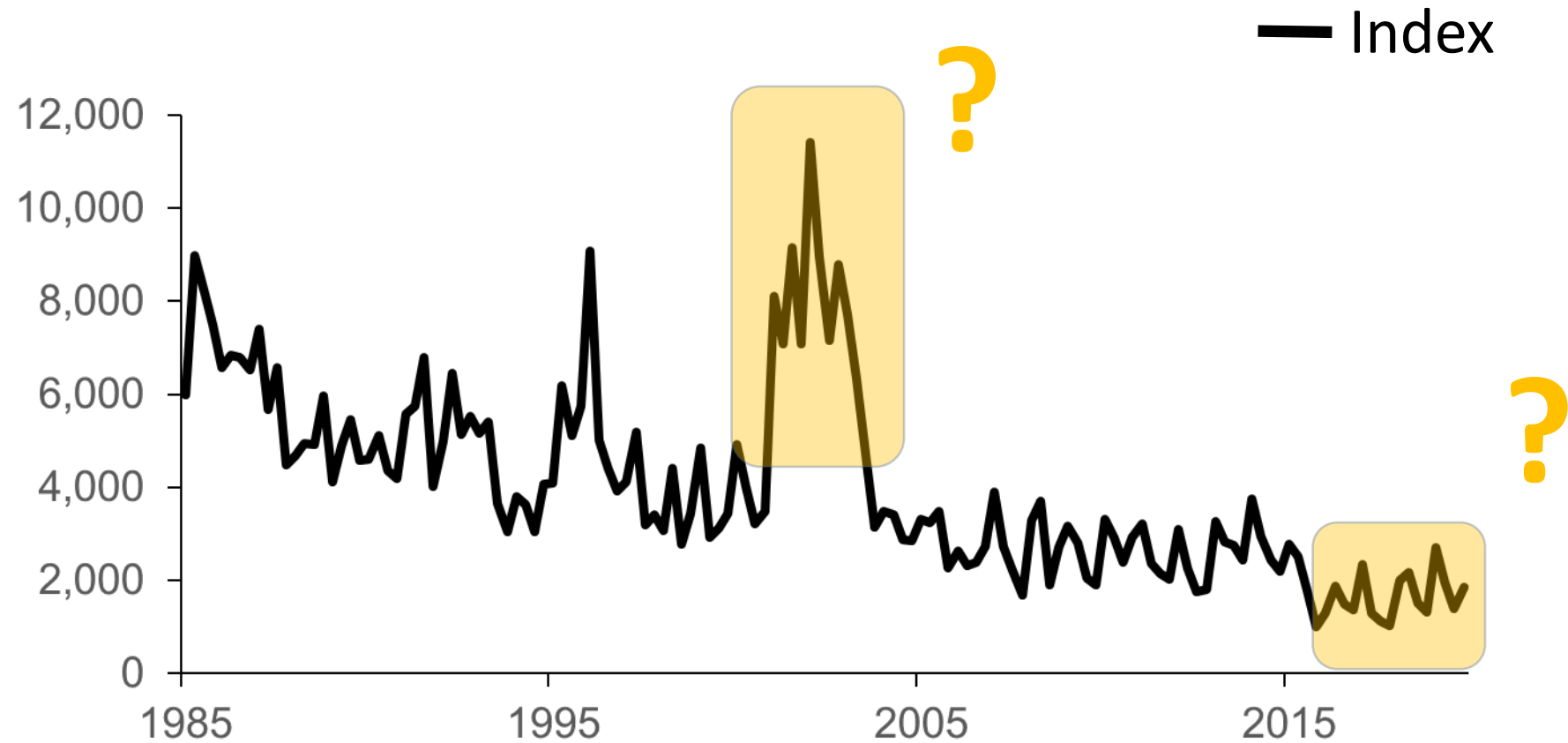
Formulation of hypotheses: YFT



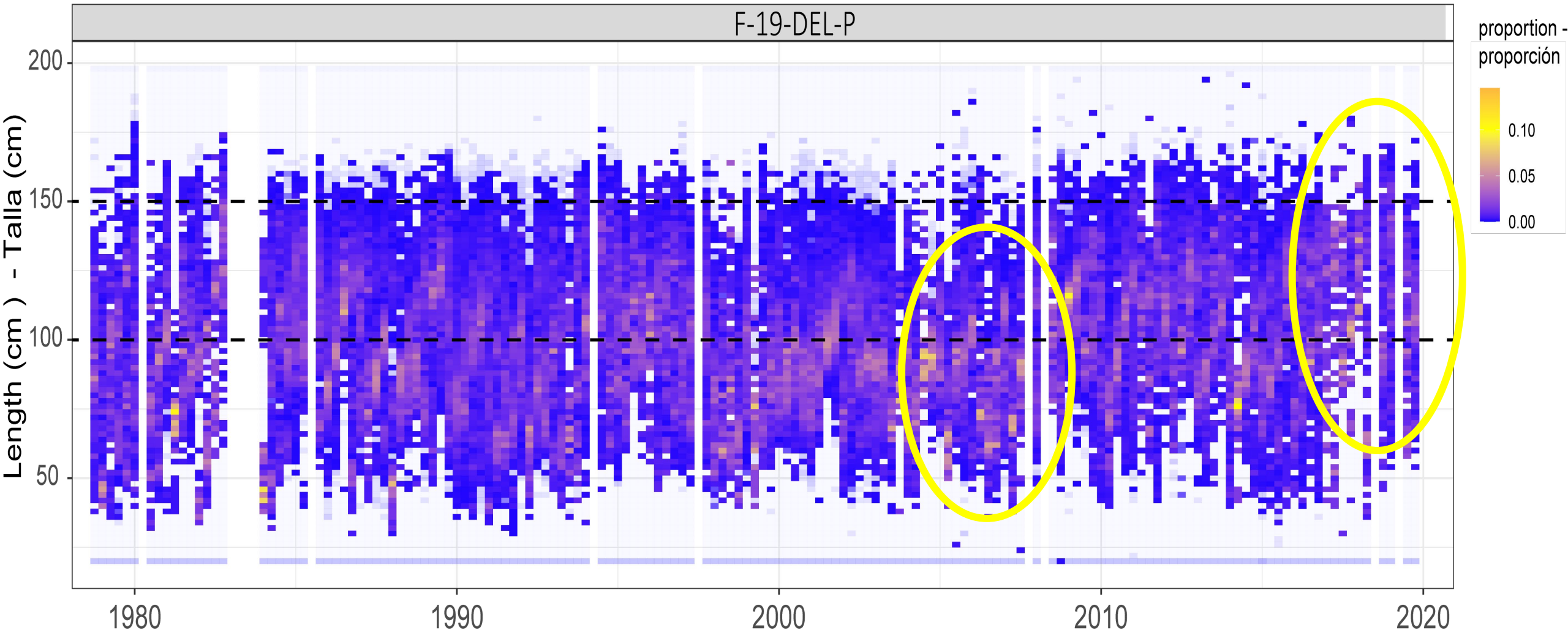
Hypotheses flow chart for yellowfin



Level 2A hypotheses: relationship between index and abundance

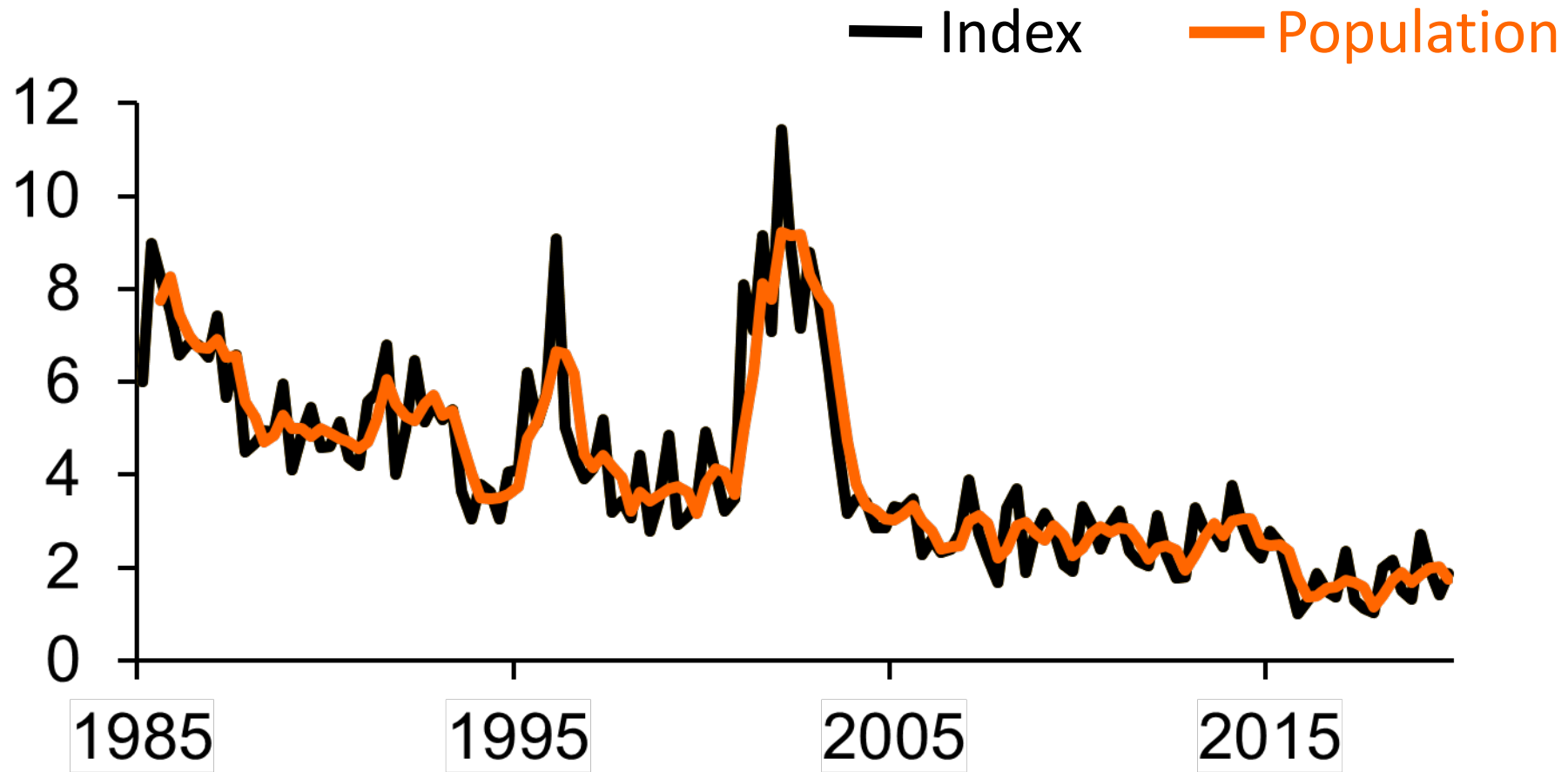


