Water-Quality Control, Monitoring and Wastewater Treatment in Lithuania 1950 to 1999

INTRODUCTION

The Republic of Lithuania is the largest of the Baltic States with an area of 65,000 km² and a population of 3.7 million. Its population is concentrated in the interior of the country. Almost 60% of urban residents live in Vilnius, Kaunas, Siauliai, Panevezys, and Klaipeda, which is the only city located on the coast. Rural residents account for less than one third of the total population.

Lithuania is characterized by rivers; its shoreline on the Baltic Sea is only 99 km long. The 2 largest rivers, the Nemunas and the Neris, can be classified as medium-sized rivers, the others are small (2–4). The Nemunas and its tributaries drain 71% of the country’s territory. The Nemunas is the third largest river according to drainage area, and fourth in the volume of discharge into the Baltic Sea (1, 5). Human impact has been of 2 types: i) the consequences of land reclamation activities, including the straightening and channelling of some riverbeds with loss of aesthetic value, and with accumulation of persistent organic pesticides from agricultural areas in sediment; ii) the pollution of rivers as main wastewater recipients is perhaps, the most significant environmental problem in Lithuania (2–6). Most of the pollution problems being faced today in Lithuania have been inherited from the time of Soviet rule (1940–1990). Most existing wastewater-treatment plants (WWTPs) were built by Lithuanian engineers, but the regulations and control measures were issued and enforced by USSR central institutions in Moscow. Since independence in 1991, Lithuania has been developing its own environmental policies and practices. This article provides a historical overview on the evolution of water-quality management in the country with respect to wastewater monitoring and protection, and it also summarizes the development of wastewater management. The main aim is to assess the contribution of the Nemunas to the pollution of the Baltic Sea.

DEVELOPMENT OF THE WATER-MANAGEMENT SYSTEM

Institutional Changes in the Water-management System

The centralized Soviet management system practically eliminated municipal control with respect to local water questions. This changed in 1991, and since then water supply and wastewater treatment have been managed by enterprises at the municipal level, for example, in Vilnius by the municipal water supply and sewerage joint stock company Vilnius Waters (Vilniaus Vandeny). During the Soviet period several institutions were engaged in water protection. Their establishment or reorganization was decreed by Moscow in the form of comprehensive changes in the ministerial network in the USSR or pursuant to special decrees of the Council of Ministry of the USSR that were later ratified by the Council of Ministry of the Lithuanian SSR (7).

The first organizations to oversee surface-water quality, wastewater loading and construction of WWTPs were established after World War II. The quality of air and surface water was monitored by the Hydrometeorological Board (Hidrometeorologijos valdyba) from 1946, and the Lithuanian Economy of Waters for Fishery (Litovskoje ribolovskoje vodnoje choziaistvo, Litry-bvodchoz) was in charge of surface water monitoring on behalf of fishery (7, 8). Regulation of polluting enterprises
was the responsibility of State Sanitary Service (Valstybinė sanitarinė tarnyba), which approved construction plans for new and renovated enterprises and controlled wastewater discharges. In the early 1960s, the duties were transferred to the newly established Board of Use and Protection of Water Resources (Vandens resurso naudojimo ir apsaugos valdyba). Until 1965, this agency was responsible for efficient use of water in industry, as well as for the protection of surface and underground water resources against pollution (7, 9). The Hydrochemical Laboratory (Respublikinė hidrocheminė laboratorija) independently monitored wastewater, and harmful discharges and took extra measurements if necessary. The Inspection of Water Economy (Vandens užkio inspekcija) collected information about pollution loads and assessed penalties for industrial pollution beginning in 1965. In 1968, the Republic’s Hydrochemical Laboratory became the independently operating Water Research Laboratory. New instructions for methods of chemical and bacteriological analysis of industrial discharges and punishment for polluting enterprises were introduced in 1964 throughout the USSR. Regional inspections were established in Lithuania in 1965 (7). This can be considered as a beginning of the state control of industrial pollution (7). The regulation of construction and renovation of WWTPs was also entrusted to a water resources board (7, 9).

