

Scientific Knowledge and the ICJ

Trends in the Judicial Handling of Science after the Gabčíkovo-Nagymaros Case

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Abstract

This article maps current trends in the scientific engagement of the ICJ in environmental disputes. As a starting point, the analysis takes a closer look at the shortcomings in the ICJ's use of scientific knowledge and expertise in the Gabčíkovo-Nagymaros judgment. It argues that this decision marks the low-water mark of the ICJ's willingness to engage with the scientific aspects of environmental disputes, and details the direct and more subtle ways in which scientific authority was neglected and circumvented in the ICJ's inquiry. The article then points out three trends in more recent environmental decisions of the ICJ, which bespeak of a heightened judicial willingness to appreciate the scientific knowledge underlying environmental disputes. This paper examines how the ICJ now exerts greater control over the parties' negotiations in scientific matters, how it undertakes a more active role in the scrutiny of party-submitted evidence, and how recent disputes feature an extensive use of geospatial evidence. The article concludes by explaining the advantages of the ICJ's more thorough approach to science for the efficiency and legitimacy of environmental dispute resolution.

Keywords: science, scientific disputes, geospatial evidence, Gabčíkovo-Nagymaros judgment, ICJ.

1. Introduction

Perhaps the most disappointing aspect of the *Gabčíkovo-Nagymaros* judgment¹ lies in the visible efforts made by the ICJ to circumvent the apparent scientific dimensions of the parties' conflict regarding the damming of the Danube. The first contentious environmental case decided by the ICJ showcases several judicial maneuvers with which the bench sought to escape evaluating the highly technical party-submitted expert evidence, both at the stage of framing the legal dispute and during its scientific fact-finding procedure.

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1 ICJ, *Case concerning the Gabčíkovo-Nagymaros Project (Hungary v Slovakia)*, judgment, ICJ Reports 1997, p. 7.

The judgment marks a shaky start in the ICJ's history of deciding scientifically-loaded environmental disputes. Unsurprisingly, the decision was met with harsh criticism in contemporaneous scholarship for the many shortcomings in the ICJ's fact-finding technique and its lack of appreciation of the technical aspects of the case.² Since *Gabčíkovo-Nagymaros*, however, one may witness several welcome developments in the ICJ's case-law in terms of evaluating the scientific dimensions of disputes. The growing body of environmental disputes feature various techniques for the judicial framing of the scientific profile of disputes, the meaningful evaluation of expert evidence, and the use of technical evidence supplied by emerging Earth observation technologies.

This article first discusses, in Section 2, the deficiencies in the ICJ's scientific engagement in *Gabčíkovo-Nagymaros*. These shortcomings will be contrasted in Section 3 with more recent examples from the ICJ's environmental case-law, which reveal a more principled and thorough approach to scientific knowledge in several respects. First, the ICJ is now willing to exert greater control over the parties' negotiations whenever it mandates finding a mutually agreeable solution for science-heavy issues contested by the parties (Section 3.1). In addition, the ICJ has in recent cases shown openness towards taking on a more active role in the scrutiny of party-submitted evidence (Section 3.2.). Finally, recent disputes have seen an extensive judicial use of geospatial evidence (Section 3.3.). Section 4 explains the potential benefits this more transparent and hands-on approach to science for the efficiency and legitimacy of the ICJ's environmental jurisprudence.

2. The Gabčíkovo-Nagymaros Case as the Low-Water Mark of the ICJ's Engagement with Scientific Knowledge

In *Gabčíkovo-Nagymaros*, the ICJ famously held that "it is not necessary"³ to take a position on the scientific points of contention between the parties. Hence, instead of examining the merits of the scientific evidence submitted by Hungary and Slovakia, the ICJ repeatedly urged the parties to find "an agreed solution"⁴ with respect to virtually all science-heavy issues, such as specifying the volume of waters to be released to the old riverbed,⁵ and concretizing the scope of environmental damage to be compensated by Slovakia.⁶ The avoidance strategy of

2 Adriana Koe, 'Damming the Danube: The International Court of Justice and the Gabčíkovo-Nagymaros Project (Hungary v Slovakia)', *Sydney Law Review*, Vol. 20, Issue 4, 1998, p. 616; Stephen Stec & Gabriel Eckstein, 'Of Solemn Oaths and Obligations: The Environmental Impact of the ICJ's Decision in the Case Concerning the Gabčíkovo-Nagymaros Project', *Yearbook of International Environmental Law*, Vol. 8, Issue 1, 1997, pp. 41-57; Cesare PR Romano, *The Peaceful Settlement of International Environmental Disputes A Pragmatic Approach*, Kluwer Law International, 2000, pp. 259-260.

3 ICJ, *Gabčíkovo-Nagymaros*, judgment, para. 54. *see* in more detail in Chapter 3, Section 3.1.

4 *Id.* para. 142; and the same was mandated in para. 140: The parties "must find a satisfactory solution for the volume of water to be released into the old bed of the Danube."

