SCIENTIFIC COOPERATION TO SUPPORT RESPONSIBLE FISHERIES IN THE ADRIATIC SEA

MiPAF

Food and Agriculture Organization of the United Nations

Italian Ministry of Agriculture and Forestry Policies

AdriaMed

GCP/RER/010/ITA

Manual of the Recorder

AdriaMed Training Course on Data Collection and Biological Sampling System on Small Pelagics

by

Nando Cingolani and Alberto Santojanni

GCP/RER/010/ITA/OP-06

Termoli (Italy), December 2002

The conclusions and recommendations given in this and in other documents in the *Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea* Project series are those considered appropriate at the time of preparation. They may be modified in the light of further knowledge gained in subsequent stages of the Project. The designations employed and the presentation of material in this publication do not imply the expression of any opinion on the part of FAO or MiPAF concerning the legal status of any country, territory, city or area, or concerning the determination of its frontiers or boundaries.

Preface

The Regional Project "Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea" (AdriaMed) is executed by the Food and Agriculture Organization of the United Nations (FAO) and funded by the Italian Ministry of Agriculture and Forestry Policies (MiPAF).

AdriaMed was conceived to contribute to the promotion of cooperative fishery management between the participating countries (Republics of Albania, Croatia, Italy and Slovenia), in line with the Code of Conduct for Responsible Fisheries adopted by the UN-FAO.

Particular attention is given to encouraging and sustaining a smooth process of international collaboration between the Adriatic Sea coastal countries in fishery management, planning and implementation. Consideration is also given to strengthening technical coordination between the national fishery research institutes and administrations, the fishery organizations and the other relevant stakeholders of the Adriatic countries.

FAO-AdriaMed Project HQ
Corso Umberto I, 30
86039 Termoli (CB), Italy

Tel: ++39 0875 708252
Fax: ++39 0875 720065
e-mail: faoadriamed@faoadriamed.org
URL: http://www.faoadriamed.org

GCP/RER/010/ITA Publications

The AdriaMed Project publications are issued as a series of Technical Documents (GCP/RER/010/ITA/TD-00) and Occasional Papers (GCP/RER/010/ITA/OP-00) related to meetings, missions and research organized by or conducted within the framework of the Project.

Occasionally, relevant documents may be translated into national languages as AdriaMed Translations (GCP/RER/010/ITA/AT-00).

Comments on this document would be welcomed and should be sent to the Project headquarters:

FAO AdriaMed
Corso Umberto I, 30
86039 Termoli (CB)
Italy
faoadriamed@faoadriamed.org

For bibliographic purposes this document
should be cited as follows:

Cingolani, N., and Santojanni, A. 2002. Manual of the Recorder. AdriaMed Training Course on Data Collection and Biological Sampling System on Small Pelagics. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-06. *Adriamed Occasional Papers*, 6: 40 pp.

Preparation of this document

This document is the final version of the Manual of the Recorder of the AdriaMed Training Course on Data Collection and Biological Sampling System on Small Pelagics, organised by the FAO-AdriaMed Project (*Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea)* in Ancona, 8th – 11th May 2001.

The manual aims at providing a detailed and practical description of routine data collection systems specifically conceived for small pelagic fishery resources. The document is largely based on experience gained by IRPEM in setting up a data collection system for small pelagic fisheries in the western Adriatic Sea.
In the framework of the specific AdriaMed research programme, the manual is intended to assist in establishing a standardised data collection system in the Adriatic Sea coastal countries (Albania, Croatia, Italy and Slovenia) mainly from a practical and organizational point of view.
The manual is primarily for the participants in the AdriaMed programme "Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea", and it deals with the data collection methodology implemented for the execution of this programme. The manual can also be of interest for students and professionals of fisheries research particularly in the field of small pelagic fish resources. However, a comprehensive introduction to the theory of sampling design as well as to the analytical stock assessment models is outside the scope of the manual. Interested readers may find useful the literature given in Chapter 10.
The manual is to be considered as one of the output of the FAO-AdriaMed Regional Project "Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea". It is hoped that with this document a contribution can be made to the standardisation of data collection for fish stock assessment and fishery management, in addition it should serve to strengthen the cooperation between the fishery research institutes around the Adriatic Sea.

Cingolani, N. and Santojanni, A.
Manual of the Recorder. AdriaMed Training Course on Data Collection and Biological Sampling System on Small Pelagics. Ancona, 8 – 11 May 2001. *AdriaMed Occasional Papers*. No.6. GCP/RER/010/ITA/OP-06, Termoli, 2002: 40 pp.

ABSTRACT

The AdriaMed Training Course on Data Collection and Biological Sampling System on Small Pelagics was held in Ancona, Italy from the 8th – 11th May 2001. It was attended by experts from Albania, Croatia Italy and Slovenia. The main objective of the training course was to introduce a standard methodology for data collection and analysis (statistical data collection, biological sampling, age determination) to be implemented to execute the AdriaMed research programme "Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea". This Manual focuses on the contents of the first training course, particularly dealing with issues related to catch and effort data collection and biological sampling.

Table of Contents

Table of Contents..... v
Acronyms..... vi
Background information..... 1
Brief introduction to small pelagic fisheries of the Adriatic Sea..... 2
Description of the AdriaMed-SP research programme..... 3
IRPeM Research programme on small pelagics..... 4
Catches..... 4
Fishing effort..... 4
Biological sampling 5
Length frequency distribution..... 6
Age reading..... 7
Data processing..... 7
Population dynamics methods..... 7
Area of interest..... 8
Fishing techniques..... 10
Outputs 12
Statistical data collection..... 13
Codification system..... 13
Data forms..... 14
Biological sampling..... 16
Length frequency data collection..... 17
Sub-sampling..... 18
Extraction and storage of otoliths..... 19
Data input..... 19
Data file system..... 20
NADA video-mask..... 23
References..... 25
Suggested reading..... 25
Apppendix A - The codification System..... 29
Table 1 Country..... 29
Table 2 Ports..... 30
Table 3 Fishing gear..... 33
Table 4 Species..... 33
Map of fishing area..... 34
Appendix B - The forms..... 35
AdriaMed_FF form (Fishing Fleet)..... 36
AdriaMed_CF form (Catch and effort)..... 37
AdriaMed_BS form (Biological Sample)..... 38
AdriaMed_LF form (Length Frequency)..... 39
AdriaMed_SS form (Sub-Sampling)..... 40

ACRONYMS

AdriaMed	"Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea" Regional Project funded by the Italian Government and executed by the Food and Agriculture Organization (FAO) of the United Nations.
AdriaMed-SP	AdriaMed research programme entitled "Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea".
CEDA	Catch Effort Data Analysis, software developed by Marine Resources Assessment Group (MRAG), London, UK.
CPUE	Catch Per Unit of Effort, abundance index employed in fishery stock assessment.
CWLF	Catch Weighted Length Frequency.
FRI	Fisheries Research Institute, Durres, Albania.
GFCM	General Fisheries Commission for the Mediterranean, FAO, Rome, Italy.
GLM	Generalised Linear Model, statistical method.
ICES	International Council for the Exploration of the Sea, Copenhagen, Denmark.
IOF	Institute of Oceanography and Fisheries, Split, Croatia.
IRPEM	Marine Fisheries Research Institute, National Research Council, Ancona, Italy.
LCA	Length Cohort Analysis, fish stock assessment method.
MAFF – VPA	Ministry of Agriculture, Fisheries and Food (UK) – Virtual Population Analysis, software developed by Lowestoft Laboratory, UK.
MRAG	Marine Resources Assessment Group (Imperial College), London, UK.
NADA	Nice Acquisition of DAta. An IRPEM software package for the input of small pelagics data.
PESTAT	STATistiche della PEsca. The research programme PESTAT is a feasibility study for improving the sampling system for fisheries statistics. It was developed by IRPEM and it was financed by the Italian Merchant Navy Ministry.
NIB	National Institute of Biology, Ljubljana, Slovenia.
STARFISH	STATistics Reliable for FISHery. It is an EU funded research programme with the aim to develop a Sampling System for the Collection of Fishery Statistics. STARFISH is the software package jointed to this methodology derived from PESTAT.
VIT	Virtual population, yield per recruit and transition analysis, software developed by Jordi Lleonart and Jordi Salat (Instituto de Ciencias del Mar de Barcelona, Spain).
VPA	Virtual Population Analysis, fish stock assessment method.

Background information

The First Meeting of the Working Group on Small Pelagics Resources held in Split (12-13 October 2000) suggested the Statistics and Biological Sampling of Shared Small Pelagic Resources as one of the specific activities to be implemented within AdriaMed framework (Mannini, *et al*., 2001). According to this suggestion a specific research programme was presented to AdriaMed on 10 November 2000. The Second Meeting of the AdriaMed Coordination Committee held in Portorož (22-23 November 2000) included the above-mentioned research programme in the list of the proposed research programmes (AdriaMed, 2001_a). The Joint Meeting of the Working Groups on Shared Demersal and Small Pelagic Fishery Resources of the Adriatic Sea, held in Bari (13-15 February 2001), suggested implementation of the above-mentioned research programme with the title "Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea", (henceforth AdriaMed-SP). Due to the complexity of the programme, it was suggested to limit the target species to anchovy and sardine.

The overall objective of AdriaMed-SP is the implementation of a regional monitoring system for the assessment of the small pelagic fish biomass and related fishery exploitation pattern in the Adriatic Sea and supply AdriaMed participating countries with a dynamic tools for data collection and biological sampling. The other objectives are: the establishment of a common sampling protocol in Albania, Croatia, Italy and Slovenia; strengthening of international cooperation between the Adriatic countries and supporting the national capacity building in terms of expertise through the AdriaMed on-the-job training courses.

The methodology applied includes the commercial catch and effort data collection by species and gear at selected landing site (base port) around the Adriatic coast with associated biological sub sampling.

The AdriaMed-SP research programme is operative since May 2001 involving Research Institutions from Albania, Croatia, Italy and Slovenia[1] and with the participation of about 20 researchers. A common workplan has been agreed upon and it is being implemented.

In an international research programme such as AdriaMed-SP, having a long-term perspective, it is essential to use the same methodology and to standardize phases of data collection and data analysis (statistical data collection, biological sampling, age determination, etc.). For this reason the work plan of AdriaMed-SP has specified a series of tools (e.g. training courses, stages, inter-calibration) focused on the above-mentioned primary objective. Also, the available resources (staff and funds) were taken into consideration in the preparation of the workplan.

[1] The research institutes participating to the research programme AdriaMed-SP are: Fisheries Research Institute (FRI) Rruga Skanderbeg, Durres, Albania; Institute of Oceanography and Fisheries (IOF), Setaliste Ivana Mestrovica, 63 P.O.Box 500 21000 Split, Croatia; Marine Fisheries Research Institute – National Research Council (IRPEM) Largo Fiera della Pesca, 160125 Ancona, Italy; National Institute of Biology (NIB) Vecna Pot III SI 1001 Ljubljana, Slovenia.

The present Manual of the Recorder emphasises the contents of the first training course, highlighting successive phases like stages and inter-calibration exercises.

According to the AdriaMed-SP work plan document the subject of the first training course could be depicted as follows:

- general description of the programme (areas of interest, fishing techniques, outputs, etc.);
- statistical data collection (codification system, catches data, fishing effort data, forms filling);
- biological sampling (collection, storage);
- length frequency data measurement, sub-sampling (length frequency data will be used to extrapolate catch-weighted length frequency, while the sub-samples will be used for length-weight and age data);
- extraction and storage of otoliths (age length keys of anchovies and sardines will be determined, using otoliths);
- data input using a specific friendly software developed by the Marine Fisheries Research Institute (NADA package, NADA stands for Nice Acquisition of DAta). Specific data files will be obtained for fishing fleet, catches, length frequency, length-weight data.

Given the different situations that exist in different countries, the training course is designed for people with no previous experience. At the end of the training course the participants will be able to carry out statistical data collection, biological sampling, handling of biological samples (length frequency data measurement, sub-sampling, otoliths extraction), and data input.

1. Brief introduction to small pelagic fisheries of the Adriatic Sea

The small pelagic species are of key importance for Adriatic fisheries. They represent about 85% of the Italian small pelagic catches, 85% of the Croatian total catches, and a considerable percentage of the catches of Slovenia. In Albania, small pelagic fishing has the potential to increase.

