



D2 - Dams, Ecosystems and Fisheries

Author: Paul Stanton Kibel

Scope: This class focuses on how international water law principles relate to the construction and operations of on-stream dams. Within this general focus, the following more specific topics are reviewed: (1) upstream/downstream nation rights and obligations relating to the impoundment and release of water from on-stream dams; (2) effect of on-stream dams on fisheries/aquatic habitat and fishers; (3) international environmental impact assessment obligations relating to the construction and operation of on-stream dams; (4) relation of hydro-electric dams to efforts to reduce greenhouse gas emissions associated with energy production.

Purpose: Participants will learn the ways that international and national water law has evolved to take increased account of the in-stream value of water and how on-stream dams impact flow volume, flow velocity, water quality, water temperatures and fisheries. Participants will gain a deeper appreciation of how emerging international environmental impact assessment norms can help to improve the environmental performance of dams and how concerns about climate change have prompted a debate over the relative environmental impacts of on-stream hydro-electric dams.

Methodology: For the first part of the class, an overview of the class materials will be provided in a Power Point presentation and supporting briefing note. In the second part of the class, participants will be provided with legal texts and associated group exercises for the four topics identified above in the 'scope' section of this class overview.

Site: UNITED NATIONS INFORMATION PORTAL ON MULTILATERAL ENVIRONMENTAL AGREEMENTS

Course: The "Greening" of Water Law: Implementing Environment-Friendly Principles in Contemporary Water Law

Book: D2 - Dams, Ecosystems and Fisheries

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1. Key issues

- Effect of on-stream dams on fisheries/aquatic habitat and fishers.
- General principles of international fisheries law.
- Upstream/downstream nation rights and obligations relating to the impoundment and release of water from on-stream dams.
- International environmental impact assessment obligations relating to the construction and operation of on-stream dams.
- Relation of hydro-electric dams to efforts to reduce greenhouse gas emissions associated with energy production.

2. Introduction

This class will examine the impacts of on-stream dams on ecosystems and fisheries through the lens of international water law and international fisheries laws, as well as international law on the obligation to assess transboundary environmental impacts. The class will also discuss how efforts to reduce greenhouse gases that contribute to global warming are impacting the legal and policy context for evaluating the environmental effects of on-stream hydro-electric dams.

3. Effect of On-Stream Dams on Fisheries and Fishers



3.1. Dams as Barriers to Fish Passage

The presence of an on-stream dam can serve as a barrier for fish that traditionally migrate upstream and downstream of where the dam is located. For example, on the west coast of North America, wild Pacific salmon begin their life in inland freshwaters. They migrate to the ocean for several years and then return to their natal inland freshwaters to spawn. On-stream dams in the Fraser River watershed in Canada, the Columbia River/Snake River watershed in Canada and the United States and the Sacramento River/San Joaquin River watershed in the United States serve as downstream and upstream barriers to migratory salmon.

3.2. Slack Water Conditions

On-stream dams change the natural flow of a river. This change can create “slack water” conditions both above and below the dam, in which the velocity of the natural flow of a river is reduced. Slack water conditions can result in algae growth and reduced oxygen levels that impact fisheries. The environmental impacts associated with slack water conditions on the Danube River in Europe were a central issue in the 1997 decision by the International Court of Justice (“ICJ”) in the *Gabcikovo-Nagymaros* case.[1] The adverse effects related to slack water have also become a concern on the Volta River in Africa, where low flow conditions below the Akosombo Dam in Ghana have led to the spread of weeds that harbor snails that serve as intermediate hosts for lethal intestinal diseases.[2]

[1] Case Concerning the Gabcikovo-Nagymaros Project (Hungary/Slovakia)(International Court of Justice, The Hague, 25 September 1997).

[2] *Remediation of the Environmental Impacts of the Akosombo and Kpong Dam in Ghana* (2008 report by the Volta Basin Research Project, University of Ghana).

3.3. Water Temperature, Salinity and Sediment Transport

When an on-stream dam changes the timing or reduces the amount of water released downstream, this can result in an increase in water temperatures below the dam. This may in turn have particularly acute adverse impacts on some cold-water fish species. For example, salmon have a limited tolerance for higher water temperatures.

