

Further scientific advice on management of bass fisheries in relation to a 40 cm MLS; explicitly including the effects of discards from trawl fisheries (March 2007)

Summary

The effect of an increase in the bass MLS to 40 cm was modelled, based on stock assessments for 2004 that indicate that the biomass of adult bass is stable or rising in all sea areas around the UK and recruitment appears to have been strong in the late 1990s. Landings are also generally increasing in all areas, while fishing mortality (F) appears relatively stable.

In terms of relative exploitation level, line fisheries appear to be most important in the Channel and west coast fisheries, with nets more important in the North Sea. Trawl fisheries were generally least important, but note the absence from the assessments of the offshore fishery in VIle (data deficient).

Yield per recruit (YPR) analyses carried out previously suggest that gains in YPR can be made in all areas by increasing size at first capture up to around 44-48 cm assuming no change in the fisheries' activity (status quo F). At a size of 40 cm at first capture, YPR gains will be small, but significant gains in spawner per recruit (SPR) will be achieved.

Projections were carried out in 2006 for scenarios where a reduction in F on bass < 40 cm was applied to all fleets, the net and line fleet only, and the line fleet only. Although these scenarios provide an insight into the likely changes to discarding levels by the trawl fleet, discards from the trawl fleet were all considered to survive. This document compares the above projections (for status quo management arrangements and simulating a reduction in F on bass approximating to 40 cm MLS for all fleets) with an assumption that all discards of trawl-caught fish die.

Under the 40 cm MLS scenario, with no discard mortality, landings were significantly reduced in the short term (3-4 years), but subsequently recovered to levels similar to, or above, the status quo (36 cm MLS, plus netting mesh controls and bass nursery areas). Exceptions were in Division VIId, where trawl landings were reduced, and in VIleH, where line landings were slightly reduced. Spawning stock biomass (SSB) and numbers of older bass in the population were increased because F was reduced on younger ages. Assuming all trawl discards will die in the simulations had slight negative effects for both the stock and fishery, with VIIafg trawl landings and VIId net landings becoming very slightly down relative to the status quo management scenario, rather than similar as in the previous scenarios.

Relative numbers of older bass in the 1997 year class (a proxy for the 2002 year class) were increased by between 13% and 36% after 3-4 years, depending on region. Including discarding mortality by the trawl fishery reduced these percentages by between 2-5%. Total landings of the '97 year class varied between 0.96 and 1.02 relative to the status quo situation depending on area, but between 0.92 and 0.99 if trawl discards were included.

The table below summarises the comparisons of projections (F changed for all gears) without and with (in parentheses) discarded bass dying: 97 Y/C rel. pop. nos 5-11 is the relative increase in abundance of 5-11 year old bass; 97 Y/C tot. landings is the change in life-time landings of a recruiting year class; Rel. trawl lnds >5 yrs is the change in trawlers landings after 5 years; ; Rel. net lnds >5 yrs is the change in netters landings after 5 years; ; Rel. line lnds >5 yrs is the change in line fisheries landings after 5 years. All comparisons are made relative to the situation that would have resulted under *status quo* management arrangements

	Vllafig	Vlleh	Vlld	IVbc
97 Y/C rel. pop. nos 5-11	1.19 (1.15)	1.22 (1.20)	1.13 (1.08)	1.36 (1.32)
97 Y/C tot. landings	1.00 (0.98)	0.98 (0.96)	0.96 (0.92)	1.02 (0.99)
Rel. trawl lnds >5 yrs	similar (v. slightly down)	up (up)	down (down)	up (up)
Rel. net lnds >5 yrs	slightly up (v. slightly up)	similar (similar)	similar (v. slightly down)	slightly up (v. slightly up)
Rel. line lnds >5 yrs	slightly up (v. slightly up)	v. slightly down (slightly down)	slightly up (similar)	much up (much up)

It can be seen that the effects of trawl discards being assumed to die were relatively small and result in slightly more pessimistic medium-term results for each scenario.

An estimated 55 tonnes of bass would have been discarded (and probably died) from UK inshore trawlers each year out of an average catch of 230 tonnes in 2002- 2004.

