EVOLUTION OF THE ARTISANAL FISHERY IN CILENTO, ITALY

- CASE STUDY -

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Preliminary report

Food and Agriculture Organization of the United Nations
Rome, May 2002

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PREPARATION OF THIS DOCUMENT

Artisanal fishery in the Mediterranean area is a very attractive and interesting tradition. Because of its unpredictable operational pattern and its constant adaptation to internal and external phenomena it is difficult to really assess its status over time. The need to improve our knowledge of artisanal fishery and how it is conducted in the Mediterranean has been highlighted on many occasions and, in a way, still remains an ongoing issue. The FAO Copemed Project took up the challenge to initiate a sub-regional project activity to assess the situation of artisanal fisheries in the eight countries participating in the project in order to contribute regionally to an issue which, to our knowledge, is normally treated only at the national level (see reference).

It is also believed that more knowledge and, in particular, results from case studies based on actual circumstances, could help to envisage changes, highlight similarities and dissimilarities, interpret the evolution and propose options to managers and authorities in the sector.

The whole study consists of the planning and realization of the following major components: (a) the methodological design, (b) the data collection (field work), (c) the data base (ArtFiMed), (d) the case studies, (e) the processing and analysis, (f) the CD output, (g) appropriate documentation, and (h) a power-point presentation.

This paper concerns the implementation of one of the first two case studies launched on conclusion of the inventory of artisanal fishery communities in the Mediterranean in accordance with the main objective of the project activity, i.e., to "launch some studies aiming at defining management strategies for artisanal fisheries to benefit fishermen's communities and administrations, and not just be the statistical component".

The authors wish to thank Ms. Merlyn Homer for the editing of this document.

1. INTRODUCTION

Even though the offshore industrial or semi-industrial fisheries are the most productive, small-scale coastal fisheries have a much greater social significance.

Mediterranean artisanal fishing is a very variable activity. Catches are highly multispecific and fishing intensities and strategies show very rapid fluctuations in space and over time. The variation of active fishermen and boats by area, sometimes over very short periods of time, is also a significant characteristic of the artisanal fishery sector.

This sector involves several countries and encompasses many types of fishing gear and methods. Its resources, shared among various parties, move from one region to another, and the size of the fish catch varies from country to country, as does its economical value. The FAO Copemed Project, through its initiatives, offered the possibility of starting a programme of work to study this sector in depth in its area of competence (Algeria, France, Italy, Libya, Malta, Morocco, Spain and Tunisia).

At present, the various official national statistical systems cannot take into account the high variability of all the components in this sector.

Information on artisanal fishery, in the wide sense, is fundamental for planning and management purposes provided it also takes into account most of the interacting elements. It is, therefore, extremely important to document all the factors in the related sectors which interact directly or indirectly with artisanal fisheries, and describe synergies, conflicts or friction and possible interaction and relationship.

Once the preliminary phase of the project had been completed (inventory of artisanal fishery communities in each country involved) the research activities passed from a qualitative and generic inventory to timely and precise studies (case studies). These were undertaken in areas where the conditions permitted in-depth and detailed data collection and analysis.

The FAO Copemed project funded the case study in Cilento because this region's characteristics are common to most of the Italian and Western Mediterranean coastal areas, where various activities overlap and traditional fishing activities suffer from environmental degradation and significant fishing effort.

The aims of the case study are the following:

- Definition of sampling strategies and data collection routines for the selected site.
- Analysis of short-term and long-term temporal changes in artisanal fishing activities.
- Identification of biological and socio-economic indicators that could be used as a tool to assess the status of the local Artisanal Fisheries.
- Elaborate methodologies and routines that can be applied in similar areas of southern Mediterranean Sea.

The Cilento area, situated in the Campania region, was selected on the basis of several factors. First of all, its structural, economical and social importance within the artisanal fishery communities in the Western and Central Mediterranean, especially vis-à-vis the southern part of the Mediterranean. Secondly, the proved interest of the fishermen to collaborate and, thirdly, the availability of and access to detailed data from a previous survey carried out in 1994-1995.

As far as the availability of historical data is concerned, this refers to a study on traditional fishing activities in the Italian region of Cilento (southern Tyrrhenian Sea) supported by the Italian Ministry of Agriculture Resources carried out during 1994-1995 through periodic surveys at the main landing sites.

The main objectives of the study were:

- ✓ to assess dimensions and characteristics of fishing activities (fleet, fishing gears, target species, fishing areas and periods, catch composition, landings and CPUEs);
- ✓ to identify management measures to enforce artisanal fishing activities.

In the last 20 years artisanal fishery has been reducing its economic importance in the area, as can generally be seen along the Italian coasts. The main factors in this process are linked to the socio-economic development of coastal areas with the growth of the tourism industry.

During the five year period (1995-2000) traditional fishing activities in the coastal zone have been partially replaced by new activities, such as aquaculture, fishing-tourism ("pesca-turismo"), and tourist pleasure-boating along the coasts. In the forthcoming years the creation of Marine Reserves will accelerate these changes.

This study was undertaken because of the:

- Acknowledged importance of artisanal fisheries in the region.
- Reduction of artisanal fishing activities along the Italian coasts over the last 20 years.
- Lack of quantitative data on fishing activities.
- Inadequate knowledge of the factors involved in the development process.
- Contribution to the development of new integrated management plans.

1.1 Definition of artisanal fishery

By "artisanal fishery" is intended small capital investment, mostly by the owner fishermen, as opposed to "industrial fishing" which implies significant investments by companies or financial groups. Artisanal fishing is often associated with the notion of "coastal fishing", i.e., essentially fisheries located on the continental shelf, or very close to it, exploiting areas which can be reached in a few hours from the ports or beaches where the fishermen are based. Consequently, this type of activity does not imply a very long stay at sea. Another characteristic of artisanal fishing is that it employs a great number of workmen at sea as well as at the landing place. Fishing gear are extremely diversified and the fleets are generally composed of a large number of boats, mostly of low tonnage, based in a multitude of ports and shelters (Farrugio, 1996). From the activity point of view, there are also situations in the artisanal fishery where the fishing activity pattern is not dictated by the target species, the season, or the type of gear used within the same community, but rather by a sort of unwritten self-management plan of the whole fishery. One can imagine small vessel fishermen interacting with larger vessel activity during the tuna and large pelagic fishery season, the lampuka fishing season and other activities (including some tourist agriculture and other economic and non-economic commitments) as one ensemble (Coppola, 2000).

In the inventory exercise (FAO-Copemed study) a comparative analysis of practices, terminology and interpretation of artisanal fisheries in each country was undertaken. This enabled a standardised method to define Artisanal Fisheries in the Region to be established.

Artisanal Fishery is defined as the combination of the				
Port	**Gear (métier)**	**Target Species**	**Fishing Zone**	**Season**

All métiers are included in artisanal fisheries except for those practised with the following gear:

- trawl nets
- large seines for small pelagics (other than those using lampara)
- gear targeting large pelagics (purse seines, longlines, drift nets, stationary uncovered pound nets –madragues-, tuna rods, trolling lines)
- hydraulic mollusc dredges
- large longliners

1.2 General situation of the Italian fishery

The main bulk of the Italian fisheries can, therefore, be considered as "artisanal" and "coastal" except for the recent evolution of a few fleets towards a nearly "industrial" type of activity.

According to official statistics, the Italian fleet is composed of 19.798 fishing vessels, as recorded in the maritime authority's fishing licence archives. The most important sector is represented by small-scale fishery with 12.482 fishing vessels (63% of the total fleet), followed by: polyvalent (3.767 vessels); trawlers (2.370 vessels); dredgers, using hydraulic dredges (755 vessels); purse seiners (277 vessels) and twin pelagic trawlers "volanti a coppia" (147 vessels). Total gross tonnage is 230.018, 14% of which belongs to artisanal fishery.

The total engine power in KW is 1.534.284, 20% of which belongs to artisanal fishery. The total number of fisherfolk is 52.342, 49% of which are in the artisanal fishery sector (IREPA, 1999).

In 1999, the estimated catch of the Italian marine fisheries was 416.400 tons, 22% of which was caught by the artisanal fishery (IREPA, 1999).

1.3 Italian fisheries legislation

In Italy fishing activities are regulated by the Decree of the President of the Italian Republic nº 1639 of 2 October 1968 regarding "Regulation for the execution of the law of 14 July 1965, nº 963, concerning the discipline of marine fishing".

The artisanal fishery is regulated by the Ministerial Decree published on 14 September 1999 "Disciplina della piccola pesca" (Conduct of small-scale fishery).

1. Small-scale fishery ("*piccola pesca*") means artisanal fishing carried out by boats with a total length between perpendiculars less than 12 m and tonnage lower than 15 GRT.

2. Artisanal fishery, as defined above, can be practised with fixed nets, entangling nets, driftnets, longlines, hooks, lines and harpoons inside the spatial range of 12 nautical

miles from the coastline. Other specific fishing gears and methods can be used locally in the coastal zone, as authorised by the maritime authorities.

3. Trawls, hydraulic dredges for mussels and all engine-powered trawling systems are not included among the authorised fishing gear. In accordance with the social and economic objectives, and recognising the need for responsible and sustainable fisheries practices, the Ministry of Agriculture Resources has prepared three-year action plans for the fisheries sector since 1982 (41/1982 Ministerial Law). This represents the norm that governs measures to identify the appropriate fisheries management strategies.

In conformity with EU regulations, Italy, like the other EU members, applies the Multi-Annual Guidance Programme (MAGP) which deals with the reduction of fishing fleets to adjust fishing effort to the volume of available fishery resources. This reduction can be achieved by removing a certain number of fishing vessels from the fleet (through demolition, transfer to a non-EU country by the creation of joint ventures, or by donating the vessel to a scientific research institute). Member states can apply for EU funds to attain the MAGP objectives.

The management measures currently in place in Italy are mainly designed to assure a sustainable exploitation of the resources, to limit fishing effort, to protect the ecosystem biodiversity, to develop aquaculture and to apply the principles of the FAO Code of Conduct for Responsible Fisheries.

1.4 Situation of Campania fisheries

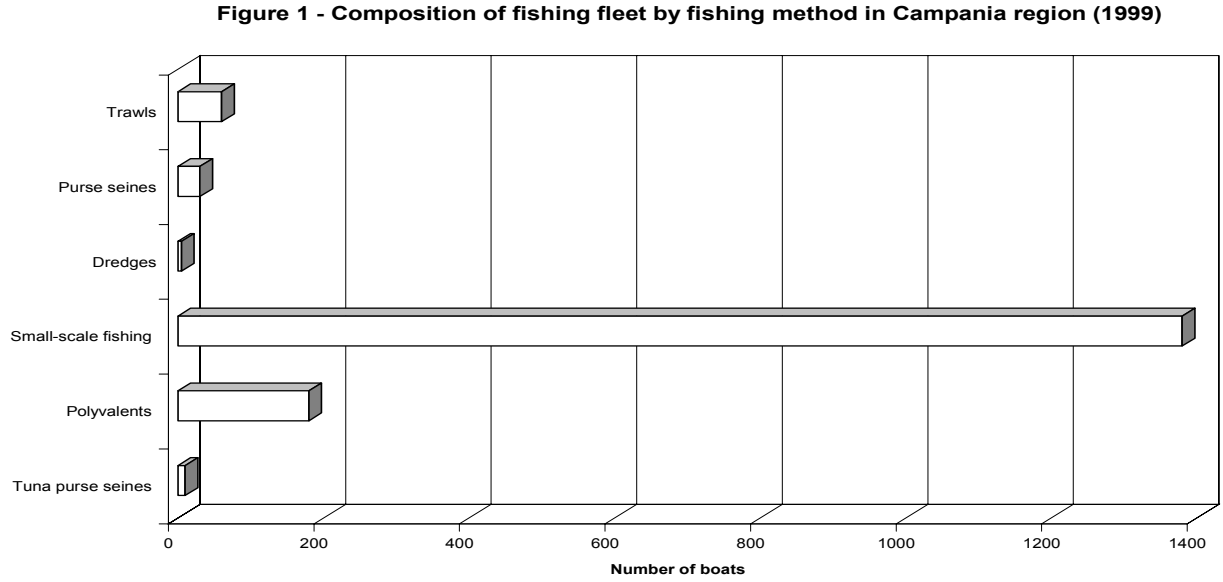
Campania, with its 480 km coastline, is divided into four administrative areas (Napoli, Castellammare di Stabia, Torre del Greco and Salerno) and 36 maritime offices. There are 35 coastal communes and some 39 landing sites. In spite of modest local production levels, Campania represents an area with a high level of consumption of fishery resources (27,44 kg per person instead of 22 kg per person at national level) (IREPA, 1999).

Campania's fishing fleet is composed of 1.623 vessels with a total gross tonnage of 11.982 and an average age of 23,9 years. This represents 8,3% of the national fleet while the total gross tonnage is only 5,2%, thus confirming the high artisanal component of this region's fleet (Figure 1). This sector represents more than 90% of the entire regional fleet and, despite the general crisis in the fishery sector, still provides many job opportunities.

This sector includes vessels with a total gross tonnage lower than 10 tons which use fishing techniques that are characterised by a high level of craftsmanship, such as gillnets, longlines, hooks and lines and traps.

The fishing activities of small-scale fisheries, in terms of fishing days, are usually dependent only on the weather conditions. This is because there are few restrictions on the fishing methods used which have a relevant impact on fishery resources.

Fig. 1 – Composition of fishing fleet by fishing method in Campania Region during 1999



Source: IREPA, Italy

2. STUDY AREA

The area of Cilento is spread over 140 Km of coastline in the southern part of Campania (southern Tyrrhenian Sea) (Figure 2). It is an area of high naturalistic importance where one of the largest European national parks (Parco Nazionale del Cilento-Valle Diano) is located. Moreover, two marine reserve areas (Costa degli Infreschi and S. Maria di Castellabate) will be established in the near future (Law 979/82). Figure 3 shows the position of the three Marine Reserves.

Table 1 shows the surface areas of coastal villages in the study area, the population density per Km^2, total resident population, and number of villages and hamlets per district. The data were taken from the 1991 population census carried out by ISTAT (ISTAT, 1991).

Table 1. Anthropological data

	Surface. (Km^2)	Density (inhab./Km^2)	Resident population	Number of villages	N° of settlements
Castellabate	37,01	200	7.414	5	10
Montecorice	22,13	110	2.440	8	13
S.M. Cilento	15,12	71	1.079	3	3
Pollica	27,89	104	2.912	6	0
Casal Velino	31,79	140	4.464	5	3
Ascea	37,63	138	5.186	7	24
Pisciotta	30,73	108	3.324	4	1
Centola	47,54	101	4.805	5	5
Camerota	70,18	104	7.322	4	0
Total	320,02	1076	38.946	47	59

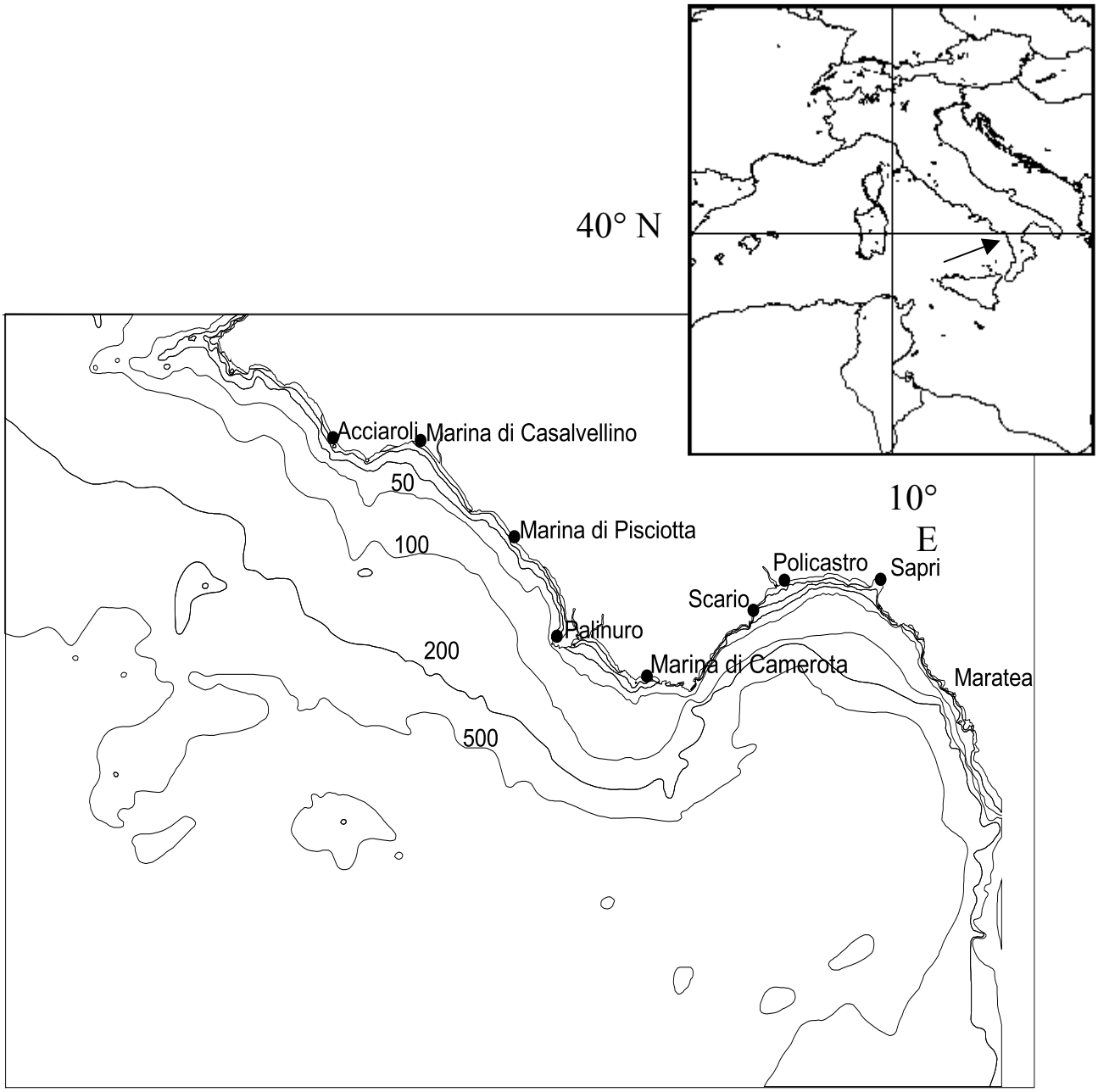

40° N
10°
E
Acciaroli
Marina di Casalvellino
Marina di Pisciotta
Palinuro
Marina di Camerota
Scario
Policastro
Sapri
Maratea
50
100
200
500

Fig. 2. Map of the Cilento region showing ports

The total surface occupied by coastal districts is 320,02 Km^2, and the total resident population is 38.964 inhabitants, with an average density of around 120 inhabitants/Km^2 (119,56). There are 47 hamlets housing 77.3% of the resident population. The remaining population is spread over 59 built-up areas (6.2%) and in scattered houses (16.5%).

Tourism

The number of the work-force population (employed, unemployed, first job seekers) is 15.593, which represents 40% of the whole population in the area.

There is a high level of unemployment everywhere, ranging from 24-50% (with an average of 35.7% in the whole area). The districts with the highest level of unemployment are Centola (50,2%), Pisciotta (44,4%) and Camerota (40,7%). The level of youth unemployment is very high, being more than 70% in some districts (Centola, Pisciotta).

