OSTSEEFISCHEREI

The BACOMA cod-end

History and recent developments in BACOMA cod-end regulations and a proposal for a better specification of the BACOMA cod-end for Baltic Sea cod fishery

Der BACOMA-Steert

Geschichte und neueste Entwicklungen in den BACOMA-Steert-Verordnungen sowie ein Vorschlag für eine bessere Definition des BACOMA-Steertes für die Ostsee-Dorschfischerei

(Technische Beschreibung auf deutsch: S. 59)

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History of the BACOMA cod-end

In 1993 the International Baltic Sea Fishery Commission (IBSFC) decided to increase the minimum mesh size in cod-ends of cod trawls from 105 mm to 120 mm. In addition, nets in the mid 1990s were developed with exit (escape) windows in the cod-ends with specially stiffened yarn to keep meshes open during tow ("Swedish Design") and thus to increase the selective properties of the nets (Larsson 1994). Experiments showed that the selectivity of these nets was considerably higher than that of normal cod-ends. The effect was achieved by the insertion of strips of specially treated stiff netting, so-called exit windows, into the sides of the cod-ends. Alternatively, attempts were made to take advantage of this principle without violating the pending patent rights for the "Swedish design" by applying square mesh escape windows in cod-end sides (Lowry et al. 1995) ("Danish Design"). Both net varieties were evaluated by ICES in 1996. However, ICES was unable to confirm the efficiency of the Danish design with respect to improved selectivity. At the same time, Swedish trials indicated that the improved selective properties of the Swedish design decrease after longer use (Tschernij et al. 1996). In addition, alterations or manipulations of conventional cod-ends with diamond-shaped meshes led to a reduction of their selectivity (Stewart and Galbraith 1989) and became common in the commercial fishery, stimulating research of other, more reliable cod-end constructions.

In view of these setbacks the European Union funded the research project "Improving Technical **Ma**nagement in **Ba**ltic **Co**d Fishery" (BACOMA) from 1997 to 2000, with Scandinavian participation only. The results were presented in 2001 and have been fundamental for the resolutions of the IBSFC and the EU since. The results were, however, not accepted in the scientific community without criticism. One of the main objections was that only one technical solution, the "Bacoma"cod-end was recommended by the project, not taking into consideration potential alternatives. The BACOMA cod-end is a cod-end with the upper panel consisting mainly of one large square-mesh window, an idea dating back to the mid 1990s (Madsen et al. 1999). Even though recommended as solution, a number of problems remained unsolved with this construction. The major problems were a flatfish bycatch in the southern Baltic, the dependency on a monopolist producer of the square mesh knotless netting material, and the particular problems of small trawls being obliged to incorporate the 3.5 m long escape window without proportional adaptation.

Irrespective of potential alternatives, the BACOMA escape window became a part of the technical regulations of the IBSFC in 2001, replacing the two-sided window cod-ends. The BACOMA escape window is of knotless material with mesh sizes of 120 mm (until 31 September 2003), whereas the remaining part of the cod-end needs

Zusammenfassung

Vor mehr als einem Jahr sind eine Reihe von Vorschriften zur Verbesserung der Situation beim Dorschbestand von der Internationalen Kommission für die Ostseefischerei (IBSFC) und von der EU-Kommission erlassen worden. Sie verpflichteten u.a. die Berufsfischer dazu Steerte mit einem Fluchtfenster, sogenannte BACOMA -Steerte, mit einer Maschenöffnung von 120 mm bis Ende September 2003 zu benutzen. Diese Steerte fangen jedoch nur Dorsche mit einer erheblich größeren Länge als der zugelassenen Mindestanlandelänge. Beim gegenwärtigen Zustand des Dorschbestandes gibt es allerdings nur wenige solcher Fische. Als Konsequenz setzten die Fischer vorwiegend andere legal zugelassene Steerte ein. Dieses waren herkömmliche Rautenmaschensteerte mit 130-mm-Maschen (Fishery Rules der IBSFC vom 1. 4. 2002), gefertigt entweder aus Doppelnetzgarn (4 mm Durchmesser) oder Einzelnetzgarn (6 mm Durchmesser). Ab dem 1. September 2003 sollte die Maschenöffnung auf 140 mm erhöhen werden. Auf Grund gesetzlich zulässiger Interpretationen dieser Regeln durch die Berufsfischerei (z. B. durch die Verwendung von drahtartig steifem Netzmaterial) hatten diese Steerte aber eine extrem schlechte Auslesewirkung erreicht, was sich durch Fang sehr kleiner Fische verdeutlichte und zeitweise große Mengen von Discard produzierte. Diese Discardmengen sind durch das Heraufsetzen der Mindestanlandelänge von 35 auf 38 cm seit Beginn 2003 noch erhöht worden. Die EU- Kommission hat auf diese unerwünschte Entwicklung mit einer Verlängerung des Sommerfangverbots reagiert.

