



Winter 1991

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### Recommended Citation

Robert D. Hayton, *Reflections on the Estuarine Zone*, 31 Nat. Resources J. 123 (1991).  
Available at: <https://digitalrepository.unm.edu/nrj/vol31/iss1/7>

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## Reflections on the Estuarine Zone\*\*

### ABSTRACT

*Estuaries, the zones where fresh water and saltwater meet and mix, are critical links in the environment. Pollution from multiple sources, both inland and at sea, has seriously degraded the quality and productivity of the estuaries, but little is yet known about them in either the scientific or legal communities. While the scientific community acquires knowledge of the functioning of estuarine systems, lawyers must begin to include them within the legal framework of water systems protection before they are lost entirely. Estuaries are seldom covered by the existing international law of water courses or the law of the sea. In some cases they are explicitly removed; in others they appear to be covered in theory, but are not in reality. The needs of estuaries must be considered and their protection must be ensured under international law so that these critical zones are not lost forever.*

### INTRODUCTION

The legal aspects of the fresh water-maritime interface (the estuarine zone) have been little studied, although that interface involves extraordinary ramifications for numerous economic activities, community development planning, and natural resources management. Until recently, even the scientific disciplines had not, on the whole, focused specifically on these areas where "sweet waters" descending from the land meet the salt waters of the seas as they surge and ebb along the coastlines of the world. Today the scientific community is highly active in the study of these zones of interaction, as are the local planners and ecologists of many countries.

However, those dedicated to the laws and institutions for water resources, both maritime and non-maritime, have, with few exceptions, scarcely noticed the dramatic rise of conflict and deterioration in the

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\*\*Reprinted from *Temas de Derecho Internacional: En Homenaje a Frida M. Pflirter de Armas Barea* (Raul E. Vinuesa ed. 1989) (Fundación del Centro de Estudios Internacionales de Buenos Aires, 1989).

estuarine zone. This critical and dramatic link in the often-extolled hydrologic cycle has been neglected.<sup>1</sup>

### THE ESTUARINE EQUATION

Water cycles from sea to atmosphere to land and back again to the sea. Like air, water is truly a "fugitive resource." The need for effective management of all interrelated fresh water resources on the basis of sustainable, environmentally sound development and use has at last been accepted in principle at the political level, heeding the persistent explanations and forewarnings of the scientific experts. Some progress has also been made with respect to international rivers, lakes, and groundwaters.

Maritime waters have come under intense scrutiny since the 1950s, culminating in the unprecedented Third United Nations Conference on the Law of the Sea. "Protection of the marine environment" has come to the fore as a major goal for nations and the international community; the significance of marine pollution from "land-based sources" is acknowledged in numerous documents.

Fresh surface water joins the sea principally via the topographical features we call estuaries and deltas. Other encounters between fresh water and salt water exist, often but not always in some relationship with a delta or an estuary. These include wetlands, adjacent beaches, and aquifers. The many interrelationships are covered by the term "estuarine zone," which embraces all coastal situations where there is a significant fresh-salt hydraulic interplay. The force and volume of flow, as well as the quality of the fresh waters, fluctuate widely, even to extremes, over time. Some rivers make a more or less direct and uncomplicated entry to the sea, but many others empty into a complex "frontier" with numerous consequences for the uses of the adjacent terrain and the interface waters. This more difficult passage may involve a delta or an estuary, or both, as well as coastal marshes, lagoons, sandbars, or one or more barrier islands or reefs, through and around which the fresh water must move before it becomes so mixed into the ocean waters as to lose its distinct fresh water characteristics.

The contribution of atmospheric water is also often important to the estuarine zone. Rainfall onto the surfaces along the interface may be considerable, even decisive, as in monsoonal regions. Fresh water also enters the marine environment via the seabed, usually quite close to shore, including in an estuary. These undersea springs are appearances of groundwater where the aquifers are open to the sea and the normal gravity flow

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1. This essay comprises meditations upon, and abbreviated exposition that is in large part derived from an extensive and documented study, *The Freshwater-Maritime Interface: Legal and Institutional Aspects*, United Nations Food and Agriculture Organization pub., FAO Legislative Study 46 Rome 1990 (by R. Hayton).

discharges fresh groundwater along the submarine "horizon." Such contributions to the estuarine environment can be substantial but frequently are not taken into account. The familiar phenomenon known as "saltwater intrusion," upstream in rivers and underground in coastal aquifers, occurs naturally in accordance with fluctuating hydrostatic pressure, but is often induced or aggravated by man's activities, such as heavy pumping of coastal-area groundwater and reduction of instream flows by diversions upstream.