Technical detail: short/medium term age structured projections approximating to removal of fishing mortality for fish less than 40 cm

Age-structured short to medium term projections were carried out to evaluate the possible effects on bass populations and fisheries of a 40 cm MLS and supporting measures, by reducing fishing mortality for ages less than 5 to zero and halving F on age 5. Mean length at age 5 (estimated using alternative assumptions regarding statistical distributions) varied from 38.6cm to 42cm (Table 1). The length distribution of fish aged 5 therefore seems likely to straddle a 40 cm MLS in most areas. All calculations used data for population numbers from assessments over the period 1985 – 2004. Potential management measures were implemented partly as ‘hindcasts’ and partly as forecasts, implementing changes in 2000 and assuming the strong 1997 year class as a proxy for the currently incoming 2002 year class which anglers suggest may also be strong. Recruitment from 2003 onwards was taken as a recent 10 year geometric mean (93-02). With the exception of the status quo run (to provide the comparison), future (post 2000) landings by gear assume that an MLS of 40 cm (age 5) is in place so fish of ages ≥ 5 are included in the landings, and the F for age 5 is assumed to be halved for all gears.

Table 1. Estimated mean lengths at age 5 (cm) using different statistical assumptions

	VIIafg	VIIe	VIIId	IVbc
Minimum	38.9	40.3	37.9	41.7
Maximum	39.1	40.8	38.6	42.0

Output by sea area

VIIa,f,g

- Trawl landings were reduced for the first two years, and later became similar to those from the status quo run. Assuming trawl selection remains as at present and that trawl discards die resulted in the same initial relative losses in landings, but subsequently yields were very slightly reduced compared to the run assuming perfect management implementation.
- Net and line landings were reduced (relative to the SQ run) for 3-4 years, then after around 6 years were slightly higher than under SQ management arrangements. Including trawl discards reduced the gains slightly resulting in yields very slightly above those with SQ management.
- In the medium term the new management measures resulted in catch numbers of ages 5-11 that were increased for trawls, similar for nets and slightly increased for lines when compared against SQ management. Again assuming trawl selection remains constant and all discards die resulted in very slightly reduced numbers when compared with the perfect management scenario.
- Landings from the 97 year class were above those of the status quo run after 3 years, but there is an initial cost as young fish are no longer landed.
- Total yield from the 97 year class (excluding plus group) was little changed relative to SQ management if perfect implementation was assumed, but including trawl discards resulted in lower total landings (down 2.5%) relative to SQ management.
- Under perfect implementation, trawl and line landings were slightly higher than SQ management and net landings reduced, while including trawl discards resulted in trawl and net landings being reduced relative to SQ management while line landings benefited slightly.
- Population numbers of the 97 year class were higher than the SQ scenario with slightly lower gains if trawl discards were included. Perfect implementation resulted in

a relative increase in the 97 year class numbers after 3-4 years of around 20%, but this was reduced to 15% if trawl discards were included.

VIIe,h

- Trawl landings relative to SQ management were reduced for 3 years and beyond 4 years were increased. Increases were very slightly reduced when trawl discards were included.
- Net landings were reduced (relative to SQ management) for 3 years and were subsequently similar to the status quo run in the medium term. Including trawl discards had a minimal effect.
- Line landings were reduced (relative to SQ management) significantly in the first 3 years and then slightly thereafter. Including trawl discards resulted in very slightly greater yield losses in the medium term relative to the perfect implementation.
- Catch numbers of 5-11 were higher than with SQ management for trawls and lines and similar for nets into the medium term. Including trawl discards resulted in very slightly greater yield losses in the medium term relative to the perfect implementation, but yields were still above those under SQ management.
- Landings from the 97 year class were above those of the status quo run after 3-4 years for all gears, but there was an initial cost as young fish were no longer landed. A reduction in these medium term yield increases was just perceptible in trawl discards were included.
- Total yield from the 97 year class (excluding plus group) was slightly reduced with perfect implementation of new measures and slightly more so if trawl discards were included.
- Total 97 year class trawl landings were increased, while net and line landings decreased. Gains were slightly reduced and losses slightly increased when trawl discards were included.
- Population numbers of the 97 year class were higher than the status quo scenario with a relative increase of just over 20% after 3-4 years. Including trawl discards resulted in a very slight decrease (2%) relative to perfect implementation.