Zeitgleich sind mit dem BACOMA -Steert sowohl auf schwedischen wie auf deutschen kommerziellen und Forschungsschiffen Untersuchungen durchgeführt worden, da argumentiert wurde, dass der BACOMA -Steert vor seiner Einführung nicht hinreichend untersucht worden sei. Die Ergebnisse all dieser Forschungen werden in diesem Beitrag zusammengetragen und bewertet.

Als Ergebnis einer schwedisch-dänischen-deutschen Initiative und der Forschung hat die EU- Kommission im Juni 2003 reagiert und die Erhöhung der Maschenöffnung in Rautenmaschensteerten von 130 auf 140 mm zurückgezogen.

Zum effektiveren Schutz der Dorschbestände in der Ostsee wird die Verwendung von Rautenmaschensteerten ohne Fluchtfenster in den Gewässern der Gemeinschaft ohne Ausnahme verboten. Diese Verordnung tritt am 1. 9. 2003 in Kraft. Um die Kontrolle der Schleppnetzgrundfischerei in der Ostsee zu vereinfachen, wird damit das „Ein-Steert-Prinzip“ durchgesetzt. **Dieser Steert wird der BACOMA -Steert sein, derzeit mit einer Maschenöffnung für das Fluchtfenster von 110 mm.**

Die technische Beschreibung des BACOMA -Steerts, wie in den IBSFC-Fishery Rules festgehalten (Revision der 28. Sitzung , Berlin 2002), konzentriert sich auf den Steert und das Fluchtfenster. Andere wichtige Details wie Achternetz, Tunnel, Steertanhänge etc. blieben unberücksichtigt. Daher ist die gegenwärtige Spezifikation unvollständig und lässt nach Aussage von Berufsfischern breiten Raum für Manipulation. In gemeinsamer Anstrengung haben es deswegen Fischer und Fischereitechniker in Deutschland unternommen, das gesamte Achternetz zu beschreiben, um damit einen Vorschlag zu unterbreiten, der weniger Raum für Manipulation lässt.

Ein Entwurf mit dieser Zielsetzung wird hier präsentiert. Er soll als Startpunkt für eine allgemeine Diskussion über eine international abgestimmten Vorschrift dienen, die Zustimmung bei Fischern, Wissenschaftlern und politischen Entscheidungsträgern findet.

Alle Ostseefischer werden hiermit aufgefordert, diesen Entwurf zu kommentieren und Empfehlungen für eine weitere Verbesserung und Spezifizierung abzugeben. Nach der Billigung dieses Entwurfs durch die Baltic Fishermen Association soll der IBSFC und EU-Kommission vorgelegt werden.

Summary

To improve the cod stocks in the Baltic Sea, a number of regulations have recently been established by the International Baltic Sea Fisheries Commission (IBSFC) and the European Commission. According to these, fishermen are obliged to use nets with escape windows (BACOMA nets) with a mesh size of the escape window of 120 mm until end of September 2003. These nets however, retain only fish much larger than the legal minimum landing size would allow. Due to the present stock structure only few of such large fish are however existent. As a consequence fishermen use a legal alternative net. This is a conventional trawl with a cod-end of 130 mm diamond-shaped meshes (IBSFC-rules of 1st April 2002), to be increased to 140 mm on 1st September 2003, according to the mentioned IBSFC-rule. Due legal alterations of the net by the fishermen (*e.g.* use of extra stiff net material) these nets have acquired extremely low selective properties, i. e. they catch very small fish and produce great amounts of discards. Due to the increase of the minimum landing size from 35 to 38 cm for cod in the Baltic, the amount of discards has even increased since the beginning of 2003.

Experiments have now been carried out with the BACOMA net on German and Swedish commercial and research vessels since arguments were brought forward that the BACOMA net was not yet sufficiently tested on commercial vessels. The results of all experiments conducted so far, are compiled and evaluated here.

As a result of the Swedish, Danish and German initiative and research the European Commission reacted upon this in June 2003 and rejected the increase of the diamond-meshed non-BACOMA net from 130 mm to 140mm in September 2003.

To protect the cod stocks in the Baltic Sea more effectively the use of traditional diamond meshed cod-ends without escape window are prohibited in community waters without derogation, becoming effective 1st of September 2003.

To enable more effective and simplified control of the bottom trawl fishery in the Baltic Sea the principle of a "**One-Net-Rule**“ is enforced. **This is going to be the BACOMA net, with the meshes of the escape window being 110 mm for the time being**.

The description of the BACOMA net as given in the IBSFC-rules no.10 (revision of the 28th session, Berlin 2002) concentrates on the cod-end and the escape window but only to a less extent on the design and mesh-composition of the remaining parts of the net, such as belly and funnel and many details. Thus, the present description is not complete and leaves, according to fishermen, ample opportunity for manipulation. An initiative has been started in Germany with joint effort from scientists and the fishery to better describe the entire net and to produce a proposal for a more comprehensive description, leaving less space for manipulation.

