



INSTITUTO
ESPAÑOL DE
OCEANOGRAFÍA



Assessing the sensitivity of data-limited methods for resources in the Atlantic waters

M. Cousido-Rocha, S. Cerviño, A. Alonso-Fernández, J. Gil, I. González Herraiz, M. M. Rincón, F. Ramos, C. Rodríguez-Cabello, P. Sampedro, Y. Vila, M. G. Pennino

marta.cousido@ieo.es

Instituto Español de Oceanografía (IEO, CSIC), Vigo

Introduction



Length-based methods have been widely applied to estimate biological parameters and to understand the dynamics of marine resource populations within the category of **data-limited stocks**.

Introduction

Length-based methods have been widely applied to estimate biological parameters and to understand the dynamics of marine resource populations within the category of **data-limited stocks**.

Among the length-based methods applied to data-limited stocks, the International Council for the Exploration of the Sea (ICES) identified the following as **the most appropriate methods** to achieve a reliable assessment:

Introduction

Length-based methods have been widely applied to estimate biological parameters and to understand the dynamics of marine resource populations within the category of **data-limited stocks**.

Among the length-based methods applied to data-limited stocks, the International Council for the Exploration of the Sea (ICES) identified the following as **the most appropriate methods** to achieve a reliable assessment:

- the length-based indicator (**LBI**);

Introduction

Length-based methods have been widely applied to estimate biological parameters and to understand the dynamics of marine resource populations within the category of **data-limited stocks**.

Among the length-based methods applied to data-limited stocks, the International Council for the Exploration of the Sea (ICES) identified the following as **the most appropriate methods** to achieve a reliable assessment:

- the length-based indicator (**LBI**);
- the length-based spawning potential ratio (**LBSPR**).

Introduction

Length-based methods have been widely applied to estimate biological parameters and to understand the dynamics of marine resource populations within the category of **data-limited stocks**.

Among the length-based methods applied to data-limited stocks, the International Council for the Exploration of the Sea (ICES) identified the following as **the most appropriate methods** to achieve a reliable assessment:

- the length-based indicator (**LBI**);
- the length-based spawning potential ratio (**LBSPR**).

The accuracy of the results of the model depends as much on:

Introduction

Length-based methods have been widely applied to estimate biological parameters and to understand the dynamics of marine resource populations within the category of **data-limited stocks**.

Among the length-based methods applied to data-limited stocks, the International Council for the Exploration of the Sea (ICES) identified the following as **the most appropriate methods** to achieve a reliable assessment:

- the length-based indicator (**LBI**);
- the length-based spawning potential ratio (**LBSPR**).

The accuracy of the results of the model depends as much on:

- **the precision of the estimates of the life history parameters** required as on the inputs in the methods;

Introduction

Length-based methods have been widely applied to estimate biological parameters and to understand the dynamics of marine resource populations within the category of **data-limited stocks**.

Among the length-based methods applied to data-limited stocks, the International Council for the Exploration of the Sea (ICES) identified the following as **the most appropriate methods** to achieve a reliable assessment:

- the length-based indicator (**LBI**);
- the length-based spawning potential ratio (**LBSPR**).

The accuracy of the results of the model depends as much on:

- the **precision of the estimates of the life history parameters** required as on the inputs in the methods;
- on the **assumptions made** (constant mortality and recruitment, logistic selectivity ...).

Introduction

Length-based methods have been widely applied to estimate biological parameters and to understand the dynamics of marine resource populations within the category of **data-limited stocks**.

Among the length-based methods applied to data-limited stocks, the International Council for the Exploration of the Sea (ICES) identified the following as **the most appropriate methods** to achieve a reliable assessment:

- the length-based indicator (**LBI**);
- the length-based spawning potential ratio (**LBSPR**).

The accuracy of the results of the model depends as much on:

- the **precision of the estimates of the life history parameters** required as on the inputs in the methods;
- on the **assumptions made** (constant mortality and recruitment, logistic selectivity ...).

Objectives

However, few studies have been performed to date to test the parameter sensitivity of length-based methods on stocks with different traits and fishery contexts.

Objectives

However, few studies have been performed to date to test the parameter sensitivity of length-based methods on stocks with different traits and fishery contexts.

Dual objective

- Evaluate the status of 7 different stocks of the Bay of Biscay and the Iberian Coast ecoregion using the LBI and LBSPR methods and comparing whether or not these results concur with the current available knowledge of the state of these stocks.

Objectives

However, few studies have been performed to date to test the parameter sensitivity of length-based methods on stocks with different traits and fishery contexts.

