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# Habitat Hotline Atlantic

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## Evaluating Stream Habitat for Diadromous<sup>1</sup> Fish in Atlantic Coast Watersheds: A Preliminary Assessment

by

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Resource managers and agencies are beginning to adopt a holistic approach to resource management and enhancement taking into consideration habitats, food chains, and species of management concern (Stephenson and Lane 1995). Large aquatic systems and wide-ranging species particularly challenge holistic management. However, progress is being made through the development of new techniques and improved inter- and intra-agency cooperation in interdisciplinary resource management. For example, Busch and Lary (1996) modified an assessment procedure, the Habitat Evaluation Procedure<sup>2</sup> (USFWS 1980), to evaluate the ecosystem health of Lake Ontario. Another example is the successful restoration of Atlantic striped bass attributed to the cooperation and effectiveness of inter-agency management efforts.

Building on Busch and Lary's (1996) Lake Ontario ecosystem assessment that identified physical habitat loss (damming of tributaries and shoreline alterations) as a major ecosystem stressor, we used computer databases and a Geographic Information System to assess the quantity of historic (unrestricted) versus current (restricted) stream habitat available to the migratory fish, the American eel. American eel are catadromous—referring to their life history characteristic of migrating from freshwater to spawn in saltwater. Because their geographical range extends from Canada to Florida along the east coast, we attempted to assess the loss or restriction of stream access to all Atlantic coastal watersheds, including the Lake Ontario and St. Lawrence River system. Although our assessment focused on American eel, the identified loss or restriction of stream access is generally applicable to other east coast species

which move between freshwater and saltwater to spawn (e.g., anadromous species such as American shad, Atlantic sturgeon and Atlantic striped bass which migrate from saltwater to spawn in freshwater). The particular timing and location of spawning differs by species.

### Data Sources

Spatial tributary length data, from Florida to Maine and the U.S. portion of the St. Lawrence River watershed, were obtained from the U.S. Environmental Protection Agency's Reach File Version 3.0 database at a 1:100K scale. These tributary length data were combined with a matching map projection database containing dam locations obtained from the U.S. Army Corps of Engineer's National Inventory of Dams (1995-6) to assess and quantify historic and currently accessible habitats. American eel presence/absence data were obtained from the State of Maine and the U.S. Fish and Wildlife Service.

### Results

We determined that Atlantic coastal streams from Maine to Florida have 15,115 dams that can hinder or prevent up and downstream fish movement. This results in a restriction or loss of access for fish to as much as 84 percent of the stream habitat within the historic (unrestricted) range. This is a reduction from 556,801 kilometers to 90,755 kilometers of stream habitat

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available for migratory and diadromous species such as American eel, American shad, and sturgeon. Our analyses excluded the obstruction caused by most natural barriers.

In the assessment of the Atlantic coast watersheds, the St. Lawrence River - Lake Ontario watershed was included. However, data are incomplete because only the United States' side of the Lake Ontario basin was assessed. In the U.S. portion of the watershed, 455 dams contribute to 24,693 km of streams lost or restricted from a total of 30,085 km (82% loss) to migratory fish originating in or having Lake Ontario as their destination (Table 1). The kilometers of lost or restricted fish access in this watershed would be much larger if the Canadian tributaries were included since the dams on the lower and upper St.

Lawrence River hinder connectivity for fish movement from Lake Ontario through the St. Lawrence River to and from the Atlantic Ocean.

By region, the greatest habitat loss (91%) was in the North Atlantic region (Maine to Connecticut) where stream access is estimated to have been reduced from 111,482 to 10,349 unobstructed kilometers of stream length (Table 2). Stream habitat in the Mid-Atlantic region (New York through Virginia) is estimated to have been reduced from 199,312 to 24,534 km unobstructed stream length (88% loss) (Table 3). The stream habitat in the South Atlantic region (North Carolina to Florida) is estimated to have decreased from 246,007 to 55,872 km unobstructed stream access, a 77% loss (Table 4).

