
**REPORT OF THE SCSA/SCSS/SCSI TRANSVERSAL WORKSHOP
ON SELECTIVITY IN THE MEDITERRANEAN TRAWL FISHERIES
Barcelona, Spain, 2-4 April 2007**

OPENING AND ARRANGEMENTS OF THE WORKSHOP

1. The transversal workshop on selectivity in the Mediterranean trawl fisheries was held in the Institut de Ciències del Mar (ICM-CSIC) in Barcelona, Spain, from 2 to 4 April 2007. The agenda of the meeting is given as Appendix A. The meeting was attended by 27 participants from 6 countries. The list of participants is provided in Appendix B.
2. Ms Constantina Karlou-Riga, Coordinator of the Sub-Committee on Stock Assessment (SCSA), welcomed the participants and explained some recent recommendations of the General Fisheries Commission for the Mediterranean (GFCM) in relation to selectivity.
3. Mr Abdellah Srour, Deputy Executive Secretary of the GFCM, welcomed the participants and reviewed the terms of reference (TORs) for the workshop. He underlined the importance of this workshop and made particular reference to Resolution GFCM/31/2007/3 on 40 mm square mesh size in codend of trawl nets exploiting demersal resources, and to Recommendation GFCM/31/2007/1 on the mesh size of trawl nets exploiting demersal resources.
4. Mr Francisco Sarda, the local organizer, welcomed the participants and informed them about the arrangements and facilities for the workshop.
5. The meeting was chaired by Ms Karlou-Riga and Mr Jacques Sacchi acted as convenor. Mr Enric Massutí was appointed rapporteur for this workshop.

ADOPTION OF THE AGENDA

6. Ms Karlou Riga explained the TORs of this workshop. Mr Sacchi presented the agenda which was adopted after some modifications.

REVIEW OF MAIN NATIONAL TRAWLING FISHERIES WITH A PARTICULAR ATTENTION TO GEAR CHARACTERISTICS AND SELECTIVITY REGULATIONS

7. In introduction to the workshop, the first two presentations started from the first results of investigations carried out near the partners of the network of Mediterranean technologists on the main technical characteristics of the various trawling métiers used in the Mediterranean Sea and the national measures of selectivity regulations which govern them.

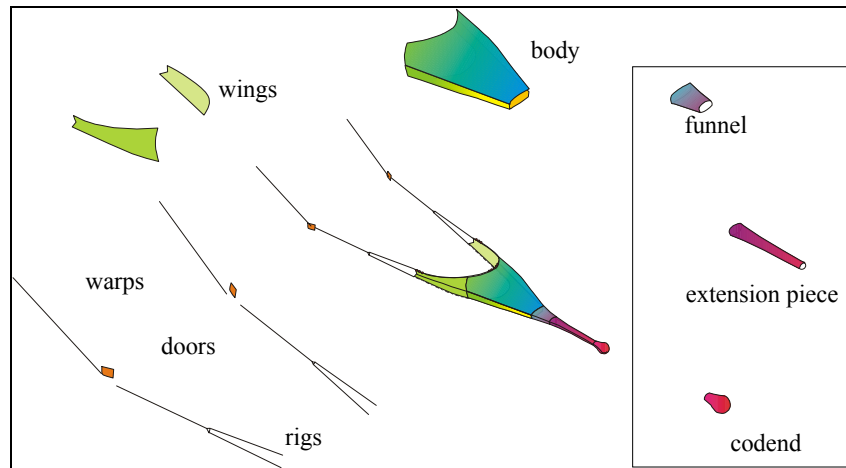


Figure 1 - Main parts of a bottom trawl

8. Through the great variability of the trawl characteristics given, it is possible to distinguish at least two commonly widespread fishing strategies around the Mediterranean basin: the trawling on the continental shelf without particular target species and the trawling of the slope targeting deep crustaceans. Complementary information should be able to make it possible to better reveal the technical differences characterizing these strategies (catch composition, duration and haul, etc.) and to identify the métiers for which the application of the square mesh would present some difficulties.

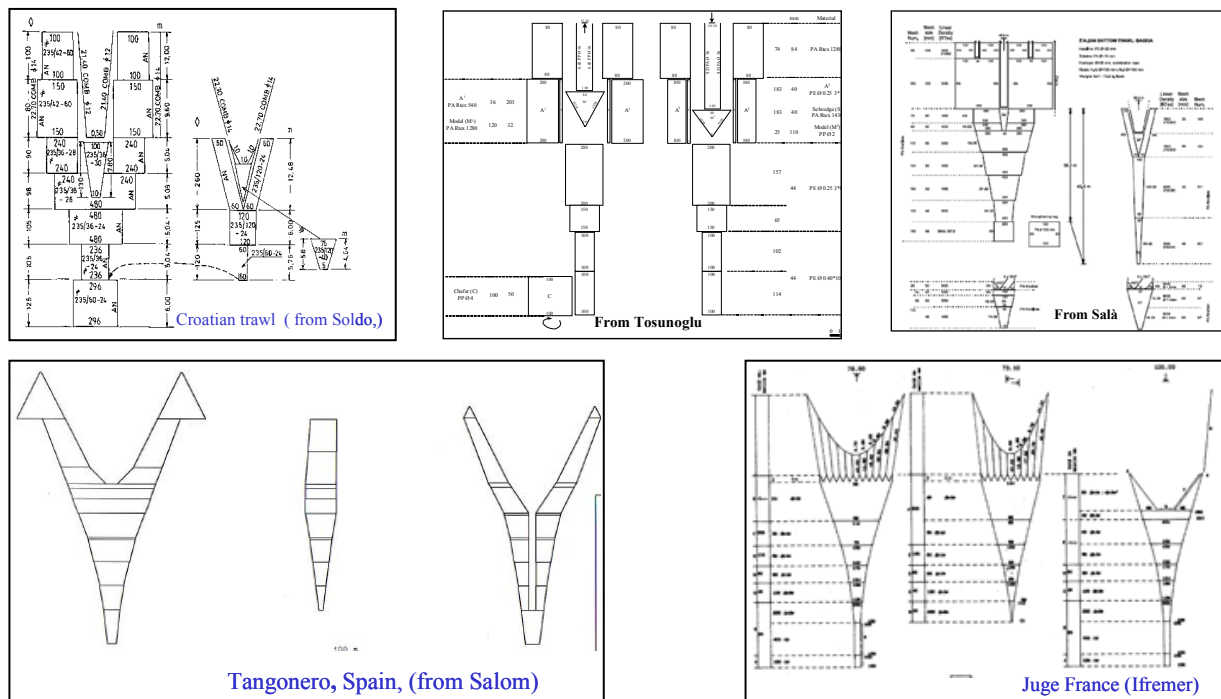


Figure 2 - Various types of Mediterranean bottom trawls

9. Concerning more particularly the codend, its mesh size spreads out between 28 and 46 mm of stretched length and its length between 3 and 13m, showing thus the need for better defining the term of codend. Additional information would also be required on the nature and twine diameter employed for its making.

10. A discussion on this particular point will be proposed to the technologists network as well as a modification of the table on the trawl characteristics. The examination of the various national legislations on the regulation of the selectivity of the trawls show in particular how those take into account the characteristics of some fisheries.

11. The debate that issued retained the positive aspect of the derogations but also of the need to explain their scientific bases to the fishermen. In addition it underlines the obstacle to the harmonization of the regulation that can set terminology problems thus of a necessary standardization of the procedures and control instruments (for example gauge).

12. Concerning the design of square mesh codend and their mounting, the talk shows that very little information exists on the best way to proceed to be able to preserve the maximum of selective effectiveness, taking account of the type of trawl concerned (with or without extension piece, mesh size of the part of the trawl on which the codend must be mounted).

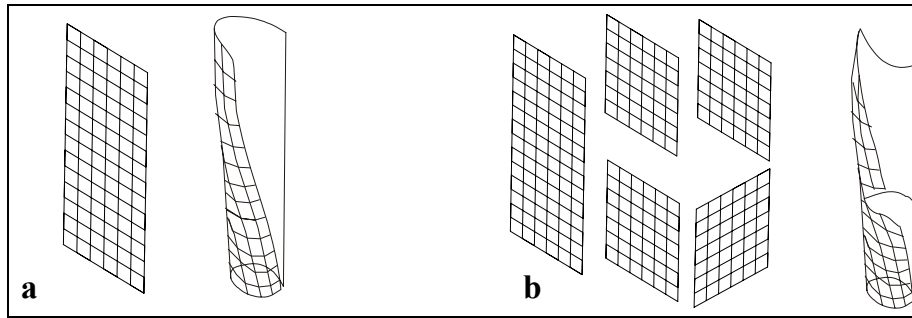


Figure 3 - Different ways to build a square mesh codend with a knotted netting

13. The discussion on the choice of the optimal mounting ratio also reveals the need for adopting a standard definition of this one, to at least facilitate the comparison of the results within the GFCM members.

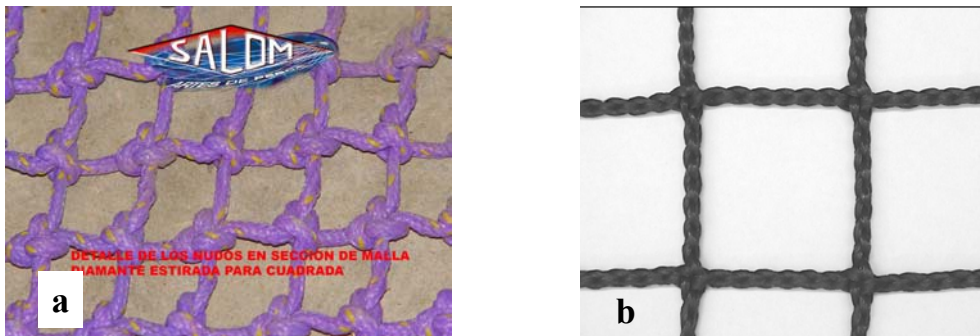


Figure 4 - Diamond meshes (a) and knotless Ultracross (b) in square mesh configuration (from Salom and Arkley).

14. The participants also agreed on the fact that the high cost of new materials used in Atlantic North (Polyéthylène Ultracross) for the manufacture of the square mesh panels will constrain the majority of the Mediterranean fleets to adapt the netting usually employed for the construction of codend (knotted or knotless PE or knotted PA or knotless PA with Raschel system) with undeniable effects on the variability of the selectivity.

REVIEW ON RECENT STUDIES AND EXPERIENCE ON SQUARE MESH SELECTIVITY IN MEDITERRANEAN

15. In the continuity of the first Atselmed workshop, 7 oral presentations had given the results of the most recent studies undertaken in the Mediterranean on bottom trawl selectivity. This research mentions gear characteristics as well as experimental methods and analysis employed. The results were dealing on more specifically the effects in terms of juvenile escapement, discard reduction, economic losses, ecosystem impact, compared between inshore fishing and deep fishing, between

different mesh size, diamond mesh and square mesh codend, knotted or knotless net, or for the use of selective grid for shellfish or of window panel. The various talks brought up open debate between the participants on the different tackled issues.

Methodologies

16. The review of the experiments carried out in the Mediterranean on the selectivity of hake and of red mullet shows that for the majority of the studies the selectivity curves are traditionally estimated from pooled within all hauls for which the controlled parameters remain unchanged, by modelling the retention probability by means of a logistic model. Nevertheless, as shows in the work here presented, the recent studies adopt the method of Fryer (1991) estimating an average curve of selectivity from the curves of each haul. The results of the captures all were in addition obtained here by the technique of the covered codend.

17. The great variability of L50 obtained for the same species draws the attention of the assistance to the role that other technical parameters can play on selectivity, like the nature, twine diameter and codend circumference, and the utmost interest to provide maximum of technical information on the tested gear and the conditions of experimentation in order to facilitate the comparison between experiments of various sources.

18. With the condition of the respect of a common and clear terminology which still remains to be clarified for certain concepts like the codend circumference; for this one, the use of the mounting ratio of assembly was proposed as for measurement index. In addition to deal with the multispecies characteristics of the fisheries, multi-variant statistical tools were used in particular to highlight the differences of the trawling strategies by the specific composition of the catches. The two strategies examined in the studies presented correspond to the most commonly met situations: the continental shelf trawling (50-100 m depth) and the continental slope trawling (100 to 600 m depth).

Size selectivity

19. The values of selectivity obtained (L50) for much of captured species, the escapement rates as well as the discard reduction are significantly higher for the bottoms in square mesh codend than for the diamond mesh codend.

Discard reduction

20. In the same way the reduction of the discards is significantly more important on the shelf than on the continental slopes. This reduction could contribute significantly to improve quality of the marketed species.

Loss of commercial species

21. According the experimentation carried out in Balearic Islands and Catalane sea, the benefits in selectivity terms of the implementation of this technical measure would not lead to a reduction of the yields for commercial categories, except for some small species as *S. smaris* which is a species very appreciated and constitute one of the main target species for the coastal trawl fishery in different area (Balearic Islands, Greece,).

22. The different presented results globally suggest that the short-term economic losses of commercial species will be lower in the slope fishery (e.g. less 5% of the total catch value in Balearic Islands and Catalan sea) than in the continental shelf (e.g. up to ~30% of the total catch value for the same areas) for the fisheries switching from 40 mm diamond mesh to 40 mm square mesh codends.

Others selectivity studies

23. 2 studies conducted in Greek waters on the selectivity benefits of the application of 40 mm diamond mesh were reported during the meeting.

24. The comparison in Thracian Sea between the 28 mm mesh codend to the 40 mm codend demonstrate that the increase of mesh size leads globally to a reduction of total discard and no difference in the total landings.



