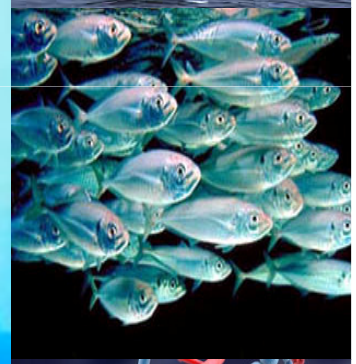
CHILEAN JACK MACKEREL WORKSHOP

Horse Mackerel (*Trachurus trachurus*) Stock Identification Research (EU-Project HOMSIR)

"A multidisciplinary approach using genetic markers and biological tags in horse mackerel (*Trachurus trachurus*) stock structure analysis"






By

Pablo Abaunza Martínez

Instituto Español de Oceanografía (IEO)
Santander, España (Spain)

HOMSIR

IEO, Spain

IPIMAR, Portugal

MFSD, Ireland

UNITUS, Italy

IMBC, Greece

UVIGO, Spain

UNIABDN, UK

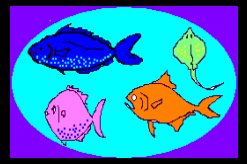
IMR, Norway

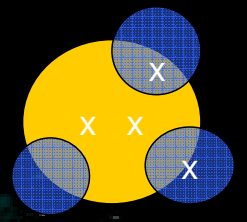
FFCUL, Portugal

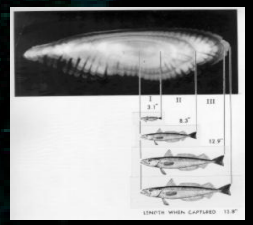
BFA Fi, Germany

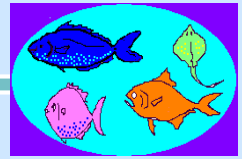
- I) INTRODUCTION
- II) OBJECTIVES
- III) SAMPLING AND METHODS
- IV) MAIN RESULTS

  Integrating the information from different stock identification approaches
- V) CONCLUSIONS





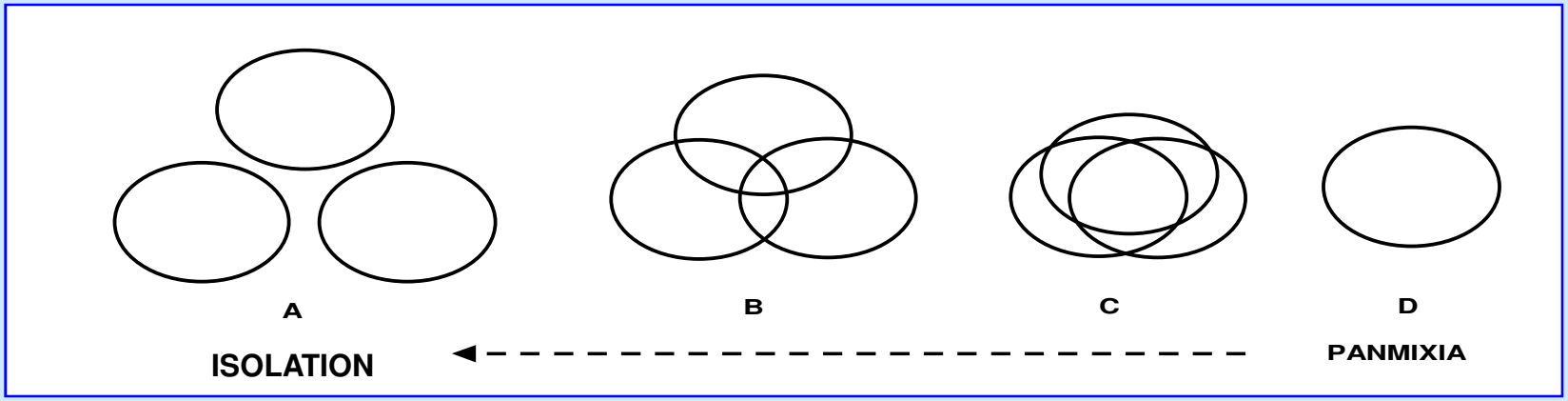




Stock concept

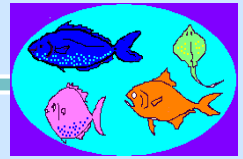
- An intraspecific group of randomly mating individuals with temporal or spatial integrity (Ihssen et al., 1981)

- Various definitions depending on the level of “integrity”
  - Genetic stock
  - Phenotypic stock
  - Contingent stock
  - Harvest stock

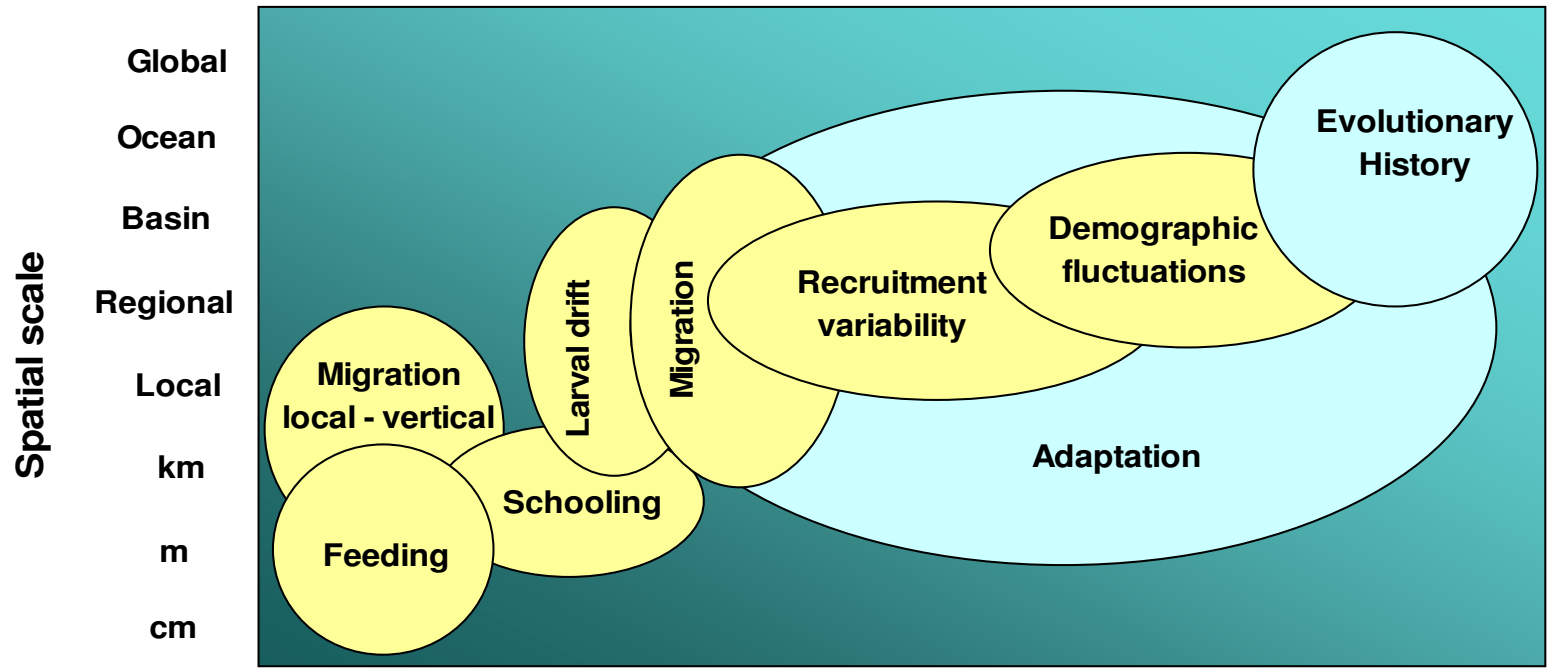


- Equivalent to the concept of population but refereeing to commercially exploited species