The small pelagic fishery has developed on both sides of the Adriatic; however, approximately 90% of the anchovy catches are landed by the Italian fleet, while the pelagic fleets from the Slovenia, Croatia and Albania have concentrated primarily on sardines. In fact the eastern Adriatic sardines catches are almost equal to the Italian Adriatic catches (Anonymous, 1975 – 1993; Anonymous, 1994). Anchovy and sardine are the most important species of the shared small pelagics stocks: in Italy and Croatia, sprat and sardinella are almost completely absent from the landed catches, and mackerel represents about 4 - 5% of the catches in the total of anchovies and sardines. In Slovenia the sardine catches represent more than 90% of the national catches. Sprats are fished in the North Adriatic, while the fishing area of sardinella is in the South. In Italy, in terms of market price, anchovies are considerably more valuable than sardines. The value of the Adriatic catch of anchovy in 1991 was estimated by STCF (Scientific and Technical Committee for Fisheries of the European Commission) to be around 14 million US $. A present estimate of the value of the anchovy

catch in the Adriatic could be in the order of 32 million US $. In Slovenia and Croatia, sardines are more desirable than anchovies.
Italian Adriatic catches of sardines reached a maximum value, (59,000 tonnes), in 1981, decreasing in successive years; current catches are about 13,000 tonnes. Slovenian sardines catches were 6,600 tonnes in 1983, while the present catches are about 1,600 tonnes. Croatian sardine catches reached a maximum in 1983 (44,793 tons) and in 1986 (41,415 tons). Significant decreases in catches were noted after 1990. Present Croatian catches are about 12,000 tonnes. Albanian sardines represented about the 90% of catches in the past (before nineties). At present, 11 boats are involved in small pelagics fishery. Present Adriatic sardines catches are about 30,000 tonnes. A high percentage of sardine catches is directed to the fishery industry. Anchovy catches in Italy reached a maximum value in 1980 (60,000 tonnes) followed by a quick decay in successive years until the crash of the 1987 (3,000 tonnes). Anchovy catches in Croatia reached the maximum value in 1985 (4,300 tonnes), followed by a period of decreases. In the last few years, anchovy population showed a recovery. Present catches of anchovies in the Adriatic are about 22,000 tonnes.

Two types of fishing gear are used in Adriatic: midwater pelagic pair trawls (volante) and purse seines with light attraction (lampara). The Italian pelagic fleet is distributed along the Adriatic coastline from Trieste in the north to Molfetta in the south and Croatian from Umag to Dubrovnik. Most small pelagics are caught in the Northern and Central Adriatic: in the western part from Trieste to Vieste, whereas in the eastern part, they are mainly caught from the Istria to the Mid-Dalmatian islands.

The small pelagics fishery is very important in the Adriatic fishery (in particular, anchovy and sardine) for economic reasons (total value of catches) and for social reasons (number of fishermen involved). Fish market preferences (anchovies are appreciated on the western coast, while sardines are appreciated on the eastern coast) should help a joint exploitation of small pelagics. It could avoid the discarding of sardines, a common practice in Italy due to the very low price of sardines. The economically most important small pelagics shared stocks listed are: anchovy (*Engraulis encrasicolus*), sardine (*Sardina pilchardus*), mackerel (*Scomber scombrus*), sprat (*Sprattus sprattus*), and sardinella (*Sardinella aurita*).

2. Description of the AdriaMed-SP research programme

The stock assessment of small pelagic species by means of population dynamics methods requires the collection of different types of data: amount of caught fish, fishing effort, biological data such as total length, weight and age of single fishes.

Two important features of AdriaMed-SP are the use of the standardization of each phase of data collection and data analysis. The latter point is very important since standardization may allow easier interaction between the research groups of the different countries and, as a consequence, comparisons between data collected and corresponding results derived from assessments. Data sets exchange may also be easier.

2.1 IRPEM research programme on small pelagics

In order to give an idea of many features and problems of AdriaMed-SP, a view of IRPEM work on this subject can be useful.

The research on the assessment of both anchovy (*E. encrasicolus*, L.) and sardine (*S. pilchardus*, Walb.) stock in the northern and central Adriatic Sea, by means of population dynamics methods, has been conducted since 1975. That involved and involves at the present time the regular collection of catch, fishing effort, and biological data pertaining to these stocks at a number of ports along the Italian Adriatic coast.

2.1.1 Catches

Daily or monthly landings are collected in the major fishing ports for pelagic fish along Italian coast: Trieste, Chioggia, Porto Garibaldi, Cesenatico, Cattolica, Ancona, San Benedetto del Tronto, Vieste, and in other fishing ports such as Grado, Marano Lagunare, Caorle, Goro, Rimini, Fano, Giulianova, where the landings are not as high as in the major ports. Note that Vieste represents the southern limit of this data collection (Figure 1).

Landing data for Croatia, Slovenia and former Yugoslavia are derived from published sources or by the Institute of Oceanography and Fisheries of Split. Anchovy landings can be considered a reliable estimate of catches because the Adriatic anchovy is required by the market; so, discards are thought to be negligible. Because the quantities of sardine discarded at sea in some years are thought to be not negligible in some Italian ports, the corresponding landings have been corrected in order to approximate the best estimate of catches.

2.1.2 Fishing effort

An important type of data is the standardized fishing effort exerted on the stocks by the fleets of the different ports. It can give an idea of the variations of fishing pressure over time. Standardization of effort implies the use of a measure unit: this is the fishing day spent by the vessel selected as a reference point. For example, provided that vessel tonnage is correlated with fishing capability, this procedure allows a calculation on how much the fishing day of a small vessel differs from the fishing day of a big vessel. If this correlation holds, the fishing day of the big vessel is expected to be “major”, compared to the fishing day of the small vessel.

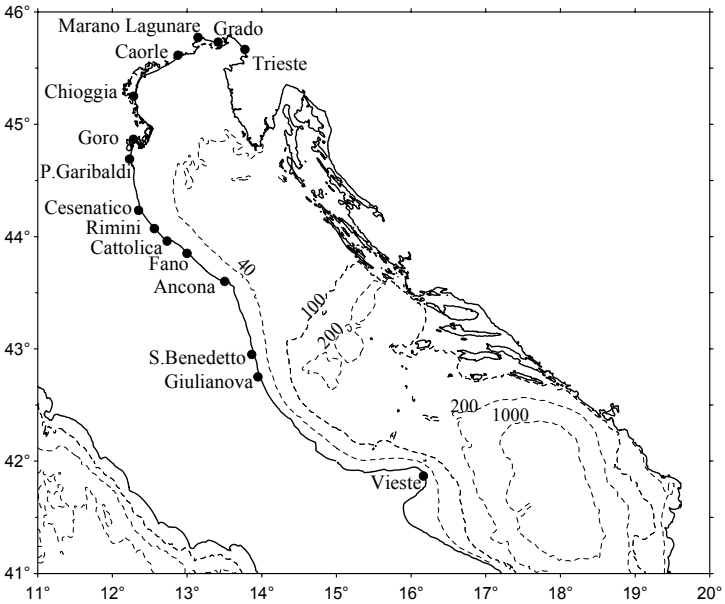

Figure 1. Italian ports for small pelagic fishery in the Adriatic.

In the IRPEM research, annual series of fishing effort data have been calculated for some Italian ports, by means of different standardization methods and taking into account the numbers of vessels, the fishing days spent, and the potential fishing power of single vessels, such as gear, engine power, and vessel tonnage. Gaps in the data prevent the obtainment of an effort series for all ports and all years.

The effort thusly calculated is thought to be applicable to both sardine and anchovy. In fact, the two species are often mixed in shoals and the fishermen usually are not able to distinguish the species composition of these shoals; so, that the catches are generally composed of a mixture of anchovies and sardines.

The ratio between catch and fishing effort is a useful abundance index, known as Catch Per Unit of Effort (CPUE). The higher the value of CPUE the higher the stock abundance is thought to be.

At present, the time series of CPUE calculated for Porto Garibaldi is used in the assessments because, in this port, the best series of effort and major amount of caught anchovy and sardine are recorded.

2.1.3 Biological sampling

Monthly biological samples have been collected in the major (Italian) ports. These samples are boxes of fish landed by fishermen. More sampling effort is allocated to ports and months that have high catches, rather than to those that have low catches. The sampling ports are distributed along the coastline, taking also into account the distribution of the fishing gear. Sampling ports are Chioggia, Porto Garibaldi, Ancona, and San Benedetto del Tronto. In the first three ports the fishing vessels use the *volante* (midwater pair trawl) gear, while in San Benedetto del Tronto they use *lampara* (purse seine).

Present intensity of sampling is equal to 65 biological samples of anchovies and to 48 biological samples for sardines per year (Table 1 and Table 2).

During August, biological sampling is suspended in the ports fishing with *volante* because of the closed fishing season. This interruption does not involve the vessels fishing with *lampara*.

Table 1. Sampling strategy for anchovy.

Month / Port	**Chioggia**	**Porto Garibaldi**	**Ancona**	**S. Benedetto T.**
January	1	1	1	1
February	3	3	3	1
March	1	1	1	1
April	1	1	1	1
May	1	1	1	1
June	3	3	3	1
July	1	1	1	1
August	0	0	0	2
September	1	1	1	2
October	1	1	1	1
November	3	3	3	1
December	1	1	1	1

Table 2. Sampling strategy for sardine.

Month / Port	**Chioggia**	**Porto Garibaldi**	**Ancona**	**S. Benedetto T.**
January	1	1	1	1
February	1	1	1	1
March	1	1	1	1
April	1	1	1	1
May	1	2	1	1
June	1	2	1	1
July	1	2	1	1
August	0	0	0	1
September	1	1	1	1
October	1	1	1	1
November	1	1	1	1
December	1	1	1	1

Samples are sometimes collected also by an observer onboard in order to make comparisons with the samples from landed boxes. This is useful to check possible sources of bias in the estimates of biological parameters.

2.1.4 Length frequency distribution

Annual length frequency distributions are obtained for each sampled box by measuring fishes on the basis of 0.5 cm total-length classes: before 1988 these measurements were on the basis

of 1 cm classes and the decision for improving precision was made. Such length frequencies are catch weighted. That means that a distribution for a given port and given month has stronger influence on the final estimate of the annual length frequency for all ports: the higher the corresponding catch in that given port and month is. Catch weighted length frequencies for port and month are obtained by multiplying the corresponding length frequency distributions by the "weights", which are ratios between catch for port and month and annual catch for all ports, calculated by taking into account those ports and months for which length frequency data exist. These catch weighted length frequencies are then summed over ports and months, yielding the total annual catch weighted frequency.

2.1.5 Age reading

Age is estimated by reading otoliths, which are calcified bodies in the equilibrium organ of fish. After otoliths have been extracted from the heads of fish, their sections are obtained. Sections display rings concentrically placed around the centre, whose formation mechanism is related with the interaction between fish metabolism and factors such as water temperature, feeding intensity, and reproductive stress. The age of a fish can be estimated by counting the numbers of these rings.
The age of a fish can also be estimated by reading scales: this methodology was implemented by IRPEM for sardine, but after several years of work, these age estimates were considered unreliable. Otolith reading was preferred.

2.1.6 Data processing

The use of information relative to both length frequency distributions and age at different lengths allows the estimated annual age frequency distribution of the total catch to be obtained.
Recruits are the young individuals which enter into the stock and represent a very important feature for the study of population dynamics of fish. In the IRPEM research, a raw recruitment index for a year is calculated for both anchovy and sardine. It is estimated as the proportion of recruits (9-10.9 cm anchovies or 13-14.9 cm sardines) on the total numbers of caught individuals. In both cases the majority of individuals in this length range are below one year in age.
The order by which all these data are organised into PC files is very important not only to avoid confusion, but also to obtain aggregations of data as functions of different variables. For example, it is useful to distinguish anchovy length frequencies relative to north ports from south ports.

2.1.7 Population dynamics methods

Finally, there are different population dynamics methods which can be used for small pelagic stock assessment: they work under some specific assumptions (stock at steady state over time, selectivity of the gear constant over time, etc.), and utilise different data inputs. For example,

Virtual Population Analysis (VPA), a common and powerful method utilised by IRPEM and recommended by ICES (International Council for the Exploration of the Sea, Copenhagen, Denmark), requires the annual age frequency distributions of the total catch during at least ten years. The above mentioned recruitment index (section 2.1.6) is required by a specific mathematical model, called DeLury method, which is suggested in some contexts by MRAG (Marine Resources Assessment Group, London, United Kingdom). All methods require total catch, and many methods necessarily require or may use CPUE data.
Other stock assessment methods utilised are the Length Cohort Analysis (LCA) and the software package VIT developed at the Instituto de Ciencias del Mar de Barcelona (Spain).
Population dynamics methods yield different outputs: the most common of them is obviously the estimate of stock biomass at sea, but it is possible to obtain estimates of mortality rates caused by fishing pressure on the stock as a whole or in the age/length classes. Further, these methods may also allow an evaluation of the effect on the stock due to hypothetical variations of fishing pressure.

2.2 Area of interest

The area covered by the AdriaMed-SP research programme is the whole Adriatic Sea. With a surface area of 138,000 km², about a twentieth part of the Mediterranean Sea, the Adriatic has very high fish catches. For example, about the 50% of the total Italian catch comes from Adriatic. In the Adriatic Sea two areas could be identified: the North and Central Adriatic characterised by a shallow area and a wide continental shelf and the South Adriatic characterised by deeper water and a narrow continental shelf. This situation is directed related to the fishing productivity, which is higher in the North and Central Adriatic than in the South Adriatic.

