

Water and international law: science and evidence in international litigation

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Water touches on every aspect of human existence, so it is not surprising that it should feature in a wide range of international cases. Water is a challenging issue for international law, even if it has been addressed for many decades by a large body of rules in the form of global and regional treaties and other rules and soft law instruments.

There are all manner of different bodies of water that could be addressed: freshwater resources, surface and groundwater, seawater, rainwater or Arctic and Antarctic frozen water. An alternative focal point could be water's intersection with different areas of international law. There is a large body of jurisprudence that has emerged in the context of water as a human right. Water is also prevalent in investment treaty arbitration where foreign investors allege that their water rights have been interfered with and they bring cases which raise questions relating to the balance between the rights of a population to have access to water and the rights of an investor. Water is also an indicator of sovereignty or sovereign rights; there is a whole body of case law concerning the delimitation of maritime spaces, territorial seas or exclusive economic zones.² Much of my professional activity is dealing with disputes over how one divides access to water rights in maritime spaces, for example in the longstanding dispute between Guyana and Suriname³ or presently in the Bay of Bengal where Bangladesh has brought cases against both India and Myanmar.⁴ There is also the issue of water as a commodity that is traded internationally and whether

it is subject to normal World Trade Organization rules or to be treated differently, in particular in foreign investment disputes. Climate change, for example, indicates that in some parts of the world freshwater supplies will become increasingly scarce and – if mainstream scientific predictions are accurate – sea-level rises will have significant implications for all manner of issues in relation to international law.

An early case was the *Trail Smelter Arbitration*⁵ of 1938 between the United States and Canada, concerning the pollution of the Columbia River by sulphides; on the evidence the Arbitral Tribunal found no demonstrable harm to the river. In the *Lac Lanoux Arbitration*,⁶ Spain alleged that France was misusing the River Carol by diverting it and returning it to its original course with a different composition and quality; the Tribunal rejected that argument, finding that there was no change to the composition of the water and no pollution had been established. One of the most important early environmental cases, which for the first time caused the International Court of Justice (ICJ) to address environmental issues, was a case brought by Australia and New Zealand in the early 1970s concerning French atmospheric nuclear testing and the pollution of the high seas as well as Australian and New Zealand waters.⁷

Rather than attempt to tackle all of these issues, this lecture addresses the topic of rivers in the context of public international law and, more specifically, international litigation. It will explore the relationship between science and law. I will reflect on three cases that I have litigated in order to explore some fascinating and very fundamental issues about how disputes of a scientific and technical character are to be presented before international courts. These three cases (of which one has recently been decided)⁸ shed light on a number of important questions, namely: how are judges to deal with competing scientific arguments on issues of merit? How do lawyers go about preparing a case that deals with complex issues before a panel of 15 judges at the ICJ, or

1 This is a revised version of the UKELA Garner Lecture I delivered on 2 December 2009 at the offices of Clifford Chance in London. Having served as counsel in the three cases discussed in the lecture, it is to be stressed that any views expressed are personal. I would also like to express my warm thanks to Andrea Mackielo and Rémi Reichhold, my research assistants at UCL, for their characteristically excellent support.

2 As of June 2010, two cases pending before the ICJ relate to maritime border delimitations: *Peru v Chile* and *Nicaragua v Colombia*; see <http://www.icj-cij.org>. There is one further case concerning a maritime border dispute currently pending before the International Tribunal for the Law of the Sea (ITLOS) between Bangladesh and Myanmar (parallel proceedings between Bangladesh and India are also pending before an Annex VII Arbitral Tribunal under the United Nations Convention on the Law of the Sea (UNCLOS)).

3 *Guyana v Suriname* Permanent Court of Arbitration, Arbitral Award of 17 September 2007 The Hague available at <http://www.pca-cpa.org/upload/files/Guyana-Suriname%20Award.pdf>.

4 See the Order of the ITLOS Tribunal in the *Dispute Concerning Delimitation of the Maritime Boundary Between Bangladesh and Myanmar in the Bay of Bengal (Bangladesh/Myanmar)* of 28 January 2010 available at <http://www.itlos.org>.

5 *Trail Smelter Arbitration (US v Canada)*, 3 RIAA 1907 (1941).

6 *Lake Lanoux Arbitration (France v Spain)*, 12 RIAA 281 (1957).

7 *Nuclear Tests Case (Australia v France; New Zealand v France)* (1974) ICJ Reports 253; *Request for an Examination of the Situation in Accordance with Paragraph 63 of the Nuclear Tests Case 1974 (New Zealand v France)* (1995) ICJ Reports 288.

8 *Case Concerning Pulp Mills on the River Uruguay (Argentina v Uruguay)* Judgment of 20 April 2010 available at <http://www.icj-cij.org>.

even 21 judges at the International Tribunal for the Law of the Sea (ITLOS), all of whom come from different legal and cultural backgrounds and who think cases ought to be litigated in a variety of different ways?

*R v Secretary of State for the Environment ex parte Kingston upon Hull City Council*⁹

This first case, although set in the domestic context, raises issues of European Community law and had a considerable impact on my approach to preparing cases of this kind, which involve complex scientific issues. The case concerned the UK Government's implementation of the EC Directive on urban waste-water treatment.¹⁰ The directive sets out minimum standards of waste-water treatment depending on two factors, namely the size of the agglomeration from which the discharges originated, measured in 'population equivalent' (p.e.) and the nature of the body of water into which the discharge is deposited. Article 4(1) of the directive establishes a general requirement for the secondary treatment of urban waste-water in order to protect the quality of the receiving environment, but is subject to an exception set out in Article 6(2):

Urban waste water discharges from agglomerations of between 10000 and 150000 p.e. to coastal waters and those from agglomerations of between 2000 and 10000 p.e. to estuaries situated in areas described in paragraph 1 may be subjected to treatment less stringent than that prescribed in Article 4 providing that:

- such discharges receive at least primary treatment as defined in Article 2 (7) in conformity with the control procedures laid down in Annex I D,
- comprehensive studies indicate that such discharges will not adversely affect the environment.

The city of Kingston upon Hull is located on the Humber Estuary, a body of water that has been so referred to since around 1704. The government of the day took the view that subjecting the discharges of Hull to secondary treatment would not improve the quality of the receiving waters in any material way, and that the £90 million or so of capital construction costs were better spent on other efforts. No doubt this view accorded with that of the local water company, which faced a hefty capital investment bill.

