
**The Firm and the Environment:
Regional/Local Co-operation Initiatives in the
Southern States - Italy**

EF/98/47/EN



EUROPEAN FOUNDATION
for the Improvement of Living and Working Conditions

The European Foundation for the Improvement of Living and Working Conditions is an autonomous body of the European Union, created to assist the formulation of future policy on social and work-related matters.

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FOREWORD

In August 1994, Ecoter delivered to the Foundation the final report on the study entitled "The Firm and the Environment - Italy".

That study analysed three cases of co-operation between small and medium-sized enterprises (SMEs) - operating in Central and Southern Italy - social partners and local authorities, with a view to improving the environment in which those firms operate.

In 1995, the Foundation decided to study an additional case identified in agreement with Confindustria, the Confederation of Italian Industrialists.

The case study concerned the use of waste from the tuna processing industry to produce animal feed.

In particular, the study analyses an initiative promoted in Calabria by some SMES operating in the tuna processing and feed production sectors.

This report therefore presents the three case studies undertaken in 1994, with an updating chapter on each, together with the new case study which was concluded in March 1996.

To make the report easier to read, the sections drafted over the 1995/1996 period are boldfaced in the Contents pages; all the other sections were of course completed in 1994.

FOREWORD

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INTRODUCTION

This document is the final report on the research on "The Firm and the Environment - Italy", which Ecoter has carried out for the Foundation for the Improvement of Living and Working Conditions (hereinafter referred to as the "Foundation").

This research forms part of the Foundation's wider programme of activities aimed at identifying corporate environmental approaches.

In particular, the Foundation seeks to turn the spotlight on initiatives which - because of their organisational features, the parties involved or the results achieved - may be taken as models to be used in analogous situations.

In-depth documentation work and field surveys were necessary for this research.

No register exists in Italy to date of corporate environmental initiatives; neither the Ministry of the Environment nor the National Employers' Association are able to provide any exhaustive information on the subject.

This made it necessary to establish contact at local level with employers, trade unions and environmental groups.

The field surveys therefore involved verbal interviews and sending out questionnaires adapted to the kind of respondent involved (see Annex 1 for the three types of questionnaire used); these questionnaires were sent to the following in particular:

- Anicav;
- Legambiente Campania;
- Corcosol in solofra;
- Orbetello Pesca Lagunare spa;
- Orbetello Commune;
- Codiso in Solofra;
- Solofra Tanners' Association.

These contacts made it possible to produce a general picture - although not an exhaustive one - of the ongoing initiatives from which the case studies were selected, with reference to the research objectives.

The four case studies in this report are presented on the basis of the available information and in the context of the relationship between firms and the environment in Italy. More specifically, the report is divided up into the following parts:

- (i) statement of the research objectives and the obstacles encountered;
- (ii) general framework of the relationship between firms and the environment in the Italian context;
- (iii) selection criteria for the case studies;
- (iv) analysis and assessment of the case studies.

With regard to the fourth case study in particular, which was the last to be carried out, it is important to note that the research focuses on the problem of recycling the waste from tuna processing for productive purposes. The industrial context and the potential economic and environmental effects of a corporate recycling initiative are therefore analysed.

This initiative has been promoted by some SMEs operating in Calabria in the tuna processing and animal feed production sectors. It took shape within the confines of what might be called the "tuna capital" of Calabria, i.e. the area of Pizza-Vibo Valentia where firms involved in the sector operate.

* * *

During 1994, the media took an interest in the problems of the Sarno river basin.

Their interest was sparked by the action taken by the Courts which, as will be seen in the report, have long been playing a decisive role in promoting a clean-up of the environment not just in the Sarno but in Italy as a whole, by combating illegal activities.

This will not be an easy task in areas of the country where illegal activity is widespread, due to the fact that for a long time both the State and the local authorities have preferred to turn a blind eye.

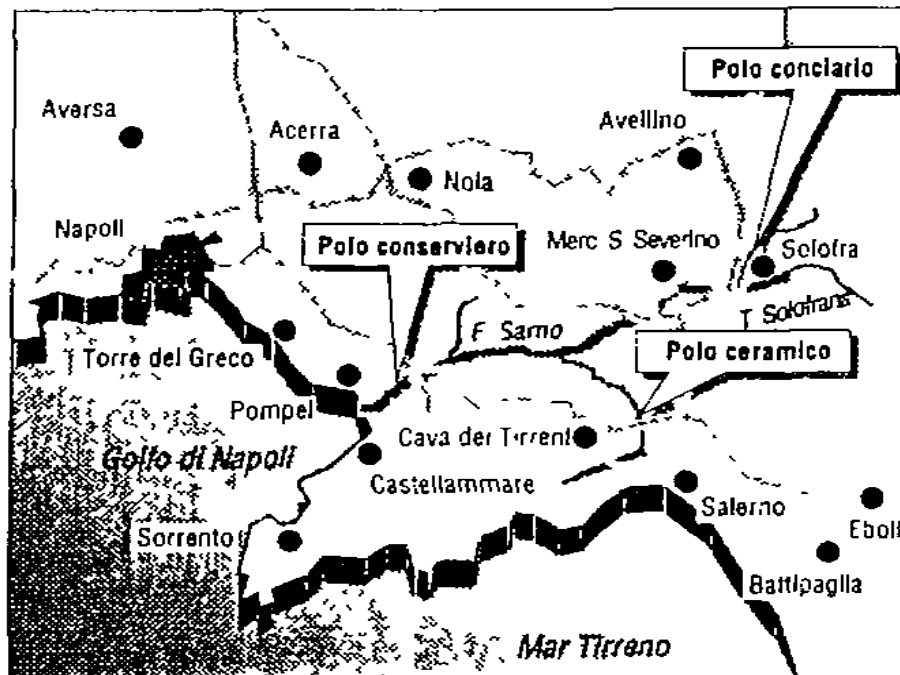
In addition to judicial action, it remains essential, especially with a view to the future, to aim at positive co-ordination between all parties involved in productive activities and in environmental protection; it is vital, regardless of the enormous difficulties involved, that the search for such co-ordination should also be pursued z.s a priority in the Sarno basin.

One hundred cautionary warrants issued in respect of the polluted Sarno

NAPLES - "The inquiry into the pollution of the Sarno is still under way and new sequestrations and new cautionary warrants are expected in the next few days". These were the words of Colonel Antonio Reho, Commander of the Ecological Operations Unit which is co-operating with the Campania police. But the provisional findings of the investigation co-ordinated by the Public Prosecutors of Nocera Inferiore, Salerno, Avellino and Torre Annunziata, have already led to the large figure of 110 cautionary warrants, especially directed at local authorities such as those of San Valentine Torio, Superiore, Sarno and Scafati, Nocera unlawful waste discharges, and at 48 firms which were sequestered for The sequestration was suspended for 40 days as not to bring commercial activity to a halt and give the firms time to fall into line.

The object of the inquiry is the deterioration of the River Sarno, the most polluted river in Italy, which the Italian Cabinet declared an environmental risk area in 1987 and in 1992. For 24 kilometres of its course, the river passes through the industrial centres of the Solofra (Avellino) tanneries, the Vietri (Salerno) ceramic works and the Nocera-Sarno area, the main European centre for the production of tinned tomatoes. Every summer, when the time comes to process the tomatoes, the Sarno turns red. Last year the stain coloured the Gulf of Naples and even reached the cliffs of Capri.

Industrial pollution on the Sarno



"Tomato peel is a product of nature. It does not pollute: at most it stains", protested Pasquale D'Acunzi, President of Anicav, the Italian canned-food industry association. Canneries. The Nocera-Sarno area, with its 120 produces some 15 million quintals and accounts for a sales volume of about Lit 1500 billion. "Three or four firms in our sector are involved in the inquiry, and for matters not relating to the river. For example" - D'Acunzi added - "because their boilers did not conform to the laws on emissions. But how can they conform if the region does not authorise any smokestacks?"

The 150 tanneries (with sales of Lit 1500 billion) also protested. Sari, President of the Solofra Tanners' Association maintains: Angelo large treatment plant. "We have a Severino instead? Why not investigate the plant at Mercato San lire under Law 64. It should have been constructed with tens of

billions of Meanwhile," Sari continued, "since a month ago, the project for the construction of another plant at Solofra has been held up at regional level. It will cost 7 billion lire: we are prepared to advance the funds ourselves, provided that it really is built."

J.G.

Source: "Il Sole 24 Ore", 24 August 1994

The river which rises in the hinterland of Salerno has become a dump for the rubbish and chemicals of forty towns and villages: it is the most polluted in Italy.

110 people accused of poisoning the Sarno

48 firms shut down, sewerage networks sequestered, cautionary warrants issued against mayors and advisers

From our correspondent

Fertilisers, acids and solvents: magistrates tell firms they must conform within a month or go out of business

SALERNO - The water which flows along the bed of the river Sarno simply serves to carry along the rubbish which will end up in the sea. Several hundredweight of tomatoes, animal carcasses, wrecked cars, envelopes and plastic objects of every size and shape poke through the white stinking foam. On the other hand, the real poisons cannot be seen, although they are a fundamental and plentiful ingredient in the cocktail which makes this river of rubbish the most polluted stretch of water in Italy and perhaps in Europe.

The Sarno rises in the hinterland of Salerno and is then swollen by two tributaries before flowing into the sea between Torre Annunziata and Castellammare di Stabia, thus becoming the prime cause of pollution in the Gulf of Naples. It drags with it the discharges of dozens of companies and the inefficiency of dozens of local authorities. Yet the latter will now have to pay the bill. Between Monday and yesterday, the courts have ordered the closure of 48 polluting firms, sequestered the sewerage networks of four towns and sent 110 cautionary warrants to mayors, advisers and prefectural officials in the Nocera-Sarno area.

This river has its share of filth to swallow, and villages on its 24 km journey as it flows through 40 towns. In 1988, environmental activists in Marevivo took on the task of collecting the waste carried along in the water. They set up barriers to filter out the rubbish and after three months they removed 1200 tonnes. Nevertheless, no one has ever been able to weigh the poisons which rush on towards the sea, but even here the range is vast: from chemical fertilisers to the acids and solvents used in the Solofra tanneries, in Irpinia, where one of the Sarno's tributaries rises, followed by the detergents from the many laundries in the area, plus dyes and who knows what else. All these poisons have not only killed the river, but daily infect the air around and pollute the lungs of those living in places like San Marzano or Nocera Superiore and yet this is how it has always been. At the time, the first project to clean up the river dates back to 1969. 130 million lire would have done the job, but nothing was ever done. So the project dragged on for years, practice but becoming ever more inflated without ever being put into Now, to install the seven purification plants needed to put oxygen and life back into not only the Sarno but also its surrounding environment, Lit 500 billion would be needed. The people currently under investigation are not the only ones responsible for this situation. The regional government and other local authorities should have taken action long ago, but they did not do so. only that. Not the Inquiry which is currently being conducted jointly by the public prosecutors of Salerno, first Avellino and Torre Annunziata is not the Two years ago, ten polluting firms were sequestered in Sant'Antonio Abate and after that case, the former Ministers for the Environment, first Carlo Ripa di Meana and then Valdo Spini, gave local government twelve months to put the necessary structures in place to end uncontrolled dumping in the river. That decree was as peremptory as it was cheerfully ignored.

Now, however, it will be difficult to continue to make the Sarno the dustbin of 40 towns and villages. Prosecutor Gian Carlo Russo, yesterday afternoon, Deputy Public who is co-ordinating the Inquiry, lifted the sequestration order on some of the firms which had been shut down. it to avoid bringing production to a halt, as this could have had consequences for the workers. Nonetheless, these firms have little more than a month to put their houses in order, or they will be shut down again. Because

the work of the courts, as the Public Prosecutor of Nocera Inferiore, Felice di Persia, has said, will not stop with the measures which have just been taken and which served, as he explained, "to establish a first level of responsibility. We cannot clean up the river, but we shall continue to leave politicians and institutions with the task of re-establishing the best possible conditions in an ecosystem which has been heavily compromised".

F.B.

[captions]

Public Prosecutor Felice di Persia; a view of the Sarno; and, alongside, police on anti-pollution duty.

source: "Corriere della **Sera**", 24 August, 1994

1. RESEARCH OBJECTIVES

The research objectives were as follows:

- (i) to identify the most significant initiatives taken jointly by industrial firms and other public and private bodies to protect the local environment;
- (ii) to announce the characteristics of four such initiatives which are representative of the range identified during the research;
- (iii) to determine any obstacles to the success of these initiatives and appropriate means of overcoming them.

In the Italian context, these objectives are in fact difficult to pursue. For reasons which will be analysed in Chapter 2, it is only in recent years that firms, especially industrial, have adopted an active approach to environmental protection.

Traditionally, firms had adopted a purely defensive approach, protecting their own interests against sectors of public opinion (environmental groups, some political parties, citizens' and consumer groups, etc) which are more sensitive to the need to clean up the environment.

In practice, they felt their backs were to the wall and this prevented them from taking a positive approach to these problems. In fact, partly as a result of the inadequate controls set up by the relevant public authorities, that approach has led them to continue behaving in a manner that jeopardises the environment.

In recent years, the relationship between firms and the environment has begun to be affected by the following factors:

- (i) the growing attention paid by public opinion and community groups to the state of the environment;
- (ii) the large-scale introduction (driven by the need to conform to decisions taken in Brussels) of environmental legislation and the improvement, however slow, in the effectiveness and above all in the scope of official control;
- (iii) the tendency of recent governments - which has not, so far, produced much in the way of practical results - to adopt a "mixed" approach to environmental questions in which, alongside the traditional "command and control" instruments, there is also a place for new instruments such as the "environmental tax" and self-regulation and voluntary compliance on the part of firms;
- (iv) an awareness that environmentally friendly production processes and products are increasingly becoming a factor in market competitiveness; in this respect, great importance can be attached to the introduction into Italian legislation early in 1994 of the eco-audit and the eco-label (through Law 70/1994)¹

It is worth pointing out that the changed climate referred to above is also the result of the gradual establishment of different relations between all the parties involved in cleaning up the environment.

The seriousness of the problems involved has in fact led the various parties to do their utmost to reach a negotiated settlement of conflicts arising from certain forms of "environmental behaviour". Past experience has indeed shown that inadequate conflict management aggravates environmental damage.

So the attempt to establish co-ordination between the various parties can therefore be regarded as an effective means of overcoming the conflict stage.

¹ The gradual definition, already applied to a great many products, of the requirements for the adoption of the environmental quality label will also arouse greater market interest in eco-friendly products

2. FIRMS AND THE ENVIRONMENT IN THE ITALIAN CONTEXT

2.1 Powers and instruments of control under environmental legislation: general framework

Italian environmental policy can be looked at from two aspects: planning and the implementation of legislation.

As regards planning, the recent "Three-year environmental protection programme 1994-1996", in force since 11 March 1994, has provoked much criticism from experts².

This can be summarised as follows:

- (i) the all-embracing (and therefore general) nature of the objectives;
- (ii) the inadequate public funding and lack of involvement of private resources;
- (iii) the risk that decentralisation of expenditure to the regions will be reflected in the implementation of projects which are not co-ordinated with reference to national or inter-regional interests.

Basically, the plan's critics lament the absence of genuine planning and in particular the fact that the financial instruments are totally unsuited to the new philosophies, including those of the European Community, underlying environmental action.

For example, the principle of making users pay for waste-water treatment and waste-disposal services is now widely accepted; and it is therefore totally contradictory for Italy, in Law No. 36 of 1994 on the reorganization of the water services, to adopt that principle, while the new three-year programme disregards it.

A second aspect worth examining as a means of assessing the policies and the implementation of the relevant legislation is the effectiveness of the controls.

Although there have been signs recently that the trend is changing (see Chapter I), effective controls are certainly not one of Italy's strong points.

The main reasons may be found in the proliferation of rules, the fragmentation of powers and the lengthy authorisation procedures for pursuing activities which are potentially harmful to the environment.

² The "Three-year programme 1994-1996" is the main government planning document dealing with public expenditure on the environment. Its general objectives are as follows:

- improvement of seriously run-down and polluted areas;
- elimination of serious environmental hazards;
- protection and improvement of the country's natural heritage;
- the promotion, activation and development of the public services pursuing environmental objectives.

The plan, which lists the sectors and areas of intervention, is divided into national and regional levels and provides for the allocation, over the three years, of about Lit 3205 billion in the following fields of activity: urban areas; catchment basins and Adriatic Sea; areas at risk; protected natural areas, employment development areas, national territory.

The State allocates financial resources to the regions - in order to carry out public and private initiative projects - on the basis of the selection by the Ministry of the Environment of the projects presented by the regions.

In our system, which contains more than 1400 legislative references to the environment, 50 authorisations have to be obtained from 11 responsible bodies, which often conflict with one another, whilst the total time taken to issue them can be more than 18 months³.

That is why employers are calling for simplified legislation and deregulation of the authorisation system.

In fact, profound changes are occurring in Italian legislation relating to the environmental sector; in January 1994, parliament passed two laws which have significant implications for the environment and major repercussions on the organisation of firms: they provide respectively for the setting up of the National Agency for the Protection of the Environment (ANPA) and simplification of the environmental, public health and safety provisions⁴; and implementation of the system of eco-management and environmental audit⁵.

While the setting up of ANPA has, on the one hand, been a source of puzzlement, for reasons which will be described below, on the other the simplification of environmental procedures is at last a coherent response to certain fundamental corporate requirements. The content of these laws is summarised below.

The setting up of ANPA⁶

Under the decree-law setting up ANPA, the latter was to be a flexible structure which, under the supervision of the Ministry of the Environment, would interact with the other responsible bodies on the basis of criteria clearly defined by law. In the course of the parliamentary debate (concerning approval of the enactment of the above decree-law), the bill was profoundly altered, which led to a substantial redefinition of institutional responsibilities in the environmental sector without linking the new legal provisions with those already in force, despite the fact that these had not even been formally repealed.

The technical and scientific activities assigned to ANPA are as follows:

- the promotion, vis-à-vis the responsible bodies, of basic and applied environmental research;
- the systematic, possibly computerised, collection and publication of full data on the environmental situation, in agreement with the national technical services;
- processing data and information of environmental interest;
- formulating proposals and opinions for the central and local administrative authorities relating to: tolerance limits for pollutant substances; quality standards for air, water resources and soil; the disposal of waste; rules for sampling and for analysing tolerance limits and quality standards; methods of recording the state of the environment and monitoring cases of pollution and risk factors, together with measures to conserve, improve and restore the environment, protected natural areas and the marine and coastal environment;
- co-operation with the European Environmental Agency and the European Communities' Statistical Institute (Eurostat), as well as with international organisations concerned with environmental conservation;

³ See: E. Sassoon and C. Rapisarda Sassoon, *Management dell'ambiente*, Il Sole - 24 Ore Libri, Milan 1993.

⁴ This is Law No. 611/1994: "Urgent provisions on the reorganization of environmental controls and setting up of the National **Agency** for the Protection of the Environment".

⁵ Law NO. 70/1994: "Regulations for the simplification of the environmental, public health and safety provisions and on the implementation of the eco-management and environmental audit system".

⁶ See : V. Cirillo, [Regeneration:"Rinnovamento: tanta voglia, pochi progetti" prime,so much interest, so few projects], *Energia e materie* No. 95, 1994.

- promoting research and the dissemination of environmentally friendly technology, of low environmental impact products and production systems, with reference also to eligibility for the EEC ecological quality label and to environmental auditing activities;
- verifying whether regulatory provisions regarding the environment are appropriate and technically effective and checking the technical documentation accompanying requests for authorisation required by the environmental laws in force;
- monitoring the physical, chemical and biological factors of noise, air, water and soil pollution, including those relating to environmental health;
- technical and scientific support for the bodies responsible for assessing and preventing the risks of major incidents connected with productive activities;
- monitoring environmental activities connected with the peaceful use of nuclear energy and controls with regard to protection from radiation;
- technical and scientific studies and activities to back up and support environmental impact assessment;
- any other activities relating to its environmental remit.

In order to carry out these technical and scientific activities, the law provides for the creation of a national agency and regional and autonomous-province agencies which in their turn are divided up into provincial technical structures.

As can be seen, apart from its monitoring powers, ANPA has a wide variety of tasks assigned to it, that are often general and introduced without repealing or amending the provisions which already give analogous powers to other bodies. In the case of the regional agencies too, the law provides that they must co-operate with ANPA, to which they must give technical support at its request within the framework of specific agreements concluded between ANPA itself and the regions; this could give rise to confusion about the criteria for co-ordination between the national agency and the regional agencies, which will retain, *inter alia*, their technical, legal and administrative autonomy and come under the supervision of the regional or (in the case of the autonomous provinces) provincial councils.

Simplifying environmental provisions

Firms fulfil all obligations to declare, communicate, report or notify provided under the existing environmental, health and safety regulations **by** compiling a single declaration form to be forwarded to the Chamber of Commerce with which the individual firm is registered; the Chamber of Commerce also ensures that the form is passed on to all the various authorities responsible for environmental matters.

The system makes it possible to simplify the monitoring procedures, to carry out statistical analyses on a national, territorial and **sector-by-sector** basis and to assess the actual environmental impact of the various productive activities at national and local level. The law identifies, for a transitional period, the first legal provisions and implementation measures whose requirements may be satisfied by means of filling in the single form (these include Law 319/1976 on water).

With regard to laws subject to the declaration procedure, the new regulations radically change the position of firms *vis-à-vis* the public administration. From now on, the latter will be putting precise questions to firms using the standardised and simplified procedure to which the firm must respond by filling in a form.

For the firm, completing the form also acts as a kind of self-certification of the characteristics of its own productive processes, although the administration still has the power to carry out inspections.

The same law provides for a definition of measures to implement the recent Community regulation (No. 1836/1993) which will enable Italian firms to take part in the Community's eco-management and environmental audit system and thus to enjoy the benefits linked to the certified grading of their own production process.

2.2 Recent trends

Over the past year, the problems of environmental protection have become intertwined in Italy with those of combating unemployment.

Two particular questions are being looked at in the debate: how to use the proceeds from the introduction of environmental taxes to create jobs; and the launch of projects involving the use of workers receiving unemployment benefit in environmental improvement initiatives.

Environmental taxes and employment

The impetus in the first case came from the proposal by the Commission of the European Union of a tax designed to reduce CO₂ emissions by 4% and which should amount to about 1% of gross domestic product (energy/carbon tax).

This tax should have the following characteristics:

- (i) it should be a "zero sum": the additional revenue would be returned to the economy in the form of other tax cuts;

it should be aimed at increasing employment by encouraging a reduction in the social security contributions paid by firms for their workers.⁷ On the question of using economic means to achieve environmental protection, Confindustria (the leading industrial association) takes a different position from Legambiente (one of the main environmental associations).

The latter maintains that a three-sided relationship must be created between taxation, the environment and employment.

In particular, polluting products and production processes must be taxed as an incentive to opt for clean technology: this tax should be offset by an equivalent cut in other deductions, especially the heavy employers' social security contributions affecting the categories of lower-paid employees.

In this way, the overall burden on taxpayers would remain unchanged, the variation in market prices resulting from the new taxes would act as a disincentive to pollution and labour costs would be reduced, leading to the creation of new jobs.

Confindustria, however, is opposed to such a tax, believing it risks creating inflationary pressure, and favours tax incentives for environmentally friendly production. Furthermore, according to industrialists, the way to avoid distorting competition, which might for example have unfavourable consequences for the industry of a particular country, solutions will have to be found to environmental and employment problems on a European scale at the very least.

Environmental improvement and employment

The second subject highlighted above was involving workers from firms in crisis in environmental improvement projects.

In the course of 1993, the emergence of a number of crisis points in the industrial structure of the country led to the government adopting provisions to protect employment based on the performance of socially useful work.

The most significant measures relate to Law 236 of 1993 and the task force set up by the Prime Minister's office.

The first provision identified "employment and environmental development areas" in the Mezzogiorno where measures would be taken to create new jobs in the fields of: waste management,

⁷ A study by the Directorate for Economic Affairs of the Commission of the European Community, published in May 1994, also points to the beneficial effects on employment of cutting employers' social security contributions. It finds that "a consistent reduction in the contributions paid for less-skilled workers would increase employment for this category by 12%; the overall increase would be 2%". According to the study, the fall in revenue could be financed by introducing a tax on energy which, compared with rises in VAT or direct taxes, should make less of an impact on inflation.

management of water resources, conservation and enhancement of the natural environment (measures already defined and funded under Law 305 of 1989, approving the first three-year environmental programme).

The decision to set up a steering committee for employment policies (known as the task force), co-ordinated from the Prime Minister's office, followed from the agreement between the government, the employers and the trade unions of 31 July 1993. The duties of the task force include those of identifying the more acute crisis areas in which to intervene on the basis of criteria such as social and institutional consultation, co-ordination of central measures and preparing effective ad hoc instruments.

Once the programme areas and related agreements, infrastructural measures and public investment, and possibly also the sponsors (local employers), have been identified, there is a possibility, in certain particularly critical situations, of resorting to a person responsible for putting the programme itself into effect, who can act as intermediary and guarantor between the Prime Minister's office and the local institutions. In this respect, it is useful to look at the first assessment of the task force's activities, drafted by the European Research Institute (CER) in July 1994.

Since last autumn, the task force has concentrated on certain types of intervention:

- Crisis areas - 33 areas have been taken into consideration: 10 in the north, 1 in the centre and 16 in the south. Not all the "depressed" areas were considered by the task force, which also worked outside, the areas coming under the ELI's Objectives 1 and 2. In most cases, the employment strains were due to processes of restructuring of basic sectors and the reorganization or privatisation of public enterprises. The CER report examines the legislative and financial support provisions, which the task force defines on a case by case basis in order to back up the action plans.⁸
- Redeployment agencies and sponsorship consortia – in 29 situations supportive action was taken by various redeployment agencies: consortia are planned in 10 crisis areas, GEPI (public body for industrial management and participation) has been involved in 9 areas, SPI (industrial promotion company - IRI Group) in 6 and ENISUD in 4.
- Corporate crisis - the preliminary investigations looked at 34 cases (between September 1993 and April 1994). The CER survey makes it clear that the major difficulties are concentrated in mature (22 cases) or basic (6 cases) sectors; moreover, as regards the cause of the difficulties, a little more than half the firms were within crisis areas where there was a reciprocal influence between industrial decline and the crisis facing large firms. For 47% of firms, the crisis was almost exclusively financial in nature.

As regards the pattern of financial resources mobilised by the task force, contributions from private sources - even if accompanied by public funding - seemed an objective worth pursuing, especially in cases where the crisis had financial connotations. The main activity was mediation with the banks in the search for the best solutions. In 23 cases, out of 34 in all, private resources were "mobilised", while in 5 others programme agreements were reached.

2.3 Possible lines of action⁹

Sustainable development requires activities and instruments for insulating production cycles from the external environment; energy saving; improving the quality and extending the life of products.

Instruments

There is a wide range of instruments and mechanisms which can be used to guide and direct economic and environmental policies towards sustainable development, making them mutually compatible and supportive.

⁸ The record is held by Naples, where 11 instruments were used.

⁹ Ministry of the Environment Commission for the global environment, Proposta di piano nazionale per lo sviluppo sostenibile in attuazione dell'agenda XXI, Rome 1994.

There is a recognised advantage in simplifying and defining more clearly the administrative and regulatory instruments, as well as the responsibilities they assign, by assembling the large body of existing environmental legislative provisions into an Environmental Consolidation Act. In this context, primary importance must be attached to:

- the adjustment of obsolete or weak regulations, particularly those on discharging industrial waste into watercourses and on the impact on the soil and groundwater of underground reservoirs of fuel and other liquid chemical substances;
- the strengthening and adjustment of operational structures (including ANPA referred to earlier) in order to implement and impose the regulations and national guidelines and to monitor their application and where appropriate adapt them to local situations.

Economic and market measures will be carefully reviewed, in the light also of recent international experiences. The Community is currently discussing the issue of re-balancing the tax system in such a way as to encourage economic recovery on the one hand and penalise products with a serious environmental impact on the other. The following are some of the main market mechanisms in question:

- direct eco-taxes (correlated with the measured or calculated quantity of process emissions, effluent and waste) and indirect eco-taxes (on goods and services associated with environmental damage during their life cycle) and tax relief (as incentives for installing pollution-reducing equipment using production methods and products more favourable to the environment);
- financial subsidies to encourage the reduction of pollution or finance the measures required to that end (grants, low-interest loans, tax relief, refund of deposits, etc);
- market intervention (tariffs, fees, environmental damage insurance, emission permits, etc).

Other instruments can accompany these, with a view to integrating environmental and economic policies, among which priority must be given to the following in order to bring about that change of attitude required for an effective strategy of sustainable development:

- information, training and environmental education to encourage better consumer choices and increase public confidence in industrial controls and product quality;
- programme agreements between the public administration and firms to limit the environmental impact and risk of their activities and ensure sound management of natural resources;
- developing product standards, partly in order to avoid distorting market competitiveness;
- the adoption of suitable precautions to ensure that industry does not use the simplification of then administrative procedures required to comply with environmental legislation as an opportunity to bypass or evade it.

Action

The action to be taken can only be outlined in terms of priority and relevance to sustainable development, but feasibility and cost-effectiveness need to be assessed and concretely defined at a further, essential decision-making stage. Bearing in mind that some of the instruments referred to earlier can also come under the heading of action, the priorities are as follows:

- the reduction of industrial emissions of acidifying pollutants and greenhouse gases (especially sulphur dioxide, nitrogen oxides, volatile organic compounds and carbon dioxide) and of heavy metals (in particular, cadmium, chromium, mercury and copper);
- the prevention of industrial risk with special reference to chemicals and the petrochemical industry and to industries and commercial activities which use organic solvents;
- the promotion of clean and cost-effective technologies and products;
- the management of dangerous and harmful chemical substances;

- management of the disposal at the end of their life cycle of motor vehicles and parts thereof;
- reduction of the impact on the environment and the landscape of quarrying activities;
- the encouragement of research and development relating to environmentally friendly products and production methods.

