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Executive summary

The WG met in Copenhagen on 24–26 November 2009 to address the following ToRs:

a) review recent research and development concerning unaccounted mortality in commercial fisheries including;
   i. Application of unaccounted mortality data to stock assessments.
   ii. Sources of data regarding IUU.
   iii. Potential for use of self (industry) sampling to account for discard mortality.

b) review and report on ongoing work for mitigating unaccounted mortality associated with ghost fishing including consideration of best practices for reducing collateral mortality in fisheries;

c) report on communication with, and guidance received from AMAWGC, WGFTFB, WGECO, assessment working groups, other ICES EGs, and organizations outside ICES.

Within these ToRs members agreed to:

- Continue to develop a better understanding of the needs of other EGs by reviewing all assessment WG reports, collating their findings to identify likely significant problems areas involving UM, and liaising direct with WG chairs through working documents as appropriate. Whist noting advice from WGECO on prioritising species members agreed to focus on commercial species, particularly those subject to recovery plans and/or going through the ICES benchmarking process.
- Work with WGFTFB to organise and refine the programme for a workshop on best practice for survival experiments associated with currently unquantified fishing mortality to be held in Turkey during 2011. The main output of the workshop would be a multi-format manual describing all factors to be taken into account in devising, conducting and interpreting experimental work in this field.
- Consider and identify cost effective methods and indicators for identifying "vulnerable species" (i.e. likely to have a high unaccounted mortality following encounters with fishing activities) and estimating the magnitude of likely sources of unaccounted mortality. Reflex inhibition was thought to be potentially the best type of indicator to use in assessing stress.
- Review information available about the 'trawl path mortality' of Nephrops.
- Review and start to quantify likely causes of cod mortality in VIa.
- Respond to a request from SGHERWAY to provide information on the impacts of catch slippage on herring.
- Track and assess progress in the use of CCTV for monitoring total catches and encourage other EG chairs to promote its adoption.
- Provide observations on the agreed text from the Coastal States in respect of managing NE Atlantic mackerel where this contained naïve or ambiguous provisions.
- Assess the need for a 'best practice guide' for static gear fisheries in order to minimise and mitigate the risks associated with gear loss and subsequent ghost fishing.

- Consider drafting a 'best practice guide' should be drafted for work on lost and abandoned fishing gears. This would aim to standardise terminology, data collection, data retrieval and experimental design.

1 Opening of the meeting

The Chair welcomed all to the meeting. All those attending then described their main areas of work. The Chair explained how he had sought to extend the skills and experience from which the WG could draw by inviting three commercial practitioners to the meeting. All had accepted but, regrettably, only one was finally able to attend. Those attending and tendering apologies are shown in Annex 1.

Procedural matters were discussed, and it was agreed that the role of raporteur should be shared by all via rotation.

Thanks were expressed to ICES for hosting and facilitating the meeting.

Note that the section numbering in the body of this report corresponds to the agenda numbering. The agenda is shown in Annex 2.

2 Current concerns and perspectives

Members were invited to make any new observations on unaccounted mortality (UM). One was that the seafood supply chain was increasingly interested in the provenance of any given product and that retailers were starting to ask about any 'associated mortality'. This was causing problems for seafood processors who were largely unable to provide this sort of information.

Leading on from this it was noted that at least one FAO-compliant seafood certification scheme had required some pelagic fisheries to demonstrate that they were reducing UM over the life of the certification (five years) and that if this could not be done then the re-certification would be at some risk.

It was also noted that any significant UM or otherwise avoidable mortality resulting from fishing could become important in the context of the European marine Strategy Framework Directive. This requires 'Good Environmental Status' to be demonstrated for all European regional seas. Fisheries that resulted in the loss of large quantities of biomass to ecosystem function could then be seen in a very negative light.

3 Review of recommendations and action points from previous meeting

Progress with actions from the previous meeting was summarised.

- there had been little progress with applying UM data to stock assessments because both members involved had been given extra duties;
- some information on IUU fishing levels had been obtained from industry sources but was either too highly aggregated or of insufficient accuracy to inform stock assessments;
- the review of best practices in reducing 'collateral mortality' in fisheries had not been carried out because the responsible member had been given other commitments;
- further contact had been made with assessment working group chairs and this was discussed in detail later in the meeting;
- good communication had been established with WGECO, it had dealt with a QAF ToR at this year's meeting, made recommendations, and expressed a wish for a more intensive dialogue between the two EGs;

- the potential for industry self-sampling to elucidate some UM – mainly discarding – had been reviewed and this would be dealt with in the agenda topic dealing with video monitoring;
- the review of the US National Bycatch Report was delayed because the report had not yet been published;
- more and broader participation in QAF had been initiated but this meeting coincided with EU-Norway negotiations and Scottish Government consultations on fisheries management so two new members were unable to attend. Despite this there is strong interest from industry (seafood processors and RACs) and NGOs in attending future meetings. One senior RAC representative was present.

Finally, Dr Mike Breen gave an introductory presentation entitled 'UM – why bother' to explain some significant concepts to new members.

4 Business under ToR c: The ICES Science Plan

Adi Kellermann from the secretariat gave members an introduction to the new ICES Science Plan. This was to help orientate members, to show which parts of the Theme Areas (TAs) were particularly relevant to QAF and to help in formulating appropriate forward ToRs. It appeared that the most directly relevant were:

- TA1, the influence of fishing activity on fish life history;
- TA2, the impacts of fishing; and
- TA3, developing socio-economic understanding.

Members asked how individual scientists employed by institutes could get the freedom to deliver an increasing workload of requests from ICES' clients. It was acknowledged that these contributions are voluntary and that individuals and their employers had to be prepared to strike an appropriate balance between paid and voluntary work. In this respect the 'ICES offer' had to be attractive in such a way that sufficient motivation was provided.

5 Business under ToR c: Advice from WGECO

Advice from WGECO was discussed at some length. The 2009 meeting of WGECO had considered a ToR from QAF requesting a rationale for prioritising species and fisheries where UM may be significant. The original context had been discussion within QAF as to whether they should continue to focus exclusively on commercial species.

Historically UM work had been undertaken opportunistically, driven by individual state's priorities and the availability of resources.

WGECO proposed that QAF should consider three criteria, alone or combined, in setting their priorities:

- any species where biomass was at a level that significant removals could affect energy flows within their ecosystem,
- species that were particularly vulnerable to fishing impacts because of life-cycle or morphological characteristics, and
- species with a status judged to be threatened or endangered by bodies like IUCN.

Members considered several arguments:

- that the IUCN 'red list' had significant shortcomings in spatial and biological scale and currency,
- the complexity of trying to examine the number and diversity of impacted non-target species in any given fishery along with evidence for changes in biodiversity indices that could be associated with fishing impacts,
- the extent to which work, to date, had been driven by industry requests,
- the need for more confidence in work on escape mortality (EM) both in methodologies and assessing species' vulnerability to EM,
- the extremely low proportion of commercial species for which any UM data were available (thought by some to be ~5%),
- the need to prioritise species under recovery plans where UM could be affecting the plans' outcomes.

Following these discussions and considering the limited resources and influence available to QAF, members agreed to:

- note the recommendations from WGECO,
- accept the recommendation for a continuing and intense dialogue between the two EGs,
- maintain the current focus on commercial species,
- seek further advice from fishery managers and industry,
- scan assessment working group reports for references to uncertainties associated with UM issues like ghost fishing, IUU, EM, etc and then to approach WG chairs picking up on these specific concerns, and
- pay special attention to species/fisheries under recovery plans and where UM insights are particularly lacking. Cod and southern hake were cited in this respect and, for cod, see further discussions in section 7.3 below.