Relying on Article 6(2) of the directive, the Secretary of State for the Environment adopted an expedient decision: he redesignated a large part of the Humber Estuary as coastal waters, thereby avoiding the

requirement for secondary treatment. As Hull is a city of more than 10,000 p.e. but less than 150,000 p.e. this was the only way in which primary treatment alone could be justified, and therefore anything seaward of the Humber bridge was reclassified as coastal waters. The municipality of Kingston upon Hull, unhappy with this course of action, decided to bring an application for judicial review against the Secretary of State for the Environment to challenge the redesignation by reference to the domestic implementation of the directive. It has to be said, however, that the directive itself does not provide a great deal of assistance in defining the term 'estuary'. Article 2(12) of the directive describes it merely as 'the transitional area at the mouth of a river between freshwater and coastal waters'. It does not refer to issues of salinity, topography or the dispersal function of an estuary, and appears to leave considerable discretion to Member States in determining for themselves what are and are not estuarine waters.

In preparing the judicial review, the lawyers examined the directive and definitions without making a great deal of progress, until Professor John Pethick from the Cambridge University Coastal Research Unit was introduced onto the team. Provided with a copy of the directive, Professor Pethick was asked to give a scientific perspective on how best to address this issue in order for the lawyers to be able to formulate legal arguments. As a scientist, he applied to his process of thinking and reflection criteria on which we, as lawyers had not immediately focused. For example, we were very focused on issues of salinity; however, this did not provide us with a way in which to move our legal arguments forward. It was Professor Pethick's independent expert report that caused us to concentrate our minds on the nature of an estuary and, in particular, on the dispersal function of estuarine waters. This despite the fact that the definition contained in the directive did not indicate that estuarine waters were to be defined by reference to their ability to disperse pollutants out of a particular area. Yet it was this dispersal function of estuaries that was, from his scientific perspective, the essence of the distinction between coastal waters on the one hand, and freshwaters or river waters on the other hand.

Acting for the government, Nigel Pleming QC pointed to 'the circularity of the definitions in Article 2(12) and (13) in that an estuary is determined by reference to "coastal waters" which, in turn, are identified by reference to the "outer limit of an estuary"'.¹¹ He argued that the definitions in the directive should be taken as they were, namely that no specific criteria were provided by the directive to ascertain the outer limit of an estuary. Consequently the only constraint on the definition of an estuary is that it must be 'a transitional area at the mouth of a river between fresh water and coastal waters'.¹² The argument made was to the effect that the directive left a

9 *R v Secretary of State for the Environment ex parte Kingston upon Hull City Council, R v Secretary of State for the Environment ex parte Bristol City Council and Another Queen's Bench Division (Crown Office List)* (1996) 8 Journal of Environmental Law 336–53.

10 Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment [1991] OJ L135/40–52 (30 May 1991).

11 *R v Secretary of State for the Environment ex parte Kingston upon Hull City Council, R v Secretary of State for the Environment ex parte Bristol City Council and Another*(n 9) at 342.

12 *ibid.*

wide discretion to Member States to determine for themselves the outer limit of an estuary, including by reference to cost implications, provided that it complied with two requirements: namely that the delimitation resulted in three zones of water (fresh water, estuarine water and coastal water) and that such delimitation was consistent with the purpose of the directive to protect the environment from the adverse effects of waste-water discharges.

Mr Justice Harrison rejected this argument. He acknowledged that there was an absence of specific criteria in the definition provided by the directive but held that if salinity or topographical features were to be used as criteria, the directive would have expressly stated so. The inevitable conclusion was that there was indeed a certain level of discretion left to Member States in determining estuarine limits, but that this discretion was not unfettered. The relevant characteristics taken into account could vary but there ought to be a genuine and rational assessment in each case of what actually constitutes an estuary having regard to all relevant circumstances, the characteristics of the area of water in question and in light of the purpose of the directive. Mr Justice Harrison ruled that economic considerations could be taken into account in defining the outer limits of estuarine waters but, crucially, this could not be the sole determining factor. It is clear from the judgment in this case that Professor Pethick played a decisive role in the reasoning of the judge. At the end of the judgment, as a result of the exchanges between the bench and the bar during oral arguments which had focused on Professor Pethick's report, Mr Justice Harrison came to a crucial conclusion: '[t]he reason why the Directive distinguishes between estuaries and coastal waters is, no doubt, because an estuary is less able than coastal waters to assimilate the discharge of waste waters into it'.¹³ This conclusion is squarely based on the scientific expert evidence in affidavit form prepared by Professor Pethick. The experience had a considerable effect on my understanding of the need to engage very early on in the preparation of these cases with individuals who are able to bring to the process of reflection an understanding as to the way in which different bodies of water function in terms of, for example, their ecology or their contribution to biodiversity. And this brings me to the international context.

*Case Concerning the Gabčíkovo-Nagymaros Project*¹⁴

International courts are different from domestic courts. As noted, more judges sit on the bench representing a variety of different backgrounds. In particular, they will have different approaches to issues of evidence, or the examination or cross-examination of witnesses and experts. The majority of international courts were

envisaged to deal with cases that predominantly involve questions of law, rather than disputed facts requiring complex technical or scientific determinations. As a result, in contrast with many domestic legal systems, complex rules relating to the production and use of evidence were not foreseen. The rules on evidence before the ICJ have been broadly drafted, the Court has wide powers to make orders and arrangements relevant to the taking of evidence and may also require that the parties produce evidence in relation to particular issues of interest.¹⁵ The Court also has *ex officio* powers, may order a visit *in loco*,¹⁶ and may appoint third parties to carry out enquiries or hear witnesses or experts.¹⁷ A great deal of flexibility was built into the rules of the Court in order to accommodate the various approaches that any given judge may be accustomed to. Over time a certain practice has developed, reflecting perhaps a certain caution on the part of the ICJ to get deeply involved in the examination or cross-examination of witnesses and experts.¹⁸ Scientists often appear before the Court as advocates. Scientists are retained by both sides in a particular dispute and address the bench as though they were counsel. This avoids the need to spend time on lengthy questioning of witnesses and experts, but the downside is that the evidence and expertise is not tested. My first experience with this approach came in 1997, in the *Case Concerning the Gabčíkovo-Nagymaros Project*.¹⁹

The case concerned the River Danube, the dispute arising in relation to a 1977 Treaty between Hungary and Czechoslovakia providing for the construction and joint operation of the Gabčíkovo-Nagymaros hydroelectric barrage system.²⁰ At this upstream point, the River Danube is a shared boundary river, which means that one state is in effect not able to undertake any major barrage works without the involvement of the other state. Accordingly, an international agreement was needed for the project to go ahead. The river also has certain characteristics that are relevant: the Danube is a large river but one that has a somewhat gentle downstream slope, which means that the water flows slowly and consistently, making its utility for generating electricity more limited. The 1977 Treaty provided for two barrages, an upstream barrage (Gabčíkovo) and a downstream barrage (Nagymaros), constructed and operated so that the flow of water would be stopped or diminished for most of the day, storing the water and then opening the barrages during times of peak

¹³ *ibid* at 344.

