Annex 7

Executive Summary, Black Sea Pollution Assessment (1999)

The present assessment of pollution in the Black Sea was completed in accordance with the requirements of the Black Sea Strategic Action Plan, signed by the Ministers of the Environment (or equivalent) of Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine, on 31st October, 1996. It gathers objective and verifiable information on the sources, levels and effects of pollution in the Black Sea as well as the preventative and remedial measures that are being taken in the region. Its main conclusions are the following:

The Black Sea ecosystem has been seriously damaged as a result of pollution. There is clear evidence to relate the decline of shelf seas ecosystems to eutrophication caused by increased loads of nitrogen and phosphorus. Much of these loads arise from major rivers, notably the Danube, but also from smaller sources in all Black Sea coastal countries. According to current estimates, some 70% of the dissolved nitrogen and phosphorus entering the Black Sea comes from the six Black Sea countries, either through discharge to the major rivers (notably the Danube) or from direct sources. The remaining 30% originate from the 11 non-coastal countries that belong to the Black Sea basin. There is insufficient information to apportion individual responsibility for contribution to these loads amongst these eleven countries. Furthermore, in addition to the dissolved nutrients entering the sea, estimates for nitrogen compounds suggest that an amount equivalent to some 50% of the dissolved load may be entering the system from atmospheric sources of indeterminate origin. The dissolved load is particularly significant however, as it directly impacts the shelf-zone systems which are critical to the health of the overall Black Sea ecosystem.

All six Black Sea countries contribute to the loads of contaminants entering the Black Sea. In the case of nutrients, the contribution is directly related to agricultural drainage, with lesser contributions from domestic sources and industry. The situation was particularly bad in the decades of the 1970s and 1980s but recent economic decline in the industrial and agricultural sectors have lowered the nitrogen and phosphorus inputs through the Danube to levels observed in the 1960s. This has resulted in very gradual improvements in the health of the NW Shelf and provides some hope that recovery might be possible. However, unless urgent measures are taken to keep nutrients on land, the recovery may be reversed as economic conditions improve and the use of chemical fertilisers resumes.

Extensive oceanographic studies of the Black Sea have not revealed any evidence of a decrease in depth of the interface between oxygenated surface waters and hydrogen sulphide rich bottom waters. The risk of a massive release of hydrogen sulphide gas from the deep Black Sea to the atmosphere remains minuscule. It will be important to continue to monitor this situation in the future.

Black Sea coastal waters remain heavily impacted by sewage, a situation exacerbated by the weak economies of coastal states. In most countries there is a serious lack of transparency regarding data on sewage indicators. Where data exists, it results from studies using methodologies that are not inter-comparable. Independent investigations and epidemiological data suggest that this situation is serious and warrants urgent action. In some circumstances, public and ecosystem health may be severely compromised. It is noted that some countries (e.g. Romania) are already investing in new wastewater treatment facilities but that treatment is absent or deficient in most places around the Black Sea. There are also serious problems with solid waste disposal. Accidental or intentional sea disposal of municipal garbage continues in Turkey and Georgia.

Oil pollution in the Black Sea does not appear to be generalised but impacts coastal areas around river mouths, sewerage outfalls and industrial installations and ports. Oil discharge through the Danube can be traced well into the north-western shelf, and at some 53,000 tons/annum, represents about half of the estimated total annual load of oil to the Black Sea. There is little or no data on operational discharges from ships and, unless properly regulated, the increase in shipping through the Black Sea could result in significant oil pollution. Reported sediment concentrations of oil residues as high as 1% (Sevastopol) illustrate the danger of unregulated harbour operations.

There is no evidence for significant heavy metal pollution in the Black Sea. Further studies are still required around industrial centres and ports but generalised pollution by these substances can be discounted.

The Black Sea has a significantly higher concentration of human produced radionuclides than the neighbouring Mediterranean. This problem is mainly attributable to the Chernobyl accident in 1986. Present levels or radioactivity do not appear to pose a significant health hazard to humans but it will be important to monitor the situation in the future. Capacitating local institutions for this purpose is continuing.

There is no evidence of system-wide pollution of the Black Sea with pesticides and other persistent organic pollutants (such as polychlorinated biphenyls, PCBs, or polyaromatic hydrocarbons, PAHs). Levels or these substances in some nearshore areas are elevated however. Current coastal-zone data is restricted to a few sites that were monitored through the efforts of the Black Sea Environmental Programme. Most historical data has been shown as unreliable. It will be important to complete a study of all coastal countries in order to detect any significantly contaminated areas.

Pioneering studies on the non-lethal effects of pollution to mussels (as indicator organisms), conducted in a pilot scale in all Black Sea countries, have indicated significant cell damage in many instances. There appears to be a relationship between the level of damage and the proximity to major effluent discharges. Levels of cell damage at some coastal sites on the north-western shelf of the Black Sea were amongst the highest recorded in any

study using similar techniques. It is not possible at this juncture to ascribe the damage to a particular type of pollutant but it provides clear evidence of the need for measures to control land-based sources of pollution in order to restore ecosystem health.

The present assessment highlights the insufficiency of current programmes for pollution monitoring in the region. With the exception of Romania, Black Sea countries are not monitoring pollution in a systematic manner. The current lack of comparable information will make it impossible to measure future trends in contamination, assess compliance with the Bucharest Convention or Black Sea Strategic Action Plan, or to adequately protect ecosystems and public health. In most cases, governments are not making the necessary resources available for this work despite the provision of equipment and training through GEF and European Union (Tacis) funding.

The Black Sea countries have adopted a framework of policies and law which, when fully implemented, should enable pollution to be controlled and abated. A similar situation exists in the non-coastal countries, inter-alia through the work of the International Commission for the Protection of the Danube River. A suite of harmonised water quality objectives have been proposed for the Black Sea in compliance with the 1996 Black Sea Strategic Action Plan. Implementation of the Plan however, is behind schedule. Urgent efforts are needed by the Black Sea countries and the international community to enable full implementation of this important comprehensive Plan.

Annex 8 : Summary of decisions and recommendations made by the 5th meeting of the Black Sea Commission

The 5th Meeting of the Black Sea Commission was held under the chairmanship of Ambassador Füsen Ok, Turkey on 27/28th of April 2000 in Istanbul.

The Meeting agreed on the following decisions and recommendations.

1. * The Commission authorized the Chairperson Ambassador Füsen Ok to sign on behalf of the Commission, the Headquarters Agreement of the Black Sea Commission with the representative of the Government of Turkey. Accordingly, the Headquarters Agreement was signed on 28th April 2000, in Istanbul.
   * The Agreement on Privileges and Immunities was signed on 28th April 2000 by those members of the Commission who had their governments' authorisation to do so: Bulgaria, Georgia, Romania and Turkey. Ukraine and Russia who did not have their governments' authorisations will sign the Agreement in due time through diplomatic channels.
   * The Turkish government, as the host country, has declared that it could unilaterally offer these Immunities and Privileges through a Council of Ministers' decree, as was practiced in other international organizations whose Secretariats were situated in Istanbul, if the Agreement on Privileges and Immunities will not be signed by all parties before the Secretariat started operating.

2. Setting up the Secretariat:

   * The PIU will circulate the job descriptions of the Executive Director and the five other professional posts to the Commission members by 1st June 2000.
   * The Commission authorized the Turkish Government to open a special account for the budget in the name of the Black Sea Commission which will be turned over to the Executive Director of the Secretariat when he/she is in function.
   * Financial contributions by the Contracting Parties are expected to be made to this account, the latest by 1st September 2000. Those Contracting Parties who have made full or partial contributions to the budget may nominate up to two candidates, through the PIU, for the two vacancies by 1st September 2000 .
   * The PIU will circulate the CVs of the nominees to members of the Commission.
   * The next meeting of the Commission will be on 14th –15th September 2000 under the Chairmanship of Ukraine, to consider these nominations, decide on recruitment and discuss the budget for the next financial year.

* The Secretariat shall come into operation on 15th October 2000.

3. The Commission reconsidered and readapted the budgets for the financial year 1 September 2000- 31 August 2001, as attached.

4. The Commission also reconsidered the workplan and adopted it, as attached.

5. The Commission reaffirmed its commitment to implement the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (BS-SAP) signed on behalf of all six countries on 31 October 1996. In this respect and in accordance with paragraph 20 of the BS-SAP, it agreed to incorporate the existing project implementation unit and the Black Sea Environmental Programme as part of its organic structure. The BSEP-PIU will act as "the body to provide support for specific projects related to the implementation of the Strategic Action Plan". It will operate on the basis of terms of reference to be agreed between the Commission and the donor community.

6. The Meeting reviewed the draft Memorandum of Understanding prepared by the Danube Commission (ICPDR) to be adopted by the Commission and the ICPDR.
   The Russian, Turkish and Ukrainian delegations asked for amendments. The revised version of the Memorandum of Understanding, as agreed by the Commission, will be sent to the Danube Commission with a view to agree on a common text for the final signature.

7. The Commission proposed that the "Ad-hoc Technical Working Group" set up on December 9, 1997 in Constanta between the ICPBS and the ICPDR follows-up the implementation of the Convention's strategic goals, outlined in the forthcoming Memorandum of Understanding between the ICPBS and the ICPDR and a coordinated approach to implement provisions of the two UNDP/GEF regional projects for the Black Sea and the Danube River Basin.

8. The Commission examined the information note by the UNEP Regional Office for Europe, on the Nutrient Oriented GPA Protocol to the Bucharest Convention/GEF PDF-B "Black Sea".
   The representative of EC-DG Environment proposed the addition of the following "the study shall also take into account relevant existing EU legislation, in particular the forthcoming EU Water Framework Directive".
   The Commission took note of the information note and asked UNEP to carry on the study.

9. The Commission took note of the UNDP/Turkey's role as Principal Project Resident Representative Office and, in this context, requested its support for

the preparation and handling of the next meeting of the Commission in September 2000.

10. The 6th meeting of the Black Sea Commission will be held on 14th – 15th September 2000 under the Chairmanship of Ukraine, who will take over the Chairmanship from Turkey as of May 1, 2000.

Enclosures:

Draft Memorandum of Understanding between the International Commission for the Protection of the Black Sea (ICPBS) and the International Commission for the Protection of the Danube River (ICPDR) on common strategic goals

- The 'International Commission for the Protection of the Black Sea (ICPBS)' was established to implement the 'Convention on the Protection of the Black Sea against Pollution'. This Convention is a 'shoreline convention', i.e. it itself holds no power over the inland activities of the States within the hydrographic drainage area discharging to the overall Black Sea (Black Sea proper, Sea of Azov).

- The 'International Commission for the Protection of the Danube River (ICPDR)' was established to implement the 'Convention on Cooperation for the Protection and Sustainable Use of the Danube River'. This Convention is a 'hydrographic basin convention' , i.e. it itself holds power over the transboundary impact via the drainage network of the River Danube Basin (valid only for Contracting Parties to this Convention).

- This Memorandum of Understanding becomes effective as soon as it has been agreed upon in the respective Meetings of both Commissions mentioned and an exchange of letters has taken place. It looses its effectiveness as soon as one of both the International Commissions mentioned notifies the other.

- This Memorandum of Understanding constitutes a framework for implementing common strategic goals.

Representatives of the ICPBS and the ICPDR with the assistance of UNDP/GEF and UNEP set up on December 8 and 9, 1997, a Joint Ad-hoc Technical Working Group ('the Group') in a Meeting at Constanta, Romania. The following elements of this Memorandum of Understanding correspond with the results of 'the Group':

- For the purpose of this Memorandum, the term 'overall Black Sea' encompasses the Black Sea proper and the Sea of Azov as water bodies receiving inputs via inland waters. Both the Black Sea proper and the Sea of Azov are in regard to their ecology and their response to discharged pollution

completely different water bodies and their ecosystems are to be considered separately.

- The term 'Black Sea Basin' refers to the basin determined by the hydrographic boundary of all inland waters discharging to the overall Black Sea and the surface area of the overall Black Sea.
- The results of the studies on the 'Ecological Indicators of Pollution in the Black Sea' carried out in the frame of the activities of the Joint Ad-hoc Working Group, have given evidence of recovery in Black Sea ecosystems. However, the ecological status of the 1960s – which is deemed to be the goal to aim for – is not yet reached.

- There is in general agreement that the status of Black Sea ecosystems is largely affected by nutrients discharged within the wider Black Sea Basin, and to a large extent by the riverine input into the overall Black Sea. Information of a possible role of other sources of pollution and their impacts on Black Sea ecosystems was not yet available.

- The size of the pollution loads reaching the overall Black Sea (dispersion both in time and in space for the Black Sea proper and the Sea of Azov) are either not known, or information is missing on the comparability of the data available.

- 'The Group' was aware of the decline of the economic activities in the countries in transition, the possible impact of them on the discharge of pollution, and the reversal of such a trend in case of future economic development (concerning in particular agricultural and industrial activities).

- The data available to 'the Group' to undertake its assessment ended at best with values for the year 1997.

In order to safeguard the Black Sea from a further deterioration of the status of its ecosystems the 'Commission for the Protection of the Black Sea against Pollution' and the 'Commission for the Protection and Sustainable Use of the Danube River' to achieve the following common strategic goals:

- *The long-term goal in the wider Black Sea Basin is to take measures to reduce the loads of nutrients and hazardous substances discharged to such levels necessary to permit Black Sea ecosystems to recover to conditions similar to those observed in the 1960s.*

- *As an intermediate goal, urgent measures should be taken in the wider Black Sea Basin in order to avoid that the loads of nutrients and hazardous substances discharged into the Seas exceed those that existed in the mid 1990s. (These discharges are only incompletely known.)*

- *The inputs of nutrients and hazardous substances into both receiving Seas (Black Sea proper and Sea of Azov) have to be assessed in a comparable way. To this very end a common Analytical Quality Assurance (AQA) system and a thorough discussion about the necessary monitoring approach, including the*

sampling procedures, has to be set up and agreed upon between the ICPBS and the ICPDR..

- *The ecological status of the Black Sea and the Sea of Azov has to be further assessed, and the comparability of the data basis has to be further increased.*

- *Both the reported input loads as well as the assessed ecological status will have to be reported annually to both the ICPBS and the ICPDR.*

- *Strategies for economic development have to be adopted to ensure appropriate practices and measures to limit the discharge of nutrients and hazardous substances, and to rehabilitate ecosystems which assimilate nutrients.*

- *Based on the annual reports and on the adopted strategies for the limitation of the discharge of nutrients and hazardous substances, a review shall be undertaken in 2007. It will have to focus on the further measures that may be required for meeting the long-term objective.*

The ICPDR and the ICPBS invite all other international organisations and States in the wider Black Sea Basin to support the common goals of this Memorandum of Understanding.

Revised budget1 of activities to be undertaken under the Convention on the protection of the Black Sea against Pollution for the first year of Activity

A. Revenues (Assessed contribution)

Country	Share of Percentage(%)	USD
Bulgaria	12	43 560
Georgia	12	43 560
Romania	12	43 560
Russian Federation	12	43 560
Republic of Turkey	40	145 200
Ukraine	12	43 560
TOTAL	100	**363 000**

B. Costs

1. Operational costs

1.1 Maintenance

3 000

1.1.1 Office furniture, upholstery, carpeting

1.1.2 All other office equipment

1.2 Communication charges

27 000

1.2.1 Telephone, fax, postage

1.3 Publication
10 000

1.3.1 Secretarial documents, meeting reports
1.3.2 Information and promotional material
1.3.3 Annual report (yearbook), maps, card, etc

1.4 Purchase or subscriptions of books, newspapers, magazines
2 000

1.5 All kind of stationary
4 000

1.6 Temporary assistance
5 000

1.6.1 Interpretation or translation
1.6.2 Secretarial work
1.6.3 Consultancy
1.6.4 Expertise
1.6.5 Vehicle renting

1.7 Unforseen costs
7 000

Sub-Group Percentage: 15.97% Sub-Group Total
58 000

2. Personnel costs

2.1 Salaries, wages, medical/social insurance
150 000

2.1.1 Director (1) - 4 500
2.1.2 Officer (1) - 3 500
2.1.3 Accountant (1) - 700 (half-time)
2.1.4 Secretary (1) - 1 300

Sub-Group Percentage: 41.33% Sub-Group Total
150 000

2.2 Meetings
155 000

2.2.1 Transportation
2.2.2 Per-diems
2.2.3 Representation

Sub-Group Percentage: 42.70% Sub-Group Total
155 000

GRAND TOTAL 363 000

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[1]UNDP will allow the Secretariat to use the furniture and office equipment already in place in the PIU

Workplan of the Secretariat of the Istanbul Commission for the first year of its activity

I. Establishing the Commission and Secretariat network

	Area of Work	Activity Partners	Estimated cost
1	Establishment of the office and accounting system as well as the general administrative practices of the secretariat	Commission-Secretariat	
2	Establishment of the necessary Advisory Groups	Commission-Secretariat	In-kind contribution from the countries
3	Exchange of letters of agreement and cooperation with similar bodies such the Barcelona Commission, OSPARCOM, HELCOM, etc, Black Sea Economic Cooperation, European Commission, specialised UN Agencies (UNEP, IOC, IMO etc) and international non-governmental organisations	Secretariat	No funds required

II. Policy Actions

	Area of Work	Activity	Partners	Estimated cost
4	Establishment of harmonised Water Quality Objectives and Water Quality Standards in order to reduce the inputs	Meeting of Advisory Group on Pollution Monitoring and Assessment – Consultants	Tacis and Phare	$ 15 000

	of pollutants			
5	Establishment of a Regional Pollution Monitoring System in compliance with the Bucharest Convention. The programme will integrate the national pollution monitoring programme. An independent quality assurance system will be developed.	Meeting of Advisory Group on Pollution Monitoring and Assessment-Consultants-National Monitoring Authorities	Tacis and Phare	$ 20 000
6	Define concentration levels for trace contaminants in dredged spoils, in accordance with article 3 of the Protocol on Dumping to the Bucharest Convention	Meeting of Advisory Group on Pollution Monitoring and Assessment-Consultants		$ 15 000
7	To agree upon and implement a uniform measurement technique and reporting procedure for bathing water quality with a common quality assurance support mechanism	Meeting of Advisory Group on Control of Pollution from Land Based Sources-WHO	WHO, EC (Tacis-Phare)	$ 15 000
8	Procedures for monitoring the actual discharge of effluent at point sources	Advisory Group on Control of Pollution from Land Based Sources-2 meetings		$ 25 000
9	To develop a draft text of a protocol on Biological Diversity and Landscape Protection to the Bucharest Convention	Advisory Group on the Conservation of Biological Diversity-Consultants		$ 15 000
10	To develop a harmonised system of port state control through the adoption of a Memorandum of Understanding on Port State control	Advisory Group on Environmental and Safety Aspects of Shipping-Consultants	Danish EPA, IMO	No funds required
11	To finalise the National and Regional	Advisory Group on Environmental	IMO	$ 15 000

	Contingency Plans	and Safety Aspects of Shipping-Consultants 2 meetings		
12	Establishment of a harmonised system of fish stock assessment	Meeting of Advisory Group on Fisheries and other Marine Living Resources-Phare consultants	Phare, FAO	$ 8 000
13	The elaboration and adoption of a Black Sea Coastal Code of Conduct based upon the Black Sea National and Regional Policies and Strategies and, as a guideline document, The Council of Europe's European Code of Conduct for Costal Waters".	Each Black Sea country will establish the legislative bases for the adoption of said document in accordance with the Strategic Action Plan		$ 12 000
14	The co-ordination of increasing the public awareness on the Bucharest Convention and Action Plan	-The Black Sea Newsletter will be published jointly with the PIU; -Each Black Sea state will publish a popularised version of its Strategic Action Plan; -Developing and updatin g the Commission Home Page on Internet; -An information package for use in schools will be produced and translated into all Black Sea languages -Implementation of regionally coordinated public awareness campaigns, including programs for schools, local communities and natural resources users.	Black Sea NGO Forum, International NGOs	$ 15 000

	TOTAL			**$ 155 000**

Annex 9-

DRAFT REGIONAL NUTRIENT ACTION PLAN FOR BLACK SEA RIPARIAN COUNTRIES

SEPTEMBER 2000

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1.1 The framework mechanism

Guidelines for the protection of the Black Sea against pollution are detailed in the Bucharest Convention, which was signed on April 21st 1992 by representatives of Bulgaria, Georgia, Romania, the Russian Federation, Turkey and Ukraine. The Convention was ratified in 1998 but not fully implemented owing to the failure of coastal countries to reach agreement on financial arrangements for its Secretariat. Presently, implementation of the Convention is carried out by the Istanbul Commission for the Protection of the Black Sea (ICPBS).

The Bucharest Convention stipulates (Article VI) that each Contracting Party shall prevent pollution to the marine environment of the Black Sea from any source of hazardous or noxious substances and matter, as specified in the Annex to the Convention. Protection of the marine environment against nutrients is listed in Annex II of the Convention under the statement:

> '*Substances which, although of a non-toxic nature, may be harmful to the marine biota owing to the quantities in which they are discharged e.g. inorganic phosphorus, nitrogen, organic matter and other nutrient compounds. Also substances which have an adverse effect on the oxygen content of the marine environment*'.

The Bucharest Convention also includes a Protocol for the protection of the Black Sea marine environment against pollution from land-based sources. This annex is accompanied by two further annexes, which separately detail the regulation of hazardous and noxious substances and matter, including nitrogen and phosphorus. This annex does not apply to discharges that contain nitrogen and phosphorous which are below the standards defined jointly by the Contracting parties, not exceeding environmental background concentrations.

In April 1993, the contracting parties reaffirmed their commitment to the Bucharest Convention by signing the Odessa Declaration. This was a pragmatic 3-year policy agreement largely implemented with financial and technical support from the GEF and the EU. The policies within the Declaration were carried out under the direction of the Black Sea Environmental Programme (BSEP) Co-ordination Unit in Istanbul.

A Transboundary Diagnostic Analysis (TDA), undertaken between 1992 and 1996 demonstrated the relative importance of different nutrient sources within the Black Sea catchment. Given that the Danube was shown to be the largest single source of nutrient input to the Black Sea, it was deemed imperative that strategies for the reduction of nutrients be adopted for this river.

The Strategic Action Plan (SAP) for the Rehabilitation and Protection of the Black Sea was signed in October 1996, with adoption at Ministerial level in 1998. This document provided the riparian countries with a wide ranging plan, which includes the setting of goals and milestones, covering many aspects of environmental protection in the Black Sea, including nutrients. A Project Implementation Unit (PIU) currently manages the SAP from Istanbul, Turkey, pending the formation of the Istanbul Commission Secretariat. The SAP is designed to pay particular attention to nutrients and defines the objective of a Black Sea Basin Strategy to negotiate a progressive series of stepwise reductions in nutrient loads, until agreed water quality objectives are met. To effectively tackle the problem of eutrophication, the SAP also highlights the need for the formation of a co-operative mechanism within the entire Black Sea drainage basin.

With regard to the Danube, the Strategic Action Plan for the Danube River Basin, which was adopted at Ministerial level in 1994, was initially managed by the Environmental Programme for the Danube River Basin (EPDRB) in Vienna. Following ratification of the Danube River Basin Convention (DRBC – known as the Sophia Convention) in 1988, the EPDRB handed over responsibility for the SAP to the International Commission for the Protection of the Danube River (ICPDR), a decision making body charged with implementing the DRBC.

1.2 A strategy to achieve common pollution reduction goals

In early 1998, a Joint ad-hoc Technical Working Group was established between the Bucharest and Sofia Conventions, consisting of representatives from all of the Danube and Black Sea States. The Terms of Reference for the Working Group detailed the primary activities, which included the assessment of available water quality data and nutrient loadings from the Black Sea Basin, as well as the determination of strategies and approaches for implementation of pollutant reductions. The latter task consisted of:

(i) Defining common pollutant reduction goals.
(ii) Assessing whether or not the implementation plans of the SAP undertaken in the Black Sea Basin are sufficient to achieve the common pollutant reduction goals.
(iii) Recommending improvements and amendments to the implementation plans of the SAP to aid in achieving the common pollution reduction goals. With regard to strategies, the Working Group was supported by developments of National Action Plans (NAPs) for each of the Black Sea countries and National Reviews for the Danube countries.

Co-operation between the Istanbul Commission for the Bucharest Convention (Black Sea) and the ICPDR in the Danube led to the recommendation that, in the long term, all states in the Black Sea Basin should:

> *"take measures to reduce the loads of nutrients and hazardous substances to such levels necessary to permit Black Sea ecosystems to recover to conditions similar to those observed in the 1960s".*

It was agreed, however, that "as an intermediate goal, urgent control measures should be taken by all states in the Black Sea Basin in order to avoid that the discharges of nutrients (and hazardous substances) into the Sea exceed those which existed in 1997". In the short term, the Working Group identified the actions required to attain this as:

(i) Reform of agricultural policies.
(ii) Improvement of wastewater treatment (including the use of alternative low cost technologies).
(iii) Rehabilitation of essential aquatic ecosystems.
(iv) Changes in consumer practice (targeted specifically at the use of phosphate-free detergents).

The Working Group also recommended that a review of progress be undertaken in 2007 to focus on further measures required to meet the long term objective of reaching an ecological status similar to that observed during the 1960s (Joint *ad-hoc* Technical Working Group ICPDR – ICPBS summary report, June 1999).

1.3 GEF nutrient reduction programme

The main objective of the GEF Nutrient Reduction Programme for the Black Sea is to assist in implementing the practical measures for restoring and protecting the Black Sea environment. The coastal countries agreed this in the 1996 Strategic Action Plan (SAP) for the rehabilitation and Protection of the Black Sea. The key issues to be addressed under the GEF are in direct support of the recommendations of the Joint ad-hoc Working Group of the ICPBS and the ICPDR.

As a component of the GEFs basin-wide Programmatic Approach to the Black Sea, the proposed programme is aimed at helping the Black Sea countries to develop and implement action plans to prevent and remedy nutrient releases, through a combination of:

- Development, reform and enforcement of environmental policy and legislation.
- The application of economic instruments.
- Strengthening public participation in nutrient reduction.
- Monitoring of trends and compliance for nutrient reduction goals.

Assisting the countries to implement these necessary measures is the main objective of the proposed GEF Black Sea Basin Programmatic Approach, which consists of the following two basic components:

(i) A "Strategic Partnership" to prepare country level investment projects for nutrient reduction under the leadership of the World Bank.

(ii) GEF Regional Projects (Danube and Black Sea) to support regional co-ordination, capacity building and policy, legal and institutional reforms for nutrient reduction. These will be jointly implemented by the three GEF implementing agencies under the leadership of UNDP

Through the World Bank/GEF Strategic Partnership, projects will be identified which will make a significant contribution to the control and/or abatement of nutrient discharges to the Black Sea. It is assumed that all national, priority environmental investment projects are identified in NBS-SAP and NEAPs.

The foremost criteria in project selection for GEF funding, which is obligatory, is that only incremental costs will be covered. An environmental project, whatever its form will have two components; a baseline cost, which relates to improvements needed to address national impacts, and an incremental cost, which relates to improvements to address regional impacts. However, in many cases, the incremental component is so small as to be negligible. The proportion of incremental to baseline cost of any one project will depend upon the category to which incremental benefits are assigned. The level of incremental cost has to be calculated on a project by project basis because of these variables, involving complex economic analyses. The level of work required to calculate 'exact' incremental costs for every project would be too involved and time consuming for an initial project selection stage and therefore a simplified methodology based possibly on generic project types is proposed to be developed as a guide to help in project selection.

The two regional projects are proposed to strengthen the respective Secretariats on all aspects of nutrient reduction issues. A PDF- Block B grant has been allocated in early 2000 for the purpose of preparing the Black Sea Regional Project. The regional benefit of the PDF grant is to establish

the regional and the national structures needed for the management and full implementation of the Nutrient Reduction Programme in the Black Sea. A regional structure is required in order to co-ordinate the country activities in general, ensure consistent and prioritised National Action Plans (NAPs), ensure liaison among the GEF partners (WB, UNDP and UNEP), and the national governments, competent national bodies, national and regional institutions and NGOs.

The PDF provides financial assistance with respect to the strategy for nutrient reduction, by providing:

(i) Provision for the formation of national inter-ministerial committees responsible for issues of nutrient use and control.
(ii) Technical support to national and regional bodies for the formulation and implementation of policy and legislation with respect to nutrient discharge and control in the Black Sea region. This includes the development of draft nutrient reduction plans (national and regional) for implementation over the next five years (Sections 2-7 of this report).
(iii) Technical support to develop process, stress reduction and environmental status indicators to determine the effectiveness of the strategies employed for nutrient reduction (Parr and Reynolds 2000).

In order to bridge legal and political issues relating to the function of the existing conventions and the two Commissions, the GEF are funding as part of the PDF, a 'Memorandum of Understanding' between the ICPBS and the ICPDR on common strategic goals. The Memorandum of Understanding will not however constitute a legal document for the joint implementation of issues relating to pollution control within transboundary waters and the wider basin. The draft document provides the following strategic goals:

(i) A long-term goal of nutrient reduction (and hazardous substances) to a level that will allow the ecosystem to recover (1960s level).
(ii) An intermediate goal not to exceed levels of nutrients (and hazardous substances) above levels encountered in 1997.
(iii) To reach agreement on a common approach to monitoring, including sampling and QA/QC procedures.
(iv) To further assess the nutrient (and hazardous substances) input loads and the ecological status of the Black Sea and the Sea of Azov.
(v) To adopt strategies FOR economic development which are in line with optimal ecosystem functioning.
(vi) To adopt strategies to control the discharge of nutrients and hazardous substances, with review in 2007.

1.4 Eutrophication

The definition of eutrophication that now receives the greatest attention in EU Member States is the version laid down in the Nitrates and Urban Wastewater Treatment Directives, viz:

> *"the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned."*

This has resulted in the underlying causes of eutrophication recently being considered only in terms of excess nitrogen or phosphorus (even though the EU definition does not exclude other nutrients).

Other workers have considered marine/estuarine eutrophication in terms of nitrogen and phosphorus (and sometimes silicate), while admitting that distinguishing between the impacts of N and/or P enrichment and organic enrichment is very difficult, if not impossible. This is the reason for a further group of scientists proposing trophic classification schemes for tidal ecosystems based on organic carbon supply.

The problem stems from the fact that organic loading can be due to:

(i) Increased growth of algae and higher plants which, in turn, contributes to increased water column BOD levels. Upon death, these plants also increase the sediment oxygen demand.
(ii) Increased organic loading from external sources, e.g. direct discharges into the marine environment via outfalls and fluvial fluxes.

Thus, even if external organic loads do not increase, providing external loads of N and P increase, the organic load generated within a waterbody is likely to increase. However, while it is relatively easy to monitor external loads of N and P, external organic loads are very much more difficult to monitor, since a greater proportion of the organic loads is associated with sediment bed-load than it is for nutrients.

Thus in the Black Sea 'Indicators' report (Parr and Reynolds 2000), eutrophication was defined in terms of the biological expression of excessive N and/or P levels (primarily in terms of increased plant growth), albeit that animal indicators were discussed because of the oxygen-depletion caused by increased primary productivity.

1.5 Nutrient cycling

To understand how a nutrient action plan aims to reduce eutrophication as a threat to the Black Sea (or any other waterbody), it is necessary to have a basic understanding of:

(i) The major nutrient sources.
(ii) The routes of entry into aquatic ecosystems.
(iii) How, once in surface waters, nutrients exert their effects and are recycled.

Parr and Reynolds (2000) present a summary of this information, but it is important to recognise the full scale and complexity of anthropogenic influence on nutrient cycling. For example, improving a WWTP to full efficiency with secondary level treatment will remove some 30% of the nutrient (N&P) load and perhaps some 90% of the BOD load entering that plant. The remaining 70% of nutrients and 10% of BOD will still be discharged to river. Unless the WWTP is equipped with a denitrification stage, the majority of N and P removed from the raw sewage will be converted into sewage sludge, and may be disposed of in several ways:

(i) Placed in a landfill (together with solid municipal waste), from where much of it may leach out and reach surface waters at a later date.

(ii) Incinerated, in which case some of it will be returned to earth as atmospheric deposition and then be transported to surface waters via runoff/leaching
(iii) Used as organic fertiliser, in which case the majority will be taken up by plants, but some will still reach surface waters via runoff/leaching.
(iv) Stored in sites above ground from where nutrients may runoff/leach into freshwaters, particularly following storm events.

This example fails to consider what proportion of nutrients used by urban communities and industry are discharged to sewer, and how much of the nutrient load discharged to sewer is transported to the WWTP. A large proportion may be lost to soil/groundwater if the sewerage system is in a poor state of repair. While it is not practicable to control the nutrient content of human faeces, it is possible to regulate against the elevated phosphorus content of detergents, which may contribute one-third to one-half of the phosphorus content of domestic wastewater. Moreover, it is also possible to regulate against the discharge of excessive industrial nutrient loads to sewer by promoting lower usage of nutrients by industry, more efficient use of nutrients within industrial processes (including improved recycling techniques) and improved pre-treatment of wastewater before discharge to sewer. Lowering the heavy metal content of industrial wastewaters also allows a higher proportion of the sewage sludge generated to be utilised as an organic fertiliser.

Of the nutrients that reach surface waters, much is made of the natural self-purification properties of aquatic ecosystems, particularly wetlands and lakes/reservoirs. These clearly act as nutrient sinks for some time, but cannot be relied on in the long-term, since they become saturated with nutrients. While nitrogen can be lost to the atmosphere via denitrification, phosphorus either remains in the water, accumulates in the sediment (from where it can be released back into the water column) or is sequestered within animals/plants. The aquatic ecosystems themselves become degraded with time, and biodiversity is drastically reduced. Indeed, this what has happened (and continues to occur) within the Black Sea itself.

With regard to agriculture, there is clearly a requirement for cost-efficient arable production to make the industry economically viable. This means maintaining soil nutrient levels at an optimum level: too low and crop yields will be poor; too high and excess nutrients will runoff into surface waters or leach into groundwaters, from where they will eventually be transported to surface waters. Leaching into coastal aquifers (especially of nitrate) may be a particular problem, since this is originally a terrestrial source, which is not recorded by river flow/concentration monitoring. Submarine freshwater springs (akin to baseflow in rivers) may contribute a large proportion of the land-derived nutrient load to coastal, shallow areas of the marine environment - exactly those regions of the Black Sea which are most sensitive to nutrient-enrichment.

To maintain soil nutrient nitrogen content at an appropriate level, a suitable estimate of how much nitrogenous fertiliser is required can be based on the growing requirement of the crop, together with a knowledge of the previous crop(s) grown in that soil. For phosphorus, however, the concentration in the soil (measured as Olsen-extractable P, or an analogous method) has to be monitored on an infrequent but regular basis. Phosphorus fertiliser application rates should then be based on the soil Olsen P level, together with the P requirements of the crop being grown.

Recycling of nutrients within agriculture is extremely important, with as much fertiliser as possible being supplied in an organic form. Thus, mixed arable/livestock farms or mixed arable/livestock areas offer better livestock waste recycling opportunities because of the high cost of transporting animal manure and slurry large distances from where they are produced. In

intense livestock areas, if all of the waste produced is applied to land, the soils become nutrient-saturated and increased nutrient export occurs.

In terms of economic instruments, experience in western Europe and the USA has shown taxes on commercial inorganic fertilisers to have weak incentive effects, while the taxation of on-farm nutrient surpluses appears to have considerable advantages (see Parr and Reynolds 2000). However, major infrastructural change and investment would be required to introduce the advice, help and enforcement required to introduce on-farm nutrient plans as a basis for economic instrument development. This investment is worthwhile in terms of environmental protection, but is best introduced over a long period, and only when the economy can support such changes. Thus, the introduction of on-farm nutrient budgets/balances cannot be introduced as part of any of the national plans, but should be considered as a long-term aim.

> *The take-home message of this section are that the major aims of any nutrient control programme should be: (i) to minimise the import of nutrients into catchments; (ii) to promote more conservative use of nutrients (greater recycling) within those catchments; and (iii) to minimise the export of nutrients from catchments.*

Improved nutrient treatment facilities are only one method of helping to achieve aims (ii) and (iii).

1.6 The way forward

A review of nutrient-related legislation, policies and practices in Black Sea riparian countries was completed in June 2000 (Parr *et al* 2000). This showed legislation to vary greatly between the six coastal counties, both in terms of the amount of legislation and its complexity. In most countries, nutrients are regarded as simply another pollutant, with little legislation designed specifically to tackle or prevent eutrophication, while in others, nutrient pollution is given a much higher priority. Nevertheless, in all countries it was apparent that the costs of enforcement of current legislation could not be met by the state. It is clear from this review that unless further funding of national enforcement agencies (and their administrative/scientific back-up) is forthcoming, then the full success of any nutrient action plan is extremely unlikely. It was strongly recommended by Parr *et al* (2000) that the polluter pays principle be further employed to reduce State costs of enforcement.

Fines for nutrient pollution should be set at an appropriate (index-linked) level to discourage further pollution in the future and funds raised from the successful prosecution of polluters should be channelled back into the regulatory regulations to pay for staffing and additional costs. Greater use of the courts, together with a central record of all prosecution cases (successful or otherwise) is to be encouraged. Similarly, a review of funding of regulatory monitoring should be undertaken (in some countries this is currently happening) to promote the polluter pays principle.

A system of increased self-monitoring by dischargers (preferably using composite samples rather than spot samples) offers considerable advantages over current practices in some countries, with greater regulatory agency involvement in QA/QC. Where possible, discharge consent conditions should be based on chemical loads (not concentrations). The revision of consent conditions should involve all interested parties.

This approach, together with the following sector-specific recommendations were made to provide the basis of the six National Nutrient Action Plans (Sections 2-7):

Municipalities. Review/revise discharge consent conditions and consent compliance data for WWTPs. Improve specifications for the development/construction of future landfill sites. Improve prosecution rates for illegal dumping of waste. Increase the use of sewage sludge as an organic fertiliser, particularly for forestry.

Industry. Review/revise conditions for trade waste discharge to sewer and direct discharge to surface waters. For the food processing/chemical industries, discharge consent conditions should include limits on total P, total N and total ammonia. Where appropriate, industrial discharge consents should include heavy metal conditions. For discharges containing high levels of toxic substances, COD consent conditions should be applied in addition to/instead of BOD conditions.

Agriculture. Develop guidance and educate farmers on cost-effective fertiliser application levels for different crops. This guidance should be for total (organic and inorganic) nutrient application rates, so should include advice on estimating the nutrient content of livestock manure. The guidance should promote the use of organic fertiliser and the development of mixed livestock/arable farms. Where possible, develop maximum livestock density norms for farms, dependent on waste handling/disposal strategies. Provide advice/education to farmers on good agricultural practice to minimise land erosion.

Forestry. Develop and implement a strategy for sustainable development of forestry.

Monitoring the success or failure of any major investment programme and institutional reform is necessary to ensure that the future selection of actions/investments is improved. In order to do this, currently available information should be used to develop indicators of process and stress for nutrient use/export from the agricultural, industrial and municipal sectors (such indicators were discussed at a stocktaking meeting on 28-29 June 2000 in Istanbul).

An environmental monitoring programme should be designed and undertaken (see Parr and Reynolds 2000), the results from which should be used to develop environmental stress indicators. Indicator targets should be developed and compliance with these targets assessed in annual status reports, using compliance to monitor the success of the National and Regional Action Plans. As required, the success of the Regional Plan should be reviewed on both a national and sectorial basis and, where necessary, amendments should be made.

2.1 Immediate objectives, priority sub-objectives, measures and activities for nutrient reduction

Inter-ministerial co-ordination and Government/NGO co-operation is important. Close co-operation with local communities and with other stakeholders groups is needed for the implementation of river basin management and nutrients control and reduction.

The following immediate objectives were identified based on the analysis of the current status of Nutrient Reduction in Bulgaria and the barriers to nutrient related legal and policy reform:

Develop policies, legal instruments and measures for nutrient reduction.

Promote institutional strengthening and capacity building.

Strengthen public participation in nutrient export control.

To achieve these objectives, priority actions consisting of measures and activities are outlined below:

2.1.1 Enact and enforce Water Law

- Develop and enforce River Basin management plans for Danube River Basin and for Black Sea catchment area.
- Develop and enforce a new tariff system for water use and effluent discharges.
- Introduce self-monitoring of wastewater quality by municipal WWTPs and Industry.

2.1.2 Draft secondary legislation for adoption and enforcement under the Water Law

- Further develop and enforce effluent limits/emission standards.
- Adopt and enforce a Regulation on "protection of water from pollution with nitrates from agricultural origin".
- Develop and enforce a revised permitting system for point sources discharges based on pollution loads.
- Strengthen control of industrial wastewater quality for discharge to the sewer.

2.1.3 Strengthen acting Regulation No 3 for permissible limits of harmful substances in the soil

- Improve soil conservation measures.
- Include norms for the phosphorus status of soils using Olsen-extractable phosphorus and the phosphorus saturation index.
- Improve monitoring of the phosphorus status of soils using Olsen-extractable phosphorus and the phosphorus saturation index (PSI).

2.1.4 Further develop and implement the national strategy for nutrient control

2.1.5 Develop/adapt methodology to assess non point sources of pollution

- Build national database of nutrient-related information/monitoring results.

2.1.6 Improve and upgrade existing water and soil monitoring systems

- Develop a monitoring system (quantity & quality) of leachate from solid waste disposal/ landfill sites and from manure storage/composting facilities.
- Develop a land/coastal erosion monitoring system and quantify the causes of erosion. Use results to help guide the national strategy for nutrient control (Section 2.1.4).
- Improve the Black Sea monitoring system to include biological, chemical and physical parameters (Parr and Reynolds 2000).
- Improve inland river monitoring systems (along the tributaries of the Danube River and Black Sea) to expand the water quality sampling and flow gauging programmes.

2.1.7 Continue to develop and apply a geographic information system to support and facilitate the management process

- Link with the GIS system (Section 2.1.5).

2.1.8 Continue to implement the National Programme for Priority Construction of Urban WWTPs for settlements with over 10,000 population equivalent in Black Sea Catchment

2.1.9 Continue to implement the National Plan for the Development of Agricultural and Rural Areas

2.2 Institutional strengthening and capacity building

2.2.1 Continue to implement river basin management

- Increase application of "polluter pays" and "users pays" principles in all sectors (municipal, industrial and agricultural).
- Establish operational River Basin Councils for both basin districts.
- Establish a centre in Veliko Tarnovo to train personnel from stakeholder groups on river basin management and nutrient control.
- Co-ordinate and monitor activities on river basin, national and international (Black Sea catchment) levels.

2.2.2 Develop and enforce guidelines to implement measures in all sectors for nutrient

- Develop and enforce good agricultural practice guidance, including: guidelines on fertiliser (organic & inorganic) application rates; crop rotation; and develop legislation on minimum specifications for manure storage facilities to prevent application of manure/slurry on snow/frozen ground.
- Develop guidelines/framework for river basin management.
- Develop standard procedures for estimating/validating sectorial and national nutrient budgets.

2.2.3 Improve operation of inter-ministerial committees for nutrient control and reduction

2.3 Public participation in nutrient reduction

2.3.1 Promote public awareness campaigns

- Produce annual publications on nutrient control initiatives to: improve the quality of the Black Sea; stimulate economic recovery of coastal communities; and provide a sound basis for agricultural development.
- Produce sector-oriented posters and brochures to promote nutrient control.
- Undertake periodic media campaigns related to nutrient control.

2.3.2 Establish an NGO lobby for nutrient reduction

- Identify relevant NGOs.

- Organise workshops and meetings to develop NGO and public support.
- Develop an action plan to participate in implementing the national nutrient action plan.

2.3.3 Conduct sectorial demonstration projects

- Develop regional agri-environmental schemes for sustainable development and efficient management of agricultural activities (including organic agriculture, manure storage, erosion control etc.)
- Undertake pilot projects to demonstrate alternative methods of domestic wastewater treatment in the small towns and villages (e.g. construction of artificial wetlands).
- Undertake pilot projects to determine the capacity of restored wetlands as nutrient "sinks".
- Establish projects to predict the effect of changes in legislation on consumer practices (including introduction and use of phosphate-free detergents).

2.4 Projects ready for implementation in the coming 5 years

The name, type, location and main characteristics of the identified projects ready for implementation in the coming 5 years are shown in Table 2.1.

Table 2.1 Priority projects ready for implementation - anticipated nutrient reduction after WWTP completion (the National Programme up to the year 2005)

	Settlement, Industry, Resort, complex	Population	BOD_5 - t/year	N - t/year	P - t/year
1	Shabla After WWTP (season)	5,500	30	18	1.80
2	Rusalka After WWTP (season)	1,500	9	9	2.50
3	Kavarna seson After WWTP (season)	15,000	5	5	0.70
	(out of season)	11,811	9	9	1.20
4	Balchik After WWTP (season)	25,000	14	14	1.80
	After WWTP (out of season)		7	7	0.98
5	Albena After WWTP	15,000	9	9	1.20
6	Zlatni Piasatzi After WWTP	14,000	7	7	1.00
7	St. Konstantin and Elena (season)	4,000	2	2	0.30
	After WWTP (out of season)	2,000	2	2	0.30
8	Varna After WWTP	350,000	59	59	3.90
9	Asparuhovo After WWTP	26,600	59	59	3.90
10	Devnia and others After WWTP	26,000	55	55	3.70
11	"SODI" & "Agropolihim"		299	898	149.00
12	Kamchia After WWTP	25,000	10	10	1.25

Table 2.1… continued

	Settlement, Industry, Resort, complex	Population	BOD_5 - t/year	N - t/year	P - t/year
13	Obzor				
	Biala				
	After WWTP (season)	15,000	6	6	0.40
	After WWTP out of season	5,300	5	5	0.30
14	Ravda-Sunny beach - Nesebar				
	After WWTP (season)	65,000	63	63	4.20
	After WWTP (out of season)	5,000	5	5	0.30
15	Elenite After WWTP	5,000	5	5	0.40
16	Pomorie After WWTP	20,000	44	44	2.90
17	Vinprom Industrial WWTP		12	12	0.50
18	Burgas After WWTP	195,255	340	340	25.00
19	Neohim After WWTP		226	226	23.00
20	Zaharni Zavodi-Kameno		16	16	1.30
21	Meden rudnik	57,000	55	55	5.00
22	Chernomoetz (season)	25,000	141	29	6.70
23	Sozopol After WWTP (season)	20,000	11	11	1.40
	After WWTP (out of season)	4,195	4	4	
24	Duni (season)	2,000	10	10	1.00
25	Primorsko - Kiten -(season)	37,500	14	14	0.90
	(out of season)	3,440	11	11	0.80
26	Lozenetz After WWTP (season)	1,500	3	3	0.20
27	Tzarevo After WWTP (season)	16,650	9	9	0.60
	out of season	6,358	7	7	0.30
28	Ahtopol After WWTP (season)	11,550	5	5	0.60
	(out of season)	1,256	1	1	0.20
29	Sinemoretz (season)	8,000	36	7	1.00
	(out of season)	500	5	1	0.10
30	Sredetz	9,787	274	274	0.80
31	Targoviste	39,892	1,699	269	36.50
32	Veliki Preslav	10,624	35	35	4.20
33	Shumen	105,980	2,740	672	96.80
34	Smiadovo	4,617	101	55	3.70
35	Dalgopol	5,129	116	21	4.00
36	Kotel	8,100	14	14	1.90
37	Kaspichan	3,501	95	18	6.40
38	Novi Pazar	14,063	490	60	11.00
39	Provadia	18,060	412	79	13.90
	Total		7,581	3,546	429.83

2.5 Investment framework

The main source for financing of capital investment for construction of the sewerage network and municipal WWTPs is the National Budget. A further source is the National Environmental Protection Fund (NEPF), which provides grants to municipalities for construction of priority WWTPs and sewerage systems. The NEPF also provides preferential credit terms for private firms wishing to construct their own WWTPs.

The National Eco-Trust Fund also provides grants for construction of the priority sewerage networks and WWTPs, but only in the Danube River Basin and the coastal Black Sea catchment where there are perceived benefits in terms of biodiversity and nature conservation.

The State Fund for Agriculture provides preferential loans aimed at supporting agricultural producers, mainly for production of wheat, maize, sunflower and sugar beet. Most of the support is granted in the form of short-term credit paid directly to farmers and repayable at harvest time. The programme enabling farmers to buy fertilisers at subsidised prices has been discontinued, but farmers remain exempt from profit tax and are not obliged to pay VAT on equipment purchases. Import duties on pesticides, agricultural machinery and other farm inputs have also been reduced.

An agreement has been signed between the Ministry of Environment and Water, and the Ministry of Agriculture and Forests. This provides joint financial support for farmers (through the State Fund for Agriculture and the NEPF) to implement agri-environmental plans, especially in mountainous regions of the country.

Other sources for financing the capital investments for nutrient control are EU pre-accession funds, such as ISPA and SAPARD.

There are a number of funding sources available for pollution/nutrient reduction, but these sources are insufficient to meet the goals in the given time framework.

3. GEORGIAN NUTRIENT ACTION PLAN

The Georgian Nutrient Action Plan is divided into 4 sections, aimed at improving:

- National nutrient-related legislation and policy (Section 3.1).
- Sectorial nutrient-related policy (Section 3.2).
- Institutional and human capacity to control nutrient export (Section 3.3).
- Public support and stakeholder involvement (Section 3.4).

This draft Nutrient Action Plan is summarised in Table 3.1, together with relevant actions from the Georgian National Environmental Action Plan (NEAP; adopted on 20 May 2000).

3.1 Nutrient-related legislation and policy

3.1.1 Harmonisation with EU environmental legislation

- Undertake gap analysis with regard to the EU legislation.
- Develop strategic plan to harmonise Georgian/EU environmental legislation.

3.1.2 Improve water-related legislation

- Complete National Environmental Finance Strategy for the water supply and treatment sector.
- Develop proposal for institutional reform of water supply and treatment systems (introduction of privatisation elements, elimination of "hidden" subsidies, reconsideration of tariff setting system, etc.).
- Undertake pilot project on institutional reform of water supply and treatment sector.

3.1.3 Improve legislation on agrochemicals (including inorganic fertilisers and pesticides)

- Develop a national system for agrochemicals licensing.
- Develop the Regulation on agrochemicals labelling.
- Develop the Regulation on import/export of agrochemicals
- Develop the Regulation on State registration and examination of agrochemicals.
- Develop guidelines on storage, transportation, sale and safe use of agrochemicals in forestry and agriculture.

3.1.4 Improve waste management legislation

- Develop the Law on Wastes.
- New regulation on landfills.
- Develop Regulation on the use sewage sludge.

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3.1.5 Develop legislation on detergents

- Regulate the phosphorus content of detergents.

3.1.6 Implement changes in national Tax Code

- Revise existing taxation rates for N and P discharges.
- Develop mechanism to increase fines and penalties for non-permitted discharges of pollutants.

3.1.7 Economic mechanisms

- Introduce progressive taxation of P in detergents.
- Develop the Law on Eco-labelling.

3.1.8 Water quality standards

Develop schedule for harmonisation of Georgian/EU standards.

3.2 Sectorial policy

3.2.1 Adjust local/regional development plans

- Introduce nutrient reduction component into national ICZM programme.
- Assess the conservation importance and nutrient reduction capacity of western Georgian wetlands.

3.2.2 Improve municipal nutrient policies

- Rehabilitate Batumi WWTP; undertake feasibility study on installation of tertiary treatment.
- Construct WWTP and improve sewerage system in Kobuleti.
- Rehabilitate Zestaphoni WWTP at river Kvirila.
- Rehabilitate Kutaisi WWTP; undertake feasibility study on installation of tertiary treatment.
- Construct WWTP and improve sewerage system in Poti.
- Assess the condition/operational capacity of Sukhumi WWTP; develop immediate action plan.
- Assess the condition/operational capacity of Gagra-Bichvinta WWTP; develop immediate action plan.
- Assess the condition/remaining capacity of Batumi landfill; develop immediate action plan.
- Assess the condition/remaining capacity Poti landfill; develop immediate action plan.
- Undertake pilot study on the use of sewage sludge use as a forest fertiliser.
- Enact buffer ("sanitary") zone regulations.

3.2.3 Industry

- Introduce N and P load limits into the discharge permitting process for selected enterprises.
- Introduce self-monitoring practices at major point sources nutrient discharges.

3.2.4 Agriculture

- Develop guidance for farmers on fertiliser application levels.
- Develop guidance for farmers on manure treatment and application.
- Develop advice to reduce soil erosion.
- Undertake pilot project on the adoption of good agricultural practice.

3.2.5 Improvement of forestry strategy

- Develop a nutrient reduction strategy and include in best practices guidance for forestry sector.

3.3 Institutional and human capacity

3.3.1 Improvement of MENRP capacity

- MENRP local/regional offices capacity-building, including institutional reform.
- Develop MENRP internal manuals on nutrient reduction regulations and procedures.

3.3.2 Strengthen data gathering/processing system to support decision making

- Develop national inventory on nutrient release and transfer from all sources (including atmospheric deposition); produce a list of key point sources.
- Establish a national Coastal Environmental Quality Monitoring & Information System.
- Develop an inventory of fertiliser sales and outdated stockpiles.
- Develop a Regulation on monitoring nutrient export from solid waste landfills.
- Develop self-monitoring guidelines for enterprises.
- Identify/develop nutrient export indicators.

3.3.3 Improve co-ordination between governmental agencies

3.3.4 Develop local expertise in nutrient control options

- Establish a training programme/seminars at the MENRP for local enterprises.

3.4 Public support and stakeholder involvement

3.4.1 Improve public information and public awareness

- Introduction a chapter on nutrients in the annual "State of the Environment" report.
- Establish a nutrient-oriented module at the public education centre in Batumi.

3.4.2 Public participation

- Establish local councils on sustainable development in coastal regions; undertake at least one pilot project to determine the best methods of improving public support and stakeholder involvement.

Table 3.1 Draft Georgian nutrient action plan

List of abbreviations used in table:

MENRP – the Ministry of Environment and Natural Resources Protection of Georgia
MoH – Ministry of Health and Social Protection
MoA – Ministry of Agriculture and Food
MoUC – Ministry of Urbanisation and Construction
MoF – Ministry of Finance
MoEc – Ministry of Economics, Industry and Trade
MoSPM – Ministry of State Property Management
MoTR – Ministry of Tax Revenues
SDoF – State Department of Forestry
SDoS – State Department of Standardisation, Metrology and Certification

Action No.	Starting date	Closing date	Activity	Responsible Agency	Other Parties Involved
1	2000	2000	Preparation of feasibility study for the project for amelioration of Kutaisi water supply system. (NEAP action.)	MENRP	Ministry of Urbanisation and Construction; TACIS; Ministry of Health and Social Protection
2	2000	2000	Study of efficiency of environmental taxation (environment pollution tax, natural resources tax), recommendations for introduction of amendments and additions to the Tax Code. (NEAP action.)	MENRP	Ministry of Finance; TACIS
3		2000	Implementation of the programme for institutional strengthening of the MENRP. (Started 1999.) (NEAP action.)	MENRP	UNDP; Dutch government
4	2000	2000	Enactment of the law and regulations on waste management, to tackle the problem of handling (classification, transportation, disposal, recycling) of waste. (NEAP action.)	Parliament of Georgia	MENRP; Ministry of Health and Social Protection

Table 3.1… continued

Action No.	Starting date	Closing date	Activity	Responsible Agency	Other Parties Involved
5	2000	2001	Setting up the project preparation unit (PPU) within the MENRP. This will be to identify and co-ordinate preparation of environmental projects for submission to international financial organisations, funds, donor countries. Assistance of the donor country in training of local personnel, logistical and other support is possible. (NEAP action.)	MENRP	
6	2000	2001	Composing water cadastre for surface water licensing. (NEAP action.)	MENRP	Giprovodkhoz Institute
7	2000	2002	Execution of programme for encouraging introduction of environmental management standard systems (e.g. ISO 14001, EMAS). (NEAP action.)	MENRP	Ministry of Industry; Sakstandarti
8	2001	2002	Preparation of investment projects envisioned by the Black Sea Rehabilitation and Protection Action Plan. Presentation of the projects to international financial organisations. (NEAP action.)	MENRP	International financial organisations, donor countries
9	2001	2002	Preparation of investment proposal for implementation of the pilot project of the best agricultural practice. Submission of this proposal to international financial organisations. (NEAP action.)	MENRP	Ministry of Agriculture and Food; Ministry of Health and Social Protection; GEF
10	2001	2002	Study of the state of disposal of above expiry date agrochemicals and mineral fertilisers available in Georgia. (NEAP action.)	MENRP	Ministry of Health and Social Protection Ministry of Agriculture and Food
11	2001	2002	Elaboration of the programme for development of environmental education, including that for foreign language schools in Georgia. (NEAP action.)	Ministry of Education	MENRP
12	2001	2002	Training of journalists dealing with environmental issues, setting up training courses. (NEAP action.)	MENRP	donor countries
13	2001	2002	Preparation of investment project for recycling of municipal and industrial waste and its submission to international financial organisations. (NEAP action.)	MENRP	Regional (local) self governing agencies

Table 3.1… continued

Action No.	Starting date	Closing date	Activity	Responsible Agency	Other Parties Involved
14	2001	2004	Introduction of new standards for air, surface and drinking water quality. (NEAP action.)	State Department of Standardisation, Metrology and Certification	MENRP; Ministry of Health and Social Protection
15	2001	2004	Implementation of the project for rehabilitation of Kutaisi water supply. (NEAP action.)	Ministry of Urbanisation and Construction	International financial organisations
16	2001	2003	Preparation of environmental manuals and textbooks for preparatory, secondary (including foreign language schools in Georgia), and high schools. (NEAP action.)	Ministry of Education	Tbilisi State University
17	2001	2002	Elaboration of the national strategy of environmental information. (NEAP action.)	MENRP	MENRP; International financial organisations.
18	2002	2003	Implementation of the pilot project in introduction of the best available practice in agriculture. (NEAP action.)	Ministry of Agriculture and Food	GEF
19		2001	Development of the gap analysis in regard to the EU legislation (including nutrients).	MENRP	MoH, MoA, SDoS
20		2002	Development of the strategic plan for harmonisation of Georgian environmental legislation with EU environmental legislation.	MENRP	MoH, MoA, SDoS
21		2001	Completion of National Environmental Financing Strategy for the water supply and treatment sector.	MENRP	MoF, MoEc, OECD task Force
22		2001	Development of the proposal for institutional revision of water supply and treatment system (introduction of privatisation elements, elimination of "hidden" subsidies, reconsideration of tariff setting system, etc.).	MENRP	MoF, MoSPM, MoUC, MoH
23		2003	At least one pilot project for introduction of institutional changes in water supply and treatment system.	Municipalities	MENRP, MoUC
24		2002	Development of national system on pesticides/agrochemicals licensing.	MoH	MENRP, MoA
25		2002	Development of the regulation for pesticides and agrochemicals labelling.	MoH	MENRP, MoA, SDoS

Table 3.1… continued

Action No.	Starting date	Closing date	Activity	Responsible Agency	Other Parties Involved
26		2002	Development of the regulation for import and export of pesticides and agrochemicals.	MoH	MENRP, MoA, MoF, MoTR
27		2002	Development of the regulation for the State registration and examination of pesticides and agrochemicals.	MoH	MENRP, MoA, SDoS, GAoS
28		2002	Development of the guidelines for storage, transportation, sale and safe use of pesticides and agrochemicals in forestry and agriculture.	MoH	MENRP, MoH, MoA, SDoF
29		2000	Development of the Law on wastes.	MENRP	MoH, SDoS, SAoS
30		2001	New regulation on landfills.	MENRP	MoUC, MoH
31		2001	Regulation on sewage sludge use.	MENRP	MoUC, MoH, MoA
32		2002	Regulation on the limitation of P content in detergents.	SDoS	MENRP, MoH, MoTR
33		2002	Revision of existing taxation rates for N and P discharges.	MENRP	MoF, MoEc, MoTR
34		2001	Development of the mechanism for increase of fines and penalties for non-permitted discharges of pollutants.	MENRP	MoF, MoEc, MoTR, SDoS
35		2002	Introduction of progressive taxation of P in detergents.	MENRP	MoF, MoEc, MoTR, SDoS
36		2001	Development of the Law on Eco-labelling.	MENRP	SDoS
37		2001	Development of the schedule for harmonisation of the national water standards with EU standards.	MENRP	MoH, SDoS
38		2001	Introduction of nutrient reduction component into national ICZM programme.	MENRP	WB
39		2002	Assessment of the value of ecological services provided by western Georgian wetlands.	MENRP	
40		2004	Rehabilitation of Batumi WWTP. Feasibility study for tertiary treatment introduction.	MoUC	MENRP, Local governments
41		2005	Construction of WWTP and improvement of sewage collection in Kobuleti.	MoUC	MENRP, Local governments
42		2004	Rehabilitation of Zestaphoni WWTP at river Kvirila.	MoUC	MENRP, Local governments

Table 3.1… continued

Action No.	Starting date	Closing date	Activity	Responsible Agency	Other Parties Involved
43		2003	Rehabilitation of Kutaisi WWTP. Feasibility study for tertiary treatment introduction.	MoUC	MENRP, Local governments
44		2005	Construction of WWTP and improvement of sewage collection in Poti.	MoUC	MENRP, Local governments
45		2002	Evaluation of the state of Sukhumi WWTP. Design of immediate actions.	MENRP	
46		2002	Evaluation of the state of Gagra-Bichvinta WWTP. Design of immediate actions.	MENRP	
47		2001	Assessment of Batumi landfill. Design of immediate actions.	MENRP	Local governments
48		2001	Assessment of Poti landfill. Design of immediate actions.	MENRP	Local governments
49		2004	Design of a pilot project for sewage sludge use as fertiliser in forestry.	SDoF	MENRP, MoA
50		2001	Enactment of buffer ("sanitary") zone regulations.	MoUC	MENRP, MoH
51		2001	Introduction of N and P load limits into discharge permitting process for selected enterprises.	MENRP	Enterprises
52		2002	Introduction of self-monitoring practices at biggest point sources of nutrient discharge.	MENRP	Enterprises
53		2002	Development of the guidance for farmers on fertiliser application levels.	MoA	MENRP
54		2002	Development of the guidance for farmers on manure treatment and application.	MoA	MENRP
55		2003	Pilot project on the introduction of good agricultural practices in rural communities.	MoA	MENRP
56		2003	Development of the manual on combating erosion on agricultural slopes.	MoA	MENRP
57		2002	Development of the nutrient reduction strategy and best practices for forestry sector.	MENRP	SDoF
58		2002	MENRP local/regional offices capacity-building, including institutional changes.	MENRP	

Table 3.1… continued

Action No.	Starting date	Closing date	Activity	Responsible Agency	Other Parties Involved
59		2001	MENRP internal manuals on nutrient reduction regulations and procedures.	MENRP	
60		2003	Setting up of the national inventory on nutrient release and transfer from all sources (including atmospheric deposition); accomplishment of the list of primary point sources.	MENRP	MoH, MoEc, MoA, SDoF
61		2003	Establishment of National Coastal Environmental Quality Monitoring & Information System.	MENRP	
62		2002	Setting up of the inventory of outdated fertiliser stocks.	MoA	MENRP
63		2002	Development of the regulation for monitoring of nutrient load from solid waste landfills	MENRP	MoUC, MoH
64		2003	Development of sectorial self-monitoring guidelines for enterprises.	MENRP	MoA, MoEc
65		2001	Development of system of nutrient reduction indicators.	MENRP	MoH, GAoS, SDoS
66		2002	Establishment of training/seminars courses at the MENRP for local enterprises.	MENRP	MoEc
67		2001	Introduction of a special chapter on nutrients in annual "State of the Environment" report.	MENRP	
68		2002	Establishment of a special nutrient-oriented module at the public education centre in Batumi.	MENRP	Local government
69		2003	Establishment of local councils on sustainable development in coastal regions; at least one pilot project launched.	MENRP	Local government; other stakeholders

4.1 General approach

In developing a priority action plan, four guiding principles have been taken into account:

(i) Priorities and actions should be based on short duration environmental audits, taking into account risk assessment.
(ii) Where possible, nutrients control measures should be low cost (e.g. establishment of buffer zones).
(iii) Priority actions should be consistent with the overall environment strategy for Romania.
(iv) Sub-actions have been considered as basic activities.