5 *Id.* para. 140.

6 *Id.* para. 155, Section (2)D.

the ICJ ultimately shaped the framing of the decisive legal issues in the case and the ICJ's approach to evidentiary assessment. These will be addressed in turn.

As to the framing of the relevant legal issues, it is salient how the ICJ simply carved out from the main thread of the judicial analysis those aspects that were most tainted with scientific complexities. Even though judicial economy, *i.e.* narrowing the scope of its judgments to the extent possible,⁷ is an established feature of the ICJ's case law,⁸ it is still striking how the ICJ 'minimized'⁹ science in its inquiry. In the ICJ's reading, it was only asked to determine the basis of compensation but not the quantum of damages.¹⁰ However, such a configuration of the judicial task in the case does not strictly follow from Article 2(2) of the Compromis of April 1993, which provides that "the Court is also requested to determine the legal consequences, including the rights and obligations for the Parties, arising from its Judgment". Arguably, even if the ICJ's mandate was indeed confined to ruling only on the legal basis but not the quantum of compensation, it should still have determined the basis and scope of compensation with more clarity. It appears that the ICJ made a strategic choice not to touch upon the science-intensive question of determining the quantum of compensation when it interpreted its mandate under the Compromis.

Such a narrow tailoring of the issues decided by the ICJ has come with a price, namely that the judgment was clearly unable to resolve the underlying conflict. The parties have failed to even begin a meaningful dialogue for over a decade after the judgment.¹¹ Subsequently, Slovakia filed a request for an additional judgment, asking the ICJ to determine the modalities for executing the original judgment.¹² Ever since, all attempts at engaging in meaningful negotiations have proven to be futile. Although the parties agreed to the formal discontinuance of the proceedings before the ICJ in 2017,¹³ their protracted bilateral consultation did not reach a mutually agreeable solution in the scientifically-loaded issues. Tellingly, *Gabčíkovo-Nagymaros* has not been removed from the ICJ's list,¹⁴ well illustrating the many questions that the judgment left unanswered.

7 Fulvio Maria Palombino, 'Judicial Economy and Limitation of the Scope of the Decision in International Adjudication', *Leiden Journal of International Law*, Vol. 23, Issue 4, 2010, p. 922.

8 Christine Gray, 'The 2016 Judicial Activity of the International Court of Justice', *American Journal of International Law*, Vol. 111, Issue 2, 2017, pp. 415-436.

9 Jorge E. Vinuales, 'Observations Sur Le Traitement Des Motifs Scientifiques Dans Le Contentieux Environnemental International', in Couveinhes Matsumoto & Nollez-Goldbach (eds.), *Les motifs non-juridiques des jugements internationaux. Actes de la 1ère journée de droit international de l'ENS*, Pedone, 2016, pp. 114-116.

10 ICJ, *Gabčíkovo-Nagymaros*, judgment, para. 152.

11 Marcel Szabó, 'The Implementation of the Judgment of the ICJ on the Gabčíkovo-Nagymaros Dispute', *Iustum Aequum Salutare*, Vol. 5, Issue 1, 2009, p. 22. See also Marcel Szabó, 'A bős-nagymarosi vízlépcsőper és utóélete – két évtized távlatából', in Gábor Kajtár & Pál Sonnevend (eds.), *A nemzetközi jog, az uniós jog és a nemzetközi kapcsolatok szerepe a 21. században: tanulmányok Valki László tiszteletére*, ELTE Eötvös, Budapest, 2021, pp. 483-198.

12 Press release of the ICJ, No. 1998/28, 3 September 1998.

13 Press release of the ICJ, No. 2017/31 21 July 2017.

14 See the ICJ's list of pending cases at www.icj-cij.org/en/pending-cases.

The *Gabčíkovo-Nagymaros* dispute also displayed a rather poor evidentiary assessment. In fact, the ICJ chose not to consider the abundant expert evidence submitted by the parties, and found the absence of an imminent environmental risk without evaluating any scientific data describing such peril.¹⁵ This path has generated harsh criticism¹⁶ given that solid and legitimate conclusions can hardly be drawn regarding matters of ecological risks without considering the substance of relevant scientific reports submitted by the parties. The ICJ's approach was in stark contrast with the position of the litigants, who regarded the issue of environmental risks as being primarily a scientific question, as evidenced by the sheer number of expert reports adduced. The Hungarian Reply alone included a 100-page long 'Scientific rebuttal,' in which it challenged the Slovakian scientific claims in detail.¹⁷ Moreover, the scientific aspect of the conflict was thoroughly investigated by a fact-finding mission of the European Communities,¹⁸ which also made express recommendations on the amount of water to be discharged into the Danube's old riverbed in order to prevent an irreversible adverse ecological impact. Nevertheless, the ICJ chose to circumvent the party-adduced evidence regarding environmental risks, and the plea of ecological necessity in particular, which led to an apparent inconsistency between "the strong environmentally-friendly language"¹⁹ of the judgment and the conclusion reached therein.