¹⁴ *Case Concerning the Gabčíkovo-Nagymaros Project (Hungary v Slovakia)* Judgment of 25 September 1997 available at <http://www.icj-cij.org>.

¹⁵ ICJ Statute arts 48 and 49 and Rules of the Court art 62.

¹⁶ This power was exercised in the *Corfu Channel Case (UK v Albania)* (1949) ICJ Reports 18.

¹⁷ ICJ Statute art 50 and Rules of the Court arts 62(2) and 67.

¹⁸ This was not always the case: in its first case, the *Corfu Channel Case* (n 16) the ICJ, during the merits phase, heard witnesses over a total of 20 days, from 22 November to 14 December 1948 and there was extensive examination and cross-examination; see CR 1949/1 *Minutes of the Sittings held from November 9th to April 9th, 1949* available at <http://www.icj-cij.org>.

¹⁹ *Case Concerning the Gabčíkovo-Nagymaros Project (Hungary v Slovakia)* (n 14).

²⁰ *Treaty Between the Hungarian People's Republic and the Czechoslovak Socialist Republic Concerning the Construction and Operation of the Gabčíkovo-Nagymaros System of Locks*, signed at Budapest on 16 September 1977, 1978 U.N.T.S. 236.

electricity demand to allow huge volumes of water to flow through over short periods of time. The effect is to generate large volumes of electricity at times when demand is highest (at breakfast time in the morning and at the end of the day). Electricity cannot be stored, so barrages that produce the same quantities of electricity evenly over a 24-hour period are less profitable than those capable of producing the same amount of electricity condensed into two shorter periods. That is the economic case. The environmental case points in a different direction.

In the late 1980s, while the project was still under construction, the Hungarian citizenry raised a number of environmental concerns. Some believe that environmental arguments in opposition to the Gabčíkovo-Nagymaros project became the principal catalyst for political change in Hungary: the Gabčíkovo-Nagymaros project became a symbol of Communist totalitarianism through which a great number of Hungarians marched in objection. When political changes began to come in late 1989 and 1990, as a result of public pressure, the barrage project was one of the first things to be attacked by the new Hungarian Government. In 1989 Hungary suspended work on the downstream part which was entirely within its own territory. Shortly afterwards work was also suspended on the upstream part.

To complicate matters further, at that very time Czechoslovakia split into two countries. The Czech Republic under President Václav Havel made it clear that it did not take any interest in the project and that it was a problem that could be dealt with solely by the Slovak Republic, on whose territory the project lay. Hungary's dispute with Czechoslovakia became a dispute with Slovakia. In 1992 Hungary decided to terminate the 1977 Treaty. In response, following an exchange of diplomatic notes and negotiations between experts appointed by both sides, as well as at least three intergovernmental negotiations in 1991, the Slovakian Government decided to embark upon a provisional solution known as 'Variant C', a smaller-scale project operating solely on Slovak territory, which provided for the unilateral diversion of the shared Danube onto Slovak territory, before reconnecting the waters to the boundary river.

In 1993, by Special Agreement the parties submitted the dispute to the ICJ, asking three questions: was Hungary entitled to abandon works on the project; was Slovakia entitled to proceed with Variant C; and what were the legal effects were of Hungary's notification of termination of the 1977 Treaty.²¹

At the heart of the case were issues of environmental pollution. Hungary relied primarily on a 'state of ecological necessity',²² arguing that the Gabčíkovo-Nagymaros system carried ecological risks which it considered to be unacceptable. These included the danger of cutting off

the flow of the water into the side arms of the Danube which, Hungary claimed, would have an adverse impact on biodiversity, and the dangers of allowing large volumes of water to be stored at the barrages. This, said Hungary, would cause pollutants that had been brought downstream to settle on the bottom of the riverbed and potentially pollute the groundwater, posing a threat to drinking water quality. Hungary also raised the risk of eutrophication of surface waters, the reduction of water flow in the Danube itself, and the negative impact on the biodiversity of fluvial fauna and flora.

In the preparation of this case there were three rounds of simultaneous filings: memorial, counter-memorial and reply. The case was extensively pleaded, with over 10,000 pages of written arguments submitted to the Court, of which more than 75 per cent were scientific in nature. It is worth pausing for a minute and to imagine you are a judge of the Court, faced with such a volume of written material and each side wheeling out scientific experts of great repute. How does a judge test such expert evidence? To compound the challenge, understand that the entire hearings will take place over a period of only three weeks, during which the Court generally sits for only three hours in the morning, during which there is a 20-minute coffee break, and does not sit in the afternoons. A week of oral arguments boils down to some 13 hours and there is no examination or cross-examination of the experts: they appear before the judges and make submissions as to scientific arguments and are treated as scientific counsel. It is noteworthy that in cases such as this, where environmental concerns lie at the heart of the dispute, the Court has, thus far to date, declined to avail itself of the power set out in Article 50 of the ICJ Statute and retain its own scientific experts to help unravel the complexities that are inherent in arguments of a scientific and technical nature.²³

In its judgment the Court first addressed the question of the existence of a 'state of ecological necessity', by which Hungary argued a right to suspend temporarily the application of the 1977 Treaty. The Court held that it had 'no difficulty in acknowledging that the concerns expressed by Hungary for its natural environment in the region affected by the Gabčíkovo-Nagymaros Project related to an "essential interest" of that State'.²⁴ However, the Court did not consider that the existence of a 'peril' had been established, notwithstanding the serious uncertainties raised by Hungary as to the ecological impact of putting in place the Gabčíkovo-Nagymaros barrage system.²⁵ The Court also found that the environmental dangers could not be said to be 'imminent' as they were long-term in nature and uncertain.²⁶ As a result the Court concluded that Hungary's ecological

21 *Special Agreement Between the Republic of Hungary and the Slovak Republic for Submission to the International Court of Justice of the Differences Between Them Concerning the Gabčíkovo-Nagymaros Project*, jointly notified to the Court on 2 July 1993.

22 *Case Concerning the Gabčíkovo-Nagymaros Project (Hungary v Slovakia)* (n 14) at para 40.

