RESULTS FROM THE JOINT DANUBE SURVEY 1

About the Joint Danube Survey 1

The first Joint Danube Survey, 'JDS1', was launched on August 14, 2001 from Regensburg, Germany. From here, a team of ten scientists from Germany, Austria, Slovakia, Hungary, Yugoslavia, Bulgaria and Romania started their 2,581 km six-week journey toward the Black Sea. Funded by Germany and Austria, the overall cost of the expedition was over 556,000 Euro.

The expedition included two ships, the German (now Serbian) *Argus* and Hungarian *Széchényi* – two of the same ships now participating in the JDS2. Each participating country provided in-kind contributions through national teams of experts who worked with the international JDS experts on their national stretch of the Danube.

The main goal of the JDS1 was to ensure a homogeneous set of data about water quality with a high comparability of results for the entire Danube River, and to identify and confirm specific pollution sources. The investigations also followed the European Union's legislation, the Water Framework Directive, which applies to chemical water quality and the river's ecological status.

The JDS1 became the most comprehensive survey ever carried out on the water quality and ecological status of the entire Danube River. A reliable and consolidated picture of the water quality of the Danube and its major tributaries in terms of chemical, biological and micro-biological parameters was produced. Similar trials had been done by earlier expeditions, but they focused only on certain stretches of the Danube or selected groups of parameters.

What Was Tested by the JDS1?

Hundreds of samples were collected from selected river cross-sections at 98 stations. Over 140 different parameters were tested including chemical pollutants, biological parameters, aquatic flora and fauna and bacteriological indicators.

All of the biological elements mentioned in the Water Framework Directive for assessing ecological status were investigated except fish, given that fish would have required a different sampling approach. For the determination of chemical status, the priority substances listed in the Directive as well as many other determinands were analysed -- some of them for the first time in the Danube River Basin.

The team followed a carefully prepared plan, taking samples of water, bottom sediments, suspended solids and mussels at each station. At the same time, biologists gathered a rich collection of animals and organisms living on the river bottom, macro- and micro-algae attached to stones and soft sediments, water plants, algae, bacteria and floating animals. Some parameters (e.g. pH) were measured on-board the laboratory ship *Argus* immediately after sampling. The rest of the samples were carefully preserved, stored and sent in regular intervals first to the JDS Central Storage facility at VITUKI in Budapest, and then to the nine JDS Reference Laboratories. Once the expedition was over, the JDS team along with other ICPDR experts immediately started gathering vast amounts of data from the ships and laboratories to prepare the final report.

What Were the Sampling Results from the JDS1?

The JDS1 in 2001 had a mix of positive and negative results. On the positive side, it found high levels of biodiversity and rare species. On the negative side, results showed concern over organic and microbiological pollution, heavy metals, oil from ships, pesticides and chemicals. Some findings are mentioned below; the full database is accessible through the Internet: Click here!

Biodiversity: The Danube boasts a high degree of biodiversity with over 1,000 aquatic species and higher-level organisms. Specifically, these are: 268 macro-zoobenthos taxa (small animals living on the bottom sediment); 340 phytobenthos taxa (algae living on the bottom sediment); 49 macrophyte species (water plants and mosses); 261 phyto-plankton taxa (algae drifting in the water); and 120 zooplankton taxa (small animals drifting in the water).

Interestingly, many rare species, especially zooplankton, were detected. And it was observed that the opening of the Main-Danube Canal in 1992 led to an increase of biodiversity because the removal of the natural biogeographical barrier, that had for millennia separated the Rhine and Danube, allowed river fauna to migrate again between the two rivers.

Organic Pollution: The organic pollution of the Danube varied between water quality class II (according to the Austrian classification scheme this means moderately polluted) and II/III (critically polluted). Many side arms and tributaries were found to be more polluted than the main stream with some even reaching class III (strongly polluted, e.g. Sió River in Hungary). In some tributaries (e.g. Iskar in Bulgaria, Olt and Arges in Romania), no macro-invertebrates were found – a clear indication of an even higher level of organic pollution or even toxic effects although this situation might be partially caused by low water conditions.

