Wow! That's a lot of eels!

But is it enough?

Bob Graham
Pete Sturke
Corey Chamberlain

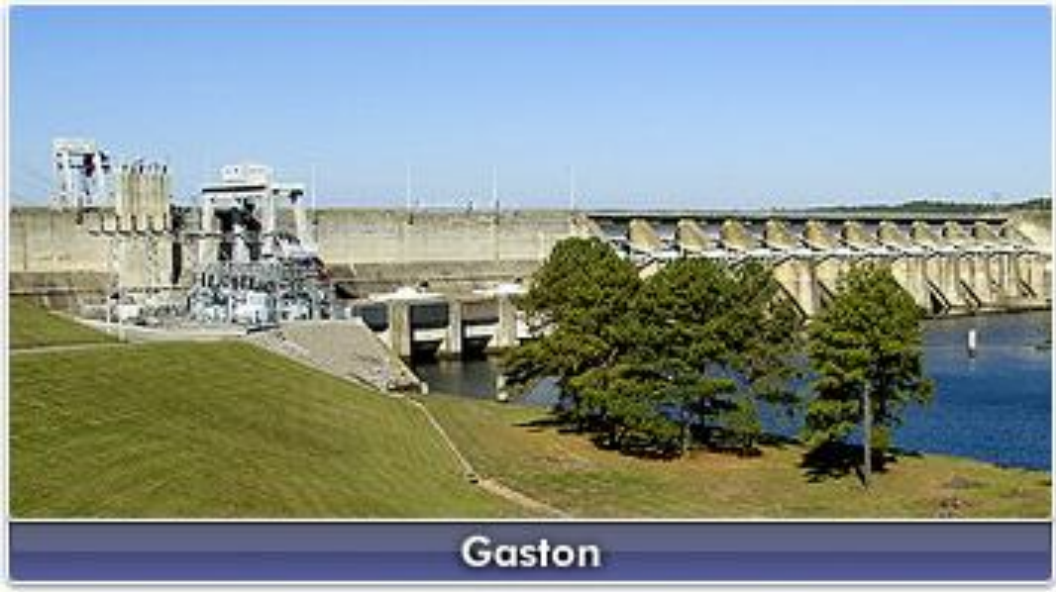
Annual meeting of the American Fisheries Society
Atlantic City, New Jersey August 23, 2018

