Improving the welfare of farmed European sea bass and gilthead sea bream

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COMPASSION in world farming Food Business

Foreword

European sea bass and gilthead sea bream are sentient beings that must be provided with a good quality of life in a farmed environment. The sea bass and sea bream welfare corporate policy should address the provision of good housing, good feeding, good health and opportunities to express appropriate behaviour. Higher stocking densities, poor water quality, veterinary treatments and other procedures that require handling, lead to stress and poor welfare.

We recommend

✔ Good Environment

- Stocking density per cage shall not exceed 13 to 15 kg/m^3 for European sea bass and gilthead sea bream in the seawater phase[1]. When the stocking density is calculated, the volume that the fish have the opportunity to move in shall be taken into account. The exact stocking density (although always below 15 kg/m^3) should be determined based on water quality, the behavioural and physiological needs of sea bass and sea bream, health status, production system and feeding methods so that welfare is optimised.[1]

- In seawater cages, water quality, such as oxygen saturation, salinity and temperature, should be monitored at least weekly. Measurements should be taken not only from surface waters but throughout the depth of the cage. Where fish are farmed in raceways or ponds, water quality parameters should be monitored, ideally continuously at the inlet and outlet sources. Immediate management steps should be taken to address fish welfare if parameters fall outside optimal ranges or if rapid changes are detected. Parameter reference ranges are discussed in more detail in "Improving the welfare of farmed European sea bass and gilthead sea bream at rearing".

✔ Good Feeding

- Food must be of optimal quality for fish species concerned and the feeding method used must minimise competition and hence aggression and ensure that all the fish have access to feed. Fasting periods should only be used when absolutely necessary and when advised by a vet. If used, for instance, prior to a disease treatment, fasting periods should be no longer than is required for fish welfare benefits (i.e. to reduce oxygen requirements and waste accumulation in the water) and should not exceed 48 hours for each fish. We also recommend that in hotter conditions this time should not exceed 24 hours. Records of the dates and duration of fasting should be kept.

- Compassion also recommends that the amount of fishmeal and fish oil (FMFO) in feed be reduced as much as possible, while still providing for the nutrition needs of farmed sea bass and sea bream. This can be done by replacing some of the FMFO with other ingredients that can meet nutritional requirements, e.g. fish trimmings (or waste from other agricultural processes where suitable, e.g. poultry), algal oils[2].

✔ Good Health

- Disease treatments that cause major welfare problems must not be used routinely and only when no better welfare alternatives are available and when prescribed by a vet. All treatments should be recorded in a veterinary health and welfare plan which should also assess fish for suitability prior to any disease treatment or management procedure. The veterinary health and welfare plan should outline planned husbandry procedures, risk assessments, disease monitoring and all treatments carried out.

✔ Opportunities to Express Appropriate Behaviour

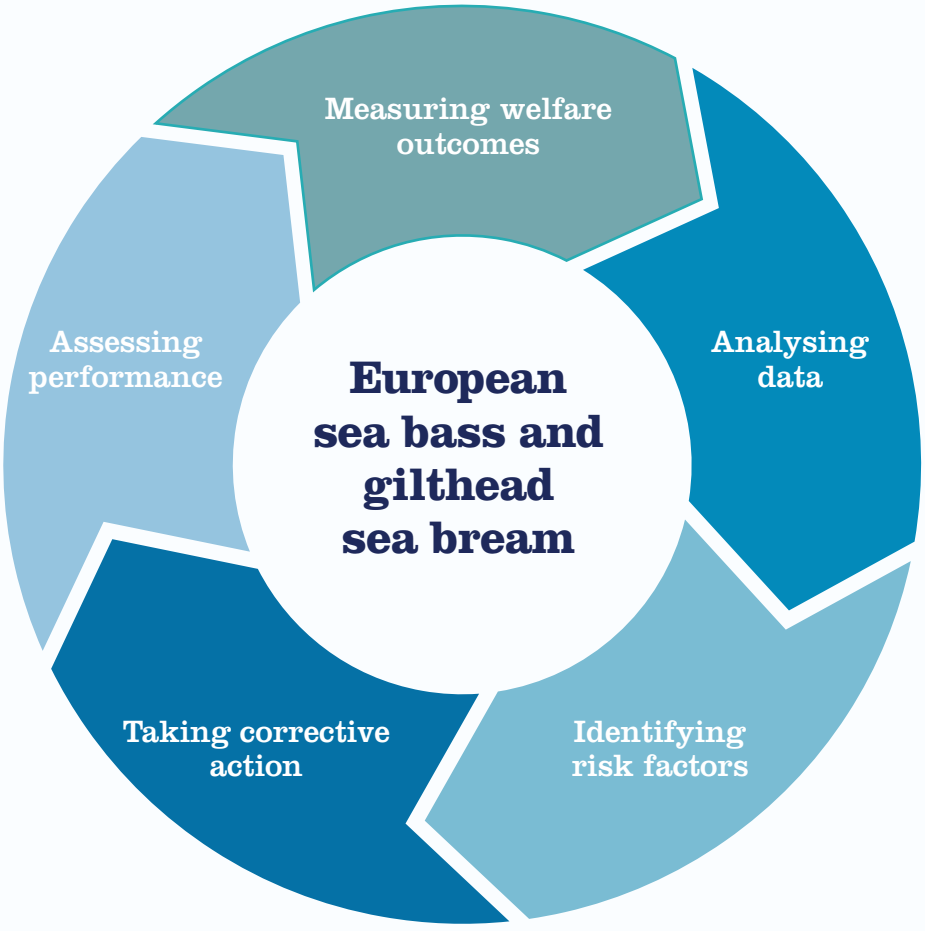
- Crowding, handling and grading should be performed only when absolutely necessary, and be as gentle as possible; fish must not be out of the water for more than 15 seconds[3]. See our resource about improving the welfare of European seabass and gilthead sea bream at slaughter for more information[4].