Level 2A hypotheses: changes in length



Level 2A: relation between the index and abundance

BASE: Proportional

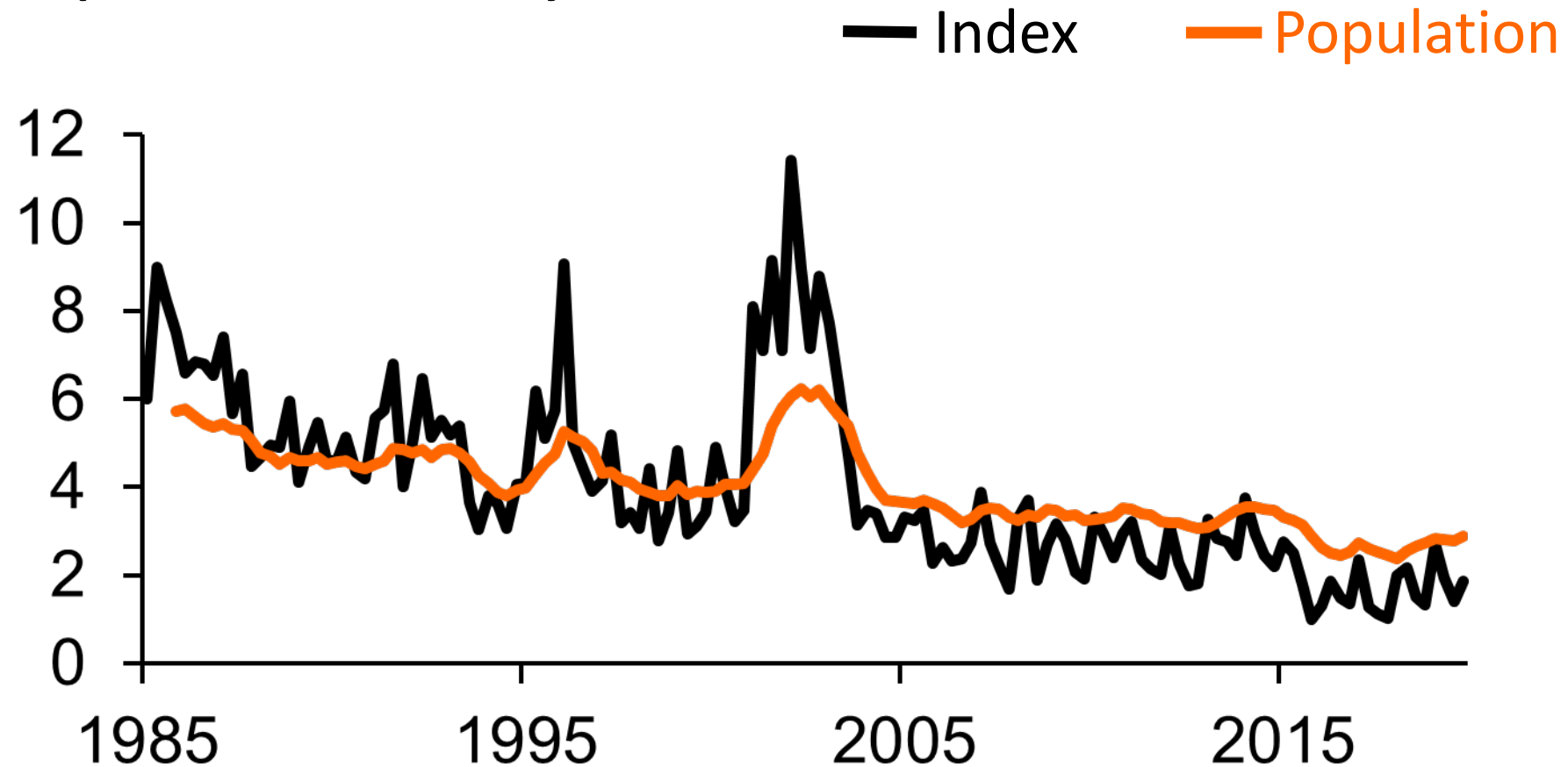


Index proportional to abundance



Level 2A: relation between the index and abundance