All the organizations responsible for pollution monitoring after 1964 have undergone intensive development and reorganization. Only the main functions, management and control, have been preserved. Early in 1965 the State Committee of Water Economy (Valstybinis vandens užkio komitetas) replaced the Board on Use and Protection of Water Resources, but at the end of the year this agency was reorganized. It became a part of the Ministry of Water Economy and Land Reclamation (Vandens užkio ir melioracijos ministerija), which was abolished in 1988. Water use and protection became the responsibility of the State Committee for Nature Protection, which had been in charge of water management. In 1990, this committee was newly reorganized into the Department of Environment Protection, which later became the Ministry of the Environmental Protection (Aplinkos apsaugos ministerija) and since 1998 has been called Ministry of Environment (Aplinkos ministerija) (7, 10).

Today, surface-water quality monitoring is performed by laboratories of the Joint Research Centre of the Ministry of Environment. The State Inspection of Environmental Protection monitors polluting enterprises. Both of these agencies have regional departments that gather statistics on water use and wastewater discharges (11). Nowadays, responsibility for building new WWTPs rests with the municipalities as a rule. However, when allocations come from the state budget or foreign funds available only through the Ministry of Environment, the Ministry has the responsibility for establishing new WWTPs. The work of water inspection is being revised to meet EU requirements (especially 96/61/EC, 96/82/EC). The main task at the moment is to create an appropriate control system.

History of Surface-water Monitoring

In 1950, the first hydrological stations on Lithuanian rivers were established and the Hydrometeorological Service of the LSSR began to measure surface-water quality. Temperature, pH and dissolved oxygen were measured at 6 permanent sampling stations (8, 12). The monitoring network was organized in 1961. From 1966 to 1970, 12–15 rivers basins were monitored 4 times per year and 15 parameters were measured. Oil products, heavy metals, phenols and others harmful substances have been monitored since 1965. Over 30 new hydrochemical sampling stations were included in the monitoring network between 1971 and 1980. In 1985, a new 10-year monitoring program for 60 rivers was approved. Hydrobiological methods became a part of water quality assessment in 1976. Monitoring results have been published since 1960, first in Hydrochemical Bulletin and later, from 1978, in Water Quality Chronicles (8, 13). In 1991, the environmental protection system was reorganized, and the river monitoring program was also revised: several observation points at small rivulets upstream from the towns were excluded and new sites in polluted rivers were chosen. In 1998, 70 parameters were measured in 48 rivers at 103 points (14). The first National Environmental Monitoring Programme was approved by the Lithuanian Government in 1998. It takes EU requirements into consideration and makes it possible to provide reliable, timely and targeted information for water-quality assessment and management. At present, the Lithuanian river-monitoring network forms part of the European water-monitoring system (15).

Surface and Wastewater-Quality Classification Systems

After World War II, surface-water quality was classified by using chemical parameters and maximum allowable concentrations (MAC) which were adopted as state standards throughout the USSR and applied to freshwater fishery requirements. Such standards were prepared by considering physicochemical parameters, odor and impact on public health (16–18). The MAC list included 13 parameters in 1944 (19); it was updated in the 1970s to measure 250 parameters (12–16). Since 1966 rivers have been classified in 4 categories: clean, moderately clean, polluted, and highly polluted (8). In 1968 a system of saprobic zones was introduced. Water quality has been assessed using both hydrobiological and hydrochemical parameters, and a classification system of 6 classes was proposed in 1971 (20, 21) and officially introduced in 1976 (13). River classification systems vary broadly across Europe (22), but it appears that Lithuania’s system is one of the most advanced.