- Welfare outcomes should be measured and recorded for both sea bass and sea bream. These include parameters such as swimming behaviour, feeding behaviour, disease incidence, skin and fin damage and skeletal deformities. Further work to develop more behavioural indicators of positive welfare for European sea bass and gilthead sea bream is required.

[1] There are no comprehensive studies that compare a useful and wide range of stocking densities for sea bass and bream to fully evaluate the effect of density in sea cages. Also, very few studies have researched stocking densities under commercial sea cage or earthen pond farming conditions; almost all scientific evidence refers to juvenile fish reared in tanks. As a result, these values are based on industry practice and may change in time if new and more informative research is becomes available.
[2] There is an urgent need to address the high numbers of fish utilised to formulate sea bass and sea bream feed with a focus on sustainability of those fisheries and welfare of the fish species. There is also a need for further research into improvements in reducing the proportion of animal protein in feed without negatively impacting the welfare of farmed European sea bass and gilthead sea bream.
[3] Humane Slaughter Association: https://www.hsa.org.uk/removal-from-water/removal-from-water
[4] https://www.compassioninfoodbusiness.com/media/7434843/humane-slaughter-european-sea-bass-and-gilthead-sea-bream.pdf

Welfare outcome measures

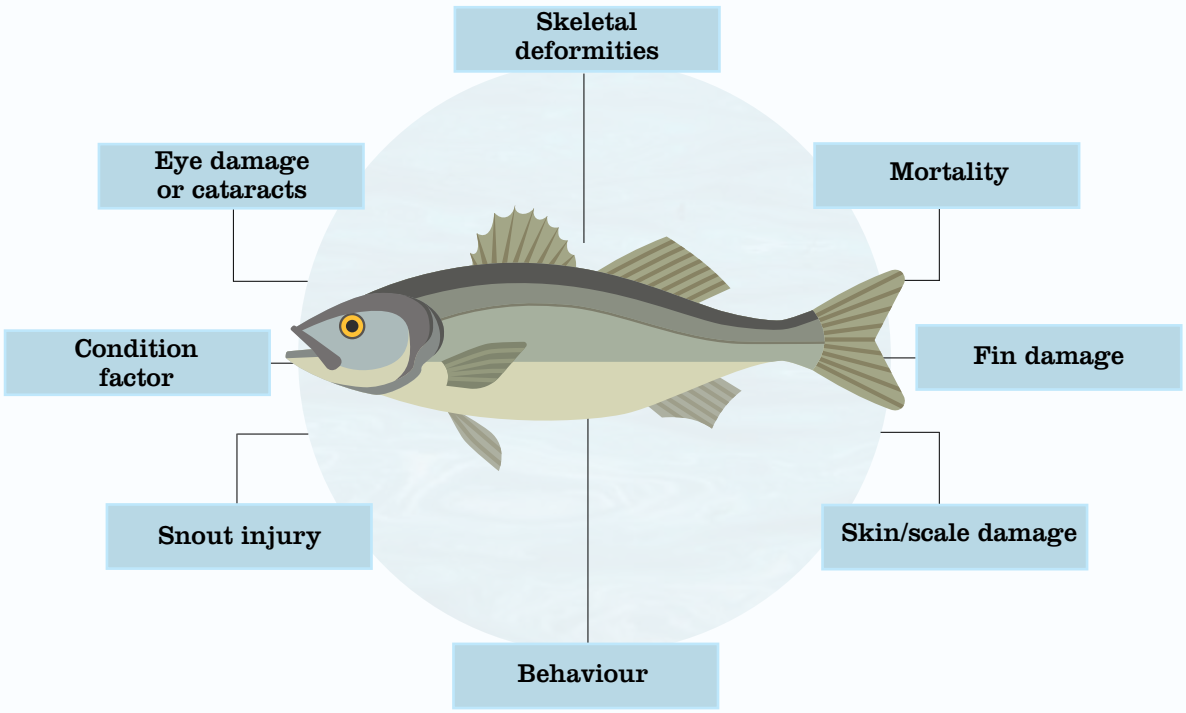
Welfare outcome measures should be used as part of a proactive programme of measurement and continuous improvement, including target setting. A programme should involve a continuous cycle of:



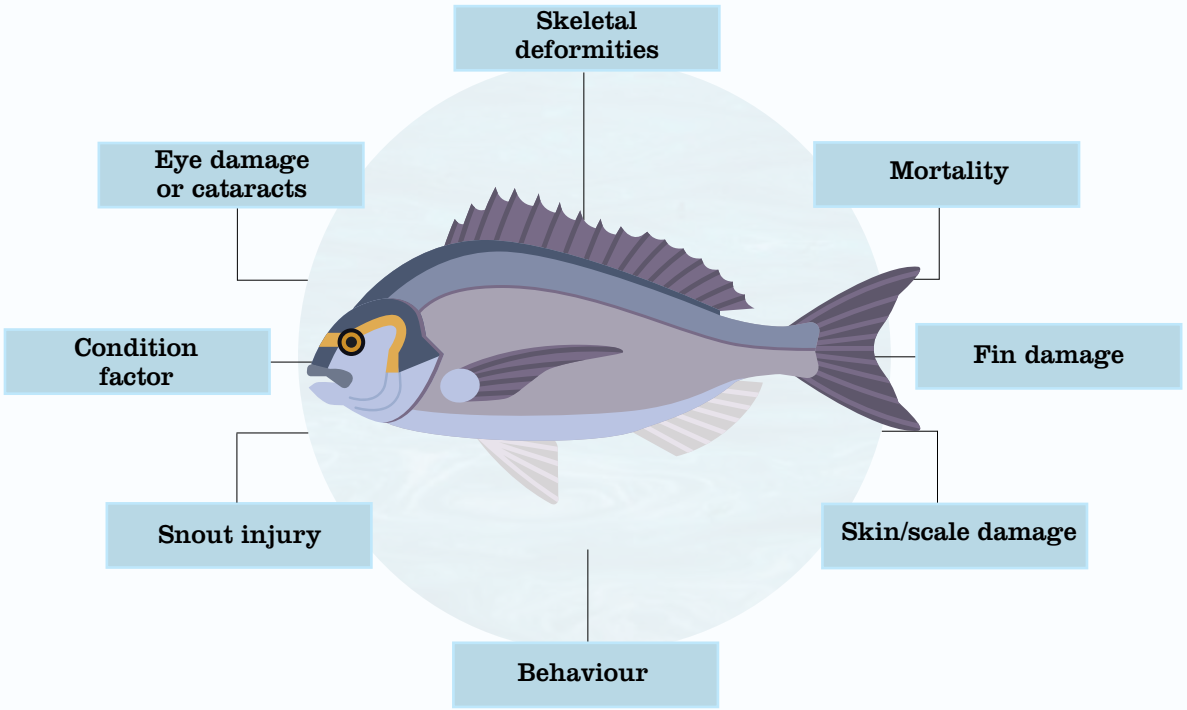
Regular monitoring of welfare outcomes enables swift detection of problems, implementation of corrective action and continuous improvement to be achieved. Some measures should be continuously recorded. For the other measures, it is recommended that they are recorded on a representative sample of a minimum of 50 fish. Target setting should be used for all measures, to drive improvement.

Welfare outcomes in sea cages

Sea bass



Sea bream



Mortality

WHAT: Record incidence of dead and moribund fish in each sea-cage.

WHY: Widely collected data – it is a crude indicator of on-farm welfare issues as it is retrospective, however increases in mortality rate can indicate welfare issues that have been overlooked.