A proposal in this direction is given here and shall be seen as a starting point for a discussion and development towards an internationally uniform net, which is agreed amongst the fishery, scientists and politicians.

The Baltic Sea fishery is invited to comment on this proposal, and recommendations for further improvement and specifications are welcomed. **Once the design is agreed by the Baltic Fishermen Association, it shall be proposed to the IBSFC and European Commission via the Baltic Fishermen Association.**

to have meshes of at least 105 mm. According to the BACOMA project report (Anon. 2000) the selection properties of such a "Bacoma" 120 mm net allows 50 % of cod of about 44 cm total length to escape (L_{50}) (Table1). For the same net 75 % of cod of 38 cm will escape, which represents the L_{25} benchmark. The minimum landing size of cod in the Baltic Sea is set at 38 cm accordingly and is legally binding since January 2003.

To date, i. e. August 2003, the fishery is, however, not obliged to use BACOMA nets. Alternatively the fishery is allowed to work with conventional trawls without an

Table 1: Overview of results of selectivity experiments with BACOMA cod-ends.
Übersicht über die Ergebnisse des Selektivitäts-Experiments mit dem Bacoma-Netz.

Type of codend	BACOMA 105	BACOMA 105	BACOMA 105	BACOMA 105	BACOMA 105
Material Top Window	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]
Mesh size (mm) of the codend	105	105	105	105	105
Mesh size (mm) of the window	105	105	105	105	105
L_{50} (cm)	39	36	41	42.3	38.7
L_{25} (cm)	35	31	38	39.6	35.9
Selection Factor	3.7	3.4	3.9	3.8	3.7
Selection Range(cm)	8.4	10.9		7.6	7.3
Basic of information	BACOMA project	BACOMA project	Sweden III-IV/2003	Sweden XII/2002	Sweden XII/2002
Remarks	side trawler	stern trawler	stern trawler	stern trawler 22.5m 440 kW Valentinsson & Tschnij 2003	stern trawler 17.8m 420 kW Valentinsson & Tschnij 2004

Type of codend	BACOMA 110	BACOMA 110	BACOMA 110	BACOMA 110	BACOMA 110
Material Top Window	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]
Mesh size (mm) of the codend	105	105	105	105	105
Mesh size (mm) of the window	110	110	110	110	110
L_{50} (cm)	42	39	38	39.4	41
L_{25} (cm)	38	33	35	36.3	38
Selection Factor	3.8	3.5	3.5	3.6	3.7
Selection Range(cm)	8.8	11.3	5.4	6.2	6.6
Basic of information	BACOMA project	BACOMA project	IFF(F) [2] III-IV/2003	this paper	Valentinsson and Tschernij/Sweden V/2003
Remarks	side trawler	stern trawler	RV "Solea" depend on vitality of fish	side trawler "Blaurobbe" June 2003	stern trawler

Type of codend	BACOMA 120	BACOMA 120	BACOMA 120	BACOMA 120	BACOMA 120	BACOMA 120
Material Top Window	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]	ultracross/ knotless max. 4.9 mm SY[1]
Mesh size (mm) of the codend	105	105	105	105	105	105
Mesh size (mm) of the window	120	120	120	120	120	120
L_{50} (cm)	47	44	47	47	49.2	43.9
L_{25} (cm)	43	38	42	42	43.6	40.3
Selection Factor	3.9	3.2	3.9	3.9	4.1	3.7
Selection Range(cm)	9.6	12.1		5.9	7.6	7.3
Basic of information	BACOMA project	BACOMA project	Sweden III-IV/2003	IFF(F) IX/2002	Sweden XII/2002	Sweden XII/2002
Remarks	side trawler IBSFC Rules since 1 April 02	stern trawler IBSFC Rules since 1 April 02	stern trawler IBSFC Rules since 1 April 02	497 Solea IBSFC Rules since 1 April 02	stern trawler 22.5m 440 kW Valentinsson & Tschnij 2003	stern trawler 17.8m 420 kW Valentinsson & Tschnij 2004

[1] Single Yarn
[2] Institute for Fishery Technology and Fish Quality (Section Fishery Technology) of the Federal Research Centre for Fishery, Germany

escape window, provided the diamond-shapes meshes in the cod-end have a width of at least 130 mm, the reason being that theoretically the selectivity pattern of this net will largely be the same as trawls with smaller mesh size in the cod-end but with the inclusion of a BACOMA 120 mm escape window. As it turned out, nearly all fishermen in the Baltic Sea take advantage of the derogation from the BACOMA rule. However, to increase catches, extra-stiff material for the cod end is used, which prevents the meshes to open due to the water pressure inside the net, no matter whether the meshes are 130 mm or 140 mm. As a consequence the alternative trawls do not have the similar selectivity properties of a net equipped with the BACOMA window. There are however many more methods to manipulate the net legally. One method is for instance to fasten a large rescue buoy at or in front of the cod-end. The increased towing drag will also prevent the meshes to open sufficiently.