Wastewater-Quality Standards

The first regulations containing standards for wastewater discharges in the USSR were issued in 1957 and 1961 (23). Compliations of these technical regulations were published in Lithuania in 1966 (24). The recommendations for activated sludge plants were given in BOD, values, depending on the capacity of the plant. New standards introduced in 1996 included Maximum Permissible Concentrations (MPC) for effluents: BOD₅, COD, suspended solids, total nitrogen, total phosphorus, and for organic (anionic and nonionic detergents, phenols, petroleum products, oils/fats) and inorganic (heavy metals, anions as cya-
nides, chlorides, sulfates, total chlorine, etc.) substances. In addition general regulations for wastewater discharges (temperature, pH, color, odor, transparency, mineralization, toxicity, etc.) were introduced (25). Most of these currently valid quality standards reflect Soviet norms. These norms are now being revised to be comparable with EU standards.

**Development of the Control of Wastewater Discharges**

Only fragmented information on wastewater discharges is available prior to 1960. The first organized statistical account of discharges was begun in 1962. Water consumers had to fill out a form, requesting information on amounts obtained and discharged (9). In 1972, a new statistical form was introduced; every consumer using more than 10 m³ day⁻¹ of water was obliged to indicate the source of the water taken, the quantity of discharged water, the recipient, and the amount of certain contaminants (9).

Enterprises had to carry out laboratory analyses once a month if the volume of wastewater they produced exceeded 500 m³ day⁻¹; once a quarter if the volume was 100–500 m³ day⁻¹. If the volume was less than 100 m³ day⁻¹, the enterprise was not obliged to perform chemical analyses. Some chemical compounds had to be analyzed according to a special list issued by the Ministry of Land Reclamation and Water Economy (26). The Republic’s Hydrochemical Laboratory, with regional laboratories in Kaunas, Klaipeda, Siauliai, and Panevezys, has been testing discharge quality independently from the laboratories of the enterprises according to water inspection plans adopted in 1964 (7, 9).

About 80% of the statistical forms were filled in erroneously in 1973–1975 and are thus not reliable (9, 27). The collected statistical data for 1972 were used for final calculations of total quantities of contaminants entering into surface waters. The results were categorized according to: i) water quality/pollution parameters; ii) different branches of industry; iii) river drainage areas (river basins), etc. (9). A new statistical account form with stricter and more precise instructions was approved in 1991 and is still in use (28).

**History of Wastewater Treatment**

From 1960, the Board on the Use and Protection of Water Resources was in charge of the construction of wastewater-treatment plants. It issued over 50 decrees for the construction, renovation and enhancement of exploitation facilities in the LSSR. This agency was a part of the Ministry of Water Usage and Land Reclamation, and when it was abolished in 1988, water protection was overseen by the State Committee of Nature Protection and later by the Environmental Protection Ministry. Currently, construction of wastewater-treatment plants is part of the activities of local municipalities. Statistical data on wastewater discharges are collected by the Water Department which is part of the Division of Environmental Quality in the Ministry of Environment (11).

The first wastewater-treatment plants were small, having been constructed to serve rural areas, and small towns, or industrial enterprises. Only later were larger facilities built in the cities in the form of activated sludge plants (7). An overview of the location and numbers of plants built up to 1970 and up to 1990 is given in Figures 1 and 2, respectively. The first wastewater-treatment facilities were biofilters that were built starting in 1950 and mostly in 1960–1970 (total number 36). They had a capacity of up to 500 m³ day⁻¹ and were recommended for industrial and domestic/municipal sewage treatment (23, 29). A total of 97 small filtration fields (mostly underground, with a capacity of 15 m³ day⁻¹) in combination with septic tank facilities used for settling were built primarily in the 1970s and the 1980s for municipalities in order to provide final treatment (30, 31). Altogether 162 oxidation ditches were built up to 1990 (mostly in 1975–1980) (14). With mechanical (surface) and diffused aeration and having a capacity up to 1000 m³ day⁻¹, they provided comprehensive biological treatment of wastewater (29, 32, 33).

