Meeting of the Focal Points of the
Regional Marine Pollution Emergency
Response Centre for the Mediterranean
Sea (REMPEC)

REMPEC/WG.18/10/2
20 July 2000

Original: English

Malta, 25 - 28 October 2000

Agenda Item 10.2

AERIAL SURVEILLANCE

Note by REMPEC

1. The Eleventh Ordinary Meeting of the Contracting Parties to the Barcelona Convention, held in Malta, 27-30 October 1999 (UNEP(OCA)/MED IG.12/9, Annex IV) adopted a set of Recommendations concerning sea-based pollution prevention and control activities, which have been addressed to both the Contracting Parties and to the Secretariat, i.e. REMPEC.

2. The fifth Recommendation addressed to the Contracting Parties invites them "to promote, either individually or through bilateral or multilateral co-operation, **aerial surveillance** as means of monitoring violations of existing regulations for the prevention of pollution from ships".

3. At the same time, the second Recommendation addressed to the Secretariat (i.e. REMPEC) suggests that, as regards the provision concerning the prevention of pollution from ships, no activity should be initiated other than the programme on port reception facilities for which financing is presently being considered by the E.U. within the framework of the MEDA programme, until such times that the necessary personnel are made available.

4. Taking into consideration that the introduction on a systematic basis of aerial surveillance in other regions had proven to be very effective means of control of illegal discharges from ships, and with a view to assisting the Contracting Parties to initiate similar activities in the Mediterranean in accordance with the Recommendations of the Meeting of the Contracting Parties, REMPEC commissioned a Consultant to prepare a study and proposals concerning the aerial surveillance in the Mediterranean region.

5. The study prepared by the Consultant is attached as **Annex I** to the present document.

6. REMPEC considered that initiating on a trial basis aerial surveillance in certain parts of the Mediterranean could be possible with a minimum additional burden for the Centre, and that on the other hand the results obtained through such initial activities could be, at a later stage, easily applied on the regional scale and contribute to significantly reducing pollution from illegal discharges from ships.

Actions requested from the Meeting of Focal Points

7. The Meeting is invited to:

a) examine and discuss the study and proposals prepared by the Consultant;

b) approve the initiative for starting, on a trial basis, aerial surveillance in selected parts of the Mediterranean, providing that the Contracting Parties directly concerned agree with the proposal;

c) give guidance to the Director of REMPEC regarding the reporting of the initial results of such aerial surveillance.

ANNEX

IMPLEMENTATION OF AERIAL SURVEILLANCE OF MARINE OIL POLLUTION IN THE MEDITERRANEAN REGION WITHIN THE FRAMEWORK OF THE BARCELONA CONVENTION

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IMPLEMENTATION OF AERIAL SURVEILLANCE OF MARINE OIL POLLUTION IN THE MEDITERRANEAN REGION WITHIN THE FRAMEWORK OF THE BARCELONA CONVENTION

1. INTRODUCTION

Over the past 20 years extensive efforts have been made on the global scale with a view to reducing the pollution of the marine environment. It refers in particular to operational and accidental oil pollution generated by maritime traffic.

The key element that contributed to the improvement of the situation in the field of operational pollution from ships was entry into force of MARPOL 73/78 Convention and its Annexes. On the other hand, in the field of accidental marine pollution, massive investment in oil spill response capability around the world combined with the development of national, regional and global systems and regimes for preparedness and response have significantly increased the capacity for dealing with marine pollution emergencies.

The countries of western and northern Europe, most of them nowadays members of the European Union, were among the first to realise the importance of co-operation in both preventing and responding to marine pollution by oil and later on by hazardous substances other than oil.

It was understood at very early stages that most often the resources required are beyond the means of any single country, and that most efficient way of overcoming economic implications of controlling marine pollution lies in pooling available resources from several countries. This led to signing a number of regional, sub-regional or bilateral agreements, primarily aimed at co-operation in preventing pollution of territorial waters and coasts of participating States and at facilitating mutual assistance in case of marine pollution emergencies.

Among these a few have reached such efficiency at operational level to be considered as examples for other countries in the implementation of new regional agreements. The Bonn Agreement covering the North Sea and the Helsinki Convention covering the Baltic Sea are two such exemplary regional agreements, and experience in their implementation was often the model on which co-operation in dealing with marine pollution in other regions was based.

Contracting Parties to the Emergency Protocol to the Barcelona Convention, that covers the Mediterranean Sea and which entered into force some time after the two above mentioned regional agreements, could therefore only benefit from the experience gained so far in these two regions, *inter alia* in avoiding duplication of expensive resources that are required infrequently.

One of the fields in which co-operation among the member States of Bonn Agreement and Helsinki Convention has proven particularly efficient and cost effective is the control and monitoring of maritime transport generated marine pollution, by means of aerial surveillance and remote sensing.

The following study aims at justifying the introduction, by the Contracting Parties to the Emergency Protocol, of similar practices in the Mediterranean region, taking into consideration the strategic goals of the second phase of the Mediterranean Action Plan in the fields of prevention and response to both, operational and accidental pollution by oil and other hazardous substances.

2. THE MEDITERRANEAN CASE

The Mediterranean Sea is a half-enclosed sea, covering about 2,5 million square kilometres, whose surrounding coastal zone is inhabited by an estimate 81 million people, expected to increase to as many as 170 million by 2025.

For what the industry is concerned, only in the north–west corner of the Mediterranean (Spain, France and Italy), there are over 50.000 industrial enterprises.

About 40 oil related sites (i.e. oil refineries, offshore platforms, pipe terminals etc.) are distributed along the Mediterranean coastal zone, from and to which an estimate of 0.55 and 0.15 billion metric tons of crude oil and hydrocarbon products are annually loaded, discharged and transported by oil tankers. Moreover due to the singularity of the coastal physiology, the coastal line length of the 20 non uniformly industrialised countries bordering the Mediterranean Sea, is not analogous to their share in the oil chain activity.

The Mediterranean has its own problems as far as sea pollution is concerned.

In the Mediterranean Sea area the tanker routes are concentrated along specific paths dictated by maritime navigation regulation in force for the area.

The tanker traffic density varies from 10 to 20 ships per day concentrated mostly along the route Port Said to Gibraltar, and with an average transit of 3 tankers per day along the Tyrrhenian Italian coasts.

Shipping, especially oil tankers, calling ports or in transit through Mediterranean waters, presents the risk of oil or chemical pollution to the marine environment as a result of collision, grounding, sinking, structural failure, loss of cargo or oil as cargo or fuel or other marine casualty.

It is estimated that around 330,000 tonnes of oil are deliberately and illegally dumped each year. Other figures indicate that there may be as much as 1,000,000 tonnes dumped each year, perhaps demonstrating that too little is known about the full extent of the pollution problem in the Mediterranean.

Although the Mediterranean has been declared by the MARPOL Convention as special area, where deliberate oil discharges are banned, there is clear evidence of continuous violation of the law.

Furthermore, spill concentration appears mostly at the approach of congested waterways such as the Messina Strait, the Suez Canal and Gibraltar Straits and in other zones of major maritime oil traffic transit, such as SE-NW zone from the Ionian to the Adriatic Sea, the Aegean Sea and the passage between the Mediterranean and the Black Sea.

Besides the ecological hazards by oil slick reaching the shore, for itself, most of the countries bordering the Mediterranean Sea rely on tourism for a significant proportion of their national income and it is to point out, that more often it is the economic threats that swift a prompt action.

Due to a mild climate and the historical background of the region, the number of tourists visiting the area is estimated to reach to as many as 260 millions/year in 2025.

Today 20 Mediterranean coastal States plus the E.U. are the 21 Contracting Parties to the Barcelona Convention, which is their only existing legal framework for co-operation in the Mediterranean area.

Today most oil pollution monitoring in the Mediterranean is carried out using ships with a coverage which is normally limited by availability and operating costs and only in very few cases they provide a regular national service.

It is a matter of fact that oil pollution monitoring in the Mediterranean ought to be looked at as a global system including all the relevant aspects such as monitoring, analysing, modelling, predicting and managing, in order to address the overall problem of oil at sea for a risk assessment and for risk managing.

Furthermore, the absence of Exclusive Economic Zones in the Mediterranean area makes most of its waters “high sea”; that is international waters upon which coastal states have no specific duties or rights.

There is no flight by oil spill monitoring planes over the south border of the western part of the Mediterranean Sea and over its eastern basin.

Following IMO recommendations, civil aviation authorities generally issue information to pilots of civil aircraft in order to encourage them to report to the appropriate air traffic control authority when substantial patches of oil, or other possible harmful substances are observed on the surface of the sea, for onward transmission to the appropriate Maritime Authorities.

Only two Mediterranean countries (France and Italy) operate flights with specialised oil slick surveillance planes but the results are neither compared nor compiled jointly.

In recent years CEDRE and the French Custom Service carried out jointly, for France, the European Pilot Project “ Oilwatch ”.

Also the air service of the Italian Coast Guard - Capitanerie di Porto - collaborated with CEDRE in the same pollution detecting project.

Another project that attracts great attention in the field of remote sensing for discovering and monitoring pollution by oil at sea is RAMSES.

Sponsored by the European Commission, RAMSES is a survey system for the Mediterranean Sea which provides oil slick monitoring by using different data sources such as: SAR satellite images from ERS, meteorological data such as sea surface temperature and wind speed etc.

In its work, RAMSES combines all the observation data with weather forecast data in order to also generate dynamic models. In such a way it allows to calculate the dimension of oil slicks, their direction, the speed of propagation and the expected time it will reaching the coast. The system is expected to integrate a larger number of data expanding its capability to detect oil slicks at any time in every weather condition and over a wider are a.

The partners in this project are France, Egypt, Italy, Malta and Morocco.

Without going into the deep discussion on the technical interpretation of the possible mismatched results of the two actions – aircraft and satellite – it is important here to underline that the partners considered that it is of great help the use of satellites to direct aeroplanes in detecting possible spills in a suspected area.

Beside these sporadic and experimental rather than operative action, in the Mediterranean Sea there is a total absence of a systematic and long-range pollution control.

Furthermore the coastal States are reluctant, also in spite of the Barcelona Convention, in exchanging information on a regular basis.

This poor collaboration is also seen among the four E.U. Mediterranean States that, as well as having adhered to the Barcelona Convention, are also part of the European Action Programme against spill from hydrocarbons released at sea.

