DISCUSSION SESSIONS

The discussion sessions were structured according to the framework outlined in figure 1. Three sessions were held. Following is a summary of the key issues discussed during each session.

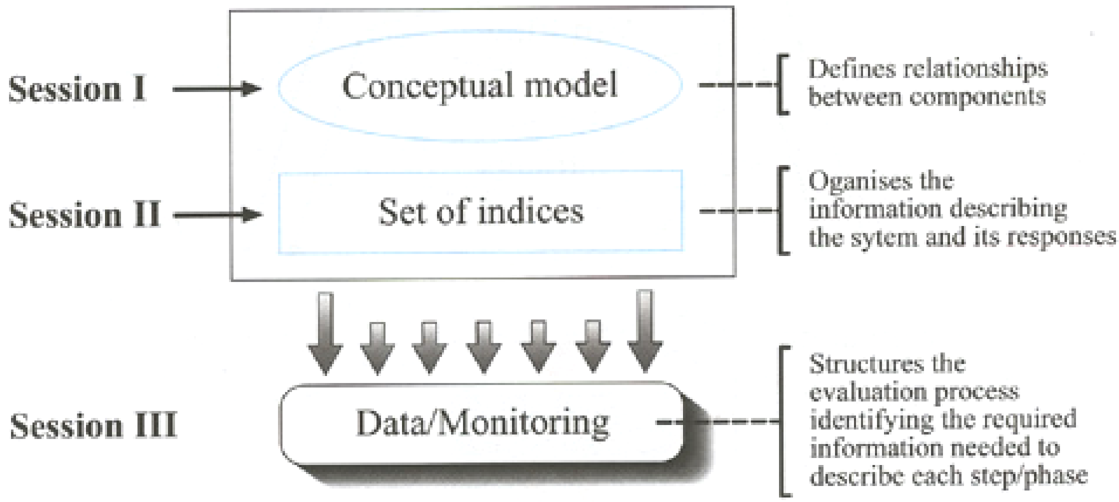

Figure 1. Frame work for discussion sessions

SESSION I: CONCEPTUAL DIAGRAM

Title: Conceptual diagram.

Purpose: To develop a tool to define relationships between components of the system.

Output: Conceptual diagram

Discussion during this session was based on a conceptual diagram presented at the beginning of the session by Vera Agostini (Figure 2).