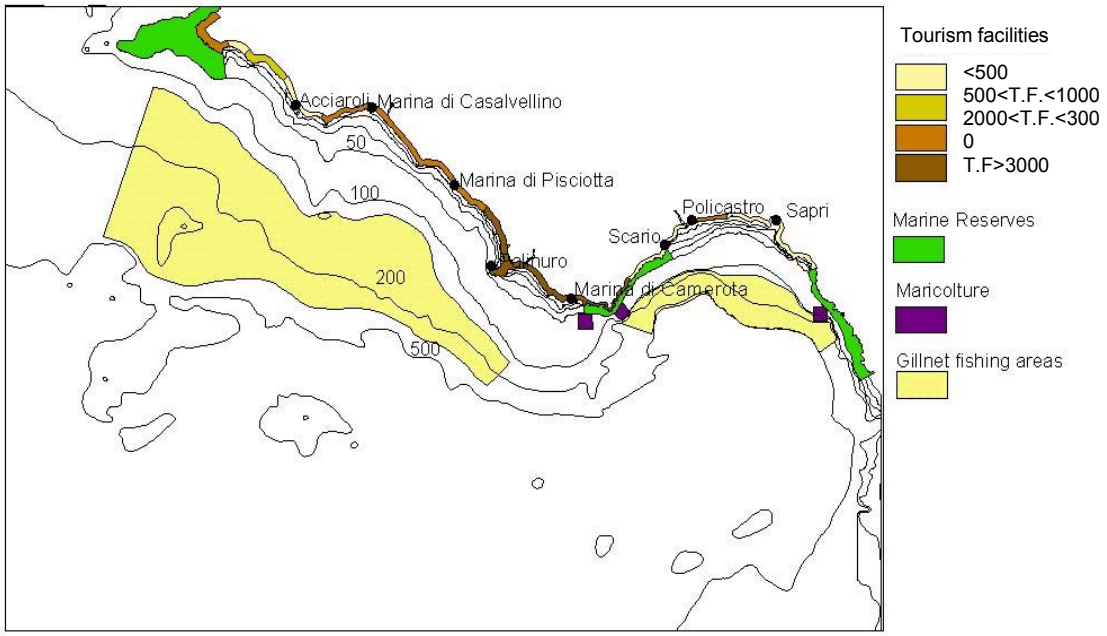


Fig. 3. Overlap of activities in Cilento coastal area: tourism facilities along the shore, as accommodations both in hotels and campings, Marine Reserves, maricolture areas and gillnet fishery areas

The principle working activities in the area are: agriculture (17,3%), building industry (12,3%), trade (10,4%) and craftsmanship (6,7%). Fishing involves 1,9% of the employed. Only in the Castellabate, Camerota and Montecorice districts does it still represent an economic sector with a relevant level of employment.

The hotel and restaurant industry is very important (5,4% of the working population). However, the tourism industry is mainly based on camping and is a seasonal (summer) activity, especially during July and August. The presence of tourists during the rest of the year and weekends is very low. This can be explained both by the shortage of suitable infrastructures and by the distance of this coastal area from the main towns, as well as by the inadequacy of the road network. The tourism facilities, in terms of bed availability are shown in Figure 3. The area with the highest number of tourists during the summer is that located between Marina di Pisciotta and Marina di Camerota.

2.2 Environmental characteristics

Available bibliography

The area is characterised by the scarcity of information on its marine habitat. The only data available on the coastal environment were collected in the Proceedings of the International Conference on "Coastal marine reserves", held in Castellabate from 18-22 June 1973.

A study regarding the availability of fry of marine species for aquaculture purposes was carried out during the 1980s (Camera di Commercio di Salerno, 1993). With regard to the evaluation of the demersal resources, experimental trawl surveys sponsored by the Ministry of Agriculture Policy and E.C., have been executed yearly since 1985 along the southern Tyrrhenian coast, including the area under study, (Relini and Piccinetti, 1996). A study on the biology of the deep-water pandalid shrimp *Plesionika edwardsii* (decapoda, caridea) based on an experimental survey with bottom traps was conducted in the Policastro Gulf during 1999 (Colloca, 2002).

And, lastly, there are the regional annual reports of IREPA (Osservatorio della Pesca Campana, 1999) which deal with the socio-economic aspects of the fishing industry.

Protected areas

National legislation regarding protected areas (No. 394 of 6 December 1991) established the National Park of "Cilento-Valle Diano" and the Marine Reserves of "Santa Maria di Castellabate", "Costa degli Infreschi" and "Costa di Maratea". For the Cilento-Valle Diano Park, the boundaries and protection measures were established by Ministry of Environment decrees of 1992 and 1993. A protected area was established between Sambuco bay and Pagliarolo point by decree in 1972. Recreational fishing is not allowed in this reserve and professional fishing is regulated.

The maritime authorities of Agropoli have forbidden boat anchorage, fishing, bathing and sediment research within a range of 250 m from Latitude 40°15'07N and Longitude 14°50'55E.

Geomorpholgy of the sea bed in the Cilento area

The Infreschi coast, so called because of the presence of numerous freshwater springs, is characterised by the slope of mount Bulgheria. Small sandy and gravelly tracks break the vertical cliffs. The depth, even very close to the entire coastline is around 10 m.

Around Iscoletti point the depth drops very quickly to 50 m and goes down to over 100 m.

Infreschi port is a natural creek characterised by the presence of a wide *Posidonia oceanica* meadow: once it was used by the ancient Romans as a harbour.

Between Iscoletti point and Bianca Bay cliffs reach depths of some 30 m. The central part of the Bay's seabed is composed of wide *Posidonia oceanica* meadow mixed with rocky zones. Between Marina di Camerota and Monte Luna are stretches of sea composed of rocky banks at a depth of 40-70 m. Around Camerota there are sandy beds mixed with Posidonia meadows.
The mouths of the Mingardo and Lambro rivers are close to Palinuro. Cape Palinuro has several caves with an underwater entrance and the bed drops to 50 m very close to the shore.
The coastline between Palinuro and Pisciotta is sandy while in the Caprioli area, south of Marina di Pisciotta, there is a wide rocky area with multiple/mixed bed types.

The coastline from Marina di Ascea to Marina di Pioppi is characterised by a sandy bed because of the presence of the Alento river mouth. This tract of Cilento coast, together with the area around Punta Licosa, represents the zone with the most developed continental shelf. Off Acciaroli there is a huge rocky bed whose peaks, called "I Candelieri" (the chandeliers), reach down to a depth of 115 and 140 m respectively.

Facing Licosa point lies the island of the same name. This is separated from the mainland by a tract of sea about 5 m deep and is bordered by a rocky area reaching a muddy bed at a depth of 50 m.

Benthonic communities

The only studies on the benthonic ecosystems carried out in the Cilento area were conducted by Edwards *et al*. (1974) in Castellabate and concerned mainly macroalgae and phanerogam composition.

In the intertidal area the sea-grass bed is characterised by low shoot density because of excessive summer solarization. Seagrass develops mainly in zones with a lower hydro-dynamic action, particularly towards Inferno point and S. Maria. The most represented species of this area are: *Littorina neritoides*, *Rivularia helmintoides*, *Gelidium crinale* and *Corallina sp*. In deeper waters this species is associated with the algae *Jania rubens*, *Laurencia papillosa*, *Hypnea musciformis*, *Gigartina acicularis*, *Enteromorpha sp.*

Coastal shelf communities are characterised by a wide variety of species of the *Cystoseira* genus; among them, several species of the *Cystoseira* genus are particularly abundant (*C.*

discors, *C. crinita)* and other algae are also found (*Corallina granifera*, *Jania rubens*, *Padina pavonia*, *Halimda tuna*, *Dasycladus vermicularis*, *Stypocaulon scoparium)* essentially linked to the sedimentary contributions.

The winter vegetation is dominated by species compatible with a temperate climate, such as *Bangia purpurea*, *Porphyra sp*., while in the summer the prevailing species are of a tropical nature, such as *Acetabularia acetabulum*, *Anadymone stellata* and *Halimeda tuna*.

In this coastal area *Posidonia oceanica* meadow is observed between depths of 5-10 m. In the same area Otero (1973) carried out an inventory of the marine shellfish found in coastal waters up to 12 m deep with partial collection to 60 m. He identified a total of 180 species of gasteropods and 100 species of lamellibranchs.

2.3 Main ports of Cilento

Marina di Camerota
(40° 00' 15"N/15° 22'48"E)

The district of Camerota occupies a surface area of 70,18 Km^2. From the population density point of view the most important settlements are: Marina di Camerota; this is the most important maritime centre especially for artisanal fishery and tourism activities; Camerota (county town) and Lentiscosa, located in the inland. Tourism is particularly important during the summer season, when the resident population increases to over 20.000 people. In the Camerota district there are 17 hotels with 848 beds and 53 holiday villages/camping sites.

This district has the highest tourist receptivity along the coastal tract between Castellabate (SA) and Maratea (PZ).
Fishing activities, where 2.7% of the employed population are involved, are undertaken in the port of Marina di Camerota. The harbour structure consists of two 450 m load-out jetties with a cross frontage of 80 m. Between the two jetties is a quay with three floating wharfs, each 80 m. long. The landing place can maintain 260 berths. The average depth is between 1.50 and 4 m. with a sandy bed. The most important infrastructures are available: ice plant; refuelling facility; water; electricity; boat and engine maintenance facilities.

Palinuro
(40° 10' 98"N/15° 01'82"E)

The harbour was obtained by exploiting the small bay on the north side of Cape Palinuro. The structure consists of a 200 m. quay sheltered on the north side by a 100 m load-out jetty. The harbour can maintain 100 berths. The average depth in the port is between 2 and 5 m. and it has a sandy-algae bed. The facilities available are: water; electricity; refuelling point; boat and engine maintenance. Tourism is particularly important during the summer. Palinuro is the point of departure for boat trips and scuba-diving tours organized by local fishermen to visit the Cape's natural caves.

The port of Acciaroli has an elbow-shaped load-out jetty and a 400 m quay. It is very well sheltered from all winds except the south-east wind. The average depth ranges between 3 and 6 m. and the bed is sandy. The harbour can maintain 100 berths. The facilities available are: water; electricity; refuelling; boat and engine maintenance.

Acciaroli
(40° 01' 81"N/15° 16'74"E)

Marina di Casal Velino
(40° 10' 45"N/15° 07'43"E)

Casal Velino is protected by a load-out jetty and there is a 300 m. quay. The average depth ranges between 2.5 to 5 m. with a sandy bed. The port is frequented by both recreational and fishing boats. The facilities available are: water; electricity; refuelling; boat and engine maintenance.

3. MATERIALS AND METHODS

The first activity was to conduct a frame survey on artisanal fishery during March-October 2001. The objective of this survey was to collect data on the size, structure, and distribution pattern of the "fishing métiers" population in the Cilento area (Campania, Italy), as well as the structural, economic, social and effort parameters.

This survey was based on the same methodological design applied in the previous survey (reference survey) conducted in the Cilento area during the period October 1994 – November 1995 (Colloca *et al*., 1998). The database and data processing tools were also the same as those used in the the previous survey. The reason for this decision was twofold: (a) to produce a "comparable set of data", and (b) to minimise costs. Obviously, some technological and operational modifications were made to the original design to make it more respondent to the present situation.

3.1 Sampling design

Some methodological notes are briefly reported below for a better understanding of the work carried out.

- The population under investigation was the artisanal metiers fishing in the survey area (Cilento region).
- The survey area was divided into three statistical strata using the fishing zone as the stratification criterion.
- The vessel/gear stratification grouped the three fishing typologies into homogeneous strata.
- The month was assumed as the "Reference Period", and two days direct interviewing per fishing port (PSUs) was the "sampling period".
- The Primary Sample Units (PSU) were all the fishing ports in the Region.
- Secondary Sampling Units (SSU) were all fishing vessels performing artisanal fishery in the given region.
- Two interview approaches were applied - the "Listing approach" for the census data collected from the official registers, and "direct interview through questionnaires" for comparative data and other sample data.

The above stratification was adopted as "sampling strategy": three main spatial strata were surveyed monthly (two daily surveys at the main fishing ports).

Figure 4 shows the position both of spatial strata and sampling port (Acciaroli, Marina di Casal Velino, Palinuro, Marina di Camerota) in the study area.

Spatial strata were defined both by the position of the main fishing ports along the coast and by geographical constraints (gulfs, capes, river mouths, *etc.*).

Identification of the main fishing ports was based on the size of the artisanal fleets registered. This information was obtained from local maritime authorities (Maritime Offices) during a pre-survey conducted in February 2001.

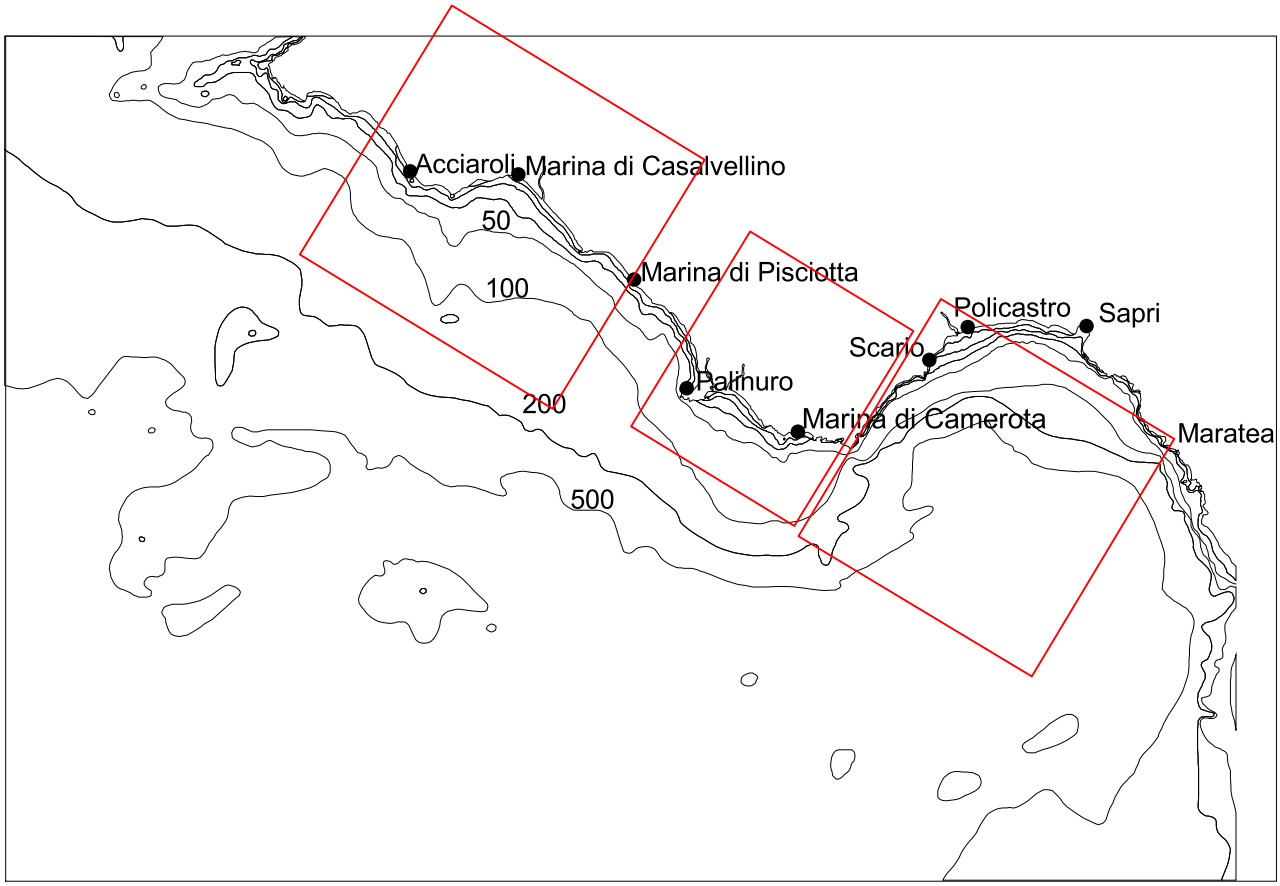

Acciaroli
Marina di Casalvellino
50
100
Marina di Pisciotta
Policastro
Sapri
Scario
Palinuro
200
Marina di Camerota
Maratea
500

Fig. 4. The three spatial strata where data on artisanal fisheries were collected during 2001. Each strata corresponds to fishing areas of inclosed ports

3.2 Data collection

Official data on the fleet

The data were obtained from the Maritime Offices of Acciaroli, Marina di Pisciotta, Palinuro, Marina di Camerota, Scario, Capitello and Sapri and concerned the following information: vessel code, vessel dimensions (tonnage, length, engine power), material used, year of construction, year registered and type of fishing licence. Data were collected for vessels registered over the past 75 years.

Catch and effort data

On each sampling day we collected the following data, by port:
- code and métiers of vessels present in ports;
- code and métiers of active vessels (vessels returning from fishing);
- fishing area, fishing time, gear characteristics, and landings by species were recorded for each active vessel.

Socio-economic data

Information on investment value and cost/benefit was collected for a sub-sample of fishing vessels, as follows:
- value of investment (boat and gear value);
- fixed costs (fuel, gear maintenance, boat maintenance, etc.);
- costs related to fishing (fuel, bait);
- benefits of fishing activity (commercial values of species);
- infrastructures and facilities;
- other forms of subsistence, markets.

3.3 Data analysis

Evolution of the fishing fleet

Data on boats registered since 1925 at the maritime offices of Marina di Camerota and Acciaroli (the two main ports in the area) were used to obtain the evolutionary trend of the fishing effort over the last 75 years. The total number of vessels, total tonnage and total engine power were calculated at five year intervals.

The average number and dimensions of new vessels registered were also calculated for the same time interval.

The changes in size of artisanal and trawl fleet that had occurred in the last ten years was analysed by comparing 1994-1995 and 2001 data.

Fleet structure

The composition and dimensions of the fleet, by port, was calculated for the three fishery typologies: trawling, purse seining and artisanal (small-scale fishery). The structure of the artisanal fleet was analysed by separating vessels by tonnage, engine power and length classes.

Gear characteristics

Fishing traditions, periods and areas were defined for each métier. The general technical features of all types of net (materials, mesh size, hanging ratio) were taken and their mean dimensions (length and height) were assessed.

The main types of longlines were described based on data collected during the 1995-96 survey.

Catch data

The mean Catch per Unit of Effort (CPUEs), as Kg/Km of net and Kg/vessel, was calculated for the main gears. Differences in CPUEs between gears were analysed using the ANOVA and Tukey-Kramer tests.

The mean weight of landed species, by vessel, was calculated to obtain the catch composition of the various gears.

The overall mean daily landing at the main ports was calculated from all landing data, by vessel, by port and by fishery segment.

Effort data

Different fishing effort indices were used to analyse the size of fishing effort by area and by métier. The percentage of active vessels of the total number of vessels present at port on that day (fishing fleet activity ratio) was used to calculate the artisanal fleet's general index of daily fishing activity while for the fishing effort by métier index we used the mean daily number of active boats, by gear, in each area.

The intensity of fishing effort (IE) in the coastal area was calculated as the mean number/Km^2 of vessels operating daily in each stratum. Only the data collected during 1995-96 survey were used for this analysis. The sampling design covered all the ports in the area thus enabling the real number of vessels operating daily in the various fishing zone to be calculated. During the 2001 survey we did not collect fishing-effort data from secondary ports and this analysis was not conducted.

Temporal changes in fishing effort from 1995-1996 to 2001 were estimated by comparing the activity ratio of the fleet in the same sampled ports.

The effort related to offshore métiers for gillnet fishery was calculated as the mean gear length and number of vessels operating daily in the two main fishing areas. The overall fishing effort with fixed nets observed in each fishing area during the 2001 survey was calculated as the total gear length used daily by active vessels.

Socio-economic data

The analysis addressed the assessment of the costs and benefits of the two main fisheries in the area, i.e., inshore vessels which use trammel, combined nets and other gear in the coastal area, and offshore gillnets targeting hake on the upper continental slope.