The priorities and timing of remedial actions are based on the following risk criteria:

- Severity of the effect of nutrients for the aquatic ecosystems.
- The extent to which the effect is reversible and the time scale for the effect to be reversed.
- The degree to which the problem is local or regional.
- The degree to which multiple sources contribute to nutrient pollution.
- Other non-risk based criteria include:
  - the cost effectiveness of the proposal;
  - public support and political viability;
  - willingness to pay;
  - the ability to achieve short term results;
  - the economic impact of the environmental degradation; and
  - the technical feasibility of control.

The resulting actions and timing are classed as follows:

Class A immediate: basic high priority actions required to reduce or stop nutrient discharges.
Class B short term (1-3 years): actions which are of less immediate priority than in class A and/or which require some measure of planning and design.
Class C medium term (3-7 years): actions dependent on the outcome of the restructuring process.
Class D long term (>7 years): actions of relatively low priority; usually with large investments associated.

Based on a sectorial analysis 53 activities have been identified of which 7.5% are of class A, 22.7% belong to class B, 47.2% to class C and 22.6% to class D. Three main action packages relate to: (i) legislation, (ii) institutional and (iii) investment actions. Group (i) and (ii) actions are usually short-term and generate group (iii) actions for the medium and long-term.

In addition to legislative and institutional related activities there are two further types of action:

- Sectorial activities such as for industry and municipalities.
- Intersectorial activities where the leading role should be paid by MWFEP in the framework of the inter-ministerial committee secretariat – NEAP (National Environmental Action Plan).

Support activities such as monitoring programmes (national) and self-monitoring (industry, agriculture, municipalities) from which indicators can be derived are also essential to the success of the national nutrient action plan.

The key actions are shown in Tables 4.1-4.4, with the class designation of each action shown in parentheses. The following abbreviations are used:

MWFEP	Ministry of Water, Forestry and Environmental Protection
MPW	Ministry of Public Works
MH	Ministry of Health
MAF	Ministry of Agriculture and Fisheries
MIT	Ministry of Industry and Transport
RW	Romanian Water (national water supply company)
BAT	Best Available Technology
BEP	Best Environmental Practice

Table 4.1 Key actions: legislation/institutional

No	Policy-Legislation-Institutional-Infrastructure (CLASS)	Responsi-bility	2000	2001	2002	2003	2004	2005	2006 2010
1	Finalise the harmonisation process with the EU nutrient related legislation: BAT/BEP implementation **(C)** 1.1 Transposition of Directives **(B)** 1.2 Implementation process **(C)** 1.3 EWFD Directive **(C)**	MWFEP + MPW + MH + MAF + MIT							
2	Introduce and develop an effective framework for water management **(C)** 2.1 River Basin Authority + Committee framework, responsibilities **(B)** 2.2 Integrated water/ land management plans **(C)** 2.2. .Develop/implement basin WQS/ effluent standards (N,P conc./loads) 2.2.2 Development diffuse pollution management plan 2.2.3 Develop buffer zones	MWFEP + MAP+ municipalities+ RW							

	plan 2.2.4 Rehabilitate/protect sensitive/ affected areas 2.2.5 Develop environmental monitoring programme 2.2.6 Water funds management								
3	Promote targets for short and medium term nutrient load reductions **(A)** 3.1 Develop ambient water quality standards and effluent standards **(A)** 3.2 Harmonise water quality classification scheme with other Danube River basin countries **(B)**	MWFEP							

Table 4.1… continued

No	Policy-Legislation-Institutional-Infrastructure (CLASS)	Responsi-bility	2000	2001	2002	2003	2004	2005	2006 2010
4	Develop environmental regulation for waste management control **(B)** 4.1 Develop marketing programme for animal waste **(B)** 4.2 Develop norms for animal farms/ complexes **(A)** 4.3 Develop norms/guidelines for manure disposal/application **(A)**	MWFEP +MIT +MAF +MH							
5	Develop a plan to reduce agricultural pollution and promote organic farming **(C)** 5.1 Complete livestock inventory **(B)** 5.2 Control of inorganic fertiliser application **(C)** 5.3 Develop/implement eco-labelling scheme for agriculture products **(B)**	MAF+ MWFEP + MH							
6	Technical assistance/ training **(C)**	MWFEP +MAF							

Table 4.2 Key actions: agriculture

No	Agriculture sector	Responsi-bility	2000	2001	2002	2003	2004	2005	2006 2010
1	Review current policies and develop integrated approach to water resources and land management **(A)** 1.1 Introduce sustainable land protection programme **(C)** 1.2 Develop/implement plan to minimise land erosion (sustainable forestry, buffer	MAF + MWFEP							

	zones, wetlands, flood plains restoration and protection **(D)** 1.3 Provide advice to control nutrient run-off/leaching from agricultural sector **(D)**									
2	Develop/introduce policy on sustainable agricultural production **(D)** 2.1 Rehabilitate/extend animal farm WWTPs **(B)** 2.2 Promote equipment/construction of manure storage and spreading facilities **(C)** 2.3 Pilot/ demo-projects of BEP for use of fertilisers **(B)** 2.4 Market development for livestock waste **(C)** 2.5 Development of manure management **(C)** 2.6 Introduce agricultural eco-labelling **(C)**	MAF + MIT+ MWFEP								

Table 4.2… continued

No	Agriculture sector	Responsi-bility	2000	2001	2002	2003	2004	2005	2006 2010
3	Develop/implement monitoring programme for nutrient application norms compliance **(D)**	MAF+ MWFEP							
4	Training/ technical assistance, guidelines -catchment management planning -manure application / disposal **(D)**	MAF+ MWFEP							

Table 4.3 Key actions: municipalities

No	Municipal sector	Responsi-bility	2000	2001	2002	2003	2004	2005	2006 2010
1	Upgrade WWTP capacity **(C)** 1.1 Improve operation and maintenance of existing WWTPs **(B)** 1.2 Apply appropriate sludge treatment and disposal **(C)** 1.3 Develop and implement programme for self-monitoring of effluents **(C)**	Municipalities+ MPW							
2	Implement the Urban Wastewater Directive **(D)** 2.1 Extend public sewer systems and connected houses with public water supply to sewer system **(D)** 2.2 Strengthen/enforce regulations and standards for pre-treatment of commercial/ industrial waste entering municipal sewerage systems **(C)** 2.3 Optimise operation and maintenance of	MPW+ Municipalities+ MWFEP							

	sewerage systems **(D)** 2.4 Construct new WWTP; extend existing ones **(D)**								
3	Implement programme for environmentally sound WW treatment for rural areas **(D)**	MWFEP							
4	Develop plans for disposal of waste from barges and ships **(C)**	Municipalities+ MT + MWFEP							
5	Revise the fee and fine structure to reflect paying capacity of water users and WWTP costs **(C)**	MPW+ Municipalities							
6	Ensure technical assistance/ training **(D)**	MPW+ MWFEP							
7	Improve public involvement **(D)**	Municipalities							

Table 4.4 Key actions: industry

No	Industry sector	Remarks	2000	2001	2002	2003	2004	2005	2006 2010
1	Develop an institutional framework to implement BAT and BEP for point and diffuse source pollution **C)** 1.1 Undertake projects on reconstruction and modernisation **(C)** 1.2 Implement industrial waste treatment reconstruction/ modernisation **(C)** 1.3 Develop self-monitoring system for consent compliance control **(C)**	MIT							
2	Plan and construct low P leachate landfills **(B)**	MIT+ MWFEP							
3	Introduce technology for phosphorous-free detergent manufacturing **(C)** 3.1 Introduce eco-labelling of industrial products **(C)**	MIT							
4	Improve technical assistance/training **(D)**	MIT+ MWFEP							

4.2 Project identification

Many of the activities are likely to generate projects. These can be divided into: (i) hot spot projects (Section 4.2.1); and (ii) general projects (Section 4.2.2).

4.2.1 ”Hot spot” projects

Table 4.5 shows areas of high nutrient status in Romania and illustrates which sector(s) are the major nutrient sources in these areas. Of these 30 hot spots 63% are considered to be high priority. In 50% of cases, elevated nutrient levels and are due primarily to municipal pollution; in 30% of cases nutrient pollution is derived principally from agriculture and in 20% of cases the excessive nutrient levels are due to industrial discharges.

Table 4.5 Nutrient "hot spots" in Romania

No	Name	Sector	Priority	Sub-basin area
1.	Oradea	municipal	high	Tisa
2.	Zalau Crasna I	municipal	high	Tisa
3.	Zalau Crasna II	municipal	high	Tisa
4.	Deva Mures	municipal	high	Tisa
5.	Timisoara/ Bega	municipal	high	Tisa
6.	Timis I	municipal	high	Tisa
7.	Timisoara/Bega	industrial	high	Tisa
8.	Timis II	industrial	high	Tisa
9.	Azomures Tg.	industrial	medium	Tisa
10	Mures	agricultural	medium	Tisa
.	Integrate Arad	agricultural	medium	Tisa
11	(food)	agricultural	medium	Tisa
.	Nutrimur Iernut -	municipal	high	Jiu
12	Mures	municipal	high	Targului/
.	Consium Moftim	municipal	high	Arges
13	Avicola Satu Mare	municipal	high	Dambovita/
.	Agroconsuim	municipal	high	Arges
14	Bontida	municipal	medium	Dunare/
.	Craiova - Jiu	municipal	medium	Danube
15	Campulung Muscel	industrial	medium	Dunare/
.	Bucuresti	industrial	medium	Danube
16	Braila	industrial	medium	Olt
.	Galati	agricultural	high	Ialomita
17	Rm. Valcea	agricultural	high	Olt
.	Targoviste	agricultural	medium	Olt
18	Nitramonia Fagaras	agricultural	medium	Olt
.	Romfosfochim	municipal	high	Vlasia/
19	Valcea	municipal	high	Ialomita
.	Tr. Magurele	agricultural	high	
20	Peris	agricultural	high	Ialomita
.	Consuim Ulmeni			Danube
21	Combil Gh. Doja			Prut
.	Braigal Braila			Prut
22	Ungheni			Prut
.	Iasi			Bahlui Prut
23	Cantemir Tomesti			
.	Suin Prod			
24	Independenta			
.				
25				
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26				
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28				

. 29 . 30 .				

4.2.1 General projects

Each of the activities could generate associated projects, such as:

- Development of a methodology to quantify diffuse pollution.
- Nutrient bioavailability appraisal.
- Buffer zone demonstration projects, etc.

4.3 Cost estimation

Implementation costs are considered in relation to:

(i) Harmonisation/implementation of EU environmental legislation.
(ii) Operational costs to achieve the nutrient targets.

4.3.1 Costs related to the EU legislation approximation process

A recent Phare project (Water Strategy - MWFEP 2000). estimated that harmonisation of Romanian and EU legislation concerned with water quality protection would cost some 3,440 mill. Euro for capital investment, with a further 316 mill. Euro operating and maintenance costs. The most costly EU Directive to implement in Romania will be the Urban Waste Directive.

With regard to the National Environmental Action Plan 84 projects are concerned with sewerage system extension and WWTP construction/upgrading at a total cost of some670 mill. Euro.

4.3.2 Cost related to the targets

The ICPDR Investment Programme costs for Romania are shown in Table 4.6: Considering that most of the objectives of the ICPDR programme are shared with the Black Sea GEF Programme, the 759 mill. USD could be considered as a suitable basis for estimating the cost(s) of the Romanian Nutrient Action Plan implementation.

Table 4.6 ICPDR Investment Program costs for Romania

Municipal (mil. USD)	Industrial (mil. USD)	Agriculture (mil. USD)	Wetlands (mil. USD)	General (mil. USD)	Total (mil. USD)
360	255	40	101	3	759
47.4%	33.6%	5.3%	13.3%	0.4%	100%

5.1 Measures related to municipalities

1. Reduce the nutrient content of wastewater discharged to rivers, lakes and coastal/estuarine waters a level that will allow self-restoration to occur.

2. Eliminate discharges of polluted and insufficiently treated wastewater by means of:

   - Treatment according to the established norms, if necessary by introducing tertiary treatment processes.
   - Collection and treatment of urban runoff.
   - Re-using treated wastewaters.

3. Develop dual 'dirty' water/urban runoff sewer systems and construct or upgrade current WWTPs to treat the wastewaters collected. Improve domestic and industrial waste collection and utilisation systems.

4. Construct or reconstruct municipal sewer systems (for domestic and urban runoff) in the settlements and towns of Rostov-on-Don, Taganrog, Azov, Novorossijsk, Tuapse, Krasnodar, Gelendgic and Anapa.

5. Where technically feasible, develop and implement a stage-by-stage transition of processing industries and municipal services located in the coastal zone to a closed-type water supply system. When it is not acceptable, construct WWTPs to prevent discharges of untreated and insufficiently treated wastewater to water bodies.

6. Reduce the nutrient load in wastewater from the city of Rostov-on-Don that enters the river Don/Sea of Azov.

5.2 Measures related to agriculture

1. Prohibit ploughing in coastal strips. Instead, promote afforestation of this land or its conversion to meadows, together with a change to ecologically safe agricultural technologies that provide soil protection and minimise mineral fertiliser application. Transfer livestock farms, agricultural aircraft airports, etc. outside water protection zones and increase surface water protection from nutrients input to the environment.

2. Optimise inorganic fertiliser application rates on agricultural lands.

3. Utilise livestock farm wastes. Prohibit livestock farms construction with manure hydroflush (slurry-based systems). Reconstruct existing farms to replace manure hydroflush systems by dry methods of manure removal.

4. Produce fodder albumen (protein) and other useful products from agricultural and food industry wastes.

5. Promote full use of the self-purification potential of natural ecosystems.

6. Provide all land users with design-and-budget documents based on the adaptive-landscape system of land cultivation. Issue passports on the pollutant status of lands.

5.3 Measures related to waste disposal and utilisation

1. Construct plants and sites for wastes disposal and utilisation.

2. Make facilities for treatment, decontamination and utilisation of harmful wastes, compulsory at waste disposal sites.

3. Develop a system to promote the collection, treatment and recycling of agricultural and municipal wastes in coastal areas of the Black and Azov Seas.

4. Utilise all harvested wood biomass to manufacture commercial products.

5.4 Measures related to normative, legal, institutional and scientific–technical support.

1. Improve the water management system to include an economic mechanism for water resources use. Update environmental legislation to strengthen responsibility for aquatic pollution, irrational use of water resources, non-compliance with regulations related to the use of water protection zones, and unauthorised water use.

2. Develop and introduce scientifically-based criteria for allowable nutrient impact on the marine ecosystems.

3. Restore the network of monitoring sites/observation stations and activities to control the nutrient content of surface, ground and marine waters.

Specific priority measures for nutrient pollution load reduction in the Azov–Black Sea basin are presented in Tables 5.1-5.3.

Table 5.1 Specific priority measures for nutrient pollution reduction in Krasnodar Kraj

	Measures	*Dates*	*Ecological effect*	*Cost estimates (thous. USD)*
1.	*Reconstruct emergency sewage collectors and WWTP in Krasnodar*	*2000–2005*	*Upgrading wastewater treatment*	*786*
2.	*Construct the third stage of the sewerage system in Krasnodar*	*2000–2005*	*– " –*	*4178*
3.	*Construct the 2nd stage of the sewerage system in Krasnodar*	*2000–2001*	*– " –*	*590*
4.	*Reconstruct and enlarge municipal WWTP in Sochi*	*2000–2010*	*Improved wastewater treatment*	*169642*
5.	*Extend and reconstruct WWTP in Adler, Dagomys, Vardane, on the river Bzugn; collectors of a pump station in Adler, Loo, Dagomys, located in the region of the health resort Sochi*	*2000–2010*	*– " –*	*19464*
6.	*Construct waste processing/treatment installations in Novorossijsk for sanitary cleaning of resorts in Anapa, Gelendgic and Novorossijsk*	*2000–2003*	*Elimination of solid domestic wastes, rehabilitation of the environmental situation*	*189*
7.	*Reconstruct the waste incineration plant in Sochi*	*2000–2005*	*Upgrading of incineration technology*	*1982*
8.	*Construct two solid domestic wastes installations in Sochi (settlements Lazarevskoje, Adler)*	*2000–2003*	*Disposal of solid domestic wastes*	*314*
9.	*Eliminate unauthorised dumping sites and land restoration*	*2000–2005*	*Landscape restoration/ elimination of environment pollution*	*193*

Table 5.1… continued

	Measures	*Dates*	*Ecological effect*	*Cost estimates (thous. USD)*
10.	*Construct facilities and networks for storm water collection and discharge in resorts on the Black Sea and Azov Sea coasts*	*2000–2004*	*Clean marine waters within the beach zones and zones of marine waters intake for swimming pools*	*1964*
11.	*Restore damaged/ polluted soils in the area of a health resort Sochi*	*2000–2004*	*Improvement of the ecological status of soils*	*1214*
12.	*Transfer livestock farms from slurry-based systems to dry manure-based systems; soil restoration in impacted areas*	*2000–2009*	*Environmental improvement*	*357*
13.	*Implement the Federal programme for the Azov–Black Sea coasts protection against dangerous natural processes in the territory of Krasnodar krai*	*2000–2003*	*Coastal protection*	*151750*
14.	*Anti–landslide and coast reinforcement works at Sochi*	*2000–2004*	*Coastal protection*	*5375*
15.	*Implement a programme for compensational afforestation*	*2000–2004*	*Forests restoration and environmental improvement*	*1307*
			Subtotal	*359305*

Table 5.2 Specific priority measures for nutrient pollution reduction in Rostov oblast

	Measures	Dates	Ecological effect	Cost estimates (thous. USD)
16.	***Third stage of the enlargement and reconstruction of the sewerage system in Rostov***	***2000–2003***	***Environmental improvement***	***6553***
17	Second stage of enlargement and reconstruction of sewerage system, reconstruction of the 1st stage of a sewage system in Rostov-on-Don	2000–2003	–"–	1560
18.	Domestic wastewater collector in Rostov-on-Don	2000–2002	–"–	114
19.	Construct sewer system in Novocherkask	2000–2002	"–"	1254
20.	Construct WWTP in the town of Aksai	2000–2004	Treatment of wastewater discharged to the River Don	721
21.	Construct biological WWTP in the town of Salsk	2000–2004	Wastewater treatment	843
22.	Sewerage system reconstruction in Konstantinovsk	2000–2004	Upgrading sanitary conditions in the territory	678
23.	WWTP reconstruction in Proletarsk	2000–2004	Elimination of untreated wastewater	160
24.	Combined WWTP reconstruction	2000–2003	–"–	8164
25.	Municipal WWTP reconstruction in Taganrog	2000–2005	Reduction of pollutant loads to the shallow part of Taganrog Bay	4314
26.	Reconstruction of the main sewage collector in Azov	2000–2002	Treated wastewater discharge	711
27.	Coastal reinforcement measures in the Taganrog Bay	2000–2005	Coastal protection	9554
28.	Construct solid domestic waste disposal facility for Rostov-on Don	2000–2002	Improvement of the sanitary and ecological state in the town	7825
29.	Flood prevention measures for the River Don delta	2000–2003	Prevention of emergency situations and decrease of economic damage	7825
			Sub-total	***50276***
			Total (Tables 5.1 and 5.2)	***409581***

Table 5.3 Measures related to legal, normative, institutional and scientific-technical support

	Measures	*Dates*	*Ecological effect*
1.	*Develop and adopt the Law on "Ecological safety of the social-economic development of the coastal areas of the Black Sea and the Sea of Azov"*	*2001-2002*	*Regulation of social and economic activities, stabilization of the environmental situation*
2.	*Develop and adopt the Law on "Responsibility for the damage caused by a negative impact on the environment in the coastal zones"*	*2001-2002*	*Increase in the effective actions of the state environmental authorities*
3.	*Establish a common unified system for environmental port control*	*2001*	*Implementation of a set of measures to reduce and prevent illegal discharges from ships*
4.	*Develop a law for the total ban of municipal wastes dumping in the coastal zone*	*2001-2002*	*Creation of conditions for stabilisation of the environmental situation in the coastal areas*
5.	*Develop and introduce criteria for maximum allowable anthropogenic loads to coastal ecosystems*	*2001-2002*	*Establishment of a system for optimal anthropogenic impact on the environment*
6.	*Extend existing environmental monitoring in Krasnodar kraj*	*Permanent*	*Effective environmental control/ obtaining of information to assess ecological status*
7.	*Extend existing environmental monitoring in Rostov*	*- " -*	*- " -*
8.	*Develop a GIS for environmental assessment in coastal areas of the Black Sea and the Sea of Azov*	*2001-2004*	*Data base creation to be used for a comprehensive analysis of the environmental potential, ecological sustainability and economic capacity of a given area*
9.	*Improve public education and awareness of environmental issues*	*Permanent*	*Personnel training to aid environment protection (managerial, scientific, administrative, etc.)*
10.	*Improve co-operation with NGOs*	*- " -*	*Arrangement of conferences, meetings, workshops, establishment of ecological committees.*

6.1 Actions related to legislation

- Issue a Soil Pollution Control Regulation, containing provisions for regulating practices (production, importation, and marketing) with regard to agricultural inputs. This should:

  - Promote the utilisation of manure as fertiliser.
  - Set specific objectives and standards for agricultural practices.
  - Include enforcement mechanisms.

  The Regulation is likely to follow a similar approach to that adopted in the EU Nitrates Directive (91/676/EEC). Maximum fertiliser application rates (organic and organic) within designated Nitrate Vulnerable Zones should be adopted in compliance with this proposed legislation.

- Amend the existing Regulation on Water Pollution Control to include norms and maximum values for total nitrogen and total phosphorus concentrations in urban wastewater discharges.

- Amend the existing Regulation on Water Pollution Control to include quality criteria for the classification of groundwater.

6.2 Actions related to monitoring and enforcement

- Develop advice on fertiliser application rates to individual crops based on Olsen-P analysis.

- Convey recommended P, N and K fertiliser application rates to farmers during training.

- Strengthen legal and institutional mechanisms for monitoring fertiliser applications rates to optimise nutrient usage on both a scientific and economic basis.

- Promote institutional strengthening of local authorities and the Ministry of Environment to achieve effective implementation of current industrial discharge regulations.

- Amend the Environment Act to encourage legal action against polluters and introduce penalties that will genuinely discourage polluters from repeat offences.

- Develop a comprehensive information system to assess compliance rates, the effectiveness of enforcement procedures, outcomes of court challenges and revenues raised through fines.

6.3 Actions related to pollution control

- Develop and prioritise environmental targets.

- Develop a capital investment pilot scheme to prioritise spending on wastewater treatment.

- Where practicable, install tertiary treatment at major municipal WWTPs.

If tackling BOD is the highest priority, then increasing the percentage of WWTPs that use secondary (biological) treatment is likely to dominate any proposed plan, whereas if reducing P is the primary aim, then tertiary treatment using iron or calcium salts is likely to dominate the plan. However, if removal of nitrogen from municipal wastewater is given equal priority to reducing phosphorus emissions, then tertiary biological treatment (oxic/anoxic zones) is likely to dominate any proposed recommendations. Wastewater discharges from Istanbul Metropolitan Area to the lower Bosphorus Strait are approximately equal to the pollution from the remaining domestic discharges into the Turkish Black Sea.

- Develop a robust agricultural management plan (AMP).

- Integrate the AMP with river basin management plans.

- Promote local government alliances for cost-effective improvements to urban infrastructure and services, particularly on issues related to solid waste disposal site selection, development, management and use of new facilities.

- Integrate different treatment technologies, such as incineration, composting and sanitary landfill within a single solid waste BATNEEC programme

- Increase emphasis on product/waste recycling.

Priority investment projects related to pollution control are presented in Table 6.1, with a timescale for implementation shown in Table 6.2.

6.4 Other actions

- Provide incentives for small farms to merge and form larger farms.

- Consider taxing agricultural nutrient balance excesses in the longer term.

- Organise basin councils to oversee the development and management of the respective river basins. These should be led by municipalities and local communities, in co-operation with NGOs, related government agencies and other stakeholders.

- Prepare river catchment management plans encompassing:

    - land use plans
    - Reforestation program including participatory schemes.
    - Institutional measures including information and education campaigns, training in forest management techniques, and clarification of land ownership and use rights.

- Establish a water quality/river flow monitoring programme to assess in-stream pollution loads.

- Construct a national database of wastewater treatment methods employed in industry and municipal WWTPs.

- Prepare municipal land use plans for integration into river catchment management plans.

Table 6.1 List of priority projects

Project	Budget US$	Priority Level
Construction of Trabzon wastewater treatment plant	31.800.000	1
Construction of Zonguldak wastewater treatment plant	27.000.000	1
Construction of Samsun wastewater treatment plant	16.000.000	1
Construction of Giresun wastewater treatment plant	9.000.000	1
Kizilirmak river basin management plan	3.280.000	1
Sakarya river basin management plan	2.350.000	1
Yesilirmak river basin management plan	2.100.000	1
Development of systems for regional pollution monitoring and control, establishment of laboratories and in-job training	1.000.000	1
Preparation of guidelines for manure utilisation as fertiliser	45.000	1
Development of instruments for Zonguldak coastal zone management	715.000	1
Public education for environment-friendly agriculture practices and erosion control	115.000	1
Training farmers in sound fertiliser utilisation and monitoring of practices	310.000	2
TÜGSAI fertiliser plant chemical treatment facilities	9.600.000	2
Construction of Ordu wastewater treatment plant	8.500.000	2
Samsun Industrial Zone wastewater treatment plant	7.500.000	2
Construction of Bafra wastewater treatment plant	6.500.000	2
Trabzon industrial zone wastewater treatment plant	6.100.000	2
Construction of Ereili wastewater treatment plant	4.500.000	2
Bartin industrial zone wastewater treatment plant	2.100.000	2
Development of nutrient recycling and pre-treatment pollution abatement measures for major industries in the Black Sea region	165.000	2
Trabzon solid waste disposal project	18.000.000	3
Zonguldak solid waste disposal project	16.000.000	3
Samsun solid waste disposal project	14.000.000	3
Development of regional strategies for the disposal of solid, medical and hazardous waste in Black Sea coastal zone	4.430.000	3
Çaycuma industrial zone wastewater treatment plant	1.700.000	3

Table 6.2 Timescale for introduction of the Turkish Nutrient Action Plan

Project	Priority Level	Budget US$	YEARS 1	2	3	4	5	6	7	8	9	10
Construction of Trabzon wastewater treatment plant	1	31.800.000										
Construction of Zonguldak wastewater treatment plant	1	27.000.000										
Construction of Samsun wastewater treatment plant	1	16.000.000										
Construction of Giresun wastewater treatment plant	1	9.000.000										
Kizilirmak river basin management plan	1	3.280.000										
Sakarya river basin management plan	1	2.350.000										
Yesilirmak river basin management plan	1	2.100.000										
Development of system for pollution monitoring and control, establishment of laboratory and in-job training	1	1.000.000										
Development of guidelines for manure utilisation as fertiliser	1	45.000										
Development of instruments for Zonguldak coastal zone management	1	715.000										
Public education for env.-friendly agricultural practices & erosion control	1	115.000										
Training for sound fertiliser utilisation and monitor of practice	2	310.000										
TÜGSAS fertiliser plant chemical treatment facilities	2	9.600.000										
Construction of Ordu wastewater treatment plant	2	8.500.000										
Samsun industrial zone wastewater treatment plant	2	7.500.000										
Construction of Bafra wastewater treatment plant	2	6.500.000										
Trabzon industrial zone wastewater treatment plant	2	6.100.000										
Construction of Eregli wastewater treatment plant	2	4.500.000										
Bartin industrial zone wastewater treatment plant	2	2.100.000										
Development of nutrient recycling and pre-treatment technology for pollution abatement measures in major industries	2	165.000										
Trabzon solid waste disposal project	3	18.000.000										
Zonguldak solid waste disposal project	3	16.000.000										
Samsun solid waste disposal project	3	14.000.000										
Dev. of strategies for the Disposal of solid, medical and hazardous waste	3	4.430.000										

Çaycuma industrial zone wastewater treatment plant	3	1.700.000										
BUDGET ALLOCATION	**US$**	**192810000**	**4775000**	**15715000**	**21670000**	**30570000**	**36790000**	**33440000**	**25550000**	**14000000**	**6000000**	**4700000**

7.1 Legal and regulatory measures

The legal and regulatory measures to be adopted by Ukraine as part of its nutrient action plan are shown in Table 7.1. The include reform and measures to strengthen the existing legal for environmental protection, in addition to the development of standardised techniques for pollution assessment that will help in the identification of major pollution sources in future years.

Table 7.1 Ukrainian legal and regulatory measures

	Measures	Type	Lead Institution		Dates
1	On coastal zone of the Azov and Black Seas	Law	Ministry of Environment and Natural Resources of Ukraine (MEANR)	Sectoral Ministries, Regional and Local Authorities	2001-2005
2	On land use in the buffer zone	Regulation	MEANR	Sectoral Ministries, Regional, and Local Authorities	2001-2005
3	On designing and construction of bank protection	Regulation	MEANR	Sectoral Ministries, Regional, and Local Authorities	2001-2005
4	On assessment of pollution load within rivers	Technique	MEANR	Sectoral Ministries, Regional, and Local Authorities	2001-2005
6	On assessment of diffuse pollution load	Technique	MEANR	Sectoral Ministries, Regional and Local Authorities	2001-2005
7	On environmental audit	Regulation	MEANR	Sectoral Ministries, Regional, and Local Authorities	2001-2005
8	On P-free detergents	Law	MEANR	Sectoral Ministries Regional, and Local Authorities	2001-2005
10.	On nutrients pollution	Regulations	MEANR	Sectoral Ministries Regional, and Local Authorities	2001-2005

7.2 Environmental monitoring of the Black and Azov seas

In addition to the proposed development of freshwater pollution monitoring/assessment techniques presented in Section 7.1, it is proposed to develop and re-start a marine programme to monitor the water and ecological quality of the Ukrainian sections of the Black and Azov seas (Table 7.3).

Table 7.2 Measures on monitoring and assessment of pollution of the Azov and Black Seas

Measures	Costs, USD th.	Dates	Implement ing Institution
Optimisation and improvement of monitoring system for the Black And Azov Seas	144	2001-2002	MEANR
Assessment of natural changes and human impact on the Azov and Black Sea Basins	30	2001-2002	MEANR
Implementation of regional monitoring strategy and system		2001-2005	MEANR, international donors

7.3 Low cost measures for nutrient reduction in the Black Sea Basin

The Ukrainian nutrient action plan includes a number of low cost measures, many of which are local projects identified as either having the potential to reduce nutrient export substantially or aimed at increasing the self-purification capacity of aquatic ecosystems (Table 7.2). Other low cost measures are aimed at capacity building to strengthen the likely success of the current proposed action plan or to promote additional future nutrient control measures.

Table 7.3 Low cost measures for nutrient reduction in the Black Sea Basin

Location	Measures	Implementing institutions	Dates
Black Sea Basin	Inventory and assessment of diffuse pollution within Black and Azov Seas Basins	MEANR and Sectoral Ministries	2002-2003
Black Sea Basin	Strengthening of Institutional Capacity of Local and Regional Control and Regulatory Bodies	MEANR and Sectoral Ministries	2001-2004
Sivesky Donets Riv er Basin	Development and Approval of Program on Protection and Rehabilitation of Siversky Donets River Basin	MEANR and Sectoral Ministries	2001-2002
Southern Bug River Basin	Development and Approval of Program on Protection and Rehabilitation of Southern Bug River Basin	MEANR and Sectoral Ministries	2001-2002
Danube River Basin	Development and Approval of Program on Protection and Rehabilitation of Danube River Basin	MEANR and Sectoral Ministries	2001-2002
Azov and Black Seas Coastal Zone	Development and Approval of Regional and Local Action Plans on Protection and Rehabilitation of Streams of Azov and Black Seas	Regional and Local Authorities	2001-2002
Black Sea Basin	Development and Organisation of Farmer Training and Education Program on Best Available Technologies and Ecologically Sound Land and Animal Husbandry.	Ministry of Agrarian policy	2001-2005
Black Sea Basin	Organic Farming Pilot Projects	Ministry of Agrarian Policy, MEANR	2001=2005
Black Sea Basin	Inventory and Assessment of P-load from detergents	MEANR	2001-2003

Table 7.3… continued

Location	Measures	Implementing institutions	Dates
Crimea	Development of projects of regional landscape parks "Kalynivsky" and National Park "Syvashsku"	Local and regional authorities	2000-2001
	Inventory of Pollution Sources of Eastern and Western Basins of the Lake Sasyk		2000-2003
	Introduction of integrated coastal zone management		2001
	Inventory of landfills within the Azov and Black Seas buffer zone and development of measures for their relocation		2001
Donetsk Region	Control of water quality from collectors and drainage systems from rice checks Implementation of the pilot project on regulation and control of toxic waste management in Mariupol	Local and regional authorities	2001-2005 2001
	Development of Regional Program on Prevention of Erosion of the Azov Sea Coast		2001
	Inventory of Household Dumping Sites within the Black and Azov Seas Buffer Zone and Development the System of Their Relocation		2001-2003
Zaporizhia Region	The Forest Management by the Enterprises of Agro-Industrial Sector of the Azov Sea Basin < total 39837 ha	Local and regional authorities	2001
	Passportisation of streams and development of river basin systems for protection and rational use of water and land resources Creation of GIS System for Azov Sea Within the Zaporizhia Region		2000-2002 2001
	Development of Program of Erosion Preventive Measures in Zaporizhia Region		2001- 2005
	Establishing the boundaries of coastal zone of the Azov Sae		2001-2005
Mykolaiv Region	Development of projects of buffer zones for limans of Mykolaiv Region	Local and regional authorities	2001-2002
	Environmental Impact Assessment of Dam in Berezan Bay		2000-2001
Odesa Region	Implementation of integrated coastal zone management	Local and regional authorities	2001
	Development of local environmental action plans for protection of the Black Sea		2001
	Inventory of Household Dumping Sites within the Black Sea Buffer Zone and Development the System of Their Relocation		2001-2003
Kherson Region	Development of recommendations on protection and rational use of wetlands		2001
	Creation of Lower Dnipro Landscape Park		2001-2005
Sevastopol	Sanitary cleaning of streams	Local and regional authorities	2001
	Environmental mapping of polluted territories		2001-2003
	Inventory of Household Dumping Sites within the Black and Azov Seas Buffer Zone and Development the System of Their Relocation		2001-2003
	Implementation of Integrated Coastal Zone Management		2001-2010

7.4 Major Ukrainian projects for nutrient reduction

Major investment projects are shown in Tables 7.4 and 7.5. These are concerned primarily with upgrading and construction of new WWTPs, but projects on coastal protection, solid waste disposal, wetland management/restoration and control of diffuse pollution are also proposed.

Table 7.4 Major investment projects for nutrient reduction in Ukraine, 2001 - 2005, mln. USD

Measures	Total	2001-2005	Incremental costs	Legal Base
Wastewater treatment and sewer system, total in the Black Sea Coastal Zone, Total	119.5	34.0	85.5	State Program on Water Supply and Canalisation
Crimea	12.2	3.2	9.0	
Donetsk	12.1	6.4	5.7	
Zaporizhia	5.2	4.6	0.6	
Mykolaiv	41.5	3.4	38.1	
Odesa	16.1	5.2	10.9	
Kherson	12.3	4.3	8.0	
Sevastopol	20	6.4	14.7	
Solid Waste Management, Total	22.8	5.1	17.7	State Program on Protection and Rehabilitation of the Azov and Black Seas
Crimea				
Donetsk	13.6	1.8	11.8	
Zaporizhia	2.4	1.5	0.9	
Mykolaiv				
Odesa	0.6	0.6	0	
Kherson	0.1	0.1	0	
Sevastopol	6.1	1.2	3.9	

Table 7.5 List of priority projects to be funded under GEF pollution reduction programme

	Location	Category	Description	Current situation	Required activities	Nutrient reduction Benefits	Co-ordinating Agency	Implementing Agencies	National Regional Priority	Duration (years)	Cost Estimate ml. USD	Cost – sharing potential
1	Kherson	WWTP	WWTP facilities and sewer system are overloaded and poorly maintained	Hot sport	expansion and upgrading wastewater treatment facilities and sewer systems	reduction of discharges from municipal wastewater treatment plants	MEANR	Kherson State Regional Administration	high	10	3.3	potential investment project
2	Mykolaiv	WWTP	WWTP facilities and sewer system are overloaded and poorly maintained	Hot spot	expansion and upgrading wastewater treatment facilities and sewer systems	reduction of discharges from municipal wastewater treatment plants	MEANR	Mykolaiv State Regional Administration	high	10	41.5	potential investment project
3	Kerch	WWTP	WWTP facilities and sewer system are overloaded and poorly maintained	hot spot	expansion and upgrading wastewater treatment facilities and sewer systems	reduction of discharges from municipal wastewater treatment plants	MEANR	Kerch state administration; Crimea Government	high	10	2.8	low
4	Skadovsk	WWTP	WWTP facilities and sewer system are overloaded and poorly maintained	hot spot	expansion and upgrading wastewater treatment facilities and sewer systems	reduction of discharges from municipal wastewater treatment plants	MEANR	Kherson regional state administration	high	5	1.3	low

5	Odesa	WWRP and sewer system	WWTP facilities and sewer system are overloaded and poorly maintained	hot spot	expansion and upgrading wastewater treatment facilities and sewer systems	reduction of discharges from municipal wastewater treatment plants	MEANR	Odesa regional state administration	high	5	16.1	

Table 7.5… continued

	Location	Category	Description	Current situation	Required activities	Nutrient reduction Benefits	Co-ordinating Agency	Implementing Agencies	National Regional Priority	Duration (years)	Cost Estimate ml. USD	Cost – sharing potential
6	Sevastopol	WWTP and sewer system	WWTP facilities and sewer system are overloaded and poorly maintained	Hot spot	expansion and upgrading wastewater treatment facilities and sewer systems	reduction of discharges from municipal wastewater treatment plants	MEANR	Sevastopol city state administration	high	5	16.7	
7	Berdiansk	WWTP	WWTP facilities and sewer system are overloaded and poorly maintained	hot spot	expansion and upgrading wastewater treatment facilities and sewer systems	reduction of discharges from municipal wastewater treatment plants	MEANR	Zaporizhia regional state administration	high	24	9.3	low
8	Coastal zone of the Black and Azov Seas	River pollution reduction	small rivers are polluted, buffer zones are not established, population is not environmentally concerned	NGO activities, no sufficient support	ecological rehabilitation of small rivers	establishment of buffer zones; clean up campaign public awareness campaign	MEANR	State Regional Administrations and local authorities of coastal zone; NGOs	high	24	1.0	medium

9	Syvash	wetlands management	inappropriate agricultural practices, lack of buffer zones, biodiversity degradation	WWF, GEF WB	reduction of diffuse agricultural pollution, biodiversity conservation	introduction of sustainable agricultural practices	MEANR	coastal regional state administrations	high	36	1.0	high

Table 7.5… continued

	Location	Category	Description	Current situation	Required activities	Nutrient reduction Benefits	Co-ordinating Agency	Implementing Agencies	National Regional Priority	Duration (years)	Cost Estimate ml. USD	Cost – sharing potential
10	Dnister mouth, Dnister liman	wetlands restoration	wetland degradation, inappropriate agricultural practices in coastal zone	documentation is prepared for governmental approval	conservation of biodiversity, restoration of wetland and establishment of Low Dnister National Park	park development; restoration of wetlands; public; institutional strengthening awareness campaigns;	MEANR	Odesa state regional administration, local authorities; EUCC	high	24	1.0	high
11	Kerch, Odesa, Sevastopol	aqua culture	Based in Kerch, Odesa and Sevastopol	TACIS project in Kerch	production facilities; marketing studies; development of regulations aquaculture farming	will decrease eutrophication of coastal waters, will improve the economic conditions of the population of coastal zone	MEANR	State Committee on Fisheries Odesa Branch of IBSS Kerch Institute of Fisheries and Oceanography	high	24	2.0	will be ready for investments
12	Pryasovje	conservation; pollution reduction	establishing the National park Lukomorje	Donetsk regional state administration	building institutional capacity, establishing buffer zones, introduction of ecologically sustainable businesses	biodiversity conservation and reduction of diffuse agricultural pollution	MEANR	Donetsk state regional administration	high	24	1.0	high

Table 7.5… continued

	Location	Category	Description	Current situation	Required activities	Nutrient reduction Benefits	Co-ordinating Agency	Implementing Agencies	National Regional Priority	Duration (years)	Cost Estimate ml. USD	Cost – sharing potential
13	Lower Dniper	wetlands management	institutional development, establishment of national parks	GEF, IDRC Canada, US AID	building institutional capacity, establishing buffer zones, introduction of ecologically sustainable businesses	reduction of agricultural pollution from rice checks	MEANR	Kherson regional State administration	high	24	1.0	high
14	Southern Bug River Basin	water management	management of river basin is not introduced, pollution from municipal, industrial and agricultural sources	TACIS educational project	building the institutional capacity Development of the Southern Bug water management plan; establishing buffer zones, etc.	will promote and support nutrient reduction activities and measures	MEANR	Industrial, Agricultural, municipal sectors	High	12	0.5	high
15	Sasyk lake	water and land management	diffuse pollution sources of surface and ground waters; impact on human health	WWF	feasibility study	will asses the scope of problems and show ways how to deal with Sasyk lake	MEANR	Odesa regional administrations, National Academy of Sciences, local authorities	high	24	0.5	high

16	Coastal zone of the Black and Azov Seas	solid waste management	diffuse pollution sources of surface and ground waters	TACIS project	relocation of dumping sites from the marine buffer zone of the Black and Azov Seas	will decrease surface nutrients run - off and hygienic state of coastal waters	MEANR	regional administrations; economic sectors	high	36	0.5	high

Table 7.5… continued

	Location	Category	Description	Current situation	Required activities	Nutrient reduction Benefits	Co-ordinating Agency	Implementing Agencies	National Regional Priority	Duration (years)	Cost Estimate ml. USD	Cost – sharing potential
17	legislation and institutional development	development of legislation on coastal zone management	lack of proper coastal legislation and institutional capacity	WB	development of Law on Coastal zone and Code of Conduct; institutional capacity building	will create legal environment to deal with diffuse and pint pollution sources	MEANR	regional administration and sectors	high	36	0.2	high

8. DISCUSSION

In considering the national action plans, it must be appreciated that the majority of Black Sea countries are currently undergoing a major economic depression, so that industrial productivity levels are now a fraction of what they were in 1989 before the collapse of the Soviet Block. Likewise, livestock levels are now about half the number and inorganic fertiliser application rates are very low compared to levels at that time. A major aim of the Regional plan should therefore be to address infrastructural needs so that when economic recovery does occur, appropriate systems are in place to control/manage nutrient import into the Region and export to the Black Sea. Otherwise, nutrient loads to the Black Sea are likely to become greater than at any other time in history.

Enforcement is not given a high priority in many of the action plans, but this is essential to the success of any nutrient control programme aimed at industrial or municipal discharges. Instead, the emphasis appears to be on capital investment projects, with no information presented on how maintenance of such structures will be funded. If no maintenance programmes or funds to support them are provided, then capital investment projects should be viewed with extreme caution. Enforcement should be at the heart of any planned infrastructural, capacity building, legal or capital investment reforms. Moreover, enforcement requires robust monitoring, analytical and administrative back-up services. Again, several of the national action plans would benefit from further attention to this.

A stronger focus on the development of N and P criteria for industrial (fertiliser and detergent production and food processing) and municipal WWTP discharge consents would further improve the robustness of the Regional action plan.

Harmonisation with EU legislation has been a major driver towards the development of national nutrient action plans for some countries, particularly with regard to the UWWT and Nitrates Directives. Although not mentioned in this report, however, the EU Habitats Directive could be used as a major driver for reducing nutrient emissions to the Black Sea, particularly if Black Sea marginal/coastal areas are designated as Special Areas of Conservation (SACs). If such designations did occur, then the discharge consents of all point sources upstream of the SACs would need to be reviewed and, where necessary revised, particularly with regard to nutrient criteria. Likewise, diffuse agricultural pollution from upstream areas and atmospheric deposition of nitrogen would also be subject to review and greater control measures. This whole-catchment approach is endorsed in the proposed EU Water Framework Directive.

The selection of indicators will be key to judging the success of sectorial, national and regional nutrient action programmes. It is clear that livestock inventories, national inorganic fertiliser sales records and regulation/enforcement indicators (e.g. number of full-time regulation/enforcement officers employed by the state, annual number of samples analysed for nitrogen and phosphorus) could all be very important. However, the choice of indicators must also be pragmatic; for example, the dominance of the black market economy is likely to make the collection of reliable fertiliser sales data effectively impossible. This underlies the approach for agricultural reform programmes. Education is central to the development of sustainable agricultural

practices, but providing a legislative, rather than an advisory basis, for such programmes may have little effect, since enforcement is effectively impossible. This is particularly so due to the collapse of large state-run farms and the development of many more (but much smaller) private farms.

At present, the depressed economies probably mean that enforcement of agricultural norms is not a major issue. Most farmers cannot afford the levels of inorganic fertiliser required for cost-effective crop production, and the market for livestock products (milk, meat, etc) is now so much smaller than before the economic collapse of the late 1980s and 1990s. However, as intimated in the opening paragraph of this discussion, a major aim of the regional action plan should be to put structures in place so that when enforcement is required in the future, it can be successfully implemented.

Some of the national action plans include the completion of a livestock inventory, yet for government control of agricultural policy, this should be a pre-requisite. (Although the collection of such information is clearly a major undertaking requiring full co-operation from all farmers, regardless of farm size.) Thus, the development of robust national agricultural census surveys, together with the infrastructural support required to collect this information, should be a very useful indicator of both economic status and nutrient action plan success status.

Although mentioned as an action in several of the national nutrient plans, the development of an environmental monitoring programme for the Black and Azov Seas should be viewed as an essential component of all the national plans. The selection of appropriate indicators should yield much information about the success of the regional and national action plans. However, monitoring the nutrient and ecological status of the seas is the only way of providing incontrovertible evidence of whether or not the action plans are succeeding in improving the quality of the seas themselves.

Finally, atmospheric deposition of nutrients has not been addressed at all in any of the national action plans. This is not of great importance for phosphorus, but it is quite possible that some 20-40% of the nitrogen load to the Black Sea enters via atmospheric deposition. Nitrogen emissions to the atmosphere occur from municipal WWTPs, the agricultural sector and those sectors involving the combustion of fossil fuels (power generation, many industrial processes and the transport sector, etc.). For those countries undergoing harmonisation with EU legislation, the IPC/IPPC Directives will cover the problem of atmospheric emission/deposition to some extent, but this issue will need to be addressed by the other countries.

REFERENCES

Parr, B. and Reynolds, P.J. (2000) The development of process, stress reduction and environmental status indicators to monitor the effects of nutrients within the Black Sea Basin. Draft Discussion Report presented to the Black Sea Environment Programme.

Parr, W., Varduca, A., Stoimenova, M., Tarasova, O., Shekhovstov, A., Stepanova, L., Keresteciogl u, M. and Lomtadze, Z. (2000) A review of nutrient-related legislation, policies and practices in black sea riparian countries. Report presented to the Black Sea Environment Programme.

Annex 10

THE DEVELOPMENT OF PROCESS, STRESS REDUCTION AND ENVIRONMENTAL STATUS INDICATORS TO MONITOR THE EFFECTS OF NUTRIENTS WITHIN THE BLACK SEA BASIN

DRAFT DISCUSSION PAPER

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The main objective of the GEF Nutrient Reduction Programme for the Black Sea is to assist in the implementation of the practical measures for restoring and protecting the Black Sea environment agreed by the coastal countries in the 1996 Strategic Action Plan (SAP) for the rehabilitation and Protection of the Black Sea. The key issues to be addressed under the GEF are in direct support of the recommendations of the Joint ad-hoc Working Group of the ICPBS and the ICPDR. As a component of the GEFs basin-wide Programmatic Approach to the Black Sea, the proposed nutrient reduction programme is aimed at helping the Black Sea countries to develop and implement action plans to prevent and remedy nutrient releases, through a combination of: (i) development, reform and enforcement of environmental policy and legislation; (ii) the application of economic instruments (iii) strengthening public participation in nutrients reduction; and (iv) monitoring of trends and compliance for nutrient reduction goals.

The present UNDP/GEF Project Development facility carried out by the PIU in Istanbul includes (i) the provision of technical support to national and regional bodies for the formulation and implementation of policy and legislation with respect to nutrient discharge and control in the Black Sea region, i.e. the development of draft framework nutrient reduction plans (national and regional) for implementation over the next five years, and (ii) technical support to develop process, stress reduction and environmental status indicators to determine the effectiveness of the strategies employed for nutrient reduction. This report focuses on the development of appropriate indicators to monitor the efficacy of the national nutrient reduction plans.

In the short term, the actions which are required not to exceed nutrient (and hazardous substances) levels above those encountered in 1997 fall upon the agricultural, industrial and municipal sectors. Process indicators identified in each sector are primarily developmental in function. In the agricultural sector, indicators include the development of (i) institutional framework for integrated environmental management, (ii) national action plans to prevent minimisation of erosion, (iii) national plans to enhance organic farming practice and assess diffuse pollution, and (iv) the development of an appropriate model for data assessment. Within the industrial and municipal sectors, the process indicators provide a measure for the development of the financial, institutional and legal frameworks required for upgrading/construction of facilities as well as for regulatory purposes.

Indicators are highlighted in each sector, which upon initiation or completion will represent a direct reduction on the stress caused by nutrients (or hazardous substances) to the black Sea ecosystem. Notably, for the agricultural sector, such reduction of stress resides with the provision of mechanism/incentives to control inorganic fertiliser application and establish guidelines for the disposal or re-use of manure. Within the industrial and municipal sectors, stress reduction indicators are identified as the initiation of upgrading or construction of facilities to control the collection and treatment of solid and liquid wastes.

The reduction of the phosphate content of industrial and domestic detergent formulations is suggested in two stages: initially a process indicator is identified as the liaison between national representatives and the detergent industry to review national detergent usage and prioritise products/formulations for review. Stress

reduction is subsequently identified as the agreement of a 5-year Environmental Code of Practice between the national regulatory authorities and the detergent industry aimed at a change to specified P-free detergents in the market by year 2005.

With respect to environmental status, the potential indicators that are available to monitor the extent of eutrophication in the Black Sea over time are reviewed, and a summary of the indicators that are judged to provide the most relevant information for the region is presented. Indicators include chemical loads, nutrient concentrations, physical indicators, microalgae, macroalgae and higher plants and sediment infauna.

To monitor progress of the 5-year nutrient reduction plans will require only the chemical load monitoring data, since the action plans are written with the specific aim of reducing nutrient loading to the Black Sea; the reduction in trophic status is an expected benefit of this. Moreover, while 1997 has been chosen as the baseline date for chemical concentration/nutrient load monitoring, it will not be possible to use this date as the baseline for other indicators, since appropriate monitoring data were not collected at that time. However, to know whether the nutrient action plans have had the desired effect of lowering the trophic status of the Black Sea, it will be necessary to monitor all of the recommended indicators.

A review of current economic instruments used for nutrient control (primarily in the agricultural sector) has been included within the report solely to aid those responsible for the assessment and the future implementation of economic instruments in the Black Sea region. The review details, on a worldwide basis, the following experience of economic instruments used for nutrient control: (i) the range and type of instruments, (ii) past research into economic instruments for N and P and (iii) cost structures. Economic instruments presently in use for nutrient control within the Black Sea region are also provided. No attempt has been made by the authors to suggest appropriate instruments for use within the Black Sea region as this is outside the scope of the present study.

OBJECTIVES OF THE DISCUSSION PAPER

The focus of this paper is to discuss the rationale for the development of indicators, based on GEFs process, stress reduction and environmental status framework, which will be used to monitor the effects within the Black Sea marine ecosystem prior to and following the implementation of national nutrient reduction action plans.

The paper is organised in the following way: Section 1 provides a review of the framework mechanism supporting the GEF nutrient reduction programme and also outlines the process and stress reduction indicators which are required to monitor the performance of national nutrient reduction action plans. Section 2 reviews the potential environmental status indicators and provides a list of recommended indicators for use in the Black Sea region. Information pertinent to river concentration and flow data is highlighted in Appendix A. The current proposed monitoring strategy for pollution assessment in the Black Sea is outlined in Appendix B. Finally, a review of economic indicators, which have been employed throughout the world for nutrient control, is provided in Appendix C as an aid to future development in the region.

1.1 Background

1.1.1 The framework mechanism

The guidelines for the protection of the Black Sea against pollution are detailed in the Bucharest Convention, which was signed on April 21st 1992 by representatives of Bulgaria, Georgia, Romania, the Russian Federation, Turkey and Ukraine. The Convention was ratified 1998 but not fully implemented owing to the failure of coastal countries to reach agreement on financial arrangements for its Secretariat. Presently, the implementation of the Convention is carried out the Istanbul Commission for the Protection of the Black Sea (ICPBS).

The Bucharest Convention stipulates (Article VI) that each Contracting Party shall prevent pollution to the marine environment of the Black Sea from any source of hazardous or noxious substances and matter, as specified in the Annex to the Convention. Protection of the marine environment against nutrients is listed in Annex II of the Convention under the statement: '*Substances which, although of a non-toxic nature, may be harmful to the marine biota owing to the quantities in which they are discharged e.g. inorganic phosphorus, nitrogen, organic matter and other nutrient compounds. Also substances which have an adverse effect on the oxygen content of the marine environment*'.

The Bucharest Convention also includes a Protocol for the protection of the Black Sea marine environment against pollution from land-based sources. This annex is accompanied by two Annexes, which separately detail the regulation of hazardous and noxious substances and matter, including nitrogen and phosphorus. This annex does not apply to discharges that contain nitrogen and phosphorous which are below the standards defined jointly by the Contracting parties, not exceeding environmental background concentrations.

In April 1993, the Contracting parties reaffirmed their commitment to the Bucharest Convention by the signing of the Odessa Declaration, which was a pragmatic 3-year policy agreement largely implemented with financial and technical support from the GEF and CEC. The policies within the Declaration were carried out under the direction of the Black Sea Programme Coordination Unit in Istanbul.

The first insight into the regional extent of the problem of eutrophication within the Black Sea was provided by a Transboundary Diagnostic Analysis (TDA), carried out between 1992 and 1996, which identified the main sources and provided empirical quantitative analysis of pollutant loads from each of the Black Sea countries and from international rivers. Given that the Danube was shown to be the largest single source of nutrient input to the Black Sea, it was deemed imperative that strategies for the reduction of nutrients be adopted for this river.

The Strategic Action Plan (SAP) for the Rehabilitation and Protection of the Black Sea was signed in October 1996, with adoption at Ministerial level in 1998. This document provided the riparian countries with a wide ranging plan, which includes the setting of goals and milestones, covering many aspects of environmental protection in the Black Sea, including nutrients. The SAP is currently managed by a

Project Implementation Unit in Istanbul, Turkey, pending the formation of the Istanbul Commission Secretariat

To address the problem of eutrophication in the Black Sea on a basin-wide level, the SAP was designed to pay particular attention to nutrients and defines the objective of a Black Sea Basin Wide Strategy to negotiate a progressive series of stepwise reductions in nutrient loads, until agreed Black Sea water quality objectives are met. To effectively tackle the problem of eutrophication, the SAP also highlighted the need for the formation of a cooperative mechanism within the entire Black Sea drainage basin.

In relation to the Danube, The Strategic Action Plan for the Danube River Basin, which was adopted at Ministerial level in 1994, was initially managed by the Environmental Programme for the Danube River Basin (EPDRB) in Vienna. Following the ratification of the Danube River Basin Convention (DRBC – known as the Sophia Convention) in 1988, the EPDBR handed over responsibility for the SAP to the ICPDR, the a decision making body charged with the implementation of the DRBC.

1.1.2 A strategy to achieve common pollution reduction goals

In early 1998, a Joint ad-hoc Technical Working Group was established between the Bucharest and Sofia Conventions, consisting of representatives from all of the Danube and Black Sea States. The Terms of Reference for the Working Group detailed the primary activities, which included the assessment of available water quality data and nutrient loadings from the Black Sea Basin, as well as the determination of strategies and approaches for implementation of pollutant reductions. The latter task comprised of (i) defining common pollutant reduction goals, (ii) assessing whether or not the implementation plans of the SAPs undertaken in the Black Sea Basin were sufficient to achieve the common pollutant reduction goals, and (iii) the proposal, if required, of recommendations for improvements and amendments to the implementation plans of the SAPs to facilitate achievements of the common pollution reduction goals. In regard to strategies, the Working Group were supported by developments of National Action Plans (NAPs) for each of the Black Sea countries and National Reviews for the Danube countries.

During the first meeting of the Working Group, it was recognised that no precise ecological indicators were available which could demonstrate the change over time of ecosystems in the Black Sea. Accordingly, and within the lifetime of the Working Group, the Danube GEF programme funded national studies within the Black Sea States to elaborate on such ecological indicators of eutrophication.

To facilitate completion of the tasks by the Working Group in time for the proposed joint Black Sea-River Danube meeting at the level of Heads of Delegations, the timeframe of the Working Group was restricted to nine months, with meetings scheduled every three months. The findings of the Working group were to fulfil two roles; (i) to provide background material and guidance for the Black Sea-River Danube meeting, and (ii) to support technical inputs for the preparation of new GEF projects within the region for submission to the November 1998 meeting of the GEF council.