There is but one only good example of co-operation among bordering countries in the Mediterranean Sea in the field of control and reduction of marine oil pollution: it is the Sub-regional Agreement between Cyprus, Egypt and Israel which was prepared by REMPEC in 1995 as result of a pilot project and it is continuously updated for best efficiency.

Also in this case however, there is a complete lack of remote sensing actions, which could be not only helpful but essential in pollution control.

All of this makes even more evident the difference between the situation in the northern European seas and the so called “Mare Nostrum”.

3. SOURCES OF POLLUTION

By far, the biggest contribution of marine pollution by oil comes from terrestrial sources, mainly in the form of urban, human and industrial wastes.

Terrestrial oil inputs are caused principally by discharges from coastal refineries, power plants etc.

Oil spilled into the sea undergoes a series of physical and chemical changes, some of which lead to its disappearance from the sea surface whilst others cause it to persist.

Pollution of the marine environment by substances other than oil became a matter of growing attention during the last decade and due to the great and continuous evolution in the chemical industry, there is a need of continuous analysis and study to identify new response techniques in case of marine accident involving chemicals.

Sources of marine pollution by chemicals can be classified, generally speaking, in the same way as the sources of marine oil pollution.

Accidental spills from ships, plus offshore exploitation, account for about 0.47 million tonnes/year world wide. They can occur because of:

- Collision of ships/tankers
- Grounding
- Bunkering operations
- Loading/unloading operations

Intentional discharges are most often cause by discharging oily waters from machinery spaces (bilge waters, other oily residues) or from cargo carrying spaces (deballasting, tank washing).

Analysis of tanker spills occurring throughout the world shows that some 75% occur inside ports during routine ship operations, and the majority of them are relatively small (less than 7 tonnes).

Accidents such as collisions and grounding reach to less than 10% of all spills from tankers, but 25% of them are larger than 700 tonnes. This means that only a few accidents are cause of the majority of the oil spilt. We should also take into account the pollution accidents caused by blow outs; they are very rare, but contribute to roughly 75% of the some 50.000 tonnes lost yearly from offshore platforms.

4. THE STATE OF THE ART IN EUROPE

Tanker wreckage may occur either close to a coast or far from it. In all cases, if certain environmental conditions allow, an assessment of the oil spill extent and of the potential damage as well as post disaster oil spill monitoring, can be performed by airborne missions (provided that the coast threatened belongs to a country that disposes of an adequate airborne surveillance infrastructure).

Besides the loss of oil due to incidents involving ships, there are other types of emissions of oil into the sea, such as the deliberate illegal discharge of oil from ships during navigation, due to various reasons, or operational incidents at the offshore installations etc. Generally people realise that there has been a spill at a latter stage, when the slick has reached the coast and it is no longer possible to identify the source of such illicit acts.

In this context, a number of coastal countries in Europe have developed surveillance services at sea with patrol boats and aircraft.

The purpose of airborne surveillance is to detect pollution by oil and other harmful substances than can threaten the marine environment, either in order to prosecute the offenders or to serve as deterent and to contribute to the prevention of deliberate discharges, but also to reduce the damage with a rapid intervention.

The use of aircraft allows to cover a larger surface in a shorter time.

Airborne detection is influenced by various factors and has operational limitations (mainly weather condition, sample collecting, and most of all the high cost of the use of aeroplanes).

Aircraft are currently used to monitor vessels in case of pollution discovered in coastal seas, because patrol boats effectiveness is limited by their range and search area. Ships in the vicinity are only capable of a rapid response to a specific location once positional information of a potential slick has been gathered from other sources.

Bonn Agreement member States employ different types of aircraft even if their performance is more or less the same: light fixed wing aircraft powered by propellers and with an average endurance of 2000/2500 n.m.

As an example, U.K. flies CESSNA 402 and 404, Italy PIAGGIO 166 P, Norway FAIRCHILD MERLIN 3B.

Many pilot projects have been accomplished in this field and many countries have developed a national service to serve the users (National Authorities, Industry, R&R etc.) with information on possible oil spills covering their waters.

5. REMOTE SENSING

Remote sensing, in general, means the detection and identification of phenomena at a distance from the object of interest using human capabilities or special sensors. Modern remote sensing instruments are normally based on optical, electronic and sometimes chemical techniques. In recent years considerable developments have been achieved in the improvement of the existing sensors and in finding new means.

A number of airborne sensors have been evaluated to assist the detection, mapping and quantification of oil on water, some of which can be used in condition of poor visibility and at night. There is however no single sensor capable of providing sufficient information in all conditions of intervention and it is therefore necessary to combine different devices to accomplish the task.

The most commonly employed combinations of sensors are: Side Looking Airborne Radar (SLAR). the Synthetic Aperture Radar (SAR), and Ultraviolet and Infrared Line Scanners (UVSL and IRLS). We will list below some reference to these systems and to some others that are in use.

SLAR is an active sensor that measures the roughness of the sea. It is particularly useful to obtain information on the overall extent of an oil slick although it cannot give any indication of its thickness. It relies on the calming effect created by oil at sea. The device emits radiation in the microwave region and can detect the differences in the echo signal from ordinary sea waves and oil damped waves. Consequently the sensors are ineffective in smooth sea condition, but in addition, other waves damping phenomena such as

wind and tide may give similar signals. However, SLAR is able to detect oil over a wide area and can operate day and night. It presently is the most commonly used device.

SAR, with respect to the scope of detection of pollution, it is similar to the SLAR. From a technical point of view there are some important differences. Where the SLAR uses a fixed antenna length, the SAR system can define the antenna length by sampling echoes over a period of time. The mechanical part of the antenna is very small. The advantage of the SAR is its improved spatial resolution that remains the same over the entire area covered: At a relatively high cost, it is possible to obtain a resolution down to one meter. At this stage of development SAR is used in satellites and in some special projects.

Laser Fluoresensor (LFS) is an active sensor emitting an intensive beam of coherent light, generated by a laser , to the sea surface immediately below the aircraft. The receiving apparatus is designed not to respond to the direct reflection of the beam, but to detect and to analyse the fluorescence of the pollution resulting from the laser strike. Currently it is tested at operational level in Germany.

UVSL is a passive device that detects reflected ultraviolet signals with a wavelength of about 0.3 micrometers. This is possible due to the fact that oil is a good reflector of the ultraviolet component of the sunlight. The scanner is mounted vertically beneath the aircraft and, as it passes over an oil slick, even an extremely thin one, it can build up a continuous picture of the entire slick. It cannot, though, distinguish between oil layers of different thickness.

IRLS is very similar to the UVSL in operating and they are normally operated together. It detects infra red radiation with a wavelength of about 10 micrometers emitted from the oil. Thin layers of oil radiate more slowly than sea water and show up as black patches on the display. Thicker layers will warm up more rapidly than the surrounding sea and show up white on the display.

IRLS can therefore give some limited information on the thickness of the oil on the surface. It is not as sensitive to oil as UVSL and the comparison of the outputs from the two sensors will indicate where to concentrate the effort in combating.

Thermal Imager is a system related to video cameras, but designed to operate in the infra red region. It gives description of the surface as precise as an IRLS, but it has the advantage of providing real time image of the whole slick.

Microwave radiometer (MWR) is a system quite similar to UVSL/IRSL. With an accurate selection of operational wavelengths and a wise analysis of the data collected, it should be possible to quantify the volume of oil in the slick.

Other useful tools are: photographic cameras, Identification cameras and low light level television cameras, that can easily be used from an aircraft.

6. THE USE OF SATELLITES

Satellite imagery can help greatly in this field, showing the probable spills in very large zones and then guiding the aerial surveys for the final assessment. Satellite data can quickly provide an overview of the situation, as large areas can be covered in one pass, indicating zones already affected or probably so and zones in danger.

Satellites offer one potential solution to the problem of providing regional coverage of seas. But optical sensor systems are limited in their ability to detect oil slicks on the surface of the water and are hampered by the presence of clouds.

The European Space Agency's ERS –1 and ERS –2 satellites carry a Synthetic Aperture Radar instruments, that can collect data independently from weather and light conditions.

The Synthetic Aperture Radar system on satellites has an all-weather day and night capability which enables it to monitor the sea in detail. Research has shown the potential oil slick detection using ERS –1 SAR data and the difficulties associated with false alarms.

Such false alarms are due to natural surface features that exhibit reduced level of radar backscatter similar to those of an oil slick.

Starting from the state of the art of the use of satellite data for monitoring and responding to marine pollution, we can conclude that the contributions that may be expected in this domain are highly positive.

A diffuse series of experiments carried out has shown the possibilities offered by space borne remote sensing either in emergency situations or in everyday activities. At the same time, limitations have also been clearly identified.

A reasonable solution seems to be found in combining the use of radar, satellites and aircraft.

In December 1997 experts from the Bonn Agreement and the European Union met in a workshop in Brest, agreed that the satellite images obtained from satellite S.A.R. have the same value of the ones taken during aerial surveillance by SLAR.

Despite the good results obtained in Northern Europe, there still is considerable reluctance in acknowledging the satellite contribution to oil spill detection and monitoring, even in connection with the potential synergy between satellite and aeroplane imagery.

7. AERIAL SURVEILLANCE IN NORTHERN EUROPE

Within the framework of the Bonn Agreement and the Helsinki Convention, it has been decided to establish a close co-operation also in this domain.

This co-operation is achieved by:

- co-ordination of the national flight plans carried out by the contracting parties;
- co-operation in areas of mutual interest e.g. by means of the so-called Co-ordinated Extended Pollution Control Operations;
- setting up special flights, joint flights and comparison exercise;
- standardisation of reporting formats and exchange of information.

Regularly the Parties appoint one Party to be lead country for an agreed period, to prepare the annual programme for the airborne surveillance.

It is very expensive to perform aerial surveillance to control the presence of oil on large areas and every country has to remain within its annual budget. This is why only a limited number of surveillance flight hours per year is possible. This time varies very much from country to country.

As an example, this is a list of the yearly oil surveillance flight-hours in some European countries:

The Netherlands	1071	(data 1995)
Germany	206	(data 1998)
Finland	1792	(data 1998)
Sweden	2544	(data 1998)
Italy	400	(data 1998)
France	426	(data 1998)

The total fly hours by specialised oil slick surveillance planes of the contracting parties of the Bonn Agreement (Belgium, Denmark, France, Norway, Sweden, The Netherlands, United Kingdom) reach an average of 3590 hours/year.

8. THE BONN AGREEMENT EXAMPLE

As an example, Chapter 4 of the Bonn Agreement Manual on Aerial Surveillance, and the 1998 annual report of its activity are reproduced below.

