Chief Inspectorate for Environmental Protection

REPORT ON

THE STATE OF THE ENVIRONMENT IN POLAND 2008

Environmental Monitoring Library
Warsaw 2010

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The Report

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TABLE OF CONTENTS

I. Introduction

This Report presents the analysis of the environmental state in Poland until 2008. It constitutes a continuation of the report entitled „The state of environment in Poland vs. European Union objectives and priorities. Indicator report 2004" worked out in the Chief Inspectorate for Environmental Protection and issued in 2006. The previous report was in a way a photograph of the environmental state in the country taken at an important social and economic moment, i.e. Poland's joining the European Union in 2004. Poland's entry in the EU structures could have a bipolar impact on the state of the environment. On the one hand one could expect the improvement of the environmental condition as a result of a strong injection of community funds to support environmentally-sound investments, while on the other hand an increased economic growth could have become a source of increased pressure on the environment. The collected data and information allow to already assess some of the effects of our presence in the EU, in particular ones related to driving forces. The inflow of the EU funds, in conjunction with the economic situation on the global markets till mid-2008, have significantly boosted the Polish economy, which is proven by the macroeconomic indicators. However, this growth did not increase the pressure (emissions to water, air and waste generation), which may prove the effectiveness of activities aimed at ensuring protection and improving the state of the environment. Less pressure did not mean an instantaneous improvement of the environmental state, which should be expected in the long-run.

However, one has to bear in mind that 2008 which closes the time frame of analyses covered in the report, was a year of breakdown of the global economy. The economic slowdown has also had its impact on Poland, although it was much less severe than in the other EU states. Such situation can be treated as a potential risk, as it may result in limited resources for environmental protection. But above all it should be treated as a challenge for the environmental policy and sectoral policies, as well as a unique opportunity to intensify activities aimed at greening the economy including effectiveness improvement in terms of the use of resources.

Due to the time frame the Report's layout refers to the tasks of two consecutive environmental policies i.e.: „The National Environmental Policy for 2003-2006 and Its 2010 Outlook" and „The National Environmental Policy for 2009-2012 and Its 2016 Outlook". At the same time the Report takes account of the priorities of the 6th Environment Action Programme of the European Community. Objectives quoted in each chapter of the Report stem from the aforementioned documents, as well as from thematic strategies or specific EU directives. The objectives were used as a leitmotif for the analysis of individual issues.

Indicator-related nature of this Report is determined by the capacity of information and transparency in presenting the environmental state. Analysis of individual issues was presented as state-pressure-response, and the indicators were selected correspondingly. This allows to present cause and effect relationships between human impact on the environment and the quality of individual environmental components, as well as preventive or remedying activities aimed at improving the existing situation. The choice of indicators was determined by both the current strategic objectives, as well as credibility, availability, unequivocal character and transparent nature of data.

The starting point for analysis of individual issues was the information about the state of individual environmental elements or environmental impacts, obtained under the state environmental monitoring (SEM) by the authorities of the Inspection for Environmental Protection. They are characterized by their credible, reliable and measurable nature. One has to bear in mind that the Report was drawn up in the situation when individual subsystems of the state environmental monitoring have been functioning pursuant to the requirements of the Community law transposed in the national legal order, which was often preceded by a deep modification of the monitoring programmes. Modification, in particular extension of SEM tasks, is still going on, along with the constantly changing Community law. This is visible in particular in the monitoring of waters, which was changed by Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive - WFD). The new requirements resulted in the necessity to revise the network of monitoring points, and to adjust their location to the arrangement of sub-basins and water bodies, as well as to modify the measurement programmes. New biological parameters became more important, as they became a basis for the assessment of the status of surface waters. This significant modification of the system made it much more difficult to compare multi-annual trends concerning the quality of waters. That is why the Report focuses on presenting the assessment of the status of individual water categories in the years 2007-2008, carried out in line with the WFD requirements. Equally important changes were implemented in the air quality assessment system. In 2007 the scope of assessment was extended with new substances: benzo(a)pyrene and heavy metals (arsenic, nickel, cadmium) in PM10. A new breakdown of the country into zones where air quality is assessed was introduced in 2008.

The Report also contains the results of two nature monitoring programmes launched in 2006: birds monitoring, including the monitoring of Natura 2000 special protection areas and species and habitats monitoring with a focus on the Natura 2000 Special Areas of Conservation, which take account of the requirements of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (Birds Directive). Moreover, the part concerning the impact of noise uses the reqults of noise maps drawn up across Europe under the first stage of implementation of Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise (Noise Directive).

The Report uses both data from the public statistics, as well as from administrative systems for the needs of characteristics of pressure and response. Wherever possible, the environmental problems were presented using international comparisons, based on data and indicators used by international institutions, such as: European Environment Agency (EEA), Eurostat and Organization for Economic Cooperation and Development (OECD). It needs pointing out, that the data collected and processed by those institutions stem from reporting also carried out by the Chief Inspector for Environmental Protection relating the the state and use of the environment.

In parallel to the work on this Report, the Chief Inspector for Environmental Protection in cooperation with national experts from the European Environment Information and Observation Network (EIONET) participated in the work on the report of the European Environment Agency on the European Environment State and Outlook Report (SOER 2010). This Report is aligned with the method of analysis of environmental problems applied by EEA. Integrated nature of both reports will be more visible after their internet versions have been completed.

II. Social and economic situation

II. Social and economic situation

Poland is located in Central and Eastern Europe in the area of the European Lowland, between the Baltic Sea and the Carpatian Mountains. It is predominantly a lowland country with average altitude 173 m a.s.l. and lowland areas (0-300 m a.s.l.) account for 90% of the country. Poland lies in the temperate transitory climate zone, between maritime and continental climate. Transitory nature of the climate results in high biodiversity of Poland, as the ranges of many plant and animal species overlap in the country. Geological structure is also strongly characterized by its transitory nature, which results in large diversity of structures and mineral resources.

Area of the country, which is 312 679 km^2, accounts for 7.4% of the European Union area and makes Poland fifth largest member state. The country is inhabited by 38 135 876 persons (as at 31.12.2008), i.e. 7.7% of the total EU population. In the years 1998 - 2007 the size of population had a falling tendency. Population shrunk by ca 1% in that period. 2008 is the first year when the population size was bigger year on year. After a period of permanent fall in birth-rate, which culminated in 2003 (-0.4/1000 persons) the value of the indicator has systematically grew to reach positive values from 2006 onwards. However, this indicator still remains low (Fig. 2.1.).

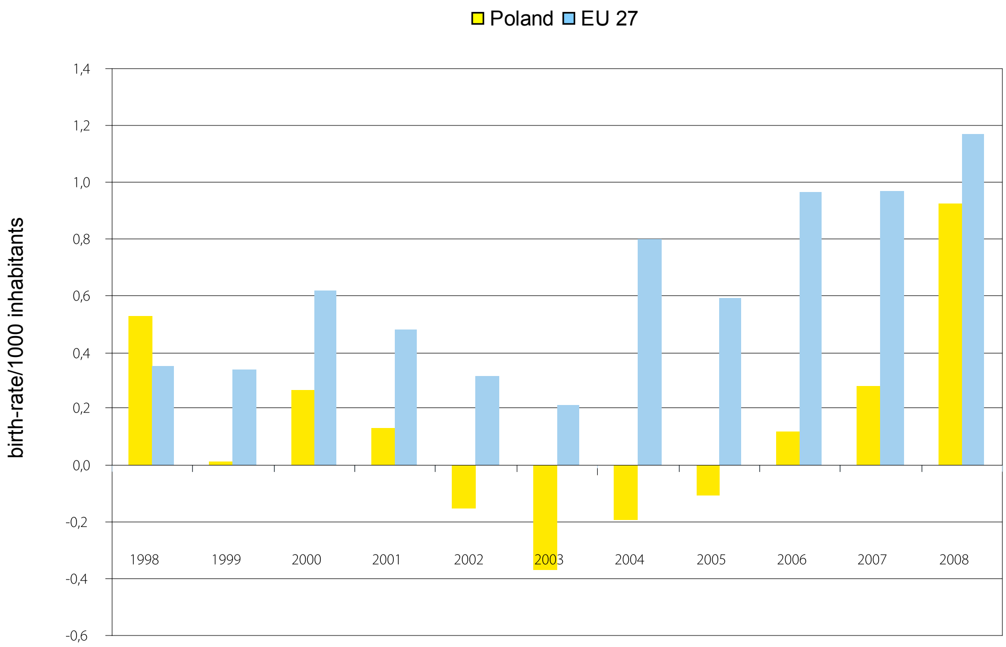

Fig. 2.1. Birth-rate in Poland and European Union in the years 1998-2008 (source: Eurostat)

At the same time the age structure of the population undergoes some disadvantageous changes (Fig. 2.2.). In the years 1998-2008 population in pre-working age (below 15 years of age) reduced by more than 24%, with a simultaneous 12% increase in population in post-working age (men above 65 years of age, women above 60 years of age). This phenomenon is both related to postponed decisions to set up a family and having less children in the family (which results from economic factors and a changed life-style), as well as to the increased average life expectancy as a result of the improved living conditions related to economic transformation which took place over the last 20 years. Increased outbound migration which intensified after Poland's entry to the EU is not insignificant. In spite of the fact that the total fertility rate has been growing (in 2008 it was 1.39), it does not ensure the replacement of generations.

Population density in Poland is 122 persons/km². 61.1% of the total population lives in urban areas, and 38.9% lives in the rural areas. In the years 1998-2008 the percentage of people living in the rural areas increased by 1.7%. In certain respects this may be a testimony of the growing suburbanization process which has been visible around major urban centres.

Poland's macroeconomic situation has been systematically improving. A process of strong economic growth started in 2004, along with joining the EU, which covered all the main sectors (i.e. services, industry and construction). Increased economic activity was continued over the next years and reached its top in 2007 when annual GDP growth was 6.8%. The growing tendency of the previous years slowed down a little in 2008 as a result of the global economic crisis (Fig. 2.3.). GDP growth in 2008 was one of the largest in the EU.

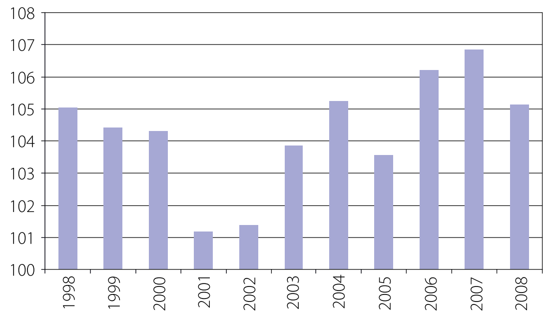

Fig. 2.3. Gross Domestic Product growth in the years 1998-2008 (previous year = 100) (source: CSO)

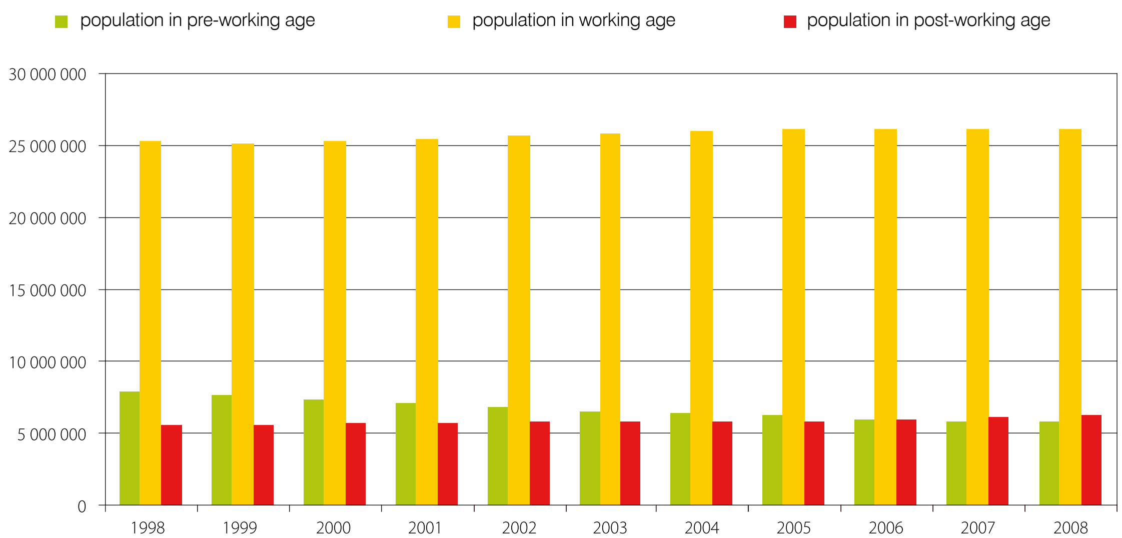

Fig. 2.2. Poland's population in pre-working age, working age and post-working age in the years 1998-2008 (source: CSO)

In spite of the dynamic improvement of the economic situation in the analysed period, GDP per capita calculated according to the purchasing power parity (PPP) still remains much lower than the average for 27 Member States (Fig. 2.4.). This difference has been decreasing slowly, but systematically from the beginning of this century. In 2000 the value of GDP per capita according to PPP accounted for 48% of the EU average, and 56% in 2008.

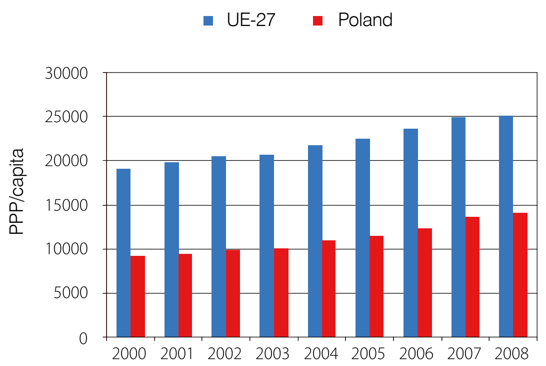

Fig. 2.4. Gross Domestic Product per capita according to Purchasing Power Parity (PPP) in Poland and in the EU Member States (source: Eurostat)

Improved economic situation has had a significant impact on the increase in the number of jobs, which resulted in a major fall of the unemployment rate observed from 2003. In 2008 the unemployment rate was 7.1% (according to Labour Force Survey of population aged 15 and more) (Fig. 2.5.)

Fig. 2.5. Unemployment rate in Poland in the years 1998-2008, according to Labour Force Survey of population aged 15 and more (source: CSO)

Both the social and economic factors influence the structure of households and the level of consumption. The average number of persons per household has been decreasing progressively. In 1999 there were on average 3.17 persons per one household, while in 2008 - 2.94. Private consumption has been growing along with the growth of GDP. In the period 1998-2008 GDP calculated at constant prices from 1998 grew by ca 50%, and private consumption by almost 60% (Fig. 2.6.)

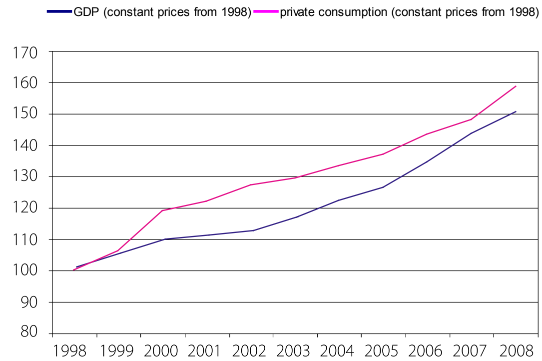

Fig. 2.6. Dynamics of GDP changes and private consumption changes expressed at constant prices from 1998 (1998=100) (source: CSO)

Positive economic trends observed in the years 1998-2008 have resulted in the improved quality of life. In the years 1990-2007 Human Development Index (HDI)[1] grew at a rate of 0.52% per year, to reach 0.880% in 2007, which ranked Poland 41st in the global ranking of human development and put it among the top high human developed countries, before Slovakia and Hungary.

Economic growth, combined with demographic processes, can be an engine of pressure on all environmental components. Unsustainable development of the country, without respect of the environment, may result in overexploatation of resources and increased emission of substances and energy to the environment.

[1] Human Development Index – composite statistic used as an index presenting results in three dimensions of human development; used by UNDP.

III. Use of materials, energy and water

III. Use of materials, energy and water

Environmental resources form the basis for the functioning of man - they are a raw material for the economy and have impact on the quality of life. The extraction and processing resources, using the products, as well as waste recovery or disposal may cause a multi-dimensional pressure on all environmental components. Therefore it is important to manage the resources in sustainable way to make sure that the management process across the whole product life-cycle is least damaging to the environment and gives access to them to the future generations. Sustainable use of resources is a key element of welfare in the long-term dimension.

Extraction of biomass in Poland, which is a part of domestic extraction (DE), in 2000 was ca 180 million tonnes, and in 2007 - ca 171 million tonnes. Dominant category in biomass extraction involved primary crops, whose share in the total biomass ranged from 49.5% in 2000 to 35.7% in 2007. The share of wood increased from 9.7% in 200 to 13.4% in 2007, and the share of fodder crops increased from 14.5% to 22.7% respectively (Fig. 3.1.)

Priority objective in the area of sustainable use of resources is „to reduce the negative environmental impact generated by the use of natural resources in a growing economy - a concept referred to as decoupling. In practical terms, this means reducing the environmental impact of resource use while at the same time improving resource productivity overall across economy"

in: „Thematic strategy on sustainable use of natural resources"

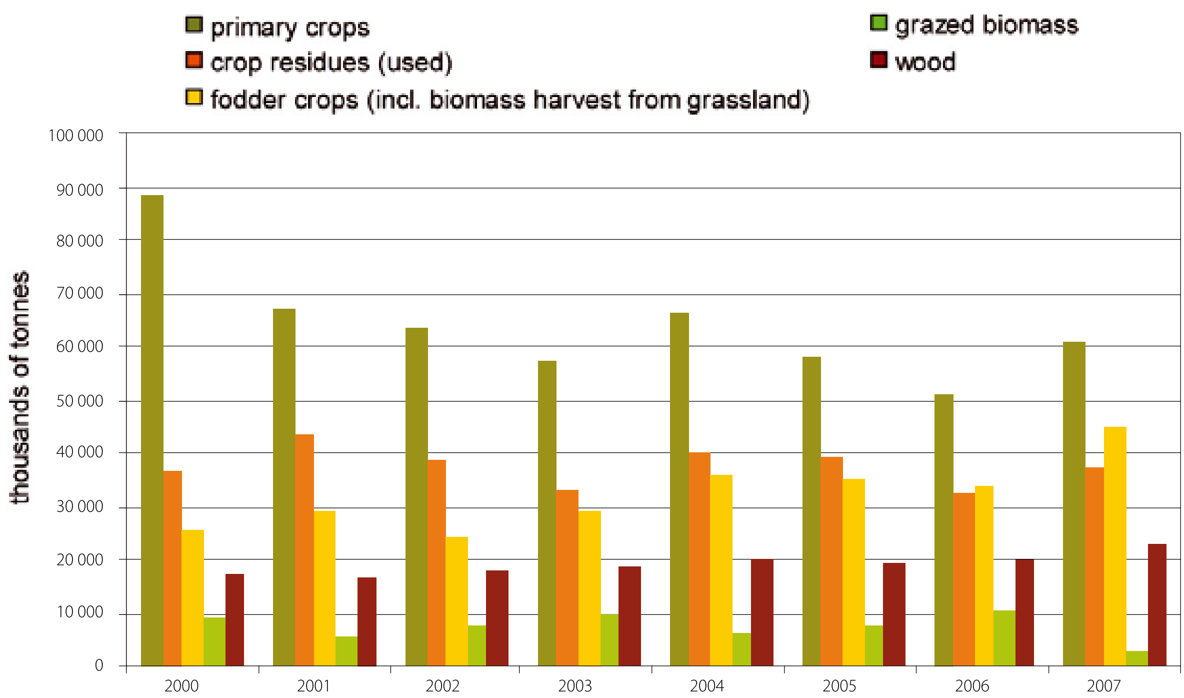

Fig. 3.1. Domestic biomass extraction in the years 2000-2007 (source: CSO)

In 2007 domestic extraction of minerals, which is the remaining part of domestic extraction apart from biomass, was about 440 million tonnes. Non metallic minerals had the largest share in extraction (60.3% in 2007). Extraction of sand and gravel was dominant in this category. Fossil energy carriers accounted for 33.4% of the domestic minerals extraction, with a dominant share of hard coal (Fig. 3.2.).

Domestic Material Consumption[2], after a period of fall in the years 2000-2002, was characterized by a growing tendency from 2003 and reached 651 million tonnes in 2007. This value was 68 million tonnes higher than the one from 2000. In 2005 Poland was one of five top EU Member States with the highest DMC (Fig. 3.3.).

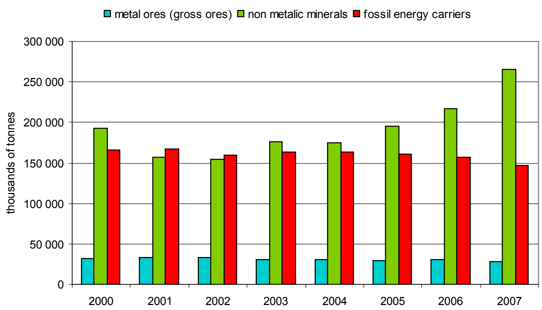

Fig. 3.2. Domestic extraction of minerals in the years 2000-2007 (source: CSO)

Material consumption in the economy is measured via material productivity ratio calculated as a relationship between GDP and the domestic material consumption, i.e. the higher the value of this indicator, the less materials are used to generate a GDP unit. According to Eurostat data material productivity ratio for Poland grew from 0.36 to 0.4 in the years 2000-2005, while its average value for all EU Member States grew from 1.23 to 1.3 over the same period.

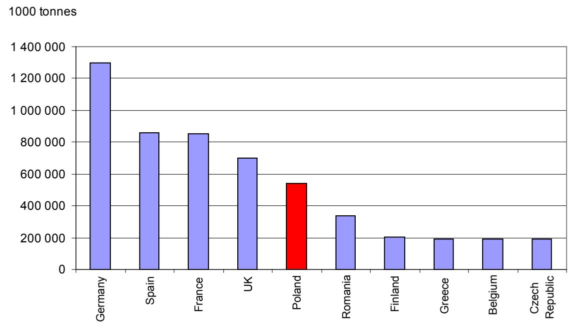

Fig. 3.3. Domestic material consumption in selected EU countries in 2005 (source: Eurostat)

Value of the ratio in Poland, just like in other new Member States, is significantly lower than the EU-average, which proves that the economy is highly material-consuming. This indicator will be growing together with the change of the economic structure, which leads to a more common use of modern technologies. However, it will be necessary to intensify the activities aimed at sustainable use of raw materials (Fig. 3.4.).

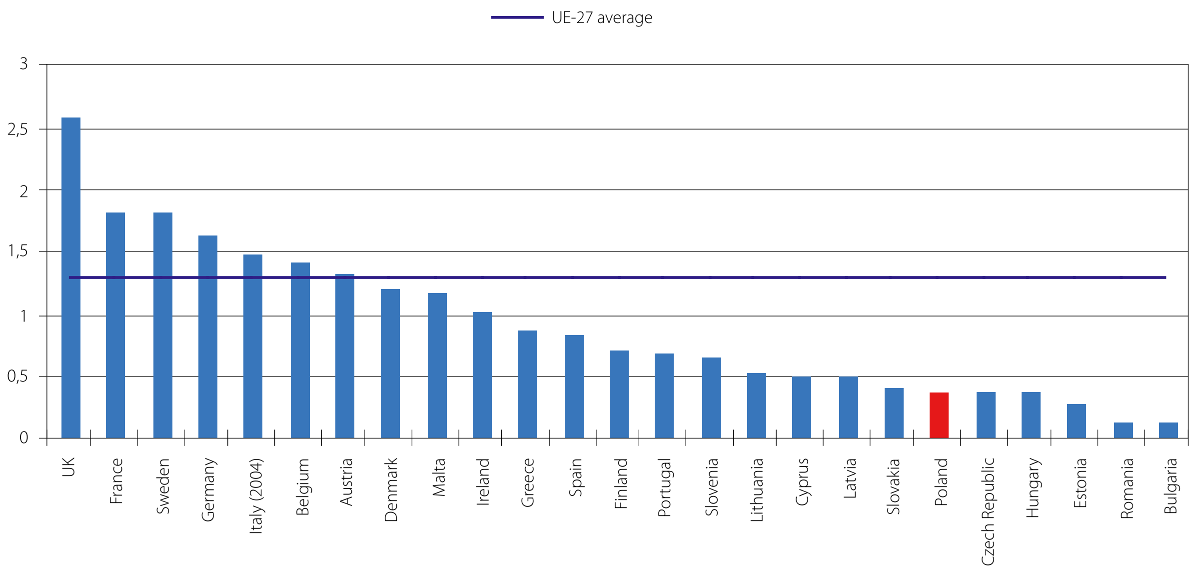

Fig. 3.4. Resource productivity ratio in the EU in 2005 (GDP/DMC) (source: Eurostat)

[2] Material used directly in economy identified as domestic extraction (DE) plus import and less export.

The main source of energy in Poland involves non-renewable resources. Dominant primary energy carriers in the Polish economy still include hard coal (46.6% of total use of energy carriers in 2008), although its share in the total use of energy carriers has been falling (a 10% decreased vis-a-vis 1998) (Fig. 3.5).

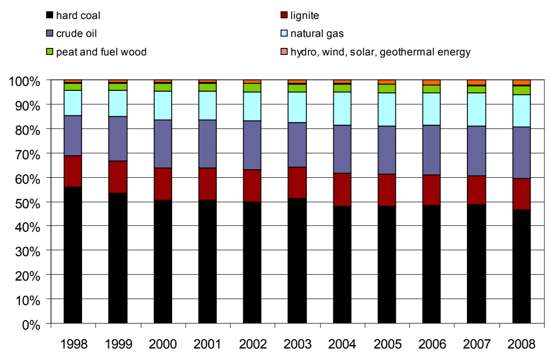

Fig. 3.5. The structure of primary energy carriers use in domestic economy in the years 1998-2008 (source: CSO)

Total energy use in the domestic economy was falling until 2002, reaching its lowest value in the analysed period, i.e. 89.18 million tonnes oil-equivalent (Mtoe). Use was growing in the following years and in 2008 it was 98.54 Mtoe. Dynamics of the growing trend in energy use in the domestic economy remained much lower than GDP dynamics (Fig. 3.6).

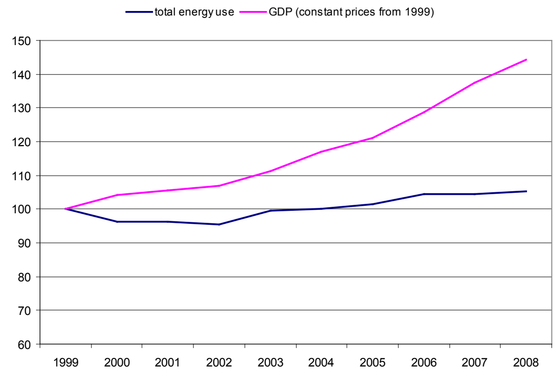

Fig. 3.6. Dynamics of energy use in the Polish domestic economy vis-a-vis GDP in the years 1999-2008 (1999=100) (source: CSO)

In spite of a whole range of activities undertaken to reduce energy-intensity of the economy, Polish economy remains one of the most energy-intensive in the European Union, with its energy-intensity ratio doubling the EU average (Fig. 3.7).

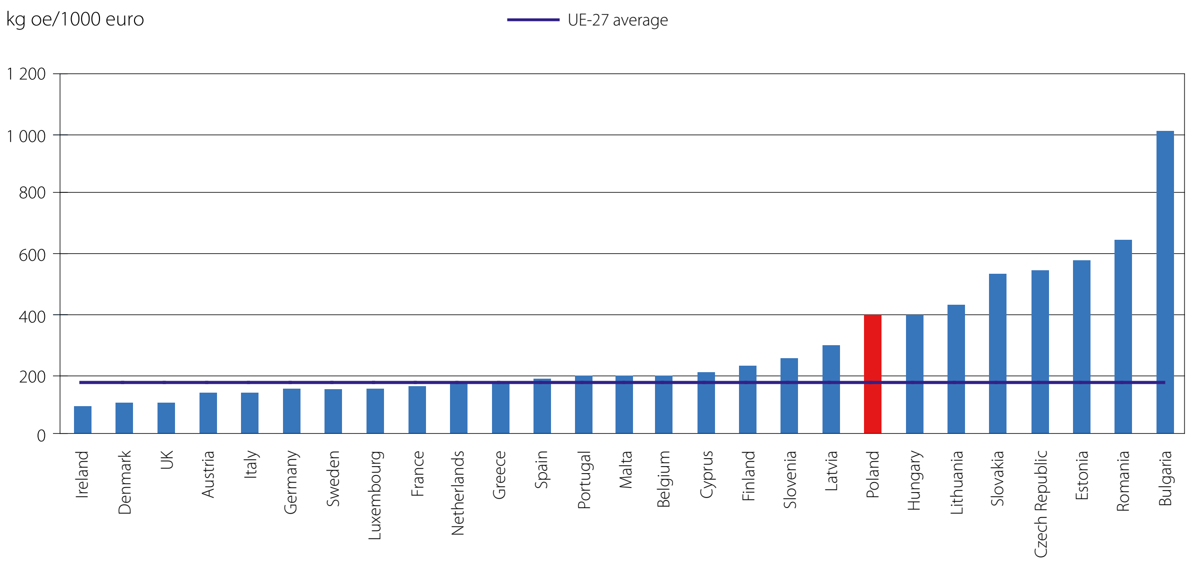

Fig. 3.7. Energy intensity of economy of EU Member States in 2007, expressed as ratio of energy use to GDP (source: Eurostat)

Poland has seen a positive trend in the growing share of energy production from renewable sources in the total energy production, as well as in the total energy consumption. In the case of production the share grew from 4.46% in 1999 to 7.24% in 2008. Biomass is the most dominant among all renewable energy sources, accounting for more than 90% of all sources.

The share of energy from renewable resources in electricity generation in Poland is still much lower than the EU average which was 15.5% in 2007 (Fig. 3.8).

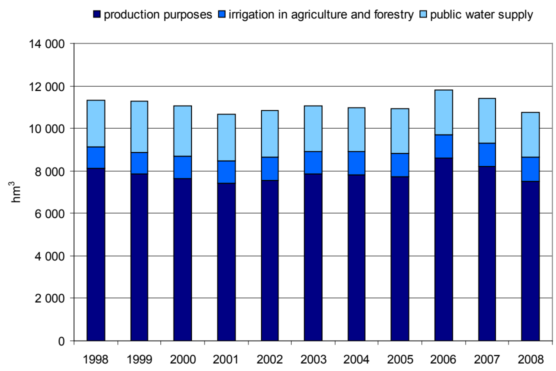

Fig. 3.9. Abstraction of water in Poland for the needs of domestic economy and population in the years 1998-2008 by purpose (source: CSO)

Poland is one of the countries in which water resources are scare. They are among the lowest in Europe per capita, which is why their rational management should remain one of the most important domestic priorities.

The basic source of water for the purposes of domestic economy and population involves surface water which account for more than 80% of the total abstraction. Groundwater, as water of a much better quality, is destined as drinking water for the population. In the years 1998-2008 abstraction of waters remained stable (Fig. 3.9.). Stabilization of water abstraction results from rationalization of water management.

Poland is a country with low water consumption in terms of the quantity of water abstraction per inhabitant (Fig. 3.10).

Cost optimization related to the functioning of businesses and organizations necessitates savings in the area of raw material and utilities use. One may therefore expect that it is mostly the economic account that will stimulate the limitation of material-, energy- and water-intensity of the economy. This process is supported by the implementation of certified environmental management systems. As at 29 January 2010 there were 19 Polish organizations and 31 objects registered in the Eco-Management and Audit Scheme (EMAS). To compare, in Germany (as at 28 October 2009) there were 1390 organizations and 1841 objects registered in EMAS.

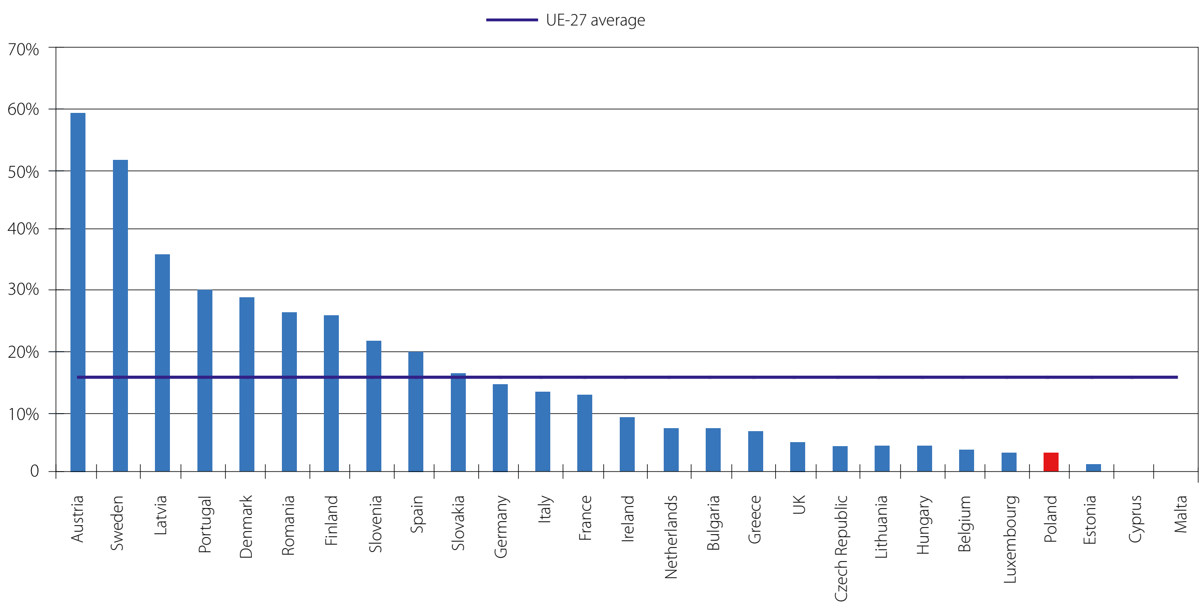

Fig 3.8. Share of energy from renewable resources in electricity generation in the EU in 2007 (source: Eurostat)

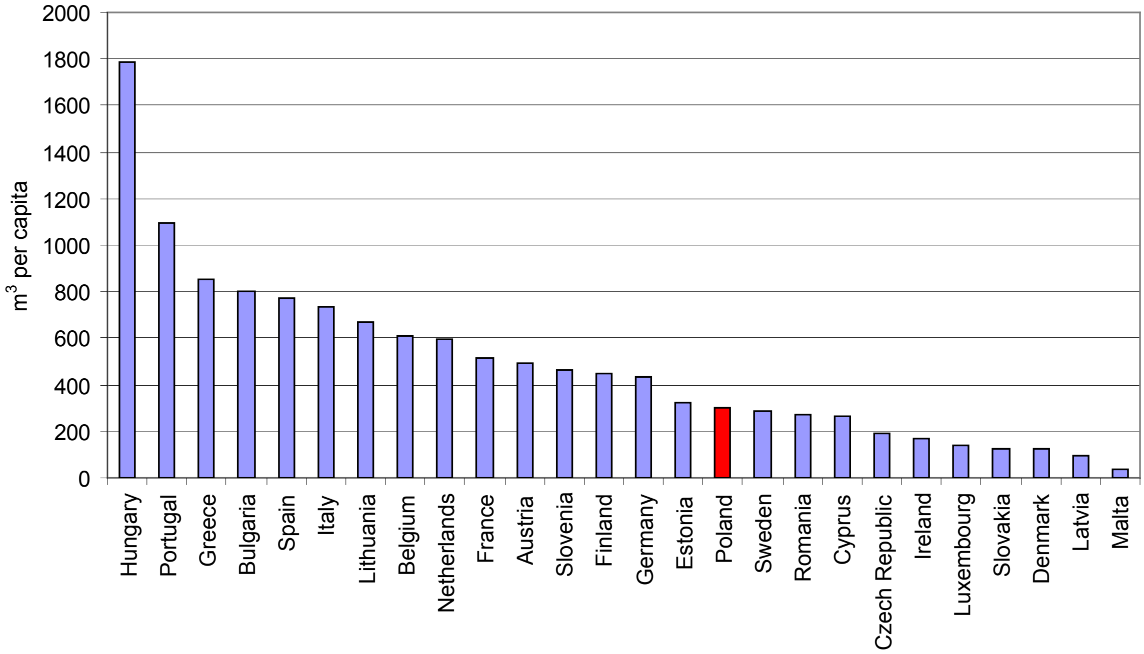

Fig. 3.10. Water abstraction per inhabitant in m³ in selected EU Member States (source: Eurostat)

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Taking care of the natural resources and their sustainable management is a condition for efficient functioning of the economy in the long-term perspective. There is a lot to be done in Poland in this regard. This concerns in particular material- and energy-intensity, which is much above the EU-average. Limited use of raw materials and energy will not only result in reduced costs of economic functioning in the future, but also in reduced pressure on all environmental components. In spite of the fact that recent years have seen a stabilization in the water abstraction, it has to be treated as one of the priorities of the environmental policy. Even more so, as it is expected that water deficit in the country will deepen in the wake of the observed climatic changes.

IV. Protection of the natural heritage

IV. Protection of the natural heritage

IV.1 Biological diversity, protection of species and areas

Nature determines the human life by supplying food, raw materials, oxygen, clean water, unpolluted soil and many other goods. It reduces the amount of carbon dioxide in natural processes, it creates living conditions for the organisms, it is an environment for a healthy life and rest for men. A superior feature of nature involves its biodiversity which ensures balance at the level of individuals, species and ecosystems. Loss of biological diversity of ecosystems poses a threat to the proper functioning of our planet, and as a consequence to the economy and humankind.

Poland has relatively a reach biological diversity. It is a result of its transitory climate, diversified relief, geological structure and soil, with no natural barriers. Biodiversity in Poland is characterized by a relatively large area of forests (9.1 million hectares), wetlands (1.8 million hectares, including 455 thousand hectares of inland waters), as well as by a relatively extensive use of agricultural areas. The nature state of ecosystems related to the latter group can be assessed using Farmland Bird Index (FBI)[3]. In 2000-2003 this index showed a 15% fall in their volume, and a slow growth from 2005 onwards to the starting level from 2000, which indicates an improvement in the natural state of agricultural areas (Fig. 4.1.1.).

A superior objective of the National strategy for biological diversity and sustainable use of biological diversity is "the maintenance of richness of biological diversity on a local, national and global scale, as well as ensuring durability and development possibilities at every level of its organization (intraspecific, interspecies and superspecies), taking account of the needs of social and economic development of Poland, as well as the necessity to ensure proper conditions of living and development of the society"

in: "The national strategy for biological biodiversity and sustainable use of biological diversity" with the "Action plan for 2007-2013".

Fig. 4.1.1. Changes of the Farmland Bird Index in 2000 - 2008 (source: CIEP/SEM)

[3] Farmland Bird Index - official index of structural changes in the environmental state of EU Member States based on the population of 23 species of birds typical for agricultural landscape habitats, as areas of their nesting or feeding.

485 plant communities[4] were identified in Poland, of which ca 12% are considered to be endemic. According to current data there are 2844 angiospermous species, 13 gymnospermous species, 13 lycophytina species, 10 equisetopsida species, 52 polypodiopsida species, 700 moss species in Poland. Estimated data mention the presence of: 250 hepatics species, ca 10 000 algae species, 1 900 lichen and lichenicolous fungi species, as well as 12 500 fungi species. It is also estimated that in Poland there are 47 000 species of wild living fauna (of which 35 500 were registered), including 98% of invertebrates, among which insects are the most populous group (as much as 75% of all animals). Vertebrates include: 18 amphibian species, 9 reptile species, 428 bird species and 105 mammal species.

Among all species present in Poland 932 animal species were in danger of extinction[5] [critically endangered (CR), endangered (EN) or vulnerable (VU)], including: 852 invertebrate species (including 394 insect species) and 80 vertebrate species (13 mammal species, 35 bird species, 3 reptile species, 29 fresh-water fish species) and 327 vascular plant species, 62 moss species, 545 lichens species, 232 macromycetes species. Compared to other countries the percentage share of all endangered mammals, birds and fish, as well as vascular plants among the species identified in Poland is relatively low (Fig. 4.1.2.).

Natural habitats and plant and animal species which are rare and endangered across Europe are subject to protection pursuant to the Habitats Directive. In Poland these are 80 types of natural habitats, 92 plant species, including 7 species which can be taken from the wild and 143 animal species (excluding birds), including 20 species which can be taken from the wild. The Habitats Directive requires that the conservation status of all these habitats and species be supervised, taking account of both their current conservation state, as well as perspectives of protection foreseeable in the future. Conservation status is evaluated on the basis of the results of monitoring and any other knowledge available on a three level scale: FV - favourable status, U1 - inadequate and U2 - bad. Assessments are carried out at the level of the so called biogeographical regions outlined in Europe. Poland is located at the area of three such regions: continental, Alpine and Baltic region.

The existing results of monitoring of species and natural habitats, taking special account of the special areas of conservation, as well as the report on the conservation status of species and natural habitats 2007 point out that the majority of habitats and species at the territory of the continental region (96.2% of Poland's area) have inadequate conservation status (U1). Alpine region (Carpathian Mountains) were identified to have a better conservation status of species and habitats, but it only accounts for 3.2% of Poland's area. The status of species was assessed higher than the status of natural habitats in both regions (Fig. 4.1.3.).

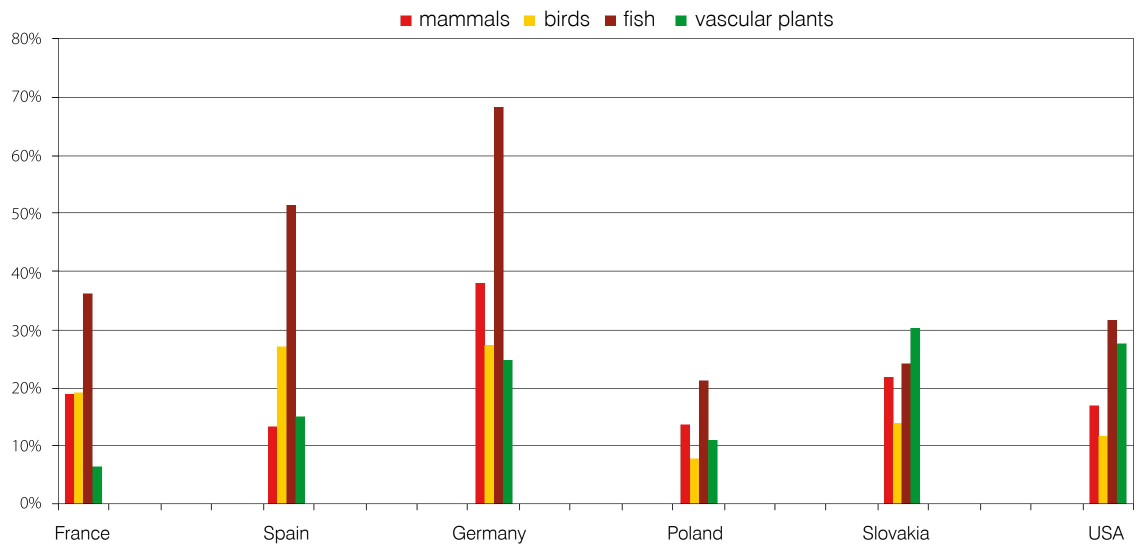

Fig. 4.1.2. Percentage share of endangered species: fish, birds and mammals, as well as vascular plants with reference to the number of species identified in selected countries (source: OECD)

4 This applies to plant communities described according to Braun Blanquet's phytosociologic principles.

5 Data provided according to the classification of the International Union for Conservation of Nature (IUCN).

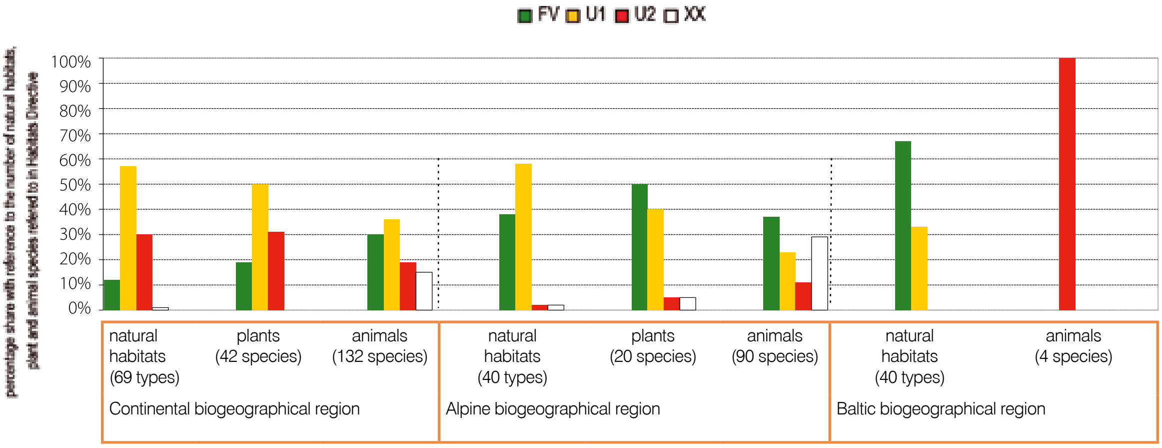

Fig. 4.1.3. Assessment of the conservation status of species and natural habitats occurring in Poland based on expert knowledge and results of the state environmental monitoring 2006-2009 (source: CIEP/SEM)

In the Polish continental region 12% of 69 types of natural habitats have a favourable conservation status. The situation is much better in the Alpine region with 38% out of 40 types being in favourable conservation status. The best preserved habitats in Poland have a mountain-like characteristics, they are relatively stable or are related to a specific substratum. The status of seminatural communities is much worse, as they are at risk of no use or intensification of use (e.g. semi-natural dry grasslands and scrubland facies on calcareous substratum and species-rich *Nardus* grasslands on silicious substrates in mountain areas [and submountain areas in Continental Europe]), as is the status of habitats which are sensitive to changes of hydrological conditions (peat land, spring areas, swamp coniferous forests or riparian forests).

One in two of 42 plant species in the Polish part of the continental region has an inadequate conservation status. These are mainly species related to wet and semi-natural habitats, as these plants are the fastest to undergo negative changes. The status of more than 30% was assessed as bad (this applies mostly to the species known only from individual sites), while 19% was assessed as favourable, e.g. *Liparis loeselii* or *Cochlearia polonica* (but mainly species with a relatively broad ecological spectrum and almost all that can be taken from the wild according to Habitats Directive). One in two of 22 plant species in the Alpine region has been conserved well (favourable conservation status).

When it comes to animals, 30% of 132 species occurring in the continental region in Poland have a favourable conservation status, 36% inadequate status and 19% bad status. Favourable conservation status in this region applies among others to 7 odonata species, 11 fish species and 16 mammal species (including otter and beaver, 9 bat species). Bad conservation status applies to: 12 species of invertebrates (including Large Blue butterflies), 5 species of fish (including sea lamprey), 1 species of reptiles (European pond terrapin) and 7 species of mammals (e.g. speckled ground squirrel and European hamster). Animal species living in the Alpine biogeographical region enjoy a better conservation status. Here, out of 90 animal species 37% have a favourable status (including 17 species of mammals and 5 species of amphibians), 23% have an inadequate status and 11% a bad status (among others Aesculapian Snake). The conservation status of four species of marine mammals in the Baltic region (among others grey seal and harbour porpoise) was assessed as bad.

A significant share of species which it was impossible to define (29% in the Alpine region, 15% in the continental region) shows that the knowledge about Polish fauna resources is insufficient, in particular when it comes to invertebrates.

A relatively high number of well conserved species and well preserved natural habitats, which were considered endangered in Europe, obliges Poland to take special responsibility for their conservation.

One of European SEBI2010 indicators assessing progress in halting the loss of biological diversity is the abundance and distribution of birds. Based on the results of bird monitoring, including monitoring of Natura 2000 special protection areas one may conclude that in 2000-2008 there was an increase in the abundance of the most popular bird species (Fig. 4.1.9.).

A representative example of changes in the natural environment involves changes in the abundance of bird species selected as flagship ones (Fig 4.1.4.), is an indicator of an extensive landscape use:

- in 2005-2008 the domestic population of White Stork (*Ciconia ciconia*) was 20% lower than in 2004 when its abundance was estimated to be 52 500 breeding pairs;
- the population of Common Crane (*Grus grus*) and Mute Swan (*Cygnus olor*) has been increasing since 2001 at an annual rate of 7-8%;
- the number of breeding Rook birds (*Corvus frugilegus*) has been decreasing since 2001 at almost 3% annually;
- the populations of Western Marsh-harrier (*Circus aeruginosus*) have not shown any clear tendencies in their abundance for the past 7 years.