DDQ: density-dependent catchability

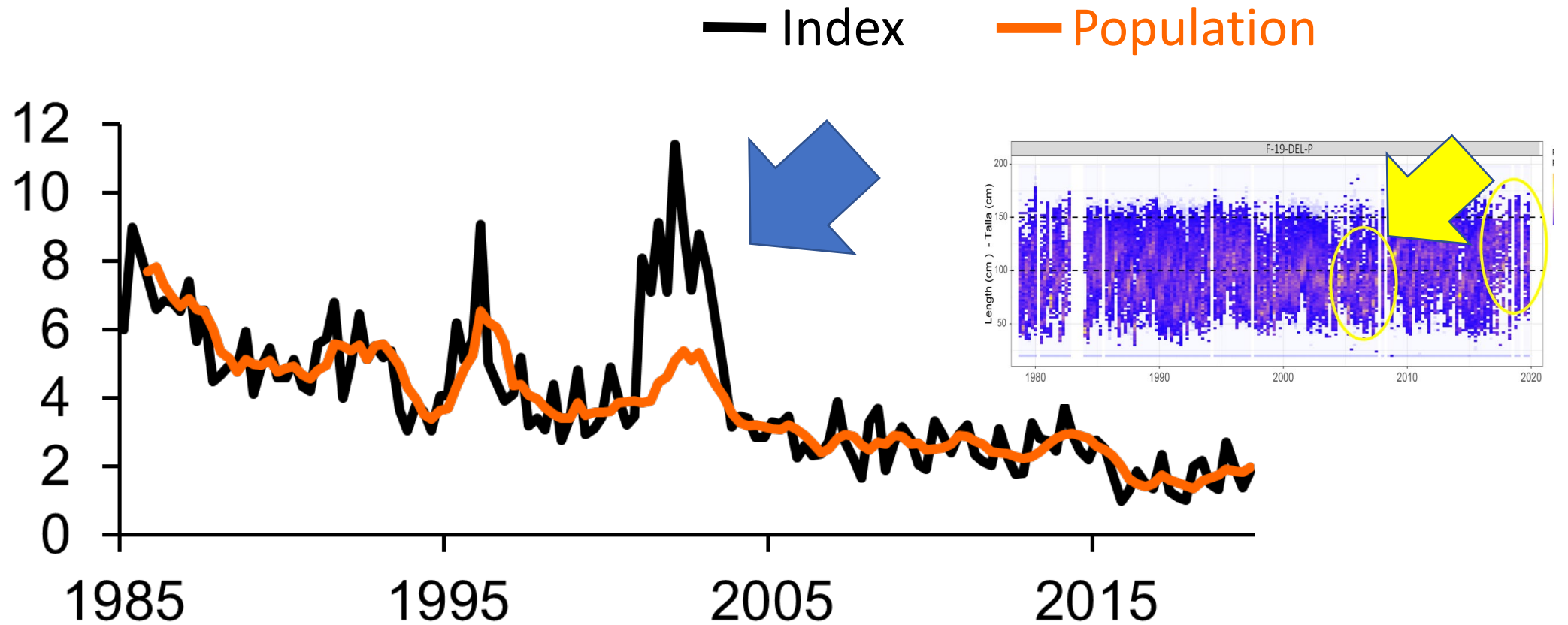


Catchability depends on abundance



Level 2A: relation between the index and abundance

TBM: time-block in the middle



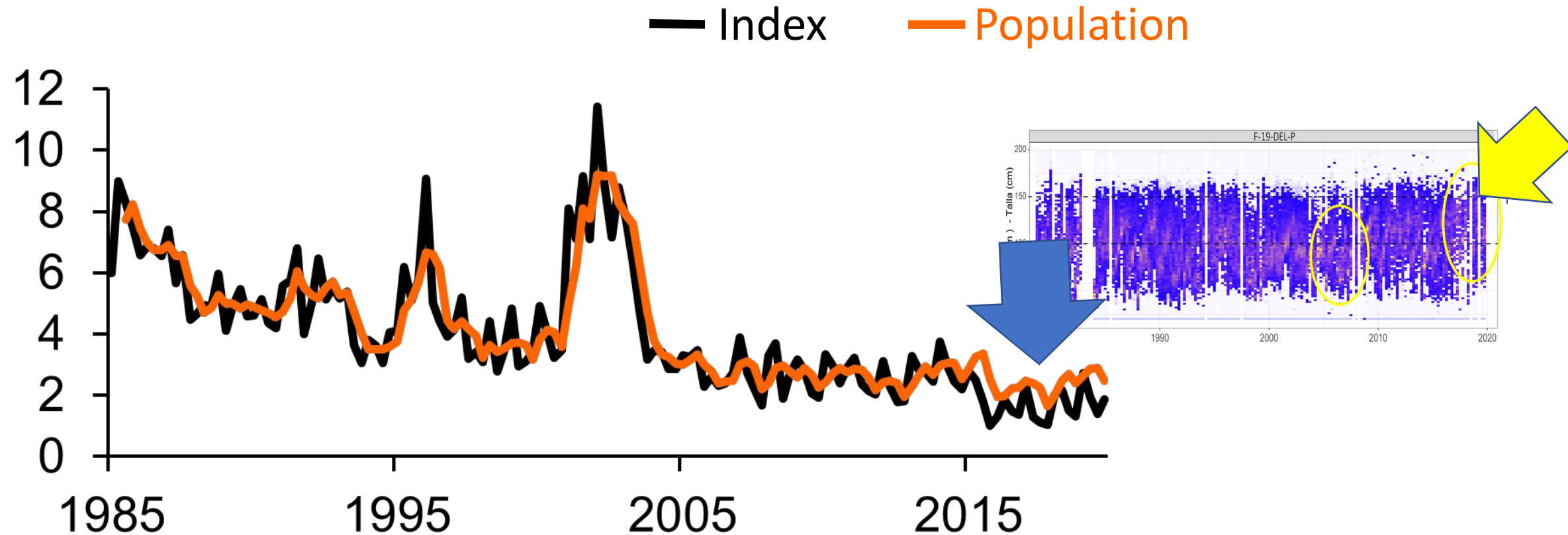