The Adriatic area can be best understood when viewed in two Geographical Management Units[1] (MU). The MU 37.2.1.a encompasses the North and Central Adriatic and its Southern boundary is the straight line between the mouth of the stream Saccione (Northern limit of the Italian Manfredonia fishery district) and the Croatia-Montenegro border (Cape Ostro on Prevlaka Peninsula. The MU 37.2.2.a includes the South Adriatic and its Southern boundary is the straight line between Porto Badisco (Southern limit of Brindisi fishery district) and the Albania-Greece border (Figure 2).
A Geographical Management Unit is an area in which management action could be undertaken. The map in Figure 2 shows the AdriaMed proposed modification of boundaries of Adriatic Geographical Management Unit 37.2.1.a and 37.2.2.b (from the solid line to dotted line). The new boundaries are well suited to the physical differences between the North Adriatic, Central Adriatic, South Adriatic, and the present boundaries of Adriatic countries (AdriaMed, 2001_b).
Inside a Management Unit, Operational Units can be identified. An Operational Unit could be defined as a group of fishing vessels practising the same type of fishing operation, targeting the same species or group of species and having a similar economic structures. The grouping

[1] Currently defined (GFCM, 2001) as Geographical Sub-Areas 17 (formerly MU 37.2.1a) and 18 (formerly MU 37.2.2b).

of fishing vessels may be subject to change over time and on the management objectives to be reached (GFCM, 2001).

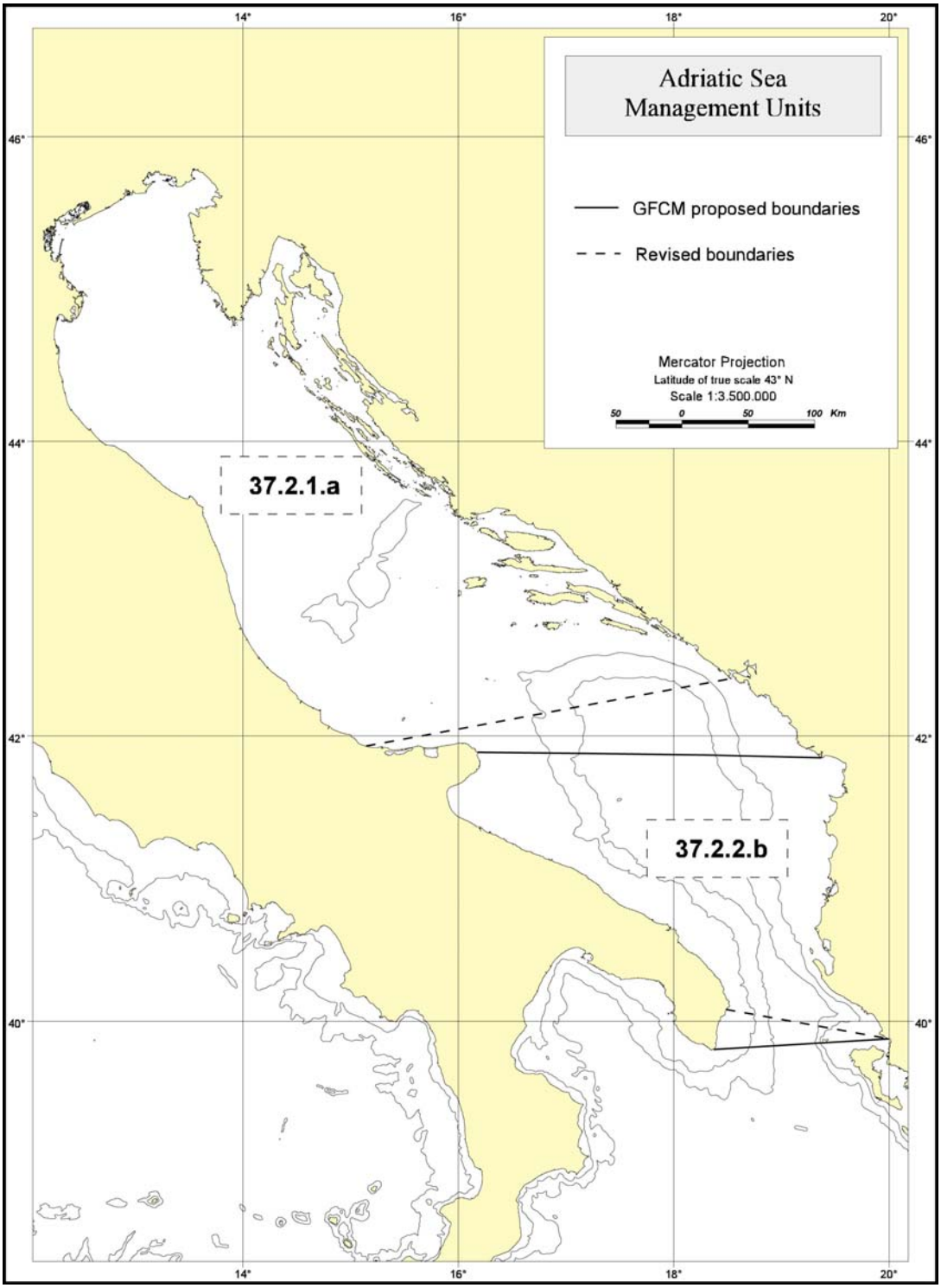

Figure 2. Map showing the boundaries of Adriatic Sea Management Unit 37.2.1.a and 37.2.2.b as originally indicated by the GFCM (solid line) and with the presently proposed revision (dotted line). (Source FAO-AdriaMed GCP/RER/010/ITA/OP-02).

For example, a fishing fleet operating on small pelagics in North and Central Adriatic could be thought as an Operational Unit.
The scientific debate on Management Units and especially on the Operational Unit is very intense because the management of fishing resources is crucial in situations of over-fishing. As a consequence programmes to collect reliable data on fisheries, like AdriaMed-SP, become strategic for managing fisheries.

2.3 Fishing techniques

The fishing fleet for small pelagics is distributed along the Adriatic coast line and two kinds of fishing gear are presently used: (1) Mid-water pelagic trawl nets towed by two vessels (*volante*) and (2) light attraction purse seines (*lampara*).
Mid-water pair trawling is the most common fishing method for anchovy in the northern Adriatic. *Volante* vessels generally fish only by daylight, and land their catches every evening: the fishing trips each last about 11-15 hours. The following Figure 3 shows how the volante gear works.

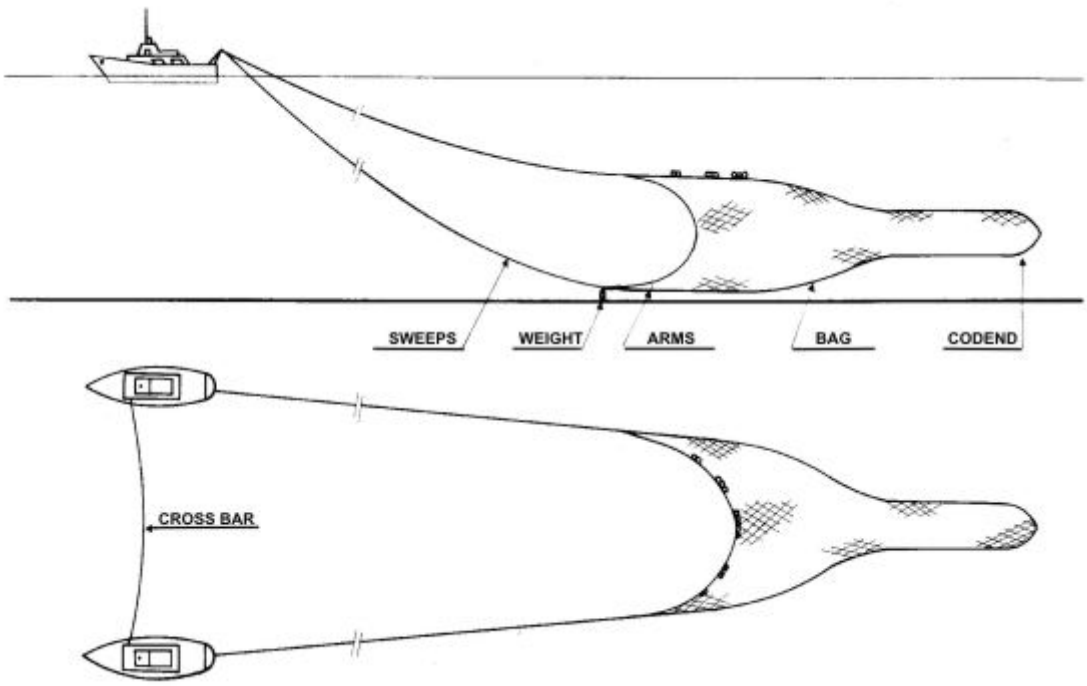

Figure 3. Mid-water pelagic pair trawl net (*volante*).

Lampara vessels fish at night in good weather, attracting fish with lights. The fishing activities start at sunset, when the fish move towards the surface, and end after dawn; thus, a trip lasts up to 16-18 hours, including sailing time (see Figure 4).

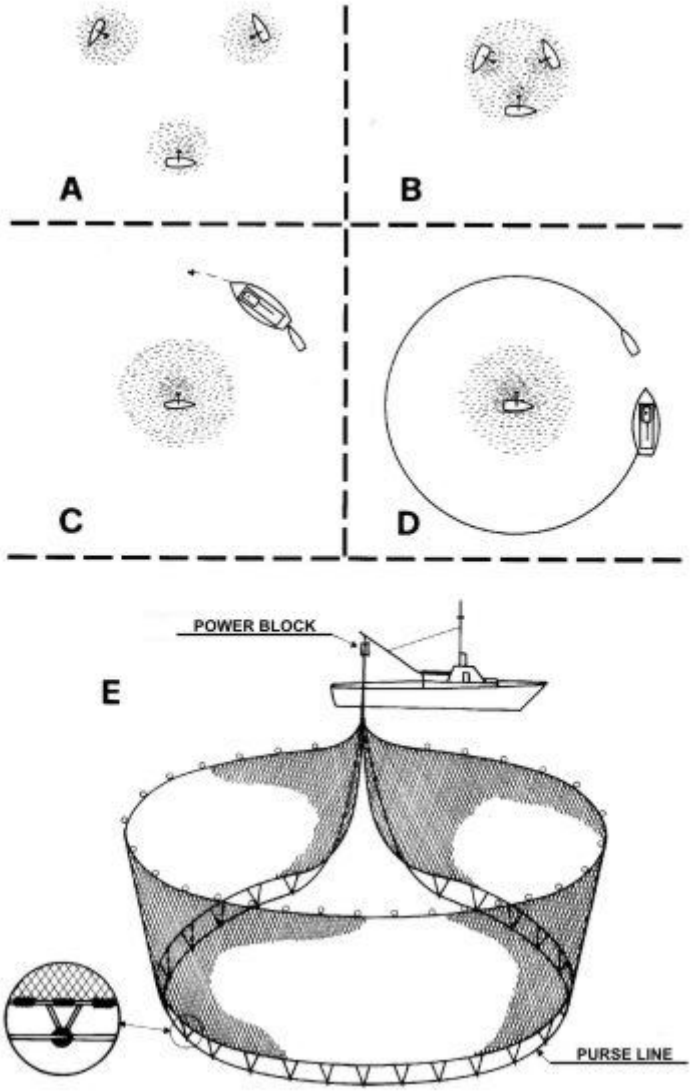

Figure 4. Purse seine using light attraction (*lampara*).

The same fishing gear catch anchovies (*E. encrasicolus*, L.), sardines (*S. pilchardus*, Walb.), and to a lesser extent other pelagic fish such as sprats (*S. sprattus*, L.), horse mackerels (*Trachurus* spp.), and mackerels (*Scomber* spp.).

The Italian fishing fleet for small pelagics is dominated by *volante*, which fish only by day and land their catches in the evening. It was introduced in the 1950s but did not begin to replace *lampara* purse seining until after the mid 1960s. In Italy there are currently about 140 *volante* vessels (70 pairs) in the Northern and Central Adriatic. The average engine power of fishing vessels using *volante* is 400 HP and the average size is 50 GRT, but there are wide variations in both size and engine power. Mesh size opening of *volante* is 20 mm in the cod-end and 14 mm for the *lampara*.

Lampara vessels operate mainly in the Central Adriatic, south of Ancona, and in the Gulf of Trieste. They fish at night in good weather, attracting fish with lights. Their activity is often, but not always, suspended during the colder months and the fishing technique is replaced by

volante. About 40 *lampara* operate in the central Adriatic, with a further 17 smaller *lampara* in Trieste. To this resident lampara fleet, approximately 40 further vessels must be added: the lampara fishing vessels registered in southern Adriatic ports which fish in the central Adriatic during a large part of the year; and the vessels originally from Sicily that, since 1992, have moved seasonally into the Central Adriatic. The *lampara* vessels generally are of bigger size than *volante* vessels (average GRT is 85), but they have lower engine power (average is 300 HP) because the *lampara* technique is not strongly influenced by this parameter.
Artisanal fishery is active on small pelagic in Slovenia, in the Gulf of Trieste, with two "volanti" fishing units. Fishing activity stops in winter because sardines migrate in the cold season. The small pelagics fishing fleet of Croatia is divided in two groups: big vessels (107) and small vessels (190). Two types of small pelagics gear, with respect to water depth and to characteristics of bottom, are used in the Croatian part of the Adriatic Sea: mid-water pelagic trawl in the North Adriatic and purse-seines mainly in the Middle Adriatic.
In Albania a small fishing fleet (11 boats) is working on small pelagics fishery, using *lampara*. An increase of this kind of activity is foreseeable in the near future.

