# Approaches for data limited stocks

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# Approaches for data limited stocks

| | | Next step |
|---|---|---|
| SCA Bell | | FU 31: Check & interpretation of the results. FU 25? |
| SCA Helen | Single model run | FU 31: Check & interpretation of the results. FU 25? |
| | HR Sensitivity analysis | FLR object construction |
| Farfish DLT | | FU 31: Check & interpretation of the results. FU 25? |
| LBI | | FU 31: Check & interpretation of the results. FU 25? |
| LB-SPR | | FU 31: Check & interpretation of the results. FU 25? |
| FU 25 Spatial analysis | | Useful? How show the results? FU 31? |
| Mean Length b.e. (z) | | Not done, start from the beginning |

| Other tools | Reference |
|---|---|
| SPICTs | |
| Combined catch and CPUE-based method | ICES WKProxy 2015 |
| Catch based method (CMSY) | ICES WKProxy 2015 |
| … | |

# SCA (Separable Cohort Analysis, Bell & Dobby)

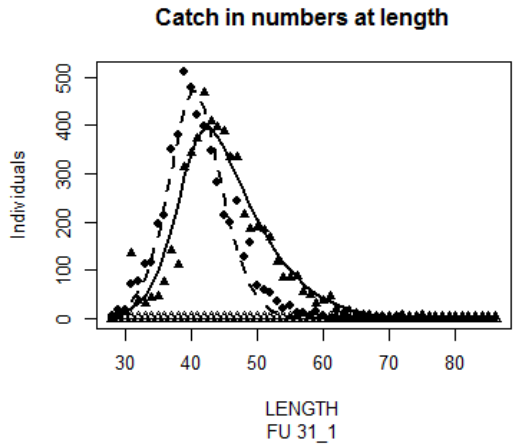
- introduction males and females information
- Nephrops specific

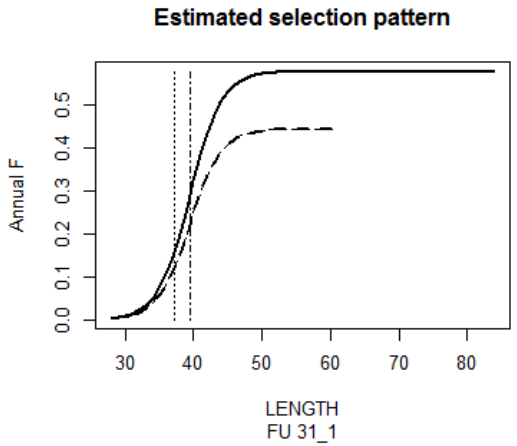
- only one length distribution (last one, 5y/3y average)

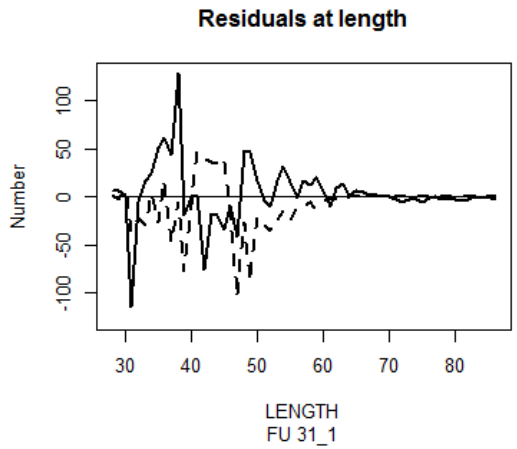
- several input data unknown (starting recruit numbers-units, etc)

