



Technical properties of purse seines targeting small pelagic species in the Adriatic Sea

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Council Regulation 1967/2006

Article 13: Minimum distances and depths for the use of fishing gears

3. The use of purse seines shall be prohibited within 300 meters of the coast or within the 50 metres isobath where that depth is reached at a shorter distance from the coast.

A purse seine shall not be deployed at depths less than 70 % of the overall drop of the purse seine itself as measured in Annex II to this Regulation.

ANNEX II: Requirements relating to the characteristics of fishing gear

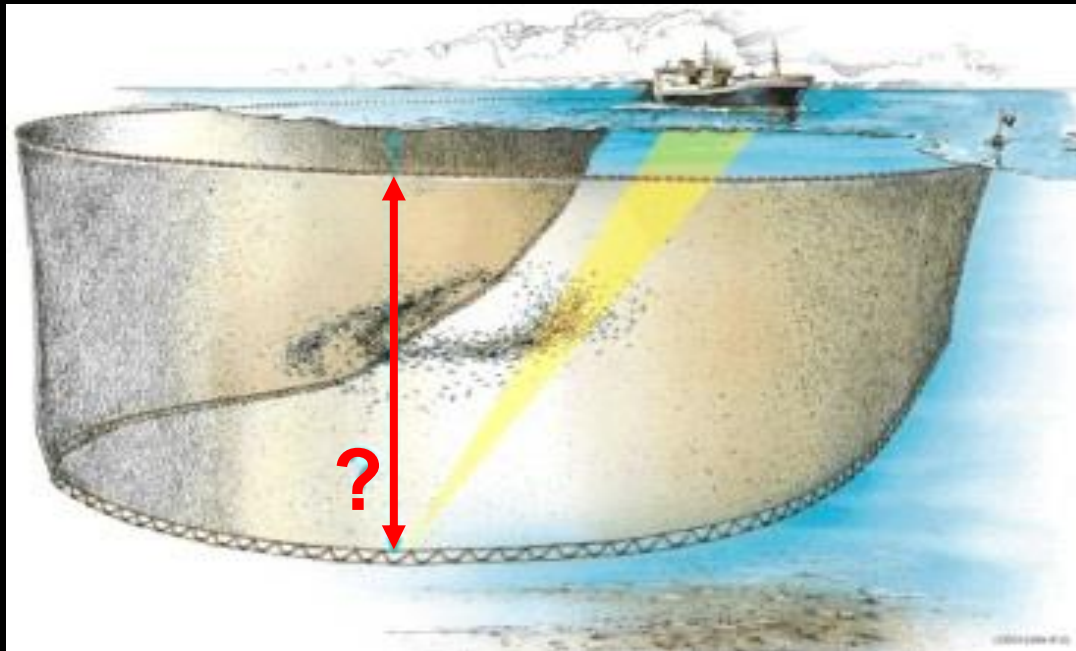
2. Surrounding nets (purse seines and seines without purse lines). The length of netting shall be restricted to 800 m and the drop to 120 m, except in the case of tuna seines.

According to these provisions a substantial part of purse seiners targeting small pelagic of Adriatic fishing fleets, could be using fishing nets which are not in line with the rules set

Main goal:

Real net drop during fishing?

Bottom impact?



Information collected

- Technical information on the fishing gear
- Purse seine behaviour
- Bottom impact

Additional information

- Purse seine fleet targeting small pelagic species
- Fishing ground explored by purse seine fleet
- Purse seine catch

Two scenarios have been identified

Maximum net drop EC Reg 1967/06

Adriatic sea (depth < 84 m)
70% rule (Gulf of Trieste and
in Northern Istria)

$$\text{Net drop} = \frac{\text{Depth} \times 100}{70}$$

Adriatic sea (depth > 84 m)
120 m net drop rule (rest of
Adriatic)

$$\text{Net drop} = 120 \text{ m}$$

Preliminary data will be presented.

Data from Croatia are still under analysis

ADRIATIC PURSE SEINE FLEET

A group of inspectors from Croatia, Italy and Slovenia performed a data collection in order to obtain an updated list of active PS vessels operating in the Adriatic Sea in 2013.

The list of active PS vessels was compared with the data stored in the European Fleet Register on the Net (<http://ec.europa.eu/fisheries/fleet/index.cfm>) in order to evidence possible incongruences

ADRIATIC PURSE SEINE FLEET

Country code	PS Fleet Type	Number of vessels	Tot. Power Main Engine [kw]	Tot. Capacity [GT]
ITA	S	14	1596.0	131.00
ITA	D	23	9248.27	2405.00
SVN	S	4	421.10	38.53

S: Shallow waters

D: Deep waters

ADRIATIC PURSE SEINE FLEET

ITALY: DEEP WATER FLEET

	Length class	No of vessels	Power [kW]	Capacity [GT]
1	0<6	0	0.00	0.00
2	6<12	0	0.00	0.00
3	12<18	5	1256.10	257.00
4	18<24	1	216.00	64.00
5	24<40	16	7018.37	1745.00
6	≥40	1	411.80	240.00
	Total:	23	8902.27	2306.00

ADRIATIC PURSE SEINE FLEET

ITALY: SHALLOW WATER FLEET

	Length class	No of vessels	Power [kW]	Capacity [GT]
1	0-<6	0	0.00	0.00
2	6-<12	6	460.20	39.00
3	12-<18	8	1135.80	92.00
4	18-<24	0	0.00	0.00
5	24-<40	0	0.00	0.00
6	≥40	0	0.00	0.00
	Total:	14	1596.00	131

ADRIATIC PURSE SEINE FLEET

SLOVENIA: SHALLOW WATER FLEET

	Length class	No of vessels	Power [kW]	Capacity [GT]
1	0<6	0	0.00	0.00
2	6<12	1	110.40	5.93
3	12<18	3	310.70	32.60
4	18<24	0	0.00	0.00
5	24<40	0	0.00	0.00
6	≥40	0	0.00	0.00
	Total:	4	421.1	38.53

FISHING GROUNDS EXPLORED BY PURSE SEINE FLEET

ITALY: VMS data (provided by the Italian Ministry for Agricultural, Food and Forestry Policies) of all units equipped by VMS fishing with the PS system in the Adriatic Sea throughout the period 2006-2013.

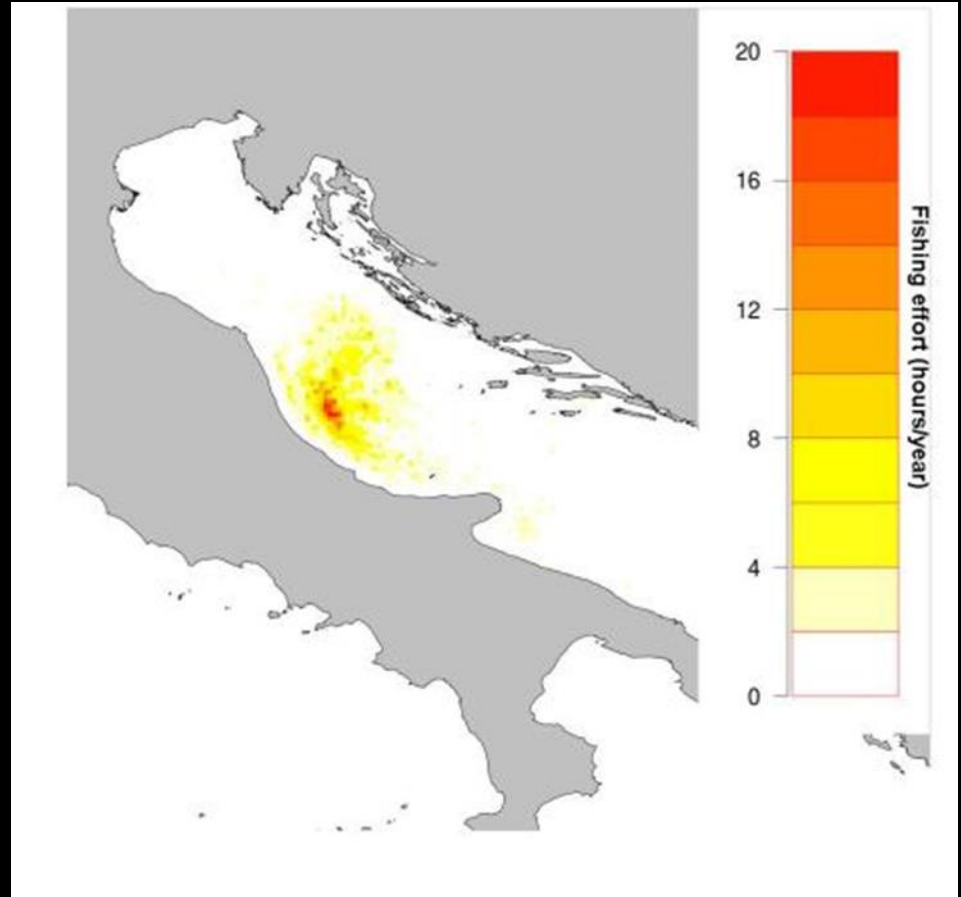
All these steps were performed using the open-source R-platform VMSbase

SLOVENIA: The position of vessels was recorded using Holux M-241 wireless real time coordinate GPS loggers

FISHING GROUNDS EXPLORED BY PURSE SEINE FLEET

ITALY: central Adriatic

Fishing activity seems to be concentrated in a wide area south Ancona harbor, with a bulk of density approximately in front of Pescara and Ortona harbors at a depth usually ranging from 80 to 120 m.