The estuarine zone is not sharply delineated. On the contrary, it is a dynamic, turbulent and often extensive region where fresh and salt waters overlap, mix, and produce specialized ecosystems of enormous importance to man and nature. Sometimes fresh water flows effect far-reaching environmental modifications along the coast and out into the sea. Sea water also cycles into the fresh water "domain" along this interface, often penetrating deeply and with vital, significant outcomes. Development in some countries has not yet seriously threatened nature along the interface; in other cases, the gathering impacts of human interventions are not fully discerned or admitted but are nonetheless present.

Natural resources specialists and planners have been fully occupied with the uses of water upstream, that is, watershed management, drainage, irrigation, inland fisheries, power generation, public health, and flood control. What went on at the "end of the line," where the river joined the sea, usually remained at the margin of the picture. After all, bays and even estuaries have been traditionally viewed as provinces of the sea.

Meanwhile, the marine specialists have had important research and operational areas in the waters seaward of the low water mark, in the deep sea: maritime transport and fisheries, continental shelf and ocean exploration, and ocean pollution. Inshore, estuarine matters were perceived but rarely were a principal focus of attention. In recent years, however, many marine specialists have turned to the coastal interface regions as key, vulnerable "factories" in the functioning of the biosphere. It is now recognized that some of the biosphere's crises are centered in the coastal zone. Finding the problems to be inherently interdisciplinary, specialists from many fields are joining forces. Ecologists and urban planners have become aware that they dare not proceed without the inputs from the estuarine and coastal zone sciences.

### THE IMPORTANCE OF THE INTERFACE ZONE

Estuarine zones are among the most highly productive ecosystems on earth. The nutrient-rich substrate is, under natural conditions, continuously in the photic zone. Numerous valuable marine organisms have their spawning and nursery grounds in estuaries. Man's interventions in these naturally productive areas frequently cause stress and disablement. Dis-

posal of untreated waste, for example, makes heavy demands on the estuaries' dissolved oxygen. The operation of the food chain is intimately linked with the physical and chemical rhythms at work. Many offshore fisheries are dependent upon stocks whose young must have access to the protection and nourishment of estuarine swamps and tidal flats. Decapods (benthic species) in the estuary depend upon the offshore sea during their larval stages. The world's marine fish catch still comes primarily from estuarine-influenced coastal waters. The fresh water's supply of nutrients to estuaries makes for preeminent primary production in the food web, but phytoplankton growth may be inhibited by, for example, high turbidity or toxins. What may not be "pollution" in lawyers' terms (not harmful to man or introduced by man) may be damaging pollution to the marine biochemist concerned with the impacts on the life cycles of marine organisms links in the food chain and the larger environment.

Naturally fluctuating interactions are balanced among biotic and abiotic constituents, stimulated by the shifting salinity and temperature gradients. Fish, crustaceans, mollusks, and other valuable life forms feed on the rich offerings and in turn are preyed upon by organisms, including man, higher up in the food chain.

Most estuaries are also greatly affected by interactions at the water-air interface because they are relatively shallow. Water level and circulation patterns, as well as temperature and salinity, can be dramatically altered temporarily by the passage of weather fronts. In addition, the surface water of an estuary may become a source of atmospheric pollution, which is then deposited elsewhere. Where much of the surface water's natural flow has been diverted upstream and diminished amounts reach the delta or estuary, or where coastal precipitation is heavy, rainfall may be the principal part of the total fresh water budget of the estuarine zone. On the other hand, in some arid areas the water content of sewage and sludge may exceed the rainfall input.

### ESTUARINE DYNAMICS

The tides are, of course, the "engine" of the saltwater-fresh water exchanges. The marine waters within the estuarine zone typically arrive from the ocean's upper layer, driven by the winds and tides. Nonetheless, all or some of the seawater may have flowed in from along the coast or welled up from benthic regions. Salinity, temperature, and kinetic energy of these inputs from the sea vary widely, including over time. The marine inflows also carry nutrients and numerous marine species.

The resulting interface zone is, normally and within uncommon parameters, a radically fluctuating microenvironmental or estuarine habitat, in which many forms of life cannot survive, but which to other forms

offers niches of advantage. A select number of species, many of singular interest to man, collectively sustain the unique habitat. Each species has adapted to the sometimes predominantly fresh, sometimes predominantly salty, commonly brackish milieu. Within this relatively stable succession of fluctuations, special systems have evolved in which each constituent of the estuarine zone, inorganic as well as organic, plays its assigned role.