Figure 5 - Knotted and knotless netting of 40mm mesh size (from Chilari)

25. One the other hand the experiments carried out in the Ionian sea show that if the use of 40 mm mesh size do not induce significant losses in deep water at the opposite in shallow waters where there are more small species, the economic loss should be evaluated. The comparison in this area between two types of bottom trawl codend, knotted and knotless, with 40 mm mesh size (stretched) do not show any differences regarding the L50, for 12 species of the 21 caught.

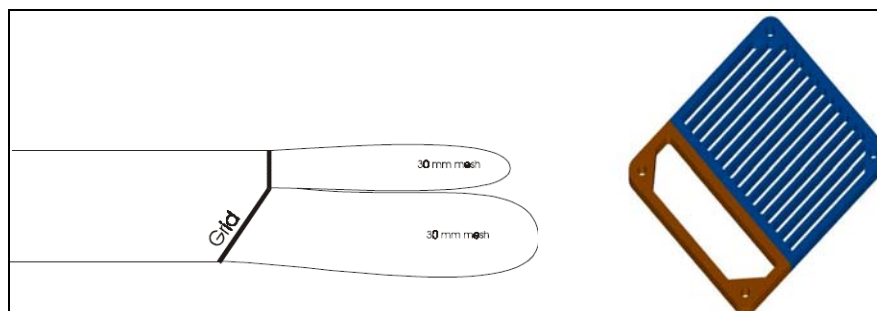


Figure 6 - Experimental device for sorting grid selectivity study (from Adamidou)

26. During the discussion the participants conclude with the speaker to the necessity to investigate in a future study the effects of the rigging of the gear (meshes around, length of extension and cod end, etc.) but also to take account of the nature of the twine (PE or PA). It was also reminded the need to develop more selectivity studies on square mesh codend effects.

27. The application of sorting grids (25mm/200mm 30mm/150mm 35mm/200mm) into the Thracian Sea trawl fisheries was also investigated showing the advantages of this technique to separate Norway lobster and shrimp from fish. Moreover size selection takes place with hake with the setting of a guiding panel used to deflect the catch to the base of the grid.

28. For the Israeli coastal bottom trawl fishery, a 50 mm square mesh panel was used as top window for reducing undersized catch and small pelagic fishes (anchovy); the speaker point out on the large variety of species encountered in the East Mediterranean trawl fishery composed of many Lessepsian fishes of various body shapes and sizes which lead to a great variability of the losses of the marketable fish and undersized fish between the hauls.

Survival after escapement

29. The first Atselmed meeting has already posed the importance of this problem and its consequences on the assessment of fishing mortality.

30. Only few studies have been conducted on this question. Figuerola et al., (2001) have given some results on escapement for few fish species (*Gobus niger* and *Solea vulgaris*) and invertebrates in their study on mortality due to trawling¹. The experiments carried out in Aegean Sea by a Turkish team show a large variability in the escaping mortality for the same species (e.g. red mullet) and between the different species (from 0% to 100%). According to the authors this study will be continued to investigate the seasonal differences in survival rates.

31. For several participants, the survivability of the fish escaping from meshes of the cod-end is a key issue to determinate the real benefit of the improvement of the codend selectivity for the fish stock and ecosystem management. For them, if the mortality rate of escaping fish would be high, the implementation of this technical measure should be reconsider.

Ecosystem impact

32. The evaluation of the impact on the ecosystem of the application of the square mesh was presented through a model representing the current conditions of the ecosystem by holding account of the recent results of selectivity. Taking into account the direct and indirect effects of fishing on the food web, the improvement of the selectivity of the trawls could have noticeable consequences on the targeted and accessory demersal species.

33. It was nevertheless underlined the high uncertainty of the real effects of the selectivity in absence of information on the survival of the individuals after escapement, considering that this question is a key issue. In addition, the participants retained the interest of such models in particular an ecosystem approach of the fishing management but recorded in the discussion their complexity and the need for collecting sufficient information validated to be able to make them operational.

Other technical measures

34. If for a single approach, improving selectivity seems to be more efficient than reduce effort, the participants acknowledge generally that the improvement of selectivity is not enough for the recovery of overexploited species and ecosystems for which other measures are generally needed as fishing effort reduction, closed areas and seasons.

APPLICATION OF SQUARE MESH PANEL OR CODEND TO THE NORTH EUROPEAN FISHERIES; DIFFICULTIES, BENEFITS FOR THE FISHING INDUSTRIES.

35. There is not to day many available information on the implementation of square mesh codend to North European fisheries; according Madsen and al. (1999), the full square mesh codend was given up for the top window made of square mesh panel. The authors point out that “the square mesh netting remain protected from bottom damage, and less square mesh netting is needed which is also an important parameter because good netting for square meshes is rather expensive”. Top windows are now specified in EU legislation.²

36. On the contrary, many examples can be easily found in the literature on the implementation of square mesh panels in North European fisheries or the use of selective grids.

¹ Figuerola P., Sanchez P., Demestre M., 2001 – Preliminary results on megafauna variations due to experimental trawling disturbance. Rapp. Com. Int. Medit. 265p.

² FTFB/CM 1999/R:01 The escape window as a management option to improve the size selectivity of the Baltic Sea cod fishery Niels Madsen¹, René Holst and Leslie Foldager.

EVALUATION OF MEDIUM AND LONG TERMS CONSEQUENCES OF THE APPLICATION OF 40 MM SQUARE MESH TO THE MEDITERRANEAN BOTTOM TRAWLS; REVIEW ON METHODS OF ANALYSIS (SOFTWARE, ETC.)

37. The study of the improvement of the French *Nephrops* trawl fishery in the Bay of Biscay was given as example of an integrated approach for the evaluation of the biological and economic consequences of several scenario of selectivity measures. “These scenario consist in varying the selectivity factor leading to an improvement of the exploitation pattern of the *Nephrops* for the fleet. These improvements could be achieved in practice either by the adoption of selectivity devices or the increase of the mesh size”. Here the simulation uses the selectivity factor which was obtained from selectivity study on sorting grid conducted by Ifremer for this fishery. Moreover, according to the objectives of this study it was assumed that the increase of selectivity for *Nephrops* does not affect the catch of other marketable species.

38. According the outcomes of the simulation the reducing of discards of non market value *Nephrops* (as well of juvenile hake) would benefit the fishery without necessarily lead to a negative net present value of rent. This advantage needs however to be checked with results of observations on commercial vessels and could be partially limited if the survival rate for *Nephrops* would be lower than 30% and if the loss of other marketable species (e.g. hake) would be effectively considered as it was pointed out during the discussion.

39. Furthermore, as it was underlined in this presentation, that selectivity measures remain insufficient to ensure the fishing recovery of the stock and limitation of the fishing effort is required by a regulation of access to the fishery.

40. The following presentation demonstrated the possibility to use the MEFISTO 3 model performed by the team of the Bemfish project for the Bio-economic analysis of selectivity changes due to the application of different technical options (mesh size increase of diamond mesh size from 40 to 50 then to 60 mm, or change from 40 mm diamond mesh to 40 mm square mesh) in the shared hake fishery in the Gulf of Lion.

41. For this case study the different simulations show an initial period of losses due to the decrease in the catch, but followed by an increase in the catch and profits. However, as the speaker calls the attention of the participants these results can be different depending on the fishery; moreover, the model actually needs few minor changes to be fully suitable to simulate all selectivity changes effects.

42. During the discussion several interventions pointed out the need to also include in the model the survival rates. On the question of the most efficient technical measures (effort reduction, changing the mesh shape or increasing the size of diamond mesh) it was accepted that results depend on the species and consequently on the management objectives chosen for the considered operational unit. As it was requested the model needs to be fed with adequate field observations in order to produce satisfactory simulation results.

MULTIDISCIPLINARY APPROACH AND STRATEGIC PROGRAM FOR THE FOLLOW-UP OF THE GRADUAL IMPLEMENTATION OF THE 40 MM SQUARE MESH

40. The success of implementation of technical measure in a fishery need to adopt a multidisciplinary approach which must take account of all consequences that this measure may be have on one hand on the ecosystem; fish population and on the other hand on the technical characteristics and economy of the exploitation.

41. This approach is now generally developed for several management plans including the enforcement of technical measures of regulation.

42. With this aim the participants were invited to build tables listing separately potential consequences for biological, technical and economical features See Appendix F. Each table was after that commented and discussed between the participants.

Biological consequences

43. The summary table which was presented on biological consequences by the biologists group want to add some information on expected outcomes for the fisheries from the implementation of the square mesh codend. This point brought some comments on the fact that the expected outcomes will be not necessarily positive for all the species; for some of them their catches could reduce even at long term.

Economical consequences

44. The summary table on the potential economical consequences gave some short terms and long terms possible effects on the socio economical characteristics of the exploitation including effects on prices, gear and maintenance costs and acceptability by the fishery sector.

45. Moreover the economist team of the workshop proposed a framework () on economical analysis of the change of mesh for any trawl fishery. The different steps to tackle this question are described with possibilities to carry out specific studies.

46. During the discussion it was considered the interest to include some expected outcomes from simulation developed with MEFISTO in the Gulf of Lions and suggested to estimate in priority the cost of the implementation the cost of changing of the gear. In last, the importance to compile economic indicators was strongly affirmed.

Technological consequences

47. The summary table on the technological consequences describe briefly the maximum of possible technical changes which may affect in short or long terms as well the conception fishing gear as the strategy of the fleet. It was proposed to add the effect on fuel consumption et pointed out that the terminology standardization is not specific to square mesh issue but must be include in the conclusions of the meeting.

SYNTHESIS OF THE DISCUSSIONS

48. All along the meeting the discussions were governed by the question to know if there is enough information on the positive aspects of the square mesh codend application to put forward against its gaps and its disadvantages. This was in particular leading by the concern to get the better acceptability conditions of this measure by the fishermen and insure therefore its successful implementation with success in all be Mediterranean trawling fisheries.

49. Considering the results obtained in the different studies presented, the participants agree on the positive aspect on the selectivity of the bottom trawling with the use of 40 mm square mesh codend, for the major part of studied species and the surrounding ecosystem. Nevertheless, it was raised as objection that the long term benefit for the biology of these species could be probably questioned by too low survival rates and consequently the efficiency of this measure.

50. On the possibilities to apply (from now on?) this measure, the common answer from the scientists who have carried out experiences on square mesh codend, was that it is possible on the slope but in other areas, (e.g. in shallow waters, Delta Ebro), for different species (e.g., *Spicara smaris*) it could be different and more difficult; in which case it was answered by that other measurements would be certainly appropriate better for these situations (e.g. closed areas and seasons).

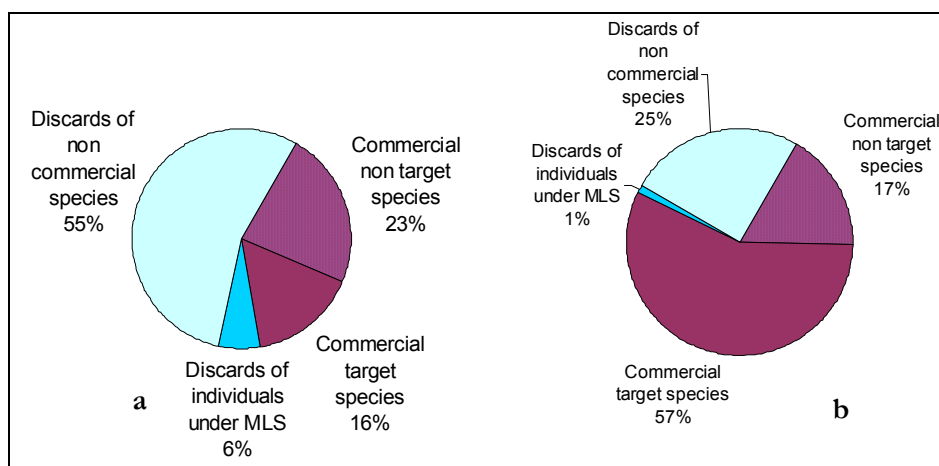


Figure 7 Difference in catch composition between hauls on continental shelf (a) and on slope (b) in the Catalan sea trawl fisheries (from Bahamon).

51. Generally speaking the little known cases of implementation of full square mesh codend and the few number of Mediterranean areas which are concerned by the studies, justified for some attendees the gradual approach recommended by the GFCM and the need to make more experimentation to evaluate all the consequences before the application of this measure. These argues were however disputed by others which were concerned by the strong increase of the fishing effort and of the fishing efficiency and think that this improvement of the selectivity must be implemented as soon as possible, asserting that each country can (have to ?) make the demonstration that this selectivity measure is not applicable for its area.

FOLLOW-UP OF THE RECOMMENDATIONS OF THE FIRST SELECTIVITY WORKSHOP (ATSELMED MEETING, SÈTE, FRANCE, MAY 2005):

Setting of a fishing gear technologist network including fishing industry.

52. Reminding of the recommendations of the thirtieth GFCM meeting (Istanbul, 24–27 January 2006,) to promote the establishment of a network of Mediterranean technologists, including from industry, Mr Jacques Sacchi presented the advancement of this task.

53. At this time, 66 Mediterranean scientists from 10 countries have replied positively to the invitation to participate to this network. It is reminding that the first aim of this network is to assist SAC in its recommendations on fisheries management dealing with fishing technology aspects (fishing gear technology, selectivity, environmental impact of fishing gear, effects on fishing effort and capacity, fuel saving, vessel conception and deck management, security) and consequently is opened to all scientists and experts involved by their works in one of these fields. It was proposed that this network offer to the members the possibility to exchange field experiences and information by the way of a standing email forum and is in charge of the organization of meeting on a fishing technology issue at the request of the SAC of GFCM. Its reports and different works could be published on the GFCM website.