2006-2013

FISHING GROUNDS EXPLORED BY PURSE SEINE FLEET

ITALY: Gulf of Trieste

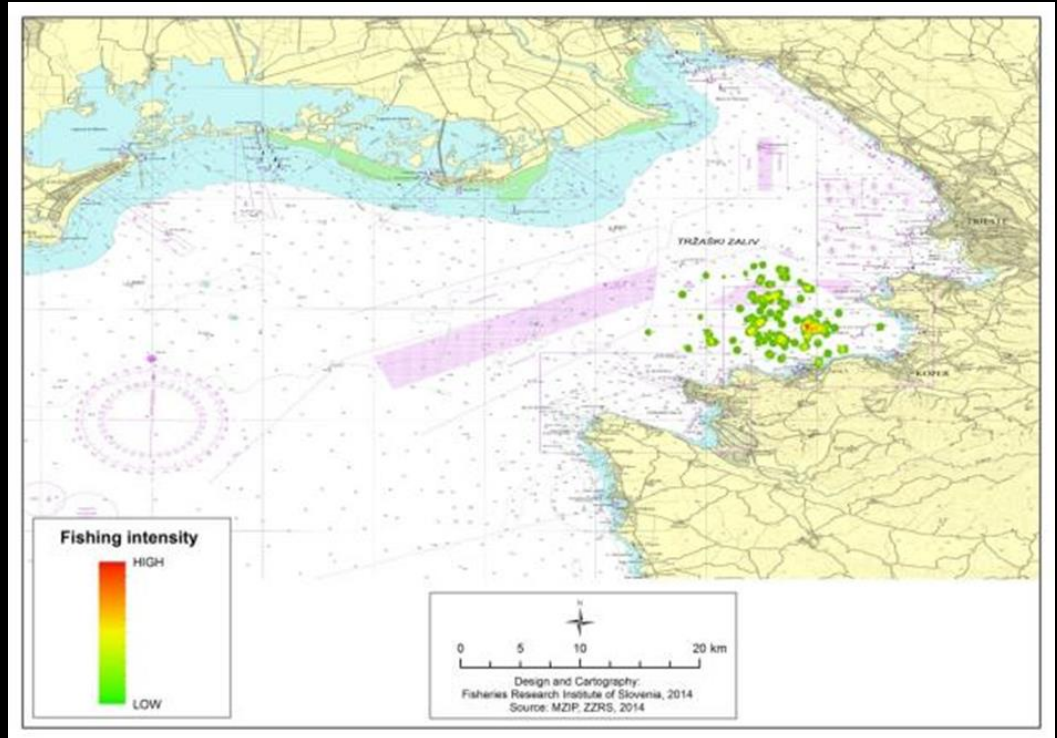
Small areas covered by Phanerogams in coastal area between Grado and Monfalcone.

The extension of these areas are limited within 0.5 miles from the coast so that the purse seines activity does not affect Phanerogams meadows.



FISHING GROUNDS EXPLORED BY PURSE SEINE FLEET

SLOVENIA: Gulf of Trieste



The majority of the fishing activity was located outside the 20 meters isobath. No fishing activity was recorded within 300 meters of the coast or in protected areas. *Posidonia oceanica* meadow approximately 1 km long, starts close to the coastline and extends 50 m off the shore (sea depth is approximately 4 m). Therefore, professional purse seiners always operate well away from these sensible areas.

PURSE SEINE CATCH

Data concerning catch and by-catch/discard composition were collected throughout DCF in 2012 by each country in GSA17.

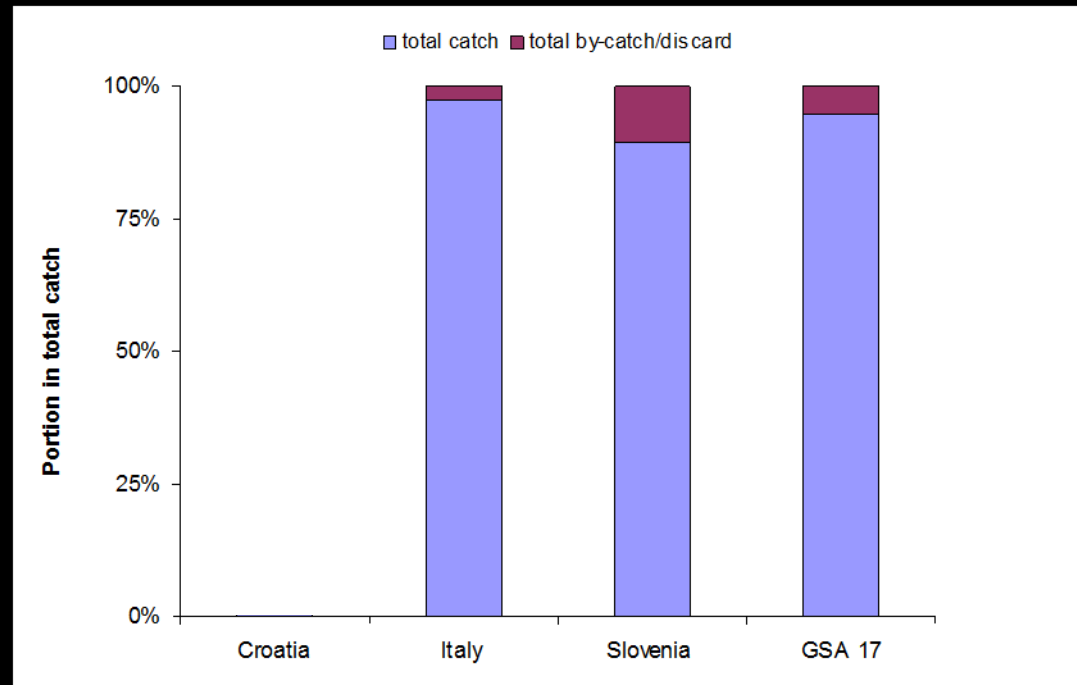
Length frequency analysis of specimens caught by commercial purse seine vessels was performed on samples collected aboard the fishing vessels in the framework of DCF.

Length Frequency Distributions (LFD) were also collected aboard Italian commercial purse seiners.

In Slovenia the catch samplings was performed in period from 22/4/2014 to 11/8/2014 (30 fishing trips)

PURSE SEINE CATCH

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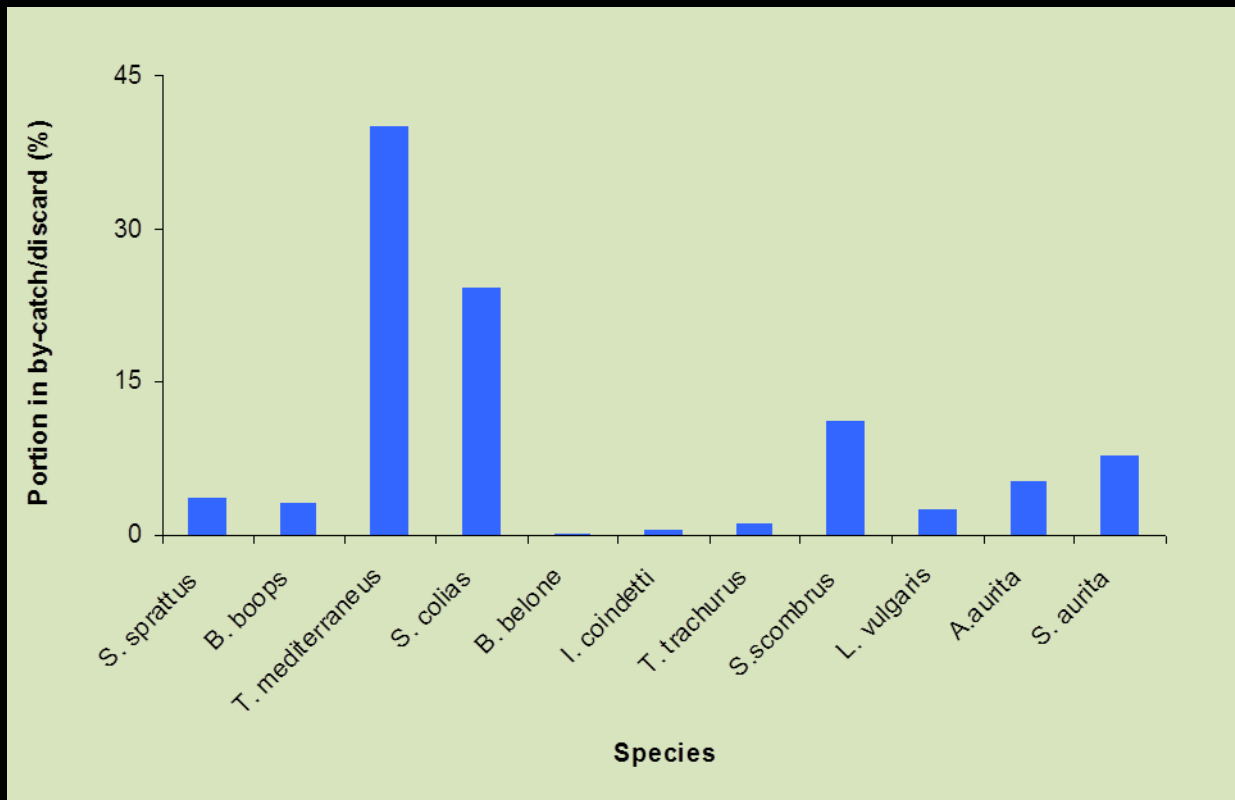