Activated sludge plants were the most commonly used biological purification method in Lithuania (396 plants until 1990). Starting in the 1970s, more activated sludge plants were built than plants of other types in Lithuania and the USSR because of relatively cheap electricity, relatively simple construction, better ability to accept shock loads, better removal of helminths and viruses and popularity of these technologies in Western Europe (29, 34–36). Only 4 high capacity plants (over 1000 m³ day⁻¹) were built in 1950–1970 and the construction of larger plants (over 10 000 m³ day⁻¹) started after 1975 (29, 32, 43). The recommendations concerning the technologies of biological WWTPs in the Soviet Union, chronology of the literature on technical standards, comparison

![Figure 1. Wastewater-treatment plants and water quality of major rivers in Lithuania in 1970.](http://www.ambio.kva.se)
of technological innovations and chronology of introduction of new Western technologies in the USSR and in Lithuania up to 1990 have been described in an earlier publication (18).

According to the national report issued in 1992 there were 819 operating wastewater-treatment plants (928 constructed in total) (29, 32, 37). Most of the treatment plants (712) were biological. In addition to municipal plants, industrial enterprises have also had wastewater-treatment facilities. With the collapse of the USSR and of the Soviet economy, some of the low capacity wastewater-treatment plants were abandoned and destroyed after 1990, along with other buildings belonging to those enterprises and farms. The government (and the Environmental Protection Ministry) decided to finish the building of large-capacity treatment plants for municipal and industrial wastewater-treatment in cities, towns, and large regional centres.

In the 1990s, the construction of new wastewater-treatment plants was delayed by the first economic recession in independent Lithuania. State budget allocations for building WWTPs increased from 13 million Lithuanian Litas (nearly USD 3 million) in 1992, to 150 (nearly USD 40 million) in 1994, but were cut to Litas 90 million (USD 22.5 million) in 1996 (4). In 1996–1997, Denmark, Sweden, Finland, and the Poland and Hungary: Action for the Restructuring of the Economy (PHARE), Nordic Environmental Financing Company (NEFCO), European Bank for Reconstruction and Development (EBRD), and the World Bank invested over USD 92 million (30 million as subsidies and 62 million as credits) for constructing new wastewater-treatment plants. By 1996, more modern biological treatment plants were put into operation in the towns of Lazdijai, Moletai, Pakruojis, and Silale, and in 1998 in Ukmerge and Sirvintos. Each of these towns has about 50 000 inhabitants (4). For example, when chemical removal of phosphorus was introduced in the Moletai plant, phosphorus loadings into the Siesartis River diminished by 4 times the previous levels (14). In 1999, a technically advanced municipal treatment plant, including nitrogen and phosphorus removal, was completed in Utena; the Klaipeda plant was

Figure 2. Wastewater-treatment plants and water quality of major rivers in Lithuania in 1990. Abbreviation and symbols for the map the same as in Figure 1 on page 299.
already operational at the beginning of the year, and the first mechanical treatment line began to function in the Kaunas municipal plant (4, 7, 17).

**CHANGES IN THE STATE OF THE RIVERS**


Lithuania has 758 rivers which are longer than 10 km, and 18 longer than 100 km. In 1992, wastewater discharges accounted for 14% of the average annual water flow of all rivers (38). Hydrological studies of the Nemunas started 180 years ago at Rusnė and Smalininkai. After World War II the quality of the rivers in Lithuania was directly influenced by industrial development and population growth. The greatest amount of pollutants was discharged from the cities of Kaunas, Vilnius, Klaipeda, Siauliai, Panevezys, and Alytus (13, 39, 43). In 1965, the Kulpe, Sesupe and Venta were mentioned as the most polluted rivers in Lithuania (8). In 1990, the largest amounts of organic pollutants were discharged into the Neris river basin, i.e. even larger than those discharged directly into Nemunas (13). The following data on the organic and nutrient pollution discharged into Lithuanian rivers in 1992–1998 indicate pollution trends over a longer period (Table 1). The trend towards a decrease in polluting substances (suspended solids, BOD, petroleum products) can be also explained by a general slowdown in the Lithuanian economy.