Table 1. Great Lakes Region<sup>3</sup> (New York and Ontario to Quebec)

Huc*Number and Watershed Name	Historical length (km)	Current length (km)	Number of dams	Dams <10 ft.	Dams 10-24 ft.	Dams 25+ ft.	Hydro-Electric	Navi-gation.
412 Eastern Lake Erie Drainage	113	66	4	0	1	3	3	0
413 Southwestern Lake Ontario Drainage	8,076	1,827	67	7	45	15	9	1
414 Southeastern Lake Ontario Drainage	16,156	2,877	159	33	74	52	19	15
415 Lake Ontario-St. Lawrence Drainage	5,740	622	225	24	118	83	150	2
Totals	30,085	5,392	455	64	238	153	181	18

Table 2. North Atlantic Region (Maine to Connecticut)

Huc Number and Watershed Name	Historical length (km)	Current length (km)	Number of dams	Dams <10 ft.	Dams 10-24 ft.	Dams 25+ ft.	Hydro-Electric	Navi-gation
101 St. John River Basin	11,335	1	37	3	19	15	10	0
102 Penobscot River Basin	15,245	207	75	9	49	17	53	0
103 Kennebec River Basin	9,186	208	97	11	66	20	54	0
104 Androscoggin River Basin	4,467	195	95	15	57	23	54	0
105 Maine Coastal - St. Croix	10,884	5,166	98	22	69	7	34	0
106 Saco, ME, NH, MA	9,414	1,685	212	28	155	29	74	0
107 Merrimack River Basin	11,006	10	533	87	348	98	93	0
108 Connecticut River Basin	20,874	99	941	93	538	310	119	0
109 MA-RI Coastal Area	7,886	1,589	708	133	487	88	13	4
110 Connecticut Coastal	10,335	1,188	713	42	467	203	49	0
111 St. Francois River Basin	850	1	13	5	5	3	8	0
Totals	111,482	10,348	3,522	448	2,260	813	561	4

Table 3. Mid-Atlantic Region (New York through Virginia)

Huc Number and Watersheds Name	Historical length (km)	Current length (km)	Number of dams	Dams <10 ft.	Dams 10-24 ft.	Dams 25+ ft.	Hydro-Electric	Navi-gation
201 Richelieu Basin including Lake Champlain drainage	9,126	1	235	24	125	83	68	1
202 Upper Hudson	22,389	1	660	91	373	194	64	17
203 Lower Hudson - Long Island	7,781	1,431	519	64	324	127	8	0
204 Delaware Coastal Area	26,934	5,148	1068	179	656	231	21	0
205 Susquehanna River Basin	52,331	251	684	75	324	285	19	2
206 Upper Chesapeake	14,884	8,862	157	13	93	51	3	0
207 Potomac River Basin	28,140	3,281	443	7	141	295	12	0
208 Lower Chesapeake	37,727	5,559	884	22	527	337	22	0
Totals	199,314	24,533	4650	475	2563	1603	217	20

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Table 4. South Atlantic Region (North Carolina to Florida)

Huc Number and Watershed Name	Historical length (km)	Current length (km)	No. of Dams	Dams <10 ft.	Dams 10-24 ft.	Dams 25+ ft.	Hydro Electric	Navi-gation
301 Chowan-Roanoke Coastal Dr.	36,775	3,632	371	3	257	230	15	0
302 Neuse-Pamlico Coastal Dr.	23,324	12,452	445	6	268	149	1	0
303 Cape Fear Coastal Dr.	20,471	5,990	626	5	385	226	9	3
304 Pee Dee Coastal Dr.	35,880	6,139	1034	58	637	333	10	0
305 Edisto-Santee Coastal Dr.	41,504	7,003	1942	52	1073	810	66	0
306 Ogeechee-Savannah Coastal Dr.	34,604	4,508	1028	33	546	447	30	1
307 Altamaha-St. Marys Coastal Dr.	37,172	4,673	1353	31	763	559	10	0
308 St. Johns Coastal Dr.	82,334	6,582	40		18	19	0	4
309 Southern Florida Coastal Dr.	8,044	4,893	105	6	46	45	0	0
Totals	246,008	55,872	6944	194	3993	2818	141	8