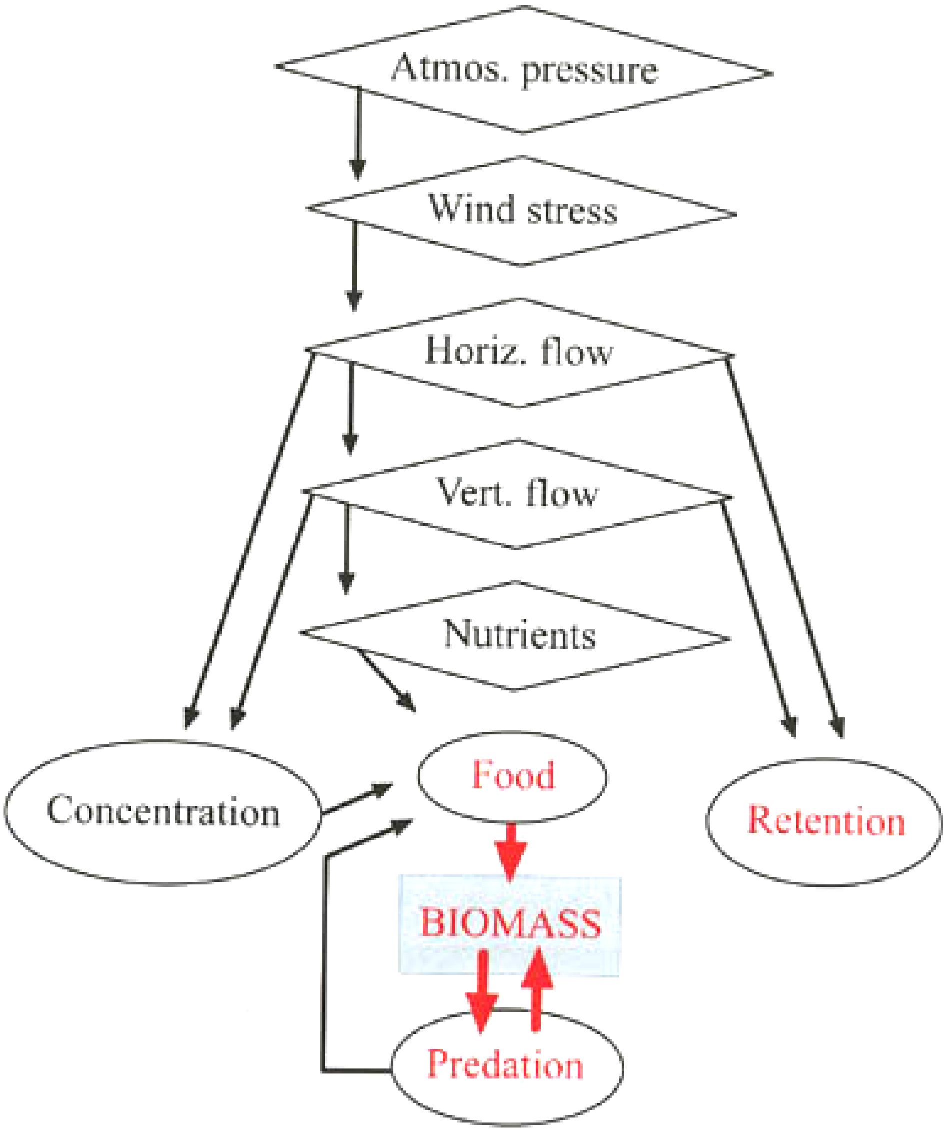

Figure 2. Suggested conceptual diagram

The purpose of this diagram was to provide a framework for discussion regarding the proper approach to take in the study of the relationship between fishery and environmental variability. Participants identified key components of the system and defined the relationships amongst them. The output of session I was a modified version of the initial diagram reflecting the changes suggested during the discussion (Figure 3). This diagram is not intended to be used as a predictive model, but simply as a list of items to address in this type of study.

