

The Most Comprehensive River Survey in the World

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The concept of Joint Danube Surveys (JDS) is driven by two legal instruments: the Danube River Protection Convention (DRPC) and the EU Water Framework Directive (WFD). The DRPC initiated establishing of the TransNational Monitoring Network (TNMN) in the Danube River Basin aiming to provide a well-balanced overall view of pollution and long-term trends in water quality and pollution loads in the Danube and its major tributaries on a regular basis. The EU WFD requires that countries in the Danube River Basin periodically assess in their territory a quite comprehensive system of water quality elements.

With the view to obtaining a complex picture of the water quality in the Danube and its major tributaries, the yearly assessment of water quality published in TNMN Yearbooks has been supplemented by periodic investigative monitoring surveys, which are carried out every six years in sync with the river basin management planning period according to the EU WFD.

The first Joint Danube Survey was carried out in 2001. For the first time, comparable data about the entire course of the river was provided covering over 140 different biological, chemical and bacteriological parameters. This data was used as an essential information source for the first analysis of the Danube River Basin District according to Art. 5 of the EU WFD. Six years later, the second Joint Danube Survey (JDS2) created a comprehensive and homogeneous database on the status of the aquatic ecosystem of the Danube and its major tributaries. For the first time, the fish survey was carried out along the entire Danube River, bringing a unique dataset and also contributing to methodological harmonization between EU and non-EU countries. The findings of JDS2 contributed to the first Danube River Basin Management Plan and were used in the EU intercalibration process of large rivers.

The third Joint Danube Survey (JDS3), which took place in 2013, provided the largest ever amount of knowledge about the Danube water pollution collected within a single scientific exercise. It reconfirmed that the Danube flora and fauna show a high degree of biodiversity. During JDS3, the depth of information on hydromorphological conditions was significantly improved, as in-situ measurements of hydrological, morphological and hydraulic characteristics were performed for the first time along the entire Danube and its tributaries. The first complex testing of antibiotic resistance was carried out along the entire stretch of the Danube River. Several new analytical techniques and strategies were applied targeting hundreds of organic substances, resulting in the most comprehensive information ever acquired on this topic for the Danube River. The analysis of such a large amount of organic substances enabled the first sugges-

tions for the update and prioritization of Danube River Basin Specific Pollutants.

As a result, the signatories of the Danube Declaration (adopted at the International Commission for the Protection of the Danube River (ICPDR) Ministerial Meeting in 2016) appreciated the very valuable scientific results of the third Joint Danube Survey in 2013 as well as its considerable effect on awareness raising for the ICPDR, requested the ICPDR to prepare, based on an evaluation of the previous surveys, a fourth Joint Danube Survey to be held in 2019, and committed to secure the necessary funding.

Joint Danube Surveys are planned and supervised by the ICPDR Monitoring and Assessment Expert Group (MA EG). When the MA EG experts evaluated the previous three Joint Danube Surveys, a common pattern was discerned: a core team of leading experts was responsible for the completion of all sampling jobs also undertaking analysis of samples in the case of biology, microbiology and hydromorphology. National experts only played a supporting role during this process, joining the core team in an observer role only when being in their respective countries (sometimes also providing assistance to the core team). Following reassessment of the previous approach, the ICPDR decided that JDS4 should be based on more active participation from countries. It was decided that most fieldwork and sampling should be carried out by national experts while the core team should have a coordinating and advisory role to ensure coherence between the approaches used by the national experts. This more active deployment of national experts put higher burden on countries but resulted in a very intense monitoring exercise, which not only generated another huge amount of data but also significantly strengthened both cooperation and coordination between the countries in the Danube River Basin.

To make sure that the methods used by the national experts in biology would provide comparable results, training workshops for each biological quality element were organized prior to JDS4. The national experts responsible for sampling and assessment of the EU WFD biological quality elements (BQEs) took part, together with the respective JDS4 Core Team members. This was the first time ever when the experts on all EU WFD BQEs from all ICPDR Contracting Parties met to discuss monitoring and assessment harmonization issues. It was already this overture to JDS4, which has demonstrated a significant benefit of the new JDS concept.

As before, the key objectives of JDS4 were decided to include producing comparable and reliable information on a wide range of water quality elements for the whole of the length of the Danube River including the major tributaries on a short-term basis. The other key objectives were to provide an opportunity for harmonization and training in WFD related monitoring and to cover the information gaps for the Danube River Basin Management Plan Update 2021.