I) INTRODUCTION

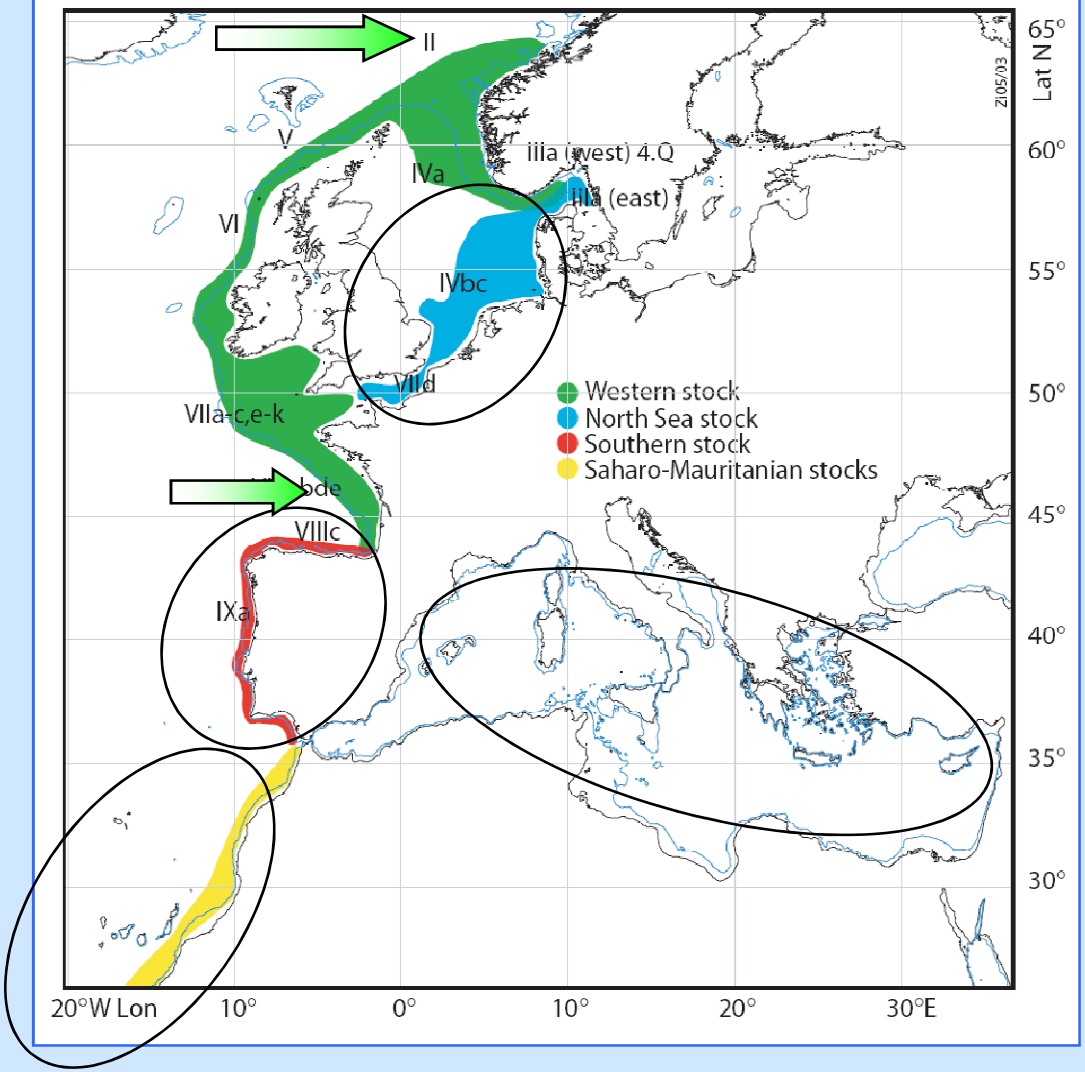


To understand the patterns of populations in time and space, their richness and variability, it is necessary to apply a holistic approach. In this way, the fullest possible picture can be obtained in response to the ecological, evolutive and operational requirements that the definition of stock may involve.



Horse mackerel (*Trachurus trachurus*) as target species

- Widely distributed, valuable fishery (250.000 – 500.000 ton.)
- Uncertainty in stock definition
- As a result = HOMSIR project (QLK5-CT1999-01438)



II) HOMSIR OBJECTIVES

- **Stock identification of horse mackerel throughout its distribution range, integrating the information from different approaches:**

- **Genetic stock assessment** (MAE, mtDNA, msDNA, SSCP)
  - Stock identification using molecular markers
  - Levels of genetic variability
  - Estimation of gene flow between populations

- **Application of other natural marks:**
  - Body morphometrics
  - Otolith shape analysis
  - Parasites as biological tags (+ genetics on anisakids)

- **Life history traits**: Growth, reproduction and distribution.

- **The evaluation of the viability of physical tagging**

Thus,
to set-up an improved multidisciplinary tool for fish stock identification,
and an exhaustive knowledge of horse mackerel stock structure,
in order to allow an enhanced management for this resource in EU waters in short, medium and long term.

Sampling in space and time

1) Sampling in space

- Intensive = Atlantic
  Exploratory = Medite-rranean
- Distribution area
  (- North of Africa)
- **20** sampling sites

2) Sampling in time

- **2** sampling years
- To detect occasional events
- Distribution: Historical data series of catches

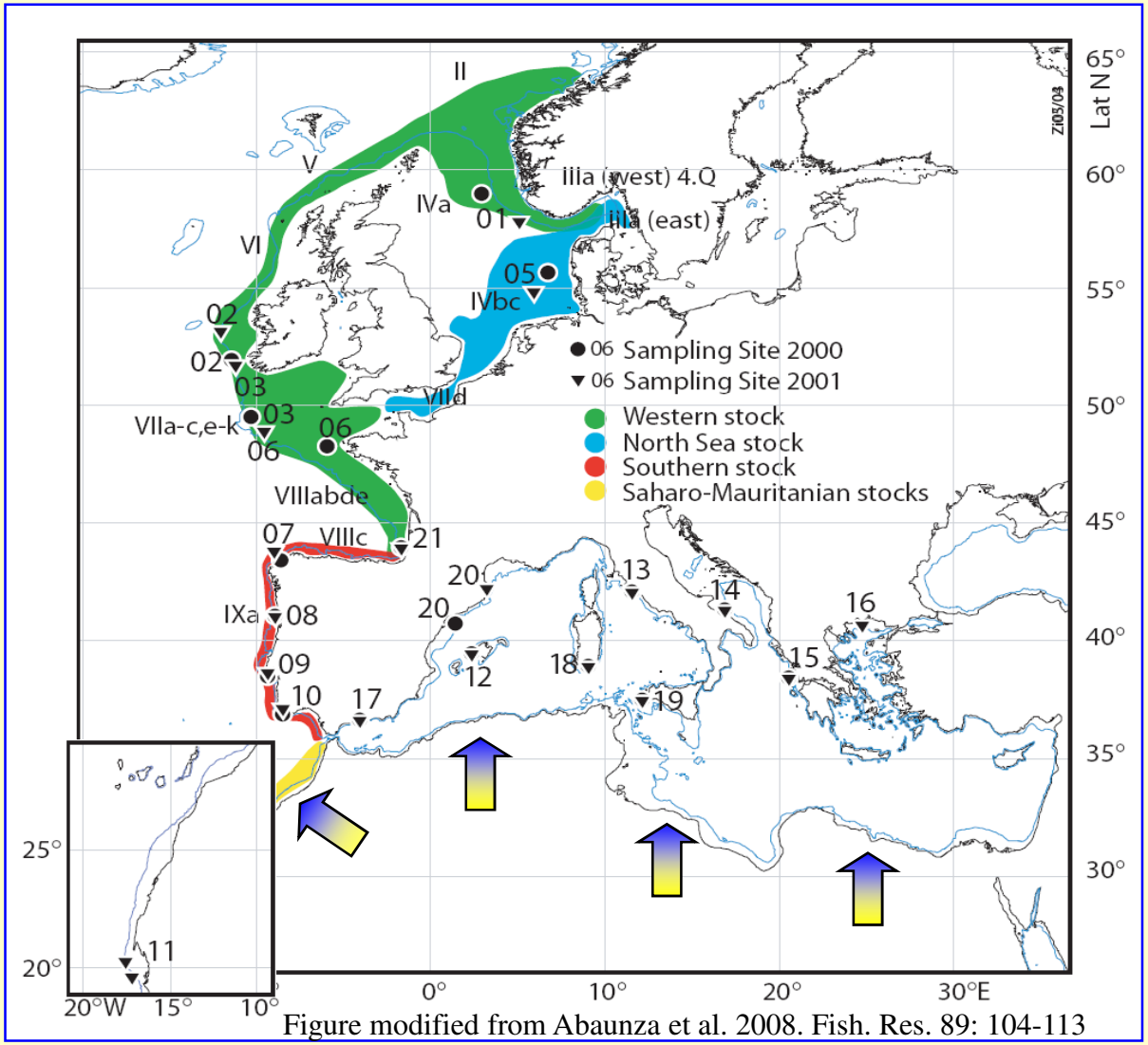
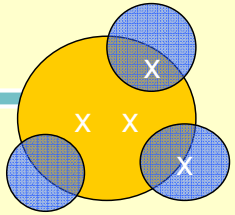