The economic performances of these two fisheries were calculated for each port. For this purpose the gross incomes of these fisheries were estimated on the basis of data on the commercial value of daily landings, by vessel. The mean number of days required by an ideal vessel to cover annual maintenance costs (i.e., gear, equipment and engine maintenance, fishing licence, other annual fees, *etc.*) was then calculated for each métier, fishing method and port.

Assessment of the health status of artisanal fisheries

The attempt to classify the Cilento artisanal fisheries was made on the basis of their ecological, technical, economic and social attributes. The method used was derived from that proposed by Pitcher *et al*. (2001) for a rapid appraisal of the health of fisheries. The attributes have been selected on the following criteria

- objectively scored on a ranked scale using available data on Cilento and Mediterranean artisanal fisheries;
- likely to discriminate among fisheries;
- easily related to sustainability of fisheries.

The reference points for evaluating the relative status of fisheries are provided by constructing hypothetical fisheries that are assigned 'good' or 'bad', defined in terms of sustainability.

An interdisciplinary analysis based on 22 attributes (Table 2) was conducted using MDS as the multivariate ordination technique. The fisheries chosen were the inshore fisheries of Marina di Camerota, Palinuro, Marina di Casal Velino, mostly based on trammel and combined nets, and the offshore fisheries of Acciaroli and Palinuro which target hake with gillnets.

The advantage of this method is that the relative importance of the different measured attributes is determined only by the data rather than by some preconceived models. Moreover, it can be useful for the assessment of poor-data fisheries like Mediterranean artisanal fisheries and allow spatial or temporal comparison. A disadvantage is that the choice of specific attributes can affect the ordination results. The choice of attributes should be carefully considered because they should remain fixed to compare future analysis.

Table 2. Definition of attributes for artisanal fisheries

Attribute	**Attribute**
CPUEs: Kg/Km net/day	Average catch value/TSL
N. of gear used during the year	Average catch value/Km nets
Average crew	Average catch value/vessel
Average Gear length	%vessels involved in tourism act.
Gear length increasing during last 5 years	% vessels applied for demolition
Kg/vessel	Catch composition

CPUE/TSL	Dimension of fishing area
Average fleet activity ratio	Average age of fishermen
Fluctuation of a.r. during the year	Conflict with industrial fishery
Average landing/active fleet ratio	Resources shared with other fisheries
Reduction of fleet during the last 5 years	Tot. Catch weight/TSL (Kg)

4. CATCH AND EFFORT DATA

4.1 Fishing fleet

Evolution of the fleet during the last 50 years

The general trend observed at the two ports Acciaroli and Marina di Camerota was a rapid increase in fleet power in terms of total tonnage and total engine power from the mid 1960s to the end of the 1980s and an abrupt decrease from 1990 onwards (Figure 5). In terms of the number of vessels, however, the trend for the two ports differed. While the Acciaroli fleet decrease irregularly, the Camerota fleet did not show any significant changes up to the end of the 1980s. After this period the number of vessels rapidly decreased to approximately that observed before the 1940s. The abrupt increases in fishing effort at the beginning of the 1970s can be related to the development of new fishing activities, such as otter trawling and gillnets for hake, which need larger and more powerful boats than those used for traditional activities in coastal areas. A similar process was observed at other Italian coastal areas (Ardizzone, 1985; Scaccini *et al*., 1970).

Between the two surveys (1995-1996 and 2001) a reduction of around 25% for the artisanal fleet and 20% for the trawl fleet was observed (Figure 6). The decrease of the artisanal fleet in the area was not homogeneous among the various ports: Acciaroli and Pisciotta did not show any significant change in the number of vessels registered; Palinuro and Sapri showed only a minor decrease; and the Camerota and Scario fleets decreased by 52% and 37% respectively.

Such a reduction in the artisanal fleet was strongly influenced by the recent measures to reduce the Italian fishing fleet as set out in the Multi-Annual Guidance Programme (MAGP IV). The measure called “Arresto definitivo” provided incentives for a reduction of the artisanal fishing effort equal to 10704 GRT and 79994 kW. Only vessels over 10 years are eligible for these incentives.

In the Cilento area applications for the demolition of a total of 50 boats were submitted to the Italian Ministry of Agriculture Policy in the years 2000-2001. Of these boats, 30 have already obtained permission while the others are still awaiting approval of their applications.

Fleet structure

A total number of 191 fishing vessels are currently registered at the local offices. Acciaroli is the port with the highest number of vessels (68) followed by Scario (31), Camerota (27), Palinuro (24), Pisciotta (22), and Sapri (16) (Table 3). The main fishery, in terms of number of boats registered (162 vessels) is small-scale fishery. Trawl and purse seine fleets comprised 26 and 3 vessels respectively. Trawlers represented about 50% of the fleet’s total tonnage and fishing power. The artisanal fleet includes vessels ranging between 0.5-10 tons, 0 –250 Hp, 4-13 m length. The bulk of the fleet is made up of vessels up to 6 GT, 8 Hp and 9 m length. The frequency distribution by tonnage, engine power and length showed a main component with modal classes respectively at 1-1.9 tons, 1-20 Hp and 6-6.9 m length (Figure 7).

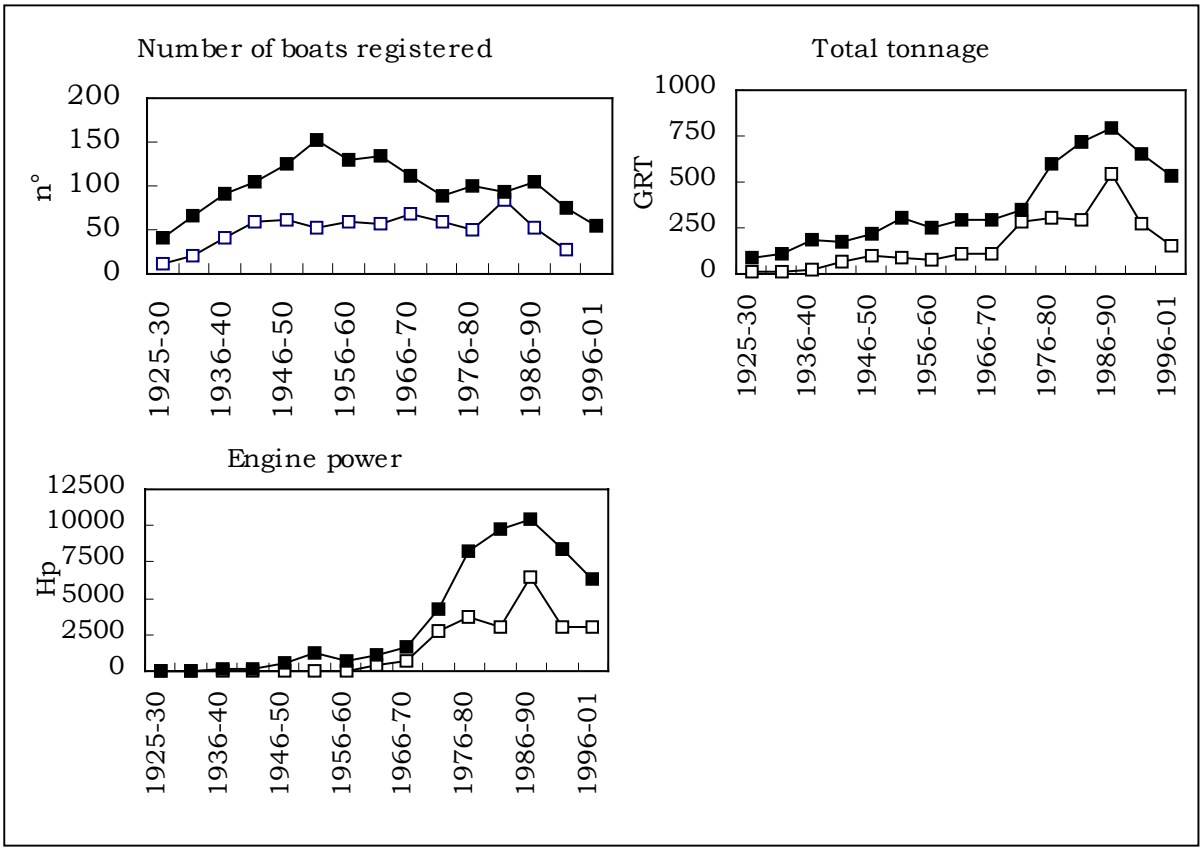


Fig. 5. Evolution of the fishing fleet of Marina di Camerota (white squares) and Acciaroli (black squares) across the century, by number of boats, total tonnage and engine power

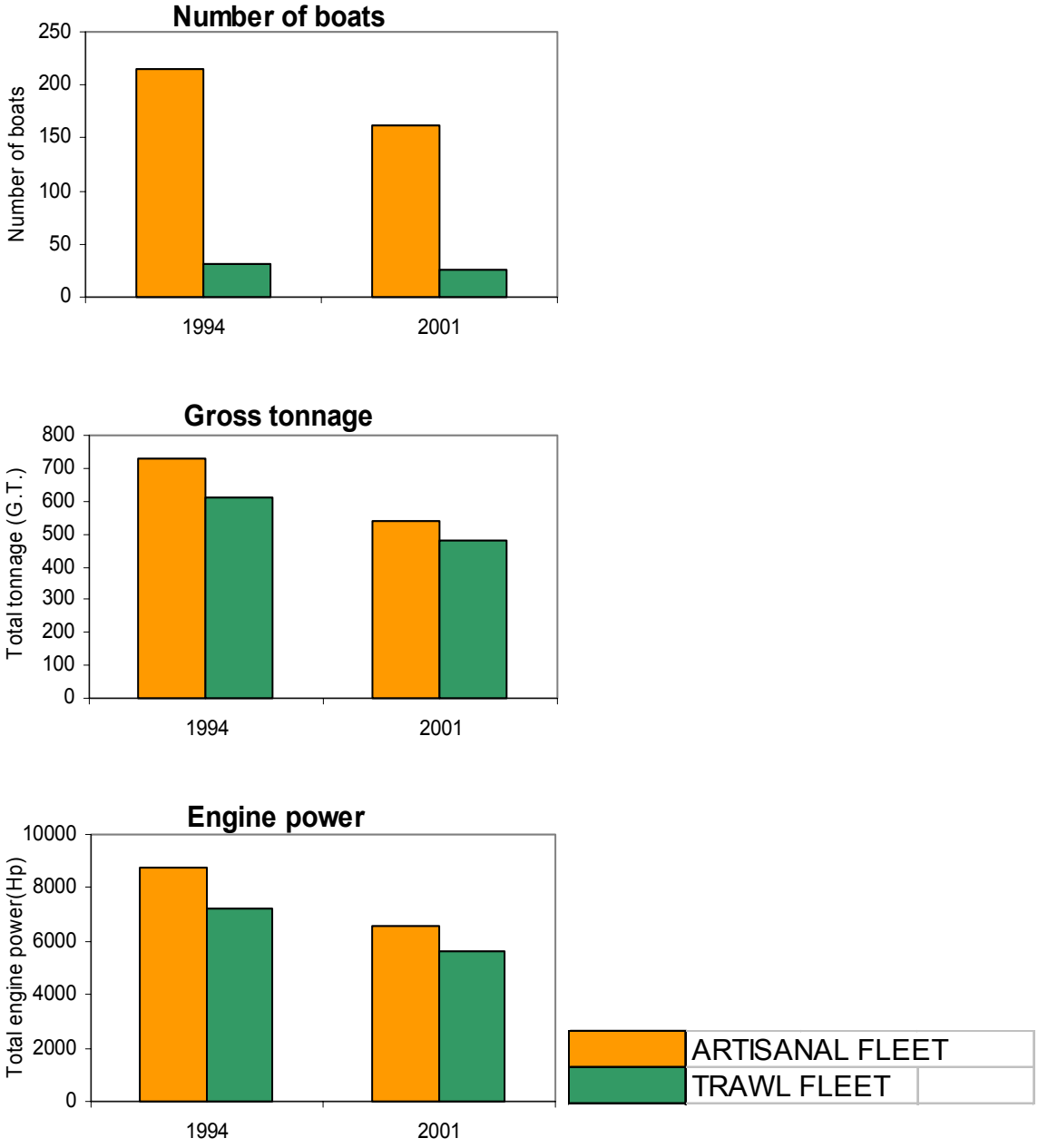


Fig. 6. Decreasing of trawl and artisanal fisheries from 1994 to 2001

ARTISANAL FLEET STRUCTURE

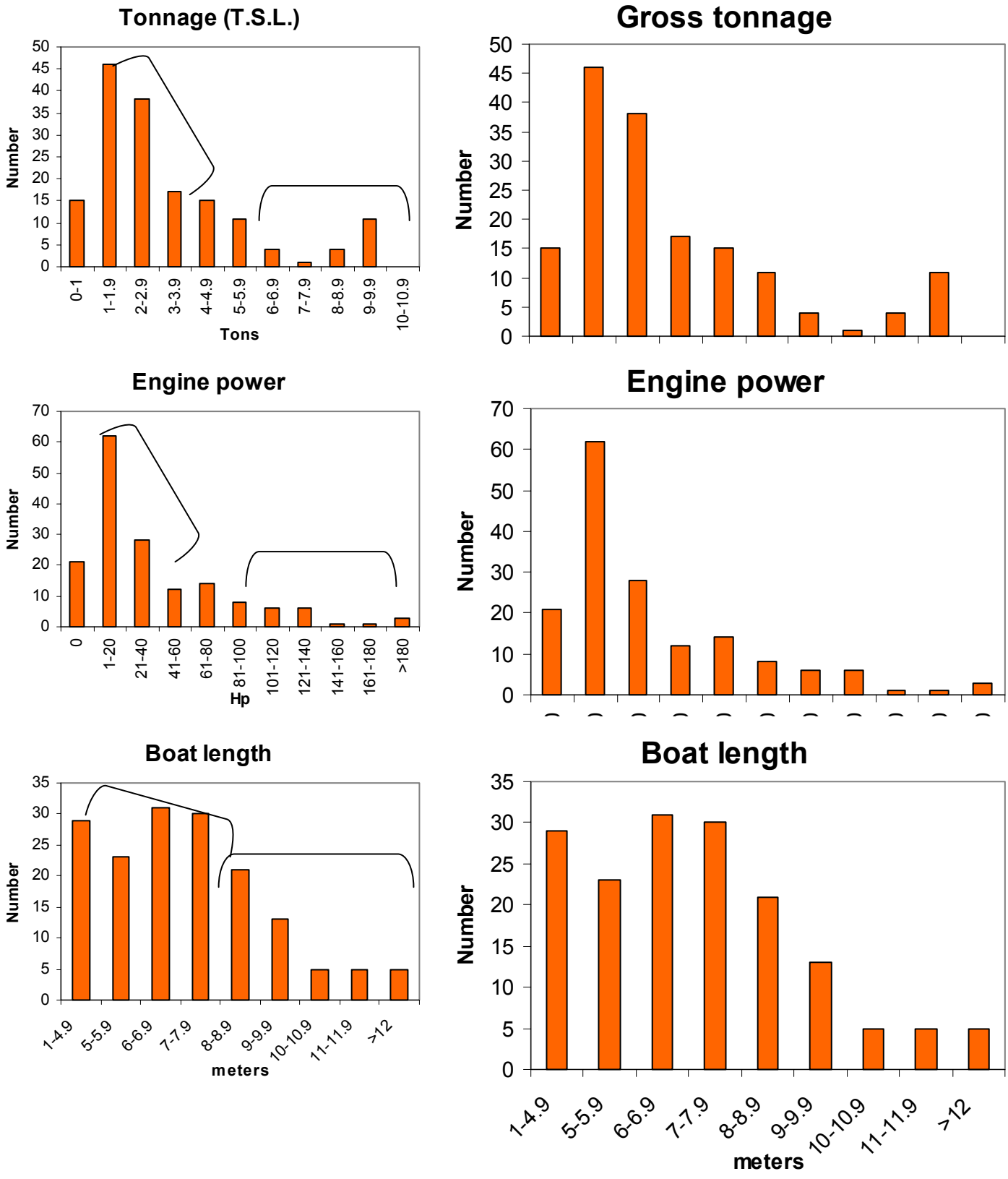


Fig. 7. Structure of the fleet by class of gross tonnage, engine power and boat length

Significant differences in the dimensions and engine power of vessels ($p>0.05$) were shown by boats operating in the coastal area, mainly with trammel nets and combined nets, and the boats that used gear offshore on the deeper shelf and upper slope (Figure 7). More than 60% of the local artisanal fleet was surveyed at the sampling ports during the study. This percentage represented about 70% of the total tonnage and engine power of the Cilento fishery (Table 4).

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Table. 4. Percentage contribution of the fleet registered at the sampling port, calculated as n. of vessels, total tonnage and total engine power, on the total dimension of the local fleet

	N (%)	TSL (%)	Hp (%)
Camerota	14,2	15,3	14,1
Palinuro	14,2	16,5	17,6
Acciaroli - Casal Velino	33,3	35,5	38,4
Total	***61,7***	***67,3***	***70,1***

The dimensions of the active fleet, namely the fishing craft, with fishing gear on board, observed at least once during the study, represented 52%, 71% and 74% respectively of the total number of vessels, total tonnage and total engine power of the officially registered fleet (Table 5).

Table 5. N. of active vessels by port and respective total tonnage and total engine power

	N	TSL	Hp
Sapri	8	25,3	264,2
Scario - Policastro	14	47,2	643
Camerota	24	82,4	989
Palinuro	15	55,8	665
Pisciotta	13	50,7	540,5
Acciaroli - Casal Velino	25	120	1740
TOTAL	*99*	*381,4*	*4841,7*

The bulk of this fleet is represented by inshore vessels which account for 75% of the total number, 65% of total tonnage and 58.6 % of total engine power of the entire active fleet (Table. 6).

Table 6. Number, total tonnage and total engine power of inshore and offshore active artisanal vessels observed in the Cilento ports during the daily surveys

	N		*TSL*		*Hp*	
	Inshore	*Offshore*	*Inshore*	*Offshore*	*Inshore*	*Offshore*
Sapri	3	5,0	16,9	8,5	218,5	45,7
Scario - Policastro	14	0,0	47,2	0,0	643,0	0,0
Camerota	20	4,0	58,8	23,6	660,0	329,0
Palinuro	14	1,0	53,1	2,7	632,0	33,0
Pisciotta	12	1,0	44,8	5,9	445,8	94,7
Acciaroli - Casal Velino	11	14,0	27,6	92,3	238,0	1502,0
TOTAL	*74*	*25*	*248*	*133*	*2837*	*2004*

The proportion of active vessels observed at the sampling ports was 64,6% of the fleet in terms of number (61,0% of inshore vessels and 76,0% of offshore vessels), 68% of the total tonnage (56,1% inshore, 89,2% offshore) and 70% of the total engine power (53,9% inshore and 93,0% offshore) (Table. 7).

Table. 7. Percentage contribution of active fleet in the sampling port on the total active fleet

	N (%)	TSL (%)	Hp (%)
Camerota	24,2	21,6	20,4
Palinuro	15,2	14,6	13,7
Acciaroli - Casal Velino	25,3	31,5	35,9
TOTAL	*64,6*	*67,7*	*70,1*

4.2 Fishing métiers

The Cilento artisanal fishery can be divided into two main categories of fishing activities: inshore activities that involve small vessels along the continental shelf, and offshore fishing activities conducted by a fleet of larger vessels mainly on the shelf edge and upper slope. Table 8 shows the general characteristics of the main artisanal métiers of the area investigated.