"CO-OPERATION ON AERIAL SURVEILLANCE OVER THE NORTH SEA" (Chapter 4 of the Bonn Agreement Manual)

INTRODUCTION

The purpose of airborne surveillance is to detect spillages of oil and other harmful substances that can threaten the marine environment of the North Sea. These spillages caused by accident or made in contravention of international conventions will be registered and if possible sampled both from sea surface and on board the suspected offender.

Within the framework of the Bonn Agreement it has been decided to establish close co-operation on airborne surveillance. This will be achieved by:

a. co-ordination of the national flight plans carried out by the Contracting Parties themselves;

b. co-operation in areas of mutual interest, e.g. by means of Co-ordinated Extended Pollution Control Operations (CEPCO);

c. setting up special flights, such as Tour d'Horizon, Joint Flights and Comparison Exercises;

d. Standardisation of reporting formats and exchange of information to Contracting Parties;

e. Working together in improving existing systems and develop new techniques to enhance the information obtained.

The Contracting Parties to the Bonn Agreement have agreed to participate in the collaboration to the best of their ability.

The surveillance is co-ordinated in accordance with the decisions of the North Sea Conferences in order to make it more efficient and to make better use of the resources.

It is agreed that this Cupertino scheme applies only to the international waters of the North Sea.

CO-ORDINATION

In their regular meetings the Contracting Parties appoint one Contracting Party to be lead country for an agreed period. The lead country prepares the annual programme and updates the Airborne Surveillance Handbook (ASH) accordingly. The ASH contains general information, flight schedules, Tour d'Horizon scheme, special flights and reporting formats. It also contains, as Annexes, the maps showing navigation points and routings, both regional and international. The ASH will be issued to Contracting Parties by the lead country. It should be read in conjunction with this chapter. The ASH is designed to be used for the day-to-day management of airborne surveillance and as a ready reference for aircrew. A lead country collects the data of the various flights executed in a particular year and makes an annual report.

OPERATIONAL FLIGHTS

National flights

These are the flights carried out by the Contracting Parties in their own territorial waters and over their part of the Continental Shelf.

Regional flights

Parties involved in a bi- or multilateral agreement (e.g. Memorandum of Understanding) carry out flights on a regular basis over an area of mutual interest.

Tour d'Horizon

All Contracting Parties agreed on performing a flight mainly along the offshore installations, of at least 600 nautical miles. The aircraft crew will concentrate on all detectable pollutions from various sources. Roughly the area between 52 north and 63 north is to be surveyed. These flights are carried out according to an agreed yearly scheme. The responsible party is entitled to inform the others on times and routing the day before departure and on changes in the prepared schedule. A Tour d'Horizon flight will be performed under suitable weather conditions. In general, the following criteria are considered to be limits for normal remote sensing operations:

- Wind: up to 36 knots
- Cloudbase: 800 feet
- Visibility: 2 nautical miles

Joint Flight Day

Once or twice a year all Contracting Parties will carry out a surveillance flight in a specific area on the same day and thus covering the major part of the North Sea area. The gathered information provides the situation for this specific day. Weather conditions will vary over the entire area to be covered, however, the following criteria apply for a "go" or "no go" decision:

- Wind: up to 36 knots
- Cloudbase: 200 feet
- Visibility: 2 nautical miles

Co-ordinated Extended Pollution Control Operations (CEPCOs)

A CEPCO operation can be defined as a continuous sequence of aerial surveillance flights supported by sea-borne assistance - and where possible also with data from satellite observations - to ensure a permanent presence (e.g. over a period of 24 hours) in a sea area with high shipping intensity. This high level of deployment of means is only possible when several (neighbouring) Contracting Parties cooperate intensively to ensure continuity and optimal co-ordination of the surveillance activities. The aims of the operation are, *inter alia*:

I. to enhance the enforcement of discharge provisions at sea;

II. to increase the deterrent effect of aerial surveillance efforts;

III. to improve the co-operation between the participating authorities.

COMPARISON EXERCISE

Each year exercises are organised by authorities of several countries within the Bonn Agreement or the European Community (EC). Participation in these fieldtrials has a bearing on the national and Bonn Agreement flight schedules. Contracting Parties agree to participate in a Comparison Exercise organised by one of the countries (not necessarily the lead country) once a year. A participant in exercises will prepare a report to make information gathered available to the organising authority. The organising authority will report to the OTSOPA meeting. The Comparison Exercise normally consists of:

a. field trials, using limited quantities of oil;

b. special substances to study the detectability by means of remote sensing;

c. evaluation of the data recorded during the exercise;

d. a workshop for the exchange of information and discussions of new improvements or developments on remote sensing equipment;

e. evaluation of the exercise by an Exercise Evaluation Team.

All participants forward conclusive reports with data analysis to the lead country.

FLIGHT PLANNING

Flight planning will be drafted under the responsibility of administrative authorities in the respective countries, which are to be identified as follows:

France	French Customs Coast guard
Belgium	Management Unit of the North Sea (MUMM)
Netherlands	Netherlands Coast Guard Centre (KUWA)
United Kingdom	Maritime and Coastguard Agency (MCA)
Federal Republic of Germany	Federal Unit for Marine Pollution Control
Denmark	Danish Environmental Protection Agency (Danish EPA)
Sweden	Coast Guard Headquarters (CGHQ)
Norway	Norwegian Pollution Control Authority (SFT)

BONN AGREEMENT AERIAL SURVEILLANCE PROGRAMME

ANNUAL REPORT ON AERIAL SURVEILLANCE FOR 1998

Introduction
Observations

Table 1: Summary of data relating to National Flights during 1998
Table 2: Summary of data relating to the Joint Flight Day during 1998
Table 3: Summary of data relating to Flights executed during Co-ordinated Extended Pollution Control Operations (CEPCOs) during 1998
Table 4: Summary of data relating to Tours d'Horizon (TdH) flights during 1998
Table 5: Summary of data relating to all flights during 1998
Fig. 1 Overview of observed slicks 1998
Fig. 2: National numbers of all flight hours 1990 – 1998
Fig. 3: National numbers of all observed slicks 1990 – 1998
Fig. 4: National ratios: "number of all observed slicks / all flight hours" 1990 – 1998
Fig. 5: Total numbers: all flight hours and all observed slicks 1986 – 1998 and their ratio.

Introduction

1. The eight countries bordering the North Sea which work together within the Bonn Agreement undertake aerial surveillance using specially equipped aircraft and specialised personnel.

2. Apart from the national flights (OPS) carried out in their own part of the maritime area, the Bonn Agreement countries co-ordinate the following flight types :

   - Joint Flight Day (JFD), when all aircraft are in the air on the same day;
   - Tour d'Horizon (TDH), a monthly flight carried out by each country in turn, to survey the offshore area of the North Sea where offshore oil and gas activities are taking place;
   - Co-ordinated Extended Pollution Operations (CEPCO), where a few neighbouring countries co-operate to survey intensively during e.g. 24 hours an area with a high traffic density.

3. In 1998 it was agreed to terminate the planning of Joint Flight Days and to focus on the organisation of more CEPCO, which are judged to be a more beneficial use of surveillance flight time.

4. The present report presents the data of all these flight types. The report demonstrates the co-operation in aerial surveillance among North Sea countries and their collective effort to detect marine pollution. The North West European Waters – the main part of which is formed by the North Sea – have been declared a Special Area by the International Maritime Organization for the purpose of MARPOL Annex I (Oil). This has taken effect on 1 August 1999. Ships should deliver all oily wastes to the reception facilities on land.

Observations

5. The results of the follow-up of "identified polluters" (cf. Tables 1, 2, 3 and 4) are not included in this report, since it may take a year or more to obtain the outcome of court or administrative proceedings in the country responsible for such proceedings (acting as flag state, coastal state or port state). The Bonn Agreement has produced a Manual on Oil Pollution at Sea – Securing Evidence on Discharges from Ships and is currently preparing a complementary Manual on Guidelines for Facilitating Effective Prosecution of Offenders.

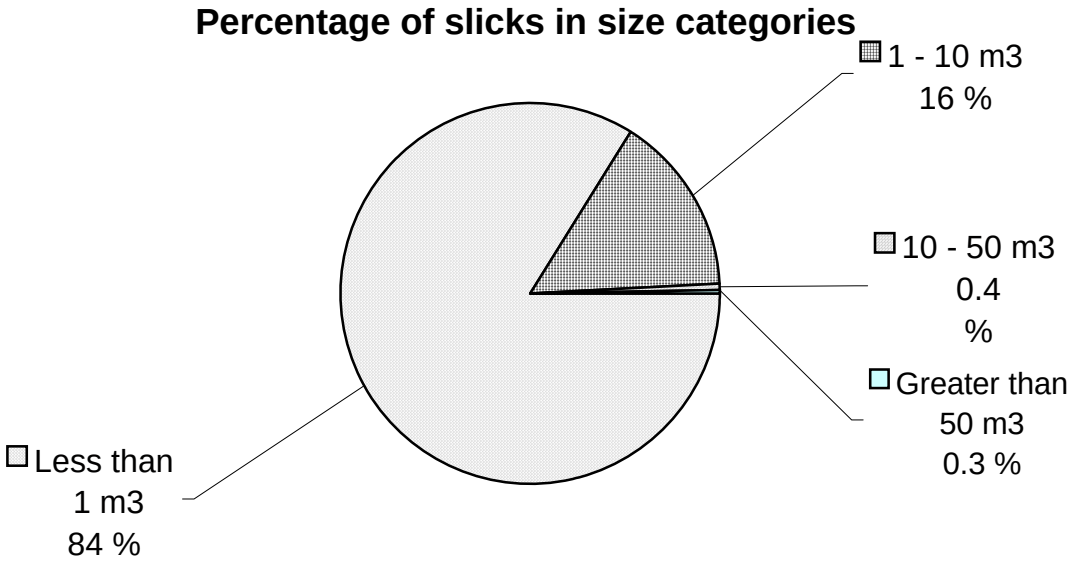
6. For most of the oil slicks observed (in 1998: approx. 68 %) the source of the slick (i.e. the polluter) is not identified. Most visible oil slicks are coming from shipping and offshore installations.

7. This report does not include estimates of the total amounts of oil discharged based on the aerial surveillance data. The Contracting Parties to the Bonn Agreement consider that the data currently available are too sparse and too diverse to allow reliable overall estimation of oil inputs, and that presenting such estimates here could be misleading. Studies are underway to assess the usefulness of aerial surveillance data for estimating the total input of oil from shipping and offshore operations in the North Sea. A number of Contracting Parties do publish their quantitative findings nationally. Joint aerial surveillance exercises are organised on a regular basis to harmonise the measurement techniques and to improve the accuracy and comparability of the data e.g. with a view to analysing them statistically.