Roanoke Rapids and Gaston Hydropower Project
FERC Project No. 2009

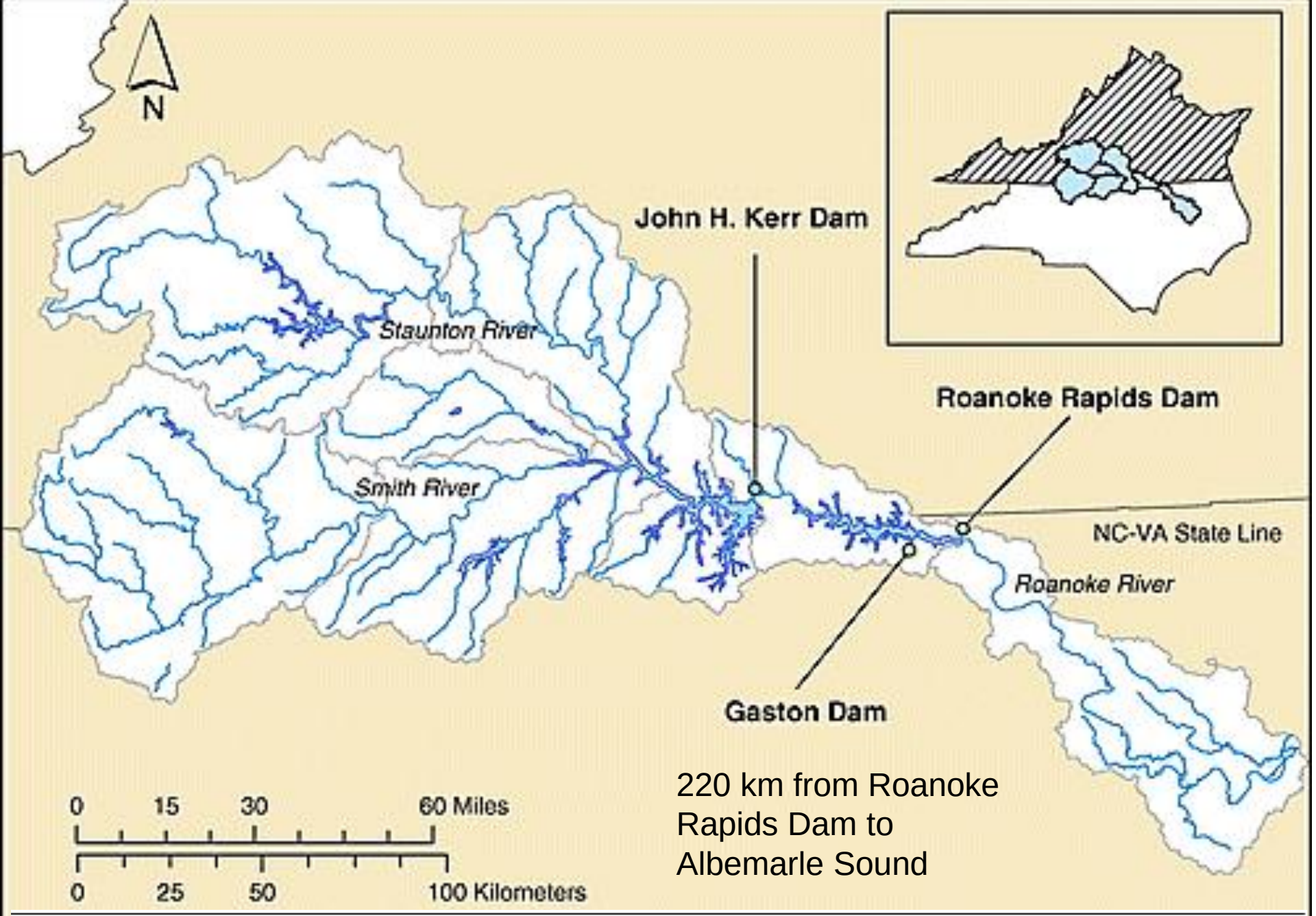
Roanoke Rapids

- Built in 1964
- 32 m high dam
- 220 MW

- Built in 1955
- 22 m high dam
- 95 MW



Gaston



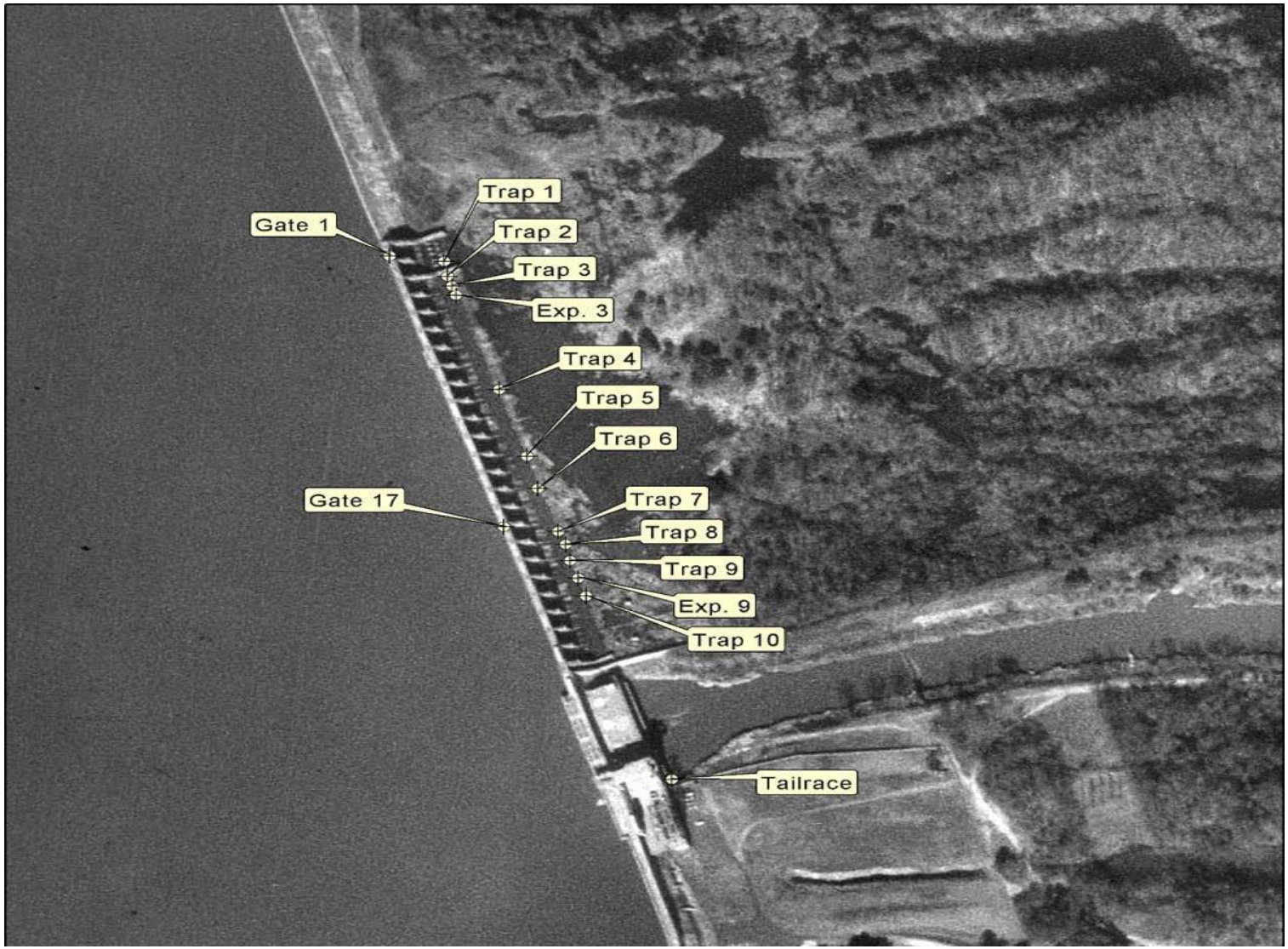
220 km from Roanoke Rapids Dam to Albemarle Sound

Dominion Energy

FERC License No. 2009
Roanoke Rapids, NC

NC Cooperative Fish and Wildlife Research Unit

- Dominion Energy – licensee
- Diadromous Fish Restoration Technical Advisory Committee (DFRTAC)
  - Dominion Energy
  - NMFS
  - USFWS
  - USGS
  - NC Wildlife Resources Commission
  - NC Department of Environmental Quality
  - NC Department of Marine Fisheries
  - NC State University
  - VA Department of Game and Inland Fisheries