These points were agreed as criteria for a short- to medium-term rationale for making research recommendations and a strategic approach was then discussed and agreed.

The first action was for each WG member to accept and review an allocation of Assessment EG reports. For each report the reviewer would please check the Overview/Introduction sections and the individual stock report sections for any references to unaccounted mortality. Subsections of particular interest would most likely have some reference to terms such as: "Data Availability", "Data Quality", "Uncertainty", "Management Considerations/Issues/Comments", and so on. Some might refer directly to "Unaccounted Mortality" (e.g. WGDEEP), or "Unreported Landings" and "Discards".

An interpretation of these terms in the context of the specific reports would then be entered into a matrix: a similar exercise had been performed some 5 years previously and the results would be compared. This should allow an assessment to be made of the extent to which the UM situation had changed over time. The earlier matrix is shown as below.

Fisheries and species where there was judged to be a high risk of significant UM would then be filtered and prioritised using the criteria above and the schedule by which fisheries were going through the ICES benchmarking process.

Finally a Working Document would be drawn up for circulation to SCICOM and Assessment EG Chairs describing the review findings, the implications for assessments and the economic returns to the fisheries in question, and proposing a mitigation strategy.

The analysis carried out in 2006 is shown in Annex 5 to this report.

6 Business under ToR c: Recommendations from WGFTFB

Recommendations from WGFTFB were discussed at some length. These comprised two recommendations regarding Mediterranean species and fisheries and a more general request that QAF should coordinate research activities in the area of fish survival and report progress to and from relevant ICES EGs.

FTFB seemed to have assumed that a lack of expertise in investigating escape and discard mortality of Mediterranean species was peculiar to that area. QAF members acknowledged a broader need to agree on generic guidelines and to publish these in a form that would have global relevance. In realising this outcome the enthusiasm for research in the Eastern Mediterranean could be a significant factor.

QAF members agreed to consider organising a workshop in the Eastern Mediterranean that could both establish the basis for a ICES Cooperative Research Report on UM research methodology and help to focus the research initiatives currently taking place in that region and more widely.

The topic areas of the report, and how these could then form the basis for the workshop, were discussed further in section 7 below.

The third request from FTFB was accepted. It was agreed that the draft criteria in section 5 above should be used as the basis for developing a longer-term strategy, for communications with Assessment EG Chairs and for establishing networks throughout the ICES structure and other, relevant organisations.

7 Business under ToR a: Theme session - demersal fisheries

7.1 Presentation: Survival of Norway lobster (*Nephrops norvegicus*) escaping through standard diamond and square mesh codends

Aida Campos (1), Margarida Castro (2), Paulo Fonseca (1), Ana Leocádio (3), Beatriz Mendes (1), Tereza Pilar-Fonseca (1)

(1) INRB/IPIMAR; (2) CCMAR; (3) CEFAS

Abstract: The survival of Norway lobster escaping from a commercial codend 70 mm mesh size and square mesh codend 55 mm was investigated onboard a Portuguese crustacean trawler. Individuals in test and control (caught with traps) groups were assigned a degree of vitality, examined for assessment of physical damages and sampled for haemolymph through the different survey phases: the arrival on deck, placement in cages that are released at sea, and finally, cage haul-up.

Log linear models were used to model survival at the end of the study, as a function of season, trial, biological parameters (sex, carapace length, vitality and degree of

damage) and operational ones (net type, total catch, time waiting before cage deployment).

High inter-haul variability was observed in survival. Vitality and degree of damage, together with trial, were found to be the main explanatory variables in the analysis.

In the ensuing discussion it was pointed out that in the protocols used in this work a number of aspects were similar to those used in discard studies, involving the hauling up onboard of escaping organisms and handling on deck before they were transferred into monitoring cages. This was responsible for experimentally-induced mortality, however, the low number of controls in this study did not allow to take this fraction of mortality into account.

7.2 Recent survival studies

The chair summarised a number of recent reports. Broadhurst *et al*. (2009) had used a codends split into two compartments (a 'trouser trawl' arrangement) to reduce the bulk in each and hence the interaction between catch components. The survival of discarded ocean prawns (sp) was significantly increased. This result was also positively correlated with total catch and jellyfish catch. In a separate study Broadhurst *et al*. (in press) used direct observation to demonstrate that redspot whiting (sp) only escaped from trawls during the short (~15 sec) period in which the towing vessel declutched in order to engage the winch.

Enever *et al.* (2009) assessed the post-capture survival of rays taken by otter trawls. He held 162 rays for up to 72 hours in deck tanks and found a survival rate of 55%. Survival was also found to correlate strongly with visual assessment of post-capture condition and with codend weight. The team estimated that global mortality of rays attributable to discarding is approximately 50% of chondrichthyans are unreported bycatch equal to commercial landings (by number).

Enever *et al.* (In press) also attempted to increases ray survival in the Bristol Channel via discard mitigation. Standard codends (80 mm diamond mesh) were compared with modified codends (100 mm diamond and square mesh/T90). Both modified nets reduced discards by ~70% (by number). Survival observations on 278 skate (held for 48 hours) showed that the modified nets produced survival rates of 59% and 65% for the diamond and square mesh codends respectively. Visual inspection of "health" again correlated well with observed survival (i.e. 86% scoring "good" survived). The "health" scores obtained from a further 1539 skate varied between the three codends: 25% (80 mm diamond); 34% (100 mm diamond); and 47% (square mesh/T90). Survival also correlated positively with increasing size supporting arguments for maximum landing sizes for the species in question (Mainly x, y and z spp).

7.3 Observations on cod

A Polish study on Baltic cod (Nowakowski *et al.*, 2009) used a partitioned cover to differentiate between cod escaping during towing and during haulback. Significant numbers were found to escape during haulback and visual inspection led the team to speculate that 'haulback escapees' would have a lower survival rate because of decompression injuries and trauma. No survival experiments were carried out.

A Belgian study (Despetelle, pers. comm.) followed the protocols of Enever (2009) to assess the survival of cod discarded on deck following capture by a beam trawl. The work was conducted whilst fishing at 16–20 m depth and 40 out of 53 fish survived >72 hours.

An Icelandic study (Ingolfsson, pers. comm.) had quantified cod escaping under trawl ground gear. Many of these were found to have spinal injuries but the direct cause was not identified.

Cod survival following the passage of an electric beam trawl had been reviewed as part of an investigation of the impact of electric beam trawl on cod and elasmobranchs. The results had not yet been published but there was clear evidence that the rheotaxic response caused severe spinal injuries in cod. An advice note from ACOM on these issues will be requested.

8 Business under ToR a: Discussion - experimental design

In a departure from the agenda, and following up the WGFTFB recommendation for a Mediterranean workshop, members decided to discuss guidelines for best practice in mortality experiments. The following paragraphs present the EG members' first thoughts on general guidelines for best practice when conducting mortality/survival experiments.

It was first agreed that there was a need for guidelines on best practice in mortality experiments. Some guidance already exists; TGUFM produced a draft protocol for WGFTFB in 2000 and Suuronen (2005) reviewed studies to date for FAO and distilled some guidance on good practice from his various sources.

It was recognised by the group that there will always be a "trade off" when conducting experiments, due to practical and resource limitations, that will inevitably detract from the "ideal" practice. As a result an early piece of advice should take the form of a note on captive observation its pros and cons and to refer readers to alternatives such as tagging studies.

The resulting section on laboratory vs. in situ study would draw out:

- what needs to be measured?
- the advantages & disadvantages to each type of approach, and
- an introduction to the use of physiological status indicators, proxy indicators and the work pioneered by Michael Davies on whole organism reflex inhibition.

It was recognised also that advice on general approach and guidelines on experimental practices might need to be species specific but could start with general guidance by species grouping: pelagics, demersal roundfish (with swimbladders), demersal species no swimbladders (including flatfish), crustaceans and molluscs.