Catchability changes in 2001-2003

(and selectivity change 2003-2007)



Level 2A: relation between the index and abundance

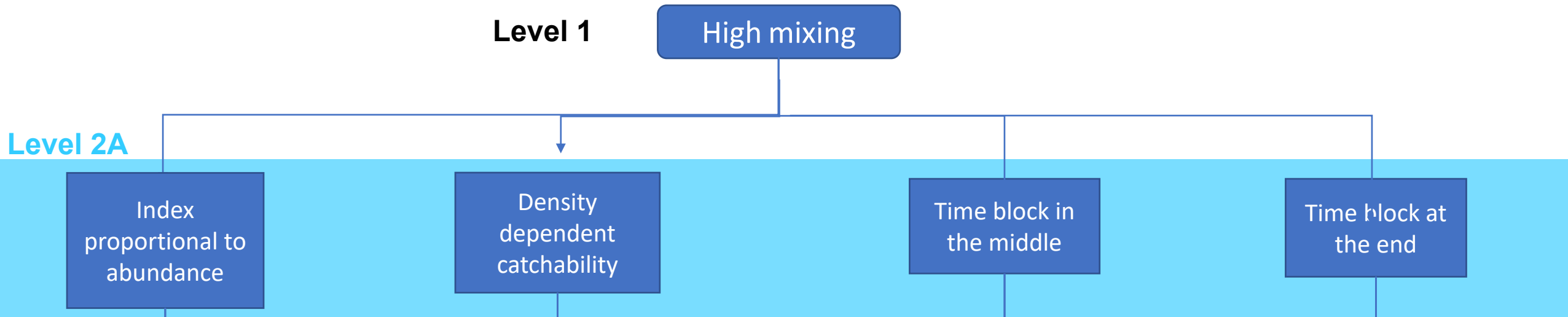
TBE: time block in the end



Catchability changes in 2015
(and selectivity change of fishery F19-DEL_P)