54. About the participation of the fishing industry to the works of this network, it was agree to restrain it to the net manufacturers in the first time; the participation of other experts (e.g. engine manufacturers, etc) canning be opportunely requested for a particular point. Consequently it was suggested that each partner propose name and address of some net manufacturers of their country to add to the email list of the network.

Setting of selectivity database

55. Mr Antonello Sala presented briefly the advancement of this issue reminding the importance to document and check every technical parameters of the different selectivity experiments and opened the discussion on the choice of the best format (database software or a excel table). Considering that this document must be easily accessible to the scientist community it was decided to compile in a first time the results in a single excel table on the GFCM website, using the format agreed at the 8th session of SAC.

56. Furthermore, an extension to static gears selectivity was proposed; with this aim a specific format will be submitted to the discussion of the network.

Drawing up of a practical guide for selectivity study

57. It was noticed that there is no progress on this task. It was reminding that the goal is not to realize a new manual on selectivity, as the one published by the ICES (Wileman and al., 1996) but a simple handbook giving practical guidelines with the help of illustrations on the best way to carry out selectivity experiments.

58. This task has still to be done and could be also extended to the static gear selectivity.

DISSEMINATION

59. It was reminding the importance to provide the maximum of information on the outcomes of this meeting to the fishing industry for a better implication of this sector in the implementation of this measure of management. With this aim, the proposition made in Sete to organize a meeting of information with the main fishermen organization (MEDISAMAK) was renewed.

60. On other hand, Antonello Sala informed the participants on the session of Topic Group on technical issues relating to the Mediterranean within the next FTFB ICES meeting in Dublin (23 – 27 April, 2007) with Antonella Sala, Jacques Sacchi and Enric Massuti as convenors. The outcomes of the 2 Atselmed meeting will be presented during the opened session of this meeting with 4 presentations on Mediterranean works.

61. In last, it was proposed that all the presentations made during this meeting will be published in the GFCM website.

CONCLUSION

62. After an opened discussion between the participants adopted the following points as conclusion:

- a. The WS confirm the necessity to standardise the terminology of Mediterranean fishing gears: glossary and catalogue are needed.
- b. It is considered that selectivity studies require a multi-disciplinary approach, integrating technologists, biologists and economists.
- c. It is necessary to develop a protocol for the standardisation of selectivity studies, taking into account the ATSELMED-1 meeting and the conclusions from the present WS, including technological, biological, ecosystem and economic aspects. The participation of fishing industry (especially fishing gear manufacturers) is also recommended.
- d. It is also needed to monitor the implementation of 40 mm square mesh cod-end, taking into account technological, biological, ecosystem and socio-economic aspects.

- e. In addition to the monitoring of implementation of 40 mm square mesh cod-end, the WS suggests to perform research on:
- Effect on discards.
 - Survival of escapees (estimation of unaccounted mortality).
 - Effect of the type of netting material and mounting.
 - Analysis of economic effects.
 - Further analyse and compare the effects on the ecosystem.
- f. The WS pointed out that the knowledge of survivability in the Mediterranean should be strongly improved, and stressed the need to establish an appropriated methodology to address this issue.
- g. The WS considered that the implementation of 40 mm square mesh cod-end is going to have generally positive effects for the majority of the studied species. From a biological point of view, the WS stressed that the 40 mm square mesh cod-end should be implemented as soon as possible.
- h. The WS stated that implementation of 40 mm square mesh is considered not sufficient to recover highly exploited species and ecosystem. Additional measures will also be required.
- i. The available information on the effect of application of 40 mm square mesh cod-end does not cover the whole Mediterranean. The WS encouraged the development of selectivity studies in more GFCM GSAs.

ADOPTION OF THE REPORT AND CLOSURE OF MEETING

63. The report of the workshop was adopted on 4 April 2007. Mr Abdellah Srour thanked Mr Francisco Sarda and the CSIC for the organization of this workshop and the attendees for the quality of their participation.

**SCSA/SCCESS/SCSI ATELIER TRANSVERSAL SUR LA SELECTIVITE
DANS LES PECHERIES CHALUTIERES MEDITERRANÉENNES
Barcelone, Espagne, 2-4 Avril 2007**

OUVERTURE ET ORGANISATION DE L'ATELIER

1. L'Atelier transversal sur la sélectivité des pêcheries chalutières en Méditerranée s'est tenue à l' Institut de Ciències del Mar (ICM-CSIC) à Barcelone, Espagne, du 2 au 4 avril 2007. L'agenda de la réunion est donné en Annexe A. La réunion a regroupé 27 participants de 6 pays. La liste des participants est fournie en Annexe B.
2. Mme Constantina Karlou-Riga, Coordinatrice du the Sous-Comité de Gestion des Stocks (SCSA), a souhaité la bienvenue aux participants et expliqué quelques uns des recommandations de la Commission Générale des Pêches pour la Méditerranée en relation avec la sélectivité.
3. M. Abdellah Srour, secrétaire exécutif de la CGPM, a souhaité la bienvenue aux participants et passe en revue les termes de référence (TOR) pour l'Atelier. Il a souligné l'importance de cet atelier et a fait particulièrement référence à la Résolution CGPM/31/2007/3 sur la maille carrée de 40 mm pour les culs des chaluts exploitant des ressources démersales, et à la Recommandation CGPM/31/2007/1 sur le maillage des chaluts exploitant des ressources démersales.
4. M. Francisco Sarda, l'organisateur local, a souhaité la bienvenue aux participants et les a informé de l'organisation et des dispositions pour la tenue de l'Atelier.
5. La réunion a été présidée par Mme Karlou-Riga et animée par M. Jacques Sacchi en tant que conveneur. M. Enric Massuti a été désigné rapporteur pour cet Atelier.

ADOPTION DE L'AGENDA

6. Mme Karlou-Riga a présenté les TOR de cet Atelier. M. Sacchi a présenté l'agenda qui fût adopté après quelques modifications.

**REVUE DES PRINCIPALES PECHERIES CHALUTIERES NATIONALES
CARACTERISTIQUES TECHNIQUES DES ENGINS ET REGLEMENTATION DE
LA SELECTIVITE**

7. En introduction au workshop, les deux premiers exposés présentent à partir des premiers résultats d'enquêtes effectuées auprès des partenaires du réseau de technologistes méditerranéens les principales caractéristiques techniques des différents métiers de chalutage utilisées en Méditerranée et les mesures nationales réglementaires de sélectivité qui les régissent.
8. Au travers de la grande variabilité des caractéristiques présentées des chaluts, on peut distinguer au moins deux stratégies communément répandues autour du bassin méditerranéen : le chalutage des fonds inférieurs à 100 m sans cible particulière et le chalutage de la pente continentale ciblant les crustacés profonds. Des information complémentaires devraient pouvoir permettre de mieux faire apparaître les différences techniques caractérisant ces stratégies (composition des captures, durée et vitesse du trait, etc.) et d'identifier les métiers pour lesquels l'application de la maille carrée présenterait quelques difficultés.
9. Concernant plus particulièrement le cul de chalut, son maillage s'échelonne entre 28 et 46 mm de maille étirée et sa longueur entre 3 et 13m., montrant par ailleurs ainsi la nécessité de mieux définir le terme de cul de chalut. Des informations complémentaires seraient aussi à requérir sur la nature et le diamètre des fils employés pour sa confection.

10. Une discussion sur ce point particulier sera proposée aux différents membres du réseau de technologistes ainsi qu'une modification de la fiche d'enquête sur les caractéristiques techniques.

11. L'examen des différentes législations nationales sur la réglementation de la sélectivité des chaluts montrent en particulier comment celles-ci prennent en compte les particularités de certaines pêcheries. Le débat que cette question souleva a retenu dans ce sens l'aspect positif des dérogations mais aussi de la nécessité de bien en expliquer les fondements scientifiques aux pêcheurs. Il souligne par ailleurs l'obstacle que peuvent poser les problèmes de terminologie à l'harmonisation de la réglementation ainsi d'une nécessaire standardisation des procédures et des instruments de contrôle (par exemple jauge).

12. Concernant la conception des culs de chalut en maille carrée et à leur montage, l'exposé montre qu'il n'existe que très peu d'informations sur la meilleure façon de procéder pour pouvoir conserver le maximum d'efficacité sélective tout en prenant en compte le type de chalut concerné (avec ou sans rallonge, maillage de la partie du chalut sur laquelle doit être montée le cul).

13. La discussion sur le choix du ratio optimal de montage fait également apparaître la nécessité d'adopter une définition standard de celui-ci, pour faciliter tout au moins la comparaison des résultats au sein de la CGPM.

14. Les participants se sont également entendus sur le fait que le coût élevé des nouveaux matériaux utilisés en Nord Atlantique (PE Ultracross) pour la fabrication des panneaux d'échappement contraint la plupart des flottilles méditerranéennes à adapter préférentiellement les nappes de filets habituellement utilisées pour la fabrication des culs de chaluts (PE noué ou PA noué ou sans nœud système Raschel), avec indubitablement des conséquences sur la variabilité de la sélectivité.

REVUE DES ETUDES RECENTES ET EXPERIENCES SUR LA SELECTIVITE DE LA MAILLE CARREE EN MEDITERRANEE

15. Dans la continuité du premier atelier Atselmed, 7 présentations orales ont donné les résultats des études les plus récentes menées en Méditerranée sur la sélectivité des chaluts. Ces recherches font état aussi bien des principales caractéristiques des engins étudiés que des méthodes expérimentales et d'analyse employées. Les résultats avancés ont plus spécifiquement porté sur les effets en termes d'échappement de juvéniles, de réduction de rejets, de pertes économiques, d'impact sur l'écosystème, comparés entre la pêche côtière et la pêche profonde, entre maillage différent, entre maille losange ou carrée, entre fil avec ou sans nœud, ou pour l'utilisation de grille sélective pour les crustacés ou de panneau d'échappement. Les différents exposés ont conduit à chaque fois à un débat ouvert entre les participants sur les différentes questions abordées.

Methodologie

16. La revue des expérimentations réalisées en Méditerranée sur la sélectivité du merlu et du rouget montre que la plupart des études que les courbes de sélectivité sont traditionnellement estimées à partir de l'ensemble des données récoltées de tous les traits pour lesquels les paramètres contrôlés restent inchangés, en modélisant la probabilité de retenue au moyen d'un modèle logistique. Néanmoins, comme le montrent les travaux ici présentés, les études récentes adoptent la méthode de Fryer (1991) d'estimation d'une courbe moyenne de sélectivité à partir des courbes de chaque trait. Les résultats des captures ont été par ailleurs tous ici obtenus par la technique du cul couvert.

17. La grande variabilité des L50 obtenus pour une même espèce attire l'attention de l'assistance sur le rôle que peuvent jouer sur la sélectivité d'autres paramètres techniques, comme la nature et le diamètre des fils et la circonférence du cul de chalut, et l'intérêt primordial de donner le maximum d'informations techniques sur les engins testés et les conditions d'expérimentation afin de faciliter la comparaison entre expérimentations de provenances diverses.

18. A la condition du respect d'une commune et claire terminologie qui reste encore à clarifier pour certains concepts comme la circonférence du cul de chalut; pour celle-ci, l'utilisation du rapport de montage a été proposé comme indice de sa mesure. Par ailleurs pour traiter du caractère multi-spécifique des pêcheries, des outils d'analyse multivariée ont été employées notamment pour mettre en évidence par la composition spécifique des captures, les différences des stratégies de chalutage. Les deux stratégies examinées dans les études présentées correspondent aux situations les plus communément rencontrées : le chalutage des plateaux continentaux et le chalutage des pentes continentales.

Longueur de sélectivité

19. Les valeurs de sélectivité obtenues (L50) pour beaucoup d'espèces capturées, les taux d'échappement comme la réduction de rejets sont significativement plus élevés pour les culs en maille carrée que pour les culs en maille losange.

Réduction des rejets et débris

20. De même la réduction des rejets est significativement plus importante sur les plateaux que sur les pentes continentales. Cette réduction pourrait contribuer à améliorer significativement la qualité des espèces commercialisées.

Perte d'espèces commerciales

21. Selon les expérimentations réalisées aux Baléares et en mer Catalane, les avantages en termes de sélectivité de l'application de cette mesure technique ne conduiraient pas nécessairement à une réduction des rendements en catégories commerciales, à l'exception de quelques espèces de petites tailles comme *Spicara smaris* qui en tant qu'espèce très appréciée constitue une des principales espèces cibles des pêches chalutières côtières de différents secteurs (îles Baléares, Grèce).

22. Les différents résultats présentés confirment globalement que les pertes économiques à court terme en espèces commerciales sont plus faibles pour la pêcherie de la pente continentale (moins 5% de toute la valeur de capture dans les îles Baléares) que pour celle du plateau continental (jusqu'à ~30% de la valeur de la capture totale pour les mêmes secteurs) pour les pêcheries passant de la maille losange de 40 millimètres à la maille carrée de 40 millimètres.

Autres études de sélectivité

23. 2 études entreprises dans les eaux grecques ont été présentées au cours de la réunion sur les gains de sélectivité obtenus par l'application de la maille losange de 40 millimètres pour les culs de chalut.

24. La comparaison en mer de Thrace entre le maillage de 28 millimètres et celui de 40 millimètres démontrent que l'augmentation de la maille mène globalement à une réduction des rejets sans qu'aucune différence ne soit notée dans les débarquements.