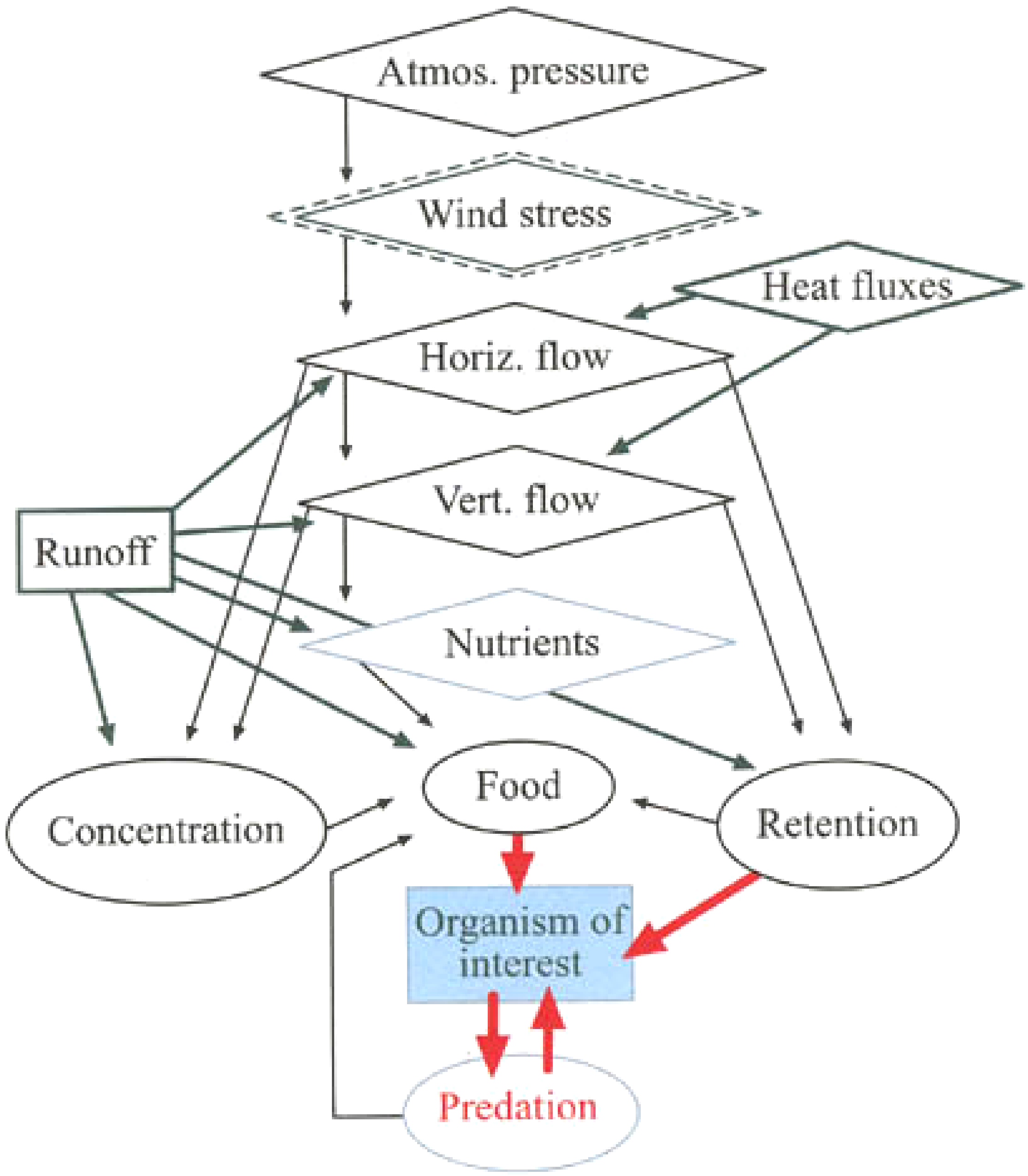

Figure 3. conceptual diagram

THE FOLLOWING IS AN OUTLINE OF KEY ISSUES DISCUSSED DURING SESSION 1

1. The purpose of the conceptual diagram:

- A framework for discussion
- A list of items that needs to be addressed in the study of fishery and environmental variability

2. Major limitations:

- Loss of information through the process of simplification
- False view of the ecosystem by collapse into one or two boxes
- Loss of generality (ability to apply to different geographic areas) due to excessive elaboration.

3. Misrepresented components:

- The biomass box should be detailed.
- Factors driving horizontal flow in the Mediterranean.
- Horizontal flow in the Mediterranean is driven by heat buoyancy losses (heat fluxes) in well identified areas. The resulting density-driven surface circulation is only slightly modified by wind stress.
- Mixing of processes and variables within the conceptual diagram.
- Ecosystem.

One of the major problems identified with the conceptual diagram is its inadequate representation of the ecosystem as a whole. Conventional approaches have focused on single species, but more and more attention is being shifted to a broader ecosystem approach. This is reflected in the FAO Code of Conduct for Responsible Fisheries and the precautionary approach to fisheries both in favour of sustainable, well managed fisheries that respect ecosystems and the whole environment. Despite this, the ecosystem scale has not received much attention in scientific studies. It was emphasized that scientific research in the Mediterranean must play an important role by addressing this question.
Aspects of using the ecosystem approach were discussed. The implications of different types of biological controls acting on ecosystems (top-down, bottom-up and wasp waist) were presented by Philippe Cury (Figure 4).