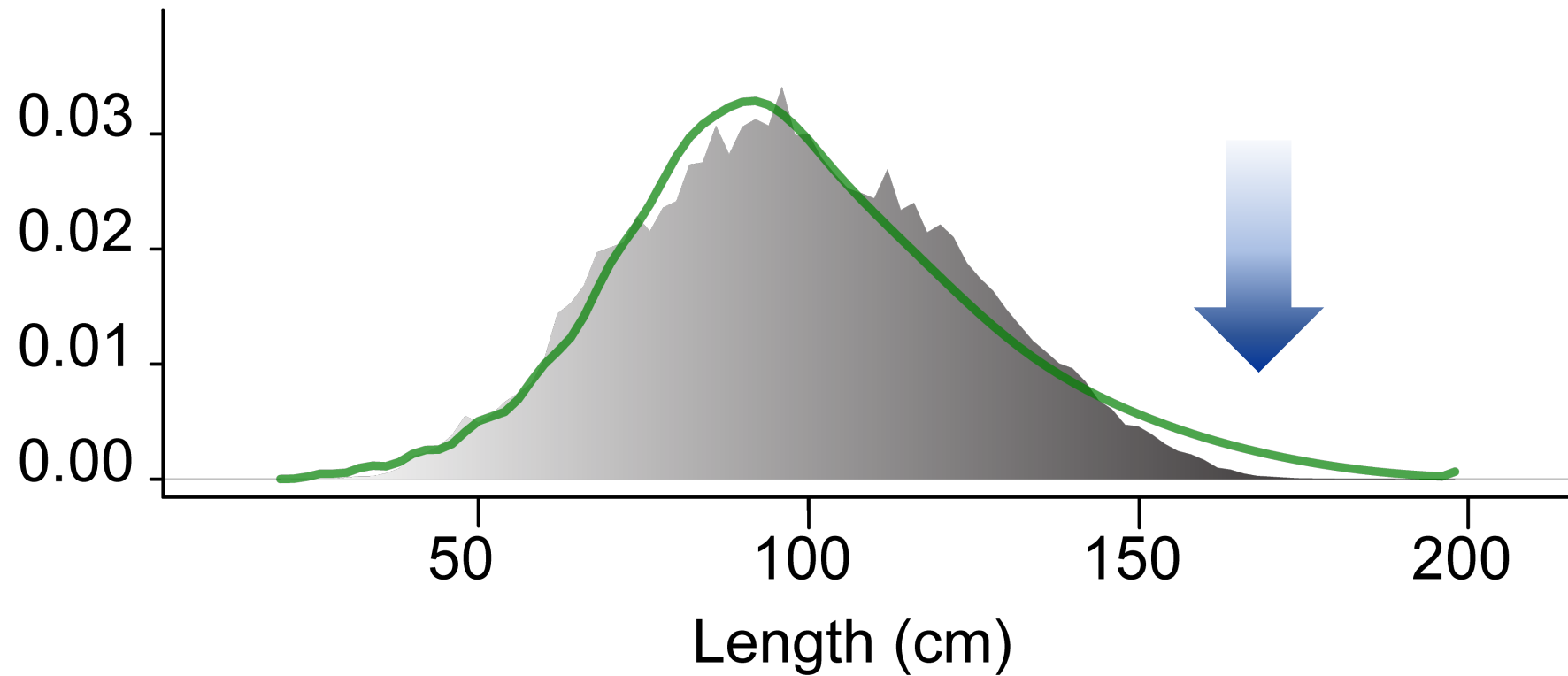


Hypotheses flow chart for yellowfin



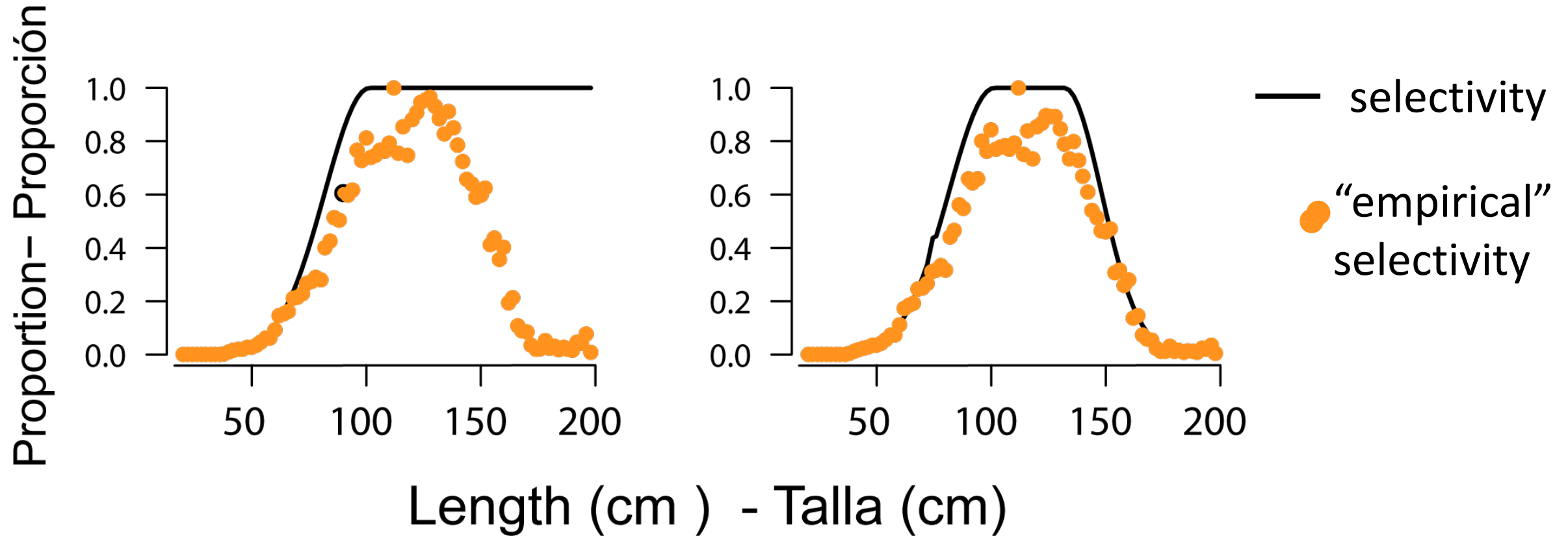
Level 2B hypotheses: fit to length frequency data