2.4 Outputs

The primary objective of the research programme AdriaMed-SP is to produce reliable fishery statistics on small pelagics (anchovy and sardine), focused on stock assessment, and to supply AdriaMed countries with modern and dynamic tools for data collection and biological sampling. Accordingly, the most important outputs of the AdriaMed-SP are the following:

- training the people involved in the project.
  Two training courses, with stages finalised to age determination and an exercise of inter-calibration of age determination, have been scheduled.
  The first training course is the subject of the present Manual of Recorder. The second training course has been scheduled for December 2001 at IOF-Split. The subject is the biological sampling, the handling of biological parameters, and the laboratory techniques focused on growth parameters, sex determination, gonad maturity stages, etc. In the period January-March 2002, each person involved in age determination will attend a stage at IRPEM-Ancona (duration about two weeks). A stage for each country will be organised. It is suggested that two people at a time participate. At the end of these stages, an exercise of inter-calibration will be organised. After the inter-calibration, age determination could start, as a routine, in each country.

- establishment of a systematic catch and effort data collection system of the small pelagic fishery devoted to anchovy and sardine;

- establishment of a systematic biological sampling system of main pelagic species (anchovy and sardine);

- construction of a network of statistical data, formed by specialised staff, and focused on stock assessment.

Further outputs at medium-long term could be emphasised:

- carrying out joint data elaboration and data analysis, based on models of population dynamics, and finalised for stock assessment;

- build a detailed time series useful for scientific purposes;

- use the network on small pelagics as basis for future extension of data collection and biological sampling to demersal species.

3. Statistical data collection

Data collection from the fishery (e.g. catch and effort data) and from biological samples (e.g. length frequency classes, age reading) are essential inputs for any design of fish management. In particular these kinds of data are well suited to stock assessments by population dynamics models. The AdriaMed meeting held in Split in October 2000 (see section 1) suggested an implementation in Slovenia, Croatia and Albania of a small pelagic data collection system, taking, as a basis, the data collection system operating in Italy since 1975.

3.1 Codification system

The codification system should be comprehensive, covering all characteristics of the phenomena under investigation, like ports, fishing vessels etc.
Appendix A shows the codification system of AdriaMed-SP that is a development of the code system of the research programme on small pelagics carried out by IRPEM. For this reason, in the updated codification system, some new fields have been introduced as the country code (see Table 1, Appendix A). The country code is now needed during data processing to distinguish data from different countries. Because more than one codification system is used in the Mediterranean, an effort to harmonize AdriaMed-SP codes has been undertaken. For example, the code country comes from the codification system adopted by an EU funded research programme (EU project n. 94/036) that developed a Sampling System for the Collection of Fishery Statistics. This EU project took into consideration the previous PESTAT codification (see the Acronyms table) derived from the FAO codification system. The software package used in the EU project n. 94/036 is named STARFISH (see the Acronyms table).
The codes of the ports, designated by 5 digits (see Table 2, Appendix A), reflect the country code (first two digits), the Administrative Region code (the third digit) and the port code (the last two digits). For example, the complete code of the port of Postira is 03326 in which “03” is the country code (Croatia), “3” is the Region code (Dalmacija), and “26” is the code port of Postira. Looking at the complete code of Postira (03326), one can determine the country and the administrative region in which Postira is located. An univocal code for each fishing port is enough for data processing requirement. Nevertheless, to show a geographical progression (e.g. from north to south and from west to east) of the port codes, Table 2 of Appendix A provides a numeration of codes with frequency of 2. This makes it possible for entries to be inserted, coherently, e.g. a forgotten port, into the geographical progression.

Nevertheless, the codification of ports of Italy shows different frequencies (e.g. the code port of Vieste is 601, Manfredonia is 604, while Bisceglie is 605). The reason is the very long period in which the sampling network was built, using codification criteria slightly different.
The common fishing gear on small pelagics are of two types: mid-water pelagic pair trawl nets (*volante*) and purse seines with lights (*lampara*). Nevertheless, Table 3 – Fishing gear, in Appendix A, records two other gears (used in the Gulf of Trieste): a daylight purse seining (*brigada*) and a drift-net (*menaide*).
Finally, Table 4 of Appendix A shows the adopted species code. The codification of "species" is related to the landed catches; so, code 2 (small anchovies of sizes under 10 cm) indicates the same species as in code 1 (anchovy), but it is used when, in the landed catches, there are boxes of small anchovies. Fishermen separate the catches by size when local markets (as in Trieste) request it. The codes of the above-mentioned Table 4 are related also to the other pelagic species that may constitute the landed catches. In such a way the recorder, using the different codes of the Table 4 of the Appendix A, may describe the composition of the landed catches. This information is important in data processing.

3.2 Data forms

Five data forms are used to facilitate and to standardize data collection. Appendix A contains all the data forms used by the AdriaMed-SP, as in the following descriptions:

- **AdriaMed_FF form (FF stays for Fishing Fleet):** This is used to collect data on the fishing fleet. At the beginning of the data collection, a census of the fishing fleet is made. Using the AdriaMed_FF, the recorder will list the vessels that fish small pelagic (e.g., in alphabetic order or in other successions) giving a three-digit number to each vessel (e.g. 001, 002, 003, etc.).
  The code number of the vessel is reported in the column "Fishing vessel code" of the form AdriaMed_FF. Then the recorder will indicate the code of the gear used (taking it from Table 3 of Appendix A) in the column "Prevailing gear used". Because a fishing vessel may use, during the year, more than one gear to fish small pelagics, and to the necessity to classify the vessels, the prevailing gear have to be indicated.
  The form used for catches data (see below) will take into account the different gear used by a vessel during the year to fish small pelagics. The form will be completed with the indication of the main structural characteristics of the vessel (Overall Length expressed in meters with two decimals, engine power expressed in kW, and the Gross Registered Tonnage – GRT).
  The univocal code of each fishing vessel will be assigned by the computer in data processing, combining the complete port code (country+administrative region+code of port cod; see also Table 2 of the Appendix A) at the top of the form AdriaMed_FF with the fishing vessel code.

  AdriaMed_CF form (CF stays for Catch and Effort): This is used to collect catch and effort data. The form may contain catch data of one month. At the top of the form the measure unit of catches (e.g. kg or box) is inserted. If the measure unit of catches is the

box, the medium weight of box is put in the heading of the form. Other measure units of catches should be indicated in the appropriate field at the top of the form.
The heading is completed with the indication of the port, the month, and the year.
The body of the form has ten identical sections. Each section is used for the catches of a fishing unit. A fishing unit is a vessel (if the fishing gear used is the *lampara*) or a couple of vessels (if the fishing gear used is the *volante).* which land catches on that day.
Two lines of each section are already headed with the words "anchovy" and "sardine" because they are the most common landed catches. The other two lines are needed to record the landed catches of other species (e.g. sprats) or other commercial categories (e.g. small anchovy). See also section 3.1.
The gear used by the fishing unit is indicated in the column "Gear". If the vessel changes the fishing gear during the month, two sections of the form will be used: one section will be used to record the catches landed with the gear 1 and the other section will be used to record catches landed with the gear 2.
The fishing unit may land the catches in a port different from the base port. In such a case, the code of the landing port should be inserted in the column "Other landing port".
The aim of this field is to track where catches are occasionally landed. If the fishing unit, during a month, continually changes landing ports, the recorder will take note of this behaviour and will collect data without taking into account, form AdriaMed-SP, the continual changes (this information is not very crucial for the stock assessment purpose).
The thirty one columns of the form are used to record daily catches of the fishing unit.
Records of the daily catches by fishing units will also show the fishing effort, expressed in number of fishing days. Because the fishing days spent at sea are not equivalent for each fishing unit (e.g. the fishing power of small *volante* is lesser than bigger *volante*), fishing effort needs some "weighing" (see also section 2.1.2).
Catches by species/port/fishing unit/fishing day have to be collected in the port chosen to calculate the index of abundance (CPUE, see section 2.1.2). The port that collects the CPUE data (CPUE data are catches and effort data) should be the port of countries with higher catches of small pelagics (anchovy and sardine).
It is not always possible to collect catches by days and by the fishing units in each port. The recorder will tend to collect the best data in the given situation of a port.
So, for the AdriaMed-SP, catches are also useful in the following aggregation:
- catches by species/port/fishing unit/month: in such cases, the amount of catches is conventionally recorded in the column of the day 1 in the form AdriaMed_CF;
- catches by species/port/fishing fleet/fishing day: in such cases, in the column "Name of fishing unit", the designation of "all fleet" and the conventional vessel code = 999 (meaning, "all fleet of the port") are recorded (see also section 8).
- catches by species/port/fishing fleet/month: again, the code for fleet is 999, and the catches are conventionally inserted in the column of day 1 of form AdriaMed_CF.

- **AdriaMed_BS form (BS stays for Biological Sample):** This is used to record data (e.g. species, date of sampling, etc.) of the box of the biological sample. This form is attached to the box before the box is stored in the freezer (see section 4).

- **AdriaMed_LF form (LF stays for Length Frequency):** This is used to record data derived from the length frequency measurement. Section 5 explains how to fill out this form.

- **AdriaMed_SS form (SS stays for Sub-Sampling):** This contains data of sub-samples. Section 6 explains how to fill out this form.

4. Biological sampling

The biological samples are boxes of anchovy or sardine collected randomly from the catches landed by fishermen over the year, at the different ports selected for the biological data collection. The weight of commercial boxes may differ, country by country and port by port. For example, on the Italian Adriatic coastline the weight of commercial boxes changes from a medium weight of 7.5 kg (in Northern ports) to a medium weight of 10 kg (in Southern ports). In any event, the biological sample should weigh at least 5 kg. A biological, random sample could be also collected on board of fishing vessel and should weigh at least 5 kg. Finally, after the biological samples have been collected, it is advisable to measure total length and weight of the fish while they are still fresh (age is measured on the basis of calcified bodies), in order to avoid any errors in measurement due to freezing conditions. Unfortunately, this is often not possible; therefore, storage of sampled boxes in freezers at temperature of –15, –20 °C is needed. Before the biological sample is stored, its own form AdriaMed_BS (BS stands for Biological Samples – see Appendix B), if with entries in any part, must be attached to the box containing the biological sample.
Data derived from catch and effort and from biological samples (total length measures) and sub-samples (age and weight measures) are essential inputs to stock assessments by means of population dynamics methods. There is thus a direct link between data collection and the success of fishery management. These data are always subject to sampling errors, and the size of these errors is a function of a number of factors, not the least of which is the sampling intensity, which inevitably is limited by the manpower and financial resources available to the data collectors.
Within the AdriaMed-SP, on the basis of the Italian experience, is considered suitable for Albania, Croatia, and Slovenia to adopt a sampling scheme based on the collection of one box per species (anchovy or sardine), per month in each sampling port. Refinements of the sampling scheme could be done in future studies, taking into account statistical data (e.g. monthly catches by port over the year), financial costs, and manpower costs.
Based on the above and on consultations with the AdriaMed – SP programme participants, the following sampling scheme has been adopted for Albania, Croatia, Italy, and Slovenia.

Italy
For Italy, the ongoing sampling scheme (see section 2.1.3) will be adopted.
The network along the Italian coastline will be extended to the South Adriatic, adding the port of Molfetta as a further sampling port.
Sampling intensity in South Adriatic: one commercial box (at least 5 kg in weight) per sampling port/species/gear/month.
Starting date of biological sampling in south Adriatic: 1 of June 2001.

Slovenia
Sampling port: Izola.
Sampling intensity: one commercial box (at least 5 kg in weight) by sampling port/species/gear/month.
Starting date of biological sampling: 1 of June 2001.

Croatia
Sampling ports: Rovinj, Novigrad, Zadar, Postira.
Sampling intensity: one commercial box (at least 5 kg in weight) by sampling port/species/gear/month.
Starting date of biological sampling: 1 of June 2001.

Albania
Sampling port: Valona.
Sampling intensity: one commercial box (at least 5 kg in weight) by sampling port/species/gear/month.
Starting date of biological sampling: 1 of June 2001.

5. Length frequency data collection

The primary biological data to be sampled are represented by the length frequency distributions of the catch. The distributions can be obtained from boxes landed by fishermen, which contain a quantity of fish ranging from a minimum of 6 kg to a maximum of 12 kg (in the IRPEM data collection), corresponding to a number of fishes sufficiently high to obtain a well defined statistical distribution: the features of distribution like mean and skewness, through the weight range do not change in an appreciable way by adding other counted individuals to it. In the event of sardines all the individuals have to be measured, but for anchovy (usually smaller than sardine) half a box may provide a sufficiently high number of individuals for length distribution.
Total length of fish is measured from the head to the end of tail in increments of 0.5 cm classes. The total length is measured to the "nearest unit below". For example, an individual with a length of 10.4 cm belongs to the range 10.0-10.4 cm, called the 10 cm length class. An individual with a length of 10.5 cm belongs to the subsequent range 10.5-10.9 cm, called the 10.5 cm length class, and so on.
The length measurement is made on a steel tablet (size about 15 cm x 25 cm x about 1.5 mm thick) with one of the 15 cm sides folded up one centimetre high to form an angle of 90 degree with the plane of the tablet. The plane of tablet is scaled in half cm increments, for at least 23 cm, along one of the 25 cm sides.
For the length measurement, the form AdriaMed_LF (LF stands for Length Frequency) – see Appendix B - is used.
Specifications about the measurement of a whole/half box, along with net weight of whole box, are reported in the same paper form utilised for the numbers of individuals for each length class.