8. The quantities of oil discharged into the North Sea by the offshore industry are reported to the OSPAR Commission by the countries under whose jurisdiction offshore oil extraction takes place (total reported for 1997: 16 753 tonnes). There are at present no equivalent reliable figures for the amount of oil input to the North Sea from land-based sources and from shipping.

9. During 1998, two slicks of over 50 tonnes were reported.

10. The 679 slicks where volumes were reported can be subdivided in the following size categories:



Most slicks are thus in a size category that does not warrant combating since they will evaporate, dissolve and disperse naturally.

11. An overview of the positions of the slicks observed during 1998 is given in Figure 1. When examining Figure 1, the reader should take account of the following:

a) the density of ship traffic and the associated likelihood of observing slicks is the highest in the traffic corridor along the south-eastern shore of the Bonn Agreement area;

b) Contracting Parties flight hours reported in Table 1 are mostly spent surveying the national zones of interest, which in most cases correspond with the national EEZ or continental shelf areas. There are large differences in the sizes of these zones of interest and the respective total numbers of hours spent surveying them. This implies that the relative frequency with which areas are visited – and thus the potential density of the observations – varies significantly between Contracting Parties.

Tables and figures in annex

9. NEED FOR INTERVENTION IN THE MEDITERRANEAN AREA

Our ancestors used to say that “Rome was not built in one day” and it will certainly take years to build up and complete an efficient general co-operation in the field of control and reduction of pollution caused by spillage of hydrocarbons from ships at sea in the Mediterranean Sea area.

Leaving the operational management within the framework of the Mediterranean Action Plan to REMPEC and taking also into account that the OPRC Convention provides a framework for international co-operation for combating oil pollution incidents and also puts various obligations on signatories, time has come to initiate some actions in the field of discovering and monitoring oil pollution at sea involving airborne means and, when possible, with the integration of the most up-to-date satellite systems, considering that there is no satisfactory surveillance infrastructure, and that aircraft patrols do not provide enough coverage to efficiently survey wide areas of the Mediterranean Sea.

One has to keep in mind that one of the primary objectives in routine patrolling is to encounter ships in the act of illegally discharging oil or other harmful substances, and to gather sufficient evidence to be able to prosecute the offenders.

The first step must be the identification of some countries that agree to establish bilateral or trilateral co-operation relaying on early warning and remote sensing systems, that in the future could be combined in an integrated network. Moreover, it is vital to select at least three highly sensitive zones within which to start a valuable day by day exercise for the detection and quantification of pollution at sea.

An effective collaboration in patrolling and providing early warning of pollution at sea would certainly :

- create a deterrent against illegal spills;
- repress at once unlawful acts of pollution, even in high sea;
- allow timely action to reduce damage from oil spills, wherever spotted:

From a concrete and accurate analysis of the actual situation in the Mediterranean region, taking also into account the structures already existing, three major zones have been identified where to start with specific pilot projects to test the benefits coming from co-operation in monitoring sea by airborne means. These are:

1. The “Sanctuary of Cetacean” in the upper Thyrrenian sea, created by an agreement between France, Italy and Monaco, signed in 1999 by the Ministers of the Environment (Map 1 attached).

2. The sea area in the so-called Sicily canal and limited by Cape Bon, Maltese Islands and the south coast of Sicily (Map 2 attached).

3. The sea area in which the Sub-regional agreement between Cyprus, Egypt and Israel is still in to force (Map 3 attached).

10. THE PROPOSED PILOT PROJECTS

In order to start in this direction and give a positive signal of awakening from the Mediterranean States towards their sea, REMPEC must promote the implementation of pilot projects for collaboration in remote sensing, namely on aerial and/or satellite integrated monitoring actions, between the States bordering the above indicated zones of particularly high sensitivity.

The projects are not aiming, for the time being, to create complete sub-regional agreements for mutual collaboration in case of major marine pollution accident.

They should only be agreements regarding the creation of a system for the interchange of information on one specific topic for which the parties agree to set up a similar service.

As a matter of fact, where a Sub-regional Agreement already exists within a zone (such as in the case of Cyprus, Egypt and Israel or in the case of RAMOGE), these projects could constitute its valid complement.

Objective and main goals

The objective and main goals of these pilot projects should be:

- to decide common procedure for the exchange of information;

- to evaluate the possibility of direct communication between operational authorities of the various partners in the project, without having to follow the official diplomatic routes trough the national contact points, in order to speed up any possible action (this aspect in fact is the stronghold of the countries participating to the Bonn Agreement and the Helsinki Convention);

- to extent the patrolling over the high sea, creating areas of competence in order not to leave areas uncovered;

- to co-ordinate a schedule in order to make patrolling most cost effective;

- to maintain the capability to fly surveillance flights to detect and deter illegal operational discharges in the area assigned;

- to submit to the authorities of the parties, evidence for consideration of prosecuting those responsible for illegal discharges;

- to form a tested system as an example for other further co-operation between Mediterranean coastal States.

Project description

With the spirit of promoting collaboration between bordering countries, the projects will test the benefits that may come from a combined routine patrol service at sea to protect the environment.

The operational exercise should consist for the parties, in over- flying the assigned areas at the time scheduled and report the mission in the agreed form.

The parties should agree to carry out respectively their missions of 2 fly-hours each, at the time scheduled.

The parties should also endeavour to enlarge the exercise to the use of satellite in order to complement the data collected.

Phase I (three months, three meetings)

- Definition of the common area of interest
- Definition of the means to be employed
- Definition of the operational limits
- Definition of the communication means, the language and standard reporting form
- Quantification of the costs.

Phase II (two months, two meetings)

- Definition of the concept of lead country (to be changed every 4 months)
- Definition of the duties of the crew and the reporting obligation
- Gathering together the crew for an exchange of opinion

Phase III (Sixteen months)

- Operational exercise in order to gain common experience also in view of the preparation of a common Manual.

Phase IV (final Workshop)

- to gather the experience gained and analyse the results.

Cost estimate (only as an example)

Preparation

Travel and accommodation cost for personnel during the preparatory meetings (5 meetings, 2 persons from each country plus 2 person from REMPEC)	
Travel	15,000 USD
Accommodation and meals(3 days per meeting)	17,000 USD

Operations

Flight hours (480 hrs)	800.000 USD*
Workshop	68.000 USD
TOTAL EXPECTED	900,000 USD

* (This cost is calculated on the basis of the declared cost by the Italian Authorities for the use of Piaggio P 166/D/3 engaged in missions or operations within NATO countries)

A) PILOT PROJECT BETWEEN FRANCE, ITALY AND MONACO FOR COLLABORATION IN AERIAL PATROL OF THE "SANCTUARY OF THE CETACEAN"

Definition of the area

The Sanctuary is formed by a sea triangle bordered at west by a line from the Point Escanpobariou of the Giens peninsula (43°01'70"N 06°05'09"E) to Cape Falcone in Sardinia (40°58'00"N 08°12'00"E) and at east by the line from Cape Ferro (41°09'18"N 09°31'18"E) to the Chiarone river (42°21'24"N 011°31'00"E) in the south of Tuscany (see map attached).

The Sanctuary can easily be considered to be partly lying within the area of competence of RAMOGE Plan. It lies for two third in international waters beyond national jurisdictions.

However, international legislation allows to prosecute any criminal polluter, as long as it is discovered in time.

Countries involved

France, Italy, Monaco.

The authorities concerned should be:

FRANCE:	Ministry of Environment Secretariat General de la Mer
ITALY:	Ministry of Environment Ministry of Transport
MONACO:	Ministry of the Environment

The project should be accomplished by determining national operational surveillance entities such as the French Customs Air Service and the Italian Coast Guard.

In the respect of the duty assigned to it by the Emergency Protocol to the Barcelona Convention, REMPEC should act as co-ordinator of the project.

Financing

The Parties should provide for the cost of their personnel and for their own operational activities.

Possibly (eventually) a contribution could be found by the E.C. from the LIFE Nature financing mechanism and from the Unit Civil Protection and Marine Pollution of the Directorate C of the General Direction for the Environment, for the Workshop. In this context, REMPEC would support the countries in the preparation of the appropriate documentation to be submitted to the European Commission.

B) ITALIAN-TUNISIAN-MALTESE PILOT PROJECT FOR COLLABORATION IN MONITORING THE AREA OF COMMON INTEREST BY PLANE AND OTHER REMOTE SENSING SYSTEMS

Taking into consideration the proposal presented by the Tunisian delegation in Malta at the Meeting of REMPEC's Focal Points in November 1998 for a sub-regional agreement in airborne surveillance, and the interest for collaboration in monitoring against oil pollution at sea, using aircraft, shown by other bordering countries, the conditions exist for the implementation of a specific pilot project.

Definition of the area

The area of interest should be the sea zone formed by the Sicilian canal limited by Cape Bon, Maltese Islands and the south coast of Sicily, which is considered highly sensitive for the environment.

Countries involved

Italy, Malta, Tunisia.

The authorities concerned should be:

ITALY: Ministry of Environment (Ispettorato Centrale Difesa Mare)
Ministry of Transport

MALTA: Ministry of Environment

TUNISIA: Ministère de l'Environnrment et de l'Aménagement du Territoire
Agence Nationale de Protection de l'Environnement (ANPE)
Direction Générale de la Marine Marchande

The operational points of reference should be:

- the air base of the Italian Coast Guard and the Direzione Marittima of Catania for Italy;
- the MAP–Regional Activity Center for Environment Remote Sensing (RAC/ERS) in Palermo for REMPEC;
- the Tunisian operational authorities;
- the Maltese operational authorities.

The project is aiming to experiment the possibility of constituting an integrated service in monitoring the area of interest with the means already existing within the partners, and with the use of services of the Regional Activity Center for Environmental Remote Sensing in Palermo.

It could be interesting to consider the present programme of co-operation in fighting marine pollution between the Italian Navy and the Tunisian Navy, for a possible implication in the project.

Financing

This kind of project is eligible for financing by the European Commission in the light of the MEDA mechanism. REMPEC, in collaboration with the competent national authorities of the three countries concerned could prepare the documentation to be submitted to the Commission for its support.