25. D'un autre côté, les expériences effectuées en mer Ionienne prouvent que si l'utilisation de la maille de 40 millimètres n'induit pas de pertes significatives en eaux profondes à l'opposé dans les eaux moins profondes, où existent davantage d'espèces de petite taille, la perte économique reste à évaluer. La comparaison dans cette région entre deux types de culs de chalut en maillage étiré de 40 mm, l'un en filet noué, l'autre en filet sans nœud, ne montre aucune différence concernant le L50, pour 12 des 21 espèces pêchées.

26. Au cours de la discussion, les participants ont conclu avec l'intervenant à la nécessité d'examiner au cours des prochaines études l'influence de l'armement du chalut (nombre de mailles de

pourtour, longueur de la rallonge et du cul de chalut, etc.) mais aussi de la nature du fil (PE ou PA). Il a été également rappelé la nécessité de développer davantage d'études de sélectivité sur des effets de l'utilisation de cul en maille carrée.

27. L'application de grilles sélectives (25mm/200mm 30mm/150mm 35mm/200mm) à la pêche chalutière de la mer de Thrace a été aussi examinée montrant les avantages de cette technique pour séparer la langoustine et la crevette des poissons. De plus la sélectivité du merlu par taille peut être obtenue au moyen d'un panneau de guidage pour diriger les captures vers la base de la grille.

28. Pour la pêche chalutière israélienne, un panneau de maille carrée de 50 mm a été testée comme fenêtre supérieure d'échappement à fin de réduire les captures de poissons de juvéniles et de petits pélagiques (anchois), l'orateur a mis en évidence la grande variété d'espèces rencontrées dans les pêcheries chalutières de la Méditerranée orientale, composées de beaucoup de poissons Lessepsiens, qui en raison de la diversité de leurs formes et de leurs tailles conduisent à une grande variabilité entre les traits des pertes en poissons commercialisables et en juvéniles.

Survie après échappement

29. Le premier atelier Atselmed avait déjà mis en évidence l'importance de ce problème et de ses conséquences sur l'estimation de la mortalité par pêche.

30. Peu d'études ont été menées sur ce sujet. Les expériences conduites en mer Egée par une équipe turque ont montré une large variabilité dans la mortalité après échappement des mailles du cul de chalut que cela soit pour une même espèce (ex : le rouget) ou entre espèces différentes (de 0 à 100%). Selon les auteurs, cette étude sera poursuivie par l'analyse des variations saisonnières des taux de survie.

31. Pour plusieurs participants, la survie des poissons échappés des mailles du cul est une question clé déterminante pour l'évaluation du bénéfice réel de l'amélioration de la sélectivité du cul de chalut pour la gestion des stocks et de l'écosystème. Selon eux, si les taux de mortalité des poissons échappés s'avéraient trop élevés, l'application de cette mesure technique devrait être reconsidérée.

Impact sur l'écosystème

32. L'évaluation de l'impact sur l'écosystème de l'application de la maille carrée a été présentée au travers de l'exposé d'un modèle représentant les conditions habituelles de l'écosystème et en tenant compte des résultats récents de sélectivité. Compte tenu des effets directs et indirects de la pêche sur la chaîne alimentaire, l'amélioration de la sélectivité des chaluts pourrait avoir des conséquences notables sur les espèces démersales ciblées et accessoires. Il fut néanmoins souligné la haute incertitude des effets réels de la sélectivité en absence d'information sur la survie des individus après leur échappement.

33. En outre, si les participants ont retenu l'intérêt de tels modèles, notamment dans le cadre d'une approche écosystémique de la gestion des pêches, ils ont cependant souligné au cours de la discussion leur complexité et la nécessité de collecter suffisamment d'informations validées pour pouvoir les rendre opérationnels.

Autres mesures techniques

34. Si pour une approche simple, l'amélioration de la sélectivité semble être plus efficace que la réduction de l'effort, les participants ont reconnu que l'amélioration de la sélectivité n'est pas suffisante pour la reconstruction des espèces et des écosystèmes surexploités ; pour cela d'autres mesures sont généralement nécessaires comme la réduction de l'effort, la fermeture de zone de pêche et les arrêts saisonniers.

APPLICATION DE PANNEAU OU DE CUL EN MAILLE CARRÉE DANS LES PÊCHERIES NORD EUROPÉENNES; DIFFICULTÉS, AVANTAGES POUR LES INDUSTRIES DE LA PÊCHE

35. Il n'y a pas à ce jour beaucoup d'information disponible sur l'application de cul de chalut en maille carrée dans les pêcheries nord européennes ; selon Madsen et Al (1999), le cul complètement en maille carrée a été rapidement abandonné au profit de fenêtre supérieure d'échappement faite d'un panneau de maille carrée. Les auteurs précisent que " cette disposition évite l'usure des mailles carrées inférieures... et nécessite moins de fabrication de maille carrée ce qui est également un paramètre important compte tenu du coût élevé de leur fabrication ». L'utilisation de fenêtres supérieures est désormais préconisée dans la législation de l'EU.

36. A l'opposé, beaucoup d'exemples peuvent être facilement trouvés dans la littérature sur l'application de panneaux en maille carrée dans les pêcheries nord européennes ainsi que sur l'utilisation de grilles sélectives.

ÉVALUATION DES CONSÉQUENCES A MOYEN ET LONG TERMES DE L'APPLICATION DE LA MAILLE CARRÉE DE 40 MILLIMÈTRES AUX CHALUTS DE FOND MÉDITERRANÉENS ; REVUE DES MÉTHODES D'ANALYSE (LOGICIEL, ETC...)

37. L'étude de l'amélioration de la pêche française de la langoustine (*Nephrops norvegicus*) au chalut du Golfe de Gascogne a été donnée comme exemple d'une approche intégrée pour l'évaluation des conséquences biologiques et économiques de plusieurs scénarios de mesures de sélectivité. "Ces scénarios consistent à changer le facteur de sélectivité menant à une amélioration du modèle d'exploitation de la langoustine. Ces améliorations pourraient être réalisées dans la pratique par l'adoption de dispositifs de sélectivité ou l'augmentation de la maille ". Ici la simulation utilise le facteur de sélectivité qui a été obtenu à partir de l'étude menée par Ifremer sur les grilles sélectives pour cette pêcherie. De plus, selon les objectifs de cette étude, l'accroissement de la sélectivité pour *Nephrops* est supposé ne pas affecter la capture des autres espèces commercialisables. De plus, en accord avec les objectifs de cette étude on a supposé que l'augmentation de la sélectivité pour *Nephrops* n'affecte pas la capture des autres espèces commercialisables.

38. Selon les résultats de la simulation, la réduction des rejets de langoustines de non valeur marchande (aussi bien que des juvéniles de merlu) serait bénéfique à la pêcherie sans nécessairement conduire à une valeur négative du revenu net. Cet avantage devra cependant être vérifié avec les résultats d'observations à effectuer sur les navires de pêche et pourrait par ailleurs être en partie limité si le taux de survie pour *Nephrops* était inférieur à 30% et si la perte d'autres espèces commercialisables (par exemple le merlu) était effectivement prise en considération comme cela l'a été précisé pendant la discussion.

39. En outre, comme cela l'a été souligné dans cette présentation, les mesures de sélectivité restent toutefois insuffisantes pour assurer le rétablissement des stocks et la limitation de l'effort de pêche reste indispensable par une régulation de l'accès à la pêche.

40. La présentation suivante a démontré la possibilité d'utiliser le modèle MEFISTO 3 réalisé par l'équipe du projet Bemfish pour effectuer l'analyse bio-économique des changements de sélectivité dus à l'application de différentes options techniques (l'augmentation du maillage de la maille losange de 40 à 50 puis à 60 millimètres, ou le changement de la maille losange de 40 millimètres en maille carrée de 40 millimètres) dans la pêcherie partagée de merlu du Golfe du lion.

41. Pour cette étude de cas les différentes simulations montrent une période initiale de pertes dues à la diminution des captures, mais suivie d'une augmentation des captures et des bénéfices. Cependant,

comme l'intervenant le faisait remarquer aux participants les résultats peuvent être différents selon la pêcherie; de plus, le modèle ne nécessite que des modifications mineures pour être complètement adapté à la simulation de tous les effets de changements de sélectivité.

42. Pendant la discussion plusieurs interventions ont précisé la nécessité d'inclure également dans le modèle les taux de survie. Sur la question des mesures techniques les plus efficaces (réduction de l'effort, changement de forme de maille ou augmentation du maillage de la maille losange) il a été admis que le résultat dépend des espèces et par conséquent des objectifs de gestion choisis pour l'unité opérationnelle considérée. Comme cela a été demandé le modèle nécessite d'être alimenté par des observations de terrain adéquates dans le but de pouvoir fournir des résultats de simulation satisfaisants.

Approche multidisciplinaire et programme stratégique pour le suivi de l'exécution progressive de la maille carrée de 40 millimètres.

43. Le succès de l'application d'une mesure technique dans une pêcherie nécessite d'adopter une approche pluridisciplinaire qui doit tenir compte de toutes les conséquences que cette mesure peut avoir d'une part sur l'écosystème, sur les populations de poissons et d'autre part sur les caractéristiques techniques et l'économie de l'exploitation.

44. Cette approche est actuellement utilisée généralement pour plusieurs plans de gestion comprenant l'application de mesures techniques réglementaires.

45. Dans ce but les participants ont été invités à construire des tableaux présentant séparément les conséquences potentielles pour les aspects biologiques, techniques et économiques (voir Annexe F). Chaque tableau a été ensuite commenté et discuté entre les participants.

Conséquences biologiques

46. Le tableau qui a été présenté sur des conséquences biologiques par le groupe de biologistes a apporté quelques informations sur des résultats espérés par l'application de cul en maille carrée. Ce point a amené quelques commentaires sur le fait que les résultats prévus ne seront pas nécessairement positifs pour toutes les espèces ; pour certains d'entre elles les captures pourraient en être réduites même à long terme.

Conséquences économiques

47. Le tableau résumant les conséquences économiques potentielles ont donné quelques courts longues et termes effets possibles sur les caractéristiques socio-économiques de l'exploitation incluant des effets sur les prix, les coûts d'engin de pêche et de maintenance et l'acceptabilité par le secteur de la pêche.

48. En outre, l'équipe d'économiste de l'atelier a proposé un cadre pour l'analyse économique du changement de maille pour n'importe quelle pêcherie de chalut. Les différentes étapes pour aborder cette question sont décrites avec les possibilités d'effectuer des études spécifiques.

49. Pendant la discussion on a considéré l'intérêt d'inclure quelques résultats de la simulation développée avec MEFISTO pour le Golfe du Lion et suggéré d'estimer le coût de l'application en priorité par le coût des modifications de l'engin de pêche. Enfin, l'importance de compiler des indicateurs économiques a été fortement réaffirmée.

Conséquences technologiques

50. Le tableau synoptique sur les conséquences technologiques décrit brièvement le maximum de changements techniques possibles qui peuvent affecter à courts ou longs termes aussi bien la conception des engins de pêche que la stratégie de la flottille. Il a été proposé d'ajouter l'effet sur la consommation de carburant et précisé que la standardisation de la terminologie n'est pas uniquement spécifique au problème de la maille carrée mais doit être inclus dans les conclusions de la réunion.

SYNTHESE DES DISCUSSIONS

51. Tout le long de la réunion les discussions ont été régies par la question de savoir s'il y a suffisamment d'informations disponibles sur les aspects positifs de l'application du cul en maille carrée à opposer à ses lacunes et ses inconvénients. Ceci en particulier étant mené par le souci d'obtenir les meilleures conditions d'acceptabilité de cette mesure par les pêcheurs et d'assurer ainsi le succès de son application à l'ensemble de la pêche chalutière méditerranéenne.

52. Au vu des résultats obtenus par les différentes études présentées, les participants ont été d'accord pour reconnaître l'aspect positif de l'utilisation du cul en maille carrée de 40mm, sur la sélectivité du chalutage de fond, pour la majeure partie des espèces étudiées et l'écosystème environnant. Néanmoins, il a été objecté que par des taux de survie trop faible, l'avantage à long terme pour la biologie de ces espèces pourrait être probablement remis en cause et en conséquence l'efficacité de cette mesure.

53. Sur les possibilités d'appliquer (dès que possible?) cette mesure, la réponse commune des scientifiques qui avaient effectué des expériences sur les culs en maille carrée, a été que si sur la pente continentale il y avait peu d'inconvénients par contre, dans d'autres secteurs, (par exemple dans les eaux peu profondes, le delta de l'Ebre), et pour certaines espèces (par exemple, *Spicara smaris*) cela pourrait être différent et plus difficile ; auquel cas, il était répondu que d'autres mesures seraient certainement mieux appropriées pour ces situations (par exemple la fermeture de zones de pêche et les arrêts saisonniers).

54. D'une manière générale, le peu de cas connus d'application de cul en maille carrée et le faible nombre de régions méditerranéennes concernées par les études de ce dispositif, justifient pour quelques uns des participants l'approche progressive recommandée par la CGPM et la nécessité de faire plus d'expérimentation pour évaluer toutes les conséquences de l'application de cette mesure. Ces arguments ont été cependant contestés par d'autres qui, inquiets de la forte augmentation de l'effort et de l'efficacité de pêche pensent que cette amélioration de la sélectivité doit être mise en application dès que possible, affirmant que c'est à chaque pays a la possibilité de (doit ?) faire la démonstration que cette mesure de sélectivité n'est pas applicable pour sa région.

SUIVI DES RECOMMANDATIONS DU PREMIER ATELIER DE SÉLECTIVITÉ (RÉUNION D'ATSELMED, SÈTE, FRANCE, MAI 2005)

Création d'un réseau de technologistes des pêches incluant l'industrie de la pêche.