2.4 How firms approach the environment

As we saw earlier, corporate attitudes towards environmental matters are changing.

This can be put down to various factors: regulations, market trends, corporate image, etc.

Environmental legislation is undergoing change and, most importantly, it is changing in the direction of self-regulation on the part of the firms.

One example of this, described in Section 2.1, is the incorporation of eco-audits into our system and the introduction of the "green form", i.e. of a single document bringing together all the environmental declarations firms have to make.

Thanks mainly to the certification of product quality (the "eco-label" was also introduced into Italy in 1994), the market is increasingly receptive to eco-friendly products.

Being "green" gives firms a favourable image, which boosts their competitiveness.

Self-certification of observance of the legislation, moves towards environmentally friendly processes and products, improvement of the firm's own "environmental image": these seem to be the trends of the new corporate environmental approach.

It is clear, however, that the central issue for firms, especially in the short term, remains the costs linked to observance of environmental standards and hence the acquisition of equipment, the adoption of new technologies, etc.

These are costs which, even if offset by the benefits deriving from the eco-audit (elimination of prior checking and reduction in the time taken to issue authorisations) and a share of the "green market", will be difficult to absorb - again in the short term - in the absence of adequate State incentives.

In this context, great importance can be attached to the awareness campaigns carried out by trade associations with reference to the need for firms to become more "educated" about environmental problems and the promotion of "instruments to overcome the concept of 'constraints', of 'command/control', in order to move towards a system which gives a central role to prevention and to emergency measures and which places more emphasis on the contribution of firms and citizens".

These same associations hope that "...in the field, organisations will be set up which will ensure not only effective interaction between the public and the private sphere at every stage of the project process, but democratic participation in the decision-making process of all the social partners involved"¹⁰.

It might be interesting, at the end of this summary of corporate environmental behaviour, briefly to set out the findings of research into managerial models of environmental management carried out by the Catholic University of Milan in 1992¹¹.

Interview with 16 firms (out of 30 consulted) showed that:

- the environment was regarded as a critical success factor and they recognised its pervasive nature;
- the majority of firms considered it important to have a "green image" or to acquire it in the near future;

¹⁰ M. Martinelli (President of the Commission on economic relations between young businessmen) in "Ambiente - impresa: dalla cultura del vincolo alla cultura del progetto", *Quale impresa*, No. XII, 1993 (P.7).

¹¹ Quoted in E. Sassoon and C. Rapisarda Sassoon, *op cit.*

- the attractiveness of green markets was still only partial, but growing; however, a polarisation was emerging between firms which already exploited their potential and those which did not regard them as having any influence;
- insistence on suppliers' compliance with environmental requirements is still weak, but growing;
- the main constraints on the adoption of environmental strategies are first economic (investments and costs) and then technological.

3. THE SELECTION OF CASE STUDIES

3.1 Appraisal

Within the context analysed above, a preliminary appraisal was carried out with a view to selecting case studies.

Areas at high risk of environmental crisis

First of all, the appraisal looked at "areas at high risk of environmental crisis". From a territorial point of view, the distorted urban and industrial growth of recent decades has in fact produced situations of serious environmental degradation, especially in these areas (See Table 1):

The term is applied to certain areas plus, where appropriate, adjacent stretches of sea, characterised by wide-scale and profound changes in their ecological balance involving serious risks to health and the environment, which the Cabinet has declared as such. The declaration (valid for a maximum of five years) sets out the objectives of the clean-up operation and the deadline and guidelines for drawing up a plan to identify the emergency measures necessary to remedy the risk situations and restore the environment of the area in question.

The plan must also define the methods, criteria and measures for co-ordinating the ordinary expenditure of the state, the regions and the local authorities on carrying out the proposed action.

Table 1 Areas at high risk of environmental crisis in Italy

High-risk areas	Regions in question
Lambro-Olona-Seveso rivers *	Lombardy
Bormida valley*	Liguria-Piedmont
PO river (Polesine)	Veneto
Conoidi	Emilia-Romagna
Burano - PO di Volano*	Emilia-Romagna
Orbetello lagoon	Tuscany
Massa carrara	Tuscany
Sarno river	Campania
Province of Naples*	Campania
Sulcis-Iglesiente	Sardinia
Manfredonia	Puglia
Brindisi	Puglia
Taranto	Puglia
Gela	Sicily
Priolo-Augusta	Sicily
Livorno**	Tuscany
Genoa**	Liguria

* expired, renewal in progress

** in the course of declaration

source: Ministry of the Environment, 1994-96 three-year environmental protection programme, 1994

At present, there are 17 declared "at risk" areas, of very different types; in fact these may involve all or part of large urban regions (such as the province of Naples or the hinterland of Milan) or specific situations of degradation and environmental risk (as in the case of the urban centres of Massa Carrara and Manfredonia).

The clean-up plans are put forward by the Ministry of the Environment in agreement With the region concerned and at present they are at various stages of implementation; public finance is available for planned operations to be distributed on the basis of "programme agreements" with the regions.

The central/southern area

The appraisal therefore covered the central-southern regions of the country for reasons connected with the territorial distribution of the firms and the effects on them of the current economic crisis. From preliminary contracts established with the Foundation, it emerged that it should also cover the environmental behaviour of small and medium-sized enterprises (SMES), given the serious employment problems facing them.

From that point of view, it seemed that the central/southern area of Italy was the most significant observation point: broadly speaking, one could say that the SMEs most hard hit by the crisis are located in that part of the country; in the north, by contrast, the crisis mainly affects large firms and the "mature" manufacturing sectors (cars, mining, chemicals, etc).

Having made this selection, it gradually became clear from the analysis that there were some extremely serious environmental and employment situations (often combined): over them past decades, in many central-southern areas, the environment has been regarded as a zero-cost production factor, which undoubtedly encouraged the development of heavily polluting processes.

We must take account of the fact that environmental degradation - like the decline of the social fabric and production apparatus - has taken place in the "absence of the State", a term used to describe the lack of diligence of state officials who, in practice, have more or less entirely given up checking on compliance with legislation.

Of course, this also applies to the laws and regulations relating to environmental protection and conservation.

However, since a few years ago, stricter environmental constraints and controls (due largely to the Italian Parliament's incorporation of Community legislation), have been making it increasingly difficult to follow the "old" production methods.

The current situation, on which our research is based, can therefore be described as follows:

- (i) it is increasingly necessary for firms to take account of environmental constraints;
- (ii) there is an increasing shortage of public financial resources for cleaning up the environment;
- (iii) the harsh European and national economic climate has seriously affected employment.

In this difficult situation, there are nonetheless signs of behaviour which could help to improve relations between the firm and the environment:

- (i) the gradual recognition on the part of firms that it is useful to try to clean up the environment, both in order to improve their own market image and to benefit from the contributions or facilities granted by the state¹²;
- (ii) the tendency of firms to associate and group together in order to carry out environmental improvement projects, either in place of OL integrated with those funded with public money;
- (iii) the fact that the central government, trades unions, firms and the regions are drawing up programmes and projects for using surplus workers in environmental improvement schemes, as a means of pursuing environmental and employment objectives at the same time.

3.2 The selection criteria

On the basis of the appraisal, two types of case were therefore selected:

¹² This applies in particular to firms operating in "areas at high risk of environmental crisis", on the basis of decrees by the Ministries of Civil Defence and of the Environment.

- (a) those which seemed worth studying in the field because of their environmental and productive context and, above all, because of their interdependence;
- (b) those it seemed useful to single out in order to show the variety of ongoing initiatives.

The "a" type cases (see Fig. 1), analysed in Chapter 4, include the following:

- (1) fishing and fish-farming in the ecosystem of Orbetello lagoon (province of Grosseto, region of Tuscany);
- (2) the agricultural produce industry in the river Sarno basin (province of Salerno, region of Campania);
- (3) the Solofra tannery centre (province of Avellino, region of Campania);
- (4) the tuna processing industry (province of Vibo Valentia, region of Calabria) .

As will become clearer below, the effects of cases 2 and 3 are in effect both felt within the Sarno basin and, consequently, in the Gulf of Naples area.

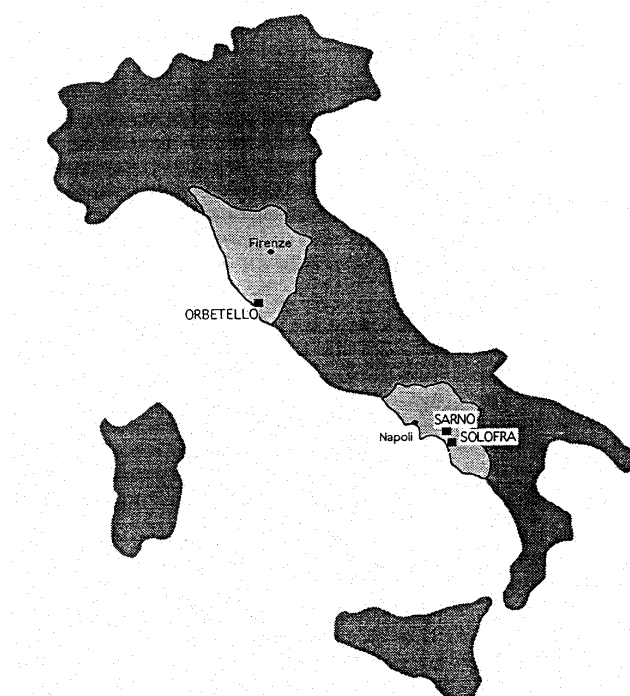


Figure 1 Sites of case studies

In addition to the waste water from the canning industry, waste water from the Solofra tanning industry flows into the river via a tributary.

Two case studies located in the same catchment area were selected because of their specific natures: there were different causes and degrees of seriousness of the forms of pollution: and the scope of the ongoing and planned initiatives to reduce that pollution was different. More generally, the selection of two cases in the Sarno basin, i.e. in Campania, was intended to draw attention to the very serious state of an area and a river which can be regarded as symbolic of a region in which environmental degradation is perhaps the worst in Italy.

There are many "b" type cases, of which it seems useful to single out: the Fare project (Fiat Auto Recycling) to recycle scrapped cars; monitoring the quality of the air in the Augusta-Priolo petrochemical complex in Sicily; the disposal of vegetation water from the olive presses in Basilicata; the programmes for environmental restoration and absorption of unemployed workers in the Sulcis-Iglesiente area (in Sardinia); the action taken by the Trani District Court and Legambiente against the marble industry which discharges inert processing waste along the stretch of coastline near Trani, together with the improvement plan put together by the Commune, Bari province (Puqlia region) and Assindustria as a result.

With reference to the activities carried out in the Italian Mezzogiorno, one can also cite the "waste oil consortium", set up by Presidential Decree 691 of 1988, to which every firm of whatever size and nature that obtains waste oil must consign it. The consortium, made up of oil regeneration firms and those which market crude and refined lubricant oils on a national scale, has now been operating for some years with a collection service.

4. THE CASE STUDIES

4.1 The problem of water treatment: legislative framework

The formulation of organic legislation on protecting water from pollution is still at a fairly recent stage in the Italian legal system: the first "exhaustive" law on water is No. 319 of 1976. Its object is the "control of discharges of all types, public and private, direct and indirect, in all surface and underground, inland and marine waters, whether publicly or privately owned or in sewerage systems, on the surface and underground".

The basic content of Law 319/1976 can be deduced from Table 2 and Fig. 2.

Table 2 Powers of the central and local public administrations with regard to waste water

State powers:
<ul style="list-style-type: none"> • policy and co-ordination of functions;
<ul style="list-style-type: none"> • determining the limits of acceptability (shown in the relevant tables) and consumption standards (for saving and salvaging purposes);
<ul style="list-style-type: none"> • preparing criteria and methods for recording the features of the water, updating and forming water registers;
<ul style="list-style-type: none"> • drawing up a general water plan on the basis of regional plans;
<ul style="list-style-type: none"> • indicating criteria and methods for the correct use of water;
<ul style="list-style-type: none"> • defining general technical standards (regulations on sewage; methods for the installation and operation of waterworks, sewerage systems and treatment plants; disposal of residual sludge from processing and purification).
Regional powers:
<ul style="list-style-type: none"> • drafting the regional water improvement plan;
<ul style="list-style-type: none"> • co-ordinating the activities of the local authorities (provincial and communal);
<ul style="list-style-type: none"> • recording the quantitative and qualitative features of the waters in this territory;
<ul style="list-style-type: none"> • issuing legislation integrating and implementing that of the state.
Local authorities' powers:
<ul style="list-style-type: none"> • Provinces: register of public and private discharges in surface waters and checking the application of the general criteria for water management.
<ul style="list-style-type: none"> • Communes : technical control of public and private discharges as regards the limits of acceptability; checking observance of the acceptability limits of public sewerage systems; installation and management of sewerage systems and purification plants and recording the state of the waterworks system.

Source: Law 319/1976

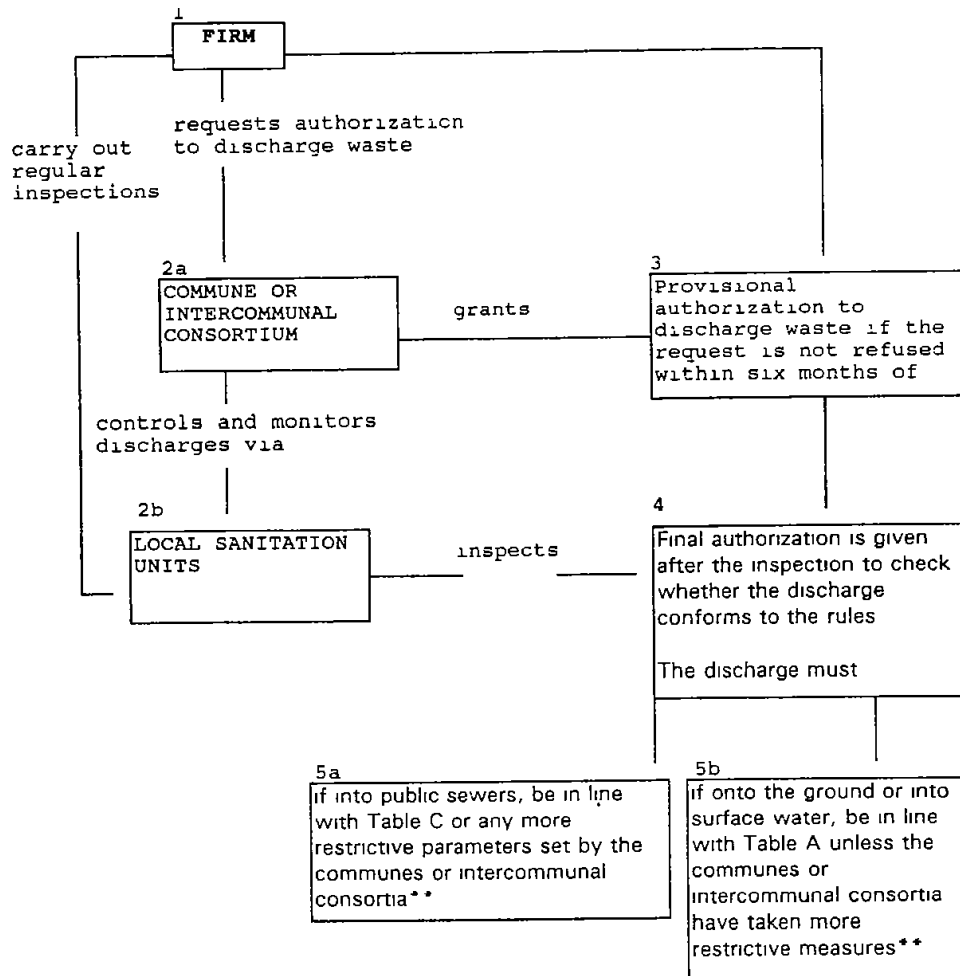


Figure 2 Procedures for issuing authorisations related controls

(Law 319/1976, Art. 9 subpara 6)

* The authorisations are renewed in the event of a change of destination, or the enlargement or restructuring of the productive installation.

** The local sanitation units can request pre-treatment of waste containing the substances listed in Point 10 of Tables A and C (see Annex 2).

The subsequent law, No. 650/1979, brought modifications to No. 319/1976 and called on the regions to define the system of controlling waste in public sewerage systems when they draw up their regional water treatment plans as required by Law 319/1976.

This last law stepped up the production of "water" legislation; however, the framework remained very fragmented: the quality of sea water and groundwater; the coastal, fluvial and humid ecosystems; and the use of freshwater and sea water come under different, autonomous rules.

It would be too cumbersome to list all the provisions on the protection and utilisation of water resources; it should be noted, however, that Law 319/1976 is still the main legislative reference point in force.

Recently, Law 3611994 was adopted, by which legislation it is intended to bring about an organic and comprehensive reorganization of the water services; in fact, the distribution of powers between central government, the regions, provinces and the communes has not changed substantially in relation to Law 319/1976.

Similarly, in the case of water treatment, Law 36 does not substantially alter the provisions of Law 319/1976¹³; Article 11 concerns the duties of the communes and provinces, in particular the surveying of water supply and distribution, sewerage and treatment operations, defining procedures and methods, some on a multi-year basis, with a view to determining the content of the agreement to be reached with the managers. Under the same law, the local authorities must also prepare a programme of necessary measures, accompanied by a financial plan and a management and organisational model.

Law 36 also refers to the authority responsible for the basin (defined by Law 183/1989¹⁴). The latter does not replace other agencies (for example those responsible for managing drinking water or for controlling discharges), but exists side by side with them, thereby complicating instead of simplifying the management of the system.

In fact, Law 183/1989, approved after a gestation period of more than twenty years, should have brought about the unification of the sector-specific legislation on the water cycle given that, de facto, the Basin Plan introduces environmental planning into the Italian legislative system.

The Basin Plan is in fact the "cognitive, regulatory and technical operational instrument for planning and programming the activities and standard regulations designed to conserve, protect and improve the soil and ensure the correct utilisation of water, on the basis of the physical and environmental characteristics of the area in question".

While the report was at the final editing stage, a decree-law (No. 449 of 15 July 1994) was issued, introducing several modifications to Law 319/1976; in fact, this was widely criticised by public opinion and experts in the sector.

The main changes concerned the procedures for the authorisation of waste disposal and the removal of the penalty for non-observance of the limits fixed by the above law. Parliament will now have to decide, no later than 60 days after the date of issue, whether or not to enact the decree.

4.2 Fishing and aquaculture in Orbetello Lagoon (Tuscany)

4.2.1 Case study profile

This case study concerns the initiatives for cleaning up the Orbetello lagoon, which is seriously affected by eutrophication.

This situation is the result of the discharge into the lagoon, at an increasing rate in recent decades, of domestic and industrial waste water.

Although located between the coast (included in the commune of Orbetello) and the Monte Argentario headland (corresponding to the commune of the same name), the lagoon receives pollutants almost exclusively from the inhabited areas of the Orbetello commune.¹⁵

After the lagoon was declared an "area at high risk of environmental crisis", a decision endorsed by the Government in 1993, a programme of urgent measures was drawn up to be carried out by the first half of 1995.

In this context, it is very interesting to note the undertaking given by the fishermen's co-operative which operates in the lagoon to collaborate with the commune in environmental clean-up activities.

¹³ Recently amended, as we shall see below, by Decree-Law No. 449 of 15 July 1994.

¹⁴ Law 183/1989, "Rules on the organizational and functional restructuring of the protection of the soil", defines the catchment basin as an indissoluble physical unit within which, on the basis of a unitary approach and criteria, measures to protect water and the soil must be implemented in line with uniform technical concepts (Basin Plan).

¹⁵ The communes of Monte Argentario and Orbetello form part of the province of Grosseto in the region of Tuscany.

The further decline in the hygiene and health situation as a result of the fermentation of algae - especially during the summer season - could cause serious economic damage to tourist activity, which is fostered by the natural and archaeological resources found near the lagoon (Monte Argentario headland, Marimba Nature Reserve, remains of the Etrusco-Roman city of Cosa on the hill of Ansedonia).

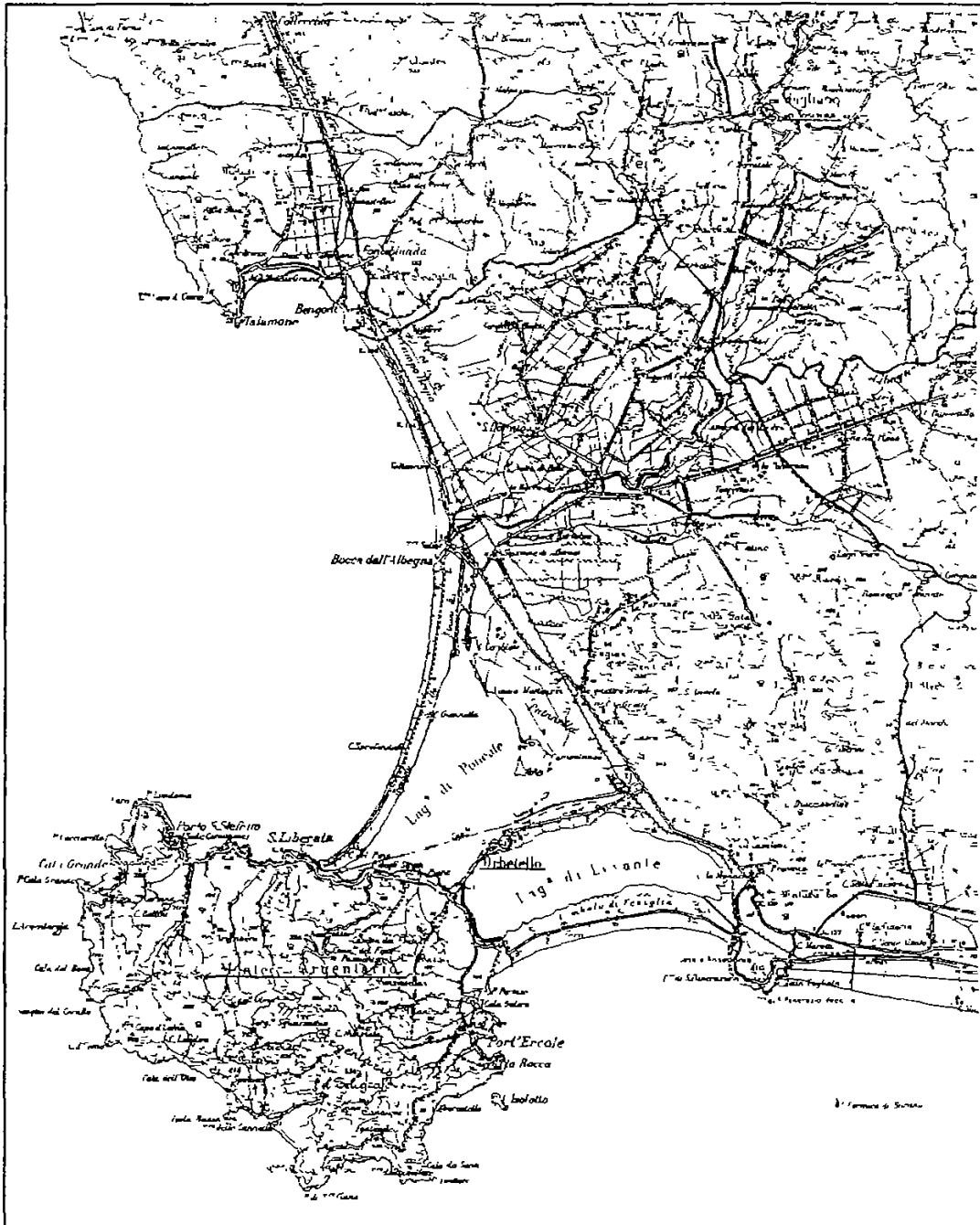
4.2.2 The environmental, residential and industrial context

Resources and the 'disease' of the lagoon

Geomorphology, hydrology, flora and fauna

Orbetello lagoon is situated along the southern coast of Tuscany, in an area noted for its important natural heritage and unspoilt by major urbanisation.

Located between the coast and the Monte Argentario headland, the lagoon is a few kilometres away from the Maremma Nature Reserve, 100 km² of Mediterranean bush frequented by wild cattle and migratory waterfowl (see Fig. 3).



Source: Military Geographical Institute

Figure 3 Orbetello lagoon and the Monte Argentario headland in a territorial context (indicative scale 1:125 000)

The lagoon (or, to be more precise, the great coastal pool¹⁶) extends over 26 km² and is bounded to the south-west by Monte Argentario, to the north-east by the Giannella bar and to the south-east by

¹⁶ The bottom of the "lagoon", situated at an average depth of 1.5 m, is flat and has none of the natural channels or morphological features (such as sandbanks or high-tide mark,, etc) which depend closely on the ebb and flow of the tides and are peculiar to lagoons. This is in fact a typical characteristic of coastal pools, that can be distinguished from lagoons by the absence of any pronounced tidal activity which would clearly determine the morphology, hydrological regime and sedimentological features. On this basis, the term "lagoon" is obviously unsuitable for a coastal ecosystem such as that at Orbetello, which clearly comes under the category of coastal pools

the Feniglia bar; the Orbetello isthmus and its artificial extension as far as Argentaria divide it into two parts: the western lagoon and the eastern lagoon.

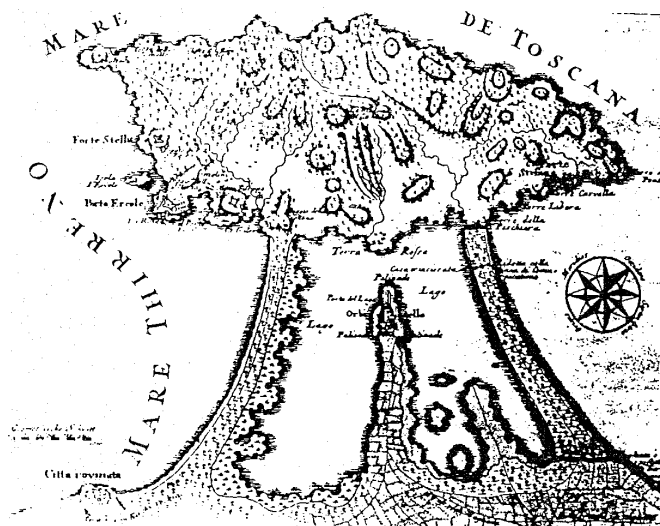
The genesis of this lagoon is the result of a Slow evolution which reached its present state (see Fig. 4) only in historical times, with the formation of the Giannella bar (about 400 years ago). The exchanges of water between the lagoon and the sea and the mouth of the river Albegna take place via three channels (see Fig. 5): Nassa (situated in San Liberata, connecting the western lagoon with the sea), Fibbia (links the western lagoon with the mouth of the river Albegna) and Ansedonia (links the eastern lagoon with the sea).

All the channels are equipped with sluice-gates to check the flow of water into and out of the lagoon; moreover, water-pumps have been installed in the Ansedonia and Nassa channels which are activated at moments of crisis to force sea water into the lagoon, an effective if very expensive remedy.

The brackish lagoon waters, asphyxiated and frequently malodorous, are the site of fish-farming and urban waste dumping and there is an excessive proliferation of algae leading to frequent incidents of high fish mortality: this happens mainly in the summer because of lack of oxygen and an excess of H_2S .

The Ministry of the Environment has identified the following causes of the current pollution¹⁷:

- "external pollutant inputs, consisting of waste water discharged directly into the lagoon and originating from residential settlements, tourist activities and intensive aquaculture installations;
- internal pollutant inputs, consisting of the release into the water of pollutant or nutrient substances already present in the lagoon-bed sediments or resulting from processes of decomposition taking place there;
- the inefficient water exchange between the lagoon and both the sea and the river Albegna and the limited internal water circulation as a result either of operations relating to fish-farming activities in the lagoon, which have caused increasing isolation of the lagoon waters, or of the natural silting up of the sea outlets of the channels within the lagoon".