PURSE SEINE: HIGH SPECIES-SELECTIVE GEAR

PURSE SEINE CATCH

	Anchovy	Sardine
ITA_PS_VL_2440	4651	4500
SVN_PS_VL_1218	43	16
TOT	12776	64407

PURSE SEINE CATCH



PURSE SEINE: HIGH SPECIES-SELECTIVE GEAR

PURSE SEINE CATCH

Length ranges

West GSA 17

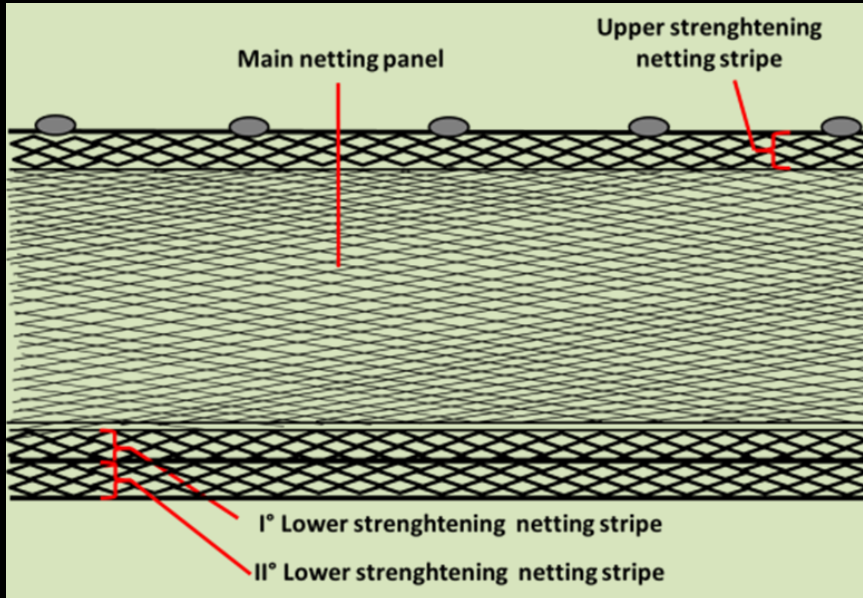
Species	Length range (cm)	Dominant length class (cm, portion %)
<i>S. pilchardus</i>	12.5 - 15.5	14.0 (31.0%)
<i>E. encrasicolus</i>	10.0 - 15.5	13.5 (29.1%)

PURSE SEINE GEAR PROPERTIES

- 1 – Technical properties (direct measurements-interviews)
- 2 – Gear performance (sensors and UW cameras)

PURSE SEINE GEAR PROPERTIES

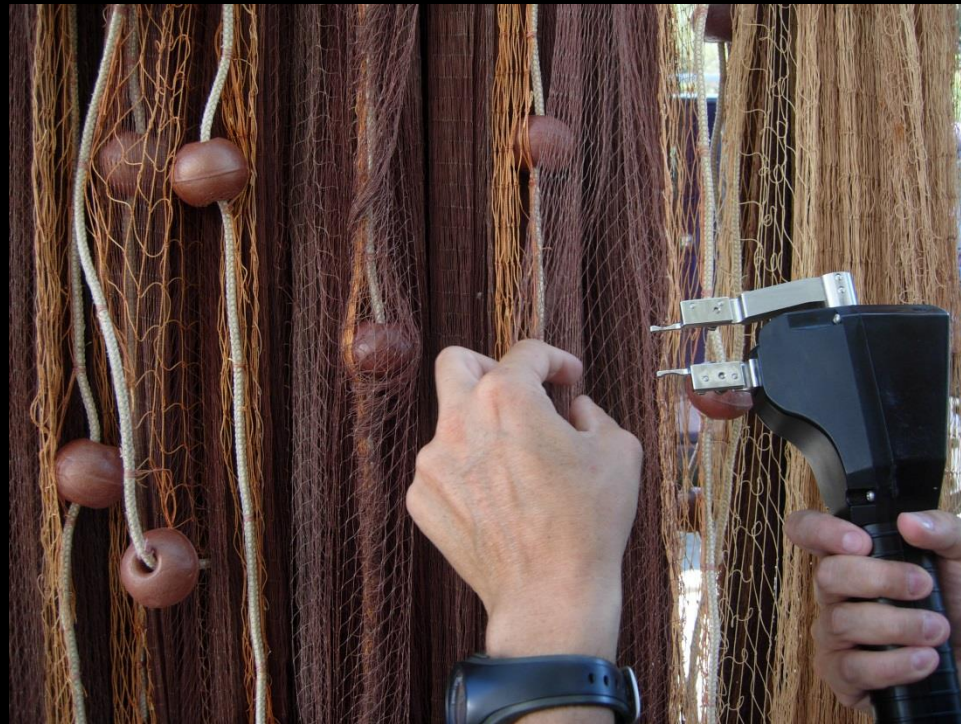
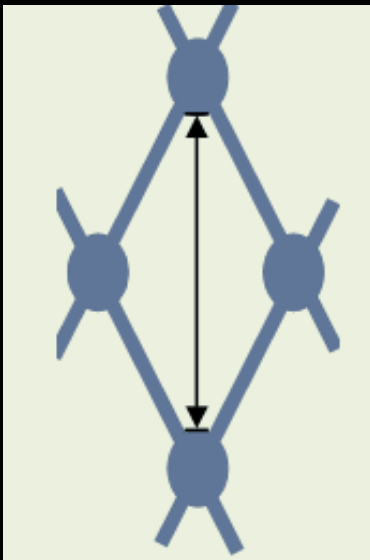
1 – Technical properties



Parameter to be collected

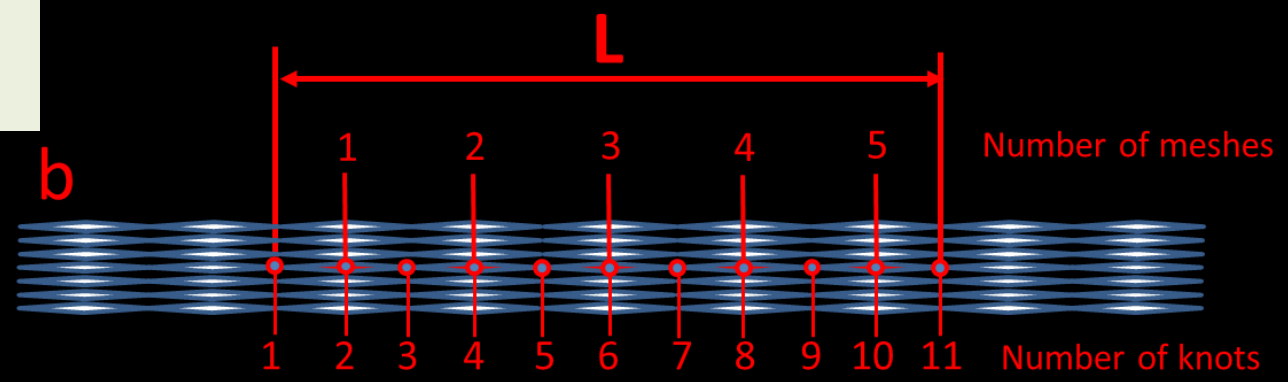
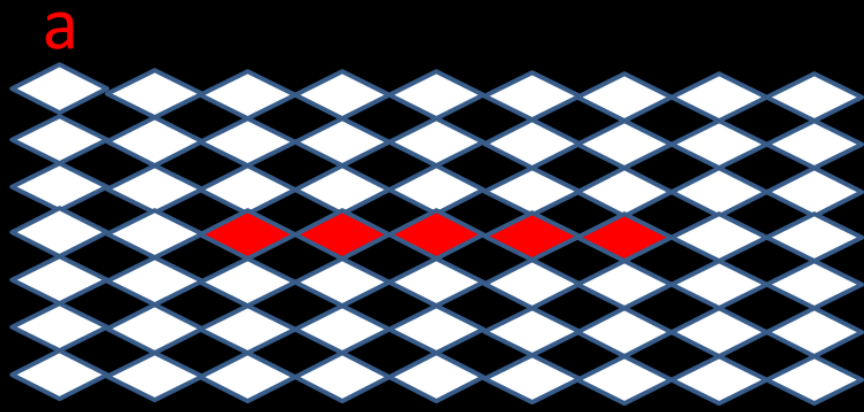
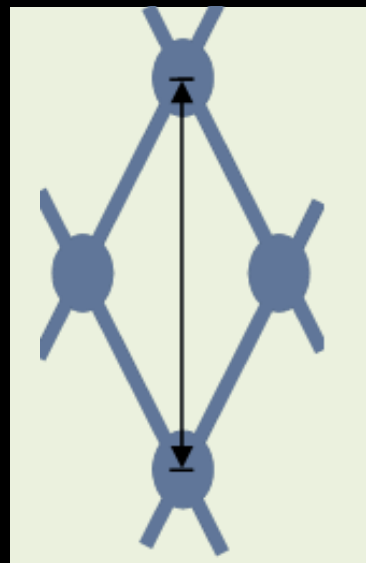
Mesh opening:

EC Regulation 517/2008: the longest distance between two opposite knots or joints in the same mesh when fully extended