C) PILOT PROJECT FOR IMPLEMENTATION OF PHASE III "REMOTE SENSING AND AIRBORNE MONITORING" IN THE FRAMEWORK OF THE SUB-REGIONAL AGREEMENT BETWEEN CYPRUS, EGYPT AND ISRAEL FOR CO-OPERATION IN CASE OF A MAJOR POLLUTION ACCIDENT

Countries involved:

Cyprus, Egypt, Israel.

The authorities concerned should be:

CYPRUS: Ministry of Agriculture, Natural Resources and Environment (Department of Fisheries and Marine Research)

EGYPT: Egyptian Environmental Affairs Agency (EEAA)

ISRAEL: Ministry of the Environment (Marine and Coastal Environment Division)

Project description

The project aims at completing and complementing the already existent sub-regional agreement between the three countries, with the implementation of an airborne system for co-operation in the control and detection of pollution at sea.

The operational exercise should consist for the Parties, in defining the authorities responsible to carry out the task of aerial surveillance by over-flying the assigned areas at the times scheduled and to report the mission in the agreed form.

The parties should also evaluate the possibility of enlarging the exercise to the use of satellites in order to complement the data collected.

The forecasting model developed within the framework of the LIFE Third Countries project for the development of spill response capabilities of Cyprus, Egypt and Israel (LIFE TCY96/INT/08) would be utilised for processing the relevant data obtained through the monitoring activities.

Financing

The project seems to be suitable to fall in the domain of the LIFE Third Countries mechanism of the European Commission for financial support.

REMPEC will provide co-ordination of the project and will submit the proposal to the Commission for its financial contribution.

11. CONCLUSIONS AND RECOMMENDATIONS

Aerial surveillance of marine oil pollution has been implemented for a number of years on a regular basis in the North Sea and the Baltic Sea areas, within the framework of Bonn Agreement and Helsinki Convention respectively.

It has proven to be a very efficient tool in the field of prevention of operational pollution from ships, i.e. the reduction of illegal discharges, as well as in the increasing the effectiveness of response to accidental marine pollution.

As regards the **prevention** of operational pollution, the aerial surveillance is the fastest and the most efficient way of **detecting illegal discharges** from ships. In addition it largely facilitates the **identification** of offenders and may provide valuable **evidence for their prosecution**.

Aerial surveillance also significantly increases the level of **preparedness** for combating accidental marine pollution and improves the results of **response** operations. **Early detection** by aerial surveillance of spills of oil or other hazardous substances reduces the reaction time in cases necessitating intervention. Control and guidance of response operations using aircraft and one or more of available remote sensing techniques enables **optimisation and guidance of spill response operations**. Using reports and data obtained through aerial surveillance authorities in charge of response activities can select the most adequate response strategies and techniques, with a view to reducing the damage for the environment and economy, obtaining better result of response operations, and reducing their costs.

The systematic implementation of aerial surveillance in the Mediterranean region, within the framework of Emergency Protocol to the Barcelona Convention, is therefor strongly recommended.

Its use will greatly facilitate achieving the objectives of the Mediterranean Action Plan - Phase II as defined in its component dealing with the prevention and response to the pollution of the marine environment from sea based activities.

This refers in particular to:

- the enforcement of existing international regulations for the prevention of ship generated marine pollution;
- increasing the level of preparedness for responding to marine pollution accidents; and
- improving the results of response activities in case of accidental marine pollution.

Finally, the implementation of proposed pilot projects is expected to assist in capacity building at national, subregional and regional levels through:

- better co-operation and co-ordination between various national authorities;
- better co-operation among the national authorities of the Contracting Parties involved.

The first concrete and systematic results of the three proposed pilot activities, that could realistically be expected approximately two years after the commencement of these activities, would be subsequently utilised for defining the regional aerial surveillance and remote sensing policy.

It is further recommended to ensure the expert advice and the technical support for the proposed pilot projects, before and during their implementation, through the close collaboration of REMPEC and the Secretariat of the Bonn Agreement and the Helsinki Commission respectively.

APPENDIX A

TABLES AND FIGURES RELATED TO THE BONN AGREEMENT ANNUAL REPORT ON AERIAL SURVEILLANCE 1998

1. Summary of data relating to National flights during 1998

Country	No. of flights	No. of flight hours			No. of slicks detected			No. of identified polluters		No. of slicks per flight hour			Remarks
		in day-light	in dark-ness	sum	in day-light	in dark-ness	sum	Ships	Rigs	in day-light	in dark-ness	overall	
Belgium	174	215.5	12.75	228.3	60	1	61	1	0	0.278	0.078	0.267	
Denmark	103	219	0	219	55	-	55	2	6	0.251	-	0.251	
France	150	426	0	426	45	-	45	14	0	0.106	-	0.106	
Germany	276	683.8	150.8	834.7	116	2	118	9	0	0.169	0.013	0.141	
Netherlands	285	481	233	714	298	146	444	46	6	0.169	0.627	0.621	
Norway	202	538	0	538	69	-	69	2	40	0.128	-	0.128	86 flights (225 hours) executed with back-up aircraft (no sensors). 36 slicks detected from back-up aircraft (visual observation only).
Sweden	160	186	36	222	22	5	27	4	-	0.118	0.139	0.122	
UK	152	649	150	799	62	1	63	7	39	0.095	0.007	0.079	
Total	**1502**	**3398**	**582.6**	**3981**	**727**	**155**	**882**	**85**	**91**	**0.214**	**0.266**	**0.222**	

2. Summary of data relating to the Joint Flight Day during 1998

Country	No. of flights	No. of flight hours			No. of slicks detected			No. of identified polluters		No. of slicks per flight hour			Remarks
		in day-light	in dark-ness	sum	in day-light	in dark-ness	sum	Ships	Rigs	in day-light	in dark-ness	overall	
Belgium	1	2.75	0	2.75	0	-	0	-	-	0.000	-	0.000	
Denmark	1	4.4	0	4.4	0	-	0	-	-	0.000	-	0.000	
France	0	-	-	-	-	-	-	-	-	-	-		
Germany	1	3.33	0	3.33	0	-	0	-	-	0.000	-	0.000	
Netherlands	1	3.17	0	3.17	0	-	0	-	-	0.000	-	0.000	
Norway	1	4.5	0	4.5	2	-	2	0	2	0.444	-	0.444	
Sweden	1	4	0	4	1	-	1	0	0	0.250	-	0.250	
UK	4	19	0	19	3	-	3	0	2	0.158	-	0.158	
Total	**10**	**41.1**	**0**	**41.1**	**6**	**-**	**6**	**0**	**4**	**0.146**	**-**	**0.146**	

3. Summary of data relating to flights executed during Co-ordinated Extended Pollution Control Operations (CEPCOs) during 1998

Country	No. of flights	No. of flight hours			No. of slicks detected			No. of identified polluters		No. of slicks per flight hour			Remarks
		in day-light	in dark-ness	sum	in day-light	in dark-ness	sum	Ships	Rigs	in day-light	in dark-ness	overall	
Belgium	2	5.8	0	5.8	4	-	4	0	0	0.689	-	0.689	
Denmark	2	2.18	0	2.18	0	-	0	-	-	0.000	-	0.000	
France	2	4.9	0	4.9	0	-	0	-	-	0.000	-	0.000	
Germany	0	-	-	-	-	-	-	-	-	-	-	-	no participation (technical problems)
Netherlands	1	4.17	0	4.17	0	-	0	-	-	0.000	-	0.000	
Norway	2	2.25	0	2.25	1	0	1	0	0	0.444	-	0.444	SLAR only (fog)
Sweden	1	5	0	5	0	-	0	-	-	0.000	-	0.000	
UK	2	0	10	10	-	0	0	-	-	-	0.000	0.000	
Total	**12**	**24.3**	**10**	**34.3**	**5**	**0**	**5**	**0**	**0**	**0.205**	**0.000**	**0.145**	

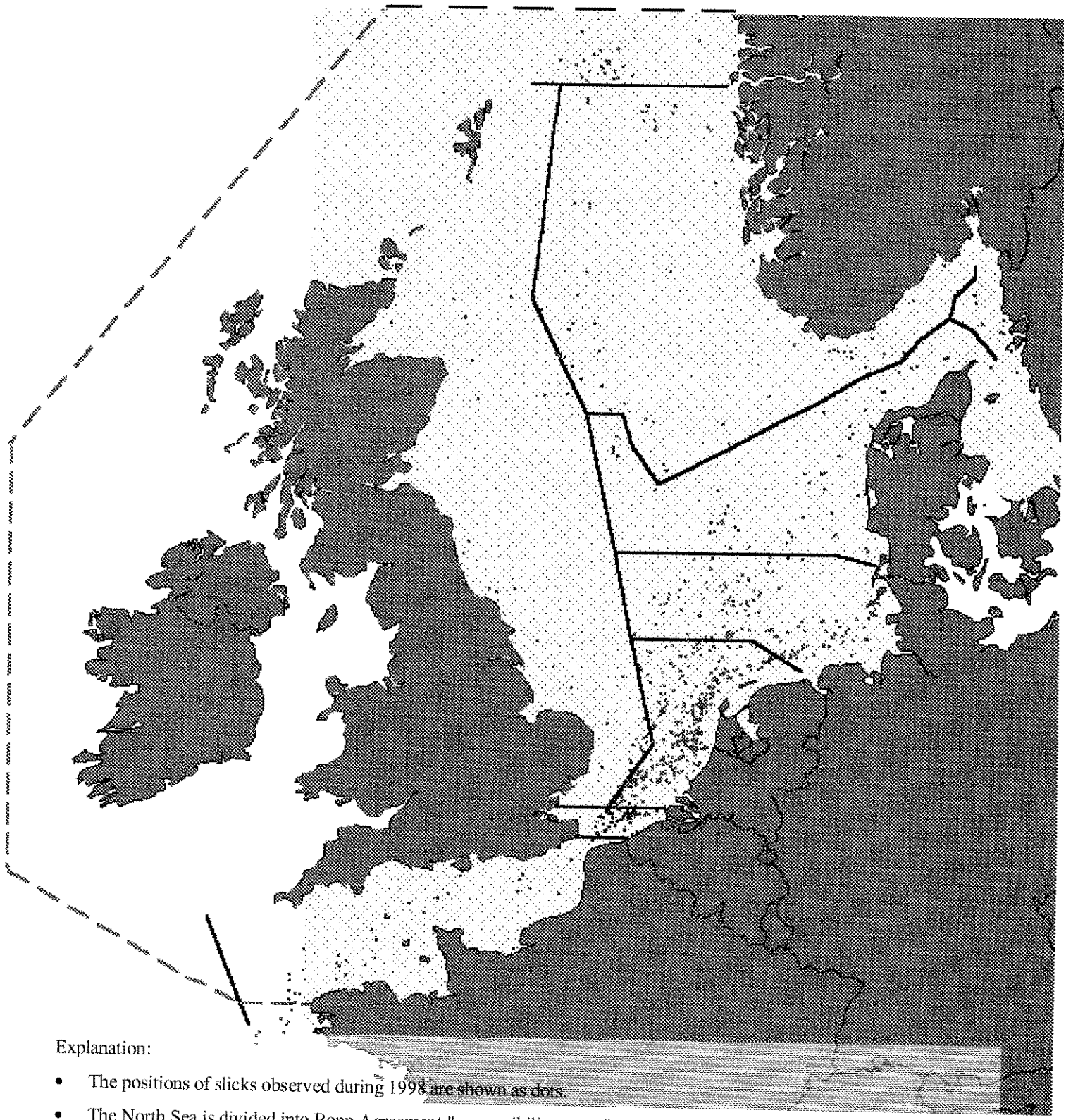
4. Summary of data relating to Tour d'Horizon (TdH) flights during 1998