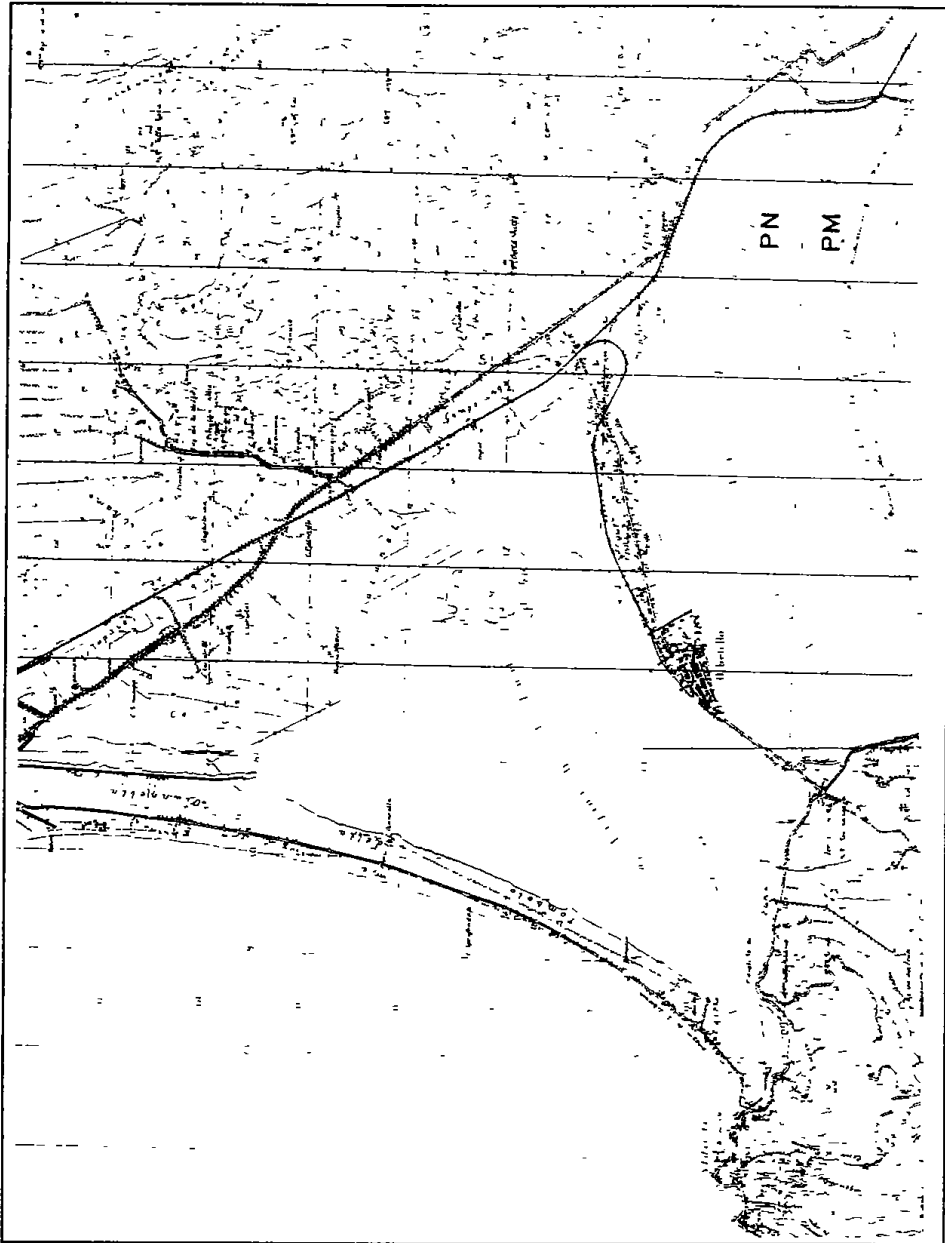


Source: Curioses Staats und Kriegs Theatrum in Italien, Gabriel Bodenehr Kupfferstecher, Augsburg

Figure 4 Old engraving of Orbetello lagoon (16th-17th Century)

(L.Naviglio and I.PratiSi, Risanamento ambientale della laguna di Orbetello. Sintesi delle ricerche effettuate dal 1987 al 1990 sulla fknologia e sulla biomassa della vegetazione macrofitica, ENEA, 1992).

¹⁷ See the Annex to the Ministry of the Environment Decree of 2 April 1993 defining "areas at high risk of environmental Crisis".



Source: Military Geographical Institute

Figure 5 Orbatello lagoon (indicative scale 1: 40 000)

In the Ministry's view, a further decline in the situation could lead to:

- "damage to fishing activity in the lagoon;
- damage to the tourist economy because of interference with the quality of the bathing water along the coastal strip overlooking the lagoon;
- the overall decline in the ecological, natural and scientific interest of the biotope, with particular reference to its typical characteristics of "biodiversity".

Although degraded, the natural environment is still fairly diversified: little islands of mud emerge from the brackish water of the lagoon, covered in marsh plants, in which many species of birds build their nests¹⁸. The vegetation consists of: Mediterranean bush, a few pines left over from past afforestation, hygrophilous woods and cork oaks, an abundance of reed-beds, crops and pasture. Typical patches of glasswort (resistant to the high saline level) and heather grow at the edge of the bush; Orbetello is the furthest south that the latter, a relic of the original heathland, can be found near the sea.

There are many animals, sustained by the biological wealth of the lagoon: fish, turtles, the mammals most commonly found in the Tuscan Maremma (foxes, weasels, badgers and porcupines) and many species of birds which also require protection (little egrets, black-winged stilts, flamingos, mallard, stone curlews, and so on).

Part of the Orbetello lagoon (in the western sector) has been included in a World Wildlife Fund sanctuary since 1971 (the lagoon occupies about 300 of the 800 hectares of sanctuary); moreover, it was declared a wetland of international importance by Ministerial Decree of 9 May 1977: "Declaration on the international value of the wetland area known as Orbetello Lagoon (northern part) under the agreement on wetland areas of international interest, especially as a habitat of waterfowl, signed in Ramsar (Iran) on 2 February 1971 and ratified by Presidential Decree NO. 448 of 13 March 1976".

The characteristics of the main productive activity: aquaculture¹⁹

From an environmental point of view, the establishment and development of Italian aquaculture should respect the following conditions:

- production techniques must be used whose waste does not damage the environment;
- aquaculture must not lead to the squandering of water resources but be integrated "positively" in the water cycle;
- in brackish end marine environments, aquaculture must be closely integrated and compatible with the ecosystems in which it is practised.

Being aware of the theoretic validity of these conditions and of the difficult environmental situation in which it is actually working, the Italian aquaculture industry is beginning to take notice of the environmental problems, providing (or suggesting) effective solutions to them.

From an environmental point of view, a careful distinction must be drawn in aquaculture between "natural" production systems, which manage the water and nutritional resource⁸ of ecosystems, and intensive farming which, by various means, uses water as a basis for a process of turning enriched foods, brought in from outside, into an economically more valuable food product.

Of course these two systems can be combined in integrated strategies which, if correctly proportioned, can resolve, if only in part, the problem of the disposal of waste water, and even help recover energy.

¹⁸ This year, flamingos built about 30 nests in the vicinity of the World Wildlife Fund sanctuaries the Orbetello lagoon is their only nesting site in continental Italy (the other is in the Molentargius pond in Sardinia).

¹⁹ The term fish-farming is really more appropriate than aquaculture because only fish are involved.

The intensive strategies must, however, fit in harmoniously with environmental policies, especially as regards waste water.

The environmental impact of intensive aquaculture is mainly attributable to two sets of causes:

- uneaten feed and feed dust, incompletely digested components of the diet, products of catabolism;
- disinfectant, biocidal and scale-removing products, antibiotics, antiparasitic and bacteriostatic products.

The direct and indirect action of the discharged products can be summarised as:

- toxic action with acute effects (products such as ammonia, nitrites, anoxic water, products released by the anaerobic bacterial flora of anoxic sediments);
- toxic action with chronic effects, bioaccumulation, bio-abundance eco-toxic action (low-concentration toxic agents);
- biological oxygen demand (organic feed residues or faecal products, nitrogenised **catabolites**, residues of phytoplankton and zooplankton which have developed in the tanks, organic material removed when the tanks are cleaned out);
- eutrophication of the recipient masses of water;
- clouding and colouring of the water (suspended solids from feeding and digestion residues and the removal of sediments; products from disinfection; residues of antibiotics).

Attention must also be paid to the impact of escaped species intended for intensive breeding, which may affect the genetic structure of indigenous populations or which, in the case of foreign species, may radically affect the original food chain.

Such impacts can be minimised by the following means:

- optimising the feed consumed/release of pollutants ratio;
- keeping the level of prophylactic and therapeutic treatment to a minimum, on the basis of optimum treatment regimes and the choice of rapidly degradable remedies;
- adopting adequate technologies and regimes for the oxygenation of the water;
- adopting carefully proportioned phyto-purification strategies;
- adequate treatment of the solids suspended in the waste;
- basing the scale of production on the absorption capacity of the recipient environment, following the adoption of all the **available** devices for reducing pollution.

Extensive production systems in lagoons and wetlands are certainly the most vulnerable, given the state of the ecosystems in which they operate.

Here too we must look at the most significant aspects of the problem so that, in choosing development models, the environmental risks to and from aquaculture are calculated.

Amongst the main forms of ecological production - a general term that covers production based on use of the nutritional resources of the environment - are extensive farms for fish production (apart from shellfish culture, which **can** produce very **substantial biomass** from the lowest level of the nutritional system).

The environmental problems of ecological production are well known. In cases such as managed lagoons and lagoon fish-farming, there are obvious problems linked with the quality of continental, lagoon and coastal waters.

There are increasingly frequent disturbances in the food chain which, although not rare in the past either, are now occurring more and more. Often because of the modified conditions in and around the catchment basins.

Lagoon fishing and fish-farming on their own cannot always justify environmental improvement measures, which are very expensive. Productive activities in such ecosystems can be the spur for

clean-up operations, designed to protect collective environmental assets and tourism and conserve stretches of coast of outstanding natural value.

Correct hydraulic **management of these systems** can effectively ensure a variety of benefits along the above-mentioned lines.

One aspect which is assuming increasing importance, in terms of its economic implications and the conflicts which can arise between fish-farming and environmental conservation, is that of fish-eating birds.

In particular, the growing number of cormorants is restricting the development of extensive fish-farming schemes which, from an economic point of view, frustrates the attempt to find environmentally friendly production techniques.

In this respect, it is worth noting the case of the Oristanese ponds in Sardinia from which it was estimated - on the basis of data collected in the course of two seasons (1991-1992) - that 111 tonnes of fish were taken per year, with a colony of about 2000 cormorants staying, on average, for 180 days²⁰.

Studies of the wetland fish-farming environment in the PO Delta have estimated that between 30 and 53 tonnes of fish were taken per year.

This problem calls for very objective thinking about future development strategies - not forgetting that extensive aquaculture and fish production in salt-water lagoon fish farms has led to the conservation and maintenance of many wetland areas of great natural interest.

Hydraulic regime

On the basis of hydrological and hydrogeological studies²¹ carried out in the Orbetello lagoon, it has been possible to define the internal hydrodynamics of the lagoon and its exchanges with the sea, the Albegna river and groundwater. Determining the amount of water exchanged is most important to an understanding of the causes of the increasingly serious problems of environmental decline in the lagoon.

The following points emerge from these studies:

- tidal inflows are extremely limited, making it difficult to obtain effective hydraulic gradients for water-exchange purposes;
- the morphology of the channels (length, depth) further limits the scale of the water exchange;
- the volumes of water exchanged between the lagoon and the sea are influenced by wind conditions;
- the exchange of water is also hindered by the presence of close mesh grids (needed for fish-farming);
- the temperature and salinity values oscillate sharply according to season and vary to a more limited extent from day to day, in relation also to the shallowness of the lagoon waters (one metre deep on average) ;
- circulation within the lagoon is also restricted by the breakwater between Orbetello and the Argentaria headland;

²⁰ Source: Ministry of Agricultural, Food and Forestry Resources, Ministerial Decree of 21 December 1993 "Adoption of the fourth three-year plan for sea fishing and aquaculture in marine and brackish waters 1994-96".

²¹ See; ENEA - National Committee for Research and Development in Nuclear Energy and Alternative Energies, Risanamento ambientale della laguna di Orbetello [environmental improvement of Orbetello lagoon], 1987.

- it is therefore very useful to have pumps for bringing sea water into the lagoon in an emergency.

A recent study²² compared the data relating to the main environmental parameters, including dissolved nitrogen and phosphorous salts, in the central area of the western lagoon, collected by various authors over a period of seventy years. This comparison shows that until 1923 the lagoon environment was eutrophic, with a wide chemical and physical range. But as from 1981, and even more since 1988, the parameter values have become increasingly extreme; in particular, the dissolved oxygen content fell to low/anoxic levels during the three or four months of the hottest season.

The content of macro-nutrients was also very variable.

Type and location of waste discharges

The average amount of waste discharged per day per inhabitant (12 000 people) has been calculated²³ at 12.3 grams of atomic nitrogen and 2.5 grams of atomic phosphorous; the resident population therefore feeds the lagoon with some 54 tonnes of nitrogen and 11 tonnes of phosphorous per year.

With regard to the tourist population (100 000 tourists a year in Orbetello and Monte Argentario in the late 1980s), it should be noted that their contribution to the trophic system of the lagoon, although it cannot be estimated exactly, is definitely a major one, partly because the waste is discharged during a short space of time. If we assume that at least half the tourists stay around the lagoon perimeter for periods of 15 days, that means 65 tonnes of nitrogen and 13 tonnes of phosphorous are released into the lagoon.

Recent trends in plant ecosystems

There has been a very definite change in vegetation since the 1980s compared with the situation described in 1975-76²⁴; in the early 1980s, signs were appearing of a considerable growth in **macro-algae** and a notable reduction in the typical rooted vegetation of the lagoon was observed.

From the late 1980s until today, primary macro-algal and micro-algal production has been quite unpredictable in terms of quality and quantity, fluctuating and alternating widely.

Macro-algal growth occurs between winter and spring; from the second half of spring, the algal masses degenerate and accumulate on the lagoon bed. The process of mineralisation of these masses and the release of organic molecules of varying complexity produces micro-algal and **bacterial** bloom throughout the mass of water; as a result the dissolved oxygen content falls and meteorological/climatic conditions become extremely important.

During that phase, wind blowing in a certain direction may release the gases produced by the fermentation of the algal masses retained by the dense and compact decomposing mat of algae; these gases, mainly hydrogen sulphide, virtually eliminate the oxygen throughout the water mass in question and are toxic in themselves; they are usually responsible for high mortality amongst the fauna.

The residential settlements

Virtually all the residential settlements which exert human pressure on, the lagoon are within the commune of Orbetello: they are situated on the isthmus in the centre of the lagoon, on the stretch of land at its northern boundary ("Gianella bar") and in the hinterland.

²² See: V. Bombelli and M. Lenzi, **L'evoluzione** del sistema laguno-costiero di Orbetello: rapporto tra eutrofizzazione, struttura dei popolamenti e produttività?, 1994.

²³ See: V. Bombelli and M. Lenzi, op cit.

²⁴ See: V. Bombelli and M. Lenzi, op cit. V. Bombelli and M. Lenzi, op cit.

The shorter side of the lagoon (or, if preferred, the shorter sides of the two sub-basins of which it is composed) faces the commune of Monte Argentario (which extends over the entire headland), this stretch of which is practically devoid of habitation.

Tables 3, 4 and 5 show the distribution of population and housing per type of inhabited area for the communes of Monte Argentario and Orbetello.

In this context, an estimated population of some 12 000 permanent inhabitants (living in the localities of Albinia, Giannella, Orbetello and Orbetello Scala and half of the scattered houses) puts pressure on the lake, to which may be added an average of at least another 9700 inhabitants during the summer period²⁵.

Industrial activity

As regards industrial activity, at present (June 1994), the data on the local production units recorded by the Central Statistical Institute as part of the General Survey of Economic Activity in 1991 are not yet available. Some indication, even if indirect, of industrial activity in the territory of the commune of Orbetello can be obtained from the data on the working population recorded as employed in such activity in 1991 (see Fig. 6).

Table 3 Population per type of inhabited area in 1991 (communes of Monte Argentaria and Orbetello)

Commune	Surface area (km')	Population (inhab.)	Density (inhab. Per km2)	Centres*		Nuclei*		Scattered Housing	
				NO.	POP.	NO.	Pop.	NO.	POP.
Monte Argentaria	60.3	12 643	210	3	12 181	13	146	-	316
Orbetello	227.0	14 862	65	8	11 992	4	185	-	2 685

* The centres, are larger than the nuclei and provide services for the population.

Source: Istituto centrale di statistica [Central Statistical Office]

Table 4 Housing per type of inhabited area in 1991 (communes of Monte Argentaria and Orbetello)

Commune	Centres		Nuclei		Scattered housing		Inhabited areas		
	Total	of which occupied	Total	of which occupied	Total	of which occupied	Total	of which occupied	
								No	%
Monte Argentario	7 896	4 289	901	52	396	106	9 193	4 447	46.4
Orbetello	6 853	4 413	106	63	1 377	853	8 336	5 329	63.9

Source: Istituto centrale di statistica [Central Statistical Office]

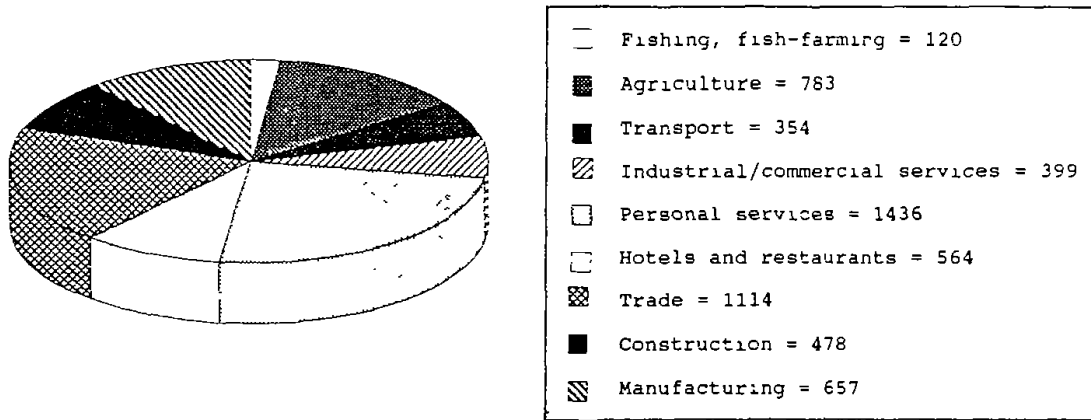
²⁵ In the, four localities cited and in half the scattered housing, some 5800 dwellings were registered in 1991. Applying to this figure the same rate of non-occupation because of holidays (30.6%) recorded over the entire territory, of the commune, it can be estimated that during the summer period some 5000 people reside in the non-occupied houses (assuming a "charge" of 2.8 persons per dwelling, as recorded for then stable population of the occupied dwellings). The occupants of the, houses may be joined by a further 4700 persons, corresponding to half the capacity of hotels and other accommodation (the former account for a total of 940 beds, then latter for 30 places in "official" rented accommodation and 9300 in camp sites).

Table 5 Population, families and housing in the commune of Orbetello per type of inhabited area (1991)

Inhabited commune and areas	Altitude (metres)	Population (inhab.)	Families (No.)	Housing (No.)
ORBETELLO	0/354	14 862	5 356	8 336
INHABITED CENTRES:				
ALBINIA	2	2 453	845	1 086
ANSEDONIA	13	106	45	513
FONTEBLANDA	13	944	351	638
GIANNBLLA	2	101	46	572
ORBETELLO	3	7 038	2 629	3 027
ORBETELLO SCALO	3	1 012	380	424
SALINE SAWN	2	17	8	70
TALAMONE	32	321	130	523
INHABITED NUCLEI:				
Polverosa	13	57	19	19
Quattro Strade	9	78	29	44
San Donate Centre	33	21	8	19
San Donato Vecchio	9	29	7	24
SCATTERED HOUSING	-	2 685	859	1 377

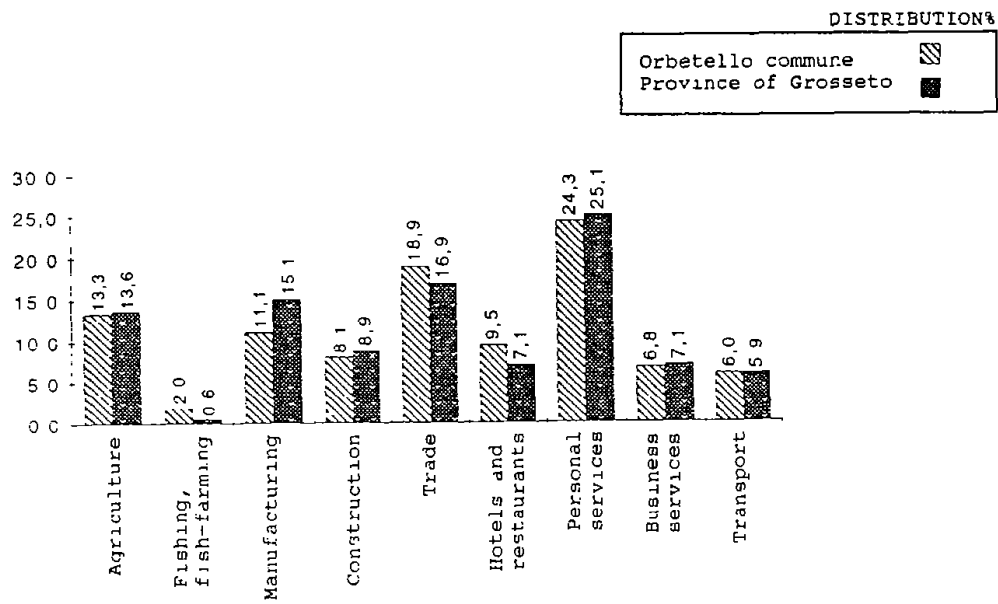
Source: Istituto centrale di statistica [Central Statistical Office]

Figure 6 Working population in the commune of Orbetello by type of economic activity



TOTAL ACTIVE POPULATION* = 5905 UNITS

* BOTH EMPLOYED AND UNEMPLOYED



Source: Istat 1991

Farming

Farming around the perimeter of the lagoon is not on a significant scale and therefore has little influence in terms of environmental impact.

What is uncertain, however, is the effect of the Albegna river, whose vast catchment area is farmed intensively. The Fibbia channel between the sea and the lagoon is also connected to the mouth of the river, whose waters enter the lagoon at high tide and during floods²⁶.

AS can be seen from Table 6, the agricultural sector of the Orbetello commune comprises 661 farms, which make up 3.6% of the total number in the province; they occupy a total area of 16 323 hectares, with 10 133 hectares under **cultivation**.

Most of the farms are run directly by the farmer (620) and represent a cultivated area of 6829 hectares. These use mainly family labour (565 farms), with a cultivated area of 5214 hectares.

Table 6 Cultivated area and farms in Orbetello and the province of Grosseto

Location	Total surface area (ha)	Cultivated area (ha)	Farms (No.)
Orbetello commune	16 323.45	10 132.79	661
Province of Grosseto	372 986.94	216 083.21	18 361

Source: Istat, 1991

In Orbetello commune, the farming system is mixed, with 8478 hectares of arable land, 1122 hectares of permanent crops and 532 hectares of permanent grassland and pasture.

Fishing and aquaculture

Fishing in brackish wetland areas is an economic/productive activity directly correlated with the protection of the environment; in fact, it gives economic impetus to the protection of the lagoons - insofar as they are wetland areas - and, moreover, it is an indicative factor of the environmental condition of the water, a decline in which will always affect the catch.

On the Italian peninsula, the conservation and present conformation of the main coastal wetland areas often derive from the way man still manages them in relation to fish production, an activity which has helped protect many of these brackish areas from reclamation.

The origins of lagoon fish management are directly related to the biology of certain fish species such as eels (*Anguilla anguilla*), grey mullet (*Mugil cephalus*), gilthead (Sparus aurata) and sea bass (*Dicentrarchus labrax*).

The instinct of these species is to embark on periodic migrations between the sea and brackish waters for feeding and reproduction purposes. Understanding these migrations has enabled the lagoon fishermen to identify forms of environmental management adapted to a rational and economically profitable catch.

The fish are caught during their stay there by means of fixed devices, constructed at the contact points between the inland waters and the sea (channels), which enable a commercially viable product to be efficiently and profitably fished.

In the Orbetello lagoon, fishing takes place in the three channels as the fish swim back towards the sea (each season is characterised by specific types such as grey mullet, gilthead or sea bass, which are small when they enter the lagoon and large when they leave it).

Intensive farming of sea-fish species is an important primary activity which began in the Orbetello area in the 1970s and increased considerably over the next decade. There are five fish farms, accounting for a total of 25% of national fish-farm production.

Even when the regulations on the high dilution of waste substances are observed, fish-farming creates serious pollution in terms of the annual total of concentrates discharged into the lagoon. This,

²⁶ See: V. Bombelli and M. Lenzi, op cit.

together with the other pollutant factors, is another reason for the fall in the annual catch: as stated earlier, it now represents 25% of national fish-farming production, as against 60% in past years²⁷.

A breakdown of the nutrients released by firms in this economic sector directly into the lagoon, on the basis of data collected by the Unit: Sanitarie Locali [local sanitation units] and ENEA over the three-year period 1987-1989, gives a total of about 37 tonnes of atomic nitrogen and 1.2 tonnes of atomic phosphorus per year. Nor should one underestimate the disturbance caused by certain farms releasing water from hypothermal strata into the lagoon, which stimulates algal production even during the winter season.

4.2.3 Details of initiatives taken

In 1993, the Orbetello lagoon was declared an "area at high risk of environmental crisis" by decree of the Ministry of the Environment dated 2 April 1993; the lagoon is in fact dying and human activity is accelerating the silting-up process (which would take about 150 years if nothing were done) and hindering its natural drainage. With a view to managing the environmental clean-up operation, the state appointed a Commissioner for the lagoon, whose powers are at present divided between the mayors of Orbetello and Monte Argentario.

Those most directly concerned with the clean-up operation - to be funded by the state (FIO and Ministry of the Environment funds), the European Union (Envireg) and possibly the local authorities - apart from the province of Grosseto, the Commune of Orbetello and the Region of Tuscany, are the fishing and fish-farming firms which operate in the lagoon (of which the most important is Orbetello Pesca Lagunare spa).

Others who could suffer from the environmental decline of the lagoon are the local tourist operators and, obviously, the inhabitants of Orbetello.

There are three types of initiative in relation to clearing up the Orbetello lagoon (see Table 7):

- the medium-term infrastructure plan;
- the (short-term) lagoon clean-up plan drawn up by the **Ministry** of the Environment;
- measures taken by firms

Table 7 summary of initiatives relating to the Orbetello lagoon

Type of measure	Objectives	Agencies involved	
		Financing	Implementation
Plan for medium-term infrastructural measures (ongoing)	Completion and improvement of system for collecting domestic (and industrial) waste water; adaptation of treatment plants	State (Fio: investment and employment fund); European Union (Envireg)	Region, province, commune, Commissioner for the Lagoon
Plan to clean up the Lagoon (short-term) drawn up by the Ministry of the Environment (ongoing)	Dredging channels, removing algal biomass, opening sluice-gates at channel mouths and increasing the power of the water pumps	State (Ministry of the Environment)	Commissioner for the lagoon
Corporate measures (ongoing)	Cleaning the lagoon (experimental phyto-purification system for fish-farming waste water)	Orbetello Pesca Lagunare spa (Envireg funds)	Lagoon Ecology and Aquaculture Laboratory of Orbetello Pesca Lagunare spa (company)

²⁷ The quality and quantity of the catch has varied widely, with an increase in grey-mullet production until 1991 and a sharp fall after that date (see: V. Bombelli and M. Lenzi, op cit.).

The medium-term infrastructure plan

This plan aims to supplement and improve the system for collecting domestic (and to a minimal degree industrial) waste water, as well as to construct and adapt treatment plants.

Waste water is dumped into the lagoon without authorisation and, as we saw earlier, is a determining factor in the eutrophication of the water; in addition, the existing treatment plants (in Albinia and Orbetello) do not work well and are too small.

The project has unfortunately been held up since 1992 as a result of administrative and bureaucratic problems, as have the Lit 40 billion of funds needed to implement the proposed measures.

The project also envisages setting up a phyto-purification scheme linked to Orbetello's treatment plant.

The plan to clean up the lagoon drawn up by the Ministry of the Environment

The objective of the plan to clean up the lagoon, prepared by the Ministry of the Environment, is to ensure integrated management of the lagoon by means of an ad hoc structure - defined in agreement with the **regional** and local authorities - to ensure the necessary balance between nature conservation, water management, fish-farming and the tourist and hotel trade.

The proposed measures (some of which are now under way) include the following: operations to dredge the channels linking the sea with the lagoon²⁸ and the channels within the lagoon itself, the removal of the algal biomass by means of "algae-consuming" barges²⁹, the opening of the sluice-gates at the channel mouths and increasing the power of the pumps.

As regards dredging the lagoons bed (an estimated 500,000m³ of sludge to be removed and disposed of), at present only a few of the channels are being dredged and the removed mud is going into the first "silt bund"; once the bund is filled, its visual impact will be mitigated by planting hygrophilous vegetation to reconstitute the environment.

The other ongoing measures are designed to strengthen the pumps on the exit channel (Fibbia Sull'Albegna), which has already been done on the two entry channels (Canale Ansedania and Nassa S. Liberata).

The three-year 1994-1996 environmental protection programme allocates Lit 30 billion for improving the lagoon; a further Lit 10 billion has been added following an agreement (26 April 1994) between the Ministry of the Environment and the President of the Tuscan Region.

Measures taken by firms

At the moment, the Orbetello Pesca Lagunare spa company is drawing up a phyto-purification project (also known as a "lagooning" system) to clean up the water used in fish-farming; it is to be put into effect by the end of the year.

The Premiership also issued a Decree which set a time limit of 31 March 1994 - since extended to 31 March 1995 by a further order - for taking urgent measures to deal with algae: collection at the mouths of the channels flowing into the sea and disposal operations.

This project (purification using plant species) is based on systems already applied in other countries (in both brackish and freshwater): the United States, Sweden, Switzerland, Belgium, Austria, France and Germany - the latter country also treats domestic waste water by this means. These systems

²⁸ The Premiership also issued a Decree which set a time limit of 31 March 1994 - since extended to 31 March 1995 by a further order - for taking urgent measures to deal with algae: collection at the mouths of the channels flowing into the sea and disposal operations.

²⁹ It will be necessary, in the short/medium term, to perfect new techniques for disposing of and recycling the biomass collected.

combine efficient treatment with landscape improvement: the operation is carried out in what are in fact small, intercommunicating pools, surrounded by dense vegetation.

There are a few examples of phyto-purification units in Italy too: in Montalto di Castro (Lazio), San Michele sull'Adige and the PO Delta (Veneto), on the river Flumendosa (Sardinia), at CittZ di Castello (Umhria) and elsewhere.

