



GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

SCIENTIFIC ADVISORY COMMITTEE

SUB-COMMITTEE FOR STOCK ASSESSMENT

REPORT

FAO Headquarters. German Room (C-269). Rome, 15-18 May 2001

1. OPENING OF THE MEETING, ADOPTION OF THE AGENDA AND ARRANGEMENTS OF THE SESSION

- The meeting was opened by the Coordinator of the Sub-committee on Stock Assessment (SCSA), Mr J. Lleonart (ICM, Barcelona), and the FAO contact person, Mr P. Oliver (FAO, Rome) acted as technical secretary.
- The meeting was attended by 31 scientists from 9 countries and 5 international organisations. The list of participants is attached as Annex A.
- The Agenda of the meeting (Annex B) was adopted.
- Two Rapporteurs were designed: Mr E. Massutí (IEO, Spain) and Mr P. Mannini (FAO-ADRIAMED, Italy).
- Following a request for clarification about the level of representativity of the participants to the meeting, the Coordinator reminded that SCSA is composed by scientists participating in their personal capacity and not as national delegates and only scientific contributions and discussion should be dealt with. Since some doubts were stated about that, Mr Ben Alaya (Secretary of GFCM) and Mr. Camiñas (president of the SAC) confirmed the Co-ordinator's statement. A formal communication will be provided by the Secretariat during the next SAC meeting.

2. REVIEW AND ANALYSIS OF THE ASSESSMENT PRESENTED TO THE SMALL PELAGICS AND DEMERSAL WORKING GROUP

- The following procedure was adopted: (i) the Coordinators of the Working Groups (WG) will present the report, with special details on assessments; (ii) the SCSA will review and discuss each assessment by species and Management Unit (MU).

2.2. SMALL PELAGICS

- Mr A. Kallianotis (Coordinator of small pelagic WG) pointed out the poor level of attendance of eastern and southern Mediterranean and Black Sea countries.
- Ten assessment documents and other two papers related to methodological aspects (echo surveys and eggs production methods) were presented.

- The SC proposed to the SAC the inclusion of *Trachurus mediterraneus* and *Boops boops* as priority species.
- The SC expressed its concern regarding the scarcity of assessments on shared stocks. In this sense, there was proposed to present in next WG meeting assessments of sardine and anchovy shared stocks in Gulf of Lions and the Adriatic Sea. The necessity of dispose of a list of shared stocks was pointed out.

Anchovy

ANE-01-01. *Engraulis encrasicolus*. Northern Alboran Sea. 1990-2000

Doc n 3 Stock assessment of *Engraulis encrasicolus* in Northern Alboran Sea

- **WG comments:** The forms do not include formal stock assessments, but actually available basic data. Several acoustic surveys have been performed during the last decade, but due to the special characteristics of this area (very narrow shelf) information needs to be re-analyzed in depth before presenting the results on biomass evolution. Catch and effort data from 1990 onwards, obtained from IEO port sampling network, would permit in theory to apply global models for stocks evaluation; but some uncertainties related to the reliability of effective effort estimations, due to observed differences in spatial distribution of sardine and anchovy stocks, discards etc., prevented up to now the use of this models. The implementation of an on board sampling program starting this year will provide complementary data which will permit to improve the effective effort estimations. In any case, both the low level of landings and acoustic surveys indicate that anchovy stock remain depleted after the 80's collapse, so the fishing pressure on this stock must be reduced.
- **SC comments:** The SC did not agree with the WG comments. If there is not recent information from echo surveys or other assessment methods, it cannot be concluded that stock remains depleted. Although, current level of catches are very low and have maintained at this level from the 80's collapse. In 1993, the lowest catch level since the 40's were recorded.
- **SC recommendations:** Despite landings do not show any trend in the last ten years, the SC recommended to set the minimum legal size on that of first maturity, in order to reduce the risk of recruitment overfishing. The SC urged the WG to update the information available in order to give a more accurate assessment of this stock.

ANE-06-01 *Engraulis encrasicolus*. Northern Spanish coast. 1990-2000

Doc n 4 Stock assessment of *Engraulis encrasicolus* in Northern Spain

- **WG comments:** Despite no data on CPUE evolution neither recent length sampling data are not still available, preventing the use of global or analytical models, some ideas on stock state can be drawn from catch data tacking into account that fleet capacity and activity has remained more or less stable over this period. So, anchovy landings show a consistent decreasing trend from 1995 up to now. Acoustic data, despite they seems to present some weakness, indicates also that recruitment have been low the last years. Then, further restrictions of fishing effort must be considered.

- **SC comments:** Although the two peaks (1997 and 2000) in biomass estimation, obtained from acoustic surveys series (1996-2000), no particular trend appears. Furthermore since the level of effort is not changed while there is a decreasing trends of landings the WG suggests a decrease of CPUE. Values have remained at low level during the last years and in 2000 the recruitment estimation was very low.
- **SC recommendations:** The SC recommended to set the minimum legal landing size at length of first maturity and to reduce the fishing effort, in order to reduce the risk of recruitment overfishing.

ANE-16-01 *Engraulis encrasicolus*. South of Sicily. 1998 and 2000.

Doc n 1 Echo-survey estimates and distribution of anchovy and sardine populations in the strait of Sicily: a comparison between 1998 and 2000 results

- **WG comments:** The biomass evaluations of anchovy stock in the management unit 16 (South of Sicily) obtained by applying acoustic methods in summer 1998 and 2000 produced consistent results compared to the commercial abundance indices based on data collected at Sciacca the main base port in the study for the small pelagic landings. Observed consistency extends also to the available anchovy DEPM evaluations carried out in 1998 and 1999. Preliminary analyses of the age structure of local anchovy population indicate the importance of recruitment for the yearly stock levels and accounts for the high inter-annual fluctuations in the catches. Further studies were still required to evaluate the state of exploitation of this resource.
- **SC comments:** No clear results on assessment and state of this stock are included. Due to the preliminary character of this assessment presented, it is not considered.

ANE-17-01. *Engraulis encrasicolus*. Northern and Central Adriatic Sea. 1975-1996

Doc n 5 Stock assessments of anchovy (*Engraulis encrasicolus*, L.) in the northern and central Adriatic Sea, in the period 1975-1996

- **WG comments:** The estimated stock biomass showed a strong fluctuation in the period 1975-1996. The stock collapsed in 1987. Although overfishing is thought not to be the primary cause of the anchovy collapse of 1987, it remains true that the levels of recruitment following the 1987 have not yet reached the previous higher levels. Given this situation and considering also the current levels of catches (25% of biomass) and the decrease of the biomass in 1996, it is recommended to maintain the current level of fishing effort. CPUE data updated to 1999 show a trend of stock abundance similar to the previous years. Market investigations are recommended to increase the human consumption of sardine to reduce both the discards of sardine at sea and the fishing pressure on the anchovy.
- **SC comments:** WG comments were endorsed.

General comments and recommendations of anchovy stock in the Mediterranean from the assessments of this species presented at the WG:

- Due to the potential danger of recruitment over-exploitation, it is recommended to set the minimum legal size to length at first maturity.

- Considering the different information about length at first maturity in different areas, the SC invited Mrs. Giráldez (IEO Spain) to prepare a brief document, to be presented to the SAC, containing available information on this topic.

Sardine

PIL-01-01. *Sardina pilchardus*. Northern Alboran Sea. 1990-2000

Doc 8 Stock assessment of *Sardina pilchardus* in Northern Alboran Sea

- **WG comments:** The forms do not include formal stock assessments, but actually available basic data. Several acoustic surveys have been performed during the last decade, but due to the special characteristics of this area (very narrow shelf) information needs to be re-analysed in depth before presenting the results on biomass evolution. Catch and effort data from 1990 onwards, obtained from IEO port sampling network, would permit in theory to apply global models for stocks evaluation; but some uncertainties related to the reliability of effective effort estimations, due to observed differences in spatial distribution of sardine and anchovy stocks, discards etc, prevented up to now the use of this models. The implementation of an on board sampling program starting this year will provide complementary data which will permit to improve the effective effort estimations. (...) Sardine landings show also a clear decreasing trend between 1997-2000 and the same recommendation would be applicable. In parallel, environmental influence on stocks fluctuations and the ecological implications (for example, increase of other non commercial species as *Capros aper*) of such a fluctuations must be studied.
- **SC comments:** The WG comments were endorsed, however landings on 1998 and 1999 increased by comparison with previous years.

PIL-06-01 *Sardina pilchardus*. Northern Spanish coast. 1990-2000

Doc 7 Stock assessment of *Sardina pilchardus* in Northern Spain

- **WG comments:** Despite no data on CPUE evolution neither recent length sampling data are not still available, preventing the use of global or analytical models, some ideas on stock state can be drawn from catch data tacking into account that fleet capacity and activity has remained more or less stable over this period. (...) For sardine, acoustic surveys show a consistent decreasing trend from 1992 up to now, suggesting a situation of overexploitation, despite landings remain stable. Since this phenomenon of apparent stock equilibrium when the actual situation is one of stock declining is well known for pelagic species, the stock evolution must be monitored carefully and possible further effort reductions considered. Further investigations on the effect of environmental fluctuation on the biomass of these resources should be encouraged.
- **SC comments:** The SC endorsed the WG comments. Nevertheless, inconsistency between acoustic surveys (showing a decreasing trend) and landings (stable) was detected. Acoustic surveys were considered more reliable than landings information, which are not good indicators of biomass in this species.
- **SC recommendations:** The SC encouraged the WG to update the information available in order to give a more accurate assessment of this stock.