Both the BACOMA net and its alternative have lead to a situation where nets have come in use with selection properties not being in harmony with the minimum landing size (MLS). The MLS of 35 cm was maintained until end of 2002 increasing to 38 cm in 2003. However, the minimum mesh size of the traditional mesh cod-ends was increased from 120 to 130 mm for polyethylene cod-ends and to 125 mm for polyamide cod-ends. This mesh size was again changed to 140 mm in 2002, supposed to become effective in September 2003. Already before 2002 the length distribution of cod in the Swedish trawl catches remained unchanged, in spite of the increase of the MLS from 33 to 35 cm (Valentisson and Tschernij 2003).

Unfortunately, the further amendments of the IBSFC regulations have not only failed to meet their objectives but have also enhanced the discard problem. Due to the fact that nearly all fishermen took advantage of the non-BACOMA alternative, a great number of fish smaller than 35 cm were discarded until the end of 2002, and from then on additionally all fish smaller than 38 cm. Swedish on-board observers estimated that in January 2003 on average 34 % of the trawl catches were undersized cod (Valentisson and Tschnernij 2003). In German catches the discard rates varied on average between 2 and 16 %, with single values up to 60 % (Ernst et al. (unpublished)). From Table 1 it appears that the L_{50} of the BACOMA-120-mm is 47cm in the Western Baltic Sea (SD 22, 24), which means that only 50 % of the fish smaller than 47cm will be retained by the net and will become the fishermen's catch. However, only few fish in the western Baltic are larger than this, and as a result the fishermen are not be able to make a living by using the 120 mm BACOMA net.

In the light of this situation the IBSFC and the European Commission reacted on this and decided in June 2003 to cancel the increase of the mesh size of the alternative nets, scheduled to become effective 1st September 2003, to prohibit all alternative nets in the Community waters becoming effective 1st of September 2003, to reduce the BACOMA window mesh size to 110mm and to make this the only and mandatory net for the community waters. These regulations are supposed to be reviewed after some time and the mesh size will in the future be increased according to the development of the stock structure.

In the past there has been ample dispute about the pros and cons of different nets. This debate was largely nourished by criticism on the scientific evaluation of the nets and the limited conclusions, which could be drawn from these. The main difficulty was that for different experimental set-ups with BACOMA nets different results have been achieved. For that reason, and to bring the discussion to an end, ad hoc experiments were carried out in spring and summer 2003 by Sweden and Germany with ordinary commercial cutters and it may now be stipulated that sufficient data are available from different commercial and research vessels to estimate the selection of the BACOMA net (Table1). A summary of the state of the art of the research for nets with and without BACOMA window is given here.

The fishery is not principally in opposition of the BACOMA net. By contrast, the fishery signalled cooperation provided that the net allows catches of cod of sizes coming down close to the MLS and if one and the same net was mandatory for all fishermen in the demersal trawl fishery without derogation, thus giving all fishermen equal chances. Based on the ample experience in the every-day practice, the German fishery proclaimed to be supportive and proactive in the sense of proposing net modifications, which make it harder to manipulate it. A first specific proposal for a standard BACOMA net is included here and shall be the basis of a far more comprehensive gear description of the BACOMA net as so far given by the EU-regulation.

Proposal and technical description of a standard BACOMA-110-mm net

The BACOMA cod-end is to be used in the cod fishery with trawls, Danish Seines and similar towed gear. In the cod-end an escape window is inserted, which is made of 110 mm meshes. The diamond meshes in the upper and lower panel have a mesh size of at least i = 105 mm. The general design of the net is given in Figure 1. The detailed descriptions of the net are given in Figures 2 and 3.

Cod-end, extension piece and end-piece of the trawl

The cod-end and the extension piece are composed of two sheets of the same size. The single sheets are to be cut along the knots (cut AN). It is prohibited to use cod-

ends and extension pieces, which are made only of one piece of net material and have only one lest ridge.

It is forbidden to carry on board or to use cod-ends and extension pieces consisting of more than 50 open meshes. The end-piece of the trawl and the extension piece must have the same number of open meshes in circumference as the cod-end. A deviation up to 4 % shall however be allowed. The length of the meshes in the end-piece of the trawl may not be smaller than 2a = 120 mm. The remaining tapered part of the panel may not have a smaller diameter at any part.

Escape window

The escape window is to be inserted in the upper panel of the cod-end (Figure 1) and ends 8 half meshes in front of the end of the cod-end. This includes the joining round to the escape window and the cod-line meshes. The width of the escape window is equal to the half of the open diamond meshes of the upper panel of the cod-end. The net material of the escape window is knotless and made with the "knotless-braided-technique". In this net material the braided twine crosses vertically in the crossing-overs. All four sides of the escape window are cut along the bars (cut AB). The escape window is inserted into the cod-end with the bars of the meshes being parallel or perpendicular to the length-direction of the net. The yarn diameter of the escape window is > 4.5 mm.