Superficial evidentiary assessments are usually justified with reference to specialized State organs' superior epistemic capacity to make highly technical evaluations. This argument is often deemed as warranting an epistemically deferential review from international courts and tribunals.²⁰ However, a too deferential judicial review may easily undermine the exercise of the judicial function in science-heavy cases, as it leaves the parties' scientific narratives largely unchecked.²¹ The dissenting opinion of Judge Herczegh pointed to a similar deficiency in the majority's position in *Gabčíkovo-Nagymaros*:

15 Koe 1998, p. 616.

16 Anna Riddell, 'Scientific Evidence in the International Court of Justice – Problems and Possibilities', *Finnish Yearbook of International Law*, Vol. 20, 2009, p. 242. See Joint Dissenting Opinion of Judge Al-Khasawneh and Judge Simma, Declaration of Judge Yusuf, Dissenting Opinion of Judge Vinuesa.

17 ICJ, *Gabčíkovo-Nagymaros*, Reply of the Republic of Hungary, Volume 2, Scientific Rebuttal, 20 June 1995, pp. 1-108.

18 Mission report of the Commission of the European Communities Czech and Slovak Federal Republic and Republic of Hungary, October 31, 1992, Bratislava (Annex 13 to the Memorandum of Republic of Hungary); Commission of the European Communities Republic of Hungary, Slovak Republic, Working Group of Monitoring and water management experts for the Gabčíkovo system of locks. Report on Temporary water management regime, December 1, 1993, Bratislava (Annex 19 to the Memorandum of Republic of Hungary).

19 James Crawford, 'In Dubio Pro Natura: The Dissent of Judge Herczegh', in Péter Kovács (ed.), *International law: a Quiet Strength. Miscellanea in memoriam Géza Herczegh*, Pázmány Press, Budapest, 2011, p. 268.

20 Esmé Shirlow, *Judging at the Interface - Deference to State Decision-Making Authority in International Adjudication*, Cambridge University Press, Cambridge, 2021, pp. 20-24.

21 Katalin Sulyok, *Judicial Deference and Science, Law and Proceedings of International Courts and Tribunals*, forthcoming in 2022, manuscript on file with the author.

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“As a judicial organ, the Court was admittedly not empowered to decide scientific questions touching on biology, hydrology, and so on, or questions of a technical type which arose out of the G/N [Gabčíkovo-Nagymaros] Project; but it could – and even should – have ruled on the legal consequences of certain facts alleged by one Party”.²²

The ICJ indeed appeared to draw conclusions about Hungary’s scientific arguments without making any transparent evaluation of the underlying facts. In particular, it dismissed Hungary’s plea of ecological necessity by distinguishing “possible peril”, described by uncertain scientific claims, from the “objective existence of a peril”, which was to be supported by foreseeable future damage.²³ A slight majority found that the several hundred pages of scientific evidence only sufficed to suggest “serious uncertainties”,²⁴ but could not establish an objective peril that justified a state of necessity. Choosing between these two legal scenarios, the factual bases of which run so closely together, without touching upon the scientific evidence submitted, let alone providing any transparent evaluation thereof, seriously undermines the legitimacy of the reasoning.

As a final note, the *Gabčíkovo-Nagymaros* judgment also proves that judges may sometimes react to the uncertainties in the underlying scientific knowledge in an asymmetric way. Not being familiar with the conventions and processes of scientific knowledge production, lawyers may often be skeptical about the reliable and unbiased nature of scientific arguments or tend to assume political considerations behind science-backed arguments. In the material case, Judge Oda in his dissenting opinion first asserted that “it cannot be said that the drafters of either the Treaty or of the Joint Contractual Plan failed to take due account of the environment”.²⁵ This language suggests that Judge Oda did not question the credibility and scientific soundness of decisions made by the leaders of the Communist Parties, which negated all scientific concerns pertaining to the project when they concluded the treaty in 1977, despite having no detailed prior environmental impact assessment.²⁶ In the following sentence, the dissenting opinion voiced a “firm conviction” that concerns about environmental risks raised by environmental opposition groups in Hungary were without merit. Such a reasoning, which suspects political bias with regard to certain scientific claims but refutes those in relation to other scientific assumptions without any in-depth assessment of the scientific evidence can easily be vulnerable to criticism, as it appears to be arbitrary from an epistemic point of view.