Phyto-purification is particularly effective against pathogenic micro-organisms such as faecal coliform bacteria (which are totally destroyed), worm eggs, bacteria and viruses, but also against nitrogen and phosphorus and heavy **metals** such as cadmium, nickel, lead, mercury and cobalt. Some plants are also effective against phenols and their derivatives and some even neutralise insecticides³⁰; even odours are effectively destroyed by water lentils (*Zemna minor* and *Lemna gibba*).

The plants which are most active in this respect include the following: marsh reeds (*Phragmites australis* and *Phragmites communis*), rushes (*Juncus effusus*), **irises** (*Iris pseudacorus*) and water hyacinths (*Eicchornia crassipes*), reeds (*Typha latifolia*), water weeds (*Elodea densa*, which mop up phosphorous and nitrogen); the most specialised of all, however, are the, floating plants such as water lentils, water chestnuts (*Trapa natans*) and the *Salvinia natans* fern which can even remove mercury.

A complete biological cycle can **be** established in these ponds, which breaks down and absorbs substances by the interaction of bacteria, algae, zookplankton, microphytes and macrophytes.

The purification cycle takes about three months and the sludge is collected every ten years; this sludge, with a high mineral content and low in bacteria, can be applied directly to the soil as natural fertilizer.

In Orbetello lagoon, with its brackish water, it is planned to destroy the nitrogen and phosphorus by using the marsh reed *Phragmites australis* and a few algae of the genera *Gracilaria* and *Chaetomorpha* (see Fig. 7).

All fish-farms must be equipped with three communicating tanks in which the water must be left to settle for two days so that it is pure when discharged.

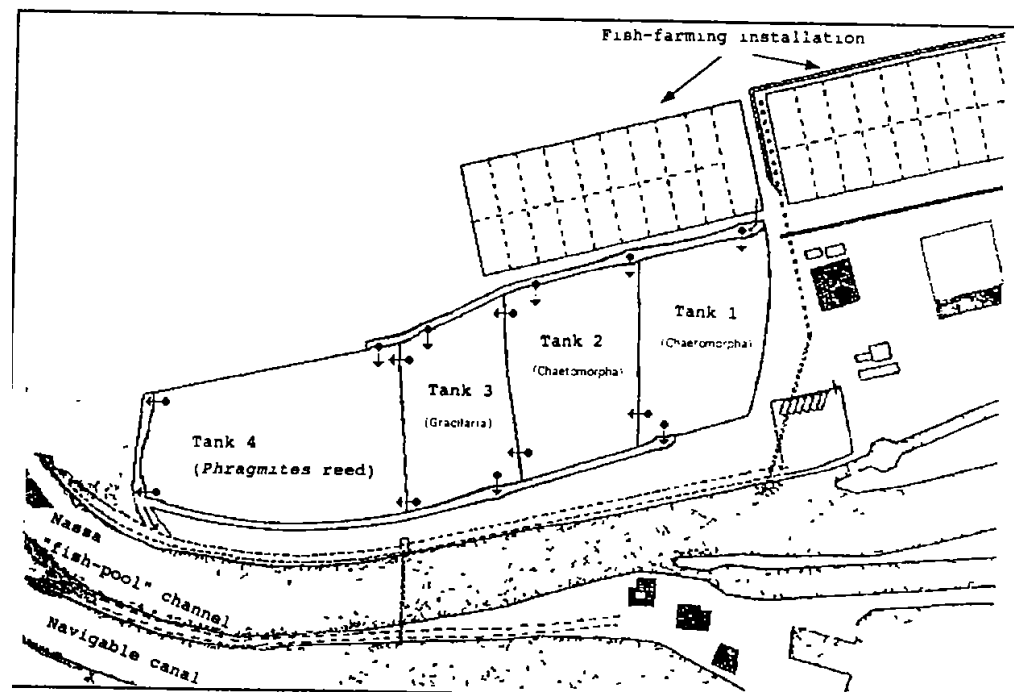


Figure 7 Sketch of the planned "phyto-purification" unit in Orbetello lagoon

Source: Oprbetello Pesca Lagunare spa (1994)

³⁰ See: U. Sasso, "Esempi di fitodepurazione", Quarry and Construction, May 1994

4.2.4 Updated situation as at March 1996

During the Berlusconi government (which, as is well known, certainly did not favour environmental policy), a decree was issued appointing a Special Commissioner to handle the work on sewerage, treatment and re-utilisation of water in the Orbetello Lagoon. The request that a Commissioner be appointed for this work had been made - by the Tuscany region, the Province of Grosseto and the office of the Commissioner responsible for the Orbetello lagoon - to speed up the work; the choice of this new Commissioner could and should have involved only a representative of an institution from a higher level than the Commune.

The Special Commissioner appointed for the purpose was, in fact, the mayor of the Commune of Monte Argentario, adjacent to Orbetello Commune, causing several MPs to raise questions in the House.

As the work in question was to be carried out on the territory of Orbetello Commune (the lagoon is entirely within the Commune's boundaries), there was reason to question an appointment which ignored the law (relating to the autonomy of local authorities) which provides that the Commissioner shall either be the mayor of the area involved (who, moreover, was already in place and responsible for the work of cleaning up the waters of the lagoon, i.e. the mayor of Orbetello), or from a higher-level authority, such as the provincial administration, the region, or the Ministry of the Environment.

This gave rise to considerable controversy, including within the administration of Orbetello Commune which, in the person of the mayor, was still the Commissioner responsible for cleaning up the lagoon, as already mentioned, and would have to work side-by-side with the new Commissioner who would be supervising matters relating to the treatment of plants under the medium-term infrastructural project, at a total cost of Lit 40 billion.

Now that the controversy has subsided, the picture six months later is as follows: 25 of the 40 billion lire allocated for cleaning up the lagoon went to Monte Argentario (Commissioner for the lagoon and mayor H. Corsi) and 15 have been left for Orbetello (Commissioner for the lagoon and mayor A. Minucci), with a subdivision along "thematic" lines: Orbetello handles work on the lagoon itself and Monte Argentario deals with the sewerage network.

As far as Orbetello is concerned, experts for the office of the Commissioner responsible for the lagoon are continuing operations to clean up the water (by phyto-purification, although they have received only tacit agreement from the Ministry of the Environment and not official consensus).

With regard to Monte Argentario, responsible for the sewerage network, experts were thinking of discharging effluent, after treatment, through Sea outfalls, both from the northern network (Talamone, Albinia and Giannella) and the southern network (Monte Argentario, Orbetello and Ansedonia).

Following the intervention of the experts from Orbetello (who do in fact think that the lagoon needs freshwater in order better to be able to cope with potentially polluting stresses), a partial agreement has been reached: waste water from the northern network, after treatment at the new plant in Albinia, will be discharged in the lagoon or into the Albegna river (and not into the sea), while the southern network will discharge into the lagoon with a sea outfall.

June 1996 has been set as the date for completion of the work; it is likely that Orbetello's share will be completed, as all the work has already been contracted, whereas Monte **'Argentaria's** share will probably require an extension to complete work on the sewerage network.

It remains therefore only to resolve a management problem relating to the ordinary maintenance of the lagoon (summer pumping of the water and removal of algae) and the waste water collection system.

This management problem will probably be resolved by setting up an authority (hierarchically superior to the commissioners) for the lagoon, which will be able to manage these operations *super partes*.

4.3 Areas of concentration of the canning and tannery industries in the Sarno river basin (Campania)

4.3.1 Case study profile

Campania is one, of the Italian regions with the highest ,recorded levels of intensive land use and environmental decline.

In that region, the River Sarno is also one of the most polluted masses of water.

The two case studies analysed here concern initiatives to clean up the serious environmental pollution in the Sarno river basin caused by the canning and tannery industries.

This has resulted, at an increasing rate over the past few decades, from the unauthorised discharge into the river and hits tributaries of domestic and industrial waste water. The waters of the Sarno - once it has been joined by the Alveo di Nocera river, formed by the Solofrana and Cavaiola streams - pass through the city of Scafati before flowing into the Gulf of Naples (see Fig. 8).

This is one of the most densely populated and run-down areas in the central/southern regions, with a high level of pollutant waste from industrial, agricultural and domestic sources which: seriously affects the ecological balance of the water, air and soil.

Alterations in the environmental balance create health risks for 'the local inhabitants, ranging from infectious (typhoid, paratyphoid, hepatitis, etc) to parasitic (amoebic dysentery) diseases, respiratory ailments and tumours.



Figure 8 The case-study areas in the context of the Campania region

Source: Touring Club Italiano, 1986

In the 1970s, after the cholera epidemic which hit Naples, the Cassa per il Mezzogiorno (Casmez) drew up the "Special Project for cleaning up the Gulf of Naples"³¹, with the aim of setting up three large treatment plants (Alto Sarno, Media Sarno and Face) and a close-knit network of collection points. Subsequently, the special project, which came under the responsibility of the Campania Regional Authorities and the Special Government Commissioner, was absorbed into the Regional Plan for Water Purification, but the work has been held up for several years.

However, it is clear that, over the past twenty years, territorial conditions in the basin have changed entirely and that the measures planned originally will have to be redefined if they are to have any real impact on the changed situation in the area.

Since January 1994, the plan to remodel the Special Project to clean up the Gulf of Naples has been closely examined jointly by the civil engineering departments of Salerno and Avellino, which have to deliver an opinion on its feasibility, as required by the Campania Region. After this, it is to be further evaluated by the Regional Technical Committee, before the Regional Council takes a final decision on carrying out the work.

The need to plan urgent measures was also endorsed by the Cabinet which, as we saw earlier, has 'declared the Sarno basin an "area although risk of environmental crisis"; this involves communes in the provinces of Naples (16), Salerno (18) and Avellino (4).

Following the "high-risk" declaration, approved by the Government on 2 August 1992³², a plan is being prepared to clean up the entire area. In this context, attention should be drawn to the undertaking given by many public and private bodies to co-operate in the environmental clean-up operation.

Recently, the Ministry of the Environment and the Regional Ecology Council of Campania declared, during a meeting in Salerno on 26 October 1993, that the now outdated clean-up plan under the Special Project was to be superseded. In addition, the approval of the regional law setting up the Basin Authority³³, should give further impetus to the planning of new measures.

The cases under consideration (the canning industry in the communes of Angri, Scafati, S. Antonio Abate, S. Egidio, Pagani, Nocera Inferior, S. Marzano and the tanneries in Solofra commune, Figs. 9 and 10) have 'been placed within the environmental, social and productive context of the area, given that the waste water from both types of industrial production flows (in one case into an upstream tributary and, in the other, downstream) into the Sarno river.

As the ongoing or planned initiatives to improve the environmental situation in the two areas each have their own specific characteristics, they are analysed separately.

³¹ It should be noted that the special projects for systematic, intervention in the southern regions, on a multi-sector or inter-regional basis, were introduced into the legislation on extraordinary measures in the Mezzogiorno by Law 853/1971. That law required the Interministerial Committee for Economic Planning (CIPE) to draw up special projects in implementation of the national economic plan and made Casmez responsible for technical planning and execution of these projects. Pursuant to this legislative provision, the CIPE made a resolution on 4 August 1972, setting up the special project for cleaning up the Gulf of Naples. This decision was taken because of the high level of pollution in the waters of the Gulf of Naples (five times higher than national average). Measures to reduce this high level of pollution, and to protect human health, would remove one of the most glaring aspects of environmental decline in the Naples area and also offer the production apparatus the support of a health and sanitation infrastructure.

³² Within the terms of Laws NO. 349 of 1986 and No. 305 of 1989.

³³ See Section 4.1.

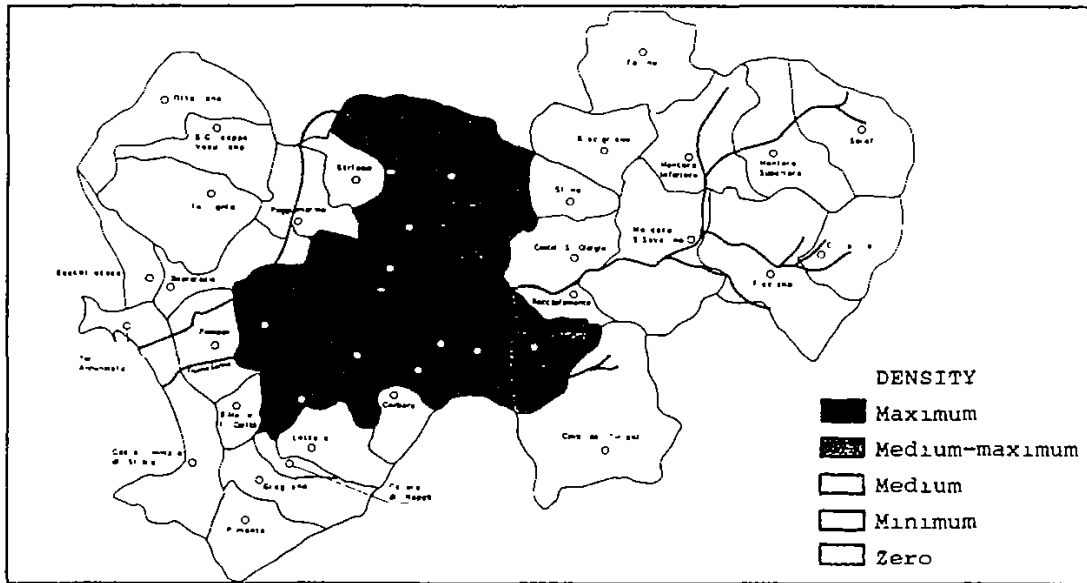


Figure 9 Sarno basin: map of the density of the canning industries

Source: Legambiente, 1994

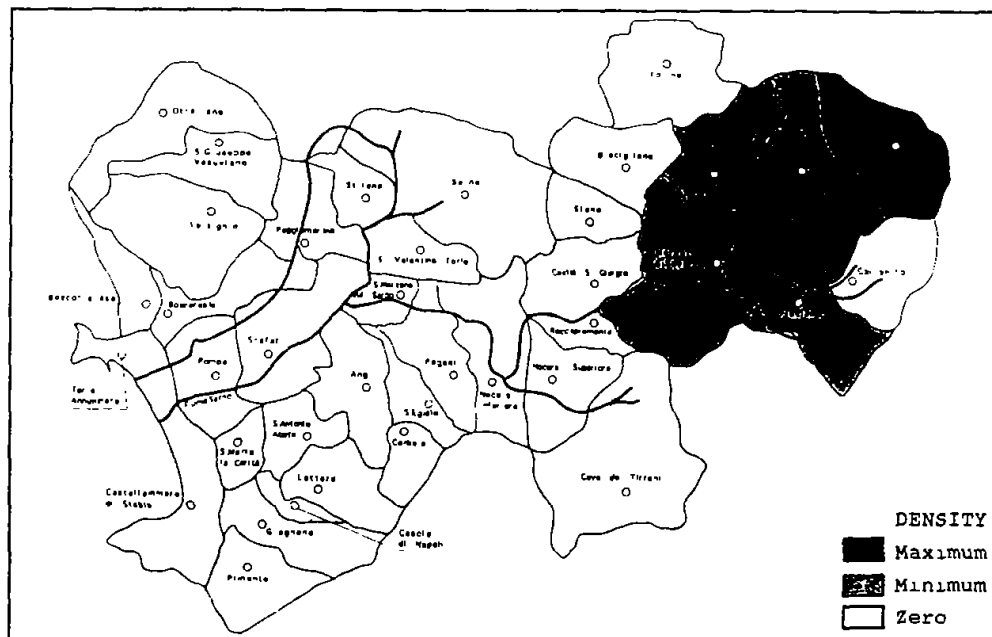


Figure 10 Sarno basin: map of the density of the tanning industries

Source: Legambiente, 1994

4.3.2 The environmental, residential and industrial context

General characteristics

The Sarno river, which is about 24 km long and has a catchment basin of 400 km², rises from various springs³⁴ situated at the foot of the coal-bearing massif of the Sarno mountains. Table 8³⁵

³⁴ There are 11 of these, listed in the State Hydrography Service publication No. 14 of 1942.

³⁵ see: Legambiente, *Il bacino del Sarno: problemi e prospettive*, Istituto di ricerche Ambiente Italia, Comune di Castellammare di Stabia, 1994.

Table 8 Average flow of the main sources of the river Sarno in 1980 and 1993

Springs	Altitude at sea level (m)	Average flow rate (litres/second)	
		1980	1993
Santa Maria della face	30	2520	10
Mercato Palazzo	25	2968	960
Cerola	26	664	nil
Santa Maria di Lavorate	27	1580	47
San Mauro	28	400	Nil

Source: Legambiente, 1994

So the flow rate of these springs fell from 8132 l/sec. in 1980 to 1017 l/sec. in June 1993, **meaning** that about 87% of the flow from the sources of the Sarno river has been lost in the space of thirteen years.

As regards climatic data, according to a study by the Societa Ricerche d'Acqua (water research company) and Basilicata University in 1993, the entire basin into which the Sarno's sources flow has been affected as of 1987 by a reduction in rainfall. The same study also makes it clear that the reduction in rainfall is not sufficient to explain the drastic reduction we have described in the flow. It singles out the main cause of that phenomenon as the presence throughout the area of a great number of water collection points.

The two secondary basins forming part of the Sarno catchment basin are those of the Solofrana and Cavaiola streams.

The Solofrana's catchment basin covers an overall area of a little over **260 km²**; the stream rises in the S. Agata Irpina area and is about 20 km long.

The sources of the Solofrana stream had a maximum flow rate of about **20 l/set.** until a few years ago; at present some 16 l/set. are used as drinking water by the commune of Solofra, while nearly all the springs which fed the river at a higher level have disappeared in recent years.

The secondary basin of the Cavaiola stream extends over some 39.6 km²; the watercourse takes its name from the small town of Cava dei Tirreni I, where it, rises. The Cavaiola stream has a total length of some 4219 km.

Hydrogeological imbalance and water quality

We have seen that the Sarno basin began to be affected by reduced rainfall in 1987, but that this is not sufficient to explain the reduced flow of the river's sources; we have also seen that there is an enormous amount of uncontrolled offtake from these. The **main** cause of the present imbalance is the over-exploitation of groundwater for industrial purposes, irrigation and drinking water, which has led to a significant fall in the water-table.

As this involves the drying up of the springs, it results in a drastic reduction in or even the disappearance of natural stream and river waters. What remains in the watercourses is mainly waste water. We have seen, for example, that the sources of the Solofrana are either used for drinking water or have dried up; so it could be said that the stream, deprived of its natural waters, has become little more than a sewer.

The Sarno river, especially near the springs, is not devoid of life and spring-waters still flow into it, but how long can they go on flowing in view of the fact that, in recent years, their **volume** has already fallen by about 87% ?

The current uncontrolled exploitation of water resources not only leads to the disappearance of the rivers and their ecosystems, but also affects the local population. In fact, the fall in the water-table leads to a general decline in the quality of both surface water and groundwater, which are used for industrial, irrigation and drinking purposes. In an area which releases very high levels of pollutant waste into the environment without any treatment (so far there are few controls and no adequate treatment plants), such a drastic reduction in natural surface water and groundwater means that the pollutants are not sufficiently diluted and increase proportionately.

In the **Solofrana valley**, the polluted stream waters filter into the surface stratum, together with other pollutants discharged on the surface. This valley also contains natural drainage areas for the water which circulates in the surface and deeper strata. The polluted waters of the surface stratum also reach the deeper stratum, which provides for drinking water, via the **uncemented** linings of the very numerous wells drilled on the plain.

On the Sarno plain, the water-table in many areas is just below the surface and therefore particularly vulnerable to pollution. The problem of natural conditions allowing contamination of the aquifers is compounded by the following human activities: continuous and uncontrolled discharge of pollutant substances; illicit tapping of water resources for industrial, irrigation and drinking purposes, resulting in a drastically reduced self-purifying capacity; greater risk of polluted water infiltrating through the uncemented linings of wells.

As a rule, riparian woodland is a forest habitat along the banks of watercourses, made up of vegetation which is relatively independent of the effects of altitude, but depends more on the water regime governing soil formation, water availability and nutrient supply. The **term** riparian woodland is generally applied to wooded areas which, apart from the actual bank, also occupy any stretches of flood plain up to the embankments which separate these from the higher, cultivated areas.

Unfortunately, people very often greatly modify this characteristic environment in order to carry out such projects as building embankments, straightening the river-bed, or tree-felling and undergrowth clearance to make way for farmland. The immense amount of work undertaken at the beginning of this century in order to create more farmland did not spare the Sarno basin. The physical and biological parameters of the main **watercourse** and its two largest tributaries (Solofrana and Cavaiola) were radically modified. Many stretches of the river-bed were straightened and deepened, if not actually covered over, and the banks made steeper and cleared of the vegetation which covered them naturally. In watercourses which have been heavily modified in this way, the surface waters lose nearly all their self-purification capacity, in the sense of the capacity, of natural and untouched watercourses to sustain, assimilate, store and biologically convert the nutrients which flow into their waters. Moreover, nutrients washed away from farmland are carried into the main catchment areas and thence to the sea more quickly, while the almost total absence of strips of riparian vegetation means there is no possibility of reducing their concentration.

According to a study carried out in 1974 by the **Water** Research Institute (IRSA) of the National Research Council, the deterioration in the original quality of the waters of the Sarno area is due to direct and indirect pollution, such as sewage from built-up areas - especially in the middle stretch of the river - and inadequately treated or totally untreated industrial waste water from the large number of manufacturing firms of various kinds situated mainly on its lower course.

The very low-quality Water from the Cavaiola stream was also regarded by the study as an indirect source of pollution.

In fact, before flowing into the Sarno, the Cavaiola takes in the water from the Solofrana stream, which is seriously polluted by the industrial waste from the tanning industry in the Solofra area, as well as by waste water from the canning and food industries concentrated in particular in the Nocera plain and by domestic effluent from the area.

In addition to the pollution caused by the **various** forms of liquid waste, the survey mentioned that caused by solid waste of an organic and inorganic nature discharged along the banks of the river, especially from the middle course up to the mouth. Even twenty years ago, the self-purifying capacity of the river from its middle course onwards was said to be irredeemably damaged by the huge number of pollutant sources along that stretch.

Researchers from the Istituto di Chimica Agraria [institute of agricultural chemistry], of Naples University, who carried out analyses to determine the chemical and physical quality of the waters of the Sarno area on a monthly basis in 1975 and then again in November 1979, September 1983 and January 1986, came to the same conclusions.

In practice, all the research carried out reached similar findings, confirming that upstream from the confluence of the Cavaiola, and Solofrana, pollution is attributable chiefly to the amount of domestic sewage and industrial waste, in addition to the pollution from the intensive farming characteristic of

that area. Downstream from the confluence, however, the pollution is mainly of industrial origin and particularly dangerous.

Subsequent data (which are actually very scarce) relate to analysis of samples taken in the basin by the local sanitation units. A first set of analyses was carried out from May to September 1990 at five collection points, whose exact location is not indicated³⁶. Except for the first sampling point/the situation in the other four shows a very serious state of deterioration from both the chemical, physical and microbiological points of view; in particular, the high chromium concentrations show how much the waste from the Solofra tannery centres contributes to the level of pollution.

The biological analyses therefore endorse the conclusion that the waters of the Sarno are very seriously polluted and agree with the findings of other researchers on the total, or almost total, loss of self-purification capacity in the middle to lower course of the river. The situation is certainly even more serious in the two tributaries which, as we have seen, are responsible to a large extent for the deterioration of the quality of the Sarno waters.

As regards the origins of this deterioration, the data at our disposal confirm the extent to which the high pollution level of the Sarno basin waters is caused by waste from the Solofra tanneries, the canning industries and the intensive farming practised in the Nocera-Sarno area; one contributory factor which is difficult to measure, given the almost total pollution of the Sarno waters along the final stretch up to the mouth, but which is certainly significant, is the industrial area of Pompei-Scafati (paper-mills, metalworking, etc).

Waste from residential settlements also represents a constant pollutant factor (foul water from the sewerage networks of all then communes situated between Solofra and Castellammare di Stabia, where treatment plants are inadequate or non-existent). The absence of local town-planning measures, and very often of adequate sewerage networks or sewage treatment systems, is in fact characteristic of all the inhabited areas scattered throughout the basin. All this means a continuous discharge of untreated sewage into one recipient - the Sarno river - which, already seriously polluted from industrial waste, also represents the **main** means of disposal of **urban** and industrial waste water.

Residential areas

The population residing in the Sarno basin area at the date of the most recent Istat census (October 1991), amounted to some 727 000 inhabitants. **This** figure includes the residents of all 38 communes into whose territory the Sarno catchment basin falls, within the meaning of Art. 6 of **Law** 305/1989 and of the Cabinet resolution of 28 February 1987.

The inhabitants are distributed between the communes in the provinces of Salerno (49%), Naples (**47%**) and **Avellino** (4%) (see Table 9).

As regards the economic activity characteristic of the basin communes, the substantial activity in the tertiary sector in the communes of the province of Salerno is backed **by** an equally high concentration of industrial installations in the manufacturing, textile, clothing, wood and furniture sectors. In the communes of the province of Naples, the predominant economic activity is in the tertiary sector, especially services and the public administration, while there are few industrial installations. In the communes of the province of Avellino, however, economic activity is much less diversified and characterised by a concentration of industry in the tannery sector, with Solofra as the focal point.'

Over the decade 1981-1991, the population of the Sarno **basin** increased from some 683 000 to about 727 000 inhabitants.

The greatest increases recorded were again in the communes near the middle course of the Sarno. Of particular significance are the data relating to Nocera Superiore, where the population increase was calculated at 26.4%, with a density (in 1991) of 1518 inhabitants/km'. At the other extreme, in a situation of general population increase, *we see a 12.6%* decrease for the commune of Torre Annunziata.

³⁶ See: Legambiente; *Il bacino del Sarno*, op cit.

Population density around the Sarno basin is 1267 inhabitants/km', three times higher than the figure of 414 inhabitants/km' for the whole of Campania region.

A comparison of the population density in the 38 communes in the basin has shown a few extreme situations, mainly involving communes in the province of Naples, including Torre Annunziata (7213 inhab/km') and Castellammare di Stabia (3881 inhab/km).

In the absence of adequate town planning, the high population density found in the basin is a contributory factor in the marked increase in biological pollution which, together with the industrial (canning and tanning industries) and chemical/biological (intensive farming) pollution, creates a high environmental risk by altering the ecological **balance** of the water, air and soil.

We need only remember that the rise in population density, from 1179 to 1267 inhabitants/km' **between censuses**, involves a larger quantity of waste being discharged into the Sarno, not to mention the reduced flow of the river's own waters, which cannot therefore dilute the waste water, meaning that natural watersheds such as the Solofrana and Cavaioia, which have no dilutant water of their own, frankly become open-air sewers during dry periods.

Productive activities

The industrial sector

The structure of the industrial sector can only be analysed with reference to the 1971 and 1981 census data, since the breakdown per commune of the information from the 1991 register of industries is not yet available. It should be noted, however, that consultation of the commercial registers, updated to 1993, at the Chambers of Commerce of the three provinces in question, provides confirmation of the conclusions which emerge from analysis, 1981 stat data.

In the communes of these three provinces, we see a trend emerging between 1971 and 1981 towards an increase in the size of firms. In the province of Avellino, the number of employees rose from an average of 5.8 in 1971 to **a.5** in 1981. In the province of Naples, the corresponding figures were 6.6 and 10.1 respectively, a considerable increase, while the province of Salerno showed a rise from 7.5 to 10.6. Overall, throughout the basin, the average figure fluctuates between 7.0 employees in 1971 and 10.2 in 1981.

In 1971, the industrial sectors containing the largest number of firms and local units in the Sarno basin were metalworking and engineering, followed by footwear and clothing and then woodworking, with 1439, 1302 and 802 firms respectively.

In terms of employment density, however, the food industry topped the list: the 563 local units registered in the communes in the area in question had 8436 employees. Of particular significance is the figure relating to then communes in the province of Avellino, where the tanning industry employed the largest number of workers. In 1971, there were 145 local tanneries, but the number almost tripled during the 1980s before settling down in the early 1990s to a figure of between 130 and 150 small and medium-sized units with 4000 people employed either directly or indirectly.

Between 1971 and 1981, industrial activity in the Sarno basin fell noticeably with an estimated drop in the number of local units of around 6%.

The sectors most affected by this phenomenon were metalworking, engineering, footwear and clothing.

Quantitative information of major economic significance is available for 1993 on the canning industries situated in the provinces of Naples and Salerno. In the province of Naples, of the 29 industries which process tomatoes, no less than 20 are located in the commune of S. Antonio Abate which process about 253 000 tonnes of produce, making up some 86% of the total. Here therefore, we see a definite polarisation of activity as regards processing into both tomato concentrate and peeled tomatoes, as well as other products.

In the province of Salerno, on the contrary, we see a bipolarisation of the canning industries. Of 68 firms, as many as 21 are located in Scafati and 10 in Angri, but there are also 7 in Castel S. Giorgio and S. Marzano sul with 6 each in Nocera Superiore and S. Egidio del Monte Albino. Then quantities of tomatoes processed by these industries, compared with the overall total, amount

respectively to about 26.3% and 21.0% for Scafati and Angri, 18.0% and 4.0% for Castel S. Giorgio and S. Marzano sul Sarno, 8.0% and 6.0% for Nocera Superiore and S. Egidio del Monte Albino. So we may say that in the province of Salerno there is a wide spread of industry and a more efficient distribution of processing activity.

The growth of the engineering sector, for instance, which related mainly to machine construction for the food industry and the production of tin plate and metal containers for canning, could not have occurred without the canning industry as an outlet. The validity of these firms' choice of site is confirmed by the close relationship between agricultural production in the area in question and the overall production capacity of the industrial firms processing vegetable and fruit products.