Dual objective

- Evaluate the status of 7 different stocks of the Bay of Biscay and the Iberian Coast ecoregion using the LBI and LBSPR methods and comparing whether or not these results concur with the current available knowledge of the state of these stocks. With this aim, it was checked if disagreements among both sources of information (i.e., current knowledge vs. our results) can be related to the noncompliance of model assumptions in each case.

Objectives

However, few studies have been performed to date to test the parameter sensitivity of length-based methods on stocks with different traits and fishery contexts.

Dual objective

- Evaluate the status of 7 different stocks of the Bay of Biscay and the Iberian Coast ecoregion using the LBI and LBSPR methods and comparing whether or not these results concur with the current available knowledge of the state of these stocks. With this aim, it was checked if disagreements among both sources of information (i.e., current knowledge vs. our results) can be related to the noncompliance of model assumptions in each case.
- The robustness of these methods was analysed for the studied stocks under various scenarios, testing in particular the sensitivity of the most important parameters (L_{∞} , von Bertalanffy asymptotic average maximum body size, and M/k , ratio of natural mortality to von Bertalanffy growth rate).

Objectives

However, few studies have been performed to date to test the parameter sensitivity of length-based methods on stocks with different traits and fishery contexts.

Dual objective

- Evaluate the status of 7 different stocks of the Bay of Biscay and the Iberian Coast ecoregion using the LBI and LBSPR methods and comparing whether or not these results concur with the current available knowledge of the state of these stocks. With this aim, it was checked if disagreements among both sources of information (i.e., current knowledge vs. our results) can be related to the noncompliance of model assumptions in each case.
- The robustness of these methods was analysed for the studied stocks under various scenarios, testing in particular the sensitivity of the most important parameters (L_{∞} , von Bertalanffy asymptotic average maximum body size, and M/k , ratio of natural mortality to von Bertalanffy growth rate).

Conclusions: first aim

Stock status was assessed using the results of the LBI and LBSPR methods in the reference parameter configuration (L_{∞} and M/k equal to the values obtained after a literature review or the analysis of other reliable information).

Conclusions: first aim

Stock status was assessed using the results of the LBI and LBSPR methods in the reference parameter configuration (L_{∞} and M/k equal to the values obtained after a literature review or the analysis of other reliable information).

Results of LBI and LBSPR methods concur with the **current available knowledge** of the state of these stocks for 3 and 1 of the 7 stocks, respectively.

Disagreements among both sources of information has been related to:

Conclusions: first aim

Stock status was assessed using the results of the LBI and LBSPR methods in the reference parameter configuration (L_{∞} and M/k equal to the values obtained after a literature review or the analysis of other reliable information).

Results of LBI and LBSPR methods concur with the **current available knowledge** of the state of these stocks for 3 and 1 of the 7 stocks, respectively.

Disagreements among both sources of information has been related to:

- model assumptions constant recruitment and total mortality are not met.

Conclusions: first aim

Stock status was assessed using the results of the LBI and LBSPR methods in the reference parameter configuration (L_{∞} and M/k equal to the values obtained after a literature review or the analysis of other reliable information).

Results of LBI and LBSPR methods concur with the **current available knowledge** of the state of these stocks for 3 and 1 of the 7 stocks, respectively.

Disagreements among both sources of information has been related to:

- model assumptions constant recruitment and total mortality are not met.
- life history parameters are high uncertainty or need to be updated.

Conclusions: first aim

Stock status was assessed using the results of the LBI and LBSPR methods in the reference parameter configuration (L_{∞} and M/k equal to the values obtained after a literature review or the analysis of other reliable information).

Results of LBI and LBSPR methods concur with the **current available knowledge** of the state of these stocks for 3 and 1 of the 7 stocks, respectively.

Disagreements among both sources of information has been related to:

- model assumptions constant recruitment and total mortality are not met.
- life history parameters are high uncertainty or need to be updated.
- logistic selectivity assumption is not fulfilled.

Conclusions: first aim

Stock status was assessed using the results of the LBI and LBSPR methods in the reference parameter configuration (L_{∞} and M/k equal to the values obtained after a literature review or the analysis of other reliable information).

Results of LBI and LBSPR methods concur with the **current available knowledge** of the state of these stocks for 3 and 1 of the 7 stocks, respectively.

Disagreements among both sources of information has been related to:

- model assumptions constant recruitment and total mortality are not met.
- life history parameters are high uncertainty or need to be updated.
- logistic selectivity assumption is not fulfilled.
- a spatial component is required (for example, stocks which inhabit burrow).

Conclusions: first aim

Stock status was assessed using the results of the LBI and LBSPR methods in the reference parameter configuration (L_{∞} and M/k equal to the values obtained after a literature review or the analysis of other reliable information).

Results of LBI and LBSPR methods concur with the **current available knowledge** of the state of these stocks for 3 and 1 of the 7 stocks, respectively.