PIL-17-01. *Sardina pilchardus*. Northern and central Adriatic. 1975-1999

Doc 6 Stock assessments of sardine (*Sardina pilchardus*, Walb.) in the northern and central Adriatic Sea, in the period 1975-1999

- **WG comments:** The stock assessment corrected with estimates of historical discards indicates that the mid-year sardine stock biomass rose steadily from around 400,000 tons in 1975 to a peak of around 950,000 tons in 1984. After that, the biomass declined steadily, with current levels being around 300,000 tons. Current catches are around 20,000 tons, down from the peak levels of 80,000 tons in the first half of the 1980s. Due to scarcity fish market demand, discards of sardine at sea may occur. Monitoring of sardine discards at sea it is recommended. Market investigations to increase the human consumption of sardine, to diminish discards at sea and to increase catches are also recommended.
- **SC comments:** The SC endorsed the WG report, however it should be noted that discard and market considerations are only related to Italian fishery.
- **SC recommendations:** The SC suggested that SAC includes in the mandate of the SC on Economy and Social Sciences a market study on sardine at subregional level.

Sardinella**SAA- 12-13-01.** *Sardinella aurita*. Tunisia. 1994 -1998

Doc n 9 Parametres biologiques de la sardinelle ronde (*Sardinella aurita* Valenciennes, 1847) dans la region du Cap Bon (canal siculo-tunisien)

- **WG comments:** The paper did not present an assesment of the species as per se. However, the data and information provided may be useful for the direct and indirect evaluation methods of this species. The paper analysed the biological parameters (reproduction and growth) of the round sardinelle wich is considered of high importance to the commercial tunisian fisheries, in the transition area of the two management units 12 and 13. According to the present knowledge of the stocks of this species in Tunisia, it would be premature to give information about the state of this ressource. There are some doubts on the unicity of the stocks. Further studies are still required to clarify the issue.
- **SC comments:** Due to the preliminary character of this assessment, it is not considered. However, the SC stated the necessity to make studies related to predatory effects of *Sardinella aurita* upon fish eggs, particularly those of anchovy.

Horse mackerel**HOM-22-01** *Trachurus trachurus*. Central Aegean. 1998-2000

Doc n 10 Assessment of the state of the stocks for *Trachurus trachurus* and *Boops boops* in the Saronikos Gulf and the Cyclades islands

- **WG comments:** The Central Aegean stock has been assessed during the years 1998–2000. The results show that this stock is fully exploited to slightly overexploited depended on the actual value of the natural mortality. Because

abundance index estimated during the previous years (1988 -1995) from landings was found to be normally distributed, the WG recommends keeping the fishing effort at the current level. On the other hand, because *T. mediterraneus* is also commercial of even higher price than that of *T. trachurus*, and that *T. mediterraneus* as a more migratory species in relation with *T. trachurus*, can be considered possibly as a shaved stock, the assessment of the state of stock of this species was also encouraged by the WG.

- **SC comments:** The SC endorsed the WG comments.

Bogue

BOG-22-01. *Boops boops*. Central Aegean. 1998-2000

Doc n 10 Assessment of the state of the stocks for *Trachurus trachurus* and *Boops boops* in the Saronikos Gulf and the Cyclades islands

- **WG comments:** The Central Aegean stock has been assessed during the years 1998–2000. the results show that this stock is fully exploited to slightly overexploited. Given that this species is being caught besides trawlers (the sampling gear) by beach-seine and purse-seiner as well, the results can be considered preliminary. Thus the W.G recommends keeping the fishing effort at the current level until multi-gear assessments; works to be done.
- **SC comments:** The SC endorsed the WG comments.

In Annex C, the summary of stocks retained by the SC is presented.

2.2. DEMERSAL

- The number of assessments related to hake, a species considered as priority by SAC, was underlined. See Annex C. 13 assessments of five species considered as priority by SAC were performed affecting 10 MU, out of the 30 MU. Moreover, only one shared stock (hake of gulf of Lions) has been assessed.

Hake

HKE-7-01 *Merluccius merluccius*. Gulf of Lions. 1997-1999

Doc n 4 Stock assessment of the French-Spanish shared stock of hake (*Merluccius merluccius*) in the gulf of Lions

- **WG comments and recommendations:** The assessment of this stock showed a situation of growth overfishing and a risk of recruitment overfishing. In order to correct it, the WG recommend to improve the fishing pattern of the trawl and reduce effort of all gears.
- **SC comments and recommendations:** The SC endorsed the WG comments and recommendations and encouraged to continue next year the assessment of this shared stock.

HKE-9-01. *Merluccius merluccius*. Eastern Ligurian-northern Tyrrhenian 1990-1998

Doc n 6 Stock assessment of hake (*Merluccius merluccius*) in the eastern Ligurian-northern Tyrrhenian area

- **WG comments:** The species did not show signs of recruitment overfishing. However, the current value for the rate SSB (current spawning stock biomass) / SSB (virgin stock) was markedly less than currently accepted as safe for the stock self-renewal. A modest reduction of effort of trawl vessels would drive this rate to a safer value. Most of the adult individuals live in deep waters, on not trawlable grounds and this constitutes some kind of refugium of spawners.
- The recommendations are summarised as follows: (i) area or seasonal closures should be useful in order to protect the highly concentrated and vulnerable individuals present in the nursery areas; (ii) in order to drive the spawning biomass to a more safe situation (currently it represents about 16% of the pristine biomass), a moderate reduction of 15% in effort is suggested; (iii) the mesh size currently in use define a too small size of first capture (8-9 cm), that is much lower than the legal size of the species, however, the adoption of a bigger mesh should produce a light improvement in Y/R for hake but contemporarily important losses as regards to the catch of several other species that make part of the commercial assemblages; (iv) an increase in the size of first capture can also be obtained by self-regulation of the fleet by avoiding the fishing grounds where small hakes are concentrated or by enforcement of temporal or total closures of defined areas.
- **SC recommendations:** SC agreed with WG comments and endorsed the recommendations.

HKE-20+22-01 *Merluccius merluccius*. Hellenic seas. 1998-1999

Doc n 14 The status of the hake (*Merluccius merluccius*) and red mullet (*Mullus barbatus*) populations in the Hellenic seas

HKE-22-01. *Merluccius merluccius*. Cyclade islands. 1998-200

Doc n 11 Assesment of the state of some demersal fish stocks in the Saronikos gulf and the Cyclades islands

- **WG comments (HKE-20+22-01):** This stock was defined as overexploited, therefore the enforcement of the existing measures and regulations were strongly recommended. Furthermore, a reduction of the fishing effort directed to the spawners was recommended by applying regulations to the fixed gears. In addition, the extension of closed seasons in the main nursery grounds would protect the recruits.
- **WG comments (HKE-22-01):** The Central Aegean stock showed heavy growth overexploitation since 1988. The bulk of trawler catch for hake was of length size smaller than that at first maturity, the mesh size in use defined a length at first capture smaller than the legal one, and the recent increase of mesh size from 14 mm (from knot to knot) to 20 mm did not change the length at first capture. In order to reach MSY and to avoid losses for the fishermen, the WG recommended to: (i) establish a seasonal closure during the recruitment period (late spring); (ii) decrease the time at sea and improve trawl selectivity; (iii) enforce the current measures.

- **SC comments and recommendations:** The SC considered to join these assessments, due that their analyse same stocks. According to available data, the stock was defined as overexploited. In the scope to protect as far as possible this stock, the following recommendations were made: (i) enforcement strongly existing technical measures and regulations; (ii) considering the existing closing season for demersal trawlers during four months in the Hellenic Seas and the spatial distribution of nursery grounds of this species, an amelioration of the situation of this stock would be expected.

General comments of hake stock in the Mediterranean from four assessments of hake presented at the WG:

- It appears a clear growth overexploitation on all hake assessments presented.
- It was discussed the possibility to propose a legal minimum landing size closer to the length at first maturity.

General recommendations of hake stock in the Mediterranean from four assessments of hake presented at the WG:

- It was considered a priority to reduce the effort and increase the selectivity on this species, avoiding to catch small individuals.
- It was stated the necessity to extend hake assessment to other areas of the Mediterranean.

Red mullet

MUT-9-01. *Mullus barbatus* 1990-1998. Southern Ligurian-northern Tyrrhenian
Doc n 5 Stock assessment of red mullet (*Mullus barbatus*) in the southern Ligurian-northern Tyrrhenian area

- **WG comments:** The assessment presented shows that the species was heavily exploited, especially in the southern eastern Ligurian sea. Indices of abundance (from both commercial landings and scientific surveys) did not show any trend for the red mullet biomass at sea. Nevertheless with the current level of exploitation there was a risk of depletion of this stock that should be taken into consideration.
- The recommendations are summarised as follows: (i) total closure of the three miles coastal stripe is considered enough for the protection of the juveniles immediately after recruitment; (ii) settlement of artificial obstacles onto the three miles stripe were demonstrated useful to avoiding illegal groundfish trawling; (iii) a seasonal closure during the period of post-recruitment could be theoretically efficient in order to delay the catch of new settled individuals; (iv) the current level of effort is considered too high and a reduction of effort should be encouraged; (v) mesh size currently in use defines a length of first capture smaller than the legal size, anyhow, the enforcement of area and temporal closures can determine an increase in the above mentioned size that makes unnecessary an increase in mesh size for the species.