The main activities of the coastal fishery are with trammel nets, combined gillnets-trammel nets and gillnets. The first two are mainly targeted on cuttlefish (*Sepia officinalis*), and, to a lesser extent, on red mullet (*Mullus barbatus* and *M. surmuletus*) and lobster (*Palinurus elephas*). Gillnets are generally employed to catch the juveniles of great hamberjack (*Seriola dumerilii*) in late summer and red pandora (*Pagellus erythrinus*) in the spring. Longlines are traditionally used to catch dolphin fish and the juveniles of *Xiphias gladius* in the autumn. Only a few vessels used longlines sporadically for Sparidae (*Diplodus sargus*, *Dentex dentex*, *etc*.). Pisciotta's fishing craft is the last fleet along the Italian coasts that still uses driftnets for anchovy (*Engraulis encrasicolus*) in late spring. Traps are not currently used.
Offshore artisanal fishery employs mainly gillnets (*schette*) for hake (*Merluccius merluccius*) during the winter and spring. Bottom and floating longlines are used to catch *Lepidopus caudatus* and *Xiphias gladius* respectively in the summer and autumn.

Table 8. General characteristics of artisanal métiers of the Cilento area: gear local name, target species, number of active vessels observed during the survey, fishing period and area are given for each gear

Gear	Local Name	Target Species	Number of Active Vessels	Period	Area
TRAMMEL NETS / COMBINED GILLNETS-TRAMMEL NETS	Tramaglio / Incastellata	*Sepia officinalis*	47	December-June	Coastal shelf (3-40 m)
TRAMMEL NETS / COMBINED GILLNETS-TRAMMEL NETS	Tramaglio / Incastellata	*Mullus barbatus & M. surmuletus*	7	July-November	Coastal shelf (3-50 m)
TRAMMEL NETS	Tramaglio	*Palinurus elephas*	10	June-August	Coastal shelf (15-50 m)
MONOFILAMENT GILLNETS	Schetta	*Merluccius merluccius*	16	December-June	Upper and middle slope (120-500 m)
MONOFILAMENT GILLNETS	Schetta	*Pagellus erythrinus*	2	February-June	Coastal shelf (30-60 m)
MONOFILAMENT GILLNETS	Schetta	*Mullus barbatus & M. surmuletus*	2	July-November	Coastal shelf (3-50 m)
MONOFILAMENT GILLNETS	Schetta	*Sphyraena sphyraena*	1	May-November	Coastal shelf (3-20 m)
MULTIFILAMENT GILLNETS	Palamitara	*Seriola dumerilii*	12	September-December	Coastal shelf (3-30 m)
BOAT SEINE	Sciabica	*Sardina pilchardus* larvae	1	January-April	Coastal (1-10 m)
DRIFTNET	Menaica	*Engraulis encrasicolus*	9	April-June	Offshore neritic waters
FLOATING LONGLINE	Coffa	*Xiphias gladius*	10	October-January	Offshore neritic waters
BOTTOM LONGLINE	Coffa	*Lepidopus caudatus*	10	October-January	Upper and middle slope (120-500 m)
BOTTOM LONGLINE	Coffa	*Sparidae-Serranidae*	5	All year	Rocky bottoms (10-50 m)

Trammel nets and combined gillnet-trammel nets

The trammel net consists of three walls of netting, the two outer walls being of a larger mesh size than the loosely hung smaller-meshed inner netting panel. Slack netting is ensured both by setting the net loosely on the head and foot ropes and also by having the inner net 1.5 to 2 times the depth of the outer walls. In this way there is always sufficient slack net in which fish can become entangled. The hanging ratio of the inner net usually ranges between 0.3 and 0.5. The outer net is hung more tightly and the hanging ratio is of the order of 0.5.07. In the trammel nets the fish are generally held within a pocket of netting formed by the small-meshed inner net pushed through the large–meshed outer net. In the combined gillnet-trammel nets the lower part consists of a trammel net while the upper part is a gillnet. The upper part often acts as a barrier leading fish towards the lower section. Moreover, the gillnet increases the catch of nektobenthic species, like grey mullet and sparids. Mesh size of the gillnet is usually the same as the inner wall, while the hanging ratio is between 0.5-0.65. Two main types of trammel-combined nets are currently used in Cilento (Table 9). The most common type is that targeting cuttlefish (*Sepia officinalis*) which is employed during the winter-spring period when this cephalopod migrate toward the coastal beds to reproduce. This gear is also used in the summer and fall to catch scorpionfish (*Scorpaena scrofa*) and other fish species when cuttlefish are not available in the coastal areas.

Table 9. Characteristics of trammel – combined nets used in the Cilento area

			Mean Dimensions		***Mesh size***		***Hanging ratio***			
							Head rope		**Foot rope**	
Target species	**Gear**	**n.**	**Length m+/- s.d.**	**Height range (m)**	**Inner wall**	**Outer wall**	**Inner wall**	**Outer wall**	**Inner wall**	**Outer wall**
Sepia officinalis	Trammel	37	1969+/-736	1.3-1.6	2.04-3.78	10.0-28.0	0.38-0.50	0.55-0.60	0.40-0.52	0.55-0.60
Sepia officinalis	Combined	12	1890+/-736	2.0-10.0	2.20-3.30	10.0-28.0	0.40-0.50	0.54-0.58	0.42-0.52	0.56-0.60
Mullus spp.	Combined	5	1060+/-555	2.5-3.5	1.20-2.20	10.0-12.5	0.47	0.57	0.49	0.59
Palinurus elephas	Trammel	3	1930+/-115	1.5-2.0	3.30-5.30	13.0-16.5				

A third type of trammel net is that used to catch red lobster (*Palinurus elephas)* during late spring and summer. In contrast to the trammel net for cuttlefish, this type is characterised both by a thicker multifilament yarn and a wider mesh size (Table 9). A major robustness than more conventional trammel nets is required to operate on the rocky beds where the red lobster lives.

Moreover, the soak time is usually more than 12 hours and can reach up to 48 hours. The higher soak time improves the catch of red lobsters which are attracted by fish entangled in the net. During the study we observed only three vessels using the trammel for red lobster. The trammel/combined nets for red mullet (*Mullus barbatus* and *M. surmuletus*) are generally used from May-June to October-November. The nets are set just before sunrise or sunset and hauled in just 2-4 hours later. The lower soak period is determined by the fragility of the red mullet which tend to deteriorate quickly once they become entangled in the net. The combined net is generally preferred to the trammel net. This métier is practiced especially by the Palinuro fishing boats when the cuttlefish catch begins to decrease.

The size structure of red mullet and cuttlefish catches is shown in Figure 8. The red mullet consist basically of adults larger than first maturity. Cuttlefish are captured when they migrate toward the coastal area to reproduce.

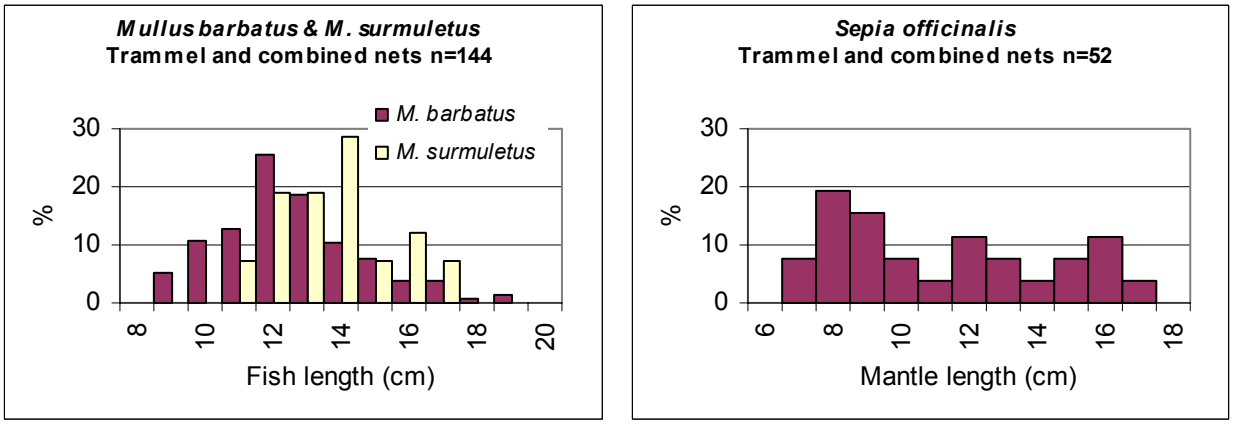


Fig. 8. Size distributions of Mullus barbatus - M. surmuletus (left) and Sepia officinalis *(right) catches of trammel and combined nets in the Cilento Region during 1995-1996*

Gillnets

A gillnet consists of a single wall of netting fixed at the top to a headline carrying floats and at the bottom to a weighted footrope. The hanging ratio usually exceeds 0.5. In this type of net, most fish are caught when they become held within a single mesh of the net. There are different positions in which fish become caught. Wedging occurs when the opening of the net is larger than the girth of the fish's head but smaller than the maximum girth of the body. Fish is said to be gilled when the mesh catches under the gill-cover. Fish is entangled when some part of its body snags against the net material. In Cilento the most widely used gillnets are monofilament gillnets ("schette") targeting hake mostly during the winter-spring period. Multifilament gillnets are used in the Gulf of Policastro area especially during summer on the upper slope bottoms up to 600m depth. The main characteristics of these nets are listed in Table. 10.

The monofilament gillnets for hake are generally longer than 2 miles and can reach 6 miles/vessel.

The mesh size used is generally smaller in winter than in summer when vessels exploit larger hakes on deeper bottoms, especially in the Gulf of Policastro area.

The wire diameter is 0.25-0.30 mm. A general feature of gillnets for hake is a low hanging ratio value (0.5-0.6) that reduces the selectivity of nets allowing fishermen to exploit hake over a wide range of sizes. Gillnet for hake exploits individuals over 20 cm in length. Monofilament gillnets catch mainly individuals between 20 and 40 cm in length, while the catch of multifilament gillnets is composed mainly of fish over 40 cm (Figure 9). Hake are often entangled and held within the slack net in a way similar to trammel nets.

In the area there are two different fishing zones for hake gillnet (see Figure 7) located off the north-western Cilento coast, between 150 and 300 m depth, and in the Policastro Gulf (south-eastern Cilento) up to 500 m depth.

Table 10. Characteristics of gillnets for hake used in the Cilento area

			Gear dimensions		*Mesh size*	*Hanging ratio*	
Target species	**Gear**	**n.**	**Length m+/- s.d.**	**Height range (m)**		***Head rope***	***Foot rope***
Merluccius merluccius	Gillnets	16	6900+/-2700	2.5-4.0	2.20-3.78	0.50-0.60	0.52-0.62

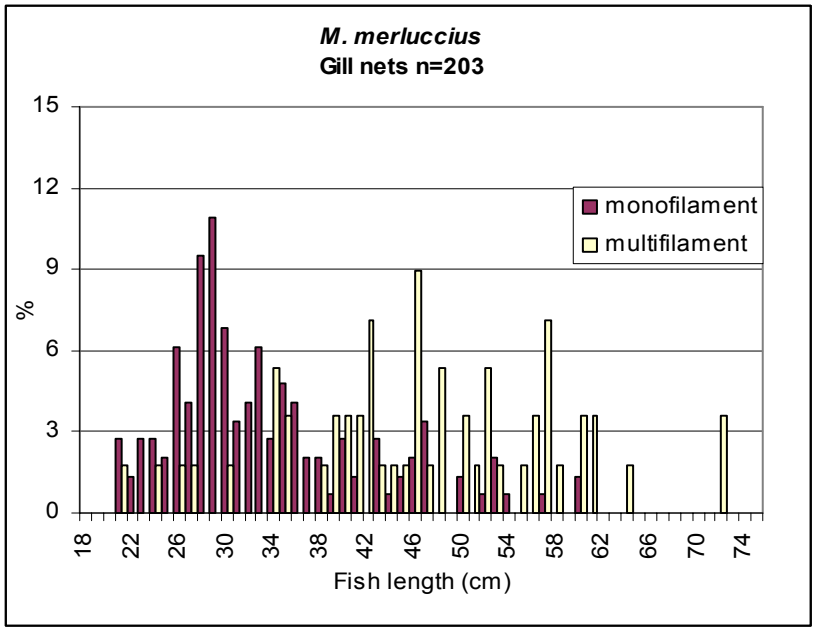


Fig. 9. Size composition of multifilament and monofilament hake catch in the Cilento region during 1995-1996

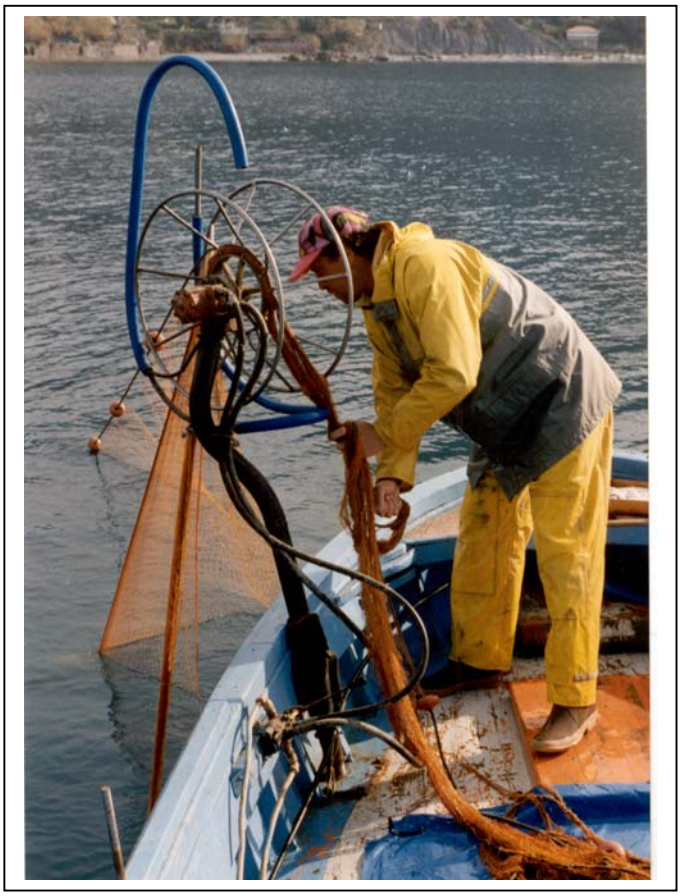
In the Cilento fishing zone, vessels operate from Acciaroli, Marina di Pisciotta e Palinuro. Vessels leave the port to fish around midnight and take 1-2 hours to reach the fishing grounds. The nets are set up on a fixed bathymetry, to avoid hampering the trawlers' towing routes.

Fishing time depends on the dimensions of the nets. In general, fishermen haul in their nets only when they have finished setting the nets starting from the opposite side. The total time spent at sea is around 12 hours and they come back to the port at around 12.00 noon on the day after they leave.

In the Policastro Gulf area fishermen work on untrawlable beds and are then free to set the nets at different depths to avoid conflicting with the trawlers. In this way they are able to continuously monitor depth and areas where there are the highest concentrations of hake. In good weather conditions nets are set on board every morning and soaked again at the end of the morning. In this way the nets fish continuously until there is a change in the weather. The depth exploited can reach 600 m during the summer.

Some gillnets are used sporadically to catch red pandora (*Pagellus erythrinus)* on sand-muddy beds up to a depth of 60 m (during surveys only two vessels from Marina di Camerota were recorded as using this gear). A vessel from Marina di Casal Velino used gillnets to catch barracuda (*Sphyraena sphyraena)* near the mouth of the Alento river.

Multifilament gillnets for the greater hamberjack (*Seriola dumerilii*)



The local name for these nets is "palamitare". They are used to catch juvenile specimens of greater hamberjack (usually under 2 Kg weight).

The main characteristic of these nets is their height which reaches 18 m and 200 meshes that allows barring short coastal areas from the surface to the seabed.

This fishing method requires a good knowledge of the biology of the target species as well as of the local environmental characteristics. The fishing season begins in September and continues until December and nets with growing mesh size are employed. In this way, the dimension of the meshes are progressively adapted to the growing fish length classes, allowing better catches for a longer period of time.

Nets are hung quite stretched with a hanging ratio up to 0.8. These nets are very common in the local harbours and almost all the boats fishing in the coastal area have this typology. However, during the study period this fishing gear was not used by the fishermen because of the low quantity of prey.

Driftnets

The only type of driftnet used at local level is the "menaica" for anchovies, and it is a fishing method characteristic of the port of Pisciotta. Before the Second World War it was one of the most commonly used fishing methods in southern Italy and Sicily. Nowadays, Pisciotta is one of the last ports, if not the last, still using this métier. These driftnets are employed at night without the aid of light or echo-sounder to attract and detect fishing schools. Fishing boats remain tied to the nets, once they are set at sea. During the fishing season, every night several sets are made according to the catches. There is no net hauler or other gear handling equipment on the boat.

Net dimensions range between 150 and 350 m in length, between 10 and 20 m in height, with a stretched mesh of 2.5-2.6 cm.

Nets are hung stretched to the maximum with a hanging ratio of 0.8. Several floaters are tied on to the headline with smaller ropes 1.5-2 m long which give a buoyancy of 20 Kg. Their purpose is to maintain the balance of the gear and keep it operative during consecutive catches, even if they are of large quantities.

The commercial value of anchovy caught by "menaica" is very much higher than the one usually found on the national market. Driftnets for anchovies are particularly well adapted for salting, either because of their size which is usually bigger than those fished by purse seine, or because the heads of the fish are removed on board. In this way the fish have already bled and their flesh is of a better quality when they are salted.

Longlines

A longline consists of a mainline, to which snoods are attached at regular intervals (2-5 m.). Hooks are placed at the end of the snoods which are 0.5-1 m long. The size of the hooks and bait used is one of the important features which determines the species caught and size selectivity. In the Cilento area bottom longlines, anchored floating longlines and drifting longlines are used.

The characteristics of bottom longlines change in relation to the target species, meaning that several typologies of gear can be noted. In Cilento only one fishing boat uses different types of longlines during the year.

Bottom longlines for hake (*Merluccius merluccius*)

This métier was still employed in1995-1996 in the port of Marina di Camerota by two vessels. During the study period any vessel could use this fishing method.

Bottom longlines are set over the continental shelf, on the upper and deep slope up to depths ranging between 200 and 500 m, throughout the year.

The catch is mainly composed of adult hake generally longer than 40 cm. The main characteristics of bottom longlines recorded during the previous survey were the following:

- mainline 7000 m
- snoods 1.8 m long each attached to the mainline every 7.2 m
- number of hooks 600-1000 (hook: tinned straight mustad n.6)
- bait: sardine *Sardina pilchardus.*

Bottom longlines for silver scabbardfish *Lepidopus caudatus*

This gear is used by the Acciaroli offshore artisanal fleet during summer and autumn. The shelf edge and upper slope between 150 and 300 m depth are the fishing grounds of this métier. The soak time is limited to the time necessary to finish the setting operation. Usually the time spent fishing is around 3-5 hours.

- mainline (nylon diameter 1.2 mm) of 2500-4000 m long;
- snoods (nylon diameter 0.30-0.40 mm) 1.0 m long each attached to the mainline every 5-6 m.; steel wire snoods are used;
- number of hooks: 1400-2000 (hook: tinned straight mustad n.7);
- bait: sardine Sardina pilchardus.

Bottom longlines for Sparidae

This is a "light" longline which is used by the inshore artisanal fleet on rocky beds. Data on four different longlines for sparidae have been collected during the two surveys.

The main characteristics of these longlines are the following:

- mainline (nylon diameter 0.7 mm) 500-1000 m long;
- snoods (nylon diameter 1.2 mm) 1.1-2.2 m long each attached to the mainline every 1.15-2.25 m.; steel wire snoods are used;
- number of hooks: 100-200 (hook: tinned straight mustad n.14-16, short shank n.12);
- bait: squids, holothurians, limpets, etc.

