ABSTRACT

Many technical measures aiming at the conservation and recovery of fish stocks are based on the implementation of minimum mesh sizes to guarantee minimum gear selectivity. The definition of the minimum mesh sizes results from selectivity experiments. At present, different methods are used for the determination of the mesh opening, depending on whether the measurement serves fisheries research, fisheries inspection or the manufacturing of netting for fishing nets. It follows that in practice cod-end selectivity will be lower than anticipated by the scientific advice. Furthermore, the present measurement method used for enforcement is much contested by the industry. In 1999 ICES established the Study Group on Mesh Measurement Methodology (SGMESH) to refine mesh measurement procedures to take account of the wider range of twines and netting types used in the fishing industry since 1962 when the current ICES and wedge gauge methods were adopted. At the same time two other international bodies (CEN and EU) and the fishing industry agreed that there is a need to consider the adoption of a standard mesh measurement method. This paper reviews the problems related to mesh measurement, the work of SGMESH and other international initiatives aiming at improving mesh measurement methodology, amongst which the development of a new, objective mesh gauge.

1 INTRODUCTION

Since 1980 considerable effort has been put in the development of alternative devices to improve both size and species selectivity in towed netting. These devices include
separator panels, grid sorting devices, square mesh and other designs of selector panels. Despite these new developments, the implementation of minimum mesh sizes to guarantee minimum gear selectivity is still the most general applied method in technical measures aiming at the conservation and recovery of fish stocks. There are many reasons for this continuing success, the most important ones being:

- it is a simple, well-know technique
- the effect of a change in mesh size is easy to evaluate by well-known and sound experimental techniques
- easy to enforce and to control
- cheap to implement.

Mesh measurement is inherent to technical measures based on minimum mesh sizes. A mesh gauge designed for scientific use became the ICES standard gauge for research activities in 1962 (Anon., 1962) and is since then known as the ICES gauge. During the measurement the ICES gauge exerts a fixed longitudinal measuring force on the mesh. The recommended measuring force is 4 kg. When the ICES gauge is correctly used, the measurements are free of human influence. Since 1962 the ICES gauge is commonly used in selectivity experiments and these experiments were the basis for scientific advice on minimum mesh sizes. However, the much simpler wedge gauge remained the legal mesh gauge for fisheries inspection. The wedge gauge is normally operated by hand force and this makes the measurements liable to human influences. In case the skipper contests the measurements, a 5 kg weight (2 kg for meshes under 35 mm) or dynamometer must be used to control the measuring force. Because this procedure generally yields lower mesh openings than the hand force, it is hardly ever requested by the fishermen. Since the introduction of the ICES gauge a wide range of new twines and netting types are used in the fishing industry. These modern twines vary significantly in thickness and stiffness and it is known that these characteristics affect both mesh size and selectivity. Measurements made with the ICES gauge yield lower mesh openings than the wedge gauge (Ferro and Xu, 1996; Fonteyne et al., 1998; Anon., 2002). This implies that a cod-end with the legal minimum mesh size, as measured with the wedge gauge, will have a lower selectivity than anticipated when the minimum mesh size was proposed, since this proposal was based on experiments in which the ICES gauge was used.

The question whether a 4kg load is still appropriate to exert sufficient force to stretch the mesh fully lengthwise in modern netting types was first risen during a Concerted Action Project to evaluate mesh measurement methodologies (Fonteyne et al., 1998). At the same time two international bodies (CEN and EU) and the fishing industry (both fishermen and net makers) agreed that there is a need to consider the adoption of a standard mesh measurement method for use by the fishing industry, enforcement agencies and scientists. As a result of these discussions ICES established the Study Group on Mesh Measurement Methodology (SGMESH) (Anon., 2000) with the following Terms of Reference

a) advise on improvements and further standardisation of current mesh measurement practices in view of the netting types now in use in ICES Member Countries;
b) consider whether the current definition of mesh size is still appropriate for scientific and industrial purposes;

c) compile an inventory of commercially available netting associated with the selectivity process, identifying the fisheries in which they are used;

d) consider the need to define groups of netting types for which the same measurement conditions (e.g. tension) can be applied;

e) propose the specification of a suitable mesh measurement methodology and the conditions under which mesh measurements for all fishing gears in ICES areas are made

Parallel with the activities of SGMESH steps were taken to develop a new objective mesh gauge capable of performing mesh measurements according to the protocol recommended by the Study Group.