55. Rappelant les recommandations de la trentième réunion de GFCM (Istanbul, 24-27 janvier 2006) de favoriser l'établissement d'un réseau des technologistes méditerranéens, incluant le secteur de l'industrie de la pêche, Jacques Sacchi a présenté l'avancement de cette tâche.

56. Actuellement, 66 scientifiques méditerranéens de 10 pays ont répondu favorablement à l'invitation de participer à ce réseau. Il a été rappelé que le premier but de ce réseau est d'aider le SAC dans ses recommandations sur la gestion des pêches sur les aspects traitant de la technologie des pêches (technologie des engins de pêche, sélectivité, impacts sur l'environnement des engins de pêche, effets sur l'effort et la capacité de pêche, économie de carburant, conception de navire et aménagement

des ponts de pêche, sécurité) ; ce réseau est par conséquent ouvert à tous les chercheurs et experts impliqués par leurs travaux dans un de ces domaines. Il a été proposé que ce réseau soit pour ses membres une possibilité d'échanger des expériences de terrain et de l'information par l'intermédiaire d'un forum d'email et puisse être chargé de l'organisation de groupe de travail sur une question de technologie de pêche à demande du SAC de la CGPM. Ses rapports et ses différents travaux devront être en outre édités sur le site internet de la CGPM.

57. Au sujet de la participation de l'industrie de la pêche aux travaux de ce réseau, il a été entendu de limiter celle-ci dans un premier temps aux fabricants de filets; la participation d'autres experts (comme par exemple celle de fabricants de moteur) pouvant être à l'occasion requise pour un point particulier. En conséquence, il a été suggéré que chaque partenaire du réseau propose le nom et l'adresse de quelques fabricants de filet de leur pays à ajouter à la liste email du réseau.

Création d'une base de données de sélectivité

58. Antonello Sala a présenté brièvement l'avancement de cette tâche rappelant l'importance de documenter et de vérifier chacun des paramètres techniques des différentes expériences de sélectivité et a ouvert la discussion sur le choix du meilleur format (logiciel de base de données ou table excel). Considérant que ce document doit être facilement accessible à la communauté scientifique, il a été décidé de compiler dans un premier temps les données dans un simple tableau de type Excel sur le site Web de la CGPM, en utilisant le format convenu à la 8ème session du SAC.

59. En outre, il a été proposé d'étendre cette base à la sélectivité des engins statiques; dans ce but, un format spécifique sera soumis à l'approbation du réseau.

Élaboration d'un guide pratique pour l'étude de sélectivité

60. Il a été noté que ce sujet n'a pas progressé. Il est rappelé que le but ici n'est pas de réaliser un nouveau manuel sur la sélectivité, comme celui édité par le CIEM (Wileman et Al, 1996) mais un simple manuel donnant les directives pratiques avec l'appui d'illustrations sur la meilleure façon d'effectuer des expériences de sélectivité.

61. Cette tâche reste encore à accomplir et pourrait être également étendue à la sélectivité des engins statiques.

DIFFUSION

62. L'importance de fournir le maximum d'informations sur les résultats de cette réunion à l'industrie de la pêche a été rappelée, pour une meilleure implication de ce secteur dans l'application de cette mesure de gestion. Dans ce but, la proposition faite à Sète d'organiser une réunion d'information avec l'organisation principale de pêcheurs (MEDISAMAK) a été reconduite.

63. D'autre part, Antonello Sala a informé les participants de la tenue d'un groupe thématique sur les questions technologiques concernant la Méditerranée au sein de la réunion du groupe de travail FTFB du CIEM à Dublin (23 au 27 avril, 2007) avec Antonella Sala, Jacques Sacchi et Enric Massuti en tant que conveneurs. Les résultats des 2 ateliers Atselmed seront présentés au cours de la session ouverte de cette réunion avec 4 présentations de travaux de recherche méditerranéens.

64. Enfin, il a été proposé que toutes les présentations effectuées au cours de cette réunion soient éditées sur le site internet de la CGPM.

CONCLUSION

65. Après une discussion ouverte entre les participants les points suivants ont été adoptés comme conclusion :

- a. L'Atelier confirme la nécessité de normaliser la terminologie des engins de pêche méditerranéens : un glossaire et un catalogue sont nécessaires.
- b. On a considéré que les études de sélectivité exigent une approche multidisciplinaire, intégrant technologues, biologistes et économistes.
- c. Il est nécessaire de développer un protocole pour la standardisation des études de sélectivité, tenant compte de la réunion ATSELMED-1 et des conclusions de l'Atelier actuel, y compris les aspects technologiques, biologiques, écosystémiques et économiques. La participation de l'industrie de la pêche (particulièrement des fabricants d'engins de pêche) est également recommandée.
- d. Il est nécessaire également de pouvoir suivre l'application du cul en maille carrée de 40 millimètres, en tenant compte des aspects technologique, biologique, écosystémique et socio-économique.
- e. En plus du suivi de l'application du cul de chalut en maille carrée de maille de 40 millimètres, l'Atelier suggère d'entreprendre des recherches sur :
 - effet sur les rejets.
 - survie des individus échappés (l'évaluation de la mortalité non comptée).
 - effet du type de filet et du montage.
 - analyse des effets économiques.
 - autres analyses et comparaison des effets sur l'écosystème.
- f. L'Atelier a précisé que la connaissance de la survie après échappement en Méditerranée devrait être fortement améliorée et souligné la nécessité d'établir une méthodologie appropriée pour aborder cette question.
- g. L'Atelier a considéré que l'application du cul en maille carrée de 40 millimètres aura des effets généralement positifs pour la majorité des espèces étudiées. D'un point de vue biologique, l'Atelier appuie sur le fait que le cul de chalut en maille carrée de 40 millimètres devrait être mise en application dès que possible.
- h. L'Atelier a déclaré que l'application de la maille carrée de 40 millimètres est considérée insuffisante pour la récupération des espèces et des écosystèmes fortement exploités. Des mesures additionnelles seront également exigées.
- i. L'information disponible sur l'effet de l'application du cul en maille carrée de 40 millimètres ne couvre pas toute la Méditerranée. L'Atelier a encouragé le développement d'études de sélectivité dans plus de GSA de la CGPM.

FIN DE LA REUNION

66. Les divers points de l'ordre du jour ayant été traités, Abdellah Srouf a remercié Francisco Sarda et le CICS de l'organisation de cet atelier et les participants de la qualité de leur participation.

Agenda of the workshop

1. Opening and arrangements of the workshop
2. Review of main national trawling fisheries with a particular attention to gear characteristics and selectivity regulations
3. Review on recent studies and experience on square mesh selectivity in the Mediterranean Sea
4. Application of square mesh panel or codend to the North European fisheries: difficulties and benefits for the fishing industries
5. Evaluation of medium- and long-term consequences of the application of 40 mm square mesh to the Mediterranean bottom trawls: Review on methods of analysis
6. Multidisciplinary approach and strategic program for the follow-up of the gradual implementation of the 40 mm square mesh
7. Synthesis of the discussions
8. Follow-up of the recommendations of the first selectivity workshop (Sète, France, May 2005)
9. Dissemination of the works
10. Conclusions
11. Adoption of the Report and closure of meeting

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**GFCM Resolution and Recommendation
from Report of the 31st Session of the GFCM**

**RESOLUTION GFCM/31/2007/3
40 mm SQUARE MESH SIZE IN CODEND OF TRAWL NETS
EXPLOITING DEMERSAL RESOURCES**

The General Fisheries Commission for the Mediterranean (GFCM),

RECALLING that the objectives of the Agreement establishing the General Fisheries Commission for the Mediterranean are to promote the development, conservation, rational management and proper utilization of living marine resources;

RECALLING Recommendation GFCM/29/2005/1 on the management of certain fisheries exploiting demersal and deepwater species and, notably, Article 1 therein;

REAFFIRMING its commitment to further improve the selectivity of demersal trawl fisheries beyond that which is permitted by the 40 mm diamond mesh size with the view to ensure a better protection of juveniles of several species as well as to reduce discarding practices in a multispecies context;

CONSIDERING the advice on several demersal stocks given at the ninth session of the Scientific Advisory Committee (SAC);

RECOGNIZING that from a socio-economic point of view, and unless otherwise requested by conservation needs, it is necessary to ensure gradual changes in the exploitation pattern of fisheries;

TAKING into account the need to assess the possible short and long-term socio-economic impact of the change in mesh size;

ADOPTS that:

1. Members of GFCM implement on a voluntary basis at least the 40 mm square mesh codend in bottom trawling.
2. Experimental selectivity trials with 40 mm square mesh codend trawl nets are undertaken particularly in those Geographical Sub-Areas (GSAs) where such information is not yet available and Members consider advisable to acquire it before any possible implementation.
3. SAC shall evaluate the results of such trials, including the short and long-term impact, at the latest by 2010 and shall advise accordingly.

RECOMMENDATION GFCM/31/2007/1

ON THE MESH SIZE OF TRAWL NETS EXPLOITING DEMERSAL RESOURCES

The General Fisheries Commission for the Mediterranean (GFCM),

RECALLING that the objectives of the Agreement establishing the General Fisheries Commission for the Mediterranean are to promote the development, conservation, rational management and proper utilization of living marine resources;

RECALLING Recommendation GFCM/29/2005/1 on the management of certain fisheries exploiting demersal and deepwater species and, notably, Article 1 therein;

REAFFIRMING its commitment to further improve the selectivity of demersal trawl fisheries beyond that which is permitted by the 40 mm diamond mesh size with the view to ensure a better protection of juveniles of several species as well as to reduce discarding practices in a multispecies context;

NOTING that the wide diversity of fishing fleets and gear used in the zone under the competence of the Commission makes it essential to establish a general regulatory framework that permits the formulation and application of national regulations adapted to individual cases, in an effort to achieve the maximum effectiveness of sustainable management of living marine resources;

NOTING that some local and seasonal trawl fisheries exploiting not-shared demersal stocks in coastal areas may need some more time to adjust to the diamond mesh size of 40 mm;

RECOGNIZING that from a socio-economic point of view it is necessary to avoid immediate disruption of those local and seasonal fisheries while ensuring their gradual phasing out;

ADOPTS in conformity with the provision of paragraph 1 (b) and (h) of Article III and Article V of the GFCM Agreement that:

1. By way of derogation from Article 1 of Recommendation GFCM/29/2005/1 establishing the immediate implementation of at least a 40 mm diamond mesh size for the whole codend of demersal trawlers, the Members of GFCM may continue authorizing, until 31 May 2010 only, the use of codend mesh size smaller than 40 mm to operate in certain local and seasonal demersal trawl fisheries exploiting not-shared demersal stocks.
2. The derogation referred to in Article 1 above shall apply only to fishing activities already formally authorized by the GFCM Members and shall not involve any future increase in fishing effort provided.
3. A list of authorized fishing vessels involved in the fisheries, referred to in paragraph 1, and their characteristics together with the indication of the exploited resources and mesh size characteristics shall be communicated to the Secretariat at least two months before the next 32nd Session of the GFCM.

Terms of Reference of the Workshop

The Workshop will focus on the following subjects:

- Review of main Mediterranean trawling métiers with a particular attention to the gear characteristics and their national selectivity regulations
- Review of application of square mesh panel or codend to European fisheries; difficulties, benefits for the fishing industries
- Presentation on recent studies on square mesh codend selectivity in Mediterranean sea and their application to the fisheries
- Review on square mesh selectivity and on different process to build and fix square mesh panels or cod-end to a bottom trawl
- Consequences of the application of 40 mm square mesh to Mediterranean bottom trawl
 - Analysis of technological consequences (fuel and time saving, change in fishing practices and strategy, fishing gear, effect on effort, catch quality)
 - Analysis of biological consequences (change in species and size composition, discards, by catch, catch of protected species, etc.)
 - Analysis of socio-economical consequences (effects on prices, costs and profitability of technical and biological consequences)
 - Setting of a strategic program for the follow-up of the gradual implementation of the 40 mm square mesh.
- Follow up of the recommendations of the first selectivity workshop (Atselmed meeting Sète, France, May 2005):
 - Setting of a fishing gear technologist network; organisation, website, participation of the fishing industry
 - Setting of selectivity database
 - Drawing up of a practical guide for selectivity study

Abstracts

1. Jacques Sacchi.- Overview on main technical characteristics of Mediterranean trawl related to their selectivity

This provisory review of various type of bottom trawls used by the different Mediterranean fleets was made from UE/SGMED workshop (2005) and completed by several Mediterranean scientists. These collected data are partial but can help for a better understanding of the difficulties which could be encountered with the implementation of full square mesh codend. They are generally designed more according to the practice than to a specific species. However 2 main categories can be recognized Mediterranean and “Atlantic” shapes. The first ones are generally made of a top face more larger than the bottom one and have low vertical opening, essentially using sweep and sometimes small bridles. The second ones have generally a more large vertical opening and thanks sometimes to the addition of lateral panel; In few cases larger lateral panel and fork rig are used to obtain higher vertical opening for the catch of midwater fishes. The most of Mediterranean trawls are made by the fishermen themselves using only basic rules of cutting and mounting; while Atlantic trawls are made following more advanced rules and drawing designs: The headline length is between 20.7 to 70 m with a ratio between headline and groundline around 0.80. Stretched mesh sizes for the codend are between 28 and 46 mm. The variability of the data for the codend length is essentially due to the misunderstanding of definition of codend and extension piece. These definition and more generally terminology for describing trawl net and rig have to be standardized for a common interest.