HOW: Record the number of dead and culled fish in each cage, ideally on a daily basis, as they are removed and analysed for cause of death and for disposal. Report % and cause of death, if known.

Body condition factor and emaciation state

WHAT: Condition factor assesses and monitors the body fat reserves (condition) of individual fish. It will also identify any thin or emaciated fish. Common causes for loss of condition include adverse environmental conditions, poor feeding, disease and stress.

WHY: Good nutritional status, measured by condition factor, is required for successful production as well as for good welfare. A drop in condition factor generally indicates a welfare issue. Emaciated fish, being smaller, will quickly be outcompeted for food and can experience low welfare for a long time before they die. These fish can also be a vector for transmitting diseases to other healthier fish.

HOW: Condition factor (K) is calculated as: 100 x weight (g) x length (cm). It can be measured automatically. If manually, it should be measured as frequently as possible, but as a minimum, during risk periods such as fasting, stressful periods and feeding deficits. 0 is normal; 1 is potentially emaciated; 2 is emaciated and 3 is extremely emaciated.

Fin damage

WHAT: Fin damage can be scored by looking for fin erosion, splitting (a loss of fin tissue between fin rays), ray deformity or necrosis. It is measured as an individual welfare indicator where the severity and prevalence of fin damage and lesions are manually scored on a 0-4 scale[5] (see below).

WHY: Fin damage can indicate welfare problems such as increased aggression, overstocking, strong water currents, recent rough handling or disease. In sea bass, 3 fins are particularly vulnerable to damage: the tail fin (active in propulsion), the posterior dorsal fin (a stabilizer, involved in manoeuvring, stress and defence responses) and pectoral fins (involved in propulsion and reorientation).

HOW: Individual fish are scored by checking all fins. The anterior dorsal fin is very small and often damaged by the act of handling so may be excluded. 0: all fins intact; 1: no obvious change in total fin area (<10%), but loss of fin profile and either microsplits (white indented rings) or one deep split present (>1/2 fin length); 2: moderate decrease in total fin area (<20%) but no obvious change in fin profile, <5 minor splits (<1/3 fin length) or one deep split (>1/3 fin length); 3: marked decrease in total fin area (<50%) with major changes in fin profile (>5 minor splits or at least 3 major splits), common fin thickening but absence of blood spots or necrosis; 4: short and dysfunctional fins, marked loss of total fin area (> 50%), major damage with extensive tissue degradation, bleeding spots and secondary infections common.

Snout damage

WHAT: Record incidence and severity of snout damage and lesions via manual scoring system.

WHY: Often occurs in relation to handling procedures such as crowding, pumping or netting.

HOW: Damage is scored on a 0-3 scale with 0 being no damage noted; 1 being a minor wound on the snout (either jaw); 2 being a moderate wound and broken skin on snout and 3 showing a large, deep and extensive wound which can cover the whole head.

Eye damage or lesions

WHAT: Record the incidence and severity of eye damage and lesions (haemorrhage, cataracts, globe rupture) via manual scoring system.

WHY: Fish have no eyelids and their eyes protrude so are very vulnerable to damage. Trauma can indicate recent poor handling procedures. Causes of cataracts are multifactorial (nutritional deficiencies, osmotic imbalances, water temperature or salinity changes), and also linked to exposure to repetitive stress or secondary to other diseases. Whilst minor changes may not affect vision, development of cataracts eventually leads to blindness, inability to feed and thus poor welfare.

HOW: Eye damage is scored on a 0-3 scale with 0 being no damage noted; 1 being minor damage or haemorrhage; 2 being moderate damage or larger haemorrhage/trauma; and 3 being a major haemorrhage/trauma (eye may be ruptured). Cataracts are scored on a 0-4 scale with 0: no cataract; 1: cataract covers <10% lens diameter; 2: cataract covers 10-50%; 3: cataract covers 50-75%; 4: cataract covers >75% lens diameter.

Skin/scale damage

WHAT: Loss of tissue anywhere on the fish's body – can be accompanied by haemorrhaging, ulceration or changes in skin colour.

WHY: Fish with damaged skin or scale loss are more vulnerable to infection and secondary bacterial infection; damage is likely to cause pain and larger ulcers/lesions may affect the fish's ability to osmoregulate.