Country	No. of flights	No. of flight hours			No. of slicks detected			No. of identified polluters		No. of slicks per flight hour			Remarks
		in day-light	in dark-ness	sum	in day-light	in dark-ness	sum	Ships	Rigs	in day-light	in dark-ness	overall	
Belgium	6	11.8	0	11.8	5	-	5	0	6	0.420	-	0.420	
Denmark	3	6.6	0	6.6	2	-	2	0	2	0.300	-	0.300	
France	0	-	-	-	-	-	-	-	-	-	-	-	
Germany	1	12.25	0	12.25	2		2	0	2	0.163	-	0.163	
Netherlands	4	12.75	0	12.75	14	-	14	2	8	1.098	-	1.098	
Norway	0	-	-	-	-	-	-	-	-	-	-	-	
Sweden	4	13	0	13	3	-	3	-	-	0.230	-	0.230	
UK	4	13	0	13	3	-	3	-	-	0.230	-	0.230	
Total	**22**	**69.4**	**0**	**69.4**	**29**	**-**	**29**	**2**	**18**	**0.417**	**-**	**0.417**	

5. Summary of data relating to all flights during 1998

	No. of flights	No. of flight hours			No. of slicks detected			No. of identified polluters		No. of slicks per flight hour			Remarks
		in day-light	in dark-ness	sum	in day-light	in dark-ness	sum	Ships	Rigs	in day-light	in dark-ness	overall	
Belgium	183	235.9	12.75	248.8	69	1	70	1	6	0.292	0.078	0.281	
Denmark	108	232.2	0	232.2	57	0	57	2	8	0.245	-	0.245	
France	152	430.9	0	430.9	45	0	45	14	0	0.104	-	0.104	
Germany	278	699.4	150.8	850.2	118	2	120	9	2	0.169	0.013	0.141	
Netherlands	291	501.1	233	734.1	312	146	458	48	14	0.622	0.626	0.624	
Norway	205	544.8	0	544.8	72	0	72	2	42	0.132	-	0.132	
Sweden	166	208	36	244	26	5	31	4	-	0.125	0.139	0.127	
UK	162	681	160	841	68	1	69	7	41	0.100	0.006	0.082	
Total	**1545**	**3533.3**	**592.55**	**4126**	**767**	**155**	**922**	**87**	**113**	**0.217**	**0.261**	**0.223**	

Figure 1 - Overview of slicks observed during Bonn Agreement aerial surveillance activities in 1998



Explanation:

- The positions of slicks observed during 1998 are shown as dots.
- The North Sea is divided into Bonn Agreement "responsibility zones" (solid lines).
- The boundary of the new MARPOL Special Area ("North West European Waters"), declared by the International Maritime Organization and effective since August 1999, is also shown (area enclosed by dashed boundary line).
- The shaded area is the "Greater North Sea" as defined for assessment purposes within the OSPAR Commission.