The presence of on-stream dams can also affect the salinity levels of waters below the dams due to seawater intrusion. When the amount of freshwater flowing downstream is reduced by on-stream dams, the seawater pushes farther upstream. Rising salinity levels can affect freshwater fisheries with low tolerance for higher salt concentrations.

The presence of on-stream dams can also trap sand and gravel that would otherwise be carried downstream. To the extent sand and gravel serve as important elements of aquatic habitat for fisheries downstream, the interference of dams with natural sediment transport can adversely impact fisheries.

3.4. Fishers Dependent on Impacted Fisheries

in considering the harm that on-stream dams can cause to fisheries, it is critical to remember that this harm goes beyond biodiversity. In many watersheds, freshwater fisheries serve as an important food source for local populations and/or support local commercial fishers. The loss of fisheries caused by on-stream dams can therefore exacerbate poverty conditions in watershed communities and adversely affect the economic viability of the fishing sector.

4. General Principles of International Fisheries Law

There is a well-developed body of international fisheries law, but this body of law has focused primarily on ocean fisheries or anadromous fisheries (which spend at least part of their life cycle in the ocean). There are general legal principles established in the context of ocean and anadromous fisheries that may be pertinent and relevant to the evaluation of disputes over rights and obligations respecting freshwater fisheries.

4.1. United Nations Convention on the Law of the Sea and the United Nations Straddling Stocks Treaty

In regard to ocean and anadromous fisheries, two of the primary sources of international law are the 1982 United Nations Convention on the Law of the Sea (“UNCLOS”) and the 1996 United Nations Treaty on Straddling and Migratory Fish Stocks (“UN Straddling Stocks Treaty”)[1]. Both of these treaties address the rights and obligations of nations in regard to fish stocks that move between the international high seas and a nation’s 200-mile off-shore exclusive economic zone (“EEZ”), or that move between different nations’ EEZs.

Article 63(1) UNCLOS provides: “Where the same stock or stocks of associated species occur within the exclusive economic zone of two or more coastal states, these States shall seek, either directly or through appropriate subregional or regional organizations, to agree upon the measures necessary to co-ordinate and ensure the conservation and development of such stocks.” Article 64(1) of UNCLOS is titled “Highly migratory species” and provides: “The coastal states and other States whose nationals fish in the region for the highly migratory species listed in Annex I shall co-operate directly or through appropriate international organizations with a view to ensuring conservation and promoting the objective of optimum use of such species throughout the region, both with and beyond the exclusive economic zone.”

[1] The full name of the United Nations Treaty on Straddling and Migratory Fish Stocks is “The United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks”.

4.2. United Nations Convention on the Law of the Sea and the United Nations Straddling Stocks Treaty (Contd)

The UN Straddling Stocks Treaty sought to provide further guidance on the participatory rights of different nations in terms of the regional fishery management organizations described in Articles 63(1) and 64(1) of UNCLOS. These participatory rights would, in turn, help determine the respective rights and obligations of nations whose nationals actively fished in the area or for the species regulated by a particular regional fishery management organization. Article 11 of the UN Straddling Stocks Treaty provides:

In determining the nature and extent of participatory rights for new members of a subregional or regional fisheries management organization, or for new participants in a subregional or regional fisheries management organization, States shall take into account, inter alia: (a) the status of the straddling fish stocks and highly migratory fish stocks and the existing levels of fishing effort in the fishery; (b) the respective interests, fishing patterns and fishing practices of new and existing members or participants; (c) the respective contributions of new and existing members or participants to conservation and management of the stocks, and to the collection and provisions of accurate data and to the conduct of scientific research on the stocks; (d) the needs of coastal fishing communities which are dependent mainly on fishing for the stocks; (e) the needs of coastal States whose economies are overwhelmingly dependent on the exploitation of living marine resources; and (f) the interests of developing States from the subregion or region in whose area of national jurisdiction the stocks also occur.