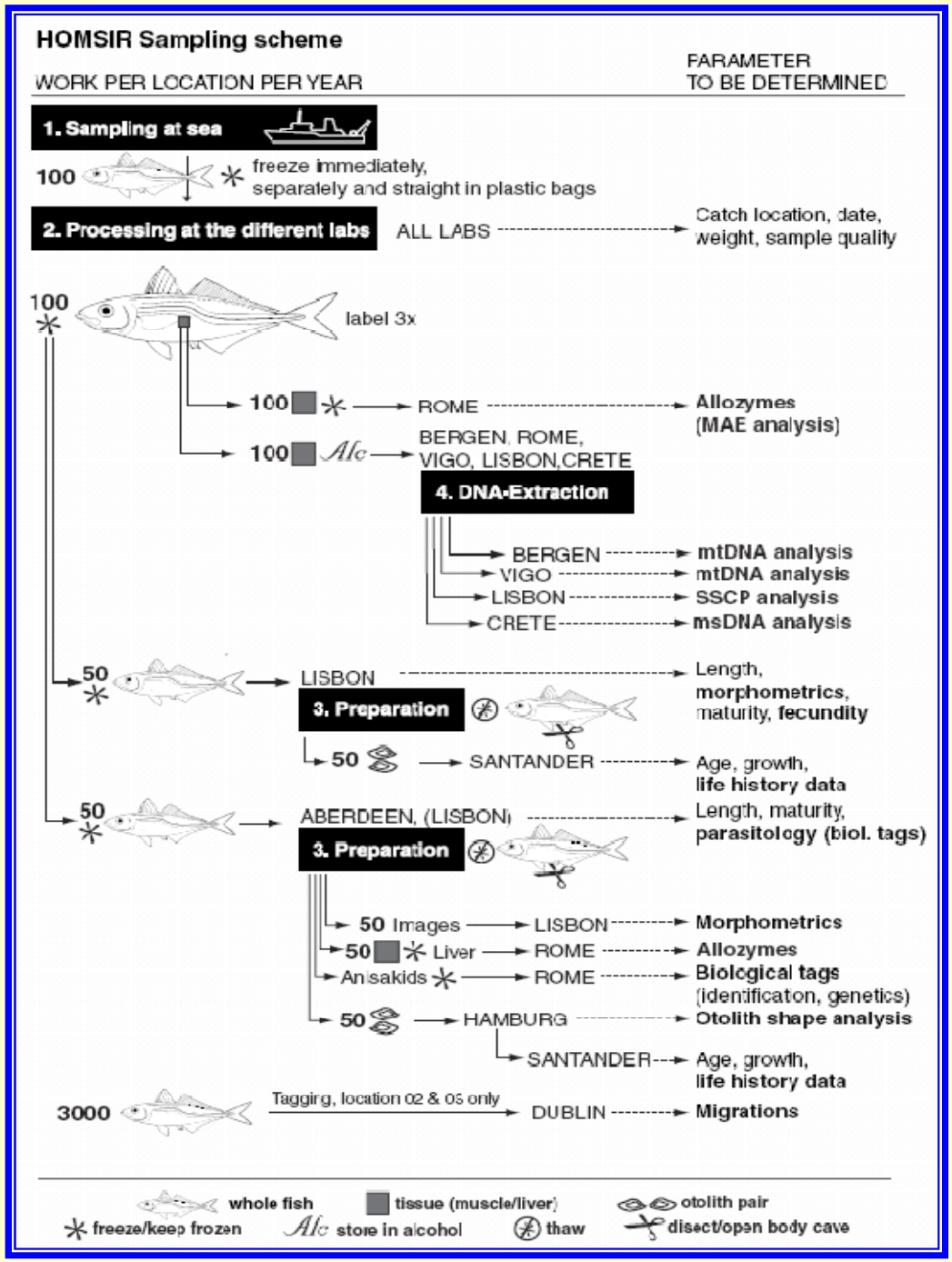
Figure modified from Abaunza et al. 2008. Fish. Res. 89: 104-113



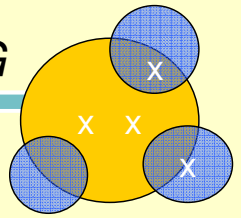
200 specimens per sampling site
(two years)

All techniques applied on the same specimen

Collected during spawning season



III) HOMSIR SAMPLING



⇨ Sampling at sea

⇨ Processing at labs

100 ⇨ 100 genetics

50 (Life history traits) Lisbon

50 (All techniques) Aberdeen

⇨ Marcado físico

Figure from Abaunza et al. 2008. Fish. Res. 89: 104-113


Main results

- *In general, horse mackerel shows low levels of genetic differentiation, high genetic variability and a stable genetic structure over time*

- **F_{st} = 0.013**
- **Heterozigosity = 0.11 – 0.14**

Migratory adults

Allozymes, mtDNA and msDNA analysis showed similar results.
Results from SSCP were uncertain and are at present under revision

- *A major separation between the Atlantic Ocean and the Mediterranean Sea exists, although the most western part of the Mediterranean Sea could be partially connected with the Atlantic Ocean*

- Body morphometrics: 84% classified correctly (discriminant analysis)
- Otolith shape analysis: 90% (discriminant analysis)
- Parasites (species composition, anisakids)

IV) MAIN RESULTS

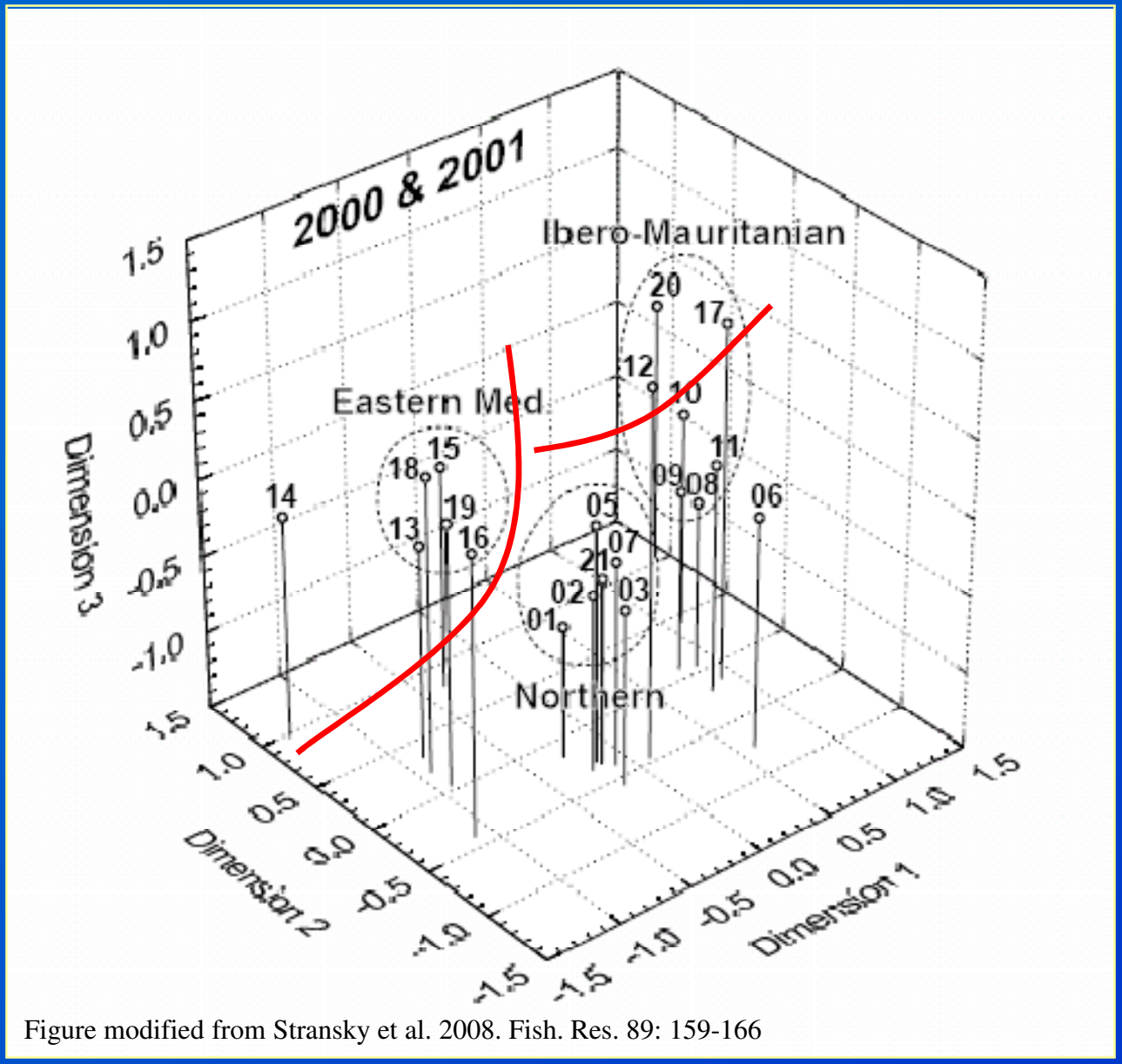


Figure modified from Stransky et al. 2008. Fish. Res. 89: 159-166

Otolith shape analysis

MDS ordination plot of the Euclidean distances between mean size-corrected Fourier descriptors in each sampling area