Co-operation between the Istanbul Commission for the Bucharest Convention (Black Sea) and the ICPDR in the Danube led to the recommendation (ICPBS/ICPDR, 1999)

that in the long term, all States in the Black Sea Basin should "take measures to reduce the loads of nutrients and hazardous substances to such levels necessary to permit Black Sea ecosystems to recover to conditions similar to those observed in the 1960s". It was agreed however that "as an intermediate goal, urgent control measures should be taken by all states in the Black Sea Basin in order to avoid that the discharges of nutrients (and hazardous substances) into the Sea exceed those which existed in 1997". In the short term, the actions required to attain this were identified by the Working group as falling into the following area: (i) reforms of agricultural policies, (ii) improvement of wastewater treatment (including the use of alternative low cost technologies), (iii) rehabilitation of essential aquatic ecosystems, (iv) changes in consumer practice (targeted specifically at the use of phosphate-free detergents).

The Working group also recommended that a review of progress be undertaken in 2007 to focus on further measures that may be required for meeting the long term objective of reaching an ecological status similar to that observed during the 1960s (Joint Ad-hoc Technical Working Group ICPDR – ICPBS summary report, June 1999).

1.1.3 GEFs nutrient reduction programme

The main objective of the GEF Nutrient Reduction Programme for the Black Sea is to assist in the implementation of the practical measures for restoring and protecting the Black Sea environment agreed by the coastal countries in the 1996 Strategic Action Plan (SAP) for the rehabilitation and Protection of the Black Sea. The key issues to be addressed under the GEF are in direct support of the recommendations of the Joint ad-hoc Working Group of the ICPBS and the ICPDR.

As a component of the GEFs basin-wide Programmatic Approach to the Black Sea, the proposed programme is aimed at helping the Black Sea countries to develop and implement action plans to prevent and remedy nutrient releases, through a combination of:

- Development, reform and enforcement of environmental policy and legislation;
- The application of economic instruments;
- Strengthening public participation in nutrients reduction;
- Monitoring of trends and compliance for nutrient reduction goals

Assisting the countries to implement these necessary measures is the main objective of the proposed GEF Black Sea Basin Programmatic Approach, which consists of the following two basic components;

1. A "Strategic Partnership" to prepare country level investment projects for nutrient reduction under the leadership of the World Bank.
2. GEF Regional Projects (Danube and Black Sea) to support regional coordination, capacity building and policy, legal and institutional reforms for nutrient reduction. These will be jointly implemented by the three GEF implementing agencies under the leadership of UNDP

Through the World Bank/GEF Strategic Partnership, projects will be identified which will make a significant contribution to the control and/or abatement of nutrient

discharges to the Black Sea. It is assumed that all national, priority environmental investment projects are identified in NBS-SAP and NEAPs

The foremost criteria in project selection for GEF funding, which is obligatory, is that only incremental costs will be covered. An environmental project, whatever its form will have two components; a baseline cost, which relates to improvements needed to address national impacts, and an incremental cost, which relates to improvements to address regional impacts. However, in many cases, the incremental component is so small as to be negligible. The proportion of incremental to baseline cost of any one project will depend upon the category to which incremental benefits being evaluated The level of incremental cost has to be calculated on a project by project basis because of these variables, involving complex economic analyses. The level of work required to calculate 'exact' incremental costs for every project will too involved and time consuming for an initial project selection stage and therefore a simplified methodology based possibly on generic project types is proposed to be developed as a guide to help in project selection.

The two regional projects are proposed to strengthen the respective Secretariats on all aspects of nutrient reduction issues. A PDF- Block B grant has been allocated in early 2000 for the purpose to preparing the Black Sea Regional Project. The regional benefit of the PDF grant is to establish the regional and the national structures needed for the management and ultimate full implementation of the Nutrient Reduction Programme in the Black Sea. A regional structure is required in order to coordinate the country activities in general, ensure consistent and prioritised National Action Plans (NAPs), ensure liaison among the GEF partners (WB, UNDP and UNEP), and the national governments, competent national bodies, national and regional institutions and NGOs.

The PDF provides financial assistance with respect to the strategy for nutrient reduction, by providing (a) provision for the formation of national inter-ministerial committees responsible for issues of nutrient use and control, (b) technical support to national and regional bodies for the formulation and implementation of policy and legislation with respect to nutrient discharge and control in the Black Sea region, i.e. the development of draft framework nutrient reduction plans (national and regional) for implementation over the next five years, and (c) technical support to develop process, stress reduction and environmental status indicators to determine the effectiveness of the strategies employed for nutrient reduction (this report). Both reports will be presented at Black Sea Basin Stocktaking Meeting in Istanbul PIU in June 29-30th 2000.

In order to bridge legal and political issues relating to the function of the existing conventions and the two Commissions, the GEF are funding as part of the PDF, a 'principle of cooperation' in the form of a 'Memorandum of Understanding' between the ICPBS and the ICPDR on common strategic goals. The Memorandom of Understanding will not however constitute a legal document for the joint implementation of issues relating to pollution control within transboundary waters and the wider basin. In brief, the draft document provides the following strategic goals: (i) a long term goal of nutrient reduction (and hazardous substances) to a level which will allow the ecosystem to recover (1960s level), (ii) an intermediate goal not to exceed levels of nutrients (and hazardous substances) above levels encountered in 1997, (iii) to reach agreement on a common methodology for a monitoring approach, including sampling and AQC procedures; (iv) to further assess the nutrient (and hazardous

substances) input loads and the ecological status of the Black Sea and the Sea of Azov, (v) to adopt strategies of economic development which are in line with optimal ecosystem functioning, and (vi) to adopt strategies for limitation of discharge of nutrients and hazardous substances, with review in 2007.

1.1.4 Key stakeholders

It is important to stress that the components within the process of nutrient reduction as stated above will ultimately represent all sectors of society. This is ultimately important since, as is stated in the SAP for the Black Sea, '*participation of all sectors of society is an essential requirement for the development of sustainable policies in the region*.' With respect to public sector involvement, the GEF PDF grant does accommodate projects from NGOs within a 'small-grants' programme. It is understandable and timely to involve NGOs at this stage of the process, with a view to general public awareness within the near future, especially in respect of consumer practice. Representatives from agricultural and relevant industrial sectors will need to be briefed on the proposal for the basin-wide reduction of nutrients at the earliest opportunity, since their cooperation within the overall process is vital.

Working alongside agricultural/industrial stakeholders may prove to be key to achieving nutrient reduction goals. For example, with respect to the industrial sector, how easily achieved and enforceable is a ban on the use of polyphosphates in detergent formulations without the involvement of the detergent industry? In the EC, the detergent industry proposed a voluntary Code of Good Environmental Practice in 1998 (Reynolds, 1997), which was marketed as a Community wide effort to educate consumers to use detergents correctly. The EC subsequently accepted the Code in principle as a supplement to legislation. During the next five years, and as one objective of the Code, the detergent industry aim to reduce the amount of non-biodegradable chemicals (e.g. polyphosphates) within their formulations by 10%. The proposal of a 10% reduction can be shared on a Community–wide basis, which allows the detergent industry flexibility in certain market sectors. The policy should result in a progressive reduction rather than an outright ban on chemical additions such as polyphosphates Furthermore, since the cost of phosphate removal in detergents is undoubtedly passed on to the consumer, is it realistic within the present Black Sea basin economy to believe a total ban on polyphosphates in detergents is a viable option?

Another example of successful co-operation, in relation to nutrient control, can be seen by the North Carolina Environmental Management Commission (EMC). In 1989 the EMC designated the Pamlico-Tar basin as a Nutrient Sensitive Water. The classification, based on years of detailed nutrient loading studies, required the development and implementation of a strategy to manage both point and non-point nutrient sources to meet water quality goals.

The North Carolina Division of Environmental Management (NCDEM) responded by developing stricter nitrogen and phosphorus effluent standards for dischargers in the basin. However, dischargers were concerned about the high capital costs that might be required to achieve the nutrient reduction goals. Consequently, a coalition of dischargers, working in cooperation with the Environmental Defence Fund, the Pamlico-Tar River Foundation, and NCDEM, proposed a nutrient trading framework through which dischargers can pay for the development and implementation of

agricultural best management practices (BMPs) to achieve all or part of the total nutrient reduction goals. The EMC approved the program in December 1989, and the implementation phase (Phase 1) is currently under way. As a condition of EMC's approval, the discharger coalition agreed to fund the development of an estuarine model. The model will be used as a tool to evaluate specific nutrient reduction strategies for the basin. This information will then be used to revise effluent nutrient standards for Phase 2 of the project. The nutrient trading program is proving to be a popular solution, largely because it achieves the state's nutrient reduction goals and addresses non-point loadings while also reducing the economic burden to municipal dischargers.

1.2 Process and Stress Reduction Indicators to Monitor the Performance of National Nutrient Reduction Action Plans within the Black Sea Region

1.2.1 General Objectives

As outlined in Section 1.1.2, in the short term, the actions which are required to maintain (or reduce) nutrients (and hazardous substances) to 1997 levels fall upon the agricultural, industrial and municipal sectors. In all cases these sectors encompass issues relating to legislation, research and integrated monitoring. In order to define the indicators for process and stress reduction, it is important firstly to define, in broad terms, the common regional actions required to be undertaken by each of the three sectors in order to achieve the programme goals.

The following actions were outlined during a Workshop held at the PIU in Istanbul (31st March – 1st April) to discuss eutrophication-related legislation, policies and practices:

Agricultural Sector

Main Problem:

- Inadequate land management and improper agricultural practices related to the fertilizers - organic and inorganic application

Actions:

- The implementation of Good Agricultural Practice (GAP), the provision of training
- Mechanisms for control of nutrient application
- Mechanisms for sustainable land management
- Strategy for manure disposal/application and organic farming
- Development of methodological approach to determine nutrient requirements

Industrial Sector

Main Problem:

- Ecologically unsustainable industrial activities - improper WWTP technical facilities

Actions:

- Introduction of Best Available Technologies (BAT) for point discharges
- Introduction of Best Environmental Practice (BEP) for mitigation of diffuse pollution
- Work towards phosphorous removal in detergent formulations used in the region

Municipal Sector

Main Problem:

- Inadequate management of waste water and solid waste; limited or inadequate connection with WWTP for all communities - direct waste water discharges from some cities directly or indirectly to the Black Sea

Actions:

- Improvement of waste water and solid waste management to reduce point and diffuse sources of nutrients
- Provision of an adequate connection of national population to sewerage with treatment facility.

A current review of the national policies and legislation is presently being undertaken within the framework of the PDF – Block B programme under Activity 2 and at the time of writing this report was not completed. Issues relating to research efforts are also not covered in this present document since their definition will depend on the final outcome of the development of nutrient related legislation. The issue of integrated monitoring to provide information concerning the trend over time of nutrient impact within the ecosystem is detailed within Section 2 of this report.

1.2.2 Potential indicators for the agricultural sector

Control of run-off from agriculture enterprises and livestock operations is a central element in the short and longer-term strategy to restore the balance and health of Black Sea habitats and biodiversity. Measures to reduce nutrient run-off from agricultural activities can be classified into three types: (i) reductions in application of chemical fertilisers and manure; (ii) changes in the arable land use towards crops reducing nutrient leakage, and (iii) changed practices for manure treatment.

Since 1990 the retail price of inorganic fertiliser has increased markedly in the Black Sea region, resulting in a drastic reduction in fertiliser use. By means of example, in Romania, the use of inorganic fertiliser has decreased from about 140 kg/ha to about 30 kg/ha, and presently nitrogen application represents only about 25% of crop requirements. In addition, between 1992 and 1996 the head of livestock in the Black Sea region was also significantly reduced, resulting in a closure of farms or a marked reduction in activity.

It is important to stress that a revitalisation of the agricultural sector will only be compatible with a programme of nutrient reduction if following measures are considered:

- Minimisation of erosion and other causes generating diffuse pollution sources of nutrients, i.e. buffer zone extension, wetland and floodplains restoration;

- Introduction of sustainable agriculture production - agricultural production on pilot farms; guidelines, training system for farmers - manure application/ disposal; promotion of equipment for manure storage and spreading; market for the waste from livestock; development of manure management

- The implementation of appropriate economic instruments to control nutrient export to waterbodies (review provided in Appendix C)

With respect to land use, measures that favour nutrient reduction include: (i) increases in the area for set-aside, catch crops, energy forest and extensively used agricultural land. Changes in manure treatment imply a change in the spreading time of manure from autumn to spring. Application of manure in autumn usually implies higher leaching than during the rest of the year since there are no crops available to makes use of the nutrients. Conservation tillage is considered to be the best measure to leave more crop or residue cover and thus minimise soil erosion. The establishment of buffer strips along waterways and shorelines is a sensible measure to decrease the velocity of surface runoff, thus reducing transport of eroded material. However, the success of buffer strips is reduced when sited on steeply sloping ground and they are better suited to reducing particulate export during continuous low-level rainfall than if the same amount of rain falls in a series of irregular storm events. Phosphorus runoff by erosion would be further controlled by increasing the phosphorus surplus from fertilizer and manure application.

Following the development of a national institutional framework for integrated water and land management, it will be essential in the short-term to develop guidelines for sustainable agriculture practices backed-up with training programs targeted at both regulators and the farming community. A longer-term change in agricultural practice will be aided by conducting pilot projects to demonstrate the improved storage and application of chemical and natural fertilizers, constructions of model storage and treatment facilities and testing of new equipment for manure spreading.

To determine the impact of national nutrient reduction action plans on the agricultural sector, baseline and status monitoring will be required. This will include (i) a detailed soil survey of the catchments, (ii) yearly survey of land-use and fertilizer practices, and (iii) an analysis of water and nutrient discharges from all parts of the hydrological cycle.

In each catchment, soil profiles will require analysing for physical and chemical properties (texture, water retention, total carbon, total nitrogen, and organic matter content). From the data collected, detailed soil maps (topsoil and subsoil) can be produced and connected to hydro-geological properties of the catchments, based on existing soil classification and other information. The maps will serve to facilitate a description of individual field types in the catchments.

Information on land use and agricultural practice may be obtained by a yearly survey (questionnaire) to the farmers covering practically all farms in the catchments. The

questionnaires will need to provide information on two levels: (i) *Farm level*: Land area, land use, soil type, drainage, point loadings. Livestock units, production of farm yard manure/slurry, storage capacity of farm yard manure/slurry, and (ii) *Field level*: Crops, catch crops, yields, use of straw/crop residues, "green fields", and dates of field activities including application of fertilizers and manure/slurry.

The programme will also need to include measurements of climate and water and nutrient flows in soil water, drainage water, ground water and stream water.

In order to assess the data in relation to the pressure applied by national nutrient reduction action plans, an empirical model for the Environmental Integrated Assessment on eutrophication will be required. Such a model will need to provide an estimate of the annual nutrient leaching under standard and actual climatic conditions within an entire catchment area. In addition, it is required that the model provides a measure of the benefit and disadvantages of nutrient leaching in scenarios with different agricultural practices.

1.2.3 Potential indicators for the industrial sector

The industrial sector is commencing a period of great transition. The withdrawal of most subsidies coupled with the need to pay for materials in hand currency is having a dramatic effect on this sector. Some major polluting industries have been forced to reduce production by between 30-50% and, as a consequence, there has been dramatic reduction in industrial waste generation and energy consumption.

In the light of an economic upturn, the primary initiative of the regulatory authorities that are responsible for the industrial sector will be to provide an institutional and legal framework for the implementation of the Best Available Technologies (BAT) for the point discharges and Best Environmental Practices (BEP) in the case of diffuse pollution prevention, in order to reduce the nutrient load and hazardous substance discharges into surface waters. Monitoring of the process will require the development and implementation of procedures for compliance monitoring with respect to nutrients and hazardous substances. The main outputs expected are clean technologies and abatement for pollution of water and pre-treatment facilities of industrial (food processing, fertilizers) wastewater.

In order to meet national nutrient targets, the recovery of industrial activity must marked by developments focused on construction, reconstruction and modernisation of existing technologies, including pre-treatment and process facilities. Thus, it would be essential to review existing process and treatment facilities, devise suitable strategies for upgrading industrial facilities and draw-up pre-investment proposals. The process of upgrading facilities would be expected to start within the 5-year timeframe of the national nutrient reduction action plans.

Special attention should be paid for the phosphorous free detergent production/ import for the market. Liaison between national representatives and the detergent industry would be beneficial initially to review national detergent usage and prioritise products/formulations for review. In line with European initiatives, it may be useful to agree an Environmental Code of Practice between the national regulatory authorities and the detergent industry for the duration of the national nutrient reduction action plans (i.e. 5 years). Such a 'non-binding' agreement could pave the way for a change to P-free detergents in the market by year 2005.

1.2.3 Potential indicators for the municipal sector

In the municipal sector, the overriding action required is to improve the management of wastewater and solid waste in order to reduce the point and non-point emissions of nutrients. Of highest concern is the population within the region that are connected to a sewerage system (albeit ineffective) but lack adequate treatment facilities.

Municipal treatment of domestic sewage within the Black Sea region ranges from primary to secondary treatment. Sludge treatment may involve drying beds or lagoons in smaller communities and anaerobic digestion in larger localities. Tertiary treatment for N and P removal is practically non-existent. Although previous investments within the region concerning municipal wastewater treatment have been substantial, they are reported to be less effective than expected, a fact that is partly due to a lack of adequate investment planning. The down turn of the economy has inevitably led to a marked reduction to any new investments in treatment plants, and financial shortfalls make it hard for many industries and municipalities to operate and maintain existing plants adequately.

Of primary concerns in the municipal sector are (i) the maintenance and upgrading of the sewer networks, (ii) the upgrading and maintenance of existing WWTPs, and (iii) where necessary, the construction of new treatment facilities. Addressing these wide-ranging needs will require a strategy for phased increase of public supply connection to sewerage system together with the identification of the requirements of WWTPs in each municipality. Where necessary, construction of solid and liquid waste facilities will need to be identified and their need prioritised. Such a strategy will also be required to take into account the incidence of direct discharge of municipal wastewaters in each country and propose adequate methods of pollution abatement. The completion of a pre-investment plan for construction and maintenance of sewer delivery system and upgrading/construction of WWTPs should permit for the establishment of connectivity and adequate treatment for 95% of municipalities with population over 5,000 by 2005, with treatment of waste waters applied in 75% of settlements with population over 5000 by the year 2010.

One issue facing many municipal wastewater treatment plants is the discharge of insufficiently treated industrial wastewater. A revision of regulations concerning treatment of trade waste and WWTP effluent standards is required. Enactment and enforcement of regulations and standards for pre-treatment of commercial/ industrial waste entering municipal sewerage system together is a prerequisite to obtaining satisfactory effluent discharge.

With respect to achieving adequate wastewater treatment in rural areas, the design of a programme of action will need to both review present status of rural wastewater management and also devise strategy in view of environmental and economic impact. Demonstration programmes would inevitably act as an aid to heighten public awareness.

Table 1.1 Summary of Process and Stress Indicators

ACTION	INDICATOR	TYPE[1]	COMPLETION 2000+				
Agricultural Sector			01	02	03	04	05
1. Review of current policies for integrated approach in water resources and land management: • Preparation of guidelines for catchment management planning • Provision of training courses • Introduction of sustainable land practices	• Development of a national institutional framework for integrated water and land management • Completion of training courses for catchment management planning • Development of demonstration pilot projects • Integrated management of river basin achieved by 2010	P P SR SR		X X	 X		
2. Minimisation of erosion and other causes generating diffuse pollution sources of nutrients: • Forestation plan development and implementation • Buffer zones planning and development • Wetlands, floodplains restoration and protection.	• Development of a national action plans for forestation, buffer zones, wetland and floodplain restoration – identify sensitive/vulnerable catchment areas – identify necessary rehabilitation/protection plans • Development of demonstration pilot projects • Implementation of plans - extension of buffer zones (50%?) by year 2005	P SR SR		X	 X		 X

3. Introduction of sustainable agriculture production • Agricultural production on pilot farms • Guidelines, training system for farmers - manure application/ disposal • Promotion of equipment for manure storage and spreading • Market for the waste from livestock • Development of manure management	• Development of a plan to enhance organic farming practice • Complete training courses for GAP for farmers • Establish a mechanism for the control of inorganic fertiliser application • Provide mechanism/incentive to promote the use of equipment for manure storage and spreading • Establish guidelines for the application and disposal of manure • The N, P total fertilizer consumption stabilized at the level of 1997 • By the year 2005, 50% of all animal farms with over 1000 livestock unit should be equipped with WWTP and by the year 2010 this figure should reach 70%. • Reduction of the agriculture target group weight in the nutrient emission balance to 25% by the year 2005	P P SR SR SR SR SR SR	X	X X X	X		X X X
4. Control of run-off from agricultural enterprises and livestock operations	• Develop a national strategy for the reduction of pollution from agricultural run-off • Develop suitable methodologies for diffuse pollution assessment • Decrease of the nitrate concentration in the ground water	P P SR		X	X X		
5. Monitoring of nutrient application norms and compliance with recommended procedures	• Baseline measurements undertaken • Selection of appropriate empirical model for data assessment • Status monitoring completed	ES P ES	X		X		X
Industrial Sector							
1.Provide an institutional and legal framework for implementation of BAT and BEP and regulation of installations with respect to control of nutrients and hazardous substances.	• Adoption of legal framework • Development of institutional framework • Adoption of effluent standards/normatives and enforcement procedures • Decreasing pollution in line with BAT and BEP by year 2010, by the construction of pre-treatment plants	P P P SR		X X	X		

2.Development of projects focused on reconstruction and modernisation of existing technologies including treatment and process facilities	• Review existing process and treatment facilities • Devise strategy for upgrading industrial facilities • Complete investment proposals • Initiate upgrading procedure	P P P SR	X	X	X X		
3. Where necessary, construct solid and liquid waste treatment facilities, including where necessary for pre-treatment.	• Complete priority list for capital investment • Complete national investment proposals • Initiate construction - decreasing pollution in line with BAT and BEP by year 2010, by the construction of pre-treatment plants	P P SR		X	X		X
4.Design of solid waste disposal facilities for sludges containing phosphate, i.e. landfill containment	• Complete review to determine the most appropriate method of sludge disposal – quantify problem and propose solutions • Complete demonstration pilot study	P S		X		X	
5.Reduction of phosphate content of industrial and domestic detergent formulations	• Initiate liaison between national representatives and the detergent industry to review national detergent usage and prioritise products/formulations for review • Agree a 5 year Environmental Code of Practice between the national regulatory authorities and the detergent industry aimed at a change to specified P-free detergents in the market by year 2005 • Implement updated national legislation	P P/SR P	X X		 X		
6.Develop and implement procedures for compliance monitoring with respect to nutrients and hazardous substances	• Complete a strategy for a permitting and charging scheme for pollution prevention and control – peer review • Enforce permitting/charging scheme	P SR			X	 X	
Municipal Sector							

1. Optimise operation and maintenance of sewer system	• Complete strategy to increase the connection of public supply to sewerage system • Complete pre-investment plan for construction and maintenance of sewer delivery system • Initiate construction - extension and improvement management of existing sewerage system and establishment of new ones achieved in 95% of municipalities with population over 5000 by 2005 - treatment of waste waters applied in 75% of settlements with population over 5000 by the year 2010	P P SR	X		X		
2. Up-grade treatment capacity • Improve operations and maintenance of existing WWTP • Apply appropriate sludge treatment and disposal	• Complete strategy to improve operations and maintenance of existing WWTPs • Complete pre-investment plan for upgrading and maintenance of WWTPs • Initiate operations	P P SR	X		X		X
3. Where necessary, construct Wastewater treatment facilities	• Complete priority list for capital investment • Complete national investment proposals • Initiate construction	P P SR		X	X		X
4. Eliminate direct discharges without appropriate treatment	• Complete survey of all national municipal discharges with inadequate treatment facility • Complete strategy for elimination of direct discharges – link pre-investment plan to 1 and 2 above • Initiate operations	P P SR	X		X		X
5. Enactment and enforcement of regulations and standards for (i) pre-treatment of commercial/ industrial waste entering municipal sewerage system, (ii) effluent standards from municipal WWTPs	• Revise regulations concerning treatment of trade waste and WWTP effluent standards • Adoption of standards/normatives (for pre-treatment as point 1 – Industrial Sector above)	P SR		X	X		
6. Implement programs for environmentally sound individual waste water management system to rural areas	• Review present status of rural waste water management and devise strategy in view of environmental and economic impact • Initiate a demonstration programme to heighten public awareness	P SR		X	X		

7.Develop a monitoring programme for WWTPs	• Propose a monitoring strategy for WWTPs - peer review • Implement monitoring programme	P SR		X	X		

[1] Indicators:

P = Process;
SR=Stress Reduction;
ES = Environmental Status (in relation to agricultural activities only)

2.1 Preamble

This section provides (i) a definition of eutrophication, (ii) a brief overview of the behaviour of nutrients in coastal waters together with the factors affecting the expression of elevated nutrient levels as eutrophication' (iii) lessons learned from previous monitoring programmes, (iv) potential indicators

A preliminary set of Black Sea ecosystem indicators for monitoring the environmental status is suggested in the final chapter.

2.2 Definitions

Providing a definition of eutrophication which can be applied to the Black Sea and be used as a basis for monitoring is more complex than may at first be considered, since indicators can include chemical, biological and physical parameters. The problem stems from the fact that different legislators and scientists have failed to adopt a single definition of eutrophication, with literally hundreds of definitions having been proposed in the past.

The definition of eutrophication that now receives the greatest attention in EU Member States is the version laid down in the Nitrates and Urban Waste Water Treatment Directives, viz:

"the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned."

This has resulted in the underlying causes of eutrophication recently being considered only in terms of excess nitrogen or phosphorus (even though the EU definition does not exclude other nutrients). However, much of the work undertaken in the Black Sea during the past 10-20 years has considered eutrophication to be due to excessive organic loading. For example, Mee (1999) defines eutrophication as "the over-enrichment of water bodies with organic matter". Other authors (e.g. Parr and Wheeler 1996) have considered marine/estuarine eutrophication in terms of nitrogen and phosphorus (and sometimes silicate), while admitting that distinguishing between the impacts of N and/or P enrichment and organic enrichment is very difficult, if not impossible. This is the reason for Nixon (1995) proposing a trophic classification scheme for tidal ecosystems based on organic carbon supply.

The problem stems from the fact that organic loading can be due to:

1. Increased growth of algae and higher plants which, in turn, contributes to increased water column BOD levels. Upon death, these plants also increase the sediment oxygen demand.

2. Increased organic loading from external sources, e.g. direct discharges into the marine environment via outfalls and fluvial fluxes.

Thus, even if external organic loads do not increase, providing external loads of N and P increase, the organic load generated within a waterbody will increase. However, while it is relatively easy to monitor external loads of N and P, external organic loads are very much more difficult to monitor, since a greater proportion of the organic loads is associated with sediment bed-load than it is for nutrients.

In general terms, the first organisms to respond to N and P enrichment are primary producers (plants), and in particular microalgae because of their rapid rate of growth (a typical doubling rate of 2-3 days under ideal growth conditions). Microalgae (planktonic or sediment-dwelling) can therefore be considered the most sensitive indicators of nutrient enrichment. However, the first organisms to respond to increased organic loading are bacteria. These are present in the water column (bacterioplankton), but are concentrated in the sediment, and rapidly remove oxygen from their surroundings when supplied with a source of assimilable organic carbon. The effect of this is to strip oxygen from the sediment and lower, poorly mixed waters. This results in a secondary impact on the fauna, and most notably the infauna (invertebrates living in the sediment, rather than on the surface of it). Thus, if eutrophication is defined (and ecological impacts monitored) in terms of N and P enrichment those ecological indicators are likely to be more sensitive to a change in trophic status than if eutrophication is defined in terms of organic enrichment, since a primary rather a secondary impact is monitored. As chemical water quality improves, the initial recovery will be noted in terms of primary impacts, with a lag period before improvements in secondary effects is recorded.

In this report, eutrophication is defined in terms of the biological expression of excessive N and/or P levels (primarily in terms of increased plant growth), albeit that animal indicators are discussed because of the oxygen-depletion caused by increased primary productivity.

2.3 Nutrients and Coastal Waters - an overview

2.3.1 Limiting nutrients

Two macronutrients are commonly referred to as being potentially limiting in marine coastal waters: nitrogen and phosphorus. In this paper the term 'limiting nutrient' is defined as any nutrient, which if present in greater concentrations would stimulate algal growth. However, care should be exercised over the use of the word 'limiting', since another factor (often light) usually has a more limiting effect on algal/macrophyte growth

At N:P ratios of <8 (w/w) nitrogen is said to be limiting, and at N:P ratios of >8 (w/w) phosphorus is said to be limiting. The cut-off value of about 8 (the so-called Redfield ratio) varies between algal species, albeit with most species falling within the range 6-10, and is based on the ratio of total N:total P found in a ‘typical’ alga growing in ideal conditions (e.g. OECD 1982). In wetland ecosystems (bogs, fens, wet heathlands, dune slacks and wet grasslands) an N:P ratio of 15:1 is more typical of higher plants (Koerselman and Meuleman 1996).

Other nutrients have also been reported to limit algal growth, of which silicon is probably the most widely reported, albeit in a different manner to nitrogen or phosphorus. With silicon, the growth of only certain types of algae is limited, so a shortage of silicon tends to affect what grows, rather than how much grows. Reports of algal growth being limited by a shortage of micronutrients, such as vitamin B_{12}, are much less frequent and tend to be species-specific, typical of, e.g. auxotrophic flagellates.

Within the past decade, there has been increased discussion over the possible limitation of phytoplankton growth by a shortage of iron, particularly with regard to diatoms, in oceanic waters and warmer climates (Martin *et al* 1994). Phytoplankton require more iron than any other trace metal (Wells *et al* 1983), since it is a cofactor for many enzymes, notably with regard to oxidase systems (i.e. the oxygen evolution step of photosynthesis). However, coastal waters tend to contain higher levels of iron than the open sea, since land is a major source of this metal, as it is for nitrogen and phosphorus. It is therefore considered unlikely that low iron levels would be a major factor limiting algal growth in the Black Sea.

The expression of increased nutrient levels as increased algal biomass is a highly complex process which is controlled and mediated by many variables. The mode of action by which increased nutrient levels affect plant species distribution and standing crop may be responsible for nature conservation concerns which are not recorded by traditional methods of monitoring trophic status, such as water column chlorophyll-a levels (see Parr *et al* 1993 for a review). For example, changes in denitrifying bacterial populations brought about by increased nutrients may impact directly on heterotrophic bacteria in light-limited areas.

2.3.2 Nutrient sources

The greatest source of nutrients in oceanic waters and associated seas is the water itself. For example, the ISSG (1990) estimated that 99.99% of the nitrogen input to the Irish Sea is from the Atlantic. However, in enclosed seas, particularly those with a very shallow tidal range (such as the Black Sea), land represents by far the greatest source of nutrients. These nutrients can enter the sea directly via

- Fluvial fluxes from rivers draining the catchment (these also carry nutrients that are discharged directly into the rivers).
- Surface runoff from riparian land.
- Direct discharges of waste from coastal communities and industrial plants.
- Submarine groundwater discharges (similar to baseflow in rivers).
- Atmospheric deposition (likely to be an important route of entry for nitrogen, but much less important for phosphorus).

2.3.3 Nutrient cycling

Several recent reviews of coastal/estuarine nutrient cycling and ecological impacts are available (e.g. Parr *et al* 1999, Scott *et al* 1997). It is not intended to repeat their work here, but a brief overview of the major processes involved in nutrient transformations will highlight the complexity involved in monitoring particular nutrient species as an indicator of trophic status.

It should also be remembered that the construction of large reservoirs in rivers dramatically affects the nutrient content of the rivers flowing out of those reservoirs, since these reservoirs function as enormous bioreactors and settling tanks. Therefore, reservoirs greatly reduce the nutrient content of rivers. Similarly, if water is abstracted from rivers for irrigation, by the time this water has returned to river, much of the phosphorus contained within it will have been stripped out by soil and plants. With nitrogen the situation is more complicated, since historic over-fertilisation with inorganic nitrogen fertilisers and the fact that nitrate binds much more weakly to soil than phosphorus, mean that less nitrogen would be retained in crops and the soil profile.

2.3.3.1 Nitrogen

Marine water nitrogen dynamics, as in other waters are dominated by a number of well-defined processes (Sprent, 1987):

- **Nitrification** - the conversion of ammonium to nitrate (via nitrite). This is dependent on the presence of both nitrogen and oxygen, and is therefore inhibited in anoxic environments, such as in the sediment and lower waters of the Black Sea. Nitrification may occur primarily at the sediment-water interface or in open water. It may also shift between the two as oxygen at the sediment-water interface is depleted.

- **Denitrification** - the conversion of nitrate to molecular nitrogen via ammonium. In temperate climates this is highly seasonal, even when significant populations of appropriate bacteria are present. Denitrification occurs primarily at the sediment-water interface. The major loss of nitrogen from marine waters to the atmosphere occurs via the release of gaseous N_2 and N_2O.

- **Mineralisation (ammonification)** - the process by which complex organic nitrogen is metabolised to ammonium. This process is undertaken predominantly by the microbial population, but in recent the important role of benthic fauna in increasing the breakdown rate of organic nitrogen has become better understood (see Scott *et al* 1997). Mineralisation may occur in the water column, but is more important in the sediments. Likewise, the importance of mineralisation in supplying nitrogen to benthic algae is now becoming clear (Jeffrey *et al* 1991, 1995).

- **Ammonia assimilation** - the uptake and conversion of ammonia to organic nitrogen by plants (predominantly phytoplankton) and microbes.

- **Nitrate assimilation** - the conversion of oxidised nitrogen (nitrite and nitrate) to organic nitrogen by plants (predominantly phytoplankton) and microbes.

- **Nitrogen fixation** - the conversion of molecular nitrogen to ammonium and, ultimately, to oxidised and organic nitrogen. This is an energy-expensive process that tends to occur when combined nitrogen (nitrate, ammonium, urea, etc.) levels are low.

Other processes such as dissimilatory nitrate reduction (the use of nitrate as an electron acceptor in respiration instead of oxygen by some bacteria and plants) are unimportant by comparison.

Thus, while inorganic nitrogen is immediately available to fuel algal growth, organic nitrogen may rapidly be mineralised to a bioavailable form. This is especially the case where plankton are the major plant biomass, since following the collapse of algal blooms, dead phytoplankton cells are more rapidly broken down (mineralised) than macroalgae or higher plants.

This means that although levels of inorganic nitrogen may be low due to rapid DIN assimilation rates, algal productivity may be very high if mineralisation rates are sufficient to ensure rapid cycling of organic nitrogen. The rate at which mineralisation occurs is dependent on local factors (mixing, nitrogen speciation of major inputs, etc.), but the higher the temperature, the more important organic nitrogen is likely to be in determining algal productivity. As a 'rule of thumb', for every 8-10 °C increase in temperature, a doubling of both algal and bacterial activity (growth rate) occurs.

2.3.3.2 Phosphorus

The phosphorus cycle in coastal marine waters is mediated by the amount of orthophosphate present in the water column, in a similar way to which ammonium lies at the heart of the nitrogen cycle. Orthophosphate is assimilated by phytoplankton, and converted to organic phosphate that is later (after death) mineralised. Mineralisation of organic phosphate may take place in the water column but, more importantly, occurs in the sediment, from which the release of orthophosphate is enhanced at low dissolved oxygen levels. Thus, phosphorus recycling is greatly affected by thermal/saline stratification and the organic content of sediment.

2.3.4 Organic carbon

Assimilable organic carbon (AOC, bioavailable carbon) is at the centre of the carbon cycle. Unlike ammonia in the nitrogen cycle, AOC, is only rarely measured (and then usually only in potable water), and consists of a broad array of compounds. Most of these are low molecular weight compounds e.g. carbohydrates such as glucose, but some microbes e.g. Actinomycetes, are able to break down and take up high molecular weight compounds as smaller, simpler molecules. These low molecular weight compounds are then metabolised into the high molecular weight organic compounds that form the majority of the dry weight of microbes, the organisms that feed on them, and so on up the trophic ladder.

Since the early part of the 20th century, a surrogate of AOC has been measured in environmental monitoring programmes – biochemical oxygen demand BOD_5. This is the amount of oxygen consumed within a 5-day period by a sample of unfiltered water under aerobic conditions at 20°C. If the microbial count in the water sample is low to start with, a bacterial inoculum may also be added. In addition, allylthiourea (ATU) is also added to prevent oxygen uptake by nitrification. BOD_5 has been heavily criticised as an oxygen uptake test, and in its wider role as a broad-scale test of environmental health, particularly because of the phenomenon of 'sliding BOD'. This occurs when toxicants are present in high enough concentrations to inhibit microbial growth. In such cases, by diluting the environmental sample with distilled/deionised

water, a higher BOD result will be obtained. This is a particular problem in toxic industrial effluents.

In addition, although the 5-day incubation period was chosen, since that is when the BOD plateau is reached in most aquatic samples, in situations, such as the Black Sea, the most appropriate theoretical test would be BOD_{∞}. Even though the rate of oxygen uptake may decrease greatly after 5 days in most samples, in some samples the total amount of oxygen which can be consumed during the following month, year, etc, can be higher than that consumed within the first 5 days. For this reason, when modelling the dissolved oxygen status of lakes and coastal waters, it is normal to divide BOD loads into BOD_{fast} and BOD_{slow}.

A variety of alternatives to the BOD_5 test have therefore been proposed, such as chemical oxygen demand (COD), total organic carbon, suspended solids, and a range of different bioprobes/biomonitors (Parr 1992a). The latter can give an immediate result, rather than the 5 days BOD incubation period – important for process control in sewage treatment works and the chemical/food industry.

2.4 Lessons learnt from previous trophic status monitoring programmes

Even if a nutrient reduction plan is successful, so external nutrient loads to the Black Sea are reduced within 5 years, this is no guarantee that ecological improvements will become apparent over the same timescale. The reasons for this are explained below.

2.4.1 Physical and Biological Factors

Parr and Wheeler (1996), in an assessment of the impact of nutrient levels within (and nutrient loads to) 12 English tidal waters areas, reviewed the biological and physical factors which affected eutrophication of tidal water ecosystems. These included:

- Turbidity (depth of light penetration - examined in more detail by Parr *et al* 1997).
- Depth of mixing.
- Bathymetry.
- Windspeed and direction.
- Coriolis force.
- Freshwater volumetric input.
- Marine water volumetric input (tidal range).
- Temperature.
- Biological growth rate.
- Grazing pressure.

These factors in themselves are pertinent to the understanding of tidal/marine eutrophication, since they control the biological expression of changing nutrient levels as eutrophication (increased primary productivity, leading to increased secondary, tertiary, etc. productivity higher up the food chain. Because so many factors are involved in relating nutrient status to trophic status, any prediction of trophic status

from nutrient status necessarily has wide confidence limits. For example, in freshwater lakes, the 95% confidence limits for predicting chlorophyll-a levels from total phosphorus levels are an order of magnitude apart (OECD 1982). In marine waters, similarly wide confidence limits have been reported (e.g. Gowen *et al* 1992), although the introduction of a 'flushing factor' to these simple linear relationship can improve the confidence associated with such predictions (Parr *et al* 1995).

However, it should be recognised that while such simplistic linear relationships 'force' a linear regression through the chlorophyll/nutrient concentration data, the line which best fits such data is sigmoidal and asymptotic (e.g. McCauley *et al* 1989). A number of authors have, therefore, cited nutrient levels (for various types of waterbody) above which chlorophyll levels do not significantly increase. Although there is disagreement about the actual concentrations involved (Reynolds 1992), for a number of lakes the 'saturation' level lies in the range 75-150 $\mu g\ P.l^{-1}$ (e.g. McCauley *et al* 1989, Prairie *et al* 1989, Sas 1989). However, this critical level will differ from one waterbody to another. For example, in waterbodies which are turbid during the growing season the 'saturation' phosphorus limit is likely to be at the lower end of the range, since shading from suspended sediment will limit algal growth.

Moreover, simple chlorophyll-a/nutrient relationships are usually based on data from different waterbodies, or from different sites in large waterbodies. These represent steady-state sites

2.4.2 Alternative Stable States

The concept of alternative stable states has been most widely recognised in lakes, but in rivers the same process is also apparent (Mainstone *et al* 2000). In shallow lakes of low trophic status, primary productivity is dominated by macrophytes, but as nutrient concentrations increase, the phytoplankton standing crop increases thereby reducing light availability to these macrophytes. In addition, the standing cop of epiphytic plants increases (predominantly algae – unicellular [notably diatoms] and macrophytic/fimamentous [notably *Cladophora* spp]), further reducing light availability to higher macrophytes. Ultimately, the higher macrophytes die out due to light starvation, and the lakes become dominated by phytoplankton. This has subsequent effects on the fish population, leading to a change whereby fish have a planktivorous life stage (feeding predominantly on zooplankton rather than phytoplankton – although some do exist) tend to dominate, together with those fish which feed on sediment (and the invertebrates contained therein). Thus a second stable stable state becomes established which, even if nutrient concentrations are reduced to similar levels to those which occurred when the former stable state existed, remains the stable state.

The only way to revert to the original stable state is by introducing a biomanipulation programme as external nutrient loading to the waterbody is reduced. This is achieved by promoting those animals which feed directly on phytoplankton (e.g. much work has been done on the introduction of silver carp, *Hypophthlmychthis molitrix*, Parr 1992b, 1993), or introducing fish species which do not feed on zooplankton (see Moss *et al* 1996). Given the sheer scale of the Black Sea, even if alternative ecological stable states could exist (and there is no evidence for such a change, even though there is a widely reported change in ecological indicators of trophic status), it would not be possible to undertake a biomanipulation programme. Current evidence suggests that large bodies of saline water do not undergo alternative stable states, but it is clear that

an ecological transition occurs as nutrient status increases (Zaitsev and Mamaev 1997).

With regards to marine environments generally, and the Black sea in particular, it is likely only to be in shallow coastal waters where two alternate stable states could exist. However, an obvious change in the maximum depth of colonisation in macroalgae and higher plants has been reported as a consequence of eutrophication from other parts of the world (Parr *et al* 1997). The factors involved in reducing light penetration are discussed by Burt *et al* (1995a) and Parr *et al* (1997). The effects of epiphyte biomass on the light availability to an Australian marine sea grass are shown clearly in Figure 2.1. Moreover, the depth of macrophytic/macroalgal growth is used a method of monitoring the trophic status of marine waters at the entrance to the Baltic Sea by Danish scientists (Sand-Jensen *et al* 1994, Borum 1996) who established the following relationships as part of this study (Z = depth):

- Zostera: $Z_{(\text{lower colonisation limit})} = 0.787\ Z_{(\text{Secchi})} + 0.339$, $R^2=0.606$, n=101
- Brown macroalgae: $Z_{(\text{lower colonisation limit})} = 1.427\ Z_{(\text{Secchi})} - 1.252$, $R^2=0.584$, n=84
- Other macroalgae: $Z_{(\text{lower colonisation limit})} = 1.568\ Z_{(\text{Secchi})} - 1.1$, $R^2=0.638$, n=119

2.4.3 Chemical Factors - Internal Loading

It should be noted that this paper deals with eutrophication in the broadest sense of the word. Consequently, increased organic loadings should also be considered part of the eutrophication process. This has a far greater impact on sediment infauna than elevated nutrient concentrations/loadings *per se*, but must also be considered in the context of sediment type with regard to particle size.

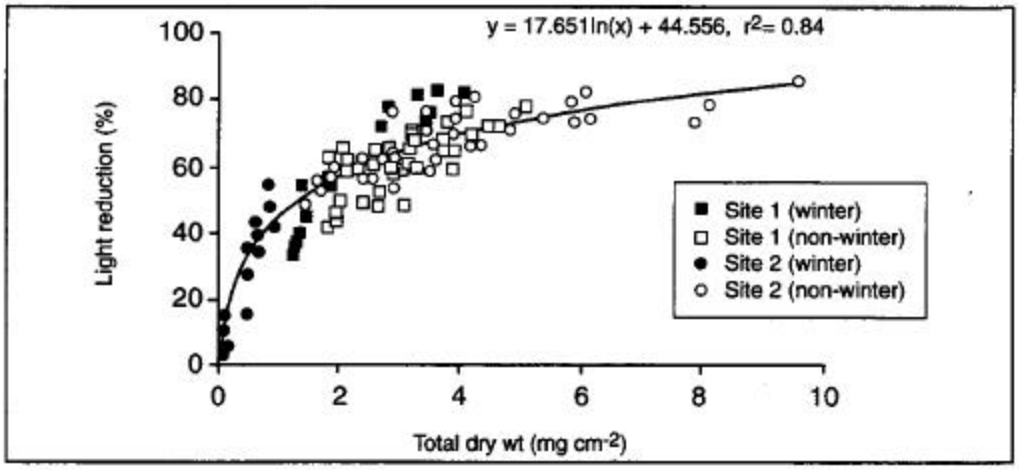

Figure 2.1 Relationship between periphyton biomass and light reduction to host artificial seagrass plants (Burt *et al* 1995b)

2.4.4 Seasonality

Nutrient concentrations in tidal/marine waters and external nutrient loads to those waters exhibit pronounced seasonality in temperate climates. Within the Black Sea itself, nutrient (N and P) concentrations will peak in winter and be at a minimum in summer. The reasons for this are associated with:

- Primary productivity – at a peak during longer, more brightly lit days in summer, so increased amounts of nutrients are sequestered by plants (predominantly algae and most importantly, phytoplankton).
- As the phytoplankton population, benthic/marginal macroalgal and higher plant communities decline during late autumn/winter, nutrients sequestered within these organisms are released into the water column or sink to the seabed. These are then mineralised and re-released into the water column over winter.
- Stormy weather results in deeper areas of sediment being mixed into the water column, mixing nutrient-rich interstitial water into the main water column.
- Stormy weather also contributes to the collapse of perennial macroalgal populations.
- Freshwater macrophytes, phytoplankton and terrestrial plants lying within the catchment undergo similar seasonal patterns of growth and senescence increasing the seasonal nutrient load into rivers.
- The higher levels of rainfall, means that nutrients are flushed from the catchment into rivers. Nitrogen is exported predominantly by leaching, although losses via surface runoff can be considerable during/following heavy rainfall events; while phosphorus is lost predominantly by surface runoff, particularly when this is linked to soil erosion (Parr *et al* 1999).
- The increased river flows in winter are partly due to an increase in river velocity. Particulates that settle out of suspension during low flows are therefore resuspended during elevated winter flows. This increase in suspended solids is particularly important for phosphorus, which binds strongly to particulates, but as in the sea, dissolved N and P in riverine sediment interstitial water is also released into the water column.
- The above factors always result in increased river nutrient loads in winter, and where river nutrient budgets are dominated by diffuse sources, the instream concentration also increases. However, in rivers that are dominated by point sources, the increased dilution offered by the additional water can, in some cases result in lower nutrient concentrations.
- Atmospheric deposition of nutrients is likely to be associated with increased frequency and severity of rainfall.

Depending on the purpose of the monitoring programme, it may therefore be necessary to monitor throughout the year or only at a particular time of the year. Instream nutrient loads are always monitored on a continuous basis, with results usually presented as an annual mean load. However, in terms of trend analysis, it is vital that confidence limits are also calculated. For nutrient concentrations, particularly those in marine waters, it is more usual to monitor concentrations only when they are at a maximum and algal productivity is at a minimum (i.e. during winter. See, for example Rees *et al* 1994, Gunby *et al* 1995). This approach is not chosen because it necessarily yields the most useful information, but because it minimises the seasonal variability. Indeed, it is the nutrient concentrations during the 'growing season' (nominally April- September) which are of the greatest ecological relevance. From an environmental impact point of view, the nutrient concentration in winter is unimportant, since temperatures are too cold and light availability too limited for phytoplankton, macroalgae or rooted plants to grow.

In contrast to the monitoring of nutrient levels within the Black Sea, biological indicators are best monitored when either productivity or standing crops are at a maximum. Thus, if monitoring the intertidal area occupied by *Enteromorpha* spp, the best time of year would be during summer/early autumn when biomass is highest.

Enteromorpha standing crop is linked to the oxygen status of underlying sediments and so the density and species composition of sediment infauna. While the primary productivity of this genus probably reaches a maximum during late spring/early summer, where nitrogen is limiting the best indicator of maximum standing crop appears to be the sediment nitrogen mineralisation rate in late spring (Jeffrey *et al* 1991, 1995).

Physical indicators of trophic status suspended solids are represented by Secchi depth, suspended solids concentrations and water column light attenuation/transmission. However, while phytoplankton standing crop (as measured by chlorophyll-a concentration) may be an important component of light attenuation/transmission at individual sampling sites, when information from a large number of sampling sites is included, the relationship between these parameters may be surprisingly weak (Figure 2.2). However, this data is from two single coastal cruises undertaken by the UK National Rivers Authority (now the UK Environment Agency) – one in summer and the other in winter - in which water quality was monitored every 10 seconds.

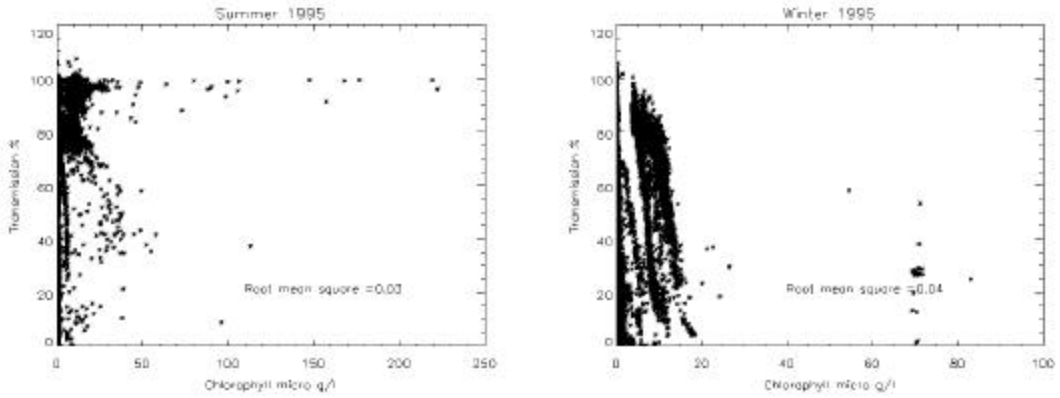

Figure 2.2 Relationship between light transmission and chlorophyll-a levels in English and Welsh coastal waters during summer and winter 1995, showing R^2 value for linear regression (Parr *et al* 1997)

In contrast to the conclusion drawn from the above data, Kirk (1994) estimated that in 'idealised' coastal waters containing chlorophyll levels of 1-4 µg/l, some 8.5-27.2% of water column light in the photosynthetically active range (400-700 nm wavelength) is captured by phytoplankton. Other workers have also shown light attenuation/turbidity to be strongly correlated with chlorophyll-a levels (e.g. Prieur and Sathyendranath 1981).

Nevertheless, according to Parr *et al* (1997) the results serve to illustrate that it is better to monitor a smaller number of sites more frequently than a large number of sites less frequently, in addition to the absolute requirement for good analytical quality control procedures. Because the results of turbidity-related physical parameters can change so rapidly and are so strongly influenced by meteorological conditions (particularly in shallow coastal waters), monitoring needs to be carried out on a frequent basis. Furthermore, such monitoring should be undertaken at sites that are not influenced by coastal erosion nor by turbidity plumes from inflowing rivers.

2.4.5 Nutrient bioavailability

An apparent paradox exists with regard to nutrient monitoring and trophic status. In freshwater lakes the emphasis is on total nutrients (total N and total P), while in rivers

impassioned arguments have been made for both total nutrients and bioavailable nutrients. Similarly in tidal and offshore waters, arguments have been made for both bioavailable and total nutrients. The debate is based not only on scientific integrity, but also on finances – the available monitoring budget.

Plants can only grow using bioavailable nutrients, so it may at first seem appropriate to base a monitoring programme on those chemical parameters most closely related to bioavailable nutrients, assuming that bioassays themselves are not practicable. However, while water column SRP and DIN levels may approximate to water column bioavailable nutrients, and so be relevant to phytoplankton growth, a substantial proportion of the nutrient budget of seaweeds and benthic diatoms, while still represented by SRP and DIN, is likely to be obtained from the sediment. For rooted higher plants (including salt marsh species), the vast majority of their nutrient uptake is likely to directly from the sediment, and bioavailable nutrient levels in sediment may be very different from those in overlying water. Indeed it is possible for rooted salt marsh species to be limited by Nitrogen availability, while phytoplankton growth in overlying waters is phosphorus limited (and *vice versa*; see Parr *et al* 1999).

Furthermore, when considering nutrient concentrations in sediment, an appropriate sample depth must be chosen. For benthic diatoms, the bioavailable nutrient concentrations both in the overlying water and in surface sediment interstitial water is important. However, for deep-rooted macrophytes, it may be more appropriate to monitor the bioavailable nutrient concentration in interstitial water at 15-50 cm depth. The monitoring programme for each site should be based on local knowledge of the flora present.

However, the ratio of total: bioavailable nutrients can change both on a spatial and temporal basis – hence the reason for external nutrient loads to be measured in terms of total nutrients, since this represents the potential bioavailable nutrient load, not the nutrient load at a particular time. For example, only 50% of the total nutrient load may be in a bioavailable form, but in the future, much of the non-bioavailable nutrient load may be mineralised to a bioavailable form. This is the reason why the OECD (1982) trophic status classification of lakes is based on total nitrogen and total phosphorus, not the bioavailable forms. However, it is the bioavailable forms that drive productivity in all waters, and hence monitoring of nutrient status of the Black Sea itself should be undertaken in terms of bioavailable nutrients.

2.5 Potential Indicators

A crucial aspect the Black Sea Environmental Programme (BSEP) is the development of a management framework for maintaining and improving the quality of marine waters in order to ensure the safety and sustainability of the aquatic ecosystems and certain specific water "uses". To this effect, a ‘consultation’ document was produced to provide a framework, based on the concept of Environmental Quality Objectives (EQOs), for prioritising pollution control activities and to aid in establishing realistic goals for water and sediment quality improvement (Reynolds and Denga, 1999). For the protection and improvement of ecosystems, the framework aims to apply water and sediment quality objectives to all Black Sea areas, whereas for human uses, objectives would apply only to those areas that are (or intended to be) exploited for such use. In this way, the proposed management framework considers the protection

and improvement of aquatic ecosystems as a separate issue to maintaining waters for specific human uses.

The management framework has been developed on the basis of 5-point classification schemes that define the quality of water required to provide ecosystem protection and support specific human uses of different water bodies. To provide consistency with European Union (EU) initiatives, each scheme is based on Environmental Quality Standards (EQSs) and other regulatory values that have been derived either at the EU level or national levels under the provisions of a relevant Directive.

In November 1998, the Advisory Committee on Pollution Monitoring produced a draft of a sampling strategy for the Black Sea based on water use, which was integrated into the EQO consultation document. An outline of the draft plan is presented in Appendix B. Monitoring variables were included to determine the trend in chemical (and trophic) status of the Black Sea ecosystem with respect to nutrients (as shown by shaded areas in Appendix B), in accordance with statutory quality objectives for estuaries and coastal waters described by Rees *et al* (1994). The sampling strategy proposed by the Advisory Committee would however need to readjusted in order to monitor the effectiveness of nutrient reduction measures by the riparian countries. In particular, further inclusion of environmental status indicators (especially with regard to biological indicators) would be required.

A regional marine AQC training scheme has been implemented by TACIS, which should make current AQC procedures considerably better than those employed in the past. However, the adoption of AQC procedures (both internal laboratory procedures and participation in interlaboratory quality control schemes) is only one aspect of producing reliable data. Standard Operating Procedures (SOPs) are also critical if the monitoring data is to be considered truly trustworthy, with the same SOPs to be used by all organisations involved in the monitoring. These are required for the adoption of a single protocol for the selection of sampling sites, sampling procedures, the use of preservatives (where required) and storage conditions/maximum length of time between sample collection and analysis.

In such a complex environment as the Black Sea ecosystem, a single variable is unlikely to explain the distribution and abundance of particular species. However, temperature and salinity (as indicators of seasonal change) may exhibit strong correlations with abundance of some benthic fauna, e.g. mysids (Williams and Collins, 1984), some fish (Claridge and Potter, 1983), and many macroalgae. Zooplankton have been shown in numerous studies to relate to a generalised salinity-based classification in many marine environments (Williams 1984). Other factors are also likely to be critical in determining species presence and abundance, notably the presence and concentrations of toxicants.

The following sections (2.5.1 to 2.5.7) provide a review of the potential trophic status indicators that are available to monitor the extent of eutrophication in the Black Sea over time. A summary of the indicators that are judged to provide the most relevant information for the region are provided in Table 3.3. It must be stressed that a baseline survey will be required (except in the case of chemical loads) in order to set intermediate and long-term targets for each indicator in order to reflect an ecological status similar to that observed during the 1997 and 1960s, respectively.

2.5.1 Chemical Loads to the Black Sea

Data should be requested on nutrient concentrations (total phosphorus [TP], soluble reactive phosphorus [SRP], nitrite, nitrate, ammonium and Kjeldahl nitrogen) concentrations and (where available) flow for the lowest freshwater monitoring point on all rivers feeding into the Black Sea. All data held for these sites should be requested with, where possible, flow data as daily means. Where nitrite, nitrate and ammonium data are supplied, these determinands would be added together to produce total inorganic nitrogen [TIN] concentrations. Samples should be collected on a weekly basis. Advice on statistical analysis of these data is presented in Appendix A.

Loads reported for 1997 that were transported by the Danube River were: orthophosphate 16,000 tons (as P), total inorganic nitrogen, i.e. the sum of ammonia-N, nitrite-N and nitrate-N, 300,400 tons (as N) (A. Cociasu, 1998, reported in Joint Ad-hoc Technical Working Group ICPDR – ICPBS summary report, June 1999). The actual target has yet to be finally agreed since it is established that an averaging over a 2.5 year time span either side of 1997 will provide a more realistic indication of nutrient export.

2.5.2 Chemical Concentrations and Nutrient Cycling Within the Black Sea

2.5.2.1 Water Column

Bioavailable nutrients (SRP, TIN and BOD) should be monitored in the water column at a minimum of 3 depths – in surface waters (1 m depth), some 20 m below the pycnocline and in bottom waters (approximately 5-10 m above the sea bed). Sampling should be undertaken at a range of sites, once per year only (during winter). Care should be taken to ensure that bottom water samples are not contaminated with sediment. Consideration should also be given to setting up permanent continuous monitoring stations for dissolved oxygen and salinity within the Black Sea at a range of depths.

2.5.2.2 Sediment

Bioavailable N and P should be monitored in interstitial water collected from surfacial sediments in shallow waters and saltmarshes. Surface sediment should be sampled and analysed for total organic carbon and BOD. Cores should also be collected from shallow and deep water sediments, and monitored for sediment oxygen demand (SOD). (Temperature must be recorded at the same time that samples are collected.) Guidance on the measurement of SOD is presented by Nixon (1990).

Consideration should be given to developing and employing a monitoring methodology for anoxic sediments. Likewise, consideration should be given to monitoring mineralisation, nitrification (Reynolds *et al.*, 1994) and denitrification rates in sediment. These should be monitored on a seasonal (4 times per year) basis.

2.5.3 Physical Indicators – turbidity-related parameters

Depending upon the equipment used, turbidity is a measure of scattered light, transmitted light or a combination of both (Hatton 1992, Kirk 1994 and Russel 1994).

Light transmission turbidimeters (also known as tranmissometers) are used in highly turbid waters, not being well suited to the measurement of low turbidities, since this requires the detection of a small change in a very large signal. The intensity of transmitted light falls off exponentially with increasing suspended solids content of the sample, the specific relationship depending on the concentration of the absorbing species and its ability to absorb light of the frequency being used. Results are expressed in Formazine Turbidity Units (FTU)[1].

Scattered light turbidimeters provide a measure of the amount of light reflected by suspended solids, rather than light absorption/transmission. This scattering of light is measured at a chosen angle to the incident light - often 180°, 135°, 90°, 25° or forward (0°). The intensity of the detected light is assumed to be directly proportional to turbidity, with a zero signal at zero turbidity. Results from scattered light turbidimeters are expressed in Nephelometric Turbidity Units (NTUs)[2].

Ratiometric turbidimeters measure both light transmission and light scattering. The results from the two detectors are integrated, allowing compensation to be made for variations in sample colour and light source intensity.

A further method of measuring turbidity is to use a Secchi disk. The disk is lowered into the water until it can no longer be seen and the depth at which this occurs is recorded. Other authorities measure the depth at which the disk reappears when it brought closer to the surface and yet others take the mean of the disappearance/reappearance depths as being the true measure of Secchi depth. Holmes (1970) states that that the compensation depth is 2.0-3.5 Secchi depth.