In sum, *Gabčíkovo-Nagymaros* appears as the low-water mark of the ICJ’s willingness to face, and openly deal with scientific complexities implicated in legal disputes referred to it. The ICJ was criticized for “acrobatically avoiding”²⁷ the ecological aspects of the dispute, for throwing the dispute “back into the lap of

22 ICJ, *Gabčíkovo-Nagymaros*, Dissenting Opinion of Judge Herczegh, p. 177.

23 ICJ, *Gabčíkovo-Nagymaros*, judgment, para. 54.

24 Id.

25 ICJ, *Gabčíkovo-Nagymaros*, Dissenting Opinion of Judge Oda, para. 12.

26 ICJ, *Gabčíkovo-Nagymaros*, judgment, para. 57.

27 Stec & Eckstein 1997, p. 42.

the parties”,²⁸ for deciding the dispute “solely on the law”,²⁹ and also for “camouflaging” its factual evaluation in a suspicious manner.³⁰ There are indeed good reasons for regarding the *Gabčíkovo-Nagymaros* judgment as proof of the ICJ’s “unwillingness or unsuitability”³¹ at the time to deal with scientific disputes. Nevertheless, later cases attest a growing appreciation of the ICJ for the instrumental role that scientific knowledge plays in deciding environmental legal disputes.

3. Developments since *Gabčíkovo-Nagymaros*: the ICJ’s Growing Appreciation for the Scientific Profile of Environmental Disputes

Ever since *Gabčíkovo-Nagymaros*, the number of scientific disputes referred to the ICJ has been on the rise.³² These proceedings have seen considerable developments in how the ICJ approaches scientific knowledge embedded in the parties’ arguments. Importantly, however, as the harsh criticism engendered by the majority’s evidentiary findings in *Pulp Mills* shows, the ICJ’s experiments with handling scientific evidence have not been without controversies.³³ Nevertheless, recent jurisprudence showcases a more direct and thorough engagement with science in the judicial inquiry. These developments include a judicial framing of disputes in a way as to include science-heavy aspects in the legally relevant ambit of cases (Section 3.1.), the use of geospatial data as persuasive evidence (Section 3.2.), and a closer judicial scrutiny of science-based positions (Section 3.3.).

3.1. Framing the Judicial Task to Reflect on the Scientific Dimensions of Disputes

In more recent environmental proceedings, the ICJ appears to frame environmental disputes in a way that allows scientific knowledge to enter the sphere of judicially relevant considerations. Such an approach is manifest, for instance, in the ICJ’s more active involvement in the parties’ negotiations regarding science-based, contested legal issues. Similarly, one may find occasions in more recent case-law when the ICJ is ready to follow the science-heavy pleadings of the parties, resulting in an equally science-intensive judicial inquiry. This is a marked improvement compared to *Gabčíkovo-Nagymaros*, where the ICJ

28 Romano 2000, p. 256.

29 Anna Riddell & Brendan Plant, *Evidence before the International Court of Justice*, British Institute of International and Comparative Law, 2016, p. 353.

30 Vinuales 2016, pp. 114-115.

31 Riddell & Plant 2016, p. 348.

32 ICJ, *Pulp Mills on the River Uruguay (Argentina v Uruguay)*, judgment, ICJ Reports 2010, p. 14; ICJ, *Aerial Herbicide Spraying (Ecuador v Colombia)*, Discontinuance, Order of 13 September 2013, ICJ Reports 2013, p. 278; ICJ, *Whaling in the Antarctic (Australia v Japan: New Zealand intervening)*, judgment, ICJ Reports 2014, p. 226; ICJ, *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v Nicaragua)* and *Construction of a Road in Costa Rica along the San Juan River (Nicaragua v Costa Rica)*, judgment, ICJ Reports 2015, p. 665; *Dispute over the Status and Use of the Waters of the Silala (Chile v Bolivia)*, filed in the Registry of the ICJ on 6 June 2016.

33 Riddell 2009, p. 242.

refused to consider the scientific submissions of the parties in resolving the dispute. Lastly, the bench has now become more open to base findings on probabilistic scientific proof. Concrete examples of such framing techniques will now be addressed below.

First, the ICJ assumes a more active role in overviewing and supervising science-intensive negotiation processes. As addressed above, in *Gabčíkovo-Nagymaros*, the judgment outsourced the resolution of such questions to the parties in an open-ended negotiation process in which the ICJ had no role to play. In contrast, in *Certain Activities/Construction of a Road*, the ICJ set a deadline for the parties' consultation to determine the amount of compensation payable by Nicaragua for the environmental damage arising out of violating Costa Rica's territorial sovereignty. Importantly, the ICJ was ready to set the quantum of compensation in a separate judgment when the parties failed to find a solution of their own.³⁴ This judicial oversight of the consultation process therefore ensured an effective resolution of the disputed questions, even when the parties had reached a stalemate.