Other specifications

The specifications given below go beyond the existing regulation EC 3440/84 and are a reaction on the obvious loopholes in the existing text. In combination with the detailed figures of the net (Figures 1 to 3) these specifications are to limit the possibilities of manipulation and to reduce ambiguous formulations, which still exist in the present regulation. Deviating from the regulation EC 3440/84 are round straps at a BACOMA cod-end and the extension pieces generally prohibited. A supporting strap of 1m length is however allowed at the very end of the escape window. A topside chafer or a strengthening bag shall generally be forbidden. Only one dividing or lifting strap (halving becket) shall be allowed for the cod-end and the extension piece. Its length must have at least the width of the escape window plus half the width of all diamond meshes in circumference. The attached lazy deckie must be at least as long as the lestridge part between fastening point and halving becket.

An attached rescue or cod-end buoy may not have a lift greater than 15 kg and may only be fastened to the codline. It is allowed to install a flabber or no-return device in the extension piece or in the net body. The panels of such device may however not overlap with the escape window. If the upper and lower panel are connected by lacings instead of a knotted joining round, then these lacings need to be at least as long as one stretched width of the panel.

On both sides of the escape window a maximum of 10 % (i. e. a total of 20 % for the entire net) of the open diamond meshes in the upper panel may remain as rim (Figure1). The length of the escape window (in metre) is calculated from the number of free diamond meshes in the circumference of the cod-end, multiplied by the factor of 0.035, rounded downwards to full centimetre. This is a significant and important deviation from the existing regulation since it would allow to adjust the size of the escape window to the size of the trawl accordingly.

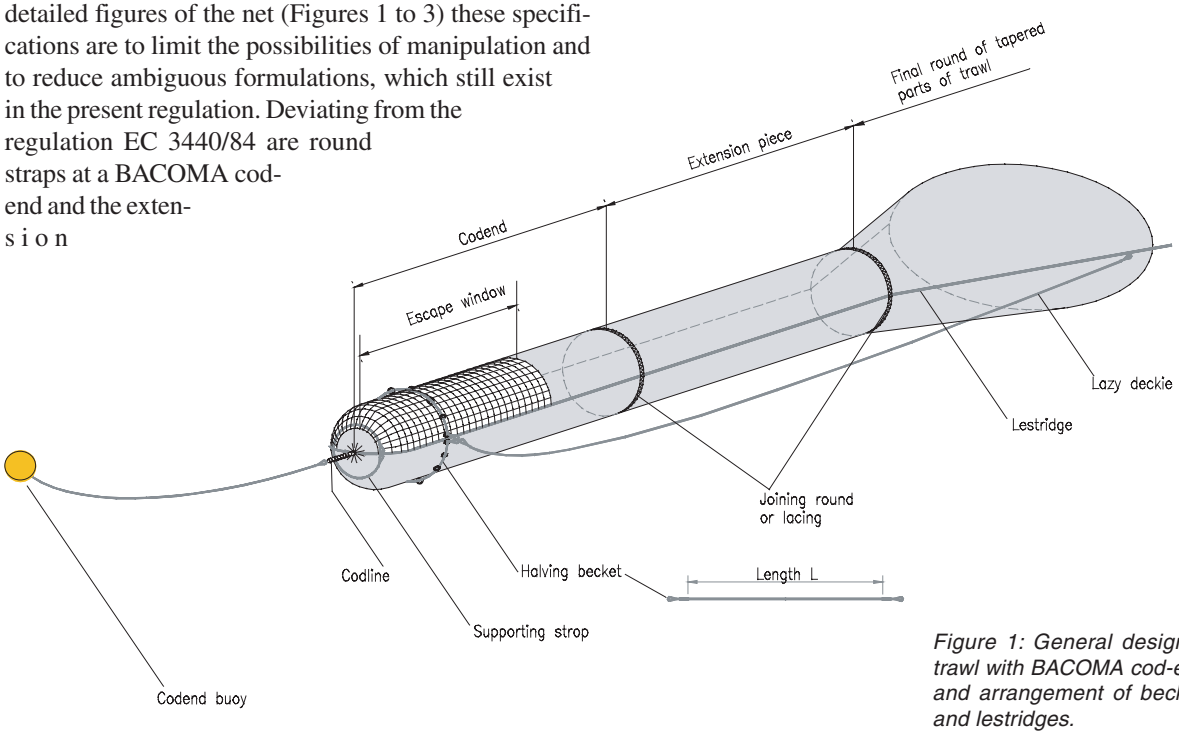

Figure 1: General design of trawl with BACOMA cod-end, and arrangement of beckets and lestridges.