F19-DEL-P fisheries

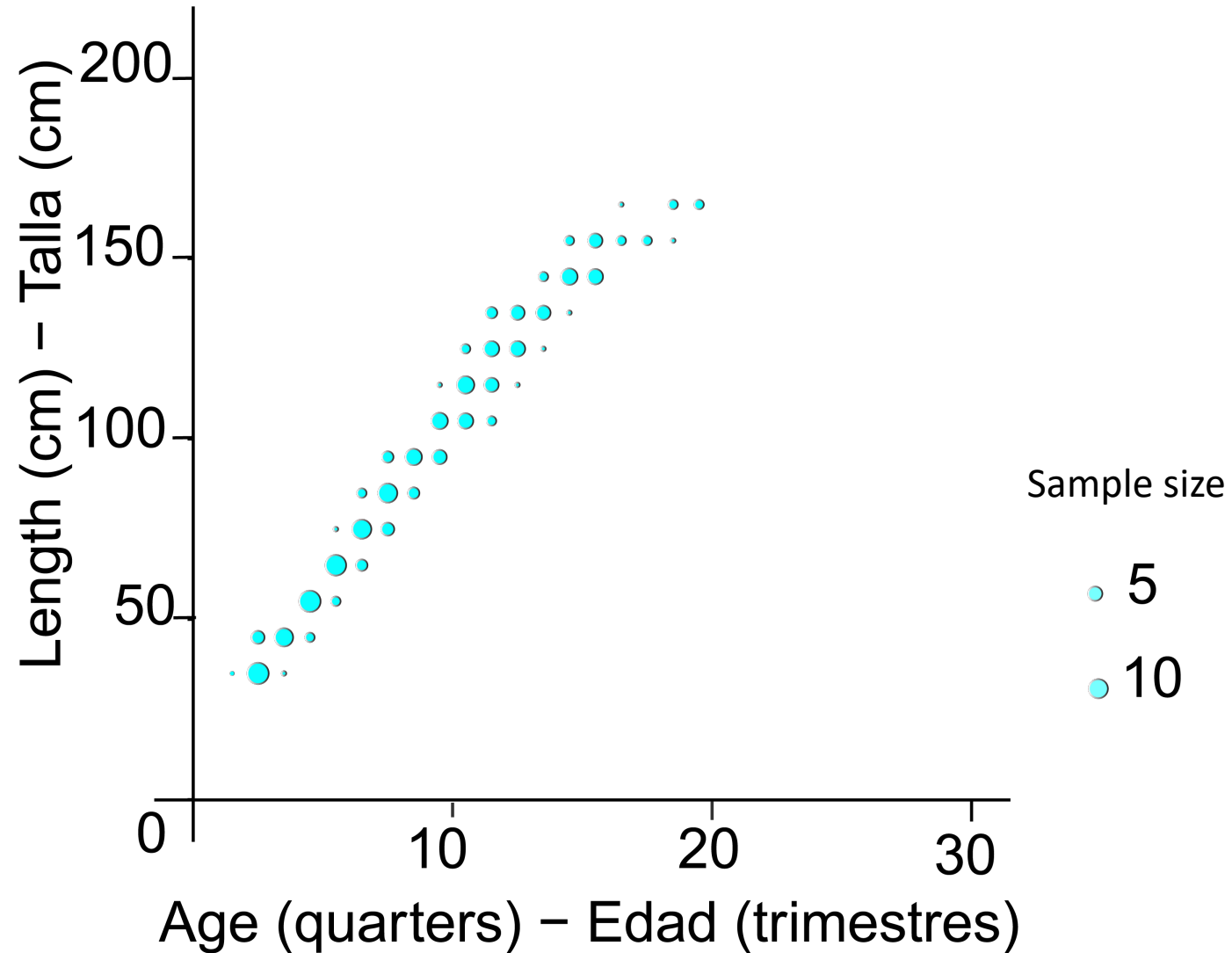


Level 2B hypotheses: fit to length frequency data

F19-DEL-P fisheries



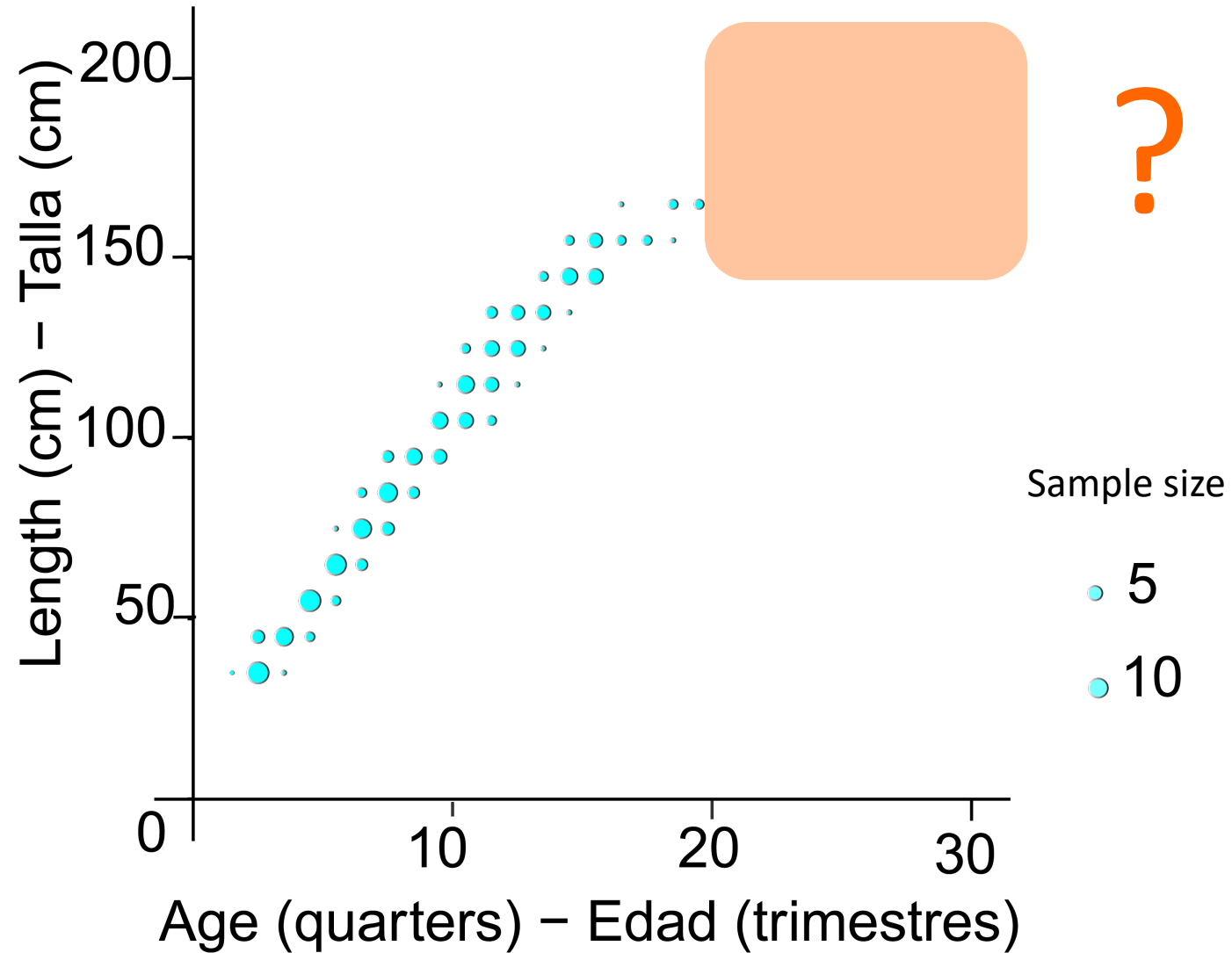
Level 2B hypotheses: fit to length frequency data