Changes in the abundance of rare birds species inform the fastest about the changes of the environmental state. The results of bird monitoring point out to the following tendencies:

- population of the Baltic Dunlin (*Calidris alpina)* is at the verge of extinction within Poland's borders;
- abundance of Ferruginous Duck (*Aythya nyroca*) has been assessed to be 80-90 pairs in both observed years, which points out to a slight population recovery after a dramatic fall over the past two decades (only about 40 breeding pairs at the end of 1990's);
- Whooper Swan (*Cygnus cygnus*) has constantly increased its population in Poland - over the last two seasons its breeding population was estimated to be 40-50 and 51-57 pairs;
- Mediterranean Gull (*Larus melanocephalus*) has continued its expansion in Poland - 2007 saw the highest abundance of its breeding population - 96 pairs, and 55 pairs in 2008;
- the population of Golden Eagle (*Aquila chrysaetos*) has had a slight growing tendency since the beginning of 21st century; in 2007 and 2008 there were 27 and 28 pairs respectively; its nesting area has also been on the increase in Poland;
- Osprey (*Pandion haliaetus*) has seen a progressing fall in the abundance of its population down to 31 breeding pairs in 2008 and the its breeding area; from 2000 its domestic population has been shrinking at 3% annually.

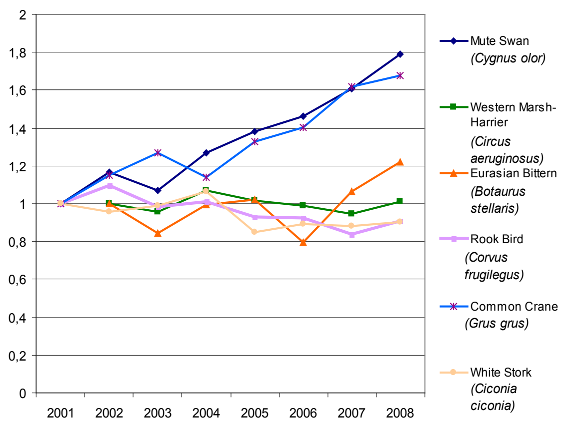

Fig. 4.1.4. Indicator of abundance of selected flagship bird species (source: CIEP/SEM)

Due to their high position in the trophic levels birds of prey form a group of birds which are very sensitive to environmental changes, thus being good indicators of the environmental state. It is estimated[6] that in 2008 there were: ca 60 110 Common Buzzard pairs (*Buteo buteo*), 10 730 Marsh Harrier pairs *(Circus aeruginosus)*, 7 580 Hawk pairs (*Accipiter gentilis), 7* 560 Common Kestrel pairs *(Falco tinnunculus),* 3 300 Montagu's Harrier pairs *(Circus pygargus)*, almost 3 400 Honey Buzzard pairs (*Pernis apivorus)*, 3 100 Eurasian Hobby pairs (*Falco subbuteo)*, more than 2 900 Lesser Spotted Eagle pairs *(Aquila pomarina)*, 2 110 Black Stork Pairs (*Ciconia nigra)*[7], 1 400 White-tailed Eagle pairs (*Haliaetus albicilla)*, 1 000 Black Kite (*Milvus migrans)* and Red Kite pairs *(Milvus milvus)* (Fig. 4.1.5.) in Poland. There has been a significant growth in the abundance of population of these species since 2000, except for Black Kite and Common Kestrel whose abundance has fallen, and Marsh Harrier whose abundance can be referred to as stable.

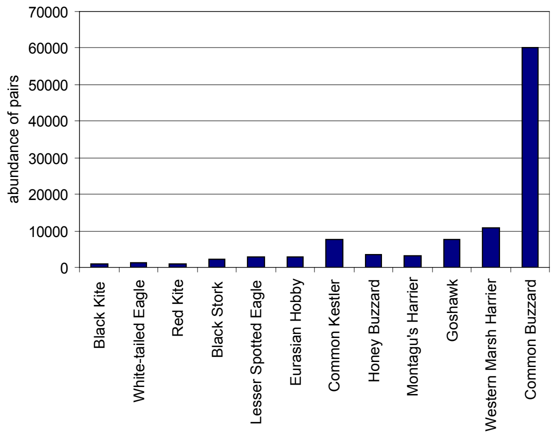

Fig. 4.1.5. Abundance of selected species of birds of prey in Poland in 2008 (source: CIEP/SEM)

The main adverse changes in nature, observed among others within the framework of monitoring of species and natural habitats, include: loss of birds habitats especially non-forest and wetland, fragmentation of habitats, including breaking down of ecological corridors, distortion of composition of species in natural habitats (in particular non-forest, marsh and seminatural habitats), secondary succession of non-forest habitats via tree and bush encroachments, as well as eutrification of lakes and plant communities, displacement of typical and native species by invasive and foreign ones, pollution of waters as flora and fauna environment, mechanical damages to the rare plants and natural habitats, degradation of landscape features. The main driving forces which may pose a threat in the future include: melioration, abandonment of agricultural use, improper hydro-technical development and regulation of rivers, construction of communication and tourist infrastructure, urbanization, excessive fertilization, as well as hurricanes and forest fires.

An extremely fast development of communication and transport significantly facilitates moving of species across the world, and thus contributes to an increased number of foreign species. In Poland almost one in five of new species are invasive. The impact of 2/3 of foreign species is not known (Fig. 4.1.6.).

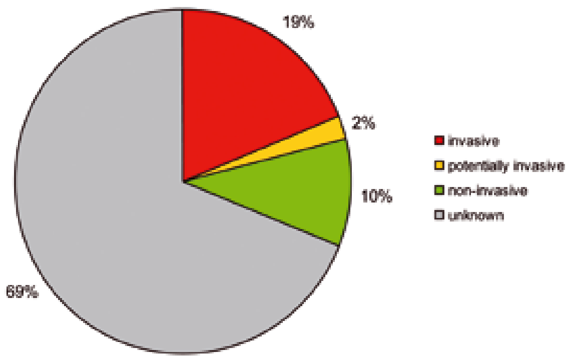

Fig. 4.1.6. Share of invasive species in foreign species in Poland (source: NOBANIS)

The most numerous species which are foreign to the Polish biocenosis include 466 plant and 348 invertebrate species. Arthropods were the most numerous in the latter group (267 species), as well as: 85 species of fungi, 44 species of birds, 36 species of fish, 19 species of mammals and 6 species of reptiles. New foreign species are constantly identified (table 4.1.1.).

In order to preserve Poland's natural heritage 10 102 thousand hectares of Poland's area was covered with the national forms of nature conservation at the end of 2008 (according do data of the Central Statistical Office), which comprised 3.1% national parks, 24.9% landscape parks, 1.7% nature reserves and 70% of areas of protected landscape. In 1998-2008 384 thousand hectares new high nature value areas were covered with national forms of nature conservation (Fig. 4.1.7.).

6 Based on extrapolation of bird monitoring results (State Environmental Monitoring).

7 Black Stork is a wading species, although due to its nesting behaviour it is monitored in the framework of Birds-of-Prey monitoring program

Table 4.1.1. Number of foreign species of fungi, plants and animals in Poland in 2009 (source: Nature Protection Institute, Polish Academy of Sciences)		
Vertebrates	Mammals	19
	Birds	58
	Reptiles	6
	Fish	37
Invertebrates	Molluscs	34
	Arthropods	267
	other invertebrates	44
Vascular plants		466
Fungi		85
Other		44

In 2001 Warta Mouth National Park was established with the area of 8 074 hectares. It is one of the most important wetland bird areas in Poland. Moreover, new nature reserves with the total area of 32.4 thousand hectares and protected landscape areas covering 198.2 thousand hectares and new forms of conservation, i.e.documentation posts, ecological sites, as well as nature-landscape complexes and landscape communities covering a total of 34.5 thousand hectares were established in the period 1998-2008.

A large part of legally protected natural sites, in particular all national parks and some landscape parks form a part of the Natura 2000 network (Fig. 4.1.7).

Due to the obligations resulting from Poland's EU accession Natura 2000 network has been designed from 2001 and implemented from 2004. The network comprises special protection areas (SPAs) and sites of Community importance (SCIs) which will become special areas of conservation (SACs) under the regulation of the Minister of Environment. Natural habitats, as well as rare species of plants and animals on a European scale, listed in Annexes to the Habitats and Birds Directive, are protected within the framework of Natura 2000 sites. A network of "bird" sites was established by the end of 2008. It provides sufficient protection to bird species occurring in Poland and protected under the Birds Directive. The network comprises 141 special protection

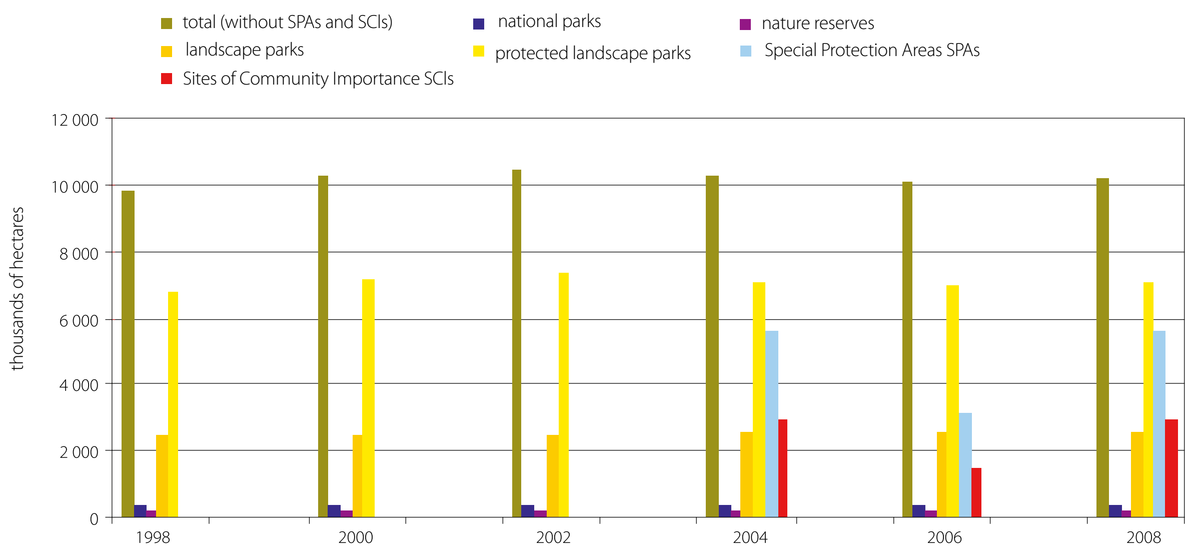

Fig. 4.1.7. Area of legally protected areas of special nature value and Natura 2000 site network in 1998-2008 (source: CSO)

areas covering a total of 5 511.8 thousand hectares, including 4 862.8 thousand hectares of land areas, which accounts for 15.6% of Poland's land area (Fig. 4.1.7). In 2009 the European Commission approved 364 sites of Community importance (SCI) which cover 2 888.4 thousand hectares, including 2 528.4 thousand hectares of land areas which accounts for 8.1% of Poland's land area (Fig. 4.1.8. and 4.1.10.).

It is foretasted that a complete Natura 2000 network will be approved in 2010 after it has been completed with the missing special protection areas and special areas of conservation. The network will cover 823 SCIs with the total area of 3 792 thousand hectares, including 3 432 thousand hectares of land areas, which will account for 11% of Poland's land area and 144 SPAs covering 5 571.9 thousand hectares (enlarged due to the necessity to compensate investments), which will account for 15.8% of Poland's land area. SCI and SPA networks overlap in ca 25% of surface.

Correctness of Natura 2000 special protection areas designation is proven by the results of common breeding birds monitoring (CBBM) (Fig. 4.1.9.). The results show that the abundance trend for 87 most common species registered under the programme (being above 10%) is higher in SPA sites than outside them.

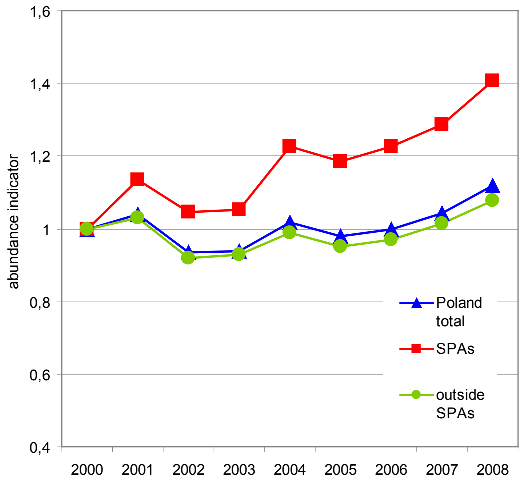

Fig. 4.1.9. Changes of aggregated abundance indicator of 87 common bird species registered in the CBBM programme, broken down into protection areas: SPAs, sites outside SPA network and the whole country (source: CIEP/SEM)

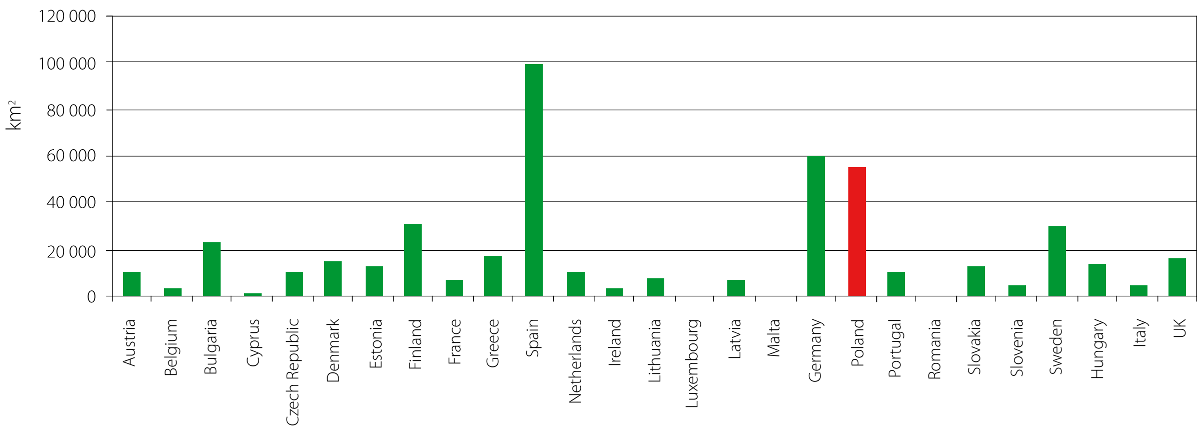

Fig. 4.1.8. Total area of Natura 2000 special protection areas as at July 2009. (source: http://ec.europa.eu/environment/nature/natura2000/barometer/docs/spa.pdf)

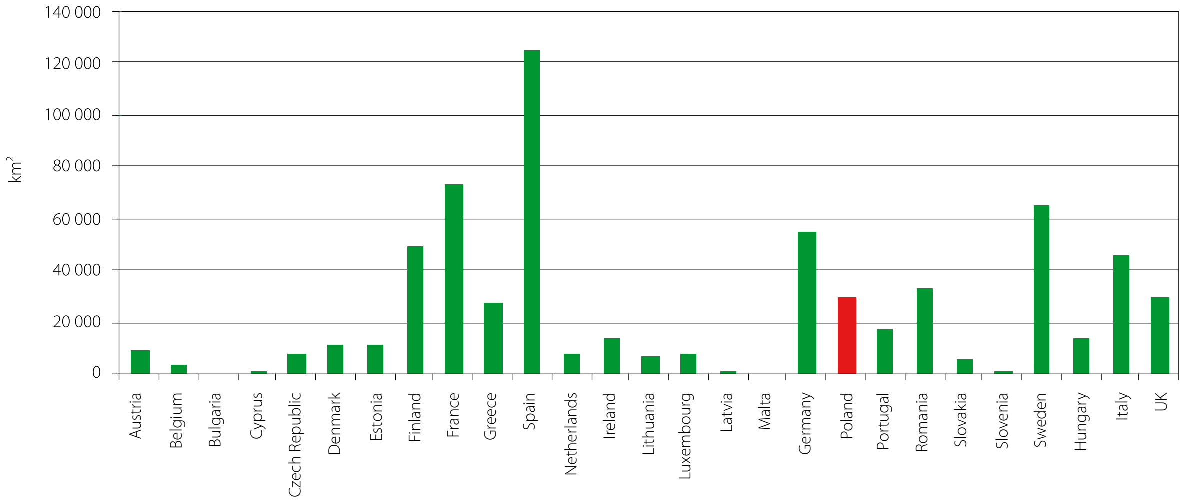

Fig. 4.1.10. Total area of Natura 2000 special areas of conservation as at July 2009 (source: http://ec.europa.eu/environment/nature/natura2000/barometer/docs/sci.pdf)

Since 1998 the area of other international valuable natural sites has been extended. Ramsar list was extended with five new wetland sites which are important as a waterfowl habitat, covering a total of 35 305 hectares (Wigierski National Park, Poleski National Park, Narwiański National Park, Drużno Lake Reserve and Subalpine peat land in the Karkonoski National Park). Moreover, two new biosphere reserves were established: Kampinoska Forest (covering 76 232 hectares) and Polesie Zachodnie (covering 139 917 hectares).

New species and their habitats were granted protection, genetic resources in zoological and botanical gardens were enriched, restitution was carried out in selected sites, involving among others Peregrine Falcon in Pieniny Mountains, wisent in Karpatian mountains, Atlantic sturgeon, the Zarte, Atlantic salmon and brown trout in Northern Poland and in the drainage area of upper Vistula river, European Silver Fir in Sudety mountains, Taxus in Poland; there was reintroduction of Eurasian lynx in Polesie region, Apollo butterfly in Peninski National Park, Black Grouse and Western Capercaillie in Wisła forest division, plant species in Western Poland (e.g. *Gladiolus palustris* or *Saxifraga nivalis* in the South).

It needs pointing out that in Poland there is relatively a lot of rare species on a European or global scale, which obliges Poland to take special responsibility for their protection. A spectacular example involves Aquatic Warbler (*Acrocephalus paludicola*), a bird endangered globally, whose 25% of global population occurs in Poland (Fig. 4.1.11.).

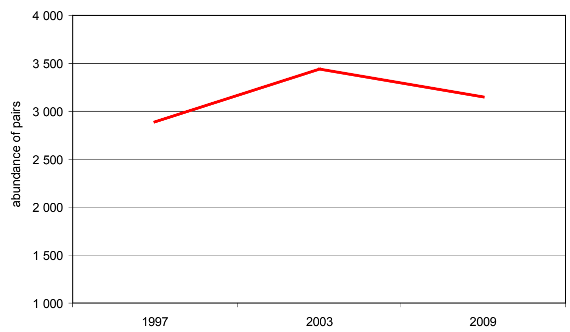

Fig.4.1.11. Abundance of Aquatic Warbler "pairs[8] in Poland over 12 years - results of national stocktaking dated 1997, 2003 and 2009 (source: OTOP)

[8] Simplified wording - *Acrocephalus paludicola* does not form pairs, stocktaking covers males responding with a mating sound, and the total gender proportion is 1:1, that is why the text refers to "pairs".

In spite of the fact that the abundance of Aquatic Warbler on a national scale maintains at a level of 3 070 "pairs" (Fig. 4.1.11.), with minor fluctuations, its status has been dramatically deteriorating since 2003. This is proven by a reduction of abundance or disappearance of Aquatic Warbler in the so called small sites. They include an isolated Western-Pomeranian population which reduced dramatically from 142 "pairs" in 1998 to 61 in 2008, thus posing a risk of extinction in this region (Fig. 4.1.12).

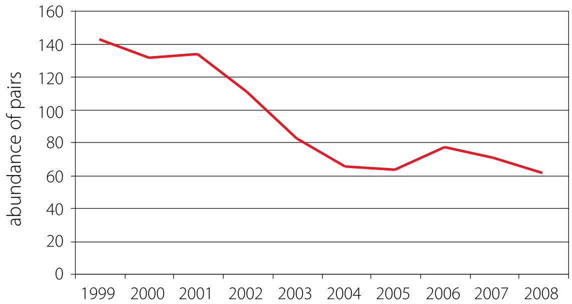

Fig. 4.1.12. Population of Aquatic Warbler "pairs" (Acrocephalus paludicola) in Western Pomeranian region in 1999-2008 (source: OTOP)

Reintroduction of Peregrine Falcon (*Falco peregrinus*) has been carried out from 1990. The first nest of free living individuals (active pairs) was observed in 1998. The first pairs with breeding success were recorded already in 1999. The population oscillated at the level of 11 active pairs, 9 pairs with yield and 15 young individuals in 2009 (Fig. 4.1.13.).

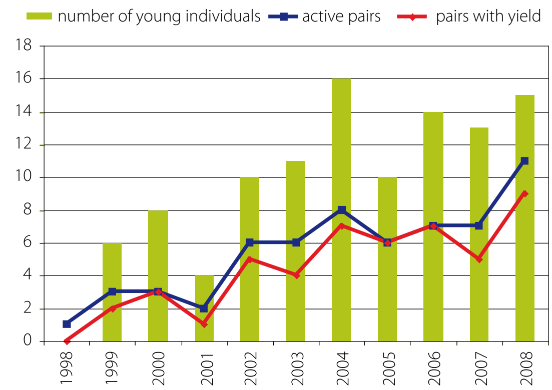

Fig. 4.1.13. Population of Peregrine Falcon (Falco peregrinus) pairs in 1998-2008 (source: Sokół Association for Wild Animals)

The number of wisents (*Bison bonasus*) individuals grew from 704 in 1995 to 1007 individuals in 2008, number of chamois (*Rupicapra rupicapra*) increased from 87 individuals in 2000 to 150 in 2008 and the number of brown bears (*Ursus arctos*) from 69 individuals in 1995 to 156 in 1998 (Fig. 4.1.14.).

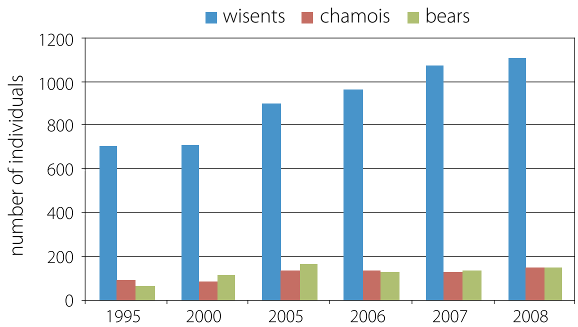

Fig. 4.1.14. Wisent (Bison bonasus), chamois (Rucicapra rupicapra) and brown bear (Ursus arctos) population in Poland in 1995-2008 (source: CSO)

There was a very big increase in the number of beavers (*Castor fiber*) from ca 12 740 in 1995 to ca 58 847 in 2008 (Fig. 4.1.15.). It needs pointing out that the increase in beaver population is on the one hand related to the improved state of nature (among others improvement of water relations) and on the other hand to intensification of damages done by beaver (among others drowning of land, in particular meadows and crops, as well as by cutting and damaging of trees).

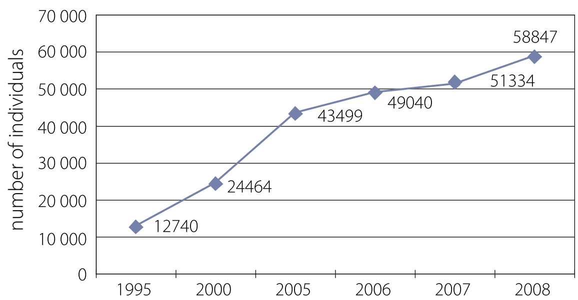

Fig. 4.1.15. Beaver (Castor fiber) population in Poland in 1995-2008 (source: CSO)

In order to increase knowledge about the resources and condition of nature in 2006 two national monitoring programmes were launched, adjusted to the requirements of the Habitats Directive and Birds Directive, i.e. monitoring with the assessment of species and natural habitats conservation status, as well as bird monitoring. National nature-forest inventory of species and natural habitats was also carried out and a database of foreign species was developed along with more precise principles of handling these species.

Some important changes in nature conservation management were implemented. General Directorate for Environmental Protection (GDEP) and regional directorates for environmental protection (RDEP) reporting to it were created. They are responsible for managing Natura 2000 network, handling the environmental impact assessments and species protection. RDEP substituted the existing the voivodship nature conservator which comprised the services of voivods (heads of voivodship). Landscape parks and protected landscape sites matters were shifted from competences of voivods to voivodship assemblies, while ecological sites, natural and landscape communities and natural monuments matters were shifted to the competences of municipality councils.

The management of site and species protection was simplified among others by facilitating the method of working out conservation plans. In order to facilitate the protection of species and natural habitats covered by Natura 2000 network 55 preliminary conservation plans of selected Natura 2000 sites were worked out, as well as 15 preliminary conservation programs of selected plant and animal species listed in the Annexes of the Habitats Directive. A mechanism of nature compensation of investments with negative environmental impact was also implemented.

Launching agri-environmental programmes that promote pro-natural agricultural use in rural high nature value areas is of great importance for the protection of species and habitats. A broad environmental education, among others in schools, at the territory of protected sites and in forests has an important impact on the social awareness and as a consequence on the decisions taken in the future.

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Poland is characterized by big natural values, including large biological diversity. The number of protected valuable natural sites has been increasing. A large area of Natura 2000 sites which is being designed and covers 20% of Poland's area is also a proof of the values of nature. The sites were created to protect species and natural habitats endangered on a European scale. Growing populations of many bird species point out to the improvement of the natural status of agricultural areas and other extensively utilized areas.

However, the conservation status of the majority of species and natural habitats endangered on a European scale is assessed as inadequate. Since it is an intermediate assessment, there is a large chance that after implementing respective conservation measures the status may improve to a favourable level. The state of threat of species, assessed in line with IUCN classification, is not big when compared to other countries. The presence of many rare flora and fauna species (e.g. Aquatic Warbler, bear, wisent or chamois, many rare plants on a European scale, e.g. Polish scurvy-grass, liparis loeselii) imposes a special responsibility on Poland for the protection of natural heritage, particularly when the conservation status is bad (e.g. Aesculapian Snake) or is vehemently deteriorating (e.g. Aquatic Warbler).

At the same time, resignation from the use of valuable non-forest sites, meliorations, development of road-, turist-, industrial- and energy infrastructure (small water power plants, wind power plants) pose some serious threats to the maintenance of habitats and species, contributing in particular to the fragmentation of habitats and secondary succession.

Those negative phenomena are supposed to be prevented among others by agri-environmental programmes supporting environmentally friendly agriculture, by working out and implementing conservation tasks, as well as by conservation plans for the protected sites and species, and by facilitating the process of issuing of decisions on the location of projects which may have a major environmental impact, as well as by nature compensation.

IV.2. Forests

Forests are an integral element of the natural environment. According to the National environmental policy from 2002 they should be utilized in a balanced and sustainable way in order to ensure their durability and multifunctionality for the future generations. Forests fulfil a lot of environmental functions, among others by stabilizing water circulation in nature, protecting soils from erosion, shaping global and local climate, as well as creating conditions for the maintenance of biological potential of a large number of species, ecosystems and genetic values of organisms. Forests play important production functions, by supplying timber, as well as fruit, herbs and mushrooms. They also fulfil vital social functions.

The basic objective of forest management involves "gradual increase in forest cover up to ca 30% in 2010 and to 33% in 2050, extending the scope of renaturalization of forest areas, implementing the principles of protection and increase in biological diversity in forests by introducing indigenous species and reconstructing monocultures".

in: "The National Environmental Policy for 2003-2006 and Its 2010 Outlook".

Forests in Poland cover the area of 9 065.9 thousand hectares (according to the Central Statistical Office - state as at 31.12.2008), which corresponds to 29.0% of country forest cover (Fig. 4.2.1.). Poland's forest cover, specified according to an international standard[9], amounted to 30.3% at the end of 2008 and was lower than the European average (33.8% excluding the Russian Federation).

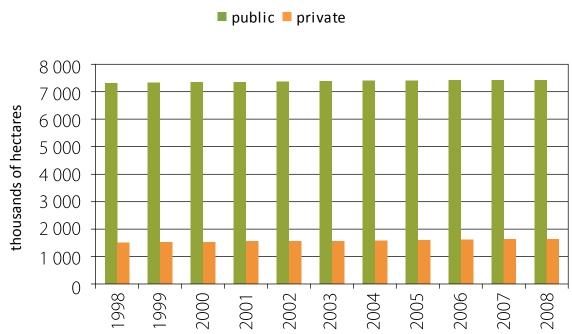


Fig. 4.2.1. Area of forests in Poland in 1998-2008 (source: CSO)

Species structure of the Polish forests has been undergoing positive changes since 1945, involving a gradual increase in deciduous species in the forests managed by the State Forests National Forest Holding (SF NFH). Coniferous species account for more than 75% of the total forest area in the country. This includes 69.3% share of pine tree in the area of SF NFH and 63% in private and municipality forests.

Dominance of pine forest stands results from the structure of habitats occupied by forests. Forests grow on the poorest soils, therefore coniferous habitats covering 54.5% are in the majority. Broadleaved forests cover 45.5%, of which 3.8% include alder and riparian trees. This situation results from large-space afforestation of post-agricultural land carried out in 1950's (Fig. 4.2.2.).

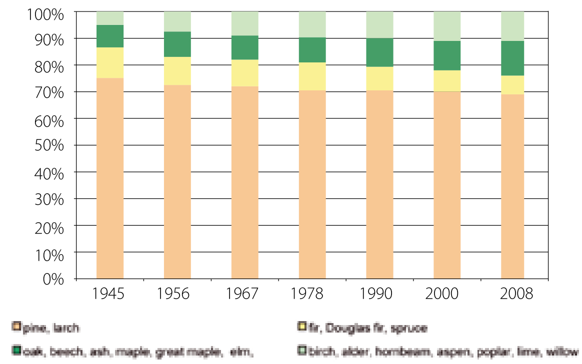


Fig. 4.2.2. Species structure of forests managed by State Forests NFH in 1945-2008 (source: BFMG,CSO)

9 With reference to their land excluding inland waters.

The age structure of the State Forests NFH is dominated by age class III stands (41-60 years) and age class IV stands (61-80 years) covering 24.7% and 19.2% of space respectively. 35% private and municipality forests (state from 1999) were covered by age class II stands (21-40 years), 25% were age class III stands. VI and VII age class stands (above 100 years) including RC (restocking class), CFR (class for restocking) and CSS (stands with selection structure) occupy 14.1% area of SF NFH. Non-forested area covers ca 5% of area in private and municipality forests, and 1.3% in SF NFH (Fig. 4.2.3.).

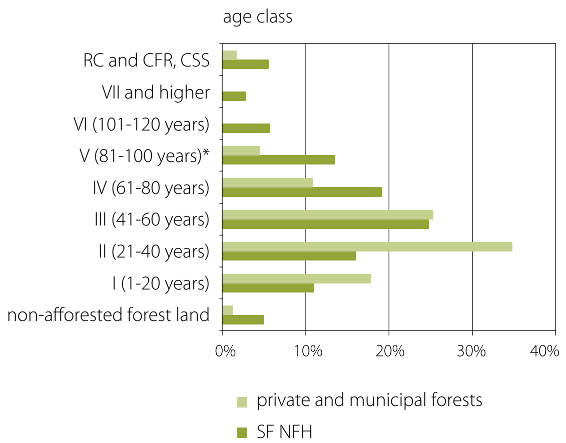


Fig. 4.2.3. Forest stand structure by age classes in State Forests (1.01.2008) and in private and municipal forests (1.01.1999), (source: BFMG)
**- in private and municipal forests V and higher age classes jointly*

There is a constant increase in the share of stands above 80 years, from ca 0.9 million hectares in 1945 to ca 1.55 million hectares in 2008 (excluding RC and CFR). Average age stand in 2008 in state forests was 60 years, while in private forests in 1999 it was 40 years (Fig. 4.2.3.).

According recent information provided by BFMG and SF NFH timber resources in forests managed by SF NFH reached 1676.2 million m^3 gross merchantable timber[10]. Total size of timber resources in forests under all forms of ownership (expert's estimates) is ca 1 914 million m^3 of gross merchantable timber (state as at 1 January 2008) (Fig 4.2.4.).

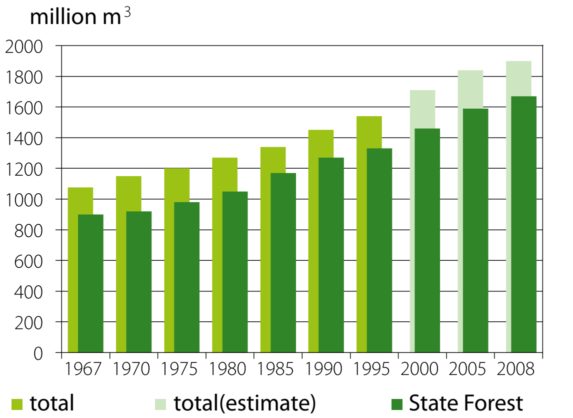


Fig. 4.2.4. Volume of timber resources in Polish forests in 1967-2008 in million m^3 of gross merchantable timber (source: CSO,BFMG)

Health condition of forests in Poland over the past decade was characterized by a lot of stability. The share of healthy trees (defoliation up to 10%, class 0) ranged between 8.10% in 2003 to 12.21% in 2005. The share of damaged trees (defoliation above 25%, class 2-4) reached the lowest level of 30.6% in 2001 and the highest level of 34.78% in 2003. The structure of forest monitoring observation plots was changed in 2006 and as a result studies covered forests of all ownership categories, as well as younger stands (aged 20-40 years). The changes were reflected in the results of research on the health condition of forests in 2006-2008: there was an increase in the share of healthy trees up to 27.01% in 2006 and a decrease in the share of damaged trees with the lowest level of 18.01% in 2008 (Fig. 4.2.5.).

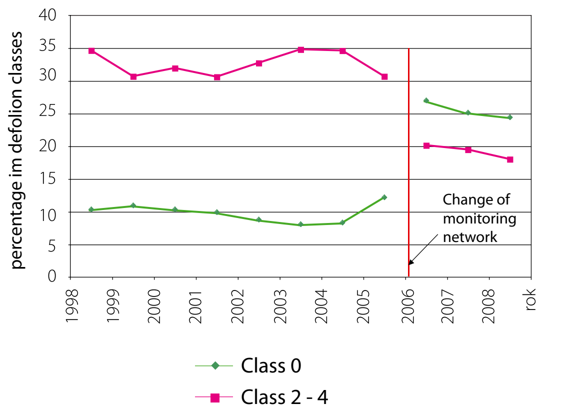


Fig. 4.2.5. Percentage share of trees in defoliation classes in permanent observation plots I range in 1998-2008 (source: CIEP/SEM)

[10] Merchantable (Large) timber - (1) log volume from stump height, with diameter of the thinner end of at least 7 cm with bark (applies to standing timber); (2) roundwood with diameter of the thinner end without bark of at least 5 cm (applies to harvested timber); gross merchantable timber –is over bark; net merchantable timber is under bark, without losses during bucking.

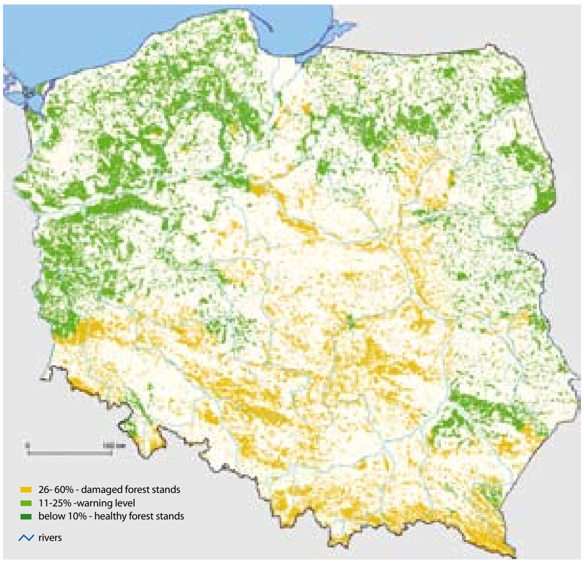


Fig. 4.2.6. Level of forest damage in 1998 based on defoliation assessment in permanent observation plots with focus on 3 defoliation classes (source: CIEP/SEM)

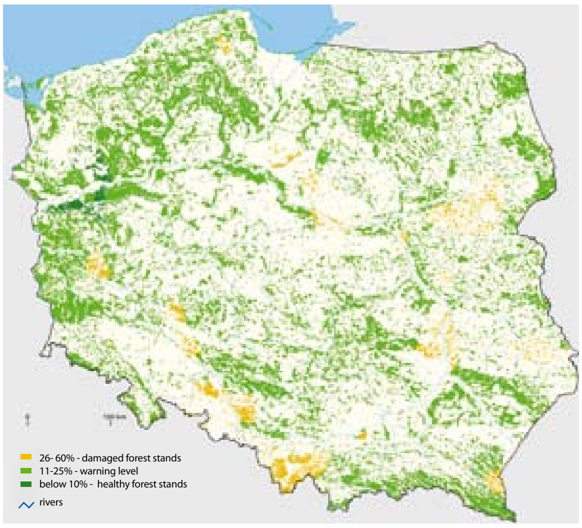


Fig. 4.2.7. Level of forest damage in 1998 based on defoliation assessment in permanent observation plots with focus on 3 defoliation classes (source: CIEP/SEM)

Areal differentiation of the health state of forests in Poland has been decreasing. In 1998-2008 the level of tree health in Southern Poland increased significantly, reducing the previous difference between Northern and Southern Poland (Fig. 4.2.6., Fig. 4.2.7.).

In 2008 beech stands were the most healthy - 43.37% of healthy trees and 9.97% of damaged trees. The least healthy were oak stands - 14.46% of healthy trees and 28.02% of damaged trees, and spruce stands - 25.30% healthy trees and 25.94% of damaged trees (table 4.2.1.).

Health state of forests ranks Poland in the group of countries with an average health level. Percentage share of healthy trees in Europe ranges from 3.1 to 74.6, while in Poland it is 24.5%. The share of damaged trees in Europe ranges from 8.0% to 56.7, while in Poland it amounts to 18.0%.

The perspectives of future tree health largely depend on climatic changes. Changes in the volume of atmospheric precipitation will be of particular importance. If the increase in average annual temperature is accompanied by a falling volume of precipitation, the health of tree stands in Poland will deteriorate.

Tree health in Poland depends of abiotic and biotic factors of natural and anthropogenic nature.

The most important abiotic factors involve changes of weather conditions, in particular the volume of atmospheric precipitation, which has impact on the level of satisfaction of water needs of tree stands. In recent years the sum of precipitation during the vegetation period oscillated around a multi-year mean and had no negative impact on the health condition of forests. Water deficits in forest stands were only regional and relatively short.

Tab. 4.2.1. Percentage share of trees in defoliation classes by species in permanent observation plots 1st range - tree stands aged above 20 years - all forms of ownership, 2008

Classification		Species											
Defoliation classes	Percentage of defoliation	pine	spruce	fir	other coniferous trees	total coniferous trees	beech	oak	birch	alder	other deciduous trees	total deciduous trees	total all species
0-without defoliation	0-10%	21.62	25.80	39.13	38.92	22.88	43.47	14.46	22.73	35.08	32.35	27.55	24.45
1-slight defoliation	11-25%	61.81	48.26	40.50	45.81	59.67	46.56	57.52	56.41	51.96	49.19	53.33	57.54
2-average defoliation	26-60%	15.99	23.15	19.94	14.28	16,68	9.65	27.35	19.73	11.74	16.57	18.03	17.14
3-large defoliation	> 60%	0.37	2.25	0.32	0.74	0.53	0.32	0.52	0.69	0.61	1.54	0.75	0.60
4-dead trees		0.21	0.54	0.11	0.25	0.24	0.00	0.15	0.44	0.61	0.35	0.34	0.27

The condition of tree stands is also influenced by temperature anomalies, reduced level of ground waters and strong winds. In 2008 (October 2007 - September 2008) in forests managed by SF NFH damages caused by abiotic factors were identified on the area of 117 thousand hectares stands aged 20 years and more, including more than 61 thousand hectares damaged stands as a result of wind.

The main anthropogenic factors involved pollution of air, water and soils, as well as fires. The role of air pollution in the context of forest health has reduced significantly (although it is still important in the South of the country), which is mainly related to a reduced sulphur dioxide concentration in atmospheric air in recent years. However, a maintaining NO_2 level in air, as well as deposits of eutrifying compounds are still an important factor. Large deposits of biogenic compounds result in the increase of tree stands, but at the same time make the stands more sensitive to the impact of negative biotic and abiotic factors.

Fire hazard in forests is strictly related to weather conditions and biotic factors (nature of habitat, composition of species). Arsons and accidental fires are an important factor. The highest number of fires (17 088) and burnt area (21 200 hectares) was recorded in 2003, and the cause of fires involved weather conditions and fire propagation from non-forest areas. There were 9 091 forest fires and 3028 hectares forest stands were burnt in 2008 (Fig. 4.2.8.). The most fires were recorded at the territory of Mazovian Voivodship. The lowest number of fires occured in Opolskie and Warmińsko-Mazurskie Voivodship.

Health of stands is also conditioned by biotic factors which include above all insect pests and fungal diseases. The most endangered tree stands involve the ones located in the North of the country, i.e. in western part of the Mazurian Lakeland, as well as at Pomorskie and Wielkopolske Lakeland. Moreover, there is an equally large threat posed by insect pests focused in the regions of Southern Poland (in Sudety Mountains, Śląsk Opolski and Beskid Wysoki) (Fig. 4.2.9.).

Provisions of the "National environmental policy" and "National policy on forests" provide for activities aimed at preserving and protecting forest resources, in line with the principle of permanent and sustainable forest development. In order to promote an environmentally friendly model of forest management at the territory of SF NFH 19 Promotional Forest Complexes (PFC) covering the area of 999.2 thousand hectares (as at 2008 according to CSO) were established.

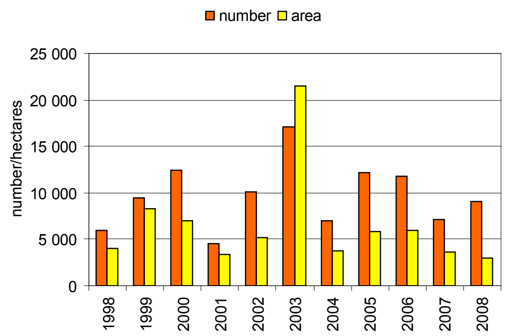


Fig. 4.2.8. Number of fires / burnt area in ha in Poland in 1998-2008 (source: CSO)

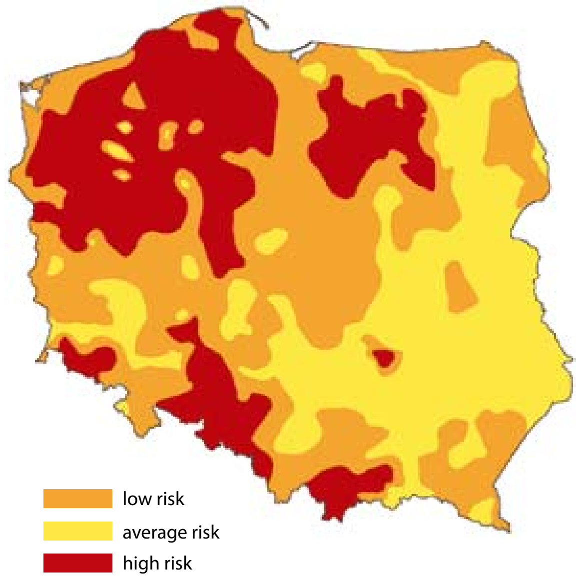


Fig. 4.2.9. Polish forest zones at risk of insect pests (total - primary and secondary) (source: FRI)

The area of forests with the status of protected forests due to their dominant ecological function has been successfully increasing. Total area of protected forests in Poland is 3 299.1 thousand hectares, which accounts for 36.4% (9 065.9 thousand hectares) of the total forest area (as at 2008 according to CSO). The area of private protected forests is estimated to be 73.3 thousand hectares, which accounts for 4.5% of their total area, while municipal forests in this category cover 25.8 thousand hectares (30.2%). Work aimed at enriching the composition of species in forests and adjusting it to forest habitats has been carried out for many years now.

7.9 thousand hectares of agricultural land unfit for agricultural production and wasteland were afforested in 2008 under the "National programme for increasing forest cover". 194.3 thousand hectares of land were afforested in 1998-2008 (according to CSO, 2008) (Fig. 4.2.10).

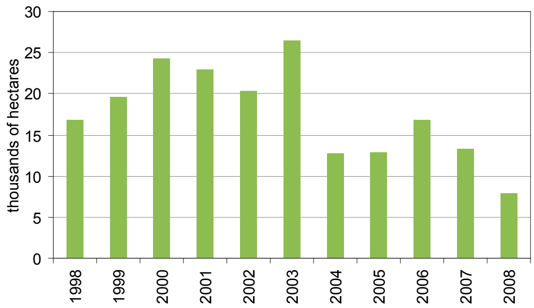


Fig. 4.2.2010. Area of afforestation in thousands hectares in Poland in 1998-2008 (source: CSO)

Forests are covered by a whole range of conservation activities, among others to protect them from insect pests, in order to improve tree health. Rescue activities limiting the abundance of harmful insect species were carried out on the total area of 85.5 thousand hectares (Pine-tree Lappet was eradicated on the largest area of 34.5 thousand hectares) in 2008.

Another important issue related to forests involves activities aimed at increasing biodiversity. These activities are based on: keeping rotten trees and fallen trunks (the so called dead wood), protecting mature trees, keeping naturally valuable peatland and meadows within forests, creating the so called forest depots and reconstructing forest stand in order to differentiate the composition of species.

***

Forest cover in Poland has grown over the past few years from 28.7% in 2004 (forest area – 8 972.5 thousand hectares) to 29.0% at the end of 2008 (forest area – 9 065.9 thousand hectares). Forest stands are continuously reconstructed to adjust the composition of their species to the habitat. Moreover, the share of stands above 90 years (excluding RC and CFR) has been constantly growing. Average age of forest stands is 60 years.

Health condition of forests in Poland in the decade under discussion was characterized by a lot of stability. The difference in health between forest stands in the South and in the North of the country has decreased.

IV.3. Land and soil

Land provides space and resources for the functioning of man and economic development. It is indispensable for various production processes (among others farming of plants or resources extraction), as well as for the arrangement of various socio-economic activities (among others construction of road-, industrial-, services- and housing infrastructure). Human impact involving the change of spatial layout is a multidimentional phenomenon which often results in the transformation of landscape, fragmentation of ecosystems and natural habitats, pollution of air and waters, loss of the soil functions.

Soil protection is of particular importance, as it plays various functions, both natural ones, as well as socio-economic and cultural ones. It is a source of food, biomass and resources. It serves as a platform for the activities of man and constitutes a natural habitat for many organisms, its is also a place where genetic resources are stored. Soil stores, filtrates and processes many substances, including water, nutrients and carbon. It is one of the most important carbon store in nature.

Priority objectives related to the protection of soils and earth surface include:
Preventing further soil degradation and preserving of its functions;
Restoring damaged soil to a level of functionality consistent at least with current and intended use,

in: "Thematic strategy for soil protection "

Agricultural land having the largest share in the country's area covered 19 025 thousand hectares in 2008 (Fig. 4.3.1.). This significant share (60.8%) results both from conducive conditions of the natural environment for agriculture, as well as less intensive economic development in comparison to the Western European countries.

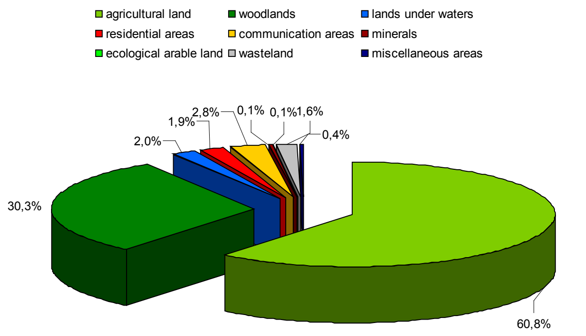


Fig. 4.3.1. Percentage share of individual groups of land use in 2008 (source: CSO)

The structure of land used for farming purposes is dominated by arable land which covers more than 14 000 thousand hectares (more than 70% of agricultural land). Permanent meadows also have a significant share, as they cover ca 2 300 thousand hectares (12.3% of agricultural land) (Fig. 4.3.2.). Directions of agricultural development of land are strongly diversified depending on the region and they result both from varying agricultural and environmental conditions, as well as from diversified socio-economic development.