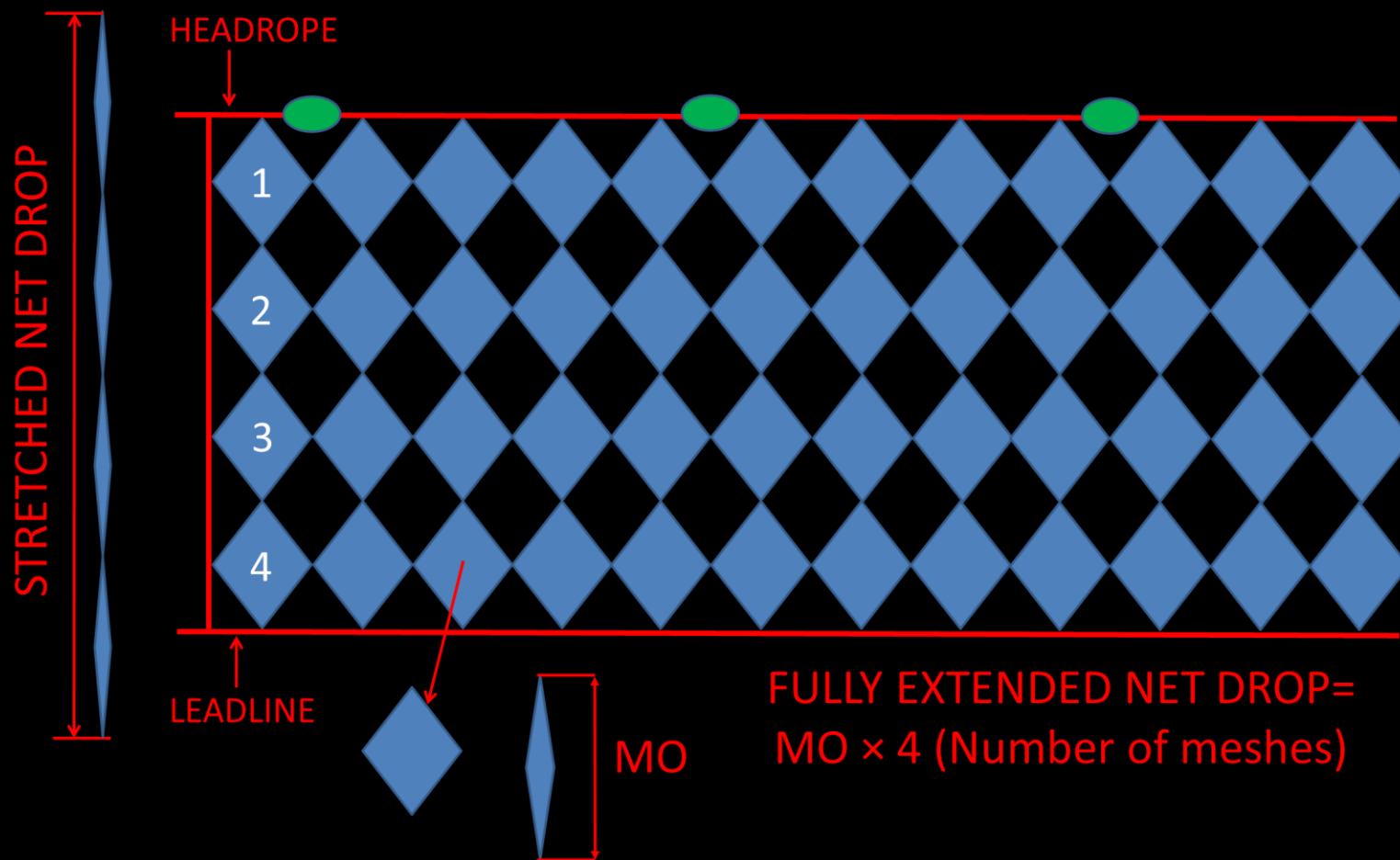


Mesh length

the distance between the centres of two opposite knots or joints in the same mesh when fully extended in the N direction



Fictitious or stretched or fully extended net drop
(EC Reg. 1967/2006): the drop of nets shall be defined as the sum of the height of the meshes (including knots) when wet and stretched perpendicular to the float line.

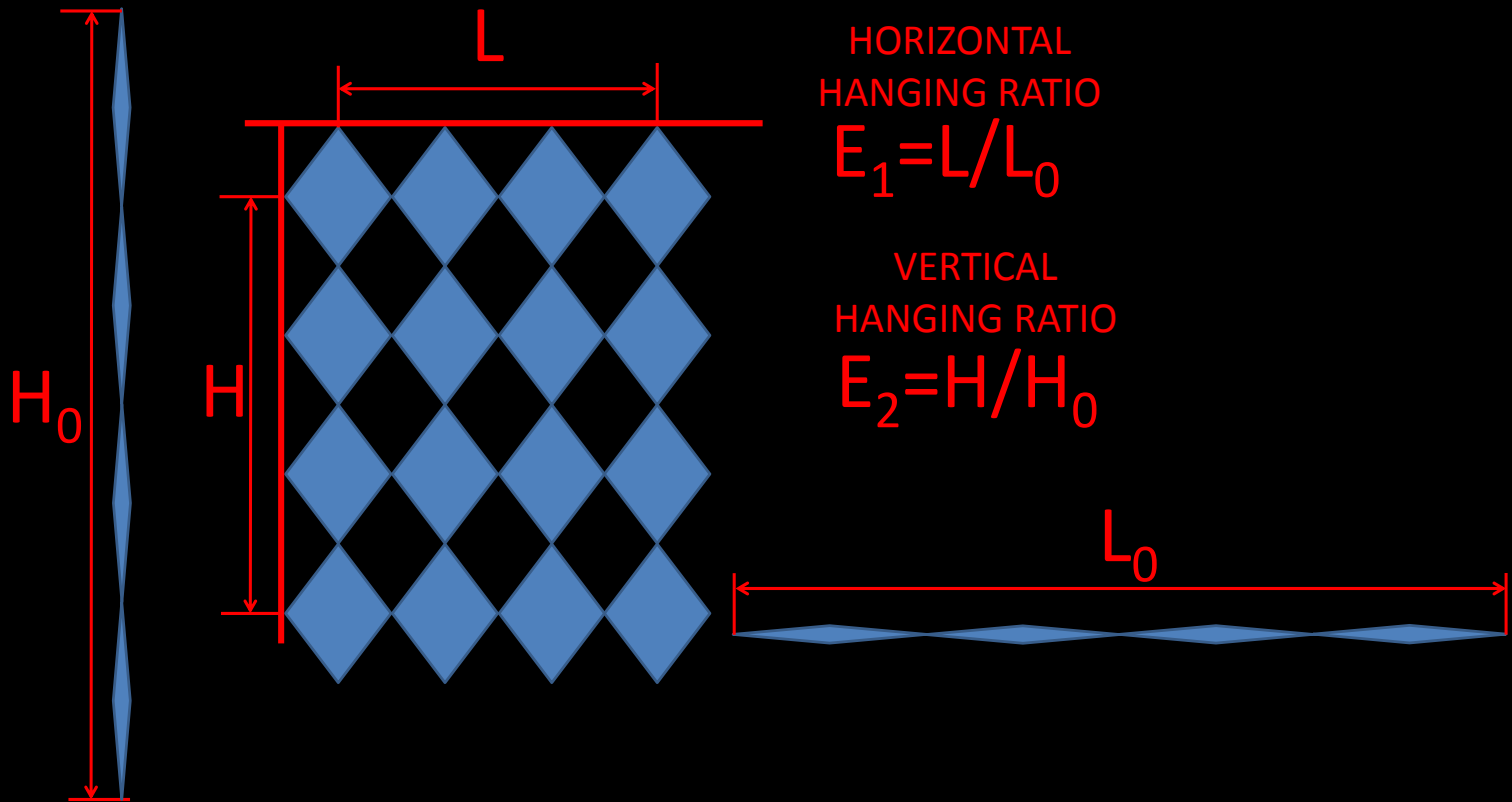


- Headline length (HLL): Length of the headline;
- Stretched net length (NL): it is the length of the netting mounted on the headrope when fully extended;



Hanging ratio:

The hanging ratio (E) is commonly defined as $E = L/L_0 = \text{Length of rope on which a net panel is mounted } (L) / \text{Length of stretched netting hung on the rope } (L_0)$.



Hanging ratio:

$E = 1.00$

$E = 0,9$

$E = 0,8$

$E = 0,7$

$E = 0,4$



Eg: 200 meshes, 50 mm mesh opening, mounted on headrope 8 m

$$E = \frac{8}{0,05 \times 200} = 0,80 = 80\%$$

Hanging ratio:

Detail of a net mounted on the headline with a different hanging ratio



Real net drop during fishing

- The fully extended net drop or fictitious drop is a useful (since it is enclosed in the EC Reg. 1967/2006) but theoretic parameter. The net drop is never completely stretched.
- Therefore the real net drop during fishing operations is usually quite different from the fully extended net drop.
- The only way to measure the real net drop with high precision is by using sensors mounted on the leadrope.
- However a possible way to estimate the real net drop is by calculating the vertical hanging ratio starting from the horizontal hanging ratio.

Real net drop during fishing

The primary or horizontal hanging ratio:

$$E_1 = \frac{L}{L_0}$$

The secondary or vertical hanging ratio:

$$E_2 = \frac{H}{H_0}$$

The real net height during fishing operation could be defined as the hung height or mounted length of the side hanging line, that is H , with a certain margin for error.