The guidance should then be presented under a series of headings with first thoughts being the following:

Validate captive observation – in order to provide control populations it is essential to demonstrate an ability to capture & hold specimens in captivity (i.e. under conditions to be used on test subjects) with minimal captivity stress.

Captive conditions – should emulate specimens' natural habitat as closely as possible and should minimise handling & confinement stress. Constant environmental conditions should be maintained and monitored throughout the period of captivity (including temperature, salinity, dissolved oxygen, depth/pressure, light levels,

currents/water movement). Where constant conditions cannot be maintained, this should be identified explicitly and accounted for in control groups.

Guidance for some target species may be available via appropriate aquaculture or other fish welfare protocols.

When setting up in situ cage sites careful consideration must be give to appropriate navigation hazards – i.e. navigation lights/markers, notification of hazard to local mariners & coastguard.

Pelagic:

- to maintain natural schooling behaviour need sufficient number of specimens
- large numbers of specimens require large volume containment
- containment needs to be free-floating in offshore conditions, consider navigation hazards & tracking
- ensure monitoring of a free floating cage does not affect other cages
- exclusion of predators – eg. Seabirds, marine mammals
- surface sea state is likely to affect captive specimens & damage cages – consider lowering cages to avoid

Monitoring captivity stress – using appropriate control groups to monitor fatal effects, as well as measurable behavioural and physiological parameters for the captive population (monitor activity levels, reflex inhibition, social interaction/shoaling, feeding activity and blood chemistry: cortisol, lactate, Na+, K+, Cl-, haematocrit, leucocrit, glucose, total protein, total fatty acids).

Consider the most suitable capture methods for controls – pots, traps, purse seine, handline, etc.

Emulate commercial fishing conditions as closely as possible –

all variables that might affect the course and outcome of the experiment must be recorded – this requires considerable experience and insight on the part of the observers.

Discard monitoring programmes could record variables that may be explanatory variables for mortality. these could include gear type, selective device type, sorting time, in water vs. surface environmental conditions, hauling time, towing time, catch size, deck handling procedures/practices, holding/sorting tanks, open/sheltered deck, etc.)

This could be used to account for variability in stock assessment UFM estimation. For example there is a requirement for the Norwegian pelagic fleet to keep logs of burst nets and all slippage events.

Pelagic species:

- provide the potential for greater variation in, for example, catch sizes and environmental conditions,
- pose questions as to whether full-scale operations be emulated in respect of factors such as catch size and gear size.

Sampling experimental subjects (specific to *in situ* experiments) – should be representative and should have no impact upon subjects or be properly controlled.

General handling guidance – to be emphasised for pelagic species:

- be aware and take appropriate care,
- avoid all physical contact to the extent practicable,
- avoid stressful stimuli such as light/dark variations, confinement,
- minimise disruption of natural shoaling behaviour
- experimental design should take into account that careful handling takes time
- monitor key parameters (as in 3 & 4)

An example of care protocols is probably available from the tuna farming/ranching industry.

9 Business under ToR a: Catch and discard monitoring

Presentation: catch and discard monitoring: use of video on Scottish vessels, Mike Park on behalf of the Scottish White Fish Producers' Association

The presentation started with a description of the Scottish industry-initiated scheme for real time area closures (RTCs) where vessels reached a threshold catch rate of cod in the North Sea. This scheme and the use of technical measures more stringent than required under the CFP entitled participating vessels to extra days at sea. This was on the basis of a substantial reduction of discarding of all gadoid species which had been verified by observers and was now being monitored experimentally by CCTV.

There had been 150 RTCs in 2009 and they had moved from a voluntary scheme to being mandatory. Infringement resulted in days at sea being lost.

A range of options was now being explored by which extra quota could be made available based on a proportion of what would have been discarded by vessels working in 'normal' mode.

Trials with CCTV were aimed at of monitoring whole catches and discarding, including high grading. Seven vessels were currently each carrying six cameras covering all relevant working areas and the sorting conveyor. Evidence from these trials was demonstrating that both discarding and high grading were reduced as a result of surveillance. Mr Park's thesis was that the comprehensive use of CCTV and recording codend and/or discard weights could demonstrate the effectiveness of industry conservation initiatives, build confidence between the industry and managers and facilitate quota negotiations. This last point was as a result of increased confidence in levels of fishing mortality and the potential to use 'all catch' quotas rather than 'retained fish' quotas.

The CCTV systems cost ~€8.2 to install plus ~€9k annual running costs. This was very substantially cheaper than the equivalent coverage by observers who were currently being charged out at up to €800/day. The Scottish Government was currently covering all costs.

Questioned as to the 'whole fleet' reaction to the idea of comprehensive CCTV coverage Mr Park agreed that the reaction had been guarded but much was positive.

The discussion then considered the potential for combining fish identification systems with real-time monitoring and the contrasts between relatively simple northern demersal species mixes and the range of species taken by beam trawling in more southerly latitudes.

It was agreed that CCTV was a potent means of reducing uncertainty about mortality rates. It was a transparent, more cost-effective and perhaps more reliable means of

catch monitoring than observers alone. Its use could also encourage the uptake and conscientious use of more selective fishing gears.

The Group agreed to recommend to fishery managers and other EG chairs that they encourage the evaluation of CCTV monitoring of fisheries in which they had any interest or responsibility.

10 Business under ToR a: Definition of 'bycatch' and 'discards'

The group considered the request from FAO to WGFTFB and WGQAF to advise on the definition and use of the words 'bycatch' and 'discards'. It was noted that FAO now recognise that 'bycatch' is used in various pieces of fisheries management legislation. The implication is that while it may be desirable to recommend the phasing out of this very ambiguous term, that is not a practical option.

It was recognised that 'bycatch' is sometimes used unwittingly as a synonym for 'discards', sometimes to mean 'non-target catch' whether retained or not, commercially valuable or not.

Given the range of possible meanings that can be ascribed to 'bycatch' it is not possible for this group to be prescriptive in defining all possible meanings. Accordingly the group urges that, wherever the term is used, its definition is made clear for that specific application by the user.

The term 'discard' can be used with a lack of precision because there are a number of drivers that cause the practice and several groups of organisms that may, or may not, be included when quantifying the phenomenon. As examples the former category can include regulatory, non-commercial or high-graded discards and the latter may be restricted to commercial finfish species, include some or all shellfish, include all of what could be loosely termed macro- and mega-fauna, or include some flora.

As with 'bycatch' it is incumbent on the user to explain clearly how the term is defined specific to any given application.

11 Business under ToR a: Theme session - pelagic fisheries

The session started with Iren Huse updating members on the interpretation of field work carried out largely in 2008 and reported by Irene Huse, Jostein Saltskår and AV Soldal.

Abstract

A new offshore method was used to study the effect of crowding with subsequent slipping from a purse seine on the mortality of Atlantic mackerel (Scomber scombrus L). Mackerel were carefully transferred from a purse seine into two identical large floating net-pens through a transfer channel. One pen was used as control and left floating in the sea without further treatment. The other was used for simulating crowding and slipping from purse seines. The water volume in the pen was gradually decreased by hoisting the bottom of the pen by a crane until the fish started to show flash expansion behaviour (or started to 'boil' as denoted by fishermen), and this density was kept for 15 (2006) or 10 min (2007). The volume was then returned to normal and the net-pens left drifting freely in the open sea for 3 to 6 days. Fish was filled in experimental or control pens ten times. Although four of these were somewhat deranged by experimental problems, it was evident that crowding had a major effect on survival of mackerel. In all five experiments, the mortality was higher among the crowded fish (80–100 % mortality) than among the controls (0.1–46 % mor-

tality), and the difference was significant. The experiments showed that slipping of mackerel from purse seines should be avoided, if possible, to avoid massive killing of fish.