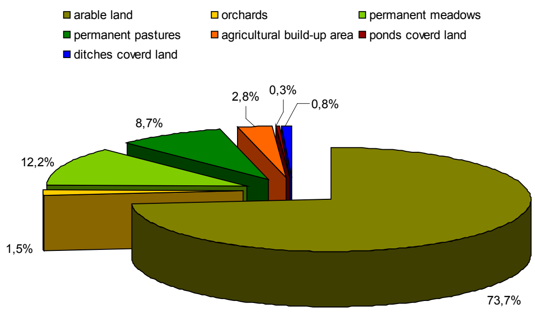


Fig. 4.3.2. Directions of country's area use as regards area used as farmland in 2008 (source: CSO)

Observing the changes in the directions of use of land in the country in 1999-2008 one may conclude that the area of woodland, as well as afforested and shrubbed land has been successively increasing (more than 1% share increase), while at the same time the area of agriculture land has been decreasing from 2004 onwards (0.7% share decrease). The process of shrinking agriculture land area is mainly related to the development of the area of fallow- and idle land which are being successively afforested.

Urbanized and build-up areas covered 1 511 thousand hectares in 2008, which accounts for ca 4.8% of the country's area. Their dominant group included communication areas (in particular areas covered by roads) and residential areas. Their area was 887 thousand hectares and 594 thousand hectares in 2008 respectively.

Residential areas which include housing-, industrial-, other build-up-, urbanized unbuilt-, recreational and leisure areas, as well as communication areas are mainly located in urban and suburbian areas of big cities which have seen the progress of suburbanization, as well as in industrialized areas.

Area of urbanized and build-up areas in 2003-2008 increased by 3.6%.

Fig. 4.3.3. CORINE Land Cover 2006 - map of land cover/use in Poland (source: CIEP/SEM) http://clc.gios.gov.pl

Tracing of changes in land cover/use at a European and national level is made possible by CORINE Land Cover (CLC) databases, which are based on a common European methodology and CLC classification. Data concerning land cover are obtained on the basis of satellite image interpretation and mapping and constitute a spatial data source. Thematic scope of CLC Program as well as level of accuracy of gathered data is mostly fitted to EU institutions needs. CLC nomenclature of land cover includes all categories of land cover occurring at European continent.

Results of CORINE Land Cover 2006 show that domestic land cover is dominated by agricultural areas (62.7% of country's area), with the largest share of arable land (44.5% of country's area), as well as forests and seminatural areas (31.2%) with a dominant share of forests (30.1% of country's area). Artificial surfaces cover 4% of the country's area. Urban fabric was dominant in this category (3.2% of country's area) (Fig. 4.3.3.).

Working out databases on land cover for reference years 1990, 2000 and 2006 under CORINE Land Cover projects made it possible to determine the main directions of change of land cover in Poland in the periods 1990-2000 and 2000-2006. In both analyzed periods the changes in land cover in Poland were relatively small, as they did not exceed 1% of the country's area, covering 0.8% (2 544 km^2) and 0.5% (1 821 km^2) of Poland's territory respectively. However, their dynamics, directions and spatial arrangement were different.

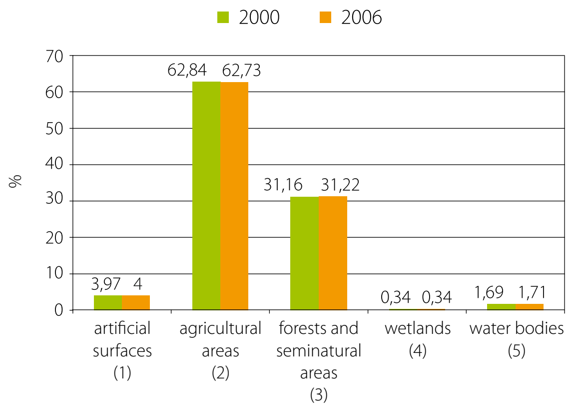
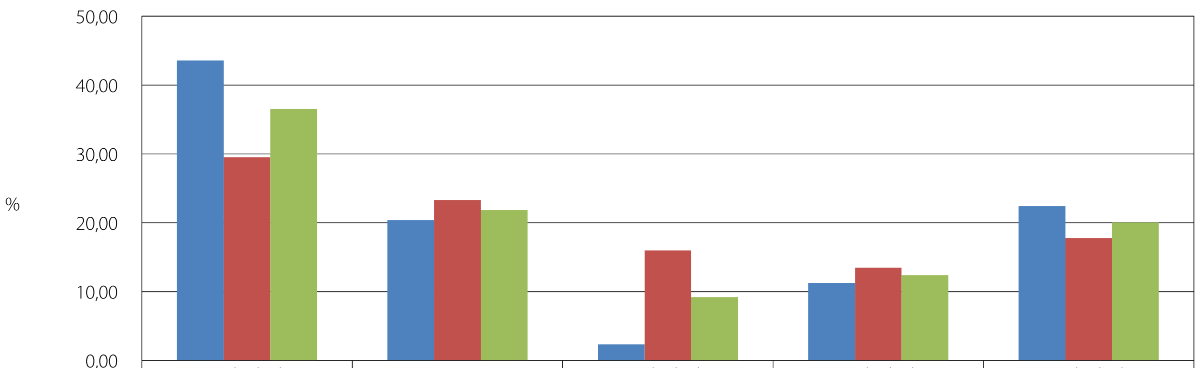


Fig. 4.3.4. Land cover in 2000 and 2006 based on the results of CLC2006 project (source: CIEP/SEM)

Changes in 1990-2000 mainly involved an increase of afforested areas, surface mining areas and areas used for discontinuous development, and to a much lesser extent industrial- and commercial areas, as well as communication areas. The area of these forms of land cover increased mainly at a cost of reduced area of arable land, meadows and pastures. In the analyzed period there were no changes in the area of continuous development, which should be explained by the fact that the development of construction industry and construction of many new buildings occurred in those areas, causing more dense development, without increasing its area.



	Land take by mines, quarries waste dumpsite	Land take by construction sites	Land take by transport network & infrastructure	Land take by industrial & commercial site	Land take by housing, services & recreation
1990 -2000	43,58	20,38	2,36	11,28	22,40
2000 -2006	29,50	23,29	15,96	13,48	17,77
1990 -2006	36,50	21,84	9,20	12,39	20,07

Fig. 4.3.5. Distribution of individual land cover categories in the newly-established anthropogenic areas, based on CLC_changes 90-00 and CLC_changes 00-06 (source: CLC_changes 90-00 - CIEP/SEM and IGC, CLC_changes 00-06 – CIEP/SEM)

In the period 2000-2006[11] more than 60% of all observed changes concerned forest areas, which are marked with areas of wood exploitation and areas of big natural disasters (windfalls). Changes in agricultural areas were ranked second in terms of area - a total of 30% of changes. Changes on areas artificial surfaces accounted for slightly more than 8% of all changes. The remaining forms of coverage saw no major area changes in the analyzed period (Fig. 4.3.4. and Fig. 4.3.5.).

In 2000-2006 there was sa significant increase in the share of areas related to transport and its infrastructure, which accounted for 15.96% of newly established areas artificial surfaces. In 1990-2000 areas used by transport increased by only 2.36%. Also the share of residential development surface with green areas shrunk from 22.4% in 1990-2000 to 17.77% in 2000-2006. In the years 2000-2006 there was a 2.2% increase in the share of industrial areas vis-a-vis 1990-2000.

Upon analysing data related to changes in land cover in Europe, one may conclude that in Poland the changes apply to a much smaller area, and their speed is slower than in many other European countries. This applies in particular to such indicators as the share of areas used for transport and communication, development of areas artificial surfaces, fragmentation of forests and areas used by agriculture. In 1990-2000 the changes in land cover below 1% of the country's area were recorded only in Austria and Slovenia, apart from Poland.

In Poland soils are mainly lessive, brown, podzolized and rusty, generated mainly from postglacial formations. Among hydrogenic (wetland) ecosystems, referred to as boggy, peat (organic) soils are in the majority.

Forest- and meadow soils have largely kept their natural properties. However, the properties of arable land, as well as urban and industrial areas were changed to a large extent, as a result the adjustment of their properties to the requirements of arable crops or as a result of non-agricultural activities.

Soils in Poland are mainly characterized by an average or low agricultural usability (IV, V and VI soil valuation classes), usually they are light soils, generated from sands, covering ca. 74% of farmland. There is a general opinion, that class VI arable land, as well as a vast part of the poorest class V soils should not be used for agricultural purposes due to their low yield and high susceptibility to degradation. They should be subjected to afforestation instead. Soils of high useful quality (I, II and II soil valuation classes) cover 26% of all farmland. They include: lessive soils, silt and loam soils, medium firm soils, rich in humus.

Since the quality of soils has impact on the quality of agricultural crops and food, the monitoring of arable land were included in the system of the state environmental monitoring. The existing results (from three measurement cycles in: 1995, 2000 and 2005) show that there were no significant changes in the properties of soils, in particular negative ones (impoverishment and degradation). However, the changes do not have any major impact on the agricultural usability of soils. A vast majority of arable land (more than 96%) is characterized by a natural or slightly increased[12] content of heavy metals (cadmium, copper, nickel, lead, zinc). (Fig. 4.3.6.).

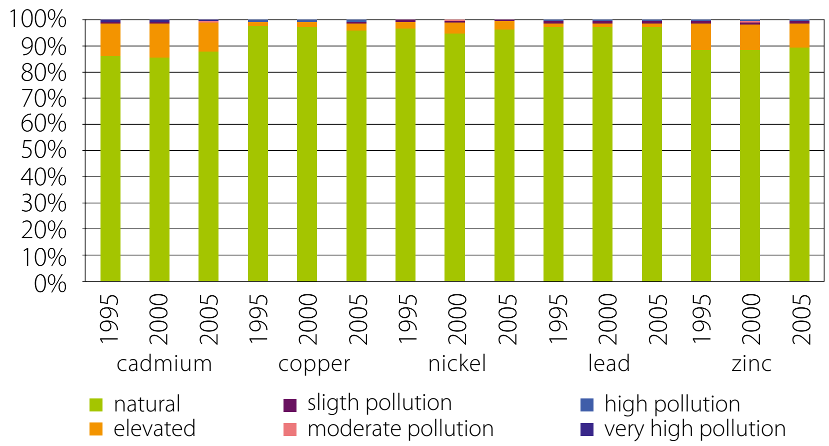


Fig. 4.3.6. Pollution of soils with heavy metal (percentage of samples) (source: CIEP/SEM)

[11] Modification of the methodology of registering changes in land cover in 2000-2006, related to the necessity of registering all changes larger than 5 hectares, resulted in the increase of spatial resolution of the database, and thus in the registration of area of small "isolated" changes which were not collected in the changes database from 1990-2000.

[12] These soils can be used to grow all crops cultivated in the fields, excluding vegetables for vegetable products and for direct consumption by children.

In terms of the contents of polycyclic aromatic hydrocarbons, 76% of arable land can be considered non-polluted, while 24% - polluted in a low and medium grade. None of the monitored soils had a high or very high level of pollutants.

The quality of soils is influenced by many factors. Some have a supra-local range (such as agricultural activities or deposition of pollutants from precipitation), others have a very limited area of impact (among others industrial facilities, landfills). Another important problem involves soils sealing which leads to an increased surface run-off, mainly due to urbanization and development of transport infrastructure. In practice the impact of these factors adds up, causing degradation and devastation of soils.

The influence of agricultural activity on the quality of soils involves improper use of mineral fertilizers and pesticides, as well as improper agrotechnical activities. Poland is a country with a relatively low use of mineral fertilizers (NPK) and pesticides. In 1998-2003 the use of mineral fertilizers maintained at a comparable level of ca 93 kg/ha. Their usage has grown from 2004 to ca. 130 kg/ha (Fig. 4.3.7).

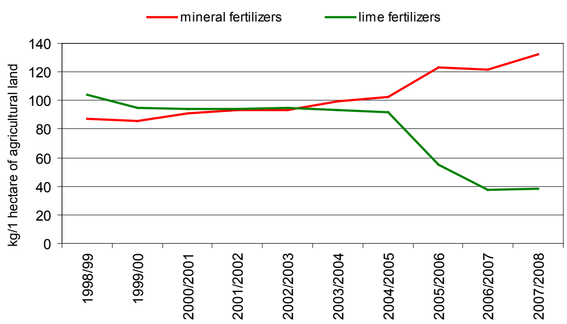


Fig. 4.3.7. Consumption of mineral and lime fertilizers in Poland in 1998-2008 (source: CSO)

Purchase of plant protection products in 1998-2001 was at a comparable level of ca. 8 500 tons. In 2002 there was a slight growth, and over the next two years a fall in the purchase of plant protection products in Poland. In the period 2005 - 2008 there was a significant increase in the purchase of plant protection products from ca. 16 000 tons in 2005 to 20 000 tons in 2008 (Fig. 4.3.8.).

The increase of plant protection products purchase results from admission into turnover and use all products (ca. 1000) according to EU requirements.

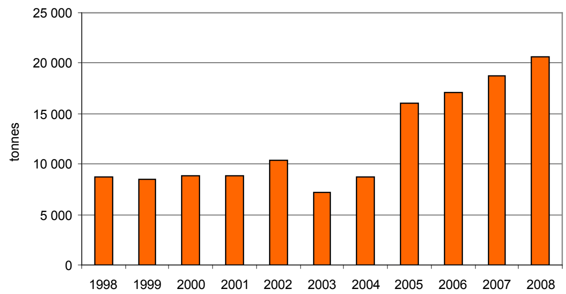


Fig. 4.3.8. Purchase of plant protection products in 1998-2008 in tonnes of active substance (source: CSO)

In 1998 - 2008 the area converted for non-agricultural and non-forest purposes from agricultural land and forest land tripled (Fig. 4.3.9.).

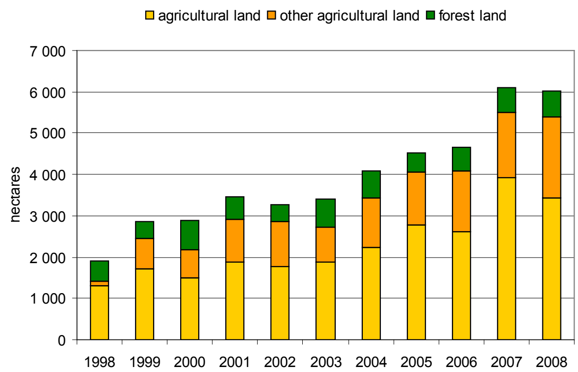


Fig. 4.3.9. Agricultural and forest lands converted for non-agricultural and non-forest purposes in 1998-2008 (source: CSO)

Among agricultural and forest lands converted for non-agricultural and non-forest purposes by directions of conversion, areas which were converted for residential purposes had the largest share – 3 205 hectares (Fig. 4.3.10). In 2008 they accounted for almost 50% of all conversions. The next biggest share involved land converted for other purposes 1 123 hectares, land converted for industrial purposes - 925 hectares and for surface mining use - 572 hectares.

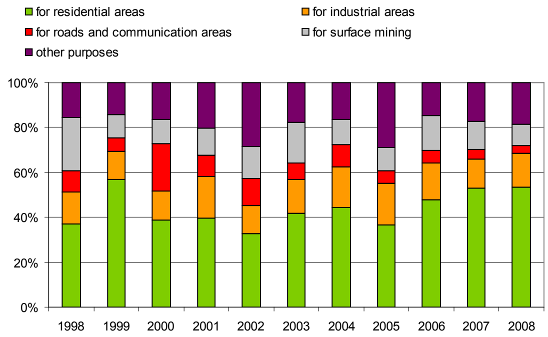


Fig. 4.3.10. Agricultual and forest land converted for non-agricultural and non-forest purposes by directions of conversion (excluding agricultural land converted for the purpose of afforestation and increasing stand density) (source: CSO)

Land is subject to protection based on the act on 27 April 2001 - Environmental Protection Law. The protection involves a multitude of activities aimed at maintaining a high quality of land via its rational use, management, maintenance of natural values and possibilities of use for production, limiting the changes of the natural shape, maintaining the quality of soil and ground above or at least at the level of the required standards, ensuring that the quality of soil and ground meets the required standards whenever they are not met, maintaining cultural values, taking account of the archaeological cultural artefacts.

The act on the protection of arable and forest land on 3 February 1995 provides for the principles of their protection, as well as reclamation and improvement of the useful value. Pursuant to the law in force, land protection involves:

- limiting their conversion for non-agricultural or non-forest purposes,
- preventing the processes of their degradation and devastation,
- counteracting negative effects of non-agricultural activity which reduces the yield potential of soils,
- reclamation and development of land for agricultural purposes,
- maintaining peat lands and small ponds as natural water basins.

An important element of the protection of soils involves limiting the release of pollutants by the industry and municipal sector, including proper waste management, as well as use of the poorest soils for industrial purposes and for development of communication infrastructure.

Protection of soils from agricultural pressure means moderate use of mineral fertilizers and plant protection products, as well as implementation of agricultural production methods which follow the principles of sustainable farming and Code of good farming practices.

A special way of farming involves organic farming, which is a system of sustainable plant and animal production within an agricultural holding, based on biological and mineral resources which were not subjected to technological processing. The basic principle involves rejection of agricultural-, veterinary- and food chemistry agents in the process of food production. In 2008 there were almost 15 000 organic farms in Poland (certified and in the course of conversion), covering a total of 315 thousand hectares, which accounted for 1.65% of the area of arable land. In the analyzed period the area of organic farms grew almost 60-fold (Fig. 4.3.11.). A particularly intensive increase in organic farming occurred after 2004. It is related to the effective implementation of agricultural and environmental programmes, as well as increasing environmental awareness, which results in the consistently growing demand for organic food. In spite of their intensive growth, the share of organic farms in the area of agriculture land remains much lower than the EU average (4.3%).

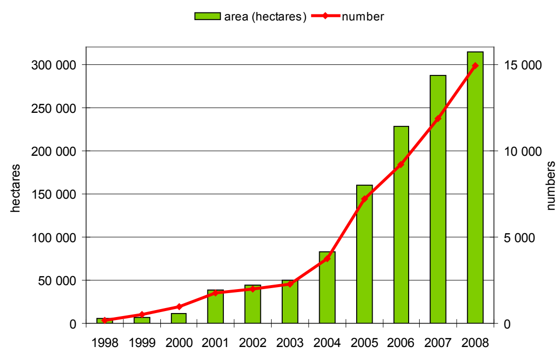


Fig. 4.3.11. Organic farms in Poland in the years 1998-2008 (source: AFQI)

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More than 90% of the country's area is used for agriculture or forestry. Changes in land use observed over the past decade have been insignificant. The area of urbanized and build-up areas has been growing, and the phenomenon of suburbization can be observed around big city agglomerations.

More than 96% of arable land is characterlized by natural or slightly increased content of heavy metals, which qualifies it as high-quality soil that can be used for the production of safe food. There have been no major changes in the quality of soils, which could have a significant impact on their usefulness for the production of food.

There has been a satisfactory growth of the share of organic farms in the area of agricultural land, although this value sill remains lower than the EU average.



V. Environment and Health

V. Environment and Health

V. 1 Air pollution

Air pollution significantly affects human health, causing many illnesses of the respiratory and circulatory systems. The greatest impact of air pollution on human and animal health is observed in industrial and urban areas. The most vulnerable groups include: children, elderly people and people with respiratory system diseases. Polluted air has also negative impact on the condition of ecosystems and destruction of materials (such as corrosion of metals).

Air quality status should be maintained where it is already good, or improved, where the objectives for ambient air quality are not met.
In order to protect human health and the environment as a whole, it is particularly important to combat emissions of pollutants at source and to identify and implement the most effective emission reduction measures at local, national and Community level.

in: Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

Due to the adverse impacts of air pollutants on human health and the condition of ecosystems, there is carried out an annual air quality assessment in terms of its pollution with sulphur dioxide, nitrogen dioxide, carbon monoxide, benzene and ozone, as well as PM10 particulate matter and pollutants identified in the PM10 particulate matter: lead, arsenic, cadmium, nickel and benzo(a) pyrene[13].

Despite systematic improvement of ambient air quality in Poland, there still exist significant problems: in summer – too high concentration of tropospheric ozone, and in winter – excessive concentrations of PM10 particulate matter and benzo(a)pyrene.

Ozone is a strong photochemical oxidiser, which causes serious health problems, destroys materials and crops. Exposure of humans to a slightly increased ozone concentration may lead to an inflammatory response of the eyes, the respiratory tract, as well as decreasing lung capacity. It is the reason for the occurrence of the symptoms of sleepiness, headache and fatigue, as well as it causes a fall in blood pleasure. At higher concentrations, there occur the symptoms of malaise, headaches intensify, excitability, fatigue and exhaustion increase, the symptoms of apathy appear.

Tropospheric ozone is created as a result of photochemical reactions of nitrogen oxides and volatile organic compounds and has the ability to move over long distances, so the concentrations of that pollutant on the territory of Poland depend to a high extent on its concentrations in the air masses flowing into the territory of Poland – mainly from southern and south-western Europe. The other causes of the occurrence of high 8-hour concentrations of ozone, exceeding the level of 120 $\mu g/m^3$, are believed to include:

- photochemical changes of ozone precursors under the influence of UV-B radiation,
- adverse meteorological conditions,
- natural emission sources of ozone precursors.

13 Regulation of the Minister of the Environment of 17 December 2008 on carrying out the assessment of the levels of substances in ambient air.

Maximum 8-hour concentration is the basis for classification of zones in the annual air quality assessment in terms of ozone concentration. The past results of ambient air ozone measurements indicate that the number of days with exceedance of the target value is variable. Interestingly, the number of days with exceedance of the target value in 2008 was one of the lowest in the last decade (Fig. 5.1.1.).

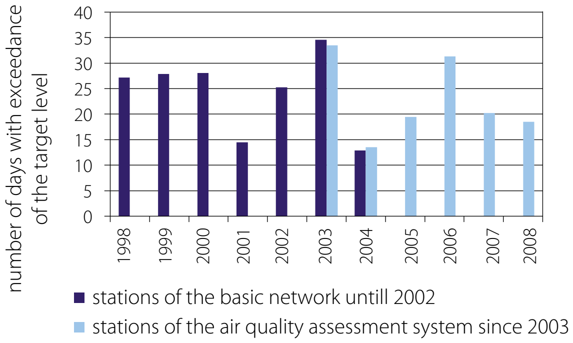

Fig. 5.1.1. Arithmetic mean of days with 8-hour concentrations of ozone higher than 120 µg/m³ in the years 1998-2008 (source: CIEP/SEM)

Of the 28 zones assessed in Poland for ozone in 2008 in terms of health protection, 18 zones (ca. 64% of the area of the country) were included in class A. The other 10 zones were classified as C[14]. Class C included zones located in south-western and central Poland (Fig. 5.1.2.).

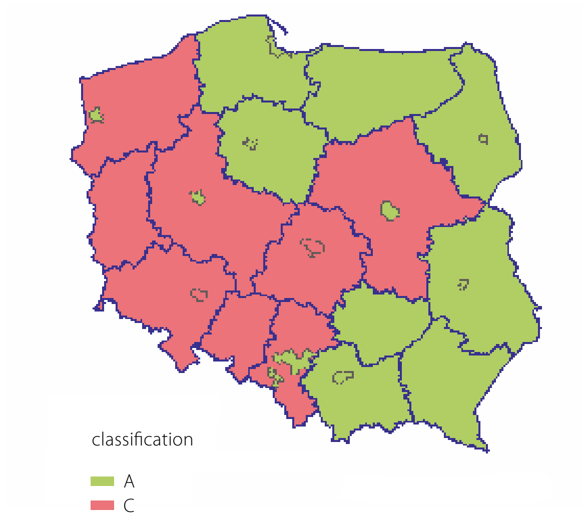

Fig. 5.1.2. Classification of zones in Poland for ozone on the basis of air quality assessment for 2008 (target value, human health protection) (source: CIEP/SEM)

In recent years, exceedances of the maximum 8-hour ozone concentrations have taken place in most areas in Europe (Fig. 5.1.3.).

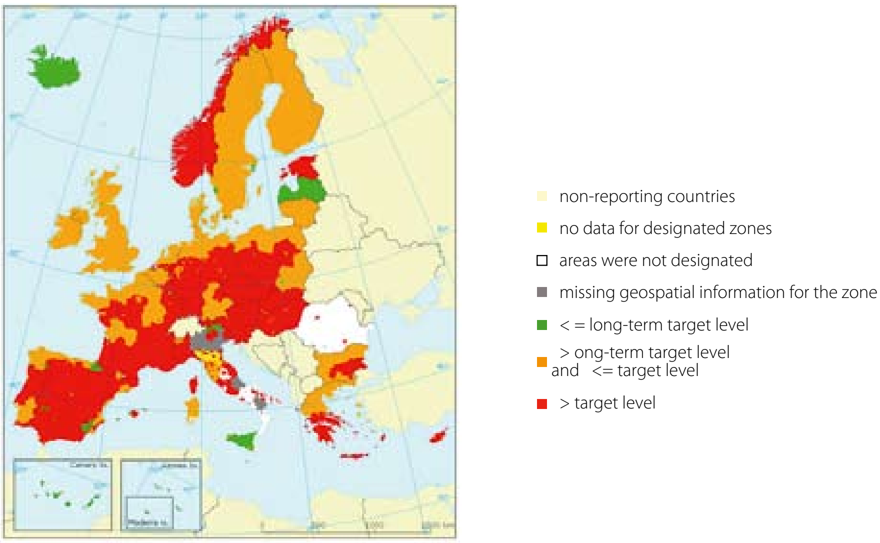

Fig. 5.1.3. Classification of zones in the EU for maximum 8-hour ozone concentrations with reference to human health protection for 2007 (source: EEA)

[14] Zones are classified in accordance with the Regulation of the Minister of the Environment of 6 March 2008 on zones, in which air quality is assessed, where for class A concentration levels do not exceed the target value, and the concentration levels exceed the target value for class C. As regards the target value of ozone concentration:
- the period of averaging of concentrations amounts to 8 hours (eight-hour running averages are calculated from 1-hour concentrations),
- the target value in ambient air is 120 µg/m³,
- the permissible number of days with exceedance of the target value in a calendar year is 25 days (the number of days with exceedance of the target value in a calendar year averaged during three subsequent years; in the case of lack of measurement data from three years, meeting the permissible frequency of exceedances is verified on the basis of measurement data from at least one year).

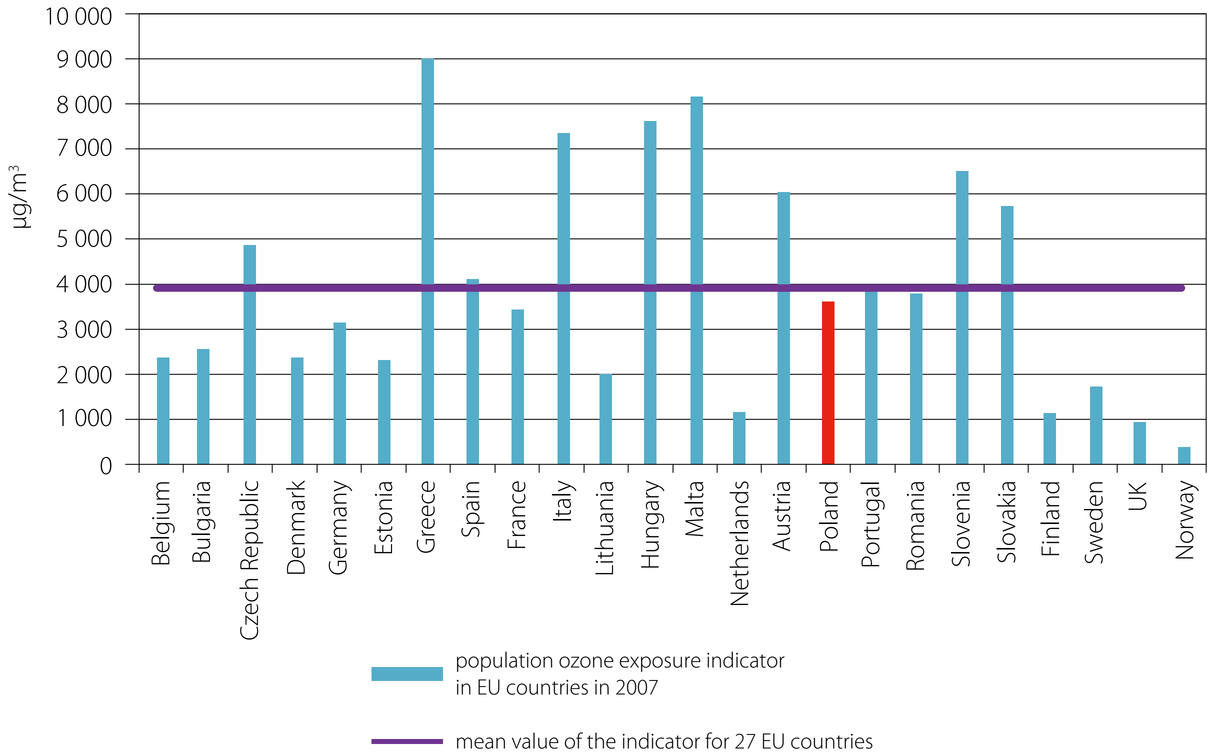

Fig. 5.1.4. Population exposure indicator SOMO35[15] based on monitoring results from urban background stations in EU agglomerations in 2007 (source: Eurostat, based on SEM data submitted to the AirBase)

In 2007, the value of the "Urban population exposure to air pollution by ozone" indicator in Poland (Fig. 5.1.4.) was close to the average value of that indicator for 27 states of the European Union.

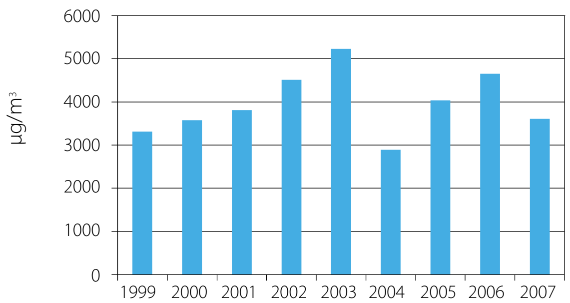

Fig. 5.1.5. Population exposure indicator SOMO35 based on monitoring results from urban background stations in agglomerations in Poland in the years 1999-2007 (source: Eurostat, based on data of the SEM submitted to the AirBase)

The indicator of urban population exposure to air pollution by ozone in Poland was characterised by lack of a clear downwards trend in the years 1999-2007. Interestingly, the lowest value of that indicator in the period under analysis was observed in 2004 (Fig. 5.1.5.).

It should be remembered that the values of ozone concentrations at ground level – thus the value of the exposure indicator – are significantly influenced, beside the emission of ozone precursors, by meteorological conditions: high air temperature, high insolation and lack of precipitation.

[15] SOMO35 – indicator calculated as the sum of differences between a concentration of 70 $\mu g/m^3$ (35 ppb) and maximum daily 8-hour running mean concentrations greater than 70 $\mu g/m^3$ (= 35 parts per billion) .

The impact of small (PM10) and very small (PM2.5) particles on health depends on the number of particles retained in various areas in the respiratory system. However, PM2.5 has the ability to penetrate into the deepest sections of the lungs, where they are accumulated or dissolved in biological liquids. As a result, they cause: aggravation of asthma, acute respiratory responses, impairment of the lung activity, etc.

Particulate matter – in which a fraction of particles with a diameter less than 10 μm (PM10) is differentiated, which includes a fraction with a diameter of less than 2.5 μm (PM2.5) – is a mixture of very small solid and liquid particles, composed of both organic and inorganic compounds (e.g. hydrocarbons, silicon compounds, aluminium, iron, trace metals, sulphates, nitrates and ammonium compounds). The composition of particulate matter changes depending on the origin, season and weather conditions.

Particulate matter (including fine particles) come from direct emissions – mainly from municipal and household sources – or are created in the atmosphere as a result of reactions between substances in the atmosphere. Precursors of the latter (the so-called secondary aerosols) include in particular: sulphur dioxide (SO_2), nitrogen oxides (NO_x), hydrocarbons (NMVOCs) and ammonia (NH_3).

Despite the recorded reduction in emissions of precursors of particulate matter and the actions undertaken to reduce the concentrations of particulate matter in ambient air, in particular the smallest fractions, exceedances of the standards for PM10 remain the key problem of air quality in Poland. The exceedances take place both in terms of the daily standard and the annual standard and pertain in particular to downtown areas of cities and agglomerations.

Exceedances of the daily limit value of PM10 concentrations usually take place in the winter season. In all voivodeships, exceedances are most often related to the emission of particulate matter from heating of individual buildings and transport. Further sources include the impact of emissions from industrial plants, heating plants, power plants and unfavourable meteorological conditions. In this respect, 2006 was marked as a very unfortunate year, when several high-pressure systems occurred in the winter period, characterised by very low temperatures, which were accompanied by long periods of stillness and the phenomenon of inversion.

The location of some Polish cities has a significant impact on air pollution with respect to PM10 particulate matter, such as location in mountain valleys or river depressions, which hinders dispersion of pollutants, as well as concentration of industry in agglomerations or in their direct vicinity (e.g. the Cracow or Upper Silesian agglomerations).

In the annual air quality assessment for 2008 in terms of PM10 particulate matter, of 170 zones covered by assessment, 105 zones (ca. 62%) were classified into class A and 65 zones (38% zones) into class C[16] based on 24-hour concentrations (Fig. 5.1.6.).

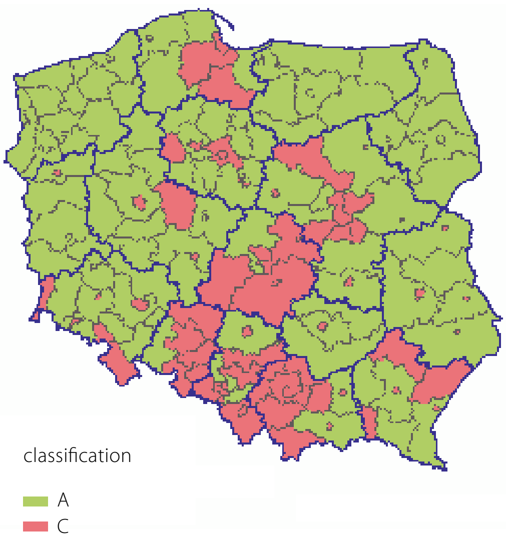

Fig. 5.1.6. Classes of zones determined on the basis of 24-hour concentrations of PM10 particulate matter as a result of ambient air quality assessment for 2008 (according to criteria pertinent to human health protection) (source: CIEP/SEM)

[16] Zones in Poland are classified in accordance with the Regulation of the Minister of the Environment of 6 March 2008 on zones, in which air quality is assessed, where for class A concentration do not exceed the limit value, and the concentration exceed the limit value for class C. For averaging period amounting to:
- 24 hours – the limit value for PM10 particulate matter in ambient air amounts to 50 $\mu g/m^3$, which can be exceeded up to 35 days in a calendar year,
- calendar year – limit value for concentration of PM10 particulate matter in ambient air is 40 $\mu g/m^3$.

The issue of exceedances of 24-hour concentrations of PM10 particulate matter exists not only in Poland, but also in other European countries (Fig. 5.1.7.).

- non-reporting countries
- no data for designated zones
- areas were not designated
- missing geospatial information for the zone
- < = limit value
- > limit value

Fig. 5.1.7. Classification of zones in the EU for exceedances of 24-hour PM10 particulate matter concentrations in 2007 (source: EEA)

Based on average annual PM10 concentrations in 2008, 150 zones were classified into class A (ca. 88% of all zones) and 20 zones (ca. 12%) - to class C.

The number of zones classified into class C as a result of the assessment for 2008 based on 24-hour concentrations of particulate matter is more than three times higher than the number of zones obtained on the basis of average annual concentrations. Similar proportions were also recorded in the previous years. They are a result of problems with meeting the strict standard for 24-hour PM10 concentrations.

In the years 2001-2008, PM10 measurement results from selected sampling points in agglomerations showed decreases and increases in annual mean concentrations. From 2004 to 2006, at most of the considered stations, an upwards trend for PM10 concentrations was recorded. In 2006, the annual average concentration at the considered stations were the highest in the period under analysis. High concentration of particulate matter in 2006 was , however, connected to very unfavourable meteorological conditions in the winter season that year. In 2007, annual mean concentration of PM10 was significantly lower than in the previous year. Falls in the annual mean concentrations occurred at all stations covered by the analysis. Lower concentrations in 2007 were the result of better meteorological conditions in the cool season of 2007 in relation to the previous year. In January and February 2007, there took place no significant falls in air temperature (stimulating emission of particulate matter related to heating) as in January 2006, nor did there occur long-lasting inversion conditions contributing to accumulation of pollutants at the ground-level. In 2008, annual average PM10 particulate matter concentrations were close to the values from the previous year at most analysed stations, while the greatest fall was recorded at the station in Gdańsk (Fig. 5.1.8).

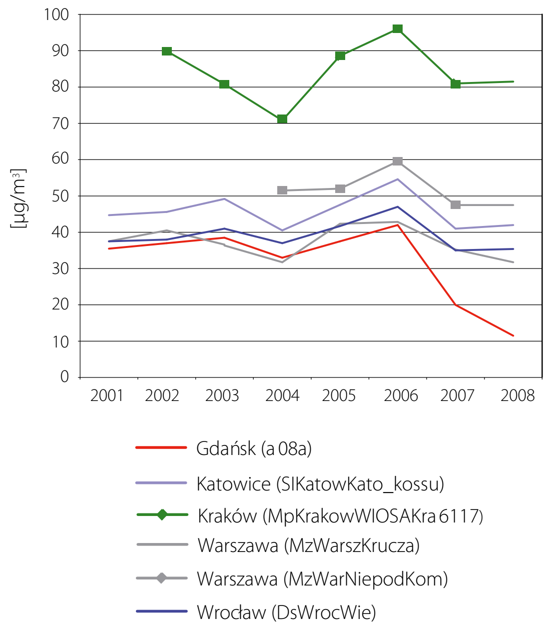

Fig. 5.1.8. Annual mean concentration of PM10 particulate matter in the years 2001-2008 at selected stations in agglomerations in Poland (source: CIEP/SEM)

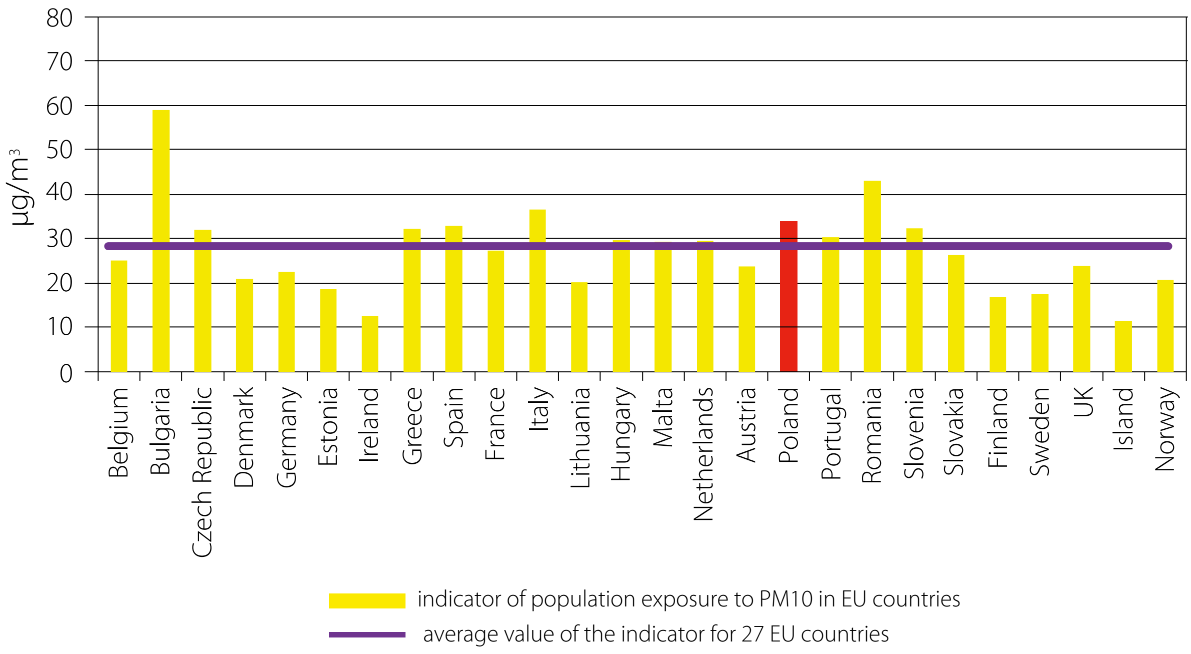

Fig. 5.1.9. Indicator: Urban population exposure to air pollution by particles calculated as annual mean concentration of PM10 particulate matter at urban background locations in agglomerations of the EU in 2007 (source: Eurostat, based on SEM data submitted to the AirBase)

Analyses of the EU indicator: "Urban population exposure to air pollution by particles based on annual mean concentration of PM10 particulate matter" demonstrated that the share of population exposed in Poland exceeded the European average in 2007 (Fig. 5.1.9.).

The indicator of population exposure to PM10 particulate matter at urban background stations in Polish agglomerations over the years 1999-2007 reached the lowest value for 2007 (Fig. 5.1.10.).

Air pollutants important for their negative health effects include also compounds from the group of polycyclic aromatic hydrocarbons (PAHs). Scientific evidence shows that the compounds have cancerous and mutagenic properties. Benzo(a)pyrene identified in PM10 particulate matter is used as an indicator for PAHs in the air quality assessment.

Ambient air quality assessment for 2008 in terms of benzo(a)pyrene demonstrated that, of the 170 zones covered by assessment, 94 were classified in class A (about 55% of all zones). As many as 76 zones (almost 45%) were classified into class C. All zones in the following voivodeships were assigned to that class: Mazowieckie and Śląskie and most of zones in the Małopolskie, Podkarpackie and Kujawsko-Pomorskie voivodeships. Such a high number of zones classified into class C is related to very low and hard to meet target value determined for benzo(a)pyrene[17] and household fuel use patterns (Fig. 5.1.11.).

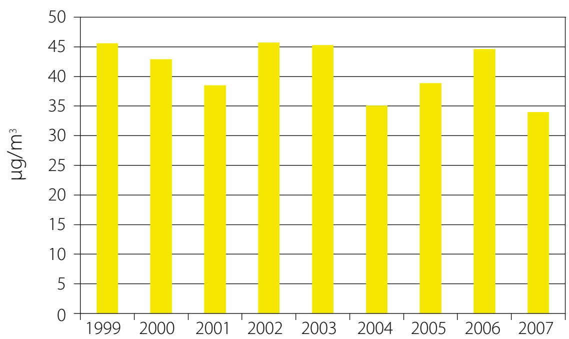

Fig. 5.1.10. Indicator: Urban population exposure to air pollution by particles calculated as population weighed annual mean concentration of PM10 particular matter measured at urban background stations in agglomerations in Poland in the years 1999-2007 (source: Eurostat, based on SEM data submitted to the AirBase)

[17] Zones in Poland are classified in accordance with the Regulation of the Minister of the Environment of 6 March 2008 on zones, in which air quality is assessed, where for class A concentration do not exceed the target value, and the concentration exceed the target value for class C. For the averaging period amounting to a calendar year – the target value of benzo(a)pyrene in ambient air is 1 ng/m³.

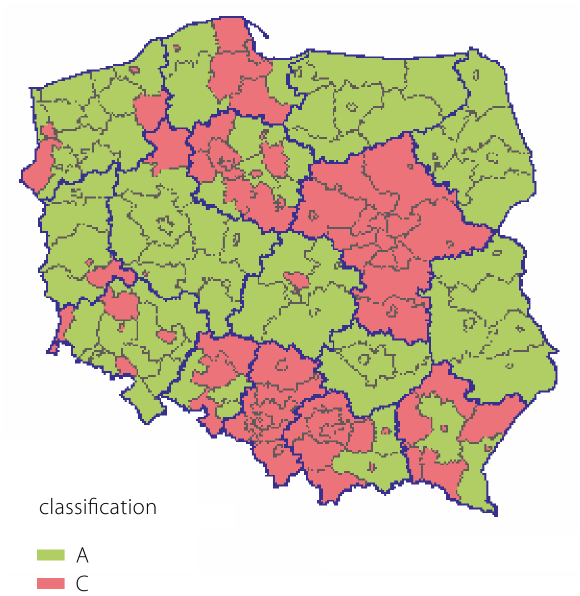

Fig. 5.1.11. Classification of zones in Poland for benzo(a)pyrene on the basis of annual ambient air quality assessment for 2008 (human health protection) (source: CIEP/SEM)

What is an important indicator of the degree of pollution of ambient air is the quality of precipitation, which is one of the meteorological elements gathering and transporting pollutants, thus affecting ecosystems by the processes of eutrophication and acidifiaction of soil and water. The processes, are related to the presence of such substances in the air as: sulphur dioxide, nitrogen oxides, ammonia and their deposition to the ground.

Precipitation is the source of minerals coming not only directly from the atmosphere, but also rinsed from the surface of plants and other objects. It must be borne in mind though that concentrations of particular substances depend on many factors, such as: duration of precipitation, intensity of precipitation or the duration of precipitation-free period preceding precipitation.

Results of the study on chemical composition precipitation and deposition of pollutants to the ground in Poland, carried out over the last 10 years, reveal gradual diminishing of the deposition of some pollutants to the ground. The process is perceptible in relation to the deposition of sulphates. At the same time, in the case of pollutants causing eutrophication, lack of such a tendency should be noted (Fig. 5.1.12.).

The recorded downwards trend in acidification of precipitation, expressed by the growth of the pH value of precipitation, is an effect of gradual reduction of emission of acidifying pollutants to the atmosphere at the scale of the continent, which leads to gradual lowering of the concentrations of those pollutants in the atmosphere (Fig. 5.1.13.).

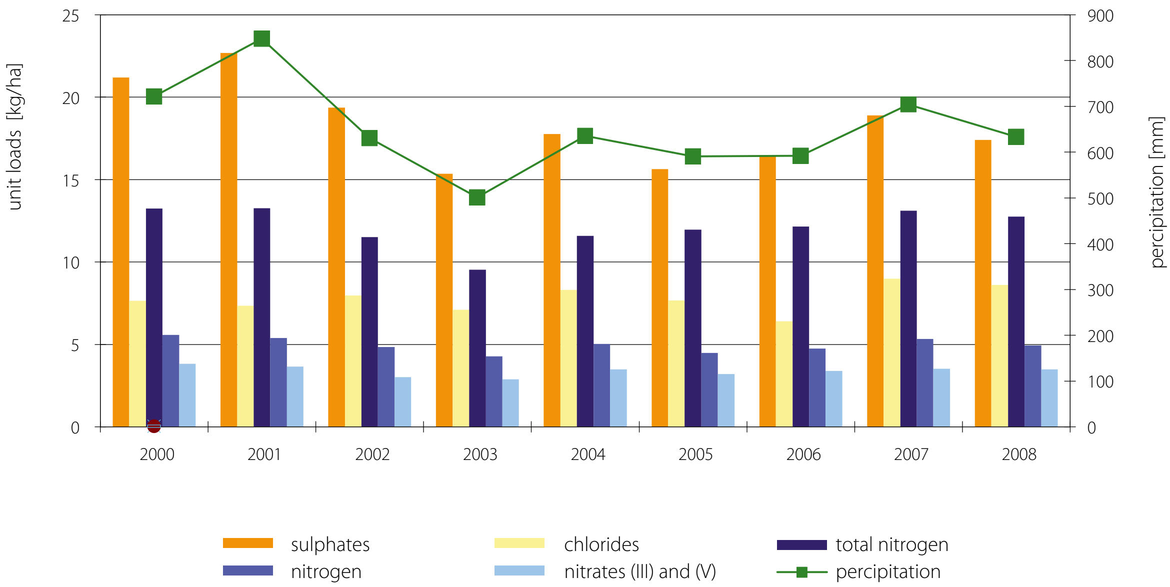

Fig. 5.1.12. Deposition of substances introduced with precipitation to the area of Poland in the years 2000-2008 against the average annual precipitation (source: CIEP/SEM)

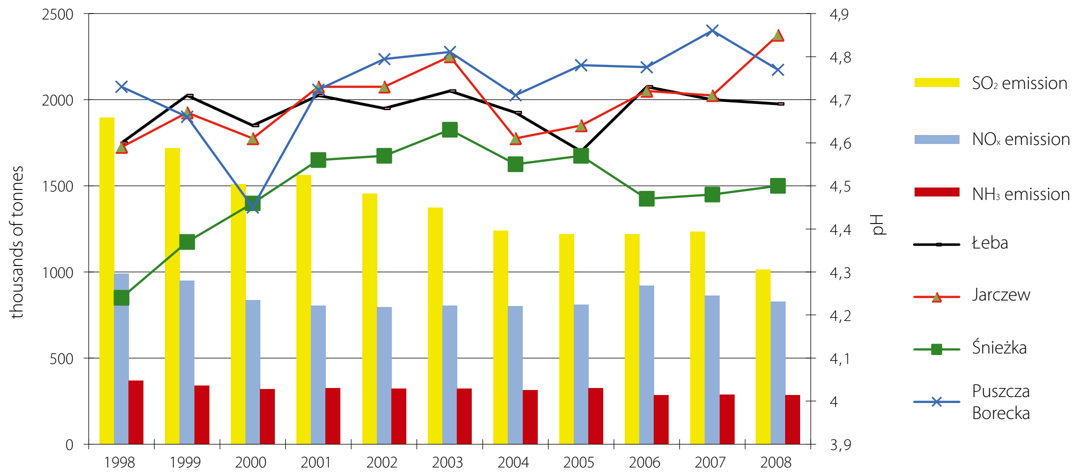

Fig. 5.1.13. Annual average pH of precipitation in Poland for background measurement stations against the emission volumes of SO_2, NO_x, NH_3 in the years 1998-2008[18] (source: ME and CIEP/SEM)

The state of ambient air in Poland depends mostly on the values and spatial distribution of emissions from fixed and mobile sources, after consideration of transboundary flows and physical and chemical transformations taking place in the atmosphere. The processes affect both the formation of the so-called pollution background, which is the result of establishment of dynamic balance at a greater distance from the emission sources, as well as the occurrence of increased concentrations in the area under direct impact of emitters.