In the same paper form, other types of information are taken into account: species, date and port relative to the landing of the sampled box, name(s) of the vessel (vessel pair) that caught the fish presently in the box, and the gear successfully used.
Note, in the PC files, that vessel, name and gear will be replaced by *ad hoc* code numbers. Geographical co-ordinates, if available, of the fishing area of the sampled box will be recorded in the paper form. (See the Map of fishing areas in the Appendix A.)
If more than one species is present in the box, they are each weighed and reported at the foot of the form AdriaMed_LF.
The video-mask shown by NADA (see section 8.2, Figure 6) has the field in which the code and the weight of the non-main species are inserted.
It should be noted that the field "Net weight of box" of the form AdriaMed_LF must always be the weight of the species from which the length frequency are taken.

6. Sub-sampling

Another important type of data is the annual age frequency distribution of the catch. It is possible to calculate this distribution by combining information relative to length frequencies and age at different lengths. In the latter case, the annual age frequency distribution is estimated within each length class: all these age distributions represent the annual age-length key. Applying the annual age-length key to the annual catch weighted length frequency distribution gives the annual age frequency distribution of the catch.
Sub-sampling can check individuals not only for age determination but also for body weight measurements, which are needed to obtain length-weight and weight at age relationships.
The pool of fish employed to obtain individual length distribution present in a given port and on a given date is sub-sampled, in order to determine a sub-sample pool size with a lower but sufficient number of individuals, from which both weight and age can be determined.
Obviously, those individuals in best physical condition are selected from the available pool.
For the sub-sampling the form AdriaMed_SS (SS stands for Sub-Sampling) – see Appendix B - is used.
To obtain the sub-sample, five individuals are sub-sampled for each 0.5 cm length class. For example: five individuals for the 17 cm class (17.0-17.4 cm range), five for the 17.5 cm class (17.5-17.9 cm range), five for the 18 cm class (18.0-18.4 cm range), and so on.
Ten individuals for each 1 cm class have to be present: if only three individuals are available for the range 18.5-18.9, seven individuals, if available, have to be sub-sampled for the range 18.0-18.4. Three + seven = ten individuals are so obtained for the range 18-18.9 cm. Sometimes, the smaller and the bigger length class sizes do less than the necessary ten individuals in each of their classes. In addition, the procedure of sub-sampling has to provide information on the length of the sub-sampled fish along with the corresponding weight and age. With this aim, a specific number reported in the AdriaMed_SS form is used as a reference point for each individual of the sub-sample. As a consequence, the number of the series relative to each species increases while data collection is ongoing.
Data to be reported in the form AdriaMed_SS are:

- Species;
- Port (this is the port from which the biological sample had been collected);
- Date (this is the date on which the biological sample had been collected);

- Number of fish (this is the specific number assigned to each fish of the sub-sample);
- Total length (this is the length of each fish of the sub-sample);
- Weight (this is the weight of each fish of the sub-sample).

7. Extraction and storage of otoliths

The age of a fish is estimated by reading its otoliths. These are small calcified bodies made of proteins and calcium carbonate, whose longest side in anchovy and sardine adults has a range of around 2-5 mm. These structures are part of the equilibrium organ of fish and are located on both sides of the head, inside the otic capsules. The number of otoliths in each capsule is three: *lapillus* or uticulolith, *sagitta* or sacculith, *asteriscus* or lagenolith. The *sagitta* is the otolith used in most cases for age determination, because of its bigger size in comparison to the other two structures. Otolith stands for *sagitta*.
After the fish head has been opened with a common cutter, the extraction of otoliths is achieved with tweezers. The otoliths are cleaned, dried at room temperature, and stored in *ad hoc* small plastic tubes with stopper. The tubes, with no further material added, are sealed; it has been noted that preservation of otoliths in formaldehyde solutions may cause decalcification and reduced clarity. Inside each single tube, only the two otoliths from the same individual are present, together with a small piece of paper, on which the corresponding fish number has been written. This allows individuals with similar measures of length, age, weight, and landing data such as date, port, etc., as reported on the AdriaMed_SS form during the sub-sampling, to be compared.

8. Data input

An intense data handling programme is needed to process data suitable for stock assessment (e.g. catch weighted length frequency, catch-at-age, weight-at-age, etc.). Data handling means the possibility to assemble data quickly from various combinations of ports (e.g. northern ports), dates, species, catches, sub-samples, length frequencies, fishing fleets, etc.

To facilitate this task at the beginning of the 1990s, a software package named NADA (stands for Nice Acquisition of Data) was developed at IRPEM, using DBIII+ language.
NADA is a user-friendly programme, specific for data obtained from the ongoing research programme.

Because NADA should be used by all Adriatic countries, this software has been translated into English and some adjustments of the codification systems has been set up. Nevertheless, further improvements are necessary, like a translation of it into a windows language such as Visual Basic. These task are now in progress.

8.1 Data file system

Due to the need for intense handling of data during data processing, the NADA file system is organised with a lot of specific data files containing data for fishing fleet, catches, length frequency, and length-weight data (data derived from the sub-samples).
For each year and for each port, there is a catch data file, a length frequency data file, and a length-weight data file (when the port is a sampling port).
The data file of fishing fleet is always the same: it contains fishing fleet data for all ports, and it is upgraded every year.
If one considers the current research programme of IRPEM for each year, there are 15 data catch files, 4 length frequency data files, and 4 length-weight data files. As the time series becomes longer, the number of the files rises quickly.
In order to identify quickly the data in a file, it is necessary to carefully plan the composition of the file name and directory name in which the files are stored.
The name of the file has a maximum of eight characters (one should not forget that NADA system was born in a DOS environment. Take, as an example, the set of the three files of Ancona for the year 1999 (catch data, length frequency data), as listed below:

ANCA99.DBF
ANSA99.DBF
ANSS99.DBF

Appropriately, the first two characters indicate the port (AN = ANcona). Because the port codification of the Table 2 of Appendix A is too long for the limited number of digits of the DOS name file, each port has a codification of only two characters.
The fifth and sixth characters, “99”, means the year 1999, as “75” would mean 1975. The 2000 year would be indicated by “00”, the 2001 by “01”, and so on.
The third and the fourth characters have different meanings, depending on what kind of data the file contains:

- the first file, ANCA99.DBF, contains catch data; the characters “CA” inside the name of the file stands for the English expression “landed CAtches”.

- the second file, ANSA99.DBF, contains length frequency data. This kind of data is derived from the biological sample. The characters “SA” inside the name of the file stands for “biological SAmple”.

- the third file, ANSS99.DBF, contains the length-weight data. This kind of data comes from the biological sub-samples. The characters “SS” inside the name of the file stands for “biological Sub-Sample”.

To give a better understanding, the abbreviation and filenames of small pelagic fisheries ports in Italy (from Trieste to Vieste) are listed in Table 3 below:

Table 3. Examples of the file names in the NADA system.

Name of the port	Abbreviation	Example of catch data file (CA file)	Example of length-freq.data file (SA file)	Example of length-weight data file (SS file)
TRieste	TR	TRCA01.DBF	TRSA89.DBF	TRSS89.DBF
GRado	GR	GRCA00.DBF		
Marano Lagunare	ML	MLCA82.DBF		
CaorLe	CL	CLCA99.DBF		
CHioggia	CH	CHCA78.DBF	CHSA78.DBF	CHSS78.DBF
GOro	GO	GOCA99.DBF		
Porto Garibaldi	PG	PGCA85.DBF	PGSA85.DBF	PGSS85.DBF
CEsenatico	CE	CECA01.DBF	CESA92.DBF	CESS89.DBF
RImini	RI	RICA93.DBF		
CAttolica	CA	CACA99.DBF	CASA85.DBF	CASS85.DBF
FAno	FA	FACA96.DBF		
ANcona	AN	ANCA88.DBF	ANSA88.DBF	ANSS88.DBF
S. Benedetto del Tronto	SB	SBCA84.DBF	SBSA84.DBF	SBSS84.DBF
GIulianova	GI	GICA97.DBF		
VIeste	VI	VICA85.DBF	VISA85.DBF	VISS85.DBF

In the preceding table the ports in bold type are the present sampling ports.

A port such as Goro that was never used for sampling does not have any SA files or SS files. A port such as Cesenatico, that is not at present a sampling port, but was in the past, may have a SA file like CESA92.DBF or an SS file like CESS89.DBF. Ports like Trieste or Vieste, that were sampling ports in the past, may have similar designations.
With some practise, one can easily construct file names which immediately depict the contents of the files.
The next step is to store each file in the directory, with a coherent name that enables the file to be easily located.
As an example, the files of the NADA system for the year 1995 are stored in the following directories:

CA95 it contains the catch datafiles;
SA95 it contains the length frequency datafiles;
SS95 it contains the length-weight datafiles.

The following list is of the files contained in the above mentioned directories:

Directory of C:\NPA\CA95

.		<DIR>		19/07/00	6.53	.
..		<DIR>		19/07/00	6.53	..
DBF95		<DIR>		19/07/00	6.53	DBF95
CECA95	DBF		35.317	07/05/96	16.55	CECA95.DBF
CHCA95	DBF		5.848	08/05/96	10.44	CHCA95.DBF
GICA95	DBF		21.941	01/05/96	8.41	GICA95.DBF
PGCA95	DBF		102.912	08/05/96	10.07	PGCA95.DBF
SBCA95	DBF		60.397	05/06/97	14.38	SBCA95.DBF
TRCA95	DBF		50.574	05/04/96	11.54	TRCA95.DBF
VICA95	DBF		16.507	09/05/96	10.58	VICA95.DBF

.....

Directory of C:\NPA\SA95

.		<DIR>		19/07/00	6.55	.
..		<DIR>		19/07/00	6.55	..
DBF95		<DIR>		19/07/00	6.55	DBF95
ANSA95	DBF		7.435	13/05/96	11.04	ANSA95.DBF
CHSA95	DBF		6.680	13/05/96	11.00	CHSA95.DBF
PGSA95	DBF		12.267	13/05/96	11.03	PGSA95.DBF
SBSA95	DBF		4.717	13/05/96	11.04	SBSA95.DBF
TRSA95	DBF		3.660	13/05/96	11.00	TRSA95.DBF
VISA95	DBF		5.321	13/05/96	11.04	VISA95.DBF

Directory of C:\NPA\SS95

ANSS95	DBF	133.458	13/05/96	17.50	ANSS95.DBF
CHSS95	DBF	104.217	13/05/96	17.49	CHSS95.DBF
PGSS95	DBF	223.125	13/05/96	17.50	PGSS95.DBF
SBSS95	DBF	65.661	13/05/96	17.51	SBSS95.DBF
TRSS95	DBF	37.068	13/05/96	17.49	TRSS95.DBF
VISS95	DBF	76.758	13/05/96	17.51	VISS95.DBF
ANAK95	DBF	5.169	04/06/96	16.33	ANAK95.DBF
CHAK95	DBF	5.169	04/06/96	16.33	CHAK95.DBF
PGAK95	DBF	5.169	04/06/96	16.33	PGAK95.DBF
SBAK95	DBF	5.169	04/06/96	16.33	SBAK95.DBF
VIAK95	DBF	5.169	04/06/96	16.33	VIAK95.DBF

In order to avoid having the numerous directories (three per year) scattered on the hard disk, they are inserted into a large directory named NSP, which means National Small Pelagic. In the latter part of the list of the sub-directory C:\NPA\SS95, there is a series of files with the third and fourth characters equal to “AK”. This is an extension of the nomenclature, indicating Age-length Keys data. This kind of data is not managed by NADA. They belong to the phase of data processing, successive to data input managed by NADA.

8.2 NADA video-mask

The NADA package, as an input data programme, uses video-masks. This enables non-expert people to acquire data. Some examples of the video-masks are shown. The following mask is used to acquire data of catches. In the example (Figure 5) of Porto Garibaldi data, the measure unit used is the box. The medium weight of a commercial box of Porto Garibaldi is about 7.5 kg. The species is anchovy (field SPECIES = 1), and the fishing gear is the *volante* (field GEAR = 1). The fishing unit consists of the fishing vessel with code = 107 and the fishing vessel with code = 108.