23 This is explored in more detail below in the context of the *Pulp Mills Dispute (Case Concerning Pulp Mills on the River Uruguay (Argentina v Uruguay))* Judgment of 20 April 2010).

24 *Dispute Concerning Delimitation of the Maritime Boundary between Bangladesh and Myanmar in the Bay of Bengal (Bangladesh/Myanmar)* (n 4) at para 53.

25 *ibid* para 54.

26 *ibid* paras 56, 57.

concerns over the project were not sufficient to justify the suspension of works in 1989 on the basis of necessity.

In response to Slovakia's arguments that it was entitled to proceed with Variant C, the Court determined that Hungary, by suspending works and invoking ecological concerns, had not forfeited its basic right to an equitable and reasonable sharing of its resources.²⁷ As a result Slovakia had committed an internationally wrongful act by putting Variant C into operation. In an attempt to justify its termination of the 1977 Treaty, Hungary raised a number of other arguments as to the impossibility to perform the obligations enshrined in the Treaty; the occurrence of a fundamental change of circumstances; the material breach of the Treaty by Slovakia by implementing Variant C as well as the development of new norms of international environmental law. The Court dismissed all of these arguments on the ground that Hungary's purported notification of termination of the 1977 Treaty did not have the legal effect of terminating it. However, the Court pointed out that newly developed norms of environmental law were relevant for the implementation of the Treaty and that the Treaty itself made provision for their incorporation through various provisions

... requiring the parties, in carrying out their obligations to ensure that the quality of the water in the Danube is not impaired and that nature is protected, to take new environmental norms into consideration when agreeing upon the means to be specified in the Joint Contractual Plan.²⁸

The Court recognised that both parties had agreed on the need to take environmental concerns seriously and to take the required precautionary measures, but fundamentally disagreed over the consequences this had for the joint project.²⁹ However, the Court itself did not provide a resolution, instead recommending that 'third-party involvement may be helpful and instrumental in finding a solution, provided each of the parties is flexible in its position'.³⁰ Nor did the Court rule on the future conduct of the parties in respect of the project. The ICJ constrained itself to note that it was of 'cardinal importance' that the 1977 Treaty was still in force and continued to govern the relationship between the parties, and considered that decisions on the future implementation of the Gabčíkovo-Nagymaros project were, first and foremost, for the parties themselves.³¹ The Court also added that the parties should take into account the concept of 'sustainable development', remarking that for the purposes of the present case that meant that the parties should look afresh at the effects of the operation of the project on the environment. In particular, the parties had to find a satisfactory solution for the volume of water

to be released into the Danube and the side-arms on both sides of the river.³²

For present purposes, one remarkable aspect of the case is the apparent lack of impact of the huge volume of scientific evidence put forward by both parties. After four years of arguments, thousands of pages of written pleadings, at least 20 scientists on both sides and countless hours preparing scientific arguments, what did the ICJ have to say on the subject of the scientific evidence? Rather little. The Court said:

Both Parties have placed on record an impressive amount of scientific material aimed at reinforcing their respective arguments. The Court has given most careful attention to this material, in which the Parties have developed their opposing views as to the ecological consequences of the Project. It concludes, however, that [. . .] it is not necessary in order to respond to the questions put to it in the Special Agreement for it to determine which of those points of view is scientifically better founded.³³

The Court seems to have side-stepped the scientific and environmental complexities. If the scientific material had an impact, the Court wasn't saying. From this case, I learnt a number of lessons. First, as with the *Kingston upon Hull* case, the early involvement of able and expert scientists is vitally important in preparing a case, both on its merits and strategically. Secondly, and consequently, the choice of scientist is of great importance, all the more so where the expertise is not tested but, rather, the scientist stands before the judges and reads out a text that he or she has prepared. Thirdly, I understood that the arguments about environmental effects resonate more strongly where it can be demonstrated that the impact on the water is going to have a demonstrable effect on human lives: courts tends to be anthropocentric, not ecocentric. This third factor emerged in the *Gabčíkovo-Nagymaros* case, but it is a sense that I have picked up in all courts: reviewing the judgment, it seems it was the impact on drinking water quality – not on biodiversity, or fish life or plant life – that resonated more strongly with the judges.

In the end, the Court cut the cake down the middle, giving a judgment that seemed to point to the continued operation of the upstream barrage but not requiring the construction of the second barrage that Hungary had abandoned. More acutely, early on in my international practice the case seemed to indicate that the international legal system as currently structured through its courts may not be ideally equipped to adjudicate between two sets of well-put but competing scientific arguments.

27 *ibid* para 78.

28 *ibid* para 112.

29 *ibid* para 113.

30 *ibid*.

31 *ibid* paras 132–37.

32 *ibid* para 140.

33 *ibid* para 54.

*Case Concerning Pulp Mills on the River Uruguay (Argentina v Uruguay)*³⁴

The third case I would like to talk about, by reference to the issue of scientific evidence and its treatment by courts, arose out of a contentious dispute between Argentina and Uruguay over the construction and operation of two pulp mills. Uruguay had decided to build two pulp mills using eucalyptus as the source of wood for the production of pulp (the eucalyptus had been grown over the past 20 years as part of a long-term economic development project). The two planned mills were to be located near the town of Fray Bentos on the banks of the River Uruguay, which is the boundary river between the two countries. These were to be two of the largest pulp mills in the world; modern, efficient and state-of-the-art. Argentina disagreed and took the view that this was not an appropriate location, owing to the close proximity to an Argentine beach resort and because of the impact on the quality of the receiving waters and on the biological diversity of the area in question.

In this area the River Uruguay is governed by the 1975 River Uruguay Statute, a bilateral treaty entered into by Argentina and Uruguay.³⁵ Argentina claimed that Uruguay had violated a number of the procedural obligations enshrined in the Statute relating to notification, conduct of an environmental impact assessment and the disclosing of information to Argentina (as set out in Articles 7–12 of the Statute). Although these provisions formed a large part the dispute, they are not directly pertinent to issues of scientific evidence addressed in this article. The parts of the Statute most relevant to this discussion are Articles 36, 40 and 41. Article 36 directs the parties to ‘co-ordinate, through the [River] Commission, the necessary measures to avoid any change in the ecological balance and to control pests and other harmful factors in the river and the areas affected by it’. Article 41 obliges the parties inter alia to ‘protect and preserve the aquatic environment and, in particular, to prevent its pollution’. Article 40 sets out the classical definition of pollution: ‘the direct or indirect introduction by man into the aquatic environment of substances or energy which have harmful effects’. When Uruguay proceeded to authorise the two pulp mills, Argentina claimed that this was a violation of the requirements of Articles 36 and 41 and in May 2006 submitted an application on the dispute to the ICJ.³⁶ Argentina also sought injunctive relief from the Court, making an application for provisional measures to suspend the construction of the pulp mills.³⁷ This request was rejected by the Court in July 2006, on the ground that Argentina had failed to demonstrate that during the

construction phase there was going to be imminent harm to the river such as to meet the requirement of urgency under the Court’s Statute to justify provisional measures.³⁸ In September 2006 one of the pulp mills (supported by ENCE, a Spanish company) was abandoned, apparently as a result of the political difficulties the project had given rise to within Argentina. But the second project, Botnia, which was sponsored by a Finnish company, proceeded and the plant went into operation producing a million tons of pulp a year.