In 1968–1990, the Hydrochemical Laboratory and the information division of the Department of Environmental Protection (later Environmental Protection Ministry) were responsible for preparing maps on the state of river-water quality. The maps presented average annual flows, and classified water quality according to sampling data for BOD, total nitrogen, and total phosphorus (13, 20, 21). Those maps were manuscripts for internal official use only. The reconstructed maps are presented here in Figures 1 and 2, where water quality is classified according to BOD values. In 1970 (Fig. 1), the heavily polluted rivers included: the Nevezis downstream from Panevezys, the Dane near Klaipeda, the Daugyvone downstream from Sedauna, the Musa, the Kulpe, the Salituona and the Salcia. The Kulpe River was classified as extremely polluted because of its low natural flow rate and the heavy discharges from the city of Siauliai. The other polluted northern small rivers, the Obele, the Tautula and the Sidobra, were heavily polluted. The largest rivers, the Nemunas downstream from Kaunas city, the Neris 100 km downstream from Vilnius city, were classified as moderately and slightly polluted in 1970 (40).

Water quality improved notably from 1970 to 1990 in the following rivers: the Nevezis, the Dane, the Daugyvone, the Salituona, and the Sesupe (Fig. 2). The water in the Nemunas and the Neris was classified as moderately polluted. Previously relatively clean rivers, such as the Zeimena, and part of the Sventoji, became more polluted due to the development of rural areas regardless of a large number of small capacity treatment plants built in these regions. The pollution of the Neris and the Nemunas rivers was related to the growth of Vilnius and Kaunas.

However, airborne transport, (bio)degradation of older persistent organic pollutants, and possible infiltration in some places from improper storage of banned and collected pesticides (983 tonnes were registered in 1994) create a risk. In 1998, river water and sediment analyses revealed new polluted areas: i) in the Merkys river downstream from Puvociat village (0.002 mg γ-HCH kg⁻¹ in sediment and 0.01 mg kg⁻¹ DDE, 1.31 mg L⁻¹ of 3,4-dichlorobenzoic acid in water); ii) in the Neris at Buvydzial (0.002 mg γ-HCH kg⁻¹ in sediment and 0.01 mg kg⁻¹ DDE, 0.03 mg L⁻¹ of 3,4-dichlorobenzoic acid in water), and downstream from Klaipeda.
from Vilnius (0.552 mg L⁻¹ 3,4-dichlorobenzoic acid in water); iii) in the Nevezis downstream from Kedainiai (0.01 mg kg⁻¹ DDE in sediment, 1.180 mg L⁻¹ 3,4-dichlorobenzoic acid in water); iv) in the Sesupe downstream from Marijampole (0.37 mg L⁻¹ 3,4-dichlorobenzoic acid in water); and v) in the Jura downstream from Taurage (0.39 mg L⁻¹ 3,4-dichlorobenzoic acid in water) (14).

Nevertheless, wastewater discharges as well as pollution of rivers started to decrease in general in the 1990s due to declining industrial activity, higher prices for water and lower water consumption.

Between 1990 and 1998, discharges in Lithuania were reduced by more than 50%. During the same period, the amount of qualitatively treated wastewater (WW treatment up to MPPS) increased by 54% (Table 2). These promising facts can be explained by: i) the increased effectiveness of wastewater treatment after putting into operation new large capacity WWTPs; and ii) the sharp economic downturn in 1991. Now, compared to those of other countries in Europe, the majority of surface waters in Lithuania should be regarded as clean or just moderately polluted.