Eutrophication: Particularly high concentrations of algal biomass/chlorophyll-a were found in the Hungarian stretch of the Danube downstream of Budapest, indicating elevated nutrient concentrations. The overproduction of algal biomass can lead to a variety of problems ranging from anoxic waters (i.e. without oxygen) in deeper regions (through decomposition) and toxic algal blooms to decreased biodiversity and habitat destruction. The algal blooming observed during the Survey increased both the pH values and the daily dissolved oxygen concentration in the Middle Danube[1] reach.

Microbiological pollution: Microbiological (bacterial) indicators are widely applied for the assessment of anthropogenic impacts such as faecal pollution caused by untreated or insufficiently treated sewage as well as diffuse impacts from farm land and pasture (manure). Faecal bacteria also indicate the potential

[1] The Danube is divided into three sections: the Upper Danube from the spring to the Devin Gate, the Middle Danube from the Devin Gate to the Iron Gate and finally the Lower Danube from the Iron Gate to Sulina.

presence of pathogenic bacteria, viruses and parasites endangering human health. The highest values in microbiological pollution were observed in the Danube's tributaries (Rusenski Lom in Bulgaria and Arges in Romania in particular) and side arms (e.g. Moson Arm, the upper part of Soroksár Arm in Hungary).

Heavy Metals: Specific heavy metal pollution hot-spots were detected. The biggest excesses in terms of heavy metal concentrations in water were observed in the Rusenski Lom, the Iskar and the Timok tributaries. Sediment analyses revealed that German quality targets for cadmium, lead and zinc in the Iskar River, and for arsenic and copper in the Timok River, were exceeded, making the two tributaries serious contamination sources.

Pollution: From Navigation: Navigation along the Danube was the main source of oil pollution observed during the Survey. The highest values for petroleum hydrocarbons in sediments and suspended solids were found in the Middle Danube reach.

Pesticides: From 23 pesticides under investigation, only Atrazine and Desethylatrazine could be found along the Danube at average concentrations around 0,05 µg/l. Only in a few samples was the 0,1 µg/l quality target exceeded. Elevated concentrations of Atrazine were found mainly in tributaries -- the maximum value was found in the Sava River at 0,78 µg/l, affecting the Danube River downstream from the Sava confluence.

Chemical Pollutants**:** Significant concentrations of harmful chemical pollutants (e.g. 4-iso-nonylphenol and di[2-ethyl-hexyl] phthalate) featured in the EU Water Framework Directive 'List of Priority Pollutants' were found in bottom sediments and in suspended solids. Their concentrations ranged from a few µg/kg up to more than 100 mg/kg. Most of the elevated concentrations of nonylphenol were found in the Serbian section of the Danube. This may be caused by the use of alkylphenol-containing detergents in this region. These compounds were monitored in the Danube River for the first time during the Survey.

Awareness Raised

The JDS1 raised significant awareness about the Danube and need for pollution reduction measures. Followed by journalists and TV crews, it usually made it into the headlines of major newspaper, radio broadcast and TV news. At many locations where the boats stopped, public events were held with messages about recent national and local efforts made to reduce pollution. The scientists and crew were often heartily welcomed on entering a new country, be it with music groups, champagne, local foods or majorettes. There was also plenty of opportunity for them to create close contacts with country and local representatives, experts, media and the public, thereby creating a new forum for raising public awareness.

About the Joint Danube Survey 2

The **Joint Danube Survey 2**, also known as 'JDS2', is the world's biggest river research expedition in

2007. Its main goal is to produce highly comparable and reliable information on water quality and pollution for the entire Danube River and many of its tributaries. The Secretariat of the International Commission for the Protection of the Danube River (ICPDR) coordinates the implementation of JDS 2.

Launched on August 14, 2007 from Regensburg, Germany, the three boats of the JDS2 will travel 2,375 km downstream the Danube River, through 10 countries, to the Danube Delta in Romania and Ukraine until late September.

Get involved! Online (www.icpdr.org/JDS) you can view the JDS2 and some of its results, stories and pictures. Or just come to the river and see it live!

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