Uruguay’s position was that the river was able to assimilate such volume of pollutants as may be discharged by the plant. Argentina, on the other hand, argued that its scientific evidence pointed to a different conclusion. It is at this point that the lawyers became involved. The lawyers on both sides ensured that each had retained scientific expertise available to them to assist in the preparation of arguments for the Court. Another important factor in this case is that an international organization – the International Finance Corporation (IFC) – was involved in the financing of the project. The IFC decided that it was necessary to go through its own scientific and environmental assessment in order to determine whether to proceed with the financing of the project and so retained its own independent scientific experts to advise it on the impact of the project. The scientists retained independently by the IFC reported that although initially there had been certain concerns, these had now been resolved and they were of the opinion that the project posed no significant or material long-term environmental threat to the river. This turned out to be a large body of the scientific evidence on which Uruguay relied in its arguments before the ICJ. Rather like the *Gabčíkovo-Nagymaros* case, there were extensive legal pleadings accompanied with even more extensive scientific arguments. Once again the ICJ was faced with the situation of having to deal with competing arguments which were, at their core, of a technical and scientific nature. These arguments were, broadly speaking, in relation to the existing level of pollution in the river as well as the existing state of biodiversity in the river, fish life, plant life and the volume and content of the discharges vis-à-vis the receiving capacity of the body of water. Essentially it boiled down to a question of whether the river had the capacity to cope with the discharges from the Botnia plant, taking into account the fact that the flow of the river varies seasonally.

At this point, something interesting emerged late on in the arguments between the parties as a result of independent scientific expertise put forward by Argentina. The written pleadings were completed in the summer of 2008, and the oral hearings scheduled to take place in the autumn of 2009. The parties agreed that it would be appropriate to update the Court on events that had occurred in the year between written pleadings and opening of oral arguments. Two months before the oral

34 *Case Concerning Pulp Mills on the River Uruguay (Argentina v Uruguay)* (n 8).

35 *Statute of the River Uruguay*, signed at Salto on 26 February 1975, 1982 U.N.T.S. 340.

36 *Application Instituting Proceedings* filed in the Registry of the Court on 4 May 2006, *Pulp Mills on the River Uruguay (Argentina v Uruguay)* available at <http://www.icj-cij.org>.

37 *Demande en indication de mesures conservatoires présenté par le Gouvernement de la République argentine* (4 May 2006) available at <http://www.icj-cij.org>.

38 *Case Concerning Pulp Mills on the River Uruguay (Argentina v Uruguay), Request for the Indication of Provisional Measures* Order of 13 July 2006 available at <http://www.icj-cij.org>.

hearings both parties submitted new documents, with Argentina presenting more than 1000 pages of new technical material.

The new material seemed to establish that the river actually flowed in both directions at the same time. Although it may seem odd, and even difficult to comprehend, one body of water can flow partly downstream and partly upstream at the same time. The upstream flow is known as 'reverse flow', and is not an entirely rare phenomenon. An Argentine expert had discovered this by placing a current meter into the river, measuring the rate and direction of flow at different depths below the surface. Although discovered rather late in the judicial process, it was of interest and potential significance. This curious feature became a subject of attention for both parties, coupled with the occurrence of an unprecedented algal bloom that occurred in the river, in the vicinity of the plant, in the period between the close of the written pleadings and the opening of the oral arguments.

Throughout the hearing it was readily apparent that the judges were keenly interested in the scientific and technical issues, so much so that – contrary to the *Gabèikovo-Nagyymaros* case a decade earlier – questions were asked of the parties on some of the more complex technical issues. Here too it must be borne in mind that appearing before the ICJ is different from appearing before an English court: the lawyers read out prepared texts, trying to maintain the attention of the judges in circumstances in which there is no verbal interaction between counsel and the bench. Moreover, at no point before or during the hearings does the Court give any indication as to the issues that the judges may be interested in. So whilst it may seem odd to an English legal audience, I can share with you that receiving two questions during the course of a three-week oral hearing at the ICJ, on issues of scientific complexity, is a matter of considerable interest, if not excitement.

The two questions posed may have been the subject of discussion in the Court beforehand, and both were of interest. The first question was one of substance, and came from the German judge Bruno Simma. It was a complex question and the fact that it was asked was noteworthy because it indicated that the Court was grappling with technical issues. Judge Simma's question was:

1. Would it be technically (I repeat: technically) possible to convert the technology used in the Fray Bentos mill from the Elemental chlorine free to the Total chlorine free technology?
2. (a) From a technical and environmental viewpoint, would it be possible, and would it make sense, to add facilities for tertiary treatment to the wastewater treatment plant of the Botnia mill, or would the carbon emissions involved in the production of the energy necessary for such tertiary treatment undo the advantages of adding this third stage?³⁹

39 CR 2009/15 at 68 (Simma).

The second question, equally important, was one of procedure, and related to the issue of the use of experts. As mentioned, the Court has rules on the production of evidence and the use of experts. Although it has the capacity in its rules to appoint its own experts to assist it on complex technical issues, the Court's practise over the last 50 years has been not to do so as it is not willing to conduct hearings over long periods, which is what would be required in order to examine, re-examine and cross-examine expert testimony on substantive scientific and technical issues. The practise has been that scientific and technical experts present their findings as individuals serving as a member of the delegation making submissions. Against this extensive practise by the ICJ, Judge Bennouna of Morocco asked the following question:

When the Parties refer to an 'independent expert' to whom they have had recourse, what do they understand by this term? In particular, in the context of the case before the Court, is it possible for an expert commissioned by one or other of the Parties to be considered as an independent expert?⁴⁰

This question also had significant consequences in a case in which one of the parties (Uruguay) was able to rely on expertise retained by the IFC. The answer provided by Uruguay to Judge Bennouna's question was that a state party that retains its own expert deprives that individual of its independent expertise for the purposes of the authority, weight and effectiveness of the submissions that are made. Uruguay argued that such evidence should be treated with caution, perfectly understandable given that Uruguay was in a position to rely on experts retained by the IFC.⁴¹ Argentina put forward a contrary argument, namely that by reference to its practice the Court had treated experts retained and assisted by states as independent, having regard to the relationship between the individual and the instructing party, as well as the relationship with the subject matter in dispute. Argentina distinguished between experts who were, for example, employees of the state and who might be expert but could not be characterized as independent, and individuals who were not employees of the state but rather employed by other entities such as universities and who could not be directed or controlled by the party that had retained their services.⁴² That is the traditional way in which the Court has proceeded.