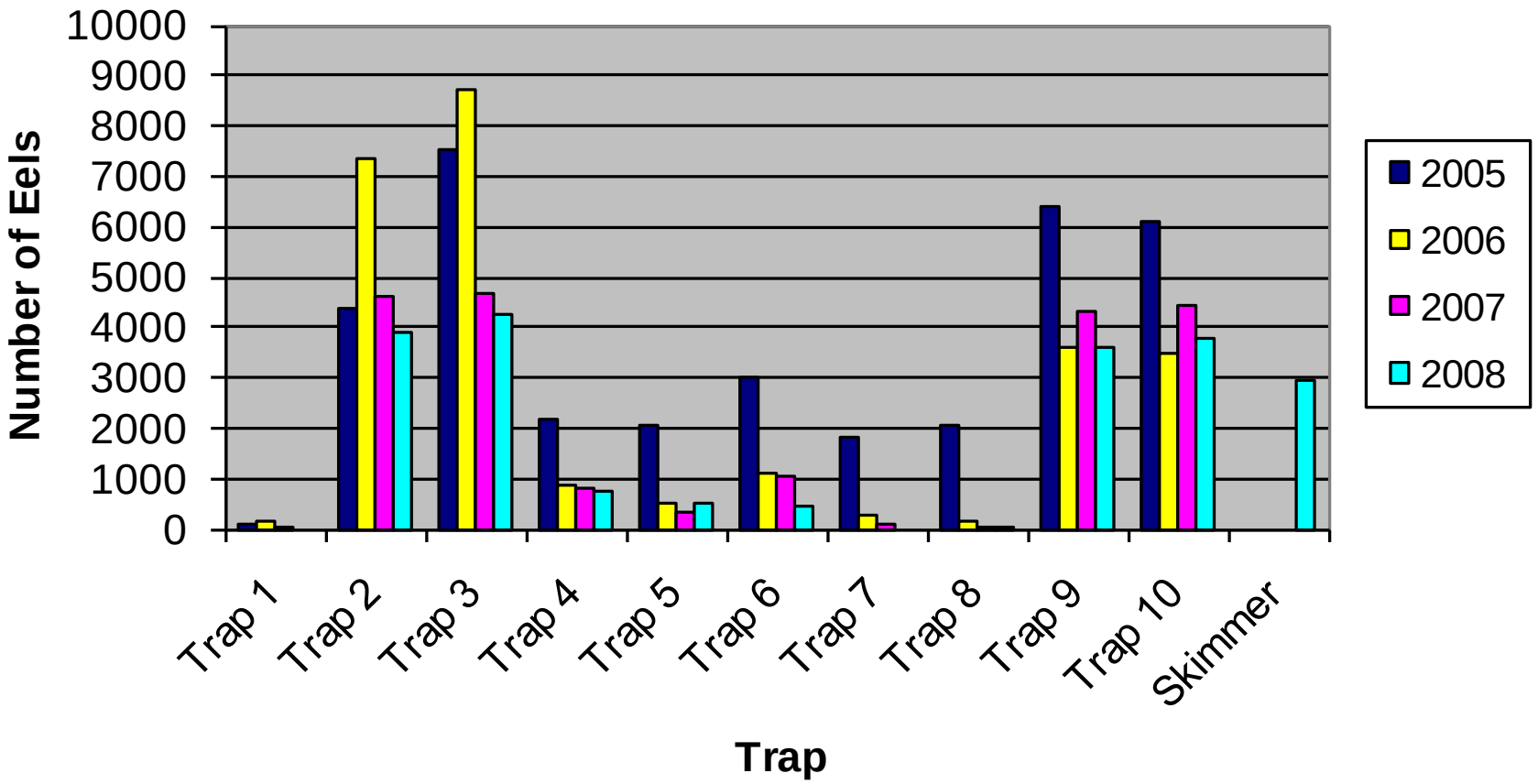


Dominion Energy

August 17, 2018

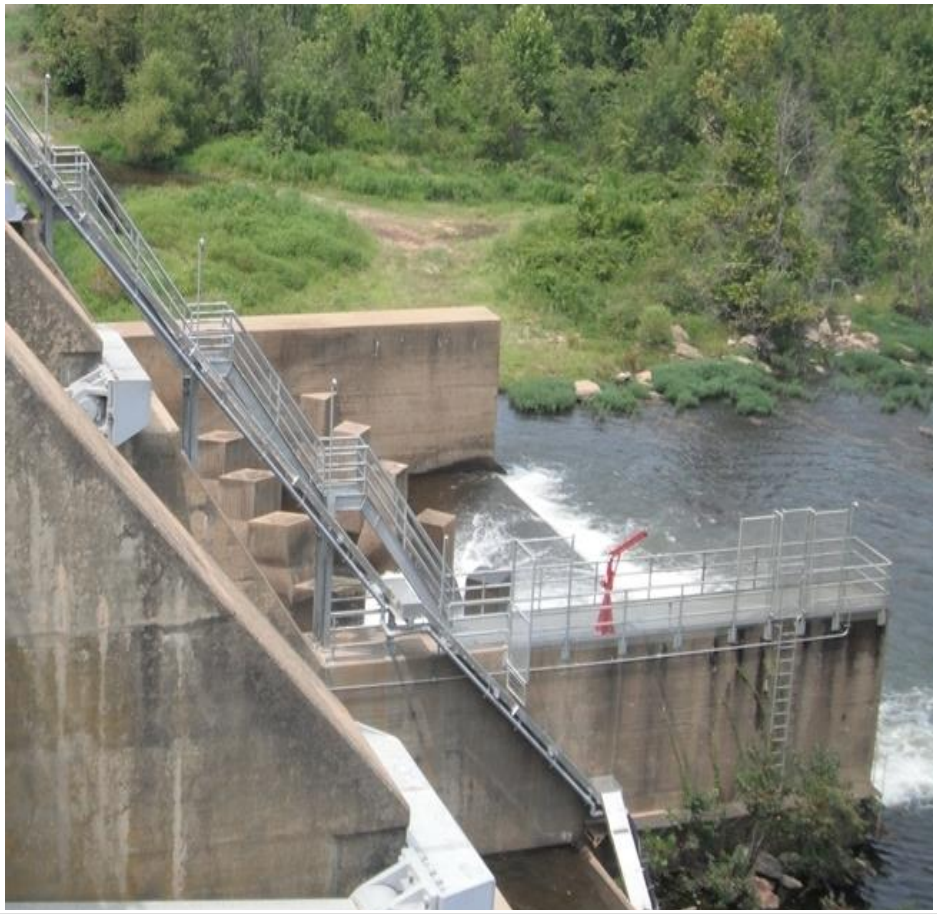
Dominion Energy

Numbers of American eels collected in the bypass by trap in 2005, 2006, 2007 and 2008.



Roanoke Rapids Eelways – Milieu elver substrate, aluminum framing, ramp slopes 42-45º, attraction (~ 473 Lpm) and conveyance (11 lpm) flows sourced from impoundment (Roanoke Rapids Lake).

North Eelway – ramp is 30.2 m (99 ft) long, two turn pools



South Eelway – ramp is 8.2 m (27 ft) long, no turn pools

Dominion Energy

AEWG Eelway Effectiveness Studies

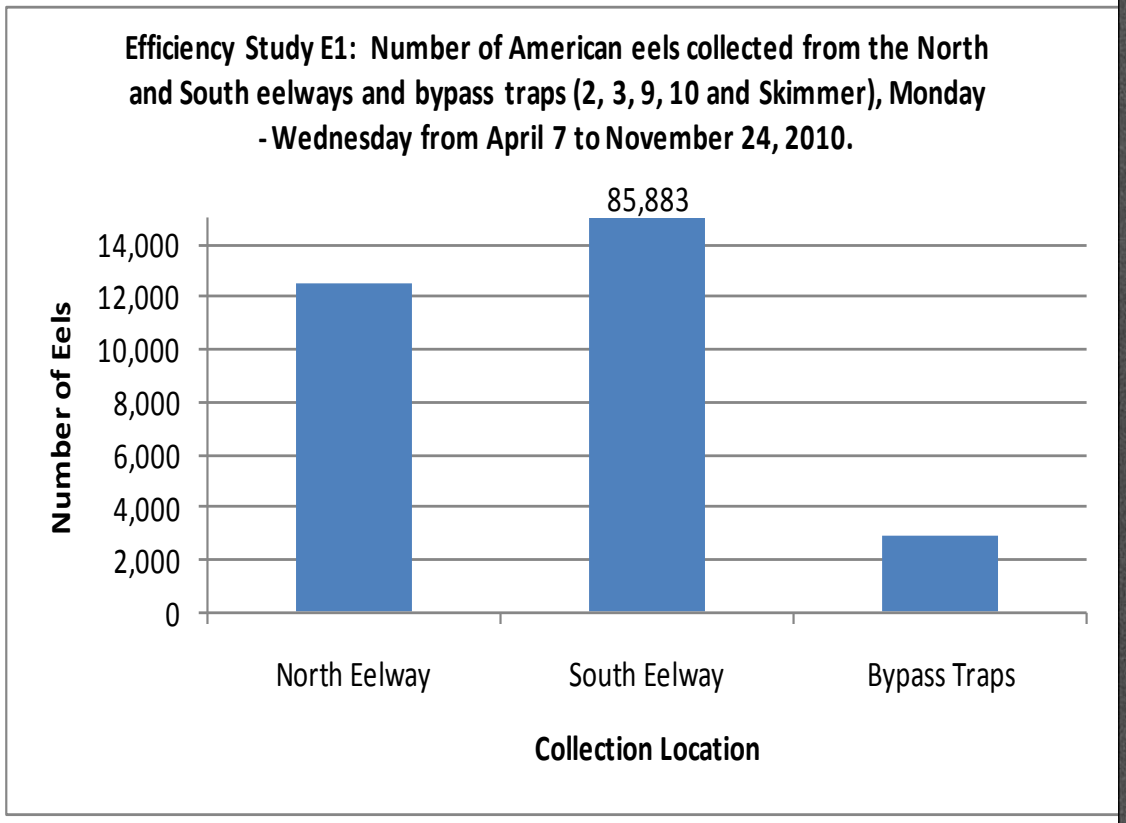
- **E1 How effective are the eelways in attracting eels into each eelway?**