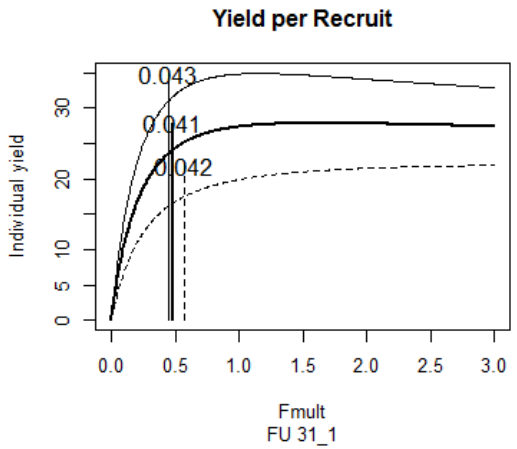
- interpretation of the results

# SCA (Separable Cohort Analysis, Bell)



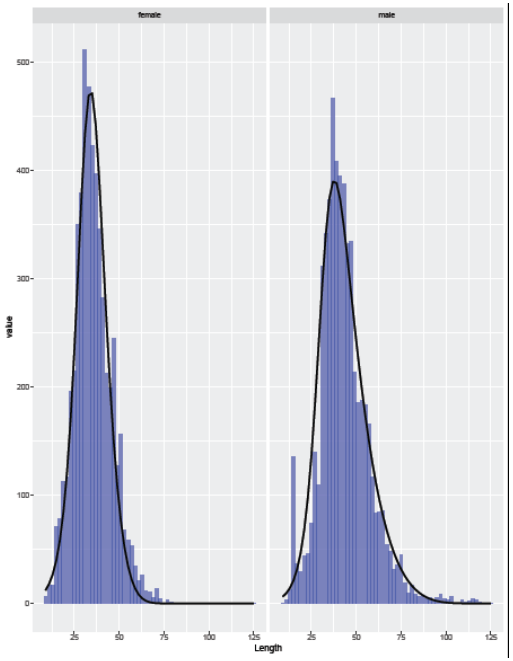



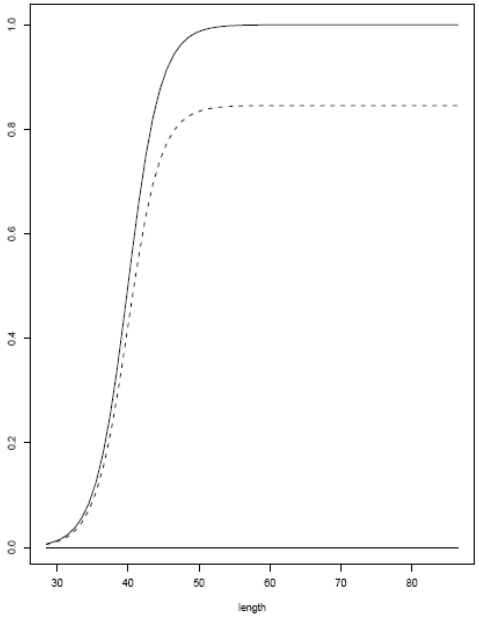



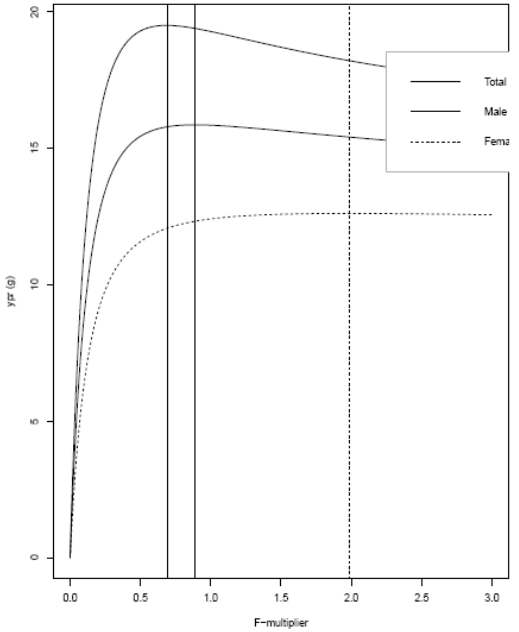

| |
|---|
| pop.Male |
| pop.Female |
| S.25 |
| S.50 |
| fmult.Male |
| fmult.Female |
| Sel |
| Ret |
| F.Male |
| F.Female |
| ann.F.Male |
| ann.F.Female |
| FemaleMatu |
| MaleMaturity |
| Delta.T.Male |
| Delta.T.Fema |
| Fland.Male |
| Fland.Female |
| ann.Fland.Ma |
| ann.Fland.Fe |
| Z.Male |
| Z.Female |
| M.Male |
| M.Female |
| Time.Male |
| Time.Female |

| |
|---|
| N.CATCHhat. |
| N.CATCHhat. |
| N.LANDhat.M |
| N.LANDhat.F |
| N.DISChat.M |
| N.DISChat.Fe |
| ssq.land |
| ssq.disc |
| ssq |
| LENGTH |
| nat.Male |
| nat.Female |
| TV.selectivity |
| N.LAND.Male |
| N.LAND.Fem |
| N.DISC.Male |
| N.DISC.Fema |
| WEIGHT.Male |
| WEIGHT.Fem |
| R.25 |
| R.50 |
| M.Male.t |
| M.Female.t |
| TV.Male |
| TV.Female |