It seemed from Judge Bennouna's question that the Court was giving active consideration to the issue of how much weight to give to the expertise of particular individuals. Inherent in the question is a recognition of the real difficulties of articulating complex scientific and factual issues to a Court in the context of an international dispute mechanism that was perhaps not designed to deal with the resolution of these kinds of complexities. In the context of issues such as climate change, sea-level rise,

40 CR 2009/17 at 59 (Bennouna).

41 CR 2009/19 at 33–44 (Reichler).

42 CR 2009/21 at 22–27 (Sands).

loss of biodiversity or fisheries, there is an expectation that international courts and tribunals will somehow be able to resolve complex disputes by reference to some means of balancing out good and bad scientific arguments. Yet international courts and tribunals have extremely limited resources both in human and financial terms, and they certainly have not often addressed issues of this kind of complexity. The questions put forward by the Court in the *Pulp Mills* case mark a positive development in relation to substance and process.

The Court delivered its judgment on 20 April 2010, ruling that Uruguay had breached its procedural obligations under the 1975 River Statute⁴³ but that it had not violated substantive obligations concerning the optimum and rational utilization of the River, changes in the ecological balance and the prevention of pollution.⁴⁴ As counsel in that case it would not be appropriate for me to express views on the Court's substantive conclusions and so I do not do so.

For present purposes, however, what the Court had to say about the presentation and assessment of evidence and expertise, including by scientists, is of some interest.⁴⁵ In particular, the Court has taken the opportunity to indicate a change of direction, opening the door to the examination and cross-examination of witnesses and experts, with all that implies for the conduct and duration of hearings. A range of views has also been expressed on the possibilities for the Court to retain its own expertise.

As in the *Gabčíkovo-Nagymaros* case, the Court noted that that '[b]oth Argentina and Uruguay have placed before the Court a vast amount of factual and scientific material in support of their respective claims'.⁴⁶ Referring to the question posed by Judge Bennouna during the oral hearings, the Court recognised that the parties

... disagree on the authority and reliability of the studies and reports submitted as part of the record and prepared, on the one hand, by their respective experts and consultants, and on the other, by the experts of the IFC, which contain, in many instances, conflicting claims and conclusions.⁴⁷

Whereas the raw data provided by each party was often consistent, there were differences in the way in which each party interpreted the raw data.⁴⁸ The Court then indicated a rejection of its prior approach:

The Court has given most careful attention to the material submitted to it by the Parties, as will be shown in its consideration of the evidence below with respect to alleged violations of substantive obligations. Regarding those experts who appeared before it as counsel at the hearings, the Court would have found

it more useful had they been presented by the Parties as expert witnesses under Articles 57 and 64 of the Rules of Court, instead of being included as counsel in their respective delegations. The Court indeed considers that those persons who provide evidence before the Court based on their scientific or technical knowledge and on their personal experience should testify before the Court as experts, witnesses or in some cases in both capacities, rather than counsel, so that they may be submitted to questioning by the other party as well as by the Court.⁴⁹

The ICJ also went a step further than it had in the *Gabčíkovo-Nagymaros* case and identified its central role in considering the relevance and value of the scientific evidence submitted by the parties in order to determine whether Uruguay had breached the substantive provisions under the River Statute.

As for the independence of such experts, the Court does not find it necessary in order to adjudicate the present case to enter into a general discussion on the relative merits, reliability and authority of the documents and studies prepared by the experts and consultants of the Parties. It needs only be mindful of the fact that, despite the volume and complexity of the factual information submitted to it, it is the responsibility of the Court, after having given careful consideration to all the evidence placed before it by the Parties, to determine which facts must be considered relevant, to assess their probative value, and to draw conclusions from them as appropriate. Thus, in keeping with its practice, the Court will make its own determination of the facts, on the basis of the evidence presented to it, and then it will apply the relevant rules of international law to those facts which it has found to have existed.⁵⁰

It is apparent from these passages that the Court is signalling a desire to engage in the assessment of evidence and expertise by the testing of individuals in Court. This is a welcome development, and one that is referred to by a number of the judges in separate and dissenting opinions.

In his Separate Opinion, for example, Judge Greenwood expresses strong support for the new approach adopted by the Court, noting that experts and witnesses owe duties to the Court under the Rules of the ICJ that are different to those duties owed by persons acting as counsel.⁵¹ On his view, with which I agree, the practise of experts appearing as counsel blurs the 'distinction between evidence and advocacy'.⁵² Judge Greenwood also expressed the view that such a practise could be unfair to the other party to a dispute, although in this case 'any

43 *Case Concerning Pulp Mills on the River Uruguay (Argentina v Uruguay)* (n 8) at paras 67–158.

44 *ibid* paras 169–266.

45 *ibid* para 159.

46 *ibid* para 165.

47 *ibid* para 166.

48 *ibid*.

49 *Case Concerning Pulp Mills on the River Uruguay (Argentina v Uruguay)* (n 8) at para 167.

50 *ibid* para 168.

51 Separate Opinion of Judge Greenwood at para 27 available at <http://www.icj-cij.org>.

52 *ibid*.

unfairness was mitigated by the fact that both Parties engaged in the same practice.⁵³ It might be mentioned, however, that both parties in the case did no more than what the Court had allowed – and perhaps encouraged – in past cases. If the parties are to adopt a different approach, then clear guidance is needed from the Court. The basis for this now seems to have been offered, and it remains to be seen what steps the Court might take in the future to elaborate such guidance. One option might be to make use of the Court's innovative Practise Directions to set out in detail the Court's expectations on the examination and cross-examination of experts, having regard to limitations on time. From the perspective of the parties, it would also be useful if the Court might indicate well in advance of the hearings the issue or issues on which it might welcome an opportunity to hear from and test expert evidence, if only to avoid time being wasted on issues that the Court does not consider to be pertinent. That would require the Court to form a view in advance of the oral hearings of what those issues might be, which would impose a change in the internal deliberative process. However, the approach could draw upon the experience of other international courts and tribunals, including arbitrations, that have grappled with the need to establish efficient approaches to the administration of justice. If the Court is feeling particularly innovative, it might even seek to move beyond the traditional cut and thrust of examination and cross-examination of the parties' experts, and devote a part of the hearings to a session held in conference during which both parties' experts could sit together and engage in a dialogue under questioning from the Court and counsel with a view to teasing out key points of convergence and difference. This has been used in arbitral procedures, for example under ICSID Rules, bringing efficiencies of time and great effectiveness, and allowing the adjudicators to control the process.