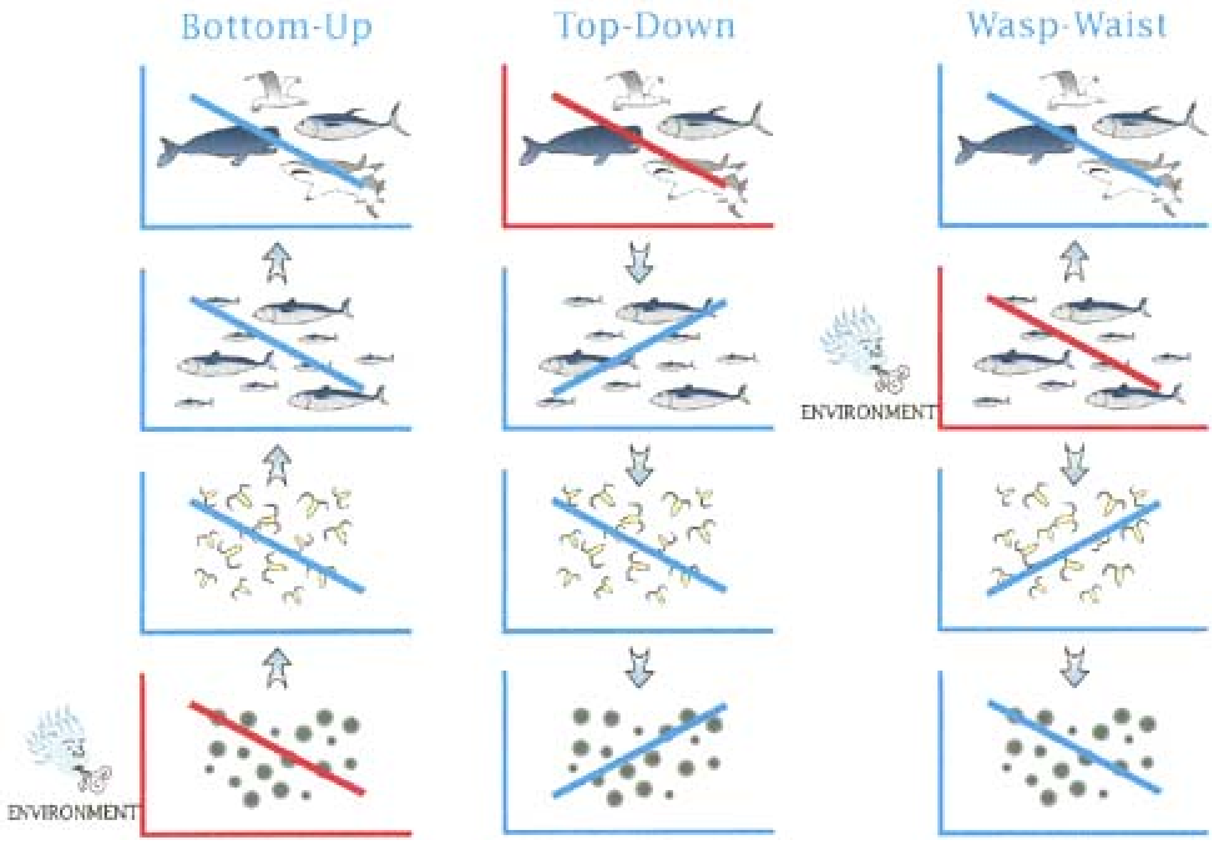

Figure 4. Different type of biological controls acting on ecosystems

The issue of differences in both spatial and chronological scales was also discussed. One of the difficulties identified in designing a diagram is ensuring that it is sufficiently general to be applied to different biological systems (i.e. different areas of the Mediterranean). Warren Wooster proposed a more general conceptual diagram, viewed as more easily transportable to different Mediterranean ecosystems (Figure 5).