The determination of suspended solids concentrations is often used as a surrogate for turbidity monitoring (and *vice versa*). Suspended solids concentrations are determined by separating the suspended solids from the water (by filtration - GF/C or cellulose ester - or centrifugation) and drying. For routine analysis, drying is undertaken at 105°C, but for the determination of volatile matter and ash (not to be undertaken using cellulose ester filters), the separated solids are subjected to a further period of drying (30 min) at 500°C.

Optical methods for determining suspended solids are also available, and these are discussed above in terms of turbidimeters. This is confusing, since it means that the results from turbidimeters may be referred to as turbidity or suspended solids (depending upon the calibration used), when there is a great deal of difference between the two. Ratios of nephelometrically-determined turbidity measurements to weighed suspended solids concentrations vary greatly depending on particle size, light wavelength and instrument type.

The setting of turbidity-based water quality objectives is complicated by the high degree of spatial and temporal variability, added to the fact that the assessment of

[1] 1 FTU = 1/400th of the turbidity of a stock formazine solution. This is made by adding 5.00 ml of 10% (w/v) hexamethylenetetramine and 5.00 ml of 1% (w/v) hydrazine sulphate solution to 90.00 ml of distilled water.

[2] 1 FTU = 1 NTU measured on a formazine-calibrated 90° scatter instrument.

whether conservation interests have been damaged is largely a matter of subjective judgement. For example, would an increase in turbidity leading to the loss of 5% of the benthic area within the euphotic zone of a sampling transect constitute serious ecological damage if community structure remained similar, with no loss of species diversity?

It should be emphasised that turbidity is not the only method by which light availability is reduced to benthic floral communities. Competition for light between different species in such communities will also be important. Thus, epiphytic algae will be at a competitive advantage over those that require a rocky substrate for anchorage. The role of epiphytes in reducing light availability to benthic macroalgae and higher plants is extremely important, sometimes causing a greater reduction in light availability to host plants than water column turbidity. Since the maximum depth of colonisation is related both to turbidity and to epiphyte biomass, and epiphyte biomass is related to nutrient status, it is a natural step to use the ratio of the maximum depth of colonisation:Secchi depth as a trophic status indicator. For example, for brown algae growing in a nutrient-poor environment, the ratio may be between 3.0 and 3.5, but for the same taxa growing in nutrient-rich waters, the ratio is likely to be reduced, perhaps to 2.0-2.5.

It is important that the effects of changing turbidity levels are considered separately for invertebrate and animal communities, even though the effects of gradually increased sediment deposition rates may be long-term for both communities - for flora in terms of light-limitation and for fauna in terms of changing sediment particle size.

Of the different methods of monitoring turbidity discussed above, Secchi disc is by far the cheapest and simplest to monitor during calm weather, but can be difficult and the results may be untrustworthy if monitoring when there is only a small swell. Nevertheless, the results are widely understood. Secchi depth should be monitored away from the turbidity plumes of inflowing rivers where turbidity due to phytoplankton will not be overwhelmed by turbidity due to resuspended sediment. Monitoring should be undertaken on a fortnightly or monthly basis (as for chlorophyll-a analysis**.**

2.5.4 Biological Indicators – Microalgae

2.5.4.1 Productivity

Benthic microalgae may typically account for 20-25% of the primary productivity in salt marshes (Kennish 1986, Adam 1990), but the reduced seasonality in microalgal growth makes it distinct from other primary production. Thus, in temperate regions, algal productivity may be the major component of marsh productivity during autumn/winter (Zedler *et al* 1978, Pomeroy *et al* 1981).

Despite this, some seasonality is still present. For example, Sullivan and Daiber (1975) found benthic algal productivity to be lowest in autumn/winter and highest in spring. During summer, nutrient availability and shading by macrophytes may have limited benthic algal productivity.

Peletier (1996) reported that in the Ems-Dollard Estuary, benthic chlorophyll-a levels were high (>100 mg/m^2) for much of the year, with no obvious spring or autumn bloom when the sediments were organically enriched. However, since organic loading

to the estuary has decreased, benthic chlorophyll-a levels have fallen, with pronounced peaks in benthic microalgal standing crops during spring and autumn. This change in the standing crop and seasonality of microalgal standing crops was attributed to increased abundance of macrofaunal diatom grazers (*Nereis diversicolor* and *Corophium volutator*). *N. diversicolor* individuals have been estimated to consume 5476-12,184 diatom cells/day while *C. volutator* individuals ate 2150-3767 diatom cells/day (Smith *et al* 1996).

Primary productivity measurements for epiphytic microalgae may also make a substantial contribution to saltmarsh and coastal primary productivity. For example, Marshall (1970) measured a value of 0.2 tonne C/ha/year, and Jones (1968) provided a value for a marine grass (Florida) that was an order of magnitude higher. In the latter case, the epiphytic macroalgae amounted to 20% of the macrophyte productivity, a value that falls within the range of 18-50% cited by Kennish (1986) for *Zostera marina* leaf and epiphyte production. For comparison, rates of microalgal primary productivity in marine waters range from 0.05 to2.2 tonne C/ha/year

The values discussed so far illustrate just how important it is to differentiate between standing crop and productivity. The standing crop (dry weight) of benthic microalgae is usually negligible compared to the standing crop of vascular plants, but the production cycles of the two groups of plants are what makes them both important in production terms. While microalgae have a very short life span and rapid turnover, the life span of macrophytes is usually very much longer and its turnover very much slower. Breakdown of dead macrophytes may take years (e.g. Filip and Alberts 1989), with Kirby (1989; cited in Walton 1994) reporting a *Spartina* root mass to persist for nine years after treatment with herbicide. Decomposition of microalgae is probably better measured in days or weeks.

Changes in microalgal (particularly phytoplankton) productivity have been widely discussed as one of the major effects of eutrophication, but the fact remains that growth rate/nutrient concentration plots demonstrate that only at very low nutrient levels (e.g. <10 µg/l SRP) are nutrients actually limiting to algal growth. It remains a paradox that although higher microalgal biomass (as measured by chlorophyll-a content) is likely to be present at higher nutrient concentrations, maximum growth rate (i.e. productivity) can be achieved at low levels. Light availability is more likely to be a limiting factor to phytoplankton productivity than nutrient availability. Measurement of microalgal primary productivity as an indicator of trophic status is, therefore, not recommended.

2.5.4.2 Standing crop

When monitoring to investigate trends or abrupt changes in status, be it chemical or ecological quality, it is necessary to minimise as many sources of variability as possible. This means that the sampling/monitoring window should be narrowed on a seasonal basis to record peak levels, or the sampling window must be wide enough and sampling undertaken frequently enough to ensure that a reasonable representation of the mean value can be measured.

Phytoplankton have a typical doubling rate of 2-3 days under ideal growth conditions, but typically have at least two periods when peak standing crops can occur – spring and summer. More importantly, peak levels may easily occur a month apart during successive years. This rapid rate of growth is reflected in the population dynamics -

minor blooms form and crash within a matter of weeks, so that weekly or twice-weekly sampling is required if an estimation of peak levels is to be recorded. Fortnightly or monthly sampling may miss blooms completely (Parr *et al* 1993). Weekly sampling is labour intensive and expensive, so monitoring of peak algal standing crop (chlorophyll-a) cannot be considered a realistic option. Twice weekly sampling for chlorophyll-a analysis to calculate annual mean levels is therefore recommended, but if this is too costly, monthly sampling may suffice, albeit that wider confidence limits will be associated with the estimated annual mean value.

Sampling for chlorophyll-a analysis should be undertaken using an integrated sampler – effectively a 5-metre long tube that is lowered vertically into the water column. The uppermost end is sealed and the tube withdrawn from the water so that a 5-metre core of water is sampled. This helps reduce variability associated with phytoplankton stratification during calm weather, since flagellates are able to control their position within the euphotic zone to some extent.

2.5.4.3 Community composition

Diatoms are probably best known (in an international context) for their use in monitoring the pH status of freshwaters (e.g. Keithan *et al* 1988), notably as a palaeolimnological technique for assessing historic water quality (e.g. Battarbee and Charles 1986, Duthie 1989, Jenkins *et al* 1990). However, at least as much attention (if not more) has been paid to their use for assessing the organic carbon content of waters (e.g. Watanabe 1986, Watanabe *et al* 1988, Prygiel and Coste 1993, 1996). Much work has also been undertaken to relate indicator species to the nutrient (phosphorus) status of waters (e.g. Keithan *et al* 1988; Niederhauser and Schanz 1993).

Within the last 15-20 years, the use of diatom communities to monitor freshwater quality has been increasingly recognised. As with macroinvertebrate indices, a number of methods have been suggested for calculating a result that can be related either to a particular aspect of water quality, or for use as a broader-scale measure of water quality. To date, the development of diatom indices for monitoring environmental quality has concentrated on epilithic diatom communities (those attached to stones), with palaeoecological benthic diatom studies focusing on lakes. However, a growing number of diatom palaeoecological studies have also been undertaken in marine waters, and a body of information has been built up concerning the type of habitats favoured by a range of marine/estuarine diatom species.

Unlike freshwaters, however, very little work appears to have been undertaken on the development of diatom indices in marine/estuarine habitats. Instead, work has focused on benthic diatom indicator species. For example, Vos and de Wolf (1993) built up a large database linking Baltic Sea diatom taxa to community type (planktonic, episammic, epiphytic, etc.), salinity, pH, nutrient, temperature, tide and current preferences.

It is clear that the development of an index or the identification of indicator species should be undertaken only on a single community (one of the problems with river epilithic diatom indices is that the epilithon consists of several communities or sub-communities; see Round 1993). The estuarine/marine benthic diatom community consists of three individual communities (according to Vos and de Wolf 1993), so it is essential that development and identification work should concentrate only on one of

these communities. Of these, either the diatom community attached to sand grains or the free-living community in interstitial water appears to be the best population to target for the identification of Black Sea diatom indicator species and ultimately the development of trophic status diatom index. The benthic diatom community represents an ideal indicator of community, since the population lives close to the very surface of the sediment, so is influenced by both water column and sediment quality.

The benthic diatom community represents an ideal indicator of trophic status, albeit only for shallow water sediments (those lying within the euphotic zone). It is strongly recommended that that this community be sampled, individual taxa identified and the sediment analysed for chemical and physical parameters (including nutrients, organic carbon, salinity, toxicants, and particle size). The Vos and de Wolf database should be used as a guide to the storage of this information, and the Baltic Sea data should be pooled with the Black Sea data in the development of a marine trophic diatom index.

2.5.5 Biological Indicators – Macroalgae and Higher Plants

2.5.5.1 Maximum depth of colonisation

Macroalgae can be used to monitor turbidity as an indicator of trophic status by recording the maximum depth of colonisation of key species or genera. In addition, the depth of macroalgal/macrophyte colonisation offers three major advantages over convenional Secchi depth or suspended solids monitoring:

- It provides an integrated measure of turbidity over time - perhaps 6 months-2 years.
- It provides a genuine measure of the depth of the euphotic zone, not simply a measure of water clarity at a particular depth within the water column.
- It is much more ecologically relevant.

Monitoring of colonisation depth requires SCUBA diving equipment, so both the equipment itself and the training costs are likely to be high during years when monitoring is carried out. However, since individual sites would require monitoring only once every second or third years, the costs are not as great as may first be thought, and the data gathered is amongst the best of all ecological indicators.

The maximum depth of macrophyte colonisation can also be used as indicator, since this is thought to be subject to less temporal variability than macroalgal populations (carbohydrate reserves stored in the roots of seagrasses enable the plants to survive for extensive periods when light levels are below the compensation point). While seagrasses are usually confined to discrete areas, making them unsuitable for monitoring purposes at many sites, they also tend to form distinct colonies that start and end quite abruptly. In contrast, the maximum depth of macroalgal growth can

vary considerably over short distances, so that the maximum depth of seaweed colonisation may be more difficult to determine.

There are advantages to choosing an individual species as a bio-indicator, as Lumb (1989) suggests with *Laminaria digitata*, since this will reduce any possible effect of inter-species variability that may occur when a relatively large taxonomic group, such as 'brown algae', is chosen. However, since *L. digitata* is replaced by other members of the Laminariales at depth, the transition from one species to another may occur over a depth of several metres, with the lower limit of *L. digitata*, in practice, being difficult to determine at some sites. Until a comparison is made of the species/genus/order approaches, however, it is not possible to say which method is best. Of course, one of the aims of a macroalgal colonisation depth monitoring programme could (and should) be to determine which is the best option by asking divers to measure the depth of all three and comparing the results against Secchi depth data at selected sites. The minimum light requirements for seagrasses and macroalgae are shown in Table 2.1.

Table 2.1 Minimum light requirements of seagrasses and macroalgae (Masini *et al* 1995, Lumb 1989, Lüning and Dring 1979)

	PAR[1] at $Z_{(lower\ colonisation\ limit)}$ (% of PAR just below the water surface)	PAR at $Z_{(lower\ colonisation\ limit)}$ (% of solar radiation above the water surface)	Location
Zostera marina (seagrass)	19.8 21.6	8.5 9.3	Northeast USA Denmark
Thalassia testudinum (seagrass)	25.7	11.0	Puerto Rica
Posidonia sinuosa (seagrass)	7.8-13.7 depending on epiphyte density	3.4-5.9 depending on epiphyte density	Western Australia
All seagrass species	15.6	6.7	Worldwide
Laminariales (brown algae)		0.7-1.4%	Worldwide
Foliose and/or crustose coralline red algae	0.01-0.1%	0.05%	Worldwide

[1]PAR -photosynthetically active radiation (approximately 400-700 nm wavelength). The range of light energy capable of driving photosynthesis.

Whether using seagrasses or macroalgae, it is necessary to measure the depth of colonisation from ordnance datum to either the sediment surface or to the holdfast attaching the stipe to the rocky substrate. It will also be necessary to devise a simple method for estimating the extent of epiphyte abundance.

To prevent the maximum depth of colonisation being recorded perhaps several hundred metres apart on successive occasions, the position of monitoring sites should be indicated with permanent buoys and shore markers. Borrowing from the Danish National Marine Monitoring Programme, a line (transect) can then be run from the shore marker to the appropriate buoy, along which the maximum depth of colonisation is measured.

'Conventional' turbidity measurements would be a valuable addition to depth of colonisation data, so whenever a depth of colonisation record is made, recorders should be encouraged to monitor Secchi depth. Clearly, however, this cannot be undertaken by shore-based divers, since a boat is required.

2.5.5.2 Biomass and productivity

Saltmarshes are considered to be amongst the most productive ecosystems in the world (e.g. Howes *et al* 1986; Table 2.2), but estimates of productivity are usually based on above-surface standing crop measurements at the end of the growing seasons. Biomass losses during the growing season are, therefore, not usually accounted for.

Table 2.2 Productivity of marine/estuarine ecosystems (Carter 1988)

Ecosystem	Productivity (tonne $C.ha^{-1}.yr^{-1}$)
Coastal waters	
Oceanic waters	0.05-0.5
Upwelling zones	0.5-2.2
Shallow shelf	0.3-1.5
Coastal bays	0.5-1.2
Subtidal	
Seaweeds	8-15
Coral reefs	17-25
Seagrasses	1.2-3.5
Intertidal	
Seaweeds	1-2.5
Molluscs	0.1
Sandy beaches	0.1-0.3
Estuarine flats	5-7.5
Supra-tidal	
Salt marshes (temperate)	7-13
Salt marshes (Arctic)	1-1.5

Sand dunes (fore)	4-5
Sand dunes (rear)	1.5-1.75

This is important since underground standing crops of are often much greater than the above-surface standing crops (Valiela *et al* 1976, Long and Mason 1983, Agnew 1986), so cited values are often gross underestimates. For example between 50 and 90% of the biomass of *Spartina alterniflora* is estimated to be below ground (see Kennish 1986). Moreover, such estimates are often based on the results of a small number of quadrats, perhaps covering less than $1/100{,}000^{th}$ or $1/1{,}000{,}000^{th}$ of the area of which the quadrat results are supposed to be representative. Storm damage prior to biomass measurements can also greatly affect results, particularly for rocky shore macroalgal communities. Bearing in mind the high degree of spatial heterogeneity that may already be present in intertidal plant populations, this could lead to false conclusions being drawn.

Growth of macroalgae and macrophytes is clearly seasonal, so it when monitoring biomass and/or productivity it is necessary to reduce the sampling window to the period when maximum standing crops are achieved (late summer). However, this fails to address spatial variability. It is likely that the number of samples required to detect a significantly significant change in biomass over, say, 5 years, would be far too high and costly for a pragmatic macroalgal/macrophyte biomass sampling programme to be undertaken.

In summary, the results of macrophyte and macrolalgal biomass density surveys cannot be recommended as part of the proposed monitoring programme because of the high degree of spatial variability and the short-medium term temporal variability that may be caused by storm damage. Moreover, productivity data is likely to be scientifically flawed.

2.5.5.3 Biochemical/physiological indicators

If macrophyte standing crop is too costly to measure robustly, is it possible to monitor a biochemical/physiological indicator of macrophyte productivity instead? The answer appears to be a qualified yes. Microalgae are renowned for accumulating nutrients intracellularly during periods when extracellular nutrients are present at concentrations greater than those required simply to fuel growth. However, 'luxury uptake' also occurs (albeit to a lesser extent) in macroalgae and in some higher plants, such as *Spartina* spp and *Zostera*. It is possible that an increase in C:nutrient ratios during early spring may result in greater productivity, but that growth through spring and summer may deplete this internal nutrient store. Thus, by autumn, the C:N and C:P ratios in *Spartina* growing in nutrient-rich and nutrient-poor sediments may show little difference. The use of plant C:N:P ratios as an indicator of trophic status appears promising, but is not yet well-enough understood to recommend as an indicator of trophic status.

2.5.6 Invertebrates

Some meiofauna (notably nematodes) are generally tolerant of low dissolved oxygen levels and organic enrichment (Sandull and de Nicola 1991), but other macroinvertebrates are not. As such, benthic communities show marked taxonomic changes in response to eutrophication.

The majority of available information for the Black Sea invertebrate community is for the sediment infauna and this is the invertebrate community most often monitored in relation to environmental change. The response of the macrobenthic communities to organic enrichment is well documented (e.g. Edwards and Jack 1994) and a carefully designed monitoring programme could detect changes in the degree of organic enrichment using a number of standard measures. However, there would need to be some established link between a change in nutrient status resulting in a greater production of organic detritus for any change in macrobenthic community status to be linked even indirectly to a change in nutrient (N and P) status.

While there is a very obvious link between organic and nutrient enrichment of coastal waters, when large numbers of sampling sites are compared, within a single waterbody the relationship is likely to be much weaker. Furthermore, any detection of eutrophication impact on the infaunal community is likely to occur only after other more sensitive (primary producer-based) indicators of change in nutrient status have indicated change.

The use of the meiofauna in environmental monitoring is becoming more popular but is still restricted to specialist organisations because the level of taxonomic skill required is high. However, these animals have certain advantages over the macrofauna, including a more rapid response time. It is also possible with nematode taxa to divide them into functional or feeding groups. Some of these groups utilise benthic diatoms as a prime food source. Thus, if a change in nutrient status was to result in a change in the benthic diatom community or productivity, a secondary shift in the nematode distribution in favour of these species could be linked to the change in nutrient status.

The secondary productivity of benthos has been investigated in a similar manner to primary productivity, with reviews presented, e.g. by Kennish (1986) and Warwick (1980). Notable UK studies include work by Hughes (1970), Chambers and Milne (1975), Warwick and Price (1975), Hibbert (1976) and Warwick *et al* (1978). For individual species, values may exceed 1 tonne dry weight/ha in extreme cases, but an overall total macrobenthic production rate of 0.3-0.6 tonne dry weight/ha appears to be typical for many estuaries and coastal waters (Kennish 1986).

It is strongly recommended that the sediment infauna be used as an indicator of trophic status, albeit for monitoring medium-long term recovery. However, for the results to be used for this purpose it is essential that all organisations use the same monitoring protocol. This includes:

- using the same type of grab when boat sampling;
- collecting the same sample size (area and depth) when shore sampling;
- using the same mesh size to filter the sample; and
- biological AQC procedures.

For the results to be fully understood, it will also be necessary to sample the sediment at the same time as collecting the biota. The sediment should be analysed for toxicants (organic and inorganic), particle size analysis and total organic carbon, in addition to water column salinity. Such a monitoring programme is likely to be costly, but need only be undertaken once every five years, using the surveys undertaken on the Mersey Estuary (Codling 1990, Codling *et al* 1991a, 1991b) as the basis of a sampling

programme. Sampling sites should be selected well away from known point sources of pollution (outfalls).

In terms of reporting, a variety of invertebrate indices are available, of which the infaunal trophic index (ITI) appears to offer the greatest chance of success. This was originally developed in the USA for monitoring organic pollution around marine outfalls (REF), and has since been adapted for use in UK tidal waters. It is unlikely that the index could be used in either it US or UK format without adaptation for the environmental conditions in the Black Sea, and probably could not be used at all in deeper waters because of the anoxic conditions. However, for marginal sediment infaunal communities it may provide a valuable aid to reporting complex ecological data in a simple, easily-understood manner.

2.5.7 Other Indicators

Compliance with water quality objectives is the most widely used indicator of water quality, but such an approach is only valid when the WQOs are set at an appropriate level. Similarly, temporal trends in nutrient concentrations is also a commonly-used indicator. Likewise, compliance with consents (for municipal sewage treatment works and industrial discharges) is a widely used indicator of water quality status, particularly when those consents are derived taking WQOs into account. However, such approaches are of limited use in terms of protecting the Black Sea, since they are based on concentration, not loads, and consents/WQOs rarely include nutrient parameters (except when conservation objectives have been set). In terms of protecting the Black Sea, it is the nutrient load, not the nutrient concentration that requires the greatest control.

On-farm nutrient balances have received much attention during the last decade, to the extent that in some EU countries they are used as the basis of economic instruments to prevent excessive nutrient pollution from agriculture (Parr *et al* 1999). The same approach can be scaled up using national agricultural census statistics to determine nutrient balances for agricultural production of whole countries. In such studies, the input is represented by the N and P content of bought-in animal feed, inorganic fertiliser usage and (in some studies) by atmospheric deposition of nitrogen. Output is represented by the nutrient content of meat and harvested crops.

From nitrogen balance studies on agricultural land in the EU12 countries it has been shown that the surplus (difference between input and output) varies from over 200 kg N/ha/yr in the Netherlands to less than 10 kg N/ha/yr in Portugal (Figure 2.3). In general, there is an increasing surplus with increasing inputs, reflecting increasing potential leaching with increasing inputs. In terms of phosphorus balance studies, calculations indicate that all EU12 countries are operating on a surplus, representing a net annual accumulation of P in European agricultural soils (Brouwer *et al* 1995).

Agricultural nutrient balances for the proportions of those countries which drain into the Black Sea would represent and excellent indicator of the success of an agricultural nutrient control programme. However, such balances must be based on trustworthy information, including that gathered from fertiliser sales statistics, crop production figures and typical crop nutrient content data. This information is not considered likely to be accurate enough at present.

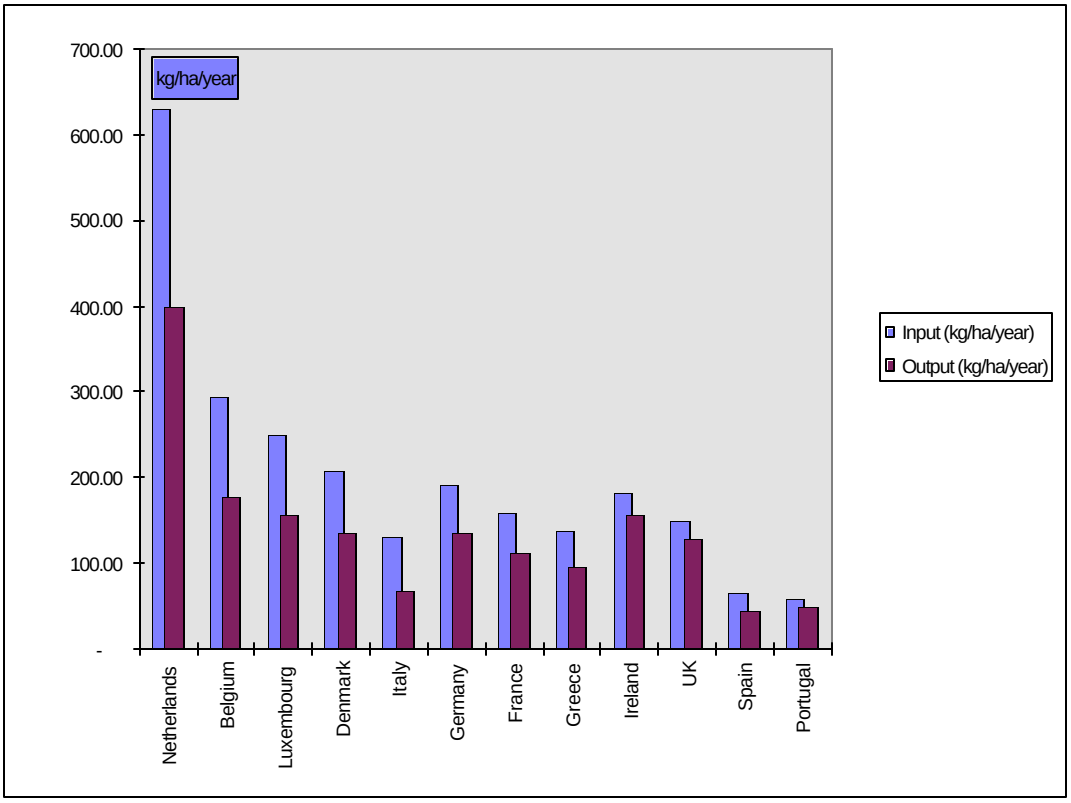

Figure 2.3 Nitrogen balances for agricultural land in EU12 countries (1993) (Crouzet *et al* 1999)

2.6 Summary of Recommended Trophic Status Monitoring Programme

A summary of the recommended trophic status indicators is given in Table 2.3.

Table 2.3 Recommended trophic status indicators for the Black Sea

Indicator	Sampling frequency	Comments
Chemical Loads: TP, SRP, nitrite, nitrate, ammonium (DIN]), Kjeldahl nitrogen, BOD, total organic carbon and COD.	Weekly concentration data; continuous flow measurement reported as daily mean flows.	Data analysis discussed in appendix A. Confidence limits must be calculated.
Nutrient concentrations: Water column - SRP, TIN and BOD. Sediment – Bioavailable N and P, total organic carbon, BOD and SOD.	Once per year at 3 depths. Once per year.	Consider developing methodology for anoxic sediments. Consider monitoring mineralisation, nitrification and denitrification rates in sediment on a seasonal basis (4 times per year).
Physical indicators: Secchi depth.	Once every two weeks or once per month depending on monitoring budget.	Monitor away from the turbidity plumes of inflowing rivers. Shallow water monitoring sites should coincide with maximum depth of macroalgal/ macrophyte colonisation monitoring sites.
Microalgae: Standing crop (chlorophyll-a). Community composition (benthic diatom community).	Once every two weeks or once per month depending on monitoring budget. Twice per year.	Collect sample using a 5-m integrated sampler. Sample wherever Secchi depth is recorded. The Vos and de Wolf (1993) Baltic Sea data should be pooled with Black Sea data in the development of a marine trophic diatom index. Also monitor sediments for nutrients, organic carbon, pH, salinity, toxicants, and particle size).

Table 2.3 Continued…

Indicator	Sampling frequency	Comments
Macroalgae and higher plants: Maximum depth of colonisation	Once every second or third year (during summer) depending on monitoring budget	Also record Secchi depth and chlorophyll-a at these monitoring sites. Use results to determine whether species, genus or order approach is the best option for longer-term monitoring.
Invertebrates: Sediment infauna	Major survey every 5 years	To be used for monitoring medium-long term (>5 years) recovery of the Black Sea. Sampling sites should be selected well away from known point sources of pollution. The sediment should also be analysed for toxicants (organic and inorganic), particle size analysis and total organic carbon, in addition to water column salinity.

As to habitats for environmental monitoring, according to Zaitsev (personnel communication) hotspots need to be in the centre of attention, as areas rich in total numbers of species or/and areas of especially high man-made impact (Norse, 1993). The following information was kindly provided by Professor Zaitsev:

In the Black Sea the most important hotspots are following habitats.

In the bottom realm:

- The *Phyllophora* field in the central part of the north-western shelf. It is a large aggregation of red agar-bearing algae of the *Phyllophora* genus. *Phyllophora* is a nucleus of a bio-community known as the *Phyllophora* biocoenosis, which included up to 120 species of invertebrates and 50 species of fish (Vinogradov, 1967). As a result of turbidity related environmental parameters, the stocks of *Phyllophora* sharply decreased. In the 1950s, the area occupied by *Phyllophora* was 10,000 km^2, with a total biomass of about 10,000,000 t. Toward 1980s, this area had diminished to 3,000 km^2 and biomass had declined to 1,000,000 t. In 1990 these values had declined even further to 500 km^2 and 500,000 t respectively. At the same time another small *Phyllophora* field, situated at 10-15 m depth on the same shelf continued its normal development (Zaitsev, 1992).

- Seasonal hypoxic zones at 10-30 m depth in front of largest rivers- Danube, Dniester and Dnieper, where in summer-autumn seasons mass mortalities of bottom-living invertebrates and fish occurs (Zaitsev, 1993). A drastic fall in benthic animals stocks, including commercial species like the blue mussel *Mytilus galloprovincialis* occurs. The biological losses due to hypoxia on the north-western shelf are estimated at 100 to 200 t per square kilometre of seabed.

- Rocky shores, inhabited by the brown alga *Cystoseira barbata*, a nucleus of the *Cystoseira* biocoenosis, which included up to 70 species of epiphyte algae, invertebrates and fish. *Cystoseira* is very sensitive to eutrophication and has virtually disappeared in impacted shore zones, where was replaced by filamentous algae (Minicheva, 1990, Zaitsev&Mamaev, 1997). *Cystoseira* began disappearing along NW shores in Romania and Ukraine in the 1980s (Petranu, 1997, Zaitsev&Alexandrov, 1998).

- Sandy beaches, inhabited by dozen of species of psammobiontic organisms. The most sensitive of them to the siltation by organic particles (one of consequences of eutrophication) in the supralittoral zone are the worm *Ophelia bicornis* (Polychaeta) and the bivalve *Donacilla cornea*. At 5-10 m depth, very sensitive to eutrophication are the hermit crab *Diogenes pugilator* and the ghost shrimps *Upogebia pusilla* and *Callianassa pestai*. These species practically have been disappeared on the north-western shelf since the 1970s, but after the middle 1990s their populations are gently increasing (Zaitsev, 1998).

In the pelagic realm:

The ecotone between fresh and marine waters. This narrow transitional zone of 1-5 m wide is clearly visible in front of the river water plumes owing to concentration of foam, fragments of algae, leafs of *Zostera* and different kind of flotsam. This is a convergence zone, in which surface marine and river waters come together and where large amounts of surface-living organisms, both of marine and fresh-water origin occurs. This ecotone is especially rich in blue-green neustonic copepods *Pontella mediterranea* and *Anomalocera patersoni*, isopod *Idothea stephenseni*, zoea and megalops of shrimps and crabs, fry of gray mullets *Mugil cephalus, Liza saliens, L. aurata*, red mullet *Mullus barbatus ponticus*, garfish *Belone belone euxini* and dragonets *Callionymus belenus* and *C. festivus*. In the 1960s, in one metre of the Danube river ecotone, which was at 8 nautical miles from the shore, were catched up to 60,000 pontellid copepods, 25 zoea and megalops, 18 Idothea stephenseni and 30 gray mullet fry (Zaitsev, 1971). In the 1980s, only 5-10 pontellids, 1-2 larvae of decapods, 1-2 isopods and 2-3 fry of gray mullets in the same area were observed. Instead of them, huge amounts of *Noctiluca scintillans* were detected (Zaitsev et al., 1988). In the late 1990s, a gentle rehabilitation of this were specific habitat is observed.
The open coastal (neritic) waters. In eutrophication conditions (Zaitsev, 1998) these waters are inhabited mostly by dinoflagellates (e.g. *Exuviaella cordata, Noctiluca scintillans*), infusorians (e.g. *Mesodinium rubrum*, which is able to give a red colour to the sea surface during its vertical migrations at noon), small crustaceans (e.g. *Podon polyphemoides*), the scyphozoan *Aurelia aurita*. The ratio Dinoflagellates/Diatoms is a rather good biological indicator of eutrophication levels: in the 1960s, the Dinoflagellate cell numbers was 15-20% of the total, whereas in the

1980s it reached up 35-45% (Ivanov, 1967, Nesterova, 1987). A very characteristic consequence of the Black Sea eutrophication for phytoplankton is the increase in numbers of "mass species" (i.e. those exhibiting concentrations of more than 100,000 cells.l^{-1}. According to Bodeanu (1987-1988), there were 16 mass species in 1960-1970. This increased to 22 in 1971-1982, and in 1983-1988 to 54 species. Since the 1970s, large phytoplankton blooms became ordinary events in Ukrainian, Romanian and Bulgarian coastal waters (Mihnea, 1984, Konsulov, 1998, Petranu, 1997, Zaitsev&Alexandrov, 1998).

In coastal wetlands:

Brackish-water limans (e.g. Razelm-Sinoe complex in Romania, and Dniester and Dnieper rivers limans in Ukraine) are inhabited mostly by pontian relics. There are polychaetes *Hypania invalida* and *Hypaniola kowalewskii*, bivalves *Dreissena polymorpha, Hypanis relicta, Hypanis colorata*, crustaceans *Pontogammarus maeoticus* and *Paramysis pontica*, fish as *Clupeonella delicatula*, sturgeons, herings (Wilson&Moser, 1994, Zaitsev&Mamaev, 1997). In eutrophication conditions, bottom hypoxic zones in these areas appeared. (Marinov et al., 1984, Zaitsev&Mamaev, 1997).

Salt-water limans and lagoons, inhabited mostly by mediterranean origin species. Some of such water bodies are sites of traditional gray mullets culture (Konsulov, 1998, Petranu, 1997, Zaitsev&Alexandrov, 1998). The main food of these fish are benthic microalgae and meiobenthic animals, which are strongly influenced by the eutrophication syndrome (Gomoiu, 1985, Guslyakov et al., 1992, Vorobyova et al., 1992).

Although the cause of eutrophication (increased availability of nutrients) is easily understood, the biological responses and interactions, in addition to changes that occur in nutrient cycling pathways, are very complex. For this reason it is necessary to monitor a range of indicators (chemical, physical and biological) in order to robustly assess the extent of eutrophication and any change in trophic status.

While 1997 has been chosen as the baseline date for chemical concentration/nutrient load monitoring, it will not be possible to use this date as the baseline for other indicators, since appropriate monitoring data were not collected at that time. This is almost certainly true with regard to macroalgae/higher plants, sediment chemistry and the composition of sediment infaunal and benthic diatom communities. Moreover, nutrient concentrations vary within the Sea itself on both a temporal (seasonal) and spatial basis; so unless the same sampling times and sites are used as in 1997, the results may not be suitable for comparison with data from the programme outlined above.

While it is recommended that chemical load data (possibly in addition to chlorophyll-a, chemical concentration and Secchi depth data) collected as part of the recommended monitoring programme (Table 2.3) are used with historical data as part of a trend analysis, other data will need to be treated differently. Thus, macroalgae/higher plant, diatom community, sediment infaunal community and sediment chemistry monitoring data collected during the first years sampling should be used as the baseline for analysis by comparison (sediment invertebrate data) or as part of a 5-year trend analysis with data collected in later years.

Bearing in mind the very long retention time of the Black Sea, it is not expected that major (or possibly even significant) changes in trophic status will be observed within 5 years of Nutrient Action Plans (NAPs) being implemented in riparian countries. Land in a further 11 countries drains into the Black Sea, and nutrient export from this land will also need to be addressed. Five years is therefore a very short time-scale over which to judge the effect of the NAPs, especially when it is realised that any legislative changes required as part of the NAPs could take 5 years to achieve. Improvements in trophic status are likely to be observed first in shallow marginal waters. It is, therefore, hoped that in subsequent years funds will be made available to continue monitoring beyond the initial 5-year period.

To monitor progress of the 5-year nutrient reduction plans will require only the chemical load monitoring data, since the action plans are written with the specific aim of reducing nutrient loading to the Black Sea; the reduction in trophic status is an expected benefit of this. However, to know whether the nutrient action plans have had the desired effect of lowering the trophic status of the Black Sea, it will be necessary to monitor all of the recommended indicators.

Because of the reasons laid out above, and the fact that sampling sites have not yet been chosen, it is not possible to provide targets for the monitoring programme; only to recommend that trend analysis is undertaken on the data collected.

Adam, P. (1990) *Saltmarsh Ecology.* Cambridge University Press, Cambridge.

Agnew, A.D.Q. (1986) The salt marsh. In: *Ynyslas Nature Reserve Handbook.* Part 4: The Estuary, pp. 160-167. Nature Conservancy Council.

Battarbee, R.W. and Charles, D.F. (1986) pH reconstruction studies of acid lakes in Europe and North America: a synthesis, *Water, Air and Soil Pollution*, **30**, 347-354.

Bodeanu, N., (1987) Structure et dynamique de l'algoflore unicellulaire dans les eaux du littoral roumain de la Mer Noire. Cercetari marine, Constanta, 20/21: 19-250 (in French).

Borum, J. (1996) Shallow waters and land/sea boundaries. In: B.B. Jorgensen and K. Richardson (eds.) *Eutrophication in Coastal Marine Ecosystems.* pp. 179-203. American Geophysical Union. Washington, DC.

Brouwer, F.M., Goeschalk, F.E., Hellegers, P.J. and Kelholt, H.J. (1995) Mineral balances at the farm level in the European Union. Agricultural Economics Institute, The Hague.

Burt, J.S., Masini, R.J. and Simpson, C.J. (1995a) Light and *Posidonia sinuosa* seagrass meadows in the temperate coastal waters of western Australia. I. Factors influencing water column light attenuation. Department of Environmental Protection, Perth, Western Australia 6000.

Burt, J.S., Kendrick, G.A., Masini, R.J. and Simpson, C.J. (1995b) Light and *Posidonia sinuosa* seagrass meadows in the temperate coastal waters of western Australia. II. Effect of epiphyte species assemblage and biomass on attenuating light to the leaf surface. Department of Environmental Protection, Perth, Western Australia 6000.

Carter, R.W.G. (1988) *Coastal Environments*. Academic Press, London.

Chambers, M.R. and Milne, H (1975) The production of Macoma balthica (L.) in the Ythan Estuary, *Estuarine, Coastal and Marine Science*, **3**, 443.

Claridge, P.N. and Potter, I.C. (1983) Movements, abundance, age composition and growth of bass *Dicentrarchus labrax* in the Severn Estuary and inner Bristol Channel, UK, *Journal of the Marine Biological Association UK*, **63**, 871-880.

Codling, I.D. (1990) Biological assessment of the Mersey Estuary, Journal of the Marine Biological Association UK, 70, 670-671.

Codling, I.D., Nixon, S.C., Ashley, S.J., Butler, R., Flower, T. and Horn, K. (1991a) Biological assessment of the water quality of the Mersey Estuary - final report. WRc report No. CO 2770-M.

Codling, I.D., Nixon, S.C. and Platt, H.M. (1991b) The Mersey Estuary. An assessment of the biological status of intertidal sediments. WRc report No NR 2757.

Crouzet, P., Leonard, J., Laffon, L., Nixon, S.C., Rees, Y., Parr, W., Bøgestrand, J., Kristensen, P., Lallana, C., Izzo, G., Bokn, T. and Bak, K. (1998) Excessive anthropogenic nutrients in European ecosystems. Draft report to the European Environment Agency. ETC/IW Report No. PO24/97/1.
Duthie, H.C. (1989) Diatom-inferred pH history of Kejimkujic Lake, Nova Scotia: a reinterpretation, *Water, Air and Soil Pollution*, **46**,317-322.

Edwards, A. and Jack, I.A. (1994) Forecasting the deposition and biological effects of excess organic carbon from sewage discharges: a review of the literature. Report to SNIFFER No. SR 6002.

Ellis, J.C., van Dijk, P.A.H. and Kinley, R.D. (1993) Codes of practice for data handling - version 1. NRA R&D Note 241.

Filip, Z. and Alberts, J.J. (1989) Humic substances isolated from *Spartina alterniflora* (Loisel.) following long-term decomposition in sea water, *Science of the Total Environment*, **83**, 273-285.

Gomoiu, M.-T. (1985). Problemes comcernant l'eutrophisation marine. Cercetari marine, Constanta, 18: 59-95 (in French).

Gowen, R.J., Tett, P. and Jones, K.J. (1992) Predicting marine eutrophication: the yield of chlorophyll from nitrogen in Scottish coastal waters, *Marine Ecology Progress Series*, **85**, 153-161.

Gunby, A., Nixon, S.C. and Wheeler, M.A. (1995) Development and testing of General Quality Assessment schemes: nutrients in estuaries and coastal waters. National Rivers Authority Project Record 469/16/HO.

Guslyakov, N.E., Zakordonets, O.A. and Gerasimyuk V.P. (19920 Atlas of benthic Diatoms of the North-Western Black Sea and adjacent waters. Kiev: Nakova Dumka Publ. 112 p. (in Russian).

Hatton, E. (1992) Review of turbidity. National Rivers Authority R&D Note 91.

Holmes, R.W. (1970) The Secchi disk in turbid coastal waters, *Limnology and Oceanography*, **15**, 688-694.

Hibbert, C.J. (1976) Biomass and production of a bivalve community of an intertidal mudflat, *Journal of Experimental Marine Biology and Ecology*, **25**, 249.

Howes, B.L., Dacey, J.W.H. and Goehringer, D.D. (1986) Factors controlling the growth form of Spartina alterniflora; feedbacks between above-ground

production, sediment oxidation, nitrogen and salinity, *Journal of Ecology*, **74**, 881-98.

Hughes, R.N. (1970) An energy budget for a tidal flat population of the bivalve *Scrobicularia plana* (da Costa), *Journal of Animal Ecology*, **39**, 357.

ISSG (1990) The Irish Sea: An Environmental Review. Part Two: Waste Inputs and Pollution. Published for the Irish Sea Study Group by Liverpool University Press.

Ivanov, A.I. 1967. Phytoplankton. Biology of the north-western part of the Black Sea, Kiev: Naukova Dumka Publ., pp. 59-75 (in Russian). Konsulov, A. (comp.) 1998. Black Sea Biological Diversity. Bulgaria. New York: United Nations Publications, 131 p. (in English).

Jeffrey, D.W., Madden, B., Rafferty, B., Dwyer, R. and Wilson, J.G. (1991) Indicator organisms as a guide to estuarine management. In: D.W. Jeffrey and B. Madden (eds) *Bioindicators and Environmental Management*, Academic Press, pp 55-64.

Jeffrey, D.W., Brenan, M.T., Jennings, E., Madden, B. and Wilson, J.G. (1995) Nutrient sources for in-shore nuisance macroalgae - the Dublin Bay case study, *Ophelia*, **42**, 147-161.

Jenkins, A., Whitehead, P.G., Cosby, P.J. and Birks, H.J.B. (1990) Modelling long-term acidification: a comparison with diatom reconstructions and the implications for reversibility, *Philosophical Transactions of the Royal Society of London, Series B*, **327**, 435-440.

Joint Ad-hoc Technical Working Group ICPDR–ICPBS (June 1999) Causes and effects of eutrophication in the Black Sea – Summary report.

Jones, J.A. (1968) Primary productivity by the tropical marine turtle grass *Thalassia testudinum* König, and its epiphytes. PhD thesis, University of Miami.

Keithan, E.D., Lowe, R.L and DeYoe, H.R. (1988) Benthic diatom distribution in a Pennsylvania stream: role of pH and nutrients, *Journal of Phycology*, **24**, 581-585.

Kennish M.J. (1986). *Ecology of Estuaries. Vol 1. Physical and Chemical Aspects.* CRC Press.

Kirk, J.T.O. (1994) *Light and Photosynthesis in Aquatic Ecosystems.* Second Edition. Cambridge University Press.

Koerselman, W. and Meuleman, A.F.M. (1996) The vegetation N:P ratio: a new tool to detect the nature of nutrient limitation, *Journal of Applied Ecology*, **33**, 1441-1450.

Long, S.P. and Mason, C.F. (1983) Saltmarsh Ecology, Blackie, Glasgow.

Lumb, C.M. (1989) Algal depth distribution as an indicator of long-term turbidity change. In: M. Elliott and J. McManus (eds) Developments in Estuarine and Coastal Study Techniques, pp. 69-74. Olsen & Olsen, Fredensborg, Denmark.

Lüning, K. and Dring, M.J. (1979) Continuous underwater light measurement near Helgoland (North Sea) and its significance for characteristic light limits in the sublittoral region, *Helgoländer Wess. Meeresunters*, **32**, 403-424.

Mainstone, C.P., Parr, W. and Day, M. (2000) Phosphorus in Rivers: tackling sewage treatment (in press)

Marinov, T., Petrova-Karadshova, V.I and Konsoulov, A. 1984. Recent state and trends in hydrobiological researches in the Black Sea. Izvestia na Instit. po rybny resursy. Varna, 43: 17-23 (in Bulgarian).

Marshall, N (1970) Food transfer through the lower trophic levels of the benthic environment. In: J.H. Steele (ed), Marine food chains, 52. Oliver and Boyd, Edinburgh.

Martin, J.H., Coale, K.H., Johnson, K.S. *et al* (1994) Testing of the iron hypothesis in ecosystems of the equatorial Pacific Ocean, *Nature*, **371**, 123-129.

Masini, R.J., Burt, J.S. and Simpson, C.J. (1995) Light and *Posidonia sinuosa* seagrass meadows in the temperate coastal waters of western Australia. III. Minimum Light requirements. Department of Environmental Protection, Perth, Western Australia 6000.

McCauley, E., Downing, J.A. and Watson, S. (1989) Sigmoid relationship between nutrients and chlorophyll-a among lakes, *Canadian Journal of Fisheries and Aquatic Sciences*, 1171-1175.

Mee, L.D. (1999) How to save the Black Sea. Your Guide to the Black Sea Strategic Action Plan. The Black Sea Environmental Programme, Black Sea Project Implementation Unit, Hareket Kosku II, Dolmabahce Sarayi, Besiktas, 80680, Istanbul, Turkey.

McCauley, E., Downing, J.A. and Watson, S. (1989) Sigmoid relationship between nutrients and chlorophyll-a among lakes, *Canadian Journal of Fisheries and Aquatic Sciences*, 1171-1175.

Mihnea, P.E., 1984. Phytoplankton indicator species-effect of pollution on phytoplankton species. Rapp. Comm. Int. Mer. Medit., 29, 9: 85-88.

Minicheva, G.G., 1990. The prediction of phytobenthos structure with the help of specific surface indices of algae. Botan zhurn., 75, 11, pp. 1611-1618 (in Russian).

Moss, B, Madgwick, J. and Phillips, G. (1996) A guide to the restoration of nutrient-enriched shallow lakes. The Broads Authority, 18 Colegate, Norwich, Norfolk NR3 1BQ, UK.

Nesterova, D.A.,1987. Features of phytoplankton successions in the north-western part of the Black Sea. Hydrobiological Journ., 23: 16-21 (in Russian).

Niederhauser, P. and Schanz, F. (1993) Effects of nutrient (N, P, C) enrichment upon the littoral diatom community of an oligotrophic high-mountain lake, *Hydrobiologia* , **269/270**, 447-452.

Nixon, S.C. (1990) Oxygen balance in estuaries. WRc report No PRS 2462-M.

Norse, E.A. (Ed). 1993. Global marine biological diversity. A strategy for building conservation into decision making. Washington D.C.: Island Press, 383 pp.

OECD (1982) *Eutrophication of Waters: Monitoring, Assessment and Control.* Report of the OECD cooperative programme on eutrophication, edited by R.A. Vollenweider and J. Kerekes. Organisation for Economic Development and Cooperation, Paris.

Parr, W. (1992a) Possible replacements for the biochemical oxygen demand ($BOD_{(5)}$) test and suspended solids as measures of effluent and water quality. WRc report No. NR 3210/3213.

Parr, W. (1992b) Manipulation of fish communities to control algal levels in reservoirs. Foundation for Water Research report No. FR 0300.

Parr, W. (1993) Biological control of blue-green algal levels in reservoirs: the utility of silver carp. Foundation for Water Research report No. FR 0365.

Parr, W. (1993) Algal bioassays: a review of their potential for monitoring and managing the trophic status of natural waters. WRc Report No SR 3439/1.

Parr, W., Nixon, S.C., Ashley, S. and Woodrow, D. (1993) Classification options for trophic status. WRc report No NR 3402/1/7075. NRA R&D note 248.

Parr, W., Nixon, S.C. and Wheeler, M.A. (1995) Review of water quality objectives for algal growth potential. Hydraulics and Water Research (Asia) Ltd report No. HWR 130 to Hong Kong Government, Environmental Protection Division.

Parr, W. and Wheeler, M.A. (1996) Trends in nutrient enrichment of sensitive marine areas in England. WRc report No. CO 4055.

Parr, W., Clarke, S.J., van Dijk, P. and Morgan, N. (1997) Turbidity in English and Welsh Tidal Waters. WRc Report No. CO 4301.

Parr, W., Wheeler, M.A. and Codling, I. (1999) The Glaslyn/Dwyryd, Mawddach and Dyfi estuaries: nutrient status, nutrient budgets and ecological importance. WRc report No. CO 4704.

Parr, W., Andrews, K., Mainstone, C.P. and Clarke, S.J. (1999) Diffuse pollution: sources of N and P. WRc report No. DETR 4755 to DETR.

Peletier, H. (1996) Long-term changes in intertidal estuarine diatom assemblages related to reduced input of organic waste, *Marine Ecology-Progress Series*, **137**, 265-271.

Petranu, A. (Comp.), 1997. Black Sea Biological Diversity. Romania. New York: United Nations Publications, 314 pp

Pomeroy, L.R., Darley, W.M., Dunn, E.L., Gallagher, J.L., Haines, E.B. and Whitney, D.M. (1981) Primary production. In: L.R. Pomeroy and R.G. Wiegert (eds), *The Ecology of Salt Marsh*, 39-67. Springer-Verlag, New York.

Prairie, Y.T., Duarte, C.M. and Kalff, J. (1989) Unifying nutrient-chlorophyll-a relationships in Lakes, *Canadian Journal of Fisheries and Aquatic Sciences*, 1176-1182.

Prieur, L. and Sathyendranath, S. (1981) An optical classification of coastal and oceanic waters based on the specific spectral absorbance curves of phytoplankton pigments, dissolved organic matter, and other particulate materials, *Limnology and Oceanography*, **26**, 671-689.

Prygiel, J. and Coste, M. (1996) Diatoms and diatom indices in the networks for quality measurement of French watercourses - short history and future, *Bulletin Francais de la Peche et de la Pisciculture*, **341/42**, 65-79.

Rees, Y.J., Nixon, S.C., Parr, W. and van Dijk, P. (1994) Nutrient levels and statutory quality objectives for estuaries and coastal waters. WRc report No NR 3055/1/4277. NRA R&D Note 70.

Rekolainen, S. (1989) Phosphorus and nitrogen load from forest and agricultural areas in Finland, *Aqua Fennica*, **19**, 95-107.

Reynolds P.J. (1997) An Assessment of the A.I.S.E. Code of Good Environmental Practice for Household Laundry Detergents. Final Report to the European Commission (DGIII), EC 10735, October.

Reynolds, P.J., Bealing, D.J., Sidorowicz, S.V. and Watson, S.J. (1994) Nitrification rates in rivers and estuaries. NRA R&D Note 346.

Reynolds, P.J and Denga, Y (1999) Environmental Quality Objectives for the Black Sea Ecosystem. Final report prepared for TACIS, Project No. ENVRUS9602.

Round, F.E. (1993) A review and methods for the use of epilithic diatoms for detecting and monitoring changes in river water quality 1993. Methods for the examination of waters and associated materials. HMSO.

Russell, S. (1994a) Turbidity: a guide to measurement in water applications. WRc Instrument handbooks. WRc plc, Swindon.

Sand-Jensen, K., Nielsen, S.L., Borum, J. and Geertz, O. (1994) Fytoplankton ogmakrofyt udvikling I danske kystområder. Havforskning fra miljøstyrelsen No. 30.

Sandull, R. and de Nicola, M. (1991) Responses of meiobenthic communities along a gradient of sewage pollution, *Marine Pollution Bulletin*, **22**, 463-467.

Sas, H. (1989) Lake restoration by reduction of nutrient loading. Academia Verlag.

Scott, C.R., Hemingway, K.L., Elliott, M., de Jonge, V.N., Pethick, J.S., Malcolm, S. and Wilkinson, M. (1997) Impact of nutrients in estuaries - Phase 2 (edited by M. Ellliott). Environment Agency Project Record.

Smith, D., Hughes, R.G. and Cox, E.J. (1996) Predation of epipelic diatoms by the amphipod *Corophium volutator* and the polychaete *Nereis diversicolor*, *Marine Ecology Progress Series*, **145**, 53-61.

Sprent, J.I. (1987) *The Ecology of the Nitrogen Cycle*. Cambridge University Press.

Sullivan, M.J. and Daiber, F.C. (1975) Light, nitrogen and phosphorus limitation of edaphic algae in a Delaware salt marsh, *Journal of Experimental Marine Biology and Ecology*, **18**, 79-88.

Valiela, I, Teal, J.M. and Persson, N.Y. (1976) Production and dynamics of experimentally enriched salt marsh vegetation: below ground biomass, *Limnology and Oceanography*, **21**, 245-252.

Vinogradov, K.A. (Ed.), 1967. Biology of the north-western part of the Black Sea, Kiev: Naukova Dumka Publ., 268 pp. (in Russian).

Vorobyova, L.V., Zaitsev, Yu.P., Kulakova, I.I., 1992. Interstitial meiofauna of the Black Sea sandy beaches. Kiev: Naukova Dumka Publ., 142 pp. (in Russian).

Vos, P.C. and de Wolf, H. (1993) Diatoms as a tool for reconstructing sedimentary environments in coastal wetlands; methodological aspects, *Hydrobiologia*, **269/270**, 285-296.

Walton, S. (1994) Control of *Spartina anglica* on the Mawddach Estuary, Wales. MSc thesis, University College of North Wales, Bangor.

Watanabe, T. (1986) Saprophilous and eurysaprobic diatom taxa to organic water pollution and diatom assemblage index (DAIpo), *Diatom*, **2**, 23-73.

Watanabe, T., Asai, K. and Houki, A. (1988) Numerical estimation to organic pollution of flowing water by using the epilithic diatom assemblage - diatom assemblage index (DAIpo), *Science of the Total Environment*, **55**, 209-218.

Warwick, R.M. (1980) In: Tenore, K.R. and Coull, B.C. (eds) *Marine Benthic Dynamics*. University of South Carolina Press, Columbia.

Warwick, R.M. and Price, R. (1975) Macrofaunal production in an estuarine mudflat, *Journal of the Marine Biological Association UK*, **55**, 1-18.

Warwick, R.M., George, CL. and Davies, J.R. (1978) Annual macrofauna production in a Venus community, *Estuarine, Coastal and Marine Science*, **7**, 215.

Wells, M.L., Zorkin, N.G., and Lewis, A.G. (1983) The role of colloid chemistry in providing a source of iron to phytoplankton, *Journal of Marine Research*, **41,** 731.

Williams, R. (1984) Zooplankton of the Bristol Channel and Severn Estuary, *Marine Pollution Bulletin* , **15**, 66-70.

Williams, R. and Collins, N.R. (1984) Distribution and variability in abundance of *Schistomysis spiritus* crustacea mysidacea in the Bristol Channel, UK, in relation to environmental variables, with comments on other mysids, *Marine Biology (Berlin)*, **80**, 197-206.

Wilson, A.M. and Moser, M.E., 1994. Conservation of Black Sea wetlands: a review and preliminary action plan. IWRB Publ. 33, 76 pp. (in English).

Wyatt, R.J., Ellis, J.C., Milne, I. and Gunby, J.A. (1998) Improved environmental monitoring: manual of best practice for the design of water quality monitoring programmes. Environment Agency R&D Technical Report E59.

Zaitsev, Yu.P., (1971). Marine Neustonology. Jerusalem: Israel Program for Scientific Translations, 207 pp.

Zaitsev, Yu.P., (1992) Recent changes in the trophic structure of the Black Sea. Fisheries Oceanography, 1, 2, 180-189

Zaitsev, Yu.P., (19930. Impacts of eutrophication on the Black Sea fauna. General Fisheries Council for the Mediterranean. Studies and Reviews, Rome, FAO, 63-86

Zaitsev, Yu.P., (1998) Eutrophication of the Black Sea and its Major Consequences. In: Black Sea Pollution Assessment. Edited by L.D. Mee and G. Topping. New York: United Nations Publications, pp. 57-67

Zaitsev, Yu.P. and Alexandrov, B.G., (1998) Black Sea Biological Diversity. Ukraine. New York: United Nations Publications, 351 pp

Zaitsev, Yu. and Mamaev, V. (1997) Marine Biological Diversity in the Black Sea. A Study of Change and Decline. New York: United Nations Publications, 208 pp.

Zaitsev, Yu.P., Polischuk, L.N., Nastenko, E. V. And Trofankhuk G.M., (1988) Superconcentrations of the *Noctiluca miliaris* Suriray in the neustonic layer of the Black Sea. Doklady Acad. Nauk Ukr.SSR, 10, pp. 67-69 (in Russian).

Zedler, J., Winfield, T. and Mauiello, D. (1978) Primary productivity in a So. Carolina estuary. In: *Coastal Zone '78. Symposium on Technical, Environmental, Socioeconomic and Regulatory Aspects of Coastal Zone*

Management, Vol II, 649-662. American Society of Civil Engineers, New York.

A.1 River Concentration and Flow Data

All data manipulation can be undertaken using Excel spreadsheet software, with output files stored on an Access database. Statistical analysis of output files can be performed using the AARDVARK (Analyse Any Routine Data, Visually Acquire Real Knowledge) software package (WRc plc) which has already been selected for seasonal water quality data analysis within the Danubian countries. The choice of AARDVARK is due to a functional ability that allows data sets to be de-seasonalised. It should be noted that because of the statistical procedures utilised in the AARDVARK software, and the highly skewed nature of daily load data, for the purposed of trend or step analysis all data should be log transformed to normalise the distribution prior to analysis. An example of this is shown in Figure A1.

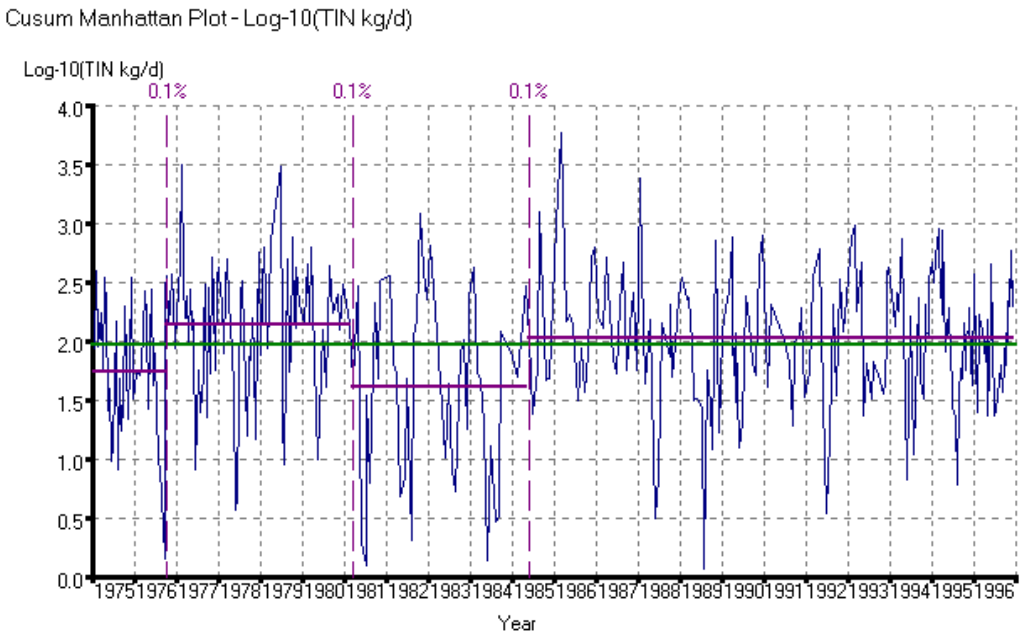

Figure A1 AARDVARK time series analysis showing statistically significant (P <5%) changes in inorganic nitrogen daily loading rates from theriver Glaslyn to the Glaslyn/Dwyryd Estuary, Wales (UK) (Parr *et al* 1999)

AARDVARK is a very useful tool for temporal step analysis (it detects sudden, statistically significant changes in concentrations or loads) and is likely to be very useful for the analysis of loads to the Black Sea and concentrations within the Sea. However, AARDVARK it is not designed for the purposes of trend analysis, since data showing a statistically significant trend may not contain statistically significant step changes. Since AARDVARK was first produced, the suite of WRc statistical software for the design of monitoring programmes and interpretation of monitoring data has expanded considerably. The most notable advance occurred as a result of the Integrated Environmental Monitoring work programme undertaken for the English and Welsh Environment Agency in the UK (Wyatt *et al* 1998). This has resulted in the production of statistical software which performs both step and trend analysis.