A related issue addressed by some judges in the *Pulp Mills* case is the possibility that the Court could appoint its own expert, under Article 50 of the Statute, a procedure that seems to have been utilized in only two cases.⁵⁴ Article 50 provides:

The Court may, at any time, entrust any individual, body, bureau, commission, or other organization that it may select, with the task of carrying out an enquiry or giving an expert opinion.

In a Separate Opinion, Judge Keith expressed the view that in the *Pulp Mills* case the resolution of the scientific and technical matters was 'relatively straightforward', so that the appointment of an expert under the Article 50 procedure would not have been of any real assistance to the Court: it would only have added to the huge volume of data already presented by the parties.⁵⁵ That appears

to have been the view of the majority, although some judges expressed a different view, concluding that the Court should have made use of the procedure under Article 50 of the ICJ Statute.⁵⁶

In his Dissenting Opinion, Judge *ad hoc* Vinuesa stated that the Court 'could and should have called for an expert opinion to assess the scientific and factual evidence presented by the Parties', and that Article 50 was 'conceived precisely for cases like the present one'.⁵⁷ Judge Cançado Trindade thought the Court should have obtained 'further evidence *motu proprio* ... (e.g. by means of *in loco fact-finding*)', although he recognized that the impact on the conclusions 'would be to a large extent conjectural'.⁵⁸ Although with the majority, Judge Yusuf expressed concerns about 'the manner in which the Court decided to handle the abundant factual material presented by the Parties'. He considered that the Court was not in a position adequately to compare, for example, the hydrodynamic data regarding the flow of the river, because each of the parties collected their data 'from monitoring at different stations, at different depths, and on different dates'.⁵⁹ The Article 50 mechanism would have enabled the Court to deal with only one set of scientific data, rather than try to evaluate the relative merits, relevancy, accuracy and probative value of two sets of conflicting evidence. Judge Yusuf points out – rightly in my view – that recourse to Court-appointed expertise does not deprive the Court of its judicial function:

Thus, although experts may assist the Court to develop a finer grasp of the scientific and technical details of factual issues arising in the case, it always remains the ultimate responsibility of the judge to decide on the relevance and significance of those facts to the adjudication of the dispute.⁶⁰

Judge Yusuf also makes the point that in a scientifically complex dispute such as the *Pulp Mills* case, the credibility of the Court may be undermined by the failure to appoint its own experts, and this could serve to discourage states from bringing further fact-intensive cases of scientific complexity before the Court. This strikes me as a highly pertinent observation, not least since a state that is considering taking a case will sometimes have options as between two or more potential fora. The ability of an international court to engage with complex facts and to be willing to take extra steps so to engage is one factor that states have, in my experience, in mind when exercising that choice.

In a robust Joint Dissenting Opinion, Judges Al-Khasawneh and Simma set out a strong critique of the Court's approach. They concluded that:

53 *ibid* at para 28.

54 The ICJ made orders under Article 50 in the *Corfu Channel Case (United Kingdom v Albania)* (n 16) and in the *Gulf of Maine Case (Canada v United States of America)* (1984) ICJ Reports 246.

55 Separate Opinion of Judge Keith at para 11 available at <http://www.icj-cij.org>.

56 See Joint Dissenting Opinion of Judges Al-Khasawneh and Simma; Dissenting Opinion of Judge *ad hoc* Vinuesa; Declaration of Judge Yusuf, all available at <http://www.icj-cij.org>.

57 Dissenting Opinion of Judge *ad hoc* Vinuesa at para 95.

58 Separate Opinion of Judge Cançado Trindade at para 151.

59 Declaration of Judge Yusuf at para 3.

60 *ibid* para 12.

... the Court has evaluated the scientific evidence brought before it by the Parties in ways that we consider flawed methodologically: the Court has not followed the path it ought to have pursued with regard to disputed scientific facts; it has omitted to resort to the possibilities provided by its Statute and thus simply has not done what would have been necessary in order to arrive at a basis for the application of the law to the facts as scientifically certain as is possible in a judicial proceeding. Therefore, faced with the results of a deficient method of scientific fact-finding, we are not in a position to agree “that the Eastern Republic of Uruguay has not breached its substantive obligations under Articles 35, 36 and 41 of the 1975 Statute of the River Uruguay.”⁶¹

Judges Al-Khasawneh and Simma expressed the view that the Court ‘on its own is not in a position adequately to assess and weigh complex scientific evidence of the type presented by the Parties’, and that a court of justice cannot assess, without the assistance of experts, complex and competing scientific claims as to ‘whether two or three-dimensional modelling is the best or even appropriate practise in evaluating the hydrodynamics of a river’, or ‘the effects of the breakdown of nonylphenoethoxylates’, or ‘the possible chain of causation which can lead to an algal bloom’. In their view, ‘the task of a court of justice is not to give a scientific assessment of what has happened, but to evaluate the claims of parties before it and whether such claims are sufficiently well-founded so as to constitute evidence of a breach of a legal obligation.’⁶²

So the issue becomes, how should a court obtain that additional assistance? As Judges Al-Khasawneh and Simma note, one option is to call upon the parties to produce more evidence or explanations, or for their experts to be examined by the parties and the bench, under the control of the President.⁶³ It is not immediately apparent, however, that this would advance the Court a great deal where two competing views are put with more or less equal authority, and the scientific or technical arguments are finely balanced. They conclude that the ‘more compelling alternative’ is the appointment by the Court of one or more experts under Article 50.

