

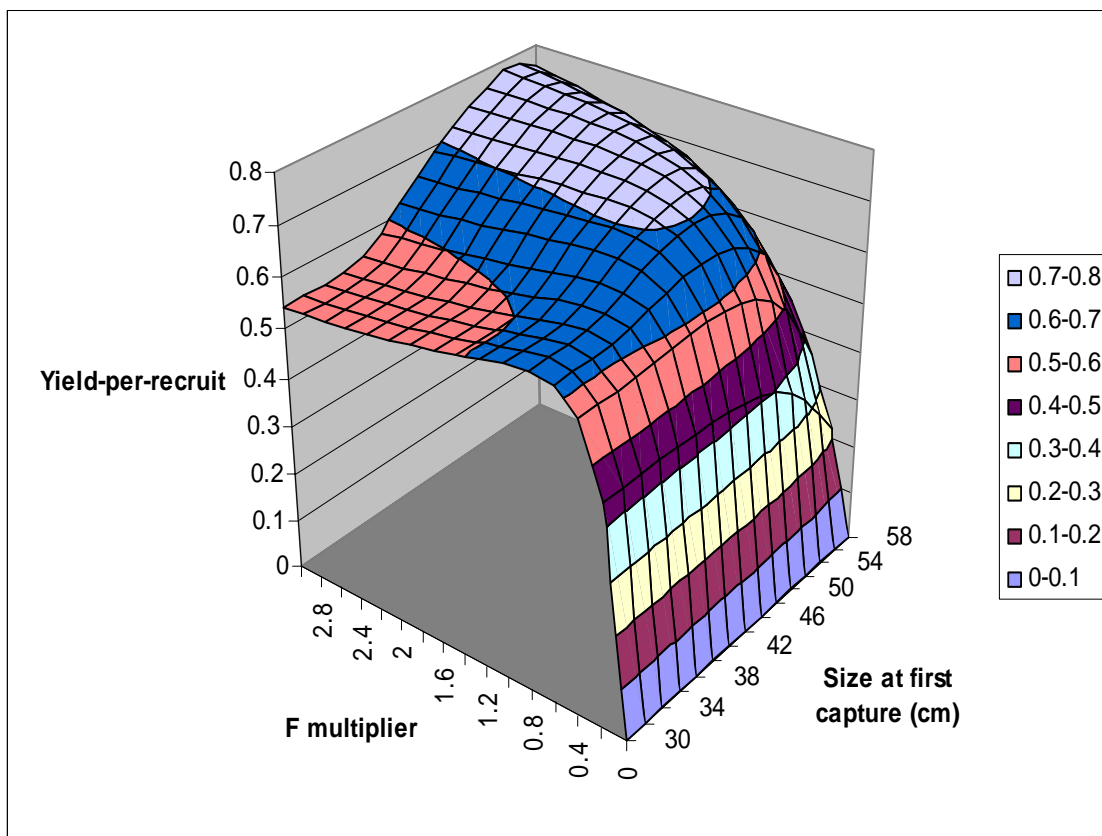
CEFAS SCIENTIFIC PAPER

Bass management plan: scientific advice on increased MLS and complementary mesh sizes for enmeshing nets.

Basis for a 45 cm MLS.

Calculations of yield to the fishery per bass recruit at age 3 (before they enter the fishery) have been used to show that the predicted benefits of the 1990 bass management package – a 30-40% higher yield to the fishery– did indeed take place, and a paper has been published in Fisheries Research (Pawson, Pickett and Smith, 2005). The objective in 1990 was to protect juvenile bass and raise the age at first capture from 3-5 to 5-6, by implementing a MLS of 36 cm, a banned range of mesh sizes in enmeshing nets at 65-89 mm, and prohibition of fishing for bass in areas where undersized fish are particularly vulnerable to capture (the “bass nursery areas”). These calculations made no assumptions about changes in the fishery or levels of recruitment. Since 1990, recruitment has increased (largely due to a favourable climate change, especially warmer winters), and both effort and catches in the fishery have also increased (shown in a paper submitted to the ICES Science Journal; Pawson, Kupschus and Pickett).