# SCA (Separable Cohort Analysis, Dobby)



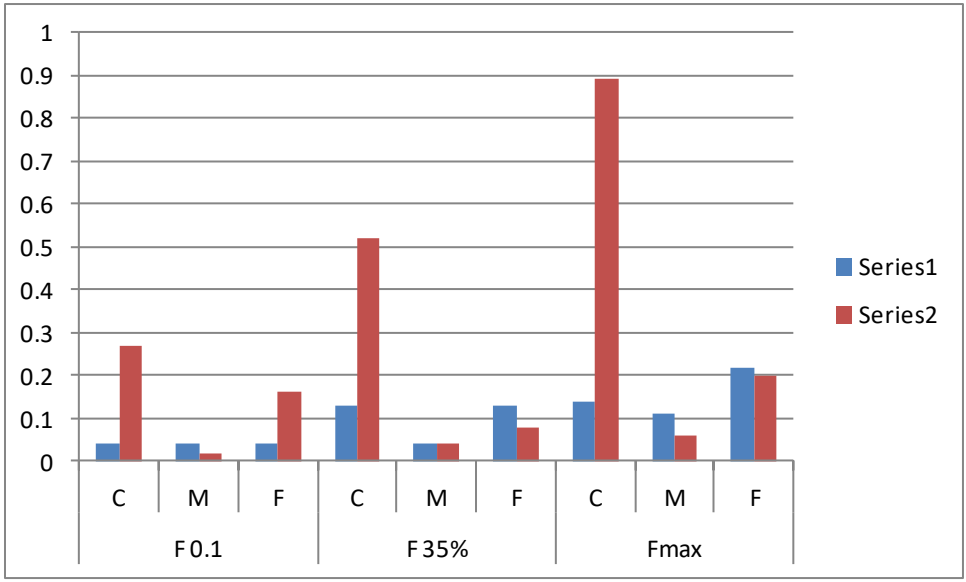

| | Fmult | F(M) | F(F) | HR | SSB%(M) | SSB%(F) | SSB%(T) |
|---|---|---|---|---|---|---|---|
| F0.1(M) | 0.26 | 0.02 | 0.03 | 6.09 | 44.53 | 52.91 | 48.31 |
| F0.1(F) | 1.59 | 0.14 | 0.16 | 14.82 | 16.59 | 26.81 | 21.20 |
| F0.1(T) | 0.27 | 0.02 | 0.03 | 6.24 | 43.64 | 52.17 | 47.49 |
| Fmax(M) | 0.69 | 0.06 | 0.07 | 10.58 | 25.50 | 36.36 | 30.40 |
| Fmax(F) | 1.99 | 0.17 | 0.20 | 15.98 | 15.04 | 24.80 | 19.44 |
| Fmax(T) | 0.89 | 0.08 | 0.09 | 11.86 | 22.14 | 33.04 | 27.06 |
| F35%(M) | 0.41 | 0.04 | 0.04 | 8.07 | 34.50 | 44.47 | 39.00 |
| F35%(F) | 0.77 | 0.07 | 0.08 | 11.13 | 23.98 | 34.88 | 28.90 |
| F35%(T) | 0.52 | 0.05 | 0.05 | 9.20 | 30.04 | 40.54 | 34.77 |

**Table 2 Harvest rate ranges i.e at 95% YPR**

| lower | upper |
|---|---|
| 5.44 | 18.13 |
| 7.60 | 18.13 |
| 5.61 | 18.13 |
| 7.96 | 18.13 |
| 7.36 | 18.13 |
| 8.07 | 17.80 |
| 6.83 | 18.13 |
| 8.07 | 17.91 |
| 7.48 | 18.13 |

# Comparison

| | | SCA Bell | SCA Dobby |
|---|---|---|---|
| F 0.1 | C | 0.04 | 0.27 |
| | M | 0.04 | 0.02 |
| | F | 0.04 | 0.16 |
| F 35% | C | 0.13 | 0.52 |
| | M | 0.04 | 0.04 |
| | F | 0.13 | 0.08 |
| Fmax | C | 0.14 | 0.89 |
| | M | 0.11 | 0.06 |
| | F | 0.22 | 0.2 |
| HR 0.1 | C | 15 | 6.2 |
| | M | 14 | 6.1 |
| | F | 17 | 14.8 |
| HR 35% | C | 30 | 9.2 |
| | M | 12 | 8.1 |
| | F | 32 | 11.1 |
| HR max | C | 31 | 11.9 |
| | M | 26 | 10.6 |
| | F | 41 | 16 |




# Farfish Data Limited Method

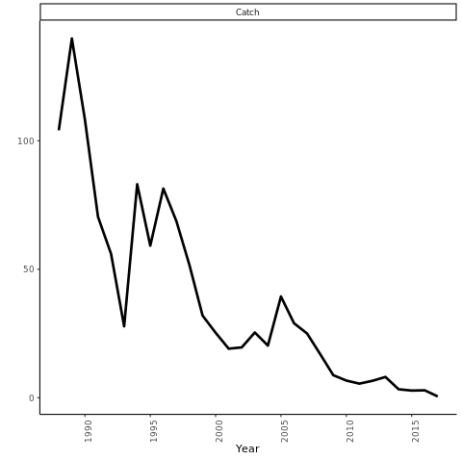
Interactive plataform of H2020 Farfish project (until 2021)