The estuary is the archetypal water body where the commingling of physical, biological, and chemical agents are most in evidence. Where the river's discharge is weak and the tide strong, the influence of the sea will be manifest even hundreds of miles upstream. A few mighty rivers drive their currents far offshore, even beyond territorial waters. Some deltas front on the open sea itself, such as the Irrawaddy, the Volga, the Mississippi, or the Nile; others on a gulf or bay, such as the Huang Ho, the Don, the Dnepr, the Oder, and technically, the Parana. Other rivers empty into semi-enclosed bays, such as the Tagus, the Colorado (Mexico), the Murray, and the Tangtze. The frequency of these occurrences and the inestimable value of these areas justifies pointing out at least a few illustrations.

### THE APPLICABLE LAW?

Some of the rivers involved are international, which brings into play the law of international water resources and the joint and several responsibilities of the basin States with respect to the "care and feeding" of those rivers' estuarine areas. The international border, in a few cases (such as the Plata River), may bisect the estuarine zone.

Just as important is the connection with another branch of international law, the law of the sea. On this point it matters not whether the river is national or international, or whether it is a major watercourse. Estuaries were given prominence in the first article of the 1982 Law of the Sea Convention:<sup>2</sup>

"pollution of the marine environment" means the introduction by man, direct or indirectly, of substances or energy into the *marine environment, including estuaries*, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of *the sea*, impairment of quality for use of *sea water* and reduction of amenities.<sup>3</sup>

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2. United Nations Convention on the Law of the Sea, Dec. 2, 1982, U.N. Doc. A/CONF.62/122, 21 I.L.M. 1261. At the time of this writing, the convention had not yet come into force.

3. *Id.*, art. 1, para. 1(4) (emphasis added).

It should be noted that the convention nowhere defines "the sea," "sea water" or, for that matter, "estuaries." Moreover, many of the "living resources" that have established themselves in the estuaries' brackish environment would not thrive or survive at sea; the fresh water component of estuaries is not recognized in the convention's language. It is significant, however, that estuaries were singled out for specific mention.

Disturbing from the legal point of view is the fact that no account seems to be taken of the fact that usually the greater part, and oftentimes the entirety of an estuary or estuarine zone lies behind the baseline of territorial waters, the generally accepted starting point for the applicability of the law of the sea. Although the geographical name of bay, gulf, inlet, channel, sea, or lagoon may have been historically affixed, many such bodies are estuaries in fact. Many estuarine bodies of water are behind barrier islands, peninsulas, or points of land which clearly render them "inland" or national waters. Major centers of population, industry, and commerce are often found on their shores. Typical examples would include Guanabara Bay (Rio de Janeiro), Tokyo Bay, Manila Bay, Chesapeake Bay (Baltimore), San Francisco Bay, Estuaire du Gabon (Libreville), Golfe de Tunis, Telek Jakarta, Teluk Brunei, Hangchow Bay, Peter the Great Bay (Vladivostok), and Laguna Veneta (Venice).

Thus, although the Law of the Sea Convention purports to be applicable directly to some States' internal waters, the sovereignty of a coastal State is acknowledged in the convention to extend "beyond its land territory and internal waters . . . to an adjacent belt of sea, described as the territorial sea."<sup>4</sup> "[S]overeignty over the territorial sea is exercised subject to this Convention and to other rules of international law,"<sup>5</sup> but no such assertion is made with respect to internal waters. Except as provided in the convention's Part IV<sup>6</sup> on Archipelagic States, "waters on the landward side of the baseline of the territorial sea form part of the internal waters of the State,"<sup>7</sup> which would seem to confirm their removal from the purview of the Law of the Sea.

Other articles in the convention, however, also relate to "internal" and onshore matters. For example, diadromous species, which must twice pass through the estuary and frequently spend portions of their life cycles there, are addressed in the articles on "Anadromous stocks"<sup>8</sup> and "Catadromous species."<sup>9</sup> States where stocks originate are placed under a duty to "ensure their conservation"; attention to conditions in the es-

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4. *Id.*, art. 2, para. 1.

5. *Id.*, art. 2, para. 3.

6. *Id.*, Part IV.

7. *Id.*, art. 8, para. 1.

8. *Id.*, art. 66.