We have used the same approach to model the likely effects of a further increase in MLS, based on our current assessments of the bass fishery. For example, in ICES Divisions VIIa,f,g the yield per recruit (YPR) curve is relatively flat at current levels of fishing (F multiplier of 1.0), but the highest YPR occurs at around 45 cm (line in the pink band) and decreases thereafter (Figure below). This result is consistent with that obtained for the North Sea and SW England in the 1980s.



This also shows that a 55 cm MLS (as requested by BASS) would not realise the increases in yield to the fishery, unless fishing effort was increased considerably.

A first exploitation size at 45 cm also confers considerable protection of female bass up to the size at which they first spawn, which is consistently above 42 cm in NW Europe (Pawson and Pickett, 1996).

Impact of a 45 cm MLS on the bass population.

Using the same assessment, we have carried out simulations imposing a MLS of 45 cm on the west coast bass fishery, to indicate how the numbers of bigger bass in the population and yields to the fishery things might develop over the next 10 years. Because we have little information on the most recent year classes, which are not yet large enough to enter the fishery, we have stepped back 5 years to use the 1997 year class. These fish were the most abundant year class in the 1990s, and feature well in our assessments, so can be used as a proxy for the 2002 year class which will enter the fishery in 2006/7. We have assumed that new year classes will be of average abundance recorded over the 1990s.

If an effective MLS of 45 cm (and complementary mesh size for enmeshing nets) is imposed in the fishery, this is equivalent to removing all bass of 6 years and younger from the fishery's catch, and leaves many more fish to survive to be bigger than 45 cm. The following table shows how the number of bass in the 2002 year class (the first that would be protected by new measures) on the west coast is predicted to change over the next 8 years, if an effective MLS of 45 cm is introduced in 2006, assuming that fishing effort will remain the same as in 2004. (F<7 = 0 implies no fishing mortality by any gear on bass under 7 years old; FLN<7 = 0 implies no fishing mortality by lines or nets on bass under 7 years old; FL<7 = 0 implies no fishing mortality by lines on bass under 7 years old)

Relative increase in numbers of bass at age (2002 year class)

Age	Year	F<7=0	FLN<7=0	FL<7=0
3	2005	1.00	1.00	1.00
4	2006	1.03	1.02	1.02
5	2007	1.09	1.08	1.05
6	2008	1.31	1.27	1.10
7	2009	1.60	1.51	1.20
8	2010	1.60	1.51	1.20
9	2011	1.60	1.51	1.20
10	2012	1.60	1.51	1.20
11	2013	1.60	1.51	1.20

This suggests that a measurable increase in the numbers of the 2002 year class should be apparent by 2008/9, and that this increase would be largest if the measures apply effectively to all

fishing gears, and least if they only applied to lines (i.e. just a 45 cm MLS). It is important, therefore, that the whole fishery is subject to measures that protect undersized bass.

Impact of protection of bass < 45 cm on fishery.

Because the reduction of mortality on younger fish allows more to survive to be caught when older (and larger), the catch of 7 years and older bass is increased for all gears. Landings (weight) for trawls, nets and lines show initial declines, but these recover and will be close to (trawls) or above (nets and lines) the current level after 5 years. The greatest increase in landings is in the line fishery when appropriate measures are applied either to all gears or to lines and nets only, and the largest reduction in the overall commercial catch from the 2002 year class will be obtained when the measures are implemented for lines only.

This analysis assumes that the larger bass will not be targeted as effectively as smaller fish, but we expect the fishery to adapt rapidly to any new management measures, and the recovery in landings to occur that much faster. One benefit will be that the increase in average size of fish in the catch will attract higher value per kg on the market.

Note that we have assumed discards in the trawl (and sometimes net) fishery are landed/killed. Thus, the numbers of larger fish in the population are underestimated if discarded fish survive. We could also model the size distribution of each age group (rather than just assuming all bass under 7 years will be protected), and include a modified gill net selection pattern that will take more larger fish (see below). It is unlikely that the results will be markedly different from the above.