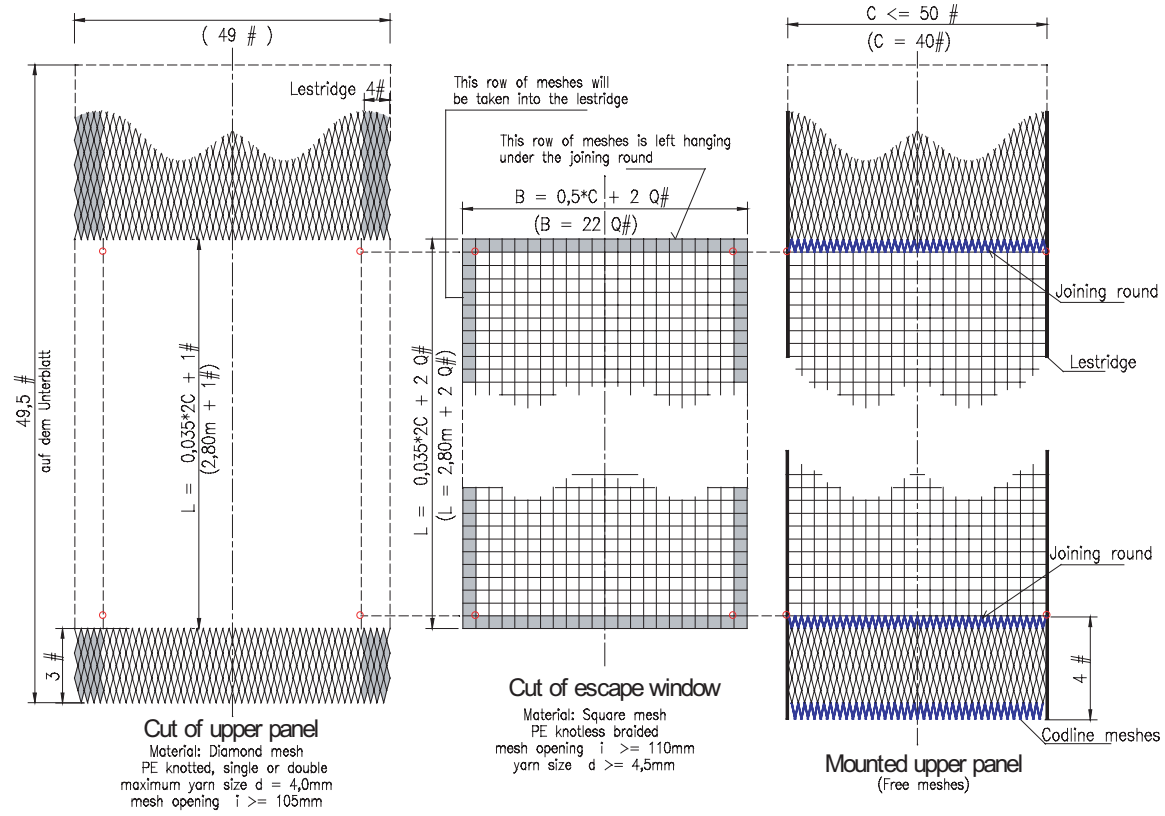

Figure 2: BACOMA cod-end example 1. Numbers in parenthesis refer to the given example of a BACOMA net for a small cod-end with 80 free meshes in circumference.