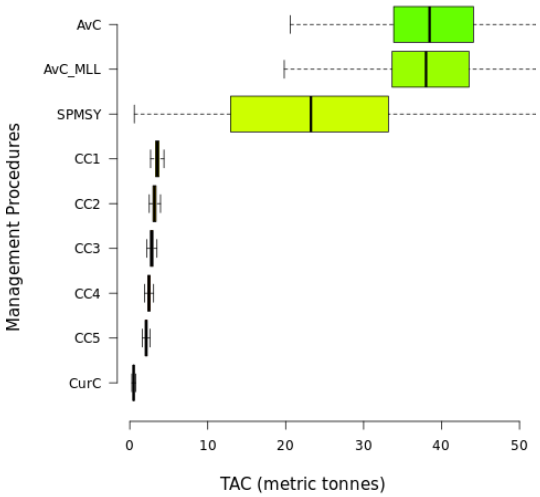
Objective: Provide an easy tool for outside Europe fisheries (Mauritania, Cabo Verde, Seychelles, Senegal, Brasil, etc). See information in sharepoint.

OK:
- shiny https://ffdb.farfish.eu/shiny/dlmgui
- you can introduce all the time series of lengths distributions.
- Diagnostics - Quick answer when ask
- TAC plot

NO OK:
- NO DATA ESTIMATIONS? (F, HR, ETC)
- you can not introduce males and females lengths.
- beta version
- files upload problems

# Farfish Data Limited Method



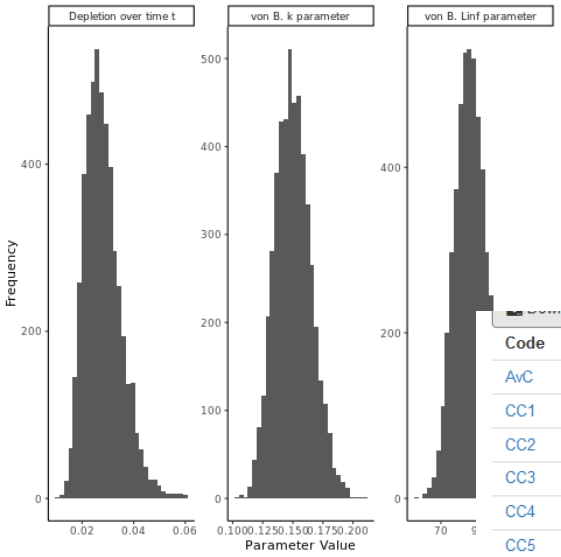




## Enough data to produce

| Direction | Code | Name | Type | Description |
|---|---|---|---|---|
| | AvC_MLL (https://dlmtool.github.io/DLMtool/reference/AvC_MLL.html) | Average Catch with a size limit | | A example mixed control MP that uses the average catch output control MP together with a minimul size limit set at the size of maturity. |
| input | curE (https://dlmtool.github.io/DLMtool/reference/curE.html) | Current effort | Effort | A reference input control that maintains current effort (subject to fishing efficiency changes) |
| input | curE75 (https://dlmtool.github.io/DLMtool/reference/curE.html) | 75% of Current effort | Effort | A reference input control that maintains 75% of current effort |

## Cannot produce

| Direction | Code | Name | Type | Reason |
|---|---|---|---|---|
| | DDes (https://dlmtool.github.io/DLMtool/reference/DDs.html) | Effort-based Delay - Difference Stock Assessment | | Missing data: Mort, Ind |
| | DTe40 (https://dlmtool.github.io/DLMtool/reference/DTe40.html) | Effort searching MP aiming for a fixed stock depletion | | Missing data: Dep |




| Code | Name | Type | Description |
|---|---|---|---|
| AvC | Average Catch | Catch | Sets TAC as average historical catch |
| CC1 | Constant catch linked to average catches | Catch | TAC is a average historical catches |
| CC2 | Constant catch linked to average catches | Catch | TAC is 90% of average historical catches |
| CC3 | Constant catch linked to average catches | Catch | TAC is 80% of average historical catches |
| CC4 | Constant catch linked to average catches | Catch | TAC is 70% of average historical catches |
| CC5 | Constant catch linked to average catches | Catch | TAC is 60% of average historical catches |
| NFref | No reference point | Catch | A reference MP that sets annual catch to almost zero (0.01) |
| SPMSY | Catch-trend MSY MP | Catch | Catch trends reflect depletion and combined with catches can be used to find viable r-K pairs. The OFL is dep x (1-dep) x 2 x r x K |