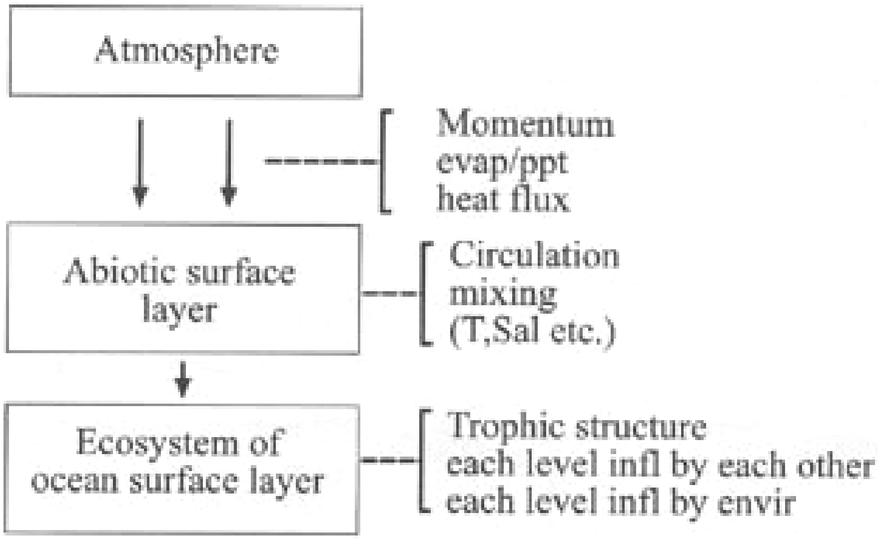

Figure 5. General conceptual diagram

Workshop participants concluded that the more detailed diagram produced (Figure 3) could be useful in order to outline and discuss important components of the system. This diagram would need to be re-evaluated and possibly adjusted to reflect the particular characteristicsof the area to be studied.

The group briefly discussed potential methods to be employed in this type of study. Andrew Bakun suggested the following potential approach summarised in Table 1 to be applied in the analysis of marine ecosystems.

Table 1 Potential approach to be applied in the analysis of marine ecosystems.

STEP 1	Perform climatological analysis of the ecological sytem (behavioral characteristics versus cahracteristic seasonal and geographical of environmental processes to identify potential controlling enviromental processes.
STEP 2	Construct time series indicators of variabilty in these controlling environmental processes
STEP 3	Assume (a) response to value of anomalies (positive and negative anomalieshaving opposite effects) or (b) "optimal window" --Type reason (e.g.,response to absolute value of anomalies)
STEP 4	Construct multiple seasonal anomaly time series (for both a and b assumptions) based on different filterings of the raw time series of independent variables (different assumed "adaptive" response timescales)
STEP 5	Perform multiple empirical tests to identufy (I) a favored forth of response (a or b), (2) best-fit adaptive timescale, (3) etc.
STEP 6	Repeat steps 1 to 5 for different regional fish-environment systems
STEP 7	Identify informative patterns in 1, 2, 3 of step b that may yield generalised insights

SESSION II: INDICATORS

Title: Indicators:
Purpose: To develop vehicles for the organisation of information and description of the system and its responses.
Output: Preliminary list of indicators.

Workshop participants discussed appropriate indicators to represent diagram components outlined during session I. Indicators were identified for each component. A preliminary list is presented in table 2. This list needs to be expanded and further refined taking into account the needs of particular geographic areas, and the experience of other groups of experts, etc...