I express no personal view on the merits of the competing arguments as to whether the Article 50 procedure should have been used in this case. What is welcome – even very welcome – is that the Court’s judges are turning their minds to these issues, so that this becomes the first case in which the assessment of evidence on an environmental case is the subject of judicial opinion publicly expressed. That will reassure states that are thinking about bringing cases of this kind to the Court, or that may already have such cases in the pipeline before the Court. States will also want to know, however, the conditions under which the Article 50 procedure might

be utilized. Judges Al-Khasawneh and Simma consider that ‘it would not be sufficient if the Court, in disputes with a complex scientific component, were to continue having recourse to internal “experts fantômes”, as appears to have been the case, *inter alia*, in certain boundary or maritime delimitation cases.’⁶⁴ In this regard, they refer to the view of the Court’s Registrar, Philippe Couvreur, that experts retained by the Court have the status of temporary Registry staff members, bound by an oath of confidentiality, whose ‘conclusions would never be made public.’⁶⁵ Judges Al-Khasawneh and Simma did not mince their words:

While such consultation of ‘invisible’ experts may be pardonable if the input they provide relates to the scientific margins of a case, the situation is quite different in complex scientific disputes, as is the case here. Under circumstances such as in the present case, adopting such a practice would deprive the Court of the ... advantages of transparency, openness, procedural fairness, and the ability for the Parties to comment upon or otherwise assist the Court in understanding the evidence before it. These are concerns based not purely on abstract principle, but on the good administration of justice ...⁶⁶

From the perspective of counsel to a party that view seems unimpeachable. The idea that on matters of such significance an international court or tribunal might identify, retain and rely upon the view of one or more experts without having first ascertained the views of the parties raises serious concerns. The parties may disagree about the nature of the expertise to be sought, or upon the merits or independence of a particular candidate, or the manner in which the expert went about her or his business. At the end of the day it will be for the Court to decide, but having heard the views of the parties will be likely to protect the integrity of the process and the outcome. That becomes all the more important if the outcome turns in any material way on the views of the Court-appointed expert.

The route of prior consultation with the parties is tried and tested. In one case in which I was involved – the maritime boundary dispute between Guyana and Suriname – an arbitral tribunal acting under Annex VII of the 1982 Convention on the Law of the Sea decided that it would benefit from the views of a hydrographer. In accordance with the Rules of Procedure, the tribunal consulted with the parties on the expert’s terms of reference and on the identity of the expert. Following his appointment, the expert hydrographer made a site visit, accompanied by representatives of the parties, and prepared a report following the site visit on which the parties were invited to comment. The expert sat with the tribunal during the hearing, was able to ask questions of the parties and to

61 Joint Dissenting Opinion of Judges Al-Khasawneh and Simma at para 2.

62 *ibid* para 4.

63 *ibid* para 7.

64 *ibid* para 14.

65 *ibid*.

66 *ibid*.

be asked questions by the parties. The entire process was open and transparent and worked well in the eyes of both parties.⁶⁷ In this way it contributed to the integrity of the process and the authority of the award. In 2010, any alternative approach is likely to be fraught with difficulty.

Conclusions

The conclusions that I draw from my involvement in these three cases are necessarily personal, reflecting on experience, predispositions and legal culture. The lessons I have learnt break down into seven fundamental points, relating to the preparation of litigation on international disputes relating to water. These principles could equally apply to the negotiation of international environmental agreements, where issues of scientific evidence are equally germane.

A *first* point is that international cases are never won or lost on legal argument alone. The scientific and technical issues, including the manner in which expert evidence is presented, are closely connected to outcome.

The *second* point is that environmental resources, including water, are rarely seen by international judges as being worthy of protection in themselves. My sense is that technical and scientific arguments are more likely to resonate and be effective if it can be shown that their protection will in some way have a discernible benefit for a defined human population. Putting it another way, international courts are anthropocentric.

My *third* conclusion is that international judges find themselves in understandable difficulty in grappling with the complexities of scientific arguments. Counsel may have had years to get up to speed on the scientific issues, whereas the judges will have had a much shorter period of time, and will often have been presented with impressive but contradictory expert arguments. This necessarily means that in presenting material of a scientific and technical nature it is appropriate to 'keep it simple and focused': home in on the key issues and don't complicate unnecessarily.

This brings me to a *fourth* conclusion: from the point of view of counsel, it is vital to get to grips with the scientific and technical issues at a very early stage in the proceedings and, if at all possible, before the litigation is initiated. Scientists and technicians need to be available from early on in order to assist the lawyers in understanding the particular characteristics of a body of water and the threats it may face. It is also important to visit the location of these disputes in order to pick up on crucial points that may not be immediately apparent from expert reports.

Fifthly, it is important for a party to retain a team of experts that is balanced, involving locals and outsiders, nationals and non-nationals, with a view to establishing credibility and authority with the judges. You need expertise from individuals who are familiar with the particular body of water, and utilizing 'outsiders' alone risks missing the possibility of local expertise being brought to bear. Ideally, the expert team would comprise those who have first-hand knowledge of hydrography and biodiversity and the myriad of other issues that arise, and to supplement this with external expertise that can fill gaps and provide a broader comparative context. With the ICJ's new approach, indicating the increased questioning of experts by way of examination and cross-examination, the choice of experts will become all the more important.

Sixthly, to the extent that formal scientific presentations will be made by counsel, they should be kept as short and succinct as possible. Beyond 30 minutes the attention of the judges will begin to wane. The nature of the presentation is also significant: a court room is not a university lecture theatre, and it is best to avoid a long series of slides and PowerPoint presentations. There is a limit to how much technical material can be digested at one sitting.

My *seventh* and final conclusion is that in preparing scientific presentations it is vitally important to understand the DNA and practise of each court and tribunal. Just as every body of water is different, each court or tribunal is different, with differing capacities for dealing with the technical issues. Arbitration is different from proceedings before the ICJ, not least because the number of adjudicators is smaller, and because the hearings tend to be structured in such a way that the parties are able to get into a degree of detail – often through arbitrators' questions – that does not occur before the Court.

These conclusions come at a time of change, requiring us to reinvent our expectations as to the way in which international courts and tribunals, such as the ICJ, will adjudicate on scientific and technical issues of a certain complexity. When I delivered this lecture the hearings had been concluded but the Court had not yet given its judgment in the *Pulp Mills* case. The debate amongst the Court's judges as to the proper way for parties to present scientific and technical expertise, as well as the expression of differences as to the appointment by the Court of its own experts, is a significant and welcome development: as the number and range of international disputes over natural resources – and water in particular – increases, it becomes ever more important to refine clear standards and practises for the presentation, testing and assessment of matters of scientific and technical expertise.

⁶⁷ *Guyana v Suriname* (n 3) at paras 108, 394 and Appendix; see also Procedural Order No 6 appointing Mr David H Gray (27 November 2006); Corrected Report on Site Visit by Mr David H Gray (30 July 2007).