- **SC comments and recommendations:** SC endorsed the WG report and its recommendations.

MUT-22-01 *Mullus barbatus*. Cyclades Ilands. 1998-2000

Doc 11 Assesment of the state of some demersal fish stocks in the Saronikos gulf and the Cyclades islands

MUT-22+23-01. *Mullus barbatus*. Hellenic seas. 1998-1999

Doc n 14 The status of the hake (*Merluccius merluccius*) and red mullet (*Mullus barbatus*) populations in the Hellenic seas

- **WG comments (MUT-22-01):** This Central Aegean stock showed a slight growth overexploitation. The current exploitation rate increased by 20 percent of that estimated 15 years ago, when the stock was assessed as fully exploited. The WG recommended to extend the fishing ban by one month for the protection of the young individuals at the beginning of the trawler-fishing season (October).
- **WG comments (MUT-22+23-01):** This stock was defined as overexploited, therefore the enforcement of the existing measures and regulations was strongly recommended by the WG.
- **SC comments and recommendations:** The SC considered to merge these assessments, as they analyse the same stock. This stock was considered as overexploited. The SC recommended the enforcement of current management measures, the application of which is expected to reduce the mortality on juveniles in nursery areas, decreasing exploitation level of stock.

MUR-22-01 *Mullus surmuletus*. 1998-2000. Saronikos Gulf and Cyclades Islands

Doc 11 Assesment of the state of some demersal fish stocks in the Saronikos gulf and the Cyclades islands

- **WG comments:** As the results of the assessment of this Central Aegean stock presented during the meeting were just preliminary, the Working Group recommended to keep the fishing effort at the current level, until more validated assessment works are carried out.
- **SC comments:** Due to the preliminary nature of the assessment presented, it was not considered by the SC.

Red shrimp

ARA-5-01. *Aristeus antennatus*. 1992-2000. Balearic Islands

Doc n 10 Stock assessment of Shrimp *Aristeus antennatus*, Balearic Islands

- **WG comments:** The WG recognized that the stock was over-exploited and expressed concern about the decreasing trend of biomass (current biomass represents about 10% of the estimated virgin biomass). In consequence, it is recommended: (i) to reduce the fishing effort targeting this species; (ii) to implement a harvesting rule based on the fishing mortality and biomass estimates; (iii) considering that a 10-year series of data for this stock is available, a VPA (not assuming steady state) should be carried out.

- **SC comments:** When reduction of effort is recommended, it should be necessary to propose a quantitative data (e.g. percentage). However, the SC agreed this assessment and recommendations contained in points i and ii of the WG comments.

ARA-6-01 *Aristeus antennatus*. 1995-1998. Alicante Gulf

Doc n 12 An assessment on a red shrimp (*Aristeus antennatus*) fishery in the Alicante gulf

- **WG comments:** The results of LCA, VPA and Y/R analysis over a pseudocohort showed that the stock was slightly overexploited. There was a high biomass turnover, and the highest fishing mortalities were concentrated on the older age classes, especially for the females. This may be due to the fact that both sexes were not equally accessible, since exploitation was focused mainly on the largest sizes, where females predominated. It was pointed out that considering the flat shape of the Y/R curves and the diagnosis of the levels of exploitation should be considered with precaution. Thus the WG recommended not to increase the effort at the present time.
- **SC comments:** The SC endorsed the WG comments and recommendations.

Other species

EGY-14-01 *Solea aegyptiaca*. 1997-1998. Gulf of Gabes

Doc n 1 Stock assessment of sole *Solea aegyptiaca* in Gabes gulf

- **WG comments:** The current biomass represents 38 percent of the Virgin Biomass and the current Y/R (26.165 g) is slightly under the maximum estimated value (26.439 g). For these reasons, the WG considered the stock as fully exploited (the fact that Y/R is only indicating growth over-exploitation has to be considered). Taking also into account that this stock is exploited by two different gears, studies on different management strategies should be carried out.
- **SC comments:** The SC agreed with WG comments, but none recommendation can be made with this assessment.

ANN-12+13+14-01. *Diplodus annularis*. 1997-1998. Tunisia

Doc n 2 Ecobiologie et évaluation du stock de sparailon *Diplodus annularis* des côtes tunisiennes

PAC-12+13+14-01 *Pagellus erythrinus* 1997-1998. Tunisia

Doc n 3 Etude bioécologique et dynamique du pageot commun *Pagellus erythrinus* des eaux tunisiennes

- **WG comments:** The importance of these two species for the Tunisian fishery sector was discussed. They are both considered important by the volume of catches and the second one also by its value. Both species are exploited mainly by small-scale fishing fleet. It was pointed out that considering the flat shape of the Y/R curves the diagnosis of the levels of exploitation should be considered with precaution.

- **SC comments:** The SC agreed with WG report, but no recommendation can be made with with the results of these assessments.

PAC-22-01. *Pagellus erythrinus*. 1998-2000. Saronikos Gulf and Cyclades Islands
Doc n 11 Assesment of the state of some demersal fish stocks in the Saronikos gulf and the Cyclades islands

- **WG comments:** As the results of the assessment of this Central Aegean stock presented during the meeting were just preliminary, the WG recommended to keep the fishing effort at the current level, until more validated assessment works were available.
- **SC comments:** Due to the preliminary nature of the assessment presented, it was not considered.

NEP-9-01. *Nephrops norvegicus*. Southern Ligurian-northern Tyrrhenian. 1990-1998
Doc n 7 Stock assessment of norway lobster (*Nephrops norvegicus*)
in the southern Ligurian-northern Tyrrhenian area

- **WG comments:** This species can be considered as under-exploited according to most of the biological reference points currently used. No risk is hypothesised for the near future for the species, and thus no particular new management measures were proposed for the species.
- **SC comments:** The WG comments were endorsed.

SSB-16-01 *Lithognatus mormyrus*. Sicily. 1997-1999
Doc n 8 About pseudo cohort on striped bream Sicilian's stock

- **WG comments:** The analysis produced a diagnosis of full exploitation for this stock, with a low SSB (current spawning stock biomass) / SSB (virgin stock) ratio. As the results of the assessment of this stock presented during the meeting were just preliminary, the WG recommended to keep the fishing effort at the current level, until further validated assessment works (including sensitivity analysis) are carried out.
- **SC comments:** Due to the preliminary nature of the assessment presented, this was not considered.

The summary of stocks retained by the SC is presented in Annex C,.

3. REVIEW OF THE CONCLUSIONS OF THE GFCM/ICCAT WORKING GROUP ON LARGE PELAGIC FISHES (MALTA, SEPTEMBER, 2000)

Mr. Restrepo (co-ordinator of WG on large pelagic) presented the large pelagic WG report. He explained the recommendations of the WG included in its report (<http://www.iccat.es>). The following general comments were made:

- These recommendations were endorsed and it was agreed to inform accordingly to these the SC on statistics.

- It was stated that no stock assessment and management recommendations were made in this WG. The co-ordinator of the WG explained that, at this moment, the WG considered that major problem is the lack of data. However, he cited some assessment on target species (e.g. bluefin tuna, swordfish) made on previous years. The last assessment was done in 1998 for bluefin tuna and was already presented in the 2000 SC meeting.
- The SC was informed that COPEMED started, three years ago, a programme based on data collection and biological studies in Gibraltar Strait area. This programme was started with Spain and Morocco, but currently some other countries (e.g. Tunisia, Lybia, Malta) have incorporated.
- It was suggested that similar project developed by COPEMED in relation to compile statistics on these fisheries is extended to ADRIAMED area. The ADRIAMED representative informed the meeting that in this initial phase of project implementation no specific activities deal with large pelagics as the project Coordination Committee gave the priority to the demersal and small pelagic shared fishery resources.
- It was commented that tuna farming constitute an additional problem to gathering data, because it is difficult to allocate the catches to a particular fleet and, in some cases, they might appear as aquaculture production.

4. DISCUSSION ON ASSESSMENT METHODOLOGY

- Following the discussion on assessment forms it was considered desirable to use them although some critical comments were made, however no new alternative proposal were formulated.
- It was pointed out the necessity to follow the guidelines to fill these sheets. The SC took note that only few assessment sheet sets have been properly filled and submitted.
- It was stated the necessity to: (i) update yearly the assessments; (ii) incorporate new assessments from other. Also it was adopted to maintain the list of GFCM list of priority species. Similarly it was proposed to incorporate in the assessments, additional biological information (e.g. spawning and recruitment areas).
- It was pointed out the necessity to present also assessments based on direct methods. Although in the last WG on demersal resources one paper completely based on MEDITS data project was presented, it was not considered as a proper assessment paper.

5. REVIEW OF THE CURRENT MANAGEMENT MEASURES, OF THE ALTERNATIVE MANAGEMENT OPTIONS AND FORMULATION OF PROPOSALS FOR FUTURE MANAGEMENT

- The SC regretted the low participation of experts from contracting parties and the lack of information to allow an overview of the range of management measures currently enforced.