Huse then described some investigations she had made resulting in concerns over the representativeness of the Norwegian reference fleet. Further work and analyses would be undertaken to determine whether this integral part of the national monitoring system was performing as intended.

Presentation: Mortality rates and stress response of herring after slipping from purse seines, Maria Tenningen, Aud Vold and Jostein Saltskår

Abstract

Large-scale, open-sea survival experiments were carried out on herring crowded and slipped from the purse seine in the North Sea in May 2008 and 2009. Herring were caught with purse seine and transferred to large circular net pens in an early phase of hauling. Commercial crowding conditions were simulated by lifting the bottom of the net pen and thereby reducing the water volume and increasing fish density. The mortality rate four to five days after crowding ranged from 1.8% in the least crowded to 52.0% in the hardest crowded groups, control group mortality ranged from 0.9 to 2.0%. In addition herring stress response to crowding in the purse seine was analyzed. Blood samples were collected during the crowding experiments in 2009 and from two commercial catches in the spring 2009. Cl^-, Na^+ and cortisol levels increased significantly during the observation period two and four days after the simulated crowding, indicating that mortality may occur several days after crowding and that the main reasons may be problems with maintaining the water-salt balance. The stress response to crowding during commercial fishing was lower than during the crowding phase in the experiments; cortisol, Na^+, Cl^- and glucose levels were significantly lower while lactate and K^+ levels were not significantly different. This may either indicate that the fish were under more stress and received more injuries during the experiments compared with commercial fisheries or that the sampling method was not appropriate, further studies are needed before any conclusions can be drawn. These experiments provide important information on what crowding densities can be tolerated in the purse seine fisheries for herring and suggest a need to revise the legislation on slipping in these fisheries.

Discussion focused on two areas. First was the implications that this kind of work have for the current Norwegian legislation. This makes it illegal to slip 'dead or dying' fish. It appears to be impossible to determine whether fish are 'dead or dying' within a sensible and appropriate time scale hence the legislation is meaningless and will allow significant underestimation of fishing-related mortality. This work also shows that mortality rates are closely related to the fish density reached during the drying process and that this could be used as a proxy for fish likely to be 'dead or dying'. It is very difficult, however, to assess density until some point well after critical levels have been reached.

Second was the use of indicators to determine stress levels and likelihood of mortality. The standard blood components were discussed but all share the disadvantage that sampling is very stressful and sample analysis may take hours or days to complete. It was agreed that recent work by Davies *et al.* on reflex inhibition showed the most potential to provide a pragmatic and intuitive assessment of condition.

Further discussion led to the conclusion that, as a group, the pelagic species probably suffer the highest unaccounted mortality. This can frequently arise from phenomena such as:

- dumping
- escape mortality through meshes and grids
- sonic surveys
- IUU/misreporting
- slipping
- net bursting

All of which have been documented but none of which has been adequately quantified.

The group were reminded of the recent work by John Simmonds, some of which had been published as: Are reported catches sufficient to account for biomass in the NE Atlantic mackerel stock? (ref)and also referred to recent work by Ana Marçalo *et al.*, on slipping mortality of sardine on Portuguese purse seiners.

12 In response to ToR b

ToR b) review ongoing work for mitigating unaccounted mortality associated with ghost fishing including consideration of best practices for reducing collateral mortality in fisheries.

Norman Graham noted that there was strong evidence of changes in discarding behaviour in Area VI. He speculated that this was at least in part due to the introduction of the Registration of Buyers and Sellers Regulation.

Presentation: DEEPCLEAN – results from an investigation of the extent and impacts of gillnet losses in deep water NE Atlantic fishing grounds, Norman Graham

The phenomenon of ghost fishing associated with deep-water gillnet fisheries has been the subject of several previous studies. these have suggested that ghost fishing may be significant source of unaccounted mortality for both target (hake, anglerfish and deep-water shark) and by-catch (red crab and blue ling) species. Given that most deep-water fish species are long-lived and slow growing, ghost fishing may have a significant impact on the stocks.

In order to estimate the spatial extent of ghost fishing, associated unaccounted mortality and to remove lost and abandoned gillnets from known locations, an EC-funded Pilot Project "Recuperation of fishing nets lost or abandoned at sea" was initiated with the principal objectives of:

i) to conduct targeted retrieval exercises of lost, discarded and abandoned nets in deep-water gillnet fisheries > 200 m and;

ii) to conduct structured surveys in order to estimate the quantity and range of ghost nets in these fisheries.

For clarification, it is important to distinguish between nets that have been lost and those that are abandoned. Lost nets can be attributed to a number of factors that are largely out with the control of the fisher, and can be associated variously with bad weather, gear conflicts, topographical conditions and other causes. Abandonment of gear is a deliberate act where nets are left to fish with extended soak times over and above normal or legal fishing times or with no intention of recovery.

Based on a range of data including VMS and expert knowledge of the fisheries, broad areas where ghost fishing was considered likely to occur were identified. These areas were depth-stratified largely based on VMS activity and understanding of the fishery dynamics. To satisfy objective (ii) above, transects were randomly selected and formed the basis of the 'survey transects' within each depth stratum. An intelligence-gathering exercise was initiated to obtain data from fishers as to the known locations of where gill nets had previously been lost or encountered. The data gathering was conducted through direct interviews and from individual contacts active in the fishery. Attempts to initiate a voluntary data provision programme through the use of project specific logsheets failed to provide any further data. The data obtained from interviews were used to select and identify individual 'mitigation transects'.

To ensure compatibility between surveys, project-specific Standard Operating Procedures were developed and introduced and integrated with a dedicated project database linked with ArcGIS. In addition to the data gathered during this study, data from earlier surveys were also uploaded into the database to facilitate direct comparisons between this and those earlier surveys. In order not to bias estimates of the spatial scale and extent of the quantity of lost nets in the environment, data from survey and mitigation transects are treated separately and individual transects identified as either 'survey' or 'mitigation' transects.

Of possible concern from earlier studies was that where small fragments of gill nets had been retrieved, it was unclear whether these were part of a larger net and the retrieval gear had ripped out only a small section or whether these were old fragments that had been lost or broken up by trawling activity. In order to quantify the extent of lost gillnets, it is necessary to estimate the efficiency and impacts of the retrieval gear in respect of the nets themselves. In this project, direct observations of the retrieval process were made under experimental conditions. While it was not possible to provide a coefficient of efficiency, there was little evidence to suggest that gill nets disintegrated as part of the retrieval process and overall the results indicated that the efficiency of the retrieval gear was high. Unfortunately, due to time and financial constraints it was not possible to observe the interactions with gill nets longer than 2km or to carry out extensive studies in deep-water, so the results should be treated as indicative.

Four broad areas were selected for survey: Rockall & George Bligh Bank; North Shetland; South and West Porcupine; and Rosemary Bank & SE Rockall. Two charter vessels were selected following an EU wide call for tenders to conduct the four surveys. In total, 82 survey days were completed within a four month period during the summer of 2008. Over 2600 km of transects were completed. Detailed information from various sectors of the fishing industry allowed for a number of dedicated mitigation transects, but the majority of transects were randomly generated within depth strata and the survey intensity across strata was weighted based on VMS activity.