The paper reviews and compares the current mesh measurement methodologies, presents the proposals put forward by SGMESH and describes the newly developed OMEGA mesh gauge.

A different methodology is used for determining the mesh size of passive fishing gears. Since the present paper focuses on the measurement of the opening of mesh of active gears the measurement of mesh size of passive gears will not be dealt with here.

## 2 CURRENT MESH MEASUREMENT METHODOLOGIES

### 2.1 Science - ICES mesh gauge

The ICES mesh gauge (Figure 1) is the standard gauge for research activities, recommended by the International Council for the Exploration of the Sea (Anon., 1962). The two jaws (II and IV) are inserted into the diagonal of the mesh to be measured. The sliding jaw IV is then pulled steadily away from the fixed jaw II by the handle III, thus stretching the mesh. The moment that the load on the movable jaw exceeds the force exerted by the spring VII, a blocking mechanism is activated and the mesh opening can be read on the scale on the upper side of bar I. The tension at which the gauge operates, i.e. the stretching force on the mesh when its size is measured, is determined by the degree of compression of the spring, which can be adjusted. ICES has recommended a measuring force of 4 kg. The precision of the length measurement is 1 mm. More consistent measurements are obtained if the gauge is operated twice in succession without removing the jaws from the mesh and the second reading taken as the mesh size. A more detailed description of the gauge is given in Westhoff et al. (1962).

To test the gauge, a short, rigid test spring is used. This spring is of a known length when under a tensile load of 4 kg. The eyes of the test spring are fitted on the jaws and the
The gauge is operated in the normal way. The length read off on the scale should correspond with the predetermined length of the spring under a load of 4 kg. If the length from the scale is less then the gauge is not applying sufficient force; similarly, if the length is greater, the gauge is applying too much force. The compression of the spring and hence the force applied by the gauge can easily be corrected by means of screw VIII (Figure 1). The scale reading can be checked by a simple standard measure to be sure that the jaws are not deformed, e.g. by a heavy knock. The test spring itself can be checked by measuring its length under the required load.

Due to the set force applied to the mesh the measurements are close to being free of human bias.

An inquiry made among EU fisheries research institutes (Fonteyne et al., 1998) revealed that mesh measurements for scientific purposes are characterised by a lack of uniformity. This is because no clear directives exist. The only existing written recommendations for measuring the mesh opening of cod-end meshes can be read in the report of the ICES Mesh Selection Working Group 1959-1960, published in 1964 (Anon, 1964). These recommendations leave room for interpretation and are only rarely applied nowadays.

The selection of the meshes to be measured should be based on the selective performance of the gear. Hence the meshes are mostly chosen in the upper panel of the cod-end since this is the part of the gear where most mesh selection takes place. It can be assumed that the recommendations on where to measure, given in the ICES Selectivity Manual (Wileman et al., 1996), are in general complied with. The number of meshes measured is usually much larger than for inspection but the reason for choosing a certain number is not always clear.

### 2.2 Fisheries inspection – wedge gauges

The rules for determining the mesh size of fishing gears for inspection purposes are described in the regulations of the competent national or international authorities.

Flat wedge gauges as used for mesh size inspections are shown in Figure 2. The gauges are usually made of 2 mm thick plates of durable material capable of retaining its shape. They have either a series of parallel edged sides connected by intermediate tapering edges (Figure 2a), or tapering edges only (Figure 2b). The taper is 1:8 on each side. The width is inscribed on the gauge at regular intervals.

To measure the opening of mesh the net is stretched in the N-direction of the meshes. The gauge is inserted into the mesh in a direction perpendicular to the plane of the net. The gauge is inserted either by manual force or by using a weight or dynamometer, until the resistance of the mesh stops further insertion. The opening of each mesh corresponds to the width of the gauge at the point where further insertion of the gauge is prevented. The mesh size is expressed in mm and is the arithmetic mean of the total number of meshes measured, rounded up to the nearest mm. In the USA, the mesh size is expressed in eighths of inches, and the arithmetic mean of the total number of meshes is rounded to the nearest eighth.
According to the European regulation (Anon, 2003a) a series of 20 meshes is measured manually, without using a weight or dynamometer. If the mean mesh opening does not appear to comply with the rules in force, then two additional rows of 20 meshes each are measured. The mesh size is subsequently recalculated by taking into account all 60 meshes already measured. The result is considered the mesh opening of the net. If the captain of the vessel contests the mesh size thus determined, this measurement is ignored and the net is subjected to a new series of measurements. For this purpose the net is measured again using a weight or dynamometer attached to the gauge. The choice of weight or dynamometer is at the discretion of the inspector. The mesh opening is determined by measuring only one series of 20 meshes. The weight is fixed by a hook to a hole at the narrow end of the gauge. The dynamometer can either be fixed to the hole at the narrow end of the gauge or to the handle.