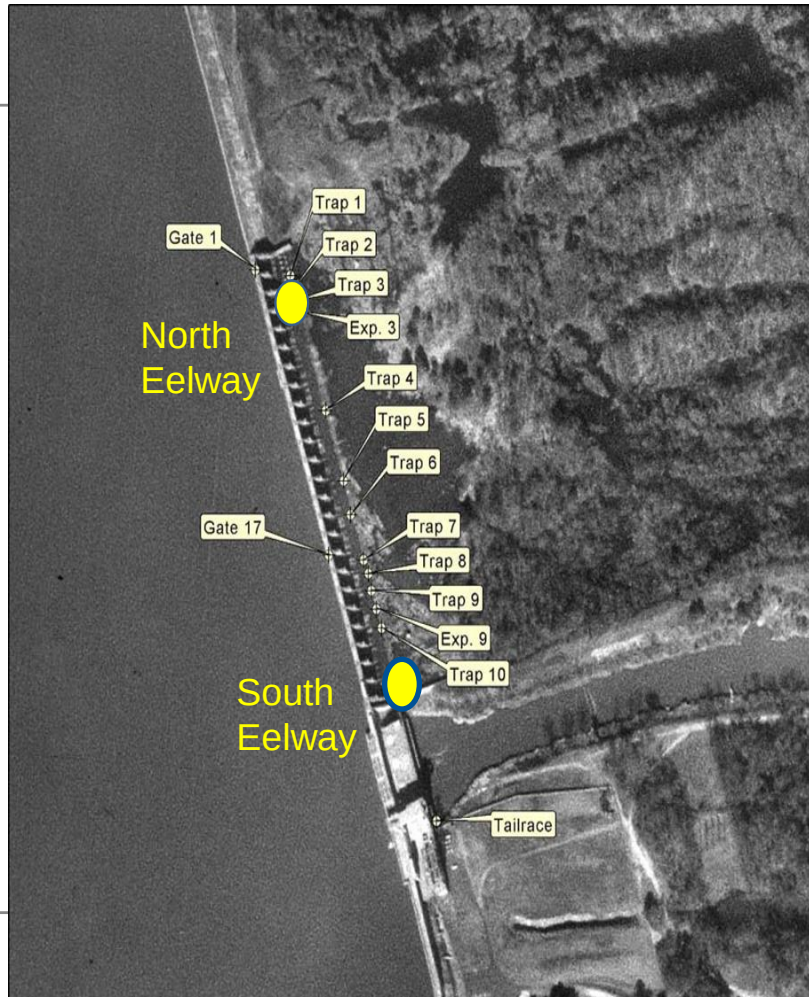
- **E2 How effective are the eelways in providing upstream passage to the collection tanks?**