Table 2. indicators

COMPONENT	**INDICATOR**
Atmospheric pressure	Sea Level Pressure
Atlantic inflow	Sea Level Height on bath sides of Strait of Gibraltar
Wind speed	Wind stress
Heat fluxes and evaporation	Air and sea surface temperature; wind intensity
Horizontal flow	Front position and mesa-scale activity (satellite SST) satellite altimetry (only valid away from the shore (at least 10 km), in the open sea and for relatively intense horizontal flows)
Vertical flow	Wind stress curl (open sea), SST images (wind driven upwelling near the shore)
Nutrients	P, Si, nitrates
Food	Primary production (chlorophyll-a, phytoplanktan abundance) Zooplanktan (abundance, species composition)
Biomass	Recruitment, spawning, egg and larval abundance, daily egg production, spawning area, .catches
Retention	Indices provided by numerical simulation. Analysis of time series of SST images
PARAMETERS FOR BIOMASS INDICATOR **DEPM parameters:** Daily egg production, Batch fecundity, mean female weight, spawning fraction.	
Condition parameters: gonado-somatic index, condition factor, lipid content, hepato-somatic index, macroscopic fat content, larval daily growth and annual growth, larval condition (RNA/DNA), genetic quality (maternal effects).	
Other parameters: Egg and larval abundance, length weight relationship, size at first maturity, zooplanktan biomass, phytaplankton biomass, food availability) micro-zooplanktan biomass.	

DURING SESSION II THE FOLLOWING KEY ISSUES EMERGED:

- The generation of indicators from the "internal boxes" (components of the system that both impact and are impacted by other components) was the most difficult.
- The lack of definition of spatial scales poses a problem in the choice of appropriate indicators.
- The identification of appropriate methods to collect data describing certain indicators (i.e. zooplankton).

SESSION III:
DATA AND MONITORING

Title: Data/monitoring.

Purpose: To identify the information required to describe each indicator.

Output: Preliminary list of data-sets available.

This session was divided into two sections. One to discuss monitoring needs in the Mediterranean, and one to discuss available data-sets.

Section I: Monitoring

The proper design of a monitoring programme and the existing possibilities for the establishment of a monitoring network in the Mediterranean were discussed following a keynote presentation by Warren Wooster.

This presentation, as well as key questions arising from it are attached in annex II.

A number of key steps in the proper design of a monitoring programme were outlined as follows:

- The identification of existing programmes and the disposition of data;
- The establishment of a system for quality controlling of data;
- The identification of a system for sharing/pooling of data.

Physical data was identified as being relatively easy to exchange, but the need for the establishment of special programmes to collect this information (i.e. ocean circulation data) was raised. Biological data are relatively available but their timely exchange is more difficult. Higher tropic levels are monitored in terms of catch data, but these data may not be sufficiently comprehensive for ecosystem analysis.

Workshop participants emphasised the need for objective assembly and analysis of data on ecosystem forcing and response. Holistic analysis of changes in ecosystems will be useful for informing governments about changes that might affect resource use.

A continuing scientific organisation such as PICES in the North Pacific and ICES in the Atlantic was suggested as a body that could coordinate: (1) operational questions of monitoring; (2) data exchange; (3) analysis and (4) promotion, development and execution of research agenda required.

The need clearly emerged for cooperative projects to further elucidate mechanisms linking changes in population of small pelagics with the environment.

The present nature and the future of existing Mediterranean databases/ monitoring programmes (MEDITS, MEDATLAS, MEDGOOS) were discussed. The short term nature of these programmes often results in the termination of valid data collection efforts. At present the main efforts focus on physical data collection. The situation for biological data and for resource information (i.e. fisheries) is not as clear. The existence of a large number of data in the form of unpublished reports was also discussed. The importance of trying to retrieve this information was emphasised. The role of a central body to pool, quality control and organise all these data was again discussed. Such a body was considered essential for the success of such an effort. The danger of duplicating efforts in the Mediterranean was stressed. The existence of Mediterranean organisations such as MedGOOS, and ICSEM/CIESM which could provide an umbrella for this type of activities was discussed. MedGOOS is scheduled to become operational in October 2001. The danger presented by the emphasis, in the MedGOOS programme, on physical components of the system, and the need for a biological focus, was discussed. A biological focus might be ensured by adopting the living marine resources elements of GOOS.