- The SC noted the (quasi) lack of comments on the appropriateness of present management measures and of the new recommendation of new or alternative measures coming from the WGs reports.
- For the above reason it was decided not to afford a detailed revision of the only current management measures available to the SC, that is the Regulation(EC) 1626/94
- The Green Paper on the future of the CFP has not been analysed and commented by the SC due to the lack of time and not enough knowledge of the document. However the EC representatives said that the document puts forward a number of objectives and show a range of options on how to improve the sustainability of the fishing sectors. In particular for the Mediterranean the EC looks at a number of options to strengthen conservation in the Mediterranean, to support the Regional Fisheries Organizations of the area and to foster co-operation with non EU Countries. The European Community looks at the way stakeholders could be involved more and earlier in the decision making process. This could also involve the establishment of regional advisory committees. The main end of the document is to provoke a wide debate among all stakeholders and that all those interested in contributing to this debate are encouraged to send, by the end of September, their comments and remarks to the European Commission.
- The SC stated the importance to take into consideration the effects of fishing activities on the ecosystem. Therefore, it was encouraged multi-species assessments and ecological approaches in fisheries studies, as well as studies directed to improve selectivity of trawl gears to eliminate the existing contradictions between minimum legal landing size and length of first capture (e.g. hake) and to reduce discards.

6. PRESENTATION OF THE RESEARCH ACTIVITIES AND ON-GOING RESEARCH PROJECTS. DISCUSSION ON RESEARCH NEEDS

It was adopted that each research team should provide to the reporter a list of research activities and on-going research projects. Information provided on this topic is enclosed in Annex D. The following remarks were made:

- Only one project deals on ecological approach to fisheries, one of the necessities pointed out by the SAC.
- Most projects are not directed to assessment. It was also stated that, in general, there is not the habit, as in other commissions, to present yearly updated assessments.
- In some countries, there is a low ratio between number of projects directed to fisheries assessments and number of assessments presented to the WGs. In this sense, the SC was informed that, in some cases, results from these projects are published on international journals and, in other cases, results were only available to national administrations which financed the research.
- The SC was informed that next year some assessments from MEDITS project will be presented at the WG. Also, currently a great amount of scientific papers from this programme is being prepared and submitted to be published in a *Scientia Marina* monograph.

- The expectations from the analysis work being performed by SAMED project were highlighted.
- It was remembered that the first objective of this SC is to assess shared stocks of priority species in the Mediterranean. In this sense, it should be necessary to elaborate a list of shared stocks and the SC encouraged their members to contribute to this objective. It was discussed the role of operational units in the identification of shared stocks. A first list, according to the definition of SAC Glossary and elaborated during this meeting, is the following:

Stock	Species	Area	Countries
1	Hake	Gulf of Lions	France and Spain
2	Hake	Adriatic	Albania, Croatia, Italy, Slovenia
3	Hake	Sicily Channel	Italy, Tunisia, Libya and Malta
4	Anchovy	Gulf of Lions	France and Spain
5	Anchovy	Adriatic	Albania, Croatia, Italy, Slovenia
6	Sardine	Adriatic	Albania, Croatia, Italy, Slovenia
7	Sprat	Adriatic	Croatia, Italy, Slovenia
8	Red mullet	Adriatic	Albania, Croatia, Italy, Slovenia
9	Blue whiting	Adriatic	Albania, Croatia, Italy
10	Bogue	Adriatic	Albania, Croatia, Italy, Slovenia
11	Bluefin tuna	All Mediterranean	All countries
12	Swordfish	All Mediterranean	All countries
13	Albacore	All Mediterranean	All countries

A complementary list of species whose stocks should be regarded as shared in the Adriatic Sea as agreed within the Adriamed framework is given in Annex E.

7. OTHER MATTERS

- It was remembered that there is a ftp page with all documents of the SC and its WG ([FTP://CUCAFERA.ICM.CSIC.ES/PUB/SCSA](ftp://CUCAFERA.ICM.CSIC.ES/PUB/SCSA)) and a mailing list of the SC (SCSA@ICM.CSIC.ES). (subscribe to **Error! No bookmark name given.**SCSA-REQUEST@ICM.CSIC.ES).
- Information of the subcommittee is also in the Website of COPEMED

Next meetings:

- The following institutes offer to host and organise the future meetings of SC: ICM (Barcelona), IRPEM (Ancona) for small pelagics WG and IFREMER (Sète).

8. CONCLUSIONS AND RECOMMENDATIONS

- High prospects had been put on the new GFCM by Mediterranean fisheries scientists, expecting it to function as other international commissions involved in stock assessment and fisheries management. In order to reach this goal, four SCs and several WGs, as well as ad hoc WGs, were created and are going on. Unfortunately, two years later, it must be recognised that little assessments have been made and not much useful recommendations can be done for fisheries management, although it

must be recognised for the SC that data necessary to carry out assessment exists (but not always are available), at least for some MU. In this context, this SC felt that it is loosing its credibility for SAC and strongly expressed its concerns about its role and the future of SAC and GFCM. Through the SAC, this situation should be highlighted to the GFCM members for discuss during the next meeting of the Commission, recommending them to intervene for the respect and maintenance of the rules fixed for GFCM and accepted by each member two years ago.

- It was stated that assessments of seven species (*Merluccius merluccius*, *Mullus barbatus*, *Aristeus antennatus*, *Engraulis encrasicolus* and *Sardina pilchardus*), considered as priority by SAC, have been presented.
- It was stated that only three shared stocks have been assessed and was strongly recommended to present assessment for additional shared stocks.
- It was pointed out the poor representation of scientists of eastern and southern Mediterranean and Black Sea countries.
- Multi-species assessments and ecological approaches in fisheries studies were encouraged as well as studies directed to increase the selectivity of trawl gears.
- It is necessary to follow the guidelines to fill the assessment forms.
- It is necessary to updated yearly the assessments and incorporate new stocks.
- It was stated that, in some countries, there is a low ratio between number of projects directed to fisheries assessments and number of assessments presented to the WGs.
- When reduction of effort is recommended, it should be necessary to propose a quantitative data (e.g. percentage).

Small pelagics

- Due to the potential danger of recruitment over-exploitation in anchovy, it is recommended to set the minimum legal size to length of first maturity . Considering the different information about length at first maturity of this species in different areas, the SC will prepare a brief document, to be presented to the SAC, containing available information on this topic.
- The SC suggested the inclusion of *Trachurus mediterraneus* and *Boops boops* as priority species of the GFCM.

Demersals

- It is necessary to present also assessments based on direct methods.
- It appears a clear growth overexploitation on all hake assessments presented. It was considered a priority to reduce the effort and increase the selectivity on this species, avoiding to catch small individuals.

- It was stated the necessity to extend hake assessment to other areas of the Mediterranean.
- It was discussed the possibility to recommend the enlargement of legal minimum landing size for hake.
- For most of analysed demersal species it was recommended to decrease fishing effort and apply other management technical measures as spatial and/or seasonal closures.

Large pelagics

- It was stated that no stock assessment and management recommendations were made during the last year in this WG. It was explained that, at this moment, the WG considered that major problem is the lack of data.

ANNEX A

LIST OF PARTICIPANTS

ALGERIA

HAOUCHINE, Mohamed
Ministère de la Pêche et des Ressources
Halieutiques
Alger
Tel.: 213 2143 3173
Fax: 213 2143 31 68
E-mail: mprh@wisal.dz

CROATIA

JUKIC-PELADIC, Stjepan
Institut of Oceanography and Fisheries
21000 Split
Tel.: 385 21 358 688
Fax: 385 21 358 650
E-mail: jukic@izor.kr

FRANCE

FARRUGIO, Henri
Centre Halieutique Méditerranéen et Tropical
IFREMER
B.P. 171 - Avenue Jean Monnet
34203 Sète Cedex
Tel.: 0499 57 32 00
Fax: 04 99 57 32 95
E-mail: henri.farrugio@ifremer.fr

MARIN, Jean
Centre Halieutique Méditerranéen et Tropical
IFREMER
B.P. 171 - Avenue Jean Monnet
34203 Sète Cedex
Tel.: 0499 57 32 00
Fax: 04 99 57 32 95
E-mail: jean.marin@ifremer.fr

JADAUD, Angélique
Centre Halieutique Méditerranéen et Tropical
IFREMER, B.P. 171 - Avenue Jean Monnet
34203 Sète Cedex
Tel.: 0499 57 32 00
Fax: 04 99 57 32 95
E-mail: angelique.jadaud@ifremer.fr

GREECE

AGIOVLASSITI, Olga
Ministry of Agriculture
Directorate General for Fisheries
Aharnon Street381
11143 Athens

Tel.: 30 01 2111175
Fax: 30 01 2125271
E-mail: a381u@minagric.gr

KALLIANIOTIS, Argyris
NAGREF
Ministry of Agriculture
Nea Peramos
64007 Kavala
Greece
Tel./Fax: 30 594 22691
E-mail:

ITALY

ABELLA, Alvaro
ARPAT
Via Marradi, 114
Livorno
Tel.: 39 0586 263456
E-mail: a.abella@arpat.toscana.it

ARNERI, Enrico
CNR - IRPEM
Largo della Fiera della Pesca, 1
60125 Ancona
Tel.: 39 071 2078849
Fax: 39 071 55313
E-mail: arneri@irpem.an.cnr.it

BELCARI, Paola
Università di Pisa
Via Volta 6
56126 Pisa
Tel.: 39 050 502715
Fax: 39 050 49694
E-mail: belcari@discat.unipi.it

CINGOLANI, Nando
CNR - IRPEM
Largo della Fiera della Pesca, 1
60125 Ancona
Tel.: 39 071 207884
Fax: 39 071 55313
E-mail: cingolani@irpem.an.cnr.it

DELLA SETA, Giovanni
Direzione Generale della Pesca e
dell'Acuacoltura
Ministero per le Politiche Agricole
e Forestali
Viale dell'Arte 16
00144 Roma
Tel.: 39 06 59084785

