Marine Strategy Framework Directive Consultation: UK Initial Assessment and proposals for Good Environmental Status

Impact Assessment Annex D

North Sea sole

Stock and recruitment

Figure 1 presents the sole time series of recruitment at age 1 estimated by the ICES WGNSSK working group at its 2011 meeting. Recruitment to the sole stock is characterised by two features:

a) Periods of lower abundance background recruitment interspersed by intermittent pulses of high recruitment.
b) A lack of high abundance recruitment events between 1965 and 1988 and subsequently a lower background level with frequent high abundance events

Figure 2 presents stock and recruitment estimates for North Sea sole plotted against each other; no strong linkage exists between recruitment and stock biomass. Two geometric means were calculated across the whole time series and from 1988 to 2011, illustrated within Figure 2, the change in recruitment patter in recent years marginally decreases the average level of recruitment across the time series.

Fishing mortality scenarios

Fishing mortality for North Sea sole currently (F = 0.34) exceeds F_{MSY} (F = 0.22) by a factor of more than 1.5. Consequently, fishing mortality for North Sea sole will be decreased to achieve the F_{MSY} target as required by the current EU management plan for the stock.

Three alternative fishing mortality scenarios are explored (Figure 3):

1) No change in the sole exploitation level – status quo fishing morality at the current level (the black line)
2) A decrease in fishing mortality to the current ICES F_{MSY} target mortality of F = 0.22 (the purple line)
3) A 10% reduction in fishing mortality per annum until the F_{MSY} target mortality of F = 0.22 is achieved, following the current North Sea sole management plan (the red line)

Discarding scenarios

Discarding of North Sea sole is considered to be negligible, consequently, no projections of discarding are presented for this stock.

Output

Percentiles of fishing mortality, spawning biomass, recruitment and landings for a run of the model for 30 years are presented for the options:

a. Status quo fishing mortality in the future
b. F_{MSY} framework mortality of F = 0.22
c. A 10% annual reduction in effort until sole achieves F = 0.22 the current EU management plan for recovery of the stock

Figures 3 – 5 present the realised fishing mortality, spawning stock biomass and landings outcomes for each scenario.

Discussion

The future trajectory of North Sea sole productivity depends on the level of incoming recruitment, as illustrated by the spawning stock biomass and landings outcomes for the three alternative fishing mortality scenarios (Figures 4 and 5). Recruitment and spawning stock biomass have increased in recent years. Consequently, there may be potential for the stock to rebuild to high levels if fishing mortality is reduced to the F_{MSY} target. The simulations have been run forward to reflect the current conditions.
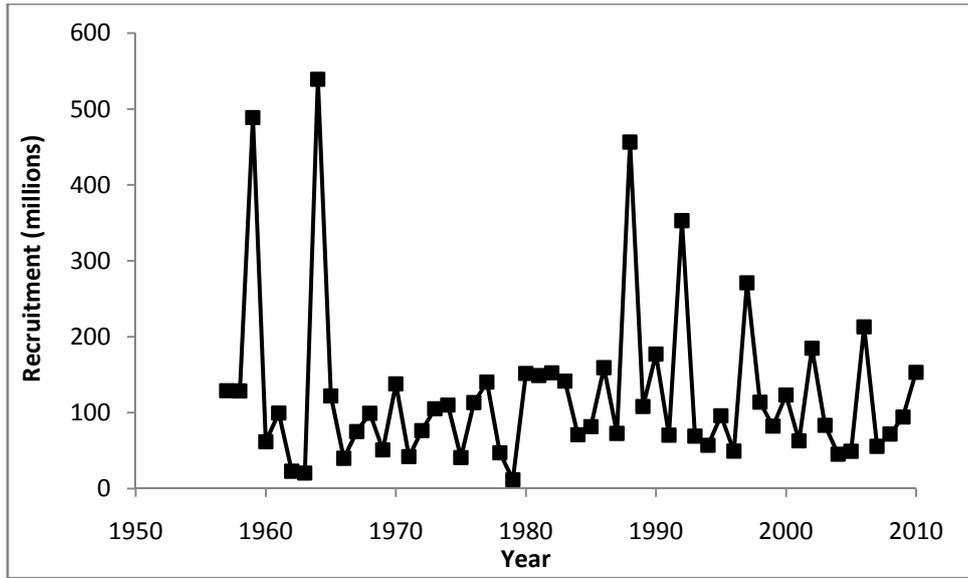
Figure 1. The time series of North Sea sole recruitment at age 1, illustrating the highly variable nature of recruitment for this stock.
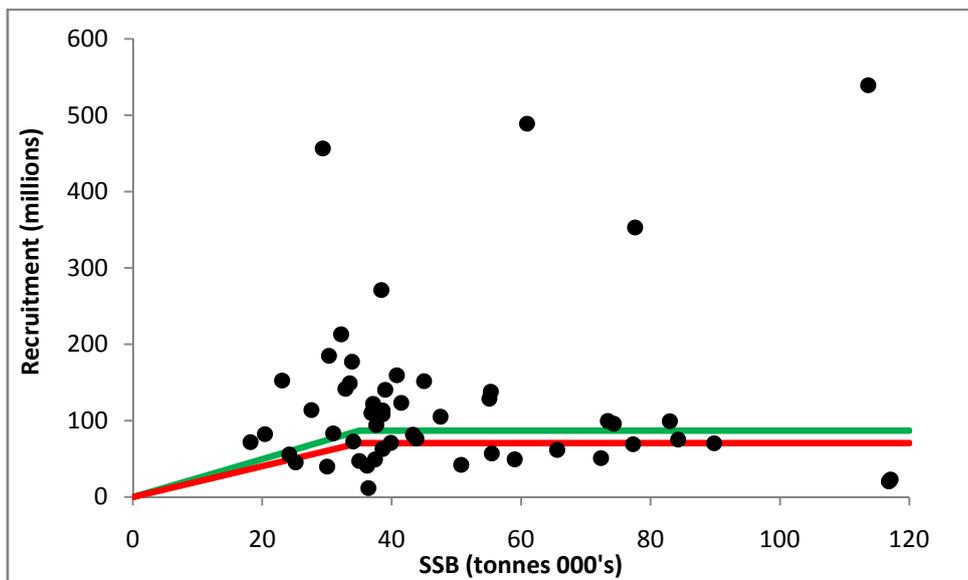