2. Alessandro Lucchetti & Antonello Sala.- Synopsis on Mediterranean legislation

The present document concerns a comparative study of fisheries laws and regulations covering the entire Mediterranean basin and focuses one main issue: the Mediterranean technical measures on fishing gears. During the last years, the technical aspects of legislation on fishing gears have become an important issue, mainly on the light of the new EC Reg. 1967/06 which have replaced the EC Reg. 1626/94. The new Regulation have changed many rules on fishing gears compared to the previous one, so it is important to define a common point of view on the new situation. The EC Reg. 1967/06 implements some technical parameters very important for the selectivity such as the mesh configuration (square mesh codend) and the twine diameter of towed net and gillnet. Nevertheless it is possible to raise a few considerations. The document underlines some possible problems, lacks or misunderstandings with new EC Reg. 1967/06. Furthermore it compares national legislations of EU and non-EU countries at the aim of finding possible alternative solutions; in fact comparing the National legislations could be useful to verify how the different countries have tackled similar problems. Thus the document intends to open a dialog between fishing gears technologist on the technical aspects of fishing gears to be considered important to manage the marine resources in different countries of the same basin. The goal of the document is to outline the technical issues we need to investigate in the future and the possible purposes we can suggest to fishery managers for a possible standardization of technical and management measures in Mediterranean sea.

3. Jacques Sacchi & Serge Mortreux.- Main process and difficulties to build and fix square mesh cod-end to a bottom trawl.

The implementation of square mesh codend to the whole Mediterranean trawling fleet needs to have in first common and good understanding of what is a square mesh and what are the different parts of a trawls which can be concerned by this selective device. The reminder of some general characteristics of a trawl and netting show that for several Mediterranean trawls there are important differences with the general design and the looseness of some definitions - as for the codend – can bring risks of misunderstanding and must be avoided. Knotted or knotless netting can be used as square meshed netting on the condition that that of the two sets of parallel lines formed by the mesh bars, one set is

parallel to and the other at right angles to the long axis of the net. “Ultracross” knotless netting offer the best mesh opening configuration and keep a good stability to the square shape but is too expansive for artisanal fleets. Knotted netting is the most common material used for the construction of the codend but badly keep the square mesh configuration and need specific procedures of mounting for reducing this drawback. Other types of knotless netting (“Raschel”) should be tested. Literature is poorly documented on description on the mounting process. For getting the maximum mesh opening, several ways of lacing are possible but the choice of optimal joining or mounting ratio between the square mesh netting and the diamond mesh netting must be respected. Standardized definition is also needed nevertheless according the EU regulation the ratio between the circumferences of the codend and of the nearest part of the trawl must be from 25 to 50% .

4. Sala Antonello, Lucchetti Alessandro, De Carlo Francesco, Palumbo Vito. - Critical review of selectivity studies for *Mullus barbatus* (Red mullet) and *Merluccius merluccius* (European hake) in Mediterranean trawl fisheries

Given the importance of hake (*Merluccius merluccius*) and red mullet (*Mullus barbatus*) in the Mediterranean bottom trawl fisheries, the relationship between mesh size, L50, SR and SF was reviewed in this paper with the contributions of several scientists, with the main objective to estimate reference selection for different codend mesh size.

Considering that the real processes are more complex, several Mediterranean fisheries scientists started to explore effects of other parameters (e.g. mesh size, mesh configuration, twine diameter, mounting ratio, etc.) on codend selectivity. This study presents an updated literature review of the Mediterranean bottom trawl selectivity, discusses and summarises the data and the work presented in several papers/reports. Advises on the experimental methodology and data analysis are provided for a better estimation of selection parameters.

The review of the literature was undertaken during 2006 and further technical information on the gear characteristics were subsequently obtained contacting by correspondence the authors. The scarcity of review papers demonstrated the need for this review. In particular, between 1969 and 2007, only 20 and 28 relevant papers were found respectively for red mullet and hake, while only few for other demersal species. Updating of published literature is on going for these 2 species and needs to be extended to other main commercial species.

5. Enric Massutí, Francesc Ordines and Beatriz Guijarro. Diamond vs. square mesh codend in the multi-species trawl shelf fishery of the Balearic Islands (Western Mediterranean): effects on catch composition, yield, size selectivity and discards

Using data from 24 hauls carried out under commercial conditions on the continental shelf off the Balearic Islands, the selectivity of the traditional 40 mm diamond mesh codend was compared with an experimental 40 mm square mesh codend. To deal with the multi-species characteristic of this fishery, multi-variant statistical tools were applied. Bathymetric differences in catch composition confirmed the existence of two different fishing strategies: one on the shallow shelf (SS, 50-80 m depth) and another on the deep shelf (DS, 150-200 m depth). In terms of biomass, the catch composition was significantly different between mesh shapes only on the SS, due to a reduction of the yields of *Spicara smaris* when the square mesh was used. No other differences attributable to mesh shape were found in commercial yields for any other target species. A clear increase of L50 was detected for most species when using square mesh, allowing many more individuals under their minimum landing size to escape. Escapement ratio and economic loss were always significantly higher with square as opposed to diamond mesh, although economic loss was almost negligible for both meshes on the DS. Significant discard reductions were detected with square mesh due to algae and fish on the SS and DS, respectively. The reduction in the discards increased the economic efficiency of square mesh, which was higher than diamond mesh on the SS, whereas no differences were detected on the DS. These results confirm that square mesh codends would help to reduce the fishing pressure on small specimens and reduce the impact of trawling on the ecosystem. The benefits would not lead to a reduction of the yields for commercial categories, except for *S. smaris*. A species very appreciated in the study area, where it is one of the main target species for the coastal trawl fishery.

6. Adamidou Angeliki, Argyris Kallianiotis. - Greek bottom trawl fishery: effects of the change in cod-end mesh size on mean length and discards . Use of sorting grids.

The technical characteristics of the traditional Greek bottom trawl net are given in detail. Some biological consequences of the application of 40 mm (full mesh, FM) meshsize to commercial bottom trawl codend in the Thracian Sea are also cited. A comparison in the commercial trawl catch between the 40mm FM and the 28 mm FM codend in the Thracian Sea showed that the use of 40mm codend caused a reduction in the total catch and in the total discarded catch while the total landings remained constant. For the species caught in both codends, mean total length (TL_{mean}) and length at which 50% of the individuals of a species is discarded (L_{50}), were calculated for each codend. It was shown that TL_{mean} and L_{50} in the 40mm codend were greater than TL_{mean} and L_{50} in the 28mm codend.

Results from experiments using sorting grids in Greek bottom trawl fisheries for species and size selection in the northern Aegean Sea are also given. Three primary grids were used: 25mm bar space / 200mm lower gap (A), 30mm bar space / 150mm lower gap (B) and 35mm bar space / 200 mm lower gap (C). The results showed that fish avoid the grid, leading to the upper codend, while the Norway lobster (*Nephrops norvegicus*) pass through the gap and the bars of the grid, directing to the lower codend. The percentage of the Norway lobster that remains in the lower codend were 73.7% in grid A, 73.3% in grid B and 83.2% in grid C. The mean carapace length of the Norway lobster was statistically different (*I-way ANOVA* test, $p < 0.05$) between the upper and the lower codend. The shrimp (*Parapenaeus longirostris*) percentage remaining in the lower codend for each grid were: 51.4% in grid A, 48.1% in grid B and 70% in grid C. The selection refers to the number of individuals that direct to the lower codend and not the size classes of the shrimp. Differences in the mean carapace length found between the two codends in every tested grid, were not important in terms of selection. The hake (*Merluccius merluccius*) swim in the upper part of the extension and try to avoid the grid, passing through the frame and lead to the upper cod end. The percentage of hake that remains in the upper cod end was: 62.1% in grid A, 72.2% in grid B and 51% in grid C. The application of sorting grid into the Aegean Sea trawl fisheries has shown that substantial proportions of Norway lobster and shrimp can be separated from fish, while size selection takes place with hake when a guiding panel is used to deflect the catch to the base of the grid.

7. Oren Sonin.- Studies on square mesh panel selectivity and on the escaping fish out of the selective trawl done in Israel.

The Israeli trawlers operate mainly bottom trawl and very seldom semi-pelagic trawl. It is a multi species fishery by definition. More than 170 species of fish, cephalopods, other molluscs and crustaceans were recorded in the Israeli trawl fishery throughout the past 10 years, some of them are Lessepsian migrants that become very important commercially for the Israeli fishery. Lessepsian migrants can exceed as much as 40% of commercial catch number. Those new species varies the diverted body shapes and sizes of fish that could already be fined in the Israeli trawl fishery. Therefore, East Mediterranean trawl fishery can serve as an utmost example for a multi species fishery. There are only two components in Israeli trawl fishery - commercial catches and discards- and consequently no-bycatch. Discards in the Israeli trawl fishery vary along the year and can reach as much as 90% of the commercial catch (numeral) sometimes in the summer months, right after the fingerlings are been recruited into the trawl nets.

Trawl selectivity studies had started in Israel at 1998, with trials of a small 50 mm square mesh panel connected to the first third of a 10 meter cod-end. The panel measurements were 50x50 centimetres. Experiments are conducted on-board commercial trawlers. A collecting net was designed to re-capture the escaping fish. A comparison between escaping and non-escaping fish is still being analysed; some of the raw data is presented in this paper. First analyses of the data collected until now suggest that as much as 35% of non-commercial fish can escape from the selective panel, while as much as 7% of commercial fish. Those first results suggest that a smaller mesh size, could be used to favour the escapement of non-commercial fish from the trawls cod-ends.

A pilot experimentation was made also to find out the survivability of the escaping fish . This experiment has involved the participation of 1 trawler, 2 boats, 17 crew men, including 12 divers and tested technically possibilities of moving the escaping fish from the collecting net into a cage, without causing more stress to the already very stress escapees. Therefore all the operation was done under the

water. A movie was also made to take underwater pictures of the escaping fish. A larger scale experiment on fish mortality after escaping the selective device was not made due to budget deficiency. The survivability is very critical issue and can have biological, technological and economic consequences. While deciding on the implementation of the 40 mm square mesh cod-end we assume that the fish escaping the net, do survive. It could be that mortality rate of escaping fish from 40 mm square mesh is so high, that the implementation of 40 mm square mesh cod-end should be reconsider. There is not enough data regarding survivability of escaping fish in a multi species fishery. A frame work for the examination of the survivability of the escaping fish from 40 mm square mesh cod-ends must be prepared as soon as possible.

8. Chilari Anna, Petrakis George, Kavadas Stefanos, Holst Rene. Selectivity trails with 40 mm knotted and 40 mm knotless cod end in Ionian Sea.

Selectivity experiments took place in the Eastern Ionian Sea during September 2003 and July 2004 in order to estimate the selectivity of two types of bottom trawl codend, knotted and knotless, with 40 mm mesh size (stretched). The covered cod end technique with hoops, was used. The mesh size of the cover was 20 mm. Four depth zones were defined for the analysis of data: 0-49 m, 50-99 m, 100-199 m and > 200 m. The ratios of escapees to retained (E/R) were 0.8, 1, 0.7 and 0.1 by weight and 2.1, 1.5, 1.4 and 0.4 by number for each zone, respectively. For hake, the ratio E/R, by weight, was generally low (< 0.1), whereas by number, was 0.3 in the 100-200 m depth zone and 0.7 in the >200 m depth zone. For red mullet, the ratio E/R by weight was 1.3 in shallow waters (where there is aggregation of juveniles), 0.5 in 50-100 m and 0.2 in deeper waters. The ratio E/R by number was 2.8 in shallow waters, 0.9 in 50-100 m and 0.5 in deeper waters. Selectivity parameters were estimated for 21 species (16 fish species, 4 cephalopods and 1 decapod). Regarding the estimated L_{50} , for 12 species there were no differences between the two cod ends, whereas for other nine species higher values of L_{50} were estimated for the knotted cod end.

9. Nixon Bahamon, Francesc Sardà, Petri Suuronen - Improvement of trawl selectivity in the NW Mediterranean demersal fishery by using a 40mm square mesh codend

Commercial fishing trials with 40mm diamond (DM40) and square (SM40) mesh codends made of 5mm diameter knotted PE-netting were conducted in July 2005 on the continental shelf (~100 m) and upper slope (~400 m) of the Catalan Sea (NW Mediterranean) to assess the size selectivity of European hake (*Merluccius merluccius*), Norway lobster (*Nephrops norvegicus*), poor cod (*Trisopterus minutus*) and greater forkbeard (*Phycis blennoides*) in the demersal multi-species trawl fishery. In total, 28 tows were done using the standard covered codend method. For all four species, the SM40 showed a significantly higher mean selection length (L_{50}) than the DM40. For hake the L_{50} was 16.0 cm in SM40 and 10.1 cm in DM40; the corresponding figures were 13.0 cm versus 9.2 cm for poor cod and 14.9 cm versus 9.8 cm for greater forkbeard. For Norway lobster, DM40 did not show any size-selectivity whereas SM40 produced a L_{50} of 22 mm. The selection range (SR) between DM40 and SM40 was not significantly ($p > 0.05$) different for any of the three fish species. Our trials indicate that substantial improvement in size-selectivity for these commercially important species is achieved by switching from the conventional 40mm diamond mesh codend to a 40mm square mesh codend. Our analysis also suggests that by using a 40mm square mesh codend the short-term economic losses of commercial species, compared to the losses of 40mm diamond mesh codend, will be low in the slope fishery (less than ~5% of the total catch value), whereas in the continental shelf losses could be up to ~30% of the total catch value.