From Article 11 of the UN Straddling Stocks Treaty the following two general principles emerge that may also be relevant to freshwater fisheries. First, the extent to which a nation is contributing to the conservation of straddling/ migratory fish stocks should be taken into account in the allocation of rights to catch such fish stocks. Second, when determining the respective rights of nations to catch straddling/migratory fish stocks, consideration should be given to local communities dependent on such stocks.

4.3. Canada-United States Pacific Salmon Treaty

As stated earlier, salmon on the west coast of North America begin their life-cycle in inland freshwater streams. From there, they head downstream to the Pacific Ocean where they spend several years and then return to their natal inland freshwater streams to spawn.

Vessels flying the Canadian and United States flags fish for salmon in off-shore ocean waters. Offshore Canadian fishers often catch salmon that originate and spawn in freshwater streams in the United States. Similarly, offshore United States fishers often catch salmon that originate and spawn in freshwater streams in British Columbia in Canada.

In the 1995 Pacific Salmon Treaty, Canada and the United States addressed this situation by basing respective fishing rights on the concept of “originations.” Pursuant to Article III(a) of the treaty, fishing rights are allocated so as to “provide for each Party to receive benefits equivalent to the production of salmon originating in its waters.”

The implications of the originations approach to fishing right allocation has significant implications for on-stream dams. That is, if on-stream dams in Canada or the United States block the upstream/downstream passage of migrating salmon or are operated in a manner that results in downstream aquatic habitat conditions that reduce the productivity of salmon stocks, the presence and operation of such dams should provide the basis for a downward adjustment of respective salmon fishing rights.

5. Upstream/Downstream Nation Rights and Obligations



5.1. Equitable Use and Vital Human Needs

In the 20th century, the principle of absolute territorial sovereignty in international water law gave way to the principle of “limited territorial sovereignty”, a principle that itself was based on the concept of “equitable use.” Equitable use posits that in a transboundary watershed all nations in the watershed have rights to equitably use the water resources and all nations in the watershed have obligations to respect other nation’s rights to such equitable usage.

Article 6(1) of the 1997 United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses (“1997 UN Watercourses Convention”) presents a non-exhaustive indicative list of factors which should be considered in determining what constitutes equitable use of international watercourses between multiple nations:

Geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character;

1. The social and economic needs of the watercourse States concerned;
2. The population dependent on the watercourse in each watercourse State;
3. The effects of the use or uses of the watercourse in one watercourse State on other watercourse States;
4. Existing and potential uses of the watercourse;
5. Conservation, protection, development and economy of use of the water resources of the watercourse and the costs of measures taken to that effect;
6. The availability of alternatives, of corresponding value, to a particular planned or existing use.

5.2. Equitable Use and Vital Human Needs (Contd)

In connection with the impacts of on-stream dams on fisheries and fishers, there are at least two potential ways that the international water law principle of equitable use may be implicated.

First, the international water law principle of equitable use can be readily paired and integrated with the international fisheries law principle of originations outlined in the Pacific Salmon Treaty and Article 11(c) of the UN Straddling Stocks Treaty. Article 6(1) of the 1997 UN Watercourses Convention provides that equitable use involves consideration of “ecological factors,” “economic needs of the watercourse States concerned,” “uses of the watercourse” and the “effects of the use or uses of the watercourse in one watercourse State on other watercourse States.” All of these factors are consistent with an originations approach to the allocation of fishing rights on international watercourses.

Second, there is a growing body of international water law which suggests that although there may be various factors considered in determining the equitable use of international watercourses, paramount consideration should be given to ensuring that “vital human needs” are met. For instance, Article 10(2) of the 1997 UN Watercourses Convention provides that a dispute between uses of an international watercourse shall be resolved “with special regard being given to the requirements of vital human needs.” Consistent with Article 10(2) of the 1997 UN Watercourses Convention, international water law scholars have suggested that vital human needs should enjoy a higher priority among the various factors considered in equitable use determinations.[1]

To date, the focus of vital human needs has been on ensuring sufficient water to meet basic drinking water and sanitation needs with an eye towards avoiding life-threatening dehydration and diseases. However, for nations or vulnerable populations within nations whose basic food supply is tied to the presence of freshwater fisheries, the concept of vital human needs can be expanded to include the obligation to operate on-stream dams in a manner consistent with the conservation of such fisheries.