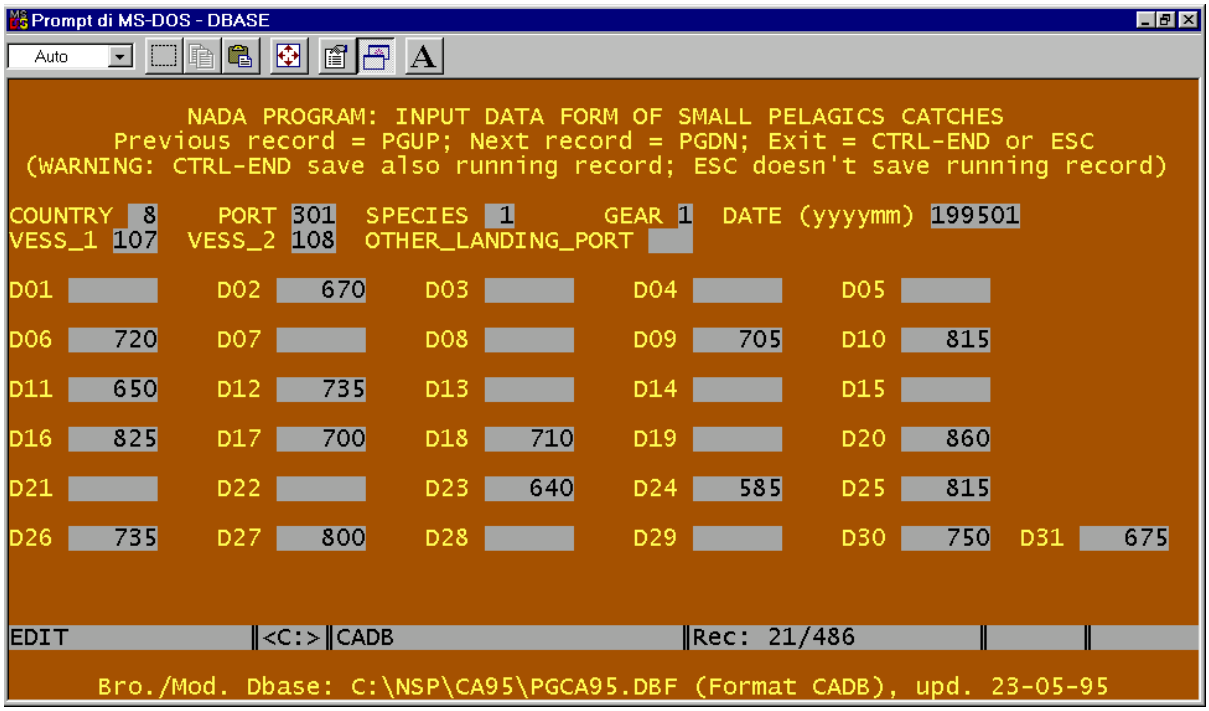

Figure 5. Video-mask of catch data.

Figure 6 shows the mask of length frequency data. The port is Porto Garibaldi (field PORT = 301). The species is anchovy (field SPECIES = 1) and the fishing gear is the *volante* (field GEAR = 1). The fishing unit consists of the fishing vessel with code = 107 and the fishing vessel with code = 108. The data collection of the biological sample is the 16th of January 1995. The biological sample weight is 7.6 kg. In the lower part of the screen, there are fields that describe the species composition of the biological sample in case of presence of mixed species in the commercial box.

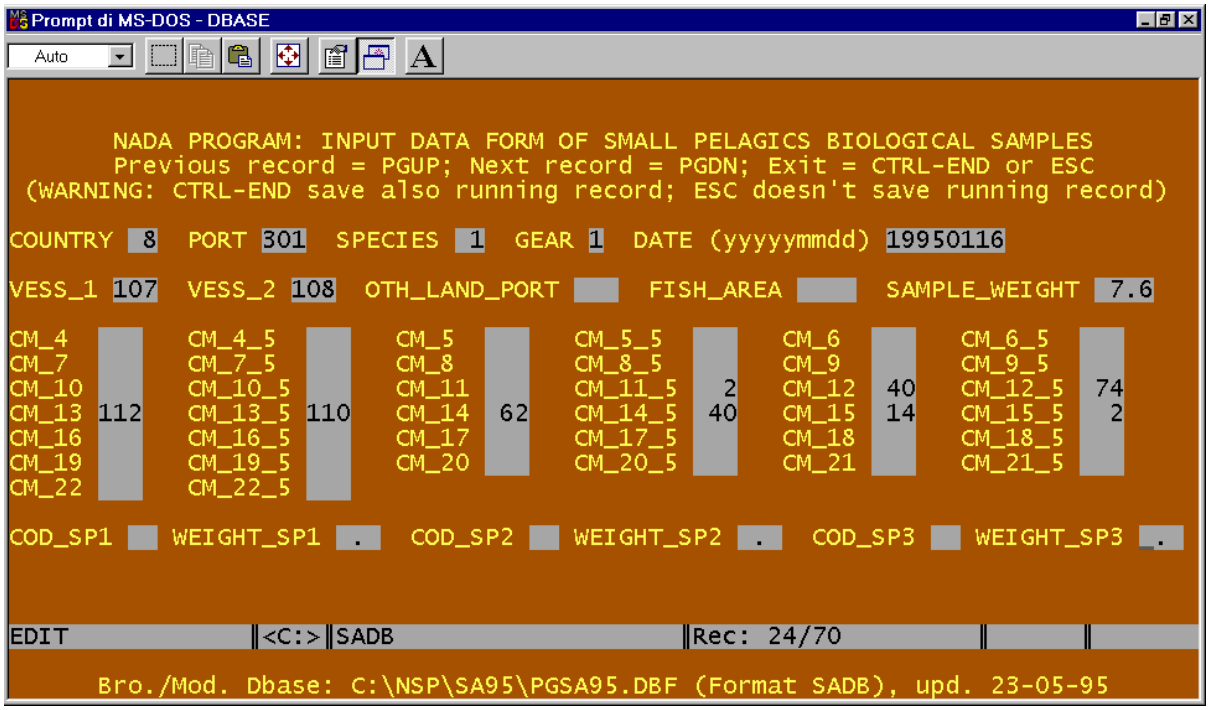

Figure 6. Video-mask of length frequency data.

Figure 7 shows the mask of length-weight data of the anchovy (field SPECIES = 1) number 61226 (= FISH_No.) of the IRPEM collection. It has a total length of 9 cm (= FISH_LENGTH) and weighs 4 g (= FISH_WEIGHT). This anchovy was caught by a *volante* (GEAR = 1). It was taken from the fishing vessel of code 108 (= VESSEL_1) was landed in Porto Garibaldi (PORT = 301) the 16th of January 1995.

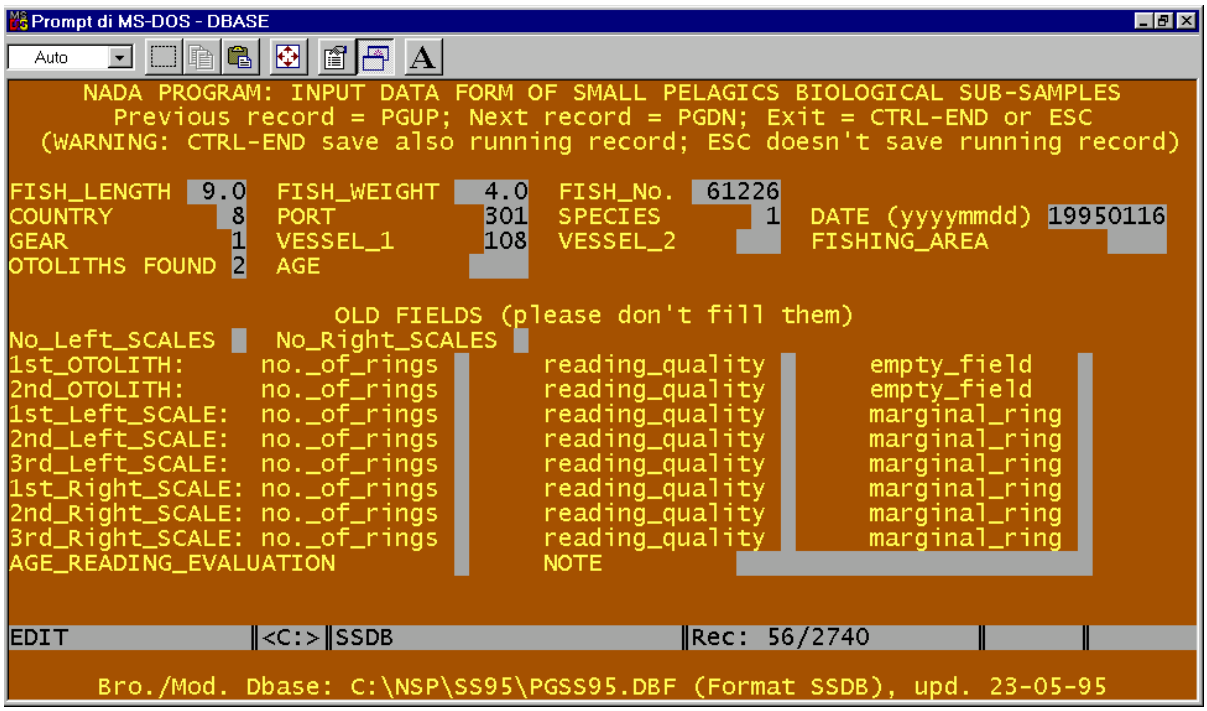

Figure 7. Video-mask of length-weight data.

9. References

Anonymous. (1975-1993) Morska lovina SFRJ po područjima i glavnim vrstama. *Morsko Ribarstvo*, 27-45.

Anonymous. (1994) Morski ulov Republike Hrvatske po područjima i glavnim vrstama. *Morsko Ribarstvo*, 46.

Mannini, P., Massa, F., and Milone, N. (eds). (2001) Priority Topics Related to Small Pelagic Fishery Resources of the Adriatic Sea. Report of the First Meeting of the AdriaMed Working Group on Small Pelagic Resources. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD-03. *AdriaMed Technical Documents,* 3: 92 pp.

AdriaMed. (2001_a) Report of the Second Meeting of the AdriaMed Coordination Committee. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD-04. *AdriaMed Technical Documents,* 4: 41 pp.

AdriaMed. (2001_b) The geographical management units of the Adriatic Sea. Paper presented at the GFCM-SAC Working Group on Management Units (Alicante, 23th-25th January 2001). FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-02: 12 pp.

GFCM. (2001) Report of the twenty-sixth session. Lacco Ameno, Ischia, Italy, 10-13 September 2001. *GFCM Report*. No. 26. Rome, FAO, 27 pp.

10. Suggested reading

Arneri, E. (1996) Fisheries resources assessment and management in the Adriatic and Ionian Seas. FAO-GFCM Third Technical Consultation on Stock Assessment in the Central Mediterranean, Tunis 8-12 November 1994. *FAO Fish. Rep*., 553(suppl.): 7-20.

Arneri, E., Donato, F., and Giannetti, G. (1998) Growth of juvenile anchovy, *Engraulis encrasicolus*, in Central Adriatic Sea. Second International Symposium on Otolith Research and Application, Bergen, Norway, 20-25 June 1998. Book of abstracts: p. 195.

Arneri, E., Giannetti, G., Levi, D., Andreoli, M.G., and Cingolani, N. (1993) Identification of two stocks of anchovies (*Engraulis encrasicolus*, L. 1758) in the Adriatic Sea by means of otolith reading. An International Symposium Fish Otolith Research and Application, Hilton Head Island, South Carolina, USA, 24-28 January 1993. Book of abstracts: p. 10.

Bembo, D.G., Carvalho, G.R., Cingolani, N., Arneri, E., Giannetti, G., and Pitcher, T.J. (1996_a) Allozymic and morphometric evidence for two stocks of the European anchovy *Engraulis encrasicolus* in Adriatic water. *Mar. Biol*., 126: 529-538.

Bembo, D.G., Carvalho, G.R., Cingolani, N., and Pitcher, T.J. (1996_b) Electrophoretic analysis of stock structure in Northern Mediterranean anchovies, *Engraulis encrasicolus*. ICES J. *Mar. Sci. Biol*., 53: 115-128.

Bembo, D.G., Carvalho, G.R., Snow, T.J., Cingolani, N. and Pitcher, T.J. (1995) Stock discrimination among European anchovies, *Engraulis encrasicolus*, by means of PCR-amplified mitochondrial DNA analysis. *Fish. Bull*., 94: 31-40.

Bombace, G., and Cingolani, N. (1988) Distribution de l'effort de pêche dans les pêcheries des mers italiennes, densité (CV/n mi²) et cpue (kg/CV) pour les différents métiers de pêche. *FAO Fish. Rep*., 394: 234-244.

Bombace, G., Cingolani, N., Coppola, S.R., and Mortera, J. (1988) Summary report on the quality check sample survey of fisheries catch and effort statistics. Adriatic area. *FAO Fish. Rep*., 394: 245-259.

Carvalho, G.R., Bembo, D.G., Carone, A., Giesbrecht, G., Piertney, S.B., Cingolani, N., Levi, D., and Pitcher, T.J. (1994) Stock discrimination in relation to the assessment of Adriatic anchovy and sardine fisheries. Final Project Report to the Commission of the European Communities, EC XIV-1/MED/ 91/001/A, 172 pp.