VIIId

- Trawl landings relative to SQ management were substantially reduced for 3 to 4 years and reduced to a lesser degree thereafter. Including trawl discards slightly increased the yield losses.
- Net landings were also reduced (relative to SQ management) for 3 to 4 years and very slightly reduced thereafter. Including trawl discards made increases to the yield losses that were just perceptible.
- Line landings were reduced (relative to SQ management) in the first 3 years and then similar or slightly increased thereafter. Including trawl discards resulted in medium term yields similar to SQ management and very slightly below those with perfect implementation of an F reduction.
- Catch numbers of ages 5-11 were reduced initially relative SQ management and similar into the medium term for all gears. Including trawl discards resulted in very slight reductions relative to the perfect implementation.
- Landings from the 97 year class were above those of the status quo run after 3-4 years for all gears, but there was an initial cost as young fish were no longer landed. A reduction in these medium term yield increases was just perceptible in trawl discards were included.
- Total yield from the 97 year class (excluding plus group) was reduced (4%) with perfect implementation of new measures and more so (8%) if trawl discards were included.

- Total 97 year class trawl and net landings were reduced relative to SQ management, while line landings increased slightly. Gains were slightly reduced and losses slightly increased when trawl discards were included.
- Population numbers of the 97 year class were higher than the status quo scenario with a relative increase of 13% after 3-4 years, but this increase was reduced to 8% when trawl discards were included.

IVb, c

- Trawl landings were reduced in the short term but increased in the medium term, relative to the status quo run. Including trawl discards resulted in reductions in yield that were just perceptible relative to perfect implementation.
- Net landings were reduced in the short term and slightly increased in the medium term, relative to the status quo run and again inclusion of trawl discards very slightly reduced medium to long-term gains relative to perfect implementation.
- Line landings were reduced in the short term and slightly increased in the medium term, relative to the status quo run and again inclusion of trawl discards very slightly reduced medium to long-term gains relative to perfect implementation.
- Catch numbers of ages 5-11 were similar or slightly reduced relative to SQ management for 3-4 years after which they were slightly increased for trawls and nets and substantially increased for lines. Inclusion of trawl discards very slightly reduced medium to long-term gains relative to perfect implementation.
- Landings from the 97 year class were above those of the status quo run after 3-4 years for all gears, but there was an initial cost as young fish were no longer landed. A reduction in these medium term yield increases was just perceptible in trawl discards were included.
- Total yield from the 97 year class (excluding plus group) was slightly increased (2.5%) with perfect implementation of new measures but very slightly reduced (<1%) if trawl discards were included.
- Total 97 year class trawl and line (substantially) landings were increased relative to SQ management, while net landings decreased slightly. Gains were slightly reduced and losses slightly increased when trawl discards were included.
- Population numbers of the 97 year class were higher than the status quo scenario with a relative increase of 36% after 3-4 years, but this increase was reduced to 32% when trawl discards were included.

Population outputs

Short to medium term age-structured projections for bass in VIIa,f,g

- Trawl landings were reduced for the first two years, and later became similar to those from the status quo run.
- Net and line landings were reduced (relative to the SQ run) for 3-4 years, then after around 6 years were very slightly higher than under SQ management arrangements.
- Assuming trawl selection remains as at present and that trawl discards die resulted in the same initial relative losses in landings, but subsequently yields are very slightly reduced compared to the run assuming perfect management implementation. Medium term landings for trawls were very slightly lower than those of the SQ run, while medium term landings for lines and nets were very slightly above those under SQ management arrangements.
- In the medium term the new management measures resulted in catch numbers of ages 5-11 that were increased for trawls, similar for nets and slightly increased for lines when compared against SQ management. Again assuming trawl selection

remains constant and all discards die resulted in very slightly reduced numbers when compared with the perfect management scenario.

Short to medium term age structured projections for bass in VIIa,f,g – 97 year class outputs

- Landings from the 97 year class were above those of the status quo run after 3 years, but there is an initial cost as young fish are no longer landed.
- Total yield from the 97 year class (excluding plus group) was little changed relative to SQ management if perfect implementation was assumed, but including trawl discards resulted in lower total landings (down 2.5%) relative to SQ management.
- Under perfect implementation trawl and line landings were slightly higher than SQ management and net landings reduced, while including trawl discards resulted in trawl and net landings being reduced relative to SQ management while line landings benefited slightly.
- Population numbers of the 97 year class were higher than the SQ scenario with slightly lower gains if trawl discards were included. Perfect implementation resulted in a relative increase in 97 year class numbers after 3-4 years of around 20%, but this was reduced to 15% if trawl discards were included.