For nets with a mesh size of 35 mm or less a force of 19.61 Newton (equivalent to a force of 2 kg) is applied; for other nets the force is 49.03 Newton (equivalent to a force of 5 kg). The accuracy of the weight or the dynamometer is certified by the competent national authority.

The description of the mesh gauges as given in the relevant regulations allows for differences in the final form of the gauge. The most striking possibilities are:

1. Different materials can be used as long as they are durable and capable of retaining the shape of the gauge.
2. There is not a unique plan shape: a choice can be made between a wedge gauge with tapered sides only and a gauge with alternating tapered and parallel sections.
3. The range of the mesh gauges to suit different ranges of mesh sizes is not standardised.
4. The weight of the gauges is not specified. A ratio of 1:5 between the lightest and the heaviest gauge for a given range has been shown (Fonteyne et al., 1998).
5. The finishing of the edges is not specified.
6. Scale markings may extend to the edge of the gauge thus making these edges notched and likely to snag in the twine.

Post (1987) showed that different measurements are obtained with mesh gauges used by different fisheries inspection services, being different versions of the EU gauge.

In Europe little use is made of the 2 or 5 kg weight or a dynamometer. On the other hand, the standard measurement procedure of the US Coast Guard requires the insertion of the wedge gauge with a 5 kg weight.

EU inspectors give several reasons for not using the weight or dynamometer (Fonteyne et al., 1998):

- fishermen rarely contest the outcome of the measurements made by hand as they fear that the average mesh size derived from measurements with the use of a weight will be lower
- some inspectors consider that the weights are impractical and unsafe to use on board
of fishing vessels.

- in most countries dynamometers are not type approved and the use of a spring to exert the force may not be accepted by the Courts.

The EU Regulation (Anon., 2003a) specifies that the accuracy of the weight or dynamometer shall be certified by the appropriate national authority but does not give directions for regular calibration of weights and dynamometers. In most countries re-calibration does not take place. If it is done, then the frequency is different (Fonteyne et al., 1998).

### 2.3 Industry

The measure used for indicating the mesh size during the manufacturing process is the length of mesh\(^1\). To check the opening of mesh a wedge gauge is used. An international standard specifying a method for the determination of the mesh opening of fishing nets using a flat wedge gauge has now been drafted (see section 2.4).

Fishermen use a diversity of wedge gauges to control the mesh opening of their nets. Fishermen are unlikely to use weights, only hand force. Next to the wedge gauge fishermen may also use rulers or measuring sticks.

### 2.4 Standardisation

Attempts have been made by the International Organization for Standardization to adopt the ICES gauge as the standard gauge for mesh measurements on fishing nets. These attempts failed, mainly because the measuring force is controlled by a spring of which the characteristics may change over time. Moreover, a test spring is used to calibrate the gauge.


The standard has two parts:
- Part 1 – Mesh opening (EN ISO, 1663-1; Anon., 2003c)
- Part 2 - Length of mesh (EN ISO, 1663-2; Anon., 2003d)

Part 1 specifies a method for the determination of the mesh opening using a flat wedge gauge. It is applicable to active fishing gears. The standard is based upon international legislation for fisheries inspection. However, both the wedge gauge and the measuring procedure are more precisely described. The most important differences are:
- the gauge shall be made of an aluminium alloy

---

\(^1\) European Standard EN ISO 1107 (Anon., 2003b) defines “length of mesh” for knotted netting as “the distance between the centres of two opposite knots in the same mesh when fully extended in the N-direction”. “Opening of mesh” is defined as “the longest distance between two opposite knots in the same mesh when fully extended in the N-direction.” The difference between “length of mesh” and “opening of mesh” is one knot.
- tapering sides only
- edges must be rounded
- printed or engraved markings shall end 2 mm from the edges
- 4 size ranges are defined
- no measurement by hand force
- the measuring forces are:
  - 2 kg for mesh sizes of 50 mm or less
  - 5 kg for mesh sizes above 50 mm up to 120 mm
  - 8 kg for mesh sizes above 120 mm
- a minimum of 20 consecutive meshes (in the N-direction) shall be measured.