There is a mathematical relationship between the two hanging ratios:

$$E_1^2 + E_2^2 = 1$$

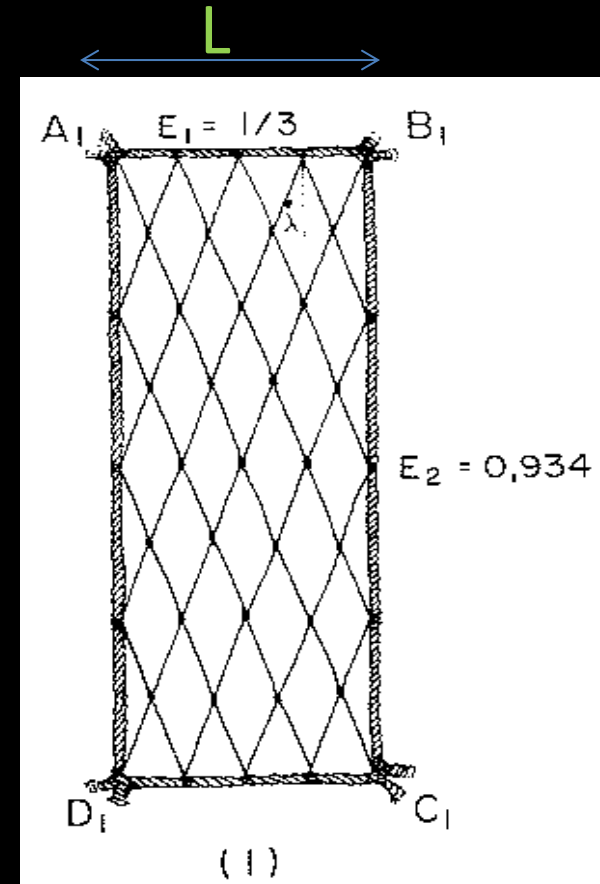
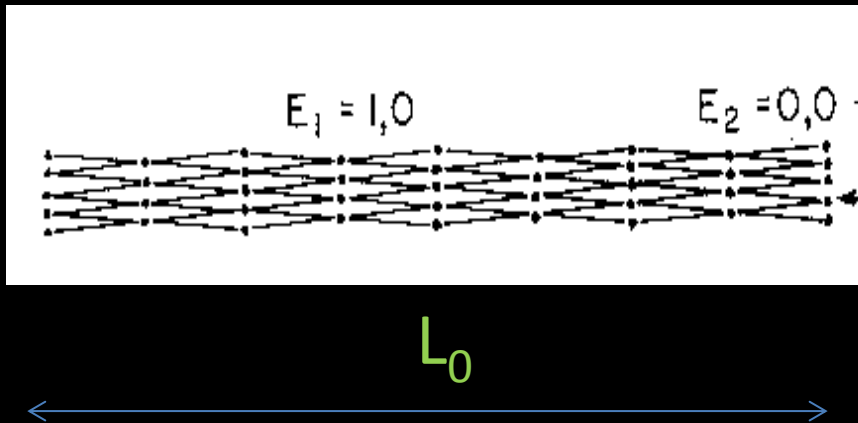
Real net drop during fishing

Therefore the real net drop (H) can be calculated as:

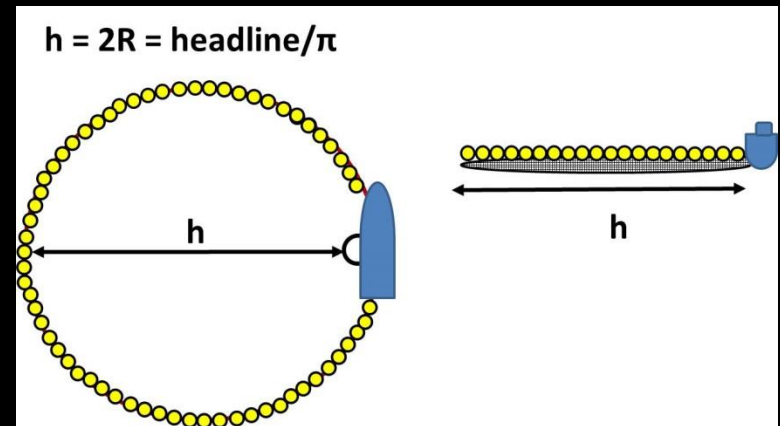
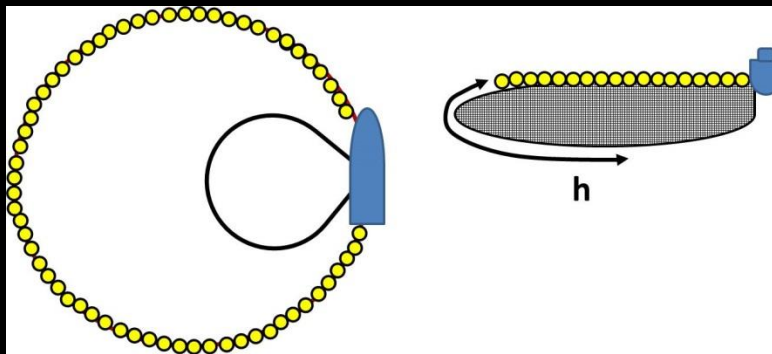
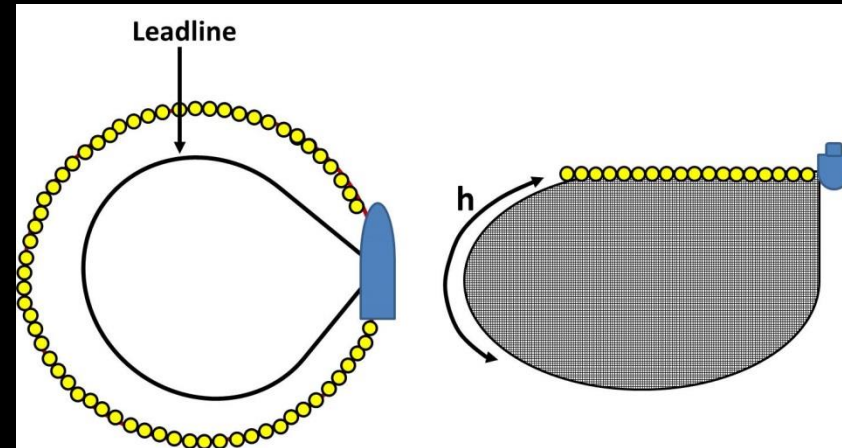
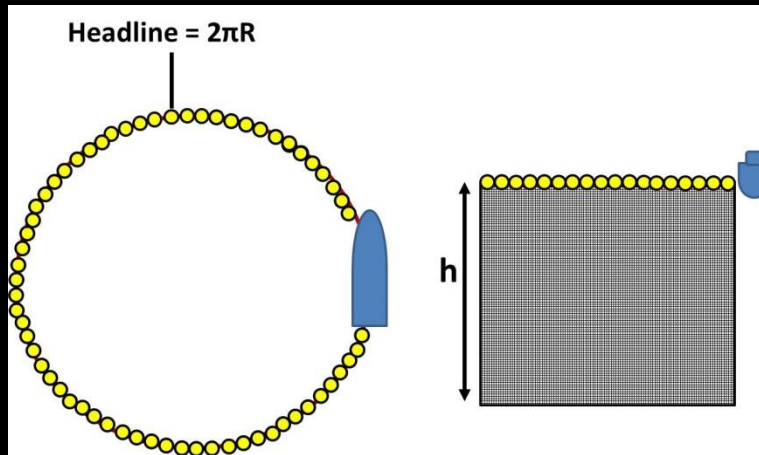
$$H = H_0 \times \sqrt{1 - E_1^2}$$

In any case it should be taken into consideration that this is a geometric and theoretic measure that could not fully reflect the real situation.