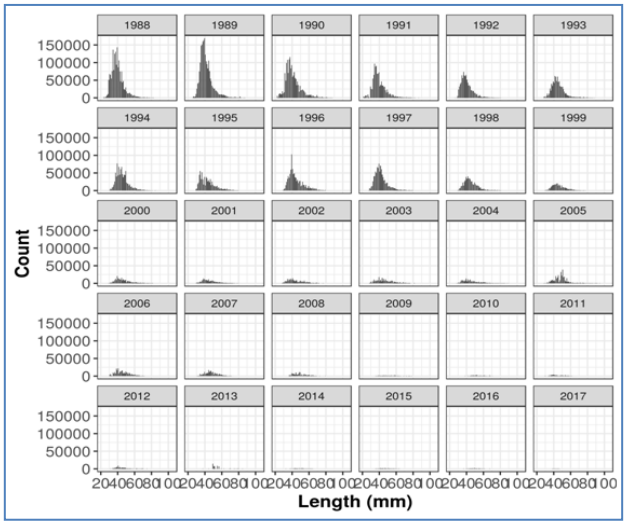
# LBI (Length Based Indicators)

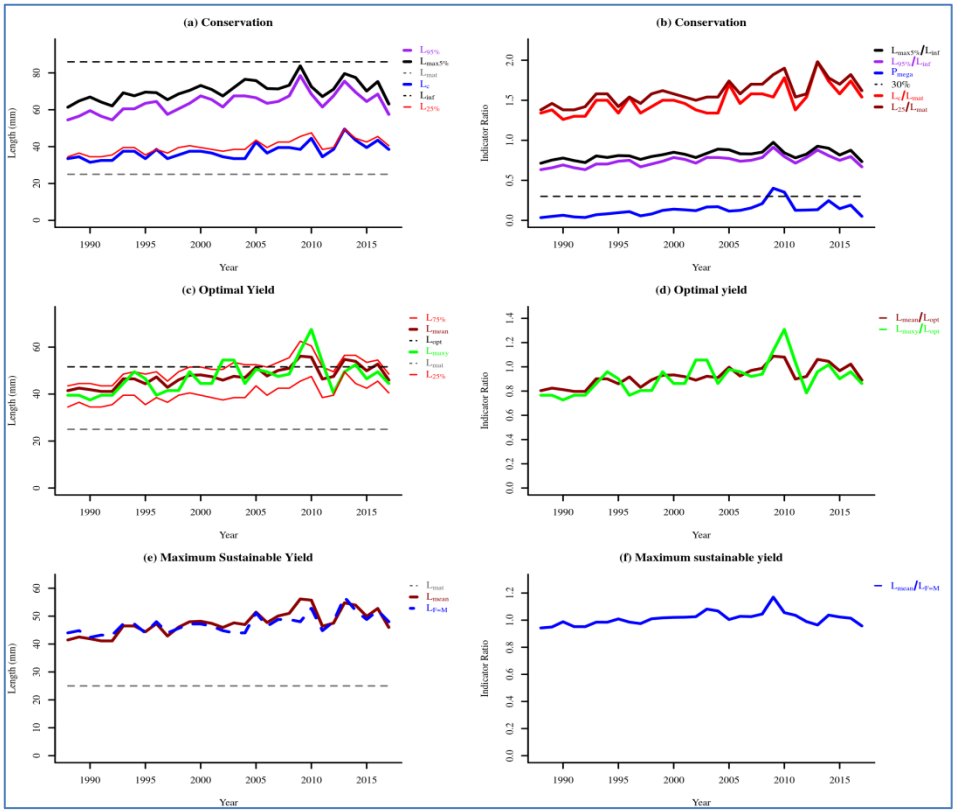
| | |
|---|---|
| OK: | - shiny https://scott.shinyapps.io/LBIndicator_shiny/<br>- you can introduce all the time series of lengths data<br>- WKProxy 2015<br>- “Utilities” the output includes an explanation of the results obtained |
| NOT OK: | - you can not introduce males and females |
| TECHNICAL DETAILS: | - needs mean weight at length, maturity, VB.<br>- M/K optional<br>- needs a unimodal length distribution<br>- asumes constant recruitment |

# LBI (Length Based Indicators)

Table 1 Selected indicators for LBI screening plots. Indicator ratios in bold used for stock status assessment with traffic light system.