Estimating gillnet mesh size consistent with a MLS of 45cm for bass

In consultations on bass management measures in the late 1980s, we argued that it was necessary to restrict the use of small mesh sizes in all enmeshing nets because:

- a) undersized fish caught in such gear have a low probability of survival even if discarded, due to the damage caused when extracting them from the meshes;
- b) it is not possible to identify a "bass gill net fishery", not least for the purposes of bringing prosecutions for infringements of regulations. The term "gill net" is applied to an increasing variety of enmeshing nets, which are often used to take a mixture of species, the relative proportions of which vary with grounds fished and season;
- c) approximately one third of the commercial bass catch in the UK was taken by enmeshing nets; and
- d) the method is commonly used by casual and part-time fishermen, with whom enforcement of any management measure (particularly specific ones such as a MLS) can be very difficult.

All four points are still valid, except that b) may no longer be applicable if we need to constrain bass exploitation quantitatively in order to achieve the management objective (more, bigger bass).

We carried out extensive trials to determine mesh selection characteristics for bass in enmeshing gears (drift and fixed nets, see Reis and Pawson, 1992), and analytically demonstrated that a minimum gill net mesh size of 90 mm complements an MLS of 36 cm for bass (as enshrined in national and EU regulations).

For the present purposes, we have used two approaches based on the length structured catch data for a range of mesh sizes used by Reis & Pawson (1992). The first method (following McCombie and Fry, 1960) is based on a relationship between mesh size and the length and maximum girth of fish captured in gill nets. These are used to produce a “master curve” that describes the characteristics of bass being retained by gill nets, viz: fish with a small girth slip through the net, those with too large a girth bounce off, those between have a range of probabilities of being retained within a mesh.

This model indicates that the mesh size that retains 10% of the cumulative distribution of bass above 45 cm is 107 mm (i.e. 10% of the bass caught in a 107 mm net would be <45 cm, assuming equal numbers of all sizes encounter the net). The optimum size of capture for this mesh is 48-49 cm.

Our second approach was to fit mesh selection curves directly to the length frequency observations (Sparre et al. 1989) and allow the shape of the selection curve to become wider with increasing mesh size (as it would in practice). This method also produces good fits of observed length distributions of bass in known mesh sizes (70 - 92 mm). It indicates that a mesh size of approximately 109 mm is needed to obtain a catch where the proportion of bass less than 45 cm is 10% of the cumulative distribution.

These two methods give similar results, and we believe that the approach is sufficiently robust to suggest that a minimum mesh size (stretched from knot to opposite knot) of between 105 and 110 mm would ensure that the majority of bass caught in enmeshing nets are above 45 cm. Reis and Pawson (1992) noted that extrapolation of such modelled retention curves for nets outside the monitored mesh size range normally used for bass (82 – 100 mm) is not without uncertainty, and it may be necessary to seek the views of the industry as to an appropriate mesh size for a bass MLS of 45 cm.

Implementation of a mesh size regulation.

On the assumption that the new bass MLS will be 45 cm, and that a 105 – 110 mm minimum mesh size would support this by reducing the chances of undersized fish being caught in nets and (probably) killed, we propose the following approach to a control measure.

This is, to stipulate that sea bass cannot be landed in an enmeshing net fishery unless a mesh size of at least 105 -110 mm is used, and/or that bass comprise less than 10% by weight of the landed catch taken in nets with a smaller mesh size (but still subject to EU regulation 850/98, which only applies to fixed gears). Taken together, this means that those targeting bass with any fixed or drifting enmeshing net must use nets with a 105 - 110 mm minimum mesh size, thus minimising the chances of bass under 45 cm being caught, whilst the 45 cm MLS protects bass taken as by-catch in fisheries targeting other species. Because the growth and biological characteristics of bass

do not vary greatly around the British Isles, we suggest that one comprehensive national regulation is to be preferred to local variations.

Impact.

This measure would have an immediate impact on most netting fisheries in which bass comprise a significant part (> 10% by weight, and much more by value) of landings (even seasonally), in that mesh sizes would have to be increased and there would be a loss not only of small bass but also of some by-catch species (mullet, sea trout). As shown above, bass catches would soon recover to a similar level to that experienced at the moment. It would have no implications for other netting fisheries, where existing mesh sizes would continue, though the increased bass MLS would result in higher levels of discards in areas where bass < 45 cm were vulnerable.

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