Moreover, the ICJ chose a fact-intensive argumentative path in the compensation judgment issued in *Certain Activities*. It was the first time that the ICJ adjudicated a compensation claim for environmental damage,³⁵ and it awarded compensation for the direct injuries resulting from the breach of territorial sovereignty. The parties could not agree on the quantum of reparation, as they disagreed about the appropriate scientific methods for valuing environmental damage.³⁶ Costa Rica put forward a 'value transfer approach', which accounted for both 'direct use value' of tradeable services (such as timber) and 'indirect use value' for non-tradeable ecosystem services (e.g. climate regulation services),³⁷ whereas Nicaragua preferred a valuation based on 'ecosystem service replacement costs'. Costa Rica therefore requested the ICJ's judgment to declare the amount of compensation.

It was in this context that the ICJ had to monetize the loss of ecosystem services provided by the wetland destroyed by Nicaraguan troops on Costa Rican territory.³⁸ The ICJ adopted an ecosystem services approach,³⁹ announcing that any "consequent impairment or loss of the ability of the environment to provide goods and services, is compensable under international law."⁴⁰ This approach yielded a particularly fact-intensive inquiry, where the ICJ had to engage closely with highly technical submissions. Even though the ICJ avowedly conducted an "overall valuation"⁴¹ providing only a rather "opaque"⁴² scientific assessment of

34 ICJ, *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v Nicaragua)*, judgment on compensation, ICJ Reports 2018, p. 15.

35 Id. para. 41.

36 ICJ, *Certain Activities*, order of 18 July 2017, ICJ Reports 2017, p. 285.

37 ICJ, *Certain Activities*, judgment on compensation, para. 47.

38 Id. paras. 22-23, 27.

39 Id. para. 46.

40 Id. para. 42.

41 Id. paras. 80, 81, 83.

42 Id. Dissenting Opinion of Judge *ad hoc* Dugard, para. 22.

the party-submitted evidence, it nevertheless conducted its own assessment regarding the valuation of various ecosystem services and did not accept any of the calculations offered by the parties in their entirety.⁴³ The bench took issue with the calculations offered by the parties when it had doubts regarding the reliability of the methodology used.⁴⁴ The ICJ therefore decided to make adjustments in its calculation of damages to “account for the shortcomings”⁴⁵ in the parties’ methodologies, though without setting out the details of its own corrected analysis. All in all, the reasoning of the ICJ became remarkably science-heavy. This gives hope that the ICJ no longer shies away from crafting a legal argumentation that is essentially rooted in scientific evidence.

A final, noteworthy development in the ICJ’s approach to science lies in how it approaches the problem of scientific uncertainty. The uncertain nature of scientific evidence means that scientific research can only provide probabilistic results as opposed to clear-cut certainties.⁴⁶ In *Gabčíkovo-Nagymaros*, scientific uncertainties in the underlying data essentially paralyzed the ICJ’s analysis and prevented it from building the judicial evaluation on the expert evidence submitted. The ICJ firmly avoided confronting its evidentiary record by deeming it unnecessary⁴⁷ to comment on the evidence in rendering its judgment. In the compensation judgment issued in *Certain Activities*, however, the ICJ took an entirely different approach. It stressed that although the state of scientific knowledge relevant to a legal dispute may often be uncertain,

“these are difficulties that must be addressed as and when they arise in light of the facts of the case at hand and the evidence presented to the Court. Ultimately, it is for the Court to decide”⁴⁸

the relevant legal question rooted in scientific facts. This is indeed a laudable turn, as it ensures that science-heavy aspects will be deemed justiciable by the ICJ, and scientific arguments will not be carved out from the judicial analysis.

3.2. Use of Geospatial Evidence

The interpretation of highly technical scientific evidence often poses hurdles for judges without scientific training. Typically, the parties have been submitting maps, graphs, aerial photos and model calculations to the ICJ. Whereas highly technical modelling results have been dismissed by the ICJ on several occasions,⁴⁹

43 Id. para. 52.

44 Id. para. 79.

45 Id. para. 86.

46 On the definition and various sources of scientific uncertainty see Katalin Sulyok, *Science and Judicial Reasoning – The Legitimacy of International Environmental Adjudication*, Cambridge University Press, Cambridge, 2021, pp. 32-36.

47 ICJ, *Gabčíkovo-Nagymaros*, judgment, para. 54.

48 ICJ, *Certain Activities*, judgment on compensation, para. 34.

49 ICJ, *Certain Activities/Construction of a Road*, judgment, paras. 203-204; ICJ, *Territorial and Maritime Dispute (Nicaragua v Colombia)*, judgment, ICJ Reports 2012, p. 624, para. 36.

a specific type of scientific evidence, namely geospatial data, is increasingly relied on by the ICJ as a basis for its findings.