| Indicator | Calculation | Reference point | Indicator ratio | Expected value | Property |
|---|---|---|---|---|---|
| $L_{max5\%}$ | Mean length of largest 5% | $L_{inf}$ | $L_{max5\%} / L_{inf}$ | > 0.8 | Conservation (large individuals) |
| $L_{95\%}$ | 95th percentile | | $L_{95\%} / L_{inf}$ | | |
| $P_{mega}$ | Proportion of individuals above $L_{opt}$ + 10% | 0.3–0.4 | Pmega | > 0.3 | |
| $L_{25\%}$ | 25th percentile of length distribution | $L_{mat}$ | $L_{25\%} / L_{mat}$ | > 1 | Conservation (immatures) |
| $L_c$ | Length at first catch (length at 50% of mode) | $L_{mat}$ | $L_c / L_{mat}$ | > 1 | |
| $L_{mean}$ | Mean length of individuals > $L_c$ | $L_{opt} = \frac{3}{3+M/k} \times L_{inf}$ | $L_{mean} / L_{opt}$ | ≈ 1 | Optimal yield |
| $L_{max_y}$ | Length class with maximum biomass in catch | $L_{opt} = \frac{3}{3+M/k} \times L_{inf}$ | $L_{maxy} / L_{opt}$ | ≈1 | |
| $L_{mean}$ | Mean length of individuals > $L_c$ | $L_{F=M} = (0.75L_c + 0.25L_{inf})$ | $L_{mean} / L_{F=M}$ | ≥ 1 | MSY |




| | Conservation | | | | Optimizing Yield | MSY |
|---|---|---|---|---|---|---|
| Year | $L_c / L_{mat}$ | $L_{25\%} / L_{mat}$ | $L_{max\,5} / L_{inf}$ | $P_{mega}$ | $L_{mean} / L_{opt}$ | $L_{mean} / L_{F=M}$ |
| 2015 | 1.58 | 1.70 | 0.82 | 0.15 | 0.97 | 1.02 |
| 2016 | 1.74 | 1.82 | 0.88 | 0.19 | 1.02 | 1.01 |
| 2017 | 1.54 | 1.62 | 0.73 | 0.05 | 0.89 | 0.96 |

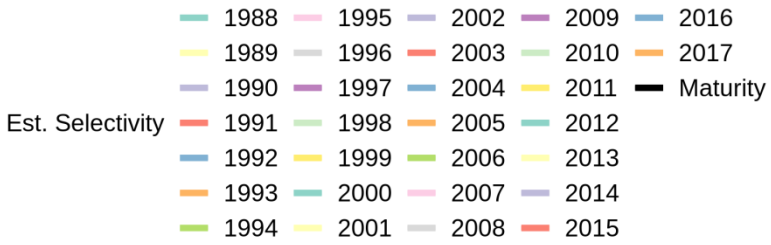
# LB-SPR (Length Based Spawning Potential Ratio)

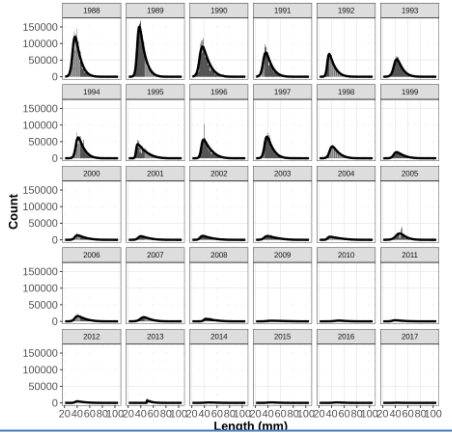
| | |
|---|---|
| OK: | - shiny http://barefootecologist.com.au/lbspr<br>- you can introduce all the time series of lengths data<br>- see sharepoint Tutorial in english |
| NOT OK: | - you can not introduce males and females |
| TECHNICAL DETAILS: | - logistic selectivity<br>- needs maturity, VB.<br>- M/K |