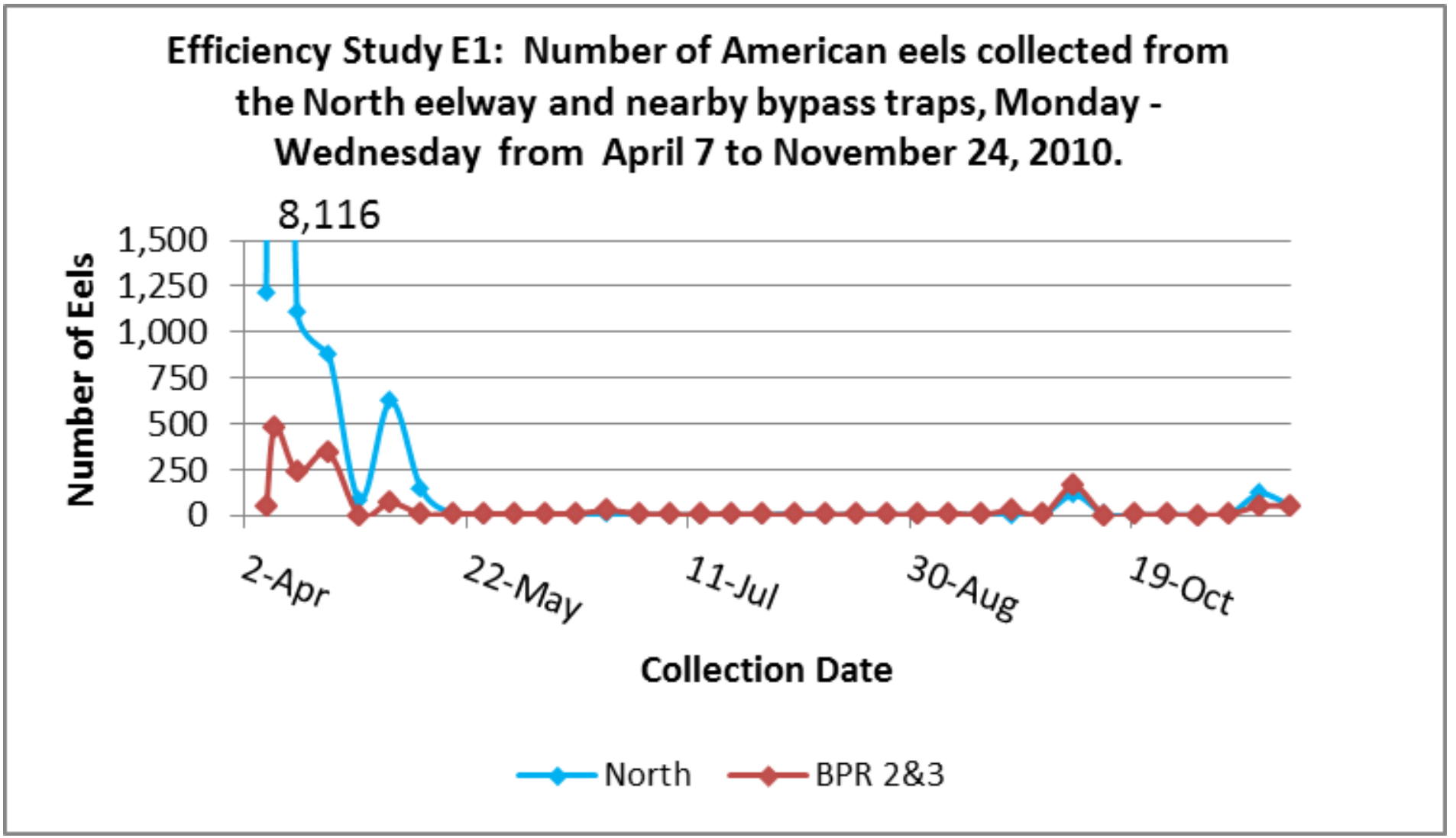
- **E3 How safe is the upstream passage?**

- **E4 What proportion of eels fall back?**

E1 How effective are the eelways in attracting eels into each eelway?






Efficiency Study E1: Number of American eels collected from the North eelway and nearby bypass traps, Monday - Wednesday from April 7 to November 24, 2010.
8,116
1,500
1,250
1,000
750
500
250
0
Number of Eels
2-Apr
22-May
11-Jul
30-Aug
19-Oct
Collection Date
North
BPR 2&3

E2 How effective are the eelways in providing upstream passage to the collection tanks?

Effectiveness Study E2: Numbers of American eels observed during nighttime surveys in comparison to numbers found in subsequent holding tank checks.

1 a.m. Observation Date	Cumulative Number of Eels Observed North Eelway	Cumulative Number of Eels Observed South Eelway	Holding Tank Check Date	Number of Eels in Holding Tank North Eelway	Number of Eels in Holding Tank South Eelway
8-Apr	2336	34	9-Apr	8116	2037
6-May	5	94	6-May	2	2159
9-Jun	1	0	9-Jun	0	34
8-Jul	2	7	9-Jul	4	15
4-Aug	8	1	4-Aug	9	16
8-Sep	6	2	8-Sep	6	14
6-Oct	9	8	6-Oct	112	1843
9-Nov	2	2	10-Nov	6	14

Dominion Energy

Effectiveness Study E2: Experimental introduction of American eels into North eelway turn pools during 2010.