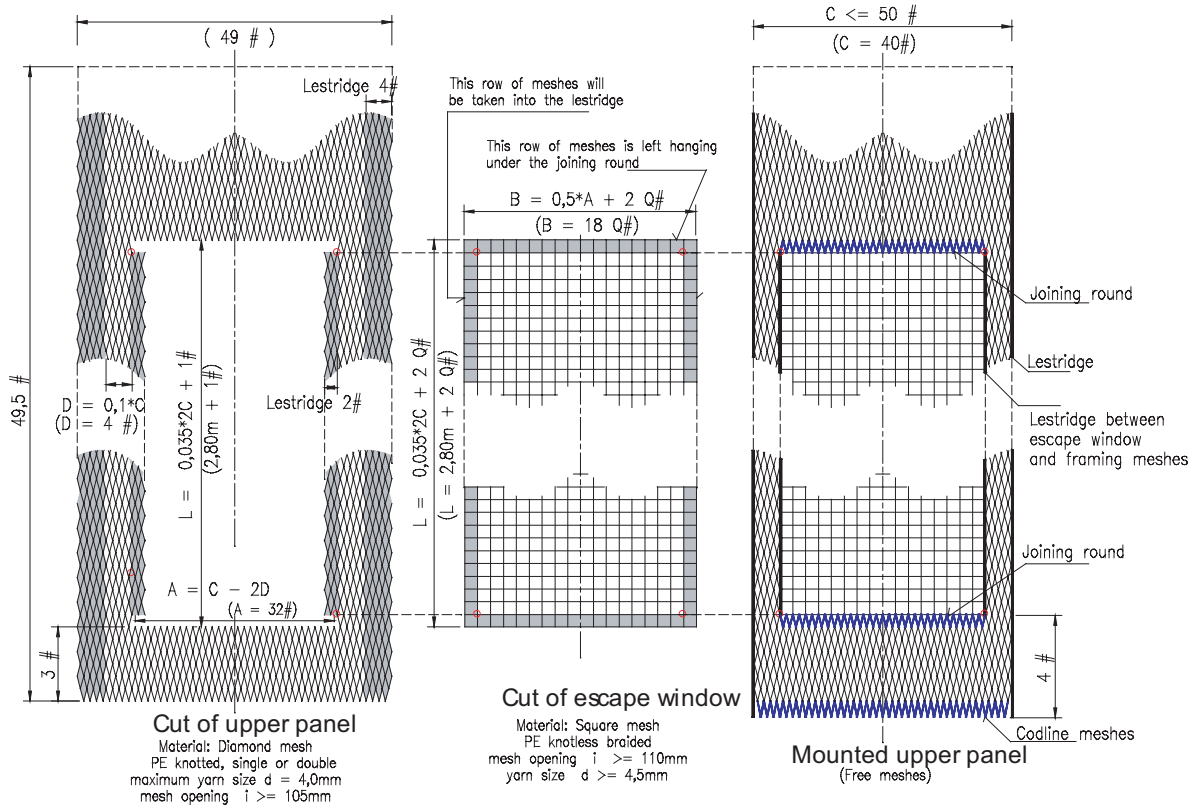

Figure 3: BACOMA cod-end example 2. Numbers in parenthesis refer to the given example of a BACOMA net for a small cod-end with 80 free meshes in circumference.

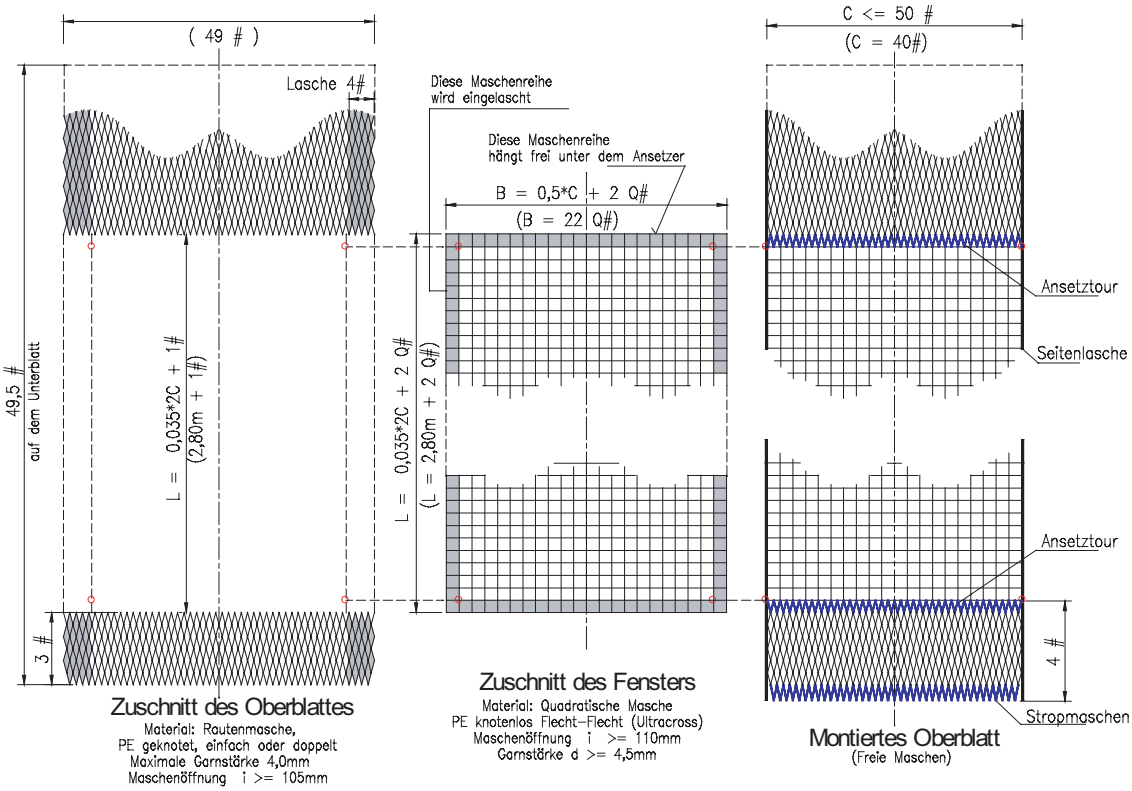

Abbildung 2: BACOMA- Steert Ausführungsbeispiel 1. Die in Klammern gesetzten Werte beziehen sich auf das dargestellte Beispiel eines kleinen Steertes von 80 freien Maschen im Umfang.