[1] Own McIntyre, *Environmental Protection of International Watercourses under International Law* (Ashgate 2007) at 109; E. Hey, “Sustainable Use of Shared Water Resources: The Need for a Paradigmatic Shift in International Water Law”, in *The Peaceful Management of Transboundary Resources* (Graham Trotman/Martinus Nijhoff, Dordrecht/Boston/London, 1995) 127-152, at 127.

5.3. Avoidance of Significant Environmental Harm

Article 7(1) of the 1997 UN Watercourses Convention provides that “Watercourse States shall, in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States.” Article 7(2) of the 1997 UN Watercourses Convention further adds that where significant harm nevertheless is caused to other watercourse States, the State whose use causes such harm shall take “all appropriate measures” to “eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation.”

Similarly, Article 12 of the International Law Association’s 2004 Berlin Rules on Water Resources Law (“Berlin Water Resource Law Rules”) provides: “Basin States shall in their respective territories manage the waters of an international drainage basin in an equitable and reasonable manner having due regard to their obligation not to cause significant harm to other basin States.”

Additionally, Articles 20 and 22 of the 1997 UN Watercourses Convention address the questions of ecosystem protection and invasive species in the transboundary river basin context. Article 20 provides “Watercourse States shall, individually and where appropriate jointly, protect and preserve the ecosystems of international watercourses.”

5.4. Avoidance of Significant Environmental Harm (Contd)

There are two ways in which the presence and operation of on-stream dams could be implicated by these provisions and principles of international water law.

First, the concept of significant environmental harm may include obstruction of fish migration and changes to instream flow regimes that negatively impact riverine ecosystems. On-stream dams frequently block the upstream and downstream migration of fish and often alter natural flow regimes, creating slack water conditions, increased water temperatures, higher salinity levels and reduced sediment/gravel transport. Depending on the severity of consequences to other watercourse nations, such impacts from on-stream dams may qualify as significant harm.

Second, consistent with Articles 63(1) and 64(1) of UNCLOS, Article 11 of the UN Straddling Stocks Treaty, nations with fisheries that migrate and move between their respective jurisdictional waters have an obligation to cooperate in efforts to conserve and sustainably manage such fisheries. The operation by one nation of an on-stream dam that undermines the conservation of a migratory fish species also present in the waters of another nation would implicate this obligation reflected in international fisheries law. More specifically, it would suggest an obligation on the part of the nation operating an on-stream dam to reach an agreement with other nations whose fisheries are impacted by the dam on what measures are needed to conserve the fisheries in question.

6. Environmental Impact Assessment Obligations

Apart from the sources of international fisheries law and international water law already discussed, there are also provisions of international environmental law generally and international water law more specifically that relate to the obligation of nations to conduct environmental impact assessment when transnational impacts are involved.

In terms of general international environmental law, the 1991 United Nations Convention on Environmental Impact Assessment in a Transboundary Context (“Espoo EIA Convention”) sets forth several relevant provisions. At the outset, it should be noted that the provisions of the Espoo EIA Convention only apply to the list of activities provided in Appendix I to the agreement. In terms of this class, Appendix I to the Espoo EIA Convention lists “Large dams and reservoirs” among the activities covered by its provisions.

Article 2(1) of the Espoo EIA Convention states: “The parties shall, either individually or jointly, take all appropriate and effective measures to prevent, reduce and control significant adverse transboundary environmental impacts from proposed activities.” Article 2(3) provides: “The party of origin shall ensure that in accordance with the provisions of this Convention an environmental impact assessment is undertaken prior to a decision to authorize or undertake a proposed activity listed in Appendix I that is likely to cause a significant adverse transboundary impact.”