In the 1990s and in the first years of the 21st century, there was recorded a gradual fall in emissions of all basic air pollutants in Poland, in particular the emissions of sulphur dioxide and nitrogen oxides dropped significantly. The decrease was highly related to the restructuring or modernisation of the energy and industrial sectors and an improvement in the quality of coal.

Since 2003, emissions of most of pollutants have remained at a similar level or, as in the case of sulphur dioxide, the emissions have been becoming smaller and smaller from year to year, but the fall has not been as significant as in the 1990s (Fig. 5.1.14.).

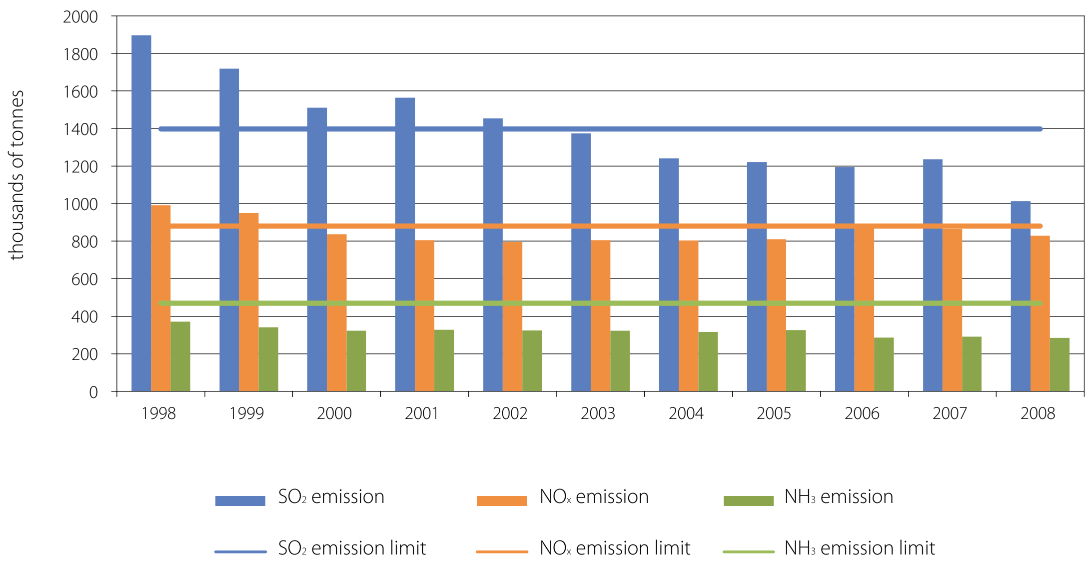

Fig. 5.1.14. Emission volumes of SO_2, NO_x, NH_3 against national emission limits of the substances stated in the Treaty of Accession of the Republic of Poland to the European Union, in the scope of directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants (source: ME)

[18] Data concerning emissions in 2008 are preliminary data.

The structure of emissions of pollutants in Poland is a derivative of the structure of use and quality of fuels. These factors determine the degree of air pollution. What influences the volume of emissions are the production processes in the energy sector and fuel use patterns in the municipal-housing sector (Fig. 5.1.15. and 5.1.16.).

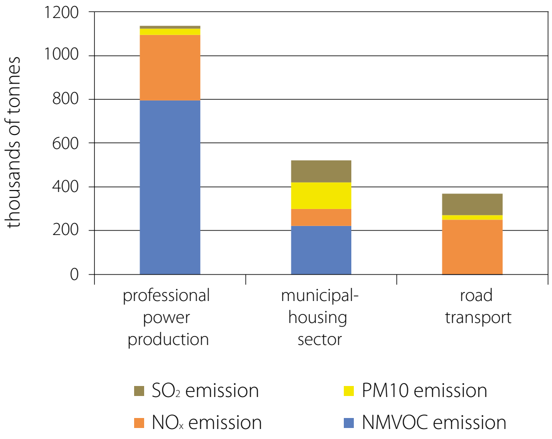

Fig. 5.1.15. Emissions of major pollutants by sector: Poland 2007 (source: ME)

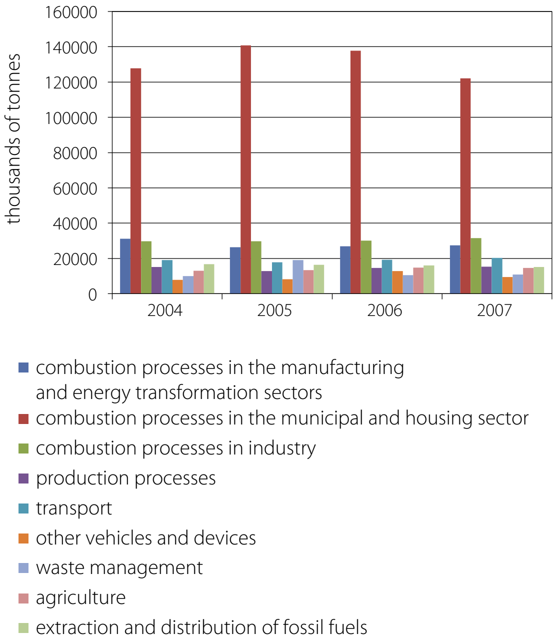

Fig. 5.1.16. Emissions of primary particulate matter PM10 by sector: Poland 2000-2007 (source: ME)

What is the main cause of emission of gases and particles to the atmosphere is the lack of significant changes in the patterns of use of energy carriers in Poland. Hard coal still remains the basic primary energy carrier in the Polish economy (51% of non-renewable energy) (Fig. 5.1.17.).

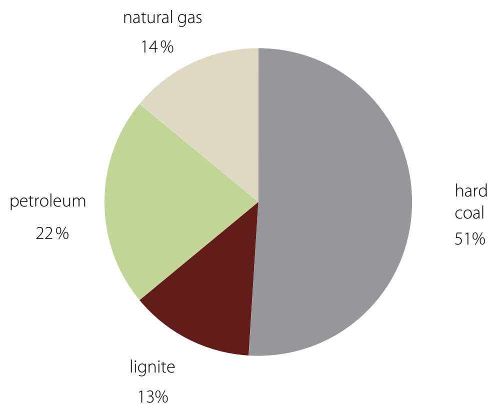

Fig. 5.1.17. Use of primary energy carriers in Poland in 2007 (source: ME)

It is a well-known fact that, to ensure protection of ambient air against excessive pollution, measures concerning rational modification of at least those production processes which produce the most burdensome pollutants are necessary.

To protect human health and protect vegetation, there have been established in Poland numerous instruments to reduce emissions of pollutants to ambient air which are to help achieve good air quality. The most important of them are: permits for introduction of gases and particles to ambient air, integrated permits, standards for emission from installations, fuel quality standards. Furthermore, the share of energy from renewable sources in the total energy production is being gradually increased and the energy-consumption of the Polish economy is being decreased (Fig. 3.6.).

Considering the current state of air pollution in Poland and the necessity to meet ambient air quality standards established in the Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, Poland is facing the task of implementation of many measures aimed at ambient air quality improvement. The basic regulation of the Directive is the introduction of new air quality standards concerning fine particles (PM2.5) in ambient air and verification and consolidation of existing EU acts in the scope of air protection. It also introduces new mechanisms concerning air quality management in zones and agglomerations.

It is worth emphasising that the systematic development of the Polish economy in the period of the last two decades, expressed by the growth of the GDP, does not lead to increased air emissions of pollutants. It is an effect of more common application of pro-environmental technologies in the industry, the energy and transport sectors (Fig. 5.1.18.).

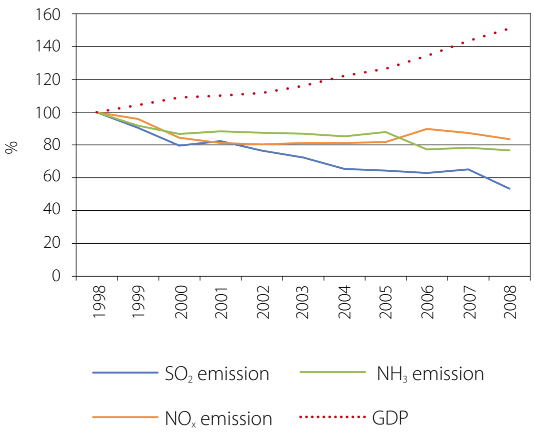

Fig. 5.1.18. Changes in the emission of the basic gaseous air pollutants against changes in the GDP in Poland in the years 1998-2008[19] with the assumption that the emission volumes in 1998 = 100 % (source: ME/CSO)

During the last decade, the number of vehicles in Poland rose by ca. 6.5 million, which, however, did not find expression in increased emissions of pollutants from that sector (Fig. 5.1.19.). It is caused by gradual increase in the share of passenger cars and lorries meeting the EURO standards. However, it must be borne in mind that the EURO standards coming into force concern new vehicles, which, due to their high technological advancement as well as good technical condition, are characterised by low levels of emission of toxic components of exhaustion fumes.

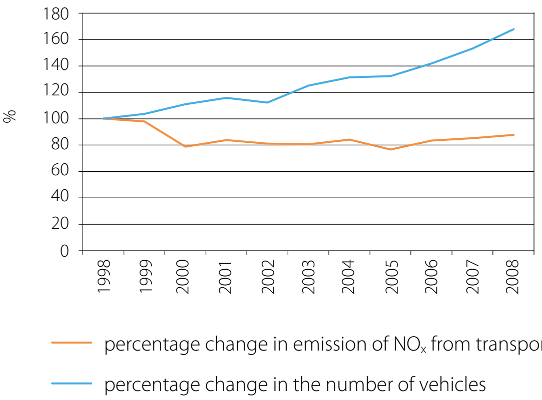

Fig. 5.1.19. Change in the emission of NO_x from road transport in Poland in the years 1998-2008[20] in relation to the change in the number of vehicles, assuming that the volume of emissions of NO_x in 1998 = 100 % (source: ME/CSO)

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The impact of air pollutants on the environment is an especially important issue with respect to the general commonness of the phenomenon, the volumes of emitted pollutants, the wide scope of impact, as well as due to the fact that the pollutants affect other elements of the environment. The significant adverse effect of pollution of the environment on human health cannot be omitted. Taking the above into consideration, it must be stressed that to protect ambient air synergy of actions within many policies and sectors, both at a local and global scale, is necessary. It is particularly important to ensure cohesion of actions aimed at air protection with actions aimed at counteracting climate change, since not all measures contributing to climate protection lead to improvement of air quality (e.g. burning biomass).

At a regional and local scale, implementation of air protection programmes is of great importance for air quality, and their development, pursuant to the Environmental Protection Law Act, is the responsibility of marshals of voivodeships. The programmes should contribute to permanent and systematic air quality improvement through actions undertaken under implementation of sustainable development of regions.

Taking into account the current state of air pollution in Poland and the necessity to meet air quality standards established by Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe and the limits of emissions of certain pollutants into the air from large combustion plants, Poland is facing the task of implementation of many measures aimed at ambient air quality improvement.

19 Data concerning emissions in 2008 are preliminary data.
20 Data concerning emissions in 2008 are preliminary data.

V.2. Water quality

Life in all its forms and human health are dependant on the availability of water of appropriate quality and in appropriate quantity. Water (in particular fresh water) resources, characterised by high quality, are an necessary element for the development of ecosystems, increase of tourist attractiveness of a region, which in turn is reflected in the development of some branches of the economy and affects the civilisation development of a country, being at the same time a factor that determines the standard of living of a society to a high extent.

Low water quality limits the possibility of its application for particular purposes, including for the needs of industry, tourism and supplying the population with water for consumption, which generates additional costs for the whole sectors of the national economy. It pertains both to inland and marine waters.

Poland is distinguished by relatively small water resources to ca. 1500 m^3/year/capita and a high population and varied state of urbanisation and management of the area. National water resources per capita are low and constitute just about 36% of the European average. The state of water resources results in difficulties with water supply in some areas of Poland. The mining and processing industries are concentrated in southern Poland and are characterised by a significant impact on water quality and water management of that region and the whole country. The water-intensive industry and development of demographic processes, as well as natural geographic and hydrographic conditions lead to the occurrence of serious water deficiencies. In the southern part of Poland, there also exists a significant variability of water flow in rivers during heavy rain and the movement of large volumes of flooding water constituting, among others, runoff from the mountains. All the factors make reasonable water management difficult, and the relatively small retention volume of artificial reservoirs does not allow artificial elimination of the problems arising from periodical surpluses and deficits of surface waters. What is the basic problem in the scope of supplying population with water is the small availability of water of high quality, whereas due to the clear decrease in consumption from industry and households, the problems with quantity have become much less important.

5.2.1. Rivers, lakes and groundwater

The basic environmental objectives with reference to waters is maintenance or improvement of water quality, the biological relations in the water environment and on wetlands, so as to:

a) for surface water bodies, avoid adverse changes to their environmental and chemical status (or the environmental potential and the chemical status in the case of artificial and heavily modified water bodies) and achieve or maintain the good ecological status (or environmental potential) and chemical status;

b) for groundwater bodies, avoid adverse changes to their quantitative and chemical status, reverse significant and persistent upwards tendencies with reference to pollution caused by human activity, ensure the balance between the extraction and recharging of groundwater and maintain or achieve a good quantitative and chemical status.

Implementing the above objectives, one should ensure that the waters, depending on the needs, are fit in particular for:

1) supplying population with water for consumption;

2) recreation and water sports;

3) habitation of fish and other water organisms in natural conditions, enabling their migration.

extract from Article 38 of the Water Law Act on 18 July 2001

Status of surface waters

The status of surface waters is assessed by comparison of the monitoring results with criteria expressed as threshold values of water quality indicators[21]. The overall status incorporates the ecological status (which includes biological elements and physicochemical and hydromorphological elements as supporting indicators) and the chemical status (assessed on the basis of chemical indicators, characterised by the occurrence of hazardous substances to the water environment, including the so-called priority substances).

The ecological status is determined for water bodies, constituting the basic unit in water management, while the term ecological status is applied for natural water bodies, and in the case of artificial or heavily modified water bodies – ecological potential. Ecological status and ecological potential are classified by assigning a water body to one of five water quality classes.[22]

Three types of monitoring of surface waters have been carried out since 2007: surveillance monitoring (aimed at establishing the status of surface water bodies, determination of the types and assessment of the intensity of significant influence resulting from human activity, performing assessments of long-term changes in the status of surface water bodies in natural conditions and performing assessments of long-term changes in the status of surface waters bodies in the conditions of broadly understood influences resulting from human activity), operational monitoring (carried out to establish the status of surface water bodies, which has been identified as endangered with failure to meet the environmental objectives set for them and water bodies, for which a specific usage goal has been established, as well as making an assessment of the changes in the status of surface waters resulting from implementation of action plans) and investigative monitoring (undertaken on an *ad hoc* basis, among others, to determine the size and influences of accidental pollution or establish the causes of clear discrepancies between the results of the assessment of the ecological status on the basis of biological and physicochemical quality elements).

Due to the implementation of a new system of water status assessment, changing not only the method of assessment, but also the threshold values for particular indicators and introducing the principle of annual assessment of a different group of water bodies (so as to assess all water bodies in Poland during a six-year water management cycle), it is impossible to compare the assessments of the years 2007 and 2008 with prior assessments. It is also not possible, on the basis of the results from the two years, to make conclusions concerning tendencies in the changes in water quality, since different surface water bodies and groundwater bodies were evaluated.

In 2007, of 267 river water bodies covered by assessment, on the basis of the results of surveillance monitoring, only 6 (2.2%) achieved the very good status, thus met the requirements set of class II. Most of the assessed river water bodies (73.8%) were assigned to class III, thus their ecological status was moderate. Of the 181 river water bodies covered by surveillance monitoring in 2008, 23 (12.7%) were classified as parts, whose ecological status was good or very good (Fig. 5.2.1.).

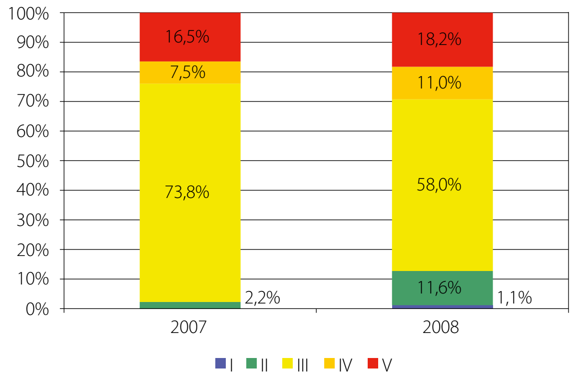


Fig. 5.2.1. Classification of the ecological status of river water bodies covered by surveillance monitoring in the years 2007-2008 (source: CIEP/SEM)

[21] Regulation of the Minister of the Environment of 20 August 2008 on the method of classification of the status of surface water bodies.

[22] Class I – very good ecological status, class II – good ecological status, class III – moderate ecological status, class IV – poor ecological status, class V – bad ecological status.

The assessment of water bodies of flowing artificial waters and highly modified water bodies covered by surveillance monitoring in the years 2007 and 2008 was very similar. In 2007, more than 66% of them were assigned to class III, thus were of moderate ecological potential, 30% – poor or bad potential and less than 4% achieved good potential and above. In 2008, 5.5% of the examined water bodies from that category met the environmental objective, thus represented good ecological potential and above.

In general, it can be concluded that the results of surveillance monitoring, after the first two years of functioning of the new monitoring system and water status classification indicate that 6.5% of bodies of flowing waters meet the identified environmental objective, thus achieve the good or very good ecological status (Table 5.2.1.). The assessment results of ecological potential of artificial and heavily modified water bodies are comparable: about 4.5% of water bodies covered by monitoring meet the environmental objectives (Table 5.2.2.).

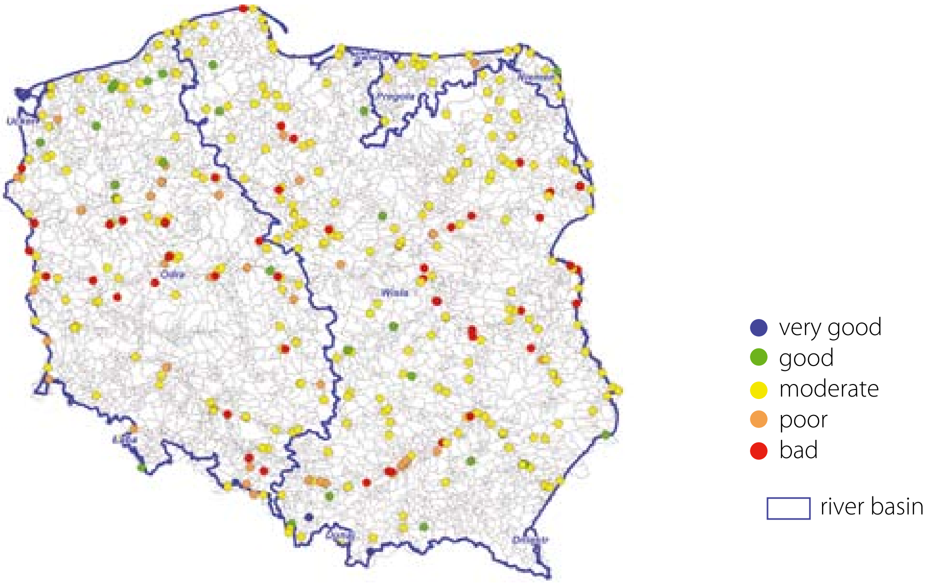


Fig. 5.2.2. Classification of the ecological status of river water bodies in the years 2007-2008; surveillance monitoring (source: CIEP/SEM)

Table 5.2.1. Classification of the ecological status of river water bodies covered by surveillance monitoring in 2007 and 2008 (source: CIEP/SEM)

status	Vistula	Odra	Dniepr	Dunaj	Jarft	Łaba	Niemen	Pregoła	Świeża	Ucker	total
very good	2										2
good	15	10				1	1				27
moderate	187	96		2		1	6	10			302
poor	17	22						5			44
bad	36	36					1				73
TOTAL	257	164		2		2	8	15			448

Table 5.2.2.Classification of the ecological potential of artificial and highly modified river water bodies covered by surveillance monitoring in 2007 and 2008 (source: CIEP/SEM)

status	Vistula	Odra	Dniepr	Dunaj	Jarft	Łaba	Niemen	Pregoła	Świeża	Ucker	total
good and above	2	4									6
moderate	46	39									85
poor	10	3									13
bad	11	17									28
TOTAL	69	63									132

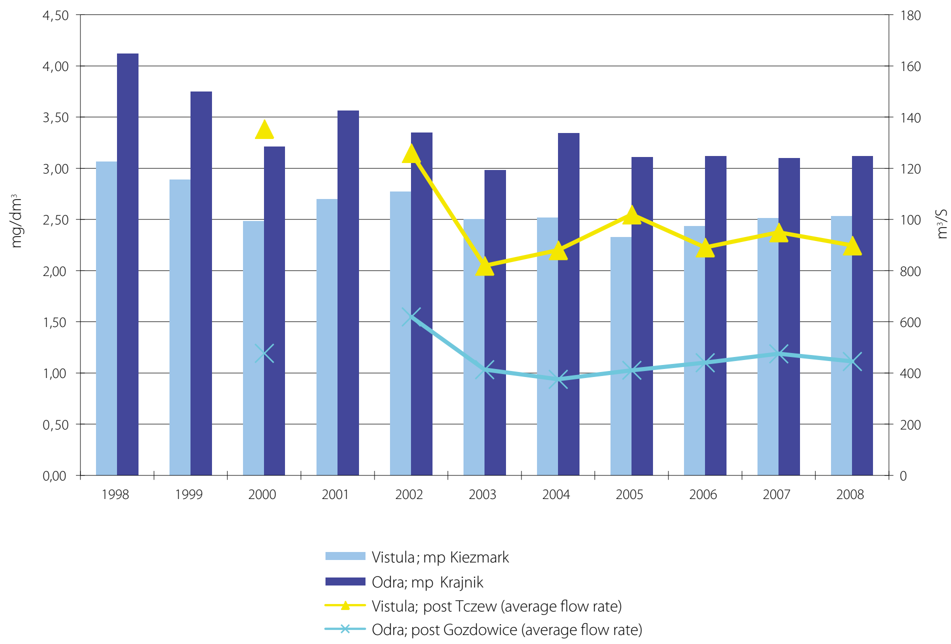


Fig. 5.2.3. Average concentration of total nitrogen at monitoring points Vistula Kiezmark and Odra Krajnik Dolny against average flow rates in the years 1998-2008 (source: CIEP/SEM)

Beside regular monitoring measurements and the results of classification of the status of waters, also the data concerning concentrations of pollutants transported by rivers from the territory of Poland to the Baltic Sea are a source of information on their quality (see: the part of this chapter concerning the Baltic). The results obtained for nitrogen suggest that its concentration in the last three years has remained at a relatively stable level, much lower than at the end of the 1990s, with simultaneous fall in the medium flows (Fig. 5.2.3.). Also the significant drop in the size of BOD5, phosphorus and nitrogen transported from Poland to the Baltic Sea in comparison to 1998 leads to the conclusion about an improvement of the status of the rivers in the scope of physicochemical elements. The value of the load of BOD5 decreased by 45% in 2008 compared to 1998.

In 2008, there was performed, based on the data from the years 2004-2007, the water eutrophication assessment. The assessment was carried out on the basis of results from monitoring obtained for biological elements (chlorophyll "a", phytobenthos or macrophytes) and physicochemical elements (indicators characterising the nutrients conditions, oxygen conditions and organic pollutants), whereas the choice of biological indicators for eutrophication assessment depended on the abiotic type of the river, where the monitoring point was located. The assessment was carried out on the basis of the provisions of Regulation of the Minister of the Environment of 20 August 2008 on the method of classification of the status of surface water bodies, and it was performed for monitoring point and not for a water bodies. A monitoring point was considered eutrophic if one or more indicators taken into account exceeded the threshold value determined for class II (good status).

The eutrophication assessment of flowing waters performed in this way indicates that the phenomenon concerns ca. 62% of watercourses (of 3268 monitoring points, from which data were included in the assessment, eutrophication was identified in 2016 points) (Fig. 5.2.4.).

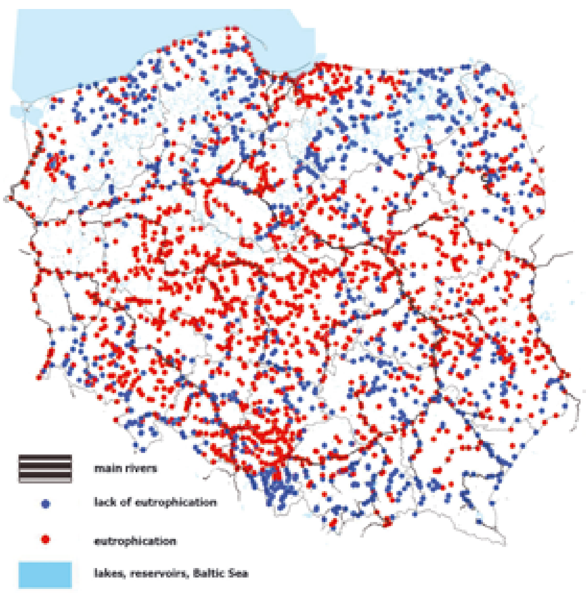


Fig. 5.2.4. Eutrophication assessment based on data from the years 2004-2007 (source: CIEP/SEM)

Until the end of the process of intercalibration of methodologies of assessment of the status of waters (for biological elements) that is being carried out in the European Union, thanks to which the concept of „good status" shall be unified for the whole European Union, comparison of their quality at the international scale is possible only on the basis of the indicators developed by the European Environment Agency (EEA). They include percentage listing of monitoring points in ranges of the identified nitrate concentrations (Fig. 5.2.5.). Poland, where concentrations exceeding the threshold value, above which eutrophication occurs (according to the Regulation of the Minister of the Environment[23] the value is 10 mg NO_3/l), were recorded at only 5% of monitoring points examined in 2005 (results from which are transferred to the EEA), occupies a position in the middle of the list[24].

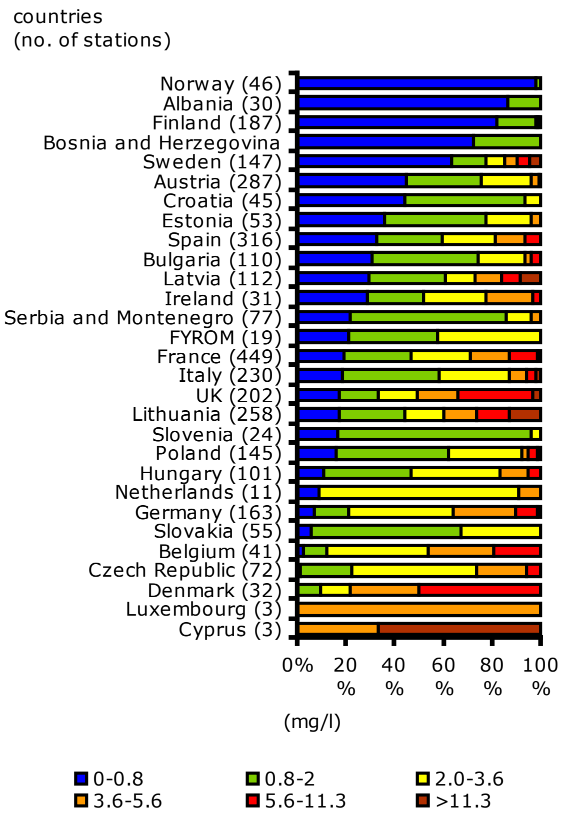


Fig. 5.2.5. Share of monitoring points on rivers in 2005 in the ranges of concentrations of NO_3 (mg/l) (data for Denmark of 2004; Bosnia and Herzegovina – 33 mp) (source: EEA, CSI 020)

Polish lakes are generally eutrophic. About half of them are characterised by morphometric and hydrographic features and geomorphological conditions that contribute to the natural aging process of lakes. It means that the eutrophic state is a natural state for many Polish lakes. The state of purity of lake waters is obviously determined not only by natural features, but also the diverse anthropogenic pressure, and, most of all, the delivery of biogenes from point and area sources, deepening and speeding up water eutrophication (also natural eutrophication). In addition, degradation of lakes and related ecosystems may be a result of implementation of improper environmental policy.

In total, 208 lakes were tested and assessed in the years 2007-2008, biological indicators were mostly taken into consideration during the assessment. Lakes with very good and good status, of which there were 98, accounted for 47.1% of the total number of lakes covered by monitoring in the period under consideration (Fig. 5.2.6.). However, with reference to the total surface area of the lakes and the volume of their water, there were much less of them, that is 32.1% and 35.3% respectively. In terms of the number of lakes, the greatest share was accounted for by lakes with good status, which account for 31.7% of the number of tested bodies of water and 24.5% of the volume of their water. It should be remembered, however, that the above assessment was carried out according to the expert judgement, in some cases diverting from the criteria determined in the Regulation of the Minister of the Environment of 20 August 2008 on the method of classification of the status of surface water bodies.

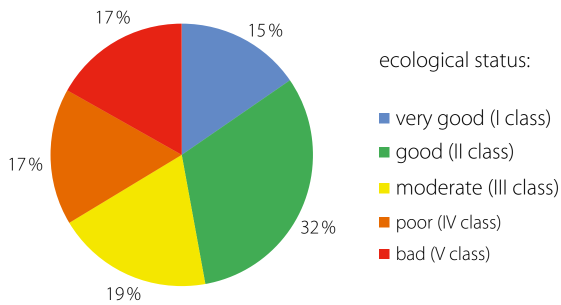


Fig. 5.2.6. Collective results of classification of lakes covered by monitoring in the years 2007-2008 by ecological status (source: CIEP/SEM)

23 Regulation of the Minister of the Environment of 23 December 2002 on the criteria of identification of waters vulnerable to pollution with nitrogen compounds from agricultural sources.

24 The result shall be treated as a pessimistic option, since due to the adopted ranges (5.6-11.3 and >11.3 mg NO_3/l) it is not possible to calculate precisely in how many of the monitoring points nitrates concentrations exceeded 10 mg NO_3/l).

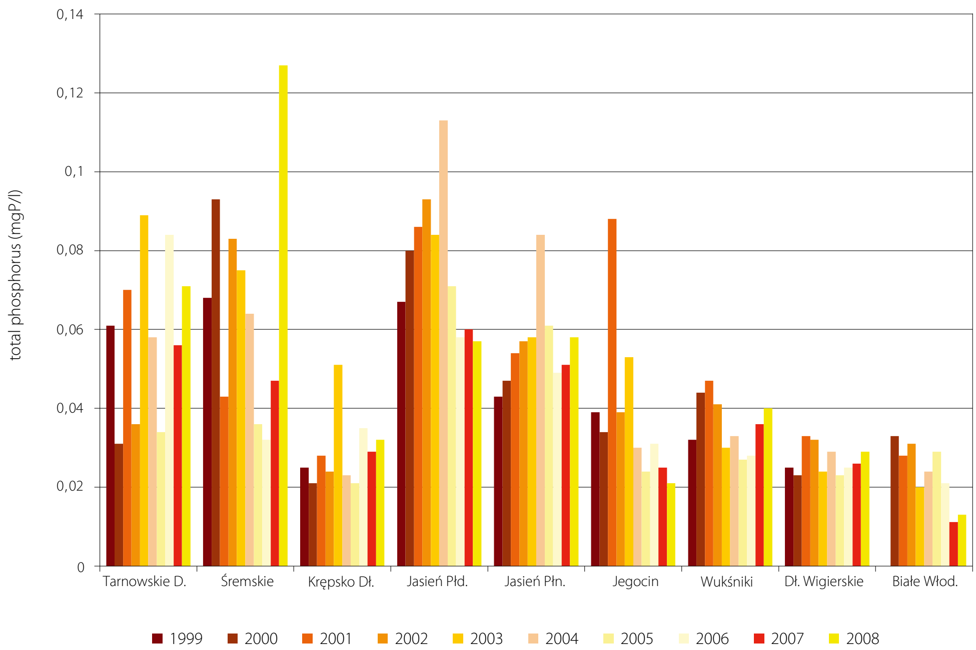


Fig. 5.2.7. Changes to the concentration of total phosphorus in the water of lakes covered by monitoring in the years 1999-2008 (source: CIEP/SEM)

The lakes in the Vistula river basin are characterised by a much better status. Almost 56% of lakes were assigned the good and very good ecological status there. In the Odra river basin, such bodies accounted for just 31%. Lakes in the drainage basin of Pregoła were characterised by varied status, but the general number of lakes covered by monitoring was too small there to make a reliable comparison. The same applies to the examined lakes in the Niemen river basin, although all monitored lakes represent very good and good status.

The observed diversity of the quality of lake water between the drainage basins results to a high extent (but not exclusively) from natural conditions. Water bodies may represent a wide range of background (referential) concentrations of nutrients, which depend mostly on the geological conditions of the basin. And so, for example, high concentrations of nutrients compounds, which are not related to adverse changes to biological elements, do not have to testify to moderate or worse ecological status. Thus, assessment of the ecological status focuses

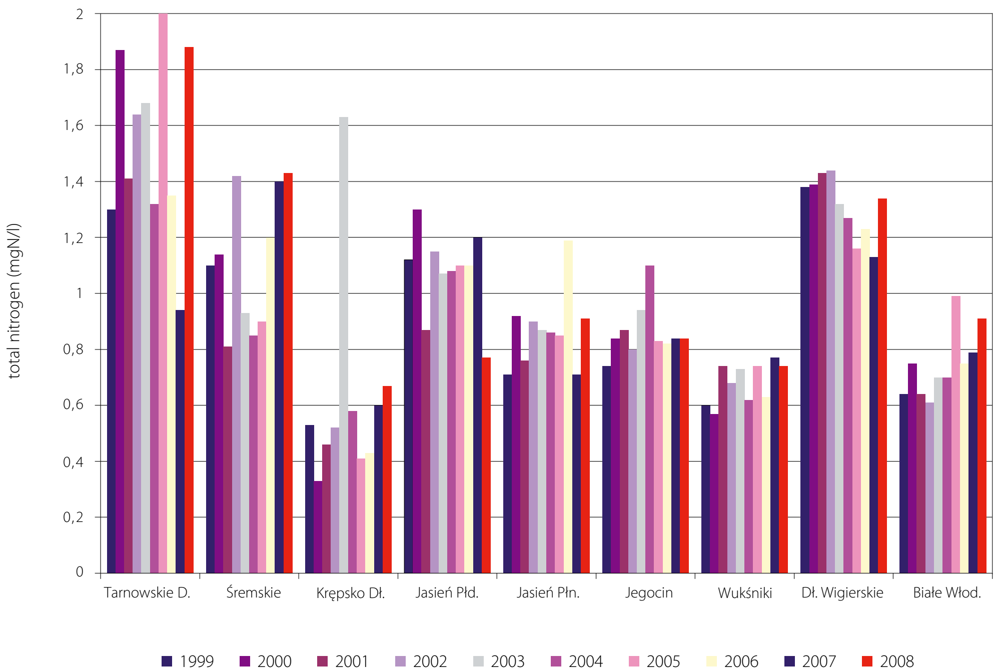


Fig. 5.2.8. Changes to the concentration of total nitrogen in the water of lakes covered by monitoring in the years 1999-2008 (source: CIEP/SEM)

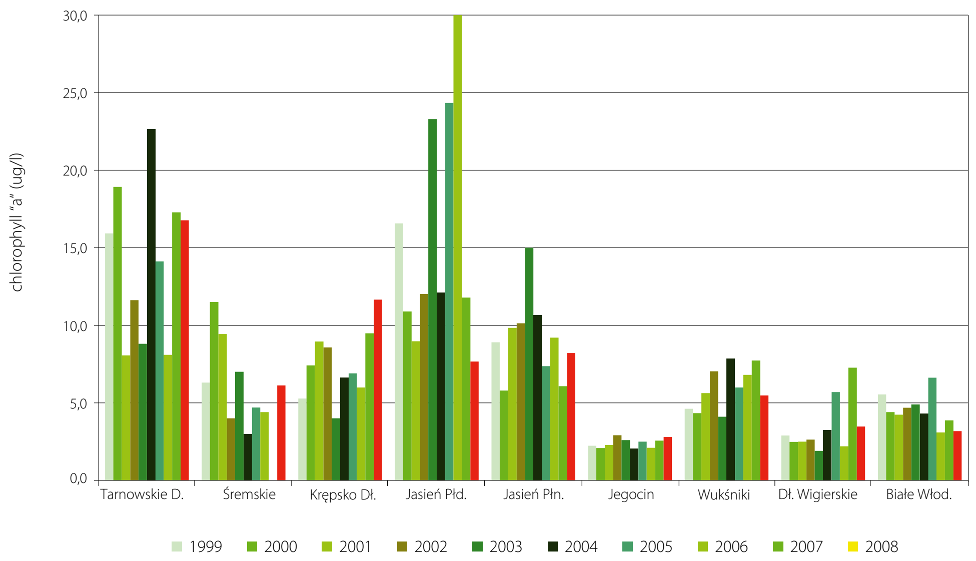


Fig. 5.2.9. Changes to the concentration of chlorophyll "a" in the water of lakes covered by monitoring in the years 1999-2008 (source: CIEP/SEM)

on biological effects of the pressure, and the thresholds defined for particular status account for the natural conditions characteristic for a given lake (its type).

An analysis of long-term trends could be carried out only for lakes tested for more than two years, that is 9 lakes of the former fundamental monitoring network (covering lakes subject to slight pressure), examined since 1999. For the lakes, there were performed analyses of the changes to the state of their waters in the years 1999-2008. On that ground, it was established that the values of the basic eutrophication parameters (phosphorus and total nitrogen concentrations, concentration of chlorophyll and water transparency), although they show some variability from year to year, remain at a constant level (whereas in the case of chlorophyll, while the data for 2007 and 2008 are not comparable with the previous data due to the implemented new sampling methodology).

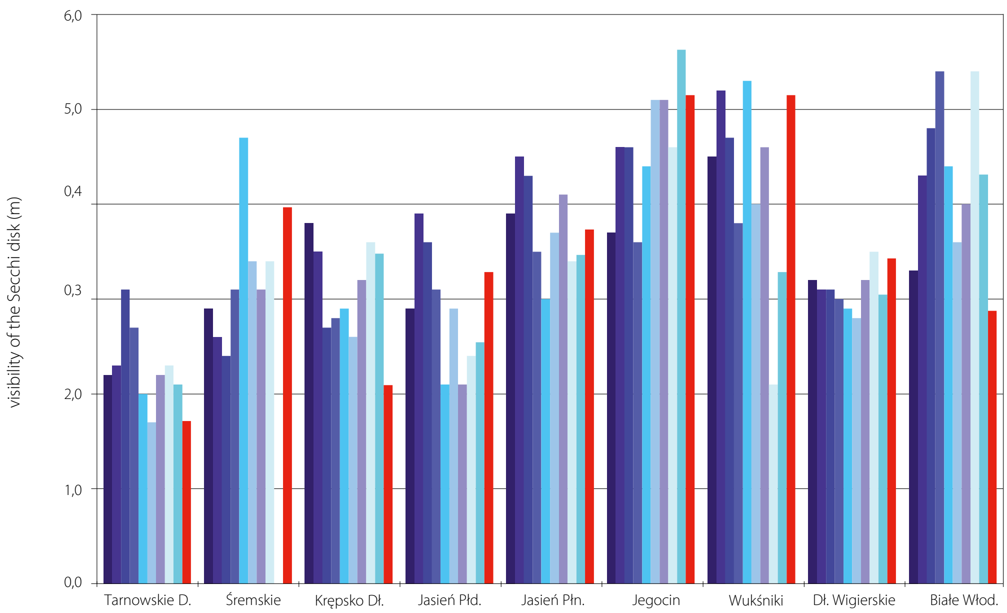


Fig. 5.2.10. Changes of transparency of the water of lakes covered by monitoring in the years 1999-2008 (source: CIEP/SEM)

In 2008, there was performed the lake water eutrophication assessment on the basis of data from the years 2004-2007. What was the basis for determination of eutrophication of waters were average values of the results of examinations of the following indicators – chlorophyll "a", total phosphorus, total nitrogen, visibility of the Secchi disk and the result of the examination of macrophytes (the Ecological State Macrophyte Index – ESMI). The assessment was carried out on the basis of the provisions of the Regulation of the Minister of the Environment of 20 August 2008 on the method of classification of the status of surface water bodies, whereas if several posts were located on a lake, one average value for the whole lake was calculated. If, in the period under analysis, a lake was tested more than once, the results coming from various years was also averaged. A lake was deemed as eutrophic if one or more indicators taken into consideration exceeded the threshold value determined for class II (good status), although in some cases exceedance of the thresholds of one indicator was not the determining factor in the general assessment, there was also taken into account the general character of the natural conditions of the lake, anthropogenic and biological factors. Assessment of eutrophication of the lake waters indicated the occurrence of that phenomenon in 268 of 432 water bodies, thus a percentage similar to that in the case of flowing waters, which amounts to ca. 62% (Fig. 5.2.11.).

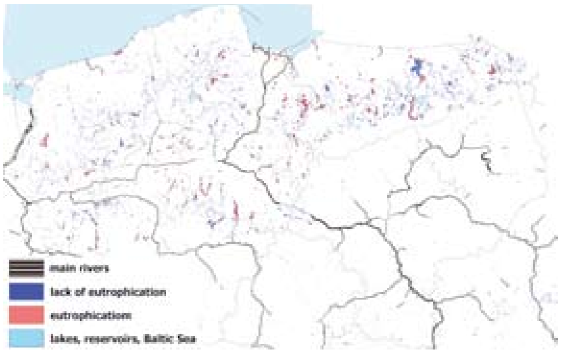


Fig. 5.2.11. Results of lakes eutrophication assessment in the basis of data from the years 2004-2007 (source: CIEP/SEM)

Status of groundwater

The assessment of the groundwater quality, carried out on the basis of the results of studies performed in 2007, presents a slightly different picture in comparison to the results of previous assessments due to the fact that the national measurement network of the groundwater monitoring has been modified in 2006 with the view to adjust it to the requirements of the Water Framework Directive and owing to the method of the groundwater quality classification[25]. In relation to the implementation of the new water monitoring and classification system, it is not possible to make comparisons to the results from previous years.

It results from the examination of the groundwater quality carried out in 2007 in the measurement points that good chemical status of groundwater (classes I, II, III) was established in ca. 80% of the examined points, whereas ca. 20% points were characterised by poor chemical status (class IV, V) (Table 5.2.3.) (Fig. 5.2.12.).

Furthermore, beside the assessment of the quality classes at particular measurement points, assessment in terms of the chemical and quantitative status was performed for the first time with reference to 161 groundwater bodies designated in Poland.

The results of the assessment of the chemical status of groundwater bodies (GWB) indicate that the chemical status is poor only in the case of 11 (out of 161), the area of which equals 11 687 km^2 (accounting for ca. 9.5% of the area of the country) (Fig. 5.2.13.). As regards quantitative assessment, it showed that 15 GWBs (occupying the area of 6 960.1 km^2, accounting for ca. 4.2% of Poland) are characterised by poor quantitative status (Fig. 5.2.14.).

Tab. 5.2.3. Results of the examination of the groundwater quality at measurement points of the national groundwater monitoring network under operational monitoring and surveillance monitoring in 2007, according to the classification defined by the Regulation of the Minister of the Environment of 23 July 2008 on the criteria and method of assessment of the groundwater status (source: CIEP/SEM)

groundwater	Sum of measurement points	chemical status of the water (share of the points)				
		GOOD			POOR	
		quality class I	quality class II	quality class III	quality class IV	quality class V
unconfined	441	10.20%	42.63%	25.62%	18.14%	3.40%
confined	566	7.77%	53.71%	21.38%	13.96%	3.18%
total	1007	8.84%	48.86%	23.24%	15.79%	3.28%

25 On the strength of Regulation of the Minister of the Environment of 23 July 2008 on the criteria and method of assessment of the status of groundwater.

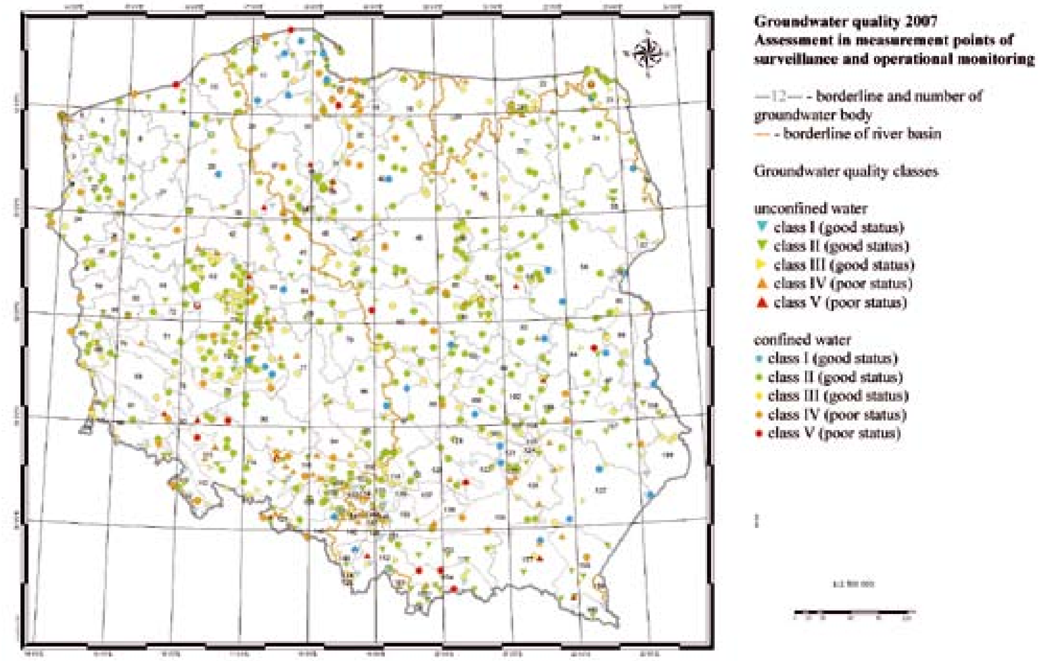


Fig. 5.2.12. Groundwater quality at measurement points (source: CIEP/SEM)

The quality of waters in Poland depends significantly on the way of managing their drainage basins. For example, sewage from neighbouring holiday resorts, tourist cabins, camping sites and other nearby buildings, whose sewage management has not been properly arranged, may get to lakes used for recreational purposes. Recreational use of lakes is often accompanied by the process of deterioration of the shores and waterside vegetation, which contributes to soil erosion and impoverishment of the vegetation and, as a consequence, enhances the inflow of substances from the drainage basin to the lake.