9. *Id.*, art. 67.

tuarine habitat is, therefore, mandated. These and other relevant "living resources" articles are found, oddly enough, in the convention's Part V, "Exclusive Economic Zone,"<sup>10</sup> which also is measured seaward from the baseline and, thus, would not ordinarily include internal waters or estuaries.

Pollution of the marine environment was clearly a principal concern of the treaty's drafters, who included clauses impinging on the freedom of action of States with an estuary-basin. It is provided that States not only have "the obligation to protect and preserve the marine environment" in general terms,<sup>11</sup> but more specific provisions bring the duties to the interface. For example, "all necessary measures consistent with this Convention to prevent, reduce and control" such pollution "from any source" are required.<sup>12</sup> The first of many clauses dealing with marine pollution from land-based sources delineates measures that will "minimize to the fullest possible extent" the "release of toxic, harmful and noxious substances, especially those which are persistent. . . ."<sup>13</sup> These measures "shall include those necessary to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened, or endangered species and other forms of marine life."<sup>14</sup> Are brackish water species included together with marine species naively, or with forethought?

States are obliged to cooperate in establishing criteria for the formulation of "rules, standards and recommended practices and procedures" for dealing with marine pollution,<sup>15</sup> which includes, by definition,<sup>16</sup> estuaries. Additionally, States must "keep under surveillance the effects of any activities which they permit or in which they engage" in order to ascertain whether pollution of the marine environment is likely.<sup>17</sup>

These and numerous other clauses have obvious bearing on estuarine zones, including substantial areas behind the baseline, though this result may not have been clearly perceived by the convention's drafters. All States which may affect the estuarine zone, not just those at the terminus of the fresh water basin, are addressed by those articles. Global and, as appropriate, regional cooperation is prescribed.<sup>18</sup> If a State within an estuarine zone or an upstream State has "reasonable grounds for believing that planned activities" under its jurisdiction or control "may cause substantial pollution of or significant and harmful changes to the marine

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10. *Id.*, Part V.

11. *Id.*, art. 192.

12. *Id.*, art. 194.

13. *Id.*, art. 194, para. 3(a).

14. *Id.*, art. 194, para. 5.

15. *Id.*, art. 201.

16. *Id.*, art. 1.

17. *Id.*, art. 204, para. 2.

18. *Id.*, art. 197; also arts. 198-200.



environment," the potential effects must be assessed and "reports of the results" communicated to the competent international organizations.<sup>19</sup>

Most specific in its requirements is the special article on "Pollution from land-based sources," the considerable internal impact of which doubtless was intended:

States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment from land-based sources, including *rivers, estuaries, pipelines and outfall structures*, . . . .<sup>20</sup>

The convention's provisions obligating States to adopt "laws and regulations to prevent, reduce and control pollution of the marine environment from or through the atmosphere, applicable to the air space under their sovereignty . . ." <sup>21</sup> are similarly germane.

Furthermore, there is a duty to take enforcement actions in connection with pollution from land-based sources and from seabed activities;<sup>22</sup> both kinds of measures could easily alter conditions in the estuarine zone. States shall also "establish international rules and standards" for the purpose of prevention, reduction, and control of pollution in the marine environment, which should include rules and standards "relating to prompt notification to coastal States, whose coastline or related interests may be affected. . . ." <sup>23</sup> The provisions on pollution-by-dumping are made applicable to the entire marine environment, although the specific stipulations speak only of dumping within the territorial sea and the exclusive economic zone and onto the continental shelf, without reference to coasts or estuaries.<sup>24</sup>

States "shall be liable in accordance with international law" for failure to fulfill "their international obligations concerning the protection and preservation of the marine environment,"<sup>25</sup> which perforce includes liability for failure with respect to their own internal estuarine zones, which are part of the marine environment. "International law," in its present form, may be found wanting upon application to internal waters.

But would a State with a legal interest in marine species harmed by another State's estuarine environment lack, under the terms of the convention, a basis for a claim and for insisting upon enforcement by the latter State in its own territory? If damage is caused by pollution of the marine environment "by natural or juridical persons under their jurisdiction," States are obliged to ensure the availability of recourse "in ac-

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19. *Id.*, art. 206, read together with art. 205.

20. *Id.*, art. 207, para. 1 (emphasis added).

21. *Id.*, art. 212.

22. *Id.*, arts. 213 and 214.

23. *Id.*, art. 211, para. 1, read together with para. 7.

24. *Id.*, arts. 210 and 216.