Anisakid species composition (parasites as biological tags)

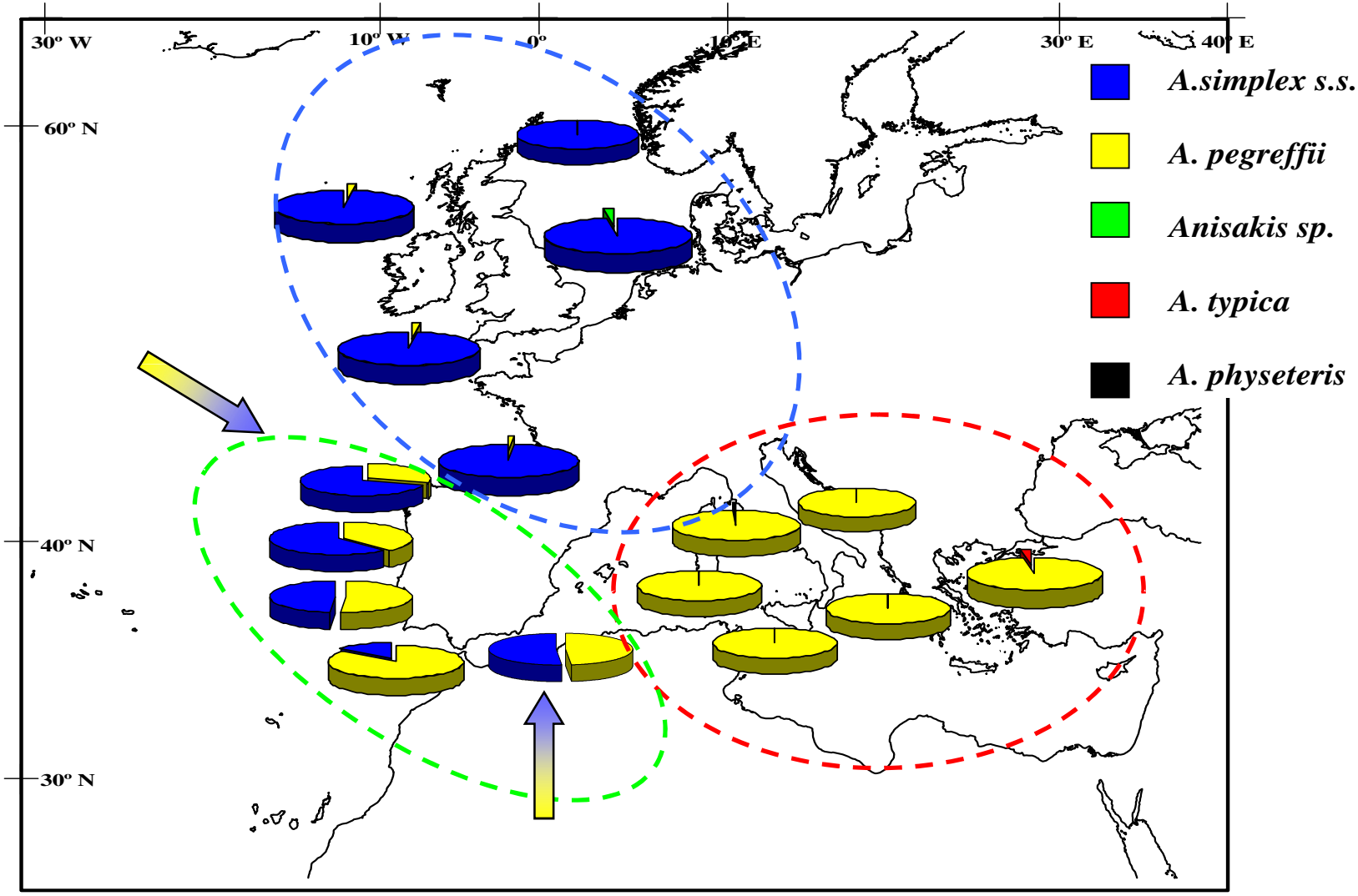


Figure modified from Mattiucci et al. 2008. Fish. Res. 89: 146-151

IV) MAIN RESULTS

- Horse mackerel from the west Iberian Atlantic coast can be distinguished from the rest of the Atlantic areas.
- The northern boundary of the “southern stock” ought to be revised, and accordingly, the shouthern boundary of the “western stock”
- The southern boundary of the so called “southern stock” is more uncertain.