Wild (1986)



Level 2B hypotheses



Wild (1986)



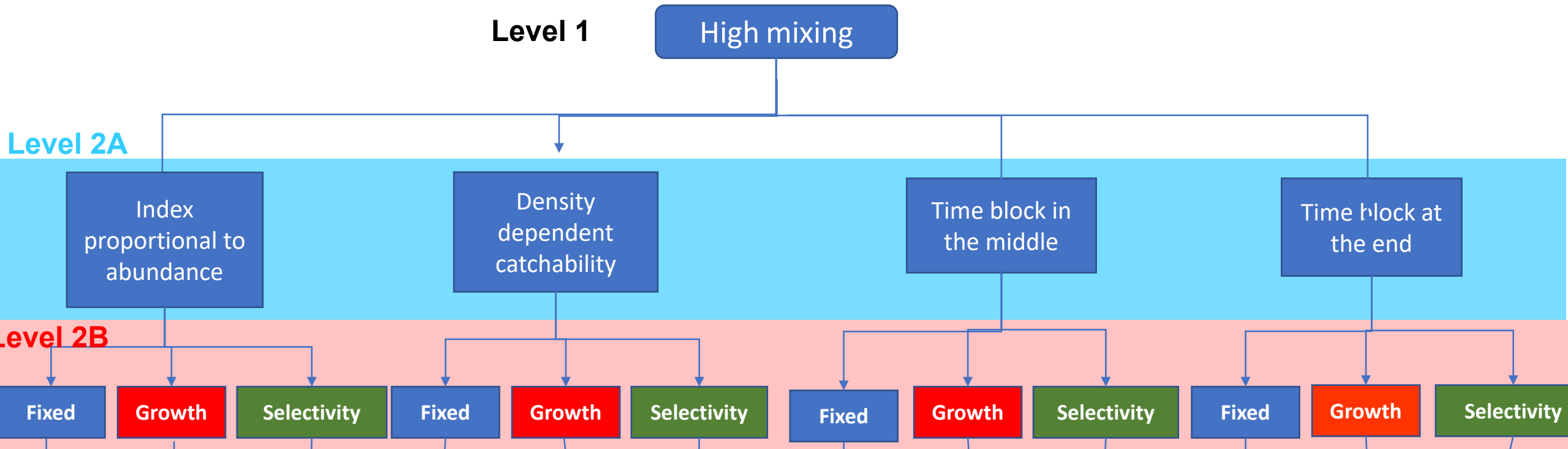
Level 2B hypotheses: fit to length frequency data

Assumptions:

Hypothesis name	Model acronym	Growth	Selectivity F19-DEL_P
Fixed	BASE	Fixed	Asymptotic
Growth	GRO	Estimated	Asymptotic
Selectivity	DS	Fixed	Dome shape