The calculation of in-stream nutrient loads (and any pollutant loads) from point sources to a large waterbody may appear to be a simple procedure and, indeed, this is

the case if the concentration varies little and flow is measured frequently. But error and variability can be introduced due to a range of factors, such as:

- Analytical precision (the variability in results when the concentration of a single sample is measured many times).
- Accuracy or bias (how close the average of these values is to the actual concentration in the sample and, if different, whether the average concentration over- or underestimates the concentration.
- Limits of detection used for the analysis - what proportion of determinations are less than this value.
- The quality of flow monitoring data.
- Whether the flow and concentration data are collected at the same site on the river.
- Whether the sample is representative of the water passing that point across the whole river cross sectional area at the time of sample collection.
- The relationship between concentration, load and river flow, and the degree of scatter associated with these relationships.

Thus, calculated nutrient loads should always be presented with an indication of the confidence associated with such estimates. Such calculated loads should not be regarded as absolute values, but rather as an indication of the likely load. Wyatt *et al*, 1998) demonstrated that on the most downstream freshwater sampling site on the River Thames, estimated in-stream annual loads based on weekly spot sampling and continuous flow monitoring were accurate only to within ±25%, while estimates based on monthly spot samples may easily have erred by ±50%. Clearly, the greater the sampling frequency the more confidence associated with the estimation of instream loads. We suggest that weekly sampling of nutrients should be undertaken in all major rivers feeding the Black Sea.

Thus, a 10% or 15% decrease in the estimated instream N or P load will be of no significance whatsoever if the 90% confidence limits associated with that load are ±25%. Such a decrease in loads could well be followed by a 20% increase in the following year, and still not be significant. The calculation of confidence limits when estimating river loads must not be considered a luxury, it is an essential part of data analysis.

However, the larger the catchment area and greater the flow of a river, the lesser the inter-annual variability. Thus, minor rivers draining catchments of, say, 300 km^2 or less, estimated inter-annual variability in phosphorus loads may vary by a factor of 3, depending on sampling frequency (e.g. Parr and Wheeler 1996), even when no major environmental changes have occurred in the catchment.

Two methods may be employed to calculate nutrient and suspended solids loads (Ellis *et al* 1993):

1. The first method involves supplying mean flow data only for those days when samples were taken for nutrients/suspended solids analysis. For such rivers, annual loads can be calculated as the arithmetic mean of the observed instantaneous (daily) loads multiplied by the number of days in each year. Instantaneous loads are calculated as the product of sample concentrations and mean daily flows. This method is routinely used by the

Environment Agency in the United Kingdom and under OSPARCOM for estimating loads of Red List substances.

2. For rivers for which mean daily flows are provided for all or most days of each year (instead of just the days when nutrients/suspended solids concentrations were sampled) the following formula should used:

$$annual\ load = \bar{l} \times \left(\overline{Q}/\overline{q}\right)$$

Where:

$\bar{l}$ = annual mean flow as calculated above.

$\overline{Q}$ = true mean flow over a period (usually 1 year but where flow data were available for less than a full year $\overline{Q}$ is estimated from the full period for which daily mean flow data were available).

$\overline{q}$ = arithmetic mean of daily flows on those days for which sample concentration data are available.

In the second method, the factor $\overline{Q}/\overline{q}$ provides a correction that, in most circumstances, improves the precision of the calculated mean annual load. No confidence limits are presented.

APPENDIX B Proposed monitoring strategy for the Black Sea

KEY

M	Monthly	S/Y	Seasonal or yearly (monitoring frequency to be decide
W	Weekly	Y	Yearly
M/2	T wice monthly	1/3Y	Once every three years
S	Seasonal	*Shaded area reflect monitoring parameters identified for nutri*	

	General Ecosystem			*Bathing waters*			*Special protected areas*			*Ports*		
	Water	**Sediment**	**Biota**	**Water**	**Sediment**	**Biota**	**Water**	**Sediment**	**Biota**	**Water**	**Sediment**	**Biota**
PHYSICAL												
Temp	S			W			S			M		
Suspended matter	S						S			M		
Salinity	S						S			M		
Secchi disc	S			M/2			S			M		
Colour	S						S			M		
Floating debris	S			D			S			M		
Gravimetric		>Y						>Y			>Y	
Detergent	S	S		M			S	S		M		
CHEMICAL												
Dissolved oxygen	S						S			M		
BOD	S			M			S			S		
pH				M								
H_2S	S											
TOC	S	Y					S	Y		S	S	
NO_2	S						S			S		

NO_3	S						S			S		
NH_4	S						S			S		
Organic N	S						S			S		
Total N	S	Y					S	Y		S	S	
PO_4	S						S			S		
Organic P	S						S			S		
Total P	S	Y					S	Y		S	S	
Silicon (dissolved)	S						S			S		

CONTAMINANTS												
Metals	S/Y	>Y	Y				S/Y	>Y	Y	S/Y	>Y	Y
Petroleum hydrocarbons	S/Y	>Y	Y				S/Y	>Y	Y	S/Y	>Y	Y
Extractable organic matter	S/Y	>Y	Y				S/Y	>Y	Y	S/Y	>Y	Y
PAHs	S/Y	>Y	Y				S/Y	>Y	Y	S/Y	>Y	Y
Lindane	S/Y						S/Y			S/Y		
PCBs	S/Y	>Y	Y				S/Y	>Y	Y	S/Y	>Y	Y
TBT	S/Y	>Y	Y				S/Y	>Y	Y	S/Y	>Y	Y
Radionuclides	S/Y	>Y	Y				S/Y	>Y	Y	S/Y	>Y	Y

BIOLOGY												
Chlorophyll	S						S			S		
Phytoplankton	S						S			S		
Zooplankton	S						S			S		
Benthos		S						S			S	
Macro phyto benthos		S						S			S	
Red Book species	1/3Y						1/3Y			1/3Y		
Fish Stock assessment	1/3Y						1/3Y			1/3Y		
Mammals	1/3Y						1/3Y			1/3Y		

MICROBIOLOGY												
E.coli		S	S	M/2	Y	S		S	S	S	S	S
Faecal Strep.		S	S	M/2	Y	S		S	S	S	S	S
Pathogens		S	S	M/2	Y	S		S	S	S	S	S
Viruses		S	S	M/2	Y	S		S	S	S	S	S
Fungi		S	S	Y/2	Y			S	S	S	S	S

	General Ecosystem			*Bathing waters*			*Special protected areas*			*Ports*		
	Water	**Sediment**	**Biota**	**Water**	**Sediment**	**Biota**	**Water**	**Sediment**	**Biota**	**Water**	**Sediment**	**Biota**
BIOLOGICAL EFFECTS												
Organism			Y						Y			Y
Cellular			Y						Y			Y

Preamble

This appendix has been included within the report solely to aid those responsible for the assessment and the future implementation of economic instruments in the Black Sea region.

The review details, on a world-wide basis, the following experience of economic instruments used for nutrient control: (i) the range and type of instruments, (ii) past research into economic instruments for N and P and (iii) cost structures. Economic instruments presently in use for nutrient control within the Black Sea region are provided at the end of the review. No attempt has been made by the authors to suggest appropriate instruments for use within the Black Sea region as this is outside the scope of the present study.

C.1 Key Aspects of Economic Instruments

Three key aspects of economic instruments that have been used worldwide to address the issue of nutrient reduction and control are presented in this appendix. These include:

- ***Range and types of instruments:*** past and current research examining the range and types of models for the application of economic instruments.
- ***Control costs:*** past and current research examining the cost structures and patterns faced by agents responsible for nutrient pollution, and
- ***Damage costs/benefits:*** past and current research examining the total and marginal damage associated with activities leading to a reduction of nutrient pollution.

C.1.1 Key issues of nutrient control

1. The variability of the effects of nutrients given the concentration, weather conditions, the nature of the waterbody, season, crop type, type of soil.
2. The varied nature of potential damage including human health and the environment.
3. Uncertainty regarding optimum economic fertiliser application rates, particularly for organic fertilisers, and consequent surplus use.
4. The influence of various related policy objectives - national aspirations, EC Directives (environmental and health related).
5. The range of instruments available - product charges for phosphate detergents, charges on chemical fertiliser nutrient content, charges with rebates to reflect local

conditions, tradable permits for fertiliser use or purchase, permits based on proxy measures such as stocking rates.

6. The inelasticity of demand for commercial fertilisers.
7. The interrelationship between chemical fertilisers and other inputs and the difficulty of "accounting" for all farm fertiliser usage.

8. The potential for point – non- point permit trading.

C.2 Range and type of instruments used for nutrient control

A wide range of publications dealing with the comparative analysis of policies to control N and P are in evidence worldwide.

Table C.1 summarises the range of economic instruments that have been or are currently applied.

Table C.1 Inventory of economic instruments

Economic Instrument	Comment
Taxation	Any scheme where a charge is made on a product or activity. Terms like levy, charge, tax are generally interchangeable. Applied in a number of countries: Sweden, Austria, Netherlands, Belgium, Germany and Norway. Application is either at the manufacturer sales stage (Sweden) or on manure surpluses/on farm mineral balances (Netherlands, Belgium, France).
Liability (fines)	Fines (as opposed to taxes) on excessive nutrient application as applied in Denmark.
Direct Payments/Subsidy	Payments made to agents to secure specific environmental goals. Incentive element most important where schemes are voluntary. Applied in many countries: Germany, Sweden, UK and the US. Technically should include public provision of advice/assistance - which is widespread.
Cost sharing	Similar to direct payments but with contribution from the polluter. Applied widely in the US. Economic incentives paramount in cost sharing bid procedures.
Tradeable rights	Allocation of rights to a specific pollution quota, e.g. catchment wide maximum daily load. Main experience in the US although still at a developmental stage.
Cross compliance	Typically where a non environmentally orientated direct payment is tied to environmental compliance. Applied notably in the US and Switzerland.
Eco-labelling	Labelling of products which have been produced using environmentally appropriate methods and materials. Applied in Switzerland and the US (not nutrients). To some extent applied in other countries in terms of "organic farming".
Rights purchase	Similar to direct payments - involving the purchase of an agents right to pollute and typically conservation banking of this right. Some experience in the US.

The following section provides more detail on a number of these approaches in Sweden, Switzerland, the US, Netherlands, Denmark, Germany, France and other countries.

C.2.1 Sweden

Kumm (1990) discusses Sweden's efforts to control nutrient pollution from agriculture, which as well as fertiliser taxes includes intensive extension programmes and incentives. Although the programmes have raised revenues and been useful in local circumstances it is argued that their efforts have been swamped by other policies which have tended to exacerbate the problem.

Some form of charge on fertilisers have been used in Sweden since 1982. This began with a "price regulation charge" and evolved into a tax. The original aim of the price regulation charge was to finance the reduction in surplus cereal production/export. The charge gradually increased to 20% of the price of fertilisers in 1990. In 1984 an environmental charge was introduced, which by 1990 was about 10% of the price of fertilisers (in addition to the price regulation charge).

Kumm reports the difficulty of assessing the impact of the tax and charge given the other policies and trends occurring at the same time (such as that available for food protein levels which has encouraged fertiliser use and growing environmental awareness in the agricultural community).

The Swedish Environmental Protection Agency (SEPA 1997) present an evaluation of the taxation system used for commercial fertilisers. It is stated that the purpose of the tax was to reduce demand and to fund a programme to reduce the impacts of agriculture on the environment. The price regulation charge ceased in 1993. In 1995 the environmental charge was converted to tax status. While the "price regulation charge" applied to nitrogen, phosphorus and potassium, the fertiliser tax applied only to nitrogen and phosphorus. In 1994 the charge on phosphorus was abolished and replaced with a charge on cadmium.

The original charge on cadmium applied to fertiliser containing above 50 $g.tonne^{-1}$. It was adjusted quickly when it became apparent that no commercial fertiliser had a cadmium content in excess of 50 $g.tonne^{-1}$. Revenues from the current charges are estimated as SEK 300m ($35m - the vast majority of which comes from nitrogen). The percentage of price accounted for by the charge has varied over the period of implementation - at its height the charge represented 30% to 35% of the price but is now at about 20%.

Originally administered by the National Board of Agriculture the tax is now administered by the Darlana County Tax Authority. The charge is levied on fertiliser manufactured in Sweden or imported. Manufacturers and importers are required to register, submit returns and pay the tax on the quantity they deliver each month. Of 45 registered manufacturers, 37 import for resale, 5 import for re-use and only 3

manufacture in Sweden. Some "undeclared import for own use" is known to occur but is not considered to be widespread.

The tax is considered to be easy to administer. The National Board of Agriculture's administration costs were estimated as SEK 0.5m annually ($600,000). SEPA suggest that the total costs amount to 0.8% of revenue - assuming that the manufacturer's administration costs are equivalent to those of the authority.
It is estimated that the charges have probably reduced fertiliser use by 10% to 20%. In its evaluation of the tax the National Board of Agriculture concluded that the main impact had been indirect - through the action programmes financed as a result of the tax. These programmes have continued despite the conversion of the charge into a tax.

C.2.2 Switzerland

Curry and Stucki (1997) describe Swiss agricultural policy which has developed separately from other European states. It is described as a "progressive direct payment system". A wide range of direct payment (subsidies) are in evidence based on an equally wide range of objectives. Payments are made as:

- compensatory payments - for general benefits in the public interest (e.g. supplements for grassland farms),
- supplements for farming in difficult areas,
- compensation for lower yields as a result of extensification,
- payments for particular types and means of production,
- social payments - to encourage small family farms.

The payments have an explicit role in the provision of public interest benefits (non-market goods). As in the US participation is voluntary, although cross-compliance (to receive price support) is also used. Evaluation criteria are linked to the payments which may be withheld (or need to be reimbursed) if the criteria are not met.

Various levels of direct environmental payments are available based on the level of "ecological" farming involved:

- ***Biological diversity on farmland*** - requiring extensive grassland cultivation and other add-ons to traditional farms.
- ***Integrated production (IP)*** - which applies to the whole farm and requires reduced inputs and the attainment of ecological and animal welfare targets above the norm. A "well-balanced use of fertiliser" according to farm requirements (e.g. a phosphorus balance of 10% in excess of that required by the vegetation) is stipulated.
- ***IP with eco-labelling*** - which allow farm produce to be labelled and achieve price premiums from consumers in return for conditions more exacting than IP alone.
- ***Organic farming*** - recognised as a distinct farming system and attracts the highest levels of direct payments.

The tiered system is seen as a method to progressively encourage farmers to achieve ecological farming as a whole. Apart from the direct payment incentives other incentives are obviously operating (e.g. moving into the IP and organic schemes involves costs but allows entrance into the premium organic produce market).

The cost of the whole scheme in 1993 was 55m CHF ($36m) and is probably closer to 500m CHF ($350m) currently. The vast majority of farms in Switzerland operate in one or all of the schemes - in 1995, 40% were either IP or organic. As Curry and Stucki (1997) point out there are many similarities between the Swiss program and other schemes in operation in EU member states such as the nitrate sensitive areas piloted in England and Wales or the MEKA programme in Germany's Baden Wurttemberg. What distinguishes the Swiss example is the degree of participation, the national coverage and the integrated nature of the approach.

C.2.3 United States

The main experience in the US has been with voluntary direct payment systems and tradeable rights. However, other economic instruments are also used. Francis (1992) reports that some US states employ a small tonnage tax on fertiliser production to support educational and research efforts. Farmers, and the industry appear to be amenable to such policies. Liang (1998) also reports that some states apply taxes on fertilisers but no federal programme operates.

Reichelderfer (1990) reports on the mainstream US experience, tied as it is mainly to erosion control strategies, with the use of incentives through cross-compliance. American agricultural policy has been characterised by a wide range of programs aimed at specific objectives in which farmers can voluntarily choose to participate based on the degree of incentive to them. The main programmes can be classified as:

- ***Technical assistance programmes*** - publicly provided technical assistance, in the context of economic instruments, needs to be seen as a subsidy for the development of human capital on farms. The major programme has been the Conservation Technical Assistance Program. Programmes have been criticised for discouraging the conservation of wetlands.
- ***Conservation subsidies*** - the federal Agricultural Conservation Program provides cost sharing assistance to farmers. Many programmes have been criticised for focusing on cost-sharing for production rather than conservation programs.
- ***Land rental for cropland conversion and retirement*** - the Soil Bank program for example, where farmers are paid annual rents to take land out of production. The Conservation Reserve Program is similar although funds are distributed through a quasi-bid system. To gain entry in a CRP a farmer must "bid" a rental amount. Only where the bid is below the maximum acceptable rental will the land be entered.
- ***Cross-compliance incentive programmes*** - the main scheme, conservation compliance, involves the adoption of certain restrictions in-order for farmers to continue to receive US Department of Agriculture benefits.

Neilsen *et al* (1989, reported in Reichelderfer) reports that conservation investment has been more influenced by macroeconomic factors (interest rates, market expectations etc.) than by the various incentive programmes. Significant impacts are only found to occur when the macroeconomic conditions are right. As these are outside the control of the programme, a high degree of uncertainty is associated with the outcome of such programmes.

Reichelderfer also points to the issue of counter and co-incentives operating within the variety of measures applied in the US. While co-incentives promote synergy, counter-incentives have the effect of cancelling each other out because the incentives are pulling in different directions. Conservation incentives for example are counter-incentives to agricultural commodity market support. Cross compliance programmes can be seen as being aimed at resolving the mixed incentives. Shortle and Laughland (1994) also point out that most evaluations of the effectiveness of economic and other policy instruments tend to ignore possible responses from other measures (e.g. increased price support) and consequently overestimate the likely effectiveness and underestimate the costs.

Helfand and Archibald (1990) report on California's Proposition 65, which involves labelling standards and public exposure restrictions for chemicals used in agriculture. Although directed mainly to toxic substances the approach has possibilities in terms of fertilisers and it could be argued that "organic labelling" of products has provided incentives for the reduction in fertiliser use.

Some experience has been established in the US through the use of watershed based trading arrangements (USEPA 1996). Table C.2 summarises the extent of experience in 1996.

Table C.2 US experience in tradeable rights

Area	Trade	Pollutant	Comments
Cherry Creek, CO	PS↔NPS	P	Point sources can earn credits by developing non-point source phosphorus controls. Implementation delayed because of an as yet unmet requirement for urban non-point sources to be halved before trades can take place.
Lake Dillon, CO	PS↔NPS NPS↔NPS	P	Wastewater treatment plants receive load credits by purchasing non-point source reductions. Few PS↔NPS and attention has shifted to NPS↔NPS.
Tar Pimlico R Basin, NC	PS↔NPS	N	Wastewater treatment plants receive credits for nitrogen load reductions by paying $85 per kg into a cost share fund which is used to support agricultural BMP's. Pollution control was thought to entail a cost of $375 to $750 per kg.

Note: PS - Point source, NPS - Non Point Source
A variety of schemes are reported to be at developmental stages. The majority of these are point to non point systems.

The report of USEPA is also useful in that it provides a framework for analysing situations in which trades may take place. The report stresses the incremental opportunities of trading and the development of partnerships at a watershed level. Five generic trading possibilities are discussed (point to point, intra-plant, pre-treatment trading, point to non-point and non-point to non-point). Two trading mechanisms are identified:

- trades within a total maximum daily load (TMDL), and

- trades within a point source permit.

Factors understood to influence the possibility of trading include: trading ratios (i.e. trading price), transaction costs, uncertainty and its alleviation, number of participants and availability of cost data. A number of worksheets are detailed which allow the screening of trading possibilities. Adler (1994), however, points out that progress on calculating maximum watershed loading rates has been slow.

The Pamlico-Tar Nutrient Trading Program's first phase (see Section 1.4) has largely been the subject of praise from the state, dischargers, and environmental groups. By addressing non-point sources, the state and environmental groups have gained a reduction program that is more comprehensive than the original NSW strategy. Dischargers are benefiting from the increased flexibility and cost-effectiveness of the trading approach. However, Phase 2 will be met with a number of challenges, including tracking compliance, determining accountability, and making sure that load reductions are actually achieved. The trading program is designed so that once a discharger makes a trading payment to the state for BMPs its responsibility for that share of pollutant reduction ends for that year. The $56 per kilogram per year trading factor is also a subject of continued debate. The technical basis for the value is poorly documented and must be further validated. In addition, the plan does not include provisions for escalating the factor due to inflation or other factors. The Association has applied for a USDA grant to study BMP effectiveness to address these challenges in Phase 2.

Boggess *et al* (1993) report on the development of management options to control phosphorus pollution of the Okeechobee. Management developed through the use of Agricultural BMP's but in 1987 led to the development of a novel rights purchase strategy whereby the state purchased the rights of the farmers to undertake dairy operations at a cost of $600 per cow. The ownership of the land capital equipment remained with the farmers. This rights purchase operated on those farms where the traditional cost sharing approach to the implementation of BMP's was considered by the farmers as too expensive.

Lichtenberg *et al* (1993) report on the cost sharing and technical assistance programme in Maryland. Traditional economic theory argues against subsidy type arrangements (such as cost sharing and the free provision of technical assistance) as a method for pollution control because they contain an incentive for industry expansion (e.g. through entering land in programmes that would not be cultivated otherwise). A counter argument is that such arrangements can be effective for small farmers who could not otherwise afford to comply with regulations. Lichtenberg's analysis of cost sharing programmes in Maryland, however, shows that it is the larger farms who tend to participate. The implication is that there remain barriers to effectively reaching small farmers through cost sharing agreements and that they should perhaps be regulated in a different manner from larger farms.

Kozloff *et al* (1992) report on the interest in the US shown in the concept of micro-targeting whereby state aided control programmes target a ranked set of land parcels rather than being applied to the catchment as a whole. Significant benefits from micro-targeting of measures are shown. Targeting is accomplished using disaggregated information about physical and economic factors that influence benefits and costs of adopting alternative land management techniques. Cost effectiveness of the strategy increases with the incorporation of further information on the heterogeneous economic factors (opportunity cost of the retired land) and physical

factors (contribution of the land to downstream load) that exist within the catchment (see also Fox *et al* 1995).

C.2.4 Netherlands

The OECD (1995) discusses a surplus manure tax applied in the Netherlands. The tax is applied to the production of animal manure according to the weight of phosphate produced. A tiered system operates with farms producing less that 125 $kg.ha^{-1}.yr^{-1}$ paying no tax. For farms producing 125-200 the tax is 0.25GL rising to 50GL for farms producing more than 200 $kg.ha^{-1}.yr^{-1}$. The Netherlands has recently introduced compulsory mineral budgets for farms as part of the National Environmental Policy Plan.

The use of a levy on manure in the Netherlands needs to be seen within the broader policy on manure and ammonia, which began in the early 1980s and is now in its third phase

- Phase 1: stabilisation of the environmental burden - involving manure production rights and use standards for livestock manure,
- Phase 2: reduction in environmental burden - tightening of use standards,
- Phase 3: achievement of equilibrium.

Phase 3 involves a mainly targeted approach on those farms associated with the greatest burden (greatest mineral losses per unit area). It was decided that mineral losses per hectare would be too difficult to measure and stocking rates were chosen as a proxy measure. As livestock registration is already required such requirements would be administratively efficient. A 'Minerals Accounting System (MINAS)' is required for farms with more than 2.5 livestock units per hectare reducing to 2 $units.ha^{-1}$ in 2002 (1 livestock unit = 1 dairy cow). Registration of mineral looses is required for pig and poultry farmers, mixed cattle and intensive cattle farmers.

MINAS involves the registration of mineral inputs (nitrogen and phosphate) used on a farm in fertiliser and animal feeds, and the mineral output in the form of products and manure (Mineral loss = Input (fertiliser and feed) - Output (product, manure))

Where the loss is larger than the allowable standard the farmer must pay a levy. MINAS has been developed jointly between industry and government. It is felt that MINAS does not require much administration for farmers as the required data are already part of normal financial administration of the farm. The burden on the government, however, is stated as being "considerable".

Farmers are allowed to declare either an exact (measured) mineral loss or a standard amount. Reporting exact losses provides an incentive for some farms to more closely track their mineral balances in return for savings. That part of mineral losses regarded as acceptable is termed the loss standard and no levy is paid on this amount. The phosphate and nitrogen loss standards are set to fall from 1998 to 2008 as detailed in Table C.3.

It is estimated that livestock farmers would see a 3% reduction in income as a result of these standards. For pig farmers this would be more like 15% while poultry and arable farmers are not expected to be affected.

As shown in Table C.3, a progressive taxation system is used, with for example, a rate of 5 Dfl.kg^{-1} on the first 10 kg above the loss standard rising to 20 Dfl for any further losses. The levies have been set so that they are higher on average than the most expensive disposal option - to encourage farmers to invest in alternative disposal options (improved feed, manure application management and manure redistribution) rather than pay the levy.

Table C.3 Development of the Dutch manure levy

	1998	2000	2002	2005	2008
Phosphate loss standard (kg P_2O_5.ha^{-1})	40	35	30	25	20
Nitrogen loss standards (kg N.ha^{-1})	300	275	250	200	180
Low levy (dfl 5) for phosphorus loss (kg P_2O_5.ha^{-1})	40-50	35-45	30-40	25-30	
Low levy (dfl 5) for phosphorus loss exceeding (kg P_2O_5.ha^{-1})	50	45	40	30	
Phosphorus supply standard		85	80	80	80
on grassland	120				
on arable land	100				

One option potentially available to farmers is obviously to export their surplus manure to other farms - notably arable farms not subject to control. To combat this a manure supply standard also operates which stipulates the amount of manure each farm is allowed to accept.

Other notable features of the Dutch policy include the progressive retirement of rights for manure production. A proportion of rights are not tied to the land and can be siphoned off when title is transferred. Several million kg of phosphate are likely to be reduced by 2002 in this way. A provision is included whereby the relocation of a farm is subject to lower reduction in production rights than sale. This policy is seen as incorporating an incentive for farms to relocate to less sensitive areas. In addition a rights purchase based restructuring fund has been set up to purchase rights not attached to the land. Apparently these rights can be freely traded on the market although the extent of trading is not clear.

C.2.5 Belgium

In Belgium a tax applied to surplus manure has operated since 1991 in the Flemish region. A base charge is levied on the nitrogen and phosphate content of surplus manure and a disposal change is levied on quantities disposed by Mestbank (the organisation established with responsibilities for manure disposal). Frederiksen (1994) also discusses the taxation of calculated farm mineral surpluses in Flanders and the requirement for large livestock farms to pay a levy based on manure production in the Walloon region.

van Gijseghem (1997) reviews the implementation of nitrate policies in Flanders. As a result of the Nitrate Directive a Manure Action Plan was developed which included a

combination of command and control regulation with an economic instrument in the form of a levy, in addition to education and awareness measures. The problem with manure in Flanders is due to explosive growth in livestock production in the last three decades. Part of the problem related to the economic stimulation of land independent livestock farms near manufacturers of feed (who were in turn generally located close to harbours and rivers for production processes).

The 1991 Manure Decree established limits to the use of fertilisers, mineral production coefficients, a definition of manure surplus and a levy based on the defined surplus. The nitrogen and phosphate production at farm level serve as a basis for the calculation of a levy. According to van Gijseghem farmers have no incentive to change farm manure production because the levy is too low to provide an incentive to reduce livestock production.

Rather than use the levy as an incentive mechanism strict disposal rules have been developed. A quota system exits at a regional level with the region divided into white, grey and black areas. In white and grey areas (phosphate production is lower than 100 $kg.ha^{-1}$) and is allowed to grow to 100 $kg.ha^{-1}$. In black areas production is greater than 125 $kg.ha^{-1}$ and growth is only permitted if production is reduced elsewhere. Limited disposal routes have required intensive farms to transport manure long distances to receiving farms and from 1999 onwards to manure processing plants.

C.2.6 Denmark

Schou (1997) reports on the Danish Plan for Sustainable Agriculture which contains a system of fines for excessive nitrogen use. The original plan was introduced in 1991 with the rules enforced from 1993. The aim was to ensure a better utilisation of nitrogen in manure, with utilisation standards set together with rules to ensure that the amount of nitrogen in fertilises and manure at farm level must not exceed the estimated need for nitrogen.

The farm level need for nitrogen is calculated on the basis of cultivated area and a crop specific standard coefficient. The standard coefficient has a number of adjustment factors reflecting soil type, climate zones, and expected yield (with further adjustments available if accompanied by documentary evidence).

A value is calculated for each farm (u) representing the utilisation of manure on farm. This is calculated as:

$$u = \frac{N - Nf}{Nm}$$

Where N is nitrogen (kg) and the subscripts m and f denote nitrogen in manure and fertilisers respectively. As Schou observes, if u is taken as fixed as is the case given the minimum utilisation standards then this rule is equivalent to a quota at farm level. To implement the regulations farmers must make a plan regarding, crop rotation, available manure and the purchase of fertilisers. Available manure is calculated with reference to the number and combination of livestock on farm. Purchased fertilisers are measured (and checked) with regard to farm accounts.

The fine/charge is made on farmers who do not make a sufficiently high utilisation of their manure. According to Schou the fine is proposed to be set at about 20 DKr per excessive kilogram plus a fixed change of 1000 DKr.kg^{-1}. Hence 10 excessive kg's would attract a charge of 1,200 DKr ($170). The system is enforced through a series of spot checks, of which over 30,000 were carried out in 1993/94 representing 30% of the total farm population.

A major issue associated with the Danish system is the ability of farmers to overestimate expected yields (which were not cross checked with historical records). There is an incentive, therefore for farmers to overestimate yields to secure compliance. From 1996/97 this was corrected by ruling that if nitrogen application is to exceed the standard nitrogen need (based on expected yields for crop types and areas) then this needs to be argued by the farmer on the basis of historical yield records or by the results of soil analysis.

C.2.7 Germany

The main areas of high nitrate concentrations are located in Northern Germany (Niedersachsen) as a result of intensive farming (maize, potatoes and sugar beet) and livestock raising and in other regions because of specialised crops (vegetables and fruit).

The general aim is to control the nitrate problem through changes in agricultural practice, with water treatment seen as a last resort. There has long been an acceptance of the principle of paying compensation to farmers for the loss in yield associated with measures to restrict nitrate pollution. This principle was first put into practice in Baden-Wurttemburg in 1986 where the "ecology programme" of the State government outlined measures to safeguard drinking water quality and payments to farmers for reductions in income due to the application of less intensive farming. The state regulations for "Protection Zones and Compensation" came into law in 1987. The regulations amended the water law of Baden Wurttemburg to legalise the levelling of charges for the abstraction of water with the revenue providing the funds necessary for the compensation to farmers. The system can therefore be thought of as an instance of the "beneficiary pays" principle. in that a tax is levied on the parties potentially benefiting from the nitrate reductions (water abstractors). The amended water law laid down the charges shown in Table C.4 for abstractions. These are highest for public water supply, but abstractions from groundwater and most industrialuses are charged higher than, for example, abstraction for crop irrigation.

Under the regulations the farmer can either opt for a lump sum payment (approximately $150 per hectare when introduced (this includes approximately $45 for the use of approved pesticides) obtainable without needing to prove actual income loss, or apply for an actual assessment of loss. It is generally felt that the standard loss figure is generous for most crops and that individual applications were made difficult in order to keep the administrative burden low. In only a few cases (5%) would it be profitable to apply for an actual loss assessment (e.g. for specialised crops such as asparagus and strawberries). This would be expected to restrict the incentives for farmers to go beyond the loss standard.

Table C.4 Abstraction charges in Germany

Abstraction purpose	Charge DM.m^{-3}

For public water supply	0.1+VAT
For geothermal power generation	0.01
For cooling water from surface water	0.01
For irrigation water from surface water	0.01
For other industrial water from surface water	0.04
For abstractions from ground water	0.1

Strictly, compensation is payable if the soil nitrate concentration is less than 45 kg NO_3-N.ha^{-1}. However, this was widely viewed as unrealistic and compensation was actually given if concentrations were above this level but reducing over time. The compensation arrangements, therefore, require a substantial monitoring programme - with 150,000 locations aimed at being sampled annually. It was hoped that these costs would reduce as better field tests were developed (at introduction sampling costs were approximately $1.5m given costs per location of $10.5 with total costs including administration etc. running at $5m). The payments are made ahead of the growing season and claimed back if the conditions are not met.

Some of the funds raised by the levy are used for educational programmes. In addition approximately 100 model farms were set up, reflecting all as wide a range of climactic and growing conditions in the state, where farming is undertaken in strict accordance to the rules governing good agricultural practice. Should exceedences be experienced in these farms (e.g. because of extreme climatic conditions) allowance is made in the compensation arrangements. It should be noted that at the time of introduction in Baden Wurttemburg it was envisaged that the compensation payments would run parallel to a system of fines (for soil concentrations above 90 kg NO_3-N.ha^{-1}). The fine system was not approved, however.

C.2.8 France

Versmersch and Raould (1997) report on a levy system applied by French River Basin Agencies regarding nitrate pollution. The main problems in France relate to animal intensive livestock farming and consequent animal wastes. Brittany is the region with the greatest problem with regard to intensive livestock production.

The 1964 Water Act introduced a system of fees for point sources covering a wide range of pollutants. The revenues are distributed to dischargers as grants, soft loans and rewards for abating pollution. There has also, since 1975, been a clear legal basis for imposing fines on non-point sources. In 1982 there was a proposal (never realised because of the opposition of farmers unions) to impose fines on pig farmers per pig according to disposal availability and spreading quality. In 1991, however, the French government decided to address the nitrate problem by introducing a levy on nitric nitrogen with the aim of extending the polluter pays principle to cover agriculture.

The levy covers four substances in livestock farming, suspended solids, oxidisable matter, reduced nitrogen and reduced phosphate. There are three steps to the calculation of the levy for an individual farm. Firstly emissions are calculated for each pollutant and each category of livestock. Coefficients are used to translate the number of animals into quantity of polluting substances and from this a gross charge is estimated.

Secondly, farms are classified according to a number of parameters including storage capacity, location of buildings, run-off from buildings, manure spreading scheme and

livestock density. Through this procedure farms are placed into one of nine categories reflecting abatement performance. The value of abatement performance is then calculated in monetary terms to arrive at a farm premium.

Finally the net charge is calculated as:

Net Pollution Charge = Gross Pollution Charge - Abatement Premium

If the net pollution charge is greater than a specified level (6,500 FF or $1050) which according to Versmersch and Raould represents a population equivalent of 200 and the "monetary equivalent of the farmer's rights on the environment", then a charge is payable.

The fee system was intended to be introduced in stages with subsidies given at early stages to ease transition. Protests from farmers groups (notably pig producers because of the exclusion of mineral fertilisers) lead to a delay in the implementation schedule. Large farms entered the scheme in 1995 with the scheme operational by 2000 but farmers will only pay full charges in 2003 because of transitional arrangements.

The information for applying the charges is derived from a compulsory farm environmental audit. This audit represents the point of departure for negotiations between the basin agency and the farm with the objective to achieve individual agreements which would reduce the net charge (e.g. through an enhanced abatement premium). Any such investment would then be state subsidised (up to 60%). According to calculations by Versmersch and Raould the total cost of the programme for France would be in the region of 12 to 16 billion FF ($2 to $2.6 billion).

C.2.9 Other countries

The majority of evidence on the experience of other countries relates to various forms of fertiliser tax applied in Northern Europe. The OECD (1995) discuss the Austrian fertiliser levy which was introduced in 1986. Despite being applied at a low level, this is described as having a significant effect on fertiliser use. No further information on this levy was available.

A fertiliser tax has also been applied in Norway since 1988. The tax is paid by wholesalers based on the content of nitrogen and phosphorus. Rapid increases in the tax were witnessed in the first years although overall the increases have lagged behind general price inflation. In 1995 the tax represented approximately 20% of the product price.

It is understood (OECD 1995) that Finland operated a fertiliser tax which was applied to the nitrogen and phosphorus content which was repealed in 1994. The tax is described as an excise tax and was 2.60 Finnish Marks.kg N^{-1} and 1.7 Finnish Marks.kg P^{-1} ($0.45 and $0.3, respectively) and raised a revenue of 516 million FIM in 1993 ($90m).

C.2.10 Experience with Applied Economic Instruments – Summary

Table C.5 summarises experience with economic instruments in a number of countries on the basis of a number of common themes:

- the objective sought in introducing the instrument;
- the nature of the instrument (tax, fine, subsidy, etc.);
- the coverage (nitrogen, phosphorus, both);
- the nature of the wider regulatory system within which the instrument operates;
- the level of application (e.g. amount of the charge or scale of application);
- issues related to administration, including costs etc.;
- the existence of complimentary measures; and
- an assessment of effectiveness.

Table C.5 Summary of applied economic instruments

Economic instrument	Fertiliser taxation in Sweden	Direct payment with eco-labelling in Switzerland	Tradeable rights in US	Levy on mineral balances in Netherlands	Manure levy in Flanders (Belgium)	Nitrogen fines in Denmark	German water tax and compensation scheme	French pollution charges
Objective	To reduce demand for chemical fertilisers and fund programmes	To secure public interest benefits from agriculture	To secure cost effective watershed improvements	Balance on farm inputs and outputs of minerals	Sustainable mineral use on farms and meeting requirements of Nitrates Directive	Better utilisation of Nitrogen in manure	Mainly drinking water protection (high reliance on groundwater)	Combat problems of intensive animal husbandry
Nature	Tax on manufacturer sales at point of delivery	Compliance with environmental objectives allows entry to premium organic markets	Varied. Generally some credit earned by point sources by securing improvements in alternative sources	Levy on surplus minerals, manure	Tax on surplus manure	Fines for excessive use of nitrogen. Effectively a quota.	Tax on abstraction used to compensate farmers for income loses	Tax on "net" pollution potential (reflecting abatement.
Coverage	Nitrogen (and cadmium). Phosphate up to 1994	Integrated	Nitrogen and Phosphorus	Phosphate directly but fertilisers (incl. nitrogen) generally	Nitrogen and phosphate	Nitrogen	Nitrogen and pesticides	Nitrogen and phosphate
Wider regulatory system	Not available	Progressive direct payment system. Not part of common agricultural policy.	Direct payment, cost sharing	Agriculture sector targets.	Manure Decree. Manure Action Plan involving limits to the use of fertilisers.	Plan for Sustainable Agriculture	Not available	Subsidies for pollution abatement investment

Table C.5 Continued...

Economic instrument	Fertiliser taxation in	Direct payment with eco-	Tradeable rights in US	Levy on mineral balances in	Manure levy in Flanders	Nitrogen fines in Denmark	German water tax and	French pollution charges

	Sweden	labelling in Switzerland		Netherlands	(Belgium)		compensation scheme	
Level	Represents 20% of the price of fertilisers. Has been higher.	40% of farms either environmental or organic farming	Trading activity generally limited	5 to 20 Dfl per kg of surplus	Unknown	Base exceedence charge combined with a per kg fine. 10 kg excessive use = $175	Lump sum payment based on standard assessment equivalent to $150 per hectare.	Payable on net pollution costs in excess of $1050 per farm.
Administration	County tax Authority. Administration costs thought to be <1% of revenue raised	National	Local. National costs in setting up framework.	Regional authorities. Administration costs "considerable"	Region (Flanders)	National. High level of monitoring (spot checks) seems to be required (30% of farms)	State (federal). Requires substantial monitoring (soil nitrogen concentrations). Need for a large number of model farms.	Local river basin authorities. Administrative cumbersome because of need for farm environmental audits

Table C.5 Continued...

Economic instrument	Fertiliser taxation in Sweden	Direct payment with eco-labelling in Switzerland	Tradeable rights in US	Levy on mineral balances in Netherlands	Manure levy in Flanders (Belgium)	Nitrogen fines in Denmark	German water tax and compensation scheme	French pollution charges
Complementary measures	programmes to promote extensive farming. Education and awareness programmes. Afforestation programmes.	Cross compliance. Direct payments	Cross compliance. Voluntary direct payments. Rights purchase.	Manure banks for disposal of surplus manure. Manure production rights (reducing quota with governments rights purchase and private trading). Manure supply standards. Farm relocation policies.	Fertiliser use restrictions. Strict disposal rules and tiered quota for production at regional level. Development of manure processing facilities. Education and awareness.	Farm manure plans.	Ecology program. Educational programmes. System of fines considered but not adopted.	Grants, soft loans, abatement rewards. Compulsory farm environmental audits.
Effectiveness	"Swamped" by other influences. Main impacts indirect (through tax funded programmes). Fertiliser use reduced by 10% to 20%	Regarded as effective	Limited	Will not achieve compliance with Nitrates Directive. Netherlands started with a large problem compared to may European countries.	Incentive element of charge is not effective but was not purpose. Main aim of charge was revenue raising	Low originally because of strategic behaviour by farmers in exploiting a loophole.	Good. Adopted in Badden Wurttemberg but extended to other states.	Unknown. Staged and delayed introduction means only large farms incorporated.

C.2.11 Experience with other sources

One of the issues which has only been briefly addressed is the possibility of charging for the diffuse inputs of phosphorus from cleaning agents. The issue of controlling phosphate inputs to receiving water through measures aimed at the detergent industry and detergent users were widely discussed at in the late 1980s and early 1990s A charge on detergents was also discussed at this time. However, a number of issues were raised. Firstly, control would have a limited impact upon the overall problem - reducing phosphorus inputs to sewage treatment works by about one third. Secondly that such a charge would reduce phosphorus pollution in a blanket manner and therefore not be cost effective in relation to more targeted approaches that could be pursued by installing treatment technologies at sewerage works discharging to "sensitive locations". Finally, the difficulty of deriving suitable replacements for phosphate and the environmental impacts of the alternatives themselves have been noted. Despite these drawbacks a detergent tax has received some attention (see Anon 1991), notably in relation to funding necessary investments in wastewater treatment.

As Morse *et al* (1993) notes, however, targeting detergent phosphorus sources has historically been an important national response to eutrophication. Most responses have taken the form of mandatory or voluntary restrictions based on adequate product performance (Sweden, Finland, Netherlands, Switzerland, Germany, Austria, Norway, Italy, France) followed by exclusion or severe restrictions by legislation (Switzerland, Italy and Norway) or by market activity (Germany, Austria and the Netherlands). In Germany for example during 1986/87 a combination of rising environmental awareness and the availability of phosphate free alternatives produced a significant shift in demand towards phosphate free detergents. The price premium associated with such products is taken as evidence of a significant willingness to pay for possible environmental improvements.

C.3 Empirical research into economic instruments for N and P

Empirical research covers a much wider set of issues in terms of the design of economic instruments and issues raised by their implementation than is evident in their application.. The following sections are grouped by main themes and intended to provide a starting point for more detailed assessment of the various issues. The main themes are:

- the need to target instruments to reflect local variability;
- impacts of various control options on affected sectors;
- integration with other policies;
- barriers to implementation.

C.3.1 Targeting instruments to reflect local variability

There is a trade-off between designing economic instruments which are administratively simple yet flexible enough to capture the high degree of local variability associated with diffuse pollution from N and P. This has lead to considerable research into tax differentiation and targeting of measures.

The closer an instrument is applied to the locality the greater will be its ability to reflect local factors. Braden and Segerson (1993) provide a useful discussion of the advantages and disadvantages of a number of policy tools at different points in the lifecycle (production output, purchased inputs, emissions/management practices, ambient concentrations and the use of liability for damage). Criteria used include the ability to target (which increases from production to liability for damage), enforceability (which tends to be higher upstream) and the correlation with water quality (which increases the further from production). One conclusion might be that combined approaches may be superior, however, it is shown that combined approaches (e.g. input tax together with liability rules) may in fact produce an inferior outcome.

Other researchers have focused on the stochastic nature of diffuse sources. Shortle (1990) makes the point that cost effectiveness calculations of pollution reduction involving stochastic emissions frequently base their evaluations on annual averages. However, such calculations can lead to misleading results. Instruments which recognise the stochastic nature of the pollutants are likely to provide superior outcomes. This is to some extent reflected in the German compensation payment scheme which make allowance for extreme climatic conditions.

Scheele (1997) discusses the choice of policy instruments in situations where the problem is highly variable across space and time. It is argued that policies need to recognise at least four components - the regulatory stimulus, technical point of application, the addressee, and the spatial dimension. Most analysis focus on only one of these choosing others by default. Practically, discussions regarding the choice faced by regulators as between taxes, tradeable permits and direct regulation is flawed, because the real issues of the problem (spatial scale, information requirements etc.) are not differentiated in this typology. For example, direct regulation is good at addressing site specific problems but may be inefficient where problems are widespread and homogeneous.

Hodge (1997) discusses the possible application of land use permits as an alternative to other regulatory options. Land use permits are shown to retain more precision in application than taxes on input use. The potential for land use permits to become traded commodities is also discussed. Land use permits can be designed on the basis of the expected nitrate emissions from different land uses. Although less efficient than a tax on emissions (leachate) such permits have been shown to be more efficient than a tax on fertilisers. The problems of actually monitoring leachate, however, render this result misleading. The estimated cost effectiveness of the alternatives is given in Pan and Hodge (1994) as 7.8, 5.3 and 5.6 $\$.mg^{-1}$ nitrate avoided per hectare (in leaching water) for the fertiliser tax, leaching tax and land use permits respectively.

Moxey and White (1994) report on an evaluation of nitrogen quotas applied at a catchment level (North East England) to nitrogen input, output (export) and an input quota targeted at individual land classes. Abatement functions for the three approaches are presented showing the least cost option to be a nitrogen emission quota. Targeted input quotas perform better than a non targeted input quota.

Hansen (1997) develops a model which recognises a further point in the life cycle of nutrients which may be subject to economic incentives for the minimisation of damage. Following input to land and emission to the environment other landscape characteristics (of the land through which the pollutant is transported) affect the ultimate level of pollution. Recognition of this fact introduces the possibility of designing incentive structures to deal with nutrient pollution after emission (e.g. by encouraging wetland construction and maintenance as preventative measures).

Clunies-Ross (1993) discuss the comparative benefits of a tax on nitrogen use as opposed to a tax on production as well as other options. The report details the then unpublished work of Dubgaard who suggested that a nitrogen tax of 150% and a reduction in crop prices of 50% would achieve the same result in terms of reduced fertiliser usage. Among the options discussed are taxes on fertilisers with variety of compensation measures to reflect farm specific characteristics - increasing commodity prices, per hectare based reimbursements and reimbursements for specified quantities.

Clunies-Ross also discuss issues associated with nitrogen quotas and animal manure. In an tradeable input quota system the point is made that a key issue is the initial allocation of quotas or entitlements in a manner which is satisfactory to all parties and retains the right mix of incentives. In some circumstances it might be more appropriate to tax surplus animal manure rather than mineral fertiliser. One option dealing with multiple sources is the application of nitrogen balance sheets with taxation based on "unaccounted for nitrogen" a principle pursued in a number of European countries. Such balance sheet taxes would also deal with the problem of substituting organic nitrogen for reductions in mineral nitrogen.

Francis (1992) discusses the relative merits of excise taxes for fertilisers, user rights, application restrictions, zoning regulations and voluntary BMP's. A comparison is made on the basis of cost, ease of enforcement, responsiveness to local problems, political viability, producer income and equity among producers. One of the problems with taxation systems is their perceived penalisation of farmers employing good practice (since the tax is paid on all units not just those contributing to a problem). A solution suggested is a tax rebate scheme, which would involve a high initial tax with a rebate for farmers who can demonstrate good practice.

Randhir and Lee (1997) report on a simulation of the application of a tax on nitrogen, a watershed level restriction on use and an acre level restriction on use, for the control of nitrogen and atrazine. The simulation examined the impacts on the cropping systems, input use, non-point source pollution, farm income and risk. Policies directed towards single outputs have a variety of impacts on the levels of other pollutants, farm income and the risk faced by farmers. The presence of these spillover effects means that instrument design must take them into account. This can be seen in a number of actually applied instruments in the importance attached to complimentary measures.

Taylor *et al* (1992) report on a simulation of economic incentives and other mechanisms to offset non-point source pollution from agriculture in the Willamete Valley (Oregon). The control measures examined included a direct tax on effluent (leachate), input taxes, per acre standards on effluent, required use of no till drills on small grains for seed and a ban on autumn fertiliser application. The main findings are

that no single policy option is optimal across all farm types and most farms can undertake a limited amount of abatement at little cost.

Fox *et al* (1995) report on an economic analysis of soil conservation measures with respect to off-site water quality. One of the main limitations on achieving effective policies is in linking polluters to the damage actually imposed. This research illustrates a means of using proxy criteria for identifying farmland which contributes most to water quality damage.

C.3.2 Impacts of various control options on affected sectors

Considerable research has been undertaken into the effects of introducing economic instruments for diffuse N and P on different sectors (farming sectors e.g. livestock versus arable, fertiliser manufacturers etc.), the economy and world markets.

McCorriston and Sheldon (1996) examined the implications for the UK fertiliser market of two nitrogen limitation policies: a nitrogen tax and a quota system. Using a model of the UK fertiliser market a 10% and 25% tax on fertilisers and a 5% and 10% reduction in fertiliser output (production) is simulated. In both cases the net effects on welfare (of farmers, and the fertiliser industry) is negative. However under the quota system the dominant fertiliser producers' profits rise at the expense of smaller producers - indicating negative distributional impacts.

Liang *et al* (1998) report on an evaluation of the impact on national income, social welfare and environmental quality of taxation schemes aimed at reducing commercial fertiliser usage. Two taxation schemes (uniform tax and a regionally differentiated tax) were examined through a Computable General Equilibrium Model. The overall macroeconomic effects were found not to be significant. A 7% to 8% reduction in fertiliser output would be associated with a 5% increase in fertiliser prices.

Taylor (1975) compared tradeable user rights (permits) for fertilisers with a fertiliser tax in Illinois. The model indicates that the outcome of the two policies would be the same, provided that non-fertiliser users did not purchase user rights. The study points to the important differences between the two systems: the ability of non-users to influence outcomes (higher under permits), the ease of adapting to changing economic circumstances (higher under the tax), and the certainty over the outcome (higher under the permit system).

Clunies-Ross (1993) reports on work by Dubgaard suggesting that achieving a 30% reduction in nitrogen use could be achieved by a reduction in price support or a nitrogen tax. The loss in farm income associated with the nitrogen tax is substantially lower than with the reduction in price support (70 to 115 ECU.ha^{-1} for the tax compared to 370 to 700 ECU.ha^{-1} for the price reduction). Other work reported is that of von Urff whose assessment of taxing agricultural inputs for the reform of CAP suggested that in Germany, while a halving of the price of cereals would make the majority of production unprofitable a doubling of the price of fertilisers would still allow production of cereals on “good” sites. As Clunies-Ross indicates, these different results arise because a reduction in price support does not alter the relative price of inputs while a tax on nitrogen does. Hence price support control options will mean a cut back on all agricultural inputs (including labour and machinery) rather than just

nitrogen (with its possible substitution with labour for example). Other work by Dubgaard is also discussed which shows how the income loss effects of a nitrogen tax could be compensated with modest increases in commodity prices. However, in practice this would mean allowing crop prices to vary with farm income, which would be very difficult to implement.

Van der Veeren and Tol (1998) present a very detailed analysis of the benefits of reallocating nitrate emission reductions (between farming sectors (e.g. arable, dairy), countries and between point and diffuse sources) in the Rhine River Basin. Policies which recognise the cost differences between sources and countries are found to be 25% cheaper than flat rate reductions. Table C.6 shows the winners (+) and losers (-) from a more cost effective allocation.

Table C.6 Winners and losers from a cost effective allocation of abatement

Source	Win/lose
Arable clay farms	+
Arable sand farms	-
Dairy clay farms	+
Dairy sand farms	+
Pig breeding	+
Pig feeding	-
Sewage treatment	-

C.3.3 Integration with other policies

Other empirical research has focused on the difficulty of designing instruments that are effective within the current policy framework - notably the Common Agricultural Policy and other market support measures. This has manifested itself through research into measures which align themselves with other objectives - voluntary direct payment schemes and cross compliance.

Klienhaans *et al* (1997) discuss the influence of CAP reform on nitrogen surpluses which are shown to be small primarily because CAP reform will not effect livestock densities. A tax on fertilisers is also shown to have a higher effect (in terms of income losses) on arable farmers than livestock farmers. A reimbursement system is required to resolve this problem. An assessment of the impacts of the Nitrate Directive, versus a nitrogen tax show that the tax would lead to lower farm income losses than the Nitrate Directive.

Gunasekera *et al* (1992) examined the wider impacts (world commodity prices, production, trade etc.) of the imposition of a 50% and 75% tax on fertilisers in the European Community. The effects were examined through a world agricultural trade model. The effect on European agricultural production and world prices for key farm commodities was estimated to be small, primarily because of the relatively small impact of the taxes on overall producer support (subsidies). By comparison, a reform of agricultural trade (the so-called Dunkel package) is shown to have a much larger impact (5 to 10 times greater changes in agricultural prices) suggesting that a more

market orientated trade system for agriculture could offer the opportunity of meeting both trade liberalisation, deregulation and environmental objectives.

C.3.4 Barriers to imple mentation

Much of the literature is concerned with explaining the apparent lack of progress on applying economic instruments despite the frequent promotion by economists and policy analysts. Transaction costs (the costs of putting a policy into practice) and the strength of interest groups are frequently cited explanations. Many researchers have suggested the fundamental difficulty with economic instruments for nutrients is that the standard "economic" solution, an emission tax on leachate, will not work for diffuse pollutants because of the high transaction costs of imposing such an instrument at the emission stage (monitoring etc.) (see for example Romstad *et al* 1998). Instead policy makers are forced to focus on upstream points (application or purchase, of fertilisers, production etc.). This means lower transaction costs but also reduced precision and an increased likelihood "side-effects".

Easter (1993) discusses transaction and compliance costs together with program effectiveness for a wide range of policy instruments. These included traditional US approaches (cost-sharing, technical assistance and education), national and local bans on specific chemicals, taxes, permits, land retirement, easements, performance and practice standards and property rights/liability.

McCann and Easter (1998) estimated the transaction costs associated with a tax on phosphate fertilisers, an education programme and two regulatory programmes. They showed that the tax actually has substantially lower transaction costs than the alternatives. Transaction costs are influenced by a number of factors including the number of agents affected, resistance to the policy, amount of abatement required, time frame and existing institutional arrangements. One of the reasons the transaction costs of the phosphates tax may be lower, however, is that there is an existing tax on fertilisers used to fund inspections and to cover the cost of accidental spills.

Lowe and Ward (1998) discuss the issue of current perceptions of the problem and the interest groups involved and how alternative forms of regulation may affect different parties. Regulation of farm pollution is a new problem and one which sits uneasily with traditional views as farmers as guardians of the environment. The conclusion is that any policy will need to be accompanied by a programme to educate and change current values to reflect the problem at hand.

Asymmetry of information between the regulator and the regulated is a complicating factor in all forms of regulation. Xepapadeas (1998) discusses the implication of asymmetry in the case of a nitrogen tax. From the regulatory perspective mineral emissions from a farm are unobservable as is the type of farmer (i.e. environmentally conscious etc.). The observable parameters are input us age (e.g. purchases under a tax). Xepapadeas shows that a scheme in which farmers are allowed to reveal their characteristics (e.g. by choosing the tax schedule they face) may produce superior

outcomes. This principle is applied in practice in a number of countries where farmers have a choice of a standard or actual assessment.

An important point made by Carpenter *et al* (1998) is the difference between management scales and ecological scales. At the watershed level ecological scales are from two to three decades, while management scales tend to be much shorter. This mismatch in scales needs to be addressed in designing economic instruments. The length of ecological time frames also means large uncertainties will be associated with outcomes. Uncertainty about the benefits of management strategies reduces their expected value and points to the potential benefits that can be realised by reducing uncertainty.

C.4 Cost structures

A great deal of research has been undertaken into cost patterns faced by farms. Much of this research has focused on defining optimal fertiliser application rates for different farm types (e.g. Schlegel *et al* 1996) and in estimating demand elasticities. Other research has examined the cost of alternative control options (best management practices for agriculture, industrial and municipal treatment, etc.)

C.4.1 Elasticities of demand for fertiliser

Estimated demand (price) elasticities are useful statistics in discussing cost structures since they demonstrate the likely reaction of farmers to price increases *given the costs of alternatives open to them.* An important distinction needs to be made between short and long run elasticities. In the short run some inputs are fixed (e.g. machinery) and hence actions are limited. In the long run these restrictions disappear. The distinction between a long and short run elasticity is frequently rather vague and in general there is a poor understanding of how price changes effect technologies, for example by stimulating research and development into more nitrogen efficient application technologies (e.g. soil injection systems). However, the key point is that in the long run farmers have more opportunities to respond to price increases (for example by replacing existing machinery with more efficient machinery at the natural end of its life).

The literature is unequivocal in pointing to the inelastic nature of fertiliser demand. This is generally attributed to the potency of the product in generating yield improvements (Easter 1993). Francis (1992) reports that fertiliser prices in the US between 1977 and 1992 fluctuated over a large range (greater than 300%) without significant changes in use patterns.

C.4.2 Abatement costs

Most of the literature on abatement costs concerns empirical (e.g. using farm level data) comparison of alternative policy options (e.g. taxes versus regulations). Many studies point to the apparent overuse of nitrogen fertiliser (above what is privately optimal to the farmer). Trachtenberg and Ogg (1994) suggest that the rate of over use

in the US is approximately 24% to 32%. There is therefore potential for cost beneficial reductions in certain circumstances which needs to be borne in mind when interpreting cost data. Other research points to the wide variation of cost patterns faced by polluters even within the same sector. Berentsen and Giesen (1998) evaluated a range of instruments for managing nitrogen surpluses on Dutch livestock farms finding that there was a wide variation in cost structures between farmers in this sector (see also van Veeren and Tol 1998).

Abatement measures can be classified as either mitigation or avoidance. Mitigation measures attempt to intervene between the pressure (fertiliser use) and the effect (e.g. eutrophication) for example by reducing the damage per unit of fertiliser use. Avoidance measures on the other hand are aimed at reducing the pressure itself. In general examinations of abatement costs relate to both types of measures.

Table C.7 summarises reported abatement costs in a number of countries for different site specific characteristics and policy options.

Table C.7 Nitrogen abatement cost estimates (agriculture)

Study	Abatement Cost	Metric
Romstad *et al* (1998) - 100% tax on fertiliser	9 to 16	$ per kg of avoided leaching. Private costs.
Romstad *et al* (1998) - catch crops 50% cover	1.5 to 4.5	$ per kg of avoided leaching. Private costs.
Romstad *et al* (1998) - combined catch crop and tax	4.5 to 9	$ per kg of avoided leaching. Private costs.
Klienhanss *et al* (1997) - Nitrates Directive	3.6	$ per kg of reduced nitrogen surplus
Van Veeren and Tol (1998)	1.5 to 7.5	$ per kg of abatement
Klienhanss *et al* (1997) - nitrogen levy	1.5	$ per kg of reduced nitrogen surplus
Crutchfield *et al* (1994)	1.5 to 10.5	$ per kg of avoided in receiving water load

A wide range of costs are in evidence reflecting varying local conditions. Comparison is also made difficult by the way in which abatement costs are presented - a variety of metrics, avoided leaching, edge of stream and receiving water load. In general agricultural abatement costs are lower than for point sources. For example, van Veeren and Tol (1998) point sources 11 to 16 $ per kg of abatement, Crutchfield *et al* (1994) $10 to $21.kg^{-1}, and Bundi (1994) $10 to $16.kg^{-1}.

For phosphorus Schleich and White (1997) provide cost estimates for various measures to reduce phosphorus from major sources exported to Lower Green Bay, Wisconsin. Cost estimates are reproduced below (Tables C.8 and C.9).

Table C.8 Agricultural and other abatement costs for phosphorus

Sources	Costs ($) to reduce 1 kg of phosphorus Low	Average	High
Agriculture	3	16	42
Municipal/industrial sources	47	100	820
Construction run-off	320	480	1020
Urban storm run off	1060	1260	2420

Table C.9 Phosphorus abatement cost estimates - agriculture

Study	Abatement Cost	Metric
Crutchfield *et al* (1994)	22 to 95	$ per kg of avoided receiving water load
Heatwole *et al* (1987)	7.5 to 9	$ per kg of reduced edge of stream load
Bann and Berbee (1989)	50	$ per kg of avoided receiving water load

Some authors point to the increasing marginal costs as targets are approached (Schliech *et al* 1996). In the Lower Green Bay example lowering the target by 33% results in an increased cost of 75%.