Bottom longlines for groupers

Longlines for groupers were used by three vessels, two from Marina di Camerota and one from Acciaroli, during the 1994-1995 survey. During the last survey this gear was used only by one vessel from Acciaroli. The target species is *Epinephelus marginatus* which is generally distributed on rocky beds between depths of 10 and 80 m.

The main characteristics of the three gears recorded were the following:

- mainline (nylon diameter 1.2-1.6 mm) 2000-4000 m long;
- snoods (nylon diameter 0.9-1.2 mm) 2.5-3.0 m long each attached to the mainline every 6-8 m.; steel wire snoods are used;
- number of hooks: 400-700 (hook: tinned straight mustad n.7;
- bait: sardine Sardina pilchardus.

Floating longlines for swordfish and dolphin fish

This fishing gear is mainly employed during autumn and at the beginning of the winter months to catch large pelagic migratory species such as *Coriphaena hyppurus*, *Thunnus alalunga* and *Xiphias gladius* juvenile. It is illegal to fish the latter but even if it is strongly opposed by local maritime authorities it is still practised extensively by local and non-local fishermen in the autumn. This métier represents one of the most traditional fishing methods in the area. Floating longlines can be anchored to the seabed at the two edges of the mainline or just at one edge. In this latter case, it is placed according to the direction of the current thus assuming the aspect of a drifting longline. The fishing area is usually within three nautical miles of the coastline.

Fishing gears recorded in the area had the following characteristics:

- mainline (nylon diameter 1.2 mm) 6000-13000 m long;
- snoods (nylon diameter 0.8-0.9 mm) 5.0-6.0 m long each attached to the mainline every 20-22 m.;
- number of hooks: 300-500 (hook: tinned straight mustad n.6-7);
- bait: sardine *Sardina pilchardus*, mackerel *Scomber scomber*.

A floating buoy is attached every 20 hooks (400 m).

Drifting longlines for swordfish

This gear is used to catch bluefin tuna *Thunnus thynnus* and adult swordfish. It is not anchored to the seabed so that it is free to drift following the surface currents.

It was used by two vessels from Camerota during 1994-1995. The fishing area is located offshore, up to 20 miles from the shore, and the longline is followed by the boat all the time it is fishing (4-5 hours). The gear surveyed showed the following characteristics:

- mainline (nylon diameter 1.4 mm) 24000-28000 m long;
- snoods (nylon diameter 1.2 mm) 5.0-6.0 m long, each attached to the mainline every 25-35 m;
- number of hooks: 700-800 (hook: tinned straight mustad n.2-4);
- bait: mackerel *Scomber scomber.*

A floating buoy is attached every 20 hooks (400 m).

4.3 Catch and landings

Landing data for 179 fishing vessels and 15 different fishing métiers were collected during the survey. Tables 11 and 12 show the number of observations and average landings as g per vessel, by species and by métier. A total of 95 different species of fish, crustaceans and cephalopods were identified at the landings of the various gear. Total landings of coastal métiers were composed of 76 different species (Table 11) while those of off-shore métiers showed a lower number of species (43) (Table. 12). Within the first group of species the most important (23% of the total) was the cuttlefish *Sepia officinalis*, followed by red mullet *Mullus spp.* (10.2%), *Octopus vulgaris* (7.7%), *Uranoscopus scaber* (4.6%), *Pagellus erithrynus* (4.4%). During the summer the landings of lobster *Palinurus elephas* and scorpionfish *Scorpaena scrofa* increased. Significant catch of other species was related to métier limited to few vessels operating during a specific period of the year.

Trammel net catch

Gillnets catch

Off-shore métiers were focused on hake *Merluccius merluccius* (28.7% of the overall landings) even if the highest catch was that of silver scabbardfish *Lepidopus caudatus* (49%). This latter species is targeted by a fleet of 7-8 vessels from Acciaroli during the summer and fall using bottom longlines. Mean daily catches of this species (330 kg/boat) were indeed much higher than those of hake (37 Kg/boat).

Other significant landings of the offshore fleet were those of species targeted by floating longlines, such as swordfish *Xiphias gladius* (3.5%), and those of by-catch species by gillnet (bullet tuna *Auxis rochei*: 6.6% the squid *Illex coindetii*: 2.6% and the horse mackerel *Trachurus trachurus*: 2%).

Figure 10 shows the daily landings by port and by fishery. Palinuro and Marina di Casalvelino landed generally less than 80 kg/day of inshore species. The Acciaroli landings were basically composed of offshore species, *M. merluccius* and *L. caudatus*. The daily amount of the first species reached 400 Kg, while that of the latter can easily reach 1400 Kg.

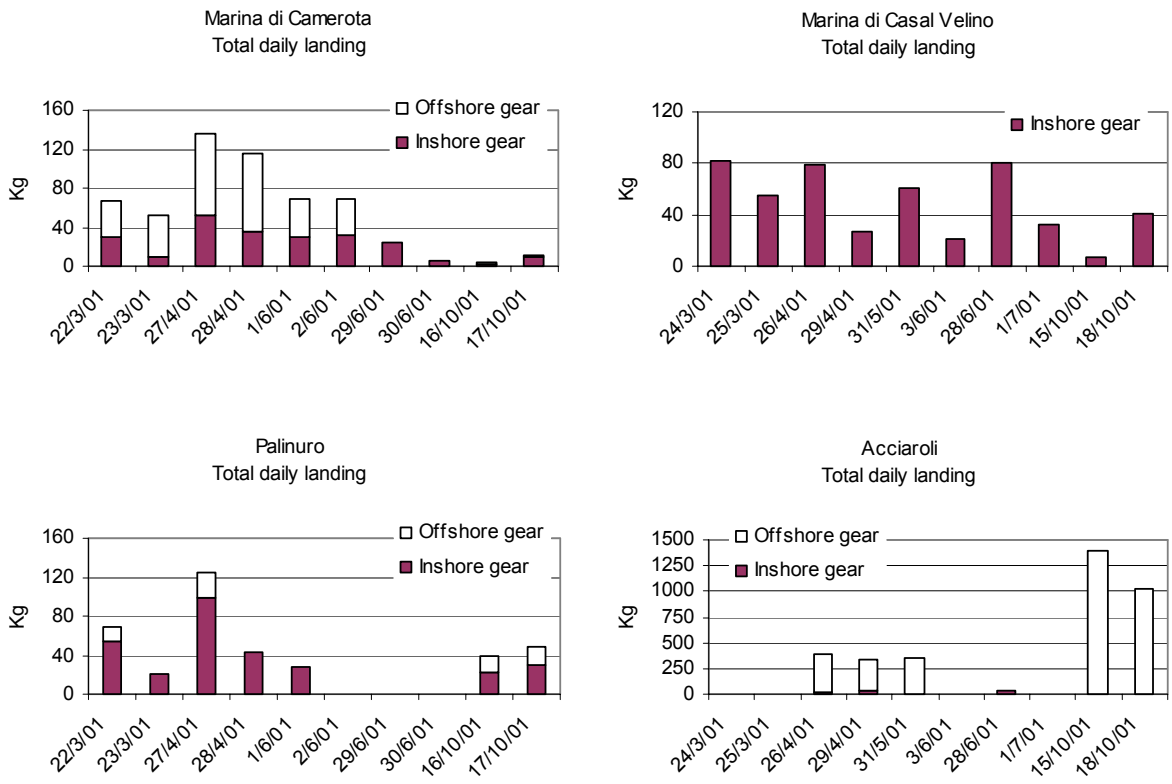


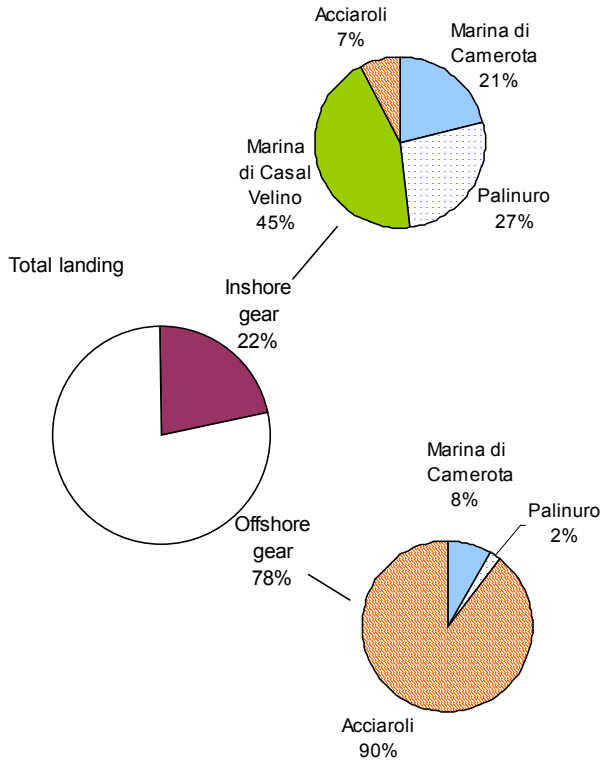
Fig. 10. Daily landing by port and fishery observed during the study

Daily variations in landings can be related principally to weather conditions which on some sampling days reduced the fleet's activity considerably.

The high landing values obtained in Acciaroli in October were due to the landings of bottom set longlines targeting silver scabbardfish.

The Acciaroli offshore fishery was responsible for most of the landings observed at the sampling ports. Inshore gear landed 22% of the total catch observed during the study (Figure 11).

Fig. 11. Percentage composition of daily landing estimated during the study by fishery and port



Yield (CPUEs)

Figure 12 shows the mean daily landings by vessel and the mean catch per unit of effort for the main types of fishing nets. Gillnets for hake showed significantly ($p<0.05$) higher yields (as Kg/boat) than other métiers, while the lowest were those caught by trammel and combined nets for the mullet. The catch per unit of effort was higher than 4 Kg/Km for all the gear considered. The highest CPUEs were those of gillnets for the hake and trammel-combined nets for the cuttlefish.

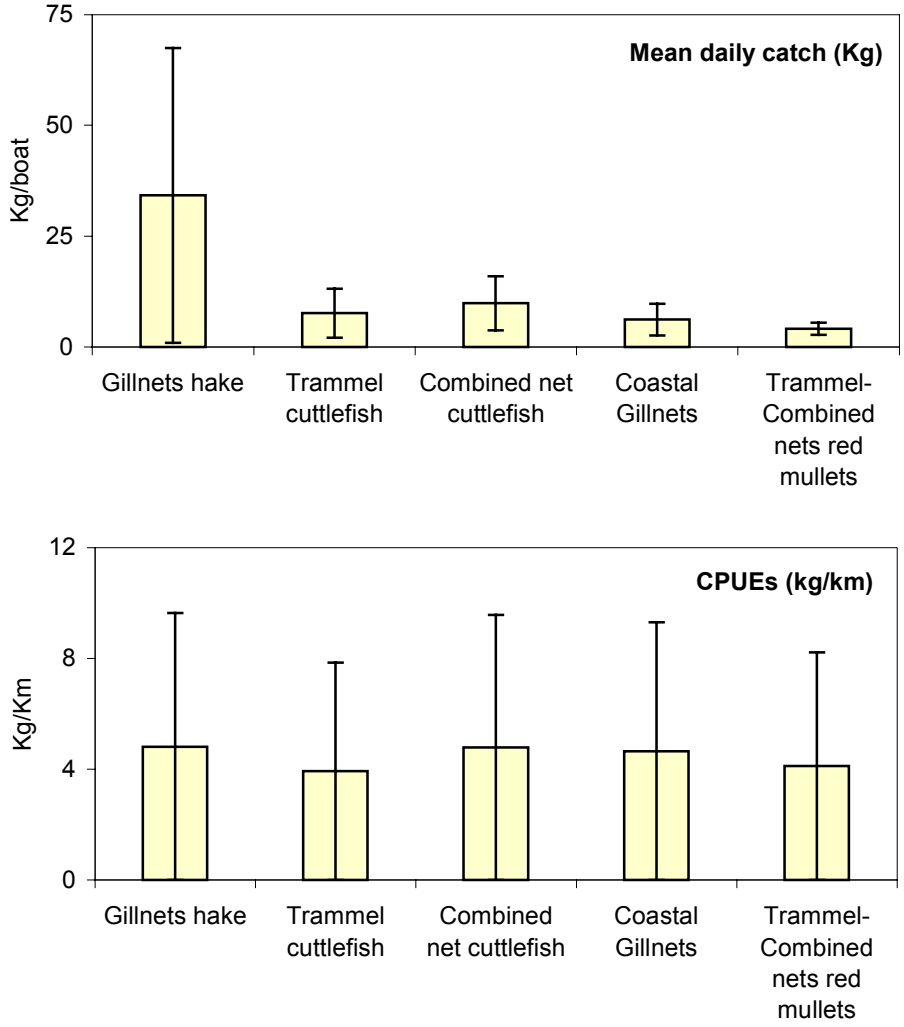


Fig. 12. Average daily yield, as Kg/boat, and mean CPUEs, as Kg/Km net, of main fishing métiers of the Cilento area

Temporal and spatial changes in average yield were assessed by comparing data of the 1995-96 and 2001 surveys for the three main fishing areas. The two most important gear, respectively trammel-combined nets for the cuttlefish and gillnet for the hake, were considered for the analysis.

The three areas showed significant differences ($p<0.05$) in mean CPUEs both in the 1994-1995 and the 2001 surveys. The lowest catches were observed in the area of Camerota both for trammel-combined nets and gillnets (Figure 13).

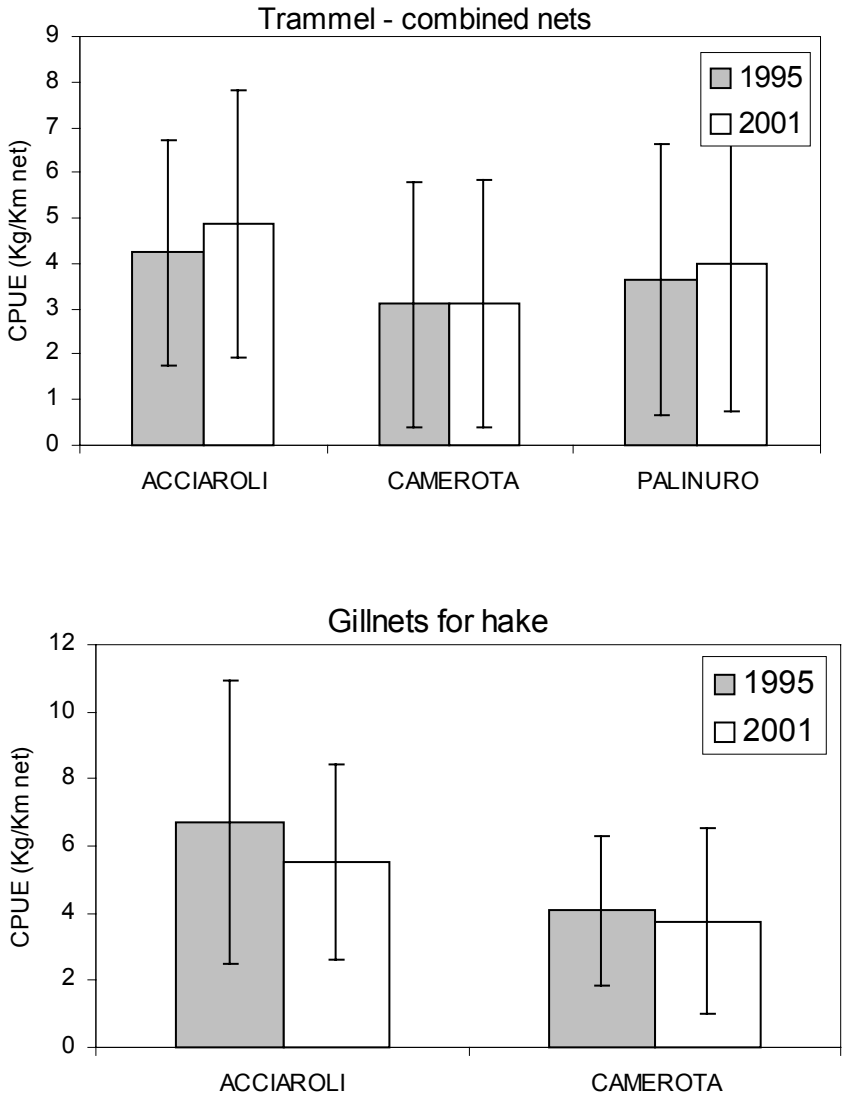


Fig. 13. Mean CPUEs of trammel-combined nets and gillnets by area and period

A reduction of gillnet fishery CPUEs was observed in both areas between the two surveys. The reduction of CPUEs was apparently balanced by an increase in the dimensions of gillnets between 1994 and 2001. The average length of gillnets increased from a mean value of 6.800 m to 9.000 m for each vessel (Figure 14). Yields of longlines were considerably higher for bottom longlines targeting silver scabbardfish. The catch by boat of this species reached 400 Kg and by-catch was limited to a few specimens of hake.

Coastal longlines targeted highly valuable species belonging both to Sparidae (*Diplodus sargus*, *Dentex dentex*, *Sparus aurata*, *Oblada melanura*) and Serranidae (*Epinephelus marginatus*). The catch ranged between 1 and 15 Kg/boat.

Floating longlines were used to catch mainly swordfish *Xiphias gladius* and dolfinfish *Coriphaena hippurus*.