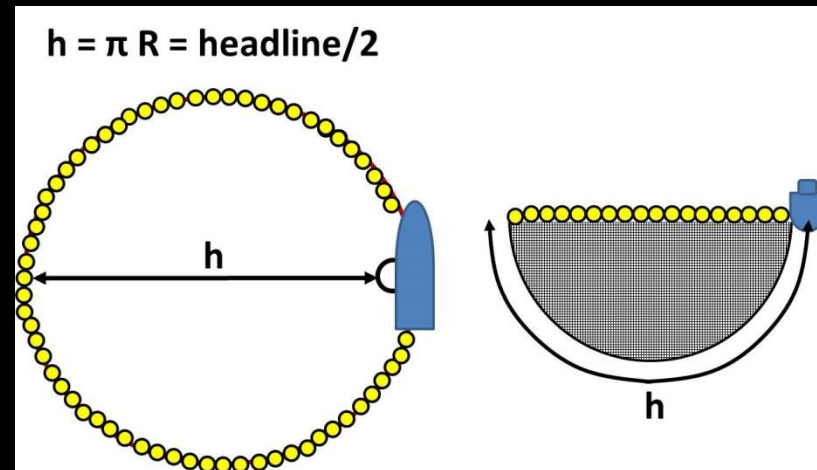
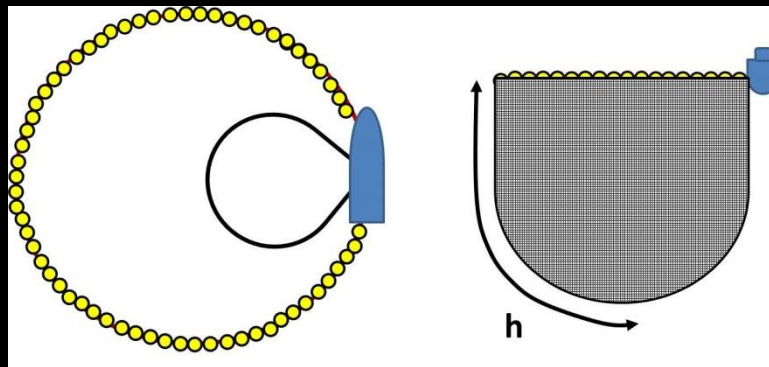
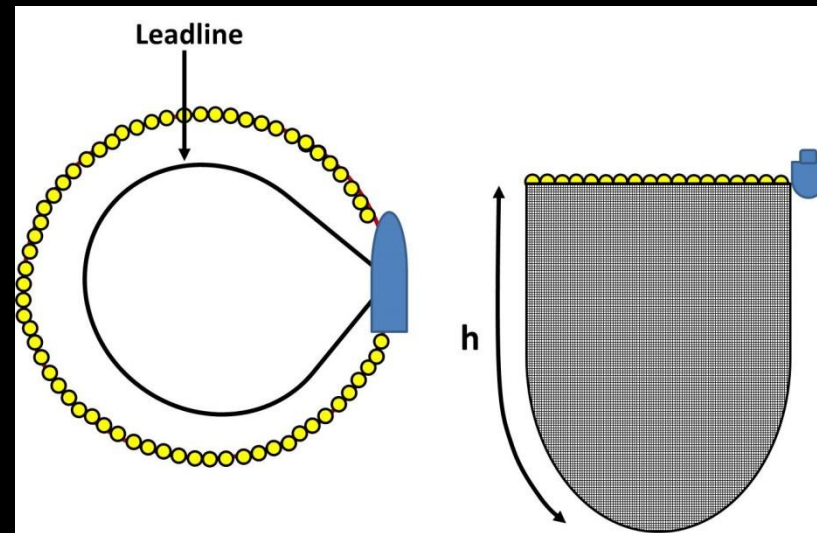
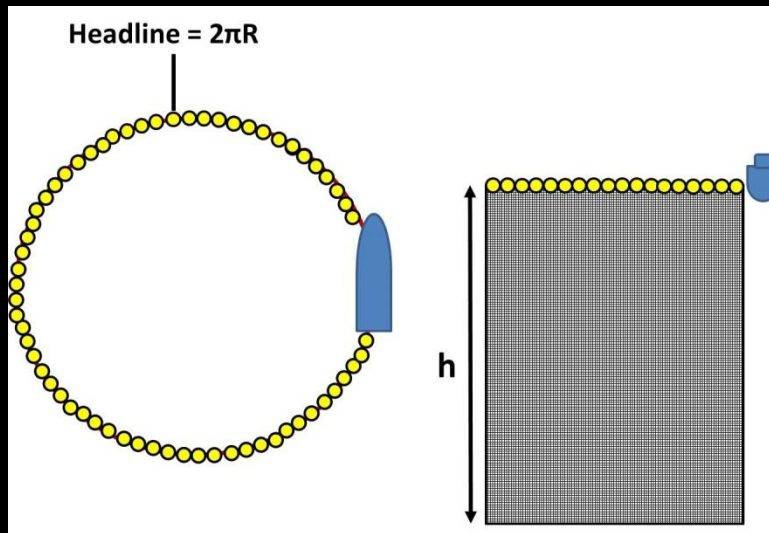
THE SHAPE AND AREA OF NETTING



Minimum Net drop: HLL/π



Maximum Net drop: $HLL/2$



$$\text{Min. ND} < \text{Net Drop} < \text{Max. ND}$$

$$\text{Length of headline}/\pi < \text{Net Drop} < \text{Length of headline}/2$$

This means that the minimum drop would be about 30% of the headline length

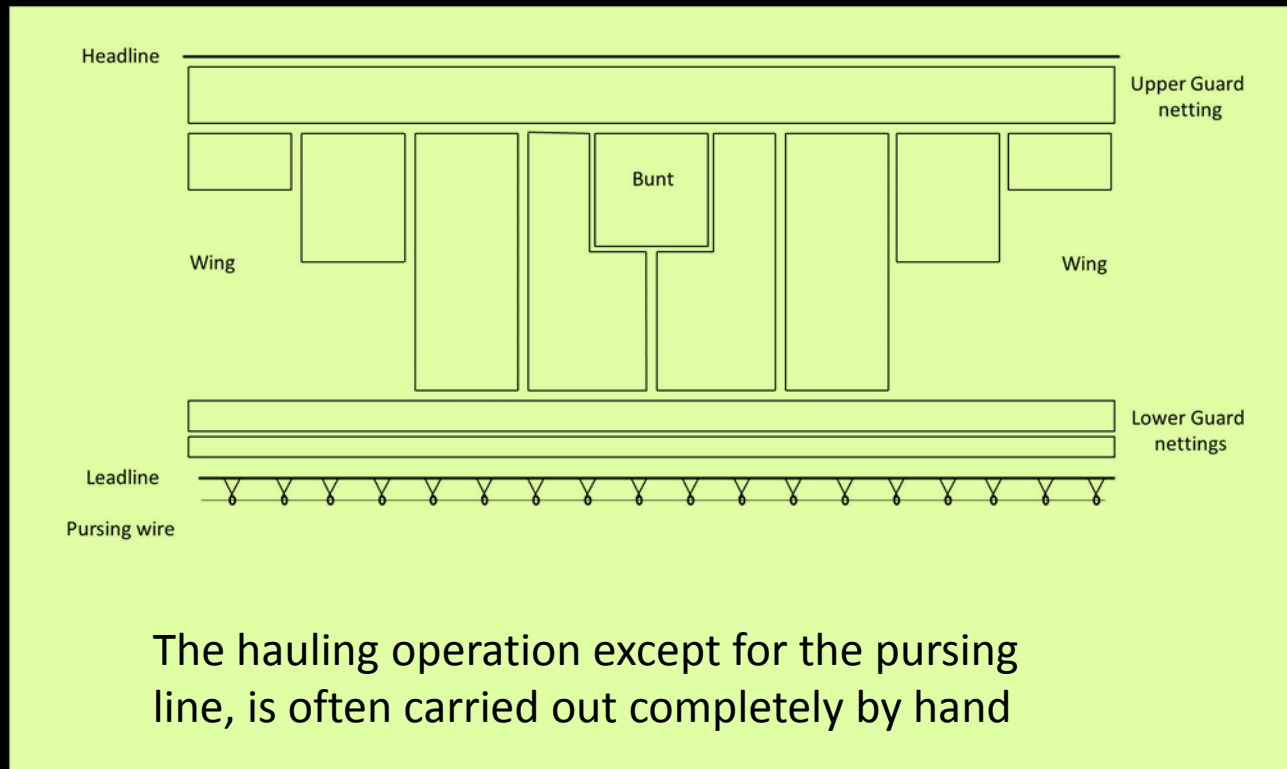
The minimum net drop required for a purse seine having a headline length of 800 m (EC Reg. 1967/2006) is:

$$\text{Net Drop} = \text{Length of headline}/\pi = 800/\pi = 254.6 \text{ m}$$

Therefore a net drop of a least 254 m is essential in order to avoid any net distortion during hauling operations, by operating with a purse seine with a maximum headline length of 800 m. On the contrary the maximum net drop would be $800/2=400 \text{ m}$.

Gulf of Trieste

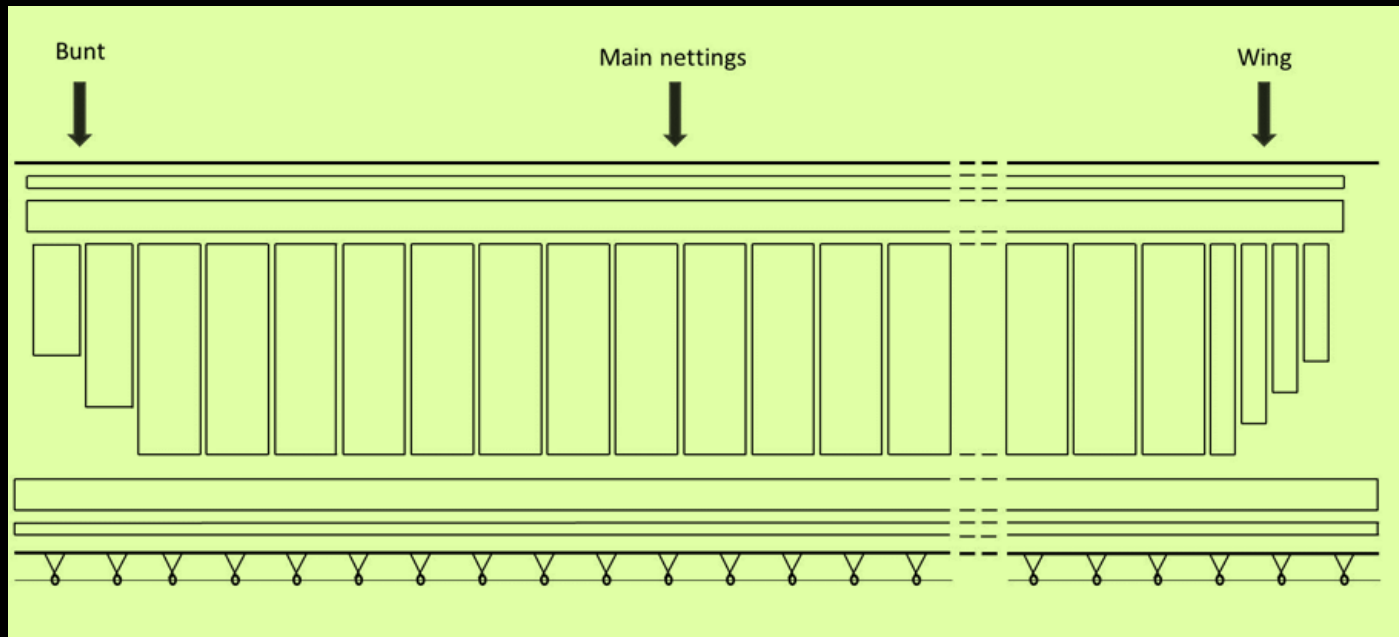
The purse seine used in this area have a symmetrical net design: two lateral net wings having the same dimensions and characteristics, the main netting body and a bunt or bag positioned in the middle of the net for the collection of the catch