The standard has an important Informative Annex recognising the limitations of the use of the wedge gauge:

“The method of test for the determination of the mesh opening is basically drawn upon international legislation for the purpose of fisheries inspection (e.g. Commission Regulation (EEC) No 2108/84 of 23 July 1984 laying down detailed rules for determining the mesh size of fishing nets). Recently the methodology using the flat wedge mesh gauge has been questioned. The method is considered as not sufficiently precise and objective, especially when using hand force to operate the mesh gauge.

The present European Standard has taken account of the criticism towards the wedge gauge by giving a more precise description of the mesh gauges and by using a weight only to exert the measuring force. The method described in the standard is appropriate for the determination of the mesh opening under controlled laboratory conditions but is considered as being less suitable for use at sea.

It is the intention to modify the present European standard as soon as a method suitable for all environmental conditions becomes available.”

Part 2 of the standard deals with the determination of the length of mesh using a ruler and is applicable to passive fishing gears only.

2.5 Effect of different methodologies on towed gear selectivity

Recently the ICES Study Group on Mesh Measurement Methodology organised a series of laboratory tests to compare different mesh measurement methodologies (Anon., 2003e). The measurements were performed on 34 netting samples used for the construction of cod-ends. In all but 7 cases the 4 kg ICES gauge yields smaller mesh openings than the wedge gauge, operated by hand or with a weight. Most of the exceptions are small mesh netting samples, made of thin yarns. Most differences between the wedge gauge with hand force and the ICES gauge are in the range 1-10% but can be as much as 14%. The difference between the ICES gauge and the wedge gauge with the weight is mostly in the order of 2-7% with a maximum of 12%. This difference implies that a cod-end with the legal minimum mesh size, measured with the wedge gauge, will
have a lower selectivity than anticipated, since the proposed minimum mesh size was based on experiments with the ICES gauge. In selecting new measuring forces, it is important that the transition should not be detrimental to cod-end selectivity and therefore deliver results similar to the present procedures set down in technical measures legislation.

3 FUTURE PERSPECTIVES

3.1 Need for a change

The ICES mesh gauge has the advantage that the measurements made are practically free from human influence. But the measuring force applied is no longer representative for modern netting and much lower than the actual measuring force exerted by the wedge gauge used for fisheries inspection.

In textile engineering a pre-tension equivalent to the weight of 250m of twine is applied to stretch the twine completely (e.g. to determine its length). This corresponds to 25% of the linear density expressed in Rtex\(^2\). A 4 kg measuring force corresponds to a netting twine of R800tex. An inventory of netting materials used for present day cod-ends showed that most cod-ends are made of double twine polyethylene netting with a twine thickness between 4 and 6 mm corresponding to a linear density of R7000tex to R15000tex and measuring forces of 7 to 15 kg (Anon., 2002).

According to Schwalbe and Werner (1977) the wedge gauge operated with a weight of 5 kg would theoretically impose a longitudinal force of 20 kg on the mesh being measured. However, friction between gauge and netting may considerably reduce the resulting measuring force. Ferro and Xu (1996) demonstrated that for four PE netting samples with a twine thickness between 2.7mm and 4.5mm, readings equivalent to the 5 kg wedge gauge can only be obtained with an ICES gauge having more than 8 kg spring force. An analysis made by SGMESH of the longitudinal forces exerted on the mesh when using the wedge gauge showed a large variability (range 3 to 22 kg) for both hand force and the 5 kg weight (Anon., 2003e). This variability is attributed mainly to human influences but differences in the value of the friction coefficient may also have played a role. O’Neill (2003) made a theoretical study of the factors influencing the measurement of mesh size. He demonstrated that most variation of mesh size occurs with measuring forces in the range 0 to 50 N. The ICES gauge exerts 20 N on each mesh bar and so any variation in the parameters studied (twine bending stiffness, frictional resistance, and boundary slope) is likely to lead to an appreciable variation in measured mesh size.

It is clear that both the measuring procedures with the ICES 4kg gauge and with the wedge gauge (hand or weight operated) are no longer suitable for the measurement of the mesh opening. The 4kg measuring force of the ICES gauge is too low to stretch the mesh completely whereas the equivalent longitudinal measuring force with the wedge gauge is too variable to allow for an objective measurement.