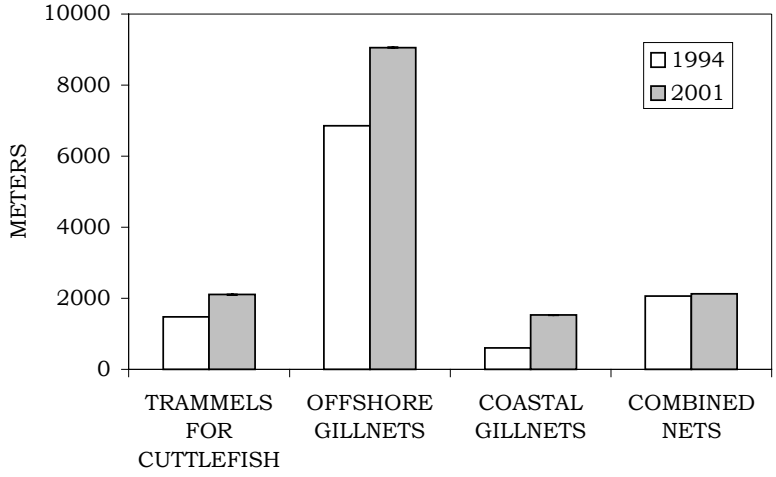


Fig. 14. Mean gear length of the main fixed gears used in the Cilento area

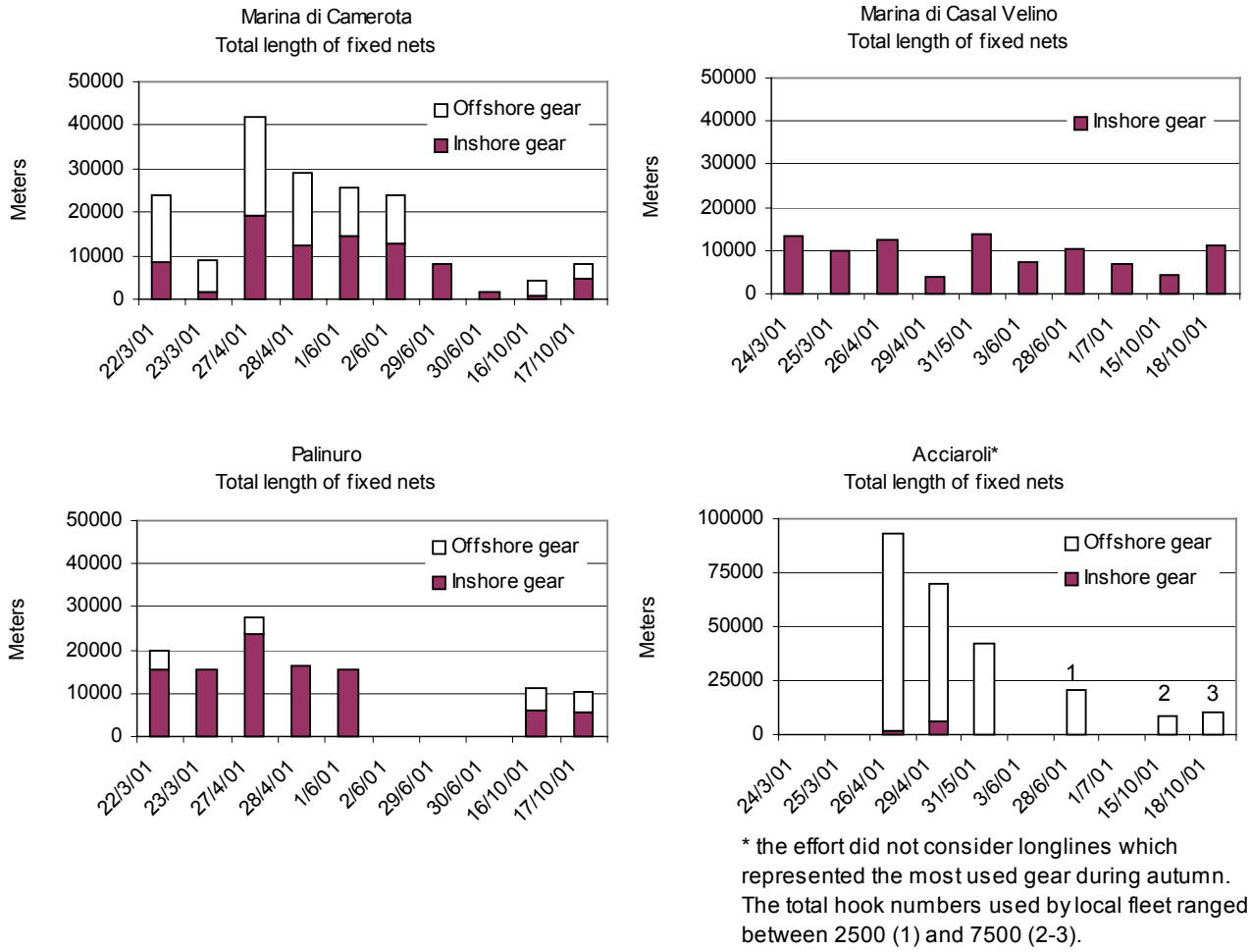
4.4 Fishing effort

Several fishing effort indicators have been used in this study to estimate effort intensity for coastal and offshore métiers (see paragraph Materials and Methods). Data have been analysed, by survey and by area, to assess both temporal and spatial change in the fishing effort.

The overall daily fishing effort estimated for the four fishing ports is shown in Figure 15. It was calculated as the total length of fixed nets employed daily by local vessels. The four ports showed differences according to the dimensions and typology of fishing effort. In Marina di Camerota this latter was equally divided between offshore and inshore fishery. Palinuro and Casal Velino exploit basically inshore stocks using respectively up to 25 Km/day and 12 km/day). The Acciaroli fleet targets offshore stocks using up to 90 Km of nets/day and 10.000 hooks/day.

Figure 16 shows the overall percentage composition of total fixed nets used by local vessels obtained by combining effort data collected at the sampling ports. Offshore gear accounted for 55% in terms of length, basically due to the Acciaroli and Marina di Camerota fleets.

Inshore gear effort (45%) was equally divided by Marina di Camerota, Palinuro and Casal Velino.



* the effort did not consider longlines which represented the most used gear during autumn. The total hook numbers used by local fleet ranged between 2500 (1) and 7500 (2-3).

Fig. 15. Overall daily fishing effort by port and fishery

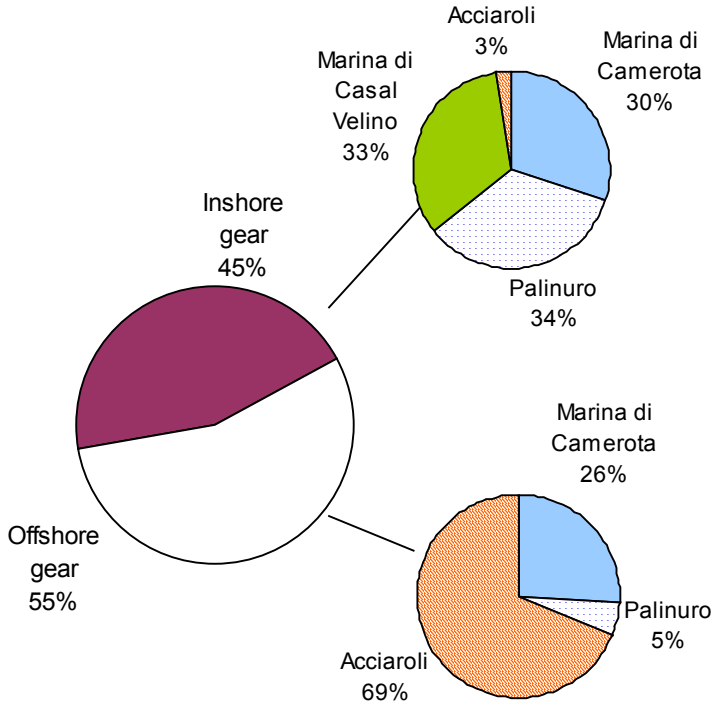


Fig. 16. Percentage composition of total gear length obtained by pooling data collected during the daily surveys by fishery and port

Activity ratio of the fleet

This value showed wide day by day fluctuations related to the conditions at sea and the period of the year. The percentage of fishing units in the coastal fishery was generally lower than 75% of the total number of fishing vessels present in port. In Acciaroli, where the activity of gillnet fishery was monitored, a higher intensity of fishing activity was observed with values up to 90 % (Figure 17). In the ports of Marina di Camerota, Palinuro and Acciaroli, a clear reduction of the fleet activity ratio was observed from March to July. The Casal Velino fleet did not decrease its activity in this period.

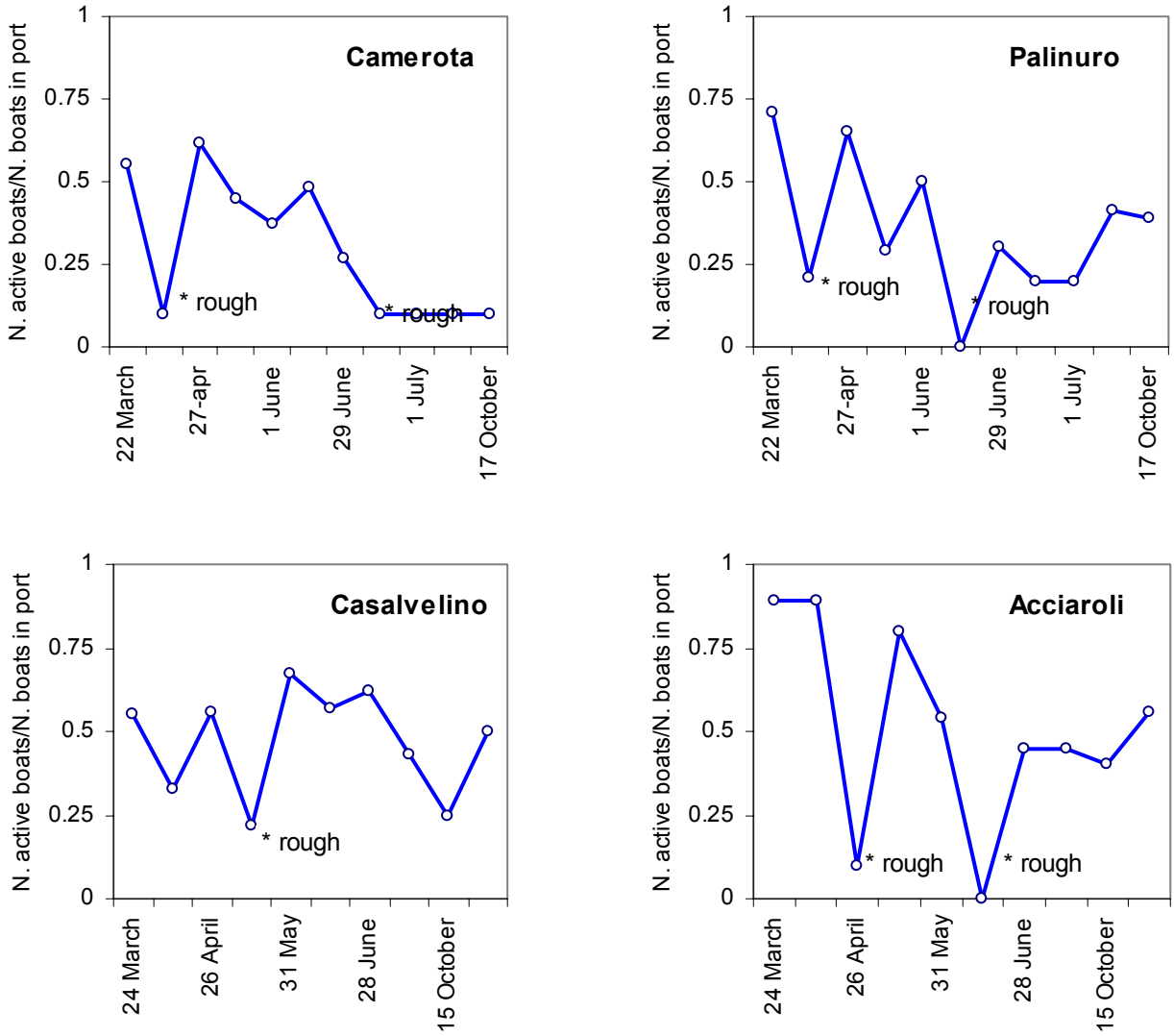


Fig. 17. Daily activity ratio of artisanal fleet, calculated as number of vessels that went to fish in each sampling date, in the sampling ports during 2001

In Figure 18 the activity ratio of the fleet by port is shown for the study period 1995-1996.

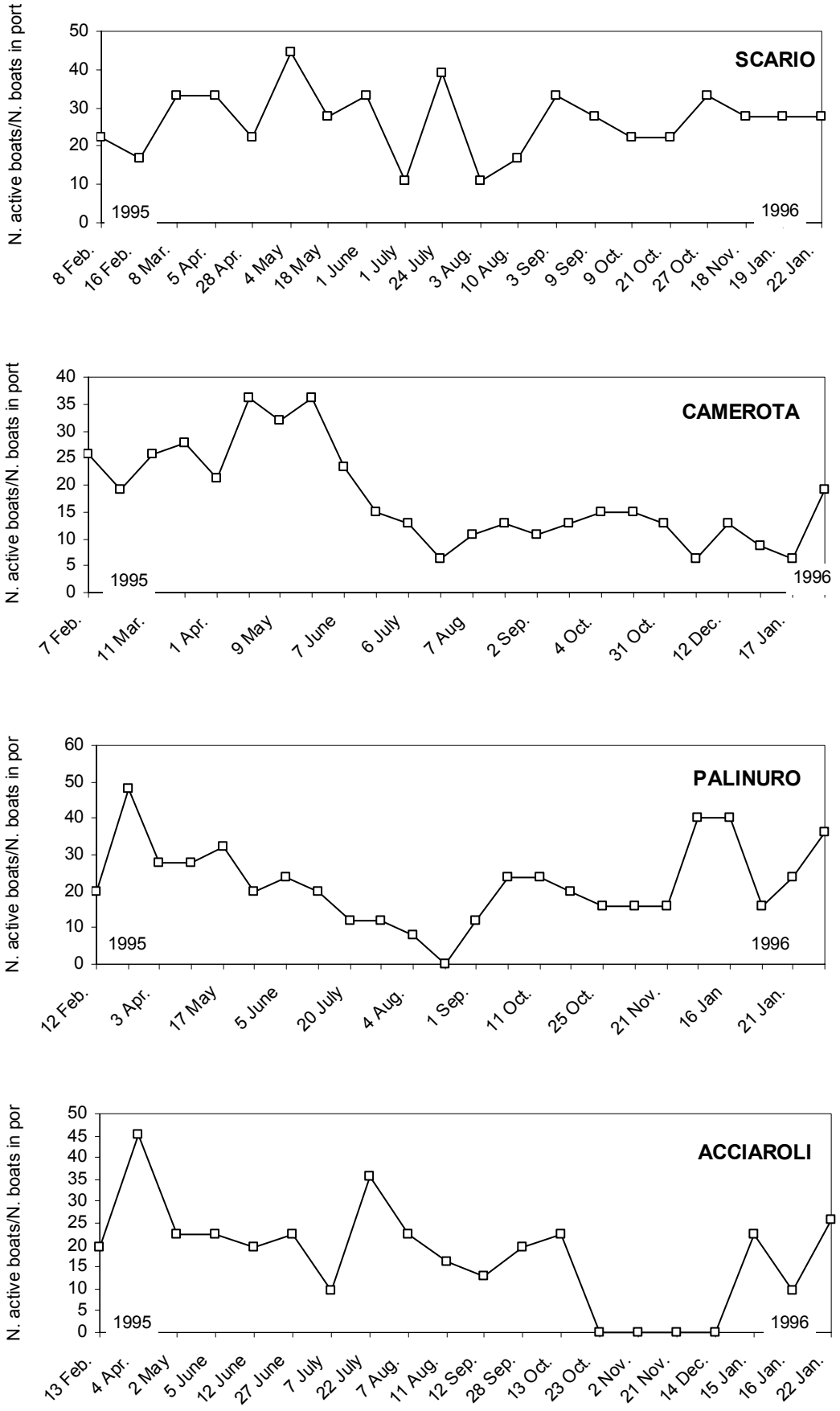


Fig. 18. Daily activity ratio of artisanal fleet in the sampling ports, calculated as number of active vessels in each sampling date

Changes in fishing effort observed between 1995 and 2001

Data collected during the 1995-1996 survey on fishing position of fixed gear used by active vessels enabled the fishing areas for each gear used in the area to be defined. This information was combined with the catch/effort data collected during daily surveys at local ports to obtain an estimate of the fishing effort, as the mean daily number of boats/Km^2, in the various fishing areas (Figure 19).

Such analysis was not repeated during the 2001 survey due to the lack of catch-effort data from the secondary ports in the area which were not surveyed during the study. The actual number of active vessels exploiting daily the various fishing areas along the shore was not assessed.

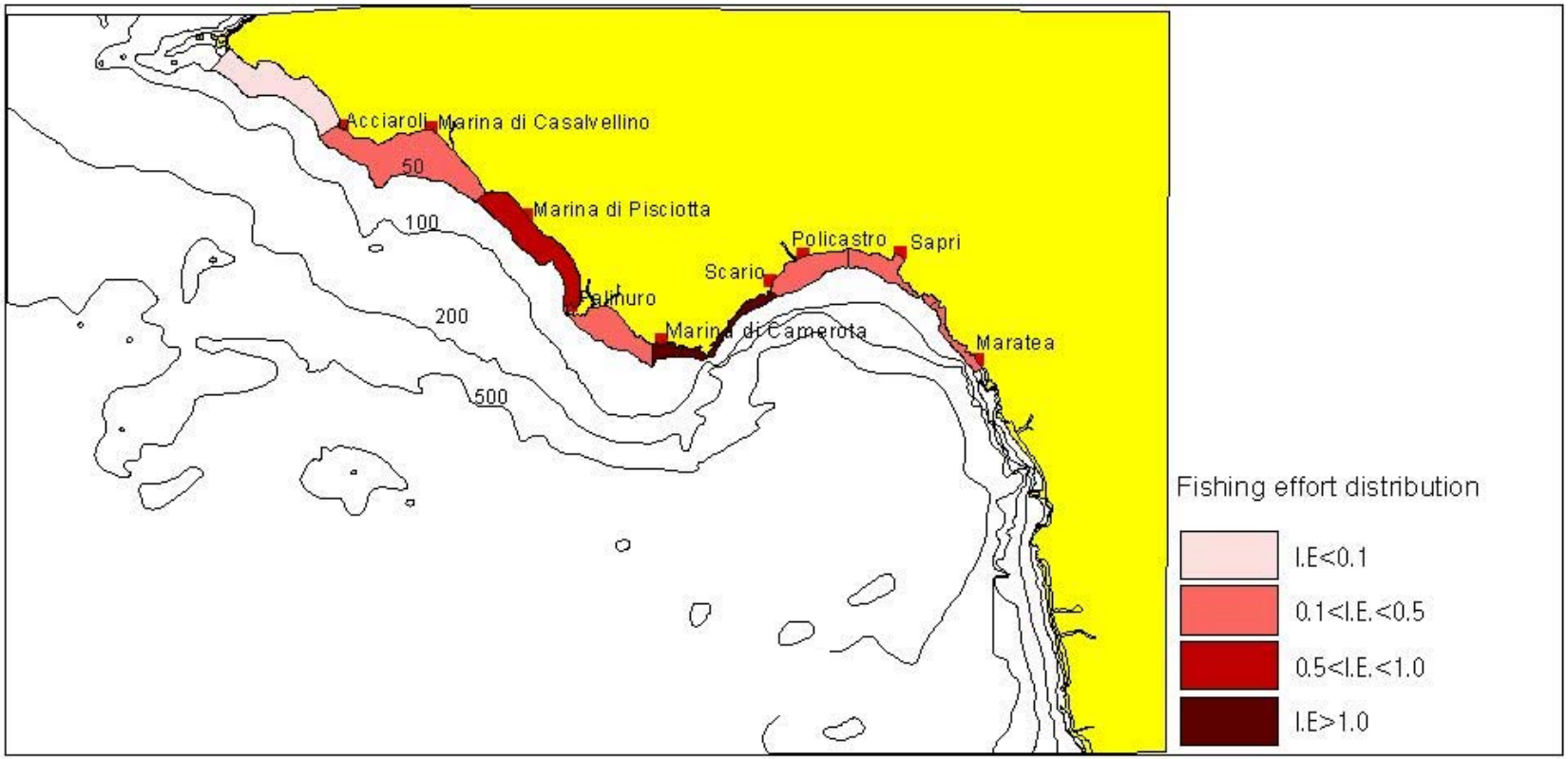
An evaluation of the current exploitation pattern was obtained by analysing changes in fishing effort between the two surveys. The daily number of active vessels by métier and by port showed significant changes only in Camerota where both inshore and offshore activities decreased and some métiers disappeared. A minor reduction was observed at Marina di Casal Velino, while no significant changes occurred in the other ports where the fleet maintained the same exploitation pattern in 2001 as that observed in 1995 (Figure 20).

Conflicts between artisanal and semi-industrial fishery

Inshore artisanal fishing is affected by the trawl activity which compete negatively with artisanal vessels both for space (also within the bathymetry of 50 m) and resources. Trawling often causes deliberate or inadvertent damage to artisanal métiers by towing through fixed gear. The result is that the fixed gear is either completely or partially lost.

To avoid such interactions, artisanal fisheres set their gear in areas where trawlers cannot operate. In this way artisanal métiers tend to confine their activities to restricted areas where they exploit a limited range of species.

Offshore artisanal fishermen adapt their fishing behaviour to avoid overlapping their activities with trawling, thus reducing conflicts. The nets are set up on a fixed bathymetry, to avoid hampering the towing routes of trawlers. The vessel remains close to the nets and the fishmaster communicates by radio the exact position of the gear to the trawlers fishing in the area.