10. Marta Coll, Nixon Bahamon, Francesc Sardà, Isabel Palomera, Sergi Tudela, Petri Suuronen. - Ecosystem effects of improved trawl selectivity in the South Catalan Sea

Potential ecosystem effects of improved selectivity in the South Catalan Sea demersal trawl fishery with a 40 mm square mesh codend and a 20 mm bar spaced sorting grid was explored with a food web model representing current conditions of the ecosystem and selectivity data from recent fishing experiments. Direct and indirect impacts of fishing were evaluated and allowed insights on the sustainability of various management options for the trawl fishery. This fishery has the biggest fleet in

the area, it is highly multispecies and catches are largely composed by juveniles of target species and non-target species often discarded in large quantities. Temporal dynamic simulations indicated that improvement of trawl selectivity would have noticeable and complex direct and indirect effects on target and non-target demersal species. The biomass and catch of various commercial species (e.g. anglerfish, adult hake) would increase, while that of invertebrates (e.g. suprabenthos, Norway lobster), juveniles and small-sized fish species (e.g. juvenile hake, blue whiting) would decrease due to higher predation mortalities and trophic cascades in the food web. A slight increase of the mean trophic level of the community and of the catch is predicted. Trawling would experience moderate catch decrease while long lining and bait trolling would gain. Including the mortality caused by the escape is shown to be important when assessing the ecosystem effects of improved trawl selectivity. Improving selectivity will not be sufficient to recovery of highly exploited or overexploited demersal species. Greater reduction of fishing effort would be necessary.

11. Macher Claire, Guyader Olivier, Talidec Catherine, Bertignac Michel - A Cost-Benefit Analysis of Improving Trawl Selectivity : The *Nephrops norvegicus* Fishery in the Bay of Biscay .

The mixed Shellfish fishery of *Nephrops* in the Bay of Biscay is characterized by a high level of discards of many species. This generates a waste for the stocks as well as for the fleet. A better exploitation pattern through increased size-selectivity would reduce discards leading to a more sustainable situation with a better valorization of the production potential. The paper analyses the biological and economic consequences of several scenarios of selectivity measures. The potential impacts of these scenarios on *Nephrops* biomass, landings, discards and economic indicators (e.g. rent) are analyzed and a cost-benefit analysis of each scenario is discussed. We show that in this kind of fishery, characterized by a high level of discards of the younger age groups below the minimum landing size, reducing discards does not necessarily lead to a negative net present value of rent over a ten year period of simulation. Reducing discards of non market value *Nephrops* would benefit the fishery as it would increase the yield per recruit. Since *Nephrops* is not a bycatch for other fisheries and is mainly exploited by French trawlers, the fleet targeting *Nephrops* would get the long term gains. By taking into account the consequences of the economic dynamics of increasing effort, we show however, that selectivity measures are insufficient to ensure the fishing recovery of the stock and a better exploitation of the production potential. Regulation of access to the fishery is required.

12. Guillen Jordi. - Bio-Economic Analysis of Selectivity Changes in the Shared Hake Fishery in the Gulf of Lions Using MEFISTO-3 Model

In this presentation are shown the results obtained in the BEMMFISH project by the research teams of ICM-CSIC, IFREMER and GEM-UB for the changes of a mesh size of 40 mm diamond into a 50 mm and 60 mm diamond mesh and a 40 mm square mesh, applying the MEFISTO-3 model. These analyses have shown that there is an initial period of losses due to the decrease in the catch, but it is followed by an increase in the catch and profits. Normally a better selectivity implies that stocks get better, and so, long term socio-economic performance. However, results can be different depending on the operational unit. The results obtained illustrate that the model can be suitable to simulate the effects of changes in the selectivity due to gear changes. However there could be the need of minor changes in the model that allow introducing the survival rates effect in order to reproduce more precisely the effects in the fishery.

13. Tosunoglu Zafer & Aydin Celalettin - Trawl codend mesh selectivity of 50 mm braided PE material for commercially important species in the Aegean Sea

The aim of this study is to estimate the selectivity of 50 mm diamond mesh (braided PE) codend for commercially important species, deep-water rose shrimp (*Parapenaeus longirostris*), hake (*Meluccius merluccius*), horse mackerel (*Trachurus trachurus*), anglerfish (*Lophius piscatorius*) and John Dory (*Zeus faber*) in the Aegean Sea. Fishing trials were carried out on commercial trawler 'Hapuloğlu' between 9 and 12 November 2006. Data were collected by a knotless PE (Raschel) codend of the 1200 mesh trawl net which is used commercially by the fishermen. The mean mesh size of the codend meshes (nominal 46 mm) was measured near to 50 mm by a digital calliper. Selectivity data were

collected by the covered codend method and analysed by means of a logistic equation with the Maximum Likelihood Method. The mean selectivity curves were estimated from the individual hauls was fitted taking into account the between haul variation. The 50% retention length and selection range of rose shrimp were estimated as 19.6 and 6.2 mm carapace length, respectively. These values were also estimated 11.4 cm and 4.1 cm for hake and 15.6 and 5.5 cm for horse mackerel. The alternative (of European Community) 50 mm diamond mesh size of braided PE for Mediterranean showed relatively better selectivity considered to the MLS of the horse mackerel and the first maturity size of the rose shrimp, whereas it shows substantially low selectivity for hake regarding MLS and no selectivity for anglerfish and John Dory. These results showed that dimension of the body shape and behaviour of the fish species play an important role in size selectivity and it is difficult to manage multi-species fisheries based simply on mesh size regulation. For this reason, codend designs (made of this material) such as narrow codend and square mesh ensure better mesh opening in relation to fish body shape during trawling must be investigated immediately.

14. Tokaç Adnan, Özbilgin Hüseyin, Hakan Kaykaç - Selectivity of commercial and square mesh codends in the deep water trawl fishery in the Aegean Sea

A switch from diamond to square mesh codends is considered as a potential measure to reduce the capture of immature fish in the Mediterranean demersal trawling. However, data on the comparison of the selectivity of diamond and square mesh codends is rather limited when the variety of the grounds and multi-species nature of the fisheries are concerned. This study presents the results of a selectivity study where commercially used diamond (DM) and square mesh codends (SM) tested for seven marketable species in the deep waters of the Aegean Sea under an EU funded project (NECESSITY). Both the codends were made of 40 mm nominal mesh size PE material. Experiments were conducted aboard commercial trawler Niyazi Reis (26.2 m LOA, 294KW) between 1st and 15th August 2005 by using covered codend method. Selection parameters were obtained by fitting logistic equation using maximum likelihood method after stacking the data for each codend.

Fifty percent retention lengths (L_{50}) of diamond and square mesh codends, respectively, were found as 16.03 (se. 0.41) and 19.38 (se. 0.51) mm for Norway lobster (*Nephrops norvegicus*), 14.46 (se. 0.14) and 16.24 (se. 0.14) mm for rose shrimp (*Parapeneus longirostris*), 11.14 (se. 0.13) and 13.78 (se. 0.40) cm for hake (*Merluccius merluccius*), 17.11 (se. 0.27) and 19.79 (se. 1.00) cm for blue whiting (*Micromesistius poutosou*), 13.13 (se. 0.12) and 15.12 (se. 0.33) cm for greater forkbeard (*Phycis blennoides*), 8.45 (se. 0.18) and 9.66 (se. 0.35) cm for blackbelly rosefish (*Helicolenus dactylopterus dactylopterus*) and, 10.23 (se. 0.08) and 8.89 (se. 0.09) cm for fourspotted megrim (*Lepidorhombus boscii*).

Results can be summarized as the presently used commercial codend is rather unselective. Square mesh codend improve the selectivity for two crustacean and four fusiform fish species, however the L_{50} is significantly reduced for four spotted megrim, the only flatfish species. Therefore, before square mesh codends applied as a legislation, special attention needs to be paid on the species composition of the fishing ground.

15. Lök Altan, Metin Cengiz, Tokaç Adnan, Özbilgin Hüseyin, Kaykaç Hakan, Ulas Ali, Metin Gülnur, Aydın İlker and Benal Gül - Size selectivity of diamond and square mesh codends for four commercial fish species in the eastern Aegean Sea

Data on the comparison of the selectivity of diamond and square mesh codends is not sufficient when the geographical area and species varieties are concerned in the Mediterranean. Here we present the selectivity of diamond (DM) and square mesh codends (SM) for four marketable fish species in Izmir Bay, Eastern Aegean Sea. Trials were carried out aboard R/V Egesüf (27 m LOA, 463HP) between 18th and 29th July 2005 by using covered codend method. Both the codends were made of 44 mm nominal mesh size PE material. Selection parameters were obtained by fitting logistic equation using maximum likelihood method after stacking the data for each codend.

Fifty percent retention lengths (L_{50}) of diamond and square mesh codends, were found as 12.37 (se. 0.21) and 14.19 (se. 0.09) cm for red mullet (*Mullus barbatus*), 9.29 (se. 0.07) and 8.71 (se. 0.14) cm for annular sea bream (*Diplodus annularis*), 14.71 (se. 0.16) and 15.36 (se. 0.18) cm for picarel

(*Spicare smaris*) and, 12.39 (se. 0.23) and 12.53 (se. 0.10) cm for common pandora (*Pagellus erythrinus*), respectively.

It can be concluded that effect of using square mesh codends instead of diamond mesh may have positive, insignificant or negative influences on selection depending on the physical and behavioural characteristics of species. Therefore, before square mesh codends applied as a legislation, which may be the case in Turkish waters in very near future, a special attention needs to be paid on the species composition of the fishing ground, and escape behaviour of common species in catch composition needs to be better understood.

16. Düzbastılar F.Ozan, Altan Lök, Cengiz Metin, Hüseyin Özbilgin, Gülnur Metin, Ali Ulaş, Aytaç Özgül, Benal Gül, İlker Aydın, Adnan Tokaç Survival rates of six fish species after escape from a trawl codend in the Aegean Sea in winter

Survival rates of red mullet (*Mullus barbatus*), annular seabream (*Diplodus annularis*), common two banded seabream (*Diplodus vulgaris*), brown comber (*Serranus hepatus*), red bandfish (*Cepola macrophthalma*) and black goby (*Gobius niger*) were investigated after escaping from a commercial bottom-trawl codend in the Bay of Izmir, east coast of the Aegean Sea. The experiments were conducted between 29th January and 5th February 2007. A traditional bottom trawl with a 40 mm codend was used. A cover was attached over the codend to catch the escaping fish. At the end of each tow, the cover was detached from the codend and deployed at the observation site (17-26 m) by divers. Two controls and three experimental hauls were carried out. First control tow was terminated in 5 min, the other control and three test tows were carried out for 15 min. The cod-line was left untied in the case of the controls. Divers observed the cages three times per day over a 7-day period to remove dead fish and feed the survivors.

Survival rates in 5 min tow control cage were higher than 15 min tow control cage for four species. There were not any *G. niger* and *D. vulgaris* in 5 min tow control cage. Survival percentages in 5 min tow control cage, 15 min tow control cage, and average of three test cages were, respectively, 89.5, 44.6, and 49.2 for *M. barbatus*, 100, 96.6, and 98.9 for *D. annularis*, not applicable, 100, and 100 for *D. vulgaris*, 98.9, 98.3, and 98.5 for *S. hepatus*, 100, 90.4, and 97.4 for *C. macrophthalma* and finally, not applicable, 57.7, and 81.6 for *G. niger*.

For the same gear and fishing ground, available data for *M. barbatus* in September 2001 indicates a significant decrease in survival rates from summer to winter with approximately 10 degree C decrease in water temperature. The study will be continued to investigate the seasonal differences in survival rates.

17. Maloulli Idrissi Mohammed, Franquesa Ramon, Guillen Jordi, Macher Claire, The economic analysis of changes in the trawl mesh

Steps needed in the economic analysis on mesh regulations

- 1. Evaluate the cost of the change of gears by individual vessel and extrapolated to the vessels and fishermen affected
- 2. Evaluate the losses in the sales (short term)
- 3. Evaluate the effects on prices (short, medium and long term)
- 4. Evaluate the effect on operative cost (carburant, etc.)
- 5. Evaluate the effect on revenues from the changes in catches (medium and long term)

Two paths to improve the knowledge

- Bio economical analysis to simulate the behaviour of the fishermen and the resource
- The microeconomic analyse over the enterprise behaviour
 - Thesis of Master of Science in Fisheries Economics and Management : *Evaluate the cost of the change in Catalonia (Spain) and one Italian region.*
- Need of support of the Mediterranean projects (Medsudmed, Copemed II, Adriamed..)
- Need of Support of regional and national administrations

The critical work : Collection of data.

- Fleets concerned: employment, investment, spatial distribution, economic situation
- Biomass status: % over the MSY, time to recover
- Develop the methodology : Extrapolation by Economic Indicators

TABLE ON BIOLOGICAL CONSEQUENCES OF IMPLEMENTING SQUARE MESH

Indicators	Expected outcome	Qualified effect		Observations
		Short term	Middle-long term	
Species level				
Size of first capture	Increase	Positive	Positive	Maybe negative for flat fish and other species
Percentage of discards (in total catches)	Decrease	Positive	Positive	
Total fishing mortality	Decrease	Positive	Positive	
Total catch of target species and other marketable by-catch species (CPUE in weight)	Variable	From negative to no effect	From negative to positive	Depending on areas, depth, operational unit, and species (ie. Spicara will decrease in the Balearic; marketable by-catch will decrease in the Ebro River delta area)
Escapes	Increase	Positive	Positive	Juveniles and small size species
Catch of undersized fish (illegal)	Decrease	Positive	Positive	
Survival	Now scarcely known in the Mediterranean. It would be species and seasonal dependent i.e. low for small pelagic species, medium for demersal fish; high for hard-shelf invertebrates	Expected to be positive	Expected to be positive	It would be not positive if survival is low
Mean trophic level of the catch	Increase	Positive	Positive	Depending on the exploitation level of the stock
Yield-per-recruit	Variable	Negative or stable	Positive	
Ecosystem level				
Biomass of fish	Increase	Positive	Positive	
Biomass of invertebrates	Decrease	Positive	Positive	
Mean trophic level of the community	Increase	Positive	Positive	

Biomass diversity (biodiversity)	Increase	Positive	Positive
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Conclusions

Implement the 40 mm square mesh as soon as possible

Implementation of square mesh is expected to be positive but not sufficient to recover highly exploited species and ecosystem. Parallel measures will also be required (reduction of fishing effort, closing seasons and areas, etc)

To set up a framework to check mortality of escapees.