25. *Id.*, art. 235, para. 1.

cordance with their legal systems for prompt and adequate compensation or other relief."<sup>26</sup> There seems to be no basis for excluding States upstream in the basin of the estuary from the application of such provisions as well. It may also be asked to what extent may it be asserted by a claimant State that some of these responsibilities, given the general acceptance of the importance of environmental protection and increasingly intensive regulatory attention to such matters in State practice, have now become part of customary international law?

This compressed survey is offered to demonstrate the strong thrust of modern law of the sea thinking, specifically with respect to State responsibility for estuarine pollution, including upstream as well as coastal States. It may be fair to say that some lawyers, and other professionals specialized in non-maritime development and natural resources, may not have appreciated fully the broad sweep of these new treaty-based obligations.

The Council of the European Economic Communities promulgated in 1976 a Directive "on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community." It applies to all waters within the Community: inland surface water, territorial waters, internal coastal waters, and groundwater. The Communities' programs of action on the environment stipulate certain measures to protect fresh water and seawater. The approach is comprehensive—the aquatic environment—not treating some waters under one regime and other waters under another, but rather treating all waters under one unified system. The Directive does define "internal coastal waters" as waters on the landward side of the baseline, "extending, in the case of watercourses, up to the fresh-water limit." Estuarine zones were clearly contemplated.

Among the numerous agreements addressing marine pollution, only a few have explicitly focused on estuarine areas. The Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and the Belts of 1973 is dedicated to the preservation and enhancement of living resources, but "internal waters" are expressly excluded from "the Convention area."<sup>27</sup> The London Convention on the Dumping of Waste at Sea of 1972<sup>28</sup> points out that "marine pollution originates in many resources, such as dumping and discharges through the atmosphere, rivers, estuaries, outfalls and pipelines. . . ."<sup>29</sup> The "dumping" covered, nonetheless, is confined to disposals "at sea",<sup>30</sup> "sea" is defined to mean "all

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26. *Id.*, art. 235, para. 2.

27. *Id.*, art II.

28. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 26 U.S.T. 2403, T.I.A.S. No. 8165, 11 I.L.M. 1291.

29. *Id.*, Preamble.

30. *Id.*, art. III, para. (1).

marine waters other than the internal waters of States"<sup>31</sup> and, therefore, does not include most estuarine zones. More specifically related to the interface zone is the 1971 Convention on Wetlands of International Importance Especially as Waterfowl Habitat,<sup>32</sup> where the "fundamental ecological functions of wetlands as regulators of water regimes and as habitats" are declared.<sup>33</sup> The wetland waters covered are "water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres."<sup>34</sup> "[R]iparian and coastal zones adjacent to the wetlands" may be included as well as "islands or bodies of marine water deeper than six meters at low tide lying within the wetlands."<sup>35</sup>

The Paris Convention of 1974 for the prevention of marine pollution from land-based sources emphasizes that the "ecological equilibrium" of the marine environment is "increasingly threatened by pollution."<sup>36</sup> Included in the concerted actions called for are "current efforts to combat the pollution of internal waterways."<sup>37</sup> The convention applies to a specified "maritime area," defined to include not only the high seas and territorial seas, but also "waters on the landward side of the base lines . . . , extending, in the case of watercourses up to the freshwater limit . . ." and, thus, clearly covering estuarine areas (unless otherwise decided under Article 16). The convention is open for accession by any State "located upstream on watercourses crossing the territory of one or more" of the Parties "and reaching the maritime area. . . ."<sup>38</sup> The convention's provisions may not be invoked against a Party to the extent that that Party "is prevented, as a result of pollution having its origin in the territory of a non-Contracting State, from ensuring their full application."<sup>39</sup> The convention is therefore intended to protect the estuarine zone to the greatest extent possible, but without forcing its application upon unwilling States.

Also dealing with the interface zone are a number of other instruments and programs, particularly the Regional Seas Programme of the United Nations Environment Programme (UNEP), and new Zambezi Action Plan under UNEP's recently inaugurated program for Environmentally Sound Management of Inland Water (EMINWA).

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31. *Id.*, art. III, para. (3).

32. Convention on Wetlands of International Importance especially as Waterfowl Habitat, February 2, 1971, 11 I.L.M. 969.

33. *Id.*, Preamble.

34. *Id.*, art. 1, para. 1.

35. *Id.*, art. 2, para. 1.

36. Preamble of the Paris Convention for the Prevention of Marine Pollution from Land-Based Sources, June 4, 1974, 13 I.L.M. 352.