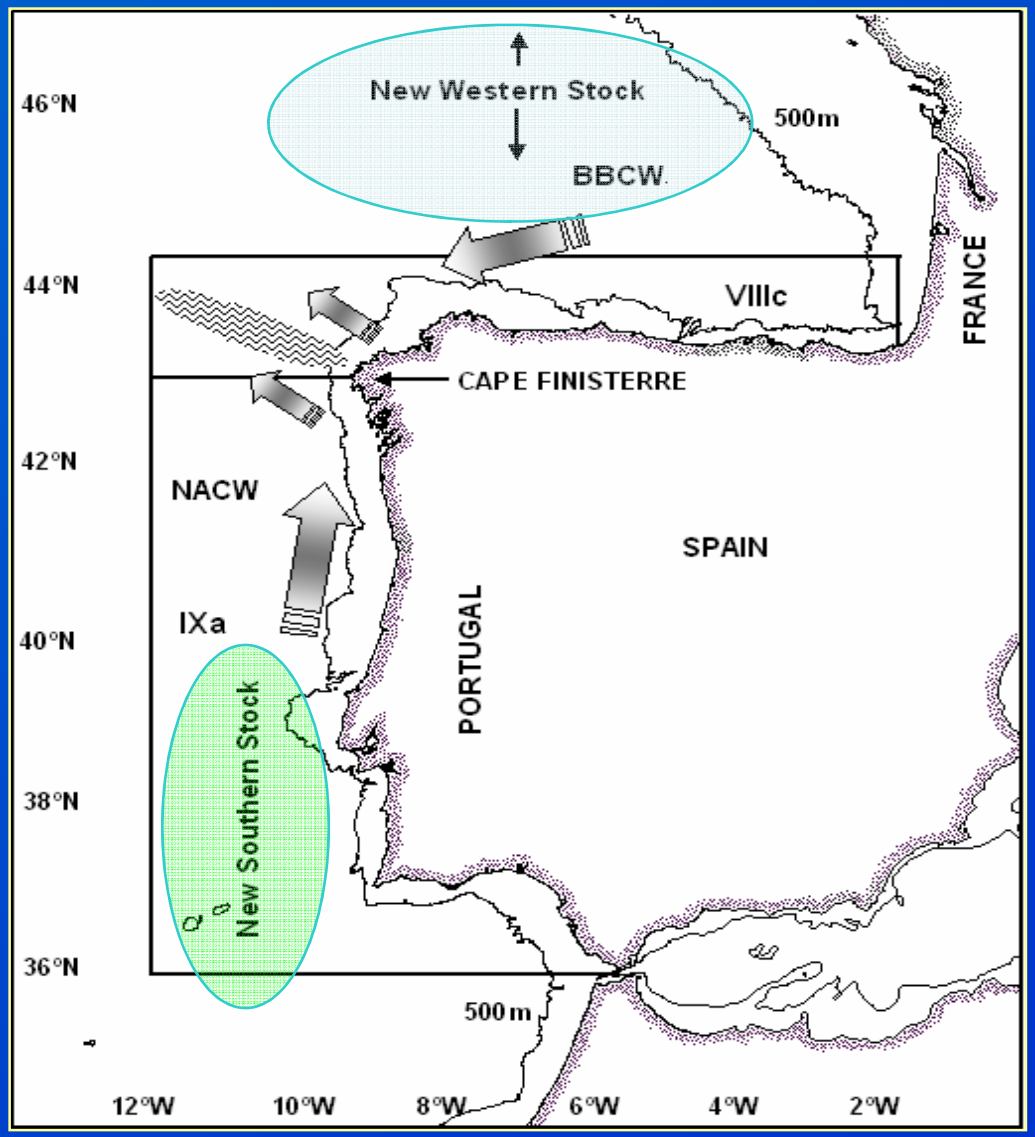


Figure modified from Abaunza et al. 2008. Fish. Res. 89: 196-209

Body morphometrics. Dendogram from Atlantic sites

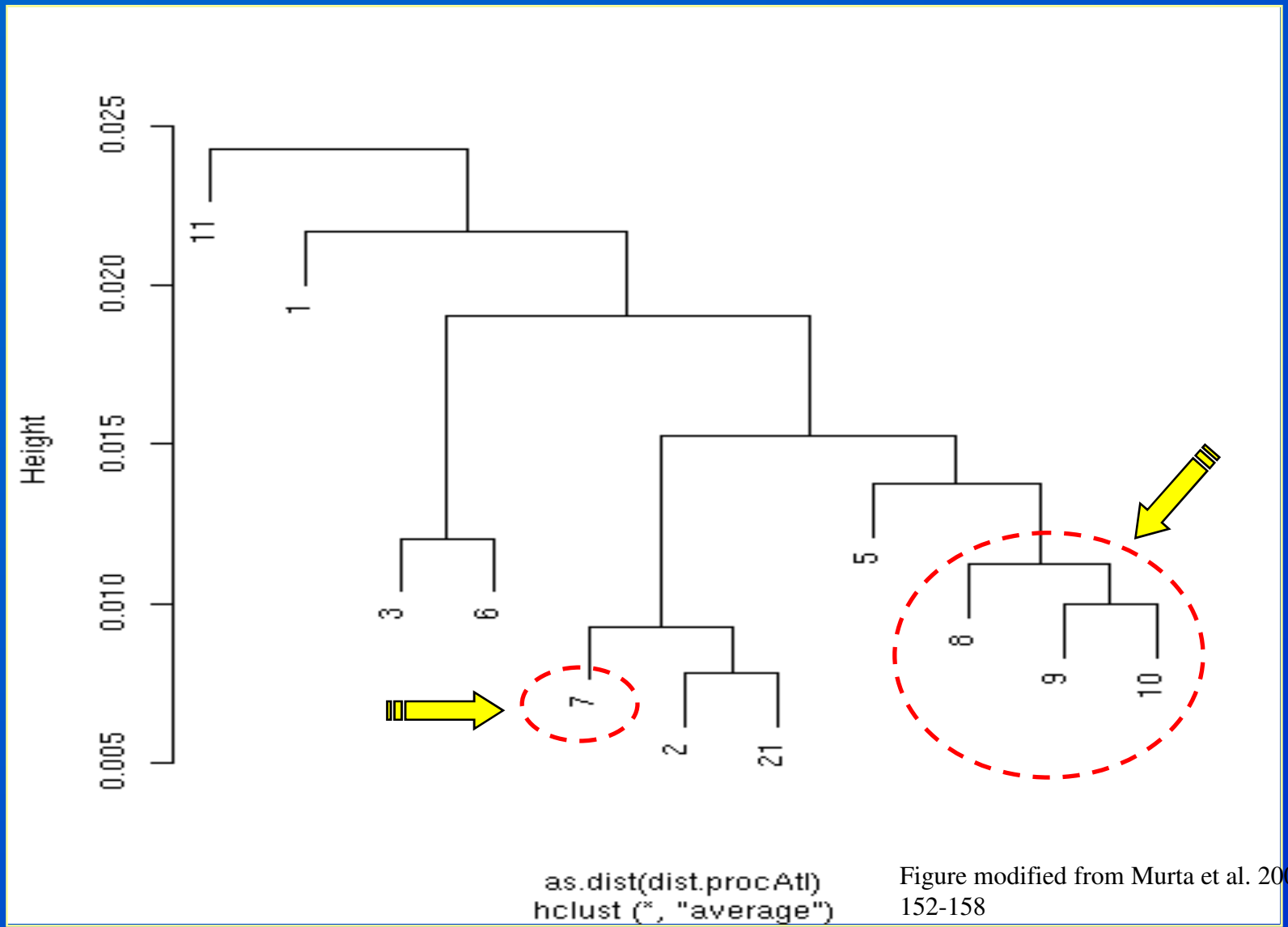
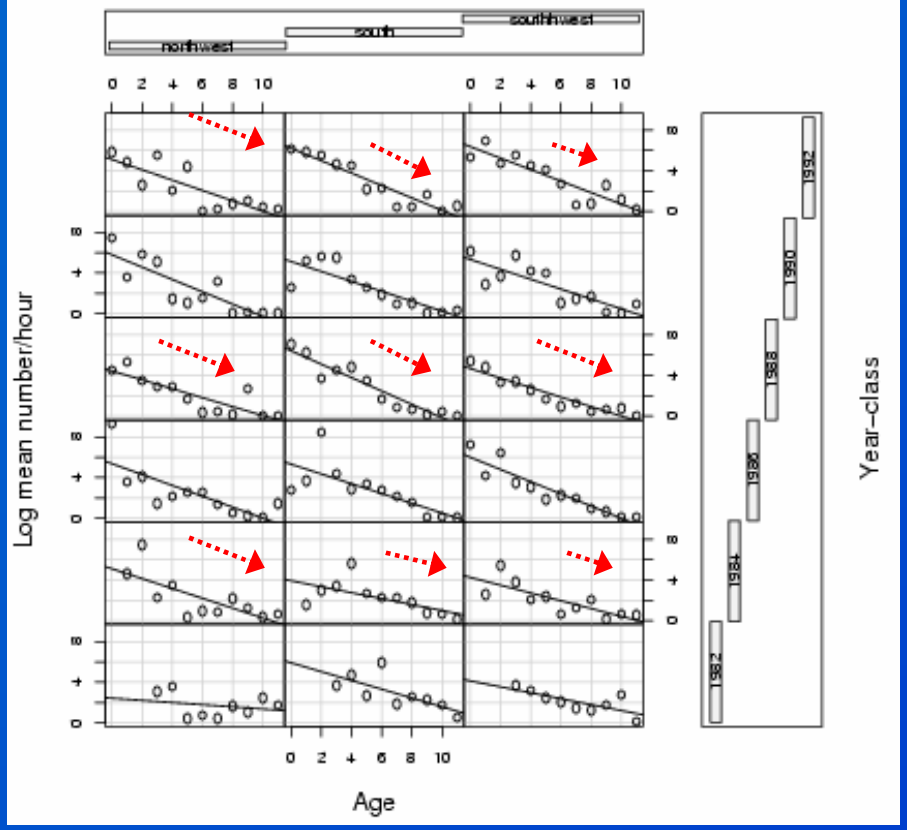


Figure modified from Murta et al. 2008. Fish. Res. 89: 152-158

IV) MAIN RESULTS

Evolution of the abundance of different year-classes, based on survey data, from Atlantic Iberian coast (Portugal and Spain)

Portugal



Spain

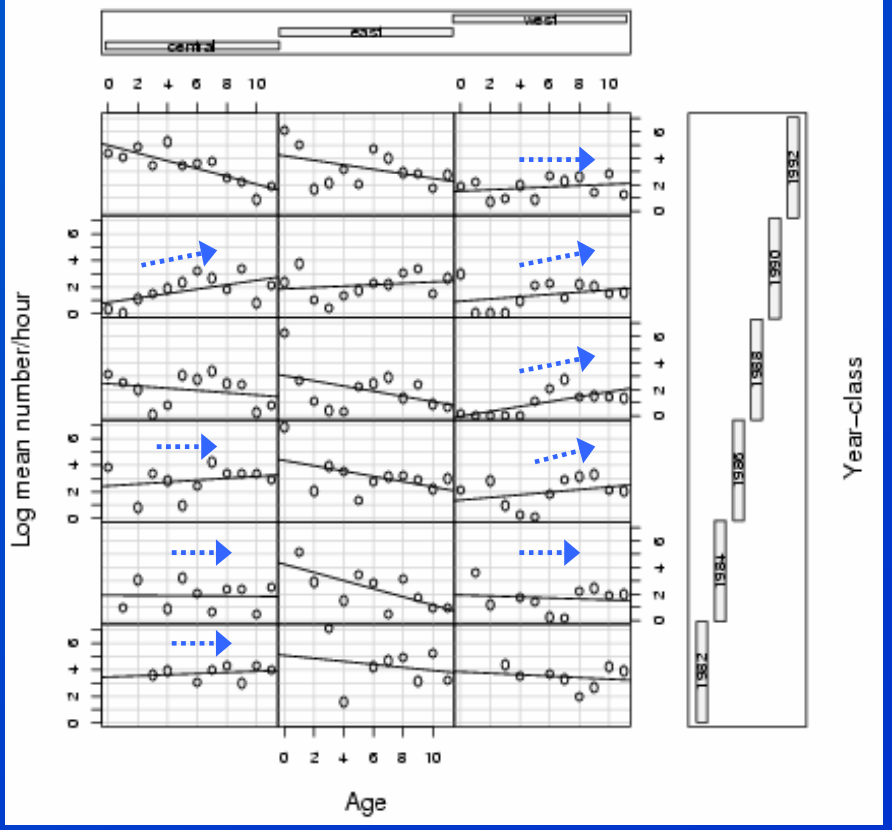


Figure modified from Murta et al. 2008. Fish. Res. 89: 186-195

IV) MAIN RESULTS

Horse mackerel from the North Sea can be distinguished by:

- Parasite composition (relative abundance of anisakids),
- low fecundity
- and body morphometrics

Concordance with Oceanic circulation regime

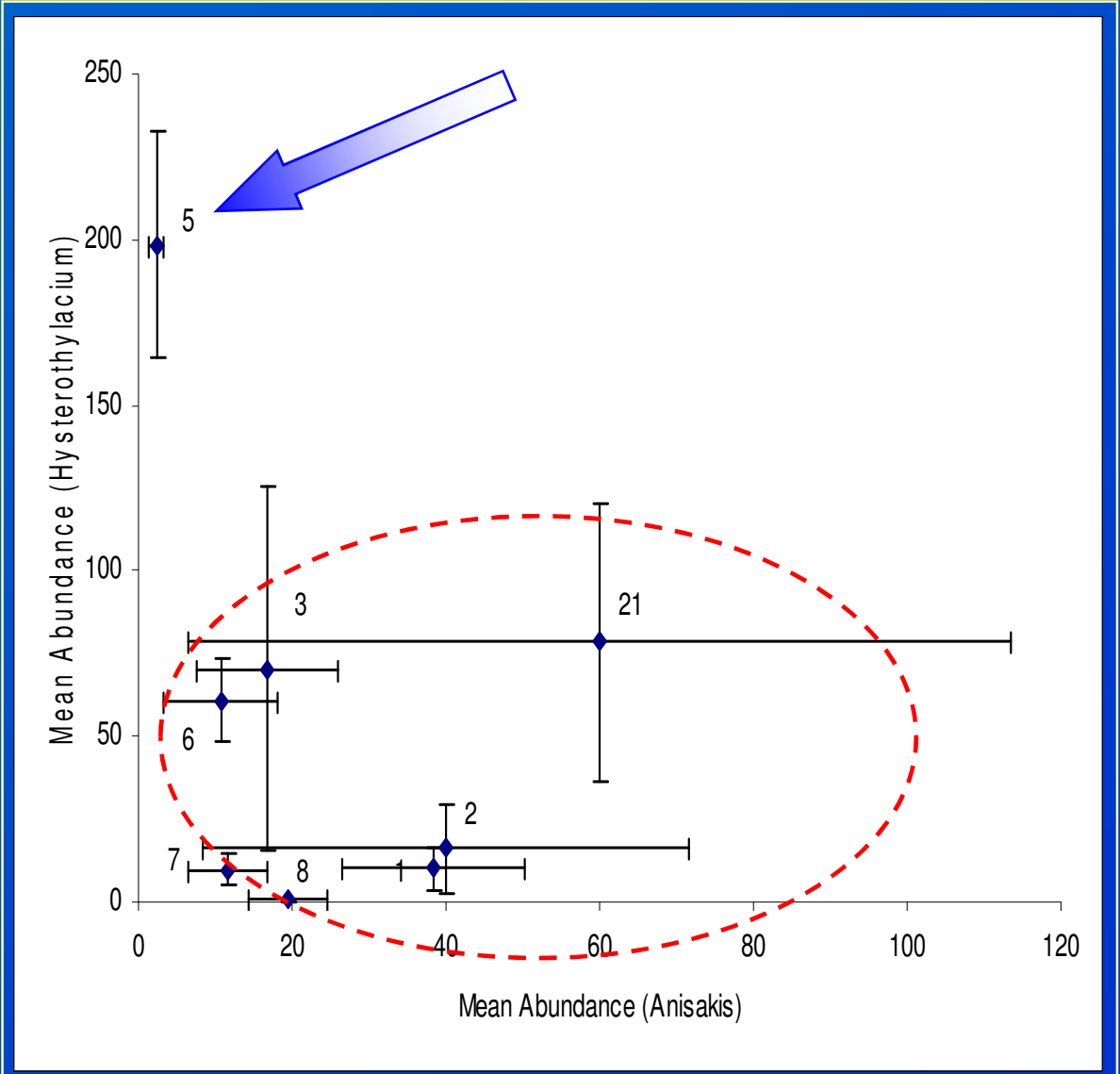


Figure modified from MacKenzie et al. 2008. Fish. Res. 89: 136-145

IV) MAIN RESULTS

- There is certain homogeneity in the characteristics of the horse mackerel from the west European waters (from Galicia to Norway) based on:
  - Otolith shape analysis
  - Body morphometrics
  - Anisakid species composition

- There are clear signals of migratory movements throughout the Atlantic areas, based on:
  - Distribution of commercial catches
  - Parasite species composition
  - Life history traits
  - Distribution of indices of abundance by age.

IV) MAIN RESULTS

Life history traits: growth studies

- Great variability in growth
- Clear pattern of increasing length with latitude:
  - areas 3→2→1
  - areas 10→9→8→7
- Mauritania shows the highest length at age values