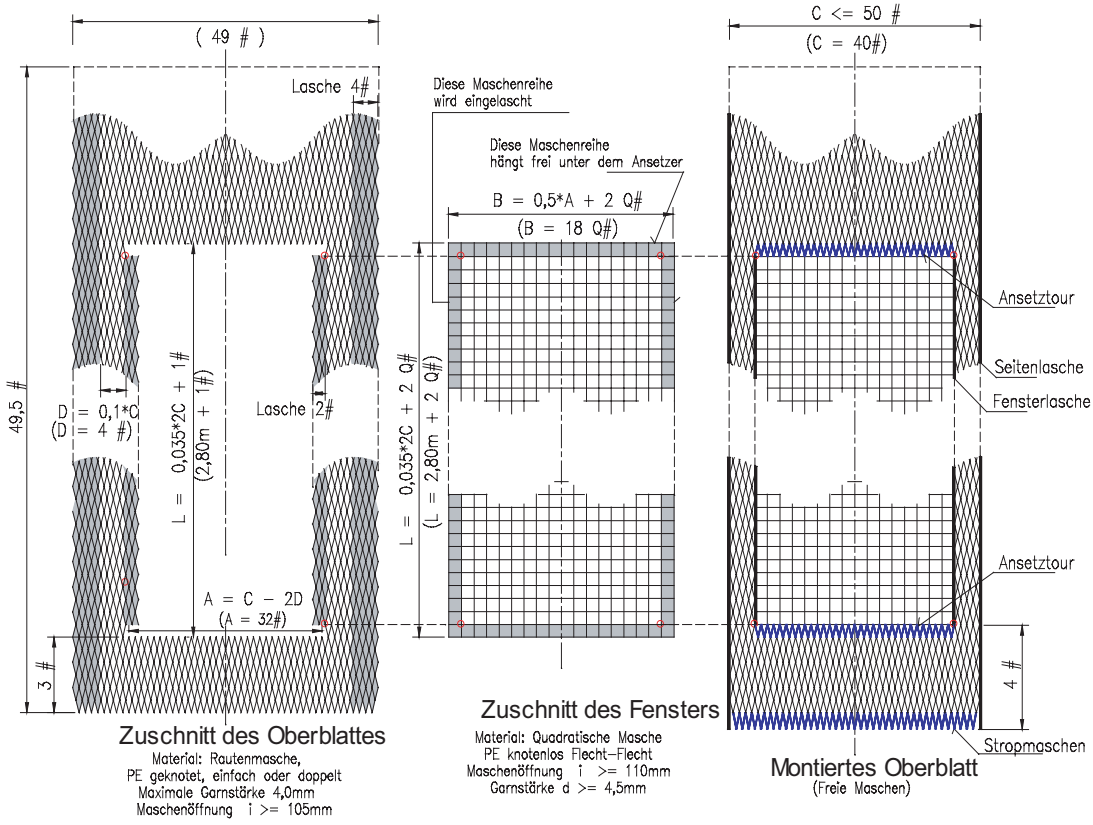

Abbildung 3: BACOMA- Steert Ausführungsbeispiel 2. Die in Klammern gesetzten Werte beziehen sich auf das dargestellte Beispiel eines kleinen Steertes von 80 freien Maschen im Umfang.

Rundstroppen sind an einem Bacoma-Steert und dessen Tunnel in Abweichung von der Verordnung (EWG) 3440/84 grundsätzlich verboten. Ein **Entlastungsstropp** mit 1 m Länge darf allerdings über dem hinteren Ende des Fluchtfensters befestigt werden. **Oberseitenscheuerschutz** und **Hievsteerte** sind im Bereich des Fluchtfensters in Abweichung von der Verordnung (EWG) 3440/84 grundsätzlich verboten. An einem Bacoma-Steert einschließlich seines Tunnels ist in Abweichung von der Verordnung (EWG) 3440/84 nur ein einziger **Teilstropp**, über dem Fluchtfenster, erlaubt. Seine Länge (L in Abbildung 1b) muss mindestens Fensterbreite plus halbe gestreckte Breite der Rautenmaschen betragen. Der angeschlagene **Beiholer** muss mindestens so lang sein wie der Laschenabschnitt zwischen Befestigungspunkt und Teilstropp. Als Auffindhilfe für einen verloren gegangenen Steert ist als **Steertboje (Hund)** ein Auftriebskörper von maximal 15 kg zulässig. Die Bojenleine darf nur an der Codleine befestigt sein. Ein **Flabber** oder **No-return-device** ist nur im Tunnel oder im eigentlichen geschleppten Netz zulässig. Seine Netzblätter dürfen nirgends das Fluchtfenster abdecken. Werden zum Verbinden der Netzteile statt geknüpfter Ansetztouren zwei **Reihleinen** zwischen den Laschen verwendet, so müssen sie jeweils mindestens so lang sein wie eine gestreckte Blattbreite.

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