HOW: Fish are scored on a 0-3 scale with 0 being no evidence of skin or scale damage; 1: loss of individual scales or small (<10 pence piece) lesion but no muscle exposed; 2: several small wounds or areas of scale loss (<10% of fish for scale loss); 3: large severe wounds or scale loss (≥10% of fish or lesion ≥ ten pence piece and exposed muscle).

Skeletal/vertebral deformities

WHAT: Vertebral and skeletal deformities may be due to many factors but links to water current speed, water temperature and diet (dietary lipids, fatty acids, vitamin A and D3) are clear[6].

WHY: Impacts morphology and swimming behaviour and therefore welfare. In addition deformities also affect automated processing methods post slaughter.

HOW: Visual scoring on a 0-3 scale with 0 being no evidence of deformitiy; 1: mild signs of deformed spine; 2: a marked spinal deformity that is visibly obvious; 3: extreme deformity.

[5] Person-Le Ruyet, J., & Le Bayon, N. (2009). Effects of temperature, stocking density and farming conditions on fin damage in European sea bass (Dicentrarchus labrax). Aquatic Living Resources, 22(3), 349-362.
[6] Georga I, Glynatsi N, Baltzois A, Karamanos D, Mazurais D, Darias MJ *et al.* (2011) Effect of vitamin A on the skeletal morphogenesis of European sea bass, Dicentrarchus labrax (Linnaeus, 1758). Aquaculture Research 42: 684–692.

Behaviour

WHAT: Extremely feasible and useful welfare indicator as it is non-invasive and doesn't require handling of the fish or removing them from the water. Behavioural indicators have the advantage of being easy to observe and record during daily management routines. Whilst large scale fish observations can easily be integrated into some aquaculture management systems (most notably for Atlantic salmon via mobile feed cameras) there is still further scope for improving technical equipment for behavioural observations in large fish groups on intensively reared sea bass and sea bream.

WHY: Provides a snapshot of the experience of the fish. For example, exploratory behaviour and feed anticipatory behaviour can all be signs of good welfare. On the other hand, abnormal behaviour can indicate poor management of the sea cage, poor health status or suboptimal environmental conditions.

HOW: Use underwater/mobile feed cameras or surface observations to observe behaviours such as feeding, swimming speeds, levels of aggression. Both sea bass and sea bream are active predators and observations of changes in swimming speeds and feeding behavior may indicate welfare issues. The challenge is that many behaviours are difficult to quantify and rely on skills and training of the observer and knowing what normal is for each life stage/production system/water environment. Additionally, behavioural observations may help to elucidate social status and more favourable conditions for each size class, leading to milder and more relaxed social conditions, thus safeguarding fish welfare. For example, a recent study based on individual feeding behaviour and social hierarchies of European sea bass has revealed that grading is not beneficial for all size classes. Large fish seem to benefit from rearing with similarly sized specimens, while small fish perform better when reared together with larger fish (Table 1)[4].

FISH COPING STYLES: There is evidence that fish possess different personalities in the way they react to novel environments and other behavioural tests in a laboratory setting. These have been described as "proactive" (individuals with active coping style or bold, aggressive personalities) and "reactive" (individuals with a passive coping, shy, or non-aggressive personalities). In fish, personality has been linked to growth performance and feed conversion, metabolism, cortisol responsiveness, and learning. For example, it has been found that wild European sea bass were initially bolder but decreased their risk-taking behaviour over time whereas farmed fish were consistent in their risk-taking behaviour. Risk-taking behaviour (boldness) is positively correlated to competitive ability (bolder fish were quicker in gaining access to food). So that selecting for increased growth in sea bass seemed to concurrently select for bolder personality and conclusions have been drawn to suggest that bolder fish are better adapted to the artificial environments of commercial production. However, selecting for fast growing, bold fish may simultaneously select for increased aggression which can impair fish welfare. Risk-taking and aggression have also been found to be consistent behaviours in gilthead sea bream.

Table 1: European sea bass and sea bream behaviours (can be assessed during routine observations)

Behaviour	Observed signs	Welfare issues
Aggression	Chasing, nipping or biting	Prevents subordinate fish from access to resources such as feed or space.
Feeding behaviour	Poor feeding response	Onset of disease, low feed quality or husbandry stressors.
Swimming speed	Increases during feeding; decreases outside feeding times (may be dependent on feeding method)	May indicate increased competition for food and inability of all fish to access feed ("scramble competition").

[4] Batzina, A., Drossos, I.-P., & Karakatsouli, N. (2018). Effects of grading on individual growth and feeding behaviour of European sea bass Dicentrarchus labrax Aquaculture Research.doi:10.1111/are.13843