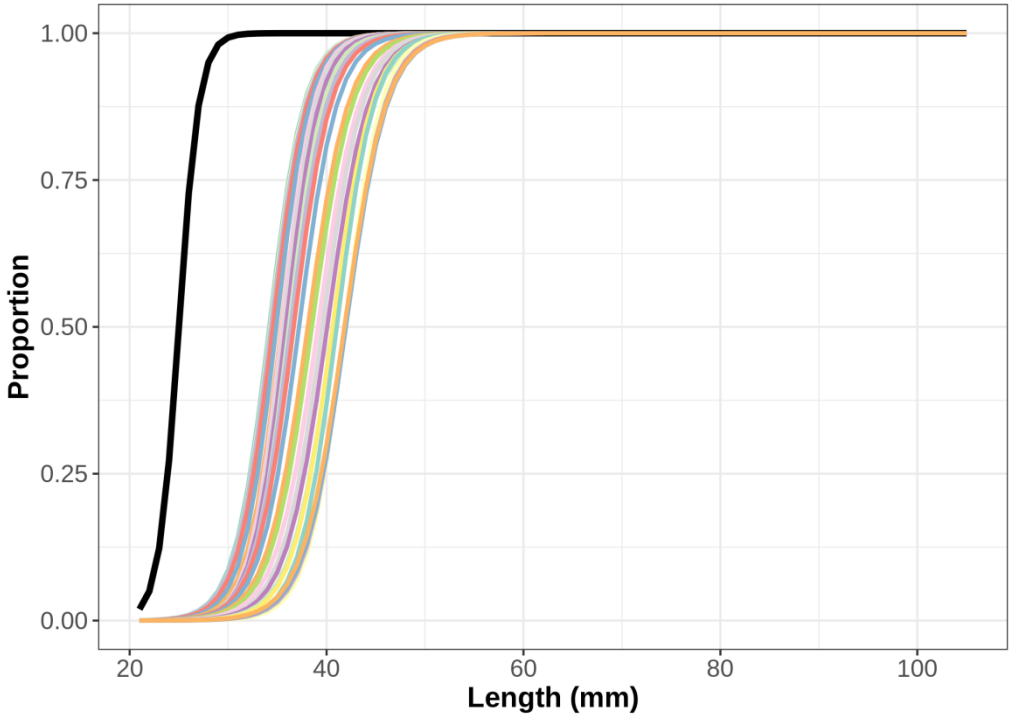
# LB-SPR (Length Based Spawning Potential Ratio)