The *agricultural sector*

In 1990, some 32 289 farms were counted, about 12% of the total in Campania; they occupied a total surface area of 33 204 hectares, with a cultivated area of 19 871 hectares. Most of them were farms in which the farmer himself carried out the manual labour: there were in fact 31 979 personally run farms, 99% of the total, occupying more than 26 000 hectares of farmland (79% of the total area), with a cultivated area of some 19 000 hectares, equal to 97% of the total. Among them were many farms managed solely by the farmer, either alone or with the assistance of family *members* (23 704 farms, i.e. more than 74%, with a total surface area of 15 547 hectares).

There were also a fair number of farms using more or at most the same amount of family labour as non-family labour: 5722, making up more than 5600 hectares, or 18% of the total farmland. Less significant are farms on which the farmer worked fewer days than his employees and farmhands. The latter account for 2533 farms' (8% of the total) occupying some 5200 hectares of farmland.

The density of farms managed on a time and material basis is rather limited considering their numbers, 306 01. 0.9%; the farmland they occupy comes to 67 88 hectares, or 20% of the total surface area. Finally, there is a negligible number of farms run on a share-cropping basis: only 4, which shows that this form of farming has almost disappeared. Between 1970 and 1992, the number of farms fell by 3166 units, with a slightly lesser fall in the past decade than in the previous one, i.e. of 1489 (4.4%) and 1677 (4.7%) farms respectively.

In conclusion, we can say that a mixed cropping system predominates in the area in question, largely because of the small size of the farms and probably because of the modest means of the farmers. So we are looking at peasant-style farming, directed in part at home consumption of the farm produce.

In weak productive units in particular, the main purpose of farming is to maximise the use of family labour and home consumption of farm produce, rather than to gain maximum profit. That ensures their survival but is certainly an obstacle to their economic growth and the modernisation of the production apparatus.

Table 9 Sarno basin: population size and density (1991)

(A) Province of Naples

Commune	Territorial area (km ²)	Resident population		Density 1991 (inhab/km ²)
		1991	% variation 1981-91	
Boscoreale	11.20	27 310	10.85	2 438
Boscotrecase	7.18	11 235	-7.99	1 573
Casola di Napoli	2.57	3 542	8.42	1 378
Castellammare di Stabia	17.71	68 733	-2.76	3 881
Gragnano	14.29	28 616	9.88	2 002
Lettere	12.03	5 415	21.14	450
Ottaviano	19.85	21 973	9.06	1 107
Pimonte	12.47	5 601	12.49	449
Poggiomarino	13.28	17 409	19.82	1 311

Pompei	12.41	25 177	9.78	2 029	
S. Antonio Abate		7.87	16 936	15.76	2 152
S. Giuseppe Vesuviano		14.09	26 336	11.31	1 869
S. Maria la Carità		4.20	10 135	24.95	2 413
Striano		7.58	6 984	17.99	921
Terrigno		23.51	13 653	25.08	581
Torre Annunziata		7.33	52 875	-12.65	7 213

(B) Province of Salerno

Commune	Territorial area (km ²)	Resident population		Density 1991 (inhab/km ²)
		1991	% variation 1981-91	
Angri	13.75	29 753	6.36	2 163
Bracigliano	14.04	5 105	11.36	364
Calvanico	14.82	1 241	11.80	84
Castel San Giorgio	13.63	11 347	3.06	849
Cava dei Tirreni	36.46	52 502	3.62	1 440
Corbara	6.66	2 420	7.60	363
Fisciano	31.52	11 421	16.09	362
Mercato S. Severino	30.21	19 078	4.81	631
Nocera Inferiore	20.85	49 053	4.47	2 353
Nocera Superiore	14.71	22 325	26.42	1 518
Pagani	12.77	33 138	2.87	2 595
Roccapiemonte	5.22	18 751	12.74	1 676
S. Marzano sul Sarno	5.15	9 556	6.63	1 855
S. Valentino Torio	9.03	8 203	7.72	908
S. Egidio M. te Albino	6.27	8 188	8.47	1 306
Sarno	39.95	31, 509	3.37	789
Scafati	19.76	40 710	19.52	2 060
Siano	8.50	9 265	18.26	1 090

(C) Province of Avellino

Commune	Territorial area (km ²)	Resident population		Density 1991 (inhab/km ²)
		1991	% variation 1981-91	
Forino	20.49	4 799	9.66	234
Montoro Inferiore	19.49	8 695	4.06	446
Montoro Superiore	20.44	7 526	22.05	368
Solofra	21.93	10 941	11.84	499

D) Total in basin

Commune	Territorial area (km ²)	Resident Population	Density 1991 (inhab/km ²)
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		1991	% variation 1981-91	
Sarno basin	573.22	726 516	6.35	1 267
Region of Campania	13 595.34	5 630 280	3.06	414

4.3.3 Initiatives relating to the area of the canning industry

Introduction

This case study is concerned with the substantial presence in the area³⁷ of various types of canning industry (especially tomato processing), the high level of effluent production ("red" water) and treatment initiatives.

The tomato-processing industry plays a **major** role in the overall national industrial stage and is of strategic importance in terms of employment for the **Nocera** and Sarno valley.

Most of the canning firms in the area are situated in the province of Salerno: there are 90, out of a total for the entire region of 149 (see **Table 10**), and there is also a spin-off industry in the form of machine manufacture for the food industry and the production of tin plate and metal containers for canning.

In terms of production, the province of Salerno processes 1,000,000 tonnes of tomatoes a year out of a regional total of 1 700 600 tonnes, of which **50%** is made up of peeled tomatoes:

Table 10 Regional distribution of the canning industry in Italy in 1992

Region	No. of firms	Quantity processed (tonnes)			
		Peeled	Concentrate	Other	Total
Abruzzo	3	4 520	7 051	6 260	17 831
Basilicato	3	12 617	17 189	27 632	57 438
Calabria	8	7 752	77 358	4 321	89 431
Campania of which:	149	841 151	619 600	255 731	1 716 482
Naples	49	286 526	129 624	63 590	479 740
Salerno	90	530 327	372 446	180 553	1 083 326
Emilia-Romagna	35	1 885	575 657	269 211	846 753
Lazio	6	4 378	84 486	9 295	98 159
Lombardy	4	0	38 455	6 776	45 231
Marche	2	5 127	7 956	4 458	17 541
Molise	2	4 273	4 496	0	8 769
Puglia	16	63 945	78 679	9 785	152 409
Sardinia	4	15 180	13 511	7 133	35 824
Sicily	2	0	9 107	2 332	11 439
Tuscany	8	10 419	53 792	8 573	72 784
Trentino	1	0	3 761	6 038	9 799
Veneto	2	0	21 300	4 577	25 877
TOTAL	245	971 247	1 612 398	622 122	3 205 767

Source: Anicav

³⁷ This refers in particular to the communes of Angri, Scafati, S. Antonio Abate, S. Egidio, Pagani, Nocera Inferiore and S. Marzano.

Outline of the production cycle

The "typical" production line begins with washing the product (in suitable tanks, to remove all extraneous material from the tomatoes), which is then placed on grading tables where the staff discard any unsuitable tomatoes. Then the produce is heated at a temperature of 90° in order to remove the skin from the pulp by mechanical or thermophysical means, after which it is transferred to conveyor belts where it is checked, to remove any damaged tomatoes, stalks and pieces of peel (in more modern industrial complexes, the grading is done by an optical selector which, thanks to a complex monitor and computer system, automatically discards tomatoes which do not meet the computer-stored requirements).

The tins are then filled with the peeled **tomatoes** and juice and vacuum sealed. Pasteurisation follows, to remove all the micro-organisms which could affect the product.

Tomato concentrate is produced by removing part of the water from the juice, which is obtained by crushing and sieving fresh tomatoes. The water is evaporated off at low pressure, in order to maintain the organoleptic and nutritional properties of the product.

A range of other products has developed alongside the traditional production of peeled tomatoes, and tomato concentrate: pulp, chopped tomatoes, puree and juice.

The water consumption of the canning industry, concentrated over 50-70 days of the processing year, is equal to the annual consumption of the entire population in the area. Given the increasing difficulty in finding adequate water resources, it is therefore vital to seek appropriate solutions to this problem in order to avoid a crisis in the productive sector and a health and sanitation emergency in the area.

Moreover, although nearly all the canneries have purification facilities, these are very often inadequate and overloaded by the concentration of production over a few days.

In fact, although the canning industry was supported in the past by State concessions and incentives, the environmental damage was considerable because of the absence of controls over water consumption and pollutant waste discharges.

The initiatives

As can be seen from Table 11, the main parties concerned with clean-up

initiatives are: the Ministry of the Environment, the Ministry of Industry (Stazione Sperimentale per l'Industria delle Conserve Alimentari [experimental centre for the preserved-food industry]), Anicav (Associazione Nazionale Industriali Conserve Alimentari Vegetali [national industrial association for preserved fruit and vegetables]), the Lega Ambiente [Environmental League] and the Region of Campania³⁸

Table 11 Summary of the (planned and ongoing) initiatives relating to the area of the canning industry

<i>Type of measure</i>	<i>Objectives</i>	<i>Agencies Involved</i>	
		<i>Financing</i>	<i>Implementation</i>
Project to clean up the Gulf of Naples (partially implemented)	To install three treatment plants	Casmez	Region of Campania
Plan to clean up the Sarno proposed by the Ministry of the Environment (ongoing)	Reclaiming area at high risk of environmental crisis	State (Ministry of the Environment)	State (Ministry of the Environment)

³⁸ The Campania Region is planning to clean up the river Sarno and to promote and take part in establishing firms to manage environmental protection initiatives.

Prevention of further pollution (ongoing)	Information and awareness campaigns directed at firms	Anicav	Anicav
Monitoring of discharges and treatment plants (ongoing)	Acquisition of the necessary information for installing joint treatment facilities	Anicav	Ministry of Industry (experimental station for the preserved-food industry)
Setting up domestic and industrial wastewater treatment plan for 4 communes (planned)	To cut down the pollution levels in the Sarno river	Anicav, the communes concerned, the region of Campania	Castalia (study)
Monitoring the complete water cycle (ongoing)	To reduce water consumption and possibly recycle used water	Anicav	Treatment plant management company, Ministry of Industry (experimental station for the preserved-food industry)
Recycling processing waste (planned)	To use tomato peel and seeds as secondary raw materials	Anicav	Ministry of Industry (experimental station for the preserved-food industry)

Both the Lega Ambiente and a number of local associations for the Sarno have presented proposals for monitoring discharges from the canning industry and for recording other types of effluent and the number of wells in the area. These monitoring activities are designed to provide the necessary information for installing joint treatment facilities and enabling firms to re-utilise the treated water.

As Anicav has been carrying out awareness campaigns for some time among its own members to ensure respect for the environment, it does not consider that singling out the waste from the canning industries as the main cause of the deterioration of the Sarno was justified. The association therefore commissioned a study from the Stazione Sperimentale per l'Industria delle Conserve Alimentari (attached to the Ministry of Industry) to evaluate the amount of pollution produced by the canning industry. The results showed that, although it is substantial, it is certainly not toxic because of the absence of highly pollutant substances (surfactant toxic metals).

Anicav has also suggested that attention should now be turned to the Solofrana and Cavaiola tributaries which, as we have seen, bring tannery waste into the Sarno.

In fact, the waste from canning consists of tomato seeds and peel and water; at present both the peel and the seeds are dumped, but Anicav has proposed using them as secondary raw materials: the tomato seeds could be used as animal feed (first contacts have already been made with firms in the sector) and the peel as agricultural fertilizer or as an element in compound animal feed. The Stazione Sperimentale per l'Industria delle Conserve Alimentari is also examining this idea.

As regards the waste water problem, two initiatives are under way:

(1) A while ago, Anicav started a project³⁹ with a view to playing its part in cleaning up the Sarno basin; it has commissioned Castalia, a company in the IRI group, to carry out a study and to draw up a plan of measures to be taken in the Sarno basin.

The study found that it would be feasible to set up a treatment plant for the waste water from the canning industry and from residential areas; this plant would serve four communes in which there are significant numbers of fruit and vegetable processing firms.

The project provides for the involvement not only of private bodies, but also of the public administrations, both of the communes themselves and the region of Campania. At present, the firms

³⁹ This project, designed to interact with the plan for cleaning up the Sarno, aims to resolve the environmental problems as a whole. In fact, it is not just a question of making firms observe the legal provisions, but also of finding a solution which includes reducing consumption.

have been asked to consider the project and indicate whether they are prepared to take part in the initiative. Steps are meanwhile being taken to involve the local authorities.

The region of Campania is already aware of this initiative, having been officially informed of it by Anicav. The environmental associations and trade union organisations, which were involved in the project from the outset, have also approved it.

(2) Anicav is about to enter into, an agreement with a company managing treatment plants and the Stazione Sperimentale delle Conserve Alimentari di Angri. This will involve monitoring the complete water cycle with a view to proposing practical ways for firms to reduce their water consumption and improve the results of the treatment plants.

According to, another proposal, put forward by the Legambiente environmental association, the following are the priority needs for cleaning up the Sarno:

1. the formulation of an accurate and exhaustive cognitive picture of the state of, the area, by means of a geographical information system;
2. the planning and management of systems for monitoring the pollution of the water, air and soil;
3. the Preparation Of land registers of dumps and records of the wells;
4. the preparation of thematic charts and risk maps;
5. the implementation of immediate measures to reduce the risks;
6. the preparation of other measures to be taken at various times prior to drawing up the Basin Plan.

Under this proposal, particular attention must also be devoted to studying the possible technical solutions which could be applied to the productive cycles of both the upstream tanneries and the canneries, which also need to save water by recycling it.

4.3.4 Initiatives relating to the tannery industry at Solofra

Introduction

The commune of Solofra is the site of one of the four major centres of the Italian tannery industry⁴⁰, of the 150 firms⁴¹ in the area, most are located in the industrial development area and some 30 in the urban area. The average firm has 30-35 employees (only two firms employ more than 100 workers). The industry employs about 4 000 people overall, both directly, and indirectly, and has a sales volume of Lit 1200 billion.

The main activity is tanning skins for clothing and, to a lesser extent, footwear, using the skins of various animals as raw material (goats, kids, lambs, calves, sheep and pigs).

Characteristics of the tanning industry

These activities have a substantial environmental impact, in the form of gas emissions, waste water and refuse; in particular, it should be stressed that 50% of the processed product ends up as waste and that tanning hides is a serious health hazard for the workers in these firms⁴² and is likely to contaminate the surrounding area.

⁴⁰ Arzignano in Veneto, S. Crbbe in Tuscany, the Tisino valley in Lombardy and Solofra in Campania.

⁴¹ Of which 130 are involved with the joint treatment plant.

⁴² The occupational diseases found in the tannery sector can be summarized as follows:

- occupational dermatitis;
- **systemic infectious diseases;**
- chronic bronchitis;

It has been calculated, with regard to environmental pollution, that for every 100 kg of dry skins treated, some 40 kg of chemical substances and 3 tonnes of water are used in the complete tanning cycle.

It has also been estimated that a small or medium-sized tannery, equipped with a single varnishing module, releases no less than 240 kg of solvents into the external environment during the eight hours of the processing cycle⁴³.

Tannery waste causes both organic and inorganic pollution deriving from the substances removed from the raw skins (blood, dung, dirt) during preparation for tanning and from the chemical additives (tannin, formaldehyde, dyes, surfactants, **lime**, chromium salts, etc) which are used to treat the skins but not entirely absorbed by them (see Table 12).

The discharges are therefore turbid, putrescent, with a nauseating **smell**, highly coloured, with abundant suspended and dissolved solids.

-
- liver disease;
 - diseases of the ear;
 - occupational tumours.

⁴³ See: M., Valsecchi, A. Cariolato and L. Lovato, I solventi nell'industria conciaria. Corso di aggiornamento, "Mappe di rischio oncologico", **Florence, May 1987**.

Table 12 Substances used during the processing stages of the tanning cycle

Disinfection	Soaking	Liming	Deliming
<ul style="list-style-type: none"> - formaldehyde - formic acid - bisulphites - tri pentachlorophenols - alkyl phenols 	<ul style="list-style-type: none"> - sodium sulphate - sodium bisulphate - anionic surfactants - soaps - salts - polyoxyethylenes - proteolytic enzymes - sodium hydroxide - aromatic amines - sodium carbonate - sulphonated higher alcohols 	<ul style="list-style-type: none"> - hydrated lime - sodium sulphite - sodium sulphate - soda - sodium bisulphate - non-ionic surfactants - proteolytic enzymes - salts - non-ionic surfactants - dimethylamino sulphate - aliphatic and aromatic amines - cyanides - ammonia - glucose 	<ul style="list-style-type: none"> - sulphuric acid - formic acid and salts - proteolytic microbiological enzymes - lactic acid - citric acid - organic acids in buffer mixtures - ammonium chloride - oxalic acid - sodium bisulphite - sodium sulphate - salts - vegetable proteolytic enzymes
Degreasing	Pickling	Tanning	Neutralizing
<ul style="list-style-type: none"> ammonia - detergent solvents - anionic solvents - non-ionic solvents 	<ul style="list-style-type: none"> salt - hydrochloric acid - formic acid - sulphuric acid - sodium chloride - sodium formate - sodium hyposulphite - resins 	<ul style="list-style-type: none"> acetic acid - formic acid (formates) - oxalic acid - basic chromium sulphate - chrome alums - potassium alums - bicarbonate - carbonate - soda 	<ul style="list-style-type: none"> sodium bicarbonate - sodium bisulphite - boracic - sodium formate - sodium acetate - ammonium bicarbonate - polyphosphates - ammonia - neutral tanning salts - oxalic acid
Re-tanning	Fat-liquoring	Dyeing	Finishing with casein
<ul style="list-style-type: none"> - chromium salts - natural and synthetic tannins - synthetic resins - zirconium salts - aluminium salts - synthetic chrome and tannin complexes - aldehydes - ammonia 	<ul style="list-style-type: none"> - fish oil - sulphonated fatty alcohols - cationic non-ionic surfactants - synthetic oils - sulphonated castor oil - coconut oil - soya oil 	<ul style="list-style-type: none"> - acid dyes - basic dyes - direct dyes - formic acid - acetic acid 	<ul style="list-style-type: none"> - organic and inorganic pigments bonded with casein - casein - casein-based top-dressing - albumin-based polish - polyethers - wax emulsions - impregnated polymers - castor oil and sulphonates and neutralizers - polymerized resins - chromium chloride - formaldehyde 10/15% - acetic acid - plasticizers

Aniline and semi-aniline finishing	Finishing with resin	Finishing with nitrocellulose	Finishing with polyurethanes
<ul style="list-style-type: none"> - aniline dyes - protein binding pigments in a transparent aqueous dispersion and coating pigments - synthetic formaldehyde resins - polymers in aqueous dispersion - transparent albumin-based polish 	<ul style="list-style-type: none"> - polymers in aqueous dispersion - albuminoid - butadiene-based polish - acetic acid - water-dispersed pigments - acrylonitrile copolymers 	<ul style="list-style-type: none"> - colourless nitrocellulose varnishes - oceque varnishes - nitro emulsion in water or in cyclohexanone solvents - butyl acetate - ethyl acetate - denatured alcohol 94/96% 	<ul style="list-style-type: none"> - polyurethane mixtures - bicomponents in solvents or aqueous <hr/> <p style="text-align: center;">Finishing with varnish</p> <hr/> <ul style="list-style-type: none"> - synthetic polymers in aqueous phase - varnish with two components - ethyl acetate - butyl acetate - cyclohexanone

The tanning cycle may be likened to a chemical process turning the raw pelt freshly removed from the animal, which is by nature biodegradable, into a technologically finished, durable product; this is quite a complex technical and chemical/physical process.

Tanning skins these days involves a number of standardised procedures which ensure that a very wide range of finished products is available⁴⁴.

Organic and inorganic pollution therefore poses very serious problems, partly because the tanning industry is nearly always heavily concentrated in small areas; the recipient watercourses are exposed to quite substantial damage to their flora and fauna, while damage may also be caused to neighbouring crops (according to a survey conducted in S. Croce sull'Arno, wine-growing was jeopardised by the infiltration of contaminated waters into the soil).

Some of the most pollutant effluent comes from the liming drums, which tend to be washed out in the early morning, using very little water⁴⁵.

The initiatives

In Solofra people began to "take an interest" in environmental problems when, in July 1987, the courts closed down several tanneries for infringing the **laws** on environmental protection. Until then, treating waste water was an expense no one was prepared to take on. In fact, even the existing treatment plants remained unused.

This situation was aggravated by the large number of firms located in the centre of the town, most of which had tie operating licences.

The present local authority (in office since November 1993) is working to **bring** those firms which have no operating licences into line and to relocate those tanneries (and firms producing chemical products) still sited in the urban centre, of which there were 30 in August 1993.

A standing committee on environmental problems (not yet operative) was then appointed; it is made up of representatives from the local authority itself, from the tanning industry and from the trade unions.

So the situation in Solofra is as follows:

- the waste water is treated at a plant managed by Codiso (Consorzio Disinquinamento Solofra⁴⁶ [Solofra purification consortium]); this plant should be able to treat the total volume of waste

⁴⁴ Basically, these may be divided into hides and skins: hides are thick, resistant products; 85% of them are bovine skins used for the construction of soles for the footwear industry; some are used in the production of travel-bags, belts, suitcases and other leather goods. Hide is generally produced by tanning using tannin. Skins are softer and more elastic than hides and used mainly for leather clothing and shoe uppers. These are generally obtained by tanning with chromium.

⁴⁵ Taken from F. Iadevaia and M. Giugni, Il trattamento degli scarichi delle industrie conciarie nell'impianto di depurazione consortile di Solofra, papers from the **seminar** on "a protezione delle risorse idropotabili del comprensorio Alto Sarno dagli scarichi industriali e civili", 1990.

water (within a radius of about 6 km) by means of a facility for biological treatment with activated sludge⁴⁷ (according to the limits set out in Table A of Law 319/M), but there are different opinions on the subject. Further investigations Should help establish the actual volume of waste water treated by the central plant;

- a specialised firm (Corcosol) handles (80% of) waste material collection (in particular shavings and clippings);
- the problems involved in reducing emissions into the atmosphere (by dust-laying or using dry filters) have only partly been resolved by those firms which have acquired the appropriate equipment; for waste water, then solutions adopted are not entirely satisfactory.

Table 13 shows the components of the initiative relating to the tanning industry in Solofra.

Table 13 Summary of planned and ongoing initiatives relating to the Salofra tannery centre

<i>Type of measure</i>	<i>Objectives</i>	<i>Agencies Involved</i>	
		<i>Financing</i>	<i>Implementation</i>
Project to clean up the Gulf of Naples (completed in part)	To install three treatment plants	Casmez	Region
Plan to clean up the Sarno drawn up by the Ministry of the Environment (planned)	To reclaim an area at high risk of environmental crisis	State (Ministry of the Environment)	State (Ministry of the Environment)
Restoration of the two existing chemical-physical facilities and construction of a new biological plant for the complete treatment of domestic and industrial waste (ongoing)	Complete purification of waste water	State, Commune, Tanners' Association and Salofra purification consortium (CODISO)	Commune, CODISO
Recovery of tanning waste, specialised collection of solid urban wastes (ongoing)	Production of fertilisers	Commune, Tanners' Association, Solofra purification consortium (CODISO) and CORCOSOL (company managing processing waste)	CORCOSOL

We will discuss below two fundamental aspects of the initiative relating to the tanning industry: disposal of waste water and recycling the solid processing waste.

Joint treatment plant in Solofra

The joint treatment plant in Solofra is one of two situated in the "Alto Sarno" area. The Solofra plant pretreats industrial effluent derived from tanning; a biological plant, which will serve the entire area and work by anaerobic digestion of activated sludge, is presently under construction. The two plants are designed to form a single treatment centre.

It is generally accepted that tannery waste is no obstacle to biological treatment; the problem is to establish an acceptable balance between liquid tannery waste and domestic sewage and, in the event of this balance not being achieved, to decide what type of pre-treatment is necessary.

⁴⁶ Consortium set up by the commune of Solofra (51%) and the Tanners' Association (49%).

⁴⁷ The residual sludge is taken to dumps four drying out.

The proportion of tannery waste in the combined effluent should not exceed 10%. Even then, it would be useful to homogenise the waste, at least in part, in order to avoid sending waste which varies too much in terms of flow and characteristics to the biological plant.

Within the limits set out in **Table A** of Law 319/81, the Solofra plant pretreats all elements of industrial waste water which are not compatible with the biological treatment process up to certain fixed values.

The complete Solofra plant was designed for the pre-treatment of the following flows:

- average flow (over 24 hours) $Q_{24} = 864 \text{ m}^3/\text{hr}$
- peak flow $Q_p = 2630 \text{ m}^3/\text{hr}$ ⁴⁸

The original project was approved by Casmez in August 1975. The overall project was drawn up with reference to the requirements for the years 1986 and 2016. It therefore developed along two parallel lines and the first unit for treating $432 \text{ m}^3/\text{hr}$ was completed.

Table 14 shows the data on which the final site of the plant will be based.

The first unit of the plant came into operation in July 1986, although it had been completed by December 1981.

Table 14 Parameters for the final size of the Solofra joint treatment plant

Parameter	Value	
Average flow over 24 hours	m^3/h	864
Peak flow	m^3/h	2630
PH		6:10
BOD3 (average value)	mg/l	2000
COD (average value)	mg/l	5000
Suspended solids (average value)	mg/l	2500
Chlorides	mg/l	From 2000 to 3000
Sulphides (average value)	mg/l	10
Phosphates	mg/l	10
Total nitrogen	mg/l	80
Sulphates	mg/l	From 600 to 1000
Trivalent chromium (max. value)	mg/l	60
Ether extract (as MBAS)	mg/l	From 6 to 10
Manganese (max. value)	mg/l	0.05

The main reasons for the delay in putting the plant into service were as follows:

- the absence of a management body;
- the absence within the region of Campania of a suitable dump for the sludge resulting from the treatment process, given that it **was likely** to be toxic and harmful.

Subsequently the region appointed codiso, which had been farmed for the purpose between the commune of Solofra and the Tanners' Association, as the management body.

So that the plant could come into service, a dump was created in the vicinity of the plant itself, for the temporary storage of the sludge resulting from the treatment process.

This dump, approved by the region of Campania, was planned as a second

⁴⁸ Taken from **F. Iadevaia** and **M. Giugni**, op cit.

category site pursuant to Presidential Decree No. 915/1982, on the assumption that the sludge was toxic and harmful; the planned storage capacity was about 10 000 m³, given that this was only a temporary site.

The sludge was subjected to the toxicity analyses required under the decree; the results led to it being classified simply as special waste⁴⁹.

This meant that the sludge accumulated to date could be transferred to outside, controlled dumping sites.

Since the original forecasts with reference to the year 2016 proved far too low, subsequent financing plans made provision for the completion of the joint treatment plant.

At this point, the measures still to be carried out by the Consortium for the Avellino industrial development area are as follows:

- (a) construction of two outlets from the sewerage network for the domestic waste water of the town of Solofra;
- (b) doubling the size of the existing joint treatment plant with a view to pretreating the waste water from the tanning industry.

The construction of the two sewers is intended as a means of separating the waste water discharged by any industrial plants still located in the urban centre from domestic waste water, within the existing sewerage system in Solofra. The urban centre possesses one dual-purpose drainage system for urban waste water and a drainage system for industrial waste water; in fact, however, the sewers of the two systems carry both domestic and industrial waste water.

On completion, the pre-treatment plant will have a sewage unit and a sludge unit, with the following treatment stages⁵⁰:

- (A) Sewage unit
 - 1. grids and screens
 - 2. de-sanding and de-oiling
 - 3. homogenisation, equalisation and oxidation
 - 4. mixing reagents and clarification/flocculation
- (B) Sludge unit
 - 1. thickening
 - 2. mechanical de-watering
 - 3. controlled dumping
 - 4. thermal drying

⁴⁹ For the purposes of Presidential Decree No. 915 of 10 September 1982, *special waste* includes the following: waste from industrial processing, agricultural; craft, commercial and service activities which cannot, for reasons of quantity *or* quality, be likened to urban waste and residues from the treatment of waste and the purification of effluent. Toxic *and harmful* waste is special waste containing concentrations above certain thresholds of the substances listed in the annex to the above decree.

⁵⁰ As regards the quality of the water, the feasibility study on tertiary treatment to guarantee the quality of the effluent from the plant is well advanced. As regards the disposal of purification sludge, it will be necessary to complete the drying plant and put it into service in the medium term, since this will markedly reduce the volume of the sludge after treatment. The investigation into the recovery of chromium from sludge using biotechnology is also at an advanced stage.

A research project for developing a process for the removal of chromium from tanning wastes using enzymes has been initiated and has already been financed.

Recycling solid waste

Corcosol recycles 50% of the waste produced by the Solofra tanneries every year, while the remaining 50% is collected by private organisations which take it to dumps, although the Corcosol shareholders are, in the main, tannery owners. In fact, Corcosol's majority shareholder is Codiso which, in its turn, as we saw earlier, is a consortium of the Tanners' Association (49%) and the commune of Solofra (51%).

Corcosol uses hydrolysis to process the solid waste (or rather, the nitrogenous part of it) produced by the Solofra tanneries into organic nitrogenous fertilizer (containing non-leachable nitrogen) known as "roasted leather".

The main solid waste collected by Corcosol is as follows:

- greasy scraps;
- untreated scraps and strips of flesh;
- strips of limed flesh;
- scraps of crust and strips of chromed flesh;
- chromed shavings;
- various packaging **materials**, containers, etc.

The shavings and scraps are transformed into organic fertilizer while the remaining waste materials, classified as special waste which can be likened to urban waste according to Presidential Decree No. 915f82, are transported to a controlled dumping site by authorised carriers.