Section II: Data

During this session the participants were divided into groups each representing the following Mediterranean sub-areas: Alboran Sea, NW Mediterranean, Adriatic Sea, Sicily channel and Aegean Sea. A preliminary list of data-sets available for each sub-area was generated (Table 3). It is important to note that these lists are not comprehensive and will need to be further elaborated.

Table 3 Preliminary list of data-sets available by sub-areas

AREA. ALBORAN SEA TYPE	**OWNER**	**DURATION**	**LOCATION**	**COMMENTS**
Monitoring program ECOMALAGA	IEO-Málaga	92-Present	Coast of Málaga	Quarterly moni-toring (T, S, Chlor, Oxygen, nutrients, phytoplanktan and ichthyaplanktan abundance
Ichtyop/Physics surveys ICTIO-Alboran	IEO-Málaga	93-Present (not all years)	N Alboran Sea	Oceanographic variables and ichthyaplanktan abundance
CANIGO project	IEO-Malaga, Univ. Málaga and other partners	96-98	Strait of Giblartar	T, S, and currents
AFLORAMIENTOS	IEO-Málaga Univ. Málaga	96-97	NW Alboran Sea	Oceanographic variables, nutrients and organic carbon
Acoustic surveys ECOMED	IEO-Málaga	?- Present	Spain	Biomass estimation of small pelagies
Catch statistics biological sampling	IEO-Malaga	?- Present	Alboran	Catches, effort
MED ATLAS	EU	Recopilation	Mediterranean	CTD profile data

AREA: NORTHWESTER MEDITERRANEAN TYPE	**OWNER**	**DURATION**	**LOCATION**	**COMMENTS**
Horizontal flow	IEO ICM	1985-2001	Balearic Sea	Irregular time space.Fram 1996 regular (quarterly) in islands channels
	IFREMER	?	Gulf of Lyons	
Food (Nutrients)	IEO IEO	1996-2001 1993-2001	Balearic Sea Balearic Sea Mallorca	Quarterly in Island channels. Weekly. Fixed station south
	ICM	1983-2001	Balearic Sea	Catalan coast Irregular
Food (PP)	Joint Int. Centre. La Spezia			Seawifs Information
Biomass (adults)	ICM, IEO	1990, 1993-1994	G. Lyons. Catalan coast	Anchovy (DEPM)

Biomass (adults)	IEO	from 1990	Spanish coast	Small pelagics (Acoustic survey)
Biomass (adults)	IFREMER	from 1993	Gulf of Lyons	Anchovy recruit-ment and small pelagics (acoustic)
Biomass (adults)	Official stat.	from 1990	Balearic Sea / port	Monthly / species
Biomass (adults)	IEO sampling	from A'90	Balearic Sea	Length distribu-tion of catches sardine and anchovy
Biomass (eggs and larvae)	IEO	from 1992	Balearic Islands	Monthly in fixed stations
Biomass (eggs and larvae)		1987-19$8	Balearic Islands	Annual cycle (8 cruises)
Biomass (eggs and larvae)		from 1982	Catalan coast	Irregular
School charact (acoust)	ICM,IRD,IRPEM	1993-1995	Catalan coast	

AREA: SICILY CHANNEL, TYPE	OWNER	DURATION	LOCATION	COMMENTS
MAGO Project (I and II) anchovy	IRMA-CNR IEO-Málaga Univ. Mlaga	1997-present	South of Sicily	Spawning period, egg and larval abun., zooplank-ton, acoustics, DEPM, biological sampling, fishery and meteo, ACDP data and daily growth, larval condition
Physic.Ocean Surveys	CNR (Mario Astraldi)	several surveys	Sicilian channel	
MED ATLAS	EU	Recopilation	Mediterranean	CTD profile data
Acoustic surveys	INSTM	1998-present	North-East-South Tunisia	Acoustic evalua-tion and oceano-graphic variables
Fishery Data Information Trawl surveys	MBRC	1993-1995	Libyan coast	Biological infor-mation of small pelagic species.