The volume of substances transferred from the drainage area to surface water is the lowest from forests, the highest, on the other hand, from industrial and urban areas.

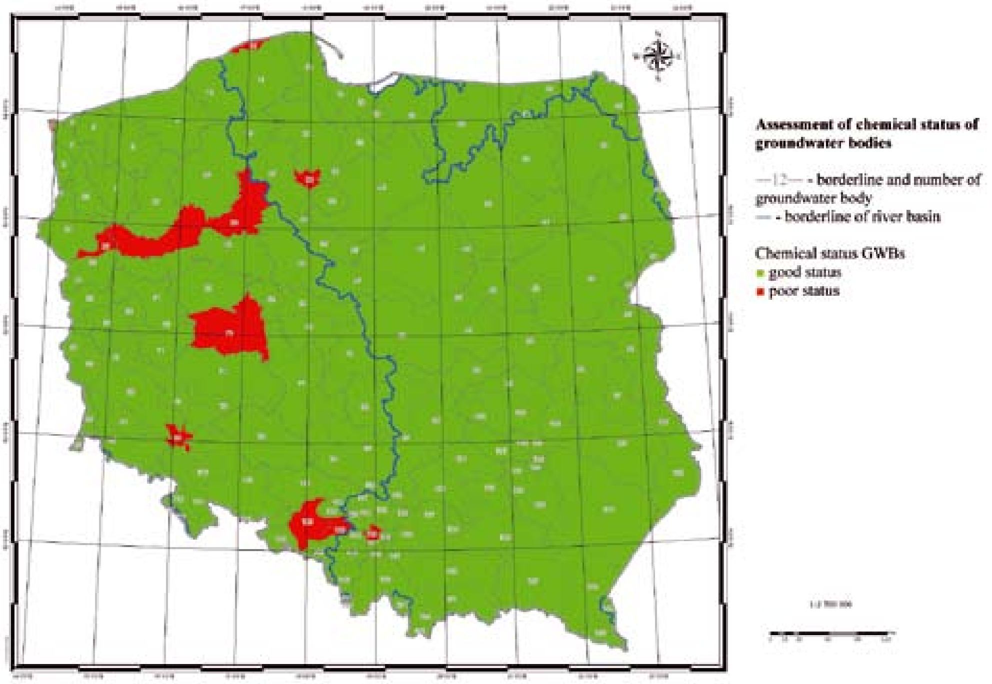


Fig. 5.2.13. Assessment of the chemical status of groundwater bodies in 2007 (source: CIEP/SEM)

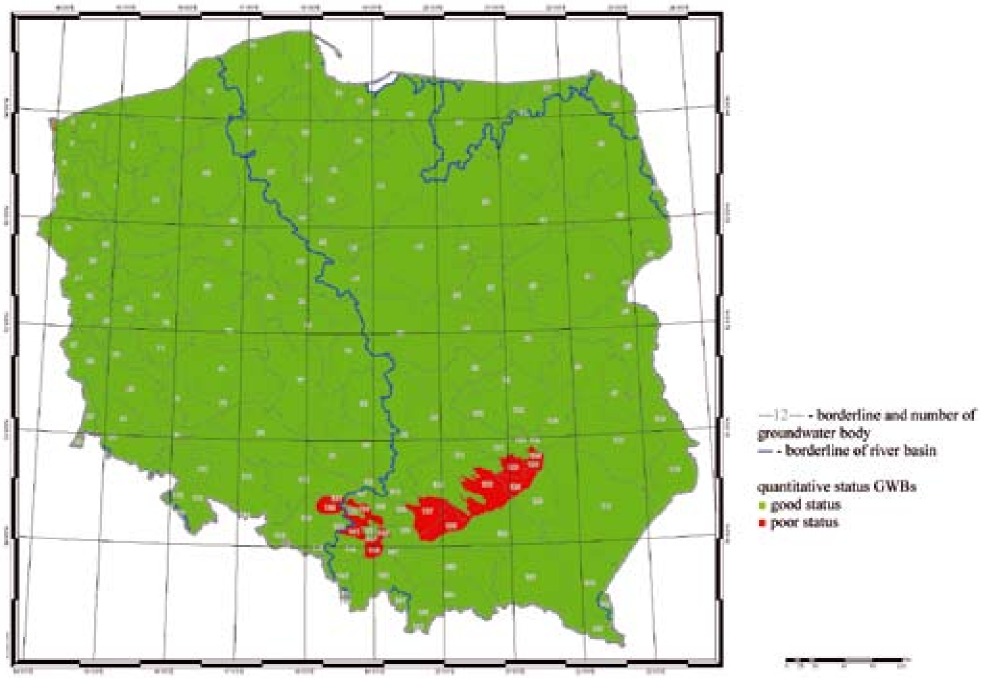


Fig. 5.2.14. Assessment of the quantitative status of groundwater bodies in 2007 (source: CIEP/SEM)

The state of rivers is mostly determined by the drainage of and improperly treated municipal and industrial waste water, including discharge of saline water from coal mines (Fig. 5.2.15.).

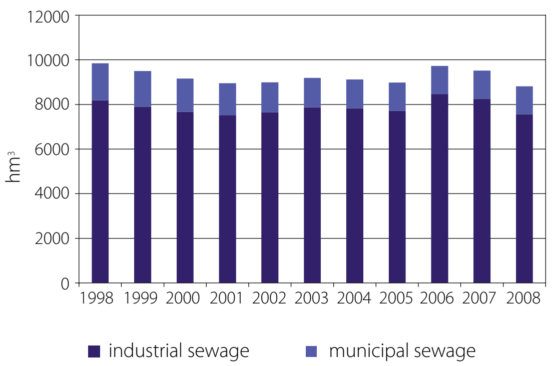


Fig. 5.2.15. Industrial and municipal sewage discharged to water or to the ground [hm³] (source: CSO)

Rearing animals and agriculture still are a source of pollutants. It often happens that fields are adjacent to the shores of rivers or lakes, and there are no protective barriers in the form of belts of trees or shrubs along the shoreline, which is conducive to the transfer of agricultural pollutants to the water. According to the data of the CSO of 2009, the total area of agricultural land in Poland amounts to 189.8 thousand km², thus covering 60.7% of the area of Poland. Consumption of phosphorus mineral fertilisers in the economic year 2007/2008 calculated per P_2O_5 amounted to 462.30 thousand tonnes and was more than 12% higher than in the economic year 2006/2007 and as much as 42.6% higher than in the year 2004/2005. On average, more than 28.6 kg of phosphorus fertilisers fell on one hectare of agricultural land in the years 2007/2008.

In the case of mineral nitrogen fertilisers, consumption in the economic year 2007/2008 amounted to 1 142.30 thousand tonnes (N). In comparison to the economic year 2004/2005, consumption of mineral nitrogen fertilisers grew by 31%. On average, more than 70 kg of nitrogen fertilisers fell on one hectare of agricultural land in the economic year 2007/2008 (see chapter: Land and soil).

High concentration of industry, in particular on areas located in the upper courses of Odra and Vistula, causes significant changes to the relief and changes to the water relations, as well as the necessity to discharge sewage to the surface river network transporting small volumes of water.

Also in the case of groundwater, abstraction of water through large municipal and industrial intakes, as well as mine drainage were the main causes of its poor quantitative status, which caused adverse changes to the location of the groundwater level (Fig. 5.2.16.).

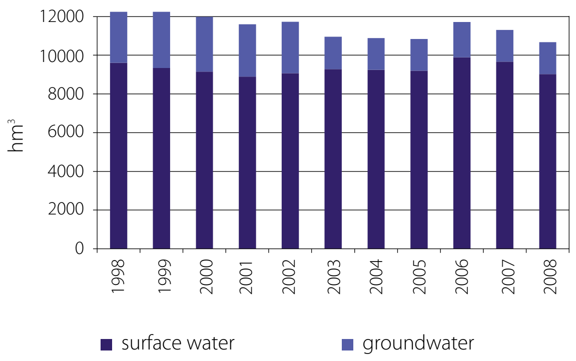


Fig. 5.2.16. Abstraction of water for the needs of economy and population (source: CSO)

As regards the main factors determining poor chemical status of groundwater, they included total iron, the presence of which exceeded the threshold value established for good chemical status in ca. 10% of examined water samples (according to the results from 2007). The problem of the presence of iron in groundwater is a national one, and is related to the natural presence of iron in numerous minerals of both igneous and sedimentary rocks. Of the remaining physicochemical indicators, the factor that was of the greatest importance for classifying the tested water as water of poor chemical status was the presence of ammonia and nitrates, whose presence in unconfined groundwater is related mostly to anthropogenic activities, while they may be present in confined groundwater also as a result of geochemical processes. It should be noted, however, that it results from the tests carried out in 2007 that the concentrations of nitrates did not exceed the permissible threshold of 50 mg/dm³ in most measurement points, and, importantly, low concentrations of nitrates were found in ca. 95% of points (under 25 mg/dm³). Furthermore, a gradual fall of the number of measurement points, where pollution with nitrates was found was observed in the subsequent years (concentration of over 50 mg/dm³).

For lakes, pressures such as: extraction of water for municipal and industrial purposes, transport, morphological changes, changes in the hydrological regime are of local importance and concern a small group of them. What is the main manifestation of degradation of lakes is the process of eutrophication. Eutrophication consists in the growth of fertility of water bodies through increased inflow of biogenes, that is phosphorus and nitrogen compounds. The concentrations of biogenic compounds found in lakes in the recent years, although lower than a dozen years ago, still are high enough to stimulate intensive water bloom.

5.2.2. The Baltic Sea

The marine environment is a precious heritage, which must be protected, preserved and, as far as possible, recovered in a way enabling, in the end, maintenance of biodiversity and preservation of diversified and dynamic character of oceans and seas, which are clear, healthy and fertile.

The Baltic is called the Mediterranean Sea of Northern Europe, as it is surrounded by land from all sides and connected to the Northern Sea only by a few shallow straits. Being about 12 000 years old, it is one of the youngest seas of the Atlantic Ocean. The Baltic Sea belongs to the largest brackish seas in the world, whose characteristics make them particularly vulnerable to pollution and eutrophication. It is a relatively shallow regional sea with an average depth of 50 metres (for comparison, the average depth of the Mediterranean Sea is 1500 m). The Baltic Sea is almost entirely closed (only 3% of the volume of water is exchanged during each year). The very long period of total exchange of water in the sea (25-30 years) is one of the factors making the Baltic one of the most polluted seas in the world.

The Polish Baltic monitoring programme covers with regular control (6 times a year) the state of the marine

The basic environmental objective with reference to marine waters is preservation or improvement of their quality, in particular through:

a) protection and preservation of the marine environment, prevention of its deterioration or, where practicable, recovery of marine ecosystems in areas where they have been adversely affected;

b) prevention and phasing out of pollution of the marine environment, so as to ensure that there are no significant impacts on or risks to marine biodervisity, marine ecosystems, human health, or legitimate uses of the sea.

extract from article 1 of the Directive2008/53/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for Community action in the field of marine environmental policy (Marine Strategy Framework Directive) (Text with EEA relevance) environment in the Polish zone of the southern Baltic at stations located in the deep-sea zone – in the area of the Gdańsk Deep (station P1=BMP L1), the Bornholm Deep (station P5=BMPK2), at the south-eastern slope of the Gotland Deep (station P140=BMP K1) and at stations located in the coastal zone (Fig. 5.2.17.).

Classification of the state of the Polish areas of the southern Baltic was carried out on the basis of measurement data obtained during implementation of the monitoring programme for the following areas/regions: the Puck Lagoon (station ZP6), the internal Bay of Gdańsk (except for the area of the estuary of Vistula; stations P110, P116, P104), high seas zone: the Gdańsk Deep (station P1), the south-eastern Gotland Basin (station P140), the shallow-water zone (up to 20 m) of the middle coast (stations: Ł7, P16, K6) and the open Bay of Pomerania (beside the are of the estuary of Odra/Świna; stations B13 and B15) (Fig. 5.2.18. - 5.2.22.).

Preliminary classification of the state was carried out on the basis of the following quality elements and indicators[26]:

- biological quality elements – phytoplankton:
  1) average concentrations of chlorophyll a in the summer months (V-IX) or annual average in the case of the Bay of Puck and the Vistula Lagoon,
- physicochemical quality elements:
  1) winter concentration of dissolved phosphates (average concentration from layer 0-10 m in the deep water zone or 0-bottom in the lagoons),
  2) winter concentrations of mineral nitrogen ($NO_3+NO_2+NH_4$),
  3) water transparency in the summer months (V - IX) or annual average in the case of the Vistula Lagoon,
  4) oxygen saturation in bottom water (average concentration of oxygen in the bottom layer) in the summer months (V-IX).

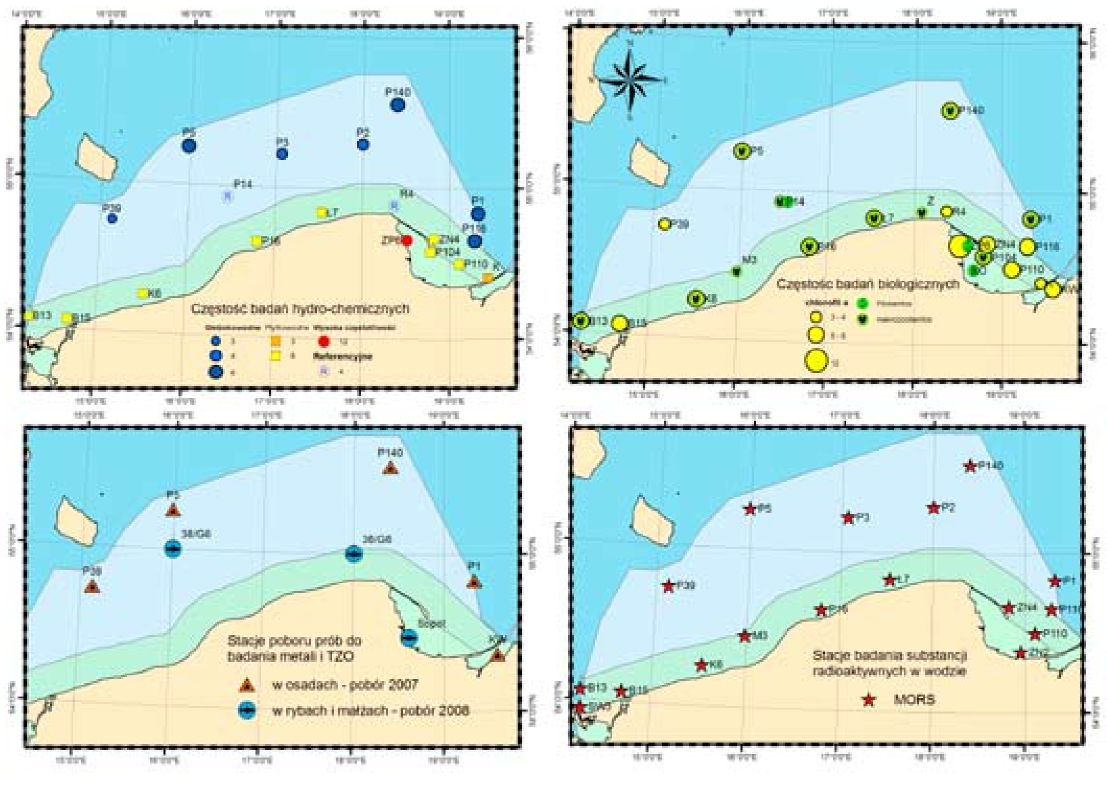


Fig. 5.2.17. Measurement stations and measurement frequency in 2008 within monitoring of the Baltic (source: CIEP/SEM)

[26] In the classification, there were used threshold values laid down in Regulation of the Minister of the Environment of 20 August 2008 on the method of classification of surface water bodies and developed for the needs of project HELCOM EUTRO PRO (http://meeting.helcom.fi/c/document_library/get_file?p_l_id=79889&folderId=377779&name=DLFE-36818.pdf).

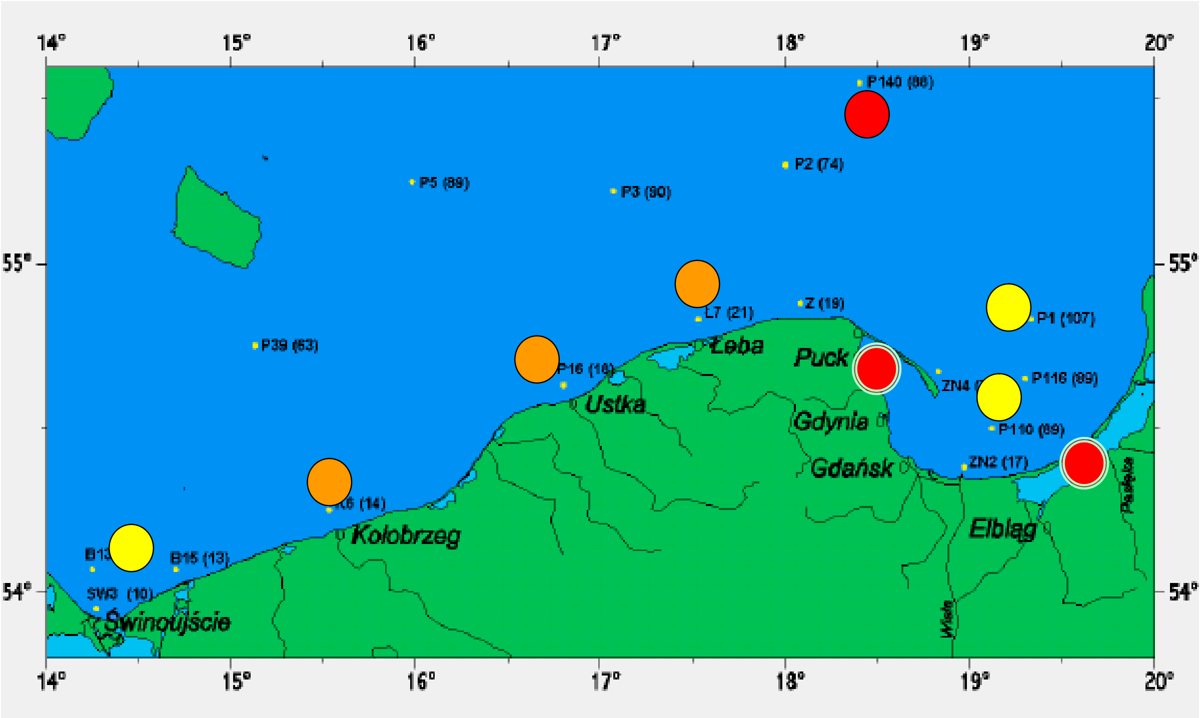


Fig.5.2.18. Classification of the state of marine waters of the Polish zone of the Southern Baltic in 2008 in terms of concentration of chlorophyll "a"; colour code: yellow – moderate state, orange – poor state, red – bad state (source: CIEP/SEM)

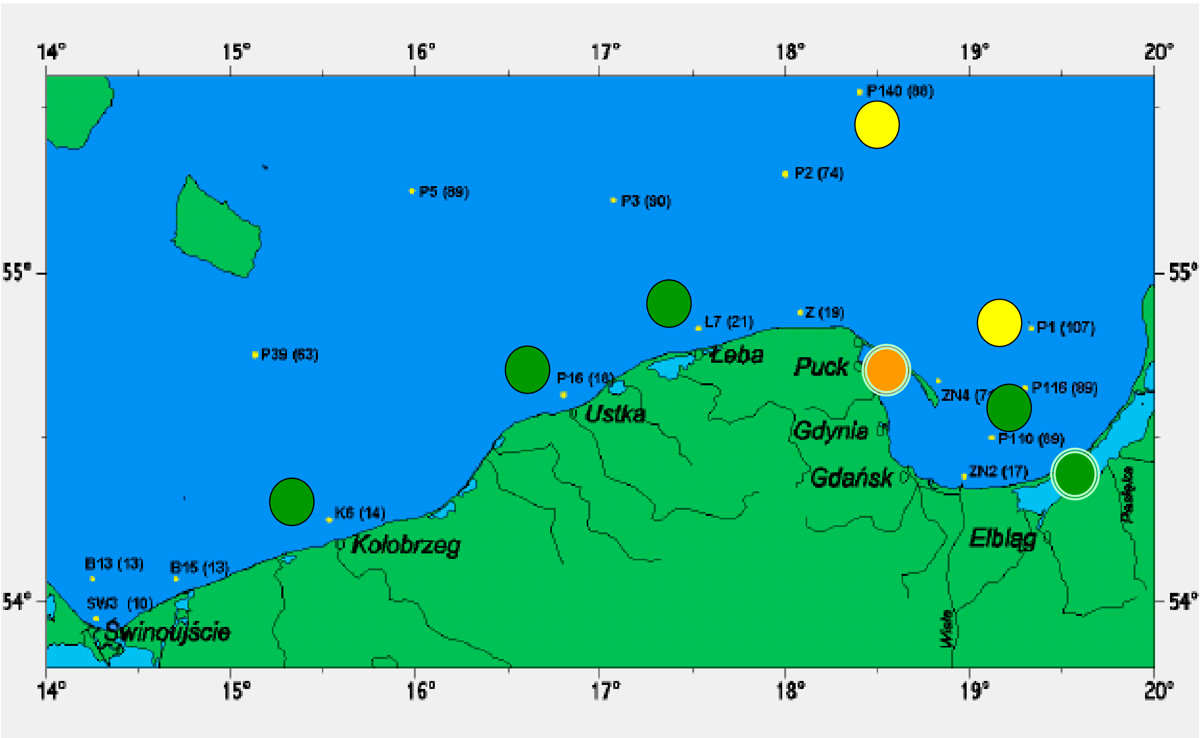


Fig. 5.2.19. Classification of the state of marine waters of the Polish zone of the Southern Baltic in 2008 in terms of winter concentration of dissolved phosphates; colour code: green – good state, yellow – moderate state, orange – poor state; note – there are no data for the Bay of Pomerania (source: CIEP/SEM)

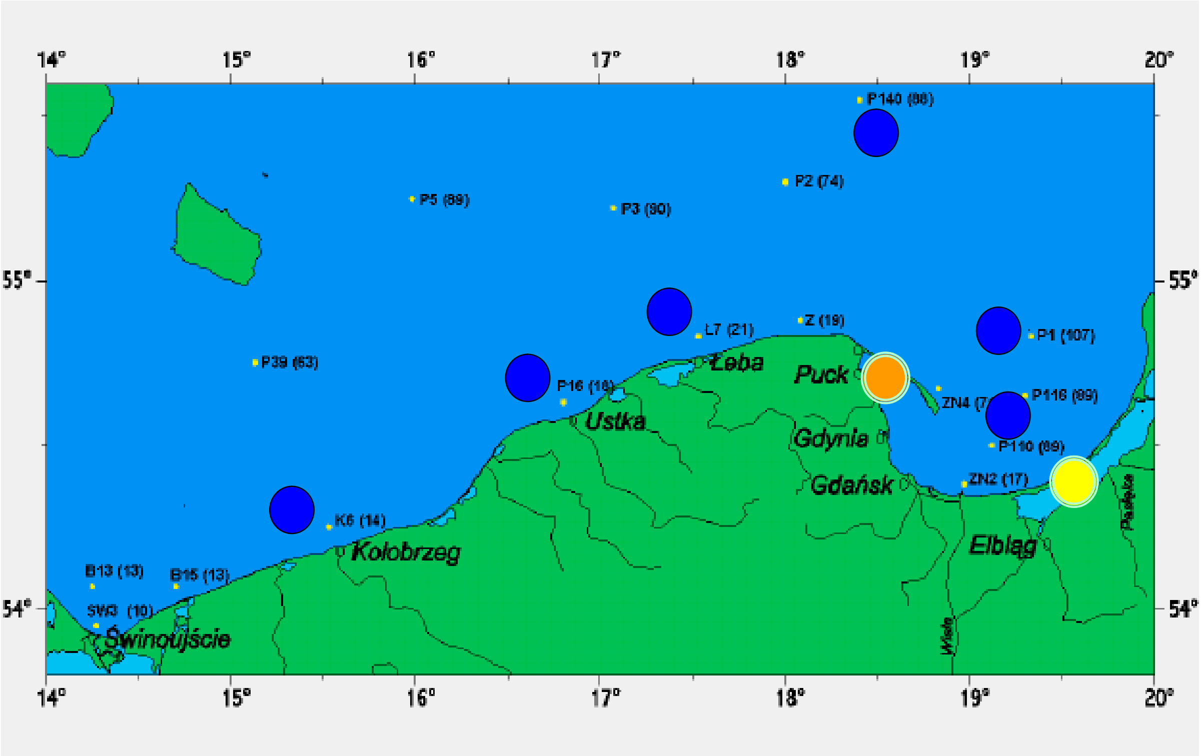


Fig. 5.2.20. Classification of the state of marine waters of the Polish zone of the Southern Baltic in 2008 in terms of winter concentration of mineral nitrogen; colour code: blue – very good state, green – good state, yellow – moderate state, orange – poor state; note – there are no data for the Bay of Pomerania for 2008 (source: CIEP/SEM)

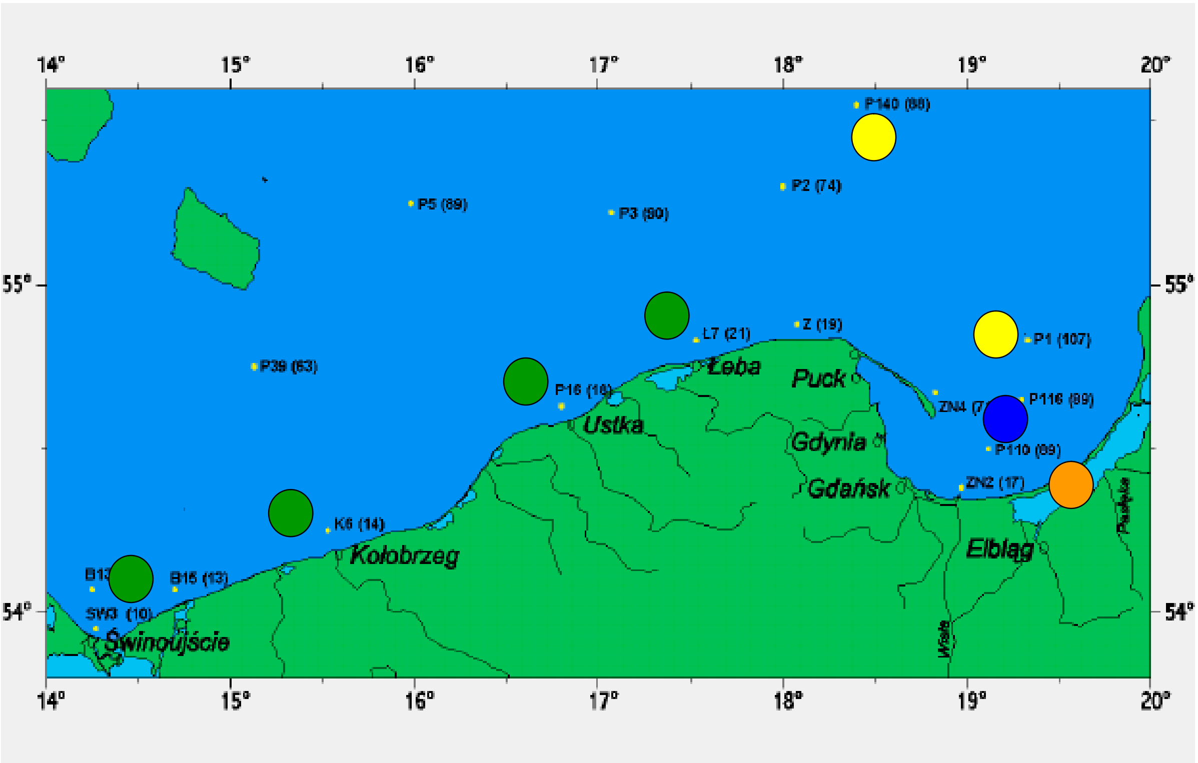


Fig. 5.2.21. Classification of the state of marine waters of the Polish zone of the Southern Baltic in 2008 in terms of transparency (visibility of the Secchi disk); colour code: blue – very good state, green – good state, yellow – moderate state, orange – poor state; note – there are no threshold values and classification for the Puck Lagoon (source: CIEP/SEM)

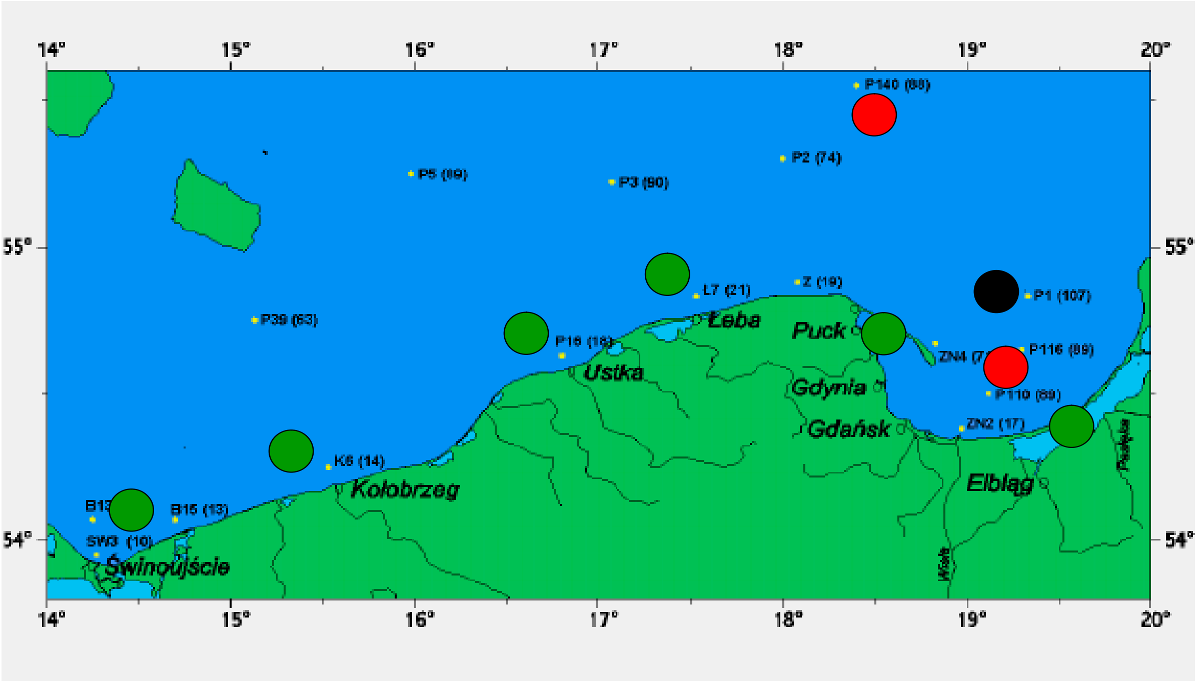


Fig. 5.2.22. Classification of the state of marine waters of the Polish zone of the Southern Baltic in 2008 in terms of oxygen saturation in bottom waters in the summer months (V-IX); colour code: green – good state, red – bad state; black – oxygen-free zone (hydrogen sulphide) (source: CIEP/SEM)

Pursuant to the above-mentioned Regulation (see footnote 26), the final result of assessment is determined by the biological element, which was previously assigned the least advantageous class, thus the ecological state of marine waters of the Polish zone of Southern Baltic is determined by the concentrations of chlorophyll "a", as the measurement of the biomass of phytoplankton. In the presented classification, the state changes from moderate to bad. Good ecological state was identified in none of the classified basins in terms of chlorophyll "a", which means that no significant improvements have been observed with respect to eutrophication of the Polish areas of the Baltic Sea.

Within the research and measurement works performed during the cruises of ship RV Baltica in the years 1998-2008, there were carried out measurements *in situ* and samples of sea water were collected for determination of the amount of chemicals in a laboratory located on the ship and water samples for tests in an onshore laboratory to perform determinations of chemical factors, biological factors and long-living radionuclides, analysis of the content of toxic substances in bottom organisms.

Seasonal changes to the production of phytoplankton took place exceptionally early for the Baltic, that is there took place strong blooming of cyanoses by the end of May and in June. Already in May, in the waters of practically the whole area of the Proper Baltic, there were identified high values of fluorescence, corresponding to high concentrations of chlorophyll "a", while the presence of numerous toxic species of *Aphanizomenon flos aquae* and *Nodularia spumigena* was recorded in July. An analogical situation took place in the Polish part of the Baltic, where the measured concentrations of chlorophyll a sometimes significantly exceeded the average results from the period of 1999-2007 (Fig. 5.2.23 – 5.2.25).

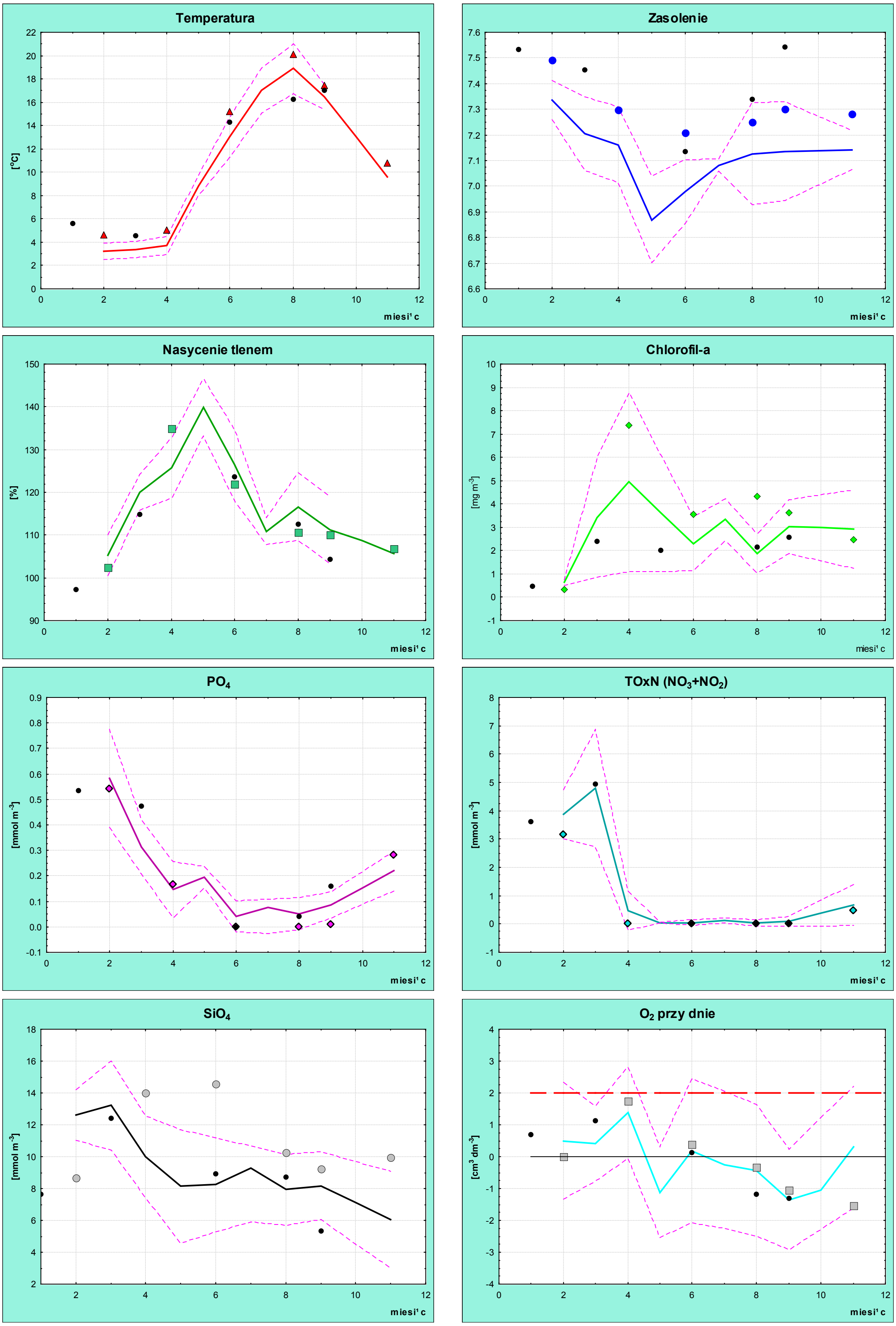
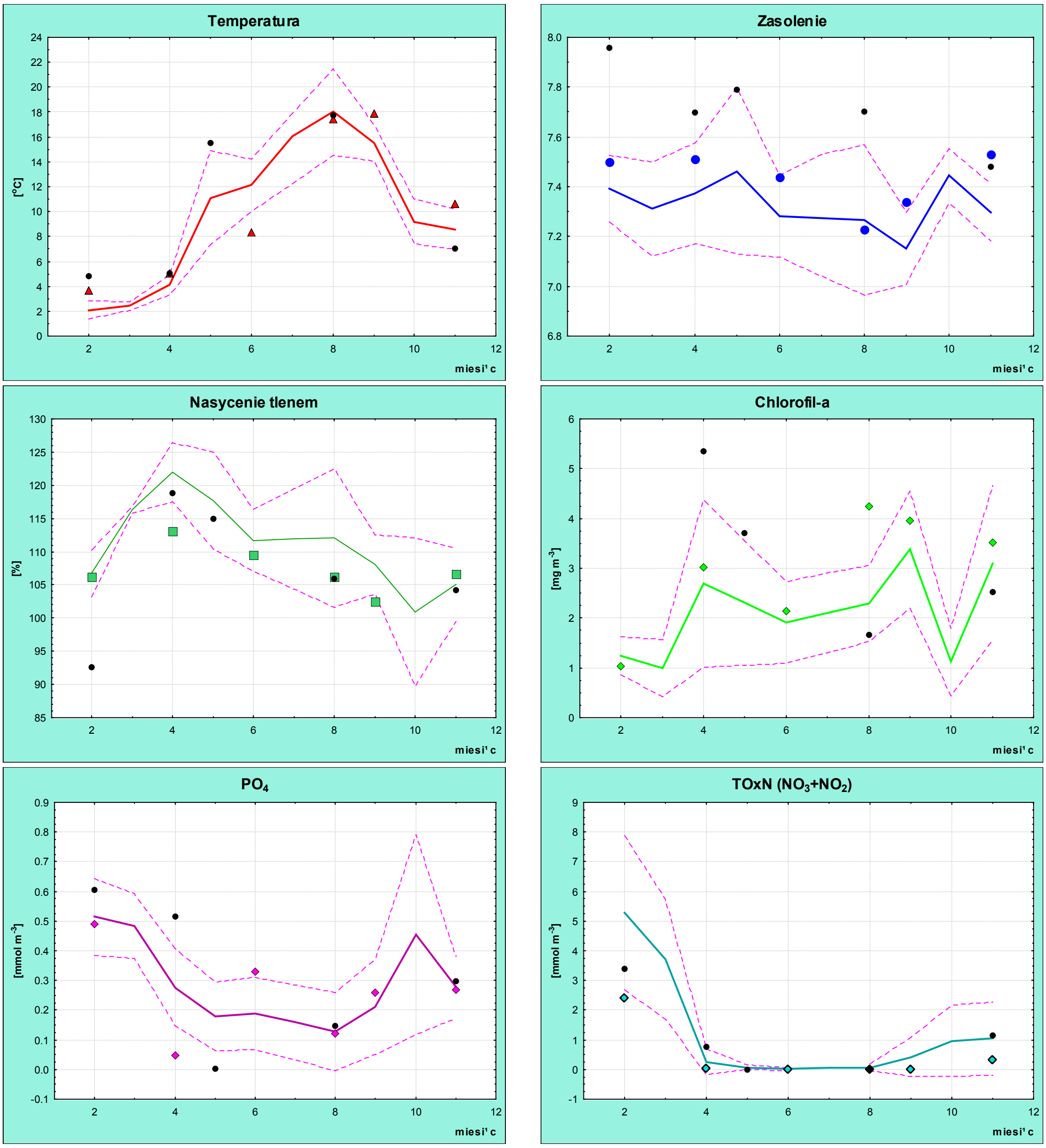


Fig. 5.2.23. Long-term (1998-2007) seasonal changes in thermohaline conditions, the content of biogenic substances and chlorophyll "a" in the surface layer of the Gdansk Deep (station P1);

— average
---- standard deviation
• values from 2007
colour marker – values from 2008 (sources: CIEP/SEM)



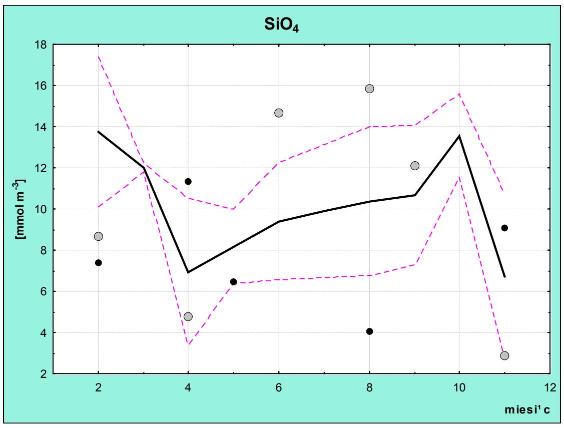
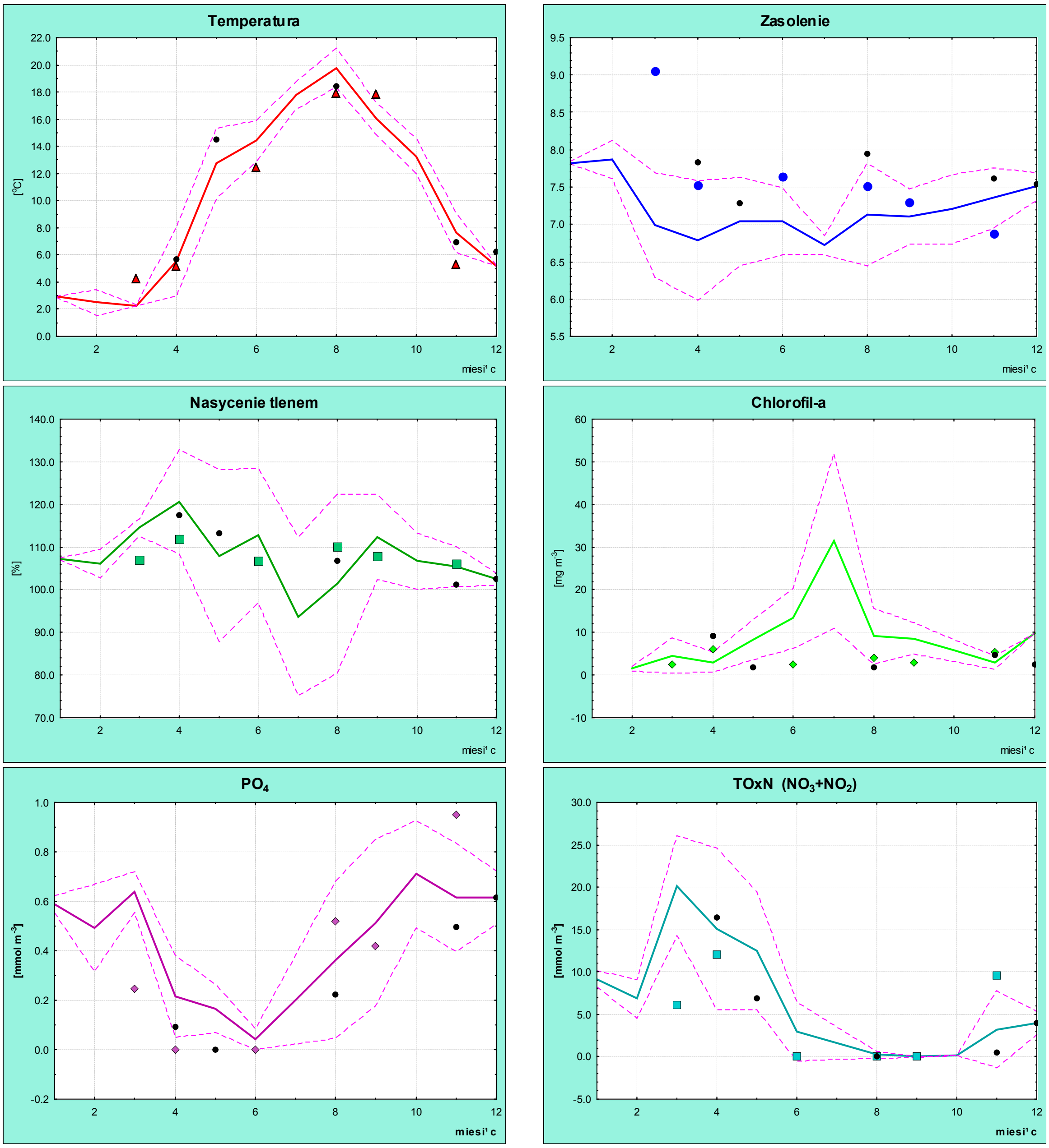
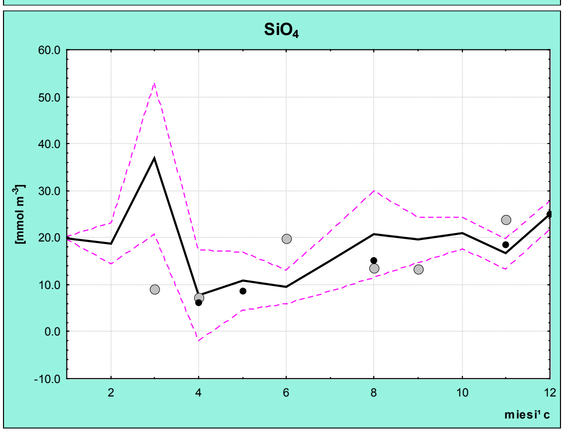


Fig. 5.2.24. Long-term (1998-2007) seasonal changes in thermohaline conditions, the content of biogenic substances and chlorophyll "a" in the shallow-water zone of middle coast (station Ł7)

— *average*
---- *standard deviation*
• *values from 2007*
colour marker – values from 2008 (source: CIEP/SEM)





Rys. 5.2.25. Long-term (1998-2007) seasonal changes in thermohaline conditions, the content of biogenic substances and chlorophyll "a" in the surface layer of the the Bay of Pomerania (station B13)

— average
---- standard deviation
• values from 2007
colour marker – values from 2008
(source: CIEP/SEM)

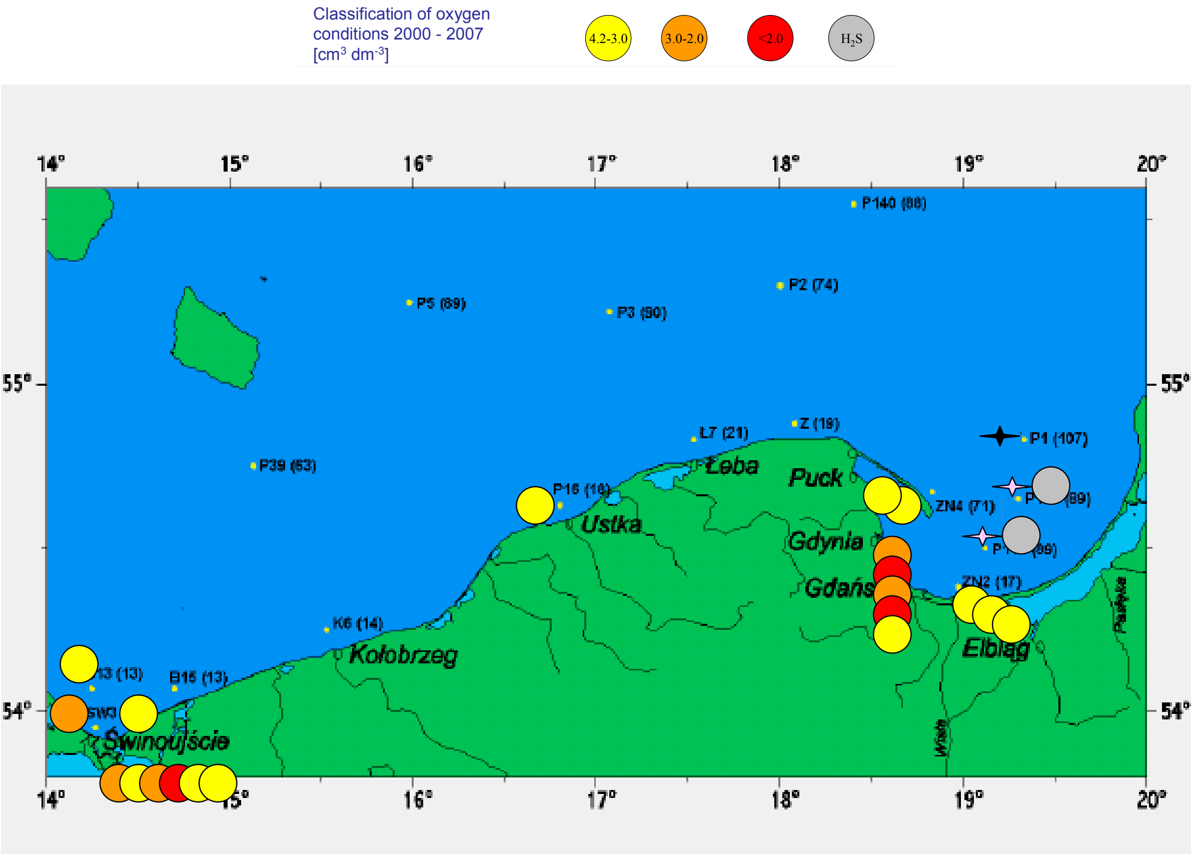


Fig. 5.2.26. Number of oxygen deficits in the Polish coastal zone in the years 2000-2007 at selected monitoring stations (colour markers determine the occurrence of minimum oxygen concentration in a year, the numbers in brackets represent the depth of the station) (source: CIEP/SEM)

Analysis of oxygen saturation of bottom layers in the period of late summer in the Polish coastal zone in the years 2000-2007 was carried out for the purposes of the all-Baltic workshops "Baltic Sea 2020 – hypoxia in the coastal zone" showed that oxygen deficiencies of various severity occur each year (Fig. 5.2.26.).