Figure 2: Number of flight hours 1990 - 1998

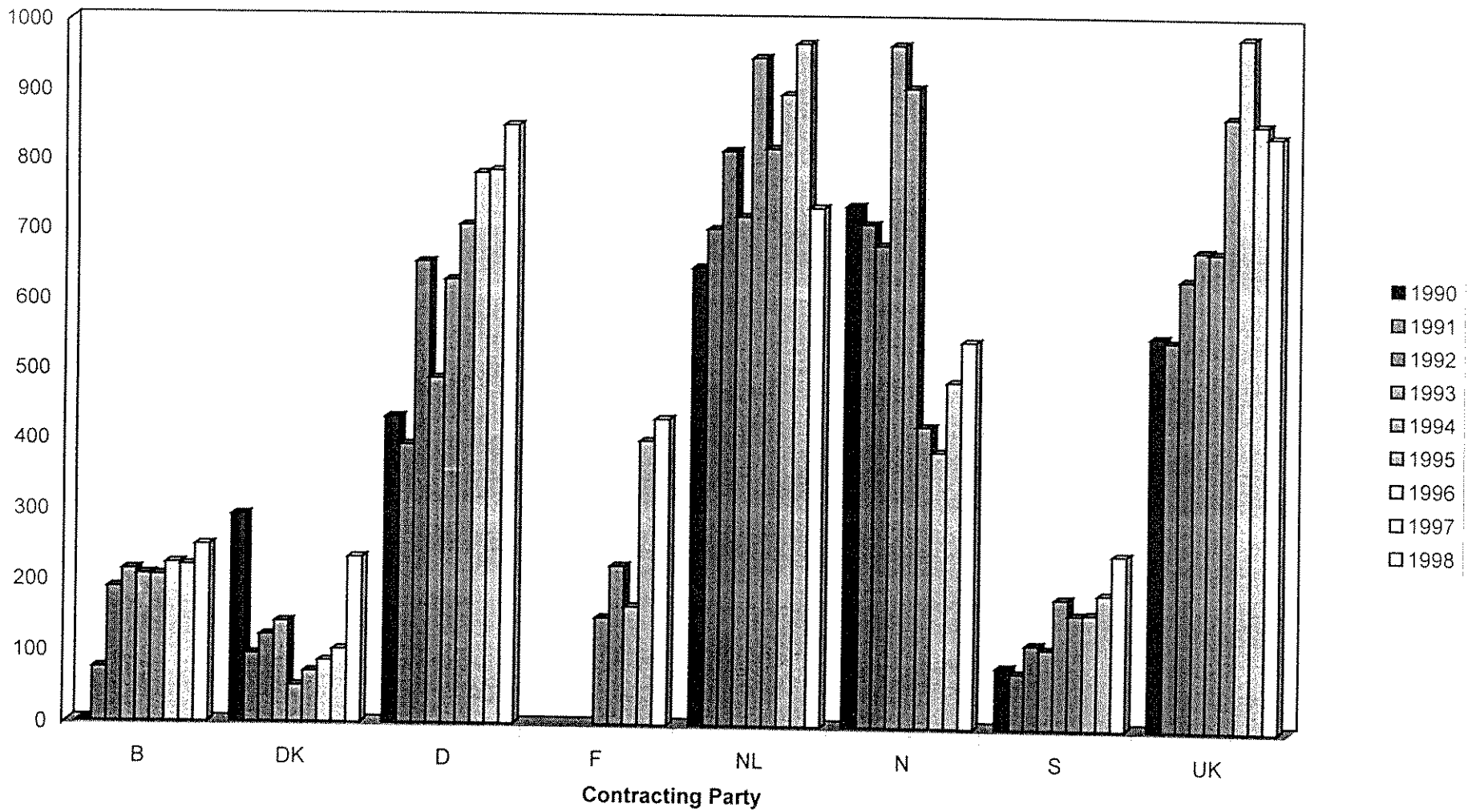


Figure 3: Number of all slicks observed 1990 - 1998

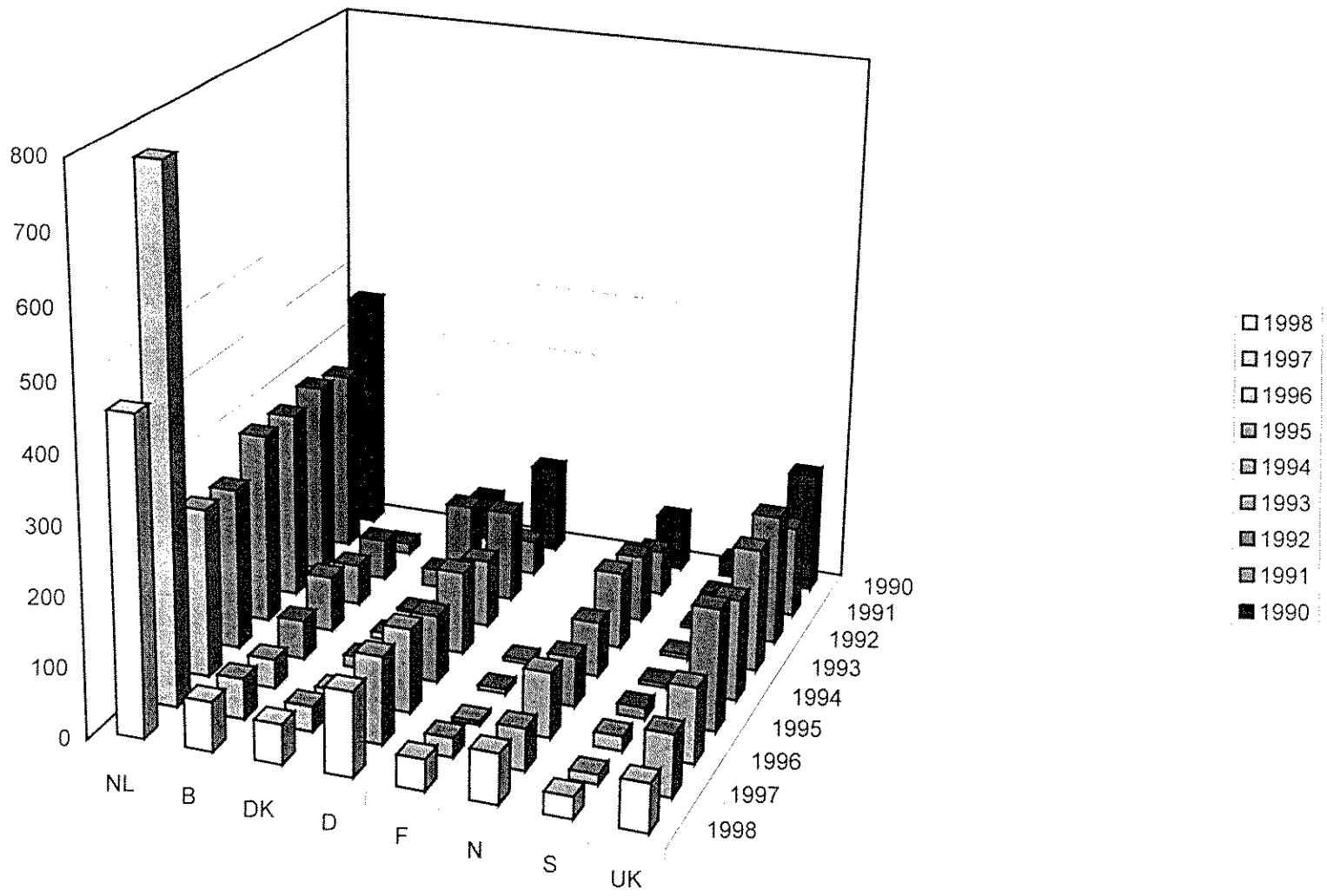


Figure 4: National ratios: "number of all slicks / all flight hours" 1990 - 1998

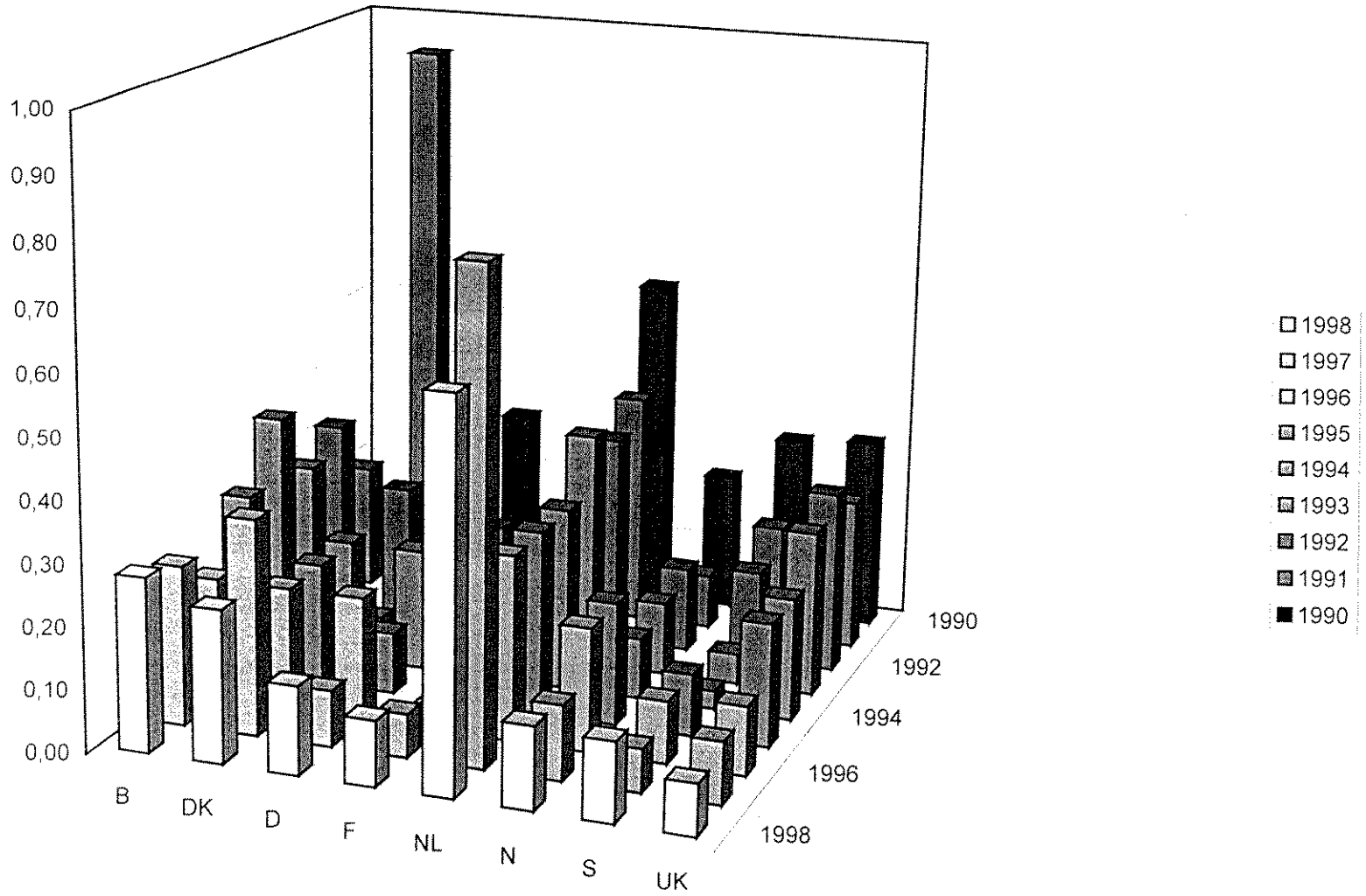
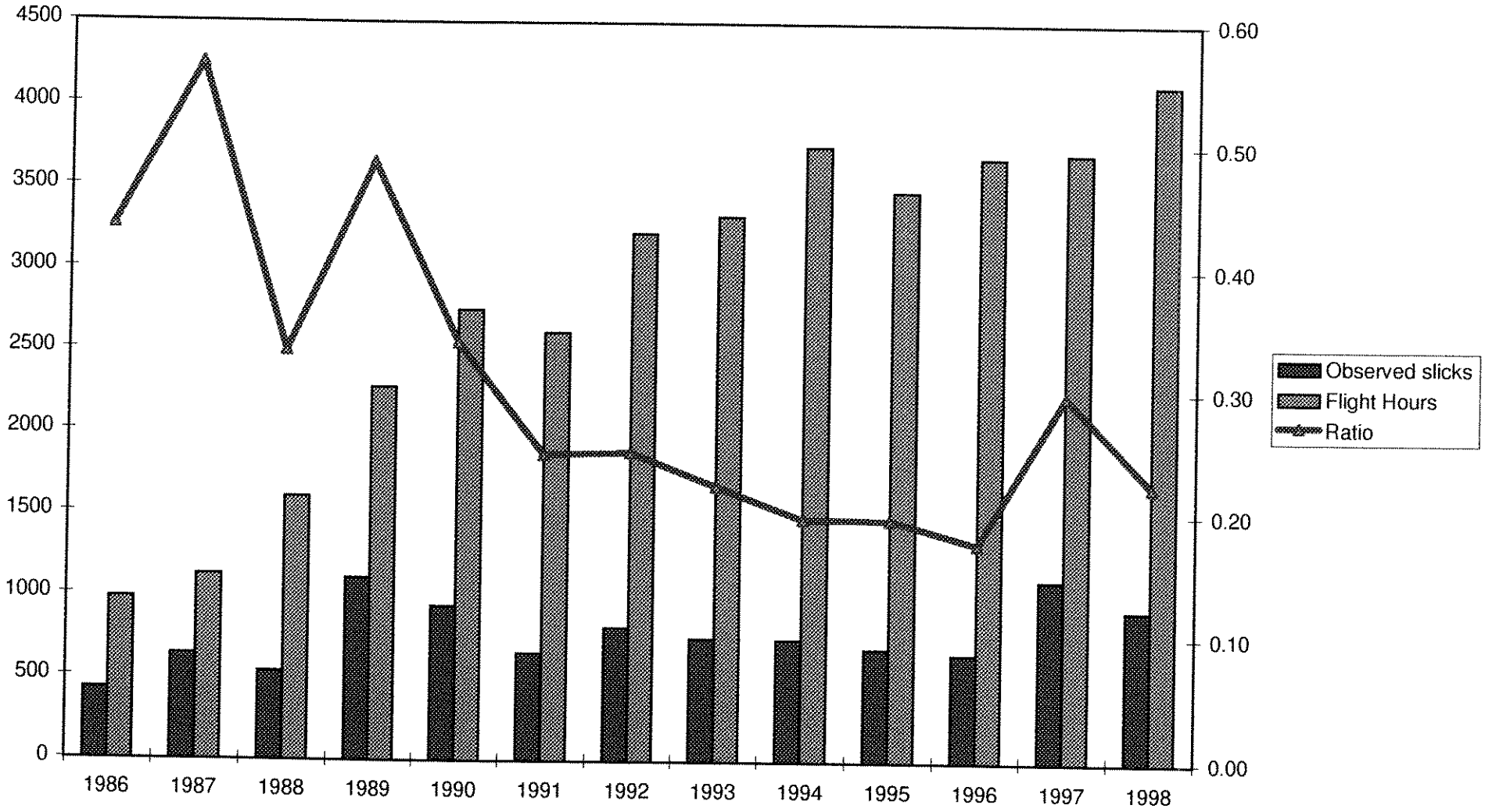
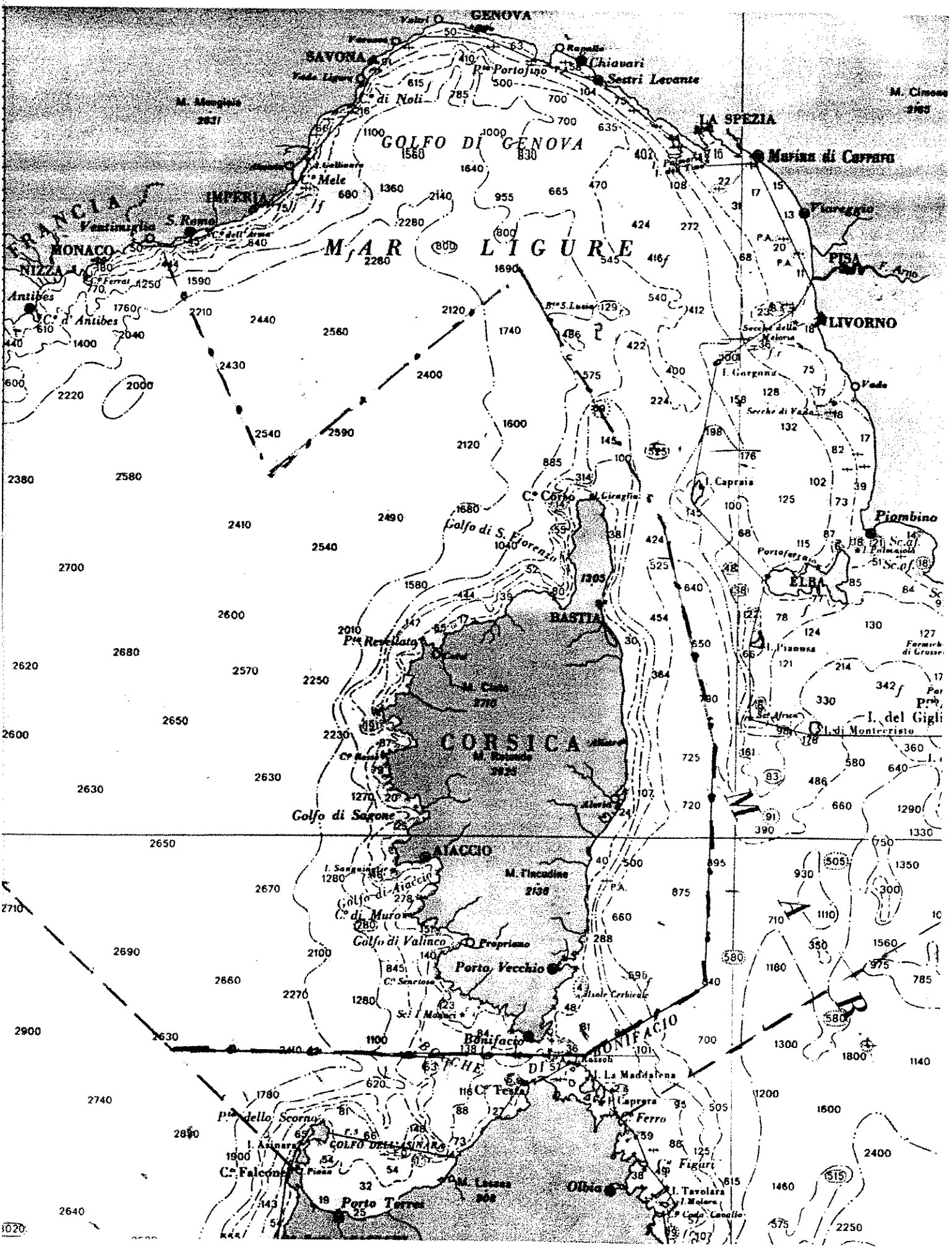