Fax: 30 06 59084144
E-mail: fossilk@tiscalinet.it

GIANNETTI, Gianfranco
CNR - IRPEM
Largo della Fiera della Pesca, 1
60125 Ancona
Tel.: 39 071 207881
Fax: 39 071 55313
E-mail: giannetti@irpem.an.cnr.it

PICCINETTI, Corrado
Direttore
Laboratorio di Biologia Marina e Pesca
Viale Adriatico, 1/N
61037 Fano
Tel. 39 721 802689
Fax: 39 721 801654

SPEDICATO, Maria Teresa
COISPA Tecnologia e Ricerca
Via dei Trulli 18-20
70045 Bari - Torre a Mare
Tel.: 39 080 5433596
Fax: 39 080 5433586
E-mail: coispa@eostel.it

VOLIANI, Alessandro
ARPAT
Via Marradi, 114
Livorno
Tel.: 39 586 263461
E-mail: a.voliani@arpat.toscana.it

MALTA

CAMILLERI, Matthew
Ministry of Agriculture and Fisheries
Department of Fisheries and Aquaculture
Fort San Lucian
Marsaxlokk, BBG06
Tel.: 356 650934
Fax: 356 659380
E-mail: matthew.camilleri@magnet.mt

MOROCCO

NOUREDDINE, Abid
INRH - Centre régional de Nador
B.P. 493
Nador
Tel.: 212 56 603828
Fax: 212 56 603828
E-mail: abid@nadornet.net.ma

SROUR, Abdellah
INRH - Centre régional de Nador
B.P. 493
Nador
Tel.: 212 56 600869

Fax: 212 56 603828
E-mail: sroure@nadornet.net.ma

SPAIN

CAMINAS, Juan Antonio
Instituto Español de Oceanografía
Centro Oceanográfico de Málaga
Apdo 285
29640 Fuengirola (Malaga)
Tel.: 34 95 2478148
Fax: 34 95 2463808
E-mail: jacaminas@ma.ieo.es

GIRALDEZ, Ana
Centro Oceanografico de Malaga
Instituto Español de Oceanografía
Apartado 285
29640 Fuengirola - Malaga
Tel.: 34 95 258 21 60
Fax: 34 95 246 38 08
E-mail: agiraldez@ma.ieo.es

LLEONART, Jordi
Institut de Ciències del Mar
Consejo Superior de Investigaciones
Científicas
Passeig. Joan de Borbo, s/n
08039 Barcelona
Tel.: 34 93 221 6416
E-mail: lleonart@icm.csic.es

MASSUTÍ, Enric
IEO-Centre Oceanogràfic de les Balears
Moll de Ponent s/n
P.O. Box 291
07080 Palma de Mallorca
Tel.: 34 971 401561
Fax: 34 971 404945
E-mail: enric.massuti@ba.ieo.es

PEREDA, Pilar
Instituto Español de Oceanografía
Centro Oceanográfico de Murcia
C/ Varadero, 1
30740 San Pedro del Pinatar
Murcia
Tel.: 34 968 180 500
Fax: 34 968 184 441
E-mail: pilar.pereda@mu.ieo.es

TUNISIA

JARBOUI, Othman
Maitre de recherche agricole à l'INSTM
B.P. 1035
3018 Sfax
Tel.: 216 4 497 117
Fax: 216 4 497 989
E-mail: othman.jarboui@instm.nrnt.tn

ADRIAMED

MANNINI, Piero
 Corso Umberto I, 30
 86039 Termoli
 Italy
 Tel.: 39 0875 708252
 Fax: 39 0875 708240
 E-mail: piero.mannini@fao.org

COPEMED

ROBLES, Rafael, Director
 Universidad de Alicante
 Ramón y Cajal 4
 03001 Alicante, Spain
 Tel.: 34 96 514 59 79
 Fax: 34 96 514 59 78
 E-mail: rafael.robles@ua.es

EUROPEAN COMMUNITY

BIAGI, Franco
 Principal Administrator
 Directorate General for Fisheries - A1
 Rue Joseph II, 99
 B-1000 Brussels, Belgium
 Tel.: 32-2 2994104
 Fax: 32-2 2955621

E-mail: franco.biagi@cec.eu.int

FAO

OLIVER, Pere
 FIRM, FAO
 Viale delle Terme di Caracalla
 00100 Rome, Italy
 Tel.: 39 06 5705 6354
 Fax: 39 06 5705 3020
 E-mail: pere.oliver@fao.org

MAJKOWSKY, Jacek
 FIRM, FAO
 Viale delle Terme di Caracalla
 00100 Rome, Italy
 Tel.: 39 06 5705 6656
 Fax: 39 06 5705 3020
 E-mail: jacek.majkowski@fao.org

ICCAT

RESTREPO, Victor
 C/Corazón de Maria, 8
 28002 Madrid, Spain
 Tel.: 34 91 416 5600
 Fax: 34 91 415 2612
 E-mail: victor.restrepo@iccat.es

ANNEX B

GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

SCIENTIFIC ADVISORY COMMITTEE

SUB-COMMITTEE FOR STOCK ASSESSMENT

**FAO headquarters. German Room (C-269)
Rome, 15-18 May 2001**

Provisional agenda

Coordinator: J. Lleonart

Email: lleonart@icm.csic.es

1. Opening of the meeting
2. Adoption of the agenda and arrangements of the session
3. Review and analysis of the assessments presented to the small pelagics and demersal Working Group
4. Review of the conclusions of the GFCM/ICCAT Working Group on Large Pelagic Fishes (Malta, September 2000)
5. Discussion on assessment methodology
6. Review of the current management measures, of the alternative management options and formulation of proposals for future management.
7. Presentation of the research activities and on-going research projects. Discussion on research needs.
8. Other matters
9. Adoption of the report

NOTES:

- To Point 6. To review the current different management approaches and measures in the Mediterranean and to analyse and comment the Green Paper on the Future of the Common Fisheries Policy of the European Union (<http://europa.eu.int/comm/fisheries/doc-et-publ/green1-en.htm#volume1>)
- To Point 7. The participants should provide the titles and abstracts of on-going research projects
- For further information please contact Mr. Lleonart.

ANNEX D

List of on-going projects

Malta.- Research and training activities

1.- MEDITS trawl surveys

The first trawl survey was carried out in 2000 providing some general indications as to the state of resources in the Maltese EEZ. Analysis of the data has been carried out and the results were compared to those for the rest of the Sicily Channel. It appears that Maltese waters are an important “refugium” and spawning ground for a number of important species. COPEMED has supported the participation of Malta in MEDITS. Malta will take part in the MEDITS campaign in 2001.

2.- Catch Assessment Scheme

A Catch Assessment Scheme is currently being designed with the support of FAO staff and COPEMED. It will serve to provide more reliable landings data, better understand fishing vessel activities and provide catch and fishing effort data. Biological sampling is expected to be an integral part of the Catch Assessment Scheme.

3.- *Coryphaena hippurus* Project

Malta has taken an active part in this COPEMED supported project since August 2000. The project focusses on the study of population dynamics of this highly migratory species together with its biology. Catch and fishing effort data is also being collected. The project is expected to provide a basis for the formulation of a Mediterranean management regime for *Coryphaena hippurus*.

4.- *Thunnus thynnus* project

Malta has also participated for the last two years in a research project on blue-fin tuna in collaboration of COPEMED (who has financed Malta’s participation) and ICCAT.

5.- Training in stock assessment and fisheries management models

Within the framework of the Higher National Diplome course in fisheries science recently set-up and delivered by the Department of Fisheries and Agriculture (Malta), training in stock assessment and fisheries management was made possible through FAO staff and other experts. COPEMED has contributed to the financing of the setting up of this course and visiting lecturers. The HND course is open to all Mediterranean countries.

Spain International

PROYECT NAME OR ACRONIME	SUPPORT ED BY:	COORDINAT OR NAME	Partners	OBJETIVES	M U	DURATION (From-to)
LLUCET	(CE-FAIR CT97-3522).	Dr. J. Lleonart. ICM, Spain.	ICM-IFREMER-CIBM-DIP.T E.RIS IMEDEA	Impact of fishery and environment on hake recruitment in Northwestern Mediterranean	6	1997–2001, Final Report presented
CABALLA	(CE DGXIV).	Dr. A. Tsangridis Investigador Principal ICM: Dra. P. Sánchez. ICM, Spain	ICM.....	Fisheries Biology and Population Genetics of <i>Scomber scombrus</i> and <i>S. japonicus</i> in the Mediterranean.	6	2000-2002
EDFAM	(QLRT - 1999-01272) Acción Concertada. ICM-IEO	Dr. F. Maynou. ICM, Spain	ICM, IEO....	European Decapod Crustacean Fisheries: Assesment and management.	6	2000–2002
DESEAS	CE DG FISH.	Dr. F. Sardà. ICM, Spain	ICM.....	Exploratory survey to collect data of the exploited and virgin stocks of deep-sea shrimp <i>A. antennatus</i> , of interest to the CFP	6	2001
DISCARDS	CE DG FISH-ICM-IEO	Dra. P. Martín. ICM, Spain	ICM, IEO, DSUA	Estimation of trawl discards in the western Mediterranean. European hake (<i>Merluccius merluccius</i>) as case study	6-5	2001
MEDA2001	DG FISH-IEO-IFREMER	Pilar Pereda. IEO, Spain	IEO, IFREMER	Collection and management of data for the assessment of the Spanish and French Mediterranean fisheries.	1-2-5-6-7	2001