AREA:ADRIATIC SEA TYPE	OWNER	DURATION	LOCATION	COMMENTS
Landings. Anchovy	IRPEM-CNR Ancona	from 1975-ongoing	North-Center Adriatic.	Shared stock Italy-Slovenia-Croatia. Also official data (from the three countries)
Landings. Sardine	IRPEM-CNR Ancona	from 19"75-ongoing	North-Center Adriatic	Same as above for anchovy
LFD.landings anchovy	IRPEM-CNR Ancona	from 19'75-ongoing	North-Center Adriatic	In the main Italian ports
LFD.landings sardine	IRPEM-CNR Ancona	from 1975-ongoing	North-Center Adriatic	In the main Italian ports
Biomass indirect methods anchovy	IRPRM-CNR Ancona	from 1976-ongoing	North-. Center Adriatic	Published

Biomass indirect methods sardine	IRPEM-CNR Ancona	from 1976-ongoing	North-Center Adriatic	Published
Biomass (Echo surveys)	IRPEM-CNR Ancona	from 1975-ongoing	North-Center Adriatic	Southern Adriatic not covered every year
Biomass indirect methods anchovy	IOF Split (Croatia)	1974-1979	Eastern Adriatic	Published
Biomass indirect methods sardine	IOF Split (Croatia)	1979-1981	Eastern Adriatic	Published
Biomass D.E.P. Method anchovy	LBM Provincia di Bari	1994-1995	South Adriatic	Published
Biomass D.E.P. Method anchovy	Servizio Ittico Ambientale, Provincia di Bari	1999	South Adriatic	UE Final Report
Biomass D.E.P. Method sardine	LBM Provincia di Bari	1994	South Adriatic	Published
School characteristics	IRPEM-ICM-IRD	1994-1995	N.west Adriatic	Including CTD stations
Anchovy and sardine egg and larvae distribution and abundance	LBMP Univ. Bologna in Fano	from 1976	North-Center Adriatic	335 microns Bongo net, 2 surveys/year
Anchovy and sardine egg and larvae distribution and abundance	LBM Provincia di Bari	from 1984	South Adriatic	335 microns Bongo net, 2 surveys/year
Zooplancton abundance	Univ.Trieste, Dept. Biology	from 1976	North-Center Adriatic	236 microns Bongo net, 2 surveys/year.
Anchovy larvae condition	ICRAM-Chioggia	1995-1996	Po river area	Detailed distr. and abund. of larvae and their food
Primary Production	IBM-CNR Venice	from 1995	North Adriatic	PRISMA and MAT projects. Published partially.
Nutrients and phytoplankton	CRM Cesenatico ARPA Emilia-Romagna	from 1988-ongoing	Emilia Romagna Region	2-3 times a week Published
River runoff	Official published data	from 1918 (monthly)	Po river	Daily data since 1993
Adriatic Tamp, Oxygen and Salinity (ATOS)	IRPEM-CNR Ancona	from 1911	Whole Adriatic	4400 historical oceanographic published data
Northern Adriatic Dataset (NADS)	IBM-CNR Venice	from 1978 ongoing	Northern Adriatic	Oceanographic stations
ECMWF 6 h reanalysis	Available at IRPEM-CNR	from 1994 ongoing	Adriatic	Mean sea level air pressure, wind components, 2m air temperature

AREA: AEGEAN TYPE	OWNER	DURATION	LOCATION	COMMENTS
Catch/effort	NSSA	from 1964	Greece	Published
Nat. Syst.Fish.Data	IMBC	from 1995	Greece	Available upon request
Biomass (Acustics+DEPM)	IMBC	from 1995	Greece	Project coord. control
Biomass (Acustics+DEPM)	Aristotel Univ,	from 1993`	NW Aegean	Project coord. control. Sardine and anchovy