Acciaroli
Marina di Casalvellino
50
Marina di Pisciotta
100
Policastro
Sapri
Scario
200
Marina di Camerota
Maratea
500
Fishing effort distribution
I.E<0.1
0.1<I.E.<0.5
0.5<I.E.<1.0
I.E>1.0

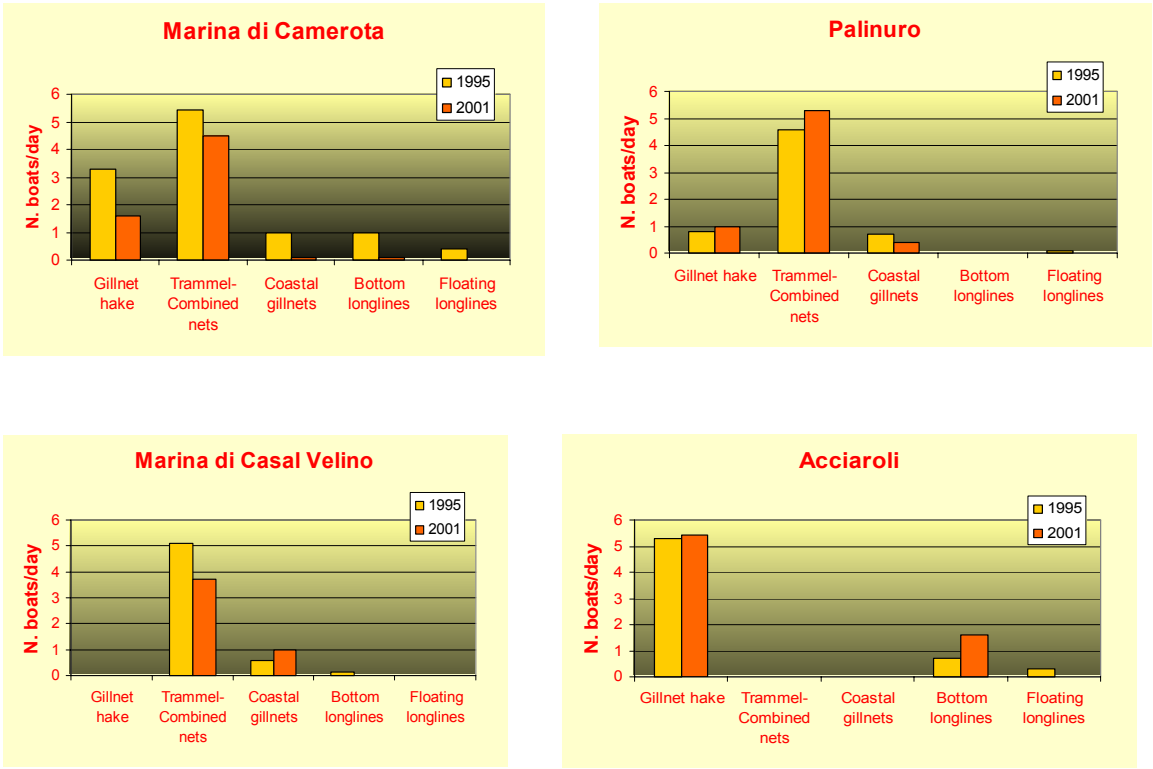


Fig. 20. Mean daily number of active fishing vessels in each sampling port by gear and survey

5. SOCIO-ECONOMIC STRUCTURE OF ARTISANAL FISHERY

The importance of fishery activities has been decreasing in coastal areas during the last 40 years. Development of tourism-based activities and general social development at the beginning of the 1970s can be viewed as the main factors influencing this process. The number of young unemployed entering the fishing sector is continuously decreasing, despite the very high level of unemployment in the Cilento area. Similarly, the average age of fishermen is increasing and a high percentage of fishermen are currently retired people.

Also, fishing is, in many cases, a secondary activity carried out to supplement the main economic activity. The main consequence of this process on the fishery sector is both a general impoverishment of the métiers and a lack of organisation of the commercial and market network. Some traditional métiers which require highly specialized man-power that was widely developed during the 1960s-1970s, such as purse seining for anchovies or longlines for hake, are disappearing.

Trade channels are widespread in the area and difficulty to identify due to the lack of a main fish market or auction markets.

Fish landed is generally sold to local fishmongers that may also commercialize the product in the inland villages through street hawking. The local fishmongers absorb most of the landings of coastal métiers and a part of the hake. Fishermen make agreements with fishmongers who undertake to buy landed catches independently of price and market fluctuations. The fisherman is obliged to furnish fish-shops even during summer. This agreement generally reduces the percentage of landings that are sold directly at the landing places by the fishermen.

Hake and silver scabbardfish are generally commercialized through local wholesalers transporting the product to the Salerno market or to other Italian regions (i.e. Sicily).

In 1996, the fishing cooperative in Marina di Camerota opened fishmonger commercializing landings for its members (i.e., associated fishermen).

5.1 Ownership and working conditions

The vessel may have single or co-ownership. In most cases the owner/s is/are members of the same family which reached this status by inheriting the vessel and gear from the family (father). The owner generally started working as a fisherman at a very early age and comes from a family who has worked in fisheries for several generations. He will act as a master fisherman on his vessel and employ a number of helpers, usually his sons.

After many years working hard as a hired hand, he may in due time acquire one or more boats which will eventually pass to his sons, as is usually the case in a patriarchal society like that of southern Italy. Vessel owners receive the whole income from fishing and usually pay crew members through a traditional quota system. About 50% of the income is set aside for the owner of the vessel and the fishing gear, the rest being shared out among the crew, including the owner if he works on the vessel. Generally, the shared quota is divided equally between the crew members. They are also entitled to any surplus fish that are not sold because of damage or which have no commercial value (fish in the third or lower category).

Most owners are organised in cooperatives whose main aim is to help its members manage their activities (i.e., administration, subsidies, catch statistics, marketing products, etc.). The most important cooperatives are: Coop Basso Tirreno, which has 109 members mainly from Marina di Camerota and Palinuro; and Copea of Agnone whose members are mainly from Acciaroli.

Membership of a cooperative involves several expenditures by the fishermen depending on the fishery sector. For small-scale fishery, the new member has to pay a membership fee (about Euro 31) and a monthly fee of Euro 20-30 to cover all public expenditure. The co-operative is responsible for monitoring the administrative practices of each member and for paying social-insurance and pension contributions, using as reference the minimum salary established by law for small-scale fishery (Euro 475.14).

A member of a cooperative should give his catches to the cooperative which is responsible for commercialising and selling the fish and sharing the total income between all members. In actual fact, however, every fisherman sells his product directly without receiving any income from the cooperative.

5.2 Social structure

The typical social structure of artisanal fishery, based on a patriarchal society where the fishing traditions are passed from father to son, generation after generation, is rapidly changing. The younger, better educated, generation shows a strong tendency to leave the fishery for shore employment. The main reasons do not seem to be related to the economic conditions of the fishermen whose income often surpasses that of an agricultural worker and even that of a skilled industrial worker. It appears rather that the real reasons behind this trend are to be found in the low status of the small-scale fisherman in the eyes of the community and the hard working conditions.

However, the ongoing evolution of the social structure of coastal communities hardly affects artisanal fishery. The turnover between generations is much reduced, since an ever decreasing number of young people enter the trade. Moreover, persons not previously connected to the fisheries do not, as a rule, join the trade unless compelled to do so by extreme economic pressure.

The age structure of the fishermen hampers progress in terms of modernization of the fisheries and application of better technologies. The aging owner generally lacks the mental flexibility needed to understand the benefits to be derived from utilising new technologies or changing the fishing traditions. Both need financial investment but the ageing fisherman usually prefers to save his money and maintain the old ways which have always been successful.

5.3 Invested capital

In calculating the financial investment the capital devaluation of both vessels and gear was ignored. The vessel value was established only on the basis of the system established within the SFOP 2000-2006 to calculate the refund for a demolished vessel. This evaluation system takes into account both the dimensions and the age of the vessel. Only vessels more than 10 years old are eligible for demolition or end-of-activity incentives. Even if the values obtained in this way are generally overestimated by about a third with respect to the market prices, this method appears to be the only one that enables obtaining information on the value of investment for the different fishing vessel typologies. The fleet and the gears are characterised by such widely different characteristics (dimensions; engine power, type and age; fishing gear) that the real market price of a vessel can only be obtained directly at the time of sale or purchase under the same conditions (Bailly and Franquesa, 1998). Anyway, collecting data using this approach is not very useful because owners rarely know the real market value of their vessels and gears. Furthermore, data can be obtained only from a limited number of the more collaborative owners.

The value of the local artisanal vessels has been calculated for the two main segment of the fleet (Table 13).

Table 13. Mean value of inshore and offshore artisanal vessels

	Inshore vessels	*Offshore vessels*
Range of value Euro	1939.2-79867.5	21236.7-80851.3
Mean value Euro	25262.8+/-16026	59510.8+/-22184

The capital invested in offshore vessels is about twice that invested in inshore vessels. Overcapitalization has forced offshore vessels to increase their fishing effort continuously to maintain economic efficiency.

5.4 Costs – Incomes of artisanal fisheries

The profit-costs of artisanal vessels are difficult to estimate due to the intrinsic characteristics of artisanal fishery. It shows much diversified trade channels, high fluctuations in the number of crew members, payment systems changing according to catch trend, *etc.*

Moreover, the activity fluctuates strongly during the year depending on weather conditions, yield of target species, market prices and other income opportunities (tourism-based activities).

Fixed costs are related to vessel and gear maintenance, fee licence and crew wages. The variable costs include mainly fuel and other minor costs related to commercialisation of the products (ice, boxes for fish, *etc.*).

Figure 21 shows the average costs for the inshore and offshore artisanal fleets. Costs related to the crew have been excluded due to the difficulty in obtaining a realistic estimation of these costs (see above). Fuel consumption has been calculated for a total of 140 fishing days. This figure of the mean number of fishing days by year represents a rough estimate of

the activity at sea for artisanal fishery in the area obtained from interviews to fishers. Inshore vessels expended a mean amount of 3900 Euro every year, equally divided between fuel consumption, vessel and gear maintenance. The main cost of offshore fishery appeared to be related to fuel consumption (8670 Euro) which covers more than 60% of total annual costs.

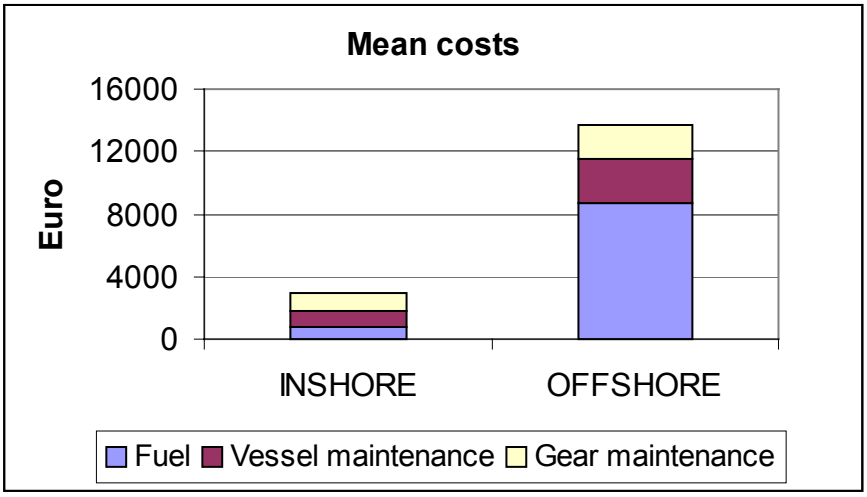


Fig. 21. Average costs of inshore (trammel-combined nets) and offshore gillnets) fishing activities

The gross profit of the trade depends strictly on the yield of the target species. The landing is generally divided into three price categories according to the local value of the catch: 1st (‘*pesce di prima’*), 2nd (‘*pesce di seconda’*) and 3rd category (‘*pesce di terza’*). The main species, the size / weight range, and their relative prices are listed in Table 14.

Figure 22 shows the mean gross incomes of the various fishing métiers. The highest landing values were observed for offshore métiers ($p<0.001$): longlines for silver scabbardfish (Euro 280) and gillnets for hake (Euro 150). Inshore métiers showed mean values generally lower than Euro 100.

The economic performances of the area’s two main fishing activities - gillnets for hake and trammel-combined nets have been compared for the three main fishing areas (Figure 23). The temporal trends of gross incomes have been calculated by summing the daily average gross incomes for the two métiers in the three fishing areas. In this way we assessed the average period that a given vessel, using a given gear in one of the three areas, needs to cover the yearly estimated fixed costs. Results showed that in each area gillnets for hake gave a better economic performance than inshore fixed nets. The lower performances were observed in Marina di Camerota.

Trammel-combined nets begin to give net incomes after a period ranging from 21 fishing days (Acciaroli) and 72 fishing days (Marina di Camerota), while the net incomes with gillnets can be obtained after a period ranging from 22 fishing days (Marina di Camerota) to 47 fishing days (Acciaroli).

Table 14. List of commercial species. Gross prizes, local names and price category is indicated for each species landed

Species	Local name	Size range or Weight	Category	Prize (euro)
Auxis rochei			Third	1.5-3.0
Balistes carolinensis	Pesce porco		Second	5.0-8.0
Coryphaena hippurus	Lampuga		Second	5.0-6.0
Dentex dentex	Dentice	Weight>250 g	First	11.0.15.0
Dicentrarchus labrax	Spigola	Weight>250 g	First	11.0.15.0
Diplodus sargus	Sarago	Weight>250 g	First	11.0.15.0
Engraulis encrasicolus	Alice		Second	4.0-6.0
Epinephelus marginatus	Cernia	Weight>250 g	First	11.0.15.0
Helicolenus dactylopterus	Occhi belli		Second	4.0-6.0
Illex coindetii	Totano		Third	1.5-3.0
Lepidopus caudatus	Pesce bandiera		Third	0.5-1.0
Lithognathus mormyrus	Murmura	Weight>250 g	First	11.0.15.0
Liza spp.	Cefalo		Second	4.0-6.0
Loligo vulgaris	Calamaro		Second	5.0-8.0
Lophius piscatorius	Rana pescatrice		Second	8.0-10.0
Merluccius merluccius	Merluzzo		Second	5.0-6.0
Mullus barbatus	Triglia di fango		Second	7.0-8.0
Mullus surmuletus	Triglia di scoglio	TL>18-20 cm	First	10.0-12.0
Naucrates ductor	Nfanfaro		Third	0.5-1.0
Nephrops norvegicus	Scampo		First	11.0.15.0
Oblada melanura	Occhiata		Second	7.0-8.0
Octopus vulgaris	Purpu		Second	7.0-8.0
Pagellus acarne	Manfrone		Third	1.5-3.0
Pagellus bogaraveo	Pezzogna	Weight>250 g	First	11.0.15.0
Pagellus erythrinus	Luvaro	Weight>250 g	First	11.0.15.0
Pagrus pagrus	Pagru	Weight>250 g	First	11.0.15.0
Palinurus elephas	Aragosta	Weight>250 g	First	20.0-40.0
Penaeus keraturus	Mazzancolla		First	11.0.15.0
Phycis phycis	Musdea		Second	7.0-8.0
Plesionika edwardsii	Gobbeto		Second	10.0-12.0
Raja asterias	Razza	Weight>500 g	Second	7.0-8.0
Sarda sarda	Palamita		Third	2.0-4.0
Sardina pilchardus	Sarda		Third	0.5-1.5
Sarpa salpa	Salpa		Third	2.0-4.0
Sciaena umbra	Corvina	Weight>250 g	First	11.0-15.0
Scomber japonicus	Sgombro		Third	0.5-1.5
Scophthalmus rombus	Rombo	Weight>250 g	First	13.0-15.0
Scorpaena elongata	Scorfano	Weight>250 g	Second	7.0-10.0
Scorpaena notata	Scorfano		Third	2.0-4.0
Scorpaena porcus	Scorfano		Third	2.0-4.0
Scorpaena scrofa	Scorfano	Weight>250 g	Second	7.0-10.0
Sepia officinalis	Siccia		Second	6.0-8.0
Seriola dumerili	Ricciola		Second	7.0-12.0
Serranus cabrilla	Perchia		Third	2.0-4.0
Serranus scriba	Perchia		Third	2.0-4.0
Solea vulgaris	Sogliola	Weight>250 g	First	12.0-18.0
Spondyliosoma cantharus	Schiantaro	Weight>250 g	First	13.0-15.0
Sphyraena sphyraena	Aluzzo		Third	4.0-5.0
Spicara smaris	Rutunno		Third	2.0-3.0
Squilla mantis	Pannocchia		Third	4.0-5.0
Thunnus thynnus	Tunnu			2.5-3.5
Todarodes sagittatus	Totano		Third	2.0-3.0
Todaropsis eblanae	Totano		Third	2.0-3.0
Trachurus mediterraneus	Sauro bianco		Third	2.0-3.0
Trachurus trachurus	Sauro		Third	2.0-3.0
Trigla lucerna	Coccio	Weight>250 g	Second	7.0-10.0
Trigloporus lastoviiza	Coccitiello		Third	2.0-3.0
Trisopterus minutus	Ficariella		Second	5.0-6.0
Uranoscopus scaber	Lucerna	Weight>250 g	Second	7.0-10.0
Xiphias gladius	Pisci spada			10.0-12.0
Xyrichthys novacula	Surice		Third	2.0-3.0
Zeus faber	S. Pietro	Weight>250 g	First	13.0-15.0

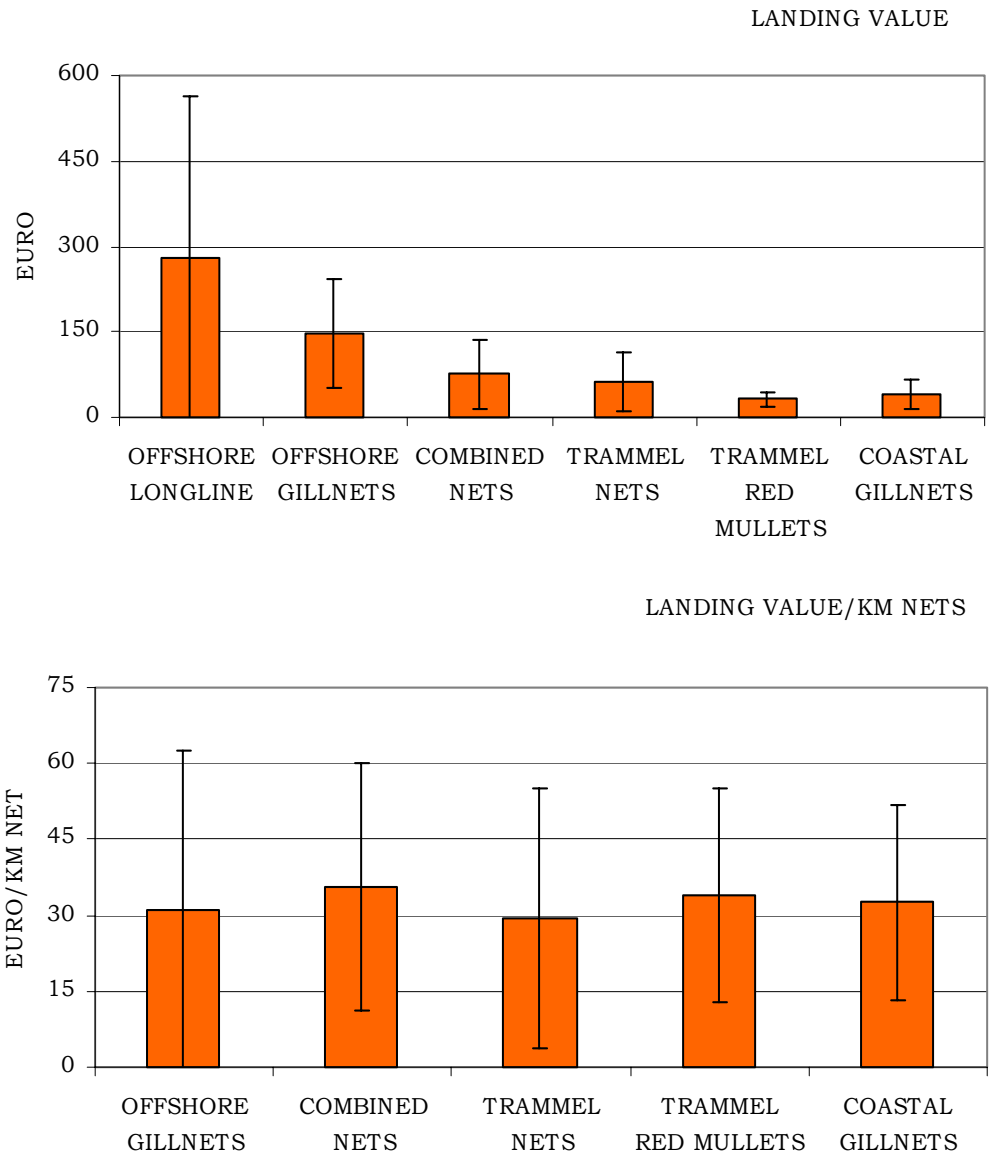


Fig. 22. Average landing value by vessel (a) and mean economic CPUE (b) of the main gear used by Cilento's artisanal fishery