Of the four general areas surveyed, the relative survey intensity was highest at Rosemary Bank, which was covered comprehensively. Coverage in Rockall and Shetland was considered high, but some areas were not surveyed due to unfavourable bottom topography or the presence of sensitive habitats. The extent of fishing activity within these areas is unknown, but VMS data from 2005 indicates some degree of activity. Given the spatial scale of the Porcupine Bank and weather constraints encountered during the survey, survey coverage was considered to be moderate in the southern part of the Porcupine and low to moderate in the western Porcupine. Overall 13.6 km of gill nets were retrieved, 10 km from mitigation transects and 3.6 km

from survey transects. While this is low compared to other mitigation surveys, the comparatively low levels of a priori data from the fishing industry on precise locations of lost nets is likely to be a significant contributing factor. Even so, given the moderate to high survey coverage, it is considered that lost nets are not widely distributed throughout the fishing area covered in this project.

A range of other marine debris was also recovered including trawl warp, trawl netting, communications cable and longlines.

The survey data imply that the extent of lost nets is not wide and, for gillnets that were retrieved, catches of marine organisms were low and comprised mainly of decapod crabs. On the basis of the level of nets recovered and the catches within them, it is considered that the issue of ghost fishing associated with lost gillnets does not constitute a high source of unaccounted catches. No evidence was found of abandoned gears or netting in any of the areas surveyed.

The geo-database allowed for direct comparisons to be made between areas. The inclusion of data from other earlier and surveys, for example the Norwegian mitigation surveys in the Greenland halibut fishery, also allows comparisons to be made with that work and with surveys in other areas. A number of transects from earlier surveys where gillnets had been previously retrieved were also repeated to assess if lost nets remained; no gillnets were retrieved from these.

The low levels of gillnets recovered precluded any formal analytical assessment to quantify the absolute levels of lost gillnets in the areas surveyed. It was considered that such an assessment would result in very high variance estimates and that such estimates could potentially be misleading given the low number of observations. It is of note that even in highly regulated fisheries such as the Norwegian Greenland halibut fishery, gill net loss is still considered to be problematic, with an average of 17.5km of netting being retrieved in 2007 and 2008. It is important to consider that the high retrieval rate observed is associated with a high level of very precise information on the location and extent of net loss facilitated through a mandatory reporting procedure and backed up by extensive interviews of gill net skippers operating in the fishery. It is recommended that such a programme be considered for EC gill net fisheries to provide data on the amount of gill net loss and as a basis for any future mitigation surveys if warranted by the data. Such an approach can only be achieved through close collaboration with the fishing industry and promoted through the development of codes of good practice that could act as an incentive to the fishing sector to provide data.

After discussing this and related work such as the 'FANTARED' projects (MacMullen *et al*., 2004) it was agreed that a 'best practice guide' should be drafted for work on lost and abandoned fishing gears. This would aim to standardise terminology, data collection, data retrieval and experimental design.

It was also agreed to re-examine the need for an industry-centred guide to good fishing practices in order to minimise the loss of static gears and mitigate their subsequent impacts.

13 The future of QAF: membership, linkages, priorities, resources, etc.

Following a letter sent by Mike Breen, contact with other EGs was discussed at some length. A response from WG Risk Assessment Chair Daniel Howard was unenthusiastic, failing to acknowledge any commonality between the two EGs. Members were disappointed and Mike Breen agreed to reply with our concerns.

Very few other responses had been received from other EG Chairs, particularly those concerned with assessments. It was agreed that the approach in section 5 above would be followed up with the dispatch of a Working Document to each EG requiring a response to the concerns expressed. The tabulated form of this exercise would also be compared with a previous exercise to determine any changes in reported uncertainties that might derive from unaccounted mortality.

The existing links with WGFTFB and WGECO should be continued and approaches made to WGDEEP.

Priority would be given to species that were scheduled for the ICES benchmarking process.

Future membership was discussed. It was agreed that involvement should be sought from at least one environmental NGO through their European umbrella group, the RACs' representative body and the seafood supply chain.

Norman Graham described some relevant discussions at STECF workshops and agreed to post the reports on the SharePoint.

14 ASC theme session

It was agreed to propose a theme for ASC 2011.

15 Forward Terms of Reference, date and venue of the next meeting

Terms of reference for the meeting in 2010 were discussed and agreed. They are shown in Annex 3 to this report.

Annex 1: List of participants

Name	Institute	Address	Email
Mike Breen	Marine Scotland	375 Victoria Road P.O. Box 101 AB11 9DB Aberdeen Torry United Kingdom	breenm@marlab.ac.uk
Aida Campos	INRB - IPIMAR	Avenida de Brasilia PT-1449-006 Lisbon Portugal	acampos@ipimar.pt
Irene Huse	Institute of Marine Research	P.O. Box 1870 N-5817 Bergen Norway	irene.huse@imr.no
Philip MacMullen (Chair)	Fishgate	William Wright Dock HU1 2ET Hull United Kingdom	p_macmullen@seafish.co.uk
Michael Park		North Lodge, 11, Bath St. AB39 2DH Stonehaven United Kingdom	mikeswfpa@aim.com
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Sofie Vandemaele	Institute for Agricultural and Fisheries Research	Ankerstraat 1 B-8400 Oostende Belgium	sofie.vandemaele@ilvo.vlaanderen.be
Aud Vold	Institute of Marine Research	P.O. Box 1870 N-5817 Bergen Norway	aud.vold@imr.no
Norman Graham	Marine Institute	Marine Institute Rinville Oranmore Co. Galway Ireland	norman.graham@marine.ie

Apologies were received from:

Mike Mitchell

Daniel Valentinsson

Giuseppe Scarcella

Wouter Willems

Olafur Ingolfsson

Alain Frechet

Alex Wiseman

Annex 2: Agenda

Tuesday 24th November			
09.30		Registration	
10.00	1	Welcome, introductions and announcements	PM
10.05	1.2	Explanation/discussion of agenda items and Terms of Reference	PM
10.15	2	Current concerns and perspectives	PM/All
10.30	3	Short review of recommendations and action points from previous meeting	
	3.1	Continue work on application of unaccounted mortality data to stock assessments & report back	MB
	3.2	Review info available on IUU from fishing companies & discuss appropriate use	MM & PM
	3.3	Review best practices for reducing 'collateral mortality' in fisheries	PM (n/a)
	3.4	Update reports on incorporating components of F in stock assessment thro direct contact with WG chairs & AMAWGC	MB
	3.5	Develop lines of communication with WGECO – 2009 report	DR & PM
	3.6	Review potential for self-sampling to address mortality questions & report back on June ICES Workshop	IH
	3.7	Review content & status of US national bycatch report	PM (n/a)
	3.8	Encourage more and broader participation in WGQAF	PM
	3.9	Presentation: UM – why bother?	MB
ToR c) Report on communication with, and guidance received from AMAWGC, WGFTFB, WGECO, assessment working groups, other ICES EGs, and organisations outside ICES.			
11.00	4	The ICES Science Plan	
	4.1	Introduction	PM
	4.2	Discussion	
11.20	5	Advice from WGECO	
	5.1	Introduction	DR
	5.2	Discussion	
11.50	6	Recommendations from WGFTFB	DR
	6.1	That investigating the survival of fish being discarded and escaping from fishing gears in the Mediterranean should be highlighted as a research priority for all ICES member states	
	6.2	That a workshop should be held to develop methods for investigating the escape and discard mortality of key species in the Mediterranean. The workshop should bring together essential areas of expertise including: fisheries biologists, gear technologists and researchers specialising in escape mortality experiments (both lab and field based)	
	6.3	That QAF should be requested to coordinate research activities in the area of fish survival and report progress to relevant ICES EGs	
	6.4	Reports on other communication with, and guidance received from ICES EGs, and organisations outside ICES	
13.00		Break	
ToR a) Review and consider recent research and development concerning unaccounted mortality in commercial fisheries			
14.00	7	Theme session: demersal fisheries	
	7.1	Presentation: Survival of Norway lobster (Nephrops norvegicus) escaping through standard diamond and square mesh codends	AC
	7.4	Australian prawn fisheries – improving discard survival	PM