\(^2\) The Rtex value indicates the mass in grams of 1000 m of the finished twine.
3.2 Need for standardisation

As advice derived from selectivity data determines mesh size regulations it is logical that all parties concerned adhere to the same measurement methodology, whether they are scientists, inspectors, netting manufacturers, net makers or fishermen. Such a standardisation is a condition sine qua non to assure that the minimum mesh selectivity aimed at by these mesh size regulations is obtained. The lack of an objective standard mesh measurement methodology is often the reason for questioning the results of mesh inspections when a case is brought to court. Standardisation is economically important since it will reduce disputes between fishermen and netting manufacturers about the mesh size of netting materials.

3.3 Proposal for a new mesh measurement methodology

The ICES gauge uses a fixed longitudinal force to stretch the mesh and minimises human influence and effects of friction between gauge and netting. SGMESH was of the opinion that this principle should be maintained. A 4 kg measuring force, however, is too small for modern netting. Ideally the measuring force should be related to the linear density or twine thickness of the netting material. However, such a methodology is impractical due to difficulties related with the measurement of linear density or twine thickness, especially at sea. Nominal values are often imprecise and should not be used without verification (Anon., 2002). Furthermore, absorption of sediments in the netting of bottom trawls will change their physical dimensions with time. The measurements made by SGMESH justifies making a distinction between small mesh netting, made of thin twines and large mesh netting made of heavier twines. The international standard EN ISO 16663 (Anon., 2003c) set a division between small and large meshes at 50 mm using existing wedge gauges. European legislation related to twine thickness applies to netting of mesh size greater than 55mm. With a view on a future standardization between methodologies for science and inspection the Study Group supported 55 mm as a borderline.

The Study Group postulated that the transition to a new measuring force should not be detrimental to cod-end selectivity and therefore this force should deliver results similar to the present procedures set down in technical measure legislation. Appropriate values for the longitudinal measuring force would be closer to 10 kg if based on the wedge gauge with 5 kg and 11 kg if based on the wedge gauge with hand force (Anon., 2003e). Fisheries inspectorates consider the wedge gauge with a 5 kg weight as the reference and this was also the opinion of the SGMESH in the light of present conservation concerns. Taking further into account that the difference between 10 and 11 kg would be minimal and that most existing selectivity data are based on measurements with the ICES gauge, which uses only 4 kg measuring force, the Study Group agreed on 100 N (10.197 kg) as value for the new measuring force. The imposition of a 100 N measuring force may well result in some existing cod-ends becoming illegal, and having to be scrapped. Based on the outcome of the measurements made, about 30% of the cod-ends that pass the inspection with the hand operated wedge gauge will become illegal if the new force is used. This number is raised to 40% if the wedge gauge with a 5 kg weight is taken as a reference. In practice, cod-ends are usually constructed from webbing with mesh sizes at least slightly larger than the minimum mesh size, as a prudent measure. Hence, the percentage of cod-ends that will need to be replaced will be lower than suggested here.
The measuring force proposed for meshes less than 55 mm opening of mesh is 40 N (4.079 kg). This choice is mainly based on theoretical assumptions. For the moment a 2 kg weight is used by inspectors for the measurement of small meshes using a wedge gauge. A 1:8 taper will convert this weight into an 8 kg longitudinal force. It is reasonable to allow for a 50% reduction for friction forces as was done for a 5 kg weight. There were not enough measured netting samples to demonstrate this conclusively but a 40 N measuring force would retain the status quo with no detriment to selectivity.

SGMESH proposes the following specification for a suitable mesh measurement methodology and the conditions under which mesh measurements for fishing gears in ICES areas are made:

1. A longitudinal force of either 40 or 100 N must be used, depending on whether mesh opening is smaller or larger than 55 mm.

2. For scientific purposes a minimum of 40 meshes is required. If a precision of the average mesh opening of 1 mm (95% confidence limits) is not achieved within these 40 meshes then measurements will continue until such precision is reached\(^3\). For fisheries inspections the numbers of meshes to be measured may remain at 20 and 60 (as set out in e.g. Anon., 2003a).

3. When measuring cod-ends or extensions care must be taken to observe previous recommendations (Wileman et al, 1996; Anon., 2003a) with regard to nearness of selvedges, mendings, etc. For scientific purposes it is recommended that two rows of 20 meshes should be measured in an area where fish are known to escape, e.g. aft upper part of cod-end when targeting roundfish.

4. State whether netting is measured in a wet or dry state.

5. Meshes must be unfrozen.

6. For scientific work the area measured must be clean and as free from sediment as possible. For inspection such matters are left to the discretion of Fisheries Inspectors.