Short to medium term age structured projections for bass in VIIe,h – population outputs

- Trawl landings relative to SQ management were reduced for 3 years and beyond 4 years were increased. Increases were very slightly reduced when trawl discards were included.
- Net landings were reduced (relative to SQ management) for 3 years and were subsequently similar to the status quo run in the medium term. Including trawl discards had a minimal effect.
- Line landings were reduced (relative to SQ management) significantly in the first 3 years and then slightly thereafter. Including trawl discards resulted in very slightly greater yield losses in the medium term relative to the perfect implementation.
- Catch numbers of 5-11 were higher than with SQ management for trawls and lines and similar for nets into the medium term. Including trawl discards resulted in very slightly greater yield losses in the medium term relative to the perfect implementation, but yields were still above those under SQ management.

Short to medium term age structured projections for bass in VIIe,h – 97 year class outputs

- Landings from the 97 year class were above those of the status quo run after 3-4 years for all gears, but there was an initial cost as young fish were no longer landed. A reduction in these medium term yield increases was just perceptible in trawl discards were included.
- Total yield from the 97 year class (excluding plus group) was slightly reduced with perfect implementation of new measures and slightly more so if trawl discards were included.
- Total 97 year class trawl landings were increased, while net and line landings decreased. Gains were slightly reduced and losses slightly increased when trawl discards were included.
- Population numbers of the 97 year class were higher than the status quo scenario with a relative increase of just over 20% after 3-4 years. Including trawl discards resulted in a very slight decrease (2%) relative to perfect implementation.

Short to medium term age structured projections for bass in VIId – population outputs

- Trawl landings relative to SQ management were substantially reduced for 3 to 4 years and reduced to a lesser degree thereafter. Including trawl discards slightly increased the yield losses.
- Net landings were also reduced (relative to SQ management) for 3 to 4 years and very slightly reduced thereafter. Including trawl discards made increases to the yield losses that were just perceptible.
- Line landings were reduced (relative to SQ management) in the first 3 years and then similar or slightly increased thereafter. Including trawl discards resulted in medium term yields similar to SQ management and very slightly below those with perfect implementation of an F reduction.
- Catch numbers of ages 5-11 were reduced initially relative SQ management and similar into the medium term for all gears. Including trawl discards resulted in very slight reductions relative to the perfect implementation.

Short to medium term age structured projections for bass in VIId – 97 year class outputs

- Landings from the 97 year class were above those of the status quo run after 3-4 years for all gears, but there was an initial cost as young fish were no longer landed. A reduction in these medium term yield increases was just perceptible in trawl discards were included.
- Total yield from the 97 year class (excluding plus group) was reduced (4%) with perfect implementation of new measures and more so (8%) if trawl discards were included.
- Total 97 year class trawl and net landings were reduced relative to SQ management, while line landings increased slightly. Gains were slightly reduced and losses slightly increased when trawl discards were included.
- Population numbers of the 97 year class were higher than the status quo scenario with a relative increase of 13% after 3-4 years, but this increase was reduced to 8% when trawl discards were included.

Short to medium term age structured projections for bass in IVb,c – population outputs

- Trawl landings were reduced in the short term but increased in the medium term, relative to the status quo run. Including trawl discards resulted in reductions in yield that were just perceptible relative to perfect implementation.
- Net landings were reduced in the short term and slightly increased in the medium term, relative to the status quo run and again inclusion of trawl discards very slightly reduced medium to long-term gains relative to perfect implementation.
- Line landings were reduced in the short term and slightly increased in the medium term, relative to the status quo run and again inclusion of trawl discards very slightly reduced medium to long-term gains relative to perfect implementation.
- Catch numbers of ages 5-11 were similar or slightly reduced relative to SQ management for 3-4 years after which they were slightly increased for trawls and nets and substantially increased for lines. Inclusion of trawl discards very slightly reduced medium to long-term gains relative to perfect implementation.

Short to medium term age structured projections for bass in IVb,c – 97 year class outputs

- Landings from the 97 year class were above those of the status quo run after 3-4 years for all gears, but there was an initial cost as young fish were no longer landed.

A reduction in these medium term yield increases was just perceptible in trawl discards were included.

- Total yield from the 97 year class (excluding plus group) was slightly increased (2.5%) with perfect implementation of new measures but very slightly reduced (<1%) if trawl discards were included.
- Total 97 year class trawl and line (substantially) landings were increased relative to SQ management, while net landings decreased slightly. Gains were slightly reduced and losses slightly increased when trawl discards were included.
- Population numbers of the 97 year class were higher than the status quo scenario with a relative increase of 36% after 3-4 years, but this increase was reduced to 32% when trawl discards were included.