	7.3	Elasmobranch survival following discarding – UK studies	PM
	7.2	Cod survival following discarding from beam trawls	SV/WW/PM
	7.5	Cod UM – recent observations from Iceland, Poland and Netherlands	DR/PM
15.40		Break	
16.00	7.6	Quantifying all mortality – demersal fisheries – experimental design and forward priorities	All
17.40	8	Presentation – Quantifying IUU fishing impacts	PM
18.00		Finish	
Wednesday 25th November			
09.00	9	Catch & discard monitoring	
	9.1	Use of video on Scottish vessels	MP
09.45	9.2	Catch/non-catch monitoring – discussion	
10.15	10	Terminology – discussion (cf FAO request to consider the use of 'bycatch' and 'discards')	
11.00		Break	
11.15	11	Theme session – pelagic fisheries	
	11.1	Presentation: sampling coverage of the Norwegian purse seine fisheries by the reference fleet	IH
	11.2	Mortality rates and stress response of herring after slipping from purse seines	MT
	11.3	Presentation: sampling of slipped mackerel from the sea bed	IH
12.45		Break	
14.00	11.4	Mortality of pelagic species – discussion	
14.30	11.5	Quantifying all mortality – pelagic fisheries – experimental design and forward priorities	All
17.00		Close	
Thursday 26th November			
09.00	12	ToR b) Review ongoing work for mitigating unaccounted mortality associated with ghost fishing including consideration of best practices for reducing collateral mortality in fisheries;	
	12.1	DEEPCLEAN: results from an investigation of the extent and impacts of gillnets losses in deep water NE Atlantic fishing grounds	NG
09.30	12.2	Quantifying all mortality – lost fishing gears – experimental design and forward priorities	All
10.30	13	The future of QAF – membership, linkages, priorities, resources, etc	
11.30	14	ASC 2010 – a QAF theme session?	
12.00	15	Forward Terms of Reference, date & venue of next meeting	
12.30		Break	
14.00	16	Recommendations and Reporting	

Annex 3: WGQAF terms of reference for the next meeting

The **Working Group on Quantifying All Fishing Mortality** (WGQAF), chaired by Philip MacMullen, UK, will meet at ICES Headquarters, Copenhagen, Denmark, 15–19 November 2010 to:

a) Review and consider recent research into unaccounted mortality in commercial fisheries;

b) Continue the process of planning (jointly with WGFTFB) a workshop that will elucidate best practice in devising and conducting survival experiments, interpreting the data generated by them, and result in a guidance manual;

c) Further refine the process of reducing uncertainty in stock assessments and in the use of technical management measures; and

d) Review progress in identifying species/fisheries most likely susceptible to unaccounted mortality and the indicators that can be used in that process.

WGQAF will report by 17 December 2010 (via SSGSUE) to the attention of SCICOM and ACOM.

Supporting Information

Priority	The current activities of this Group will lead ICES into issues related to the ecosystem affects of fisheries, especially with regard to the application of the Precautionary Approach. Consequently, these activities are considered to have a very high priority.
Scientific justification	Theme Areas 1, 2 and 3 Term of Reference a) This continuing ToR involves critical review of current and recent work as well as a role in coordinating and prioritizing future work. An increasing number of studies are being undertaken which may provide valuable insights into the impacts of fishing activities but which may also dilute effectiveness and confidence in the area. Term of Reference b) Leading on from ToR a) above, the subject would benefit from a review of methodology and interpretation. The last review of significant studies was undertaken in 2000 by the WGFTFB Topic Group on Unaccounted Mortalities. A review of more recent work will determine the need for revision and update on planning and methodology for studying this subject and how these aspects can be applied to groups of species that are 'novel in terms of their current distribution or their spatial responses to temperature change.. Term of Reference c) All fishing activities have influences that extend beyond removing target species. The approach recommended by FAO is that responsible fisheries technology should achieve management objectives with a minimum of side effects and that they should be subject to ongoing review. WGFTFB members and others are currently undertaking a range of research programmes to provide the means to minimize side effects; assessment WGs could benefit from specialist advice where, through their own reports, there are concerns over unaccounted mortality. Term of Reference d) Limited resources and a short time frame both indicate strongly that UM research should be targeted appropriately

Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by some 10-15 members and guests.
Secretariat facilities	Minimal
Financial	Minimal
Linkages to advisory committees	Through ICES Steering Group on Sustainable Use of Ecosystems.
Linkages to other committees or groups	WGQAF links closely with WGFTFB and WGECO. It is also endeavoring to strengthen links with all appropriate assessment WGs.
Linkages to other organizations	The work of this group is closely aligned with similar work in FAO and with an increasing number of commercially orientated bodies such as RACs and seafood industry representative organizations.

Annex 4: Recommendations

The following actions were agreed to form the basis of continuing work and the terms of reference for the next meeting.

RECOMMENDATION	FOR FOLLOW UP BY:
1. To review and consider recent research and related work on unaccounted mortality in commercial fisheries according to agreed priorities.	All, continuing
2. To continue to develop a better understanding of the needs of other EGs by reviewing all assessment WG reports, collating their findings to identify likely significant problems areas involving UM, and liaising direct with WG chairs through working documents as appropriate. Take advantage of the benchmarking process by concentrating on those species and stocks going through that process.	All, Mike Breen, for attention of assessment and other EGs
3. To work with WGFTFB to organise and refine the programme for a workshop to be held in Turkey during 2011. The workshop would consider best practice for survival experiments associated with currently unquantified fishing mortality; the special considerations that might need to be applied to work in the Mediterranean; and means of most effectively facilitating technology transfer between research teams. The main output of the workshop would be a multi-format manual describing all factors to be taken into account in devising, conducting and interpreting experimental work in this field.	Philip MacMullen, Mike Breen, Aida Campos leading for WGQAF; WGFTFB nominees to be agreed during 2010 meeting
4. To consider and identify cost effective methods and indicators for identifying "vulnerable species" (i.e. likely to have a high unaccounted mortality following encounters with fishing activities) and estimating the magnitude of likely sources of unaccounted mortality. For example, reflex inhibition (Davies *et al.*, various).	Aud Vold, Irene Huse, Maria Teningen, liaison with other EGs and external research entities
5. To re-examine existing video material on 'trawl path mortality' for *Nephrops*.	Mike Breen, Aida Campos, and correspondemnce with *Nephrops*-related EGs
6. To review and quantify likely causes of mortality in cod in VIa	Norman Graham and colleagues for general ICES information, and particularly cod-related EGs
7. To respond to a request from SGHERWAY to provide information on the impacts of catch slippage.	Maria Tenningen
8. To monitor and review the impacts of CCTV monitoring of catches on retained and discarded catch elements and the broader implications for management.	Mike Park, Philip MacMullen, for information to other EGs and ICES generally
9. To comment on the agreed text from the Coastal States re management of NE Atlantic mackerel, specifically relating to the difficulties of defining 'dead or dying' and there being no explicit exclusion of the use of sorting grids in pelagic trawls.	For general ICES information and communication to Coastal State parties.
10. That managers and stock assessment-related EG chairs should encourage the evaluation of CCTV monitoring of vessels involved in fisheries in which they an interest.	EG chairs, fishery managers, research managers
11. To assess the need for a 'best practice guide' for static gear fisheries in order to minimise and mitigate the risks associated with gear loss and subsequent ghost fishing.	All to action, and for general industry use

12. That a 'best practice guide' should be drafted for work on lost and abandoned fishing gears. This would aim to standardise terminology, data collection, data retrieval and experimental design.	All to action

Annex 5: Analysis of assessment reports, 2006

Status Codes	
A	No known problem
B	Estimates included in stock assessment
C	Estimates available but not included
D	Problem but no estimates
E	no information