UMED	DG FISH-IEO	Federico Álvarez. IEO, Spain	IEO,	(Factores que afectan las tasas de captura en las pesquerías de arrastre del Mediterráneo noroccidental y derivación de índices de abundancia estandarizados)	6	
MAGO II	DG FISH-IEO	Alberto García. IEO, Spain	IEO.....	La pesquería de anchoa de Sicilia y los factores que condicionan sus fluctuaciones.	16	1999-2001
MEDITS	DG FISH-IEO- IFREMER, etc	Luis Gil de Sola. IEO, Spain	IEO, ICM, IFREMER,	Assessment of demersal resources by direct methods in the Mediterranean and the adjacent seas	1-6	

Spain national

NERIT	(CICYT).	Dr. F. Sardà. ICM, Spain.	ICM	Influència del comportament rítmic de la (<i>Nephrops norvegicus</i> L.) sobre su capturabilidad por la pesquería de arrastre en el Mediterráneo Occidental	6	1998-2001
ESCAL	(Generalitat de Catalunya).	Dra. L. Recasens. ICM, Spain	ICM	Estudi i seguiment de l'evolució, colonització i impacte pesquer de l'escull artificial de Calafell.	6	1999–2001
ARO	(CICYT-MA R99-1202).	Dra. A. Sabatés. ICM, Spain	ICM	Estudio de la advección de aguas del río Ródano hacia la costa Catalana a finales de primavera y sus implicaciones en el transporte de larvas de anchoa y comunidades planctónicas asociadas	6	1999–2001
SOMI	(CICYT-RE N2000-0878)	Dra. I. Palomera. ICM, Spain	ICM	Sostenibilidad del ecosistema marino explotado en el Mediterráneo Ibérico: Aplicación del enfoque sistématico Ecopath	6	2001–2002
	PETRI-CICYT (PTR1995-0497-OP)	Dr. F. Sardà. ICM, Spain.	ICM	Transferencia de resultados para la preservación de especies marinas juveniles mediante el uso de sistemas selectivos en áreas de pesca de arrastre en el Mediterráneo Occidental'	6	2001-2002
PASET	(REN2000-0877). CICYT	Dr. Pere Abelló. ICM, Spain	ICM	Estudio del hábitat y pautas de asentamiento de la langosta común (<i>Palinurus elephas</i>) en la reserva marina de las Islas Medas	6	2001-2003
BDMED	IEO	Pilar Pereda. IEO, Spain	IEO	(Base de datos de pesca pelágica costera y demersal del Mediterráneo).	1-2-5-6-7	2000-2002
DEMERMED	IEO	Luis Gil de Sola. IEO, Spain	IEO	(Evaluación de los recursos pesqueros demersales del Mediterráneo)	1-6	2000-2002
LANGOSTA	IEO-SGPM	Raquel Goñi. IEO, Spain	IEO	Dinámica de poblaciones y pesquerías de langosta en el Mediterráneo	5	

MEGA	IEO	Aina Carbonell. IEO, Spain	IEO	Análisis de las pesquerías de gamba rosada en el Mediterráneo Español	1-2-5-6-7	2000-2002
ARTESANALES	IEO	Angel Fernández IEO, Spain	IEO	Analysis of artisanal fisheries in some ports of the Spanish Levant Region	6	2000-2002
ICTIO-ALBORAN-CADIZ	IEO	Juan Pérez Rubín. IEO, Spain	IEO	(Campañas Ictio. Alboran-Cádiz)	1	2001
APEMED	IEO	Ana Giráldez IEO, Spain	IEO	Estimation abundance and variability of small pelagic fish populations.	1-6	1998-2001
MEDER	IEO	Enric Massuti. IEO, Spain	IEO	Assessment of demersal resources (Hake, Mullus, Octopus, Lophius) caught by the Spanish fleets in the Mediterranean. Establish technical basis for management of the trawl fisheries.	1-2-5-6-7	2001
Large pelagics	IEO	José Miguel de la Serna. IEO. Spain	IEO			

France

ESPECES DEMERSALES

Au cours de l'année 2000, l'échantillonnage régulier des débarquements des principales espèces commerciales dans les principaux ports et criées du littoral s'est poursuivi. Ces données ont été saisies dans la base de données Arpège. Ces données sont utilisées pour l'évaluation indirecte des ressources, en particulier au moyen des méthodes d'analyse des populations virtuelles.

En 2000 elles ont permis en particulier d'alimenter les travaux du comité d'évaluation des stocks de la CGPM et ceux du projet communautaire MEDLAND (projet pilote d'échantillonnage des captures commerciales).

Les campagnes de chalutage MEDITS, destinées à l'évaluation directe des ressources démersales en Méditerranée le long des côtes de neuf pays riverains (Espagne, France, Italie, Slovénie, Croatie, Albanie, Grèce, Maroc, Malte) se sont poursuivies en 2000 pour la sixième année consécutive.

La France participe aussi au projet communautaire SAMED, destiné en particulier à l'analyse des variations inter-annuelles d'abondance à partir des données MEDITS depuis 1994 ; ce projet a démarré en septembre 2000 et prendra fin en février 2002

Au sein du projet communautaire LLUCET, les actions menées par IFREMER ont consisté en études basées sur les données provenant des campagnes de chalutage réalisées dans le golfe du Lion depuis 1983 : (i) distribution géographique des jeunes merlus et biomasse relative à partir des indices d'abondance; (ii) analyse de la stabilité ou variabilité temporelle des zones de nurseries; (iii) analyse de la démographie des apports des chalutiers dans les principales criées où a été réalisé un échantillonnage biologique depuis 1998.

Dans le cadre du projet communautaire MEDCPUE, une étude de la dynamique de la flottille chalutière exploitant les ressources démersales a été abordée à partir des données provenant des criées informatisées du littoral du golfe du Lion. Cette étude a pour but de mesurer les puissances de pêche des navires, les indices saisonniers et annuels de variation d'abondance, d'effectuer une standardisation de l'effort de pêche permettant de simuler divers scénarios de gestion et d'intercalibrer les séries d'indices d'abondance de merlu obtenues à partir des données sur la pêche commerciale et des pêches expérimentales (campagnes MEDITS).

Dans le cadre des activités concernant la zone côtière, une réactualisation de l'analyse détaillée des flottilles de "petits métiers" de la région Languedoc-Roussillon avait été réalisée en 1998 et 99. Ce travail se poursuit depuis septembre 2000 par l'échantillonnage des efforts de pêche et des rendements dans la région, en particulier au niveau des sites d'implantation de récifs artificiels.

ESPECES PELAGIQUES

Le laboratoire IFREMER de Sète a poursuivi en 2000 la réalisation de son programme national pluriannuel d'étude sur les petits pélagiques et en particulier sur l'anchois du golfe du Lion. Le programme consiste en une évaluation annuelle des populations par échantillonnage (campagnes PELMED du N.O. L'EUROPE) et en études sur le comportement et la variabilité spatio-temporelle de l'espèce.

L'étude du thon rouge a vu en 2000 la poursuite de travaux de modélisation ayant pour but de tester différents scénarii de recrutement, de maturité et de croissance, sur la taille du stock exploitable. Un axe de recherche résultant d'une collaboration entre l'IFREMER et l'IRD vise à étudier l'influence de la variabilité spatio-temporelle des upwellings côtiers du golfe du Lion, via l'imagerie satellitaire, sur les populations de juvéniles de thon rouge.

Le projet communautaire BFTMED, a pris fin en 2000 ; il a permis de comparer des données de captures de thon rouge en provenance de ports français et espagnols et de valider les données recueillies par enquêtes auprès des mareyeurs français et l'échantillonnage biologique (mensurations et pesées effectuées au débarquement).

Pour sa première année, le projet communautaire STROMBOLI a permis de compléter une base de données historiques sur le thon rouge. Une analyse exploratoire de ces données a été réalisée, permettant notamment de mettre à jour un important cycle séculaire chez ces populations; dans le cadre de ce projet ont été réalisés également un travail de simulation sur la résistance à l'exploitation des thons tropicaux versus les thons tempérés, et une première série de missions aéroportées orientées vers l'observation des concentrations de thon rouge en surface dans les eaux des Baléares et du golfe du Lion. L'activité et la production de la flottille thonière ont continué d'être suivies en soutien à ces travaux.

AUTRES TRAVAUX

Les travaux du projet communautaire FIGIS se sont poursuivis et ont pris fin en 2000 ; outre les résultats méthodologiques qu'ils ont permis d'obtenir, ces travaux constituent une base pratique (interface entre études scientifiques et prises de décision) pour l'application des Systèmes d'Information Géographique à l'analyse des interactions entre ressources et facteurs environnementaux et à l'étude du comportement des flottilles de pêche en interaction avec le système réglementaire.

Tunisie

Après l'achèvement du Programme National Mobyliateur (PNM) "Evaluation des Ressources Halieutiques Tunisiennes" (ERHT) en 2000, l'Institut National des Sciences et Technologie de la Mer (INSTM) a entrepris un autre programme de recherche sur contret (PRC) "Evaluation des Ressources financé par le Secretariat d'Etat à la Recherche Scientifique et à la Technologie. L'objectif principal de le programme consiste à l'étude biologique et dynamique de plus d'une dizaine d'espèces demersales et des petits pélagiques qui n'ont pas pu être considérées dans l'ancien PNM. Ces espèces représentent également un intérêt considérable dans les pêcheries tunisiennes comme la coryphène, le serre, les rougets, la langouste, les selaciens, la crevette blanche, l'anchois, la sardine, la sardinella, et le saurel.