The hauling operation except for the pursing line, is often carried out completely by hand

Adriatic (bottom depth > 25 m)

In the rest of the Adriatic Sea (bottom depth > 25-30 m), purse seines have bigger dimensions and the net design implies three main netting compartments: a single net wing, the main netting body and the bunt, which is mounted on a side of the net



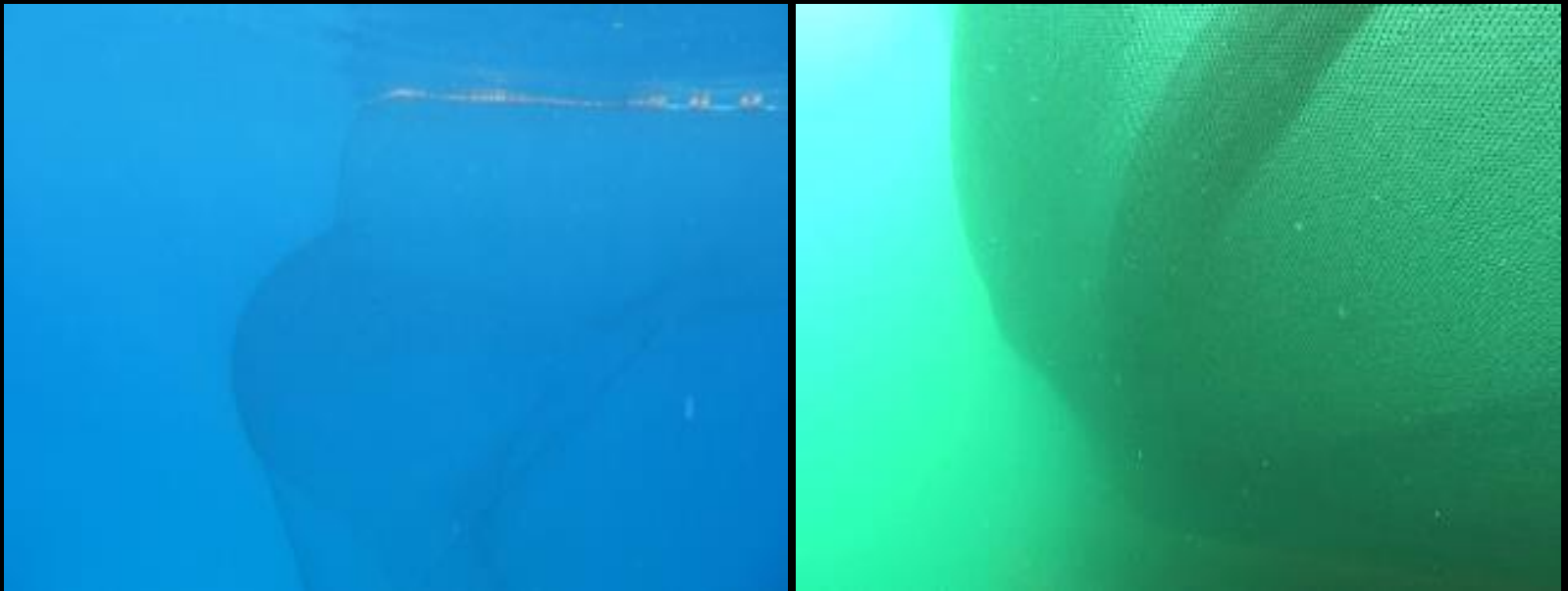
PURSE SEINES OF THE GULF OF TRIESTE (BOTTOM DEPTH < 25 m)

The maximum depth in that area is about 25 m, the maximum net drop according to the Council Regulation (EC) 1967/2006 must be no more than 35.7 m (70% rule)

- The mean headrope length was around 216 ± 26 m
- The mean net stretched net drop in this area was around 84.1 ± 1.5 m
- the net drop theoretically ranges between a minimum drop of 57.3 m and a maximum of 120.0 m. In this area it is possible to observe that the net drop is always close to the minimum theoretical net drop (difference: 15.3 ± 9.5 m)
- Effective net drop or Hung height (HH): 40.4 ± 7.6 m

PURSE SEINES OF THE GULF OF TRIESTE (BOTTOM DEPTH < 25 m)

- the main netting panels with its small meshes (mesh length 16 mm on average) may react against sea currents similar as a sail, so that the real net drop can be smaller than the Hung height



PURSE SEINES OF THE GULF OF TRIESTE (BOTTOM DEPTH < 25 m)

- The net drop was around the 34% of the net length and 39% of headline length.
- This means that, by maintaining the same net design and drop/length relation, the use of a regular net drop (35.7 m) would imply a maximum headrope length of about 91 m. This means the current nets should be shortened for about 57% to be in compliance with the EC provisions and than the real net drop during fishing operation would reduce at around 10 m, which is not an effective net height for fishing small pelagic species

ITALIAN PURSE SEINES IN THE ADRIATIC SEA (BOTTOM DEPTH > 84 m)

- the measured headrope length for the Italian purse seines ranged from 400 to 500 m (444 ± 42 m on average)
- theoretical net drop could range from 142 and 222 m
- fully extended net drop (EC Reg. 1967/2006) ranged between 184 and 198 m (185 ± 9 m on average)
- theoretical hung height is generally below the limits imposed by the EU Regulation showing a mean value equal to 103.3 ± 8.1 m

ITALIAN PURSE SEINES IN THE ADRIATIC SEA (BOTTOM DEPTH > 84 m)

- In these types of purse seines the net drop seems to have a greater importance than in the Gulf of Trieste; the net drop was around the 34% of the net length and about 42% of headline length
- By applying the same net design, the use of a net drop in compliance with the EC Reg. 1967/2006 can only be possible by using a headline length of about 288 m. This means that a reduction of the current headrope length of about 35% is required to respect the provisions of EC Reg. 1967/2006.
- In this scenario the real net height during fishing operations would be reduced at around 54 m.

PURSE SEINE PERFORMANCE AND IMPACT

ITALIAN PURSE SEINES IN THE ADRIATIC SEA (BOTTOM DEPTH > 84 m)

The average descent velocity of Italian purse seines during the shooting phase was about 12 m/min. The net took about 8.8 minutes to reach its maximum depth.

On average the groundrope was set at a distance of about 22.6 ± 5.6 m from the bottom

VESSEL_NAME	GL1	SB1
n. of hauls	133	232
Avg. Max Fishing Depth (m)	85.28 ± 8.76	77.14 ± 10.33
Net Drop EC Reg. 1967/06 (m)	120	120
Avg. Minimum Distance From Bottom (m)	17.12 ± 16.93	23.75 ± 22.97
Avg. Bottom Depth (m)	102.56 ± 18.91	101.09 ± 21.55
Avg. haul duration (from net shooting until purse wire closure) (min)	23.4 ± 14.2	13.0 ± 3.8
Avg. time to reach max depth (min)	10.0 ± 1.6	7.5 ± 1.0
Avg. max depth in first 5 min haul (m)	61.48 ± 6.83	62.48 ± 6.43
Avg. time to reach max depth within first 5 min haul (min)	4.8 ± 0.5	4.7 ± 0.14
Avg. max depth in first 10 min haul (m)	84.33 ± 8.48	77.09 ± 10.2
Avg. time to reach max depth within first 10 min haul (min)	9.3 ± 1.2	7.4 ± 0.9



PURSE SEINE PERFORMANCE AND IMPACT

ITALIAN PURSE SEINES IN THE ADRIATIC SEA (BOTTOM DEPTH > 84 m)

The measured net drop (the real net drop) was about 42% of the stretched net drop, measured in compliance with EC Reg. 1967/2006. This means that, by applying a regular net drop (120 m) **the real net drop during fishing operations would be around 54 m and the headrope length would be around 285 m**, while using the same net design.