The dam database included information on dam heights (Tables 1-4). In the North Atlantic Region a total of 3,512 dams are identified of which 448 are less than 10 ft. high, 2,260 are between 10 and 24 ft. high, and 813 are higher than 25 ft. Of these dams, 561 are used for hydropower production. The Mid-Atlantic Region has 4,650 dams of which 475 are less than 10 ft. high, 2,563 are between 10 and 24 ft. high, 1,603 are higher than 25 ft., and 217 dams are used for hydropower production. In the South Atlantic Region, the 6,944 dams identified include 194 that are less than 10 ft. high, 3,993 between 10 and 24 ft., and 2,818 higher than 25 ft. Of the dams in this region, 141 are used for hydropower production. Dams in the U.S. Lake Ontario basin include 64 that are less than 10 ft. high, 238 that are 10-24 ft. high, and 153 that are 25 ft. or higher. Hydropower production was the use identified for 181 dams.

Various factors influence successful up or downstream migration of American eel past dams. We evaluated fish migration restrictions due to dams by examining limited data on the presence or absence of eel above and below dams. The preliminary results indicate that although height and use (purpose) for the facility appear to be important factors, other criteria need to be evaluated including slope, construction material, water flow, location of the dam in the watershed, and operational procedures. The loss of stream access due to dams for species other than eel is more direct. For example, most dams prevent sturgeon movement and migration.

Dams that require special licenses such as for hydro-power production or navigation may provide opportunities for fish passage if required by the resource management agencies. However, only 1,100 were identified for hydropower production and 50 for navigation out of the total number of 15,570 identified dams. Therefore, only 7% of these dams are covered by regulatory programs that could provide fish passage. The other specific uses for dams identified in the database include water-level control, water supply and recreation.

This analysis of stream and dam data provides an overview of the potential loss of access to stream habitat for migratory fish along the east coast as a result of the construction of various types of dams. The intent of this preliminary evaluation was to conduct a gross overview and assessment of all East

coast watersheds. This provides a starting point and framework in which to begin conducting site- and species-specific assessments requiring more detailed analyses that are directly applicable for local management actions. Such detailed watershed specific analyses on habitat loss due to dams is underway in various locations (e.g., Maine, North Carolina, and Connecticut River). Our data provides a description of the cumulative impacts from this type of habitat loss, supports holistic planning and provides a tool to resource managers in identifying and prioritizing watersheds for access restoration in support of migratory fish species rehabilitation and enhancement programs.

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#### Literature Cited

- Busch, W.-D.N. and S.J. Lary. 1996. Assessment of habitat impairments impacting the aquatic resources of Lake Ontario. *Can. J. Fish. Aquat. Sci.* 53 (suppl. 1): 113-120.
- NOAA. 1996. NOAA Fisheries – National Habitat Plan – 1997 and Beyond. Silver Spring, MD, 20p.
- Stephenson, R.L. and D.E. Lane. 1995. Fisheries management science: a plea for conceptual change. *Can. J. Fish. Aquat. Sci.* 52:2051-2056.
- USFWS. 1980. U. S. Fish and Wildlife Service – Habitat Evaluation Procedures (HEP) Manual. 102 ESM. Washington, D.C.
- <sup>1</sup> Diadromous refers to fish that migrate between fresh water and salt water.
- <sup>2</sup> The Habitat Evaluation Procedure and Habitat Suitability Index models were developed to assess and quantify impacts from habitat changes. The procedure uses models of habitat requirements for species or guilds, at the major trophic levels, to assess the suitability of habitats pre and post the anthropogenic activity.
- <sup>3</sup> No Canadian data were available, therefore, data presented are only from the U.S. side of Lake Ontario.
- <sup>4</sup> Hydrologic Unit Code used in the U.S. Environmental Protection Agency Reach File data base.