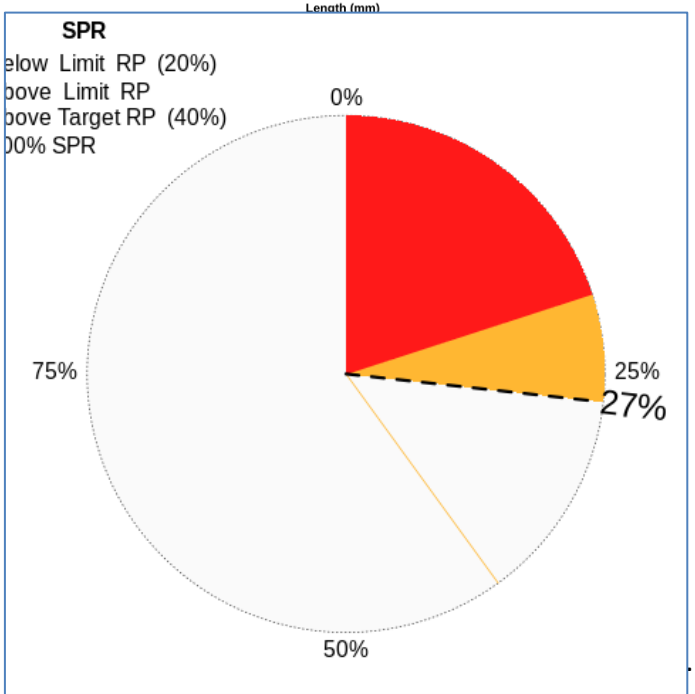
| Years | SPR | SL50 | SL95 | F/M | Note | MK | Linf | L50 | L95 | CVLinf | FecB | Mpow | Smooth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1988 | 0.2 (0.2 - 0.2) | 33.43 (33.41 - 33.45) | 38.99 (38.96 - 39.02) | 2.05 (2.04 - 2.06) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 1989 | 0.23 (0.23 - 0.23) | 34.77 (34.76 - 34.78) | 39.22 (39.2 - 39.24) | 1.89 (1.88 - 1.9) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 1990 | 0.27 (0.26 - 0.27) | 32.98 (32.96 - 33) | 39.2 (39.17 - 39.23) | 1.4 (1.4 - 1.4) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 1991 | 0.22 (0.22 - 0.22) | 33.01 (32.99 - 33.03) | 38.86 (38.83 - 38.89) | 1.79 (1.78 - 1.8) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 1992 | 0.22 (0.21 - 0.22) | 33.32 (33.3 - 33.34) | 37.04 (37.01 - 37.07) | 1.89 (1.88 - 1.9) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 1993 | 0.31 (0.31 - 0.31) | 38.79 (38.76 - 38.82) | 45.43 (45.39 - 45.47) | 1.6 (1.59 - 1.61) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 1994 | 0.32 (0.32 - 0.32) | 38.39 (38.37 - 38.41) | 43.45 (43.41 - 43.49) | 1.47 (1.46 - 1.48) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 1995 | 0.37 (0.37 - 0.38) | 32.59 (32.58 - 32.6) | 35.05 (35.02 - 35.08) | 0.86 (0.86 - 0.86) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 1996 | 0.36 (0.36 - 0.36) | 35.3 (35.28 - 35.32) | 39.38 (39.35 - 39.41) | 1.04 (1.03 - 1.05) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 1997 | 0.25 (0.25 - 0.25) | 34.99 (34.97 - 35.01) | 40.04 (40 - 40.08) | 1.68 (1.67 - 1.69) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 1998 | 0.33 (0.33 - 0.34) | 37.35 (37.32 - 37.38) | 43.11 (43.06 - 43.16) | 1.29 (1.28 - 1.3) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 1999 | 0.4 (0.39 - 0.4) | 38.12 (38.08 - 38.16) | 43.88 (43.8 - 43.96) | 1.02 (1.01 - 1.03) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2000 | 0.44 (0.43 - 0.44) | 36.57 (36.53 - 36.61) | 41.57 (41.5 - 41.64) | 0.8 (0.79 - 0.81) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2001 | 0.42 (0.41 - 0.42) | 36.18 (36.13 - 36.23) | 41.37 (41.28 - 41.46) | 0.85 (0.84 - 0.86) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2002 | 0.41 (0.4 - 0.41) | 33.38 (33.33 - 33.43) | 37.83 (37.74 - 37.92) | 0.78 (0.77 - 0.79) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2003 | 0.53 (0.52 - 0.53) | 34.24 (34.17 - 34.31) | 40.1 (39.97 - 40.23) | 0.51 (0.5 - 0.52) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2004 | 0.54 (0.54 - 0.55) | 33.68 (33.64 - 33.72) | 37.44 (37.35 - 37.53) | 0.48 (0.47 - 0.49) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2005 | 0.42 (0.41 - 0.42) | 42.83 (42.77 - 42.89) | 51.79 (51.7 - 51.88) | 1.21 (1.2 - 1.22) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2006 | 0.42 (0.42 - 0.42) | 36.68 (36.64 - 36.72) | 42.55 (42.47 - 42.63) | 0.85 (0.84 - 0.86) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2007 | 0.42 (0.42 - 0.42) | 40.59 (40.52 - 40.66) | 48.53 (48.41 - 48.65) | 1.03 (1.02 - 1.04) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2008 | 0.54 (0.54 - 0.55) | 39.31 (39.25 - 39.37) | 43.34 (43.23 - 43.45) | 0.59 (0.58 - 0.6) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2009 | 1 (1 - 1) | 38.94 (38.79 - 39.09) | 45.89 (45.59 - 46.19) | 0 (0 - 0) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2010 | 0.58 (0.57 - 0.59) | 47.06 (46.87 - 47.25) | 56.59 (56.28 - 56.9) | 0.72 (0.69 - 0.75) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2011 | 0.4 (0.39 - 0.4) | 36.02 (35.93 - 36.11) | 41.54 (41.38 - 41.7) | 0.92 (0.9 - 0.94) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2012 | 0.38 (0.37 - 0.38) | 36.97 (36.91 - 37.03) | 40.93 (40.83 - 41.03) | 1.04 (1.02 - 1.06) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2013 | 0.47 (0 - 0) | 49.28 (0 - 0) | 49.48 (0 - 0) | 1.71 (0 - 0) | Model did not converge | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2014 | 0.55 (0.54 - 0.55) | 42.98 (42.76 - 43.2) | 51.29 (50.91 - 51.67) | 0.68 (0.65 - 0.71) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2015 | 0.42 (0.41 - 0.42) | 41.12 (40.93 - 41.31) | 48.29 (47.96 - 48.62) | 1.09 (1.05 - 1.13) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2016 | 0.48 (0.47 - 0.49) | 44 (43.85 - 44.15) | 50.22 (49.95 - 50.49) | 0.98 (0.94 - 1.02) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |
| 2017 | 0.27 (0.26 - 0.28) | 40.29 (39.98 - 40.6) | 47.41 (46.89 - 47.93) | 2.33 (2.19 - 2.47) | | 2 | 86 | 25 | 28 | 0.1 | 3 | 0 | FALSE |

# LB-SPR (Length Based Spawning Potential Ratio)



# SPICT (Surplus Production models In Continuous Time)

| | |
|---|---|
| OK: | - uses continuous time, not discret<br>- you can mix annual, quarter or seasonal data |
| TECHNICAL DETAILS: | - Needs catch and an abundance index<br>- Guidelines September 2019. |

# All methods

https://github.com/ices-tools-dev/ICES_MSY

http://ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2015/WKLIFEV/wklifeV_2015.pdf

DOUBTS:

- time series with catch restricted and not restricted by TAC

- annual lengths vs one month length (nephrosp sex ratio changes)