La réalisation de ce programme a débuté depuis l'année 2000 par la collecte des données concernant la biologie (croissance, reproduction et régime alimentaire), la démographie des captures aussi que la distribution géographique et l'abondance de la ressource. Ces activités concernent les trois unités d'aménagement 12, 13 et 14.

Il est à signaler que certaines espèces comme la coryphène, les thonidés et la langouste sont étudiées dans le cadre des activités régionales mis au point et supportées par le projet FAO/COPEMED. Par ailleurs, des campagnes de prospections (demersales et pélagiques) sont programmées et réalisées chaque année dans les trois Ua à bord du bateau de recherche "Hannibal".

Italy

Les recherches sur la pêche sont effectuées en Italie par un grand nombre d'institutions scientifiques et il est difficile de donner le cadre complet des recherches, en raison aussi des différentes sources de financement.

La Direction Générale des pêches italiennes finance depuis 1982 la recherche finalisée pour la gestion des pêches. En particulier, des campagnes de chalutage de fond sont réalisées depuis 1985 jusqu'à la profondeur de 800 mètres dans toutes les eaux italiennes. Le programme est coordonné par protocole de travail commun. Il donne la distribution des espèces, les distributions des tailles par sexe, les zones de reproduction, les zones de concentration de juvéniles, etc. Un projet similaire, MEDITS, est réalisé depuis 1994, avec une méthodologie commune, par huit pays méditerranéens (Italie, Espagne, France, Maroc, Malte, Albanie, Croatie et Slovénie). Il permet de comparer l'état des ressources de ces différents pays.

Concernant les ressources de petits pélagiques, les campagnes d'échantillonnage, de DEPMM et d'échantillonnage des captures sont poursuivies depuis 1976. Des recherches sont également réalisées sur les aspects écologiques de la pêche des grands pélagiques.

Grâce au financement de l'Union Européenne, des recherches sont effectuées en coopération avec d'autres pays. Les résultats des différentes études sont régulièrement communiqués aux administrations qui financent la recherche, et publiés dans des revues scientifiques.

SAMED Project. Stock Assessment in the Mediterranean. Supported by EU DG Fish. Co-ordinator G. Lembo. SIBM. Italy. The objective of this project is to analyse 6 years time-series from MEDITS project, elaborating tendency of abundance and length structures as well as stocks parameters, in order to contribute to stock assessment.

Adriamed

Data collection and biological sampling system on small pelagics in the Adriatic Sea (ADRIAMED-SP)

Execution: Within the framework and support of the FAO Regional Project "Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea" (ADRIAMED) this programme will be executed with the participation of the following national research institutes: Fisheries Research Institute (Albania), Fishery Directorate (Albania), Institute of Oceanography and Fisheries (Croatia), Marine Fisheries Research Institute,

CNR-IRPEM (Italy), Marine Biology Laboratory (Italy); Marine Biology and Fisheries Laboratory (Italy); National Institute of Biology (Slovenia).

Brief description: Small pelagic fish stocks are of key importance for Adriatic fisheries. In particular the exploitation of anchovy and sardine is a primary activity notably with relevant consequences in terms of economics and employment. Alimentary habits and market preferences are different within the Adriatic region with anchovies being highly requested on the western markets and sardines on the eastern ones. This may cause the discarding of sardines by the western fishing fleet. Jointly concerted exploitation would be determinant in the optimisation of fishery, reducing discards of otherwise valuable resource. Small pelagic fish are resources of relatively high mobility whose stock size is characterised by between the years marked fluctuations which make small pelagic fisheries an inherently risky enterprise. Joint monitoring of the pelagic fishery dynamics and assessment of exploitable stock throughout the Adriatic Sea are fundamental requisites for sustainable exploitation and sound management of small pelagic fishery resources.

The programme will be focused on the commercial catch and effort data collection by species/gear around the Adriatic coast with associated biological sub-sampling at selected landing sites (main base ports). The activities will include: setting-up of pilot catch and effort sampling network at selected landing ports along the eastern coast of the Adriatic thus extending the data collection system on small pelagics established in Italy by CNR-IRPEM since 1975; establishment of common sampling protocol; creation of a regional database holding all the data collected by country and for the whole region; analysis of collected fishery statistics; fish samples ageing by means of otolith reading; analysis of the size/age structure of the exploited stocks; stock assessment through analytical models; tentative re-building of historical time series for the whole of Adriatic small pelagic fishery; On-the-job training on data collection and handling, fish ageing and growth and mortality parameters estimate, and on stock assessment. Some of the expected results are: improved knowledge of within-the-year Adriatic small pelagic fishery dynamics and comparative analysis of fishery exploitation patterns at regional level; estimate of current fishing mortality and assessment of stock abundance and of yield sustainability; scientific advice for optimisation of exploitation and discard reduction.

Identification of population units in Adriatic Sea shared stocks by genetic structure analysis (ADRIAMED-IPUAS)

Execution: Within the framework and support of the FAO Regional Project “Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea” ([ADRIAMED](#)) this programme will be executed with the participation of the following national research institutes: Environmental Sciences Department of the University of Bologna (Italy), Marine Biology and Fisheries Laboratory (Italy); National Institute of Biology (Slovenia).

Brief description: The role of the analysis of the genetic structure of fish and invertebrate populations in providing information on geographic limits of stocks and gene flow among sub-populations is widely recognised. The occurrence of possible sub-populations of the same species but which have some genetic differences should be considered and the possibility of managing them as separate stocks taken into account.

Knowledge of patterns of intraspecific genetic homogeneity/heterogeneity of key fishery resources is very limited for species whose stocks are shared in the Adriatic Sea.

The research will be carried out using standard technology for DNA molecular marker analysis applied to samples representative of the whole Adriatic Sea basin of seven commercial demersal species (*Eledone cirrhosa*, *Eledone moschata*, *Loligo vulgaris*, *Merlangius merlangus*, *Pagellus erythrinus*, *Sepia officinalis*, *Solea vulgaris*) whose stocks should be considered as shared by the fishing fleets of the Adriatic Sea coastal countries. The research programme will be implemented through the following phases: collection of relevant information from scientific literature and molecular databases; collection of samples from the whole Adriatic Sea basin; samples processing and collection of genetic data on target species; data elaboration and genetic pattern description; on-the-job training session will be also organised. The study is expected to result in the improved knowledge of biological stock unity in the Adriatic Sea of target species through the assessment of population genetic structure, estimate of genetic variation and gene flow between possible sub-populations.

International bottom trawl survey in the Eastern Adriatic Sea (ADRIAMED)

Execution: Within the framework and support of the FAO Regional Project “Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea” (ADRIAMED) this programme will be executed with the participation of the following national research institutes: Fisheries Research Institute (Albania), Institute of Oceanography and Fisheries (Croatia), Marine Biology Laboratory (Italy); Marine Biology and Fisheries Laboratory (Italy); National Institute of Biology (Slovenia).

Brief description: In the Adriatic experimental bottom trawl survey to monitor and assess demersal fishery resources have been carried out starting in 1948-49 (Hvar Expedition). For the most part demersal survey sampling design could cover only national and international waters. Exceptions were the 1982-84 survey, jointly executed by Croatia and Italy in the Northern and Central Adriatic, and more recently, within the EU-funded MEDITS programme the whole Adriatic has been surveyed since 1996, with the exception of Montenegrin waters. Italy has been implementing demersal trawl surveys in national and international waters to the territorial waters of the other coastal countries since 1985 for a total of 25 survey exercises. Common approach at regional level is needed when the key demersal resources are straddling stocks across the boundaries between territorial seas and international waters where open access conditions apply. The consideration in point of fact that the most important commercial stocks of the Adriatic are almost all exploited and therefore shared by the national fishing fleets makes it necessary that their monitoring and assessment be carried out over the whole Adriatic Sea.

The planned bottom trawl survey will cover the territorial water of Albania, Croatia and Slovenia. The survey exercise will be carried out in the same period of the Italian national trawl survey using the same commercial bottom trawl net. The work will be implemented as following: preparation of survey design in the Eastern Adriatic territorial waters; survey execution at the end of summer/early autumn; data collection, compiling and processing following common protocol prepared and agreed upon by all researchers involved; joint data elaboration and analysis. Some of the expected results are: relative

abundance index and occurrence pattern of target species over the whole Adriatic basin for the time of the year concerned (end summer-early autumn); availability for analysis work of two sampled season: spring (MEDITS) and October (current) even though the use of two bottom trawl gear of different design will have to be accounted for; partial integration and comparison with past or other survey results; appraisal of the status of demersal resources using common data set and standard stock assessment tools.

Ongoing stock assessment projects carried out by IRPEM-CNR

Stock assessment of anchovy (*Engraulis encrasicolus*, L.) and sardine (*Sardine pilchardus*, Walb.) in the Adriatic Sea using population dynamics methods.

Scientific responsible Nando Cingolani

Funding from Italian Directorate for Fisheries. Status: ongoing from 1975 under different sources of fundings. Main partnership Imperial College London (dr G. Kirkwood)

Since 1975, Istituto di Ricerche sulla Pesca Marittima (IRPEM), Ancona - Italy, has conducted research on assessment of pelagic stocks of anchovies and sardines in the Adriatic Sea. Data collected by IRPEM fall into a number of categories. These include total catches by species, catch and effort data, fleet characteristics, length-frequency data, length-weight data, and age-length data. This research effort has produced a series of stock assessments (Arneri, 1996; Cingolani *et al.*, 1993, 1996a,b, 1998a,b; Santojanni *et al.* 1999; Santojanni *et al.* in press,

The population dynamics methods used are the Virtual Population Analysis (VPA) by means of the software developed by Ministry of Agriculture, Fishery and Food (UK), the DeLury model with recruitment index by means of the software developed by Marine Resources Assessment Group (UK), the Length Cohort Analysis (LCA) by means of the software package VIT.