7. Netting must be stretched in the direction of the long diagonal of the meshes (as per Anon, 2003a).

8. Square mesh netting will be measured on the longest diagonal (as per Anon, 2003a).

9. \(90^\circ\) turned netting will be measured on the longest diagonal.

\(^3\) This amends the recommendation made in the ICES selectivity manual for measuring a minimum of 100 meshes (Wileman et al., 1996).
The Study Group further recommends that all parties concerned should adhere to this specification of a suitable mesh measurement methodology, whether they are scientists, inspectors, netting manufacturers, net makers or fishermen.

Until an instrument capable of making such measurements becomes widely available the Group recommends that for scientific purposes the existing ICES gauge with 4 kg measuring force should continue to be used, but in this interim period one of the following conversion formulas should be applied:

- when both the linear density and the netting material are known

\[
\text{Mesh10KG} = 8.0499 + 0.8858 \times \text{ICES4KG} + 0.000414 \times \text{ICES4KG}^2 + 5.01989 \times \text{Mat} + 0.000114 \times \text{Rtex} - 0.000217 \times \text{Mat} \times \text{Rtex}
\]

- when the twine thickness and netting material are known

\[
\text{Mesh10KG} = 4.551 + 0.8977 \times \text{ICES4KG} + 0.0000334 \times \text{ICES4KG}^2 + 8.6544 \times \text{Mat} + 1.0265 \times \text{dia} - 1.3297 \times \text{mat} \times \text{dia}.
\]

In these expressions Mesh10KG is the mesh size to be expected if the measuring force was 10 kg; ICES4KG is the mesh size obtained with the 4 kg ICES mesh gauge; “dia” is the twine thickness; Rtex is the linear density; and Mat = 0 for PE and Mat = 1 for PA.

- when the value of these parameters is unknown

\[
\text{Mesh10KG} = 11.440 + 0.8984 \times \text{ICES4KG} + 0.00034 \times \text{ICES4KG}^2.
\]

For inspection purposes use of the wedge gauge with 5 kg weight must continue until the necessary changes are made to regulations.

The Study Group also recommends that the same methods and conditions should be used for all areas of the gear as well as attachments, although this will not always be possible, e.g. for lifting bags with a limited number of meshes available for measurement. In some circumstances a certain amount of discretion will be required.

### 3.4 Development of a new mesh gauge

The present ICES gauge is not suitable for mesh measurements requiring a measuring force higher than 5kg. The ICES gauge also has the disadvantage that the measuring force is determined by a spring. Courts often question the accuracy of springs and are not readily convinced of the reliability of calibration procedures.

Recently a new mesh gauge has been developed in the international research project “Development and testing of an objective mesh gauge” (OMEGA – Contract No Q5CO-2002-01335), co-funded by the European Commission. The OMEGA mesh gauge (Figure 3) is an electric driven instrument that applies a controlled longitudinal force on the mesh
to be measured. Once this force is achieved, the exact opening of the gauge is measured automatically. Mesh width and measuring force are simultaneously shown on the digital display. A series of measurements can be performed and all measurements are stored in the onboard memory. At the end of the operation the number of measurements made and the average mesh size are shown. Stored data can be transferred to a computer via an infrared transmitter.

The mesh gauge is battery operated. Interchangeable measuring jaws enable to measure meshes from 10 to 300mm. The mesh gauge is water-resistant, accidental flow of water will not damage the instrument. Any metal involved is stainless, resistant to salt water. The longitudinal force applied on the mesh is directly measured by a force transducer. The accuracy is 1N. The movable jaw is driven by a screw connected to an electrical motor. By counting the revolutions of the screw the gauge knows exactly the opening of the mesh. Accuracy and display resolution are both +/- 1 mm.

Initial calibration will be done at the factory. For official use, the instrument will have to be re-calibrated once a year by an authorised technician. Check cycles enable witnessed checking of the instrument calibration:

- when starting up the instrument, the movable jaw automatically shifts to a reference position to calibrate the length measurement
- a check plate with fixed opening lengths should always show the exact distance
- calibrated weights allow to check the force measurement.

At the moment a prototype of the OMEGA mesh gauge undergoes an extensive test programme, in the laboratory as well as at sea. Both fisheries scientists and fisheries inspectors are involved in testing the prototype. The new mesh gauge will become commercially available in 2005. Detailed information can be found at the website www.dvz.be/omega.

REFERENCES


Figure 1 – ICES gauge
Figure 2 – Wedge gauges
Figure 3 – OMEGA gauge