	Collection	Collection	Electrofish	Water	Intro.	Intro.	Number	Length	Eels in Holding Tank				
Intro. Date	Location	Time	Effort (s)	Temp (^{o}C)	Pool	Time (h)	of Eels	Range (mm)	Day 1 a.m.	Day 1 p.m.	Day 2 a.m.	Day 2 p.m.	End of Study
12-May	Bypass North	1340	2023	21.8	Lower	2000	30	136 - 171 (n=14)	21	0	9	NA	Five euthanized on May 18 for X-ray exam of vertebrae
19-May	Bypass North	1239	1343	20.3	Upper	2000	30	151 - 314 (n=15)	27	0	3	NA	
21-Jul	Bypass South	1342	1041	28.8	Lower	2000	30	122 - 468 (N=30)	18	0	10	0	Two eels remained in lower turn pool
28-Jul	Bypass South	1346	1281	28.6	Upper	2000	30	142 - 198 (n=15)	21	0	9	NA	
8-Sep	Bypass South	1421	1279	27.0	Lower	2000	30	129 - 277 (N=30)	16	0	13	0	One eel remained in lower turn pool
15-Sep	Bypass South	1436	1560	28.2	Upper	2000	30	129 - 222 (N=30)	18	0	12	NA	

E3 How safe is the upstream passage?

Effectiveness Study E3: Signs of stress and mortality over 48 hours in American eels transferred from eelway to bypass holding tanks.

Transfer Date[1]	Release Date	Eelway	Eelway Tank[2] Temp (°C)	Eelway Tank[2] D.O. (mg/L)	Mean Daily[3] Air Temp (°C)	Mean Max[3] Air Temp (°C)	Number of Eels	Length Range (mm)	Signs of Stress[4]	24-h M (%)	48-h M (%)	Bypass[5] Temp Range (°C)	Bypass[5] D.O. Range (mg/L)
16-Aug	18-Aug	North	28.5	5.8	25.6	30.0	4	128 - 140	None	0	0	28.5 - 28.5	5.2 - 5.3
16-Aug	18-Aug	South	28.6	5.6	"	"	6	133 - 347	None	0	0	"	"
23-Aug	25-Aug	North	28.4	5.5	27.0	32.6	3	124 - 146	None	0	0	28.2 - 29.0	5.2 - 5.4
23-Aug	25-Aug	South	28.5	5.4	"	"	11	129 - 363	None	0	0	"	"
30-Aug	01-Sep	North	28.6	5.6	25.0	30.6	4	138 - 152	None	0	0	28.5 - 29.0	5.2 - 5.3
30-Aug	01-Sep	South	28.5	5.4	"	"	9	132 - 184	None	0	0	"	"
06-Sep	08-Sep	North	28.5	5.5	22.0	29.6	5	136-151	None	0	0	28.2-28.3	5.3-5.4
06-Sep	08-Sep	South	28.3	5.4	"	"	10	132-159	None	0	0	"	"

[1] Eels may have been in eelway holding tanks for up to 72 hours prior to transfer.

[2] On transfer date.

[3] For 72-hour period prior to transfer at Richmond, VA.

[4] Eels examined for signs of lethargy and disorientation.

[5] Three daily checks over 48-hour holding period.

E4 What proportion of eels fall back?

Three recaptures of tagged eel at eelways, of approximately 7,000 tagged and released.

Summary Results and AEWG Conclusion

- The numbers of American Eels utilizing the eelways exceeded those of a second trapping method, and were among the highest documented in North America.

- Nightime visual surveys indicated at least as many eels observed on the eelways were present in the holding tanks when next checked.

- Nearly 100% of eels introduced to the lowermost turn pool negotiated the North eelway to the holding tank within 48 hours.

- Mortality events were rare and associated with inadequate holding capacity, which was corrected. Holding studies conducted during summer conditions indicated the eels were being released in healthy condition.

- There was no evidence of significant fallback of American Eels, although the proclivity of eels that fall back to resume upstream migration is suspect.

- The Roanoke Rapids eelways provided safe, timely and effective passage of American Eels.