Data Quality	
1	Reliable
2	Unproven or not directly related
3	Unreliable
X	UNOBTAINABLE

Species	Region	Area	ICES Area	WG	Assessment	Status	Sources of UFM (WG record) - coded				
							IUU	Discards	Escape	Ghost	Habitat
Capelin	1	Barents Sea	Subareas I & II, ex DIV IIa W of 5degW	AFWG	Update						
Cod	1	NE Arctic	Subareas I & II	AFWG	Observation list		B1	C2			
Cod	1	Norwegian Coastal	?Subarea II?	AFWG	Observation list	Critical					

Greenland Halibut	1	NE Arctic	Subareas I & II	AFWG	Update				
Haddock	1	NE Arctic	Subareas I & II	AFWG	Update		D	D	
Saithe	1	NE Arctic	Subareas I & II	AFWG	Benchmark				
Sebastes marinus	1	NE Arctic	Subareas I & II	AFWG	Experimental	Critical		C2	
Sebastes mentella	1	NE Arctic	Subareas I & II	AFWG	Experimental	Critical		C2	
Shrimp	1	Barents Sea	Subarea I	WGPAND	Benchmark				
Shrimp	1	Norwegian Sea	Subarea II	WGPAND	Benchmark				
Capelin	2	Icelandic	Subareas V and XIV and Div IIa W of 5degW	NWWG	Update	Critical		D	
Cod	2	Greenland	Subarea XIV	NWWG	?	Critical	B2	D	
Cod	2	Icelandic	Div Va	NWWG	Update				
Haddock	2	Icelandic		NWWG	Update				C2
Halibut	2	Greenland	Subareas V and XIV	NWWG	?	Critical			
Herring	2	Icelandic	Div Va	NWWG	Benchmark				
Saithe	2	Icelandic		NWWG	Benchmark				
Sebastes marinus	2		Subareas V, VI, XII and XIV	NWWG	?			D	
Sebastes mentalla	2	Continental shelf	Subareas V, VI and XIV	NWWG	?		D	D	
Sebastes mentalla	2	Irminger Sea		NWWG	?	Critical	C2	C2	

Status Codes

A	No known problem
B	Estimates included in stock assessment
C	Estimates available but not included
D	Problem but no estimates
Blank	No available information

Data Quality

1	Reliable
2	Unproven or not directly related
3	Unreliable
X	UNOBTAINABLE

Species	Region	Area	ICES Area	WG	Assessment	Status	Sources of UFM (WG record) - coded				
							IUU	Discards	Escape	Ghost	Habitat
Anglerfish	4	Div IIIa & Subareas IV & VI	IIIa, IV & VI	WGNSSK	?						
Cod	4	North Sea, Eastern Channel & Skaggerak	IV, VIId & IIIa	WGNSSK	Observation list	Critical	B2	B1			
Haddock	4	North Sea & Div IIIa	IV & IIIa	WGNSSK	Benchmark			B1			
Herring - Autumn	4	North Sea, Eastern Channel & Skaggerak	IV, VIId & IIIa	HAWG	Observation list						
Herring - Spring	4		IIIa, 22-24	HAWG	?						

Horse Mackerel	4	North Sea	IV	WGMHSA	?			
Mackerel	4	North Sea	IV	WGMHSA	?	Critical	B1	
Nephrops	4	North Sea (various areas)	All	WGNSSK	Benchmark			
Norway Pout	4	North Sea	IV	WGNSSK	Update	Critical		
Norway Pout	4		Other	WGNSSK	Update			
Pandalus	4	North Sea (Fladden ground)	IVa	WGPAND	?			
Pandalus	4	Skaggerak & Norwegian Deeps	IIIa & IVa East	WGPAND	?			
Plaice	4	Eastern Channel	VIId	WGNSSK	Update			B1
Plaice	4	North Sea	IV	WGNSSK	Observation list			B1
Plaice	4	Skaggerak	IIIa	WGNSSK	Update			B1
Saithe	4	North Sea, Div IIIa & Subarea VI	IV, IIIa & VI	WGNSSK	Benchmark			B1
Sandeel	4	North Sea	IV	WGNSSK	Update	Critical		
Sandeel	4		Other	WGNSSK	Update			
Sole	4	Eastern Channel	VIId	WGNSSK	Update			
Sole	4	North Sea	IV	WGNSSK	Update			B1
Sole	4	Skaggerak	IIIa	WGNSSK	?			
Sprat	4	North Sea	IV	HAWG	?			
Whiting	4	North Sea & Eastern Channel	IV & VIId	WGNSSK	Update			B1

Status Codes

A	No known problem
B	Estimates included in stock assessment
C	Estimates available but not included
D	Problem but no estimates
Blank	No available information

Data Quality

1	Reliable
2	Unproven or not directly related
3	Unreliable
X	UNOBTAINABLE

Species	Region	Area	ICES Area	WG	Assessment	Status	Sources of UFM (WG record) - coded				
							IUU	Discards	Escape	Ghost	Habitat
Cod	3	Faroe Bank	Vb2	NWWG	?						
Cod	3	Faroe Plateau	Vb1	NWWG	Observation list	Critical					
Haddock	3	Faroe	Div Vb	NWWG	Update						
Saithe	3	Faroe	Div Vb	NWWG	Benchmark						
Anglerfish	5	Div IIIa & Subareas IV & VI	IIIa, IV & VI	WGNSDS	Update		D				
Cod	5	Rockall	VIb	WGNSDS	No assessment		D				
Cod	5	West of Scotland	VIa	WGNSDS	Benchmark	Critical	D	B2			
Haddock	5	West of Scotland	VIa	WGNSDS	Benchmark		D	C3			

Hake	5	Northern Stock	IIIa, IV, VI, VII and VIIIabd	WGHMM	Observation list	Critical	B2	C3
Herring	5	West of Scotland	VIa	HAWG	Update			
Megrim	5	West of Scotland & Rockall	VI	WGNSDS	Update		D	
Nephrops	5	West of Scotland (Management area C)	VIa	WGNSDS	Benchmark		D	
Norway Pout	5	West of Scotland	VIa	WGNSDS	No assess-ment		D	
Sandeel	5	West of Scotland	VIa	WGNSDS	No assess-ment		D	
Whiting	5	Rockall	VIb	WGNSDS	No assess-ment		D	D
Whiting	5	West of Scotland	VIa	WGNSDS	Update		D	C3

Status Codes

A	No known prob-lem
B	Estimates included in stock assessment
C	Estimates available but not in-cluded
D	Problem but no estimates
Blank	No available information

Data Quality

1	Reliable
2	Unproven or not directly related
3	Unreliable
X	UNOBTAINABLE

Species	**Region**	**Area**	**ICES Area**	**WG**	**Assessment**	**Status**	**Sources of UFM (WG record) - coded**				
							IUU	Discards	Escape	Ghost	Habitat

Anglerfish (L. budegassa)	6	-	VIIb-k, VIIIa,b	WGNSDS	Update		B2	C3
Anglerfish (L. piscatorius)	6	-	VIIb-k, VIIIa,b	WGNSDS	Update		B2	C3
Cod	6	Celtic Sea	VIIe-k	WGSSDS	Benchmark	Critical	D	C3
Cod	6	Irish Sea	VIIa	WGNSDS	Benchmark	Critical	B2	C3
Haddock	6	Rockall	VIb	WGNSDS	No Assess-ment	Critical	D	
Haddock	6	-	VIIb-k	WGSSDS	Update			C3
Haddock	6	Irish Sea	VIIa	WGNSDS	Benchmark		D	C3
Hake	6	Northern Stock	IIIa, IV, VI, VII and VIIIabd	WGHMM	Observation list		B2	C3
Herring	6	Celtic Sea	VIIf, g	HAWG	Update			
Herring	6	Irish Sea	VII	HAWG	?			
Herring	6		VIa & VIIb,c	HAWG	Update			
Megrim	6	Celtic Sea	VIIb,c,e-k & VIIIa,b,d	WGHMM	Benchmark		B2	B2
Nephrops	6	Management Area J	FU 14 &15	WGSSDS	?			C3
Nephrops	6	Management Area L	VIIb,c,j,k	WGHMM	Benchmark			C3
Nephrops	6	Management Area M	VIIf,g,h & VIIa	WGSSDS	?			C3
Nephrops	6	Management Area N	VIIIa,b	WGHMM	Benchmark			B1
Plaice	6	Celtic Sea	VIIf, g	WGSSDS	Benchmark	Critical		
Plaice	6	Irish Sea	VIIa	WGNSDS	Update		D	
Plaice	6	SW Ireland	VIIh-k	WGSSDS	?			