Hypotheses flow chart for yellowfin



Steepness of the stock-recruitment curve

How much the recruitment is reduced when
the reproductive population is reduced



Steepness (h) of the stock recruitment curve

$$h = 0.7$$

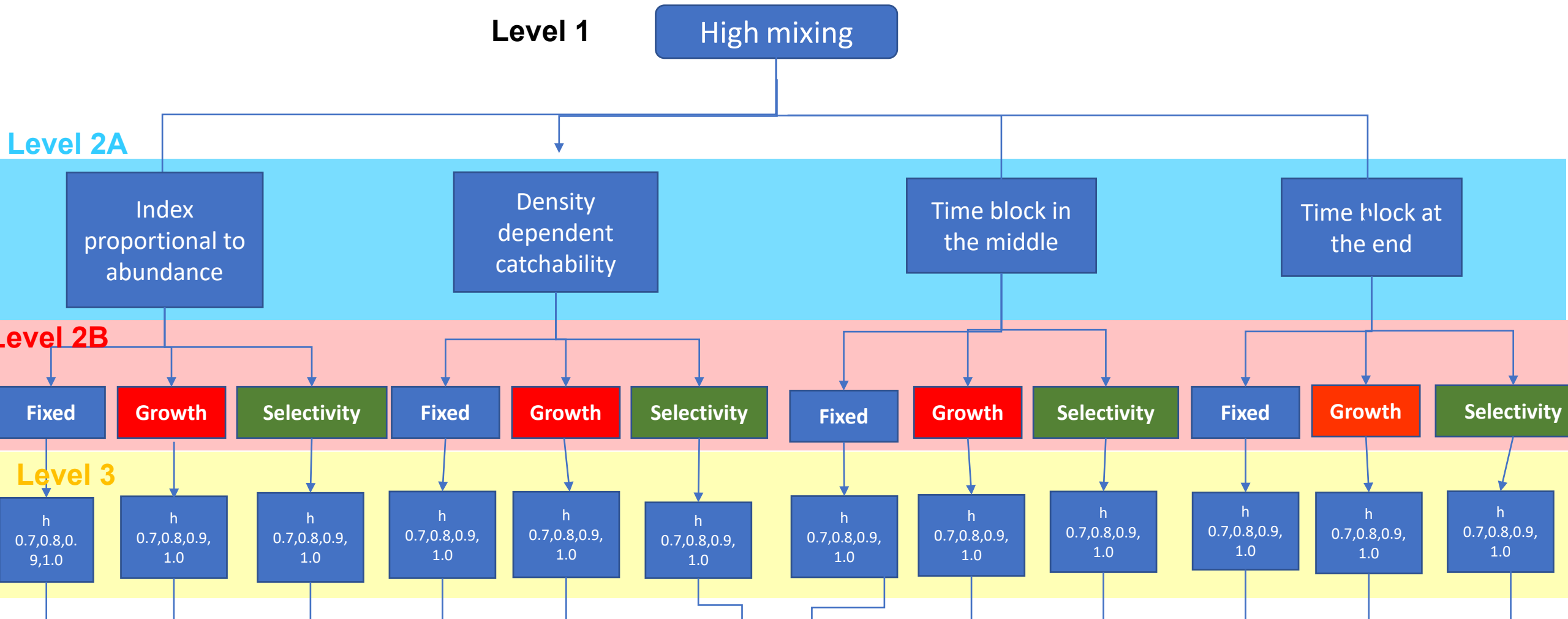
$$h = 0.8$$

$$h = 0.9$$

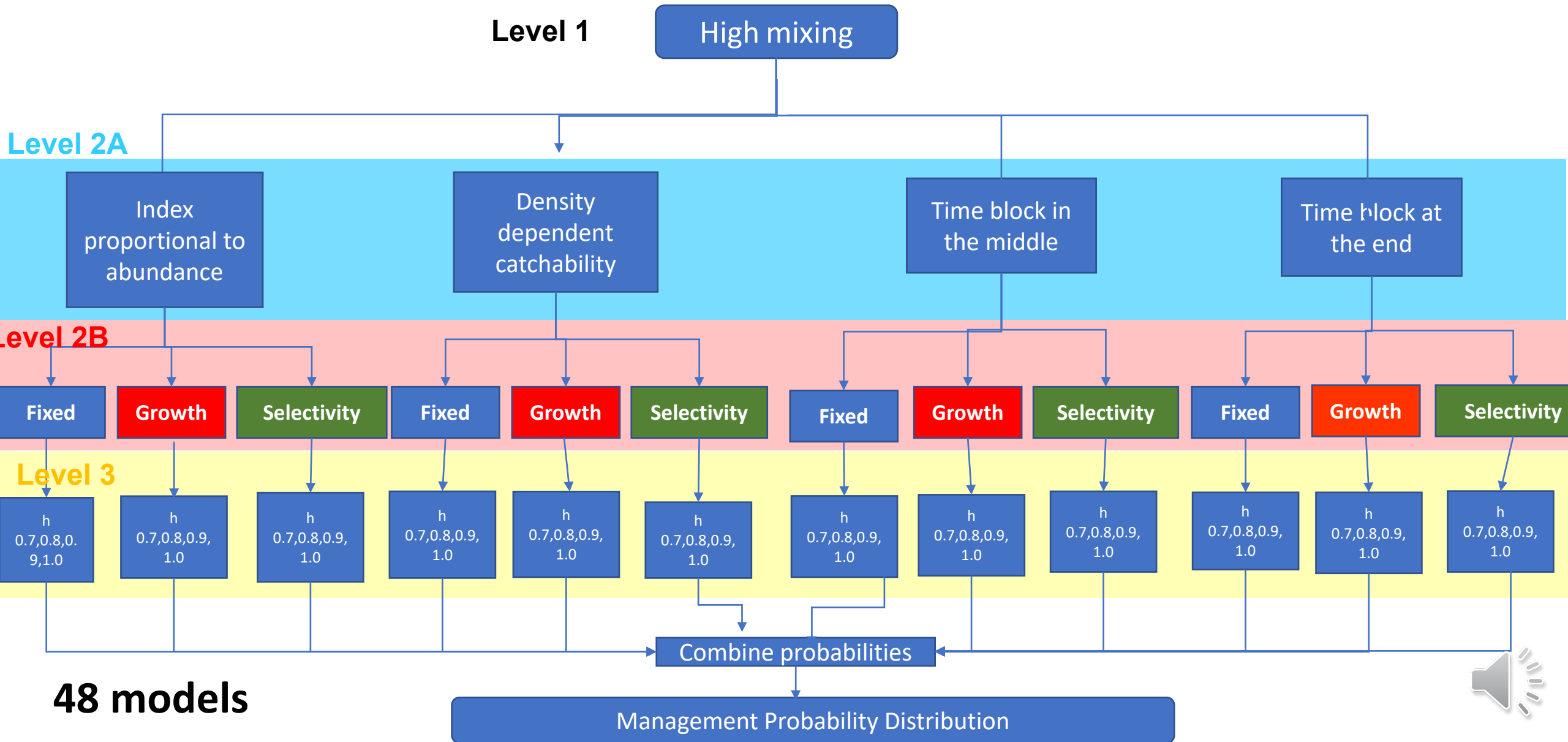
$$h = 1$$



Hypotheses flow chart for yellowfin



Hypotheses flow chart for yellowfin



Next step in the risk analysis

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Thank you