CGPM/GFCM (1980) Stock assessment in the Balearic and Gulf of Lions statistical divisions, 1979. *FAO Fish. Rep*., 227: 151 pp

Cingolani, N., Arneri, E., Giannetti, G., Santojanni, A., Belardinelli, A. (1998_a) Valutazione degli stocks pelagici di alici e sardine in Adriatico con metodi di dinamica di popolazione. Rapporto per il Ministero per le Politiche Agricole, VI+137 pp.

Cingolani, N., Arneri, E., Giannetti, G., Santojanni, A., Belardinelli, A. (1998_b) Assessment of anchovy and sardine stocks in the Adriatic Sea by means of population dynamics. *Biol. Mar. Medit*., 5(3): 321-330.

Cingolani, N., Coppola, S., (1998) Reference Manual for STARFISH Implementation – Statistical Recorders. Final Project Report on European Community Funded Project EC XIV/94/036, 106 pp.

Cingolani, N., Coppola, S., R., Garofalo, G., Belardinelli, A. (1998) Sampling System for the Collection of Fishery Statistics. Final Project Report on European Community Funded Project EC XIV/94/036, VIII + 109 pp.

Cingolani, N., Coppola, S.R., and Mortera, J. (1986) Studio di fattibilità per un sistema di rilevazione campionaria delle statistiche della pesca (PESTAT), Parte II: Statistiche sulle Catture e sullo Sforzo di Pesca. *Quad. Ist. Ric. Pesca Marittima*, 5(suppl.1): XXVIII + 754 pp.

Cingolani, N., Giannetti, G., Arneri, E., Levi, D., and Piersimoni, A. (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, 181 pp.

Cingolani, N., Giannetti G., and Arneri, E. (1996_a). Anchovy fisheries in the Adriatic Sea. *Sci. Mar.,* 60(suppl.2): 269-277.

Cingolani, N., Kirkwood, G., Arneri, E., Rousseau, J., Belardinelli, A., Giannetti, G., Santojanni, A., Barry, C. (1998_c) Optimal allocation of effort in sampling for age and length from commercial fisheries. Final Project Report to the Commission of the European Communities, EC XIV/95/33, 185 pp.

Cingolani, N., Kirkwood, G., Giannetti, G., Arneri, E., and Levi, D. (1996_b) Note on the stock assessment of *Engraulis encrasicolus* (L.) and *Sardina pilchardus* (Walb.) of the Northern and Central Adriatic Sea. FAO-GFCM Third Technical Consultation on Stock Assessment in the Central Mediterranean, Tunis 8-12 November 1994. *FAO Fish. Rep*., 553(suppl.): 1-5.

Cingolani, N., Santojanni, A., Belardinelli, A., Colella, S., Donato, F., & Penna, R., Sdogati, C. (Italy Section). (1999) Sport fishery in Eastern Mediterranean (Greece & Italy):

parameter estimates, linkages and conflict with professional fisheries. Final Project Report to the Commission of the European Communities, EU 96/018, IX+439 pp.

Cingolani, N., Santojanni, A., Belardinelli, A., Donato, F., Colella, S., & Sdogati, C., Penna, R. (1998_d) Aspetti socio-economici nella pesca delle Marche. Rapporto scientifico per la Azienda Speciale Pesca e Agricoltura (ASPEA) della Camera di Commercio di Ancona, 63 p.

Cingolani, N., and Scorcelletti, R. (1985_a) Data base organization. *Quad. Ist. Ric. Pesca Marittima*, 4(1): 35-46.

Cingolani, N. and Scorcelletti, R. (1985_b) Statistics tables. *Quad. Ist. Ric. Pesca Marittima*, 4(1): 51-64.

Coppola, S.R., and Cingolani, N. (1988) Definition and preliminary evaluation of the Italian fishing zones exploited by the national fleet. *FAO Fish. Rep*., 394: 266-274.

Coppola, S.R., and Cingolani, N. (1991) Assessment of catch and effort of Italian fleet by fishing areas based on "PESTAT" data. *FAO Fish. Rep*., 468: 36-68.

Darby, C. D., and Flatman, S. (1994) Virtual Population Analysis: version 3.1 (Windows/Dos) user guide. *Info. Tech. Ser.,* MAFF Direct. Fish. Res., Lowestoft, (1): 85 pp.

Froglia, C., and Cingolani, N. (1991) L'attività peschereccia nel porto di Ancona. Ancona e il suo porto. ESCI Marche, pp. 11-26.

Froglia, C., Piccinetti, C., Cingolani, N., Fiorentini, L., Frontini, N., Gramitto, M.E., Scorcelletti, R. (1985) Atlas de pêcheries de la Méditerranée occidentale et centrale (Italie: côte adriatique). FAO-CGPM: 84 pp.

Gallucci, V.F., Amjoun, B., Hedgepeth, J.B. and Lai, H.L. (1996) Size-based methods of stock assessment of small-scale fisheries. In: Stock Assessment: quantitative methods and applications for small scale fisheries, Edited by: Gallucci, V.F., Saila, S.B., Gustafson, D.J. and Rothschild, B.J., CRC press, Lewis Publishers, Boca Raton, pp. 9-81.

Giannetti, G.F. (1985) Age readings of anchovy otoliths. A methodological note. *Quad. Ist. Ric. Pesca Marittima*, 4(1): 35-46.

Gulland, J.A. (1983) Fish stock assessment: a manual of basic methods. John Wiley & Sons, New York, 223 pp.

Hilborn, R. and Walters, C.J. (1992) Quantitative fisheries stock assessment: choice, dynamics and uncertainty. Chapman and Hall. 570 pp.

Lleonart, J. and Salat, J. (1992) VIT Programa de Análisis de Pesquerías. *Inf. Tec. Sci. Mar*., 168-169: 116 pp.

Levi, D. (1981) Nota metodologica sullo studio della dinamica di popolazione di alcuni stocks di clupeiformi dell'Adriatico. *Quad. Lab. Tecnol. Pesca*, 3(suppl.1): 23-32.

Levi, D., Andreoli, M.G., Arneri, E., Giannetti, G., and Rizzo, P. (1994) Otolith reading as a tool for stock identification. *Fish. Res*., 20: 97-107.

Levi, D., Cingolani, N., Giannetti, G., Scorcelletti, R., Peloni, E. and Frontini, N. (1984) Preliminary results on the assessment of two stocks of small pelagic fish in the north-central Adriatic Sea (*Sardina pilchardus*, Walb. and *Engraulis encrasicolus*, L.). *FAO Fish. Rep.*, 290: 195-198.

Levi, D., Cingolani, N., Giannetti, G., Scorcelletti, R., Peloni, E. and Frontini, N. (1985) Stock assessment of *Sardina pilchardus*, (Walb.) and *Engraulis encrasicolus*, (L.) of

the north Adriatic Sea: some preliminary results. *Quad. Ist. Ric. Pesca Marittima*, 4(1): 1-34.

Levi, D. and Giannetti, G. (1972) Analisi sullo sfruttamento di una popolazione ittica mediante un modello matematico di cattura e sforzo. *Quad. Lab. Tecnol. Pesca*, 1(4): 101-114.

Levi, D. and Giannetti, G. (1973) Fuel consumption as an index of fishing effort. *Stud. Rev. Gen. Fish. Counc. Medit.,* (53): 1-17.

Mortera, J., Levi, D., and Cingolani, N. (1984) Progress Report of the PESTAT programme: A sample survey for the quality check of fisheries statistics. *FAO Fish. Rep*., 290: 175-179.

MRAG (1992) Catch and effort data analysis. The CEDA package user manual. MRAG 27 Campden Street, London W8 7EP, UK, 90 pp.

Pitcher, T.J., Basson, M., Cingolani, N. (1991) Analysis of Adriatic Pelagic Fish Stocks. Annual Report, pp. 41.

Pitcher, T.J., Cingolani, N., Arneri, E., Giannetti, G., and Bombace, G. (1992) Analysis of Adriatic Pelagic Fish Stocks. Annual Report, pp. 33.

Ragonese, S., and Cingolani, N., (1993) Un indice di priorità per la scelta delle specie bersaglio in una attività di pesca multispecifica: il caso siciliano. *Quad. Ist. Ric. Pesca Marittima*, 5(2): 129-143.

Ricker, W.E. (1975) Computation and interpretation of biological statistics of fish populations. *Bull. Fish. Res. Board. Can.,* 191: 282 pp.

Santojanni, A., Arneri, E., Belardinelli, A., Cingolani, N., Giannetti, G. (1999) Fluctuations of biomass of sardines (*Sardina pilchardus*, Walb.) in the Adriatic Sea – Atti Associazione Italiana Oceanologia Limnologia, 13 (1), pp. 11-20.

Santojanni, A., Arneri, E., Belardinelli, A., Cingolani, N., Giannetti, G. Small pelagic fish in the Adriatic: stocks fluctuations and environmental factors. Limnologia e Oceanografia – Istituto di Biologia Marina (IBM) di Venezia, Consiglio Nazionale delle Ricerche (CNR). *In press*.

Sinovcic, G. (1984) Summary of biological parameters of sardine (*Sardina pilchardus*,Walb.) from the Central Adriatic. *FAO Fish. Rep*., 290: 147-148.

STCF. (1991) Commission of the European Communities, 19th Report of the Scientific and Technical Committee for Fisheries. SEC (91) 1651: 103pp.

Annex A: The Codification System

Table 1. Country
Table 2. Ports (and administrative Regions)
Table 3. Fishing gear
Table 4. Species and commercial categories
Figure1. Map of fishing area

Table 1. Country.

Country	Country code(*)
Albania	01
Croatia	03
Italy	08
Slovenia	11
Jugoslavia Federation	15

(*) from the codification system of the EU project (n. 94/036) STARFISH

Table 2. Ports (and administrative Regions) (part 1 of 3).

Abbreviation used in data file name	Country / Administrative Region	Country code (from EU project STARFISH)	Administrative Region Code	Port Code	Complete Code
	ITALY	08			
	Friuli		1		
TR	Trieste			01	08101
GR	Grado			02	08102
ML	Marano Lagunare			03	08103
	Veneto		2		
CL	Caorle			00	08200
CH	Chioggia			01	08201
GO	Goro			02	08202
	Emilia Romagna		3		
PG	Porto Garibaldi			01	08301
CE	Cesenatico			02	08302
RI	Rimini			03	08303
CA	Cattolica			04	08304
	Marche		4		
FA	Fano			01	08401
AN	Ancona			02	08402
SB	S. Benedetto del Tronto			05	08405
	Abruzzo		5		
GI	Giulianova			01	08501
	Puglia		6		
VI	Vieste			01	08601
MF	Manfredonia			04	08604
BI	Bisceglie			05	08605
MO	Molfetta			06	08606
	SLOVENIA	11	1		
KO	Koper			02	11102
IZ	Izola			04	11104
PI	Piran			06	11106
PR	Portoroz			08	11108

Table 2. Ports (and administrative Regions) (part 2 of 3).

Abbreviation used in data file name	Country / Administrative Region	Country code (from EU project STARFISH)	Administrative Region Code	Port Code	Complete Code
	CROATIA	03			
	Istra		1		
UM	Umag			02	03102
NO	Novigrad			04	03104
PC	Porec			06	03106
RO	Rovinj			08	03108
PU	Pula (Vodnjan)			10	03110
PM	Pomer			12	03112
LA	Labin (Rabac)			14	03114
	Kvarner		2		
MD	Moscenicka Draga			02	03202
LO	Lovran			04	03204
IK	Ika			06	03206
OP	Opatija			08	03208
RK	Rieka			10	03210
KR	Kraljevica			12	03212
CR	Crikvenica			14	03214
NV	Novi Vinodolski			16	03216
KK	Krk			18	03218
SE	Senj			20	03220
CS	Cres			22	03222
RA	Rab			24	03224
MJ	Mali Losinj			26	03226
PA	Pag			28	03228
	Dalmacija		3		
NG	Novigrad			02	03302
ZA	Zadar			04	03304
SL	Sali			06	03306
VG	Vrgada			08	03308
BG	Biograd			10	03310
VO	Vodice			12	03312
SI	Sibenik			14	03314
PT	Primosten			16	03316
TG	Trogir			18	03318

Table 2. Ports (and administrative Regions) (part 3 of 3).

Abbreviation used in data file name	Country / Administrative Region	Country code (from EU project STARFISH)	Administrative Region Code	Port Code	Complete Code
SP	Split			20	03320
OM	Omis			22	03322
BR	Brac			24	03324
PO	Postira			26	03326
MK	Makarska			28	03328
HV	Hvar			30	03330
VS	Vis			32	03332
KZ	Komiza			34	03334
KL	Korcula			36	03336
VL	Vela Luka			38	03338
PL	Ploce (Metkovic)			40	03340
ST	Ston (Broce)			42	03342
SN	Slano			44	03344
LV	Lastovo			46	03346
DB	Dubrovnik			48	03348
CV	Cavtat			50	03350
	ALBANIA	01			
	Scutari or Northern region		1		
SH	Shengjin			02	01102
	Tirana-Durres		2		
DU	Durres			02	01202
	Valona or Southwest region		3		
VR	Vlore'			02	01302
SA	Sarande'			04	01304
	JUGOSLAVIA Federation (tentative list)	15			
	Montenegro		1		
TI	Tivat			02	15102
KT	Kotor			04	15104
BA	Bar			06	15106
UL	Ulcinj			08	15108

Table 3 - Fishing gear.