37. *Id.*, arts. 2 and 3(a).

38. *Id.*, art. 24, para. 3.

39. *Id.*, art 14, para. 1.

## INTERNATIONAL WATER RESOURCES LAW

Few water lawyers and fewer international lawyers have paid attention to the cases of shared or international estuarine zones when propounding principles and rules in the developing field of "international watercourses." The hydrologic interconnections and interdependencies, so often stressed with respect to rivers, lakes, and more recently groundwater and atmospheric deposition, have rarely been elongated to encompass estuaries. In truth, it should be said that the estuary is the "mouth" of the river and belongs to the fresh water regime as much as it does to the seawater regime. But "maritime" water is traditionally beyond the "jurisdiction" of the water resources lawyer.

The United Nations International Law Commission's (ILC) 1980 Note of Understanding about the meaning of "watercourse system,"<sup>40</sup> as used in its 1980 draft rules, states that the system is "formed of hydrographic components such as rivers, lakes, canals, glaciers and groundwater constituting by virtue of their physical relationship a unitary whole. . . ."<sup>41</sup> While there is no express exclusion, estuarine waters were notably not identified. In discussions of the law of international watercourses there has been continued objection by representatives of some States to the basin and system concepts, elemental in river-estuary behavior and taken for granted in the 1982 Law of the Sea Convention.

The Commission's then-Special Rapporteur on the watercourses topic, in his 1981 (Third) Report<sup>42</sup> did, however, devote a section to "the special issue of the maritime interface" and noted that

Developments with respect to the marine environment demand attention. The concern for river-groundwater system quality has, to be sure, long included saltwater intrusion—an environmental impact of the ocean upon the freshwater system—but serious attention must also be paid to the outpourings from streams and from aquifers into the sea, where serious environmental impacts have been taking place. Much of the detrimental alteration is caused by watercourses, including international watercourses.

The problem is concentrated at the deltas and in the estuaries, but in addition effects are usually transmitted along the coasts and sometimes far out to sea . . . Thus far, though these relationships are obviously of increasing importance, it seems that co-operation between marine resources managers and their opposite numbers dealing with international watercourses is rare. . . .<sup>43</sup>

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40. II Y.B. Int'l L. Comm'n 110-136, U.N. Doc. A/35/10/1980.

41. *Id.*, at 108.

42. *Third Report on the Law of the Non-Navigational Uses of International Watercourses*, Thirty-Fourth Session, Int'l L. Comm'n, U.N. Doc. A/CN.4/348/1982.

43. II Y.B. Int'l L. Comm'n 302-303, U.N. Doc. A/CN.4/348/1982.

The 1981 Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central Africa Region covers "the marine environment, coastal zones and related inland waters falling within the jurisdiction of the Parties."<sup>44</sup> "The Contracting Parties shall take all appropriate measures to prevent, reduce, combat and control pollution of the Convention area caused by discharges from rivers, estuaries, coastal establishments and outfalls, coastal dumping or emanating from any other source on their territories."<sup>45</sup> The Parties are also required, individually or jointly, "to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other marine life."<sup>46</sup> The possible contamination of neighboring areas (which would include estuaries) by the transport of pollution along coasts was also written into the agreement.<sup>47</sup>

The usual concept of estuary contamination contemplates sources from upstream in the drainage basin only. Of course, the estuary is the final segment of the drainage basin and is heavily influenced by inputs from upstream, though there are a few situations where the water from streams is meager. Forgotten often are the inputs that arrive from the sea, such as offshore oils, the by-products of many kinds of dumping (including hazardous medical wastes) and sewage, brought in from sea with the tides and along the coast by currents. The rising concern for the health of the estuarine environments, even coastal zone management in some countries, is evident. Commitments and cooperation at the international level are multiplying. For example, under the 1983 Mexico-United States Border Environmental Cooperation Agreement,<sup>48</sup> Mexico, with United States support and an Inter-American Development Bank loan, recently undertook to construct treatment works for the city of Tijuana to mitigate the sewage pollution of the Tijuana River and Estuary.<sup>49</sup>

The reach or extent of an international drainage basin is, according to the International Law Association's (ILA) famous Helsinki Rules,<sup>50</sup> the "watershed limits of the system of waters."<sup>51</sup> That should be construed to include all deltas and even some narrow estuaries, but in fact the "bottom end" of the basin was not in the minds of the drafters. The

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44. Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central Africa Region, March 23, 1981, art. 1.