The firm's productive process includes the following operations:

1. collection and storage of the tanneries' processing waste;
2. selection of waste;
3. temporary storage and authorised dumping of unusable material;

production of roasted leather, obtained **from** material selected from the tanning waste, by the following processes:

- (a) steaming the material in pressurised containers;
- (b) drying and roasting in a rotary furnace, heated by direct flame;
- (c) selection of the granular product by sifting;
- (d) crushing in a mill to obtain the powdered product.

The capacity of the plant is 6500 tonnes/year of roasted leather corresponding to the recovery of 9000 tonnes/year of tannery waste.

The material selected as suitable for processing, and therefore to be used in producing roasted leather, is stored in heaps inside sheds. Since this **material** is dry and chemically stable but flammable, no special technical measures are taken except for the installation of fire-fighting equipment. The average storage time is 30 days.

The actual waste is accumulated in metal containers provided by the transport firms, who are responsible for disposal and take it to the dumps for final storage. Because of the presence of scraps of flesh which can decompose very quickly, the material can be stored only temporarily for up to 48 hours. The containers are positioned on hard standings facing the sheds, which are adequately paved and equipped with a drainage **system**.

The firm has a gas purification and deodorizing plant and is linked up to the consortium's industrial sewerage system (Codiso).

Corcosol is useful from the point of view both of environmental protection and of jobs. In fact, as the trade unions have already proposed, it could also take on the specialised collection of solid urban waste and the recycling of the sludge from the biological purification plant planned by Codiso,

thereby offering new job opportunities to workers receiving unemployment benefit and on the move (from one job which has been lost to a new one).

The fertiliser produced by Corcosol has an expanding market: in fact, fertilizer made from roasted leather is used quite widely, but this firm confines itself to selling to other firms which produce and sell organic compound fertilisers.

Corcosol makes no profit, but it could certainly do so by embarking on a sales campaign instead of only offering a service to the tanning industry.

Such a policy could promote both environmental and job protection, involving the local authority, employers and trade unions.

In this regard, the trade unions suggested, at a meeting with the local authority to discuss environmental problems, setting up a limited company involving the communes, Codiso, Corcosol Spa, tannery owners and trade unions; this would deal with waste disposal and the treatment of industrial and urban waste water, as a first step towards co-ordinated action on environmental protection and one which could also offer new job opportunities.

4.3.5 Updated situation as at March 1996

There are two things to report with regard to the River Sarno, which areas therefore relevant to the two case studies on the canning and tannery industries.

The first relates to the start of an initial clean-up operation for the River Sarno; the aim of the project, which has already been prepared, is to turn the mouth of the river into a type of canal. This does mean more "concreting over" of course, but according to the experts should return a degree of hydrogeological balance to the area within two years.

This is not an ecological project, as it will not resolve the problems of pollution caused by the liquid waste poured into the water by the tannery industries upstream in Solofra and the canning industries further downstream.

Nevertheless, the project is a first step which will, above all, facilitate the flow of water out into the Gulf of Castellammare di Stabia, thus preventing the frequent flooding that damages the few agricultural areas which remain despite the incessant building work.

Planned expenditure on the project, designed by the Consortium for the reclamation of the countryside around the Sarno and Nocera, is over Lit 7 billion, already funded by the Public Works Council of the Campania region.,

The project aims to construct two embankments (there is only one at the moment), which will make the mouth of the river into a canal pushing out into the sea; the bed of the river in that area will be dredged to remove the obstacles which slow down the water flow.

Finally, trees and shrubs will be planted around the mouth to make a green oasis. These operations will increase the maximum flow of the river from 50 to 300 metres per second; the Special Commissioner has told the Consortium that implementing this project will partially restore the hydrogeological balance of the mouth of the Sarno.

The second point relates to cleaning up the water. An order issued by the Prime Minister on 14 April 1995 called for urgent action to be taken to deal with the state of socio-economic and environmental emergency declared in the catchment basin of the River Sarno.

In fact, there has been a further deterioration in the environmental situation; moreover, following the sequestration order against the treatment plant handling waste water from the tanneries in the Solofra area, taken out by the Public Prosecutor through the local court, the employment emergency reported by the Prefect of Avellino has also come into being.

The courts have proceeded with further sequestrations of various communal sewers, because of the lack of a purification system, the Regional Councillor for the Environment being appointed as receiver; it follows from the above that urgent action must be taken at structural and managerial level in order to reduce the causes of pollution and to allow productive activity to resume with a guarantee that the environment will be respected.

At its session of 12 April 1995, the Cabinet reviewed a report from the Minister for the Environment, which illustrated the serious environmental risks affecting the catchment basin of the Rivet Sarno and showed the impossibility of providing an adequate and timely solution to the environmental problem the related employment problem, unless special, urgent measures are taken to step up the provision of sewerage, purification and treated water disposal services; to reduce the discharge of polluting substances; to strengthen managerial activities; and to impose restrictions, if only on a temporary basis, on waste disposal onto and into the soil, into publicly owned surface water and into the public sewers.

A deputy commissioner (the Prefect of Naples, U. 'Improta) was therefore appointed to implement the necessary measures, appointed to implement the necessary measures, even if these conflicted with existing provisions, to achieve the stated objectives and in particular:

- to take steps to reduce the burden of pollution caused by the waste from industrial, craft and agricultural activities, including restrictions on the use of raw materials and product replacement, changes **in** technological processes, with separation of certain types of effluent to be handled by specific waste treatment facilities;
- to take steps to increase the treatment capacity of existing industrial and domestic facilities;
- to put in place new stretches of sewers and drains, new treatment plants and new drains for treated water, especially to enable this to be re-utilised or at least disposed of as safely as possible, as well as to integrate, supplement, monitor and restructure the above-mentioned facilities, with particular reference to effluent drainage networks;
- to set restrictions, if only on a temporary basis, on the terms and conditions for effluent discharge onto and into the soil, into the public sewerage system and into publicly owned surface waters, ordering the closure of outlets which do not respect such restrictions, terms and conditions;
- to employ the police and technical staff to patrol the area involved;
- to approve projects, emergency occupations and expropriations; to carry out work notwithstanding contract provisions, authorising public bodies to take charge of and bear official responsibility for conducting such work.

In carrying out the previously described activities, the Deputy Commissioner may call on staff from central government offices, the region of Campania and the local authorities, from the ENEA, the National Technical Services Department of the Premiership, the Department of Health, the National Environmental Protection Agency and municipal corporations, purification; reclamation and drainage consortia, universities, local sanitation units and other public structures, as well as technicians from the scientific and technical committee of the Ministry of the Environment responsible for assessing environmental protection projects.

The financial resources allocated for the above-mentioned operations are as follows:

- (a) Lit 40 billion for the area at risk of the catchment basin of the River Sarno in pursuance of CIPE [Interministerial Committee for Economic Planning] resolution dated 23 December 1993 approving the 1994-96 three-year environmental protection programme;
- (b) Lit 100 billion from funds already revoked by CIPE resolutions relating to operations already funded according to law NO. 64 dated 1 March 1986;
- (c) further sums already earmarked by the state, the region or the local authorities for the installation of sewerage, drainage, purification and treated water disposal facilities in that area, even if these were originally to be sited elsewhere, including sums allocated against FIO [investment and employment fund] funds and the special intervention fund for the Mezzogiorno, those already allocated against funds from the Ministry of the Environment and by Article 5 of law No. 119 dated 24 March 1987.

The Minister for the Environment will issue an appropriate decree appointing a scientific commission comprising seven experts: a chairman and three experts to be designated by the Minister for the Environment and three experts designated by the President of the Campania region. Apart from undertaking the tasks envisaged in the memorandum of understanding on drawing up the plan to

clean up the area of the Sarno at high risk of environmental crisis, the commission would assist the Deputy Commissioner, with a view to providing valid scientific support and ensuring the planning of operations during the emergency phase.

4.4 The problem of treating waste of animal origin: legislative framework

As everyone knows, the term "waste" is given to any substance or object deriving from human activity, which has been disposed of or is intended for disposal. The classification tied in Italy for legislative purposes is indicated in Presidential Decree 915/1982 which classes waste as urban, special, toxic and harmful.

Urban waste (or urban solid waste) i.e. that originating from houses, or other residential settlements, as well as that lying around on the streets and public areas or areas used by the public. Within the definition of urban waste, there is a special category of "dangerous urban waste": used batteries, products and their containers labelled with the symbol "T" and/or "F", expired medicines.

Special waste is that deriving from:

- industrial processes;
- agricultural, craft, commercial and service activities, but which is not the same as urban waste;
- hospitals and similar facilities;
- demolition, construction and excavation, damaged and obsolete machinery and equipment;
- motor vehicles or similar and their discarded parts;
- residues from waste treatment and effluent purification activities.

Toxic and harmful waste is that which contains (or is contaminated by) the substances listed in the annex to Presidential Decree 915/1982 (28 substances), in such quantities and/or concentration as to present a danger to health and the environment.

In Italy, there are few legally recognised incinerators, dumps and recycling plants, especially in the Mezzogiorno, and the proportion of waste discharged in accordance with environmental protection standards is consequently rather limited.

Pollution from solid waste has recently gone from bad to worse in Italy. For example, the production of urban waste has almost doubled over the last fifteen years and yet treatment has remained substantially unchanged and heavily weighted towards dumping.

Faced with this situation, a large number of decisions have been taken by the relevant agencies; in fact, at the same time as it begins to address particular crisis situations, the Environmental Commission of the Chamber of Deputies is preparing a draft framework law on waste.

If approved, this bill will tidy up the vast mass of regulations affecting the troubled waste sector which came in one after another; at the same time, attention will be given to various important European directives (so far disregarded) such as, for example, No. 62/1994 on packaging (which is responsible for about half the volume of urban waste).

Mention should also be made of the introduction by the government for the first time of a genuine environmental tax. This is levied on urban and similar **waste** taken for dumping, thus discouraging this ecologically harmful and space-consuming method of disposal.

The main directives assimilated into the Italian regulations are listed in Table 15.

Table 15 EC directives relating to waste and assimilated into Italian regulations.

Directive 442/1975 modified by Directive 156/1991, legislative framework on waste in general
Directive 319/1978 modified by Directive 689/1991, legislative framework on dangerous waste
Directive 631/1984, regulations on cross-border consignments of dangerous waste
Directive 429/1989, regulations on the incineration of urban waste in existing plants
Directive 369/1989, regulations on the incineration of urban waste in new plants

Directive 425/1990, relating to veterinary and livestock inspections applicable to trade within the Community of some live animals and products of animal origin, with a view to the internal market (modified by Directive 667/1990)

Directive 667/1990, which establishes hygiene standards for the disposal, processing and placing on the market of waste of animal origin and the protection from pathogenic agents of animal feed of animal origin or fish-based, modifying Directive 425/1990
--

Directive 689/1991, relating to dangerous waste

Directive 259/1993, regulations governing despatch of waste within and outside the Community
--

A set of rules governing waste has been in force in Italy for many years. As already pointed out, however, a relatively large number of regulations has been produced; the most important laws or 'decrees for the purposes of this study are given hereunder.

Presidential Decree 915/1982, which is a kind of framework law on waste, has in actual fact been largely ignored for various reasons, including the, inadequate financial resources available, objective difficulties in interpretation and, for many regional and local authorities, inability to cope with the tasks assigned to them by the law.

Regional authority was not exercised in good time and, in any case, it proved to be quite difficult to identify locations for new waste disposal plants, due mainly to opposition from the local people and, in many cases, the local authorities themselves.

Subsequently, Law 475/1988 laid down an "emergency procedure" (now obsolete) and a "regulation procedure", which provided for the establishment of an inventory of special waste, special waste of industrial origin similar to urban waste and toxic and harmful waste in order that all data, both quantitative and qualitative, relating to producers and disposers of waste could be collected within a unitary system on a region-wide basis.

The regulations relating to "used raw materials", the subject of an order from the Ministry of the Environment dated 26 January 1990, were partially repealed by the constitutional court on appeal from the autonomous province of Trento. In August 1990, the Cabinet had approved the order relating to the "emergency programme to adapt the waste disposal system" (as per **Article 5** of Law 475/1988). That order set various tasks for each region and autonomous province: identifying overall needs, divided by disposal methods and type of waste; identifying locations, size and typology of facilities to be installed; identifying possible franchise holders (public and private) for the construction and operation of dumps and incinerators; determining an integrated system of storage and pre-treatment areas; and so on.

The regions are thus responsible for issuing authorisations to set up and manage facilities to make safe and dispose of special waste.

In the long term, once again, priority in environmental policy is given to reducing manufacturing waste. This is to be achieved by developing "clean technology" through research and innovation, i.e. developing either new processes which use fewer materials and produce less refuse, or new, less polluting and more easily recyclable products.

In this respect, decree law 508/1992 (implementation of EEC Council Directive dated 27 November 1990, which establishes hygiene standards for the disposal, processing and placing on the market of waste of animal origin and the protection from pathogenic agents of animal feed of animal origin or which is fish-based, modifying EEC Directive 425/1990) regulates the "recycling" of various waste products of animal origin; in particular, fresh fish offal originating from plants manufacturing fish-based products designed for human consumption is considered to be "low risk material".

The relevant local health authority may insist that dispatch, storage and processing of such material take place in a suitable area and under the proper conditions.

In particular, firms using low risk material may be recognised by the Ministry of Health provided that they meet the following requirements:

- they must be suitably equipped to store and process wastes of animal origin safely; and

- have suitable facilities to arrange destruction of unusable raw waste of animal origin left after the production of pet food. ... or to arrange for this to be despatched to a processing plant or incinerator; and
- have suitable facilities to arrange for destruction of waste resulting from the productive process which, for reasons connected with human or animal health, cannot be included in other animal feed. Such facilities must allow for incineration or burial in such a way as to prevent contamination of watercourses and damage to the environment.

Moreover, fishmeal produced by factories which receive and process only low-risk material intended for the production of fishmeal must meet Particular requirements in respect of salmonella and enterobacteria content.

4.5 The production nucleus at Pizzo (Calabria): the tuna processing industry

4.5.1 The tuna industry in Italy

The Italian tuna industry is the third largest in the world after Thailand and the United States.

It is a modern, well-organised industry which has invested substantial capital in advanced technology and machinery, manufacturing high equality products, subject to strict controls, and which uses sophisticated marketing techniques and efficient sales networks.

There are currently 14' companies operating in the sector (which all belong to ANCIT, the trade association), with 17 factories employing about 5500 people either directly or indirectly.

Production in 1994 was equivalent to 86 000 tonnes of tinned tuna valued at Lit 780 billion (Table 16).

The production cycle requires an average annual input of 120 000 tonnes of tuna (raw material).

The serious difficulties which faced the sector in 1994 still persist today, both with regard to locating raw material and to keeping down production costs, in an attempt to hold these at least at an acceptable level in relation to those in the ACP, countries (Africa, Caribbean and Pacific, where labour costs are a tenth of those in the EC) or the Asian countries (such as Thailand, where labour costs \$3 for a 10-hour day). The latter have thus been able to export tinned tuna to the European Union at competitive prices notwithstanding customs duty of 24%, undercutting even the ACP states which are exempt from customs duty.

Tinned tuna from the Asian countries has now cornered almost the entire market in Northern Europe and is threatening to gain ground increasingly, in Italy, Spain, France and Portugal.

This trend is demonstrated by the constantly rising imports of tinned tuna from those countries during 1994.

From Thailand alone, overall imports into the European Union were 54 334 tonnes of preserved tuna, including 30 910 tonnes into the United Kingdom, 12 841 tonnes into Germany, 8432 tonnes into Holland and 2111 tonnes' into other Member States.

With regard to tinned tuna originating from the ACP countries, 83 120 tonnes came onto the Community market, including 72 120 tonnes imported into France. In this respect, it should be noted that the French canning industry has long since set up its own processing plants in those countries.

Consequently, should this relocation of activity continue at the same high rate, it can only mean the gradual paralysis of the tuna industries located, in the Community which have significantly higher costs.

Table 16 Main indicators in the **Italian** tinned tuna industry for the years 1993 and 1994

<i>Variable</i>	<i>1993</i>	<i>1994</i>	<i>%</i>
Production (tonnes)	90 000	86 000	-4.44

Value (Lit/million)	810 000	780 000	-3.70
Average price (Lit/kg)	3 000	3 070	+0.78
Imports (tonnes)	12 826	10 357	-19.25
Exports (tonnes)	5 058	3 840	-24.08
Apparent consumption	97 768	92 517	-5.37

4.5.2 Case study profile

The initiative under consideration is designed to use waste from tuna processing to produce animal feed.

It took shape within what might be described as the "tuna capital" of Calabria, i.e. the Pizzo area in the province of Vibo Valentia, which has historically been a centre for tuna fishing and processing (until a few decades ago, a traditional tuna fishing system or "tonnara", consisting of fixed nets to catch **migrating** tuna, was still in place in Pizzo) and is where the Calabrian tuna processing companies are located.

The study covers three Calabrian firms (with a maximum of 120 employees) operating in tuna processing (two) and animal feed production (one).

The initiative has the following specific objectives:

- (i) to establish a degree of synergy between tuna processing firms and - feed producing firms operating in Calabria;
- (ii) for the former, in particular, to lower the waste from tuna processing (keeping in mind costs of disposing of store, commissioning the services of specialised companies) and to raise revenue through participating in feed production;
- (iii) for the latter, to replace products (such as fishmeal) which are currently imported or otherwise acquired on the market, with products obtained from a jointly owned firm;
- (iv) to complete the "tuna cycle" (from processing through to use of waste products) within Calabrian territory, with advantages both in employment terms (following the establishment of a new firm) and in environmental terms (processing waste a short distance away from the tuna processing plants).

The first objectives provide benefits for the private sector, falling within the remit of the entrepreneurs involved; the fourth objective, however, is of public interest, producing additional jobs and less human pressure on the environment (reducing road transport of industrial waste, possible reduction in the amount of such waste entering disposal plants and so on).

The initiative thus seems able to combine private and public benefits, and seems particularly appropriate for a region such as Calabria, which is characterised by the weakness of its production apparatus and high levels of unemployment, as well as serious environmental degradation.

Those likely to be interested are firms operating in Calabria in the tuna processing and animal feed production sectors; there are two of the former, both located in the Pizzo area, which process about 1 million quintals per year to supply 4-5% of overall national production; these are joined by a firm producing animal feed, which is located at Vibo Valentia.

The plan is for these three parties to set up a company producing raw materials (especially fishmeal, which commands a very high price due to its high protein content) for the animal feed industry, using general waste from the food industry (for instance from the slaughter of livestock) in addition to waste from tuna processing.

The idea is that the proposed firm will also be able to use waste products from tuna processing firms in Campania.

As Calabria is one of the areas eligible for assistance *in* terms of both European Community (Objective 1 of the Structural Funds, Community environmental protection initiatives, etc) and national (legislation in favour of depressed areas, measures to encourage youth entrepreneurship, etc) policy, the project could even be funded, in a proportion to be determined, with public money.

4.5.3 The geographical and productive context

Human factors in environmental degradation

In view of the morphological structure of the region, Calabria is particularly affected by coastal degradation.

In order to consider the various types of degradation affecting the coastal strips, it is necessary first to classify the types of shoreline. There are beaches which are:

- high and/or rocky, where the sea is in direct contact with the rock;
- entirely (or almost entirely) supplied with sand or gravel from watercourses; they border on the alluvial plains, whatever their extent;
- not supplied with solid **matter** from rivers; these are usually found between bays and inlets, hemmed in by rocky promontories at the sides, almost always backed by rocks.

Erosion is of course one of the main types of degradation affecting the Italian coastline, as a result of either natural processes or human intervention.

In particular, human activity causes degradation through the intensive urbanisation of areas overlooking beaches and the sea defences put in place to impede the retreat of the shoreline.

The characteristics of shoreline advance or retreat are different on the three types of coast. Erosion processes mainly affect beaches fed by watercourses and those not supplied by watercourses, which are the most common types of beach in Calabria, be considered almost stable, while on the contrary rocky coasts may increase in recent times degradation due to erosion having shown no

Beaches by watercourses suffer the greatest problems of erosion and urbanisation, as they bear the major tourist/bathing pressure.

The major cause of erosion is certainly the reduction in solid matter brought by rivers, relating precisely to the sediment - sand and gravel which is essential to keep beaches going.

There are many reasons for this: one of the most serious is the removal of sand and gravel from river mouths or directly from beaches. Even beaches not fed by watercourses may be affected by erosion. The phenomenon is even more serious in that such beaches cannot naturally make up for losses due to erosion.

It should be pointed out that one common factor in the degradations of the three types of coast is related to the extensive urbanisation of the shorelines. The impact on the coasts has been particularly evident in regions such as Calabria, where the development of seaside tourism has often been characterised by uncontrolled building development, altering kilometres of beaches.

The concentration of built-up areas along the coasts destabilises the natural balance, in that - by unnaturally stiffening the coastline - it does not enable the latter to retreat and reconstitute itself, naturally further back; moreover, continuous intervention along the shoreline is necessary to protect public structures and infrastructure from coastal retreat.

A recent study, by the National Research Council, which covered two-thirds of the Italian shoreline made up of beaches (3000 kilometres), shows that the situation is particularly critical along the Calabrian coast and especially along the Tyrrhenian coast where erosion (affecting 70% of the low-lying coast) has eliminated the beach along several stretches, jeopardising the railway line, long stretches of which run very close to the coastline.

The construction of sea defences, for example, by changing the wave motion and the motion of coastal currents, can cause serious erosion.

Another reason for coastal erosion is the reduction in the amount of solid matter brought to the sea by watercourses, which is due to various types of human intervention, including the extraction of sand and gravel from river beds, the construction of dykes and dams, shoring up river banks and the siting of docks upstream.

Protecting and exploiting inland areas

Inland **Calabria**, apart from its specific natural and environmental resources, has a most remarkable "diffuse" environmental quality which is the most precious resource to be protected and exploited, although at different levels of intensity, through regional policies.

Overall, inland areas occupy an enormous part of the region, although they vary greatly in size and gravitational relationship.

The areas are also very diverse in **terms** of population: overall, the characteristics and levels of use of residential areas indicate the need for a broad range of policies, from promotion of the regeneration of areas so far unaffected by the flow of tourists to control over the scale and quality of regeneration of areas already subject to significant tourist pressure. In particular, in areas scattered with small historic towns and villages, where the architectures is in urgent need of attention, regeneration should seek as a priority to conserve and enhance the residential quality of the entire built environment.

More specifically, with regard to the need to integrate environmental protection and socio-economic development, four types of area may be identified within Calabria:

1. national parks and nature reserves;
2. areas, of particular natural beauty and historical/cultural interest;
3. interstitial areas between the two previous types, where these show a degree of continuity with the latter, or whose protection is deemed essential in order to guarantee their integrity;
4. remaining areas of the regional territory, in which there is already intense human activity and which do not have the recognised characteristics of the other three types.

The establishment of the regional system of "inland areas" is one of the most significant features of the regeneration policy which, combined with other instruments, could help to ensure that human activity does not have a destructive influence, taking environmental degradation to the point of no return, but is undertaken in a manner compatible with the evenly distributed, directed and controlled use of resources.

Environmental protection objectives must fit in with the overall policy framework of land-use planning. One of the first general methodological objectives is therefore to relate any initiative or strategy in the field of environmental protection to the territorial context on which it will have the most direct impact.

The housing situation

In 1991, the housing stock in Calabria amounted to 1 003 449 units, 22.7% more than in 1981.

There were 652 822 occupied units, an increase of 13.4%.

Unoccupied units (i.e. second homes used for holidays or work, houses rented to non-residents, available for sale or rent or simply unoccupied for other reasons) amounted to 349 785, representing an increase of slightly less than 110 000 units (+45.8%) in comparison with 1981.

Unoccupied housing is concentrated chiefly in communes outside the main towns: this confirms that a large part of this housing stock is made up of holiday homes (the proportion of unoccupied dwellings rose from 93.5% in 1981 to 95% of the total in 1991 in these communes).

Other types of accommodation, made up of premises which, although not functionally intended as housing (cellars, lofts, storehouses, shops, offices, caravans, boats, barges/wagons, grottoes, etc), were actually occupied by one or **more** families at the date of the census, declined by 60%, with a sharper drop in communes outside the main towns (-62.6%) where 76.6% of such accommodation is concentrated.

The socio-economic situation

Calabria had 2 038 000 inhabitants in 1991 (+0.35% compared with 1981), equivalent to 3.6% of the national population and 10.0% of the population of the southern and island regions of Italy. The projected rate of increase for the period 1993-2008 is 3.4%⁵¹.

Migration represents an extremely relevant factor to be borne in mind: between the end of World War II and the 1980s, about 809 000 Calabrians left the region while 356 000 returned: the overall loss thus amounted to 453 000 people.

As far as employment is concerned, the number of unemployed in Calabria went down from 203 000 in 1990 to 186 000 in 1991 (from 24.6% to 23.2% of the labour force): this reduction in the unemployment rate was not due to a rise in employment but to the numbers of unemployed giving up the search for work.

A look at economic activity shows a consistent increase in service jobs: from 56% of the total in 1984 to over 60% in 1990 (above all in credit and personal and business services - see Table 17).

Table 17 Employment patterns and development in Calabria 1971-91 (employees)

Sectors	1971	1981	1991	% variation 1981-91
Agriculture, ,fishing, mining	2.0	1.6	1.3	-0.3
Manufacturing industry	22.9	20.3	17.6	-2.7
Construction, energy, gas, water	13.5	16.0	15.0	-1.0
Business, repairs, catering, public service	41.6	41.2	42.1	+0.9
transport and communication	12.7	12.4	11.6	-0.8
Credit, insurance, business and personal services	7.3	8.5	12.4	+3.9
TOTAL	100.00	100.00	100.00	-

Source: Istat, records of economic activity

With regard to the processing and preserving of fish and fish-based products in particular, there were 23 firms in Calabria (:991), with 27 local plants and 297 employees.

While the structural changes in the Italian economy over the last decade have exacerbated the gap between North and South, the extent to which the Calabrian economy is lagging behind is more worrying. Data from the latest Istat regional accounting statistics, relating to the period 1980-1988, do in fact show a gradual worsening of several economic indicators which bear witness to the continuing structural weakness of the region in comparison with the rest of the country.

Although characterised by a continuous cycle of speeding up and slowing down, due mainly to the influence of the olive oil sector which is well known for the biennial nature of its production, Calabrian GDP shows a significant upward trend in the first half of the 1980s, exceeding the national average as well as growth in the central and northern areas; the dynamic movement in GDP gradually began to slow down after that, thereby widening the gap between the region and the rest of the country. The weak growth in Calabrian GDP is also illustrated by its share of the national and southern totals: in fact, these remained virtually stable at around 2% and 8.5% respectively over the years 1980-1988.

Between 1980 and 1988, final internal consumption in the region rose constantly at a more sustained rate than the national average. This helped to reduce the gap in terms of per capita consumption; in 1980, the average consumption of a Calabrian was equal to only 78% of the average consumption of other Italians; in 1988, the figure rose substantially to just over 82%.

⁵¹ Source: Region of Calabria, Planning and European Union Affairs Department: *Operational programme for Calabria 1994-99*, 1994.

The employment situation has followed a similar pattern. During the 1980s, gross fixed investment in Calabria grew at a more sustained rate than the national average. Nevertheless, if developments in individual sectors of economic activity are analysed, it can be seen that recorded growth is almost entirely due to the favourable economic situation in the service sector, while results in the industrial sectors are particularly negative. The share of industrial investment in the total fell gradually over the years from 26% in 1980 to 17% in 1988. The reduction in the rate of accumulation has, therefore, been a contributory factor in increasingly inadequate productive capacity formation in the local economy.

Another explanation for the weakness of the Calabrian economy can be found in the region's excessive dependency on foreign financial flows. From the 1970s onwards, net transfers have weighed increasingly heavily on regional GDP, reaching generally higher levels than in the Mezzogiorno as a whole.

In 1980, imports accounted for 40% of GDP in Calabria, as against 22% in the Mezzogiorno and 4% in Italy as a whole. Eight years later, the situation was worse still, the regional figure having risen by almost 17 percentage points.

Although resort to additional resources may seem, on the one hand, amply justified by the relative backwardness into which the region is sinking, it becomes worrying, on the other hand, if this does not help to speed up the rate of growth of the local economy and enable it to narrow the gap with the rest of the country.

The problem of Calabria's dependency on foreign financial flows is not so much quantitative as "qualitative": rather than being devoted to funding productive investment and increasing endogenous accumulation capacity, capital transfers have often been used to maintain the disposable income of the resident population, the only effect being to cause a rise in consumption rather than in domestic product.

The industrial sector

In the first half of 1991, according to surveys by Cerved (data bank of the Italian Chambers of Commerce), Calabrian firms operating in the industrial sector amounted to slightly over 33 000 units, of which 46% were in the building sector. In relation to the same period in the previous year, the number of local operational units had risen by more than 7%; this would suggest a resumption of business growth in Calabria after a period of slowing down which began in the second half of the 1980s and was further accentuated over the last two years.

The arising growth rate of Calabrian industrial firms follows the trend in enterprise creation quite closely, while the rate of enterprise closure appears relatively stable.

The factors which seem at first sight to have had a significant influence on the productive fabric of the region over these years are, therefore, the greater capacity of existing firms to maintain their market share (as shown by the modest rate of business failures) and the large number of new business initiatives, even though this has shown a downward trend.

The strongest growth rates have been recorded in the "various manufacturing industries" (4.7% annual average rate over the period 1990-1991), engineering (3.8%) and building sectors (3.4%), whereas there has been relatively limited growth in the mining, transport and energy sectors.