Figure 5: Total numbers: all flight hours and all observed slicks 1986 - 1998 and their ratio

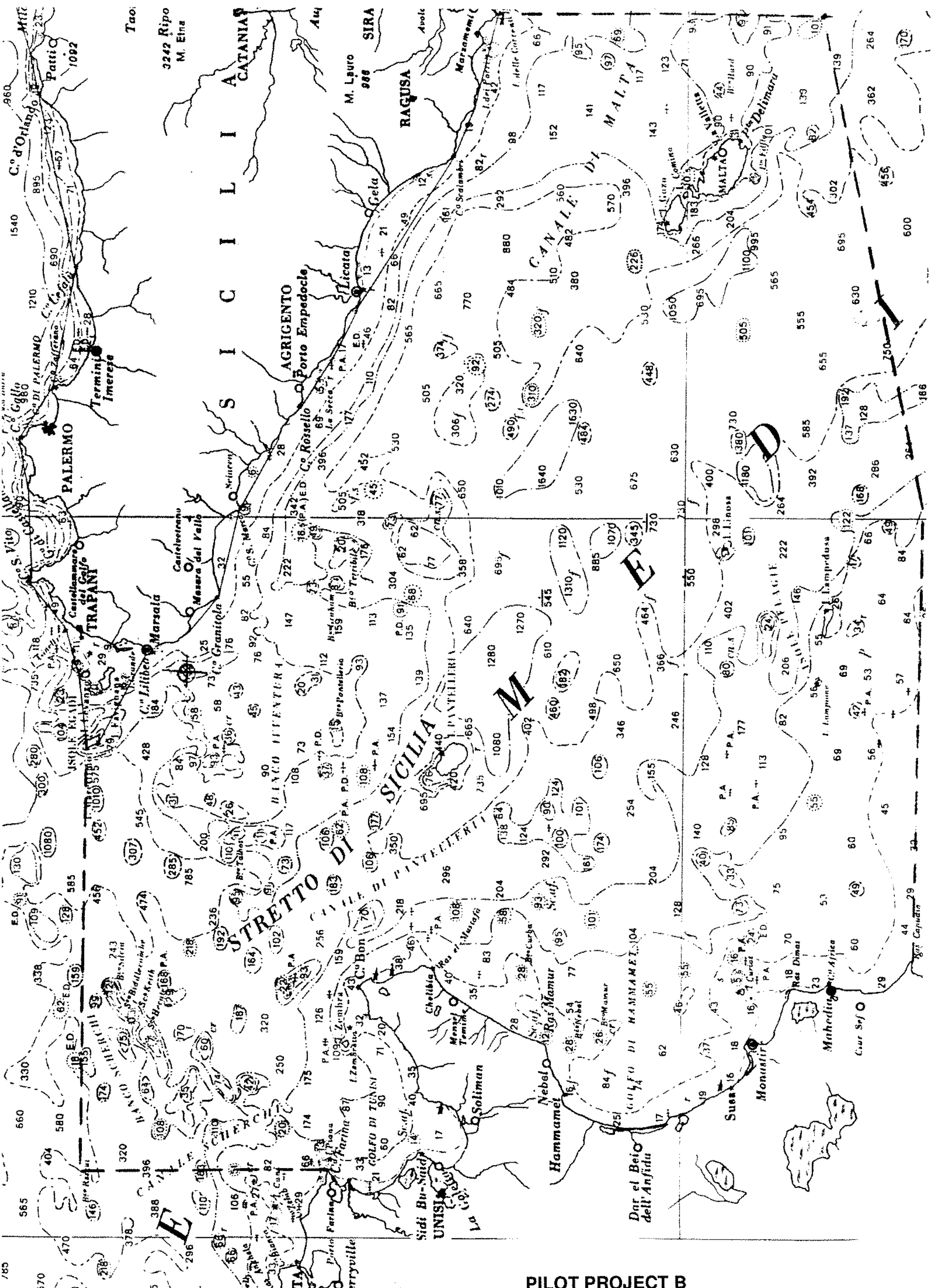


APPENDIX B

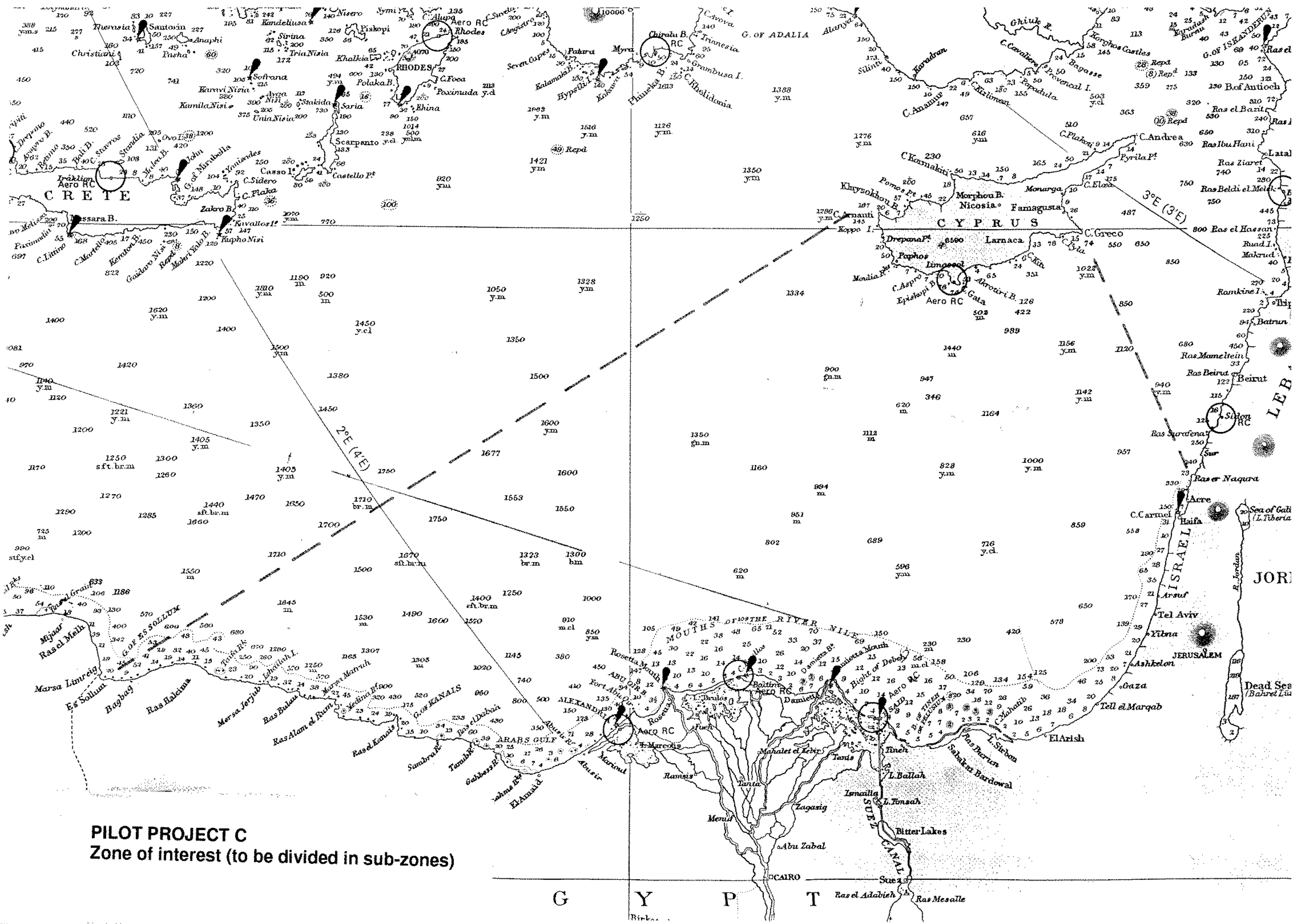
ZONES OF INTEREST
OF THE PROPOSED PILOT PROJECTS



PILOT PROJECT A
Zone of interest and sub-zones of competence



PILOT PROJECT B
Zone of interest (to be divided in sub-zones)



PILOT PROJECT C
Zone of interest (to be divided in sub-zones)