**Vilnius: A Case Study**

Vilnius has been the capital of Lithuania since World War II. The increase in the number of inhabitants in Vilnius city (from 120 000 in 1945 to 550 000 in 1986) caused a pollution load increase from 7 up to 12 times, depending on the calculation methods used. The Neris River within the city was most polluted in the mid-1950s, when as many as 15 outlets emptied into it from the municipal sewerage system. In 1979, all sewage was discharged to the Neris River through an outlet located 17 km downstream from the center of the city (i.e. Green Bridge). The industrial wastewater load into the Neris increased by about 40 times. The main polluting substances were nutrients, detergents,
oil products, and heavy metals. The amounts of pollutants discharged into the Neris in 1975–1982 and from WWTP after mechanical treatment from 1988–1992 are presented in Table 3 and Table 4. The individual measurements were made during working hours, i.e. times of most intensive discharge. This fact leads us to believe that the statistics on discharges are overestimated. In Vilnius, 33 different factories had their own treatment plants in 1990, of which 7 discharged their wastewater directly into the Vilnia River (29).

A mechanical municipal wastewater-treatment plant started to operate in 1986 (capacity 600 000 m³ day⁻¹), and an activated sludge process was not adopted until 1996 (capacity 420 000 m³ day⁻¹) (28). From the mid-1980s until the end of the 1990s, the amount of organic substances from households decreased by about 3 times because of mechanical and biological treatment. After 1996, the organic loading into the Neris decreased to minimal amounts. The stormwater system has discharge outlets into the Neris, Vilnia, Voke, Cedronas, Sudervė, the Rudamina, and to the ponds of Naujoji Vilnia, and Baltupiai as well. Only 7% of storm sewage is currently being treated (9).

The Nemunas and Load to the Baltic Sea

The drainage area of the Nemunas is over 70% of Lithuania’s territory, as illustrated in Figure 3. It is one of the most affected rivers, receiving more than two thirds of the total municipal discharges (5). Declining industrial production after 1991 and new wastewater-treatment facilities have decreased point-source pollution, but due to the lack of advanced tertiary treatment the nutrient loading is still pronounced (14, 40). Nonpoint source pollution has not yet been successfully estimated. Nevertheless, the data on livestock and use of fertilizers allow the assumption that nonpoint source pollution has decreased after 1990 (14, 40).

There are 9 monitoring stations along 475 km of the Nemunas River in Lithuania (Fig. 3). In 1992–1998, the BOD₅ values exceeded the MAC limits by up to 4 times; and in 1999 concentrations of phosphates higher than MAC were determined in stations along the river (Fig. 4) (14).

At present, persistent organic pollutants (POPs) do not constitute a major problem in the Nemunas. The concentrations of phenols in the river water were close to detection limits. No DDT, DDE and α-, β- and γ-hexachlorocyclohexane, HCH, were detected in 1998 (in 1997 γ-HCH was found in the Nemunas upstream from Kaunas – 0.027 mg L⁻¹). In October of 1998, downstream from the cities of Kaunas and Smaliniški 3,4-dichlorobenzoic acid (0.024–0.684 mg L⁻¹), and pentachlorophenol (0.002 mg L⁻¹) was detected upstream from Rusne. Heavy metal concentrations did not exceed the limits in 1997–1998 except for zinc, chromium (in water) and manganese (in water and sediment) (14). Hygienic quality, however, is often poor in summer downstream from Kaunas. For example, in July 1998 E. coli index was 2 000 000 L⁻¹, whereas upstream from Kaunas it was less than 10 000 L⁻¹ (14).

The Nemunas River flows into the Baltic Sea via the Curonian Lagoon and the Klaipeda Straits. The area of the lagoon is 1584 km² and it is separated from the sea by a narrow, sandy spit. The total inflow is approximately 22 km³, most coming from the Nemunas, with the inflow from the Prieglius, the Dane, and the Smeltale being insignificant (39). The southern part of Curonian Lagoon belongs to Russia (Kaliningrad). In 1993, it was estimated that the municipal and industrial wastewater discharges of half of the total loadings entering the lagoon via the Nemunas were coming from the Russian towns of Sovetsk and Neman (where paper mills are located) (13). These discharges account for up to 50% of the total load of organic substances and 40% of inorganic nitrogen loading discharged in Lithuania (38, 39).