The key advantages of the new approach used for JDS4 were confirmed by the survey outcomes and these include:

- Reaching a higher level of cooperation in the Danube River Basin. A shift from country experts watching how the leading experts do the job towards the job being done by the countries;
- An excellent opportunity for all ICPDR Contracting Parties to demonstrate in practical terms the cooperation towards better water quality;
- ICPDR Contracting Parties, which are not sharing the Danube main course (Czech Republic, Slovenia, Bosnia and Herzegovina) were given the opportunity to be fully-fledged participants in JDS4;
- This new concept did not require an expensive ship deployment. Monitoring by cars and boats enabled more cost-effective sampling in the whole Danube River Basin as well as more flexible sampling patterns allowing to choose optimal conditions for sample collection. Substantially increased flexibility of the survey logistics helped to solve the logistical problems concerning sampling under bad weather conditions, which caused dangerous situations during previous surveys. The flexible set-up enabled sampling of groundwater and wastewater as well;
- Strengthened ownership: carrying out the significant part of sampling activities and of biological analysis increased the ownership of JDS4 results by the ICPDR countries;
- Strong training, educational and harmonization value of the new concept: JDS4 provided an additional contribution to the intercalibration exercise as defined by the EU WFD;
- Establishing close links between national and international monitoring programs;
- Active involvement of all participants led to a high spirit of cooperation, which engaged more people, being an important mobilizing factor for the ICPDR Contracting Parties to put more support into the project;
- The new concept enabled linking of JDS4 monitoring to national surveillance monitoring, which is obligatory for each EU Member State once every six years. The countries had the possibility to synchronize their national surveillance monitoring with JDS4 and to therefore provide a significant in-kind contribution to JDS4 at no extra cost;
- It conveyed a very strong message that the Danube countries had entered a higher level of international cooperation and were ready to carry out ground-breaking special JDS4 monitoring by themselves using harmonized methods.

Post-JDS4 discussions among ICPDR experts saw overall positive feedback on the new JDS4 concept. The new approach was found successful in terms of national and international exchange of experiences and harmonization in sampling methods. The training and harmonization workshops were found to have been very helpful. The new JDS4 spirit created much stronger national activities and engagement amongst concerned authorities and their staff. All standard operating procedures prepared for JDS4 were found to be detailed and effective reference documents for the sampling procedure.

As with previous surveys, JDS4 was not only an important source of information on Danube water quality for the ICPDR, but also presented an excellent opportunity for public awareness raising of a healthier and cleaner Danube among the people who live in the Danube River Basin and beyond. The Communication Strategy for JDS4 was carefully prepared by the ICPDR's Public Participation Expert Group, including graphic design, unique branding and a new logo. This graphic identity was deployed online and presented visibly at public events relating to JDS4. This helped to give a sense of purpose amongst the various teams working on JDS4 by unifying them behind a single graphic identity regardless of their role or location. The JDS4 motto 'Discover Danube', designed as a call to action, was also utilized as a key part of the branding, positioned readably in text, and re-used online in social media and elsewhere whenever possible to underline the message. A set of fish cards to be used by both experts and the interested public and schoolchildren alike was designed and produced as a streamlined and field-ready resource to assist in the identification of fish species in the Danube River. A special animated JDS4 video also contributed to enhancing the public perception (<https://youtu.be/il1Xw58kQ94>). The massive use of social media for promoting JDS4 as the ICPDR's flagship activity helped to increase the public visibility of this monitoring exercise substantially. Furthermore, Joint Danube Surveys have a dedicated website (www.danubesurvey.org).

JDS4 was significantly affected by the pandemic of coronavirus disease in Europe in 2020. The COVID-19 lockdown had fortunately no impact on sampling activities but it affected the laboratory work leading in many cases to delayed delivery of draft manuscripts. The ICPDR recognized the special efforts made by the authors of the JDS4 Final Report, in analysing JDS4 samples and evaluating and discussing the generated data under COVID-19 restrictions, and appreciated their enthusiasm in trying to minimize effects on the reporting plan.

The gratitude of JDS4 organizers goes to all ICPDR Contracting Parties, institutions, governmental officials, experts, stakeholders and other 'friends of the Danube' for their commitment, enthusiasm and contributions, without which JDS4 would not have been such a successful adventure.



Figure 1. Sampling teams during JDS4