Distribution of local production units according to numbers of employees shows the high concentration of Calabrian industries in the smaller categories. In fact, "atomisation" is a feature of the region's production apparatus.

Also according to Cerved surveys, in the first half of 1991, local units with fewer than 10 staff amounted to about 94.7% of those in industry as a whole, while 4.8% had between 10 and 43 employees.

Large firms, i.e. those with more than 500 employees, are few and far between and concentrated in the metallurgical, chemical and vehicle construction sectors. Even medium-sized firms (100-499 employees) are poorly represented in the regional industrial structure, with only 21 establishments; mostly operating in the engineering and traditional sectors.

With regard to specialisation, there is a clear predominance of those traditional, low-risk activities which are now tending to decline, while more modern, dynamic industrial activities have only marginal representation.

With regard to the export of industrial products, which represent about 82% of Calabrian exports, there was a significant increase in the share of the energy and timber industries, (+19%), apart from the engineering industry, while exports of non-metal products' (-34%), ferrous ,and other mineral products (-27%) and food products (-26.4%) fell.

Manufacturing imports, which represent 64% of total imports, have risen in the energy sector (+117.5%), the mineral and non-metal product sector (+13%), in the chemical (+10%) and food industries (+8%). The most important negative variations are found in vehicles (-24%) and engineering products (-17%).

Data on geographical distribution for 1989 shows that 35% of the **local** productive units are located in Cosenza province, 36% in Catanzaro province and 23% in Reggio Calabria. In particular, there are 69 communes with at least one productive unit having more than, 10 employees in Cosenza, 63 in Catanzaro and 41 in Reggio Calabria provinces. The highest concentration of production activity is in the province of Reggio Calabria with an average of 2 local units per commune, followed by Catanzaro with 1.5 and Cosenza with 1.4.

The commune with the highest number of local units is Reggio Calabria (40 units), whereas 236 communes in the region do not have productive activity with the above-mentioned characteristics on their territory ; this gives a very high coefficient of variation, 3.95, at regional level.

A feature of the current settlement pattern in Calabria is that the emergent industrial areas all coincide with **major urban** centres and the minor centres which are geographically and infrastructurally linked to them.

4.5.4 The environmental impact of the tuna production cycle: from fishing to the use of waste products

The impact of fishing

In Italy, there is an extremely ancient tradition of tuna fishing (known as "mattanza" - slaughter), due to the fact that this fish is born in the Mediterranean, moves out into the **Atlantic** to feed and then comes back up the Gibraltar Strait to reproduce in the "mare nostrum" (see Figure 11).

As already mentioned, the "mattanza" has very ancient origins because the tuna pass close to the coasts; the "tonnare" (tuna fishing nets, see Figure 12) are (or mostly were) fixed structures for catching these fish, making a kind of large, three-part trap.

The "coda" (**tail**) is a barrier of fine, wide-mesh nets, fixed to the coast, which extends into the sea up to the body of the "tonnara" and is designed to channel the tuna into this.

The "codardo" is another barrier which extends from the body of then "tonnara" into the open sea to turn the fish towards the "coda". The body has a series of seven chambers of nets: by raising and lowering the dividing nets, the shoals of fish are directed towards the killing chamber; the only one fitted with a movable bottom.

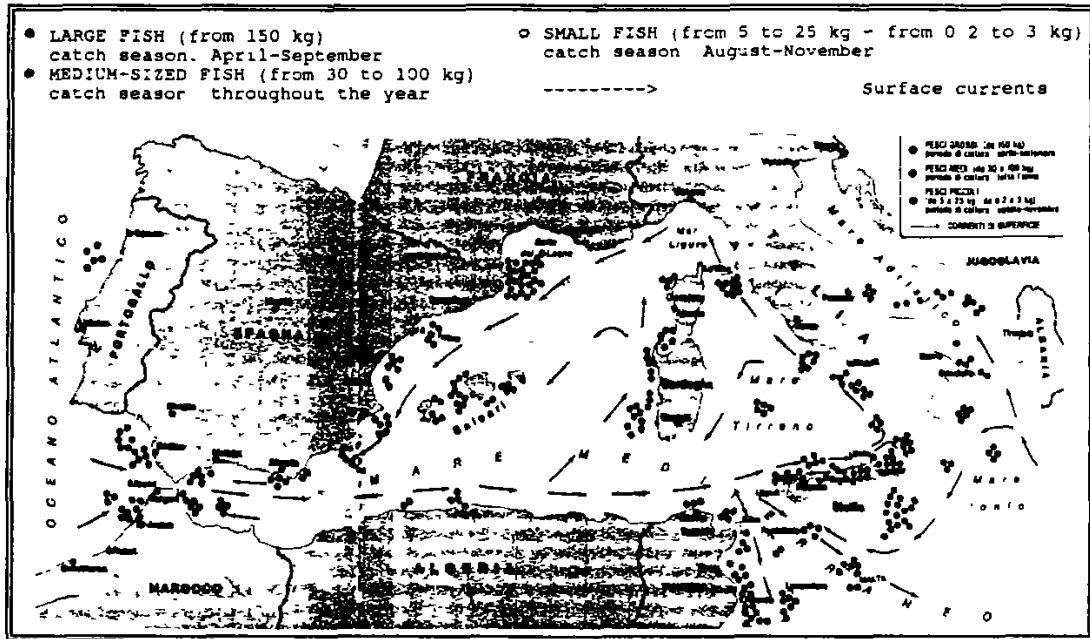


Figure 11 Map of the movements in the Hedittarrank11 Map of the movements in the Mediterranean
 Source: Airone, Mondadori Editore.

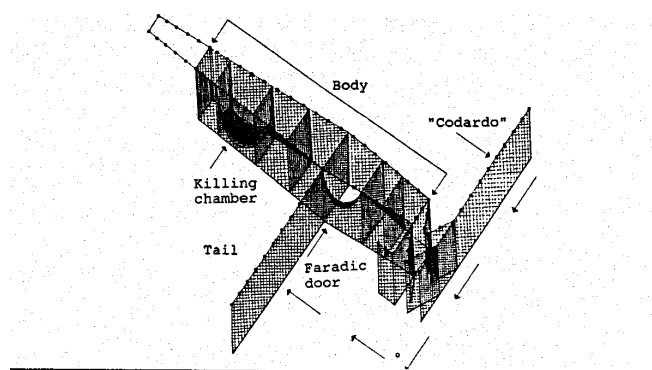


Figure 12 Structure of the tuna fishing nets (tonnara)

Source: Airone, Mondadori Ed.

The killing chamber is surrounded by the fishing boats and, during the final phase of the slaughter⁵², at a shout from the "Rais", the fishermen raise the net which closes the killing chamber and the bottom net. In a short while, the tuna find themselves in only half a metre of water and they exhaust

⁵² The tradition of the "mattanza" was so deeply rooted as to shape the destiny of the social groups who practised it. The world of the tuna fishermen was always organised into a sacred group, whose absolute and undisputed chief was the Rais, the high priest of the clan. Even in very recent times (up to 1968, in Favignana, on the Egadi island, where the last "tonnara" remained), the decisions of the Rais were law not just for the fishermen, but also for the civil authorities and other inhabitants. The whole life of the community was regulated by the date set by the Rais for the fishing season: from April to June, all activities were adjusted to his orders. A man became Rais through a cursus hokorem which lasted a lifetime, starting at the age of 3 years until death, going through a series of initiations from cabinboy to being responsible for opening the tonnara, to "arringatore"* (assigned to harpooning the tuna), to skipper, to vice-Rais.

* Literally "haranguer", because of the shouting which goes on during the operation.

themselves looking for an exit; it is then that they are harpooned and hauled on board (Figures 13 and 14).

There are many reasons for the virtual disappearance of this method, not least of which is the bloody nature of the operation (as can be seen from the preceding description) and its impact on the environment, but especially the prohibitive cost of labour in relation to the size of the catch, the old-fashioned structures, the slowness of the operation and also the falling catch.

With regard to the latter, a change in the behaviour of the tuna has been noted, in that reproduction occurs increasingly far from the coasts; the main reason is to be found in overall pollution: the transparency of the water is in fact an important factor for the tuna, as are variations in salinity and temperature. There is also noise pollution, caused by the large number of boats passing through the coastal areas and the decline in the fish species on which the tuna feed.

The tuna fishermen have therefore turned to alternative, more profitable solutions: from fishing by encirclement (using the trawl net, a large rectangular net drawn up with hydraulic apparatus which surrounds the shoal of fish and rapidly encloses it even from below, in a kind of inverted cone) to ships which work together with a helicopter to be sure of sighting fish. The boats are often equipped to freeze the fish immediately.

The catch is more than ten times larger using such methods.

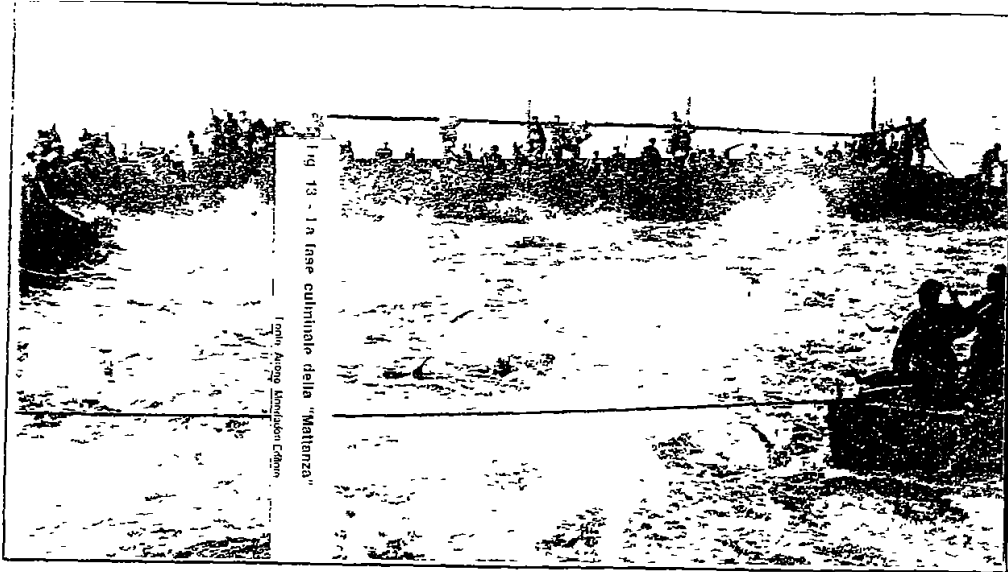


Figure 13 The final phase of the "Mattanza"
Source: Airone, Mondadori Editore

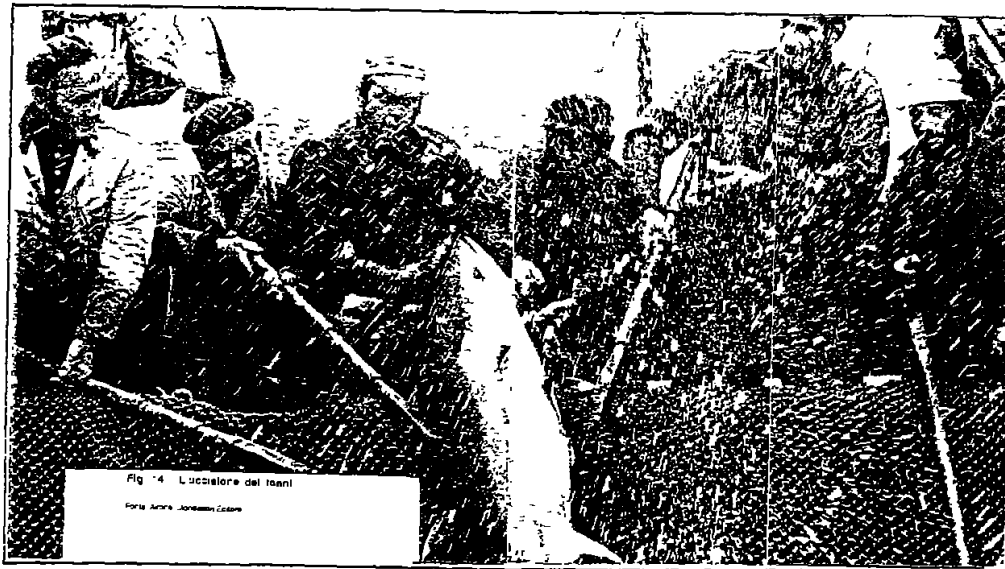


Figure 14 Killing the tuna
Source: Airone, Mondadori Editore

Anyone who thought, therefore, that the "tornare" were structures with a serious impact on the environment had not reckoned on modern technology (which, in some cases, even uses satellites to locate the fish); in fact, these fishing methods have one **major** drawback: tuna (not just Mediterranean tuna – *Thunnus thynnus* – to which we have referred so far) swim in shoals

below cetaceans (especially dolphins) and so catching the former means killing the latter.

For this reason, an agreement has been drawn up (in which Greenpeace is also taking part) with a view to avoid fishing with these methods in the Pacific Ocean especially, where it seems that dolphins are actually **being** exterminated.

Some Italian firms which process tuna (especially Nostromo) do not import frozen fish from that ocean, but only from oceans where there is a lower risk of killing dolphins. **Japan**, which is the leading expert in modern tuna fishing methods, has not signed the agreement.

The impact of tuna processing firms

The criteria used to assess the environmental effects of various types of activity, whether planned or in progress, are based on analysing a matrix of environmental components and typologies of operations.

This procedure is generally used for "ex ante" impact **assessments on a large** scale or related to planning models which have not been finalised.

The following Table 18 therefore shows the effects on the surrounding environment, or rather on its components, potentially deriving from the operation of a firm which processes tuna (assessed ex post).

It should be stressed that the table shows all the possible effects on the environment; as already mentioned, these are still potential effects, which proper management of activities (for example in accordance with the regulations in force) can mitigate easily in most cases.

Table 18 Effects on the environment of tuna processing activity

Environmental components	Effects
Air	emissions from motor vehicles used to transport the goods; emissions from plants processing the products; unpleasant smelling emissions
Water environment	pollution caused by the discharge of water used to wash the fish and machinery and for boiling
Soil and subsoil	possible pollution of the soil due to infiltration from waste water and incorrect disposal of processing waste
Noises and vibration	modest increase in noise pollution
Ionising and non-ionising radiation	effects cannot be predicted
Landscape	permanent alteration of landscape due to the presence of industrial sheds
Vegetation, flora	effect cannot be assessed (the impact on this component occurred during the shed Construction phase)
Fauna	Possible increase in species which feed on the fish scraps, attracted by the smell and presence of waste
Ecosystems	effect cannot be assessed
Human health	effect cannot be assessed

As can be seen from Table 18, the various types of emission (from vehicles and processing plants) affecting the "air" component can be partially mitigated by respecting the regulations in force; the same can be said for the "water environment", even though the impact in some cases may nevertheless be quite substantial inasmuch as, notwithstanding the recovery of all by-products, the waste water will always carry polluting substances such as blood, fats, etc.

On the other hand, as far as the "soil and subsoil" component is concerned, possible pollution arising from infiltration of waste water and incorrect disposal of processing waste may be accidental and so special measures should be adopted in that sector.

The modest increase in noise pollution can easily be contained, contrary to the alteration of the landscape component deriving from the presence of the industrial sheds, which is a permanent, irreversible impact.

The effects on "vegetation, flora and **ecosystems**" cannot be assessed, inasmuch as assessment should have been conducted "ex ante" (the impact on these components mainly occurred during the construction of the industrial sheds).

As far as the "fauna" is concerned, on the other hand, a possible increase may be predicted in species which feed on fish scraps, attracted by the smell and presence of waste.

The effects on "human health" cannot be verified and it is extremely important here to ensure proper application of regulations relating to the safety of workers and accident prevention.

4.5.5 A project for the treatment of waste from the tuna processing industry

Although the planned fishmeal production plant might use waste from other productive processes (such as livestock slaughter), its main input is expected to come from the tuna industry.

It is therefore useful briefly to describe the characteristics of the productive process, using examples from two firms interested in the project which operate in the tuna sector.

Notes on the characteristics of the cycle: from processing to waste disposal

The tuna cycle may be summarised as follows:

- (i) acquiring the raw material (not more than 10% from the Mediterranean, the rest from the warm seas: especially the Indian and Pacific)
- (ii) processing, which breaks down into the cutting, cooking, skinning, canning and storage phases;
- (iii) sending the waste (inedible parts) for disposal.

With regard to this final phase, it should be stressed that a feature of the cycle is that processing waste amounts to between 55 and 70% of the weight of the raw material.

Currently, Calabrian firms hand the waste to a firm in Palermo which uses it to produce fishmeal.

As - according to experts in the sector - the market for tuna is fiercely competitive, firms have to work hard to compete, so any cost reduction exercise, such as using the by-products of processing⁵³, **becomes extremely important.**

The impetus provided by the market situation is compounded by a legal issue: EC regulations relating to the disposal of fish waste (which is mainly aqueous and highly toxic and must **be** treated within 48 hours) are, in fact, moving towards an insistence that treatment plants should be located within 100 km of processing plants.

Before disposal, scraps and **waste** from tuna processing have to **be** stored at low temperature, which means costs for the firm.

Using the waste could therefore provide a two-fold benefit to the firms involved in the initiative under consideration:

- being prepared in advance for changes in the regulations relating to waste disposal;
- turning the costs of disposal into revenue by taking part in fishmeal production.

⁵³ It is estimated that using processing waste for productive purposes could bring **about** a reduction in the costs of basic manufacturing equivalent to S-6% of the total.

The productive organisation of a processing firm (120 employees)

The establishment is located in Porte Salvo (Vibo **Valentia village**) and occupies an overall area of 26 800 m².

The activity involves producing tinned tuna from the (frozen) yellowfin species.

The production cycle is as follows (for full details see Annex 3):

- Storage of the frozen tuna, in appropriate galvanised iron cases, in cold rooms at a temperature of -18°C.
- Daily removal and defrosting of raw material through immersion in water in a special installation.
- Cutting the tuna: the fish is sliced using disc and single-blade cutting machines. The cut-up tuna is placed in suitable steel and/or plastic trolleys and/or crates.
- Washing and removal of blood from the raw fish by immersing the crates and trolleys in (steel) vats containing water and by douching.
- Cooking the flesh, either by boiling in water or steaming under pressure.
- Cooling of the cooked tuna flesh and storage in holding chambers at a temperature of 5-6°C, where it stays until it is fully used in the next phase.
- Cleaning the flesh to remove the inedible parts, i.e. skin, bones, etc.
- Packing the cleaned pulp into suitable tin-plate and/or **aluminium** cans. This is done mechanically for small cans and manually for larger ones.
- Adding salt and oil (olive oil) to the tins (mechanically for small tins and manually for the others).
- Hermetically sealing the tins by seaming the covers.
- Sterilising the packed product, after placing it in appropriate containers.
- Preparing the packaging.
- Storing the finished product for seasoning and subsequent dispatch.

Characteristics of the recycling project

The animal feed sector has been growing constantly for **some time**.

At the same time, the problem of treating industrial waste, as we have seen previously, especially that of animal origin, poses quite a few problems for the environment, companies and the **ecosystem**.

Reconciling these two considerations is the **main** aim of the project studied here.

The use of waste of animal origin, deriving from fish or meat processing, requires in-depth knowledge of the food chain and the proper application of sound, hygienic production principles.

As everyone knows, some industrial waste (especially inedible scraps) deriving from the processing of food products for human consumption, constitutes "raw material" for the livestock and farm produce industry. In fact, as in the case of human food, any preparation for animal feed has both starchy (cereals and derivatives) and protein (meal of animal and plant origin) components.

The process developed by the "Poerio-Bühler" project⁵⁴ is based on the above-mentioned understanding.

This undoubtedly brings the human food product industry into contact with the animal feed industry. In the case in point, as there is a large concentration of tuna processing industries in Calabria, the project was designed to solve the problem of disposing of the processing waste.

⁵⁴ Bühler spa is the company installing the extrusion plant described here.

This waste, as we have seen, represents the raw material for the production of proteinic meal for livestock feed; there are, however, some innovations in the various phases and modalities of the process of producing such meal, in relation to traditional methods. These are described below.

The project to process industrial waste of animal origin is based on processing the residue from tuna production and, subsequently, possibly also processing meat residues. The high percentage of waste has to be treated in a very short time due, amongst other things, to the extreme perishability of the material.

This means that technical processing times must be carefully planned; these must be linked "temporally" with the initial production processes, as indicated above. Processing the waste is, however, quite a simple operation, as shown in Figure 15.

In this figure a diagram of the extrusion plant developed by the Bühler company is given.

There are, however, certain features which should be highlighted:

- Receiving the waste:
the waste will be packed at source in thermal containers so that the "raw materials" do not deteriorate. When these arrive at the waste treatment plant, they are placed in a settling and retting vat, at a controlled temperature; they will then go through the homogenisation process.
- Production process:
the very simple process introduces some innovations: while in existing plants the process is based on the simple extraction of edible meal, in this case the "raw material" (i.e. the waste) goes through a process broken down into "extrusion", "emulsion" and "pelleting".

Premixed fillers (cereals and starches) are added to the compound, thus producing balanced, homogenised extruded products.

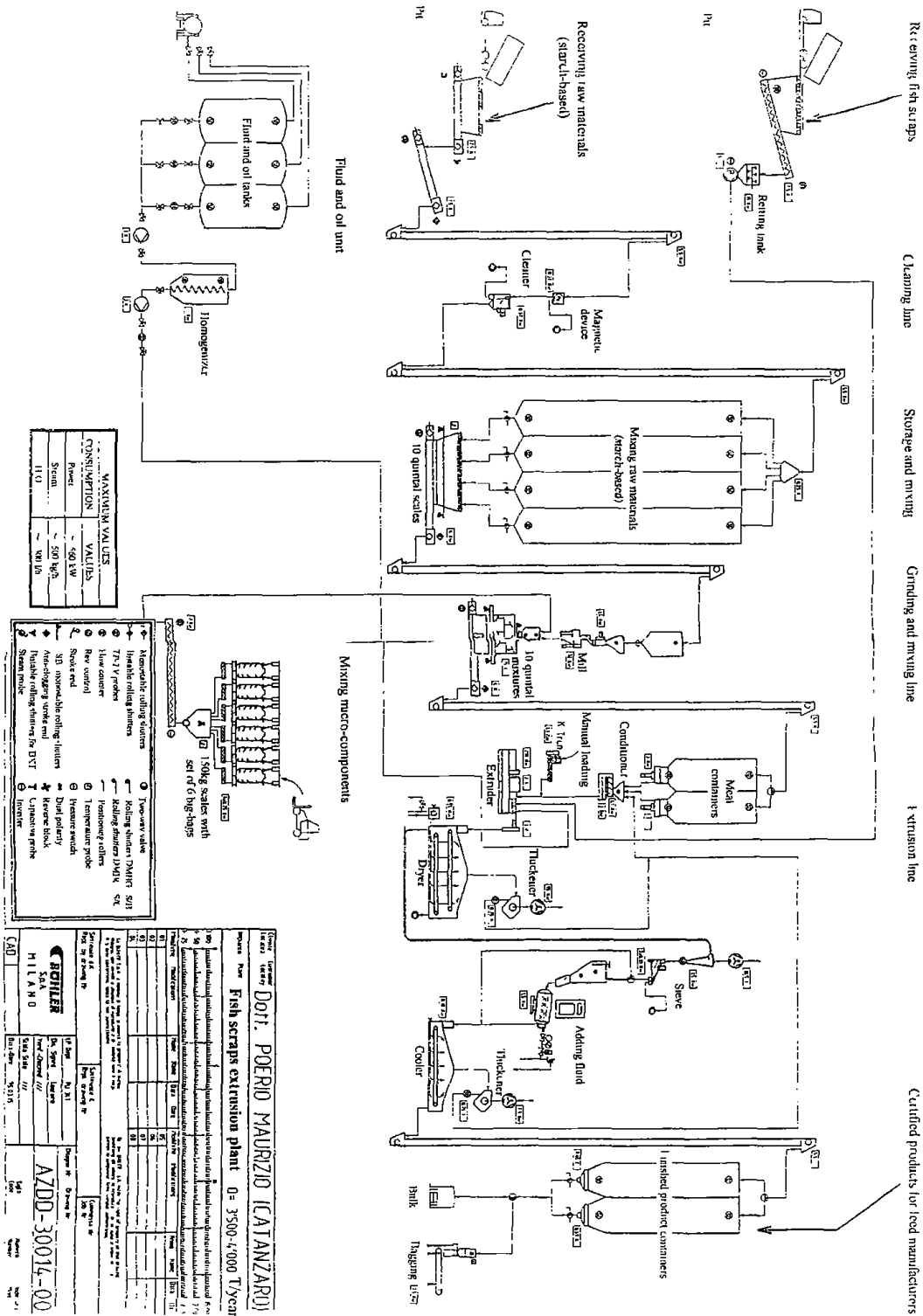
This innovative process allows for the stabilisation of the product, which would otherwise have to be used very rapidly by producers of livestock feed. The production plant must have particular features in order to carry out the above-mentioned operation.

The gelatinisation of the starches, as well as the hardness, stability and durability of the product, must closely match the specifications. The dust removal stage is also very important, as there are problems with the transmission of toxins and toxic particles.

In this way, the extrusion process results in highly digestible and palatable products.

It should also be remembered that, during waste processing, there is a problem in treating active substances: vitamins and minerals are in fact partially hygroscopic and tend to form lumps and stick together. They must therefore be treated with a neutral carrier substance to obtain a premix. In this case, very highly specialised technological equipment is used for micro-weighing the components.

The main innovative feature of the waste processing system described here is the high added value of the product: this enables feed producers to use the product in preparing nutritionally balanced compound feed for livestock



Dot. POERIO MAURIZIO (CATANZARO)

Fish scraps extrusion plant - 3500 x 000 T/yr

1) 2) 3) 4) 5) 6) 7) 8) 9) 10) 11) 12) 13) 14) 15) 16) 17) 18) 19) 20)

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5. EFFECTIVENESS AND LIMITS OF THE INITIATIVES CONSIDERED

5.1 Criteria used to evaluate the initiatives

All aspects of the problem must be clearly defined before we can evaluate the initiatives under consideration.

In the first place, we must stress that the synergy identified in the case-study analysis offers one answer, if not a complete solution, to the conflicts (or potential conflicts) between the parties involved.

Such conflicts can occur between the parties involved when one side exercises powers in relation to the environment, while the other is engaged in activities which have an impact on the environment.

In cases where the conflict, rather than becoming acute, is the subject of negotiation between the parties, it is possible that some synergy can be achieved in resolving the problem.

In order to show how synergy can be achieved, the features of the different case studies have been placed in a suitable matrix of:

- (i) environmental problems to be resolved;
- (ii) characteristics of ongoing or planned initiatives;
- (iii) agencies promoting and managing the initiatives;
- (iv) expected results of the initiatives;
- (v) obstacles to the success of the initiatives;
- (vi) possible synergy to be achieved through action taken by the agencies referred to in point (iii).

5.2 The search for synergy between the parties involved as a way of overcoming the environmental conflict

Any project to clean up the environment can potentially generate conflicts of interest between the parties involved.

Such activity will inevitably be bound up with changes in the behaviour (which is harmful to the environment) of some of them.

In this kind of situation, the following approaches can be taken:

- as regards public bodies:
 - observance of the laws and regulations in force;
 - promotion of co-ordination with private bodies;
- as regards private bodies:
 - avoidance of the laws and regulations in force;
 - observance of the latter, without being prepared to look for co-ordination with public intervention;
 - as before, but prepared to look for co-ordination with public intervention;
 - direct commitment to improving own environmental performance (corporate investment, technological innovation, etc).

Discussions (which started in the USA during the 1970s) are taking place in all the industrialised countries on the adequacy of traditional decision-making instruments in relation to measures with a major environmental impact.

It is maintained that many problems could be resolved by negotiation, rather than by technico-scientific decisions, especially in the - by no means infrequent - cases of conflict between opposing interests and values⁵⁵.

Conflicts can arise in any attempt to solve environmental problems. There can be systematic opposition from the population which considers itself harmed and the public (local bodies) or private (environmental groups) who represent them.

However, there can also **be** conflict between the public agencies who have the institutional task of protecting certain interests. Failing any administrative instruments and practices for conflict management, the situation quite often **becomes** more **acute**, with the parties divided into opposite camps on matters of principle.

The decision-making processes are therefore fairly time-consuming, difficult to control and unpredictable. Once a formal decision has been taken, the conflict can recur at the implementation stage. The defeated parties try to exploit the legal remedies available to them in order to assert their own interests. There is no matter of any importance in which the administrative tribunals do not interfere, their judgements swinging one way then the other depending on the level of the case and on the Precautionary and final **nature** of their decisions; this takes up more time and makes the **outcome even more** unpredictable.

Quite often the final decision (if and when it is taken) ends up dissatisfying everyone concerned, which leads to a general deterioration in relations between communities, groups and institutions.

The reason why the traditional decision-making methods are inadequate is that they presume the public interest can be defined by the use of objective parameters of a legal (procedures and standards) or technical and scientific nature. But the former tend to be too rigid. The legal parameters establishing the procedures generally sanction inclusion criteria which may in practice prove arbitrary, in the sense of actually excluding the most highly motivated parties who have resources and particularly relevant knowledge. Furthermore, they authorise the excluded parties to claim their rights before other bodies (administrative and ordinary tribunals, regulatory agencies, etc).

The legal parameters setting the standards often have the effect of transforming a guarantee into a hindrance and offering further opportunities for appealing to the law. Similarly, technical and scientific parameters are inadequate in cases where knowledge is shaky, the technology uncertain, the relationship between cause and effect little known and too many variables are involved.