In *Certain Activities/Construction of a Road*, for instance, Costa Rica submitted satellite images to prove the presence of Nicaraguan troops on its territory and to provide persuasive evidence on the extent of environmental damage caused to its territory. The ICJ found the imagery convincing evidence of the presence of Nicaraguan military groups on the territory, which led to the provisional measures being issued.⁵⁰ In the same proceedings, the high-resolution satellite imagery showed to the ICJ's satisfaction that the tree removal 'likely' occurred during the presence of the troops in the area.⁵¹ The ICJ was also ready to find that remote sensing data was "strong evidence to suggest" that the channels in question were also constructed during the relevant period.⁵²

These instances clearly illustrate the increasing penetration of geospatial information technologies into the sphere of international adjudication – a trend that will most likely continue in the future. Reliance on Earth observation technology is not confined to environmental disputes⁵³ and appears before several other international courts and tribunals as well.⁵⁴ One of the reasons for the influential nature of such data lies in that fact that satellite imaging techniques yield particularly powerful scientific proof. Satellite images are easily intelligible to laymen judges and provide an intuitively appealing and objective account of the factual circumstances. Geospatial evidence also allows environmental changes to be tracked over time, hence supplying information that may be relevant for a causal analysis. The rapid development and sophistication of remote sensing technology⁵⁵ means it can provide data even on nuanced environmental processes, such as gradually emerging or protracted pollution. Furthermore, Earth observation technologies can also provide high-resolution real-time data that may even substitute for site-visits by the ICJ, mimicking domestic environmental law developments, where national courts increasingly use such evidence as inspection tools.⁵⁶

50 ICJ, *Certain Activities/Construction of a Road*, provisional measures, Order of 22 November 2013, ICJ Reports 2013, p. 354, para. 46.

51 ICJ, *Certain Activities*, judgment on compensation, para. 98.

52 Id. para. 98.

53 E.g. the applicant relied on satellite imagery in the Application instituting proceedings and the Request for the indication of provisional measures (11 November 2019), para. 11. in the case concerning *Application of the Convention on the Prevention and Punishment of the Crime of Genocide (The Gambia v Myanmar)*.

54 For the use of geospatial evidence by international criminal courts and tribunals, see Lindsay Freeman, 'The Impact of Digital Technologies on International Criminal Investigations and Trials', *Fordham International Law Journal*, Vol. 41, Issue 2, 2018, pp. 285-336.

55 For a recent report released by Group of Earth Observations detailing the recent application of remote sensing in environmental policy-making, see at https://eo4sdg.org/wp-content/uploads/2018/09/EO4SDG_for_GEO.Highlights.Report.pdf.

56 Katalin Sulyok et al., *Summary Report of the European Forum of Judges for the Environment, Answers to the Questionnaire Concerning the Role of Science in Environmental Adjudication*, 2019, pp. 8-9, at www.eufje.org/images/docConf/hel2019/Summary_report_Questionnaire_EUFJE2019.pdf.

Satellite imagery is supplied by commercial providers as well as international or state agencies. Litigants may feel encouraged to commission such imagery, as its costs have been deemed compensable by the ICJ. Also, a vast amount of geospatial data can be derived free of charge from international and national satellites, which may further foster their more frequent use in interstate disputes. The ICJ's reliance on geospatial data is an important development in buttressing the scientific bases of judgments. It ensures that the judicial analysis is informed by technical evidence and hence the legal assessment of the ICJ approximates the factual realities as closely as possible in disputes with a technically complex background.

3.3. Closer Scrutiny of Party-Submitted Scientific Evidence

While in *Gabčíkovo-Nagymaros*, a “factual anxiety”⁵⁷ was the hallmark of the ICJ's assessment of complex technical evidence, more recent environmental disputes attest to a greater willingness of the ICJ to take a closer look at the scientific record of such cases. This is manifest in the questioning of the experts and in the intrusive standard of review the ICJ has set for checking the scientific claims of the parties.

Expert evidence is now routinely presented by expert witnesses, who can be questioned by the ICJ and be cross-examined by counsels. The *Certain Activities/Construction of a Road*⁵⁸ and the *Whaling in the Antarctic* cases both featured cross-examination, which allowed the ICJ to test the credibility and consistency of party-submitted scientific data. Importantly in *Whaling in the Antarctic*, the judges did not give “*carte blanche* acceptance of expert opinions”,⁵⁹ nor did they use opposing scientific views as an excuse for disregarding the expert evidence. The active dialogue between the party-appointed experts and the bench during the fact-finding procedure⁶⁰ provided the ICJ with an in-depth understanding of the technical aspects of the dispute.

The ICJ's meaningful engagement with conflicting evidence in that case⁶¹ also allowed the bench to craft a rather fact-intensive standard of review, which resulted in an intrusive scrutiny of the parties' scientific narratives. The legal controversy concerned the interpretation of the special permit procedure under the 1946 International Convention on the Regulation of Whaling (ICRW). Article VIII ICRW allows for Special Permit Whaling if it is conducted ‘for purposes of scientific research’. Japan essentially claimed that its whaling program, JARPA II, pursued ‘scientific objectives’ and therefore fell under Article VIII of ICRW, whereas Australia argued that Japan relied on science only

57 Makane Moise Mbengue, ‘Scientific Fact-finding by International Courts and Tribunals’, *Journal of International Dispute Settlement*, Vol. 3, Issue 3, 2012, p. 517.