Figure 2. Stock-recruitment estimates for North Sea sole. Note that the red and green reference lines indicate the geometric mean of low and high recruitment events, respectively, as well as MSY $B_{trigger}$.
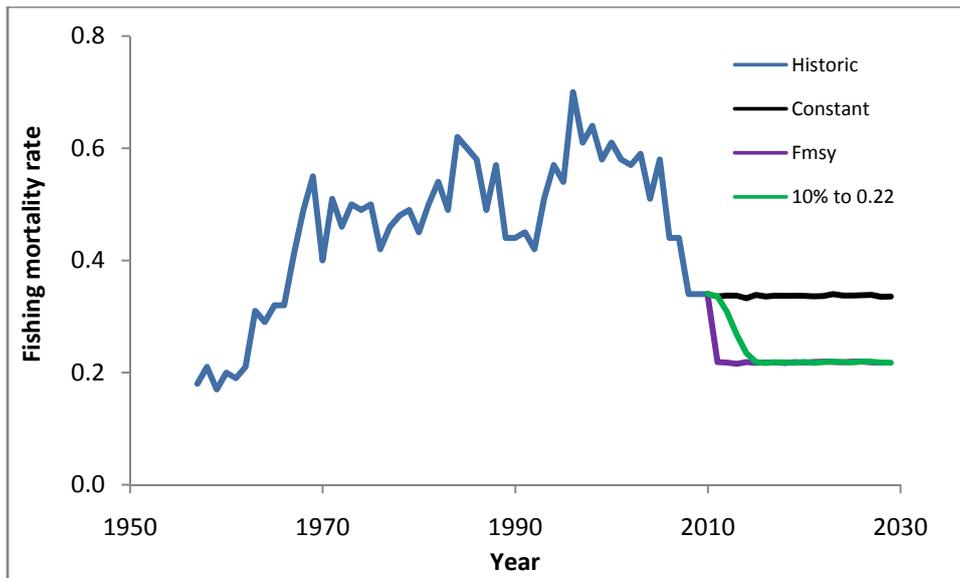
Figure 3. North Sea sole historic and representative future fishing mortality scenarios; black line – continued exploitation at the current level, purple line – a decrease in fishing mortality to reach the F_{MSY} target of F = 0.22, green line – 10% reductions in fishing mortality per annum to achieve the F_{MSY} target.
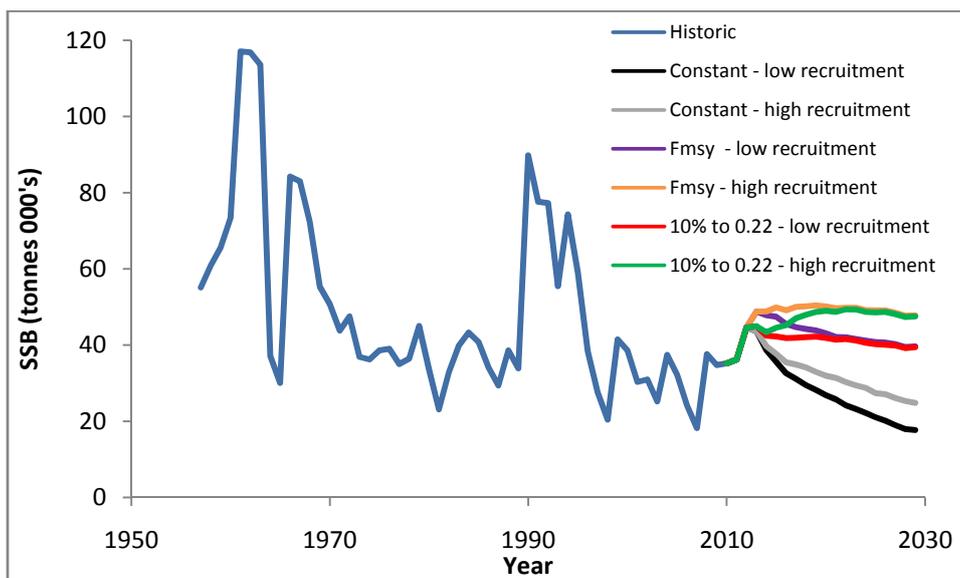