Fishing gear	Gear code
Mid-water pair trawl	1
Purse seine	2
Daylight purse seining	3
Drift-net	4

Table 4 – Species and commercial categories.

Species and commercial categories	Code
Anchovy (*Engraulis encrasicolus*, L.)	01
Small Anchovies (*Engraulis encrasicolus*, L.)	02
Sardine (*Sardina pilchardus*, Walb.)	03
Feed (mixture of dirty anchovies and sardines)	04
Anchovy feed (dirty anchovies)	05
Sardine feed (dirty sardines)	06
Sprat (*Sprattus sprattus*)	07
Dirty fish	08
Other mixed species	09
Sardinella (*Sardinella aurita*)	21
Mackerel (*Scomber scombrus*)	31
Tuna (*Thunnus thynnus*)	41

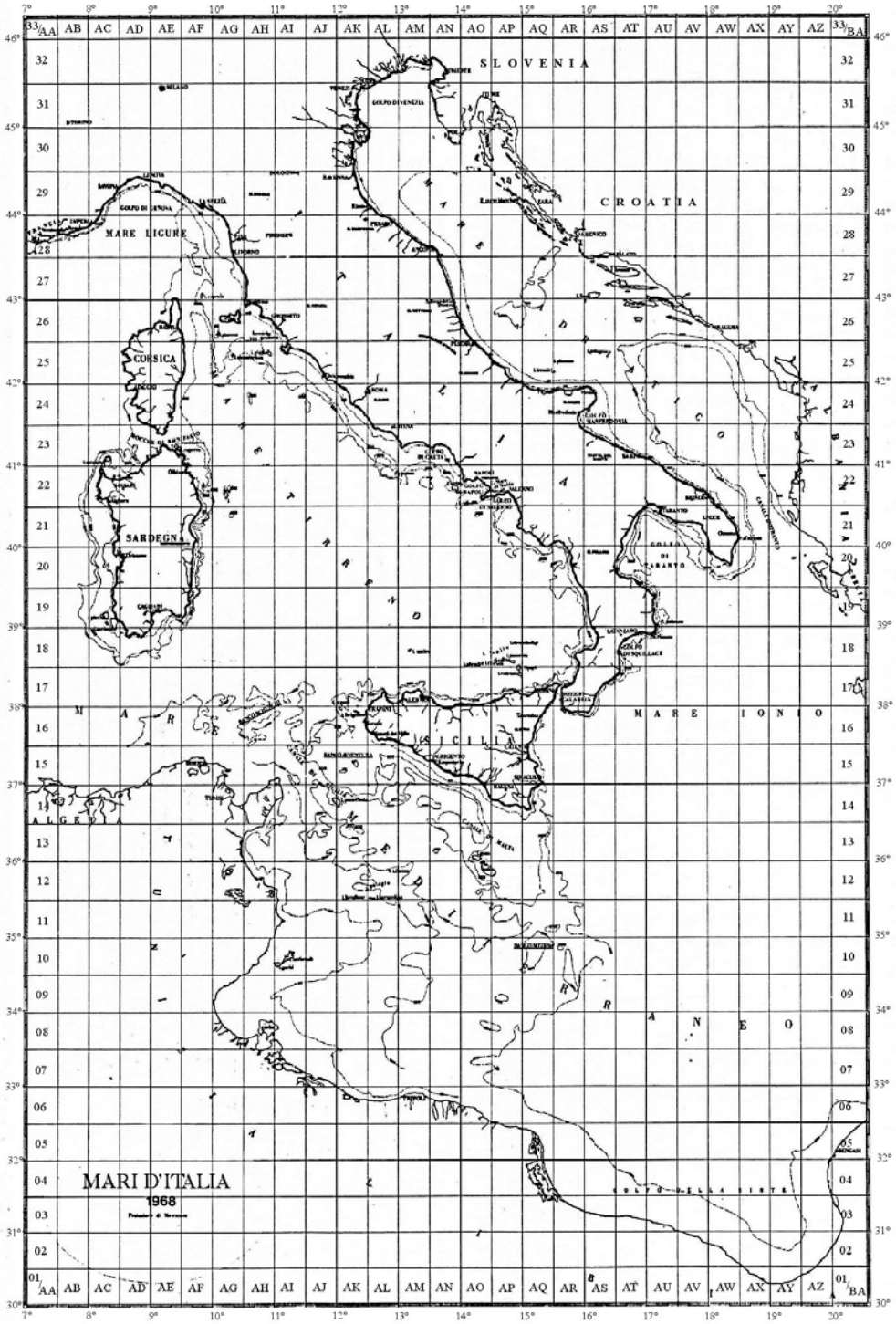

Figure 1. Map of fishing area.

Annex B: The Forms

AdriaMed_FF form (Fishing Fleet)
AdriaMed_CF form (Catch and eFfort)
AdriaMed_BS form (Biological Sample)
AdriaMed_LF form (Length Frequency)
AdriaMed_SS form (Sub-Sampling)

AdriaMed-SP: Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea - FISHING FLEET DATA FORM

Port of: _____ Port code (complete): _____

Progr. no.	Fishing vessel code	List of vessel	Prevailing gear used	Overall Length (cm)	GRT	Engine Power (kW)

Adriamed-SP: Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea

Measure unit: kg _____, box _____(weight of box_____)

CATCH AND FISHING EFFORT FORM

Adriamed_CF form (Catch and eFfort)

Measure unit: other (specify) _____ Port of _____ Month _____ Year_____

Name of fishing unit	Species	Gear	Other landing port	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Anchovy																																	
	Sardine																																	
	Anchovy																																	
	Sardine																																	
	Anchovy																																	
	Sardine																																	
	Anchovy																																	
	Sardine																																	
	Anchovy																																	
	Sardine																																	
	Anchovy																																	
	Sardine																																	
	Anchovy																																	
	Sardine																																	
	Anchovy																																	
	Sardine																																	
	Anchovy																																	
	Sardine																																	

AdriaMed-SP: Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea - BIOLOGICAL SAMPLE FORM

AdriaMed_BS form (Biological Sample)

Port of: _____

SPECIES	
DATE OF SAMPLING	
FISHING UNIT	
FISHING GEAR	

AdriaMed-SP: Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea - BIOLOGICAL SAMPLE FORM

AdriaMed_BS form (Biological Sample)

Port of: _____

SPECIES	
DATE OF SAMPLING	
FISHING UNIT	
FISHING GEAR	

AdriaMed-SP: Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea

LENGTH FREQUENCY DATA FORM

Port:	Species:	Fishing gear:
Date:	Fishing Unit:	
Fishing area:	Net weight of box (kg, e.g. 8.3):	
Measurement of half box:	Measurement of whole box:	
Remark:		

4 cm	
4.5	
5	
5.5	
6	
6.5	
7	
7.5	
8	
8.5	
9	
9.5	
10	
10.5	
11	
11.5	
12	
12.5	
13	
13.5	
14	
14.5	
15	
15.5	
16	
16.5	
17	
17.5	
18	
18.5	
19	
19.5	
20	
20.5	
21	
21.5	
22	
22.5	

AdriaMed-SP: Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea

SUB-SAMPLING DATA FORM

Port:			Species:		Date:			
Number of fish	Total length (half cm)	Weight (g, e.g. 25.2)	Number of fish	Total length (half cm)	Weight (g, e.g. 25.2)	Number of fish	Total length (half cm)	Weight (g, e.g. 25.2)

List of AdriaMed Publications

A. Technical Documents

Massa, F., Mannini, P. (eds). 2000. Report of the First Meeting of the AdriaMed Coordination Committee. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD-01: 64 pp.

AdriaMed. 2000. Priority Topics Related to Shared Demersal Fishery Resources of the Adriatic Sea. Report of the First Meeting of the AdriaMed Working Group on Shared Demersal Resources. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD-02: 21 pp.

Mannini, P., Massa, F., and Milone, N. (eds). 2001. Priority Topics Related to Small Pelagic Fishery Resources of the Adriatic Sea. Report of the First Meeting of the AdriaMed Working Group on Small Pelagic Resources. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD-03. *AdriaMed Technical Documents,* 3: 92 pp.

AdriaMed. 2001. Report of the Second Meeting of the AdriaMed Coordination Committee. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD-04. *AdriaMed Technical Documents,* 4: 41 pp.

AdriaMed. 2001. Socio-economic aspects of the Adriatic Sea fisheries. Report of AdriaMed Meeting on Socio-Economic Aspects of the Adriatic Sea Fishery Sector. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD-05. *AdriaMed Technical Documents,* 5: 53 pp.

AdriaMed. 2002. Adriatic Fishery Associations – First AdriaMed Meeting. Shoqatat e Peshkimit ne Adriatik-Takimi i Pare i AdriaMed-it. Jadranske ribarske udruge – Prvi sastanak AdriaMed-a. Associazioni della Pesca in Adriatico – Primo Meeting di AdriaMed. Jadranska ribiška združenja – Prvo srečanje v okviru AdriaMed-a. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD-06. *AdriaMed Technical Documents*, 6: 168 pp.

AdriaMed. 2001. Report of the Third Meeting of the AdriaMed Coordination Committee. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD-07. *AdriaMed Technical Documents 7:* 34 pp.

Kolding, J. and Ubal Giordano, W. 2002. Lecture notes. Report of the AdriaMed Training Course on Fish Population Dynamics and Stock Assessment. GCP/RER/010/ITA/TD-08. *AdriaMed Technical Documents,* 8: 143 pp.

AdriaMed. Aspects of Fish Markets in the Adriatic Sea. Report of the AdriaMed Meeting on the Aspects of Fish Markets in the Adriatic Sea. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD. *AdriaMed Technical Documents* (in preparation).

Vrgoč, N., Arneri, E., Jukić-Peladić S., Krstulović Šifner. S., Mannini, P., Marčeta B., Osmani, K, Piccinetti, C., and Ungaro, N. Review of current knowledge on demersal shared stocks of the Adriatic Sea. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD. *AdriaMed Technical Documents* (in preparation).

Azzali, M., Marasović, I., Luna, M., Tičina, V., Kariš, T., Franičević, M., De Felice, A., Ninčević, Ž., Grbec, B., Matić, F., Kršinić, F., Kušpilić, G., Stojanovski, L., Caccamo, G., Palumbo, V. Pilot joint echo-survey and training exercise in the Northern part of the Adriatic Sea to assess the pelagic fish biomass and correlation with environmental parameters. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD. *AdriaMed Technical Documents,* (in preparation).

AdriaMed. Report of the Fourth Meeting of the AdriaMed Coordination Committee. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD. *AdriaMed Technical Documents*. (in preparation).

B. Adriamed Translations

AdriaMed (Botim.). 2000. Përkthim në shqip i Kodit te FAO-s te Drejtimit për një Peshkim të Përgjegjëshëm. GCP/RER/010/ITA/AT-01 40f. (Albanian Translation of the FAO Code of Conduct for Responsible Fisheries, 1995).

AdriaMed (Izdavac). 2000. Hrvatski prijevod FAO Kodeks Odgovornog Ribarstva. GCP/RER/010/ITA/AT-02 38str. (Croatian Translation of the FAO Code of Conduct for Responsible Fisheries, 1995).

C. AdriaMed Occasional Papers

AdriaMed. 2000. AdriaMed seminar on the preparation of the AdriaFISH project component (Adriatic Fishery Information System). FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-01: 12 pp.

AdriaMed. 2001. The geographical management units of the Adriatic Sea. Paper presented at the GFCM-SAC Working Group on Management Units (Alicante, 23th-25th January 2001). FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-02: 12 pp.

Ungaro, N., Vrgoć, N., and Mannini, P. 2001. The biology and stock assessment of *Merluccius merluccius* (L.) in the Adriatic Sea: an historical review by geographical management units. Paper presented at the GFCM-SAC Working Group on Demersal Species (Tunis, 13th -16th March 2001). FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-03: 15 pp.

AdriaMed. 2001. A preliminary contribution to the Mediterranean Operational Units. Paper presented at the GFCM-SAC Working Group on Operational Units (Ancona, 18th -19th March 2001). FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-04: 9 pp.

Massa, F., Mannini, P. 2001. The FAO-AdriaMed Project and its activities of interest to the SAP BIO Project. Paper presented at the First Meeting of the Advisory Committee of the project for the preparation of a Strategic Action Plan for the conservation of biological diversity (SAP BIO) in the Mediterranean Region (Tunis, 22th -23th February 2001). FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-05: 4 pp.

Cingolani, N., and Santojanni, A. 2002. Manual of the Recorder. AdriaMed Training Course on Small Pelagics Data Collection and Biological Sampling System. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-06. *AdriaMed Occasional Papers*, 6: 40 pp.

AdriaMed. 2002. Source and Accessibility of Socio-Economic data in AdriaMed member countries. Paper presented at the AdriaMed Meeting "Aspects of Fish Markets in the Adriatic Sea Fishery Sector". (Ancona, 27th -28th June 2002). FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-07. *AdriaMed Occasional Papers*, 7: 27 pp.