C.4.3 Damage costs/benefits

A full understanding of the potential benefits of economic instruments needs to recognise the potential benefits and avoided damage costs of controlling diffuse sources of N and P. Le Goffe (1995) discusses the potential benefits of improvements in coastal water quality. The Brest harbour was chosen as a pilot site in an EC research programme. A contingent valuation survey was used to identify the value placed by French households on preservation of the ecosystem against eutrophication. FF120 ($18) on average was the 'willingness to pay' (WTP) per household in the area. These results may have been influenced by media reports of the enrichment of waters.

Magnussen (1992 reported in Le Goffe 1995) used a model to estimate the value of a 50% reduction in the output of nutrients, nitrogen and phosphorus, to the North Sea. The reported WTP was 1000FF ($150) per household in 1991. Bockstael (1989, reported in Le Goffe 1995) undertook a travel cost evaluation estimated a WTP for "swimable water" as a result of lower nitrogen and phosphorus concentrations equivalent to 350FF ($500) in 1987.

Gren *et al* (1997) report on a cost benefit analysis of nutrient reductions to the Baltic Sea finding that the benefits of a 50% reduction in the load of nitrogen and phosphorus are approximately equivalent to the associated costs. All Baltic Sea countries except for Lithuania, Estonia, Latvia and Poland would receive net gains

from a cost effective abatement programme involving changed agricultural prices, construction of sewage treatment works and wetland restoration.

Van Vuuren *et al* (1997) report on an evaluation of the social returns from agricultural practices aimed at water quality improvements in an Ontario watershed. The main findings were that the water quality improvements were limited because of the remaining burden from non-agricultural sources and that some measures produced positive on farm returns.

C.5 Economic Instruments for Nutrient Control within the Black Sea Region

C.5.1 Bulgaria

In general the Government intends to reformulate environmental and water legislation to provide a framework in turn with the needs of a market oriented economy. Action recently taken includes the passing of the 1991 Environmental Protection Act (EPA), its amendment in 1992. Act establishes the principles of user charges and pollution charges. "The person polluting the environment and using natural resources shall pay charges for the contamination and usage of these resources". According to the Ordinance for economic sanctions for air, water and soil pollution No24 from 1993, fines and sanctions are imposed for pollution exceeding the admissible limits. The sanctions are distributed according to the EPA in the National fund 70% and the municipal funds 30% for environmental protection and may be used only for financial support of environmental protection activities.

The study on the Introduction of Phosphate Free Detergents in the Bulgarian part of Danube River Basin has been carried out under the Danube Applied Research Programme in 1996. The objective of the project was to support Bulgaria to eliminate phosphorous (P) from detergents, used in households and in industry, as soon as technically possible and economically justified. One of the findings of the study is that the low living standard and economical background is limiting the use of detergents in the households. Disturbed market influences the industry. Low households income is related to low consumption of granulated materials and high soap application (very often home-made in the agricultural areas and small towns). On the other hand new market conditions make possible import of detergents from Western Europe as well as from Rumania, Turkey, Greece, Check Republic etc.

There is no legislation in Bulgaria dealing with eco-labeling of products. Legal documents are currently being drafted for packaging signs on environmentally clean products and financial support of its production for improving the access of Bulgarian producers to national and international markets. In relation to the detergents, work is undertaken for harmonization with European Commission Decision of 28 May 1999, establishing the ecological criteria for the award of the Community eco-label to detergents for dishwashers (1999/427/EC) and European Commission Decision of 10 June 1999, establishing the ecological criteria for the award of the Community eco-label to laundry detergents (1999/476/EC)

C.5.2 Georgia

Georgian Tax Code with respect to nutrients regulates the following economic instruments:

- Taxation. There exist limits for the discharge. The limit is the total defined amount of a harmful substance for discharge for a taxpayer for each calendar quarter. The limits are defined by the taxpayers themselves and approved by the Ministry of Environment. The Georgian Tax Code is a list of fixed taxes put on each ton of discharged harmful substance, not exceeding the defined limit. Under the Tax Code the established taxes are as follows:

  - Total nitrogen - 390 Lari per ton ($200);
  - Ammonia nitrogen - 390 Lari per ton ($200);
  - Phosphates - 156 Lari per ton (£80);
  - Phosphorus - 390 Lari per ton ($200).

The amount of money to be paid by a taxpayer is calculated on the basis of existing ecological state in specific region (water body). Established tax is multiplied by the relevant ecological state factor. For the Black Sea coastal line (category of especially polluted water bodies) ecological state factor is 1,5.

- Liability (fines). Under the Georgian Tax Code the fines for the discharge of harmful substances exceeding the limits are defined equalling 5 times as much as the established taxes.

- Eco-labelling - there exists only labelling. Labelling is defined by the Georgian Law on Pesticides and Agrochemicals.

C.5.3 Romania

The taxation system is applied by National Company "Romanian Water" for water abstraction/supply (raw water) and waste water discharges. There is not as yet any regulation concerning on-farm organic manure surpluses/ inorganic nutrient balances. Economic Instruments for nutrient control which are used or being considered in Romania include:

- Direct payments: made to wastewater treatment companies (by industry etc.).

- Cost sharing is specific for the industrial effluents when the polluter should contribute by direct payment to the WWTP.

- Tradeable rights – currently promoted by MWFEP for implementation in 2002 after the vulnerability classification of the rivers. A special methodology for nutrient application in agriculture (MWFEP/ MAF) it is expected to be carried out till 2002.

- Cross compliance – under the Water Law (new version), despite the use of penalties, there is provision for encouranging a reduction of pollution (including nutrients) without regulatory instruments.

- Concerning the phosphorous free detergents, the Ministry of Industry and Trade are considering to promote a maximum acceptable level (not only the biodegradability) of P (till the end of 2003).

C.5.4 Russia

The economic instruments targeted directly at nutrient control do not exist in Russia. The environmental law incorporates economic instruments for the purpose of the environment protection as a whole.

The purpose of the economic instruments are for: (i) environmental measures planning and financing; (ii) establishment of limits for natural resources use, emissions and discharges of pollutants to the environment, wastes disposal; (iii) establishment of payment normatives and payment rates for the use of natural resources; (iv) pollutant emissions/discharges; (v) wastes disposal and other types of harmful impact; (vi) favorable/reduced rates, credits, tax exemption and other privileges for enterprises/organisations; (vii) compensation of the damage caused to the environment and people's health.

The economic instruments include:

- payment for the natural resources (soil, mineral resources, water, forests, flora and fauna, recreational and other resources), which is charged for the right to use the natural resources within the set limits; for irrational and over the limits use of the natural resources; the raised finances are spent for the natural resources reproduction and protection;

- payment for the environment pollution and other types of impacts, which is charged for emissions/discharges of pollutants, wastes disposal within the set limits; for emissions/discharges of pollutants and wastes disposal over the established limits;

- ecological funds (federal, regional, local, publis), which are non–budgetary and state. They are established in order to implement urgent environmental measures, to compensate the damage/losses caused to the environment. They are formed by the financial resources transferred by enterprises/organisations and citizens, including payment for emissions/discharges/wastes disposal, compensation money, fines/liabilities for violation of environmental laws/regulations, etc. Ecological funds financial resources are distributed as follows: 60% – for implementation of local environmental measures, 30% – for implementation of regional environmental activities, and 10% – for implementation of federal envir onmental activities. It is prohibited to spend the money of the environmental funds for the purposes not related to the environmental activities. Public ecological funds are formed by the money of citizens, voluntary payments of public organisations and from other sources;

they are established by public organisations, trade unions; their financial resources are spent exclusively for the environment protection.

- Environmental insurance. In the Russian Federation there are two types – voluntary and obligatory – of the environmental insurance for enterprises, organisations, citizens and their properties in case of ecological accidents, emergencies, hazards, catastrophe and disaster.

- Economic incentives for the environment rational use and protection are as follows: (i) tax exemptions/reduced rates and other privileges for enterprises/organisations when they introduce low/non–waste technologies, use secondary resources; implement other effective environmental measures; (ii) tax exemption for ecological funds; (iii) stimulating prices and bonus for ecologically clean products; (iv) special taxes for ecologically harmful products; (v) favorable credit rates for enterprises and organisations, independent on their ownership, that implement effective environmental protection measures; (vi) partial transfer of the financial resources of the ecological funds (interest rate loans) to enterprises/organisations for implementation of emissions/discharges reduction measures.

According to the Russian legislation the subjects of the Russian Federation have the right to establish other economic incentives for the environment protection.

C.5.5 Turkey

Among the most common charges, which are relevant to nutrient control, are (i) those targeted for water and waste facilities in ports and sewerage discharge and (ii) the 'Cleansing Tax'. The Cleansing Tax could be singled out as the most significant economic instrument in terms of its nationwide use and awareness level. It is collected at the local level to be used primarily for solid waste expenditures of municipalities.

With respect to eco-labelling, regulations are in force as detailed in the 'Production of Plant and Animal Products by Utilizing Ecological Methods' (date of issue: 18 December 1994). The wider aim of this document is to produce, through eco-labelling, ecological friendly agricultural products in order to protect the ecological balance or, where necessary, redevelop the ecological balance. The regulations specifically aim to increase the demand for these products and to supply healthy and high quality eco-products to the consumers. To this end the document sets forth the principles to promote production processing and marketing of plant and animal products by practicing ecological methods. The plant products, which are cultivated/produced by making use of ecological methods, utilise organic fertilizers, manure from ecologically grown animals and/or organic or mineral fertilizers in their natural forms which are approved by the control authority are labelled to be differentiated from other products. The regulations apply an incentive not to use synthetic fertilizers in agricultural practices.

C.5.6 Ukraine

No data available at the time of writing this report

References for Appendix C

Adler, R.W. (1994) Re-authorising the Clean Water Act: Looking to tangible values, *Water Resources Bulletin* **30,** 799-807.
Anon (1991) Danes nutrient battle depends on agricultural action, *Water Quality International*, **3**, 44-47.
Bann, P.J.A. and Berbee, R.P.M. (1989) Diffuse Bromen, *H_20*, **22**(6), 185.
Berentsen, P.B.M. and Giesen G.W.J. (1998) Governmental policy options for decreasing nitrogen and phosphate losses on Dutch dairy farms. In E. Romstad, J. Simonsen and A. Vatn (eds) *Controlling Mineral Emissions in European Agriculture: Economics, Policies and the Environment,* pp 175-192. CAB International, Wallingford.
Boggess, W.G., Flaig, E.G. and Fonyo, C.M. (1993) Florida's experience with managing nonpoint-source phosphorus run-off into Lake Okeechobee. In C.S. Russel and J.F. Shogren (Eds) *Theory, Modelling and Experience in the Management of Non Point-Source Pollution*, pp 231-268. Kluwer Academic Publishers.
Braden, J.B. and Segerson, K. (1993) Information problems in the design of non point pollution policy. In C.S. Russel and J.F. Shogren (1993) *Theory, Modelling and Experience in the Management of Non Point-Source Pollution, pp 1 -36*. Kluwer Academic Publishers.
Carpenter, S.R., Bolgrien, D., Lathrop, R.C., Stow, C.A., Reed, T. and Wilson, M.A. (1998) Ecological and economic analysis of lake eutrophication by non-point pollution, *Australian Journal of Ecology*, **23**, 68-79.
Clunies-Ross, T. (1993) Taxing nitrogen fertilisers, *The Ecologist*, **23**, 13-17.
Crutchfield, S.R., Letson, D. and Malik, A.S. (1994) Feasibility of point-nonpoint source trading for managing agricultural pollutant loadings to coastal waters, *Water Resources Research*, **30**, 2825-2836.
Curry, N. and Stucki, E. (1997) Swiss Agricultural policy and the environment. An example for the rest of Europe to follow? *Journal of Environmental Management and Planning*, **40**(4), 465-482.
Easter, K.W. (1993) Differences in the transaction costs of strategies to control agricultural offsite and undersite damages. In C.S. Russel and J.F. Shogren (eds) *Theory, Modelling and Experience in the Management of Non Point-Source Pollution*, pp 37-68. Kluwer Academic Publishers, The Netherlands.
Fox, G., Umali, G. and Dickinson, T. (1995) An economic analysis of targeting soil conservation measures with respect to offsite water quality, *Canadian Journal of Agricultural Economics*, **43**, 105-108.
Francis, D.D. (1992) Control mechanisms to reduce fertiliser nitrogen movement into groundwater, *Journal of Soil and Water Conservation*, Nov-Dec, 444-448.
Frederiksen, B.S. (1994) National responses to the EC nitrate policy, *Journal of Environmental Management and Planning*, **38**, 253-263.
Gren, I.M., Soderqvist, T. and Wulff, F. (1997) Nutrient reductions to the Baltic Sea: ecology, costs and benefits, *Journal of Environmental Management*, **51**(2), 123-143.
Gunasekera, H.D.B.H., Rodriguez, G.R. and Andrews, N.P.(1992) World market implications of taxing fertiliser use in EC agriculture, *Agriculture and Resources Quarterly*, **4**(3), 389-396.
Hansen, L.G. (1997) An incentive-based policy for nutrient removal after emission. In E. Romstad, J. Simonsen and A. Vatn (eds) *Controlling Mineral Emissions in European Agriculture: Economics, Policies and the Environment,* pp 121-137. CAB International, Wallingford.

Heatwole, C.D., Bottcher, A.B. and Baldwin, L.B. (1987) Modelling cost effectiveness of agricultural nonpoint pollution abatement programs on two Florida basins, *Water Resources Bulletin*, **23**, 127.
Helfand, G.E. and Archibald, S.O. (1990) California's Proposition 65: a new regulatory trend? In J. Baden and S.B. Lovejoy (eds) *Agriculture and Water Quality: International Perspectives,* pp 147-168. Lynne Riemer, London.
Hodge, I. (1997) Applying land use permits for the control of mineral emissions. In E. Romstad, J. Simonsen and A. Vatn (eds) *Controlling Mineral Emissions in European Agriculture: Economics, Policies and the Environment,* pp 105-120. CAB International, Wallingford.
Klienhanss, W., Becker, H. and Schleef, K.H. (1997) Impacts of agrienvironmental policy measures on nitrogen emissions from agriculture. In E. Romstad, J. Simonsen and A. Vatn (eds) *Controlling Mineral Emissions in European Agriculture: Economics, Policies and the Environment.* CAB International, Wallingford.
Kozloff, K., Taff, S.J. and Wang, Y. (1992) Micro-targeting of acquisition cropping rights, *Water Resources Research*, **28**(3), 623-628.
Kumm, K.I. (1990) Incentive policies in Sweden. In J. Baden and S.B. Lovejoy (eds) *Agriculture and Water Quality: International Perspectives*, pp 105-116. Lynne Riemer, London.
Le Goffe, P. (1995) The benefits of improvements in coastal water quality - a contingent approach, *Journal of Environmental Management,* **45**(4), 305-317.
Liang, C., Lovejoy, S.B. and Lee, J.G. (1998) Green taxes: impacts on national income, social welfare and environmental quality. Department of Community Development and Applied Economics, University of Vermont, Burlington, Vermont.
Lichtenberg, E., Strand, I.E.R. and Lessley, W.V. (1993) Subsidising agricultural nonpoint-source pollution control - targeting cost sharing and technical assistance. In C.S. Russeland J.F. Shogren (eds) *Theory, Modelling and Experience in the Management of Non Point-Source Pollution*. Kluwer Academic Publishers.
Lowe, P. and Ward, N. (1998) The moral authority of regulation: the case of agricultural pollution. In E. Romstad, J. Simonsen and A. Vatn (eds) *Controlling Mineral Emissions in European Agriculture: Economics, Policies and the Environment.* CAB International, Wallingford.
McCann, L. and Easter, K.W. (1998) Estimating transaction costs of alternative policies to reduce phosphorus pollution in the Minnesota River. Staff Paper Series (P98-7). University of Minnesota.
McCorriston, S, and Sheldon, I.M. (1989) Welfare implications of nitrogen limitation policies, *Journal of Agricultural Economics*, **40**(2), 143-151.
Morse, G.K., Lester, J.N. and Perry, R. (1993) *The Economic and Environmental Impact of Phosphorus Removal from Wastewater in the European Community*. Selper Publications.
Moxey, A. and White, B. (1994) Efficient compliance with agricultural nitrate pollution standards, *Journal of Agricultural Economics*, **45**(1), 27-37.
OECD (1995) Environmental taxes in OECD countries. Organisation for Economic Co-Operation and Development, Paris.
Randhir, T.O. and Lee, G. (1997) Economic and water quality impacts of reducing nitrogen and pesticide use in agriculture, *Agricultural and Resource Economics Review*, **20**(1), 39-51.
Reichelderfer, K.H. (1990) National agro-environmental incentive programmes. In J. Baden and S.B. Lovejoy (eds) *Agriculture and Water Quality: International Perspectives*, pp 131-146. Lynne Riemer, London.

Romstad, E., Vatn, A., Bakken, L.R. and Batterweg, P. (1998) Economics-ecology modelling: the case of nitrogen. In E. Romstad, J. Simonsen and A. Vatn (eds) *Controlling Mineral Emissions in European Agriculture: Economics, Policies and the Environment,* pp 225-248. CAB International, Wallingford.
Scheele, M. (1997) The decomposition approach: spatially differentiated analysis and implementation of environmental strategies. In: E. Romstad, J. Simonsen and Vatn, A. (eds) *Controlling Mineral Emissions in European Agriculture: Economics, Policies and the Environment,* pp 41-58. CAB International, Wallingford.
Schlegel, A.J., Dhuyvetter, K.C. and Havlin, J.L. (1996) Economic and environmental impacts of long-term nitrogen and phosphorus fertilisation, *Journal of Production Agriculture*, **9**(1), 114-118.
Schleich, J. and White, D. (1997) Cost minimisation of nutrient reduction in watershed management using linear programming, *Journal of the American Water Resources Association*, **33**(1), 135-142.
Schleich, J., White, D. and Stephenson, K. (1996) Cost implications in achieving alternative water quality targets, *Water Resources Research*, **32**(9), 2879-2884.
Schou, J.S. (1997) Implementation of nitrate policies in Denmark. In: F. Brouwer and Klienhass, W. (eds) Implementation of Nitrate Policies in Europe. Wissenschaftsverlag Vauk, Kiel, Republic of Germany.
SEPA (1997) Environmental taxes in Sweden - economic instruments of environmental policy. Swedish Environmental Protection Agency, Stockholm.
Shortle, J.S. (1990) The allocative efficiency of water pollution abatement cost comparisons, *Water Resources Research* , **26**(5), 793-797.
Shortle, J.S. and Laughland, A. (1994) Impacts of taxes to reduce agrochemical use when farm policy is endogenous, *Journal of Agricultural Economics*, **45**(1), 3-14.
Taylor, C.R., Adams, R.M. and Miler, S.F. (1975) A regional market for rights to use fertiliser, *Journal of Environmental Economics and Management*, **2**, 7-17.
Taylor, M.L. *et al* (1992) Farm level responses to agricultural effluent control strategies - the case of Willamette Valley, *Journal of Agricultural and Resource Economics*, **17**(1), 173-185.
Trachtenberg, E. and Ogg, C, (1994) Potential for reducing nitrogen pollution through improved agronomic practices, *Water Resources Bulletin*, **30**(6), 1109-1117.
USEPA (1996) Draft framework for watershed based trading. Report No. EPA 800-R-96-001.
van der Veeren, R.J.H.M. and Tol, R.S.J. (1998) Benefits for a reallocation of nitrate emission reductions in the Rhine River Basin. Institute for Environmental Studies, Free University of Amsterdam. Report No. D98-07.
van Gijseghem, D.E.L.J. (1997) Implementation of nitrate policies in Flanders. In: F.E. Brouwer and S.W. Klienhens (eds) *The Implementation of Nitrate Policies in Europe*, pp 135-148. Wissenschaftsverlag Vauk, Kiel.
van Vuuren, W., Giraldez, J.C. and Stonehouse, D.P. (1997) The social returns of agricultural practices for promoting water quality improvement, *Canadian Journal of Agricultural Economics*, **45**(3), 219-234.
Versmersch, D. and Raould, N. (1997) Economic perspectives for nitrate policy in Brittany. In: F.E. Brouwer and S.W. Klienhens (eds) *The Implementation of Nitrate Policies in Europe,* pp 149-160. Wissenschaftsverlag Vauk, Kiel.
Xepapadeas, A. (1998) Regulation of mineral emissions under asymmetric information. In E. Romstad, J. Simonsen and A. Vatn (eds) *Controlling Mineral Emissions in European Agriculture: Economics, Policies and the Environment,* pp 89-104. CAB International, Wallingford.

Annex 11

FINAL REPORT
SUPPORTING PUBLIC INVOLVEMENT IN NUTRIENT CONTROL

Summary

Following the Terms of Reference, all tasks set in the PDF -B were fully completed and the following outcomes produced:

(1) Call for Project Proposals to the GEF/BSEP Small Grants Programme designed and disseminated broadly among coastal NGOs in Bulgaria, Georgia, Russia, Romania, Turkey and Ukraine (see Annex II);

(2) 48 NGO project proposals collected and further evaluated against set criteria by an independent expert committee (see Annex III);

(3) 29 NGO projects recommended for full or partial GEF support during the first two years of the new GEF Black Sea Programme (Annex I);

(4) Participating NGOs informed about the results of project evaluations;

(5) Written contribution to the Project Brief prepared.

1. Background information

1.1. Black Sea NGO Forum

The previous GEF Black Sea Programme has recognized the importance of including the coastal non-governmental organizations (NGOs) into the regional efforts of protecting the Black Sea. In 1994, with the GEF/BSEP support, the Black Sea Environmental NGO Forum was set up as a mechanism for local NGOs to exchange their experiences, implement joint projects and participate (as observers) at intergovernmental Black Sea meetings. In 1997/98, the Black Sea NGO Forum jointly with the Field Studies Council (UK) organized a series of international and national training workshops to improve the capacity of coastal NGOs. That project was successful and widened the circle of NGOs involved in the GEF/BSEP Black Sea Programme. Another successful NGO Forum initiative was the Black Sea Action Day. It was originally proposed by the NGOs as a celebration of the signing of the Black Sea Action Plan in 1996. Until 1998, this initiative was supported by BSEP. Afterwards, the local communities continued to celebrate the Black Sea Day, raising their own funds for public activities.

Although it no longer functions as an organization, the NGO Forum provides important lessons. First, it revealed that there are genuine citizen groups all along the coast, working to restore and protect the Black Sea. These groups are the basis for the development of the civil society in this region and as such they need international recognition and support. Second, it showed that international NGO netwoking in the Black Sea region is poorly developed and requires supportive coordination.

1.2. Black Sea Environmental NGO Network

Although most Black Sea NGOs are primarily concerned with very local issues, they recognize the need for a regional information and coordination mechanism. When in 1998 it became apparent that the Black Sea NGO Forum was not able to sustain itself without the GEF/BSEP support, a number of Black Sea NGOs (some members of the previous Forum), took the opportunity of a new source of funding (NOVIB) to form a Black Sea Environmental NGO Network (BSNN). Today, the BSNN is a registered international NGO based in Varna, Bulgaria. It provides regular information and assistance to its NGO members through international meetings, its own website and a newsletter. It also serves as a lobbying mechanism for coastal NGOs on critical Black Sea issues (particularly in Bulgaria).

In a short time, the BSNN has made its presence noticeable in the Black Sea region. Its work (especially a functioning website and a newsletter) is highly appreciated by the coastal Black Sea NGOs, as well as by NGOs from other regions. Sustainability of the BSNN depends largely on outside support because the coastal NGOs are not in a position to pay high fees. With GEF support in this new phase of the Black Sea Programme, the BSNN could be strengthened and further developed (Section 1.3).

1.3. Support to local NGOs through Small Grants Programmes

In the previous phase of the GEF Black Sea Programme, local Black Sea NGO initiatives were supported through Small Grants Programmes, one in 1995 and the other one in 1997/98. The main focus of these programmes was on raising public awareness of the Black Sea issues, and on environmental education. Participating NGOs designed interesting projects and were able to deliver good quality products. Because the previous experience with Small Grants was positive, this approach was used again in the preparatory stage of this subcomponent (Section 2).

2. New GEF Small Grants

Like the rest of the new GEF Black Sea Programme, the Public Information and Involvement Subcomponent focuses on minimizing eutrophication in the Black Sea. In designing this Subcomponent, it was decided to first identify whether the local NGOs were interested and prepared to use the GEF support in local activities, contributing to nutrient reduction in the Black Sea. A "Call for Project Proposals" was circulated among the coastal NGOs in all 6 countries, which defined clear funding priorities:

- Restoration and conservation of wetlands
- Promotion of organic (chemical-free) agriculture and farming
- Introduction of low-technology waste water treatment techniques in small coastal communities
- Promotion of phosphate-free detergents
- Production of visual educational materials for schools, local authorities and general public on:
    (1) the ecological role of wetlands and the need for their preservation;
    (2) techniques and importance of water conservation;
    (3) problems and solutions (low-technology) of wastewater treatment.

In total, 48 NGO proposals were submitted. They were evaluated by a committee, including: (1) an expert from the Regional Environmental Center for Central and

Eastern Europe, (2) a WWF expert, and (3) a Tacis Black Sea Programme expert. In the evaluation process, the NGO proposals were prioritised as "High," "Medium," and "Low." The first two categories of proposals will be included in the Project Brief for GEF funding. The "Low" priority proposals will not be considered for funding at this stage. The full table with evaluated proposals is included with this report.

3. Conclusions

Environmental protection of the Black Sea depends not only on international agreements, but also on the daily actions of the coastal population. The PDF-B provided support to develop a portfolio of small public initiatives contributing to nutrient reduction in the Black Sea. These were submitted, evaluated and prioritised through a competitive process including peer review. Selected NGO proposals are directed at minimising eutrophication in the Black Sea through: (1) restoration of wetlands (Ukraine, Russia, Moldova), (2) promotion of cost-effective water treatment facilities (Ukraine), (3) constructed wetlands (Bulgaria), (4) development of organic farming (Georgia, Bulgaria), (5) production of educational materials for schools and general public (Bulgaria, Romania, Russia, Turkey, Ukraine), (6) public awareness and involvement campaigns (Turkey, Romania). Based on the outcome of these initiatives, a second tranche of small projects is proposed after a two-year period. Project implementation will be monitored from the PIU. Additionally activities to strengthen the regional network of NGOs are included.

Annex I. GEF/BSEP Small Grants Evaluation Results

Table 1. Black Sea NGO Projects proposed for funding

Country Priority [3]	Organization	Project Name	Duration	Requested from GEF (USD)[4]	Suggested GEF contribution (USD)
UKRAINE					
Medium	Odessa Department of the Socio-ecological Union	The Revival of the Dniester mouth region	30 months	19,939*	10,000
Medium	Fund of Natural Sciences and Ecology (Odessa)	Series of video films "Wetlands of the Ukrainian Black Sea Region"	24 months	20,100*	15,000
Medium	Ecological Club "The Seventh Continent" (Bolgrad)	"Clean water, green forests for our children"	3 months	1,750*	1,750
Medium	INECO – South Branch	Promote Cost-effective water treatment facilities for small coastal communities in Ukraine	18 months	13,610	10,000
Medium	Youth Environmental Society GAIA	Education on sustainable usage of water preservation and eutrophication in Ukraine	10 months	7,700	5,000
Medium	Ecostyle (Crimea)	Show-bench "Living Water"	24 months	5,000	5,000
Medium selected projects, must be further developed	3 NGO proposals coordinated by Dr. Sergey Khvorov	"Stop human-made eutrophication of the Black Sea -- a role for everyone"	24 months	65,000	Maximum 20,000
TURKEY					
High	The Black Sea Environmentalist	Raising the public awareness on the effects of	24 months	15,000*	11,000

[3] When evaluated, all submitted projects were prioritized into "Low," "Medium," and "High," with the last two categories being recommended for GEF funding at this stage.

[4] Note: A star mark (*) after the amount requested from the GEF means that it is smaller than the total project budget. The absence of such mark means that the project budget does not reflect any cost-sharing.

	(Trabzon)	pollution on environment, human health and wildlife in Trabzon			

Medium to High	Turkish Environmental and Woodland Protection Society, Istanbul	Watching out the Black Sea Coastal Hot Spots	30 months	33,200*	15,000
Medium	Research Association of Rural Environment and Forestry, Ankara	Determination of Polluting factors of rural environmental problems on Black Sea, and education of local people	28 months	7,250*	5,000
Medium	Underwater Research Society, Ankara	Public Awareness and education project on wetland ecology	19 months	16,550	12,000
RUSSIA					
Medium to High	Krasnodar Regional NGO Ecourse	Clever Dacha (Farming) for the Environment	2001-03	18,100*	15,000
Medium	Green Lungs Novorossiysk	"Let's Keep for Future"	30 months	17,995*	17,995
Medium-High	Environmental Center of Sochi	Wetland Education for Children	11 months	9,850*	8,000
Medium-High	Sochi Branch of the Russian Geographic Society	Restoration of Imeretinskaya Wetland on the Russian Coast of the Black Sea	24 months	9,580*	9,580
Medium	Sports and Health Society "Sailing Academy	"The Green Filter for the polluted drains"	24 months	22,092*	10,000
ROMANIA					
High	Mare Nostrum	Romanian Coastal Watershed Voluntary Programme -- an organizational framework to provide environmental education, training and direct assistance to rural and urban residents for controlling non-point source pollution	24 months	21,659*	21,659
Medium-High on provision of scaling	G.E.S.S. -- The Group for Underwater and Speleological	Black Sea Public Awareness Project	24 months	43,030*	20,000

down to 20,000	Exploration					

Medium-High	Prietenii Pamantului (Earth Friends)	Water is Life -- production of visual educational materials for schools, local authorities and the general public	24 months	15,578*	15,578
Medium-High	UNESCO Pro Natura -- Association for Action in Protected Areas	Waters and Wetlands National Information Internet NGO Website	21 months	14,625*	10,000
GEORGIA					
Medium	Biological Farming Association ELKANA	Organic farming for farmers, local authorities and other stakeholders in Western Georgia (Black Sea Coast)	4 months	6,728	5,000
Medium	Association Green Wave	Weekly radio programme “All About the Black Sea”	12 months	13,030	10,000
BULGARIA					
High	Black Sea Coastal Association, Varna	Study and Promotion of Constructed Wetlands for Wastewater Treatment in Small Coastal Communities in Bulgaria	24 months	12,870	12,870
Medium-Low	Bulgarian Democratic Youth	“Let’s save the wetlands of Bulgarian Black Sea coast” (educational film)	24 months	9,130	5,000
Medium	ECOFARM Association	Organic Farming in the Catchment Area of the Bourgas Bay	3 years	25,000	25,000
MOLDOVA					
Medium	National Association Water Science (Kishinev)	Protection and Rehabilitation of the Wetland Area dislocated in the zoneof the lakes Beleu and Manta on the river Prut in the Black Sea Basin	17 months	8,000	8,000

Table 2 Projects not selected (low priority projects)

Country Priority [5]	Organization	Project Name	Duration	Amount requested from GEF (USD)[6]
UKRAINE				
Low	Ecological Center "Delta" (Vilkovo))	Creation, support and updating of the Internet website "Ecology of Odessa Area"	24 months	7,360*
Low	Ecological Club "Danube"	Preparation, edition and introduction in target groups of a text-book "Rare and endangered birds of the Ukrainian Black Sea coastal areas"	9 months	8,225*
Low	Yalta Student Scientific Society	Visual materials of Crimean wetlands and wastewater treatment	2,5 years	15,550
Low	Research Center "Noosphera" (Odessa)	Monitoring of the eutrophication's level in the Black Sea zone under the Danube water influence	36 months	25,000*
Low	Youth Environmental League of Prydnyprovya, Dnipropetrovsk	Towards Sustainability in the Black Sea basin: Reduction of Pollution of Dnipro River at the Local Level	24 months	24, 850*
Low	Youth Ecological Center Sumscheena, Sumy	The Territory of the Ukraine is the Black Sea Basin	7 months	22,490*
Low	Regional NGO "Green Defence"	Reduction of eutrophication influence of the small rivers and limans of the Odessa region....	24 months	21,958*
N/A	Black Sea Biosphere Reserve	Popular Science Book "The Wetlands birds of the Black Sea Biosphere Reserve"	18 months	18, 450*
Low	Informal educational and reserach circle Eco-soil (National Agricultural University of Ukraine)	1. To identify ecological consequences of excessive wet soil remediation... 2. Water pollution and eutrophication in the Dnipro....		
TURKEY				

[5] When evaluated, all submitted projects were prioritized into "Low," "Medium," and "High," with the last two categories being recommended for GEF funding at this stage.

[6] Note: A star mark (*) after the amount requested from the GEF means that it is smaller than the total project budget. The absence of such mark means that the project budget does not reflect any cost-sharing.

Incomplet proposal	Environmental Protection Association of Zonguldak	A biological refining system for the wastewater of Bahcelievler District in Zonguldak	1-2 years	24,000*
RUSSIA				
Medium-Low	NGO Ecological-Recreation Consortium ERCONS	Formation of Public Opinion of the Rostov Region Population intended to conservation and preservation of the Don River delta and the Sea of Azov Wetlands	24 months	17,300*
Low	Novorossiysk Public Organization of Study and Protection of Biological variety of Flora and Fauna	Sudzhuk Lagoon (wetlands) should be clear	6 months	7,700*
Low	Social-Cultural Center of Rostov Oblast, Ecopont	Developing of proposals for the conservation of wetlands, coastal lakes, and Sudjukskaya lagoon in northeast of the Black Sea	24 months	50,000*
N/A	Green Don	Improvement of the Strategic Action Proposal in order to promote the conservation of biodiversity and fish stocks in the Black Sea	12 months	5,000
Low	Sochi State University	Develop ways and water purification facilities in small rivers and temporary waterways of the Caucasus Black Sea coast	24 months	20,000*
ROMANIA				
Low-Medium	EcoCouncelling Center Galati	Raising Public Awareness and Involvement in Reducing the Danube's nutrients Load, so as to protect the Black Sea	24 months	24, 670*
N/A	Daciafilm the 7th Art Foundation	Save the Life in the Black Sea	12 months	23,942*
GEORGIA				
Low	GAEC -- Guria Youth Ecocenter	Infobus for Kolkheti Wetlands 2001		
Low	Foundation Caucasus Environment	Eutrophication and Harmful Algal Bloom Events in Georgian Black Sea Coast		
Low	The Greens Movement of Georgia/Friends of the Earth	"Kolkheti Wetlands -- Surviving Together"		
N/A	Zoology Institute of the	Production and use of ecologically clean organic		

	Academy of Sciences of Georgia	fertilizer on the basis of local worm		
BULGARIA				
Low	ECO-CLUB 2000	Restoration and conservation of the Black Sea coastal river firths in Bulgaria		
Low	ECO-CLUB 2000	The creation of constructed wetlands (feasibility study)		

Annex II. **CALL FOR PROPOSALS**

GEF/BSEP SMALL GRANTS PROGRAMME

The Black Sea Environmental Programme (BSEP) is announcing **Call for Proposals** to be submitted for the projected new phase of the Global Environment Facility (GEF) support to the Black Sea countries of Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine.

Background Information

From 1993 until 1997 the GEF together with other donors, has funded the Black Sea Environmental Programme. This Programme has enabled many specialists from Black Sea countries to integrate their efforts in understanding the state of the Black Sea and propose measures to protect and restore its environment. Specifically, it has resulted in a comprehensive assessment of the environmental problems in the Black Sea and their causes. Based on this technical document, the Black Sea Strategic Action Plan (BSAP) was approved in 1996. In BSAP, the governments of Black Sea countries committed themselves to a long-term programme of actions to protect the Black Sea.

The environmental assessment of the Black Sea revealed that the major cause of chronic degradation in the sea is a phenomenon known as eutrophication (excessive production of organic material in the sea). Eutrophication in the Black Sea has been caused by an increase in the discharge of nitrogen and phosphorus compounds to the Sea or to its tributary rivers. These compounds, often referred to as nutrients, have resulted in massive growth of the tiny floating plants (phytoplankton) that form the basis of the Sea's food chain. This has led to major changes in the Black Sea ecosystem and the loss of important plant and animal communities. Many of these changes may be reversed, if the discharge of nutrients is returned to levels similar to those encountered some 40 years ago.

The proposed new phase of the GEF Black Sea Environmental Programme focuses on the **control of eutrophication**. Public participation will be an important component of this project. The present call for proposals aims to facilitate the design of the public participation sub-component. The amount of funding for this sub-component largely depends on the level of interest and commitment expressed by local communities in the Black Sea region. Simply expressed, if there are no proposals from the region, there will be no funding.

What kind of projects will be supported?

Projects should contribute to minimising eutrophication in the Black Sea. The

following types of projects are particularly encouraged:

- Restoration and conservation of wetlands
- Promotion of organic (chemical-free) agriculture and farming
- Introduction of low-technology waste water treatment techniques in small coastal communities
- Promotion of phosphate-free detergents
- Production of visual educational materials for schools, local authorities and general public on:
    a) the ecological role of wetlands and the need for their preservation
    b) the techniques and importance of water conservation
    c) problems and solutions (low-technology) of wastewater treatment

Eligibility

- NGOs which are formally registered as a distinct legal entity and are active in the Black Sea work in Bulgaria, Georgia, Romania, Russia, Turkey, and Ukraine[7]
- Community-based educational organisations (schools, clubs, youth groups, etc.)

What grants will be available?

The amount of funding for each Black Sea country will depend directly on the number and quality of submitted proposals. Just as a general guidance, it is hoped to raise at least US $50,000 per country. Individual projects can range from US $5,000 to 25,000.

Project duration

Longer-term projects (2-3 years) are encouraged. Shorter projects will also be considered.

Language of the project proposal

The project proposals should be submitted in **English language only**

Selection Process

First Stage: All submitted project proposals will be evaluated by a committee of Black Sea and international experts to make sure that they: (1) correspond to the set criteria, (2) can be realistically implemented, and (3) that the impact can be sustained over a longer period of time. The results of this initial evaluation will be known by the end of June 2000.

Second Stage: Pre-selected proposals will be incorporated in the overall Nutrient Reduction Programme for the Black Sea and submitted to the GEF Council for final approval. The meeting of the GEF Council will take place in November 2000. The

[7] Proposals from coastal NGOs will be given priority, although all relevant NGOs are encouraged to apply.

final decision on the Small Grants will be communicated to the successful applicants by the end of November 2000.

Due to this lengthy timeframe, **all projects should be designed to begin no earlier than January 2001.**

Please, strictly follow the application guidelines and send the original of your proposal to:

GEF Small Grants Programme
BSEP PIU
Dolmabahce Sarayi, II Harekat Kosku
80680 Besiktas, Istanbul
Turkey

E-mail a copy of your proposal to: rmihnea@dominet.in.com.tr

If you have any questions regarding this Call for Proposals, you can contact Olga Maiboroda at: olgam@btinternet.com

Deadline for submitting project proposals is 20 May 2000

APPLICATION GUIDELINES

The length of a project proposal should not exceed **4 pages**, including:

1. *Cover page (see format attached)*
2. Project description. Please describe the local situation, specifically focusing on the following:
   - What do you want to achieve?
   - Why is it needed?
   - How will it make a difference?
3. List expected results of the project
4. Timetable of project implementation. Please follow the format below:

Description of the activity	Full name(s) and qualifications of responsible person (people)	Period of implementation
1		
2		

5. Budget

Please, develop your budget in USD, providing examples for each budget item on how it is calculated. Below we suggest a possible format for presenting your budget.

Project expenses	Amount requested from the	Contributions of other donors/	Contribution of your organisatio

	GEF	Organisations	
People fees (number of people, their titles within the project, duration of their involvement, total amount)			
Project materials (prices for each item, total amount)			
Communication (phone, fax, mail, e-mail, total amount)			
Rent of any required equipment, space (purpose for renting, dates, cost of each item, total amount)			
Publishing expenses (if appropriate).			
Other categories of expenses…			
TOTAL BUDGET			

Attached to the project proposal please include:

1. Copy of registration of the organisation
2. CV of the Project Co-ordinator

GEF Black Sea Small Grants Programme

Project Proposal

Cover Page

Country
Proposing organisation: Name Address Phone/fax E-mail)
Project title
Project duration
Short description of project objectives and activities (maximum 10 lines)

Project budget: Total amount: Amount requested from the GEF:
Bank account in USD (if the organisation has one)

Annex III GEF/BSEP Small Grants Programme
Evaluation Sheet

Country:
Name of NGO:
Title of Project:

Category	***Comments***	***Score*** (1 -- lowest 10 -- highest)
Contribution to minimizing eutrophication in the Black Sea		
Public involvement		
Cooperation with other stakeholders		
Feasibility of achieving planned results		
Clear indicators of measuring progress		

Sustainability of this project (its outcome) over a longer term		
Replicability		
Cost/benefit analysis		
Experience/qualifications of Project Co-ordinator		
Total Score		

Concluding recommendation:

Evaluator:

Date:

Annex 12

ENHANCEMENT OF LEGISLATIVE PROVISIONS FOR REDUCTION OF NUTRIENTS INPUT TO THE BLACK SEA.

A report prepared by I. Zrazhevsky on the request of UNEP/ROE.

Sankt-Petersburg-Geneva 2000.

Content.

Annex 1.

Environmental Cooperation in the Black Sea region.

(Position paper prepared by I. Zrajevskij, ROE, Senior Natural Resources Officer, September 1996)

Background:

The possibility to develop a Regional Seas Action Plan for the Black Sea was first explored by OCA/PAC in 1987.

In 1989 the Governing Council of UNEP at its Fifteenth Session (Decision 15/1 "Strengthening the role and effectiveness of the United Nations Environmental Programme", part VI.3) approved "preparation of new action plans for seas not yet covered by the regional seas programme (North-West Pacific, Black Sea)" as one of the activities listed within "Supplementary Programme of Environment Fund Activities for the Biennium 1990-1991" attached as an Annex to the quoted decision. The practical steps of the preparation of the regional seas programme for the Black Sea started in 1991 when the fund for the UNEP Supplementary Programme was approved.

UNEP reported on its activities in the region to the Diplomatic Conference on the Protection of the Black Sea against Pollution (Bucharest, 21-22 April 1992). At the Conference the Governments of Bulgaria, Georgia, Romania, Russian Federation, Ukraine and Turkey signed the following legal instruments:

-Convention on the Protection of the Black Sea against Pollution;

-Protocol on Protection of the Black Sea against Pollution from Land-based Sources;

-Protocol on Cooperation in Combating Pollution of the Black Sea Marine Environment by Oil and other Harmful Substances in Emergency Situations;

-Protocol on the Protection of the Black Sea Marine Environment against Pollution by Dumping;

They also decided "to invite UNEP-OCA/PAC Regional Seas Programme to cooperage with the Contracting Parties and/or the Commission for the elaboration of a Black Sea Action Plan..." (Resolution 3 - "Cooperation with intergovernmental organizations").

The Convention is ratified by all participating countries. However, the Secretariat of the Convention is not established yet due to the lack of a fund.

As a first concrete step in the context of the requested long- term action plan for the Black Sea a Ministerial Declaration on the Protection of the Black Sea was initiated. With UNEP assistance the Declaration was prepared and adopted at the Ministerial meeting in Odessa, Ukraine on 6-7 April 1993. The Declaration constitutes an interim framework Black Sea Action Plan and establishes explicit environmental goals and a time-frame in order to concentrate national, regional and international resources on the most effective measures. It provides a common policy framework able to respond to the changing problems and institutes a mechanism for regular review and the evaluation of achievements and required amendments.

The Final Act of the Ministerial meeting calls upon "the Executive Director of UNEP to provide continued assistance to the Black Sea countries and the Commission on the Protection of the Black Sea Against Pollution to review the implementation of this Declaration, to develop recommendations on actions required to enhance implementation or to further develop the Declaration and in preparation of a consolidated triennial report on the status of the implementation of the provisions of the Declaration.»

In order to make an early start to environmental action and to develop a longer-term Action Plan, the Black Sea countries requested support from the Global Environment Facility, GEF, a fund established in 1991 under the management of the World Bank, UNDP and UNEP. In June 1993, a three-year Black Sea Environmental Programme (BSEP) was established with US$ 9.3 million funding from GEF and collateral funding from the European Union (Phare and Tacis), The Netherlands, France, Austria, Canada and Japan.

UNEP was not considered an appropriate agency for running a project of this magnitude and, therefore, UNDP was selected as a lead agency for BSEP. However, there were good relations between UNEP and BSEP mostly due to the fact that coordinator, Mr. L. Mee formally UNDP staff, had close links with OCA/PAC and UNEP Regional Seas Programme. Black Sea was considered to be one of the regions covered by the UNEP Regional Seas Programme. Odessa Declaration provides the framework Black Sea Action Plan. UNEP is a member of the Steering Committee that consists of representatives of the Governments, NGOs and GEF partners/and associate donors. The Steering Committee at its annual meetings determines the overall strategy for the GEF Project "Environmental Management and Protection of the Black Sea". UNEP is also a member of National Coordinators Contact Group. The Group consists of the Government representatives (the National Coordinators) and GEF partners only. It is established to oversee the project management, review the work plan and assure the harmonious development of project activities within the region.

BSEP resulted in the establishing and operating a network linking more than 40 institutions around the Black Sea and successful completion of the electronic mail network. The BSEP has contributed more than US$ 1.5 million to re-equipping its pollution monitoring network. The BSEP's environmental investment programme, led by the World Bank, has supported the development of an Urgent Investment

Portfolio which has already led to an US$ 18 million emergency concessionaire loan to your country. Finally BSEP has assisted with the preparation of a strategic Black Sea Action Plan to be presented to a Ministerial Conference for adoption in October 1996.

UNEP's contribution to the strategic Black Sea Action Plan relates to the problem of ctenophore *Mnemiopsis Leidyi*.The natural features of the Black Sea, such as its huge volume of anoxic waters, its relative isolation from the open ocean, and its vast drainage basin, make the ecosystem extremely vulnerable to both anthropogenic impact and intervention of opportunistic, alien species. The ecosystem of the Black Sea was *drastically* affected by a voracious animal *Mnemiopsis leidyi*, a ctenophore that was most likely introduced with ballast water. The first records of *Mnemiopsis* in the Black Sea date back to 1982. At that time it occupied only bays and coastal waters. Yet, during the summer of 1988 *Mnemiopsis* began invading the open area of the sea, and by that autumn, its biomass reached 1.5 kg/sq.m. In 1989 and 1990 the biomass of *Mnemiopsis* continued to grow, reaching 10-12 kg/sq.m. in several coastal areas. In 1991 the biomass began to decrease and declined gradually to its current level that is 4-6 times less than that of 1989.

The *Mnemiopsis* invasion has had a severe impact on the Black Sea fisheries and fishing industry. As a result of the *Mnemiopsis* invasion, the pelagic fish stock, which is the remaining commercially important resource, drastically decreased after 1988, and the Black Sea fishing industry collapsed. Total catches, estimated at 900,000 tons in 1986, fell to about 100,00 tons for all countries in 1992. Worst hit was Turkey, which in the 1970s and early 1980s relied on the Black Sea for 80 percent of all its fish. The total Turkish catches in the Black Sea and the sea of Marmara was nearly 500,000 tons in 1988, much of it anchovies. The following year the catch was almost halved at 264,000 tons. Judging by the throughput at Turkey's largest anchovy plant in Trabzon, the total fish catch may have fallen as low as 70-80,000 tons by 1991 (Data from "Saving the Black Sea", Official newsletter of the Global Environment Facility Black Sea Environmental Programme, Issue 1, Sept. 1994).

UNEP assisted the Black Sea countries with the preparation of a strategy for the control of *Mnemiopsis* through GESAMP. In cooperation with IMO, FAO and UNESCO we convened two meetings of the GESAMP Working Group on Opportunistic Settlers and Problem of the Ctenophore *Mnemiopsis Leidyi* in the Black Sea. The report of the working Group: «The Invasion of the Ctenophore *Mnemiopsis Leidyi* in the Black Sea» was approved by GESAMP for publication as GESAMP Reports and Studies No 58". The results will be reflected in the strategic Black Sea Action Plan.

The Odessa Declaration was adopted in April 1993. Therefore, a triennial report on its implementation requested from the UNEP Executive Director is due in the first half of 1996.In order to meet the obligation UNEP requested all participating countries to prepare national triennial reports on implementation of the Odessa Declaration and recommendations on actions required to enhance implementation or

to further develop the Declaration. On their basis UNEP will prepare a regional report on the implementation of the Declaration and recommendations on its further development or establishment of a new high level mechanism for regular review of achievements in the efficiency of coordinated actions for rehabilitation and protection of the Black Sea ecosystem. The regional report will be presented by UNEP to the Ministerial Conference in October 1996.

Present situation in brief:

UNEP has relations with the following three interrelated but independent frames for environmental cooperation in the Black Sea region:

- GEF Black Sea Environmental Programme (BSEP) with UNDP Programme Coordinating Unit (PCU) in Istanbul. Most active programmes With US$ 9.3 million funding from GEF and collateral funding from the European Union (Phare and Tacis), The Netherlands, France, Austria, Canada and Japan. UNEP has good relations with PCU. BSEP is also recognized as one of the regional seas programmes. UNEP took a lead role in assisting countries with the preparation of a strategy for the control of ctenophore *Mnemiopsis Leidyi* through GESAMP. At present GEF project is formally closed. UNDP supports PCU pending approval of a GEF bridging project of one year duration and 1.5 million US$ value. One side of a bridge is the present situation; nobody has clear picture what should be at the other side of the bridge. In October 1996 a Ministerial Conference will be convened in order to approve the Strategic Black Sea Action Plan and decide on the future of BSEP.

- Convention on the Protection of the Black Sea against Pollution with three protocols. The Convention is ratified by all participating countries. However, the Secretariat of the Convention is not established yet due to the lack of national funds. There is a possibility that countries will invite UNEP to provide Secretariat for the Convention if UNEP is able to support it.

- Ministerial Declaration on the Protection of the Black Sea. The Declaration constitutes an interim framework Black Sea Action Plan and establishes explicit environmental goals and a time-frame in order to concentrate national, regional and international resources on the most effective measures. The Executive Director of UNEP is requested to provide continued assistance to the Black Sea countries and the Commission on the Protection of the Black Sea Against Pollution to review the implementation of the Declaration, to develop recommendations on actions required to enhance implementation or to further develop the Declaration and in preparation of a consolidated triennial report on the status of the implementation of the provisions of the Declaration. UNEP is preparing a regional triennial report on the implementation of the Declaration and recommendations on its further development or establishment of a new high level mechanism for regular review of achievements in the efficiency of coordinated actions for rehabilitation and protection of the Black

Sea ecosystem. The report will be presented by UNEP to the Ministerial Conference in October 1996. Participation of a UNEP high level official is necessary.

Conclusions and recommendations:

1. There is a political will in the region to continue cooperation. However, most of the Black Sea countries could not provide national resources to support cooperation due to economical difficulties. Continuation of the GEF support after a bridging project of one year duration and 1.5 million US$ value is not certain. **UNEP should promote continuation of the GEF support in order to preserve and wisely use the capacity created in the region for the cooperation in the protection and restoration of the Black Sea ecosystem**. More emphasis of BSEP on the implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities might help to secure support.

2. The financial situation in UNEP does not indicate any possibility to provide support for the Secretariat of the Black Sea Convention at the required level in the near future. Therefore, we are not suggesting encouraging countries to amend the Convention in order to have a possibility to request UNEP to provide for the Secretariat of the Convention. We suggest **supporting establishment of a Programme Implementation Unit (for coordination of Implementation of BSAP) integrated into the Secretariat of the Convention**. We should assist countries and UNDP in securing funds for the Secretariat of the Convention and implementation of BSAP. We can suggest, for example, to use unfrozen Russian funds to support Secretariat of the Convention.

3. As it is mentioned above all participating countries are preparing national triennial reports on implementation of the Odessa Declaration and recommendations on actions required to enhance implementation or to further develop the Declaration. They were also asked to indicate their preference: to continue with the process established by the Odessa Declaration (national and regional reports prepared by consultants under the auspice of UNEP and Ministerial Conference) or to institute a new high level mechanism for regular review of achievements in the efficiency of coordinated actions for rehabilitation and protection of the Black Sea ecosystem. It is difficult to predict what options countries will finally select, as the positions are different. The Odessa Declaration has two main purposes: to serve as an interim framework Black Sea Action Plan and to institute a mechanism for regular review of achievements in the efficiency of coordinated actions. The first purpose will be redundant after approval of BSAP. There are three following options as regards the second purpose:

- to incorporate a review mechanism into BSAP;
- to use Secretariat of the Convention for reviewing the efficiency of coordinated actions;
- to continue with the process established by the Odessa Declaration.

The third option is our preference at the moment. However, we should come back to the problem after having received triennial reports.

Annex 2

Participation of the European countries in the Conventions for protection of water bodies.

Country member of ECE and the region	Bordering Seas	Catchment basins	Participation in the main regional and global conventions
Albania (CE)	Mediterranean Sea	Mediterranean Sea, Black Sea	ECE Water RamC BarC
Andorra (WE)		Mediterranean Sea	RamC
Armenia (EE)		Caspian Sea	RamC
Austria (WE)**		Black Sea	UNCLOS MARPOL ECE Water RamC DanC
Azerbaijan (EE)	Caspian Sea	Caspian Sea	CAS
Belarus (EE)		Baltic Sea, Black Sea	MARPOL
Belgium (WE)**	North Sea	North Sea	MARPOL RamC OSPAR
Bosnia and Herzegovnia (CE)	Mediterranean Sea	Mediterranean Sea, Black Sea	BarC
Bulgaria (CE)*	Black Sea	Mediterranean Sea, Black Sea	UNCLOS MARPOL RamC BucC DanC
Canada			
Croatia (CE)	Mediterranean Sea	Mediterranean Sea, Black Sea	UNCLOS MARPOL ECE Water RamC,DanC BarC
Cyprus (CE)*	Mediterranean Sea	Mediterranean Sea	UNCLOS

			MARPOL BarC
Czech. Republic (CE)*		North Sea, Black Sea, Baltic Sea	UNCLOS MARPOL RamC, DanC
Denmark (WE)**	Baltic Sea, North Sea	Baltic Sea, North Sea	MARPOL RamC OSPAR HelC
Country member of ECE	**Bordering Seas**	**Catchment basins**	**Participation in the main regional and global conventions**
Estonia	Baltic Sea	Baltic Sea	ECE Water RamC HelC
Finland (WE)**	Baltic Sea	Baltic Sea	UNCLOS MARPOL ECE Water RamC HelC
France (WE)**	North Atlantic Ocean, Mediterranean Sea, North Sea	Mediterranean Sea, North Sea	UNCLOS MARPOL RamC BarC BerC OSPAR
Georgia (EE)	Black Sea	Black Sea, Caspian Sea	UNCLOS MARPOL RamC BucC
Germany (WE)**	Baltic Sea, North Sea	Baltic Sea, North Sea, Black Sea	UNCLOS MARPOL ECE Water RamC HelC DanC OSPAR BerC
Greece (WE)**	Mediterranean Sea	Mediterranean Sea	UNCLOS MARPOL ECE Water

			RamC BarC
Hungary (CE)*		Black Sea	MARPOL ECE Water RamC, DanC
Iceland (WE)	North Atlantic Ocean	North Atlantic Ocean	UNCLOS MARPOL RamC OSPAR
Ireland (WE)**	North Atlantic Ocean	North Atlantic Ocean	UNCLOS MARPOL RamC OSPAR
Israel (WE)	Mediterranean Sea	Mediterranean Sea	MARPOL RamC BarC
Country member of ECE	**Bordering Seas**	**Catchment basins**	**Participation in the main regional and global conventions**
Italy (WE)**	Mediterranean Sea	Mediterranean Sea, Black Sea	UNCLOS MARPOL ECE Water RamC BarC
Kazakstan (CA)	Caspian Sea, Aral Sea	Caspian Sea, Aral Sea	MARPOL CAS
Kyrgyzstan (CA)		Aral Sea	
Latvia (CE)*	Baltic Sea	Baltic Sea	MARPOL ECE Water RamC HelC
Liechtenstein (WE)		North Sea	RamC
Lithuania (CE)*	Baltic Sea	Baltic Sea	MARPOL RamC HelC

Luxembourg (WE)**		North Sea	MARPOL ECE Water BerC OSPAR
Malta (WE)*	Mediterranean Sea	Mediterranean Sea	UNCLOS MARPOL RamC BarC
Moldova (EE)		Black Sea	ECE Water DanC
Monaco (WE)	Mediterranean Sea	Mediterranean Sea	UNCLOS MARPOL BarC
Netherlands (WE)**	North Sea	North Sea	UNCLOS MARPOL ECE Water RamC BerC OSPAR
Norway (WE)	North Sea	North Sea, Baltic Sea	UNCLOS MARPOL ECE Water RamC OSPAR
Poland (CE)*	Baltic Sea	Baltic Sea, Black Sea	MARPOL ECE Water RamC HelC
Country member of ECE	**Bordering Seas**	**Catchment basins**	**Participation in the main regional and global conventions**
Portugal (WE)**	North Atlantic Ocean	North Atlantic Ocean	UNCLOS MARPOL RamC ECE Water OSPAR
Romania (CE)*	Black Sea	Black Sea	UNCLOS MARPOL ECE Water RamC

			DanC BucC
Former Yugoslav Republic of Macedonia (CE)	Mediterranean Sea	Mediterranean Sea, Black Sea	RamC
Russian Federation (EU)	Sea of Azov, Black Sea, Baltic Sea, Caspian Sea	Sea of Azov, Black Sea, Baltic Sea, Caspian Sea	UNCLOS MARPOL ECE Water RamC HelC BucC CAS
San Marino (WE)		Mediterranean Sea	
Slovakia (CE)*		Black Sea	UNCLOS MARPOL ECE Water DanC
Slovenia (CE)*	Mediterranean Sea	Mediterranean Sea, Black Sea	UNCLOS RamC MARPOL BarC, DanC
Spain (WE)**	Mediterranean Sea, North Atlantic Ocean	Mediterranean Sea, North Atlantic Ocean	UNCLOS MARPOL RamC, BarC OSPAR
Sweden (WE)**	Baltic Sea, North Sea	Baltic Sea, North Sea	UNCLOS MARPOL ECE Water RamC, H elC OSPAR
Switzerland		Mediterranean Sea, North Sea, Black Sea	MARPOL ECE Water, RamC, BerC OSPAR
Country member of ECE	**Bordering Seas**	**Catchment basins**	**Participation in the main regional and global conventions**
Tajikistan (CA)		Aral Sea	
Turkey (CE)	Black Sea, Mediterranean Sea	Black Sea, Mediterranean	MARPOL RamC

	Mediterranean Sea	Sea, Caspian Sea	BucC BarC
Turkmenistan (CA)	Caspian Sea	Caspian Sea, Aral Sea	CAS
Ukraine (EE)	Sea of Azov, Black Sea	Sea of Azov, Black Sea, Baltic Sea	MARPOL ECE Water RamC, BucC DanC
United Kingdom (WE)**	North Sea, North Atlantic Ocean	North Sea, North Atlantic Ocean	UNCLOS MARPOL RamC OSPAR
United States			
Uzbekistan (CA)	Aral Sea	Aral Sea	
Yugoslavia (CE)	Mediterranean Sea	Mediterranean Sea, Black Sea	UNCLOS MARPOL RamC

**Member of the European Union (EU)
*countries applied to be members of EU

Abbreviations:

CA - Central Asia.
CE – Central Europe.
EE – Eastern Europe.
WE – Western Europe.

UNCLOS – United Nations Convention on the Law of the Sea.
MARPOL 73/78 - International Convention for the Prevention of Pollution from Ships.

RamC – Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat.

ECE Water - ECE Convention on the Protection and Use of Transboundary Watercourses and International lakes.

BarC - Barcelona Convention for the Protection of the Mediterranean Sea against pollution.
BerC - Berne Convention on the Protection of the Rhine.
BucC – Bucharest Convention on the Protection of the Black Sea against Pollution.
CAS – Framework Convention for the Protection of the Marine Environment of the Caspian Sea. The name of the convention is a preliminary one as it is still under the negotiations.

DanC - Convention on Cooperation for the Protection and Sustainable Use of the River Danube.
HelC–Helsinki Convention for the Protection of the Marine Environment of the Baltic Sea Area.
OSPAR – Convention on the Protection of the Marine Environment of the North-East Atlantic.

Annex 3.

Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities

(As amended in Syracusa, Italy, 7 March 19967 March 1996)

The Contracting Parties to the present Protocol,

Being Parties to the Convention for the Protection of the Mediterranean Sea against Pollution, adopted at Barcelona on 16 February 1976 and amended on 10 June 1995,

Desirous of implementing article 4, paragraph 5, and articles 8 and 21 of the said Convention,

Noting the increasing environmental pressures resulting from human activities in the Mediterranean Sea Area, particularly in the fields of industrialization and urbanization, as well as the seasonal increase in the coastal population due to tourism,

Recognizing the danger posed to the marine environment, living resources and human health by pollution from land-based sources and activities and the serious problems resulting therefrom in many coastal waters and river estuaries of the Mediterranean Sea, primarily due to the release of untreated, insufficiently treated or inadequately disposed of domestic or industrial discharges containing substances that are toxic, persistent and liable to bioaccumulate,

Applying the precautionary principle and the polluter pays principle, undertaking environmental impact assessment and utilizing the best available techniques and the best environmental practice, including clean production technologies, as provided for in article 4 of the Convention,

Recognizing the difference in levels of development between the coastal States, and taking account of the economic and social imperatives of the developing countries,

Determined to take, in close cooperation, the necessary measures to protect the Mediterranean Sea against pollution from land-based sources and activities,

Taking into consideration the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities, adopted in Washington, D.C., on 3 November 1995,
Have agreed as follows:

Article 1

GENERAL PROVISION

1. The Contracting Parties to this Protocol (hereinafter referred to as "the Parties") shall take all appropriate measures to prevent, abate, combat and eliminate to the fullest possible extent pollution of the Mediterranean Sea Area caused by discharges from rivers, coastal establishments or outfalls, or emanating from any other land-based sources and activities within their territories, giving priority to the phasing out of inputs of substances that are toxic, persistent and liable to bioaccumulate.

Article 2

DEFINITIONS

1. For the purposes of this Protocol:
   (a) "The Convention" means the Convention for the Protection of the Mediterranean Sea against Pollution, adopted at Barcelona on 16 February 1976 and amended on 10 June 1995;
   (b) "Organization" means the body referred to in article 17 of the Convention;
   (c) "Freshwater limit" means the place in watercourses where, at low tides and in a period of low freshwater flow, there is an appreciable increase in salinity due to the presence of sea-water;
   (d) The "Hydrologic Basin" means the entire watershed area within the territories of the Contracting Parties, draining into the Mediterranean Sea Area as defined in article 1 of the Convention.

Article 3

PROTOCOL AREA

1. The area to which this Protocol applies (hereinafter referred to as the "Protocol Area") shall be:
(a) The Mediterranean Sea Area as defined in article 1 of the Convention;

(b) The hydrologic basin of the Mediterranean Sea Area;

(c) Waters on the landward side of the baselines from which the breadth of the territorial sea is measured and extending, in the case of watercourses, up to the freshwater limit;
(d) Brackish waters, coastal salt waters including marshes and coastal lagoons, and ground waters communicating with the Mediterranean Sea.

Article 4

PROTOCOL APPLICATION

1. This Protocol shall apply:

(a) To discharges originating from land-based point and diffuse sources and activities within the territories of the Contracting Parties that may affect directly or indirectly the Mediterranean Sea Area. These discharges shall include those which reach the Mediterranean Area, as defined in article 3(a), (c) and (d) of this Protocol, through coastal disposals, rivers, outfalls, canals, or other watercourses, including ground water flow, or through run-off and disposal under the seabed with access from land;

(b) To inputs of polluting substances transported by the atmosphere to the Mediterranean Sea Area from land-based sources or activities within the territories of the Contracting Parties under the conditions defined in annex III to this Protocol.

2. This Protocol shall also apply to polluting discharges from fixed man-made offshore structures which are under the jurisdiction of a Party and which serve purposes other than exploration and exploitation of mineral resources of the continental shelf and the sea-bed and its subsoil.

3. The Parties shall invite States that are not parties to the Protocol and have in their territories parts of the hydrologic basin of the Mediterranean Area to cooperate in the implementation of the Protocol.

Article 5

GENERAL OBLIGATIONS

1. The Parties undertake to eliminate pollution deriving from land-based sources and activities, in particular to phase out inputs of the substances that are toxic, persistent and liable to bioaccumulate listed in annex I.

2. To this end, they shall elaborate and implement, individually or jointly, as appropriate, national and regional action plans and programmes, containing measures and timetables for their implementation.

3. The priorities and timetables for implementing the action plans, programmes and measures shall be adopted by the Parties taking into account the elements set out in annex I and shall be periodically reviewed.

4. When adopting action plans, programmes and measures, the Parties shall take into account, either individually or jointly, the best available techniques and the best environmental practice including, where appropriate, clean production technologies, taking into account the criteria set forth in annex IV.

5. The Parties shall take preventive measures to reduce to the minimum the risk of pollution caused by accidents.

Article 6

AUTHORIZATION OR REGULATION SYSTEM

1. Point source discharges into the Protocol Area, and releases into water or air that reach and may affect the Mediterranean Area, as defined in article 3(a), (c) and (d) of this Protocol, shall be strictly subject to authorization or regulation by the competent authorities of the Parties, taking due account of the provisions of this Protocol and annex II thereto, as well as the relevant decisions or recommendations of the meetings of the Contracting Parties.

2. To this end, the Parties shall provide for systems of inspection by their competent authorities to assess compliance with authorizations and regulations.

3. The Parties may be assisted by the Organization, upon request, in establishing new, or strengthening existing, competent structures for inspection of compliance with authorizations and regulations. Such assistance shall include special training

of personnel. 4. The Parties establish appropriate sanctions in case of non-compliance with the authorizations and regulations and ensure their application.

Article 7

COMMON GUIDELINES, STANDARDS AND CRITERIA

1. The Parties shall progressively formulate and adopt, in cooperation with the competent international organizations, common guidelines and, as appropriate, standards or criteria dealing in particular with:

(a) The length, depth and position of pipelines for coastal outfalls, taking into account, in particular, the methods used for pretreatment of effluents;

(b) Special requirements for effluents necessitating separate treatment;

(c) The quality of sea-water used for specific purposes that is necessary for the protection of human health, living resources and ecosystems;

(d) The control and progressive replacement of products, installations and industrial and other processes causing significant pollution of the marine environment;

(e) Specific requirements concerning the quantities of the substances discharged (listed in annex I), their concentration in effluents and methods of discharging them.

2. Without prejudice to the provisions of article 5 of this Protocol, such common guidelines, standards or criteria shall take into account local ecological, geographical and physical characteristics, the economic capacity of the Parties and their need for development, the level of existing pollution and the real absorptive capacity of the marine environment.

3. The action plans, programmes and measures referred to in articles 5 and 15 of this Protocol shall be adopted by taking into account, for their progressive implementation, the capacity to adapt and reconvert existing installations, the economic capacity of the Parties and their need for development.

Article 8

MONITORING

1. Within the framework of the provisions of, and the monitoring programmes provided for in article 12 of the Convention, and if necessary in cooperation with the competent international organizations, the Parties shall carry out at the earliest possible date monitoring activities and make access to the public of the findings in order:

(a) Systematically to assess, as far as possible, the levels of pollution along their coasts, in particular with regard to the sectors of activity and categories of substances listed in annex I, and periodically to provide information in this respect;

(b) To evaluate the effectiveness of action plans, programmes and measures implemented under this Protocol to eliminate to the fullest possible extent pollution of the marine environment.

Article 9

SCIENTIFIC AND TECHNICAL COOPERATION

1. In conformity with article 13 of the Convention, the Parties shall cooperate in scientific and technological fields related to pollution from land-based sources and activities, particularly research on inputs, pathways and effects of pollutants and on the development of new methods for their treatment, reduction or elimination, as well as the development of clean production processes to this effect. To this end, the Parties shall, in particular, endeavor to:
   (a) Exchange scientific and technical information;
   (b) Coordinate their research programmes;
   (c) Promote access to, and transfer of, environmentally sound technology including clean production technology.

Article 10

TECHNICAL ASSISTANCE

1. The Parties shall, directly or with the assistance of competent regional or other international organizations, bilaterally or multilaterally, cooperate with a view to formulating and, as far as possible, implementing programmes of assistance to developing countries, particularly in the fields of science, education and technology, with a view to preventing, reducing or, as appropriate, phasing out inputs of pollutants from land-based sources and activities and their harmful effects in the marine environment.

2. Technical assistance would include, in particular, the training of scientific and technical personnel, as well as the acquisition, utilization and production by those countries of appropriate equipment and, as appropriate, clean production technologies, on advantageous terms to be agreed upon among the Parties concerned.

Article 11

TRANSBOUNDARY POLLUTION

1. If discharges from a watercourse which flows through the territories of two or more Parties or forms a boundary between them are likely to cause pollution of the marine environment of the Protocol Area, the Parties in question, respecting the provisions of this Protocol in so far as each of them is concerned, are called upon to cooperate with a view to ensuring its full application.

2. A Party shall not be responsible for any pollution originating on the territory of a non-contracting State. However, the said Party shall endeavor to cooperate with the said State so as to make possible full application of the Protocol.

Article 12

SETTLEMENT OF DISPUTES

1. Taking into account article 28, paragraph 1, of the Convention, when land-based pollution originating from the territory of one Party is likely to prejudice directly the interests of one or more of the other Parties, the Parties concerned shall, at the request of one or more of them, undertake to enter into consultation with a view to seeking a satisfactory solution.

2. At the request of any Party concerned, the matter shall be placed on the agenda of the next meeting of the Parties held in accordance with article 14 of this Protocol; the meeting may make recommendations with a view to reaching a satisfactory solution.

Article 13

REPORTS

The Parties shall submit reports every two years, unless decided otherwise by the Meeting of the Contracting Parties, to the meetings of the Contracting Parties, through the Organization, of measures taken, results achieved and, if the case arises, of difficulties encountered in the application of this Protocol. Procedures for the submission of such reports shall be determined at the meetings of the Parties. Such reports shall include, inter alia:

(a) Statistical data on the authorizations granted in accordance with article 6 of this Protocol;
(b) Data resulting from monitoring as provided for in article 8 of this Protocol;
(c) Quantities of pollutants discharged from their territories;
(d) Action plans, programmes and measures implemented in accordance with articles 5, 7 and 15 of this Protocol.

Article 14

MEETINGS

1. Ordinary meetings of the Parties shall take place in conjunction with ordinary meetings of the Contracting Parties to the Convention held pursuant to article 18 of the Convention. The Parties may also hold extraordinary meetings in accordance with article 18 of the Convention.

2. The functions of the meetings of the Parties to this Protocol shall be, inter alia:

(a) To keep under review the implementation of this Protocol and to consider the efficacy of the action plans, programmes and measures adopted;

(b) To revise and amend any annex to this Protocol, as appropriate;

(c) To formulate and adopt action plans, programmes and measures in accordance with articles 5, 7 and 15 of this Protocol;

(d) To adopt, in accordance with article 7 of this Protocol, common guidelines, standards or criteria, in any form decided upon by the Parties;

(e) To make recommendations in accordance with article 12, paragraph 2, of this Protocol;

(f) To consider the reports submitted by the Parties under article 13 of this Protocol;

(g) To discharge such other functions as may be appropriate for the application of this Protocol.

Article 15

ADOPTION OF ACTION PLANS, PROGRAMMES AND MEASURES

1. The meeting of the Parties shall adopt, by a two-thirds majority, the short-term and medium-term regional action plans and programmes containing measures and timetables for their implementation provided for in article 5 of this Protocol.
2. Regional action plans and programmes as referred to in paragraph 1 shall be formulated by the Organization and considered and approved by the relevant technical body of the Contracting Parties within one year at the latest of the entry into force of the amendments to this Protocol. Such regional action plans and programmes shall be put on the agenda for the subsequent meeting of the Parties for adoption. The same procedure shall be followed for any additional action plans and programmes.
3. The measures and timetables adopted in accordance with paragraph 1 of this article shall be notified by the Secretariat to all the Parties. Such measures and timetables become binding on the one hundred and eightieth day following the day of notification for the Parties which have not notified the Secretariat of an objection within one hundred and seventy-nine days from the date of notification.

4. The Parties which have notified an objection in accordance with the preceding paragraph shall inform the meeting of the Parties of the provisions they intend to take, it being understood that these Parties may at any time give their consent to these measures or timetables.

Article 16

FINAL PROVISIONS

1. The provisions of the Convention relating to any Protocol shall apply with respect to this Protocol.
2. The rules of procedure and the financial rules adopted pursuant to article 24 of the Convention shall apply with respect to this Protocol, unless the Parties to this Protocol agree otherwise.
3. This Protocol shall be open for signature, at Athens from 17 May 1980 to 16 June 1980, and at Madrid from 17 June 1980 to 16 May 1981, by any State invited to the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources held at Athens from 12 May to 17 May 1980. It shall also be open until the same dates for signature by the European Economic Community and by any similar regional economic grouping of which at least one member is a coastal State of the Mediterranean Sea Area and which exercises competence in fields covered by this Protocol.
4. This Protocol shall be subject to ratification, acceptance or approval. Instruments of ratification, acceptance or approval shall be deposited with the Government of Spain, which will assume the functions of Depositary.

5. As from 17 May 1981, this Protocol shall be open for accession by the States referred to in paragraph 3 above, by the European Economic Community and by any grouping referred to in that paragraph.
6. This Protocol shall enter into force on the thirtieth day following the deposit of at least six instruments of ratification, acceptance or approval of, or accession to, the Protocol by the Parties referred to in paragraph 3 of this article.

IN WITNESS WHEREOF the undersigned, being duly authorized by their respective Governments, have signed this Protocol.

DONE at Athens on 17 May 1980 and amended at Syracuse on 7 March 1996 in a single copy in the Arabic, English, French and Spanish languages, the four texts being equally authoritative.

ANNEX I

ELEMENTS TO BE TAKEN INTO ACCOUNT IN THE PREPARATION OF ACTION

PLANS, PROGRAMMES AND MEASURES FOR THE ELIMINATION OF POLLUTION FROM

LAND-BASED SOURCES AND ACTIVITIES

This annex contains elements which will be taken into account in the preparation of action plans, programmes and measures for the elimination of pollution from land-based sources and activities referred to in articles 5, 7 and 15 of this Protocol.

Such action plans, programmes and measures will aim to cover the sectors of activity listed in section A and also cover the groups of substances enumerated in section C, selected on the basis of the characteristics listed in section B of the present annex. Priorities for action should be established by the Parties, on the basis of the relative importance of their impact on public health, the environment and socio-economic and cultural conditions. Such programmes should cover point sources, diffuse sources and atmospheric deposition.

In preparing action plans, programmes and measures, the Parties, in conformity with the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, adopted in Washington, D.C. in 1995, will give priority to substances that are toxic, persistent and liable to bioaccumulate, in particular to persistent organic pollutants (POPs), as well as to wastewater treatment and management.

A. SECTORS OF ACTIVITY

The following sectors of activity (not listed in order of priority) will be primarily considered when setting priorities for the preparation of action plans, programmes and measures for the elimination of the pollution from land-based sources and activities:

1. Energy production;
2. Fertilizer production;
3. Production and formulation of biocides;
4. The pharmaceutical industry;
5. Petroleum refining;

6. The paper and paper-pulp industry;
7. Cement production;
8. The tanning industry;
9. The metal industry;
10. Mining;
11. The shipbuilding and repairing industry;
12. Harbour operations;
13. The textile industry;
14. The electronic industry;
15. The recycling industry;
16. Other sectors of the organic chemical industry;
17. Other sectors of the inorganic chemical industry;
18. Tourism;
19. Agriculture;
20. Animal husbandry;
21. Food processing;
22. Aquaculture;
23. Treatment and disposal of hazardous wastes;
24. Treatment and disposal of domestic waste water;
25. Management of municipal solid waste;
26. Disposal of sewage sludge;
27. The waste management industry;
28. Incineration of waste and management of its residues;
29. Works which cause physical alteration of the natural state of the coastline;
30. Transport.

B. CHARACTERISTICS OF SUBSTANCES IN THE ENVIRONMENT

For the preparation of action plans, programmes and measures, the Parties should take into account the characteristics listed below:

1. Persistence;
2. Toxicity or other noxious properties (e.g. carcinogenicity, mutagenicity, teratogenicity);

3. Bioaccumulation;
4. Radioactivity;
5. The ratio between observed concentrations and no observed effect concentrations (NOEC);
6. The risk of eutrophication of anthropogenic origin;
7. Health effects and risks;
8. Transboundary significance;
9. The risk of undesirable changes in the marine ecosystem and irreversibility or durability of effects;
10. Interference with the sustainable exploitation of living resources or with other legitimate uses of the sea;
11. Effects on the taste and/or smell of marine products for human consumption;
12. Effects on the smell, colour, transparency or other characteristics of seawater;
13. Distribution pattern (i.e. quantities involved, use patterns and probability of reaching the marine environment).

C. CATEGORIES OF SUBSTANCES

The following categories of substances and sources of pollution will serve as guidance in the preparation of action plans, programmes and measures:

1. Organohalogen compounds and substances which may form such compounds in the marine environment. Priority will be given to Aldrin, Chlordane, DDT, Dieldrin, Dioxins and Furans, Endrin, Heptachlor, Hexachlorobenzene, Mirex, PCBs and Toxaphene;
2. Organophosphorus compounds and substances which may form such compounds in the marine environment;
3. Organotin compounds and substances which may form such compounds in the marine environment;
4. Polycyclic aromatic hydrocarbons;
5. Heavy metals and their compounds;
6. Used lubricating oils;
7. Radioactive substances, including their wastes, when their discharges do not comply with the principles of radiation protection as defined by the competent international organizations, taking into account the protection of the marine environment;
8. Biocides and their derivatives;
9. Pathogenic microorganisms;
10. Crude oils and hydrocarbons of petroleum origin;
11. Cyanides and fluorides;
12. Non-biodegradable detergents and other non-biodegradable surface-active substances;
13. Compounds of nitrogen and phosphorus and other substances which may cause eutrophication;
14. Litter (any persistent manufactured or processed solid material which is discarded, disposed of, or abandoned in the marine and coastal environment);
15. Thermal discharges;
16. Acid or alkaline compounds which may impair the quality of water;
17. Non-toxic substances that have an adverse effect on the oxygen content of the marine environment;

18. Non-toxic substances that may interfere with any legitimate use of the sea;
19. Non-toxic substances that may have adverse effects on the physical or chemical characteristics of seawater.

ANNEX II

ELEMENTS TO BE TAKEN INTO ACCOUNT IN THE ISSUE OF THE AUTHORIZATIONS

FOR DISCHARGES OF WASTES

With a view to the issue of an authorization for the discharges of wastes containing substances referred to in article 6 to this Protocol, particular account will be taken, as the case may be, of the following factors:

A. CHARACTERISTICS AND COMPOSITION OF THE DISCHARGES

1. Type and size of point or diffuse source (e.g. industrial process).
2. Type of discharges (e.g. origin, average composition).
3. State of waste (e.g. solid, liquid, sludge, slurry).
4. Total amount (volume discharged, e.g. per year).
5. Discharge pattern (continuous, intermittent, seasonally variable, etc.).
6. Concentrations with respect to relevant constituents of substances listed in annex I and of other substances as appropriate. 7. Physical, chemical and biochemical properties of the waste discharges.

B. CHARACTERISTICS OF DISCHARGE CONSTITUENTS WITH RESPECT TO THEIR HARMFULNESS

1. Persistence (physical, chemical, biological) in the marine environment.
2. Toxicity and other harmful effects.
3. Accumulation in biological materials or sediments.
4. Biochemical transformation producing harmful compounds.
5. Adverse effects on the oxygen content and balance.
6. Susceptibility to physical, chemical and biochemical changes and interaction in the aquatic environment with other sea-water constituents which may produce harmful biological or other effects on any of the uses listed in section E below.
7. All other characteristics as listed in annex I, section B.

C. CHARACTERISTICS OF DISCHARGE SITE AND RECEIVING ENVIRONMENT

1. Hydrographic, meteorological, geological and topographical characteristics of the coastal area.
2. Location and type of the discharge (outfall, canal outlet, etc.) and its relation to other areas (such as amenity areas, spawning, nursery, and fishing areas, shellfish grounds) and other discharges.
3. Initial dilution achieved at the point of discharge into the receiving environment.
4. Dispersion characteristics such as effects of currents, tides and wind on horizontal transport and vertical mixing.
5. Receiving water characteristics with respect to physical, chemical, biological and ecological conditions in the discharge area.
6. Capacity of the receiving marine environment to receive waste discharges without undesirable effects.

D. AVAILABILITY OF WASTE TECHNOLOGIES

The methods of waste reduction and discharge for industrial effluents as well as domestic sewage should be selected taking into account the availability and feasibility of:

(a) Alternative treatment processes;
(b) Re-use or elimination methods;
© On-land disposal alternatives;
(d) Appropriate low-waste technologies.

E. POTENTIAL IMPAIRMENT OF MARINE ECOSYSTEMS AND SEA-WATER USES

1. Effects on human health through pollution impact on:
(a) Edible marine organisms;
(b) Bathing waters;
(c) Aesthetics.

2. Effects on marine ecosystems, in particular living resources, endangered species and critical habitats.

3. Effects on other legitimate uses of the sea.

ANNEX III

CONDITIONS OF APPLICATION TO POLLUTION TRANSPORTED THROUGH THE ATMOSPHERE

This annex defines the conditions of application of this Protocol to pollution from land-based sources transported by the atmosphere in terms of Article 4.1(b) are the following:

1. This Protocol shall apply to polluting discharges into the atmosphere under the following conditions:

   (a) the discharged substance is or could be transported to the Mediterranean Sea Area under prevailing meteorological conditions;

   (b) the input of the substance into the Mediterranean Sea Area is hazardous for the environment in relation to the quantities of the same substance reaching the Area by other means.

2. This Protocol shall also apply to polluting discharges into the atmosphere affecting the Mediterranean Sea Area from land-based sources within the territories of the Parties and from fixed man-made offshore structures, subject to the provisions of article 4.2 of this Protocol.

3. In the case of pollution of the Mediterranean Sea Area from land-based sources through the atmosphere, the provisions of articles 5 and 6 of this Protocol shall apply progressively to appropriate substances and sources listed in annex I to this Protocol as will be agreed by the Parties.

4. Subject to the conditions specified in paragraph 1 of this annex, the provisions of Article 7.1 of this Protocol shall also apply to:

(a) discharges - quantity and rate - of substances emitted to the atmosphere, on the basis of the information available to the Contracting Parties concerning the location and distribution of air pollution sources;

(b) the content of hazardous substances in fuel and raw materials;

(c) the efficiency of air pollution control technologies and more efficient manufacturing and fuel burning processes;

(d) the application of hazardous substances in agriculture and forestry.

5. The provisions of annex II to this Protocol shall apply to pollution through the atmosphere whenever appropriate. Air pollution monitoring and modelling using acceptable common emission factors and methodologies shall be carried out in the assessment of atmospheric deposition of substances, as well as in the compilation of inventories of quantities and rates of pollutant emissions into the atmosphere from land-based sources.

6. All Articles, including parts thereof to this Protocol not mentioned in paragraphs 1 to 5 above shall apply equally to pollution from land-based sources transported by the atmosphere wherever applicable and subject to the conditions specified in paragraph 1 of this Annex.

ANNEX IV

CRITERIA FOR THE DEFINITION OF BEST AVAILABLE TECHNIQUES AND BEST ENVIRONMENTAL PRACTICE

A. BEST AVAILABLE TECHNIQUES

1. The use of the best available techniques shall emphasize the use of non-waste technology, if available.

2. The term "best available techniques" means the latest stage of development (state of the art) of processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste. In determining whether a set of processes, facilities and methods of operation constitute the best available techniques in general or individual cases, special consideration shall be given to:

(a) comparable processes, facilities or methods of operation which have recently been successfully tried out;

(b) technological advances and changes in scientific knowledge and understanding;

(c) the economic feasibility of such techniques;
(d) time limits for installation in both new and existing plants;
(e) the nature and volume of the discharges and emissions concerned. 3. It therefore follows that what is "best available techniques" for a particular process will change with time in the light of technological advances, economic and social factors, as well as changes in scientific knowledge and understanding. 4. If the reduction of discharges and emissions resulting from the use of best available techniques does not lead to environmentally acceptable results, additional measures have to be applied. 5. "Techniques" include both the technology used and the way in which the installation is designed, built, maintained, operated and dismantled.

B. BEST ENVIRONMENTAL PRACTICE

6. The term "best environmental practice" means the application of the most appropriate combination of environmental control measures and strategies. In making a selection for individual cases, at least the following graduated range of measures should be considered:

(a) the provision of information and education to the public and to users about the environmental consequences of choice of particular activities and choice of products, their use and ultimate disposal;

(b) the development and application of codes of good environmental practice which cover all aspects of the activity in the product's life;

(c) the mandatory application of labels informing users of environmental risks related to a product, its use and ultimate disposal;

(d) saving resources, including energy;
(e) making collection and disposal systems available to the public;

(f) avoiding the use of hazardous substances or products and the generation of hazardous waste;
(g) recycling, recovery and re-use;

(h) the application of economic instruments to activities, products or groups of products;

(i) establishing a system of licensing, involving a range of restrictions or a ban.

7. In determining what combination of measures constitute best environmental practice, in general or individual cases, particular consideration should be given to:

(a)the environmental hazard of the product and its production, use and ultimate disposal;

(b) the substitution by less polluting activities or substances;
(c) the scale of use;
(d) the potential environmental benefit or penalty of substitute materials or activities;
(e) advances and changes in scientific knowledge and understanding;
(f) time limits for implementation;
(g) social and economic implications.

8. It therefore follows that best environmental practice for a particular source will change with time in the light of technological advances, economic and social factors, as well as changes in scientific knowledge and understanding. 9. If the reduction of inputs resulting from the use of best environmental practice does not lead to environmentally acceptable results, additional measures have to be applied and best environmental practice redefined.

Annex 4

Protocol on Protection of the Black Sea Marine Environment Against Pollution from Land Based Sources

SIGNED 21 APR 1992, IN FORCE 1994

ARTICLE 1

In accordance with Article VII of the Convention, the Contracting Parties shall take all necessary measures to prevent, reduce and control pollution of the marine environment of the Black Sea caused by discharges from land-based sources on their territories such as rivers, canals, coastal establishments, other artificial structures, outfalls or run-off, or emanating from any other land-based source, including through the atmosphere.

Article 2

For the purposes of this Protocol, the fresh water limit means the landward part of the line drawn between the endpoints on the right and the left banks of a watercourse where it reaches the Black Sea.

Article 3

This protocol shall apply to the Black Sea as defined in Article I of the Convention and to the waters landward of the baselines from which the breadth of the territorial sea is measured and in the case of fresh-water courses, up to the fresh-water limit.

Article 4

The Contracting Parties undertake to prevent and eliminate pollution of the marine environment of the Black Sea from land-based sources by substances and matter listed in Annex I to this Protocol.

The Contracting Parties undertake to reduce and, whenever possible, to eliminate pollution of the marine environment of the Black Sea from land-based sources by substances and matter listed in Annex II to this Protocol.

As to water courses that are tributaries to the Black Sea, the Contracting Parties will endeavour to cooperate, as appropriate, with other States in order to achieve the purposes set forth in this Article.

Article 5

Pursuant to the provisions of Article XV of the Convention, each Contracting Party shall carry out, at the earliest possible date, monitoring activities in order to assess the levels of pollution, its sources and ecological effects along its coast, in particular with regard to the substances and matter listed in Annexes I and II to this Protocol. Additional research will be conducted upstream of river sections in order to investigate fresh/salt water interactions.

Article 6

In conformity with Article XV of the Convention, the Contracting Parties shall cooperate in elaborating common guidelines, standards or criteria dealing with special characteristics of marine outfalls and in undertaking research on specific requirements for effluents necessitating separate treatment and concerning the quantities of discharged substances and matter listed in Annexes I and II, their concentration in effluents, and methods of discharging them.

The common emission standards and timetable for the implementation of the programme and measures aimed at preventing, reducing or eliminating, as appropriate, pollution from land-based sources shall be fixed by the Contracting Parties and periodically reviewed for substances and matter listed in Annexes I and II to this Protocol.

The Commission shall define pollution prevention criteria as well as recommend appropriate measures to reduce, control and eliminate pollution of the marine environment of the Black Sea from land-based sources.

The Contracting Parties shall take into consideration the following:

a) The discharge of water from municipal sewage systems should be made in such a way as to reduce the pollution of the marine environment of the Black Sea. b) The pollution load of industrial wastes should be reduced in order to comply with the accepted concentrations of substances and matter listed in Annexes I and II to this Protocol. c) The discharge of cooling water from nuclear power plants or other industrial enterprises using large amounts of water should be made in such a way as to prevent pollution of the marine environment of the Black Sea. d) The pollution load from agricultural and forest areas affecting the water quality of the marine environment of the Black Sea should be reduced in order to comply with the accepted concentrations of substances and matter listed in Annexes I and II to this Protocol.

Article 7

The Contracting Parties shall inform one another through the Commission of measures taken, results achieved or difficulties encountered in the application of this Protocol. Procedures for the collection and transmission of such information shall be determined by the Commission.

Annex I

Hazardous Substances and Matter

The following substances or groups of substances or matter are not listed in order of priority. They have been selected mainly on the basis of their toxicity, persistence and bioaccumulation characteristics.

This Annex does not apply to discharges which contain substances and matter listed below that are below the concentration limits defined jointly by the Contracting Parties, not exceeding environmental background concentrations.

1. Organotin compounds.
2. Organohalogen compounds e. g.DDT, DDE, DDD, PCB's.
3. Persistent organophosphorus compounds.
4. Mercury and mercury compounds.
5. Cadmium and cadmium compounds.
6. Persistent substances with proven toxic carcinogenic, teratogenic or mutagenic properties.
7. Used lubricating oils.
8. Persistent synthetic materials which may float, sink or remain in suspension.

9. Radioactive substances and wastes, including used radioactive fuel. 10. Lead and lead compounds.

Annex II

Noxious Substances and Matter

The following substances and matter have been selected mainly on the basis of criteria used in Annex I, while taking into account the fact that they are less harmful or more readily rendered harmless by natural processes.

The control and strict limitation of the discharges of substances and matter referred to in this Annex shall be implemented in accordance with Annex III to this Protocol.

1. Biocides and their derivatives not covered in Annex I.

2. Cyanides, flourides, and elemental phosphorus.

3. Pathogenic micro-organisms.

4. Nonbiodegradable detergents and their surface-active substances.

5. Alkaline or acid compounds.

6. Thermal discharges.

7. Substances which, although of a non-toxic nature, may become harmful to the marine biota owing to the quantities in which they are discharged e. g. inorganic phosphorous, nitrogen, organic matter and other nutrient compounds. Also substances which have an adverse effect on the oxygen content in the marine environment.

8. The following elements and their compounds:

   Zinc, Selenium, Tin, Vanadium, Copper, Arsenic, Barium, Cobalt, Nickel, Antimony, Beryllium, Thallium, Chromium, Molybdenum, Boron, Tellurium, Titanium, Uranium, Silver.

9. Crude oil and hydrocarbons of any origin.

Annex III

The discharges of substances and matter listed in Annex II to this Protocol shall be subject to restrictions based on the following:

1. Maximum permissible concentrations of the substances and matter immediate before the outlet;

2. Maximum permissible quantity (load, inflow) of the substances and matter per annual cycle or shorter time limit;

3. In case of differences between 1 and 2 above, the stricter restriction should apply.

When issuing a permit for the discharge of wastes containing substances and matter referred to in Annexes I and II to this Protocol, the national authorities will take particular account, as the case may be, of the following factors:

A. CHARACTERISTICS AND COMPOSITION OF THE WASTE

1. Type and size of waste source (e. g. industrial process).
2. Type of waste (origin, average composition).
3. Form of waste (solid, liquid, sludge, slurry).
4. Total amount (volume discharged. e. g. per year).
5. Discharge pattern (continuous, intermittent, seasonally variable, etc.).
6. Concentrations with respect to major constituents, substances listed in Annex I, substances listed in Annex II, and other harmful substances as appropriate.
7. Physical, chemical and biological properties of the waste.

B. CHARACTERISTICS OF WASTE CONSTITUENTS WITH RESPECT TO

THEIR HARMFULNESS

1. Persistence (physical, chemical, biological) in the marine environment.
2. Toxicity and other harmful effects.
3. Accumulation in biological materials and sediments.
4. Biochemical transformation producing harmful compounds.
5. Adverse effects on the oxygen contents and balance.
6. Susceptibility to physical, chemical and biochemical changes and interaction in the marine environment with other seawater constituents which may produce harmful biological or other effects on any of the uses listed in section E below.

C. CHARACTERISTICS OF DISCHARGE SITE AND RECEIVING MARINE

ENVIRONMENT

1. Hydrographic, meteorological, geological and topographic characteristics of the coastal area.

2. Location and type of discharge (outfall, canal, outlet, etc.) and its relation to other areas (such as amenity areas, spawning, nursery and fishing areas, shellfish grounds) and other discharges.

3. Initial dilution achieved at the point of discharge into the receiving marine environment.

4. Dispersal characteristics such as the effect of currents, tides and winds on horizontal transport and vertical mixing.

5. Receiving water characteristics with respect to physical, chemical, biological and ecological conditions in the discharge area.

6. Capacity of the receiving marine environment to receive waste discharges without undesirable effects.

D. AVAILABILITY OF WASTE TECHNOLOGIES

The methods of waste reduction and discharge for industrial effluents as well as household sewage should be selected taking into account the availability and feasibility of:

a) Alternative treatment processes;

b) Recycling, re-use, or elimination methods;

c) On-land disposal alternatives; and

d) Appropriate clean and low-waste technologies.

E. POTENTIAL IMPAIRMENT OF MARINE ECOSYSTEMS AND SEA-WATER

USES

1. Effects on human life through pollution impact on:

a) Edible marine organisms;

b) Bathing waters;

c) Aesthetics.

Discharges of wastes containing substances and matter listed in Annexes I and II shall be subject to a system of self-monitoring and control by the competent national authorities.

2. Effects on marine ecosystems, in particular living resources, endangered species, and critical habitats.

3. Effects on other legitimate uses of the sea.

Annex 5

DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT
Draft Amended Protocol on Protection of the Black Sea Marine Environment
Against Pollution from Land Based Sources

The Contracting Parties to the present Protocol,

Being Parties to the Convention on the Protection of the Black Sea Against Pollution, signed at Bucharest on 21 Apr 1992 (Bucharest Convention),

Desirous of implementing the Convention, the Odessa Declaration and Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (BSSAP),

Recognizing the danger posed to the marine environment, living resources and human health by pollution from land-based sources and activities

Also recognizing that eutrophication is a phenomenon, which occurs over wide areas of the Black Sea and should be of concern to the countries of the Black Sea basin,

Applying the precautionary principle and the polluter pays principle, undertaking environmental impact assessment and utilizing the best available techniques and the best environmental practice,
including clean production technologies, as provided for in Black Sea Strategic Action Plan,

Determined to take, nationally and in close cooperation, the necessary measures to protect the Black Sea against pollution from land-based sources and activities, especially to reduce input of nutrients,

Taking into consideration the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities, adopted in Washington, D.C., on 3 November 1995,

Noting the European Union Directive on establishing a framework for Community action in the field of water policy,

Recognizing the efforts of the Danube basin countries to reduce the pollution of their fresh water resources,

Have agreed as follows:

Article 1
GENERAL PROVISION

1. In accordance with Article VII of the Convention, the Contracting Parties shall take all necessary measures to prevent, eliminate, reduce and control pollution of the marine environment of the Black Sea caused by discharges from land-based sources and activities on their territories

2. Special measures will be taken to reduce nutrient load to the Black Sea. With this respect the Contracting Parties will promote cooperation among all Black Sea basin states, and, in particular, between the Black Sea coastal states and the states of the Danube river basin.

Article 2
DEFINITIONS

For the purposes of this Protocol:

(e) "The Convention" means the Convention on the Protection of the Black Sea Against Pollution, signed at Bucharest on 21 Apr 1992 (Bucharest Convention);
(f) "Commission" means the body referred to in article 17 of the Convention;
(g) The "Hydrologic Basin" means the entire watershed area within the territories of the Contracting Parties, draining into the Black Sea as defined in article 1 of the Convention.
(h) "River basin" means the area of land from which all surface run-off flows trough a sequent of streams, rivers and, possibly, lakes into the sea at a single river moth, estuary or delta.
(i) "hot spots" means the dominant point sources of pollution on the coast of the Black Sea identified within the frame of BSAP.and listed in the Black Sea Transboundary Diagnostic Analysis (*or in the Annex to this Protocol)*
(j) "combined approach to pollution control" means application of both: i)emission standards to control emissions from individual point sources and ii)environmental quality standards to limit the cumulative impact of such emissions as well as of diffuse sources of pollution.
(k) "River Basin District" means the administrative area of land and sea, made up of one or more neighboring river basins together with their associated groundwater and coastal waters

"Surface water" means surface fresh water, estuaries and coastal waters.
"Surface fresh water" means all static or flowing water on the surface of the land upstream of the fresh water limit.

"Fresh water limit" means the place in the watercourse where, at low tide and in a period of low fresh water flow, there is an appreciable increase in salinity due to presence of seawater.
"Coastal water" means water on the landward side of a line every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate in the case of watercourses, up to the outer limit of the estuary.
"Estuary" means the transitional area at the mouth of the river between surface fresh water and coastal waters. The outer (seaward) limits of estuaries shall be defined, as necessary, by Member States. The inner (upstream) limit shall be the fresh water limit.

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Article 3
PROTOCOL AREA

The area to which this Protocol applies (hereinafter referred to as the "Protocol Area") shall be:

(e) The Black Sea as defined in article 1 of the Convention;

(f) The hydrologic basin of the Black Sea ;

(g) Coastal waters.

Article 4
PROTOCOL APPLICATION

4. This Protocol shall apply:

(c) To discharges originating from land-based point and diffuse sources and activities within the territories of the Contracting Parties that may affect directly or indirectly the Black Sea. These discharges shall include those which reach the Black Sea through coastal disposals, rivers, outfalls, canals, or other watercourses, including ground water flow, or through run-off and disposal under the seabed with access from land;

(d) To inputs of polluting substances transported by the atmosphere to the Black Sea from land-based sources or activities within the territories of the Contracting Parties.

5. This Protocol shall also apply to polluting discharges from fixed man-made offshore structures which are under the jurisdiction of a Party and which serve purposes other than exploration and exploitation of mineral resources of the continental shelf and the sea-bed and its subsoil.

6. The Parties shall invite to cooperate in the implementation of the Protocol States that are not parties to the Protocol and have in their territory parts of the river basins of rivers discharging to the Black Sea. Special mechanism should be established for cooperation with the Danube river basin countries.

Article 5
GENERAL OBLIGATIONS

1. The Contracting Parties undertake to prevent and eliminate pollution of the marine environment of the Black Sea from land-based sources by substances and matter listed in Annex I to this Protocol.

2. The Contracting Parties undertake to reduce and, whenever possible, to eliminate pollution of the marine environment of the Black Sea from land-based sources by substances and matter listed in Annex II to this Protocol.

3. To this end, they shall elaborate and implement, individually or jointly, as appropriate, national and regional action plans and programmes, containing measure and timetables for their implementation. A list of hot-spots *(The point sources listed in Annex L)* shall provide the basis for the elaboration of national strategies and timetables for realizing substantial reductions of inputs of pollutants from point sources (*hot-spots).*

4. The measures refereed to in the paragraph 3 above should be based on the best available techniques and the best environmental practice including, where appropriate, clean production technologies and application of the Integrated Coastal Zone Management, *(taking into account the crireria set forth in Annex K)*.

5. A special mechanism shall be negotiated with all states located in the Danube river basin to address the eutrophication problem in the Black Sea. The objective of the mechanism shall be to achieve a progressive series of stepwise reductions of nutrient loads, until agreed Black Sea water quality objectives are met.

Article 6
ADOPTION OF ACTION PLANS, PROGRAMMES AND MEASURES

1. The meeting of the Parties shall adopt, by a two-thirds majority, the short-term and medium-term regional action plans and programmes containing measures and timetables for their implementation provided for in article 5 of this Protocol.

2. Regional action plans and programmes as referred to in paragraph 1 shall be formulated by the Commission and considered and approved by the relevant technical body of the Contracting Parties within one year at the latest of the entry into force of the amendments to this Protocol. Such regional action plans and programmes shall be put on the agenda for the subsequent meeting of the Parties for adoption. The same procedure shall be followed for any additional action plans and programmes.

3. The measures and timetables adopted in accordance with paragraph 1 of this article shall be notified by the Commission to all the Parties. Such measures and timetables become binding on the one hundred and eightieth day following the day of notification for the Parties which have not notified the Secretariat of an objection within one hundred and seventy-nine days from the date of notification.

4. The Parties which have notified an objection in accordance with the preceding paragraph shall inform the meeting of the Parties of the provisions they intend to take, it being understood that these Parties may at any time give their consent to these measures or timetables.

Article 7
FUNDING

1. In addition to the financial participation by the Contracting Parties in accordance with Article 23 the Convention, the Commission may, in response to requests from Contracting Parties, seek additional funds or other forms of assistance for activities related to this Protocol. These funds may include voluntary contributions for the achievement of specific objectives of this Protocol made by the Contracting Parties, other governments and government agencies, international organisations, non-governmental organisations, the private sector and individuals.

2. The Contracting Parties, taking into account their capabilities, shall endeavour as far as possible to ensure that adequate financial resources are available for the formulation and implementation of projects and programmes necessary to implement this Protocol. To this end, the Contracting Parties shall:

   (a) promote the mobilisation of substantial financial resources, including grants and concessional loans, from national, bilateral and multilateral funding sources and mechanisms, including multilateral financial institutions; and
   (b) explore innovative methods and incentives for mobilising and channeling resources, including those of foundations, non-governmental organisations and other private sector entities.

3. In keeping with its development priorities, policies and strategies, each Contracting Party undertakes to mobilise financial resources to implement its plans, programmes and measures pursuant to this Protocol.

Article 8
MONITORING

1. Pursuant to the provisions of Article XV of the Convention, each Contracting Party shall carry out monitoring activities, if necessary in cooperation with the competent international organizations, in order to assess the levels of pollution, its sources and ecological effects along its coast, in particular with regard to the substances and matter listed in Annexes I and II to this Protocol.

2. Additional research and monitoring will be conducted upstream of river sections in order to investigate fresh/salt water interactions. More attention shall be focussed on the issue of airborne pollutants, particularly those that involve transboundary movements, as well as appropriate measures for controlling them at source.

3. Monitoring shall also provide for evaluation of the effectiveness of action plans, programmes and measures implemented under this Protocol to eliminate to the fullest possible extent pollution of the marine environment.

Article 9
COMMON GUIDELINES AND STANDARDS

1. In conformity with Article XV of the Convention, the Contracting Parties shall cooperate in elaborating common guidelines, standards or criteria dealing with special characteristics of marine outfalls and in undertaking research on specific requirements for effluents necessitating separate treatment and concerning the quantities of discharged substances and matter listed in Annexes I and II, their concentration in effluents, and methods of discharging them.

2. The regional action plans and programmes referred to in article 5 of this Protocol shall be elaborated and implemented on the basis of the combined approach to pollution control taking into consideration the following:
   (a) The common emission standards and timetable for the implementation of the programme and measures aimed at preventing, reducing or eliminating, as appropriate, pollution from land-based sources shall be fixed by the Contracting Parties and periodically reviewed for substances and matter listed in Annexes I and II to this Protocol.
   (b) The Commission shall define pollution prevention criteria as well as recommend appropriate measures to reduce, control and eliminate pollution of the marine environment of the Black Sea from land-based sources.

3. The Contracting Parties shall take into consideration the following:
(a)The discharge of water from municipal sewage systems should be made in such a way as to reduce the pollution of the marine environment of the Black Sea.

(b)The pollution load of industrial wastes should be reduced in order to comply with the accepted concentrations of substances and matter listed in Annexes I and II to this Protocol.

(c)The discharge of cooling water from nuclear power plants or other industrial enterprises using large amounts of water should be made in such a way as to prevent pollution of the marine environment of the Black Sea.

(d)The pollution load from agricultural and forest areas affecting the water quality of the marine environment of the Black Sea should be reduced in order to comply with the accepted concentrations of substances and matter listed in Annexes I and II to this Protocol.

4. The Commission shall prepare through its techical bodies a cod of a good agricultural practice and a cod of conduct in the coastal zone for the Black Sea reagion. The cods shall be adopted by the participating countries and recommended for implemetation.

Article 10
AUTHORIZATION OR REGULATION SYSTEM

1. Point source discharges into the Protocol Area, and releases into water or air that reach and may affect the Black Sea shall be strictly subject to authorization or regulation by the competent authorities of the Parties, taking due account of the provisions of this Protocol and the relevant decisions or recommendations of the meetings of the Contracting Parties.

2. To this end, the Parties shall provide for systems of inspection by their competent authorities to assess compliance with authorizations and regulations.

3. The Parties may be assisted by the Commission, upon request, in establishing new, or strengthening existing, competent structures for inspection of compliance with authorizations and regulations. Such assistance shall also include special training of personnel.

4. The Parties establish appropriate sanctions in case of non-compliance with the authorizations and regulations and ensure their application.

Article 11
REPORTS

The Contracting Parties shall inform one another through the Commission of measures taken, results achieved or difficulties encountered in the application of this Protocol. The reports shall be submitted every two years, unless decided otherwise by the Meeting of the Contracting Parties. Such reports shall include, inter alia:

(a) Statistical data on the authorizations granted in accordance with article 8 of this Protocol;
(b) Data resulting from monitoring as provided for in article 6 of this Protocol;
(c) Quantities of pollutants discharged from their territories;
(d) Action plans, programmes and implemented measures.

Article 12
MEETINGS

Ordinary meetings of the Parties shall take place in conjunction with ordinary meetings of the Contracting Parties to the Convention. The Parties may also hold extraordinary meetings. The functions of the meetings of the Parties to this Protocol shall be, inter alia:

(a) To keep under review the implementation of this Protocol and to consider the efficacy of the action plans, programmes and measures adopted;

(b) To revise and amend any annex to this Protocol, as appropriate;

To formulate and adopt action plans, programmes and measures;

(c) To adopt, in accordance with article 7 of this Protocol, common guidelines, standards or criteria, in any form decided upon by the Parties;

(d) To consider the reports submitted by the Parties under article 9 of this Protocol;

(e) To discharge such other functions as may be appropriate for the application of this Protocol.

Annex I

Hazardous Substances and Matter

The following substances or groups of substances or matter are not listed in order of priority. They have been selected mainly on the basis of their toxicity, persistence and bioaccumulation characteristics.

This Annex does not apply to discharges which contain substances and matter listed below that are below the concentration limits defined jointly by the Contracting Parties, not exceeding environmental background concentrations.

10. Organotin compounds.

11. Organohalogen compounds e. g. DDT, DDE, DDD, PCB's.

12. Persistent organophosphorus compounds.

13. Mercury and mercury compounds.

14. Cadmium and cadmium compounds.

15. Persistent substances with proven toxic carcinogenic, teratogenic or mutagenic properties.

16. Used lubricating oils.

17. Persistent synthetic materials, which may float, sink or remain in suspension.

18. Radioactive substances and wastes, including used radioactive fuel. 10. Lead and lead compounds.

Annex II

Noxious Substances and Matter

The following substances and matter have been selected mainly on the basis of criteria used in Annex I, while taking into account the fact that they are less harmful or more readily rendered harmless by natural processes.

The control and strict limitation of the discharges of substances and matter referred to in this Annex shall be implemented in accordance with Annex III to this Protocol.

1. Biocides and their derivatives not covered in Annex I.

9. Cyanides fluorides, and elemental phosphorus.

10. Pathogenic micro-organisms.

11. Nonbiodegradable detergents and their surface-active substances.

12. Alkaline or acid compounds.

13. Thermal discharges.

14. Substances which, although of a non-toxic nature, may become harmful to the marine biota owing to the quantities in which they are discharged e. g. inorganic phosphorous, nitrogen, organic matter and other nutrient compounds. Also substances which have an adverse effect on the oxygen content in the marine environment.

15. The following elements and their compounds:

Zinc, Selenium, Tin, Vanadium, Copper, Arsenic, Barium, Cobalt, Nickel, Antimony, Beryllium, Thallium, Chromium, Molybdenum, Boron, Tellurium, Titanium, Uranium, Silver.

9. Crude oil and hydrocarbons of any origin.

Annex III

The discharges of substances and matter listed in Annex II to this Protocol shall be subject to restrictions based on the following:

1. Maximum permissible concentrations of the substances and matter immediate before the outlet;

2. Maximum permissible quantity (load, inflow) of the substances and matter per annual cycle or shorter time limit;

3. In case of differences between 1 and 2 above, the stricter restriction should apply.

When issuing a permit for the discharge of wastes containing substances and matter referred to in Annexes I and II to this Protocol, the national authorities will take particular account, as the case may be, of the following factors:

A. CHARACTERISTICS AND COMPOSITION OF THE WASTE

8. Type and size of waste source (e. g. industrial process).

9. Type of waste (origin, average composition).

10. Form of waste (solid, liquid, sludge, slurry).

11. Total amount (volume discharged. e. g. per year).

12. Discharge pattern (continuous, intermittent, seasonally variable, etc.).

13. Concentrations with respect to major constituents, substances listed in Annex I, substances listed in Annex II, and other harmful substances as appropriate.

14. Physical, chemical and biological properties of the waste.

B. CHARACTERISTICS OF WASTE CONSTITUENTS WITH RESPECT TO

THEIR HARMFULNESS

7. Persistence (physical, chemical, biological) in the marine environment.

8. Toxicity and other harmful effects.

9. Accumulation in biological materials and sediments.

10. Biochemical transformation producing harmful compounds.

11. Adverse effects on the oxygen contents and balance.

12. Susceptibility to physical, chemical and biochemical changes and interaction in the marine environment with other seawater constituents which may produce harmful biological or other effects on any of the uses listed in section E below.

C. CHARACTERISTICS OF DISCHARGE SITE AND RECEIVING MARINE

ENVIRONMENT

7. Hydrographic, meteorological, geological and topographic characteristics of the coastal area.

8. Location and type of discharge (outfall, canal, outlet, etc.) and its relation to other areas (such as amenity areas, spawning, nursery and fishing areas, shellfish grounds) and other discharges.

9. Initial dilution achieved at the point of discharge into the receiving marine environment.

10. Dispersal characteristics such as the effect of currents tide and winds on horizontal transport and vertical mixing.

11. Receiving water characteristics with respect to physical, chemical, biological and ecological conditions in the discharge area.

12. Capacity of the receiving marine environment to receive waste discharges without undesirable effects.

D. AVAILABILITY OF WASTE TECHNOLOGIES

The methods of waste reduction and discha rge for industrial effluents as well as household sewage should be selected taking into account the availability and feasibility of:

e) Alternative treatment processes;

f) Recycling, re-use, or elimination methods;

g) On-land disposal alternatives; and

h) Appropriate clean and low-waste technologies.

E. POTENTIAL IMPAIRMENT OF MARINE ECOSYSTEMS AND SEA-WATER

USES

1. Effects on human life through pollution impact on:

d) Edible marine organisms;

e) Bathing waters;

f) Aesthetics.

> Discharges of wastes containing substances and matter listed in Annexes I and II shall be subject to a system of self-monitoring and control by the competent national authorities.

2. Effects on marine ecosystems, in particular living resources, endangered species, and critical habitats.

3. Effects on other legitimate uses of the sea.

ENHANCEMENT OF THE LEGISLATIVE PROVISIONS FOR REDUCTION OF NUTRIENTS INPUT TO THE BLACK SEA.

I. Introduction

Eutrophication and lack of effective management, control and regulation of water bodies basins are Common Problems of the European Seas. (EUROPE'S ENVIRONMENT: The Dobríš Assessment. Edited by David Stanners and Philippe Bourdeau. EEA, Copenhagen, 1995, pp.111-113). In the Black Sea region these problems are aggravated by the unfavorable natural features of the sea:

(a) considerable isolation from the world ocean (retention time is 140 years);
(b) large area occupied by the northwestern continental shelf (about 25% of a sea surface area) receiving the balk of the nutrients; and
(c) an extensive catchment area (over 1,700 000 km² versus 423,000 km² the surface area of the sea itself).

Almost 87% of the Black Sea water volume is anoxic containing high levels of hydrogen sulfide and methane and only 13% contain oxygen. The recent anthropogenic pressure has placed eventhis 13% under serve stress. This stress is, first of all, due to large input of nutrients.

Concerned about the state of the Black Sea ecosystem and the limited recovery of its resources the Black Sea countries negotiated "Convention for the Protection of the Black Sea against Pollution" that was signed in Bucharest in April 1992, and ratified by all six legislative assemblies by early 1994. Convention includes a basic framework of agreement and the following three specific Protocols:

(a) Protocol on Protection of the Black Sea Marine Environment against Pollution from Land Based Sources (LBS);
(b) Protocol on Cooperation in Combating Pollution of the Black Sea Marine Environment by Oil and other Harmful Substances in Emergency Situations;
(c) Protocol on the Protection of the Black Sea Marine Environment against Pollution by Dumping.

The goals, priorities and timetable needed to bring about environmental actions are set in the Ministerial Declaration on the Protection of the Black Sea Environment. The Declaration was signed by all six Ministers of the Environment in Odessa in April 1993.

In order to start the actual environmental cooperation in the region and to develop a longer-term Action Plan, the Black Sea countries requested support from the Global Environment Facility, GEF, a fund established in 1991 under the management of the World Bank, UNDP and UNEP. In June 1993, a three-year Black Sea Environmental Programme (BSEP) was established with US$ 9.3 million funding from GEF and collateral funding from the European Union (Phare and Tacis), The Netherlands, France, Austria, Canada and Japan. The most important achievements of BSEP were Transboundery Diagnostic Analyses (TDA) and the regional Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (BS-SAP) adopted on 31 October

1996. UNEP's contribution to the international effort in supporting environmental cooperation in the Black Sea region contains in Annex 1.

The BS-SAP revealed that the Black Sea ecosystem continues to be threatened by inputs of certain pollutants, notably nutrients. Nutrients enter the Black Sea from land-based sources, and in particular through rivers. The Danube accounts for well over half of the nutrient input to the Black Sea. Eutrophication is a phenomenon, which occurs over wide areas of the Black Sea and should be of concern to the countries of the Black Sea basin. The BS-SAP calls for the development of a Black Sea Basin Wide Strategy to address the eutrophication problem in the Black Sea. The objective of the Strategy should be to negotiate, with all states located in the Black Sea Basin, a progressive series of stepwise reductions of nutrient loads, until agreed Black Sea water quality objectives are met.

.All six coastal countries on the basis of the BS-SAP drafted National Black Sea Strategic Action Plans (NBS-SAPs), which are currently in the process of adoption. The Bucharest Convention, BS-SAP and NBS-SAPs provide for policy and legal basis for rehabilitation and protection of the Black Sea ecosystem and the sustainable use of its resources. As a follow-up to these documents the GEF Nutrient Reduction Programme was suggested in line with the GEF programmatic approach. It should assist in implementation of the further concrete actions at national and regional levels to combat eutrophication. Within the Programme UNEP was requested to assist the Black Sea countries for a revision of the Protocol on Protection of the Black Sea Marine Environment against Pollution from Land Based Sources.

This report is prepared to start the process of the requested assistance. It consists of description of the recent international developments in combating pollution from Land Based Sources, main elements suggested for amendments of the Protocol and an outline of the actions, which UNEP plans to undertake. The report is prepared by a UNEP consultant. It will be used for the preparation of a UNEP Regional project component of the GEF Project Brief: "Nutrient Reduction Programme – Regional Project for the Black Sea".

II. An objective of the revision of the Protocol and main elements suggested for amendments.

The main objective of the revision of the Protocol should be to enhance its legislative provisions for measures to reduce nutrient inputs to the Black Sea incorporating relevant positions of the BS-SAP and the recent international developments in combating pollution from Land Based Sources.

RECENT INTERNATIONAL DEVELOPMENTS IN COMBATING POLLUTION FROM LBS.

Global Programme of Action for the Protection of the Marine Environment from Land-based Activities.

The representatives of Governments and the European Commission, participating in the Conference held in Washington from 23 October to 3 November 1995, recognized the growing and serious threat from land-based activities to both human health and well being and adopted Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) and the Washington Declaration. The Global Programme of Action aims at preventing the degradation of the marine environment from land-based activities by facilitating the realization of the duty of States to preserve and protect the marine environment. It is designed to assist States in

taking actions individually or jointly within their respective policies, priorities and resources, which will lead to the prevention, reduction, control and/or elimination of the degradation of the marine environment, as well as to its recovery from the impacts of land-based activities. The Programme of Action, therefore, is designed to be a source of conceptual and practical guidance to be drawn upon by national and/or regional authorities in devising and implementing sustained action to prevent, reduce, control and/or eliminate marine degradation from land-based activities. Effective implementation of this Programme of Action is a crucial and essential step forward in the protection of the marine environment and will promote the objectives and goals of sustainable development.

The Global Programme of Action reflects the fact that States face a growing number of commitments flowing from Agenda 21 and related conventions. Its implementation will require new approaches by, and new forms of collaboration among, Governments, organizations and institutions with responsibilities and expertise relevant to marine and coastal areas, at all levels-national, regional and global. These include the promotion of innovative financial mechanisms to generate needed resources.

GPA recommends approaches to the prevention of pollution from land-based activities by source category. It provides guidance as to the actions that States should consider at national, regional and global levels to reduce and prevent inputs to the marine environment of several categories of pollutants including nutrients. In the next two years the Programme will concentrate upon implementation of the GPA Strategic Action Plan on Municipal Wastewater as a part of the preparatory process for the 2001 Intergovernmental review of the GPA.

The Washington Declaration calls for the regional cooperation to coordinate efforts for maximum efficiency and to facilitate action at the national level, including, where appropriate, becoming parties to and strengthening regional cooperative agreements and creating new agreements where necessary. The Protocol on Protection of the Black Sea Marine Environment against Pollution from Land Based Sources is one of such regional cooperative agreements and might be strengthened incorporating commitments of the Black Sea governments took in Washington in 1995. The part III "Regional Cooperation" of the GPA contains the most useful ideas, which might be used as a conceptual and practical guidance for the amendment of the Protocol and its annexes. In particular, the following requirements are relevant:

15.1 States should strengthen existing regional conventions and programmes, and their institutional arrangements in particular:

(a) Invite multilateral financing agencies, including regional development banks, and national institutions for bilateral development cooperation to cooperate in programming and in national implementation of regional agreements.

(b) National action strategies and programmes can sometimes be best developed in a regional and subregional context.

(c) The programmes of action should be developed and implemented on a timetable appropriate to regional or subregional circumstances and decided upon by the governing bodies of the regional or subregional agreements, conventions or arrangements as appropriate;

(d) Establish or strengthen regional information networks and linkages for communicating with clearing-houses and other sources of information;

(e) Ensure close collaboration between the national and regional focal points and regional economic groupings, other relevant regional and international organizations, development banks and regional rivers authorities / commissions, in the development and implementation of regional programmes of action;

(f) Encourage and facilitate cooperation between and among regional organizations / conventions to promote the exchange of information, experience and expertise;

(g) Ensure that there is adequate secretariat support for regional and subregional arrangements (legal agreements and programmes of action), including:

- Clear definition of secretariat functions and responsibilities;
- Consolidation of secretariats, including reliance on existing institutional arrangements, where cost-effective;
- Cooperation between secretariats;
- Close integration of regional and subregional programmes of action and the relevant lega l agreements that apply to the region and subregion.

15.2 In the development and implementation of the regional programmes of action, consideration should also be given to the following:

(a) Steps towards harmonization of environmental and control standards for emissions and discharges of pollutants, and agreement on data-quality assurance standards, data validation, comparative analysis, reference methods and training that are required for reliable monitoring and assessment carried out for the protection of the marine environment from land-based activities;

(b) Exploring the use of innovative financing mechanisms that will assist the implementation of national and regional programmes of action;

(c) Building capacity and, where appropriate, identifying regional centers of excellence for research, management tools and concepts, training and capacity-building as well as contingency-planning, monitoring and assessment, including environmentally sound technology assessment;

(d) Arrangements to ensure that decision-making at the regional level is based on an integrated planning and management approach adopted at the national level;

(e) Steps to protect critical habitats and endangered species;

(f) Establishment of linkages with regional or subregional fisheries arrangements, as well as other mechanisms dealing with conservation of marine species, to promote collaboration in the exchange of data and information and mutual reinforcement in the achievement of respective objectives.

The above ideas and guidance were used in many practical arrangements for protection of marine environment at the regional scale. The recommendations to explore the use of innovative financing mechanisms

for assistance of implementation of national and regional programmes of actions has been realized in the Protocol Concerning Pollution from Land-Based Sources and Activities to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region. The Protocol was adopted by the Conference of Plenipotentiaries held in Oranjestad, Aruba, between 27 September and 6 October 1999 and stipulated that:

16.1 In addition to the financial participation by the Contracting Parties in accordance with Article 23 the Convention, the Commission may, in response to requests from Contracting Parties, seek additional funds or other forms of assistance for activities related to this Protocol. These funds may include voluntary contributions for the achievement of specific objectives of this Protocol made by the Contracting Parties, other governments and government agencies, international organizations, non-governmental organizations, the private sector and individuals.