45. *Id.*, art. 7.

46. *Id.*, art. 11.

47. *Id.*, see art. 4, para. 5.

48. Border Environmental Cooperation Agreement, August 14, 1983, United States-Mexico, T.I.A.S. No. 10827.

49. The river runs toward the northwest from Baja California Norte and crosses into southern California before entering the Pacific Ocean in the outskirts of San Diego.

50. International Law Association, Report of the Fifty-Second Conference, Helsinki 1966, Helsinki, Rules on the Uses of the Waters of International Rivers at 484 (1966).

51. *Id.*, art. II.

waters from the watershed are those "flowing into a common terminus;"<sup>52</sup> inclusion of the "terminus" itself, that is the estuary or environment zone, was not considered. But where does the "river" stop and the "terminus" begin? Is the estuary part of the river, or part of the sea, or both?

After "Helsinki," however, the ILA's successor Committee on International Water Resources Law produced the earliest international legal rules applicable to estuarine problems, the Association's 1972 articles on Marine Pollution of Continental Origin, which supplements the Helsinki rules. The conduct covered includes, *inter alia*, the "discharge or introduction of substances into the sea from pipelines, extended outlets, or ships, or directly through rivers or other watercourses whether natural or artificial, or through atmospheric fallout."<sup>53</sup> The relevant factors for establishing "seawater pollution" standards were also set forth in some detail.<sup>54</sup> On the other hand, the ILA's rules on Regulation of the Flow of International Watercourses adopted in 1980 make no express reference to estuarine needs, though the "regulation" envisioned is "for any purpose."

In summary, most products of legal reasoning and of negotiation still tend to treat separately the waters in the drainage basin, or watercourse system, and the waters "out there" in the sea. Individually and in their relations with other countries, governments are in fact beginning to overhaul their legal regimes and institutional machinery in order to cope more effectively with water resources and environmental concerns. At the international level, the approach is still largely coastal, but terms such as "related internal waters" may someday be read to comprise entire drainage basins. In the past, more attention has been paid to "marine" habitat preservation, and to upstream controls, leaving the "working estuary" as if in a netherworld. The existence of a watery "third position," that is, brackish water and its peculiar environment, has gained the attention of a growing number of biologists, chemists, and their new, specialized journals. The natural resources lawyers specifically, and international lawyers generally, are only beginning to explicitly incorporate this brackish environment into their work as part of the hydrologic system.

The hydrologic cycle must be seen as an unbroken, continuous and revolving process, which also provides the organizing concept on the basis of which we can devise legal and managerial principles. That pivotal, dynamic nexus, the estuary, must come to occupy a central position in our integrated basin studies and planning. As a practical matter, we need to describe some territorial bounds for this enlarged entity—the

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52. *Id.*

53. Article 1 of the International Law Association Report of the Fifty-Fifth Conference, New York, 1972.

54. *Id.*, art. III(a).

traditional catchment area *plus* its estuarine zone—in order that legal and institutional jurisdictions may be resolved. The estuarine *divortium aquarum* in contiguous wetlands may be indistinct or shifting or fail to take in adjacent settlements, installations of infrastructure that impact significantly upon estuarine processes. And where will an estuary-basin organization's authority be cut off seaward? The oft-used baseline from which the territorial waters are measured probably has no relevance if we take the hydraulic system as our guide. If there is another overarching coastal zone management authority, or a basin commission with limited scope, or a port authority, wildlife sanctuary agency, or water supply or sanitation district, not to mention provincial or local government jurisdictions, how will these be correlated?

Land use controls—zoning, construction, and dredging and landfill permits, and cultivation and herding regulations—are traditionally independent of the water use regime, particularly at the international level. The inability to impose review and licensing requirements on activities that take place on the land but that affect water quality and estuarine dynamics remains a major drawback in effective water resources management everywhere. It is recognized that agricultural, industrial, municipal, recreational, and other activities on land often have side effects that significantly degrade water resources. Less well understood is the tendency of pollutants to concentrate in, and in many cases be retained in, the estuary. Much ado is made of the rare coastal oil spill, but we neglect the grievous, ongoing contamination (and toxic waste accidents) reaching the estuary from activities on land. The bold advances in the *marine pollution* field have now brought the interrelated land use sharply into focus; perhaps we may now break down the barriers to treating land use practices as they affect fresh and brackish water resources.