Certain aspects at least of most environmental questions fall into these categories.

If the administrative authority does not succeed in imposing generally accepted solutions because it is unable to offer an unequivocal definition of the public interest in the name of which it claims to be acting, resorting to legal means of resolving conflicts is equally incongruous. Judges can indeed pronounce on questions on the basis of criteria inappropriate to the nature of the problems involved; they settle the conflict as far as the law is concerned, but cannot resolve the problem from which the conflict arose.

The alternative is to tackle conflict by means of negotiations in which all the interested parties take part on a voluntary and informal basis (i.e. free from any judicial or legal constraints), face to face, in an attempt to bring about a freely endorsed agreement as the final result. The solution of conflicts by negotiation, or alternative dispute resolution (ADR), has been widely tested in the United States since the 1970s and is now an important strand in research and action. Many private agencies specialise in offering mediation services or advice on negotiating.

More than a decade later, this approach is becoming more widespread in Europe, although mainly at the theoretical level for the time being (but there has been some practical experience).

5.3 Details of completed and ongoing initiatives

Table 19 gives a general view of the characteristics of the initiatives considered here.

⁵⁵ see : IRKS, Relazione sulla situazione economica, sociale e territoriale del Piemonte 1993, Rosemberg and Sellier, Turin 1993.

Table 19 Characteristics of the environmental improvement initiatives covered by the study

| Area | Environmental problems | Characteristic ongoing and planned initiatives | | Parties involved | Expected results | Obstacles to success | Possibility of synergy |
|-----------|---|--|--|---|--|---|---|
| | | Objectives | Content | | | | |
| Orbetello | Clean up of Lagoon | Reduce the environmental impact of industrial activity | Plan to construct phytopurification plant for fish-farming | Orbetello Pesca Lagunare spa | Self-financing project Can be extended to other producers | Difficult relations with local people who distrust the productive activities in the lagoon | Dissemination of a behavioural model compatible with the needs of the lagoon. Research information and population consensus |
| | | Reduce pollution of lagoon waters | Construct infrastructure for purifying domestic and industrial waste discharged in the lagoon, European Union | Orbetello commune/Commissioner for the lagoon (Min of Urban) | Preventive treatment of waste in lagoon Lagoon crisis management | Delays in executing projects Little participation by other economic operators | |
| | | Reduce organic biomass | Collection of algae | Orbetello commune/Commissioner for the lagoon (Min of Env) | Reducing putrescent residues | Excessive algal growth eutrophication of water | |
| Solofra | Treatment of tannery waste water and disposal of waste | Slow down silt up process | Dredging the lagoon bed | Orbetello commune/Commissioner for the lagoon (Min of Env) | Maintenance of aquatic ecosystem | Excessive silt production soon frustrates the measures taken | The local union organizations have proposed setting up a limited company between the commune, CODISO, the company recycling tannery waste owners and the municipality disposal of industrial and urban waste water (with effects on the environment and employment) |
| | | For the tanneries pre-treatment of waste. Tab. C law 119/76 and for the joint treatment plant (CODISO), of waste water. Tab. A | Project to re-start the two existing units for chemical/physical treatment and construction of a new biological plant for the complete treatment of domestic and industrial waste | Tanners Association and CODISO (consortium to clean up Solofra), State, commune | Gradual compliance with rules governing waste dumped in the Solofrans stream | Differing declarations about the quantity of waste sent for treatment reducing efficiency of the process (when there is more waste than declared) | |
| | | Recovery of tannery waste, specialized solid urban waste collection | Marking recycled leather (nutrogenous fertilizer) for environmental and employment purposes | Tanners Association and CODISO, CORYSOL, State, commune | Increased turnover of recycled leather | Proliferation of firms collecting and storing solid tannery waste | |
| Sarno | Cleaning up the Sarno/profound environmental environmental conflict with the Solofra area | Solution to water and health/sanitation emergency in the area, re-use of tonnage processing waste | Information and awareness campaigns, waste monitoring, corporate treatment plants, building treatment plant for domestic and industrial waste water, reduction of water consumption and possible recycling of processing waste water | Region of Campania ANICAV (Producers' Association), commune, Legambiente, State | Improvement of local environment | Old plan for cleaning up the Sarno obsolete, no new plan | Integration of future (new) plan for cleaning up the Sarno with the Basin Plan and ANICAV and Legambiente initiatives |
| | | Economic and environmental benefits from waste | Installation of an extension plant | Private companies | Environmentally friendly production | Delay in identifying potential public funding sources (to co-fund the project) | |

As we have seen, the initiatives we have studied highlight the attitudes of some types of firm (operating in the sectors of fish-farming, canning, tanning and tuna processing) towards treatment of the waste water from their production processes in the first three cases and "special" waste in the fourth.

These attitudes (at least in the first three cases) reflect approaches which, broadly speaking, go beyond mere observance of current regulations, aiming to co-operate with the authorities responsible for environmental protection and land-use management.

The initiative relating to the tuna-fishing sector requires separate treatment; in fact, this case has particular features which set it apart from the other three. In the area where the planned project is to be implemented, there is actually no environmental disaster (as in the case of the Sarno; for instance) nor a place of outstanding natural beauty to protect (as in the case of Orbetello), which would require synergy to be established between the state and public and private agencies.

The aim for the tuna industry is in fact to optimise the processing cycle in environmental terms, enabling processing waste to be completely recycled close to where the industries themselves are located. This would make it possible, as illustrated elsewhere in this study, to start up new activities, providing new income and new jobs, in a manner compatible with environmental protection.

However, it must be pointed out that these are fairly recent approaches and, in the first three cases in particular, were adopted only when the state of the environment in question was already seriously damaged.

This shows that, until a few years ago, the predominant approach was one of indifference on the part of firms (which off-loaded the costs of waste water disposal on the public authorities or future generations) and inadequate action on the part of the public authorities responsible for environmental controls.

The factors discussed in Chapter 2, and the intervention of the courts (which have called on all the parties involved to observe the laws in force) led, as we have said, to the endeavour to establish co-operation between firms and the public authorities.

More generally, there was a growing awareness that the further deterioration of the environment was doing (and would increasingly do so in the future) serious damage to the health of the people and to local economic activity.

Co-operation between firms and the public authorities has taken the following forms:

- (i) sharing of information with a view to drawing up and implementing projects;
- (ii) promotion and co-funding of environmental clean-up programmes and projects;
- (iii) setting up joint ventures (whether with public or private capital) to tackle environmental protection issues.

In the case of Orbetello, close co-operation was observed between the local authorities and the fishermen's co-operative, which also runs some of the fish-farming installations in the lagoon.

In the area occupied by the canning industry in the Sarno basin, the producers' association has encouraged research and surveys on the nature of the pollution produced by the canneries.

That association has also proposed building a plant, with public and private finance, to treat the waste water from both the canning industry and the residential areas.

The project has been endorsed by environmental groups and the trade unions.

In Solofra, a major centre for tanneries, the local authorities and the producers' association, in agreement with the trade unions, are planning to promote the total treatment of the solid waste and waste water resulting from the production processes of the tanning industry.

The joint undertaking by the commune and the producers is certainly a positive step: it may stimulate the search for solutions to environmental problems which take account of both community and industrial interests.

Unfortunately, as will be seen, the problem of waste water from the tanning industry is, from what is known at present, very difficult to resolve: the level of concentration of the productive units is too

high and consequently so is that of the waste, which is far more polluting (mainly because of the presence of metals and surfactants) than that from the canning industry.

As far as Pizza is concerned, the project has developed on the basis that a secondary market exists for processing by-products, with producers of food for human consumption (tinned tuna) and feed for livestock working in close co-operation. As already pointed out, there is indeed a degree of synergy between these two commodity sectors which complete the complex circle of the food-processing chain.

Moreover, the very specific regulations discussed in Section 4.4 will allow for appropriate disposal of the (very limited) waste from the extrusion plant.

5.4 Obstacles to the success of the initiatives

The case-study initiatives have been beset by difficulties of various kinds.

It is clear from the evidence collected that the financial and procedural difficulties, which are by no means negligible, can be overcome (all things considered, the former rather more than the latter)⁵⁶.

On the other hand, technical and technological problems may prove to be obstacles which are hard to overcome or - as things stand at present quite insurmountable.

In the case of Orbetello lagoon - where the commitment of the relevant authorities (in particular, the Commissioner for the Lagoon⁵⁷ and the Ministry of the Environment) has made it possible, however belatedly, to utilise the available financial resources - it was necessary to resolve the problem of how to dispose of the mud dredged from the bed of the lagoon.

The solution, which not everyone accepted, was to create "silt bunds" in the lagoon itself, leading to a reduction, however negligible, in the surface area of the water (which will, however, be mitigated in time by the planting of hygrophilous vegetation).

The use of the "phyto-purification" technique in fish-farming, on the other hand, proved satisfactory and is likely to be used increasingly in future.

Orbetello is therefore a case in which, since there are no "insurmountable" technical difficulties, co-ordinated action by the parties involved can help resolve the environmental problems more quickly.

Two years on, it can be said that such co-ordinated action has been directed towards implementing the programmes to enhance the domestic and agricultural waste-water collection and treatment systems, as well as the "self-purification" programmes for the waste from fish-farming.

There is rather more dispute about the problems involved in cleaning up the environment in the Sarno basin.

The two case studies relating to the basin are examples of two different sets of problems.

As we have seen, there are two separate forms of pollution: one from the canning industry and the other from the tanneries.

If appropriate measures are taken, the former can gradually become compatible with the aquatic environment of the river Sarno and is therefore susceptible to co-ordinated action by the parties involved.

The environmental association "Legambiente" has recorded a definite change over the course of the last few years in the environmental approach taken by the major canneries.

Their approach can now be said to be broadly in line with current legislation.

The same cannot be said for medium-sized and, in particular, small firms, whose environmental approach still tends to consist of evasion of the law.

⁵⁶ This obviously does not mean that unlimited financial **resources** are available, just that more is available than the local administrations' spending capacity.

⁵⁷ Even today (March 1996), as indicated in the update on the case study, there are two.

A common commitment on the part of employers, local authorities, environmental associations and trade unions towards a joint project for the treatment of industrial and domestic waste could therefore, in time, produce positive results.

The case of the pollution produced by the tanning industry is different: at present, on the basis of the available technology, it does not look as though this can be brought within the limits set in the current legislation.

In fact, the concentration of waste is too high in relation to the flow of the recipient mass of water, the Solofrana stream.

The effect of discharging waste into the stream has therefore been, and still is, to render it biologically "dead".

Consequently, unless a form of technology is adopted which can resolve the above problem, there is a risk that joint action by the parties involved will not produce positive results.

With regard to Pizza, at the time of writing, the problems which might hinder the implementation of the project to recycle the waste from the tuna-processing industry are primarily financial in nature.

Attempts are in fact being made to locate "public" financial resources to co-fund the extrusion plant, within the framework of the European Union's Structural Funds for "Objective 1" regions and funds available under Law 44/1988 for young entrepreneurs.

5.5 Possible action and synergy

Corporate action to clean up water resources will have to vary according to the nature and gravity of the **problems** in the different areas.

The following measures could be taken:

- (i) the promotion and funding (totally or in part) of projects aimed at bringing discharges into line with current legislation;
- (ii) studies and research on the pollution caused by the various industrial activities;
- (iii) research initiatives designed to perfect new production techniques (involving lower water consumption for example) or new treatment technology;
- (iv) the promotion, via the trade associations, of information campaigns relating to the above techniques and technology.

Each of these **measures** may, in different contexts, lead to co-ordinated action with the other parties involved: the effectiveness of the synergy achieved will in its turn vary in accordance with the quality of the measures taken by each party and with the constraints arising from the particular context (see Fig. 16).

More generally, the search for synergy might be facilitated by initiatives - possibly also encouraged by the Commission of the European Communities, the State and the regions concerned - aimed at:

- (a) clarifying and rationalising current legislation;
- (b) encouraging the regions and communes concerned to set up "round tables" and possibly task forces **amongst** the parties interested in co-operating to resolve environmental problems;
- (c) instituting an observatory - at least in the areas "at high risk of environmental crisis", if not in all the areas with serious environmental problems - to monitor the application of the legislation and the implementation of the expenditure laws, as well as to ensure that the measures are carried out and work efficiently.

The corporate initiative on disposing of the waste from tuna processing offers interesting commercial and technological possibilities.

Measures could include:

- designing and implementing projects aimed at reducing corporate costs and setting up new initiatives;

- developing (and testing) technology and processes for recycling such waste.

Synergy could be sought:

- between the regional administration and local authorities responsible for environmental protection and managing ecological services respectively - on the one hand and firms on the other, in reducing the pollution caused by transporting waste consigned to the dumps or recycling plants, and by disposal of the waste itself;
- between tuna-producing firms and firms using the relative waste to optimise and complete the productive cycles in the food chain (for both humans and animals).

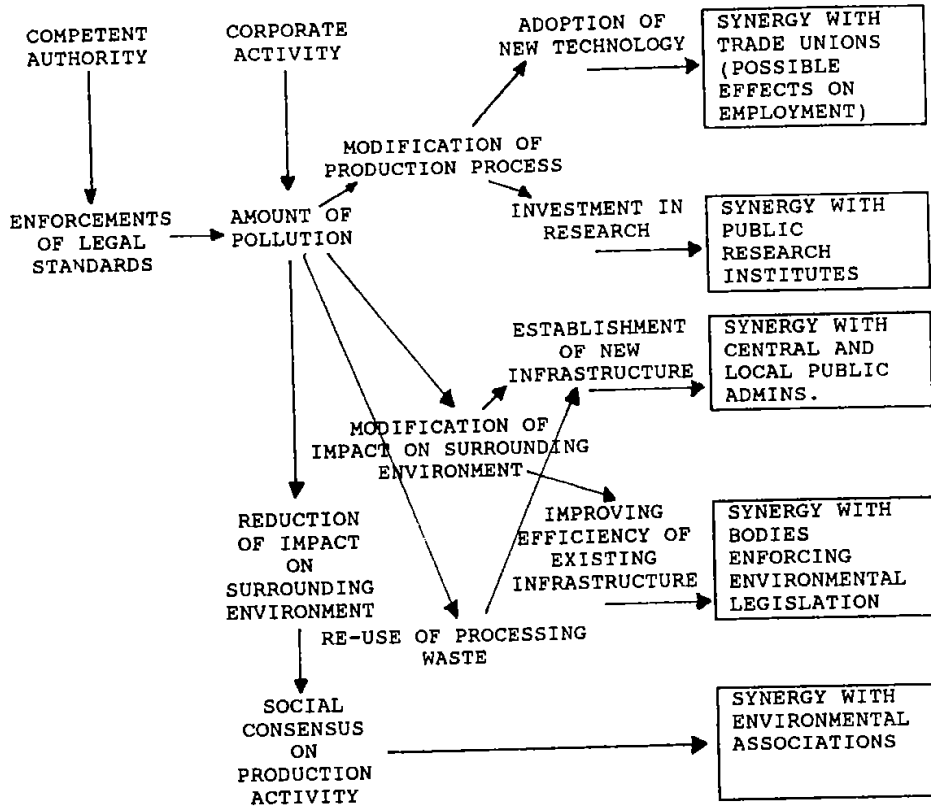


Figure 16 Outline of possible coordinated action to reduce pollution by industrial firms

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ANNEX 1 Questionnaires used for the field survey

Note: Photocopies of annexes may be requested from:

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ANNEX 2 Characteristics of industrial tuna processing

The raw material: tuna

Common names of the various species of tuna

Thunnus thynnus: bluefin tuna

This is the name given to the species which lives in the Mediterranean Sea and which, in the regions of Calabria, Sicily and Sardinia, forms the basis of small-scale tuna processing. It can be from 1.5 to 5 metres long and weigh between 150 and 600 kilos, although fish weighing about 150 kilos are usually processed in order to ensure that mercury, which accumulates in the body over the life of the fish, is not present in levels exceeding the legal limit. Mobile "tonnare" (tuna-fishing nets) are now cast in the open sea, replacing the traditional use of fixed nets which were anchored close to the coast. The dark pink flesh is of firm consistency, rather oily and therefore full of flavour; it is only processed fresh and is greatly appreciated by connoisseurs. For some years now, the size of the tuna catch has been going down gradually, while the purchase price has gone up on a yearly basis, to the extent that bluefin tuna is now considered a rare, prized species which is processed only by a few firms in Italy.

Yellowfin tuna

This species lives mainly in the Atlantic, Pacific and Indian Oceans. It is 1.5 metres long on average and weighs 40 to 50 kilos. Encircling nets are used to catch the fish. In recent years, a world-wide agreement between processors and environmental associations has led to a substantial reduction in the catch in the Pacific Ocean and has forbidden the import of yellowfin tuna for processing, due to the high mortality amongst the dolphins which live in those seas and move around with the tuna. The fish are frozen in brine or blast-frozen on board the ships and are kept continuously in the cold chain until they reach the processing works. The flesh is light pink in colour and less oily. This tuna is the most widely used commercially by the canning industries and therefore the most well known and appreciated by Italian consumers. Amongst the species of imported frozen tuna, it is undoubtedly the best and has tended to replace consumption of bluefin tuna in Italy, partly due to advertising, because unlike the latter it is available in large quantities and therefore less expensive. For some years, to reduce labour costs, cleaned, cooked, frozen and vacuum-packed yellowfin tuna has been imported from the countries where it is caught, under the name "Loins". In terms of processing, this product has a higher water content and is of imperfect quality when cleaning has not been done carefully enough.

Skipjack tuna

This species, which lives mainly in the Atlantic Ocean, is of small size and varies in weight from 1 to 4 kilos. In Italy, it is processed mainly from frozen, whereas in Portugal (especially in the Azores) it is also processed from fresh. Lines or nets are used to catch skipjack tuna. The flesh is deep pink in colour, with characteristic **small** dark patches made up of blood clots; it is considered to **be** of low quality and therefore has a lower price than any other imported tuna. When processed fresh, this type of tuna is only tinned in "fillets" (or chunks), not because the tuna is really **being** filleted, but because the small size of the slices makes any other form of tinning impossible. Advertising has given the fresh-processed product an excellent image in Italy, despite the fact that this fish could not even be tinned under the name of tuna until a few years ago. On the other hand, the same product, when frozen, is used almost exclusively in the manufacture of lower-priced products. "**Loins**" of this quality tuna are also imported.

Big-eye tuna

This species, which lives mainly in the Pacific Ocean, can **be over 2 metres in** length and over 250 kilos in **weight**. The flesh is of inferior quality and rather yellowish in colour. It is little used in **Italy** and usually only for lower-priced products.

Albacore tuna

This species lives in the temperate waters of all oceans and even in the Mediterranean. The flesh is almost white in colour, with little flavour; it is packed and distributed **almost exclusively abroad, as this** type of flesh is not appreciated in Italy.

The Callipo firm: general and production characteristics

Company profile

The firm was set up in 1913 by Giacinto Callipo and was the first in Calabria and amongst the first in Italy to begin processing the highly appreciated Mediterranean tuna. The firm's headquarters are at Pizza, a small town in the heart of the Sant'Eufemia Gulf, which has historical links with tuna fishing.

The firm began processing tuna to use up the surplus remaining after fresh tuna consumption. The activity was seasonal to begin with, as only the fish caught by the local "tonnare" over the spring/summer period was used.

Nowadays, the works cover some 34 000 m² with a covered area of 5000 m' and give an appearance of modernity and efficiency due to the advanced technology of the plants and equipment. Production is around 25 000 quintals per year of processed tuna, equal to 80% of the firm's productive capacity.

Fresh tuna production

The Mediterranean bluefin tuna, whose scientific name is *Thunnus thynnus*, is the tastiest and rarest of all tuna. This species lives in the Mediterranean and, in the spring, it rises from the depths of the sea to lay its eggs.

The characteristic feature of this type of tuna is its length, which can be up to 3 to 4 metres and its weight of up to 3 to 4 quintals. The flesh is dark red in colour in mature tuna and a lighter pink in the younger fish; it is oilier and softer and therefore has more flavour.

"Belly of tuna" is extracted from these fish, i.e. the most valuable part, which is made up of the adipose tissue which covers the lower part of the ventral cavity. The latter is processed very carefully, as it is extremely tender and delicate,

These tuna are processed in an almost continuous cycle, as they are processed directly from fresh: the heads and guts are removed, they are cut into pieces and washed in large quantities of water, before being steam cooked and vacuum cooled to eliminate excess moisture. After cooking, the tuna is placed in an appropriate conditioning chamber so that the slices can dry out further.

Subsequently, the skin, **bones** and blemished parts are removed from the tuna pieces, which are then selected on the basis of size and quality.

The **smaller tin sizes**, from 80 to 160 grammes, are produced using an entirely automated process. For larger sizes (from 320 grammes to 4 kilos), the tuna pieces are scrupulously selected and stowed by hand. **The** product is then salted and packed in olive oil before the lid is sealed and the tin: washed.

Finally, the tins of tuna are sterilised in steam autoclaves and, after cooling, packed in cartons or heat-insulated containers.

The following phase - seasoning for several months - is very important for the final quality of the product. This is to **ensure** that the tuna matures and releases its full fragrance when the tin is opened for consumption.

The tuna roe or "caviar" is always harvested from these fish. It goes through a long process before being dried and then packed in blocks or in extra virgin olive oil.

Frozen tuna production

Over the last few years, the firm has gradually been able, **by maintaining a** relationship with external markets, to move from purely seasonal processing to continuous processing throughout the year. This means that during the other months it processes imported tuna which may have various origins (Atlantic or Indian Oceans).

Production is based on yellowfin tuna (see Table 1). This species is the best imported product, it is the most commercially well known tuna and its pinkish white flesh is leaner and therefore more full-bodied. These tuna weigh no more than 78/88 kilos and are therefore of smaller size. As soon as they are caught, the fish are frozen in brine or blast-frozen on board, **being** kept in the cold chain until arrival at the works for processing.

The production process for this type of tuna, like that for bluefin tuna, includes gradual defrosting in water allowing the blood to drain **out**. The **successive** processing phases, both for hand-stowed pieces and those passing through the automatic production line, are the same as for bluefin tuna.

Nets, which can be as **much** as several kilometres long, are used to catch the tuna which swim in shoals near the surface. When the fish have been located, one or two boats stretch the net around the shoal. When the whole of the shoal has been collected together, the bottom of the net is closed; the yield depends on how quickly this manoeuvre can be completed.

Table 1 - Notes to identify "tuna in olive oil"

| | |
|---------------------------|---|
| Family: | Thunnide |
| Scientific name: | Neothunnus |
| Species: | N. macropterus |
| Common name: | Yellowfin tuna |
| Commercial forms of tuna: | Round/GG/D.W.T./Dressed |
| Round = | Whole |
| GG = | gutted, without gills or fins, caudal fin cut off |
| DWT = | head removed, gutted, without fins, caudal fin cut off |
| Dressed = | head removed, gutted, without fins or tail |
| Fishing grounds allowed: | Indian Ocean/West Pacific/Atlantic |
| Fishing system: | with free-standing "tonnare" (fishing boats equipped to fish only for tuna) and encirclement nets |

Preservation of tuna following capture up to arrival at the factory

AS Soon as the fish are caught, they are plunged immediately, on board the fishing boats themselves, into a cooling liquid which is kept in circulation (refrigeration in brine).

In 24 to 48 hours, the centre of the fish's body reaches a temperature of -10C. AS soon as the tanks are full, the brine in the circulating system is discharged and replaced with brine pre-cooled to -11⁰C. Under such conditions, the fish can maintain their initial freshness for several weeks.

The subsequent phase is freezing (in brine) to -18/-21°C with a brine content of 20 to 24%.

When the fishing operation is complete, the boats go to the closest refrigerated terminals where the tuna is stored at a temperature of between -18O and -20OC. The tuna is then transhipped from these cold stores to refrigerated ships which sail to the main Italian ports, keeping the temperature at the above-mentioned level; it is then taken to the works by refrigerated lorry where the following operations occur during the unloading phase:

- checking that the temperature is not above -9°C;
- visual check on quality;
- sorting by size into the various containers;
- storage in refrigerated chambers at -20°C.

Defrosting

After the quality of the fish to be processed has been assessed, the tuna is extracted from the storage chamber and put to defrost in the same metal containers under running water until the heart of the fish reaches a temperature varying between 0° and +5°C. Naturally, the amount of tuna taken must be the same size.

Cutting operation

The tuna must be cut up after the defrosting phase, when the muscle tissue is still sufficiently compact to allow a uniform cut. This operation, carried out with bolt-saws, also allows the fish to be gutted and then cut up into sections, sides, quarters and tail pieces. At the same time, the slices are sorted by size into appropriate trolleys and boxes.

During the cutting operation, a series of water jets washes and removes blood from the slices.

Bloodletting

Once the trolleys are filled with the cooking boxes full of tuna slices, these are placed under a water spray for about two hours so that all the blood drains out.

Cooking

90% of the tuna will undergo steam cooking. the first phase of which is conducted under pressure in a suitable autoclave to get rid of any air inside. After this, the steam flowing in brings the surrounding temperature to 102/103°C.

When the probes indicate that the temperature at the heart of the autoclave has reached 65°C, cooking is stopped and the product is cooled, again under pressure. When a certain temperature is reached at the centre of the tuna within the autoclave, the cooling phase is brought to an end and the trolleys are unloaded.

Conditioning

As soon as cooking is completed, the trolleys are placed in a refrigerated chamber at a temperature of -15°C for conditioning of the product over a period of about 12116 hours. This operation helps to ensure complete evaporation of excess water.

Cleaning up

After drying/cooling, the tuna goes to the cleaning operations. These include removing the skin, bones, etc and any parts which may have blood stains, oxidised or blackened patches or strange colouring. Grading is done during this operation:

| | |
|---------------|--------------------------------------|
| Top grade: | - characteristic fresh fish smell |
| | - typical colour of the species |
| | - characteristic taste of fresh fish |
| | - excellent consistency |
| | - no oxidization |
| Second grade: | - no fresh fish smell |
| | - pinkish/brown colour |
| | - normal fish flavour |
| | - normal or spongy consistency |
| | - slight surface oxidization |
| | - stringy/crumby flesh |

Everything is separated into clearly marked trays to be sent for packing.

Packing

For tin sizes from 350 to 4000 grammes, slices of tuna from 2 to 12 centimetres thick are used, after being cut from already cleaned slices.

Packing is done by hand and, where necessary, the pieces of tuna are halved and the pattern of the tin must show up on the surface. Generally speaking, for 2 or 4 kilo tins, two superimposed layers are formed. The tins **must be** filled so that the clearance is not excessive, in order to avoid unpleasant spills of oil on opening.

All the packed fish must have the same colouring and be of the same quality.

After packing a tin, each operator will put a stamp on it which presses a letter onto the tuna slices, identifying the operator who has produced the tin and therefore carried out the packing and is responsible for the quality of the work.

After placing on a conveyor belt, the tins are dosed with salt in an amount equivalent to 1% of the declared weight. They are then filled with olive oil at 80°C and seamed. Before **being** placed in the basket, they are washed to eliminate traces of tuna and surface oil.

For sizes between 80 and 300 grammes, the tuna fillets are placed in a separate machine which cuts them up, forms them into a block and fills the empty tins.

When those are full of tuna, a visual inspection on appearance and colour is carried out and the tins are dosed with between 14 and 24% of brine, before being packed under pressure with olive oil at 80°C.

Once the tin has been sealed and washed, it is placed in the basket for the next phase.

Sterilisation

This is done in automatic autoclaves, in order to destroy or irreversibly inactivate micro-organisms and enzymes which could damage the product, rendering the tuna sterile for commercial purposes. This phase may last from 30 to 240 minutes at a temperature of 120°C depending on the size of the tins.

Packaging, storage and seasoning

Tinned tuna needs to be kept for a long time until it reaches an appropriate level of maturity. During that period, the oil completely penetrates the muscle tissue of the fish, like the salt which is distributed uniformly throughout the product. The time needed to reach maturity (see Table 2) depends on the size of the tins.

Table 2 – Minimum length of storage

| Pack size | Minimum duration |
|------------------|-------------------------|
| 80 g | 3 weeks |
| 160 g | 5 weeks |
| 300/800 g | 80/90 days |
| 2000 g | 100 days |
| 4000 g | 120 days |

The Nostromo firm

The works are at Porte Salvo (Vibo Valentia, on highway 522, 15 km from Tropea, and occupy an overall area of 26 800 m².

The activity involves producing tinned tuna from frozen yellowfin tuna.

The production cycle is as follows:

- - Storage of the frozen tuna, in appropriate galvanised iron cases, in cold rooms at a temperature of -18°C.

- -Daily removal and defrosting of raw material through immersion in water in a special installation.
- - Cutting the tuna: the fish is sliced using disc and single-blade cutting machines. The cut-up tuna is placed in **suitable steel** and/or plastic trolleys and/or crates.
- Washing and removal of blood from the raw fish by immersing the crates and trolleys in (steel) vats containing water and by douching.
- - Cooking the flesh, either by boiling in water or steaming under pressure.
- - Cooling of the cooked tuna flesh and storage in holding **chambers at** a temperature of 5-6OC. The flesh stays there until it is fully used in the next phase.
- - Cleaning the flesh to remove the inedible parts, i.e. skin, bones, etc.
- - Packing the cleaned pulp into suitable tin-plate and/or aluminium can. This is done mechanically for small cans and manually for larger ones.
- - Adding salt and (olive) oil to the tins (mechanically for small tins and manually for the others).
- Hermetic sealing of the tins by seaming the covers.
- - Sterilising the packed product, after placing same in appropriate containers.
- Preparing the packaging.
- Storing the finished product for seasoning and subsequent despatch.

European Foundation for the Improvement of Living and Working Conditions

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