16.2 The Contracting Parties, taking into account their capabilities, shall endeavor as far as possible to ensure that adequate financial resources are available for the formulation and implementation of projects and programmes necessary to implement this Protocol. To this end, the Contracting Parties shall:

(c) promote the mobilization of substantial financial resources, including grants and concessional loans, from national, bilateral and multilateral funding sources and mechanisms, including multilateral financial institutions; and

(d) explore innovative methods and incentives for mobilizing and channeling resources, including those of foundations, non-governmental organizations and other private sector entities.

16.3 In keeping with its development priorities, policies and strategies, each Contracting Party undertakes to mobilize financial resources to implement its plans, programmes and measures pursuant to this Protocol.

GPA also suggests that:

17.1 Land-locked States whose river systems and drainage basins are linked to a particular marine region or subregion should be encouraged to participate in the relevant regional and subregional arrangements; and

17.2 States should encourage, where appropriate, regions to enter into interregional cooperation in order to exchange experiences and to help implement policies. Interregional cooperation may also be necessary to promote coordination of efforts for the protection and preservation of marine ecosystems and habitats.

UNEP Regional Seas Programme and amended Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities.

In 1974 UNEP initiated the Regional Seas Programme as a global programme implemented through regional components. At present it includes 13 regions and has over 140 coastal States and Territories participating in it. All programmes have developed and approved their action plans in one or another form. Each regional action plan is

formulated according to the needs of the region as perceived by the Governments concerned. The action plans promote the parallel development of regional legal framework agreements and of action-oriented programme activities. The first action plan approved within the Regional Seas Programme was the Mediterranean Action Plan (MAP). MAP was adopted in Barcelona, Spain in 1975 under the auspices of the United Nations Environment Programme (UNEP). It aims to protect the environment and to foster development in the Mediterranean Basin. The European participating countries are listed in Annex 2. Algeria, Egypt, Lebanon, Morocco, Syria, Tunisia, and the European Commission also participate. The MAP legal framework comprises the Barcelona Convention and six Protocols covering specific aspects of environmental protection. Since its adoption by all Mediterranean states and the EC, the Action Plan has served as the basis for the development of a comprehensive, environment and development programme in the region involving the Mediterranean coastal states, specialized organizations of the United Nations system, Intergovernmental and Non-governmental Programmes and Organizations.

The Contracting Parties to the Barcelona Convention (the Mediterranean States and the European Union) meet every two years on a Ministerial level, to deliberate on general policy, strategy and political issues relevant to their cooperation as well as to decide on MAP's programme and budget. They keep their legal instruments up to date through constant reviewing and amending them. The Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities (see Annex 3) was adopted in Athens on 17 May 1980, entered into force on 17 June 1983. and amended in Syracusa, Italy in March 1996.

The Protocol may serve as a good example for the amendemnt of the Black Sea LBS Protocol due to the following reasons:

(a) it was amended to incorporate new developments, in particular to apply the precautionary principle and the polluter pays principle and to take into consideration the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities;
(b) the Mediterranean and Black Sea regions are very close geographically; and in general
(c) the legal instruments developed in the Mediterranean region often service as a model for other regions within UNEP Regional Seas Programme.

The following elements might be considered for incorporation into the amended Black Sea LBS Protocol:

22.1 In “General Provision” the Contracting Parties committed themselves to take all appropriate measures to eliminate pollution along with the prevention, abatement and combating.

22.2 The important defin ition of a “Hydrologic Basin” extends the Protocol area application to the entire watershed area within the territories of the Contracting Parties, draining into the Mediterranean Sea.
22.3 The sources to which the Protocol is applied are extended and well defined.
22.4 The contracting parties committed themselves to the preparation and implementation of national and regional action plans and programmes, containing inter alia, binding measures and timetables for their implementations. The action plans should be adopted and periodically reviewed by the Parties. The elements of the action plans and criteria for their adoption are set forth in annexes to the Protocol.
22.5 The Parties shall submit reports every two years to the meeting of the Contracting Parties. Such reports shall include, inter alia:

(a) Statistical data on the authorizations granted in accordance with the Protocol;
(b) Data resulting from monitoring as provided for in the Protocol;
(c) Quantities of pollutants discharged from their territories;
(d) Ac tion plans, programmes and measures implemented in accordance with the Protocol.

22.6 The meeting of the Parties shall adopt, by a two-thirds majority, the short-term and medium-term regional action plans and programmes containing measures and timetables for their implementation. Such measures and timetables become binding on the one hundred and eightieth day following the day of notification. As we mentioned earlier in the UNEP Regional Seas Programme has a good experience in the financial issue. The Parties to the Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region, (done at Cartagena de Indias, Colombia on 24 March 1983) have adopted recently an LBS Protocol, which contains many useful clauses especially on financial matter. The details were discussed above.

European Union Water Framework Directive.
The European Union (EU) is the result of a process of cooperation and integration which began in 1951. The EU today has fifteen Member States (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom) and is preparing for its fifth enlargement, this time towards Eastern and Southern Europe. The process of enlargement of the European Union was launched on 30 March 1998. Negotiations are

currently being held with the following twelve applicants: Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia. Foe the purpose of this report we prepared a table showing participation of the European countries in the main international conventions on protection of water bodies. The table also includes information on the bordering seas and catchments basins, which includes the whole or part of the territory of the country. The table is annexed to this report as Annex 2. As it follows from this annex three EU members and seven applicants have the whole or the part of their territories within the Black Sea Basin mainly in the Danube basin. Some 58% of the total nitrogen and 66% of the total phosphorus flowing in dissolved form into the Black Sea come from the Danube basin. Therefore, the European Union policy on the protection, management, control and regulation of water bodies has a direct impact for the state of the Black Sea environment. The most of the EU's water legislation will be rationalized with the adoption of the new European Parliament and Council Directive establishing a framework for Community action in the field of water policy (EU Directive). It was recently approved by the Conciliation Committee between the Council and the European Parliament.

The Directive aims to protect the inland surface water, transitional waters, coastal waters and groundwater. As a result of the new directive, EU member states will have to clean up their waters achieving good surface water status by 31 December 2010. The Directive will also have a serious impact on industry and agriculture.

The Directive will provide an overall framework within which national governments and regional institutions can develop integrated and coherent water policies. Of considerable interest, with respect to purposes of this report, is that it is proposed to achieve the Directive's objectives through the principle use of Rive Basin Management. Not only will this include the area of land surface run-off to the estuary but will include groundwater and coastal waters.

The following provisions of the Directive are of special interest:

28.1 Definitions:

- "Surface water" means surface fresh water, estuaries and coastal waters.
  - "Surface fresh water" means all static or flowing water on the surface of the land upstream of the fresh water limit.
  - "Fresh water limit" means the place in the watercourse where, at low tide and in a period of low fresh water flow, there is an appreciable increase in salinity due to presence of seawater.
  - "Coastal water" means water on the landward side of a line every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial

waters is measured, extending where appropriate in the case of watercourses, up to the outer limit of the estuary.

- "Estuary" means the transitional area at the mouth of the river between surface fresh water and coastal waters. The outer (seaward) limits of estuaries shall be defined, as necessary, by Member States. The inner (upstream) limit shall be the fresh water limit.
- "River basin" means the area of land from which all surface run-off flows trough a sequent of streams, rivers and, possibly, lakes into the sea at a single river moth, estuary or delta.
- "River Basin District" means the administrative area of land and sea, made up of one or more neighboring river basins together with their associated groundwater and coastal waters.

28.2 Each Member State will have to identify individual river basins lying within their national territories and assign them to a river basin district that should include relevant groundwater, and coastal waters. In those rivers, which cross national boundaries, it is intended to set up international river basin districts.

28.3 For each river basin district – some of which will transcend national frontiers – "a river basin management plan" will need to be established and regularly updated.

28.4 Central to each river basin management plan will be the requirement for Member States to establish a programme of measures to ensure that all waters in the river basin achieve the objective of good water status.

The Directive takes a combined approach to pollution control, requiring Member States to set down in their programmes of measures both limit values to control emissions from individual point sources and environmental quality standards to limit the cumulative impact of such emissions as well as of diffuse sources of pollution.

Member States shall ensure the establishment of a register of all areas lying within each river basin district which have been designated as requiring special protection under specific Community, national or local legislation for the protection of their surface water and groundwater or for the conservation of habitats and species. Within each river basin district, the register of protected areas shall be kept under review and up to date.

The Directive is the first piece of EU water legislation to address the issue of water quantity. It stipulates that the programme of measures established for each river basin district must aim to ensure a balance between the abstraction and recharge of groundwater. Moreover, all abstraction of surface water or groundwater will require prior authorization except in areas where it can be demonstrated that this will have no significant impact on the status of the water.

MAIN ELEMENTS TO BE INCLUDED IN THE AMENDED PROTOCOL.

Provisions for the development and implementation of a Black Sea basin wide approach.

The need for an integrated approach to the management of the marine and coastal environment, including associated river basins and groundwater systems, are among the main issues emerged during the last decade on the global scale. The above analyses of the recent international developments in combating pollution from Land Based Sources support this statement. The integrated approach is especially important for the Black Sea due to its extensive drainage basin and large number of incoming rivers. The following table shows the major rivers of the Black Sea basin:

Name	*Cathment Area, km²*	*Length, km*	*Total Runoff Km³/year (%)*	*Sediment Discharge, mill.t/year*
Danube	*817 000*	*2 860*	*208 (64.6)*	*51.7*
Dnieper	*505 810*	*2 285*	*51.2 (15.9)*	*2.12*
Kizilirmak	*78 200*	*1 151*	*5.02 (1.6)*	*5.02*
Dniester	*71 990*	*1 328*	*10.2 (3.2)*	*2.50*
Southern Bug	*68 000*	*857*	*3.0 (0.9)*	*0.53*
Sakarya	*65 000*	*790*	*6.38 (2.0)*	*6.38*
Yesilirmak	*36 100*	*416*	*4.93 (1.5)*	*4.93*
Coruh	*22 000*	*500*	*8.69 (2.7)*	*15.13*
Rioni	*13 300*	*228*	*12.8 (4.0)*	*7.08*
Inguri	*4 060*	*221*	*4.63 (1.4)*	*2.78*
Kodori	*2 030*	*84*	*4.08 (1.3)*	*1.01*
Bzyb	*1 410*	*-*	*3.07 (0.9)*	*0.60*
Total	***1 684 900***	*-*	***322 (100)***	

As we mentioned earlier only 13% of the total volume of the Black Sea contains oxygen. The rivers, therefore, transport each year to the Black Sea the volume of the fresh water, which is comparable to the seawater volume containing oxygen. The catchment area of the Danube is of 1.5 times of the sea surface area (547000 km³). These figures strongly support the need **to extend the geographical coverage of the Black Sea LBS Protocol** to the river catchment areas at least within the territory of the country party to the Bucharest Convention like in the Mediterranean LBS Protocol. The Protocol thus will provide a legislative basis for national governments and the Commission of the Bucharest Convention to develop integrated and coherent policies **to reduce input of the nutrients to the Black Sea from the whole catchment area**. Of considerable interest, with this respect, are the requirements of the EU Directive to use Rive Basin Management and to establish River Basin

Districts. Not only will this include the area of land surface run-off to the estuary but will include groundwater and coastal waters.
The following terms defined in the EU Directive might be used for the amendment of the Protocol:

- "Surface water".
  - "Surface fresh water".
  - "Fresh water limit".
  - "Coastal water.
  - "Estuary".
  - "River basin".
  - "River Basin District".

If the countries are not willing to elaborate so much they can use the definition of the "Hydrologic Basin" from the Mediterranean Sea LBS Protocol. This definition, also not so detailed, will nevertheless extend the Protocol area application to the entire watershed area within the territories of the Contracting Parties, draining into the Black Sea.
If the Black Sea countries are inclined to follow the EU Directive requirements the Protocol should include provisions for each of them to:

- **identify individual river basins** lying within their national territories **and assign them to a river basin district that should include relevant groundwater, and coastal waters.** In those rivers, which cross national boundaries, an international river basin districts should be set up.
- **establish and regularly update a river basin management plan** for each river basin district – some of which will transcend national frontiers.
- **establish a programme of measures to ensure that all waters in the river basin achieve the objective of good water status.**

Importance of the diffuse sources of the nutrients necessitates taking of **a combined approach to pollution control**. This will require Participating Countries to set down in their programmes of measures both limit values to control emissions from individual point sources and environmental quality standards to limit the cumulative impact of such emissions as well as of diffuse sources of pollution.
Amending the Protocol the participating countries may wish to take into account the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities and the Washington Declaration.
The amended Protocol, in this respect, should provide for:

(a) **Innovative financing mechanisms** that will assist the implementation of national and regional programmes of action;

(b) Development of **national action strategies and programmes in a regional** and subregional **context.**

(c) Development and implementation of the **programmes of action** on a timetable appropriate to regional circumstances and **guided by the Commission of the Bucharest Convention.**

(d) Strengthening of regional information networks for communicating with clearing-houses and other sources of information;

(e) Close collaboration between the national and regional focal points and regional economic groupings, other relevant regional and international organizations, development banks and regional rivers authorities / commissions, in the development and implementation of regional programmes of action;

(f) Cooperation between and among regional organizations / conventions to promote the exchange of information, experience and expertise;

The amended Protocol should provide for close cooperation and coordination of actions for protection and management of water between the Black Sea countries and the countries of its basin. Cooperation with the countries in the basins of Danube and Dnieper should be specially mentioned. The mechanisms for such cooperation might be also regulated by the amended Protocol.

Provisions for preparation of the regional action plan and country level investment projects for nutrient reduction.

The nutrients enter the marine environment with rivers run-off, direct discharge, the surface run-off and atmospheric fall-out. The Black Sea Transboundery Diagnostic Analysis (TDA) exposed that the international rivers accounted for more than 80% of the Biological Oxygen Demand and Total Suspended Solid loads. Some 58% of the total nitrogen and 66% of the total phosphorus flowing in dissolved form into the Black Sea come from the Danube Basin. Some studies indicate that about 30% of dissolved nitrogen and phosphorus are coming from the non-coastal countries (see Annex 2).

However, the authors of TDA caution to interpret the nutrient **influx from the Danube as being the only issue worthy of action**. The data reveals rather large BOD fluxes from virtually all Black Sea countries. Many of these discharges correspond with inadequate treatment facilities of so called “hot spots”.

Therefore, the amended **Protocol should provide for actions coordinated in the whole catchment area including elimination of the hot spots**. The relevant provisions of the Mediterranean LBS Protocol and EU Directive might help to amend the Black Protocol with this respect.

Development of the coordinated measures, their approval and reporting on the implementation are well elaborated in the Mediterranean LBS

Protocol. The following clauses should be carefully studied by the Black Sea countries while working on the amendment of their LBS Protocol:

45.1 "The Parties undertake to eliminate pollution deriving from land-based sources and activities… To this end, they shall elaborate and implement, individually or jointly, as appropriate, **national and regional action plans and programmes, containing measures and timetables for their implementation**…" (Article 5).

45.2 "1. The **meeting of the Parties shall adopt**, by a two-thirds majority, the short-term and medium-term regional action plans and programmes containing **measures and timetables for their implementation** provided for in article 5 of this Protocol… 2. Regional action plans and programmes as referred to in paragraph 1 shall be formulated by the Organization and considered and approved by the relevant technical body of the Contracting Parties… 3. The measures and timetables adopted in accordance with paragraph 1 of this article shall be notified by the Secretariat to all the Parties. **Such measures and timetables become binding** on the one hundred and eightieth day following the day of notification…" (Article 15)

45.3 The **Parties shall submit reports every two years…** to the meeting of the Contracting Parties…. Such reports shall include, inter alia:

(e) Statistical data on the authorizations granted in accordance with the Protocol;
(f) Data resulting from monitoring as provided for in the Protocol;
(g) Quantities of pollutants discharged from their territories;
(h) Action plans, programmes and measures implemented in accordance with the Protocol.

The EU Directive provisions for principle **Rive Basin Management through the establishment of River Basin Districts** might be also used in the amended Protocol as an instrument for the regulation of regionally coordinated national and regional action plans and programmes, containing measures and timetables for their implementation.

The precautionary principal and anticipatory actions should be included in the action plans and programmes. The amended Protocol should also have provision for harmonization of the water quality objectives and application of the Integrated Coastal Zone Management as requested by BSAP. The Protocol should establish an obligation for the Black Sea countries to adopt and implement, in accordance with its own legal system, the legal and other instruments required to facilitate Integrated Coastal Zone Management. A mechanism for the preparation and approval of a Regional Black Sea Strategy should be also elaborated.

III. Conclusions and recommendations.

A lot of new developments have taken place in the field of combating pollution from LBS since the adoption of the Black Sea LBS Protocol. If the countries wish to see the Protocol as a modern legal instrument providing for sustainable measures to eliminate or reduce eutrophication of the Black Sea they should amend it considering the following policy issues:

48.1 Extension of the geographical coverage in order to reduce the input of the nutrients from the whole catchment area.

48.2 Elaboration and implementation of the regional action plans and programmes containing binding measures and timetables.

48.3 Development of national action strategies and programmes in a regional context.

48.4 Development of an innovative financing mechanisms that will assist the implementation of national and regional programmes of action;

48.5 Application of the Rive Basin Management principles through the establishment of the River Basin Districts.

48.6 Application of a combined approach to pollution control.

48.7 Preparation of a cod of a good agricultural practice and the Black Sea cod of conduct in the coastal zone.

48.8 Reporting to the Contracting Parties meetings every two years.

48.9 Inclusion in the action plans and programmes precautionary principal and anticipatory actions.

48.10 Harmonization of the water quality objectives.

48.11 Application of the Integrated Coastal Zone Management.

48.12 Participation of NGOs.

The Black Sea countries may wish to consider the amendments of the LBS Protocol as part of their obligations under the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities.

We took a liberty to suggest some elements for amendments of the Black Sea LBS Protocol (see Annex 5).

AN OUTLINE OF THE UNEP's ACTIONS TO BE UNDERTAKEN FOR THE REVISION OF THE PROTOCOL.

UNEP/ROE should inform the Black Sea and Danube basins countries (or members of the joint Danube-Black Sea Technical Working Group) on its activities with regard to the legal instruments on reduction of the nutrients input into the Black Sea and call for a meeting.

The meeting should consider this report and similar report of a consultant for the Danube basin, comment on both of them and recommend UNEP/ROE the follow-up actions. As regards the amendment of the Black Sea LBS Protocol the meeting should also elaborate on the above policy issues and advise on the indicators assessing effectiveness of the Protocol.

The role of the LBS Protocol in the whole GEF Nutrient Reduction Programme is also a very important issue. The meeting should recommend the Protocol as a legal instrument regulating preparation and implementation of measures in the frame of the GEF Programme on nutrient reduction.

After the meeting UNEP should organize preparation of an amended version of the Protocol with the explanation note. Then one or two meetings of experts will be required to finalize the text of the Protocol. When the text of the Protocol is agreed upon at the expert level a meeting of plenipotentiary should be called upon.

Addressing Transboundary Priorities in the Danube/Black Sea Basin:

A Strategic Partnership

Introduction:

The GEF, its Implementing Agencies, the European Community and others are working together to assist the 17 countries in the Danube/Black Sea basin in addressing their top priority transboundary waters issues. The GEF Secretariat, UNDP, the World Bank and UNEP, in consultation with other key donors, the International Commission for the Protection of the Danube River, the Black Sea Commission and the Danube and Black Sea Secretariats/PIU, have prepared this strategy paper in order to:

- Describe the collaboration among the Implementing Agencies, funding partners and Danube/Black Sea basin countries in the first "GEF Strategic Partnership" to a geographic area in the International Waters focal area;
- Inform the GEF Council on the approach being taken by the GEF Implementing Agencies in the Danube/Black Sea basin;
- Provide a framework for interagency and inter-governmental cooperation and coordination in addressing transboundary issues in the Danube/Black Sea basin;
- Help to leverage and coordinate additional inputs to the region from other donors;
- Provide guidance and orientation for the development of the Danube and Black Sea GEF Regional Projects;
- Serve as a tool to assure coherence between donor activities and the policies and strategies of the respective Conventions;
- Provide guidance to assure coherence between donor activities and the objectives and work programs of the respective Secretariats;
- Establish a common agreement among the countries and Agencies for objectives and programmatic indicators that will be utilized to measure progress over the five year program.
- Support the efforts of EU accession countries in the Danube/Black Sea basin to comply with EU Water Directives (nitrate, phosphate) and the forthcoming Water Framework Directives.

This basin-wide, multi-stakeholder collaboration is needed to accelerate on-the-ground implementation of measures and to consolidate gains made in jointly reversing nutrient over-enrichment and toxics contamination of the Danube/Black Sea basin (see Annex 2) under the Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-Based Activities. The participating countries have the opportunity to shorten by one-half the time frame for significant environmental improvements that have taken 2-3 decades to accomplish for other transboundary waterbodies in Europe and North America. This draft was shared and discussed with the countries at the recent Black Sea basin-wide Stocktaking meeting as part of preparing their collaborative projects for consideration by the GEF Council in May, 2001.

Objectives and Programmatic Indicators:

Objective 1:

In support of the implementation of the Black Sea and Danube Strategic Action Plans and the "Common Platform for Development of National Policies and Actions for Pollution Reduction under the Danube River Protection Convention", and taking into account the mandate of the Sofia and Bucharest Conventions, Danube/Black Sea basin countries adopt and implement policy, institutional and regulatory changes to reduce point and non-point source nutrient discharges, restore nutrient 'sinks', and prevent and remediate toxics restore "hot spots".

Indicators: By 2005, 100% of participating countries introduce one or more policy or regulatory measures (including phosphorus-free detergents) to reduce nutrient discharges in the agricultural, municipal, or industrial sectors, and to restore nutrient "hot spots sinks (wetlands, flood plains), and to prevent and remediate toxics "hot spots", and 50% adopt multiple measures, towards goals of maintaining 1997 levels of nutrient inputs to the Black Sea, and towards remediation of toxics "hot spots" substantially reducing toxics contamination in the basin.

Objective 2:

Countries gain experience in making investments in nutrient reduction and prevention and remediation of toxics "hot spots".

Indicators: 100% of participating countries implement one or more investments in agricultural, municipal, land use or industrial sectors for nutrient discharge reduction, nutrient sink restoration, and prevention and remediation of hot spots of toxic substances, some with GEF assistance, by 2005 to accompany expected baseline investments.

Objective 3:

Capacity of the Danube and Black Sea Convention Secretariats is increased through permanent status, sustainable funding, and development of international waters process, stress reduction and environmental status indicators adopted through Convention processes.

Indicators: PCU/PIU functions evolve into Convention Secretariats (Danube already in place; Black Sea effective September 2000); payments of contributions by all contracting parties made for 2001-03-29 and pledged for the period beyond project duration; nutrient control, toxics reduction and ecosystem indicators assessing processes in place, stress reduction, and environmental status, are developed, harmonized and adopted for reporting to Secretariat databases by 2005.

Objective 4:

Country commitments to a cap on nutrient releases to the Black Sea at 1997 levels and agreed targets for toxics reduction for the interim, and possible future reductions or revisions using an adaptive management approach after 2004 are formalized into a specific nutrients control and toxics discharge protocol(s) or Annex(es) to the respective Conventions or via other legally binding mechanisms.

Indicators: Countries adopt protocols or annexes to their two conventions and/or develop legally binding "Action Plans" regarding nutrients and toxics reduction commitments as part of their obligations under the Global Programme of Action for Protection of the Marine Environment for Land-Based Activities by 2005 towards agreed goal to restore the Sea to 1960's environmental status. For the Danube, such a commitment will be contained in the revised Nutrient Reduction Plans (coherent with the ICPDR Joint Action Programme) and developed in accord with the application of the relevant EU Water Directives.

Objective 5:

Implementing Agencies, the European Union, other funding partners and countries formalize nutrient and toxics reduction commitments into IA, EU and partner regular programs with countries.

Indicators: Regular programs of IA's and EC support country nutrient and toxics reduction commitments during 2000-2005 as part of expected baseline activities and incorporate them into CCF (UNDP), GPA Office Support (UNEP), CAS (WB), and EU (Accession support) by 2005.

Objective 6:

Pilot techniques for restoration of Danube/Black Sea basin nutrient sinks and reduction of non-point source nutrient discharges -through integrated management of land and water resources and their ecosystems in -river sub-basins by involving private sector, government-NGO's and communities in restoration and prevention activities, and utilizing GEF Biodiversity and MSP projects to accelerate implementation of results.

Indicators: All countries in basin begin "nutrient sink" restoration and non-point source discharge reduction by 2005 through integrated river sub-basin management of land, water and ecosystems with support from IA's, partners and GEF through small grants to communities, biodiversity projects for wetlands and flood plain conservation, enforcement by legal authorities and holistic approaches to water quality, quantity and biodiversity of aquatic ecosystems.

The Danube/Black Sea Basin: A Strategic Partnership

To accomplish the objectives summarized above aimed at addressing Danube/Black Sea basin pollution reduction, with particular attention to nutrients and toxic substances, in the most efficient and coordinated manner possible, the GEF and its Implementing Agencies are proposing a strategic programme of capital investments, economic instruments, development and enforcement of environmental law and policy, strengthening of public participation, and monitoring of trends and compliance. The programme would include both GEF and non-GEF (EC, EBRD, IA regular programs, etc.) elements.

Operationally, within the GEF International Waters and Biodiversity focal areas, the interagency Strategic Partnership proposed for the Danube/Black Sea basin includes eight principal elements:

Elements of the Strategic Partnership:

1. A GEF Black Sea Regional Project implemented in cooperation with the Black Sea Commission;

2. A GEF Danube River Basin Regional Project implemented in cooperation with the International Commission for the Protection of the Danube River (ICPDR);

UNDP and UNEP propose to develop and jointly implement these two regional capacity building projects aimed at addressing transboundary environmental degradation in the Danube/Black Sea basin through policy and legal reform, public awareness raising, and institutional strengthening. Each project will be operated through or closely linked to the respective Black Sea and Danube Secretariats in Istanbul and Vienna. The two projects will each focus on the following areas within the Danube and Black Sea convention countries, with the GEF lead agency shown for each:

~~1.~~ a) Actions to revise and/or create legally binding nutrients and toxics reduction protocols/action plans to the Black Sea Convention in accordance with the Global Programme of Action to Protect the Marine Environment from Land Based Activities (UNEP). For the Danube, strategies and measures for nutrient reduction will be reflected in the ICPDR Action Plan, which will be endorsed and thus become legally binding to the contracting Danube countries under the Danube River Protection Convention (UNDP).

~~2.~~ b) Activities to develop and implement policies and legislation aimed at addressing sectoral causes of nutrient and toxics releases, such as phosphate detergent phase-out, agricultural reform, cleaner production in industry, etc. (UNDP);

~~3.~~ c) Policy and legislative reforms aimed at promoting the protection and restoration of critical nutrient sinks, particularly wetlands and floodplains (UNDP);

~~4.~~ d) Strengthening of the institutional capacities of the Black Sea and Danube Secretariats to build in long-term capacity to understand, address and monitor levels and impacts of transboundary nutrients and toxics (UNDP);

~~5.~~ e) Public awareness raising in support of basin-wide nutrient and toxics reduction efforts (UNDP);

~~6.~~ f) Harmonization of water regulatory standards (in line with EU regulations and new Convention protocols, where applicable) among the Danube/Black Sea basin countries to include similar nutrient and toxics reduction provisions (UNDP);

~~7.~~ g) Development of Black Sea and Danube River basin Monitoring and Evaluation indicators harmonized among countries for process, stress reduction and environmental status indicators (UNDP);

h) Strengthening of the Information System to allow interactive information exchange and update and development of public area for specific topics of nutrient reduction (UNDP);

i) Support to further development of NGO activities at national and regional level (UNDP);

j) Establishment of Small Grants Fund to reinforce community based actions for nutrient reduction with particular attention to agricultural reform projects, wetland restoration and use of lagoons for nutrient reduction (UNDP);

k) FA feasibility studies for a nutrients emission trading system at the national and regional levels. The Black Sea project will coordinate an overall study for the Black Sea basin as a whole while the ICPDR/KfW will carry out a study specific to the Danube River Basin towards the possibility of developing economic instruments for nutrient management in the Danube River Basin (UNDP).

3. The World Bank-GEF Partnership Investment Facility for Nutrient Reduction

The Partnership will finance incremental costs associated with the reduction of nutrient loads and discharges into the Danube River, its tributaries, the Black Sea and other rivers which feed it. Three types of projects (or combination thereof) would be eligible for financing under the Partnership:

1. a) Wetland restoration or creation, that reduce nutrients discharge or loads;

2. b) Reform and improvement of agriculture and land management practices with impact on nutrient use and/or diffuse discharges through run-off;

3. c) Wastewater treatment in small communities (normally with a population less than 100,000) and small industries or large ones if opportunity exists.

The Partnership would finance specific components of World Bank or bilateral financed projects. Baseline costs would be covered by a combination of national financing, a World Bank --- or other IFI ---loan and grant funds from other sources. The GEF financed component would leverage additional funds (including national funds) in at least a 1:2 ratio against the amount of the GEF grant. Self-standing GEF-financed projects without a corresponding World Bank loan or bilateral financing could be also considered, in exceptional cases, if important policy reforms would be accomplished by the GEF grant or where national funding, in cash and in-kind, is at least as large as GEF funding (i.e. 1:1 ratio).

Eligible projects must have: (i) the endorsement of the country's GEF focal point; (ii) be included in the country's Black Sea or Danube National Environmental Program and selected as a priority investment; (iii) form part of the Regional Environmental Program, as approved by the respective Commission; and (iv) the proposing country be up to date on contributions to the Black Sea and/or Danube Secretariat(s). This would include an explicit recognition from the countries that the transboundary control of nutrients is a priority issue in their NEAP/NAPs.

As in the case of all GEF financed projects, eligible projects will be prepared, appraised and implemented under the same terms as a regular World Bank project and subject to the standard World Bank review process before being submitted to the GEF Secretariat. Therefore, institutional requirements, sustainability, financial, economic, social and environmental conditionality normally required in World Bank projects would also apply to Partnership projects.

Whenever a project has additional global benefits, such as biodiversity preservation (i.e. through the recovery of a Ramsar site), the existence of such additional benefits would be a positive factor, but not constitute an eligibility criteria, even though it could lead to additional incremental GEF resources. In any case, nutrient removal is the essential eligibility condition for all projects.

The World Bank is preparing the Partnership ~~For~~Investment Facility for Nutrient Reduction proposal for consideration at the May, 2001 meeting of the GEF Council. A figure of approximately $60 million would be reserved for nutrient reduction investments under the Strategic Partnership as described above. Additional contributions will be solicited from bilateral donors. If approved, the World Bank could then vet projects directly through the GEF Secretariat without having to bring each separate project to Council. Two concepts, Bulgaria Wetland Restoration and Romanian Agricultural Reform, have already been approved as likely components of the investment programme. The GEF Secretariat would review and approve projects based on the criteria summarized above.

The World Bank will also promote the Investment Partnership, the investments it supports and the Strategic Partnership in its country dialogues, include the Black Sea and Danube perspectives in relevant World Bank Country Assistance Strategies (CASs) as they are updated, and promote policies that address nutrient reduction as part of country dialogues. These activities will be closely coordinated with related and supporting activities planned under the Black Sea and Danube Regional Projects.

4. The GEF Dnieper Basin Environment Programme (DBEP):

The Dnieper River transports some 20,000 tons of nitrogen annually to the Black Sea, further exacerbating the Black Sea's eutrophication problem. A GEF project to assist the riparian countries of the Dnieper River (Russia, Belarus and Ukraine) in the development and implementation of a Transboundary Diagnostic Analysis and a Strategic Action Programme for the Dnieper River basin was approved by GEF in March, 1998 and commenced full implementation in September, 2000. Inter alia, the project will assist the Dnieper basin countries in identifying, prioritizing and addressing both point and non-point sources of nutrient and toxics pollution to the Dnieper and the downstream Black Sea, through legal, policy and institutional reforms and priority investments. The GEF Dnieper project is designed to enable full coordination of project activities with the Danube/Black Sea basin Strategic Partnership.

5. Georgia: World Bank GEF Agricultural Development Project II

The overall development objective of the project is to increase agricultural production sustainably, while reducing pollution of natural resources. The project includes reforms targeting prevention of nutrient releases. It represents the first phase of a ten-year Program, to be implemented in three phases, for the reform of on-farm agricultural and environmental practices. Under phase one, GEF would support the costs of implementing measures aimed at improving on-farm environmental practices, such as storage and management of manure water quality monitoring, which over the long term would reduce nutrients from entering the Black Sea.

6. GEF Biodiversity and Medium-Sized Projects in the Danube/Black Sea basin

GEF Biodiversity and Medium Sized Projects in the Danube/Black Sea basin to address nutrients and toxics hot spots and nutrient sinks, test different approaches and catalytically accelerate on-the-ground results. These include:

Biodiversity Projects:

Integrated Coastal Management Project, Georgia (World Bank; WP entry 7/98)

Danube Delta Biodiversity, Romania (World Bank; WP entry 4/92)

Biodiversity Conservation in the Azov-Black Sea Ecological Corridor, Ukraine (World Bank; WP entry 1/98)

Danube Delta Biodiversity, Ukraine (World Bank; WP entry 4/92)

Integrated Biodiversity Conservation and Wetland Management for the Mid-Pripyat River and Floodplains (UNDP, PDF-A)

Integrated Management of the Carpathian River Basins (GEF project concept, OP12)

Medium-Sized Projects:

Transfer of Environmentally Sound Technology (TEST) to Reduce Transboundary Pollution in the Danube River Basin (UNDP; MSP concept approved by GEF December, 1999; brief approved by GEF August, 2000; implementation commenced February, 2001; UNIDO as Executing Agency)

Building Environmental Citizenship to Support Transboundary Pollution Reduction in the Danube: A Pilot Project in Hungary and Slovenia (UNDP; MSP approved November, 1998; implementation commenced April, 2000; Regional Environment Centre as Executing Agency)

7. Nutrient control and reduction Projects executed by European Bank for Reconstruction and Development (EBRD) under the new GEF 'Expanded Opportunities for Executing Agencies':

EBRD's main focus is to identify bankable investment projects together with supporting activities to facilitate these investments. EBRD contributes to pollution reduction in the Danube and Black Sea Basin by financing projects particularly in the municipal and industrial sectors, and by applying environmental appraisal procedures and international environmental standards to all of the Bank's operations in the region.

Danube Pollution Reduction Programme: Financing of Pollution Reduction Projects by Local Financial Intermediaries (IA: UNDP):

The main objective of the project is to facilitate principally small and medium sized private sector investment projects in the industrial and agricultural sector. The project would identify mechanisms, using the Bank's local financial intermediaries within the relevant countries to provide to the private sector financial resources, including loans and GEF grants for eligible components for the reduction of pollutants that are responsible for the degradation of the aquatic environment in the Danube River Basin and the Black Sea. Considering the pilot character of the investments, the proposed project will initially concentrate on Slovenia.

8. Accelerated implementation of environmental management programs for mining related "hot spots" identified by the Danube SAP and TDA.

This activity would support accelerated actions to address "hot spots" in the Danube River Basin and other basins associated with mining operations and tailing ponds. This would allow for targeted investments, consistent with ICPDR proposed actions for prevention and control of accidental pollution, to improve emergency warning systems, develop preventive management programs and undertake selected priority investment actions. The activity would complement ongoing UNEP and EU activities to support the development and implementation of medium and long-term preventive measures for management of operating, decommissioned and abandoned tailing dams at priority "hot spots" in the Danube River Basin. This would provide a mechanism to enhance joint efforts in the Tisza River basin and other areas where similar "hot spots" exist and there is a significant need for improved preventive management programs.

Non-GEF Activities which support the Strategic Partnership:

European Union

The European Union is a major political and financial actor in the Central and Eastern European and NIS area mainly through its enlargement and NIS relations' policies.

The enlargement of the EU to the ten candidate countries of Central and Eastern Europe will involve:

- The adoption and implementation by these countries of the EU environmental legislation and standards as a prerequisite for their entry into the Union
- The financial assistance by the EU to these countries toward the development of the infrastructures necessary for the implementation of the EU legislation

The financial assistance will involve primarily the pre-accession financial instruments PHARE and ISPA.

In March 1998 the Commission, the World Bank and the EBRD signed a Memorandum of Understanding on pre-accession financing. This was updated in March 2000 to take account of the new pre-accession financial instruments (ISPA and SAPARD) and to extend co-operation to cover the NIS countries.

The Memorandum includes commitments to:

- Co-ordinate project implementation;
- Implement co-financing projects jointly which foster the adoption of the EU legislation;
- Identify future co-financing opportunities which could foster accession;
- Be as flexible as possible with the delivery of the grants.

The PHARE-funded Large Scale Infrastructure Facility (€ 250 million for 1998-99) was developed to co-finance accession-related projects in transport and environment with the international financing institutions (IFIs). Realising that environmental projects would take much longer to put together than transport ones, DG Environment of the European Commission co-operated with the World Bank to develop a pipeline of viable projects to enable environment to take a reasonable share of the new Facility, screening all projects for accession relevance. The result was a substantial list of environmental co-financing projects for 1998 and 1999 (50% of the total Facility).

The **ISPA** instrument has some €500 million a year to spend on environmental infrastructure investment over the period 2000-06. The minimum size of projects is normally € 5 million, and there is money for project preparation. Although the ISPA Regulation does not formally require co-financing with the IFIs, this is greatly encouraged. ISPA needs a project pipeline, while the grants could make it easier for the IFIs to lend to the accession countries.

DG ENV is developing a Priority Environmental Investment Programme for Accession **(PEPA)**, which aims to develop investment strategies, priorities and a project pipeline for all Community sources of finance and potentially non-Community such as the World Bank. World Bank officials have participated actively at a number of meetings to promote this project.

The EU has concluded Partnership and Cooperation Agreements with each one of the Newly Independent States. In this context it is providing financial assistance through the use of the TACIS programme. The new TACIS Regulation foresees greater assistance on environmental pre-investment activities.

To date Phare and Tacis have contributed about € 18 million to the Black Sea Environment Programme and about € 8 million to the Danube Environment Programme. The latest € 4.6 million Tacis programme to the BSEP is ending in 2000. It gave support to the Black Sea Implementation Unit and to BSEP Activity Centers in Georgia, Russia and Ukraine.

Under the new Tacis Regional Programme 2000 currently under preparation the European Commission is planning on a € 12 million Black Sea Investment Support Programme for 2001-2003. The overall objectives of this programme will be :

Investment support

Co-financing with IFIs of pilot investments yielding significant environmental benefits. These might include the following in particular:

- Waste water treatment (including nutrient removal)
- End of pipe industrial discharge treatment (including upstream industrial facilities and oil terminals)
- Grants to new industrial facilities designed to minimise polluting discharges
- Landfills to replace marine waste dumping
- Prevention/remediation of oil spills from shipping
- Construction of harbour facilities

The investments should be available for all riverine countries and would include up-stream as well as coastal sites. Tacis should provide both technical assistance, including project preparation, and investment grants in the form of interest subsidies or otherwise.

Institutional support

Continuation of the work of the Black Sea Commission is of crucial importance for concerted action of the riparian countries to tackle the problems of the Black Sea.

Support may also be included to the three Activity Centres in order to fulfill the regional coordinating role for which they have also been designated . These are:

- Batumi, Georgia: biodiversity monitoring and development of strategy;
- Odessa, Ukraine: water quality monitoring and development of strategy;
- Krasnodar, Russia: coastal zone management.

EU is also anticipating a project on Nutrient Management in the Danube River Basin and its impact on the Black Sea (total cost 3,5 million €) as part of its 5th Framework Programme.

It will be important to seek the close cooperation of the EU programmes in the Danube and Black Sea areas with those of the GEF, the World Bank, the EBRD etc. so that synergies can be found in the execution of these programmes.

European Bank for Reconstruction and Development (EBRD)

EBRD has carried out pre-investment regional and sector studies in the Danube River Basin and technical co-operation projects in Hungary and Romania. The Bank's main focus is to identify and to promote investment projects together with supporting activities to facilitate these investments. The Bank attaches particular importance to promoting environmentally orientated operations in line with its mandate, both through "stand-alone" operations with primarily environmental objectives, such as upgrading of waste water management and solid and hazardous waste management, and also by financing environmental improvements in the industrial often as part of a larger-scale restructuring and modernisation investment.

EBRD municipal environmental infrastructure projects under implementation:

Municipal Utilities Development Programme (MUDP) I and II, Romania:

Water and wastewater sector loans to two programmes covering 6 and 10 cities, respectively. As well as improving the water quality of the Danube River and the Black Sea, the municipal infrastructure investments will also bring the water companies in line with EU environmental standards.

Maribor water and waste-water BOT project, Slovenia:

Loan to finance construction of a wastewater treatment plant in Maribor, Slovenia's second largest city. The project will have a major positive impact on the water quality of the Drava River.

Budapest Waste Water Services, Hungary:

The Bank has invested in the partly privatised Budapest Municipal Sewerage Company (BMSC). BMSC has subsequently developed an environmental action plan which will bring the facilities into compliance over time with both Hungarian and EU environmental standards.

Zaporozhia-Water Utility Development & Investment Programme, Ukraine:

The project is financing investments in the water supply and waste-water sector and enhancing the financial and operational performance of Vodokanal, the municipally owned water and waste-water company of Zaporizhia . The project will reduce discharges of untreated waste water into the Dnieper river and, ultimately, the Black Sea.

Brno-Modice Waste-Water Treatment Plant, Czech Republic:

Loan to the water utility of the city of Brno to finance the extension and upgrading of the Brno-Modice waste-water treatment plant and part of the city's sewerage network, contributing to the further reduction of the pollution of the River Svratka.

Zagreb landfill rehabilitation, Croatia:

EBRD has funded the rehabilitation of one of the largest uncontrolled landfills in Europe to bring the landfill in line with EU environmental standards. The project includes a leachate collection and treatment facility to prevent discharge into the Sava River, a tributary to the Danube.

EBRD municipal environmental infrastructure projects under preparation:

- Sofia Water, Bulgaria
- Zagreb Waste-water treatment plant, Croatia

- Municipal Environment Loan Facility, Romania
- Sevastopol Water, Ukraine
- Municipal Utilities Development Programme, Ukraine

EBRD industrial projects under implementation:

Slovalco Aluminium Smelter, Slovak Republic:

EBRD made a loan and took equity to enable the company to complete the construction and operation of a new smelter and to shut down inefficient and polluting aluminium smelters and plants. Slovalco is now in full compliance with EBRD's environmental covenants and is a "zero emission plant", with all process waters being recycled and no wastewater discharges being discharged from the site.

Ambro/Sical, Romania:

An EBRD loan to Ambro to modernise its pulp and paper production facilities is also resulting in improvements in environmental conditions at the plant, including improvements in the treatment of black liquor, waste-water and sludge.

Further examples of EBRD-supported industrial projects under implementation in the water and wastewater management sector in the Danube catchment area are:

- Egis (pharmaceutical industry), Hungary
- Borchodchem (chemical industry), Hungary
- TVK (chemical industry), Hungary
- Petrom (petro-chemical industry), Romania
- Somatra zink smelter, Copca Mica, Romania
- ALRO aluminium smelter, Slotina, Romania
- Phoenix copper smelter, Baia Mare, Romania
- Policolor (print and ink factory), Bukarest, Romania, and Ruse, Bulgaria
- PIRDOP copper smelter, Bulgaria
- Sodi (Solvay-processing), Bulgaria
- Celhart (pulp and paper), Bulgaria.

The Bank has also undertaken environmental investments in the agribusiness sector focusing, typically, on the control of waste-water discharges, the improvement of waste-water treatment and the protection of groundwater.

UNDP Country Cooperation Frameworks/Regional Cooperation Frameworks

UNDP is supporting the Strategic Partnership through interventions under both its Environment and Governance focus areas. Under Environment, during the pilot phase Danube and Black Sea projects UNDP provided over $2 million in support to Danube/Black Sea basin issues through projects such as:

- Ukraine: Improving Environmental Monitoring Capacity ($1.099 million; 1995-1999)
- Ukraine: Environmental Impact Assessment Demonstration ($138,000; 1997-2000)
- Russia: Water Quality Evaluation and Prediction in Areas Affected by the Chernobyl Accident ($278,000; 1997-2000).

- Georgia: Capacity Building for the Ministry of Environment ($620,000; 1998-2000)

The Danube/Black Sea Basin Strategic Partnership has a strong focus on facilitating legal, policy and institutional reform in support of transboundary pollution reduction. These new laws, policies and institutions can only be effective if they have the appropriate level of trust, legitimacy and credibility in civil society. In addition, as has been the case in the West, environmental protection is being propelled more and more by public demand. UNDP is supporting the empowerment of individuals and NGOs with skills and information to increase their involvement in the environmental policymaking and enforcement processes. During the Danube and Black Sea pilot phase programs, UNDP provided assistance totaling nearly $6 million to the Black Sea basin countries in support of governance, democracy and public participation. Sample projects included:

- Regional Umbrella Program to Support Democracy, Governance and Participation in Europe and the CIS ($2.153 million, 1997-1999)
- Moldova: Governance and Democracy: Strengthening the Judicial and Legislative Systems ($1.739 million, 1996-1999).
- Georgia: Capacity Building for the Ministry of the Environment ($0.620 million, 1998-2000).
- Regional Programme on the Environment and Development ($1.8 million, 1997-1999). National Agenda 21's, policy reforms, institutional strengthening, public participation and networking, strengthening of inter-sectoral cooperation.

In addition, through the GEF Small Grants Programme in Turkey, UNDP supported a survey of monk seals and their habitats along the Black Sea coast, a coastal management programme in the Black Sea province of Trabzon, and a small scale Waste Water and Sanitation Project in the town of Hacimahmutlu.

Through its ongoing support to Environment and Governance in the Central European and CIS countries, UNDP will continue to provide the framework for successful implementation of the key reforms envisioned under the Strategic Partnership. During the five year period of the programme, UNDP will support, inter alia, the following projects which support the goals of the Strategic Partnership:

- Implementing Local Agenda 21's in Turkey: Phase II (includes 3 Black Sea provinces of Trabzon, Samsun and Zonguldak); ~$100,000.

- Turkey: National Programme for Environmental Management and Sustainable Development (includes efforts to combat desertification); $100,000.

- Management Planning for Conservation of Fen Mire Biodiversity in Belarus (Dnieper River Basin), $143,000.

- Ukraine: Promoting and Strengthening Horizontal Cooperation (supports Ukraine's process of triple transition to statehood, democracy and a market-oriented economy by acquainting Ukrainian government officials and policymakers with relevant reform experiences in other countries of the region, Asia and Latin America); $65,000.

- Support to Economic, Social and Administrative Reforms in Ukraine (aimed at facilitating the implementation of the government's economic, social and administrative reform programme by providing timely and effective expertise to develop and implement policy reform initiatives); $704,000.

- Czech Republic, Slovakia and Slovenia: National Capacity Building for Sustainable Development (institutional strengthening, integration of SD principles into selected sectoral policies and programmes, enhancing SD awareness); $300,000.

In addition, the GEF SGP will increase its links with the Black Sea Environment Programme through projects in the Biodiversity and International Waters focal areas. 7 of 33 recently submitted project concepts have direct relevance to Black Sea environmental issues, including protection of the Mersin Fish (*Huso*), a threatened species; raising public awareness to prevent Black Sea pollution; and a small size waste water treatment project in Samsun.

Other Programs:

- World Wildlife Fund: Lower Danube Green Corridor
- Preparation of an Annex to the Danube River Protection Convention for the protection of ecosystems and nature conservation

~~**World Wildlife Fund Blue Danube Wetland Restoration Program**~~

Future Considerations Under the Strategic Partnership.

Two activities not addressed in this Strategic Partnership will be considered in more detail at a later date and initiated under the Black Sea Regional Project. The first is the Black Sea-Bosphorus Straits-Mediterranean Sea Marine Electronic Highway (MEH) Feasibility Study, and the second an International Waters Fisheries Component. Regarding the MEH, the Black Sea GEF project identified shipping as a transboundary issue and mechanisms needed to support environmental management, and the Secretariat is in a position to set environmental management shipping guidelines, but this effort lends itself to a private sector initiative. A Black Sea transboundary fisheries component will also be considered and integrated into the Strategic Partnership, once selected preparatory activities have been completed by the Black Sea Regional Project.

Annex 1

Transboundary Issues in the Danube/Black Sea Basin

It is widely agreed that regional scale eutrophication driven by excess nutrient inputs, primarily from riverine sources, is the major transboundary issue impacting the Danube/Black Sea basin. As a result of the pollution source inventory conducted during the preparatory work for the Black Sea Strategic Action Plan, it has been possible to gather data on the inputs of dissolved nitrogen and phosphorus compounds to the Black Sea (as of 1995). To the best of our knowledge[8], some 14% of total nitrogen are from Bulgaria, 27% from Romania, 12% from Ukraine, 10% from the Russian Federation, less than 1% from Georgia, 6% from Turkey and about 30% from the non-coastal countries (Austria, Belarus, Bosnia and Herzegovina, Croatia, Czech Republic, Former Yugoslavia, Germany, Hungary, Moldova, Slovakia, Slovenia). In the case of phosphorus, the figures are Bulgaria, 5%; Romania, 23%; Ukraine, 20%; Russia, 13%; Georgia 1%; Turkey 12% and 26%, for the remaining countries, a similar story to that of nitrogen.

According to the GEF Operational Strategy (p.48-49), the GEF strategy is to meet the agreed incremental costs of:

Implementing measures that address the priority transboundary environmental concerns.

Control of land-based sources of surface and groundwater pollution that degrade the quality of international waters….High priority is also placed on abatement of common contaminants such as nutrients,…

The Black Sea Strategic Action Plan states (p.10):

29. A Black Sea Basin Wide Strategy, negotiated with all states located in the Black Sea basin, should be developed to address the eutrophication problem in the Black Sea. The objective of the Strategy should be to negotiate a progressive series of stepwise reductions of nutrient loads, until agreed Black Sea water quality objectives are met. Such a Basin Wide Strategy may also be required to ensure the reduction of inputs of other pollutants into the Black Sea, in particular oil.

30. Given that the Danube is the largest single source of nutrient inputs into the Black Sea, it is imperative that strategies for the reduction of nutrients be adopted for this river.

[8] Topping, G., H. Sarikaya and L.D. Mee (1998) Sources of pollution to the Black Sea. In: Mee, L.D. and G. Topping (Eds) (1999 *in press*) Black Sea Pollution Assessment. UN Publications, New York, 380, 280pp

The Common Platform for the Development of National Policies and Actions under the Danube River Protection Convention (DRPC) (chapter 3.2.4) states:

The eutrophication by nutrients from land-based sources of pollution is one of the most serious environmental problems of the Black Sea, one of the key explanations for its environmental decline and the principal cause for the degradation of the Black Sea environment. The main causes of negative regional effects on the Black Sea ecosystems include:

- *Pollution by untreated municipal and industrial wastes,*
- *Pollution from agricultural activities,*
- *Reduction of wetlands and forested areas.*

In the framework of the DRPC implementation the following goals and objectives have to be achieved:

Strategic Goals:

- *to improve aquatic ecosystems and biodiversity*
- *to maintain and improve water resources quality and quantity (sustainable use)*
- *to prevent, reduce and control water pollution from point and diffuse sources, in particular where hazardous substances and nutrients are involved;*
- *to prevent and control transboundary impact and contribute to the Protection of the Black Sea from land-based pollution sources*

Specific objectives for the main sectors:

- *to ensure biological and advanced waste water treatment in the municipal and industrial sector*
- *to promote the use of BAT and the adoption of BEP in all industries, particularly those involving hazardous substances*
- *to promote the adoption of BEP and sustainable land use in agriculture*

…….

As a result of the severe economic downturn in the region following the political upheavals of the early 1990's, the near collapse of the industrial and agricultural sectors in the Danube/Black Sea basin countries has resulted in some modest short-term reductions in nitrogen and phosphorus inputs to the Black Sea from the Danube and probably other rivers. In recognition of this "window of opportunity" to catalyze improvements in the status of the Black Sea ecosystem, the Joint Danube-Black Sea Technical Working Group identified the following goal for the next seven years:

The long-term goal is for all Black Sea basin countries to take measures to reduce nutrient levels and other hazardous substances to such levels necessary to permit

Black Sea ecosystems to recover to similar conditions as those observed in the 1960s.

As an intermediate goal, urgent control measures should be taken by all countries in the Black Sea basin, in order to avoid that discharges of nitrogen and phosphorus to the Black Sea exceed those levels observed in 1997. This will require countries to adopt and declare strategies that permit economic development whilst ensuring appropriate practices and measures to limit nutrient discharge, and to rehabilitate ecosystems which assimilate nitrogen and phosphorus. This target, monitored and reported annually, shall be reviewed in 2007 with a view to considering further measures that may be required for meeting the long-term objective.

The strategy put forth below integrates the technical, policy, legal, institutional and investment frameworks summarized in the preceding sections.

Addressing Danube/Black Sea Basin-wide Eutrophication through Reduction and Sequestering of Nutrient Releases:

The Joint Danube-Black Sea Technical Working Group identified four key measures which could be taken to reduce nutrient discharges to the Danube/Black Sea basin. These include:

1. Reform of agricultural policies to reduce non-point source run-off of fertilizers and manure (buffer zones, manure storage clamps, erosion control, organic agriculture, etc.);

2. Improved municipal and industrial wastewater treatment to capture nutrients, particularly using alternative technologies with low capital and O&M costs (e.g. constructed wetlands, advanced integrated ponding systems, etc.);

3. Rehabilitation of key basin ecosystems (e.g. wetland restoration) to enhance their capacities as nutrient ‘sinks’;

4. Changes in consumer practices (including use of phosphate free detergents), including legislation (where needed), enforcement and public awareness.

Annex 2

Preserving the Danube/Black Sea basin Environment: A brief history

The Black Sea was formed only seven or eight thousand years ago when changing sea level sent Mediterranean water through the Bosphorus valley into what was until then a large freshwater lake. Human populations emerged and flourished in the basin, with little apparent negative impacts on the Sea or the rivers that feed it. Though not very biologically diverse compared with open seas at similar latitudes, the Black Sea developed remarkable and unique ecosystems, particularly in its expansive northwestern shelf where the sea is relatively shallow. Today, the Danube/Black Sea basin encompasses 17 countries and supports a population of over 160 million people over an area of about …square kilometers. Over the last 30-40 years, as a result of rapid and largely unsustainable development, industrialization and the 'green revolution', the Black Sea and many of the rivers that feed it have become severely degraded, with effects including:

- Loss of species diversity;
- Severe eutrophication over large areas (particularly in the NW shelf) due to excess inputs of nutrients;
- Declining water quality due to persistent inputs and levels of hydrocarbons and other chemicals from both marine and land-based sources;
- Landscape degradation due to unplanned coastal and watershed development;
- Introduction of exotic species (at least 26 in the Black Sea) with major impacts on the ecosystem and on commercial fisheries;
- Overfishing which together with the environmental factors led to a decrease in the diversity of Black Sea commercial species from 26 species to 6 in less than two decades;
- Increased frequency of outbreaks of waterborne diseases such as cholera and frequent beach closures due to poor coastal water quality.

Donor and National Activity:

Recognizing the declining status of the Danube/Black Sea basin environment, in recent years both the governments of the region and the international community have taken steps to remediate the degradation of the Danube/Black Sea basin and to prevent future impacts through a variety of reforms. Beginning in 1993, the Black Sea Environment Programme (BSEP) was created with both donor and national funding, including major inputs from the GEF and the European Union's TACIS and Phare programs. The BSEP focused on enabling activities, capacity building, and the preparation and approval of regional and national 'Strategic Action Plans' (SAP's). The BSEP focal areas included Emergency Response, Pollution Monitoring, Biodiversity, Integrated Coastal Zone Management, Fisheries, Database Management and Geographic Information System, Environmental Economics and Investments, NGO's, Information and Communication and Policy and Legislation.

Similarly, in 1991, GEF, the European Union and the countries of the Danube River basin created the Environmental Programme for the Danube River Basin (EPDRB), designed to support the Danube countries in their long term objective of improving the environmental management of the Danube river basin. EPDRB supported SAP and NAP preparation, monitoring, collection and assessment of data, emergency

response systems, pre-investment studies, institutional strengthening, capacity building and reinforcement of -NGO activities.

Concurrently, GEF and other donor-supported environmental protection activities have been underway in other Danube/Black Sea Basin rivers, including the Dnipro (GEF), Dniester (various), Don (World Bank) and Prut (Tacis) Rivers, and the Sea of Azov (Dutch).

Legal Framework:

Both the Black Sea and the Danube, the largest river in the basin, have developed and ratified international conventions (Black Sea Convention, Danube River Protection Convention) whose objectives pertain to the prevention of pollution of the Danube/Black Sea basin. The Danube River Protection Convention came into force in October, 1998, the Black Sea Convention in February, 1994. A number of the basin countries are also parties to the UN Economic Commission for Europe's Convention on the Protection and Use of Transboundary Watercourses and International Lakes. Most countries are also party to several other relevant conventions, including the Convention on Biological Diversity, Convention on Wetlands of International Importance (Ramsar Convention). At the national level, numerous policies, laws and regulations exist relating to protection of Danube/Black Sea basin resources, but exhibit a wide range of implementation, compliance and enforcement. In most countries, legislation to address some of the priority problems, especially transboundary ones, identified by the programs noted above is still in its infancy. In the Danube River Basin, most countries, especially those in the accession process to the European Union are actually revising their policy and legal frame for environmental and water protection to be coherent with EU water directives.

Policy Framework:

The BSEP was the first programme to develop a systematic approach to policy development through the application of a Transboundary Diagnostic Analysis and a Strategic Action Plan (SAP). The Black Sea SAP, contains 59 specific commitments on policy regarding measures to reduce pollution, improve living resources management, encourage human development in a manner which does not prejudice the environment, and take steps towards improving financing for environmental projects. In adopting this plan, the Black Sea governments have committed themselves to a process of profound reform in the manner in which environmental issues are addressed in the Black Sea and its basin. Preparation of National Action Plans to operationalize the SAP at the national level is also underway.

Concurrently, the Environmental Programme for the Danube River Basin adopted a Danube River SAP in 1994 (revised in ~~1998~~ 1999 as a Common Platform for National Policies and Actions under the DRPC) which provides direction and a framework for achieving the goals of regional integrated water management and riverine environmental management expressed in the Danube River Protection Convention. The most recent GEF intervention in the Danube sought to operationalize elements of the SAP and Convention through the preparation of a Pollution Reduction Programme (PRP) which was completed in July, 1999. Over $5 billion in investments, primarily at the national level and targeting 'hot spots', were identified and project files prepared.

Preparation of a Strategic Action Programme and support to its implementation is also planned in the Dnipro River Basin through UNDP-GEF and IDRC assistance.

Institutional Framework

Several emerging or operational institutions have key roles to play in the identification and implementation of activities aimed at the remediation and protection of the Danube/Black Sea basin waters and ecosystems. Key among these are the Commission on the Protection of the Black Sea Against Pollution and the Secretariat of the Black Sea Commission, and the International Commission for the Protection of the Danube River and its Permanent Secretariat, each with responsibility for coordinating implementation of the respective Conventions. The Danube Secretariat and the ICPDR Expert Groups (Monitoring, Laboratory, Information Management Expert Group, Emission Expert Group, Accidental Emergency Warning and Prevention Expert Group and Ad-hoc Expert Group for Implementation of EU Water Framework Directives and River Basin Management) are ~~is~~ fully operational and financially sustainable whereas the Black Sea Secretariat has experienced repeated delays in overcoming political and bureaucratic challenges to its establishment. It is hoped that these will be overcome shortly (April, 2000) and the Black Sea Secretariat will come into existence in late 2000 or early 2001. In addition, donor-supported activities have resulted in the creation of non-permanent institutions such as the Black Sea PIU and Danube PCU responsible for coordination of the respective environment programmes.

Investment Framework:

Both the Black Sea and Danube Environment programmes have supported the identification and preparation of investments aimed at remediating and preventing environmental degradation in the Danube/Black Sea basin. Collectively, the 13 countries of the Danube River Basin invested approximately $560 million in municipal and industrial wastewater treatment, agricultural water pollution reduction, wetlands protection and water resources management in 1997-98. An additional $4.29 billion in water sector investments is planned for the next 2-5 years. For the Black Sea riparians, a total of nearly $100 million in water sector investments are underway or near completion.