### SHOULD ESTUARIES HAVE “WATER RIGHTS”?

The health of an estuarine zone has social and economic importance to the community it serves. The basic needs of the estuary must, then, somehow be attended to. These needs are, above all, water and water-borne nutrients. Contamination, including siltation, must be controlled, yet inorganic and organic materials, including sediments, at certain rates and times are required to maintain the well-being and viability of the estuary. Submerged aquatic vegetation and benthic and marsh organisms must have some sediment. Too much, however, fills in the shallow habitats, and navigation channels will be lost if not dredged.

Inland water projects often so modify and diminish the fresh water supply and sediments as to significantly decrease estuarine productivity. Too much water, especially if combined with too-rapid runoff and too

much silt, can be devastating. Upstream reservoirs, flood control levees, instream dredging, deforestation, and irrigation diversions all alter the basin's natural flow characteristics. The spawning and nursery stages of fish and shellfish are intimately associated with springtime runoff, as are numerous other ecological processes. The inputs to the estuary can be over-controlled or out of control and, therefore, alter the natural functioning and productivity of the estuary.

Good fresh water with its nutrients must be stirred into the fluctuating exchange of edibles from the sea to create the distinctive brackish "soup" of the estuary. Many resident species have low production or survival rates where the environment is highly saline. Pollution problems are exacerbated with diminished dilution.

It may, therefore, become essential to establish something akin to a "water right" in the estuary, so that the needed deliveries of both fresh water and saltwater can be assured. Other uses should not be permitted to divert or pollute unduly the estuarine "share" of available water. The imposition of minimum flow regimes for rivers and into lakes is not novel. In the United States, for example, such reservations of water are being most often couched in terms of an old principle known as the "public trust doctrine"; governments have a duty to provide for the minimal water needs of important water bodies. Other legal aspects would have to be associated with such rights, such as priority in times of water shortage, or forfeiture should an estuary become so modified or contaminated as to be beyond recovery. Some guarantee of delivery of the required suitable water is compelling in the case of a productive estuary.

Whether the needs of estuaries and deltas for distinctive flow regimes should prevail over upstream interests in any specific situation must be settled legally in accordance with carefully considered criteria. Where the interface zone or the drainage basin is shared between two or more countries, provision for such minimum flows should be part of an overall management agreement. Assignment of scarce water to the estuary will, at least in some years, occasion sacrifices and concessions from other users. In short, the estuary will have *some* new "rights" and other uses in the catchment area will have some new limitations. An estuary should not be allowed to "die" without a firm political decision having been made on the basis of technically sound study of the "price" that will be paid in the future in terms of, *inter alia*, fisheries (including mariculture), recreation, the amenities, and the environment.

### CONCLUSION

Estuaries have been dubbed "nature's caldrons." An amazing variety of bird, animal, plant, and brackish marine life thrives there. Human use



of these rich waters and human settlement at these aquatic junctures predates recorded history. Human activities have now become so rampant in many cases that the "bowl at the bottom of the basin" is supersaturated with uses. Intensive development involving the upper branches of watercourse systems has compounded the estuaries' plight. Man will continue to use natural resources at increasing rates. Long-term survival, however, now behooves him to be more respectful of nature. The case of the estuarine zone has become a true test of our political will to utilize without befouling excessively, to reap continuing benefits without exhausting nature's original "capital investment." When we find that further changes in the estuarine region will be unfavorable, the demands of growing coastal populations for housing, food, transport, services and jobs—and the augmented waste disposal problems thereby created—must be weighed carefully against the natural resource and environmental losses entailed.

Do we at last realize how often our sins are paid for in the estuarine zone? Estuaries are not mere ancillary arms of the sea. That conceptual error is no longer with us, but until governments, under properly integrative agreements and legislation, couple the inshore marine with the brackish and with the fresh water, it is likely that conditions in the many intensively used deltas and estuaries of the world will continue to deteriorate. It is time to affirm that the basin or system concept covers that receptacle at the bottom into which all else drains. Full membership must be granted to the estuary in the list of watercourse components. Collaboration should be promoted between the water resources lawyers and those coastal and marine law specialists, some of whom have tended to view the watershed as simply a tributary to "their" estuary.

The job of responding to the regulatory problems of the estuarine zone has often been left by default to local planners, port officials, and naval officers and their advisers. Consequently, an integrative doctrine has not evolved. When the marine specialists and the fresh water specialists gather around the table with the estuarine zone specialists, effective natural resources management schemes for the fresh water-maritime interface can be forged.