In the years 2000-2007, threshold concentration of oxygen, classified as deficit, was established incidentally also in the zone of middle coast, where the dynamic conditions – strong rip currents and the phenomenon of upwelling – should definitely counteract the occurrence of oxygen deficits. The minimum value of oxygen was recorded in 2008 confirms the growth of the risk of hypoxia also in the area of the Polish Baltic zone.

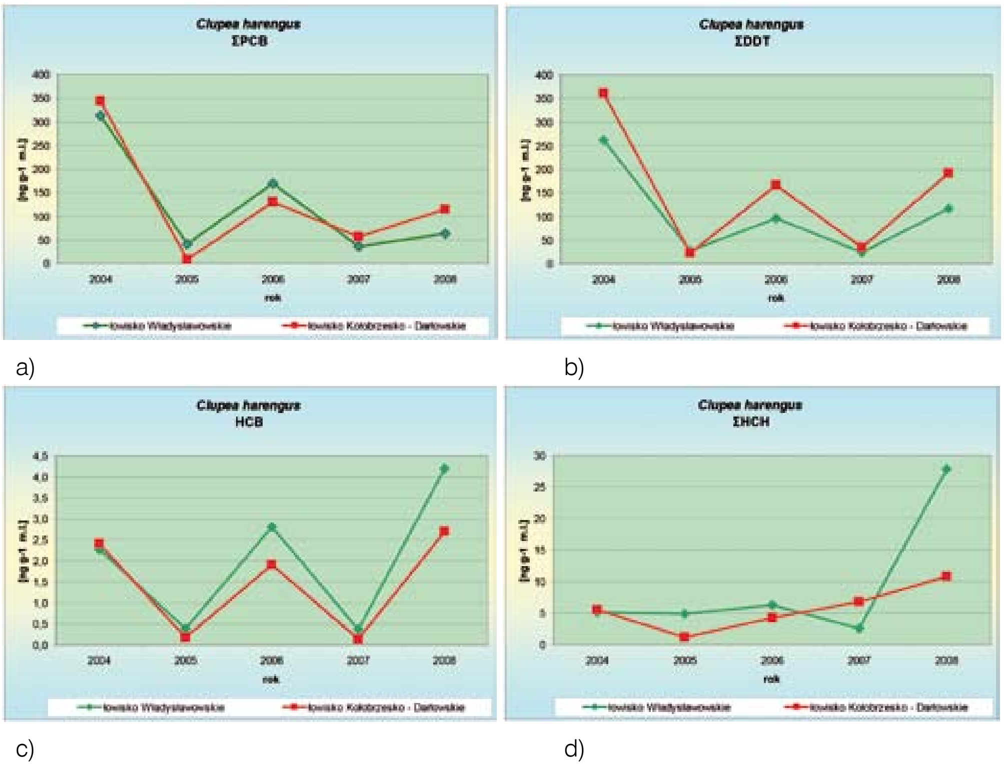


Fig. 5.2.28. Comparison of the content of particular POP calculated per mass of lipids (m.l.) in fish (Clupea harengus) from the Władysławowo and Kołobrzesko-Darłowskie fisheries in the years 2004-2008; a) ΣPCB, b)ΣDDT, c) HCB, d) ΣHCH (source: CIEP/SEM)

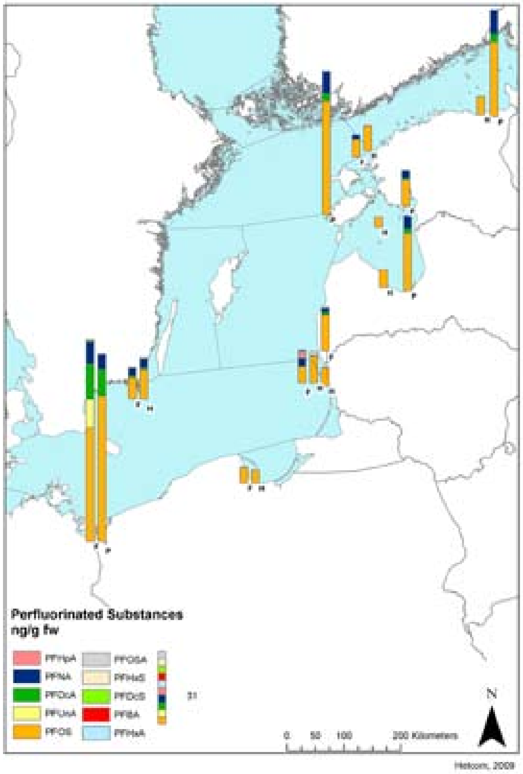


Fig. 5.2.27. Concentrations (ng/ g fw) perfluorinated substances in the liver tissues of the following fish: H = herring, F= flounder and P = perch (source: HELCOM and CIEP/SEM)

The issue of pollution of the Baltic Sea with hazardous substances is, most of all, the problem of the enormous number of various substances of anthropogenic origin flowing to it through rivers. Despite the fact that monitoring shows that the loads of some hazardous substances flowing to the Baltic have been significantly reduced in the last 20-30 years, the problem still exists, whereas the concentrations of some new substances in the marine environment even increased (e.g. compounds including fluorine, Fig. 5.2.27).

Comparing the results of persistent organic pollutants POP (carried out in 2008 in fish from both locations) to the analogous results obtained in 2004 for ΣPCB and DDT, there was recorded a fall in the average concentrations. The content of HCB and ΣHCH in the case of herrings from the Kołobrzesko-Darłowskie fishery was close to the level from 2004, whereas the content of HCB and ΣHCH in the organisms from the Władysławowo fishery was higher than in 2004, while the growth was slight in the case of HCB (Fig. 5.2.28.).

Since 1986, after the Chernobyl nuclear plant disaster, the radioactivity level in the waters of the Baltic Sea has been shaped mainly by the presence of two radionuclides of anthropogenic origin: caesium 137 (137Cs) and strontium 90 (90Sr). Both isotopes are characterised by relatively long periods of half life amounting to 30 and 28 years respectively, which, among other things, are responsible for the still elevated activity of the said isotopes in relation to the time before the Chernobyl disaster. After 1986, the activity of 137Cs in the Baltic waters was growing to maximum values, which were recorded in 1991. From that time, there has been observed a virtually uninterrupted fall in the concentrations of the said isotopes in the Baltic waters. The fall is related most of all with the radioactive decay of isotopes, the processes of bioaccumulation in animated elements of the marine environment, the processes of sedimentation and exchange of the waters between the Baltic and the Northern Sea (Fig. 5.2.29.). A one-off increase, recorded in 2004, in the average concentration of strontium 90 was the result of smaller, in terms of volume, inflow from the Northern Sea.

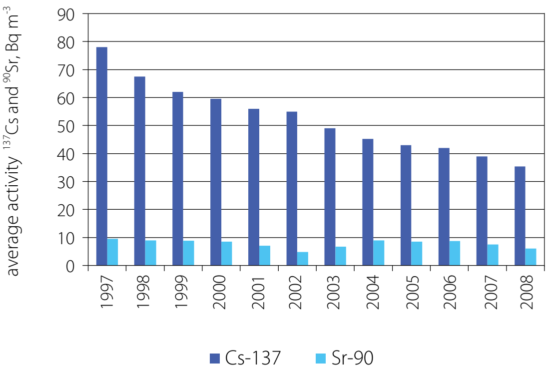


Fig. 5.2.29. Average concentrations of 137Cs and 90Sr in the Polish zone of the Baltic in the years 1997-2008 (source: CIEP/SEM)

The catchment area of the Baltic Sea is four times larger than the Sea itself and is inhabited by about 85 million people. Of the 14 countries of the catchment area of the Baltic, nine have direct access to the Sea. Eight of 9 coastal countries are members of the European Union. During the last century, there was recorded a significant negative impact on the environment of the Baltic Sea due to the growth in population and urbanisation, industrialisation and increase in the activity in agriculture. What is optimistic is the fact that there was recorded at the same time a constant downwards tendency in the total loads of nutrient substances from 1990 (according to the data of the Helsinki Commission HELCOM).

In comparison to the year 1998, the load of BOD5 transported through the rivers to the Baltic Sea from the territory of Poland fell by 49%, reaching in 2008 the level of ca. 137 thousand tonnes/year (Fig. 5.2.30.). At the same time, there was recorded a fall in total nitrogen by ca. 70% (from 260.5 thousand to 77.9 thousand tonnes/year) (Fig. 5.2.31.), and in total phosphorus by ca. 52% (from 15.5 thousand to 7.4 thousand tonnes/year).

It is, above all, the result of significant investments in the scope of treatment of municipal waste water, removal of various sources of industrial "hot-spot" sources and implementation of the Code of Good Agricultural Practice. However, it must be remembered that the last years have been characterised by relatively small flows (Fig. 5.2.3.) the downwards trend in the loads transported to the Baltic Sea may change in the subsequent years depending on hydro-meteorological conditions.

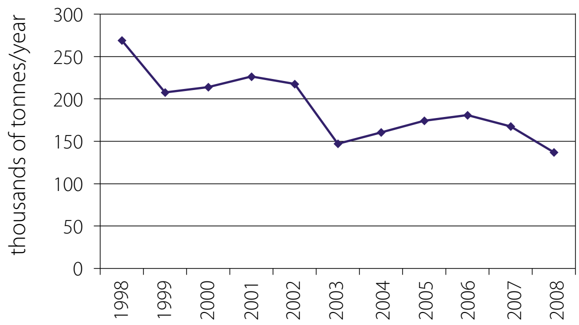


Fig. 5.2.30. Load of BOD5 transported through rivers from the territory of Poland to the Baltic Sea in the years 1995-2008 (source: CIEP/SEM)

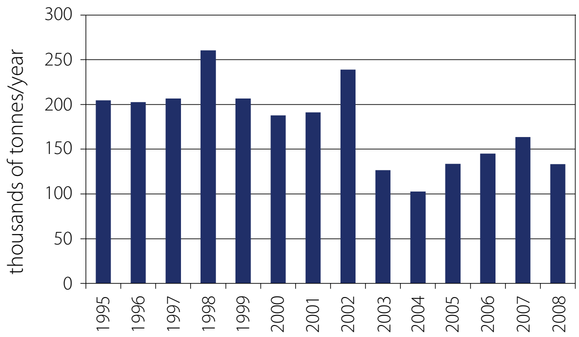


Fig. 5.2.31. Load of total nitrogen transported through rivers from the territory of Poland to the Baltic Sea in the years 1995-2008 (source: CIEP/SEM)

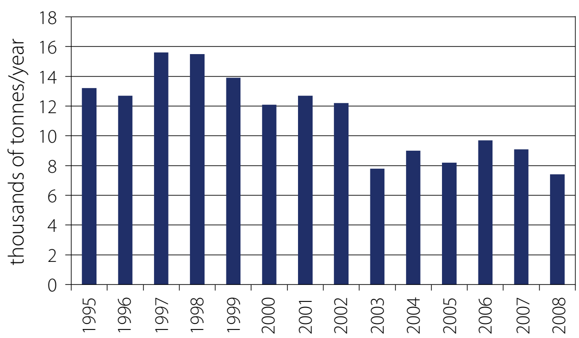


Fig. 5.2.32. Load of total phosphorus transported through rivers from the territory of Poland to the Baltic Sea in the years 1995-2008 (source: CIEP/SEM)

Fig. 5.2.33. Toxic cyanosis blooms in the Baltic Sea in 2009 – satellite photographs

Nevertheless, eutrophication is the greatest problem in the context of protection of the Baltic. The environment of the sea has changed over the last century from oligotrophic (with transparent waters) to strongly eutrophic (Fig. 5.2.33.).

Excessive loads of nitrogen and phosphorus originating from land sources, located on the area of the catchment area of the Baltic Sea and from outside of that area are the main cause of eutrophication. About 75% of the load of nitrogen, as well as at least 95% of the load of phosphorus, is introduced to the Baltic through rivers and direct point discharges from municipal installations. About 25% of the load of nitrogen originates from atmospheric deposition which, beside pressure from the land, is the second important source of pollution (Fig. 5.2.34.).

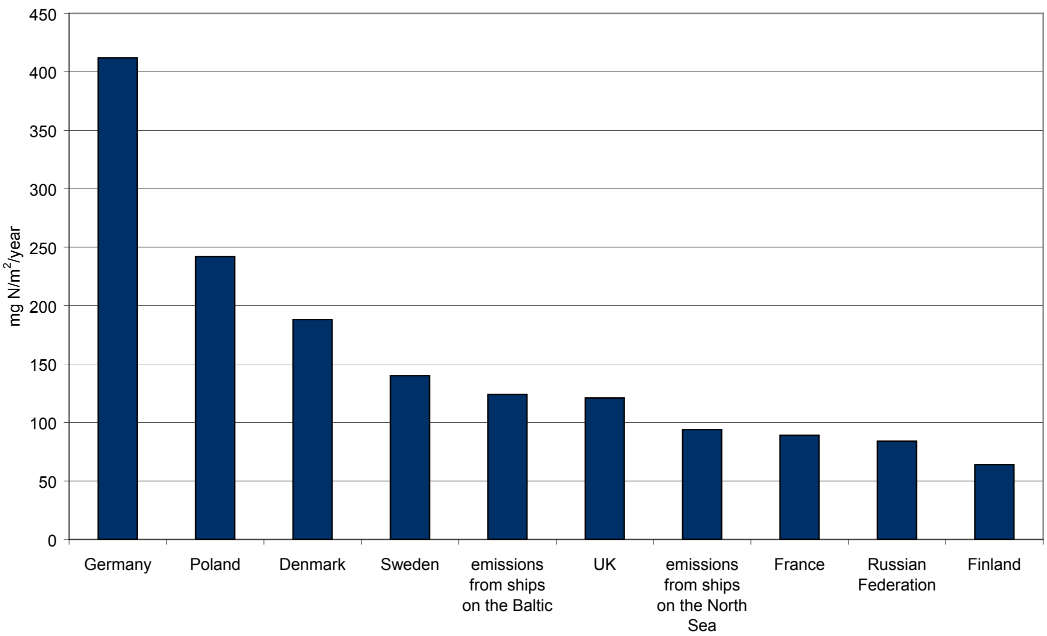


Fig. 5.2.34. Load of total nitrogen originating from deposition of atmospheric to the Baltic in 2007 (source: EMEP)

5.2.3. Actions aimed at improvement of water quality

In December 2003, the Government of Poland adopted the National Programme for Municipal Waste Water Treatment. The Programme was prepared to build, extend and modernise the collective sewage systems and municipal sewage treatment plants, as well as to define the deadlines for implementation of them, necessary for implementation of the provisions of the Treaty of Accession, referring to Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment. It means, among other things, achievement of the quality standards of sewage discharged to the water environment from sewage treatment plants required by the EU and ensuring 75% reduction of the total load of nitrogen and phosphorus in municipal wastewater from the territory of the whole country to protect surface waters, including sea waters from eutrophication.

The actions determined in the National Programme for Municipal Waste Water Treatment shall also contribute to the improvement of the investment attractiveness of Poland and its regions by the development of technical infrastructure, with simultaneous protection and improvement of the state of the environment, health, preservation of cultural identity and development of territorial cohesion.

In the period from 1995 to 2008, the efficiency of municipal sewage treatment plants increased in Poland by more than 35%. In the same period of time, according to the data from the statistical yearbook of the CSO, the share of population covered by the services of municipal sewage treatment plants increased from 42% to 63.1% (Fig. 5.2.35.), assuming a value of 86.9% for urban areas, and 25.7% for rural areas. The number of wastewater treatment plants servicing rural areas increased from 433 to 2213. In 2008, 98.6% of cities were serviced by wastewater treatment plants.

Fig. 5.2.35. Share of the total population of Poland serviced by sewage treatment plants (source: CSO)

Since 1995, the length of the combined character of the sewage network in rural areas has grown almost 9-fold, reaching the total length of 43 943 km, thanks to which, 22.6% of population in rural areas used the sewage network in 2008 (compared to 5.9% in 1995). In the same period, the indicator for urban areas increased from 65.1% to 86.9%, which means a rise by over 33% (Fig. 5.2.36. and 5.2.37.).

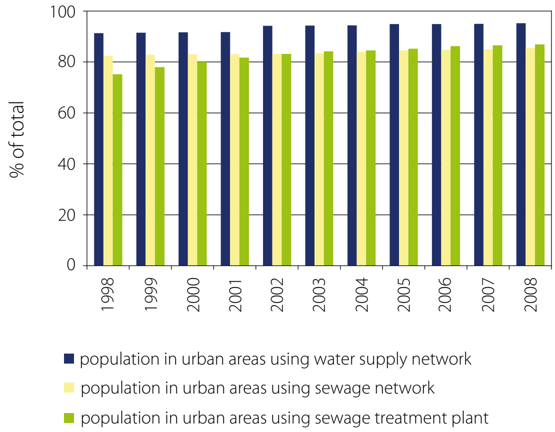


Fig. 5.2.36. Population in urban areas using a water supply and sewage network and a sewage treatment plant (source: CSO)

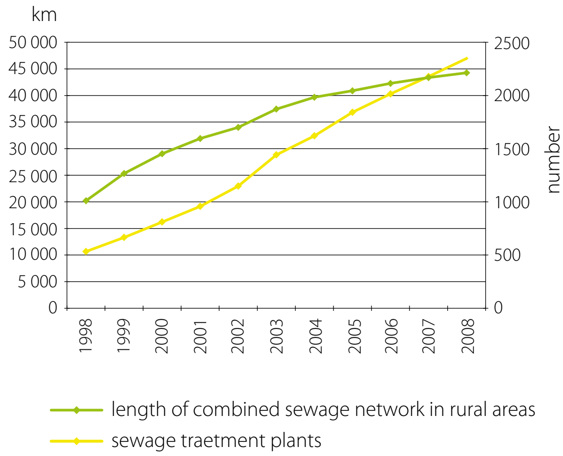


Fig. 5.2.37. Length of combined sewage network and number of sewage treatment plants (data for rural areas) (source: CSO)

As regards the share of total population serviced by sewage treatment plants, Poland, against other EU Member States, comes in the middle of the list, ahead of Belgium, for example, but at the same time being behind its neighbours (the Czech Republic or Lithuania) (Fig. 5.2.38.).

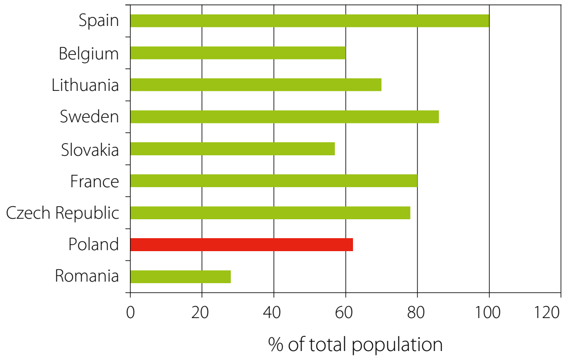


Fig. 5.2.38. Share of total population serviced by sewage treatment plants in selected EU Member States in 2007 (source: CSO)

The Baltic Sea Action Plan (BSAP) is another project meant to contribute to improvement of the state of inland and sea waters. It was adopted in 2007 at a Ministry Conference under the Convention on the Protection of the Marine Environment of the Baltic Sea Area, called the Helsinki Convention (HELCOM). Its basic aim is to obtain good ecological status by the waters of the Baltic through gradual reduction of the discharge of nutrients, that is the loads of nitrogen and phosphorus from land sources, getting to it through the catchment area or as a result of wet and dry atmospheric deposition.

According to the preliminary allocation of discharges of nutrients to the waters of the Baltic, as expressed in the BSAP, based, *inter alia*, on the use of physico-biogeochemical models (NEST), Poland has to limit the discharge of nitrogen by at least 63 400 tonnes and phosphorus by about 8 760 tonnes by 2021 in relation to the average discharges from the years 1997-2003 (adopted as base data for 2000), amounting to 191 170 tonnes and 12 650 tonnes respectively.

The Baltic Sea Action Plan is a project consistent with other projects and programmes aimed at water protection. Implementation of the provisions of the National Water-Environment Programme, water management plans or the National Programme for Municipal Waste Water Treatment shall contribute to improvement of the quality of inland waters, and thus it shall have a positive impact on the state of the ecosystem of the Baltic Sea, as the recipient of the pollutants flowing down rivers or directly from the land.

Improvement of marine environment and coastline protection is one of priorities of national marine policy directions until 2020, as was indicated in the governmental document „Assumptions for marine policy of the Republic of Poland until 2020".

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Water quality, especially the quality of water dedicated to supplying people with drinking water, has an great impact on the health of the society, as well as proper functioning of ecosystems. Despite the significant improvement of water quality recorded in recent years, which is the effect of limitation of production in many industries, modernisation of processes and building industrial and municipal sewage treatment plants, the state of purity of surface flowing waters and lakes is still insufficient.

Achievement and maintenance of a good status of waters and reasonable management of water resources requires undertaking and implementing a series of actions in the scope of: industry, agriculture, wastewater management, spatial management, formation of water relations and protection of the water environment, as well as organisational, legal, and educational actions.

The main middle-term objective, to be achieved until 2016, is to increase the self-financing of water management and rationalise the management of surface water and groundwater resources in order to protect the national economy from water deficiencies and secure against the effects of floods. What shall be the main task is striving at maximisation of saving water resources for industrial and consumption purposes, as well as increasing retention of water.

As regards protection of waters against pollution until the end of 2015, Poland shall ensure 75% reduction of the total loads of nitrogen and phosphorus in municipal sewage, continuing the process of modernisation, extension and building new sewage treatment plants within the National Programme for Municipal Waste Water Treatment, as well as implementation of the Baltic Sea Action Plan concerning fight against eutrophication of the waters of the Baltic. There shall also be undertaken further actions aimed at protection of waters against pollution caused by nitrates originating from agricultural sources in compliance with Council Directive 91/271/EEC of 21 May 1991 concerning urban wastewater treatment.

It is the overall goal of the environmental policy of Poland in the scope of protection of water resources to maintain or achieve good state of all waters, including also maintenance and recovery of ecological continuity of watercourses. Implementation of the goal shall be ensured by development and implementation, for each separated river basin area in Poland, a water management plan and a water-environmental programme for Poland. The plans (now being developed for the years 2010-2015) shall include a description of the measures that shall be undertaken to enable achievement of the assumed environmental goals.

V.3 Waste management

The problem of waste generated from both municipal and industrial sources is becoming the most urgent environmental issues of our times.

Inappropriate waste management has a negative direct impact on the quality of all elements of the environment, thus the state of ecosystems and human health. Leaks from improperly organised landfills may pollute water and soil. Landfills may also cause air pollution through emission of odours and methane, contributing to climate change. Additionally, dumping waste contributes also to the loss of land and lowering the aesthetic quality of landscapes. Unreasonable waste management may be a symptom of ineffective use of resources from the viewpoint of environmental protection.

The following issues are considered most important with reference to waste management:
increasing the level of recovery (including recycling) of industrial waste through tax policy and a system of charges for using the environment,
creation of the basis for modern municipal waste management to ensure an increase in recovery to decrease the volume of waste disposed by landfilling by at least 30% until 2006 and by 75% until 2010 (compared to 2000)

in: „The National Environmental Policy for 2003-2006 and Its 2010 Outlook"

The Polish and EU law has introduced priorities, according to which waste generation should be prevented or limited in volume by re-using, and if waste has been generated, it should be recovered or disposed. The final way of procedure is its landfilling.

In 2008, 124.97 million tonnes waste was generated in Poland. 92% of it was industrial waste – 114.94 million tonnes. The volume of industrial waste was decreasing in 2002, then an increase in generation of industrial waste attributable to economic recovery was observed, the volume of waste was remaining at a similar level from 2004 to 2007. A fall in generated industrial waste took place in Poland in 2008 (Fig. 5.3.1.).

Fig. 5.3.1.Industrial waste generated in Poland in the years 1998-2008 (source: CSO)

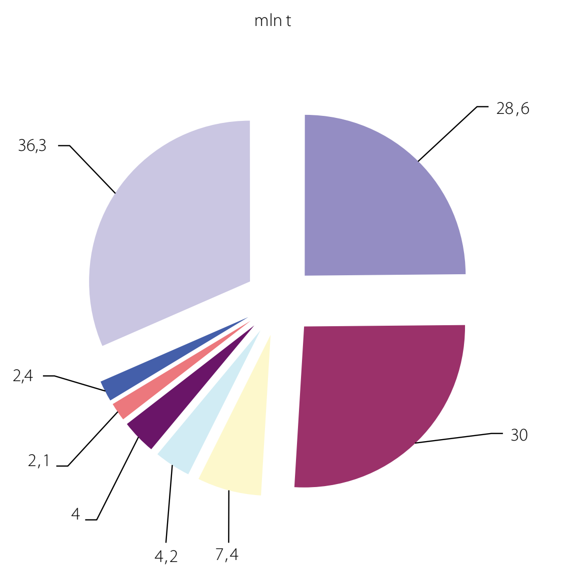

Fig. 5.3.2. Waste generated in Poland in 2008 by type, excluding municipal waste (source: CSO)

The main sources of industrial waste are: mining (in particular hard coal mining – 30% of total generated waste), industrial processing – production of metals (mainly copper – 24%), production of foodstuffs and beverages (ca. 7%) and production of chemical products (5%), as well as production and distribution of electricity (almost 13%). The greatest share in generated waste is accounted for by waste from flotation enrichment of non-ferrous metal ores (ca. 30%), waste originating from rinsing and cleaning minerals (ca. 29%) and slag and ash mixtures from wet removal of furnace waste (over 7.4%) (Fig. 5.3.2.).

What is the main factor determining the volume of generated waste is economic development, which affects both the intensity of production and the level of individual consumption and consumption patterns. Analysing the dynamic of changes in generated waste in relation to GDP changes, one may notice a positive tendency – with a constant GDP growth, the volume of industrial waste has remained at a similar level for the last ten years, which may be considered an effect of actions undertaken to rationalise waste management in Poland (Fig. 5.3.3.).

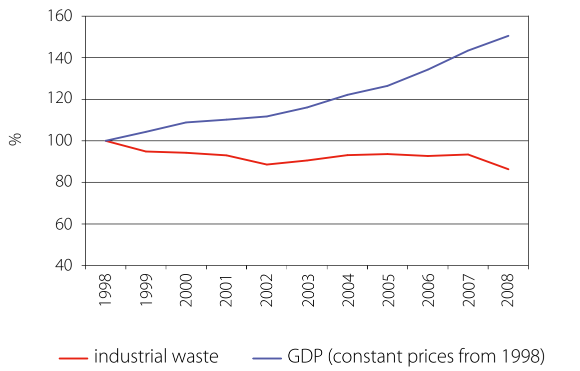

Fig. 5.3.3. Dynamic of changes in generation of industrial waste against GDP in constant prices (1998=100%) (source: CSO)

In 2008, 10.03 million tonnes of municipal waste were collected. In the years 1998-2005, a constant fall in the volume of collected municipal waste was observed. It was the result of both limitation of the generation of that waste, and handling it in an inappropriate way, such as dumping into the forest or incineration in household furnaces. In the years 2006-2008, an increase in the volume of collected municipal waste was observed. It is assumed that it is a result of the process of tightening of the municipal waste collection system, among others, the requirement to have a waste collection and removal contract (Fig. 5.3.4.).

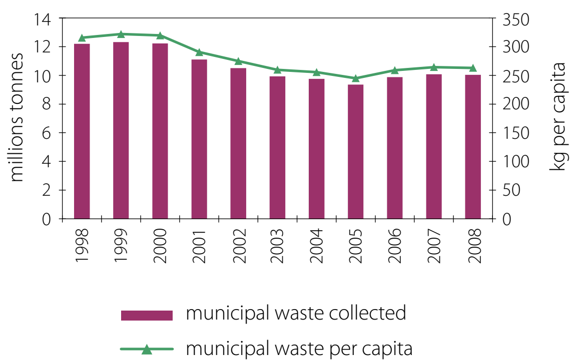

Fig. 5.3.4. Volume of municipal waste collected in Poland in the years 1998-2008 (source: CSO)

The volume of generated municipal waste is closely connected to the level of individual consumption and its patterns. Analysing the dynamics of the changes of both indicators, one should notice that the private consumption index increased by almost 60% in the years 1998-2008, whereas the volume of collected municipal waste decreased by ca. 15% in the analysed period.

Over the last three years, a growth in the volume of municipal waste has been observed, but its dynamics is much lower than the dynamics of the changes of the consumption index (Fig. 5.3.5.).

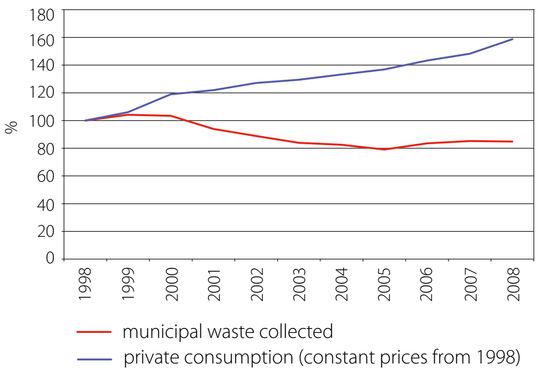

Fig. 5.3.5. Dynamics of the changes in the volume of collected municipal waste against changes in private consumption in constant prices of 1998 (1998=100%) (source: CSO)

Calculated per capita, the average of 524 kilograms of municipal waste is generated during a year in the European Union countries. In Poland, the indicator reaches a much lower level and amounts to 322 kg (Fig. 5.3.6.).

The *National Environmental Policy* sets increasing recovery of industrial waste as one of the objectives in the scope of waste management. It results from the data presented by the CSO that there was taking place a progressive increase in the share of industrial waste undergoing recovery in the years 1998-2005 with a simultaneous fall in the percentage share of landfill waste. In the years 2006-2008, there took place a decrease in the share of waste undergoing recovery from 76.83% in 2006 to 76.38% in 2007 and 74.93% in 2008. There was observed a percentage increase in the share of landfill waste from 13.41% in 2005 to ca. 15% in the years 2006-2007 and 17.65% in 2008 (Fig. 5.3.7.).

Of the total volume of waste generated in 2008, 75% underwent recovery, 18% was disposed by landfilling, 4% was disposed otherwise than by landfilling, and 3% was landfilled temporarily.

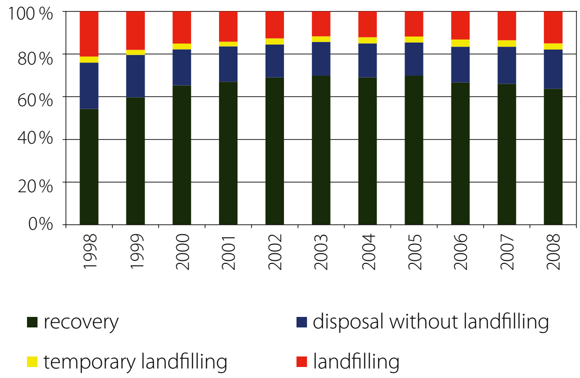

Fig. 5.3.7. Management of industrial waste in Poland in the years 1998-2008 (source: CSO)

The higher values may indicate that the actions undertaken to increase the volume of recovered industrial waste are not sufficient.

Disposal by landfilling still remains the main method

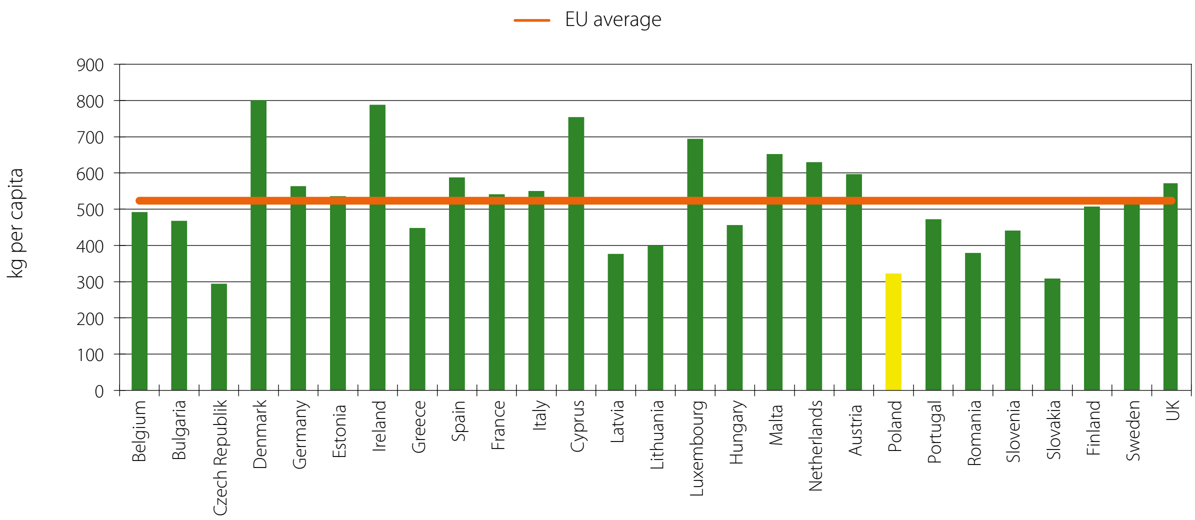

Fig. 5.3.6. Volume of generated municipal waste calculated per capita in 2007 in EU countries (source: CSO/Eurostat)

of waste management in Poland. In 2008, 8,693.2 thousand tonnes of municipal waste were landfilled, which accounts for 86.6% of all collected municipal waste. The share of landfill waste is decreasing from year to year, but it still remains high.

Achievement of the designated recycling levels for particular types of package waste is one of the objectives of the National Environmental Policy. Analysing the levels of recycling achieved in particular years 2002-2008 with the standards designated in the regulations and the National Waste Management Plan, one should stress that the levels were achieved, which indicates implementation of the objective set in the National Environmental Policy (Fig. 5.3.8.).

What is a trend observed since the moment of Poland's accession into the structures of the European Union is a growth in the number of applications to the Chief Inspector for Environmental Protection for a consent to trans-border movement of waste (in 2008 – 543 applications). Of the applications, the greatest number was accounted for by applications concerning import of waste to Poland, i.e. more than 70%, including mainly scrap ferrous and non-ferrous metals.

In 2006, European Union legislation was introduced in the scope of management of waste electronic equipment. The available data demonstrate positive tendencies in the treatment of the „electric scrap". In comparison to 2007, there took place an increase in the collection of waste electronic equipment in 2008 (Fig. 5.3.9.). In 2008, a level of collection of waste electric and electronic equipment of 10% was achieved, while the level of collection of equipment from households amounted to 6.46%. Calculated per capita, there was collected 1.48 kg waste equipment (assuming the population in 2008 of 38.135 million – source CSO).

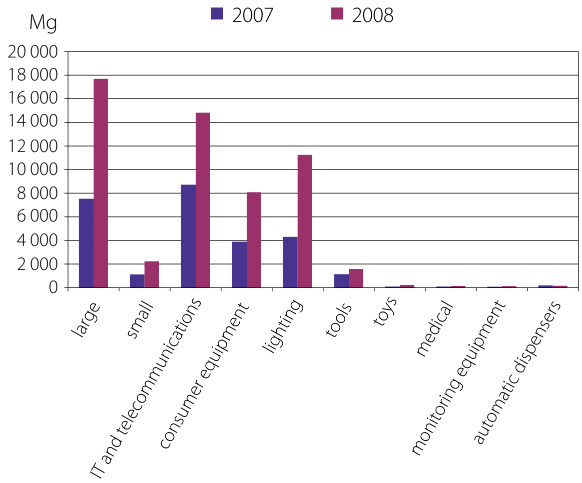

Fig. 5.3.9. Collected waste electrical equipment in Poland in the years 2007-2008 (source: CIEP)

Instruments that support rational waste management include: the National Environmental Policy and the waste management plans. The waste management plans are prepared at the national, voivodeship, poviat and gmina level. Thus, the role of local government in creation, and then implementation of the principles of reasonable waste management is crucial. The system of reports from implementation of waste management plans, covering the period of two calendar years, motivates particular administrative units to make every effort both at the stage of developing plans (as realistic assumptions as possible) and at the stage of their implementation.

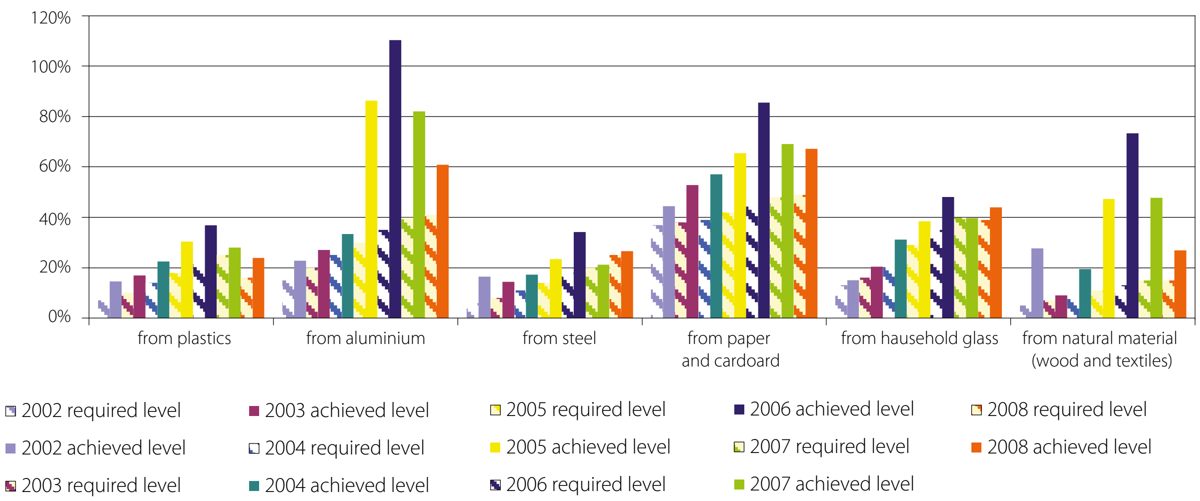

Fig. 5.3.8. Annual levels of recycling of package waste required and achieved in Poland in the years 2002-2008 (source: CSO)

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It should be noted that, with a constant growth of the GDP, the volume of generated waste remains at a similar level, which might indicate positive trends in waste management.

Data concerning the volume of recovered waste quoted in the report might suggest that the actions undertaken to increase the volume of recovered industrial waste are insufficient.

The achieved recycling levels of package waste were higher than the legally required ones in all years under analysis. It testifies to the implementation of the objective set in the National Environmental Policy.

V.4 Noise

Noise seems to be the environmental factor that causes the greatest nuisance. One of the most popular definitions states that noise is any sound that is not welcome, causes nuisance or even harmful in particular conditions. The effect of environmental noise on people is considered by international organisations, in particular the WHO, to be one of the most important health related problems. It is particularly disadvantageous during the night-time. By disturbing sleep, it causes not only the conditions of chronic fatigue, but also impairment of the immune and vegetative systems. With respect to the origins of its source noise may be divided into two general categories like installation (industrial) and traffic noise. Traffic noise includes: road traffic (street), rail traffic and aircraft noise. The major threat influencing the state of acoustic climate both in Poland and the other EU countries is the impact of traffic noise.

One of the most important tasks of all developed countries, Poland included, is the limitation of noise to the permissible levels[27]. Due to the commonness of occurrence of noise exposure, the task is a long-term one, the implementation of which shall be spread over many years (long-term perspective).

The most important middle-term goals to be achieved include:
elimination of means of transport, machines and equipment whose noise emissions does not meet European Union standards from production, and gradual elimination of the devices from use;
commencement of actions aimed at reduction of noise in urban areas around airports, industrial areas, major roads and major railways to the equivalent noise level not exceeding 55 dB at night-time;
introduction of provisions concerning noise control to local land use planning.

in : "The national Environmental Policy for 2003-2006 and Its 2010 Outlook"

Trends in changes in the acoustic climate are assessed within the state environmental monitoring on the basis of accumulated results in 5-year periods.

Road traffic noise is related to the car traffic and constitutes the major threat in urbanised areas.

Tab. 5.4.1. Percentage distributions of the numbers of road traffic noise measurement results with the application of various criteria (source: CIEP/SEM)

Period	Distribution of the noise measurements results' number [%]			
	First criterion of the analysis		Second criterion of the analysis	
	$L_{Aeq\,D}$ < 60 dB	$L_{Aeq\,D} \geq$ 60 dB	$L_{Aeq\,D}$ < 70 dB	$L_{Aeq\,D} \geq$ 70 dB
1993-1996	11.6	88.4	47.9	52.1
1997 -2001	12.0	88.0	44.7	55.4
2002-2006	7.9	92.1	59.3	40.7
2007 -2008	6.8	93.2	69.4	30.6

27 Regulation of the Minister of the Environment of 14 June 2007 on permitted environmental noise levels.

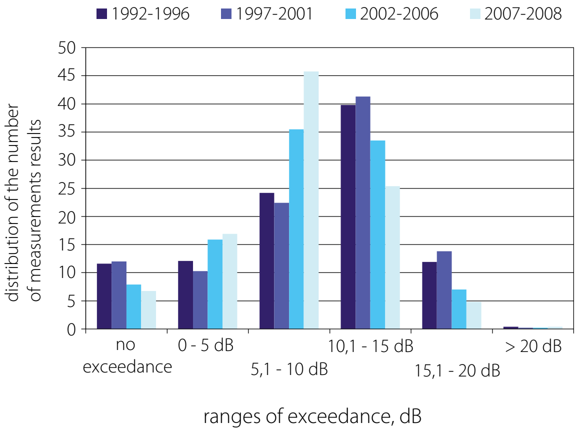

Fig. 5.4.1. Percentage distribution of exceedances of permitted day-time noise level $L_{Aeq\ D}$, for road traffic noise (including street noise) for four time periods (100% - number of measurement results with exceedances) (source: CIEP/SEM)

Comparison of the exceedances distribution indicate a clear rise in noise in the range of 65-70 dB (exceeding the noise limits by 5.1-10 dB) in the years 2007-2008[28] in comparison to the previous 5-year periods. As regards high and the highest levels (exceeding by more than 10 dB), after the growth of the number of such cases until the end of the 1990s, a slow fall started to be recorded. From that time, a moderate increase in the levels of road traffic noise is accompanied by the positive trend of the fall in the number of cases of the highest levels exceedance (Fig. 5.4.1.).

The numeric illustration of the thesis is shown in the table 5.4.1. The table includes results of the two ways of analysis of the road traffic noise trends. The trends were analyzed with adoption two criteria of the noise distribution:

- the first criterion – distribution of the noise levels in two groups: less or higher than the $L_{Aeq\ D}$ = 60 dB (limit for day-time traffic noise level),
- the second criterion – distribution of the noise levels in to ranges: less or higher than the $L_{Aeq\ D}$ = 70 dB (very high exposure to traffic noise).

The above data indicate a clear increase, by ca. 4.8%, in the number of the permitted sound levels exceedances (over 60 dB), with a simultaneous clear fall in the number of cases of sound level exceeding 70 dB.

In 2008 exposure to rail traffic noise was estimated in Poland on the basis of the timetables of trains travelling along the major national railways net of the total length of about 13 000 km. The general assessment indicate that about 500 000 people living along railways are exposed to rail traffic noise at a level of over 60 dB in the day-time and over 50 dB in the night-time. Further analyses show a slow, though in some cases significant (especially with reference to main lines) decrease in the exposure of population to noise emitted by rail traffic. The basic causes include a decrease in traffic intensity, revitalisation of many sections or railways and systematic, though slow exchange of the rail stock into less noisy.

Air traffic noise in the areas surrounding airports belongs to the most annoying acoustic phenomena in the environment. In Poland, exists one major airport Warszawa-Okęcie, several medium-size ones: Kraków-Balice, Gdańsk-Rębiechowo, Poznań-Ławica and a dozen small, which have the prospects of intensive expansion. The data for the Warszawa-Okęcie airport coming from the noise map of the airport developed in 2007, obtained with the use of the L_{den} level, that is the day-evening-night level, indicate that the exposed area for conditions corresponding to values of the equivalent noise level L_{AeqD} = 60 dB ranges from 20 to 24 km^2.

Industrial noise monitoring carried out in the recent years have shown that there occurs the greatest number of small exceedances up to 5 dB in the day-time. Exceedances in the range from 15 dB to more than 20 dB constitute a small proportion of all examined cases (Fig. 5.4.2.). In the night-time, the situation is more diverse, 71% of exceedances of the noise limits not only are included in the class of exceedances by up to 5 dB, but also in the upper class – exceedances by up to 10 dB. There are also more exceedances of permitted levels in the highest classes, i.e. for exceedances of the permitted levels by 15 dB and more (Fig. 5.4.3.).

[28] It is not a full 5-year comparative period, but some trends can be clearly recorded.

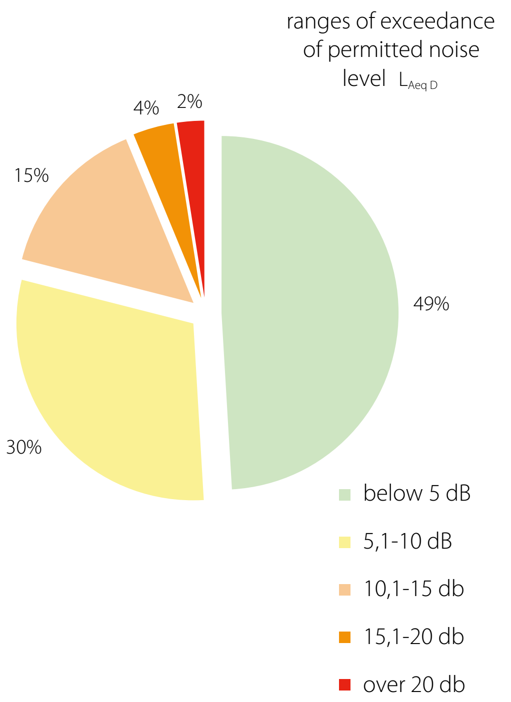

Fig. 5.4.2. Distribution of the exceedances of the permitted noise levels expressed by indicator $L_{Aeq D}$ (dB) measured around industrial plants in particular classes of exceedances in the years 2007-2008 (100% - all plants exceeding the permissible day time levels) (source: CIEP/SEM)

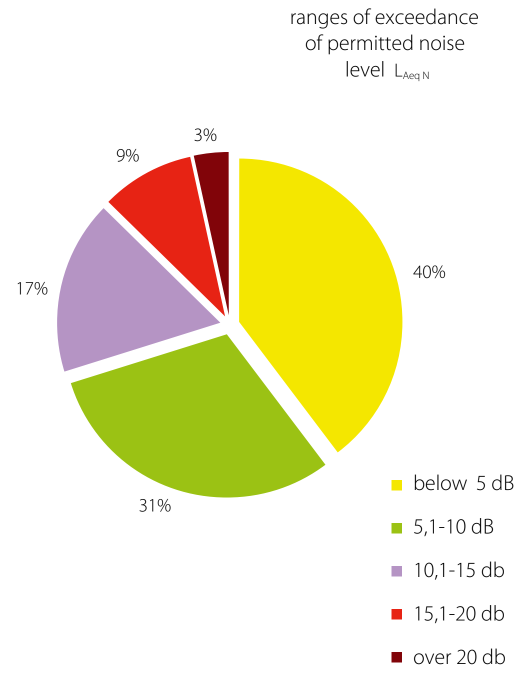

Fig. 5.4.3. Distribution of the exceedances of the permitted noise levels expressed by indicator $L_{Aeq N}$ (dB) measured around industrial plants in particular classes of exceedances in the years 2007-2008 (100% - all plants exceeding the permitted noise night-time levels) (source: CIEP/SEM)

The results of industrial noise surveys in the years 1992-2008, with reference to all examined plants, indicate that, after a fall in the exposure to this kind of noise in mid-1990s, the trend has been stopped. A fall in the exceedance of the noise limits in the day-time is becoming perceptible and, unfortunately, a small increase in the number of exceedances in the night-time (Fig. 5.4.4.).