Figure 4. North Sea sole historic and projected spawning stock biomass; black line – continued exploitation at the current level under low recruitment, grey line – continued exploitation at the current level under high recruitment, purple line – a decrease in fishing mortality to reach the F_{MSY} target of F = 0.22 under low recruitment, orange line – a decrease in fishing mortality to reach the F_{MSY} target of F = 0.22 under high recruitment, red line – 10% reductions in fishing mortality per annum to reach the F_{MSY} target under low recruitment, green line – 10% reductions in fishing mortality per annum to achieve the F_{MSY} target under high recruitment.
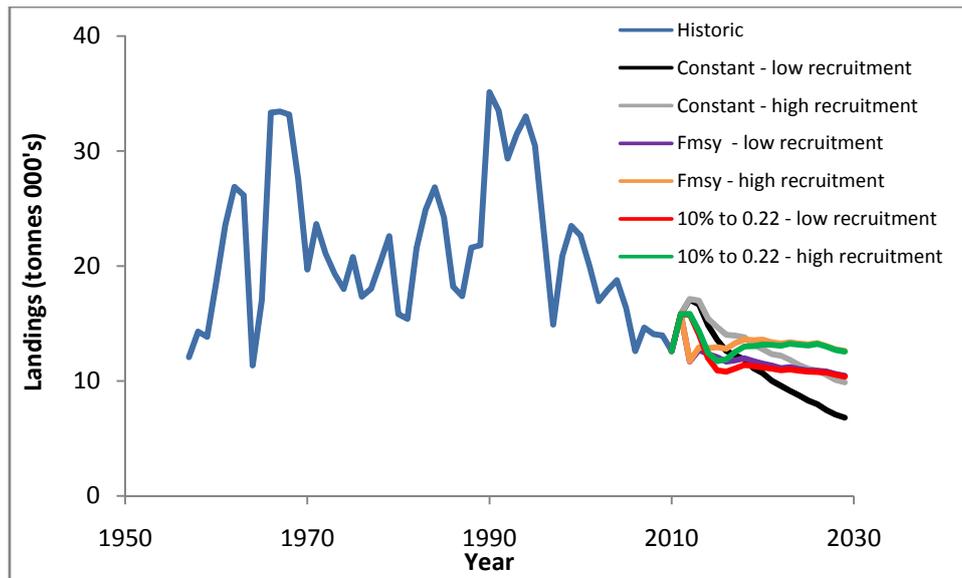
Figure 5. North Sea sole historic and projected landings assuming no discard ban; black line – continued exploitation at the current level under low recruitment, grey line – continued exploitation at the current level under high recruitment, purple line – a decrease in fishing mortality to reach the F_{MSY} target of F = 0.22 under low recruitment, orange line – a decrease in fishing mortality to reach the F_{MSY} target of F = 0.22 under high recruitment, red line – 10% reductions in fishing mortality per annum to reach the F_{MSY} target under low recruitment, green line – 10% reductions in fishing mortality per annum to achieve the F_{MSY} target under high recruitment.