References

- Arneri, E. - 1996. Fisheries resources assessment and management in the Adriatic and Ionian Seas. FAO-GFCM 3rd Technical Consultation on Stock Assessment in the Central Mediterranean, Tunis, 8-12 November 1994. FAO Fish. Rep., 553(suppl.): 7-20.
- Cingolani, N., G. Giannetti, E. Arneri, D. Levi e A. Piersimoni. - 1993. Valutazione degli stocks pelagici di alici e sardine in Adriatico con metodi di dinamica di popolazione. Rapporto per il Ministero delle Risorse Agricole, Alimentari e Forestali. Istituto di Ricerche sulla Pesca Marittima di Ancona, 181 pp.
- Cingolani, N., G. Giannetti and E. Arneri. - 1996a. Anchovy fisheries in the Adriatic Sea. Sci. Mar., 60(Supl.2): 269-277.
- Cingolani, N., G. Kirkwood, G. Giannetti, E. Arneri and D. Levi. - 1996b. Note on the stock assessment of *Engraulis encrasicolus* (L.) and *Sardina pilchardus* (Walb.) of the northern and central Adriatic Sea. FAO-GFCM 3rd Technical Consultation on Stock Assessment in the Central Mediterranean, Tunis, 8-12 November 1994. FAO Fish. Rep., 553(suppl.): 1-5.
- Cingolani, N., E. Arneri, G. Giannetti, A. Santojanni e A. Belardinelli. - 1998a. Valutazione degli stocks pelagici di alici e sardine in Adriatico con metodi di dinamica di popolazione. Rapporto per il Ministero per le Politiche Agricole. Istituto di Ricerche sulla Pesca Marittima di Ancona, 137 pp.

- Cingolani, N., E. Arneri, G. Giannetti, A. Santojanni and A. Belardinelli. - 1998b.
Assessment of anchovy and sardine stocks in the Adriatic Sea by means of population dynamics. *Biol. Mar. Medit.*, 5: 321-330.
- Santojanni, A., E. Arneri, A. Belardinelli, N. Cingolani and G. Giannetti. - 1999.
Fluctuations of biomass of sardines (*Sardina pilchardus*, Walb.) in the Adriatic Sea. *Atti del XIII Congresso dell'Associazione Italiana di Oceanologia e Limnologia*. Portonovo, 28-30 settembre 1998. Vol. 13(1). pp. 11-20.
- Santojanni, A., E. Arneri, A. Belardinelli, N. Cingolani and G. Giannetti. Small pelagic fish in the Adriatic: stocks fluctuations and environmental factors. *Limnologia e Oceanografia*. *In press*.

Technical improvements in the management of Scottish Nephrops and Adriatic clam fisheries. EU project 99/077. Start April 2000, end March 2002.

Scientific responsible Enrico Arneri

Partners: University Marine Biological Station Millport (UMBSM), Istituto di Ricerche sulla Pesca Marittima Ancona (IRPEM), Fisheries Research Services, Marine Laboratory Aberdeen (MLA)

The proposal is centred on the use of GPS-linked data-loggers to record the fine-scale position of vessels representative of the commercial fleet.

In each area the data to be generated are required for management purposes. In the case of the Scottish *Nephrops* fisheries, this is to take proper account of the spatial variability in size distribution and growth rate of *Nephrops* in stock assessment, and the relative impact of vessels of differing gear and engine power. For the Italian clam fishery, the aim is to provide essential data on fishing effort that will be used in stock assessment models, for assessing environmental impact, and for delimiting closed areas for stock recovery purposes.

Individual objectives can be summarized as follows:

1. Map micro-distribution of fishing effort and landings of representative vessels in a component of the Scottish west coast *Nephrops* fleet and the Ancona district Adriatic clam fleet .
2. To relate this to population parameters and stock density.
3. To relate this to vessel power and gear type
4. To use these data for assessment and management.

In the Adriatic, GPS-linked data loggers would be fitted to a total of 24 vessels from 3 harbours which represent the Ancona fishing district where hydraulic dredging has been assessed by IRPEM since 1984. This represents 30% of the 72 boat fleet. This method is the only accurate way to estimate the fishing effort (actual time and area fished) exerted to catch the daily quota.

In the Adriatic, the data-logging methodology will be also used in order to aid assessment of the environmental impact of the hydraulic fishing method. This is because it precisely identifies the area impacted and reveals the length of time the gear is in use.

In the Adriatic, the rate of depletion of selected clam banks will be assessed. This information will be used in models which are used to estimate population size. Given the

availability of realistic CPUE data it will be possible to validate and considerably improve current assessment of the clam resource carried out by IRPEM under Italian Directorate for Fisheries funding. Considerable use will also be made of the data to investigate the spatial variability of catch rate in relation to environmental, gear and vessel parameters.

COPEMED

- Sampling networks for data collection (catch and effort) on priority species of shared stocks in COPEMED area has already been regularly developed since the last 2-3 years.
- Updating and improvements of national fisheries statistic systems are now in progress in the majority of the southern Mediterranean COPEMED countries.
- Biological parameters (growth, reproduction, abundance indices, genetics) have also started to be studied in some key species.
- Feasibility of socio-economic indicators have also been analysed for the Alboran Sea and are in progress for the Gulf of Gabes.
- The on-going artisanal fisheries programme will permit a regional standardised knowledge of the qualitative situation of these usually forgotten or unknown fisheries.
- Training on theory and practice of sampling, acoustic and assessment methodologies have been or are going to be implemented soon in order to ensure the analysis of the collected data and the presentation of future assessment of the priority species in the different countries (Tunisia has already contributed to this Sub-committee with the presentation of some stocks assessment done).
- Genetics work on bluefin tuna for ameliorating stocks identification have been done too and these type of work will be also applied to hake and dolphinfish.
- The incorporation of Morocco and Malta to the on-going EU MEDITS project will allow these countries to present assessment data for priority **demersal species**.
- The recently started acoustic assessment cruises for **small pelagics** in Tunisia will also allow them to contribute with this type of assessments.
- Finally, specific on-going research programme with the goal to provide stocks assessment information are:
 - Bluefin tuna
 - Swordfish
 - Dolphinfish
 - Lobster

ANNEX E

Relevant common species whose stocks are shared by at least two Adriatic countries (see Adriamed Technical Document GCP/RER/010/ITA/TD-01 and GCP/RER/010/ITA/TD-03 for further details).

- : common occurrence;
- : scarce;
- blank: negligible;

Species	Area of Occurrence		
	Northern Adriatic	Central Adriatic	Southern Adriatic
Group A			
A. Geographical Management Unit	37.2.1.a		37.2.2.b
<i>Eledone cirrhosa</i>		●	●
<i>Eledone moschata</i>	●	●	○
<i>Loligo vulgaris</i>	●	●	●
<i>Lophius budegassa</i>	○	●	●
<i>Lophius piscatorius</i>		○	●
<i>Merlangus merlangus</i>	●	●	
<i>Merluccius merluccius</i>	●	●	●
<i>Mullus barbatus</i>	●	●	●
<i>Nephrops norvegicus</i>	●	●	●
<i>Pagellus erythrinus</i>	●	●	●
<i>Parapeneus longirostris</i>		○	●
<i>Sepia officinalis</i>	●	●	●
<i>Solea vulgaris</i>	●	●	○

Species	Area of Occurrence		
	Northern Adriatic	Central Adriatic	Southern Adriatic
Group B			
B. Geographical Management Unit	37.2.1.a		37.2.2.b
<i>Boops boops</i>	●	●	●
<i>Illex coindetii</i>	○	●	●
<i>Micromesistius potassou</i>		●	●
<i>Mustelus mustelus</i>	●	●	●
<i>Octopus vulgaris</i>	○	●	●
<i>Pecten jacobaeus</i>	●	●	
<i>Platichthys flesus italicus</i>	●	●	○
<i>Scyliorhynchus canicula</i>	●	●	●
<i>Spicara flexuosa</i>	●	●	○
<i>Squalus acanthias</i>	●	●	●
<i>Trachurus mediterraneus</i>	●	●	●
<i>Trachurus trachurus</i>	●	●	●

Species	Area of Occurrence		
<i>Trigla lucerna</i>		○	●
<i>Trigloporus lastoviza</i>	●	○	○
<i>Trisopterus minutus capelanus</i>	●	●	●

Species	Area of Occurrence		
Group A	Northern Adriatic	Central Adriatic	Southern Adriatic
C. Geographical Management Unit	37.2.1.a		37.2.2.b
<i>Engraulis encrasicolus</i>	●	●	●
<i>Sardina pilchardus</i>	●	●	●
<i>Sprattus sprattus</i>	●	○	
<i>Scomber scomber</i>	●	●	●

Species	Area of Occurrence		
Group B	Northern Adriatic	Central Adriatic	Southern Adriatic
D. Geographical Management Unit	37.2.1.a		37.2.2.b
<i>Scomber japonicus</i>	●	●	●
<i>Sardinella aurita</i>			●