58 ICJ, *Certain Activities/Construction of a Road*, judgment, para. 34.

59 Marc Mangel, ‘Whales, Science, and Scientific Whaling in the International Court of Justice’, *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 113, 2016, p. 14526.

60 *Id.*

61 Philippe Sands, ‘Climate Change and the Rule of Law: Adjudicating the Future of International Law’, *Journal of Environmental Law*, Vol. 28, Issue 1, 2016, p. 29.

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as a pretext to mask its commercial whaling operations.⁶² The parties offered rival definitions for the term ‘scientific research’. In essence the ICJ was asked to decide whether Japan’s appeal to scientific research could be seen as legitimate or rather a spurious claim of science. However, the ICJ geared its reasoning in such a way as to elegantly escape the difficult position of having to delineate (legitimate and valid) science from (spurious) non-science. Instead of choosing one from among the competing definitions of ‘science’ as advanced by the litigants, it decided not to become entangled in the definitional debate. Instead, it devised an objective standard of review, that of reasonableness, to assess Japan’s claim of scientific research.

Under the reasonableness test, the ICJ assessed whether the whaling program’s “design and implementation were reasonable in relation to its stated scientific objectives”.⁶³ If JARPA II failed this reasonableness assessment; the ICJ held that it could not be regarded as being ‘for purposes of’ scientific research. The judgment listed several factors that were relevant to deciding whether the use of lethal methods was reasonable, such as the scale of lethal sampling, the methodology to select such sample sizes, the program’s scientific output and the extent of scientific cooperation in relation to the program.⁶⁴ The judgment conducted a particularly science-intensive, 80-paragraph judicial inquiry into the design, methodology and implementation of the alleged research program,⁶⁵ which yielded an ambitious and intrusive standard of review.⁶⁶ This led the ICJ to conclude that JARPA cannot be deemed reasonable as to its design and implementation and declared a violation of ICRW.

In sum, the reasonableness standard of review was instrumental in enabling the ICJ to reflect closely on the scientific controversy between the parties while it also ensured that the expert opinions did not dictate the outcome of its inquiry. The bench formulated its own reading of the party-submitted scientific evidence and drew legal conclusions from the factual arguments.

4. Benefits of the ICJ’s More Thorough Approach to Scientific Knowledge

The above discussed trends all provide grounds for optimism concerning the overall position of scientific knowledge before the ICJ. Litigants’ prospects of successfully relying on scientific evidence have undoubtedly improved since the early environmental jurisprudence of the ICJ. As demonstrated above, the ICJ has made considerable headway in assessing and utilizing scientific input offered by the parties. Nevertheless, there are still open (and debated) questions pertaining to the ICJ’s scientific fact-finding, including whether relying on ex

62 ICJ, *Whaling in the Antarctic*, judgment, para. 101.

63 Id. para. 88.

64 Id. para. 88.

65 Id. paras. 147-222.

66 Sulyok 2021, pp. 112-116.

*curia experts*⁶⁷ or shadow experts⁶⁸ are desirable procedural avenues for buttressing the epistemic capacities of the bench. In any case, the currently pending *Waters of the Silala* dispute will put the ICJ's arguably more embracing approach towards science to the test, as the facts of the case rest on heavily contested scientific views between the parties.⁶⁹ We shall see in what ways the ICJ will gather expert advice and to what extent scientific input will drive its legal analysis.

Having surveyed the key respects in which the ICJ's approach has changed fundamentally towards a more transparent and direct assessment and reliance on scientific knowledge, this article concludes with offering some normative remarks on the benefits of the ICJ's growing appreciation for the scientific profile of disputes.

(i) First of all, considering science meaningfully by the ICJ levels the playing field for the party relying on scientific evidence. Evaluating technical scientific proof is often an obstacle to establishing environmental liability under international law.⁷⁰ Scientific arguments are typically invoked by those seeking to advance environmental protection measures or to challenge environmentally harmful practices. Treating uncertain and ambiguous scientific knowledge in an overly dismissive way disproportionately burdens these claims and reduces their chances of success in litigation.

(ii) Second, proper judicial engagement with scientific knowledge strengthens the binding force of environmental laws. Environmental rules cannot have a real 'bite' and be an effective deterrent if they cannot be enforced judicially. If environmental claims tend to fail for resting on uncertain scientific evidence, environmental litigation will remain ineffective. To guard against this, international courts and tribunals hearing science-heavy disputes ought to develop their *modus vivendi* with authoritative, complex, and ambiguous scientific evidence.