6.1. Environmental Impact Assessment Obligations (Contd)

Article 7 of the Espoo EIA Convention provides additional guidance on the “post-project analysis” listed in Appendix II. Article 7(1) provides for the preparation of post-project analysis to be undertaken “with a view to achieving the objectives listed in Appendix V.” Appendix V provides that the objectives of post-project analysis include “(a) Monitoring compliance with the conditions as set out in the authorization or approval of the activity and the effectiveness of mitigation measures; (b) Review of an impact for proper management and in order to cope with uncertainties; (c) Verification of past predictions in order to transfer experience to future activities of the same type.”

The approach reflected in the Espoo EIA Convention is re-enforced in other water-specific international agreements, such as Article 29(1) of the Berlin Water Resource Law Rules. Article 29(1) of the Berlin Water Resource Law Rules provides that nations “shall undertake prior and continuing assessment of the impact of programs, projects and activities that may have a significant effect on the aquatic environmental or the sustainable development of waters.”

In regard to environmental impact assessment obligations related to on-stream dams, the provisions of Article 7 and Appendix V of the Espoo EIA Convention and Article 29(1) of the Berlin Water Resource Law Rules merit particular attention. These provisions highlight that the scope of environmental impact assessment for on-stream dams should not be limited to the initial construction of these facilities. Instead, the assessment should also encompass the continuing operations of the facilities. The “post-project analysis” provided for in the Espoo EIA Convention and the “continuing assessment” provided for in the Berlin Water Resource Law Rules speak to the ways that the continuing operations of dams may be modified and adjusted to reduce adverse environmental impacts on fisheries and fishers, and the role that on-going environmental assessment of dam operations can ensure that such modification and adjustment takes place.

7. Relation of Dams to Efforts to Reduce Greenhouse Gas Emissions Associated With Energy Production

One of the major sources of greenhouse gas emissions is the burning of fossil fuels (e.g. coal, natural gas) to generate electricity. As such, greenhouse gas reduction policies have focused on substituting fossil fuel energy sources with low/non-greenhouse gas generating energy sources (sometimes referred to “renewable” energy sources). These renewable energy sources include solar, wind, wave, geothermal and, sometimes, hydro-electric facilities associated with on-stream dams. Although on-stream dams may have significant adverse impacts on fisheries and fishers, the operation of hydro-electric facilities associated with these dams often generate little or no greenhouse gases.

The inclusion of on-stream hydro-electric facilities in the definition of renewable energy is understandably controversial within the environmental community generally and within the fish conversation/fishing community more specifically. As a result of these concerns, some state, national and international definitions of renewable energy have either excluded hydro-electric facilities or imposed limitations on the circumstances under which hydro-electric facilities may be considered renewable.

A comprehensive review of hydro-electric energy’s place in climate change and renewable law and policy is beyond the scope of this class. For present purposes, the context of climate change concerns the adverse impacts of on-stream dams on fisheries, which may be weighed by some (particularly those who operate hydro-electric facilities or those who receive low cost electricity from such facilities) against the potential of hydro-electric energy to contribute to reduced greenhouse gas emissions.

8. Conclusions

When drafting laws or negotiating treaties that focus on the construction and operation of on-stream dams in transboundary basins, the following three considerations should be kept front-and-center.

First, the impact of on-stream dams on fisheries is not simply a matter of ecology and biodiversity. There are situations where the fisheries impacted by on-stream dams serve as a basic food source for local populations. In such situations, the failure of dam operators to provide for fish passage or adequate releases of water to maintain fish habitat may improperly impinge on vital human needs under international water law principles.

Second, the international fisheries law principle of originations may provide guidance on decisions regarding the construction and operation of on-stream dams in transboundary watersheds. To the extent the on-stream dams in one nation reduce the abundance and health of fish stocks that migrate through the waters of another nation, the nation that operates its dams in this manner should find its right to catch such fish stocks reduced.

Finally, nations that operate on-stream dams have a continuing obligation to assess the environmental impact of post-construction operations of the facilities. Many of the harmful effects of on-stream dams may be ameliorated by modifications to how these dams operate. These modifications are only likely to occur if laws and treaties contain provisions compelling dam operators to conduct post-construction monitoring of impacts on fisheries and obligating the adoption of appropriate mitigate measures to address the fisheries impacts revealed through this monitoring.