Simultaneously monitor the effects by following the indicators

Complete case studies in different areas with standardised methodologies and to compare results

Asses effects on other fisheries/gears

Asses other effects on ecosystem

Survival studies are required

CHECK LIST OF POTENTIAL ECONOMIC CONSEQUENCES OF SQUARE CODEND APPLICATION TO MEDITERRANEAN TRAWL FISHERIES

(From the netmaker to the market)

INDICATORS	SHORT TERM	LONG TERM	IMPORTANCE LEVEL	OBSERVATIONS
catch-landing	decrease or stable	increase		The improvement of selectivity suppose the reduction of catch of the small size individuals
effect: price-quantities/quality	increase or equal	decrease or equal		The reduction of landing supposes the reduction of the supply and the increasing of the price
costs : gear cost maintenance cost fuel cost	increase equal decrease	equal equal decrease		The change of the gear supposes en initial investment that not affects other maintenance cost. The increasing of the opening of the mesh supposes less resistance to water, less retention of biomass in the cod-end, in consequence less consumption of fuel. finally, the recover of the biomass allow in long term improve the quantity cated by fuel consumed
costs per landing if biomass recover	increase	decrease		The initial reduction of the catch supposes increasing the cost per landing
added value	decrease	increase		The initial reduction of catches supposes the reduction of the added value, net profit and wages
Net Profit	decrease	increase		idem
wages	decrease	increases		idem
social effect (employment)	decrease	stable		The initial reduction of the revenue supposes the of wages and a decrease of employment. in the long term, it could be observed an attraction to the metier as there is an increase of the wages and an net profit.
acceptability by the fishing sector	rejected	accepted		The initial cost of the transition produces a resistance to change. When the biomass is recovered, the fishermen improve their profits and so they support the new regulation

CHECK LIST OF POTENTIAL TECHNOLOGICAL CONSEQUENCES OF SQUARE-MESH CODEND APPLICATION TO MEDITERRANEAN TRAWL FISHERIES

(From the net maker to the market)

INDICATORS	SHORT TERM	LONG TERM	IMPORTANCE LEVEL	OBSERVATIONS
Codend netting material	Possible use of different netting materials (PE, Ultracross, knotless): different effects on selectivity	Possible use of different netting materials (PE, Ultracross, knotless): different effects on selectivity	***	Further studies are needed for the use of Ultracross netting
Other gear modifications	The implementation of square-mesh codend will affect the manufacture of some additional devices (i.e. strengthening bag)	-	*	Fishing industry and scientific community training and workshops
Deck equipment modification	No technical modifications are expected for the implementation of this type of selectivity device	-	ns	-
Enmeshment	There are no references evidenced fish meshing problem	-	*	Further studies are needed in different fisheries
Catch sorting	Square-mesh codend will make sorting easier for the reduction of small size non commercial species benthic invertebrates and debris in the catch	-	**	-
Catch composition (species/size)	Reduction on flatfish size selectivity and some other small cephalopods. Size selectivity improvement for the roundfish	-	***	Size selectivity depends on fish morphology and behaviour
Catch quality	Better quality is foreseen for the reduction of benthic invertebrates and debris in the catch	-	**	Further studies are needed in different fisheries

No marketable catch loss	Benefit for the reduction of discards and undersized species	-	**	-
Marketable catch loss	Disadvantage for the reduction of some small cephalopods and small species of economical local value	-	***	i.e Spicara spp, European common squid (<i>Allotheutis media</i>)
Survival rate	Possible benefit for some demersal species. No positive effects on pelagic species	-	***	Further studies are needed in different fisheries
Tactic ³ modification	Increase of towing speed, increase the weights then the physical impact of ground gears	-	**	studies of these effects are needed
Strategy ⁴ modification	Development of bigger trawls with larger horizontal and vertical openings	-	**	Limitation of the gear size
Effort modification	Possible increase of effort by haul (increase of speed, gear modification to make up for the possible economic loss	-		Effort limitation needed
Effort transfer	Displacement of effort on other fishing areas	-		Management measures needed
Safety	Decrease of breaking strength by almost 20%. Use of thicker mesh twines: negative effect on selectivity		**	Further studies are needed with the use of different netting and materials
New gear type	Introduction of new gear type to compensate for the risk of marketable fish loss			Technical and management measures
New “metiers”		Introduction of new metiers focusing the loss of marketable species		Capacity management needed

³ Tactics are defined as changes during a fishing trip, based on short time reactions (e.g. effort allocation within a trip, gear selection, selection of fishing grounds).

⁴ Strategy is defined as a change over a longer time span (e.g. a complete year).

APPENDIX G

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Peer -review of recent publications of the working group on selectivity

Selectivity of square mesh

Baro J., Munoz de los Reyes I. 2006. Bottom trawl fishing yield and selectivity comparisons between square-and diamond meshes. *Inf. Tec. Inst. Esp. Oceanogr.* 16 pp.

Bahamón, N., Sardà, F., Suuronen, P. 2006. Improvement of trawl selectivity in the NW Mediterranean demersal fishery by using a 40 mm square mesh codend. *Fisheries Research* 81:15-25

Bahamon, N., Sardà, F., Suuronen, P. 2007. Potential benefits of improved selectivity in the NW Mediterranean multi-species trawl fishery. *ICES Journal of Marine Science* 64:000-000 (in press)

Belcari P, Viva C, 2005. Study on the effects of fitting square-mesh sections to the selectivity of demersal trawling in Northern Tyrrhenian Sea (western Mediterranean). *In*: GFCM Workshop on standardization of selectivity methods applied to trawling in the Mediterranean Sea. *FAO Fish. Rep.*, 820: 28-29.

Belcari P., De Ranieri S., Ligas A., Reale A., Sartor P., Viva C. 2006. Effects of fitting a square mesh section to the selectivity of demersal trawling in the northern Tyrrhenian Sea (Western Mediterranean). ICES 2006 Symposium, "Fishing Technology in the 21st Century: Integrating Fishing and Ecosystem Conservation" 30 October-3 November, 2006 Boston.

Ferretti M., Sala A., Piccinetti C., Ungaro N., 2005. Selettività di una rete a strascico con sacchi armati a losanga ed a maglia quadrata. Rapporto Finale al Ministero per le Politiche Agricole e Forestali, VI Piano Triennale della Pesca e dell'Acquacoltura (Progetto MIPAF n. 6-B-4).

Guijarro B., Massutí E., 2006. Selectivity of diamond and square-mesh codends in the deepwater crustacean trawl fishery off the Balearic Islands (western Mediterranean). *ICES Journal of Marine Science* 63: 52-67.

Sophonidis K., A. Kallianiotis & C. Radcliffe, 2001. Introducing selective devices in the Greek trawl fishery. 36th CIESM Congress, 23-27 October 2001, pp. Congress proceedings p. 326

Massutí E, Ordines F, Guijarro B, 2007. Efficiency of mesh cod-end geometry and sorting grids to improve selectivity of bottom trawl in the western Mediterranean. Working Document to the ICES/FAO Working Group on Fishing Technology and Fish Behaviour. Dublin, 23-27 April 2007, 20 pp.

Ordines F., Massutí E., Guijarro B., Mas R. (2006). Diamond vs. square mesh codend in a multi-species trawl fishery of the western Mediterranean: effects on catch composition, yield, size selectivity and discards. *Aquat. Living Resour.* 19: 329-338.

Özbilgin H., Tosunoglu Z., Ayidin C., Kaikac H., Tokaç A. 2005. Selectivity of Standard, Narrow and Square Mesh Panel Trawl Codends for Hake (*Merluccius merluccius*) and Poor Cod (*Trisopterus minutus capelanus*). *Turk J Vet Anim Sci* 29: 967-973.

Petrakis G., Stergiou K. I., 1997. Size selectivity of diamond and square mesh codends for four commercial Mediterranean fish species. *ICES Journal of Marine Science* 54: 13–23.

Sardà, F., N. Bahamon, B. Molí and F. Sardà-Palomera. _ 2006. The use of a square mesh and sorting grids to reduce catches of young fish and improve sustainability in a multispecies bottom trawl fishery in the NW Mediterranean Sea. *Scientia Marina*, 70: 347-353.

Sala A., Piccinetti C., Ferretti M., Buglioni G., Lucchetti A., Palumbo V., Ungaro N., 2005. Selectivity comparison of diamond and square mesh codends of Mediterranean bottom trawl. *ICES CM* 2005/B:04.

Sardà, F., G.Y. Conan and Fusté.X. _ 1993. Selectivity of Norway lobster *Nephrops norvegicus* (L.) in the northwestern Mediterranean. *Scientia Marina*, 57: 167-174.

Stergiou-KI; Petrakis-G; Politou-CY Size selectivity of diamond and square mesh cod-ends for *Nephrops norvegicus* in the Aegean Sea: *Fisheries Research* . Mar 1997; 29 (3) : 203-209.

Zengin, M., Z. Tosunoğlu, 2006. Selectivity of diamond and square mesh beam trawl cod ends for *Parapenaeus longirostris* (Lucas, 1846) (Decapoda, Penaeidae) in the Sea of Marmara. *Crustaceana*, 79, 1049-1057.

Selectivity of sorting grids

Bahamón, N., Sardà, F., Suuronen, P. 2007. Selectivity of a flexible size-sorting grid in the Mediterranean multi-species trawl fishery. *Fisheries Science* (in press)

Sardà, F., Bahamon, N., Sardà-Palomera, F., Moli, B., 2005. Commercial testing of a sorting grid to reduce catches of juvenile hake (*Merluccius merluccius*) in the western Mediterranean demersal trawl fishery. *Aquatic Living Resources*, 18, 87–91.

Sardà, F., Moli, B., Palomera, I., 2004. Preservation of juvenile hake (*Merluccius merluccius*, L.) in the western Mediterranean demersal trawl fishery by using sorting grids. *Scientia Marina*, 68, 435–444.

Sofronidis, K., Kallianiotis, A., & Radcliffe, C., 2001. Introducing selective devices in the Greek trawl fisheries. *Rapp.Comm.int.Mer.Medit*, 36:326.

Ecological selectivity & management

Coll, M., Bahamon, N., Sardà, F., Palomera, I., Tudela, S., Suuronen, P. Ecosystem effects of improved trawl selectivity in the South Catalan Sea (NW Mediterranean). *Marine Ecology Progress Series* (submitted)

Suuronen, P., Sardà, F. 2007. The role of technical measures in European fisheries management: how to make them work better ICES. SFMS_088 (in press).

Sardà, F., 1998. Symptoms of overexploitation in the stock of the Norway lobster (*Nephrops norvegicus*) on the “Serola Bank” (Western Mediterranean Sea off Barcelona). *Scientia Marina* 62, 295–299.

Effects of material and construction on selectivity

Adamidou & A. Kallianiotis. 1997. Possibilities of improving the Greek bottom trawl design.. Proceedings of the 5th Hellenic Symposium of Fisheries and oceanography, 15-18 April 1997, Kavala, 29-32.

Lök A., Tokaç A., Tosunoğlu Z., Metin C., Ferro R.S.T., 1997. The effects of different cod-end design on bottom trawl selectivity in Turkish fisheries of the Aegean Sea. *Fisheries Research* 32:149-156.

Soldo, A., Cetinić P. 2006. Selectivity of different trawl constructions in Eastern Adriatic. Contributions on the theory of fishing gears and related marine systems, Vol. 4, ed. Lee, C.W., Busan, Korea: 165-174

Tosunoglu Z., Özbilgin H., Tokaç A. 2003. Effects of the protective bags on the codend selectivity in Turkish bottom-trawl fishery. *Arch. Fish. Mar. Res.* 50(3), 2003, 239–252.

Tokaç A., Lök A., Tosunoğlu Z., Metin C., Ferro R.S.T., 1998. Cod-end selectivities of a modified bottom trawl for three fish species in the Aegean Sea. *Fisheries Research* 39:17-31.

Tokaç A., Özbilgin H., Tosunoğlu Z., 2004. Effect of PA and PE material on codend selectivity in Turkish bottom trawl. *Fisheries Research* 67: 317-327.

Survival studies

Metin, C., Tokaç, A., Ulaş, A., Düzbastılar, F.O., Lök, A., Özbilgin, H., Metin, G., Tosunoğlu, Z., Kaykaç, H., Aydın, C. 2004. Survival of red mullet (*Mullus barbatus* L., 1758) after escape from a trawl codend in the Aegean Sea. *Fisheries Research* 70:49-53.

Bioeconomic analysis on selectivity

Maynou, F.; Sardà, F.; Tudela, S. & Demestre, M. 2006. Management strategies for red shrimp (*Aristeus antennatus*) fisheries in the Catalan sea (NW Mediterranean) based on bioeconomic simulation analysis. *Aquatic Living Resources*, 19, 161–171. Available at <http://www.edpsciences.org/alr>