Disagreements among both sources of information has been related to:

- model assumptions constant recruitment and total mortality are not met.
- life history parameters are high uncertainty or need to be updated.
- logistic selectivity assumption is not fulfilled.
- a spatial component is required (for example, stocks which inhabit burrow).
- stock length distribution does not represent juvenile specimens or has an extra variability due to transform quarterly distributions into yearly distributions.

Conclusions: second aim

The results of the methods in the reference setting are compared to the obtained under overestimation/underestimation of parameters M/k and L_∞ computing the **the annual average of change ratios**, defined as the mean of the annual ratios of the values of the indicator in the corresponding setting of overestimation or underestimation over the values of the indicator in the reference.

- The values of the annual average of change ratios are greater under the variation of L_∞ than under the variation M/k , supporting the conclusion that **L_∞ is crucial for accurate assessment** using either of the two methods.

Conclusions: second aim

The results of the methods in the reference setting are compared to the obtained under overestimation/underestimation of parameters M/k and L_∞ computing the **the annual average of change ratios**, defined as the mean of the annual ratios of the values of the indicator in the corresponding setting of overestimation or underestimation over the values of the indicator in the reference.

- The values of the annual average of change ratios are greater under the variation of L_∞ than under the variation M/k , supporting the conclusion that **L_∞ is crucial for accurate assessment** using either of the two methods.
- **The indicator most affected by the variation on M/k or L_∞ is P_{mega}** (proportion of megaspawnners) **followed by F/M** (fishing mortality over natural mortality) **and SPR.**

Conclusions: second aim

The results of the methods in the reference setting are compared to the obtained under overestimation/underestimation of parameters M/k and L_∞ computing the **the annual average of change ratios**, defined as the mean of the annual ratios of the values of the indicator in the corresponding setting of overestimation or underestimation over the values of the indicator in the reference.

- The values of the annual average of change ratios are greater under the variation of L_∞ than under the variation M/k , supporting the conclusion that **L_∞ is crucial for accurate assessment** using either of the two methods.
- **The indicator most affected by the variation on M/k or L_∞ is P_{mega}** (proportion of mega-spawners) followed by F/M (fishing mortality over natural mortality) and SPR.
- The variation on M/k affects similar both LBSPR indicators whereas **the effect of the variation of L_∞ is clearly larger for SPR than F/M .**

Conclusions: second aim

The results of the methods in the reference setting are compared to the obtained under overestimation/underestimation of parameters M/k and L_∞ computing the **the annual average of change ratios**, defined as the mean of the annual ratios of the values of the indicator in the corresponding setting of overestimation or underestimation over the values of the indicator in the reference.

- The values of the annual average of change ratios are greater under the variation of L_∞ than under the variation M/k , supporting the conclusion that **L_∞ is crucial for accurate assessment** using either of the two methods.
- **The indicator most affected by the variation on M/k or L_∞ is P_{mega}** (proportion of megaspawnners) followed by F/M (fishing mortality over natural mortality) and SPR.
- The variation on M/k affects similar both LBSPR indicators whereas **the effect of the variation of L_∞ is clearly larger for SPR than F/M .**
- Among the **LBI indicators, P_{mega} is the least robust indicator** to the variation/misspecification of L_∞ and M/k whereas the **most robust indicator corresponds to the MSY property.**

Conclusions: second aim

The results of the methods in the reference setting are compared to the obtained under overestimation/underestimation of parameters M/k and L_∞ computing the **the annual average of change ratios**, defined as the mean of the annual ratios of the values of the indicator in the corresponding setting of overestimation or underestimation over the values of the indicator in the reference.

- The values of the annual average of change ratios are greater under the variation of L_∞ than under the variation M/k , supporting the conclusion that **L_∞ is crucial for accurate assessment** using either of the two methods.
- **The indicator most affected by the variation on M/k or L_∞ is P_{mega}** (proportion of mega-spawners) followed by F/M (fishing mortality over natural mortality) and SPR.
- The variation on M/k affects similar both LBSPR indicators whereas **the effect of the variation of L_∞ is clearly larger for SPR than F/M .**
- Among the **LBI indicators, P_{mega} is the least robust indicator** to the variation/misspecification of L_∞ and M/k whereas the **most robust indicator corresponds to the MSY property.**
- **The LBI indicators, except P_{mega} , can be preferred over LBSPR indicators**, specially if L_∞ is uncertainty.

Thanks for your attention!

Contact: marta.cousido@ieo.es



Acknowledgments

The authors thank the financial support of the project IMPRESS (RTI2018-099868-B-I00) project, ERDF, Ministry of Science, Innovation and Universities - State Research Agency, and also of GAIN (Xunta de Galicia), GRC MERVEX (n^o IN607-A 2018-4).