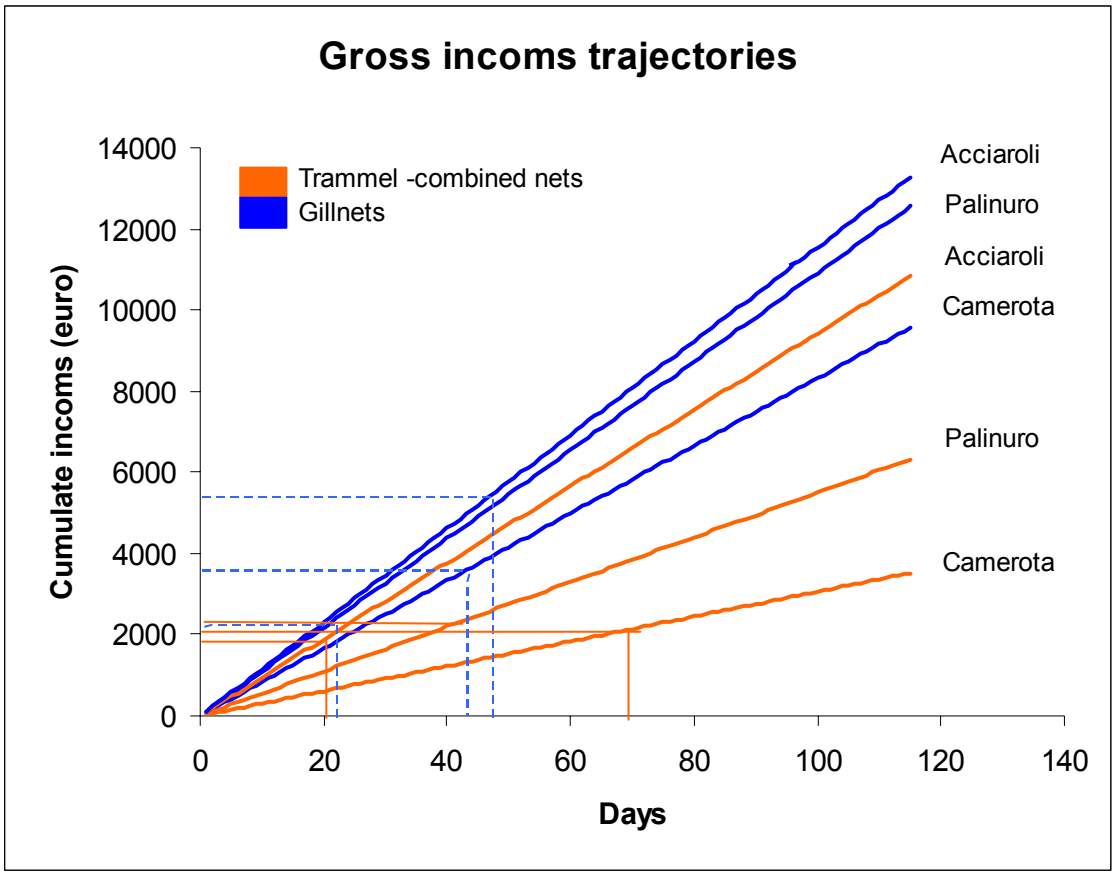


Fig. 23. Gross incomes trajectories of local fisheries (blue lines: offshore fisheries, orange lines: inshore fisheries) based on the mean value of the catch and daily fuel consuption. For each fishery are indicated the cumulate incomes corresponding to the total number of days required to cover annual fixed costs

The annual net incomes, calculated for a yearly period of 140 days, ranged from 2200.8 Euro (trammel–combined nets: Marina di Camerota) to 12300 Euro (gillnets: Palinuro). Inshore fixed nets showed an increase of their annual economic yield from Marina di Camerota to Acciaroli. Only in this latter area can such gear provide high income possibilities comparable to other typologies of inshore employment. Offshore activities gave the lowest economic performance in Marina di Camerota while Palinuro and Acciaroli did not show significant differences. The net incomes of offshore activities calculated in this way did not take into account crew wages. Considering that Acciaroli vessels have 3-4 persons on board such incomes appear insufficient to maintain trade efficiency.

Tourism related activities

The Cilento region is an important tourist resort during the summer months. The local population may increase by 100% or more between July and August. It has a fleet of about 50 vessels, most of which are fishing vessels, with some being used to transport tourists.
This activity has increased over the last ten years and new vessels licensed for traffic have been built.

In the ports of Palinuro, Marina di Camerota and Scario most of the fishing vessels interrupt fishing activities from June-July to September. Gears are landed and vessels are fitted out to host tourists. The main activity is taking tourists along the shore towards those beaches and rocky caves accessible only from the sea.

Fishing-tourism activities, which are regulated by a Decree of the Italian Ministry of Agriculture Resources, are conducted sporadically using mainly purse seiners ("lampare"). Usually, one or more sets are conducted by

fishermen at night to catch small pelagic fish such as Clupeids and other low-priced fish. The catch is immediately cooked for the tourists on the beaches along the coast.

In 1996 the fishermen from Camerota established a fishing-tourism co-operative (Consorzio Mare Cilento) with 13 members to better manage the tourism activities. Ten of these members are fishermen, each with their own vessel. Three new traffic vessels, with a capacity of 112 people on board, have been acquired by the co-operative with the income from the trade, to meet the growing request for boat tours. The fishing-tourism decree allows the co-operative to acquire fuel at a reduced price. The activity is permitted from May to September, and occasionally until October. Trade incomes are managed differently according to the vessel type: incomes from vessels fishing are shared out to members at the end of each day, independently of the type of boat which was at sea during the day. Instead, the incomes of vessels used for tourism pay the crew's salary and other trade maintenance costs (both of the vessels and of the co-operative). The net incomes are saved and reinvested to purchase new tourist boats.

The mean fare per person is about Euro 7.6 for a trip along the coast and 26 Euro for a purse-seine trip. The net income is about 5 Euro/tourist for the shore trip and about 12 Euro/person for the purse seine trip.

The annual turnover of clients in this activity is about 20.000 people. About 50% of these are transported along the shore, 40% take part in purse-seines activities and 10% are scuba divers.

The transport of tourists in Palinuro is conducted by a fleet of 30 vessels, 12 of which are fishing vessels. The fare is 10 Euro per person during the high season (July-August). In Marina di Pisciotta there is only one vessel for tourism, but some fishing vessels can conduct this activity during the summer, both for transporting scuba-divers and tourists towards Capo Palinuro.

Marina di Casal Velino has two large boats which are able to transport up to 140 people per trip during the summer.

6. CLASSIFICATION OF CILENTO ARTISANAL FISHERIES

An attempt to classify the Cilento fisheries was made on the basis of their ecological, technical, economic and social attributes. These attributes, selected according to the criteria used by Pitcher *et al*. (2001), should be:

- ranked objectively on a scale using available data on Cilento and Mediterranean artisanal fisheries;
- likely to discriminate among fisheries;
- easily related to sustainability.

An interdisciplinary analysis based on 22 attributes was conducted using MDS (Table 15). Reference points for evaluating the relative status of local fisheries were provided by defining hypothetical fisheries that were assigned “good” or “bad” in terms of sustainability. The fisheries chosen were the inshore fisheries of Marina di Camerota, Palinuro, Casal Velino, which are mostly based on trammel and combined nets, and the offshore fisheries of Acciaroli and Palinuro which target hake with gillnets.

The resulting order showed Palinuro and Camerota fisheries on the right hand side of the plot, towards the “bad” fishery condition, with the Acciaroli hake gillnet fishery and the Casal Velino inshore fishery cluster in an intermediate position. Inshore fisheries appeared quite well separated from offshore fisheries along a vertical axis according to a gradient of gear length and daily yield of vessels (Figure 24).

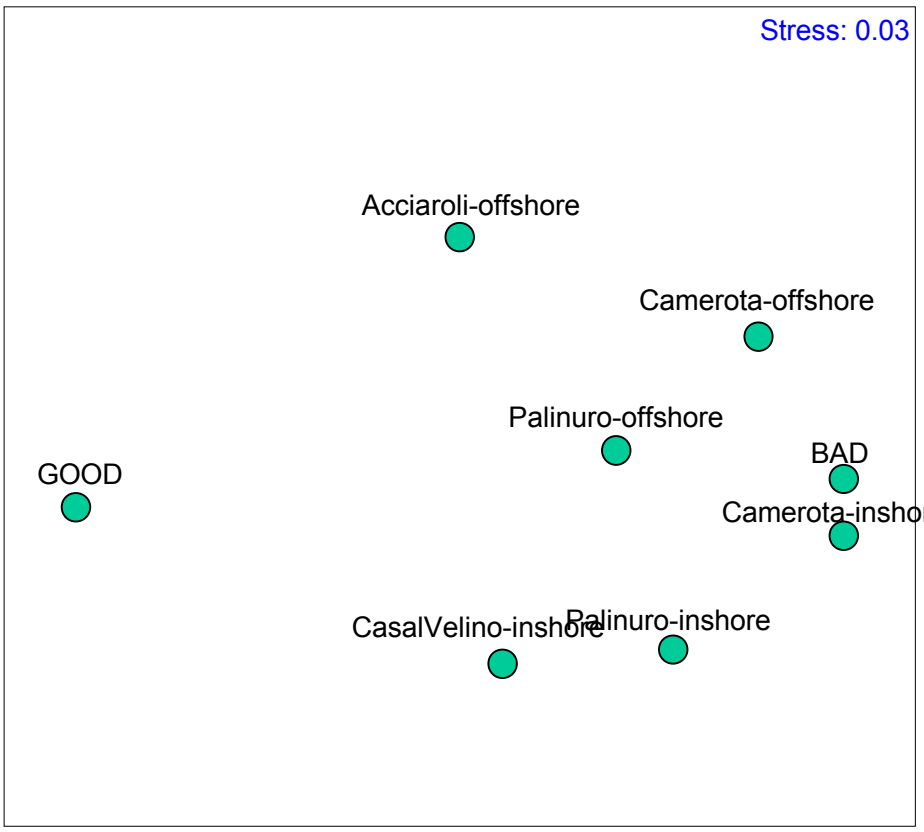


Fig. 24. Interdisciplinary ordination of the Cilento artisanal fisheries using multidimensional scaling of 22 fisheries attributes. Locations labelled as 'good' and 'bad' locations of hypothetical fisheries represent the best and worst possible scores in terms of sustainability

7. CONCLUSIONS

Artisanal fishery represents the bulk of fishery activities along the southern Italian coasts. In Campania and Cilento the artisanal vessels represent more than 85% of the whole fishing fleet in terms of number. The importance of this type of fishery is not only limited to the regional economy; it plays an important role at the local level for tourism and in virtue of its socio-cultural implications.

The Cilento region was chosen for the availability of its quantitative data on artisanal activities during the mid 1990s. A comparison of data on a short time-scale basis (5 years) showed them to be very useful to forecast changes in the fishing effort and activities pattern in future years. This information was associated with long-term data series of the local fleet (official data) for a better understanding of the evolutionary trend of fishing effort over the last decades.

Moreover, the Cilento region shows characteristics common to most Italian and Mediterranean coastal areas where various activities overlap and artisanal fisheries suffer from high fishing effort and the socio-economic evolution of local coastal communities.

The sampling design and data collection routines used in this study enabled the assessment of the dimensions of artisanal fishing activities in the Cilento area.

A spatial stratification of the study area was defined on the basis of the results of a frame survey conducted in the area to assess the dimensions and characteristics of the artisanal fisheries in each port. These data were combined with information on fishing zones to obtain homogeneous strata. Such stratification takes into account the position of the ports thus allowing catch and effort data to be collected for the whole coastal area.

The survey was carried out when the artisanal fleet's activities were at their highest, i.e., from the end of winter to the beginning of spring. Catch and effort data were collected monthly (two days/month) at the main ports. Fluctuation of fishing effort in the whole area was calculated from data collected monthly on active vessels in each secondary port.

Copemed data on the distribution of the ports and the fleets along the west Mediterranean enable the planning and/or evaluation of data collection on fishing activities in the different areas.

The evolution of the fishing fleets in the area during the last century showed a significant decreasing trend from the end of the 1980s. This negative trend can be related to the general evolution of the local social structure that has occurred during the last 30 years (see paragraph 3.5.2) and the increased importance of tourism within the coastal activities.

This general pattern accelerated negatively during the last 5 years because of the conversion of vessels towards tourism-based activities (tourist-transport, tourism fishing) and the low CPUEs of artisanal gears.

Moreover, the local fleet is being increasingly reduced because of the EC demolition incentives within measures to reduce the Italian fishing fleet (Multi Annual Guidance Programme MAGP IV - Financial Instrument for Fisheries Guidance, 2000-2006).

Artisanal fishery appeared to be much more dynamic than semi-industrial fishery (trawling) "suffering" changes in the socio-economic structure of coastal communities and abundance of resources.

Fishing métiers showed remarkable differences on a small spatial scale (from port to port) in relation to environmental characteristics (i.e., coastal shelf size, bed steepness, benthic habitats, etc.), fishing traditions, and socio-economic factors. Such small-scale (local) variability suggests that the collection of time-series of catch and effort data is fundamental for the efficient management of artisanal fisheries.

The fishing effort of artisanal fisheries cannot be estimated only on the basis of the dimension and structural characteristic of the fleet. Results of this study showed that only a portion of the official fleet was active daily and involved in fishing. Most of the vessels showed a reduced or null fishing activity during the year. Farrugio and Le Corre (1993) suggested considering the activity ratio of the fleet as giving an indication of artisanal fishing effort. We suggest combining this with data on gear and fishing area dimensions to better define intensity of fishing effort.

In the study area we defined two main segments of the fleet, one corresponding to small vessels operating inshore and and the other to larger vessels which basically exploit offshore stocks. These two segments should be considered separately in catch and effort statistics because they do not share the same fishing areas and resources.

Biological and structural parameters (CPUEs, Catch/Boat tonnage, fleet activity ratios, daily number of vessels by fishing area, etc.) could be used, together with socio-economic attributes (economic CPUEs, economic performances of métiers, mean age of fishermen, etc.) as tools to analyse the health status and trend of artisanal fisheries.

We used ranked ecological, technical and socio-economic fisheries' attributes to classify the Cilento artisanal fisheries following the method already employed by Pitcher *et al*. (2001) to classify 26 world fisheries. This technique may provide helpful diagnostics that do not rely on conventional stock assessment. The main objective of this analysis was to obtain a comparison of the status of fisheries and for this purpose the choice of a set of fixed attributes was important for future comparable analyses.

The advantage of the proposed method is the possibility of applying an interdisciplinary work strategy to fisheries with poor data, which most of the artisanal fisheries are.

A multidisciplinary approach is particularly suitable for those fisheries which are very sensitive to ecological change (in stock dimensions and habitat quality), to the socio-economic evolution of coastal communities, and to market and fishery regulations.

According to the ranking made, the Cilento fisheries appear to be in a bad state. The worst appeared to be that of Marina di Camerota whose fisheries suffer high exploitation of both coastal and offshore resources, limited fishing grounds, and lack of manpower turnover. Acciaroli offshore fishery and Casal Velino inshore fishery appeared to be in a better state. Palinuro appeared to be in an intermediate situation.

Reduction of the fleet and a parallel increase of tourism-based activities in Marina di Camerota and Palinuro seem to indicate a positive feedback to fishing effort which adjusts itself to the dimensions of resources. Low investment for vessels and gears and the chance to convert towards tourism-based activities may help artisanal fleets to reduce their fishing effort on traditional resources.

This feedback effect does not occur in the Acciaroli hake fishery which reacts to the reduction of the resources with an increased fishing effort. This fishery suffers overcapitalization, a low tourism impact on fishing activities, and a heavy impact of trawl fishery on the hake stock.

The Cilento case study demonstrated once again how the Mediterranean artisanal fishery is becoming less and less a highly socio-cultural-historical activity. It is losing its characteristic of being a family-producing unit, due to low CPUEs and changing fishing traditions.

8. RECOMMENDATIONS

1) The sampling design for quantitative data collection on artisanal fisheries should consider the high space-time variability of fishing métiers. Space stratification can be defined both on the basis of structural (dimension and composition of the fleet, fishing métiers, fishing areas) and environmental components (morphology of coastal area). Time stratification should be set up considering periods of higher and lower fishing activity.

2) The use of Copemed data to define local/regional/national survey plans and/or their evaluation. It is possible to define homogeneous areas from a management point of view by combining fisheries' data with ecological data (coastal morphology), social data (local traditions, organisation of the sector) and economic data (markets).

3) The data to be collected, as also the fishery parameters and indicators, must be standardised in order to be able to make fisheries comparable on a geographic and temporal basis as well.

4) The analytic approach must be multi-specific and take into account the use of bio-ecological indicators of the characteristics of environmental and socio-economic resources. The definition of such indicators and the allocation of standard values which reflect the level of sustainability of the fishery (low, medium, high) are extremely important and should be defined with the assistance of experts and on the basis of historical data of the fisheries.

5) The objective dimensions of the fishing effort must be defined and calibrated for artisanal fishery. They cannot be based on the dimensions and structure of the official fleet, but must take into account the active part of the fleet, the skills used and the size of the fishing areas.

6) The running of small-scale fishery must come under plans for managing the whole coastal sector. These should be defined with the involvement of the various categories concerned (plans for co-management) and calibrated by homogeneous area (Copemed

data important also here). In the case of Cilento, management plans must take into consideration the following aspects:

- a process is in place for reducing the size of the artisanal fishing fleet and the fishing effort along the coast;
- the generation turnover has diminished and there is a loss of fishing traditions;
- the high touristic value of the area leaves ample space for developing tourism-fishing activities which could be integrated with normal fishing activities and contribute to increasing the importance of local traditions;
- It is necessary to reduce the fishing effort towards over-exploited stock such as hake, through incentives to use new offshore gear (longlines, pots, etc.) and promoting alternative activities;

7) The added value on fish catch must be increased through D.O.C products and transformation (smoking, filletting, conservation). Direct sale of the catch by small-scale fishermen could be incentivated.

8) Training courses should be developed on the use of updated techniques for fishing underexploited resources, to incentivate the diffusion of tourism-fishing and to recuperate traditional fishing skills that have been lost or are in the process of becoming lost.

9) Generally speaking, the whole coastal area of the Cilento should be increased in value, given its significant naturalistic value and the high number of summer tourists. Artisanal fishing activities should be integrated within socio-cultural activities and the low impact of certain responsible fishing practices on marine reserves and protected areas should be indicated.

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