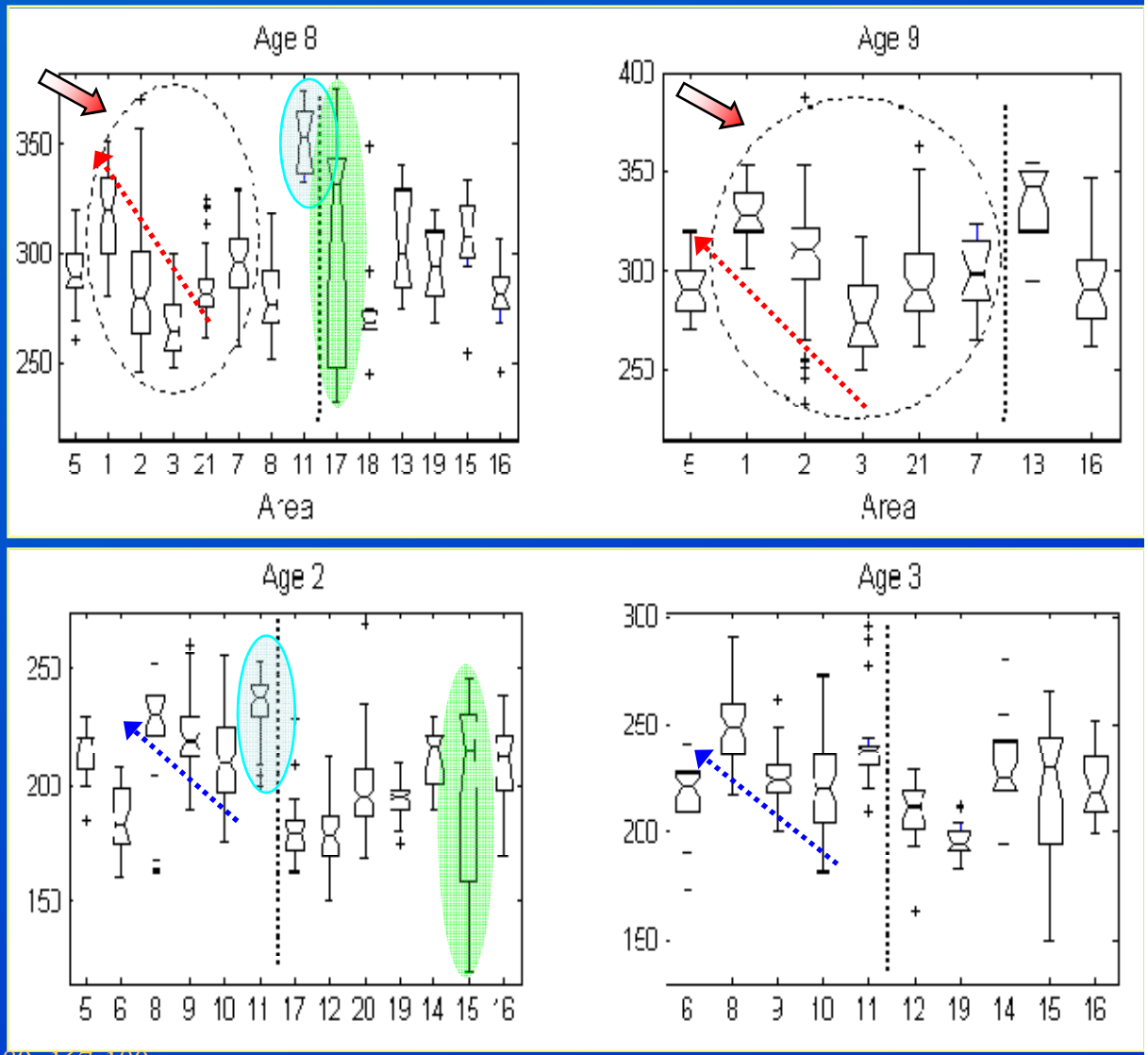


Figure modified from Abaunza et al. 2008. Fish. Res. 89: 167-180

IV) MAIN RESULTS

Distribution of commercial catches

Growth differences: a) poblational; b) length-dependent migration

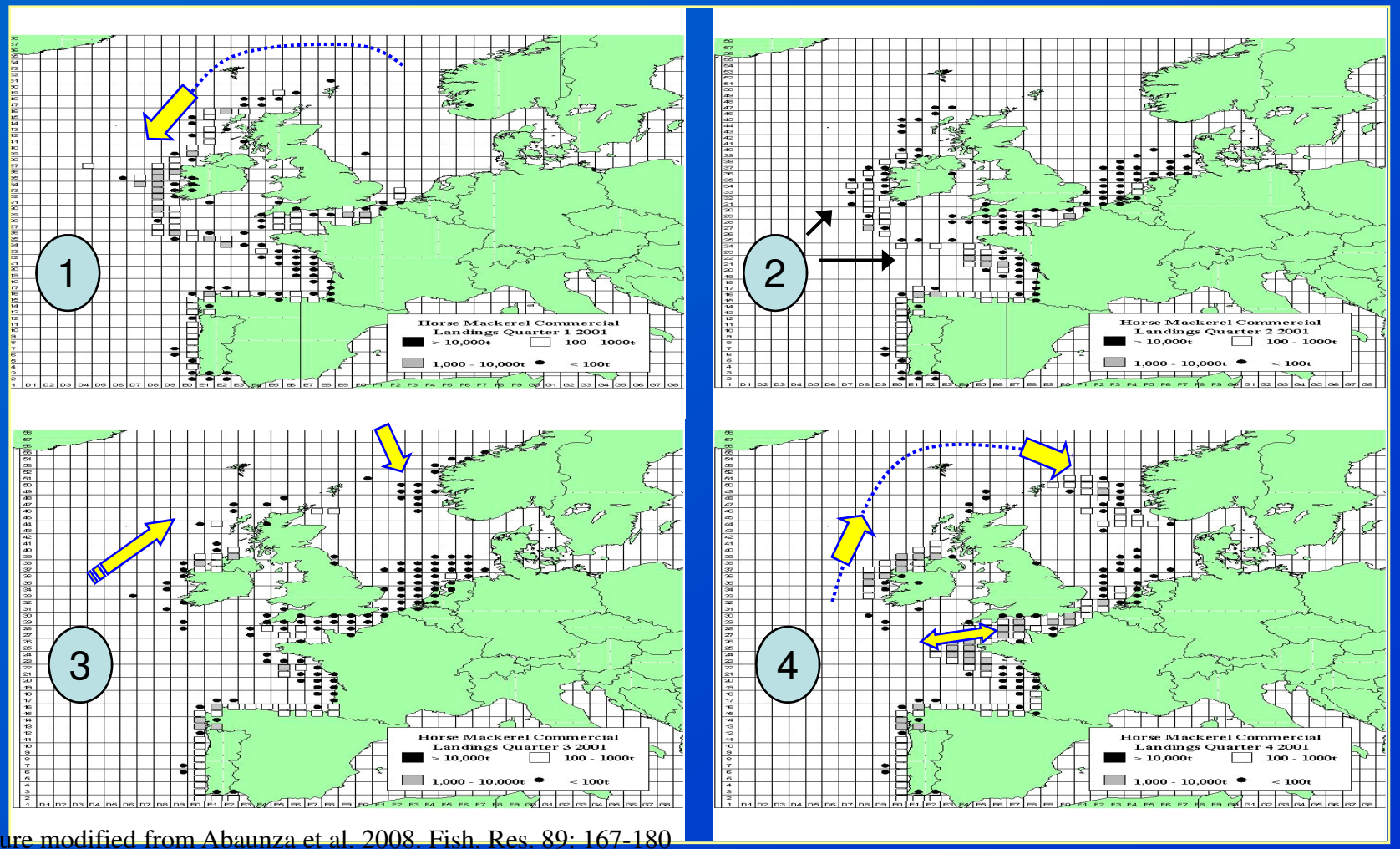


Figure modified from Abaunza et al. 2008. Fish. Res. 89: 167-180

IV) MAIN RESULTS

- Horse mackerel from Mauritanian waters is characterized by its high growth rate and high batch fecundity.

Northwest African waters is an area of high productivity

- Horse mackerel in the Mediterranean Sea is sub-structured in at least three main populations “west”, “central” and “east”, as suggested by morphometrics and parasites

Sampling limitations
First approach
Oceanography: two main sub-basins (east-west)