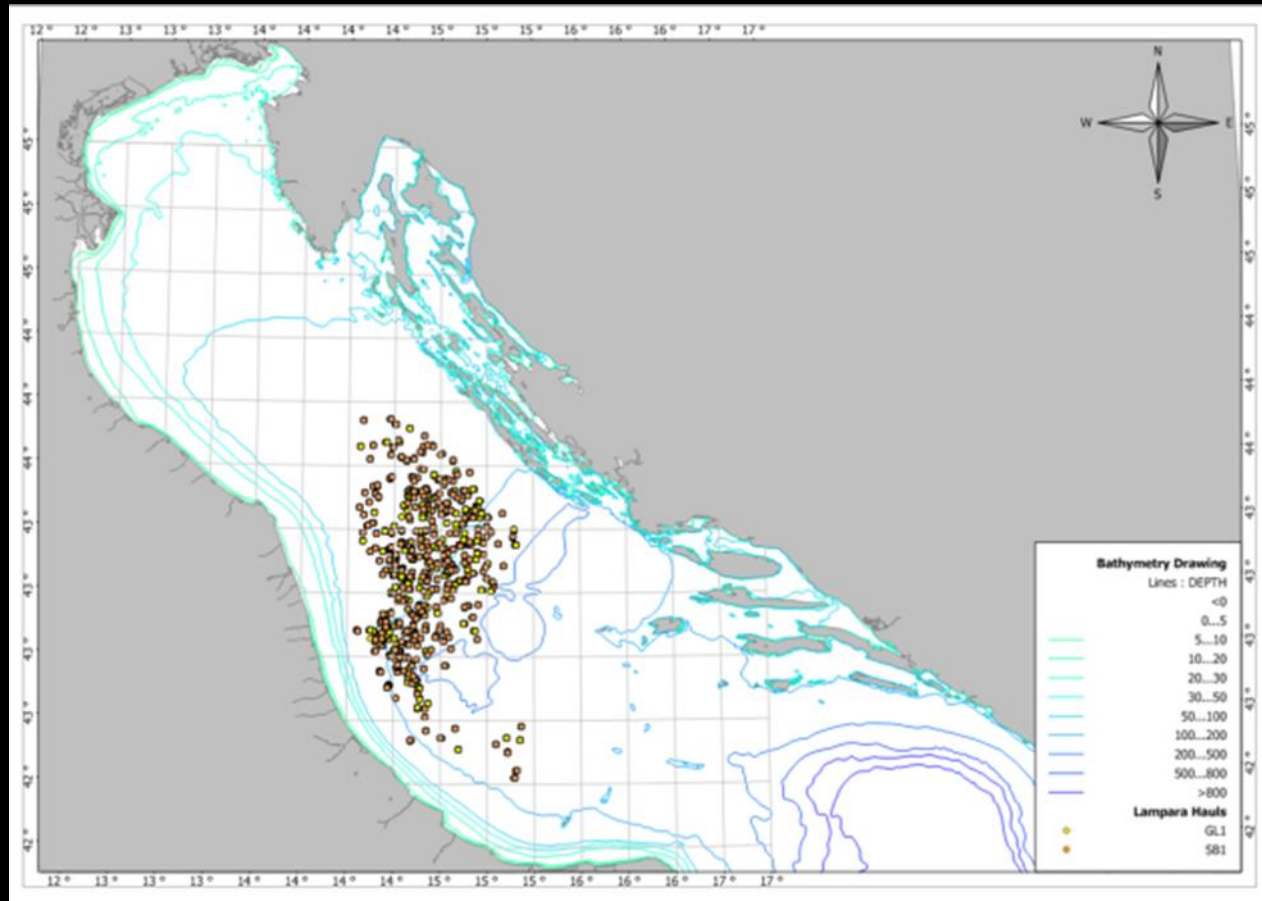
Echosounder images obtained during the survey clearly show that **the school of fish is spread in the water column until 40-50 m of depth**, even if attracted from the lights of the skiff vessels.

The dispersion of fish school justifies the use of really high net drop in this area

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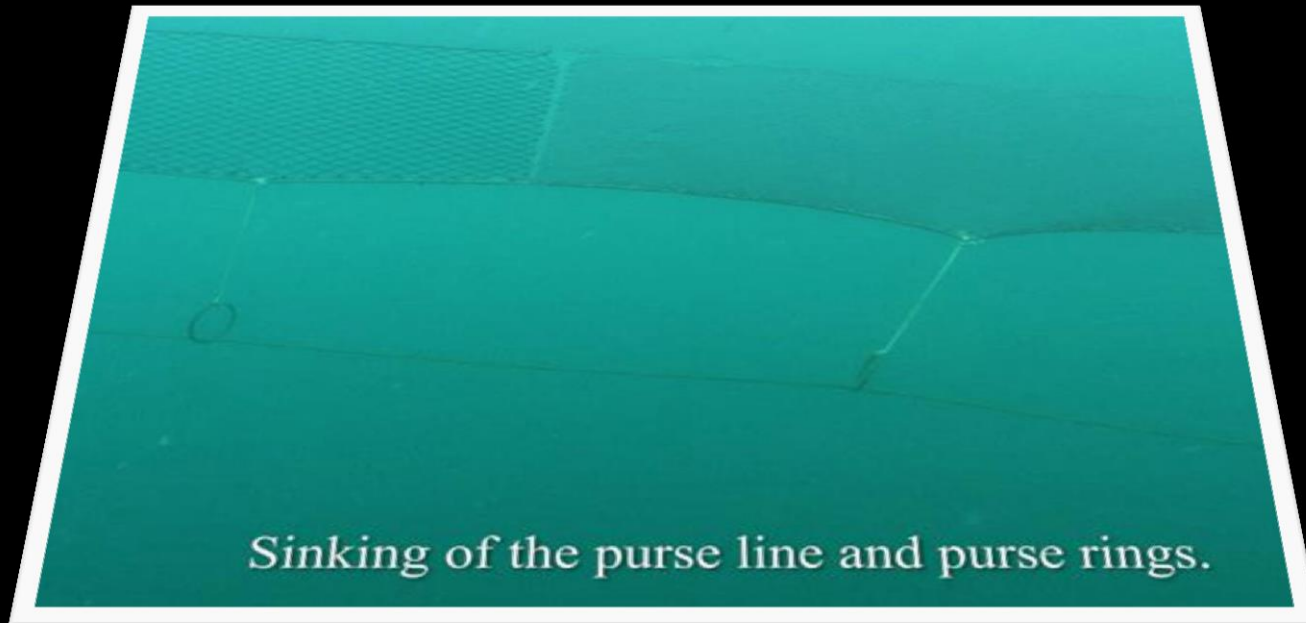
PURSE SEINE PERFORMANCE AND IMPACT

ITALIAN PURSE SEINES IN THE ADRIATIC SEA (BOTTOM DEPTH > 84 m)



PURSE SEINE PERFORMANCE AND IMPACT

PURSE SEINES OF THE GULF OF TRIESTE (BOTTOM DEPTH < 25 m)



CONCLUSIONS

- Two main scenarios can be outlined:
 - Bottom depth < 84 m (North Adriatic): Net drop = $(\text{Depth} \times 100) / 70$ m
 - Bottom depth > 84 m (Central-Adriatic): Net drop = 120 m
- Slovenian fleet only operate within the Gulf of Trieste, at a maximum depth of around 25 m. The majority of the fishing activity was located outside the 20 meters isobaths.
- Two main fishing areas can be identified for the Italian fleet in the GSA 17. Gulf of Trieste (at a maximum depth of around 25 m) and central Adriatic Sea, extending to the south (at a depth usually ranging from 80 to 120 m).

CONCLUSIONS

- The mesh size used generally in the Adriatic Sea is in general larger (14 -18 mm) than the minimum mesh size defined by EC Regulation 1967/2006 (14 mm).
- The hanging ratio is usually very high (the net is stretched horizontally to form a big belly with the sea currents). This results in an actual reduction of the height of the net in the water column of more than 50% of the total thus reducing the probability that the nets touch the bottom when used at depth of more than 60 meters.
- The stretched net drop measured in compliance with the EC Reg. 1967/2006 is always greater than the maximum net drop set in the same Regulation.

CONCLUSIONS

- The real net drop measured with pressure sensors during fishing operations is considerably smaller than the fully extended net drop.
- The use of such a huge net drop can be explained by two main reasons:
 - the use of small meshes in the main netting panel makes possible that sea currents blow the net as a sail
 - the net must stay clear from the school of fish in order to not scare it.

CONCLUSIONS

- In the Gulf of Trieste, in consideration of the really low depth (< 25 m) the groundrope of the purse seines usually operates close to the bottom. The majority of fishing activities is located outside 20 meters isobaths.
- the surveys carried out with a video camera mounted on the groundrope showed that the purse wire is recovered before the groundrope touch the bottom, so that the bottom impact is negligible.
- Posidonia oceanica meadow is only located in a small area approximately 1 km long, it starts close to the coastline and extends 50 m off the shore (sea depth is approximately 4 m). Therefore professional vessels operating with purse seines always operate well away from the sensible areas

CONCLUSIONS

- Italian purse seines operating in deeper waters: the purse wire is recovered when the groundrope is far from the bottom. The bottom contact of these nets is negligible.
- bycatch/discard data provided for all the purse seine fleets in GSA 17, where only a very small amount or no demersal fish were recorded
- To comply with the EC Reg. 1967/2006 provisions: a reduction of the net length of about 36-57% would be required.
- Moreover the use of nets in compliance with EC Regulation restrictions would imply a strong reduction of the real net drop during encircling phases that is not effective in practical situations.

CONCLUSIONS

- The length of purse seines (length of the headline) used in the Adriatic sea never exceed 600 m, that is well below the maximum length fixed by the EC Reg. 1967/2006 (800 m).
- There is a general direct relation between the size of anchovy and sardine and the depth (EC Project DG XIV 95/033 “Optimal allocation of effort in sampling for age and length from commercial fisheries”). These data can be used to support the hypothesis that the use of shorter nets would result in an increase in the fishing effort in shallower areas closer to shore on smaller individuals and increasing the interactions with the purse seiners and the other small scale fisheries operating the area.