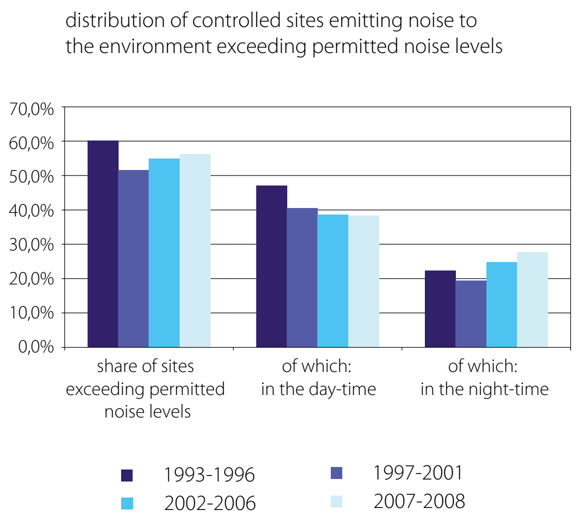

Fig. 5.4.4. Results of controls of exceedances of permitted equivalent industrial noise levels in four time periods (source: CIEP/SEM)

Studies of the distribution of permitted noise levels exceedance cases, concerning the day-time confirm the constant downwards trend.

According to the studies carried out by voivodeship inspectors for environmental protection, after the decrease in the share of sites not meeting the noise standards that started in 1997, a slight upwards trend of exceedances of the permitted level up to 5 dB was demonstrated, in particular in the night-time. This is in most cases attributable to sites causing relatively low acoustic nuisance, but located near residential area (Fig. 5.4.5. and Fig. 5.4.6.).

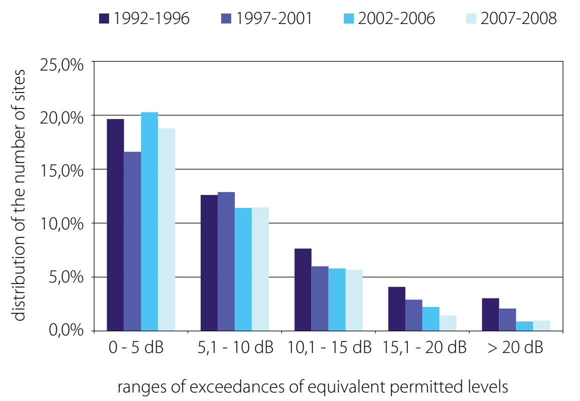

Fig. 5.4.5. Distribution number of sites emitting noise which exceeds the equivalent permitted day-time levels (100% - all sites covered by measurements) (source: CIEP/SEM)

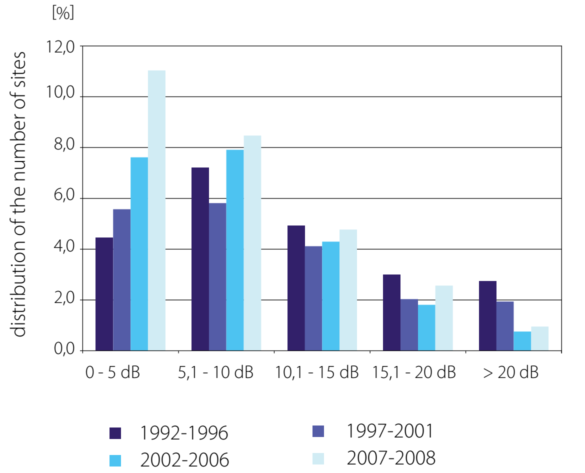

Fig. 5.4.6. Distribution of the number of sites emitting noise which exceeds the equivalent permitted night-time levels (100%=all sites covered by measurements) (source: CIEP/SEM)

The state of the acoustic climate is related to the state of social-economic development of the country. Key indicators include those relation in particular with the development of transport infrastructure and reflect changes in the exploited sources. For the most frequent source of environmental noise, i.e. the road traffic (street) noise, the so-called *motorisation environmental pressure index*, is used in analyses of the acoustic climate. The index links the streams of road traffic to the density of (road) infrastructure, whereby its value becomes proportional to the exposure to noise. The value of the motorisation pressure index has been gradually growing from the start of its development, that is for the total of 10 years, which leads to a constant increase in the exposure to road traffic noise in Poland. The phenomenon is related to the changes in the length of roads of the national communication network and the growth in density of those communication routes, as well as the growth in the number of vehicles used. In 2008, higher values of the index were recorded in the following voivodeships: Śląskie, Małopolskie and Opolskie, and the highest in the Warmińsko-Mazurskie Voivodeship (Fig. 5.4.7.).

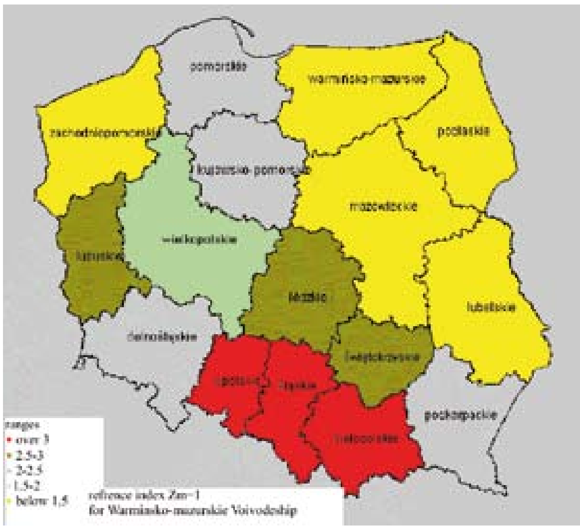

Fig. 5.4.7. Motorisation pressure index in 2008 (source: CIEP/SEM)

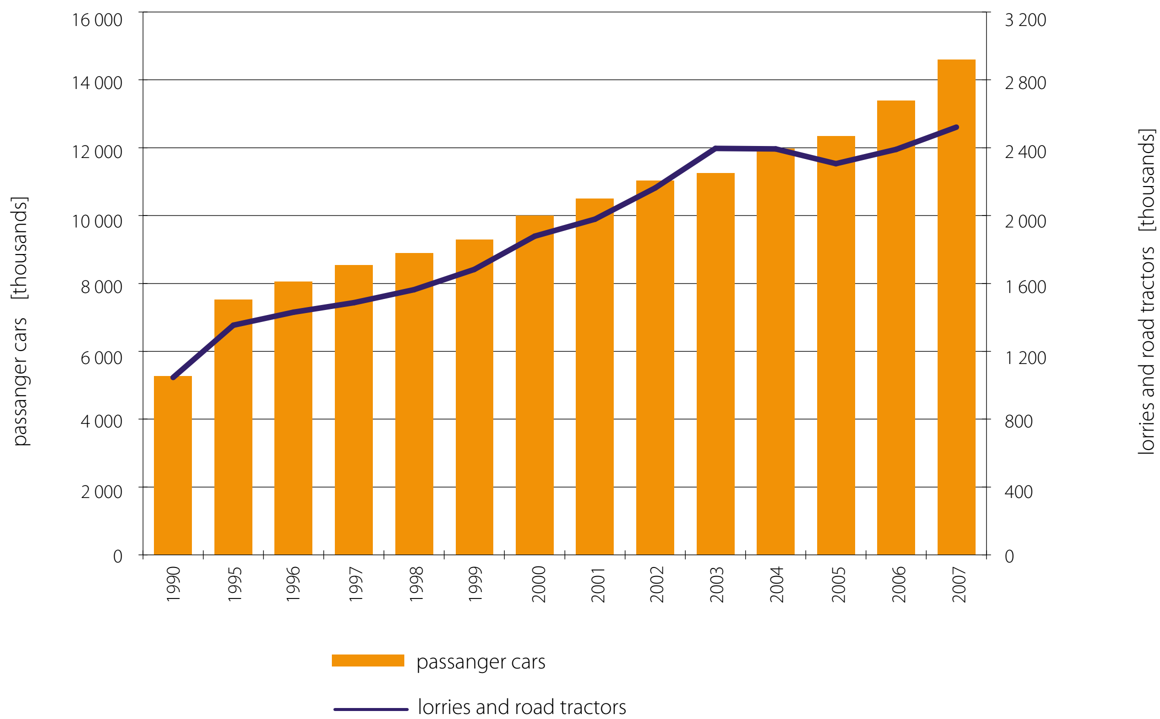

Fig. 5.4.8. Changes in the number of registered motor vehicles (source: CSO)

What is one of the basic causes of the recorded trends of changes in the motorisation pressure index, thus also noise, is the rapid growth in the number of vehicles in Poland (Fig. 5.4.8.).

As regards the pressure caused by the rail traffic, there has been observed virtual stagnation in the development of the railway network in Poland. In the recent years, there has been even recorded a clear tendency to decrease the length of railways. The continuous fall in the length of railways, as well as the number of rail connections, and at the same time actions in the scope of modernisation of the stock and replacement of rails with new ones of a more modern structure (also with reference to minimisation of noise emission) may lead in general to the fall in rail noise nuisance. Nevertheless, many major lines are modernised with the view to enable running trains at a speed of even over 200 km/h. It pertains to, for example, line CMK, E-20 (Warsaw – Poznań – Kunowice) and others. Around such lines, the acoustic climate may deteriorate.

What is a good indicator of environmental pressures are indexes related to the so-called transport work of various means of transport, in particular – relative data on that topic, indicating upwards or downwards trends. To illustrate this the most characteristic trends can be quoted, i.e. a 20% growth (in 2007) in international carriage by road, which is also reflected in national traffic (entering and leaving Poland) of the heaviest road tractors, which are the noisiest, and an about 60% growth (in 2007) in national carriage by air.

The increase in air traffic noise in Poland has been a growing problem. It is related to:

- the development of regional airports and a significant intensification in air traffic on them, in particular intensification in international connections,
- growth in the tonnage of the carried cargoes,
- development of air transport handled by small aeroplanes and helicopters; this kind of air stock is not as noisy as big aeroplanes used for regular flights, but due to their growing numbers and flying at relatively low altitudes, it is becoming a serious acoustic problem.

The predictable growth of the areas exposed to noise around the Lech Wałęsa Airport in Gdańsk constitutes a representative example of the foreseen increase in air noise exposure. The area exposed to noise is believed to grow by about 50% in the day-time in the perspective of some 10 years (depending on the economic development of the state and the region, which entails intensification in air carriage).

The growing number of service and commercial buildings (supermarkets, petrol stations, activities related to entertainment, crafts, home employment, repair shops, etc.) in the recent years has contributed to noise nuisance. More and more of such activities are located near protected (housing) development. In this situation, even relatively low levels of noise emitted from a source may cause great nuisance for local residents. The growth in acoustic nuisance in the vicinity of residential buildings is related to the development of technology, for example, many offices and shops have air conditioning, which cause deterioration of the noise condition near them.

Noise maps, developed in accordance with the requirements of Noise Directive relating to the assessment and management of environmental noise on the basis of long term indexes L_{den} and L_n are the source of additional information on the noise conditions of the environment. Noise maps, showing the current state of the acoustic climate and the population exposed to noise, present indirectly the pressure of particular kinds of noise sources. Starting from 2007, noise maps have been developed in accordance with the provisions for:

- agglomerations with population of 250 000 (12 cities accounting for ca. 30% of population in Poland),
- sections of major roads, where more than 6 million cars travel per year (ca. 1500 km of roads in Poland),
- sections of major railways, where more 60 000 trains travel per year,
- airports with over 50 000 air operations per year.

Due to the very limited scope of the examination of rail noise (ca. 17 km of sections of railways), the obtained results are of almost no significance for national estimates.

The results of studies of air noise in Warsaw – the Frederic Chopin Airport, as the only major airport in Poland, are of high importance for those living in the vicinity.

For the total population of the 12 examined agglomerations, the average share of people exposed to excessive noise:

– according to the assessments performed on the basis of indicator L_{den} – ca. 36%,
– according to the assessments performed on the basis of indicator L_n – ok. 38%.

The greatest number of population living in conditions of exceedance of the noise limits takes place in Warsaw, then come Bydgoszcz, Gdynia, and Lublin. On the other hand, the best acoustic conditions, in the light of the results of noise mapping, exist in Łódź, Poznań and Kraków[29] (Fig. 5.4.9.).

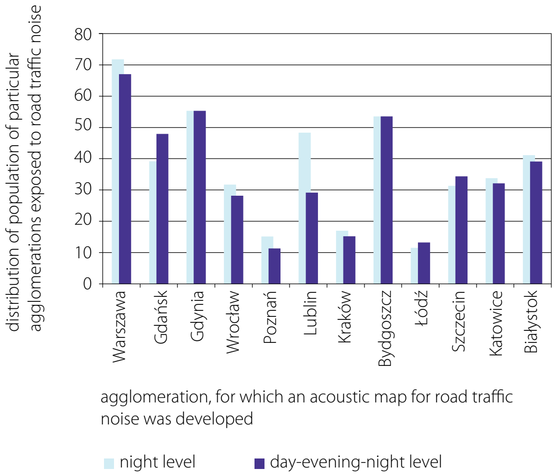

Fig. 5.4.9. Distribution of population of particular agglomerations (population over 250 000) exposed to road noise at a level of L_{den} > 60 dB and L_n > 50 dB (source: acoustic maps for cities >250 000 population)

The non-urban population exposed to excessive road noise along the most used transport routes is presented in the following diagrams (Fig. 5.4.10. and Fig. 5.4.11.).

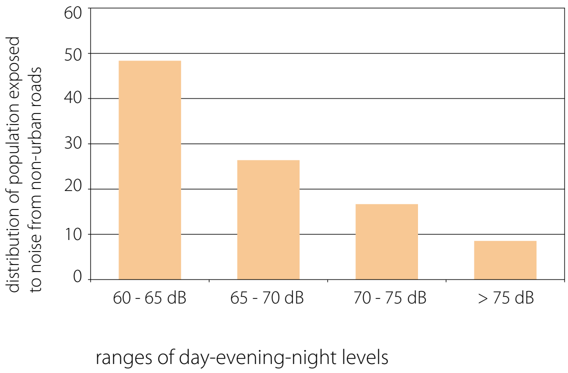

Fig. 5.4.10. Distribution of population exposed to noise from non-urban roads, assessed with L_{den} > 60 dB (100% corresponds to 230 000 population exposed at all examined sections of roads altogether) (source: CIEP/SEM)

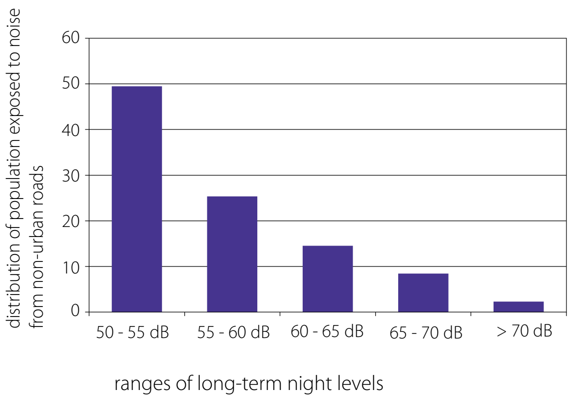

Fig. 5.4.11. Distribution of population exposed to noise from non-urban roads, assessed with L_n > 50 dB (100% corresponds to 440 000 population exposed at all examined sections of roads altogether) (source: CIEP/SEM)

The level of risk of excessive noise is in this case much lower (in comparison to agglomerations) and reaches the number of less than 500 000 population. It should, however, be taken into account that the studies covered less than 5% of national and voivodeship roads and possibly others causing high nuisance, thus the represented sample reflected only a fraction of the phenomenon.

[29] It is an interesting phenomenon, since the group also includes three largest Polish agglomeration beside Warsaw.

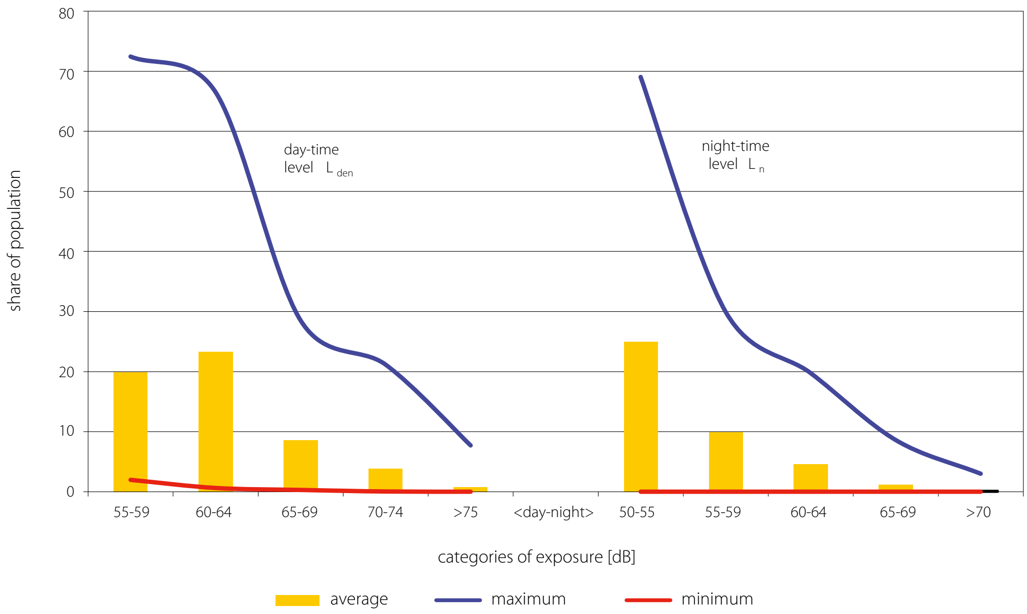

Fig. 5.4.12. Distribution of exposure to road traffic noise of EU residents in agglomerations with population of over 250,000 (source: EEA)

The results of the development of noise maps in the EU countries (including Norway), developed obligatorily, in compliance with the regulations of Noise Directive, have been submitted to the European Commission. A qualitative analysis of the obtain information reveals that, according to average national data, Poland does not belong to countries with significant noise exposure. The shares of population at risk of noise in Poland against the EU average are illustrated in the two diagrams below (Fig. 5.4.12. and Fig. 5.4.13.).

Reduction of the exposure caused by noise is mostly related to the noise sources. In that scope, significant achievements have been recorded, especially in relation to silencing road and rail vehicles, the application of modern road surfaces and rails, the introduction to exploitation of a modern generation of transport aircraft of reduced noise generation, the introduction to the market of new industrial devices and installations with reduced level of acoustic power, including additional noise reducing solutions (sound suppressors, casings etc.).

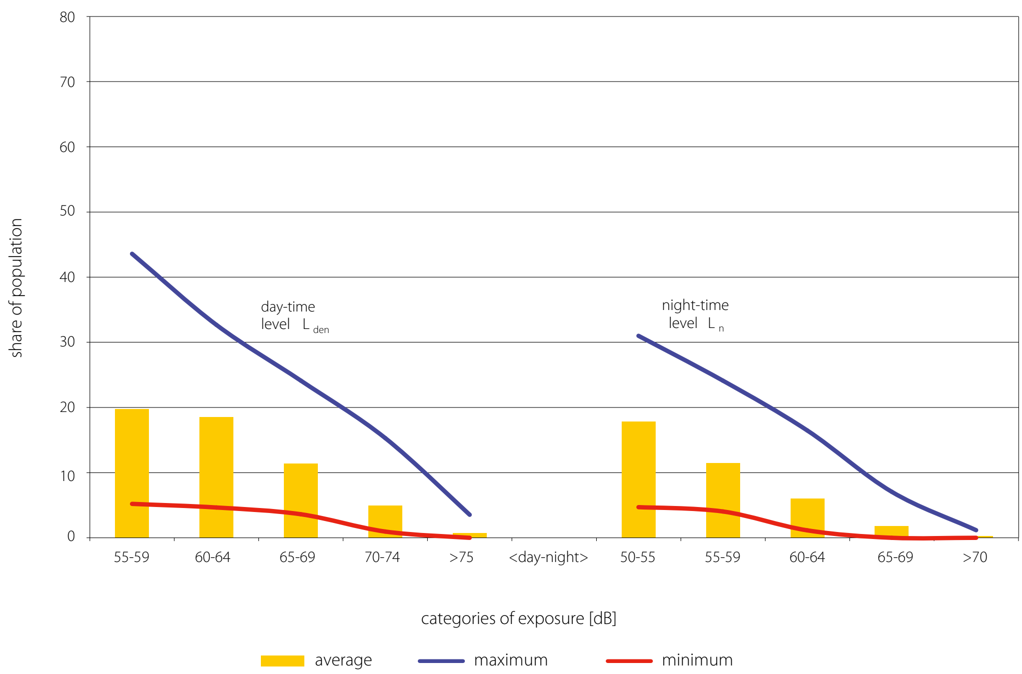

Fig. 5.4.13. Distribution of exposure to road traffic noise of Polish residents in agglomerations with population of over 250,000 (source: EEA)

The above-mentioned technical actions of a basic character are necessary for long-term activity related to limitation of environmental noise. They are not, however, sufficient at present, due to the large number of exploited noise sources, which is growing fast.

The spatial scale of the phenomenon of degradation of the acoustic environment by means of transport in particular road transport, requires the application of efficient solutions and consistent actions. The directions of those actions and the methods of proceeding are mainly determined by Noise Directive. The risk of traffic noise is actually so significant in all EU countries that it has become necessary to establish long-term programmes of protection actions. There is no country with financial ability to quickly bring the parameters of the acoustic climate to the limit values. At present, the centre of gravity of fighting noise has been moved from *ad hoc* actions to implementation of noise protection programmes, which must list the proposed protection actions.

Beside the above-mentioned long-term programme actions, there are applied, as far as possible (mostly within modernisation and rebuilding of transport routes) *ad hoc* actions, such as:

- building ring-roads[30],
- limitations in traffic and other actions related to traffic engineering (setting speed limitations have been the most frequent measures recently),
- building acoustic screens,
- application of increased insulation of windows,
- application of silent surfaces (that is, unfortunately, marginal action in Poland, but with a prospect of development).

Counteractions in the scope of industrial noise are mainly related to the introduction of a modern machine park and elimination of old, annoying industrial sites.

In local land use plans, the provisions considering protection against noise must be taken into account, with indication of areas of limited development around airports, industrial areas and major roads and main railways, where the equivalent noise level amounting to 55 dB in the night-time is exceeded.

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Trends in environmental noise in Poland indicate, on the one hand, an increase in the risk of traffic noise and, on the other hand, a reduction of the growth and existence of downwards trends with respect to industrial noise.

The upwards trends in traffic noise are most of all true for road- and air traffic noise. The growth in the risk of road traffic noise is related above all to the rapid increase in the number of cars in Poland over the last 15 years. Despite the already recorded tendency to approach the level of saturation, the growth is still significant. In the case of air traffic noise, there are recorded growing trends in the level of noise due to taking over some of international traffic by local, intensely extended airports. Furthermore, there is observed an increased in the number of national connections from airlines operating small aeroplanes, the "air taxis", helicopters, etc. In the case of industrial noise, the past actions seem right and there seems to be a chance for gradual elimination of that type of nuisance.

[30] Construction of a ring-road is not undertaken as an anti-noise measure in most cases, yet it has a significant impact on noise reduction.

V.5 Electromagnetic non-ionising radiation

Electromagnetic radiation (EMR) present in the environment may originate both from natural sources (the Earth's magnetic field, cosmic radiation, lightnings), and artificial sources introduced into the environment, in a way that is: intentional (radio and television transmitters, mobile telephone transmitters, radar stations, etc.) or unintentional, as a side effect of the operation of various devices (transmission lines, transformer stations and all kinds of power consumers). The EMR artificially introduced into the environment is sometimes called electromagnetic smog. The scope of electromagnetic non-ionising radiation ranges from 0 Hz to 300 GHz and covers: static electric and magnetic field (0 Hz), low-frequency fields (up to 300 Hz) and radio waves, including their sub-band, that is microwaves.

All organisms living on the Earth evolved in the magnetic field of natural origin and learned not only to tolerate the field, but also – in the case of many species – even to use in various life processes. The impact of the EMR on living organisms and on all objects located in the impact zone of consists in transmitting energy. The phenomenon takes different courses for fields of low and high frequency. Low frequency field causes the so-called non-thermal phenomena, whereas high frequency fields (over 100 kHz), transmitting their energy, cause increase in temperature of the object they affect (so-called thermal phenomenon). The impact of the ERM on plants and animals is different. Also the impact of the electrical and magnetic components is different, and changes both along with the frequency of radiation and the energy which the radiation carries.

In the light of the provisions of the Environmental Protection Law Act, "protection against electromagnetic fields consists in ensuring the best possible state of the environment through:
keeping the levels of electromagnetic fields below or at least at the limit values;
reduction of the levels of electromagnetic fields at least to the limit values, when they are not met."

Article 121 of the Environmental Protection Law Act of 27 April 2001

In relation to the above, it is understandable that the fact of increasing the levels of electromagnetic fields as a result of human activity gives rise to concern. The increase causes the necessity to monitor the state of the environment.

Poland is one of few countries with a complete legal system for protection of the population against electromagnetic radiation. The limit values of non-ionising radiation determined for areas intended for residential development and places available for the public[31] are, according to the regulations binding in Poland, much lower than those included in the Recommendation of the European Council[32], applied in the other EU Member States. The legal order binding from 2007[33] requires that monitoring measurements be carried out in central districts or housing estates of cities with population of over 50,000, in other cities and in rural areas.

Carried out in 2008 by voivodeship environmental protection inspectors, monitoring of electromagnetic fields in 547 measurement points indicate lack of exceedances of the limit values in the environment. The results of measurements show that the average values of intensities of electromagnetic fields are much lower than the national limit values.

Determination of long-term trends in the levels of electromagnetic fields is possible on the basis of examinations carried out in the previous years on commission from the Chief Inspector for Environmental Protection in selected Polish cities. Measurements were taken in the years: 1993, 2001-2003, 2005 and 2006 by various scientific and research institutes. For the Capital city of Warsaw, the location of measurement points has not changes in years, to observe trends in the levels of the EMR. It should be kept in mind that the examination of the levels of electromagnetic fields, although carried out by two different laboratories applying different methodologies, show convergence.

[31] Regulation of the Minister of the Environment of 30 October 2003 on limit values of electromagnetic fields in the environment and the ways to comply with those levels.

[32] Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (Recommendation 1999/519/EC).

[33] Regulation of the Minister of the Environment of 12 November 2007 on the scope and manner of periodic examination of electromagnetic field levels in the environment.

The obtained results of measurement carried out in 1993 and in the years 2001-2003 show no changes in the levels of electromagnetic fields in points located around the Palace of Culture and Science, where numerous radio and television transmitters are placed. In points distant from the Palace, there was recorded a growth of the levels of electromagnetic radiation by several or a dozen times in 2003 in relation to the results of measurements carried out in 1993 and 2001. Such a significant increase in the levels of the EMR has been caused by the development of cellular telephony in the mid-1990s. According to Regulation of the Minister of the Environment of 30 October 2003 on limit values of electromagnetic fields in the environment and the ways to comply with those levels, for the range of frequencies from 80 MHz to 1300 MHz, the legally defined permissible level of intensity of the electromagnetic field in the environment is 7 V/m. Currently mobile networks are operating in the range of frequencies from 450 MHz to 3600 MHz. The intensities of electromagnetic fields measured on the territory of Warsaw in the range of frequencies of 80 MHz-1300 MHz, fluctuate between 0.07% to 8.57% of limit values.

The results of measurements carried out in 2005 are consistent with the results of measurements performed in the years 2001–2003. The arithmetic mean value of the intensity of the electric field measured in 2005 for Warsaw is 0.65 V/m, whereas the arithmetic mean intensity of the electric field measured in 2001 in seven points located in the central districts of Warsaw also amounts to 0.65 V/m (for the range 10 MHz – 2000 MHz).

In 2006, there were performed measurements of the levels of electromagnetic fields with a probe measuring the intensity of an electric field in the range of frequencies from 100 kHz to 3 GHz and calculated results of measurements of the intensity of electric field performed in 2001 in the range from 100 kHz to 2 GHz. The value of the mean of the maximum values of intensity of the electric field measured in particular 17 measurement points carried out in 2006 is 0.87 V/m, whereas the mean value of the resultant values of the electric fields intensities measured in the same points performed in 2001 is 0.84 V/m. The above data indicate that the average level of the intensity of electromagnetic field on the area of Warsaw did not change significantly between 2001 and 2006. The value of those levels was also confirmed by measurements carried out in 2008 by the Mazovian Voivodeship Inspector for Environmental Protection.

Electromagnetic field is a phenomenon that is quite complex in terms of the sources. The main sources of electromagnetic radiation include terrestrial radio and television transmitters, base transceiver stations, radiolocation devices, power stations and lines. However, it must be born in mind that there exist, in the near surrounding of people, beside the sources of electromagnetic fields mentioned above, a huge number of various kinds of devices powered with electricity, this producing electromagnetic fields around them, with a quite wide spectrum of frequencies.

Mobile telephony is the most developing area of human activity which uses devices emitting electromagnetic field. The GSM system covers practically the whole country with its scope. Three providers have their own transmitters, and a fourth one started building its own in 2008. The number of transceiver stations of the two GSM systems: 900 and 1800 is continuously increasing. Since 2008, the network of the so-called third generation telephony, called the UMTS, has been developed, which shall eventually replace the two GSM systems, but will function along them for some time. Antennas enabling wireless access to broadband Internet, as well as antennas forming the so-called picocells, covering single streets or even buildings, are more and more frequently installed in urban areas. Such antennas are also installed more and more frequently inside buildings (office buildings) and large shopping centres (Fig. 5.5.1.).

Fig. 5.5.1.Number of transceiver stations of mobile telephony in Poland (source: CSO)

The above data indicate a constant growth in the number of one of the major sources of electromagnetic radiation, that is the mobile telephony transceiver stations, which, as a consequence, is reflected in the growth of EMR emissions to the environment.

Radio and television transmitters are the second important group of devices emitting electromagnetic radiation. The transmitters belong to high power sources, calculated in kilowatts, or even megawatts. At present, there are taking place quite important changes in the ways of emission of radio and television channels. Long, medium and short wavelengths are being abandoned. The GE06 Agreement, which was concluded in Geneva in 2006 during the IUT Regional Radiocommunication Conference, assumes that final switch-off of analogue broadcasting should take place until 17 June 2015. It means a complete turn to broadcasting channels in digital domain. According to the draft "Plan of digital TV implementation in Poland" the deadline of analogue broadcasting switch-off is 31 July 2013. The fact entails the necessity to turn off some terrestrial transmitters, and, as a consequence, lowering the emission of electromagnetic radiation to the environment. At the same time, more and more of various kinds of services and corporations use their own, internal means of wireless communication. In the coming years, considering plans of formation of new production powers in electroenergetics, an increase in the number of high voltage transmission lines is expected, especially in the north of Poland, where the ability of energy transmission is limited. The construction of such transmission lines will be facilitated by the act on transmission corridors the assumption of which has been prepared by the Ministry of Economy.

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The past monitoring measurements did not reveal exceedances of the levels of electromagnetic fields in the environment. During the last 17 years, there was recorded a growth in the levels of electromagnetic fields in the environment, caused by the development of cellular telephony to a high extent. The greatest increase in the intensity of the high frequency electromagnetic filed was recorded in the central districts or housing estates of large cities. It is expected that there will take place a development of terrestrial systems of digital techniques of broadcasting radio and television channels in the next few years, which might result in reduction in the power of radio and television transmitters, thus a drop in the intensities of electromagnetic fields around such structures. At the same time, there is taking place a quick development of wireless Internet access networks, as well as development of third generation mobile telephony, leading to increased density of mobile telephony base transceiver stations. The development of the above-mentioned sources may result in a slight growth in mean levels of electromagnetic fields, particularly in highly urbanised areas. Therefore, it may be concluded that one should not expect a radical increase in the levels of intensity of the EMR in the environment in the coming years, despite the growing number of radiation sources in the form of mobile telephony base transceiver stations.

V.6 Ionising radiation

Ionising radiation is a natural element accompanying life on our planet. Radiation from natural sources, the level of which differs in particular regions of Poland, includes cosmic radiation and radiation of natural radionuclides present in the environment. Human activity, such as medical diagnostics and radiation caused by test nuclear explosions and accidents in nuclear facilities, the biggest of which took place in 1986 in Chernobyl, cause introduction of artificial isotopes to the environment, thus disturbing the natural background of ionising radiation.

Having regard to the increasing energy demand of Member States, and at the same time the safety of their residents related to the functioning of nuclear energy there was introduced the Treaty Establishing the European Atomic Energy Community. Article 35 of the Treaty obligates each Member State to „set up the facilities necessary for the permanent control of the level of radioactivity in the atmosphere, water and soil and for controlling compliance with the basic standards."

The share of various sources of ionising radiation in the annual average dose received by a statistical resident of Poland in 2008 is presented in the following diagram (Fig. 5.6.1.).

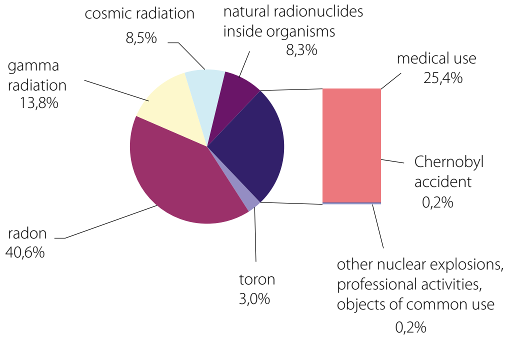

Fig. 5.6.1. Share of various sources of ionising radiation in the annual average effective dose received by a statistical resident of Poland in 2008 (source: NAEA)

Natural radionuclides are released to the environment as a result of anthropogenic activity, such as: mining and energy industry, fertilisation with compounds of phosphorus and potassium, and mining of uranium ores in the past. Artificial radioactive isotopes are released to the environment in a controlled or uncontrolled way. Controlled release of artificial radionuclides is a result of normal operation of nuclear reactors, spent nuclear fuel reprocessing plants and the operation of diagnostic devices and laboratories using radioisotopes. Uncontrolled released of artificial isotopes took place at the time of carrying out experimental nuclear explosions, in particular by the end of the 1950s and at the beginning of the 1960s, as well as during nuclear disasters.

In the first period after releasing, there exist in the environment both radionuclides with a short half life time (with half life times up to some weeks) and radionuclides with medium (from several months to a few years) and long half life times (starting from a few years). At a later time after the release, long-living radionuclides are of the greatest importance for the pollution of the environment, including mainly Cs-137 (Cs-137 is a beta and gamma emitter with a half life time T1/2 = 30,15 years), large quantities of which have been introduced into the environment as a result of the accident at the nuclear reactor in Chernobyl. Therefore, Cs-137 is the indicator used to control contamination with artificial radionuclides.

In Poland, there functions a network of early warning stations for radioactive contamination, which enable ongoing assessment of the radiation situation in Poland, as well as early detection of radioactive contamination.

In normal situation, the level of contamination is significantly influenced by radioactive isotopes, the concentration of which may change in a wide range (from microbecquerels to several becquerels per m^3) depending on meteorological conditions. They include mainly radon 222 and radon 220, as well as products of their decay.

Beside natural isotopes, there are also recorded small concentrations of Cs-137 in the air, which are the remains of experimental nuclear explosions and the Chernobyl accident. The average monthly concentrations of Cs-137 in total faullout in 2008 were at a level of 0.04 Bq/m^2. Until 1996 there were also recorded trace concentrations of Cs-134.

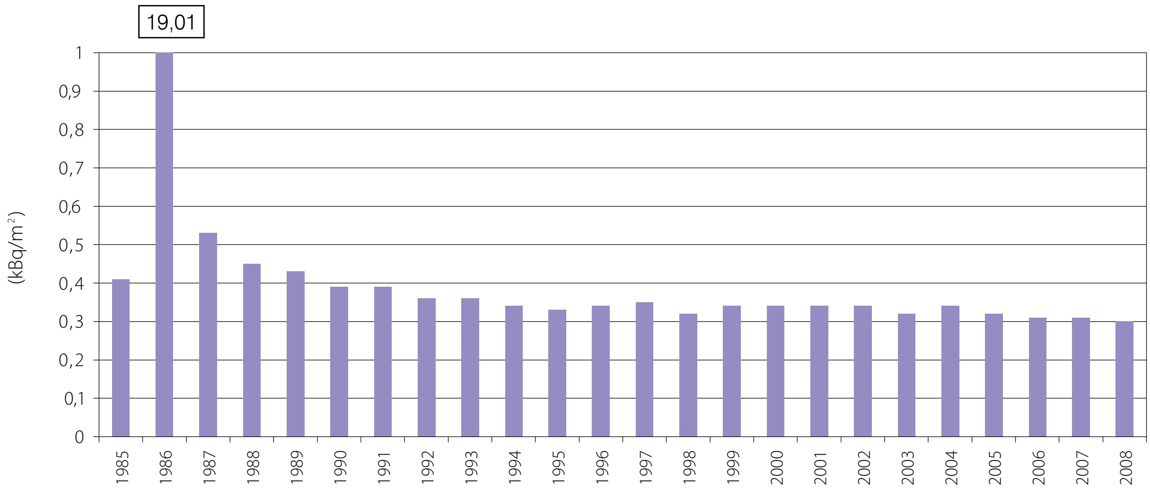

Fig. 5.6.2. Beta activity of total faullout in Poland in the years 1985-2008 (source: CIEP/SEM)

Of the sum of activity of total daily faullout results in the activity of annual faullout. The annual summary average of the beta activity of total faullout in 2008 in Poland amounted to 0.30 kBq/m^2. The value is close to the levels recorded in the years 1985 and 1988-2007 (Fig. 5.6.2.)

The activity of Cs-137 and, in the radiochemical way, the activity of Sr-90 are determined in monthly collective total fall. In 2008, the average monthly activity of Cs-137 in samples of faullout collected in the basic posts reached the level of less than 0.1 Bq/m^2, whereas the activity of Sr-90 amounted to 0.13 Bq/m^2 (Fig. 5.6.3.).

Monitoring of radioactive concentrations in surface waters and bottom sediments justifies the statement that contamination of surface waters and sediments with Cs-137 and Sr-90 is slight. Concentrations of Cs-137 in water and bottom sediments of Vistula and their tributaries show lower values in comparison to Odra and lakes. As regards the concentration of Sr-90, the level is the same in all surface waters. Higher concentrations of Sr-90 in surface waters in comparison to the concentrations of Cs-137 are the result of easier washing out of that radionuclides by precipitation from soil to surface waters.

In Poland, global faullout from the 1950s and early 1960s and faullout after the accident at the reactor in Chernobyl are the source of Pu-239,240 in the environment. The level of plutonium isotopes in bottom sediments is low. Based on the determinations of Pu-239,240 and Pu-238 in bottom sediments, it was established that plutonium from the Chernobyl faullout was present mainly in the Vistula drainage basin. In the Odra drainage basin, existence of plutonium originating from the Chernobyl accident was found only in Głogów and Chałupki. In three lakes (Wigry, Rogóżno, Niesłysz), there was recorded a share of Chernobyl Pu-239,240, while it was Pu-239,240 from global faullout in other lakes[34].

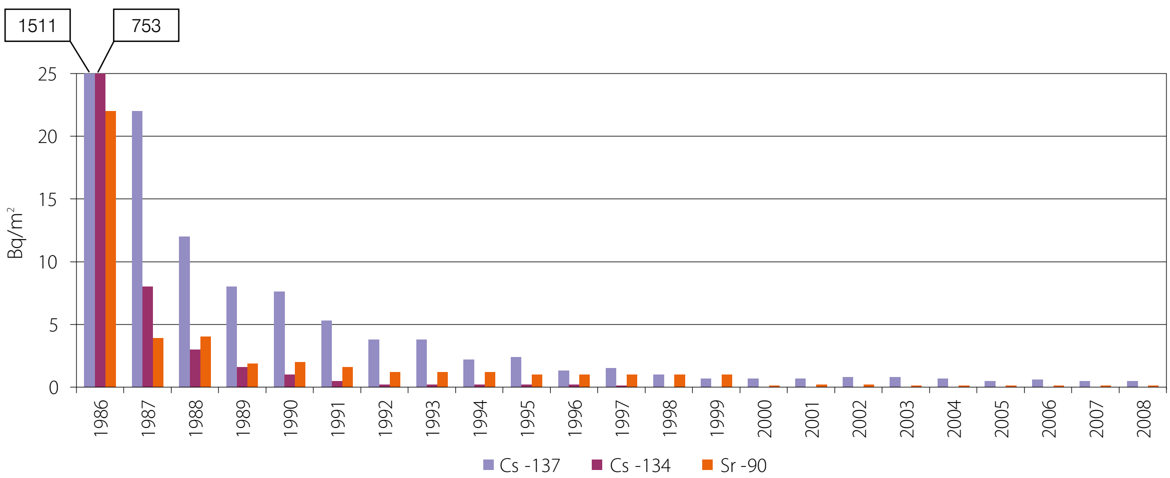

Fig. 5.6.3. Activity of Cs-134, Cs-137 and Sr-90 in the average annual faullout in Poland in the years 1986-2008 (source: CIEP/SEM)

[34] Share of Pu-239, 240 originating from Chernobyl is calculated on the basis of the relation of the activity of Pu-238 to Pu-239, 240.

The activity of Cs-137 and Sr-90 flowing with the waters of Vistula and Odra from the territory of Poland to the Baltic Sea in 2006 amounted to ca. 155 GBq, in 2007 – ca. 106 GBq and in 2008 – ca. 111 GBq.

The average concentration of Cs-137 in soil was decreasing from the value of 4.64 kBq/m^2 in 1988 to 2.41 kBq/m^2 in 2006. The changes in concentration of Cs-137 are caused by radioactive decay of that isotope (T1/2 30 years) and the processes of migration occurring in the environment, mainly the penetration of caesium into the deeper layers of the soil. At the same time, the concentration of Cs-134 was decreasing from 1988 in accordance with the half life time amounting to ca. 2 years, and the radionuclide was identified in soil samples until 2000, now it does exists in soil in Poland (Fig. 5.6.4.).

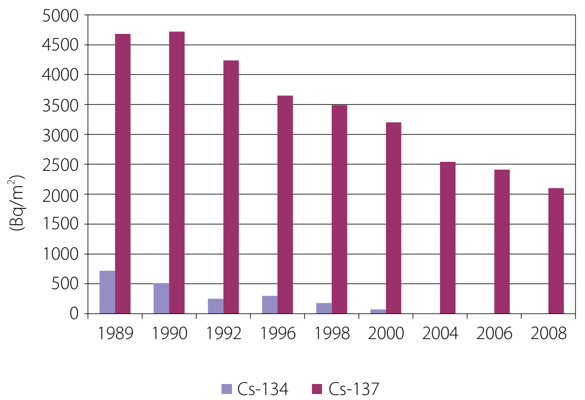

Fig. 5.6.4 Concentrations of Cs-137 and Cs-134 in the surface layer of the soil in the years 1989-2008 (source: CIEP/SME)

Monitoring of radioactive contaminations in the environment is implemented in compliance with the programme of the State Monitoring of the Environment and the recommendations of the European Commission included in the Recommendation of 8 June 2000 concerning Articles 35 and 36 of the Euratom Treaty. Article 35 of the Euratom Treaty and the Commission Recommendation of June 2000, which require each Member State to ensure means necessary for permanent monitoring of the radioactivity of air, water and soil.

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The existing threats require possessing knowledge of the movement of radioactive isotopes in the environment and ongoing monitoring of its state. Ensuring radiological security of Poland is related to the necessity to maintain a systematic and uniform sampling and measurements, enabling assessment of even small changes in the levels of contaminations in the environment in particular components of the environment, that is: the air, surface waters, bottom sediments and soil.

Monitoring of radioactive contaminations makes it possible to state that the contamination with the above-mentioned components Cs-137 and Sr-90 is slight, and the obtained results indicate that there did not take place new releases of radioactive isotopes to the environment.

V.7. State of the ozone layer

Over the last several decades, the clearly visible changes in the quantity and spatial distribution of ozone in the atmosphere has become a significant problem at the global scale. They caused much concern both of the scientific communities, and the public, mostly because ozone absorbs ultraviolet solar radiation, which is harmful to human health and the environment (UV-B).

According to the provisions of the Convention for the Protection of the Ozone Layer, signed in Vienna in 1985, to protect human health and the environment against the adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer, the parties shall, in accordance with the means at their disposal and their capabilities, "co-operate by means of systematic observations, research and information exchange in order to better understand and assess the effects of human activities on the ozone layer and the effects on human health and the environment from modification of the ozone layer." Furthermore, the parties declare in the Montreal Protocol to „protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination."

The content of ozone in the atmosphere greatly determines the volume of ultraviolet radiation (UV-B) reaching the surface of the Earth. As is known, the radiation may be harmful to all living organisms, and the increase in its intensity may cause damage to natural ecosystems, including also adverse effect on human health (rise in cancer and cataract rates and adverse impact on crops and livestock). Moreover, it is of significant importance that the changes in spatial distribution of ozone may contribute to changes in atmospheric circulation both at a regional and global scale by modification of the thermal structure of the atmosphere. It is generally agreed that the main cause for the occurrence of shortages of ozone in the stratosphere is the presence of anthropogenic chemicals in the atmosphere, particularly chlorine and bromine, which, as a result of a whole chain of chemical processes, in certain meteorological conditions, may lead to mass decomposition of ozone particles. Although, thanks to the meeting the recommendations of the Montreal Protocol, the pace of inflow to the atmosphere of compounds containing chlorine and bromine, such as freons and halons, has been reduced, due to their long lifetime, their concentration in the stratosphere remains high.

The time of "repair" of the ozone layer may be extended due to the cooling of stratosphere caused by greenhouse gases (the greenhouse effect causes increase in the temperature in the troposphere and decrease in the stratosphere). Therefore, in conducive meteorological conditions, significant shortages of ozone may exist for many years.

Measurements of the total content of ozone have been carried out for over 40 years in many research centres all around the world. As a result of human activities, at the global scale, the level of total content of ozone was in 1995 lower by 3.5%, and in 2008 by 2.5% than the average value from the years 1964-1980, when the ozone layer was not under such strong anthropopressure. An increase in the total ozone content by about 1% in the years 1995-2008 at the scale of the globe is probably a result of the decrease in the content of substances depleting the ozone layer in the atmosphere.

Since the beginning of the 1980s, the ozone layer has been significantly depleting, except for tropical regions. At the northern hemisphere, in 2008, the average level of total ozone content was lower by 3.2% (max. 5% - in winter, min. 2.5% - in summer) in comparison to the average values from the years 1964-1979. At the southern hemisphere, in the belt of mid-latitudes, the shortages of the total ozone content amounted in 2008 to 7% (max. 7.7% - in summer, min. 6.4% - in autumn), so they did not show much variation during the year. In the polar zone at the southern hemisphere, each year, at the end of winter and the beginning of spring, there occurs ozone depletion lasting until the end of spring with average shortages of the total ozone content reaching 60%. Over the Arctic, during extremely cool winter, there is observed locally low values of ozone, but in the winter period, on average, the total content of ozone decreased by 10% in relation to the values from before 1980.

In Poland, measurements of the total ozone content have been carried out since March 1963 in the Central Geophysical Observatory of the Institute of Geophysics of the Polish Academy of Sciences in Belsk. As results from the research performed there, the ozone values are typical for mid-latitudes at the northern hemisphere (Fig. 5.7.1.). The content of ozone over Poland, in the period December-February, is now 8% lower than in the years 1963-1979 (that is before the period of intense polluting of the atmosphere with substances depleting the ozone layer). In summer and autumn, the thickness of the ozone layer was only about 3% lower than in the years 1963-1979.