(iii) Third, duly considering scientific arguments can provide a response to the significant third-party effects of environmental disputes. Given the

67 Caroline E. Foster, 'New Clothes for the Emperor? Consultation of Experts by the International Court of Justice', *Journal of International Dispute Settlement*, Vol. 5, Issue 1, 2014, p. 139; Loretta Malintoppi, 'Fact Finding and Evidence Before the International Court of Justice (Notably in Scientific-Related Disputes)', *Journal of International Dispute Settlement*, Vol. 7, Issue 2, 2016, p. 421; James Devaney, *Fact-Finding before the International Court of Justice*, Cambridge University Press, Cambridge, 2016; Laurence Boisson de Chazournes *et al.*, 'One Size Does Not Fit All – Uses of Experts before International Courts and Tribunals: An Insight into the Practice', *Journal of International Dispute Settlement*, Vol. 9, Issue 3, 2018, p. 477.

68 Vinuales 2016, p. 120; Daniel Peat, 'The Use of Court-Appointed Experts by The International Court of Justice', *British Yearbook of International Law*, Vol. 84, Issue 1, 2014, p. 288; Riddell & Plant 2016.

69 ICJ, *Dispute over the Status and Use of the Waters of the Silala (Chile v Bolivia)*, filed in the Registry of the ICJ on 6 June 2016.

70 Alexandre Kiss, 'Present Limits to the Enforcement of State Responsibility for Environmental Damage', in Francesco Francioni & Tullio Scovazzi (eds.), *International Responsibility for Environmental Harm*, Graham and Trotman, 1991, p. 5; Céline Nègre, 'Responsibility and International Environmental Law', in James Crawford *et al.* (eds.), *The Law of International Responsibility*, Oxford University Press, Oxford, 2010, p. 805.

considerable public interest involved in environmental litigation, environmental adjudication cannot be handled as a strictly *inter partes* matter.⁷¹ Thorough investigation of the scientific facts in environmental conflicts ‘should be seen as a public function of relevance to the international community as a whole’,⁷² for it represents the interests of affected third parties, such as the wider community, whose air is polluted, or future generations, whose resources are depleted on longer time scales by development projects pursued in the present.

(iv) Finally, evaluating the party-submitted evidence and feeding it into the judicial decision-making process in a transparent manner supports the legitimacy of the adjudicatory findings in the eyes of the parties. This is especially true in proceedings, where the litigants themselves deem the scientific dimensions of the dispute to be legally relevant or even decisive. The losing party and even the wider public will not accept a decision as just and appropriate if the underlying reasons are not clearly explained.⁷³ However, relying on expertise in a judgment only enhances the legitimacy of a decision if the scientific opinion is properly accounted for,⁷⁴ as judicial findings concerning techno-scientific complexities must be based on a “careful consideration of relevant facts”.⁷⁵ This specific understanding of legitimacy, namely, epistemic legitimacy, requires that judgments duly respect the logic of scientific knowledge in the ways in which techno-scientific input is reflected on in the reasoning.

Securing the factual correctness of judgments in scientifically-loaded disputes is undoubtedly challenging for courts. It calls for innovative judicial solutions, both in terms of fact-finding and judicial reasoning, which may stretch beyond the epistemic comfort zone of international judges. Nevertheless, international fora should be cognizant of the consequential nature of the relationship between cognitively authoritative scientific knowledge and the convincing force of their own decisions in environmental disputes. As we have seen in the ICJ’s practice, it depends on the conscious choices of the bench whether, and to what extent it reflects on pertinent scientific information when deciding such disputes. Considering how the ICJ essentially ‘descienticized’ its inquiry in early scientific cases, more recent trends give hope that it no longer seeks to distance itself from scientific considerations when hearing environmental disputes.

71 ICJ, *Gabčíkovo-Nagymaros*, Separate Opinion of Judge Weeramantry, para. 118.

72 Neil A. Craik, ‘Recalcitrant Reality and Chosen Ideals: The Public Function of Dispute Settlement in International Environmental Law’, *The Georgetown International Environmental Law Review*, Vol. 10, Issue 2, 1998, p. 572.

73 Yuval Shany, *Assessing the Effectiveness of International Courts*, Oxford University Press, Oxford, 2014, p. 37; Boisson de Chazournes *et al.* 2018, p. 487; Irmgard Griss, ‘How Judges Think: Judicial Reasoning in Tort Cases from a Comparative Perspective’, *Journal of European Tort Law*, Vol. 4, Issue 3, 2013, p. 250.

74 Jessica Lawrence, ‘The Structural Logic of Expert Participation in WTO Decision-Making Process’, in Mónika Ambrus *et al.* (eds.), *The Role of ‘Experts’ in International and European Decision-Making Processes*, Cambridge University Press, Cambridge, 2014, p. 173.

75 Daniel C. Esty, ‘Good Governance at the World Trade Organization: Building a Foundation of Administrative Law’, *Journal of International Economic Law*, Vol. 10, Issue 3, 2007, p. 517.