IV) MAIN RESULTS

Horse mackerel body morphometric results from the Mediterranean

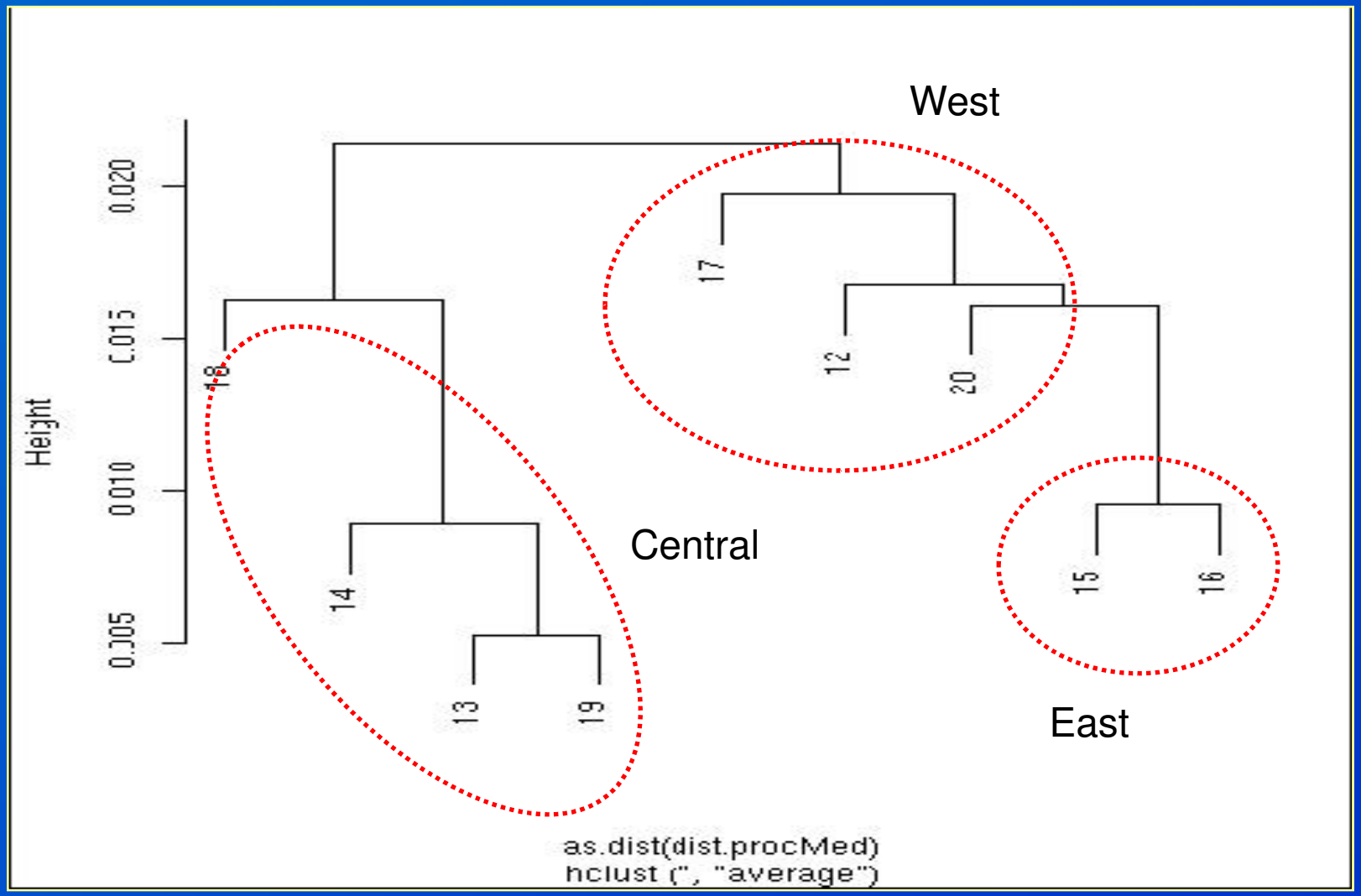


Figure modified from Murta et al. 2008. Fish. Res. 89: 152-158

IV) MAIN RESULTS

SUMMARY OF RESULTS FROM DIFFERENT APPROACHES

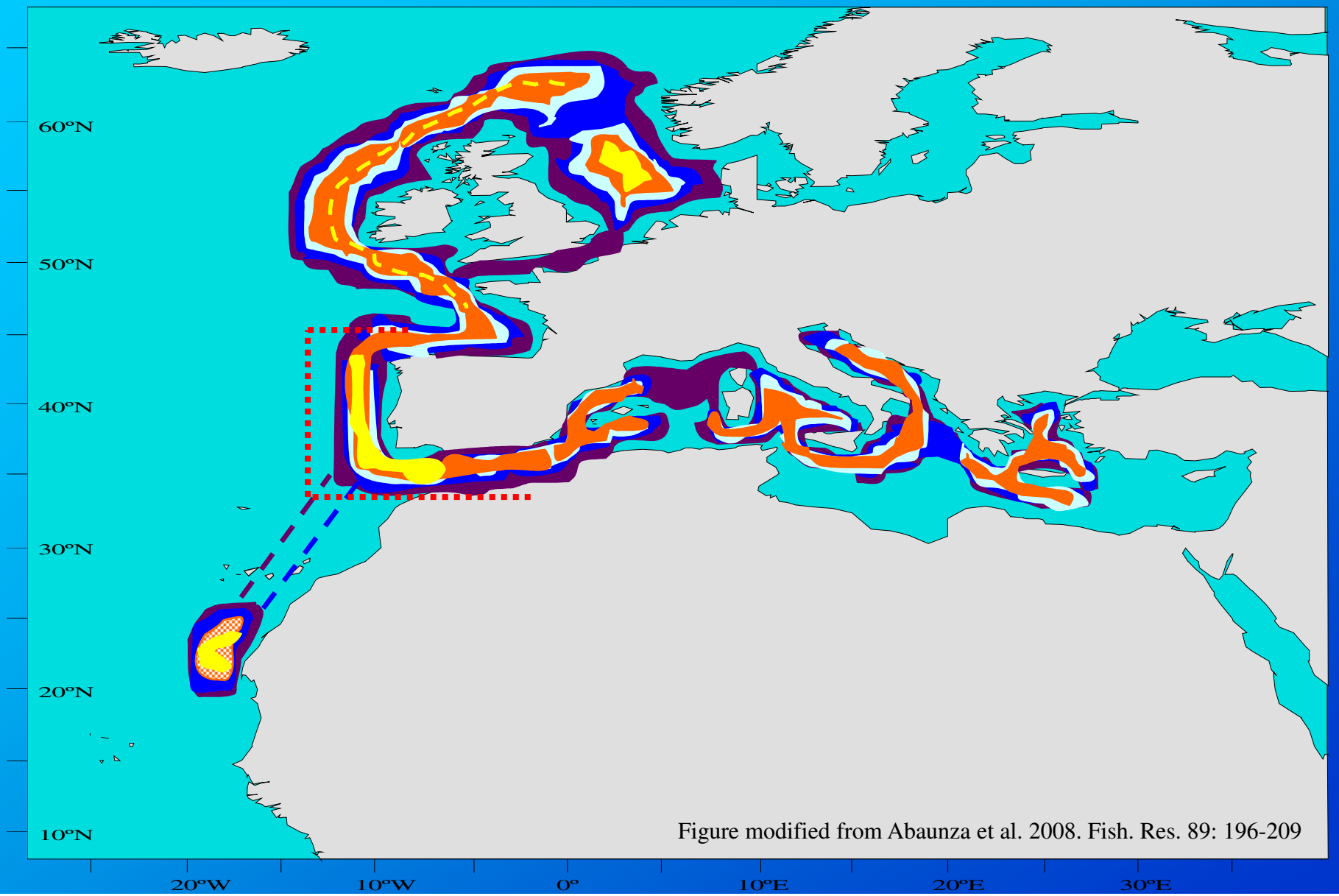


Figure modified from Abaunza et al. 2008. Fish. Res. 89: 196-209


Conclusion

HOMSIR: HORSE MACKEREL STOCK IDENTIFICATION

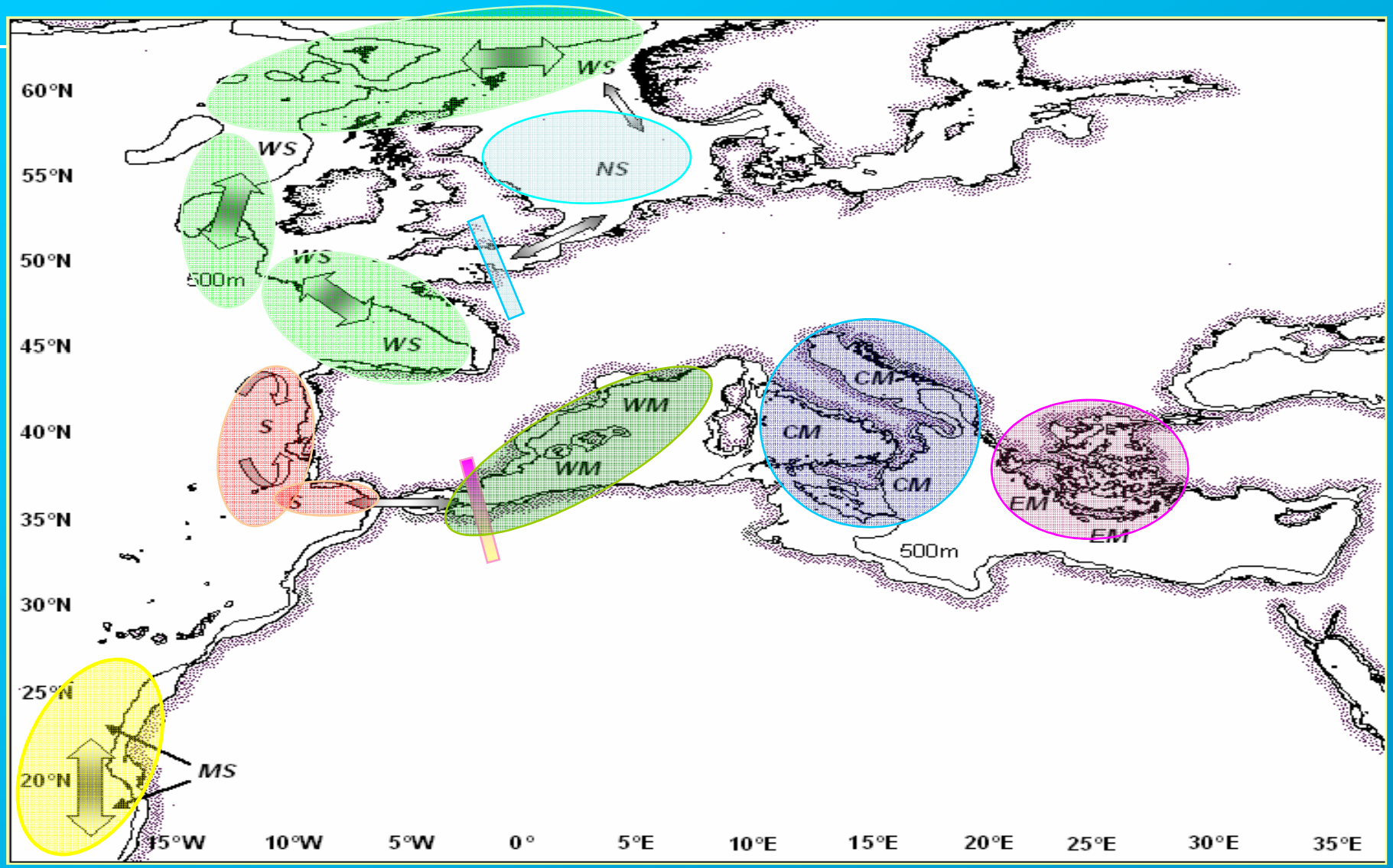


Figure modified from Abaunza et al. 2008. Fish. Res. 89: 196-209

Policy related benefits

- **Setting new basis for a better assessment and management in the Northeast Atlantic**:
  - New boundaries for the Western and Southern Stocks
  - Reallocation of assessment data (ICES, WGMHSA 2004)
  - Supporting North Sea stock
- First approach to horse mackerel stock structure through the Mediterranean Sea (three main stocks could be considered)
- Confirmation of the holistic approach to stock structure analysis and identification of appropriate tags
- Areas that should be explored further in the future: Mediterranean coasts of Africa, Northwest coast of Africa, English Channel.


Thank you for your attention