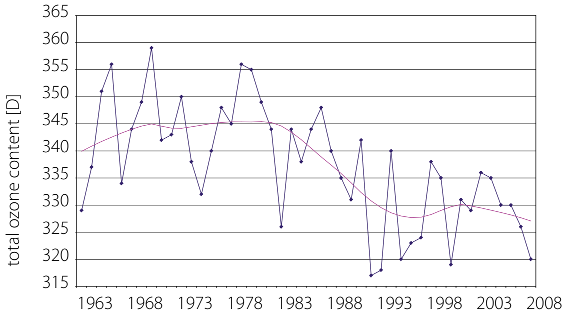

Fig. 5.7.1. Changes in the total ozone content in the atmosphere (annual average) measured in Belsk in the years 1964-2008 (source: CIEP/SEM)

What is particularly interesting is the variability of the trend in vertical profile, as it is believed that repair of the ozone layer will start from the high-temperature areas in high stratosphere, where changes in the processes of chemical destruction of ozone are easiest to observe due to limited impact of changes in the dynamics of atmosphere and chemical composition of the atmosphere on the concentration of ozone at those heights.

It should be noticed that the tendency of ozone content in the upper layer of the atmosphere is still downwards, unlike the tendency in the middle layer of the atmosphere (positive tendency since the mid-1990s) and troposphere and the lower layer (stabilisation of the level of ozone since the mid-1990s) (Fig. 5.7.2.). It suggests that lack of deterioration of the downwards tendency in atmospheric ozone in mid-latitudes is also a result of changes in the dynamics of the atmosphere, rather than only a result of decreasing of the content of substances depleting ozone in the stratosphere.

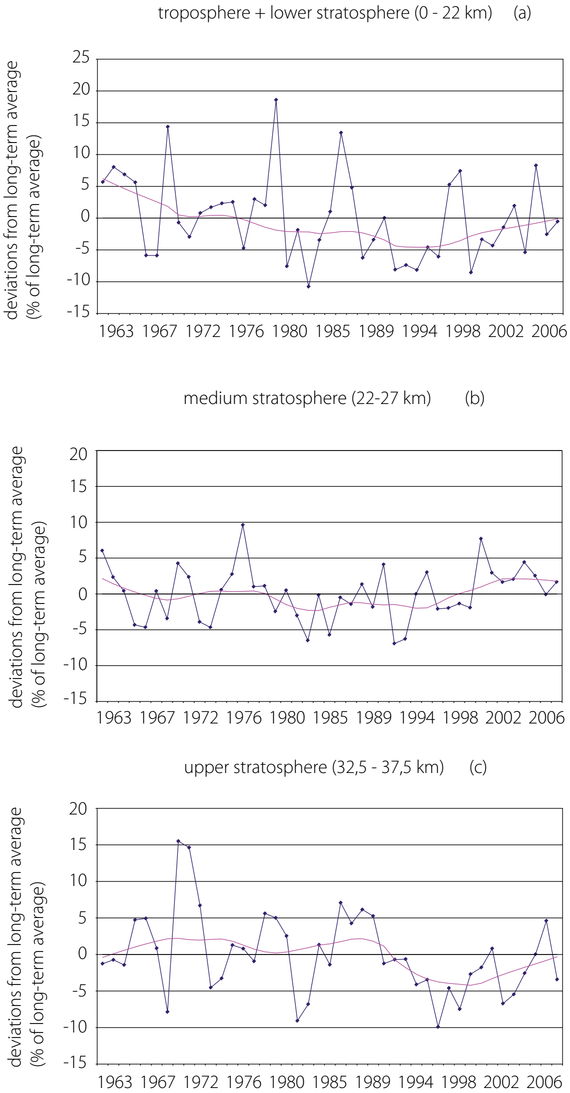

Fig. 5.7.2. Changes in the ozone content in different layers of the atmosphere (source: CIEP/SEM)

Changes in the profile of ozone are, beside total ozone content, one of the factors affecting the value of UV-B radiation reaching the Earth's surface. Measurement results reveal a correlation between the fall in the total ozone content in the atmosphere and the growth in the intensity of solar UV-B radiation at the Earth's surface (Fig. 5.7.3.). The trend for UV-B radiation is positive and statistically relevant. At our latitudes, the effect is often weakened by cloud cover.

The state of the ozone layer is greatly affected by emissions to the atmosphere of anthropogenic chemical compounds containing chlorine and bromine, such as freons and halons. The compounds at the Earth's surface level seem to by neutral and very durable, while elevated high into the stratosphere under the influence of intense solar radiation they decompose releasing chlorine and bromine, destroying the ozone exponentially. Very low temperature (below – 78°C) is a factor contributing to such processes, enabling the occurrence of the so-called polar stratospheric clouds. As a result of the reactions on the surface of particles of those clouds, the number of particles of active chlorine rises, and, as a consequence, the destruction of ozone particles intensifies. Despite the fact that the pace of inflow to the atmosphere of compounds containing chlorine and bromine (e.g. freons and halons) was decelerated, due to their lifetimes, their concentrations in the stratosphere still remain high. In conducive meteorological conditions, significant shortages of ozone may occur in the nearest years in polar and mid-latitudes of both the southern and northern hemispheres.

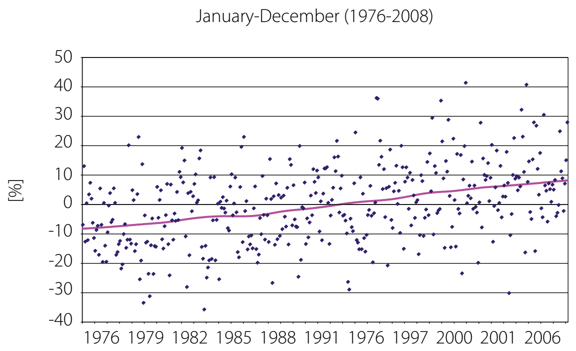

Fig. 5.7.3. Changes in the UV -B radiation in the years 1976-2008, deviations from monthly average doses of UV from long-term averages (source: CIEP/SME)

Compounds containing chlorine and bromine are still used in various kinds of devices in the cooling, insulation, pharmaceutical and cosmetic industries. In Poland, in the years 1986-2007, there took place a clear decrease in the use of substances depleting the ozone layer, that is: HCFCs (fully substituted chlorine derivatives of hydrocarbons), CFCs (partially substituted chlorine derivatives of hydrocarbons), carbon tetrachloride, halons and methyl bromide. Their consumption dropped from 7960 tonnes in 1986 to 1560 tonnes in 2007 (Fig. 5.7.4.).

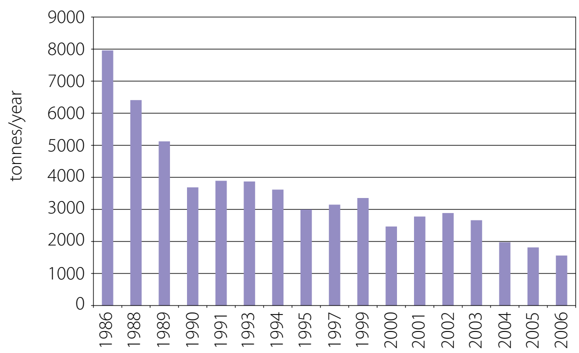

Fig. 5.7.4. Consumption of the ozone layer depleting substances in Poland (source: CSO)

The basic actions aimed at prevention of the depletion of the ozone layer are related to meeting the obligations under the Montreal Protocol, the major objective of which is complete reduction of manufacturing and use of substances that deplete the ozone layer. The substances covered by control of the Montreal Protocol belong to the group of chlorine derivatives of hydrocarbons and have various abilities to destroy ozone. Amendments to the Montreal Protocol made it necessary to replace compounds destroying the ozone layer with other less aggressive substances, according to the principle of "cleaner production." The strategy of reduction of production and consumption of substances depleting the ozone layer in Poland is consistent with the Montreal Protocol and its amendments, which has been legally determined in the Act of 20 April 2004 on substances that deplete the ozone layer. The basic regulation of the Act on substances that deplete the ozone layer is full adjustment of the Polish law in the scope of the problem of treatment of substances that deplete the ozone layer to the law of the European Union[35].

The Act on substances that deplete the ozone layer lays down:

- the principles of using and trading in substances that deplete the ozone layer, hereinafter referred to as "controlled substances," as well as products, devices and installations that contain these substances,
- the obligations of entities using or trading in the controlled substances and products, devices and installations containing these substances,
- the bodies and entities competent in issues related to the treatment of the controlled substances.

[35] Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer (Text with EEA relevance) replacing Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer.

A list of controlled substances is included in the Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer (Text with EEA relevance). It includes, among others, substances from the groups of: HCFCs, which are used mainly in the cooling and air-conditioning sector, CFC freons or carbon tetrachloride, halons or methyl bromide. The compounds, due to their harmful effect on the natural environment, may be used only in closed systems, so that they would not get to the atmosphere. Industrial plants, which manufacture, use or consume the substances, have been forced to reconsider their application, and eventually give up using them. It also pertains to CFCs and HCFCs, which contribute both to the destruction of the atmospheric ozone layer, and contribute to the occurrence of the so-called greenhouse effect.

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Measurements of the content of substances that deplete the ozone layer, in particular freons and halons, indicate that their concentrations at the Earth's surface are systematically decreasing, while the increase in their content has not been found in the high layers of the atmosphere. It testifies to the efficiency of international actions to protect the ozone layer.

During the last few years, the relations between the issue of the fall in ozone concentration and climate change have been examined more closely.

VI. Climate changes

VI. Climate changes

Climate changes are currently one of the most important environmental, social and economic threats. Over the next decades these changes can contribute among others to the reduction of water resources, increase in the frequency and intensity of floods, melting of icebergs, erosion of soils, as well as intensification of such extreme phenomena as whirlwinds, hailstorms or frost and heat waves.

A long-term purpose of the Convention is to ensure stabilization of greenhouse gas concentrations in the atmosphere at a level which would prevent dangerous anthropogenic interference in the climate system. In order to prevent the threat to food production and to facilitate sustainable economic growth this level should be reached in the period sufficient for natural adaptation of ecosystems to climate changes.

in: United Nations Framework Convention on Climate Change

Climate system warming is visible in the growth of average global air temperature and ocean temperature (Fig. 6.1.), ubiquitous melting of snow and ice, as well as raising of the global mean sea level. Among 12 warmest years in the series of instrumental measurements of global temperature, carried out from mid-19th century, as many as 11 were recorded in the period 1995-2006, while average temperature in the period 1906-2005 increased by 0.74°C. It has been observed that inland areas get warmer faster than oceans, and the increase in temperature is higher at high latitudes of the northern hemisphere. Global sea level was increasing from 1961 onwards at an average rate of 1.8 mm annually, and 3.1 mm from 1993 as a result of thermal expansion, melting of icebergs and polar continental glaciers. Global warming also results in shrinking occurrence of snow and ice - satellite data show that average annual occurrence of sea ice in the Arctic decreased by 2.7% from 1978 over a decade, with a stronger fall in the summer period, ca. 7.4% per decade. Changes of other climatic elements

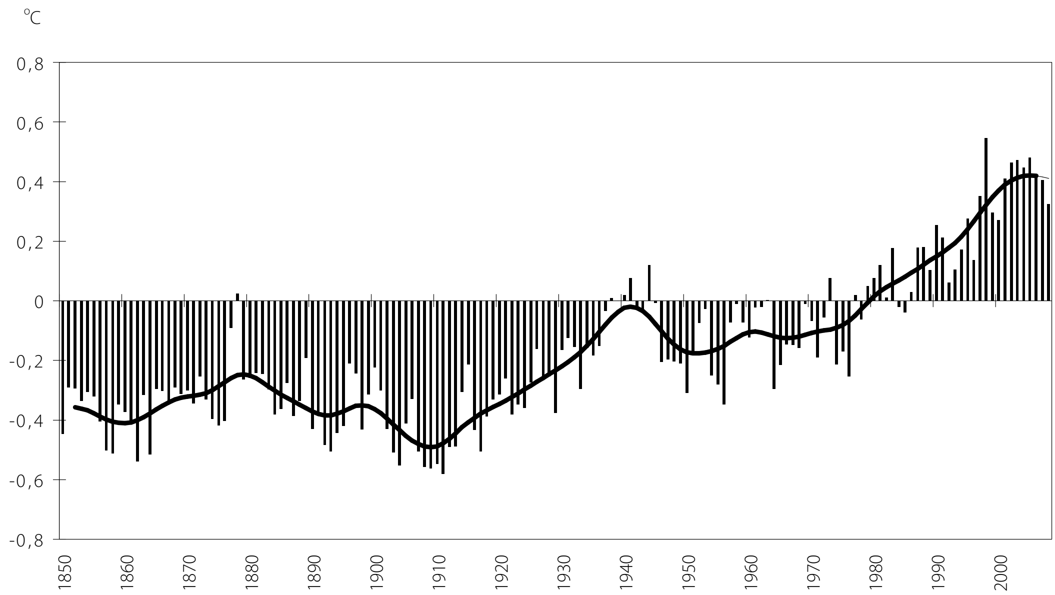

Fig. 6.1. Changes of average global annual temperature in 1850-2008 presented as mean deviation from 1961-1990 (source: Climatic Research Unit)

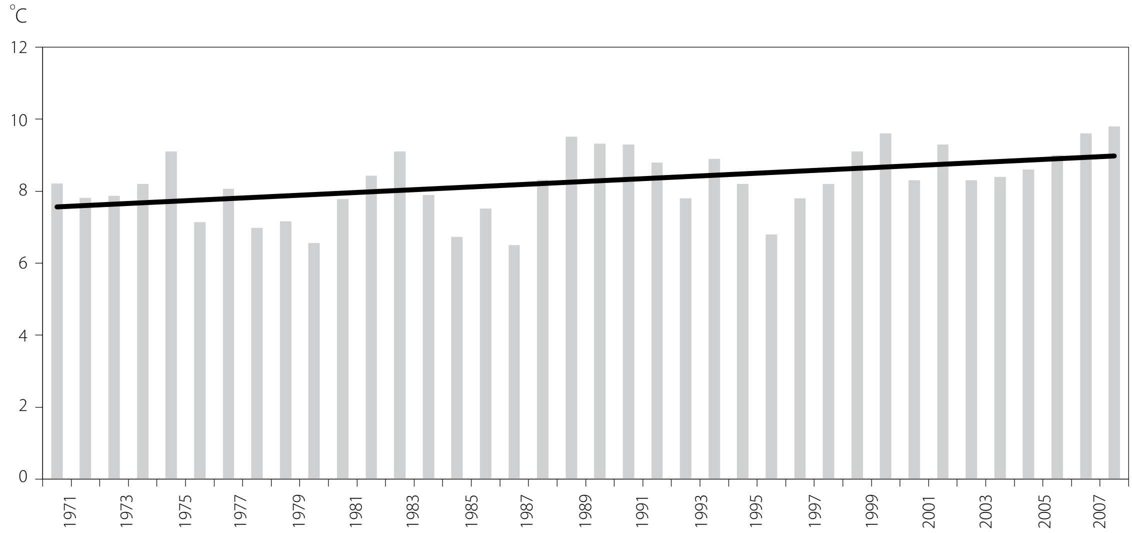

Fig. 6.2. Average annual air temperature at Warsaw Okęcie station in 1971-2008 (source: IMWM)

are also visible, e.g. size and distribution of precipitation in Eastern North and South America or Northern Europe, length and intensity of heat or frost waves, or tropical cyclones in the North Atlantic.

An increase in temperature has also been visible in Poland - the last decade of the 20th century was particularly warm, but a growing trend of the average annual temperature is both visible at meteorological stations located in the suburbs, as well as at ones located in areas with limited anthropogenic impact, e.g. Śnieżka mountain, where the increase was 0.6°C/100 years. Similar increase in average annual temperature was recorded at stations situated at the Baltic sea, which have long measurement series (Gdańsk-Wrzeszcz, Hel and Koszalin), as well as at Warsaw Okęcie station (Fig. 6.2.). Comparison of the mean annual temperature for the whole area of Poland in the period 1991-2000 with reference to 1961-1990 (WMO reference period) showed that the last decade of the 20th century was 0.6°C warmer, and the largest increase in temperature occurred in winter months: 1.9°C in January and 1.5°C in February. In December temperature values were identical in comparable periods, but lower in October and November by 0.2°C and 0.7°C respectively. A similar tendency - bigger increase in temperature in winter than in summer - has been observed across Europe (Fig. 6.3.).

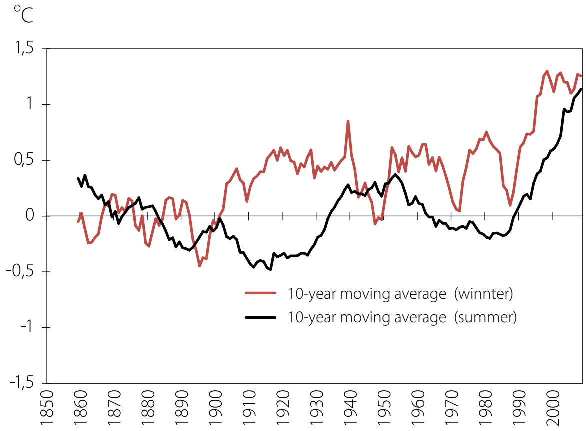

Fig. 6.3. Changes of average seasonal European (inland) temperature in 1850-2008 presented as mean deviation from 1850-1899 (source: EEA)

Changes in the atmospheric concentration of greenhouse gases and aerosols, inland flora cover and solar radiation result in changes in energy balance of the climate system. Global emissions of greenhouse gasses increased by as much as 70% in 1970-2004 as a result of human activities, reaching 49 billion tons of CO_2 equivalent, whereas the emission of CO_2 itself, the main greenhouse gas, increased by 80% over the same period. Atmospheric concentration of carbon dioxide (379 ppm) and methane (1774 ppb) in 2005 significantly exceeded the natural scope of values occurring over the last 650 thousand years. Global increase in CO_2 concentration is mainly caused by the use of fossil fuels and to a lesser extent by the changes in the land use forms. On the other hand, the observed increase in methane (CH_4) concentrations results from

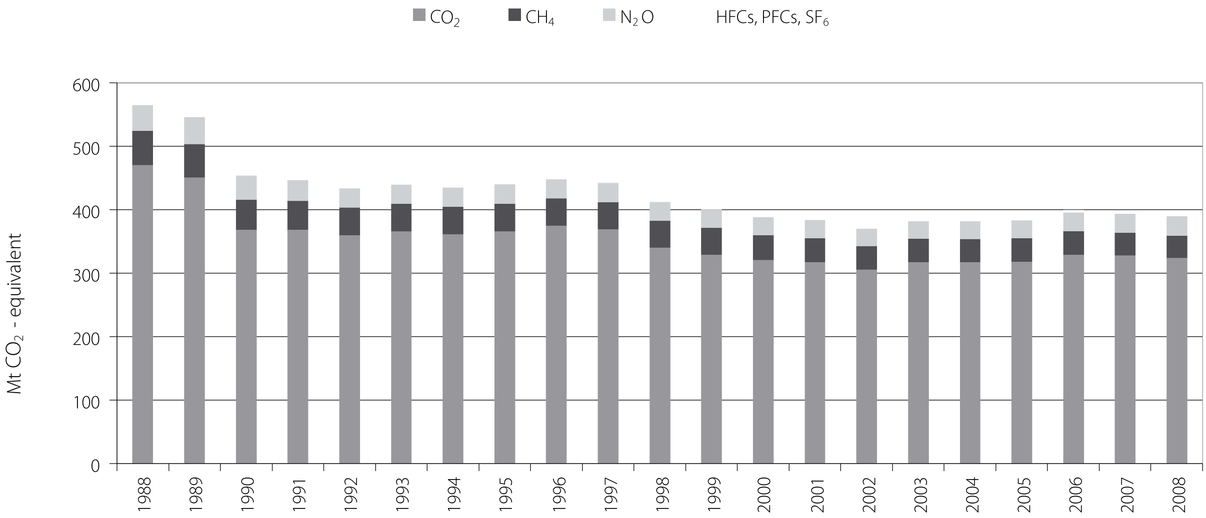

Fig. 6.4. Greenhouse gas emissions in Poland in the years 1988-2008 presented as CO_2 equivalent[36] (source: EPI-NAETS)

the development of agriculture and fossil fuels burning, and the increasing concentration of nitrous oxide (N_2O) is a derivative of agricultural activity.

The IPPC Fourth Assessment Report 2007 states with high certitude that it is mainly human activity carried out from 1750 that is the main reason behind the observed global warming. It needs pointing out here, that bigger concentrations of greenhouse gases in the atmosphere lead to the warming of Earth surface, while greater concentrations of aerosols result in its cooling. It is estimated that as a result of human economic activity from the pre-industrial era warming amounted on average to + 1.6 W/m^2, while at the same time changes in solar activity caused a small radiative forcing[37] on average amounting to +0.12 W/m^2.

According to scenarios that forecast future greenhouse gas emissions, further warming of 0.2°C per decade is expected in 21st century. With greenhouse gases maintained at the level from 2000 the foretasted warming would amount to 0.6°C in the period 2090-2099 vis-à-vis 1980-1999. In the case of further growth of emissions one may expect that in line with the model results the mean global temperature will grow from 1.8°C to 4.0°C in the last decade of 21st century.

Greenhouse gas emissions in Poland in 2008, excluding emissions from land use, land-use change and forestry, amounted to 394 million tons of CO_2 equivalent and has not exceeded 400 million tonnes CO_2 equivalent (Mt CO_2 –equivalent) since 1999. In 1988 the emission was the highest and amounted to 565 Mt CO_2 –equivalent. In 1988-1990 there was a major fall in the emissions to ca 454 Mt CO_2 –equivalent, related to system- and economic changes, which resulted in the break-down of many energy-intensive and emission-intensive industry branches (Fig. 6.4.) However, it needs pointing out that in spite of dynamic economic growth in 1990-2007, which was related for example with 75% increase in GDP, the level of greenhouse gas emissions remained on a stable level of 30% below the level from 1988. It was possible as a result of large-scale implementation of modern technologies in the industry and introduction of many instruments, including legal ones, which promote low emission and energy saving solutions. The main greenhouse gas released in Poland is CO_2 (82% of emissions). The majority of CO_2 stems from burning of fuels (92%), both in stationary sources (e.g. power plants, combined heat and power generating plants), as well as mobile ones (transportation), while the remaining amount - more than 7% - is related to industrial processes (Fig. 6.5).

[36] Data concerning emissions of greenhouse gases in 2008 are preliminary.
[37] Radiative forcing is a change of radiation balance in the atmosphere, related to distortion of the climatic system, expressed in W/m^2. The distortion can be caused by both natural, as well as anthropogenic factors, e.g. emission of greenhouse gases as a result of human activity.

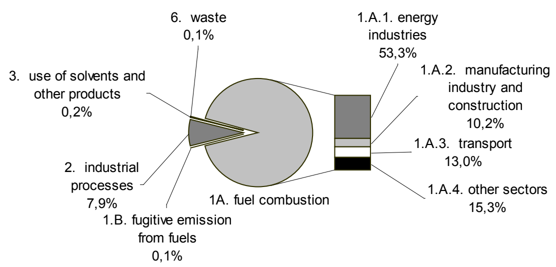

Fig. 6.5. Structure of CO_2 emissions in Poland in 2007 broken down into sectors (according to IPPC classification) (source: EPI-NAETS)

The expected climate changes will have a negative impact on many systems and sectors. That is why countries cooperate on an international level to limit the emissions of GHG by working out a United Nations Framework Convention on Climate Changes and its Kyoto Protocol. Global response to climate changes stimulates the implementation of new policies, development of an international carbon market and establishment of new institutional mechanisms that support future activities aimed at prevention of climate changes.

Poland ratified the UNFCCC in 1994, and Kyoto Protocol to the Convention in 2002, obliging itself to reduce GHG emissions (CO_2, CH_4 and N_2O) over 2008-2012 by 6% vis-à-vis emissions in 1988 base year. Poland adopted 1995 as base year for fluorinated industrial gases. The size of emission reductions vis-à-vis the base year differs depending on the country and ranges from 8% for EU, 7% for USA, 6% for Japan, Canada, Hungary and Poland. Poland and Ukraine have a possibility to stabilize emissions at the level of the base year, while Norway, Australia and Iceland have the possibility to increase emissions by 1%, 8% and 10% respectively. Countries can ensure reduction individually or jointly (like for example the European Union 15).

The European Community has used the opportunity of joint reduction. 15 Member States that constituted the Community back then (EU-15) jointly obliged themselves to reduce GHG by 8% between 1990 and the annual average of 2008-2012. However, the responsibility of individual Member States varies from 28% reduction for Luxembourg to 27% increase for Portugal. Decision on this matter was agreed and adopted in 2002 in the process of the so called burden sharing, under decision of the European Council 2002/358/EC of 25 April 2002 concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment commitments thereunder.

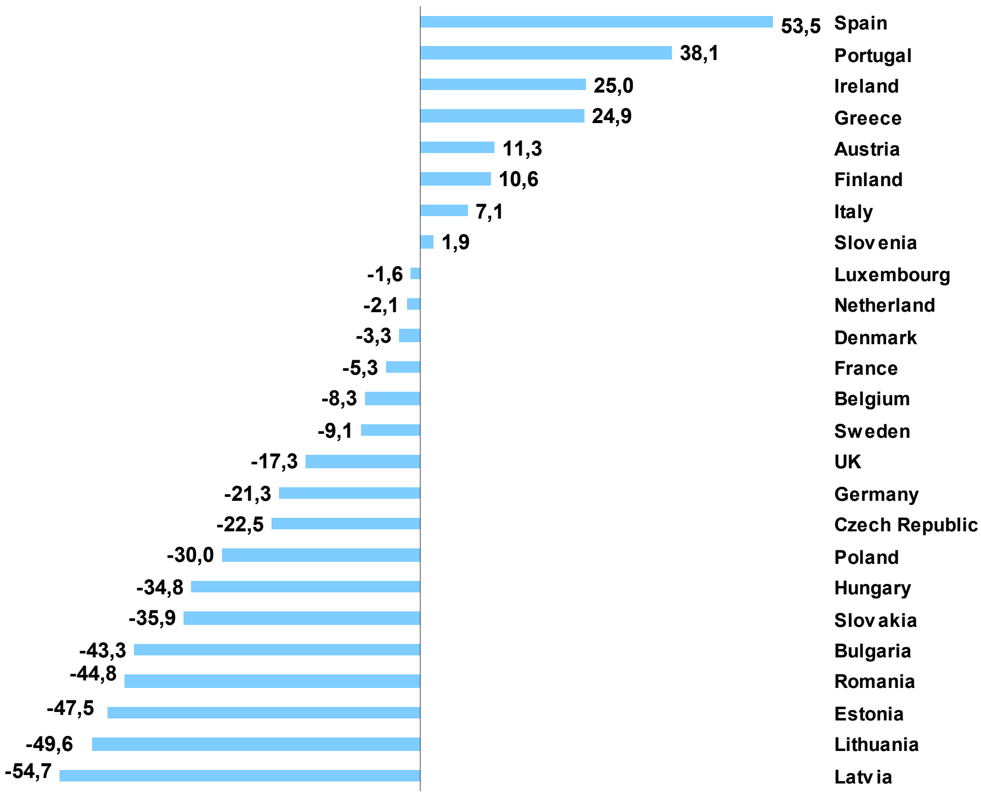

Fig. 6.6. State of implementation of individual commitments of EU Member States to reduce GHG emissions (CO_2 equivalents) under the Kyoto Protocol - percentage data. Malta and Cyprus as countries not listed in Annex I to the convention and Annex B to the Kyoto Protocol do not have any reduction commitments (source: UNFCCC)

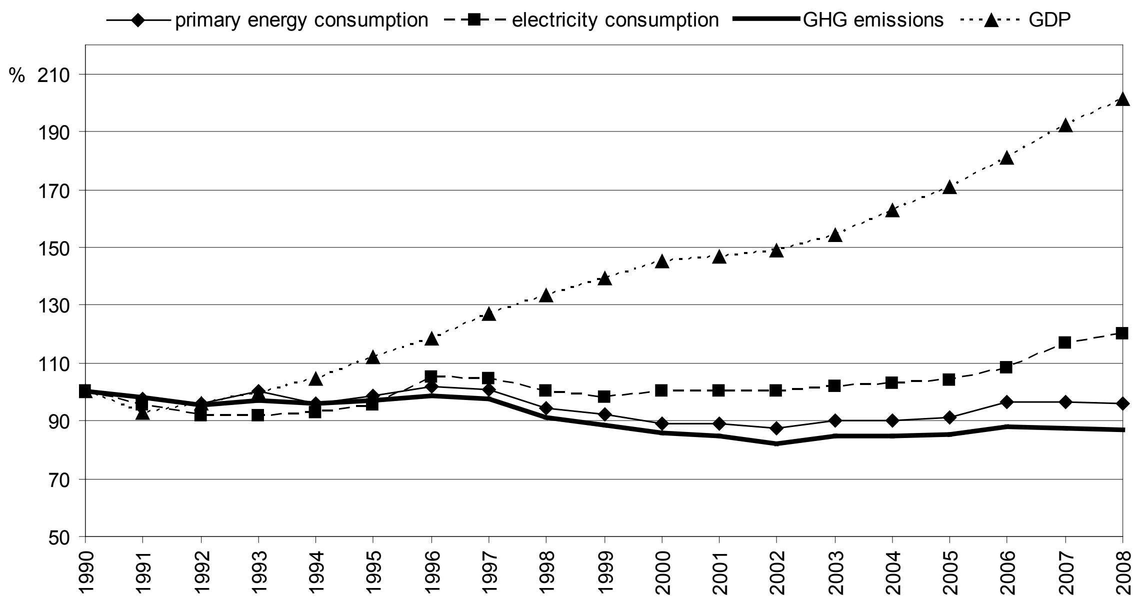

Fig. 6.7. Changes in GHG emissions in Poland (in CO_2 equivalents) compared with changes in the primary energy consumption, electricity consumption and GDP in 1990-2008[38] (1990 = 100%) (source: EPI-NAETS, CSO)

It needs pointing out that commitments concerning emission reductions apply exclusively to industrialized countries and countries with economy in transformation (this category included among others Poland due to the ongoing systemic and economic changes). Developing countries did not adopt any commitments under the Convention referring to the principle of no historic responsibility for the existing anthropogenic GHG emissions and to the right to sovereign socio-economic development, necessary to improve welfare in those countries.

A year before the start of the first obligation period under the Kyoto Protocol, emissions in the majority of countries with economy in transformation are much lower than the adopted commitments. Whereas the half of the EU-15 Member States release more GHG vis-à-vis their obligation (Fig. 6.6.). However, the EU-15 countries will try to meet their joint 8% reduction obligation according to the internal burden sharing. If joint reduction efforts towards meeting the Kyoto Protocol commitments are failed, the EU-15 countries will be held accountable individually in terms of the reduction targets set under a joint reduction obligation.

The main activities that support the efforts of countries aimed at reducing GHG emissions include primarily improved energy efficiency of the economy, promoting and implementing technologies that use renewable energy sources and capture carbon dioxide, activities aimed at limiting transport emissions, as well as promoting sustainable forms of waste management, agriculture and forestry. A governmental document that forms national environmental policy, including climate protection activities, is the national environmental policy for 2009-2012 and its 2016 outlook, adopted by the Sejm (lower chamber of the Parliament) on 22 May 2009. This document outlines the objectives, challenges and directions of actions, as well as the most important priorities of the Polish environmental policy for the next 4-8 years, including the national reduction target under the Kyoto Protocol.

A decisive element of the Polish energy policy until 2030, adopted by the Council of Ministers on 10 November 2009, that determines the limitation of emissions will involve launching highly efficient technologies for energy generation and transfer, including the modernization of current technologies. A very important element of the GHG reduction strategy involves stimulating an increased use of renewable energy sources in the energy industry. Another important element of the energy policy will involve increasing energy effectiveness of the economy, realized among other by the implementation of Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council directive 93/76/EEC (Text with EEA relevance) as well as diversification of energy production structure through implementation of nuclear energy.

[38] Data concerning emissions of greenhouse gases in 2008 are preliminary.

Other policies and activities carried out domestically in order to limit GHG emissions involve among others:

- in transport - promotion and use of biofuels and promotion of "ecologically friendly" vehicles,
- in construction - extending and modifying technical and construction provisions pertaining to the thermal protection of buildings in terms of permeation of heat through external partitions, performance of heating-, ventilation and air conditioning installations, as well as preparation of warm drinking water.
- in agriculture - rationalization of the use of fertilizers, including nitrogen ones (a system of fertilizer consultancy has been introduced to help determine precise fertilizer doses), rationalization of energy management, including production of energy from biomass waste or pig slurry; dissemination of small dispersed sources of electrical energy,
- in waste management - the national waste management plan until 2010 promotes activities aimed at preventing and minimising the generation of waste, ensuring their recovery (recycling), disposal and waste storage which is safe for human health and the environment.

Analysis of changes in GHG emissions with reference to GDP changes, as well as the primary energy consumption and electricity consumption shows that the economic growth which started in 1990 was accompanied by stabilization (until 1997) and then a fall in GHG emissions (Fig. 6.7.). Trends in the primary energy and electricity consumption are analogical to the course of GHG emissions, however the distance between emissions and primary energy consumption has been increasing from 1999, pointing out among others to a more effective energy use in the Polish economy.

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Due to a global character of the phenomenon, measures aimed at preventing climate changes can bring effects only as a result of joint activities of the whole international community. That is why counteracting climate changes is one of the priorities of the EU policy. EU Member States carry out versatile activities aimed at reducing GHG emissions, including ones aimed at integrating climate-, air protection- and energy policy through the implementation of an energy and climate package. *As a member of the European Union Poland participates in the implementation of a whole range of these measures, and counteracting climate changes is one of the most important objectives of Polish environmental policy. In 1988-2008 Poland managed to reduce GHG emissions by ca 30%, which is much above the 6% reduction level required under the Kyoto Protocol. This will allow to meet and exceed the national reduction target set forth under the Protocol within the required deadline until the end of 2012. At the same time, as the effects of climate changes are irreversible, it will be necessary for the international community, including Poland, to undertake adaptation measures in the years to come.*

In March 2007 the European Council - when defining the measures that should be undertaken to reduce GHG after 2012 - adopted the assumptions to the so called climate and energy package, including assumption on the joint emission reduction by 20% until 2020 vis-à-vis 1990. Final package was adopted in December 2008. At the same time, in its standing the European Commission declared that it is ready to increase the joint reduction target until 2020 to 30%, on condition that comparable commitments are undertaken by the remaining developed countries and provided that the most advanced developing countries (China, India, Brazil, Republic of South Africa, Korean Republic, Indonesia, Mexico) declare a 15-30% limitation of emissions vis-à-vis the currently foretasted emissions.

The principles for implementation of the aforementioned EU reduction obligation were outlined in the EU ETS directive [39] and in the decision of the European Parliament and Council No 2009/406/EC dated 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 (non-ETS decision). In order to implement the Community commitment pertaining to GHG emission reduction by at least 20% below the levels from 1990 in a cost-effective way, one should reduce the amount of emission allowances granted to those installations by 21% below their emission levels in 2005.

[39] Directive of the European Parliament and Council 2009/29/EC of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community (Text with EEA relevance).

VII. Summary

VII. Summary

Poland has been a member of the European Union for six years now. Its presence in the European structures was related to a whole range of legal-, economic- and social changes, which had a direct or indirect impact on the state of the environment.

As a result Poland changed or adopted a lot of legal instruments that regulate the use of the environment and the management of its quality. The instruments both apply to rationing and control of the release of substances and energy to the environment, as well as to meeting specific quality standards of individual environmental elements. The latter ones form a basis for determining what constitutes a violation, which requires undertaking proper actions to ensure the quality provided by law. Environmental quality standards are specified directly in the provisions of the Community law, or are developed on the national level pursuant to the objectives set forth in the directives.

It needs pointing out, that in order to ensure a stable functioning economy, Poland obtained a temporary approval for a whole range of derogations from the Community provisions concerning the mechanisms that regulate the volume of substances and energy released to the environment, while at the same time there are no such derogations pertaining to the environmental quality standards. This situation has aggravated the problems related to meeting the environmental quality standards.

Poland is in the group of highly developed countries. The main sources of threats to its environment are: the industry, in particular energy, municipal economy and transport. Both the degree and type of threats differ significantly depending on the location. The biggest pressure is observed in the area of big agglomerations. At the same time, due to its geographical location, the country is characterized by exceptionally rich nature and landscape. The fact that Poland is a habitat of rare animal and plant species in the scale of the continent, makes it particularly responsible for the protection of natural heritage.

Economic acceleration experienced by Poland following 2004 did not increase the pressure on the environment (emissions to air and waters, and waste generation), which allows for a conclusion that Poland has embarked on a road of sustainable development, and a decisive role in this regard is played above all by the industrial sector. Improved living conditions as a result of increasing income, as well as fall of unemployment have caused a change in consumption patterns, which may lead to stronger pressure on the environment by the municipal sector in the future.

In spite of the general positive trends in limiting the pressure on the environment, there is still a lot to be done. Due to its nature the Polish economy remains one of the most material- and energy-consuming economies of the European Union. However, one may assume that the costs and benefits analysis will dictate the necessity to implement eco-innovations and savings related to raw materials and energy.

A lot has been done to protect the quality of air in Poland in recent years, many instruments were introduced to reduce the emissions of pollutants to air (modernizations, improvement of fuel quality, inspection activities), which in 1990's and at the beginning of 2000 bore fruit in the form of reduced emissions of the basic pollutants to air (in particular sulphur dioxide and nitric oxides). It is also visible in the reduced deposits of some pollutants (sulphates) in the ground. Gradual reduction of emissions of acid pollutants to the atmosphere resulted in a falling trend in terms of acidity of precipitation expressed with a higher pH of precipitation.

In spite of systematic improvement of the air quality in Poland, the concentration of tropospheric ozone in the summer season and over-normative concentrations of PM10 and benzo(a)pyrene in the winter season remain a serious problem. An important factor related to exceeded ash norms involves the so called low emission from individual heating of buildings, which remains unregulated, as well as transport.

Taking into account the current state of air pollution in Poland and the necessity to meet air quality standards established by Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe and the limits of emissions of certain pollutants into the air from large combustion plants, Poland is facing the task of implementation of many measures aimed at ambient air quality improvement. It is particularly important to ensure cohesion of actions aimed at air protection with actions aimed at counteracting climate change, since not all measures contributing to climate protection lead to improvement of air quality.

Positive trends are also visible in the area of water management. For many years now water abstraction, but also waste discharges have stayed on a similar level. A whole range of investments were implemented in the area of municipal waste water treatment (effectiveness of waste water treatment plants increased, sewerage system is longer, more people use the services of waste water treatment plants), as well as in the area of limiting the negative impact of various industrial sources. It is also not without meaning that the Code of good agricultural practices has become more popular, as there are a lot of agricultural holdings and their location is fragmented. Nitrogen and phosphorus discharges released through rivers at the territory of Poland to the Baltic Sea have also visibly reduced. However, this parameter is dependent on hydro-meteorological conditions (volume of flows), which means that the trend could reverse in the future. In spite of positive changes, still the most serious problem of the Baltic Sea involved eutrophication, mainly caused by excessive loads of nitrogen and phosphorus, stemming from inland sources located in the area of the Baltic Sea basin. Eutrophication applies to more than 60% of water-courses and lakes located at the territory of the country.

Results of the assessment of the chemical status of groundwater bodies show that only 10 water bodies (out of 161), whose area covers 9.5% of the country, have a poor chemical status. In the case of surface waters 6.5% of flowing water bodies investigated in 2007-2008 had a good or very good ecological status, and in the case of artificial water bodies and heavily modified water bodies ca. 4.5 % of water bodies covered by monitoring meet the environmental objectives. On the other hand lakes with a very good and good status accounted for almost 42% of all lakes surveyed in 2007-2008.

In spite of the fact that water abstraction has recently become stable, activities related to further rationalization of water management should be treated as one of the priorities of environmental policy, particularly as water resources are scarce and in the wake of observed climate changes one can expect deepening of water deficit at the territory of the country. It is also important to meet and maintain a good status of waters in order to ensure proper quality of water used as drinking water, for leisure- and economic purposes. This long-term purpose should be met by 2015, according to the provisions of the Water Framework Directive. This objective will be met by working out and implementing a water management plan and national water-environmental programme for each basin area separated in Poland.

In the context of waste management it needs pointing out that with a permanent GDP growth the amount of waste generated has been maintained on a similar level, however recent years have seen a fall in the mass of recovered industrial waste. Another problem involves excessive share of municipal waste landfilled and lack of modern infrastructure for their disposal (incineration).

The trends in the area of environmental noise in Poland point out to an increase in traffic noise on the one hand, and to a limited growth and falling tendencies in the area of industrial noise on the other. Upward tendencies in traffic noise are mainly related to road noise and air traffic noise. Increased threat of road noise is mainly related to a steep increase in the number of cars over the past 15 years. In spite of the fact that the level has almost reached saturation, the growth is still significant. Based on data from noise maps drawn up for 12 agglomerations with more than 250 thousand inhabitants, average rate of persons exposed to risk of noise that exceeds the permitted level was ca. 36% according to assessments carried out on the basis of the indicator for day-evening-night time and 38% according to assessments carried out on the basis of an indicator for night-time.

The spatial scale of acoustic environment degradation due to traffic means, mostly road traffic, requires effective solutions and persistent measures. At present the focus in the fight with noise is being shifted from temporary activities in favour of programs aimed at noise protection, which have to contain the proposed protection measures.

When it comes to protection from electromagnetic fields, it needs pointing out, that the existing monitoring results carried out in the framework of state environmental monitoring have not shown any violations of electromagnetic fields in the environment. As a result of the expected growth in the number of wireless telephony base stations, as well as increase in the number of wireless broadband Internet transmitters, and radio and TV broadcasting stations, and due to the transfer to digital broadcasting system, the observed status may deteriorate.

Based on measurement data obtained within the framework of radiation monitoring it can be concluded that there is no threat of increased radioactivity caused by radioactive pollutants permeating to the environment at the territory of Poland. The level of ionizing radiation background and doses at which the inhabitants of Poland are exposed to do not exceed the thresholds considered to be safe for human health and life.

The condition of the ozone layer is strongly influenced by global emissions of anthropogenic chemical compounds to the atmosphere, containing chlorine and bromide, such as for example freons and halons. These compounds are still used in various appliances in cooling-, insulation-, pharmaceutical and cosmetic industry. However, in Poland in the period 1986-2007 there was a clear reduction in the use of substances depleting the ozone layer, which is a significant contribution in the activities aimed at protection of the ozone layer on a global scale.

The issue of climate changes is particularly important due to its multi-dimensional and global nature. As a member of the European Union Poland participates in a whole range of activities aimed at reduction of GHG, including activities targeted at integrating climate-, air protection- and energy policy through the implementation of the climate and energy package. Counteracting climate changes is one of the most important objectives of the Polish ecological policy. In the period 1988-2008 Poland managed to reduce GHG emissions by 30%, i.e. much above the 6% reduction level required under the Kyoto Protocol. This will allow to exceed the reduction objective under the Protocol required until the end of 2012. At the same time, as the effects of climate changes are inevitable over the next years, it will be necessary for the international community, including Poland, to undertake adaptation measures. Poland is one of the countries which have already started working on the adaptation strategy pertaining to climate changes.

List of abbreviations

6^{th} EAP	The Sixth Environment Action Programme of the European Community
AFQI	Agricultural and Food Quality Inspection
BFMG	Bureau for Forest Management and Geodesy
BOD5	biological oxygen demand over five days
BSAP	Baltic Sea Action Plan
CBBM	common breeding birds monitoring
CFC	chlorofluorocarbons
CFR	class for restocking (stand type)
CIEP	Chief Inspectorate for Environmental Protection
CIS	Common Implementation Strategy
CLC	CORINE Land Cover (CORINE – Coordination of Information on the Environment)
CR	critically endangered species in the IUCN classification
CRML	Central Railway Main Line
CSI	EEA Core Set of Indicators
CSO	Central Statistical Office
DDT	dichlorodiphenyltrichloroethane
DMC	domestic material consumption
EEA	European Environment Agency
EMAS	Eco-Management and Audit Scheme
EMEP	European Monitoring and Evaluation Programme (of the long range transmission of air pollutants)
EMF	electromagnetic field
EN	endangered species in the IUCN classification
eo	equivalent oil
EPI	Institute of Environmental Protection
ETC ACC	European Topic Centre for Air and Climate Change
EU	the European Union
EU-15	EU Member States before enlargement in 2004
EU-27	EU Member States
Euratom	European Atomic Energy Community
Eurostat	Statistical Office of European Communities
FBI	Farmland Bird Index
FRI	Forest Research Institute
FV	favourable (conservation status) of plant species/animal species/natural habitats
fw	fish weight
GAW	Global Atmosphere Watch (WMO programme)
GDEP	General Directorate for Environmental Protection
GDP	gross domestic product
GHG	greenhouse gases
GSM	Global System for Mobile Communications
GWBs	groundwater bodies
HCB	hexachlorobenzene
HCFC	hydrochlorofluorocarbons
HCH	hexachlorocyclohexane
HDI	Human Development Index
HELCOM	Helsinki Commission
Hz	hertz
IGC	Institute of Geodesy and Cartography
IMWM	Institute of Meteorology and Water Management
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardisation
IUCN	International Union for Conservation of Nature
$L_{Aeq\ D}$	equivalent continuous noise level for daytime (from 6.00 h to 22.00 h)
$L_{Aeq\ N}$	equivalent continuous noise level for night-time (from 22.00 h to. 6.00 h)
L_{den}	long-term average noise level A expressed in decibels, determined throughout the year, taking account of daytime (from 6.00 h to 18.00 h), evening(from 18^{00} to 22^{00}) and night-time (from 22^{00} to 6^{00})
lm	lipid mass
L_n	long-term average noise level A expressed in decibels, determined throughout all night-times in a year (from 22^{00} to 6^{00})
ME	Ministry of Environment
MORS	Monitoring of Radioactive Substances
Mtoe	million tonnes oil-equivalent
NAEA	National Atomic Energy Agency
NAETS	The National Administration of the Emissions Trading Scheme
NEST	NEST Decision Support System, run by Nest Baltic Institute
NMVOC	non-methane volatile organic compounds
NOBANIS	European Network on Invasive Alien Species
NPK	nitric-phosphoric-potassium (mineral fertilizers)
OTOP	The National Bird Protection Society
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PFBA	perfluorobutanoic acid
PFC	promotional forest complexes
PFDcA	perfluorodecanoic acid
PFDcS	perfluorodecane sulfonate
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid

PFHxS	perfluorohexane sulfonate
PFNA	perfluorononanoic aid
PFOS	perfluorooctane sulfonate
PFOSA	perfluorooctane sulfonamide
PFUnA	perfluoroundecanoic acid
PKiN	the Palace of Culture and Science
PM10	particulate matter with particles up to 10 μm in diameter
PM2,5	particulate matter with particles up to 2.5 μm in diameter
POP	permanent organic pollution
ppb	parts per billion
ppm	parts per million
PPP	purchasing power parity
RC	restocking class (stand type)
RDEP	Regional Directorate for Environmental Protection
SAC	special areas of conservation
SCI	Natura 2000 Sites of Community Importance
SEBI 2010	streamlining European 2010 biodiversity indicators for the assessment of progress in meeting targets set for 2010 i.e. stopping the loss of biodiversity until 2010
SEM	State Environmental Monitoring
SF NFH	State Forests National Forest Holding
SOMO35	indicator for ozone, the sum of differences between70 $\mu g/m^3$ (35 ppb) and daily maximum 8-hour running mean concentrations greater than 70 $\mu g/m^3$
SPA	Special Protection Areas
SS	structure of stand
T1/2	half-life
TOxN	total concentrations of oxidised nitrogen forms
U1	unfavourable (conservation status) – unsatisfactory status of plant species/animal species/natural habitats
U2	unfavourable (conservation status) – bad status of plant species/animal species/natural habitats
UMTS	Universal Mobile Telecommunications System
UNDP	United Nations Development Programme
UV	ultraviolet radiation
VIEP	Voivodship Inspectorate for Environmental Protection
VU	vulnerable species according to IUCN classification
WFD	Water Framework Directive
WHO	World Health Organization
WMO	World Meteorological Organisation
XX	unknown conservation status (of species/habitats)
Zm	pressure of motorization on the environment

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