Plaice	6	W of Ireland	VIIb,c	WGSSDS	?			
Plaice	6	Western Channel	VIIe	WGSSDS	Update	Critical		
Sole	6	Bay of Biscay	VIIIa, b	WGSSDS	Observation list	Critical		
Sole	6	Celtic Sea	VIIf, g	WGSSDS	Update	Critical		
Sole	6	Irish Sea	VII	WGNSDS	Update		D	
Sole	6	SW Ireland	VIIh-k	WGSSDS	?			
Sole	6	W of Ireland	VIIb,c	WGSSDS	?			
Sole	6	Western Channel	VIIe	WGSSDS	Observation list	Critical		
Whiting	6	Irish Sea	VIIa	WGNSDS	Benchmark	Critical	D	C3
Whiting	6		VIIe-k	WGSSDS	Benchmark			C3

Status Codes

A	No known problem
B	Estimates included in stock assessment
C	Estimates available but not included
D	Problem but no estimates
Blank	No available information

Data Quality

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3	Unreliable
X	UNOBTAINABLE

Species	**Region**	**Area**	**ICES Area**	**WG**	**Assessment**	**Status**	**Sources of UFM (WG record) - coded**				
							IUU	Discards	Escape	Ghost	Habitat

Anchovy	7		VIII	WGNPBW	?				
Anchovy	7		IXa	WGNPBW	?				
Anglerfish - L. budegassa	7		VIIIc & IXa	WGHMM	Update	Critical			
Anglerfish - L. piscatorius	7		VIIIc & IXa	WGHMM	Update	Critical			
Black scabbardfish	7		IXa	WGDEEP	Observation list		D		D
Blue Whiting	7	Combined stocks	I-IX, XII & XIV	WGNPBW	Observation list	Critical			
Hake	7	Northern stock		WGHMM	Observation list				
Hake	7	Southern stock	VIIIc & IXa	WGHMM	Observation list	Critical		D	
Horse Mackerel	7	Southern stock	IXa	WGMHSA	Benchmark				
L. bude	7		VIIb, k & VIIIa, b, d	WGHMM	Update				
L. pisc.	7		VIIb, k & VIIIa, b, d	WGHMM	Update				
Mackerel - NEA	7	Southern component	-	WGMHSA	Update		D		
Megrim	7		VII & VIIIa, b, d	WGHMM	Benchmark				
Megrim - L. boscii	7		VIIIc & IXa	WGHMM	Benchmark				
Megrim - L. whiff	7		VIIIc & IXa	WGHMM	Benchmark				

Nephrops	7	Cadiz (FU 30) (Management Area Q)	IXa	WGHMM	Benchmark			C2	
Nephrops	7	Cantabrian Sea (FU25-31) (Management Area O)	VIIIc	WGHMM	Benchmark	Critical		C2	
Nephrops	7	Galacian West & N of Portugal (FU26-27)	IXa	WGHMM	Benchmark	Critical		C2	
Nephrops	7	SW & S of Portugal (FU 28-29) (Management Area Q)	IXa	WGHMM	Benchmark	Critical		C2	
Red Sea bream	7		IX & X	WGDEEP	Observation list		D		D
Sardine	7		VIIIc & IXa	WGMHSA	Update				

Status Codes

A	No known problem
B	Estimates included in stock assessment
C	Estimates available but not included
D	Problem but no estimates
Blank	No available information

Data Quality

1	Reliable
2	Unproven or not directly related
3	Unreliable
X	UNOBTAINABLE

Species	Region	Area	ICES Area	WG	Assessment	Status	Sources of UFM (WG record) - coded				
							IUU	Discards	Escape	Ghost	Habitat
Brill	8		22, 26, 28, 29, 30 & 32	WGBFAS	No Assess-ment						
Cod	8	Kattegat	IIIb	WGBFAS	Observation list		D	D			
Cod	8		25-32	WGBFAS	Observation list	Critical	B2	B1			
Cod	8		22-24	WGBFAS	Update		A	B1			
Dab	8		22, 26, 28, 29, 30 & 32	WGBFAS	No Assess-ment						
Flounder	8		22, 26, 28, 29, 30 & 32	WGBFAS	No Assess-ment						
Flounder	8		24-25	WGBFAS	Exploratory		A	D			
Herring	8	GoR		WGBFAS	Update		B1	A			
Herring	8		22-24 & IIIa	HAWG	Update		B1				
Herring	8		25-29 & 32 excl GoR	WGBFAS	Update		D	A			
Herring	8		30	WGBFAS	Update		A	A			
Herring	8		31	WGBFAS	Update		A	A			
Plaice	8		22, 26, 28, 29, 30 & 32	WGBFAS	No Assess-ment						
Salmon	8	Main Basin & Gulf of Bothnia		WGBAST	Observation list						
Salmon	8			WGBAST	Update						
Sea Trout	8			WGBAST	?						
Sole	8		IIIa	WGBFAS	Benchmark		D	D			
Sprat	8		22-32	WGBFAS	Benchmark		D	D			

Turbot	8		22, 26, 28, 29, 30 & 32	WGBFAS	No Assess-ment					
Anchovy	9	Biscay		WGMHSA	Benchmark					
Blue Whiting	9			WGNPBW	Observation list					
Hake	9	Northern Stock		WGHMM	?			C3		
Herring	9	Norwegian Spring Spawning		WGNPBW	Update					
Horse Mack-erel	9	Western		WGMHSA	Benchmark					
Mackerel	9	NE Atlantic		WGMHSA	Update		D			
Sardine	9			WGMHSA	Update					

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Species	**Region**	**Area**	**ICES Area**	**WG**	**Assessment**	**Status**	**Sources of UFM (WG record) - coded**				
							IUU	Discards	Escape	Ghost	Habitat
Black Scab-bardfish	10		V VI VII VIII and IX	WGDEEP	Observation list		D			D	

Blue ling	10	I-XII & XIV	WGDEEP	Observation list	Critical	D		D
Golden Eye Perch	10	X	WGDEEP	Observation list		D		D
Greater Fork-beard	10	VI VII VIII and IX	WGDEEP	Observation list		D	C2	D
Greater Silver Smelt	10	IIa III V VI VII	WGDEEP	Observation list		D		D
Ling	10	IIa IVa V VI & VII	WGDEEP	Observation list	Critical	D	A3	D
Orange roughy	10	VI VII X & XII	WGDEEP	Observation list		D		D
Red Sea Bream	10	X and IX (VI VII VIII)	WGDEEP	Observation list		D		D
Roundnose Grenadier	10	IIIa V VI VII XII	WGDEEP	Observation list		D	C2	D
Tusk	10	IIa IVa V VI	WGDEEP	Observation list	Critical	D		D

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