After 1990, the nutrient loadings decreased; in 1992 the total nitrogen load carried by rivers was almost 26 000 tonnes along with 1500 tonnes of phosphorus (39). Since 1994, the discharges entering the lagoon from the Nemunas have been calculated according to the HELCOM recommendations (Table 5). Midsummer eutrophication is a severe problem in the lagoon. At the mouth of the Nemunas large fish kills were recorded in 1979, 1980, and 1993, and excess bacteriological pollution is registered there every year (39). Phytoplankton studies in 1994–1995 showed blue-green algae (cyanobacteria) blooms, which commonly continued in the lagoon from the end of June until November. In 1998 Aphaniotenen flos-aquae, Planktothrix agardhii, Limnothrix redekei and Pseudanabaena limnetica blue-green algae species as well as bacteriological pollution and high chlorophyll a concentrations were found in the impact zone of the Curonian Lagoon in the Baltic Sea area north of Klaipeda (41). The biomass of blue-green algae did not exceed 10 mg L⁻¹ (25 times less than the toxicity threshold) (41, 42). Based on the abundance of phytoplankton species (over 200 in total), the coastal waters of the Baltic Sea in 1998 were characterized as mesoeutrophic – eutrophic (41).

CONCLUSIONS

Between 1950 and 1990, the protection of Lithuanian surface waters was under Soviet water management. Three institutions worked to this end: the Hydrometeorological Service monitored surface-water quality, the Board on Use and Protection of Water Resources and Republican Inspection of Water Economy inspected wastewater discharges and assessed fines, and the Board on Use and Protection of Water Resources managed the building and renovations of wastewater-treatment plants.
Figure 4. River Nemunas water-quality data (1992–1999) (4, 13, 14) (Sites 1–9, see Fig. 3).

* - Data for years 1985, 1990 and 1999 presented by Joint Research Centre of Environmental Ministry.

** The numbers 1 to 9 on X-axis mean the sampling sites on the Nemunas River the same as described and marked in Figure 3.

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Surface- and wastewater-monitoring data were accessible only to a limited number of specialists. Surface-water quality monitoring started in the 1950s, and was improved in the 1960s. Monitoring of wastewater discharges by the polluting enterprises began in 1962 under the auspices of the Hydrochemical Laboratory of the LSSR. The current water-management system in Lithuania has inherited both the problems and resources of the planned economy. After 1990, the water-management strategy was redirected to solve long-existing problems, and the water management and monitoring system were revised. General environmental policies and projects are now being coordinated according to European Union legislation.

Wastewater treatment has had a notable effect on the ecological state of most rivers after 1970, when large-capacity plants started to be built. In 1990, the water quality remained poor in 4 small rivers in the northern Lithuania only. The Nemunas and the Neris were classified as moderately polluted. In the 1990s, state and foreign investments were directed towards the construction and renovation of municipal high-capacity wastewater-treatment plants. The trend towards a decrease in polluting substances can also be explained by a general slowdown in the Lithuanian economy in the 1990s.

Recent data on the Baltic Sea coastal waters of Lithuania north of Klaipeda indicate bacteriological pollution and eutrophication characterized by moderate chlorophyll a concentrations, and blue-green algae blooms. These are consequences of pollutants from the Nemunas, the Curonian Lagoon, and Klaipeda harbor. Half of the total load originates from the Russian towns of Sovetsk and Neman.

Lithuania, is the only former republic of the USSR whose history of water pollution and protection has been studied so far. Additional comparative studies are needed to examine whether the case study of Lithuania is an indicator of broader trends, or has always been to some extent exceptional.

References and Notes


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