

# GOALS AND PERFORMANCE OF THE IJC 2000 RULE CURVES FOR RAINY LAKE AND NAMAKAN RESERVOIR

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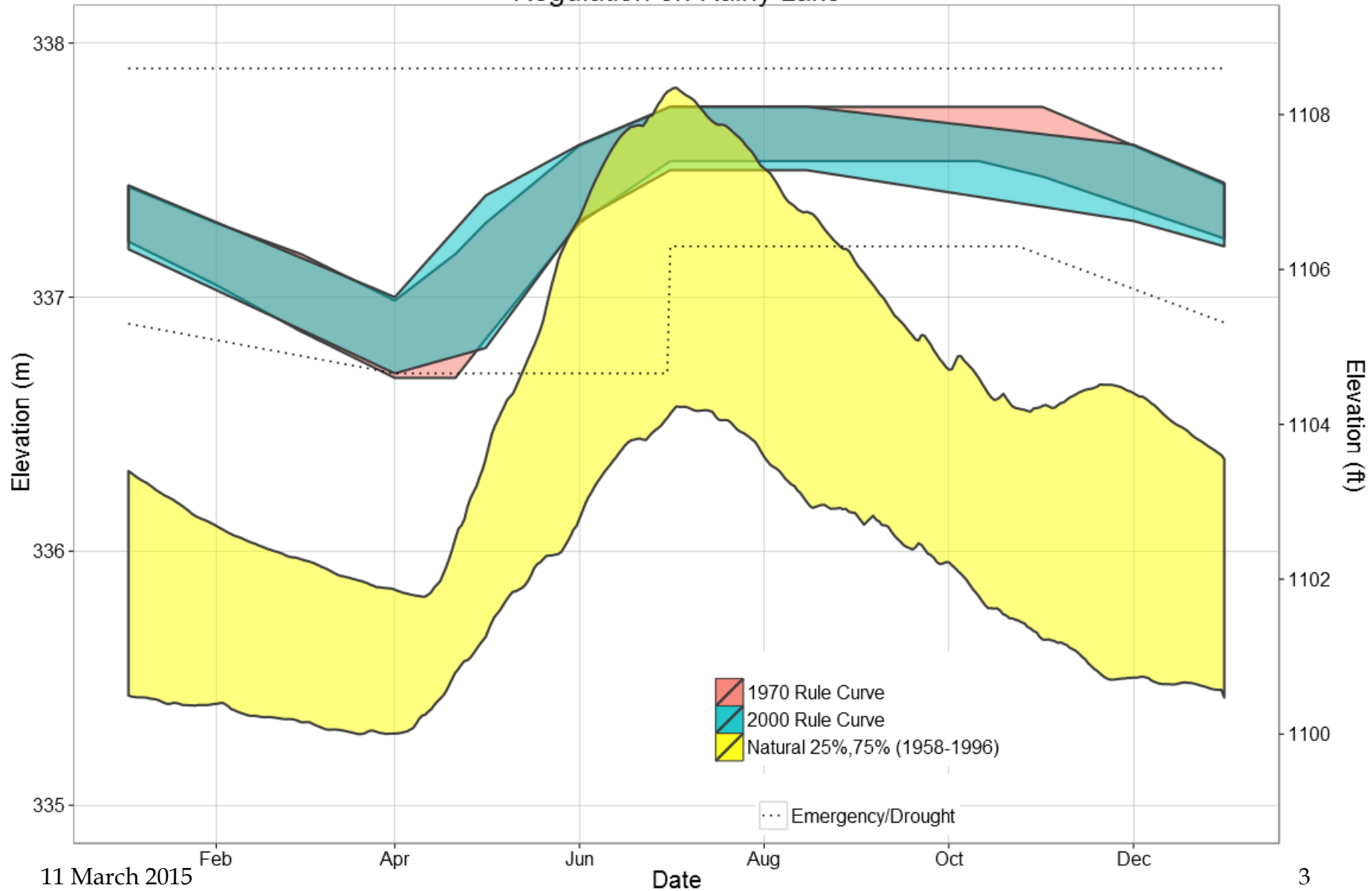
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# OUTLINE

- ▣ Rule Curve Comparison
- ▣ Aims of 2000 Rule Curves
- ▣ Differences in Rule Curves over the years
- ▣ Hydrologic performance of 2000 Rule Curve
- ▣ Conclusion

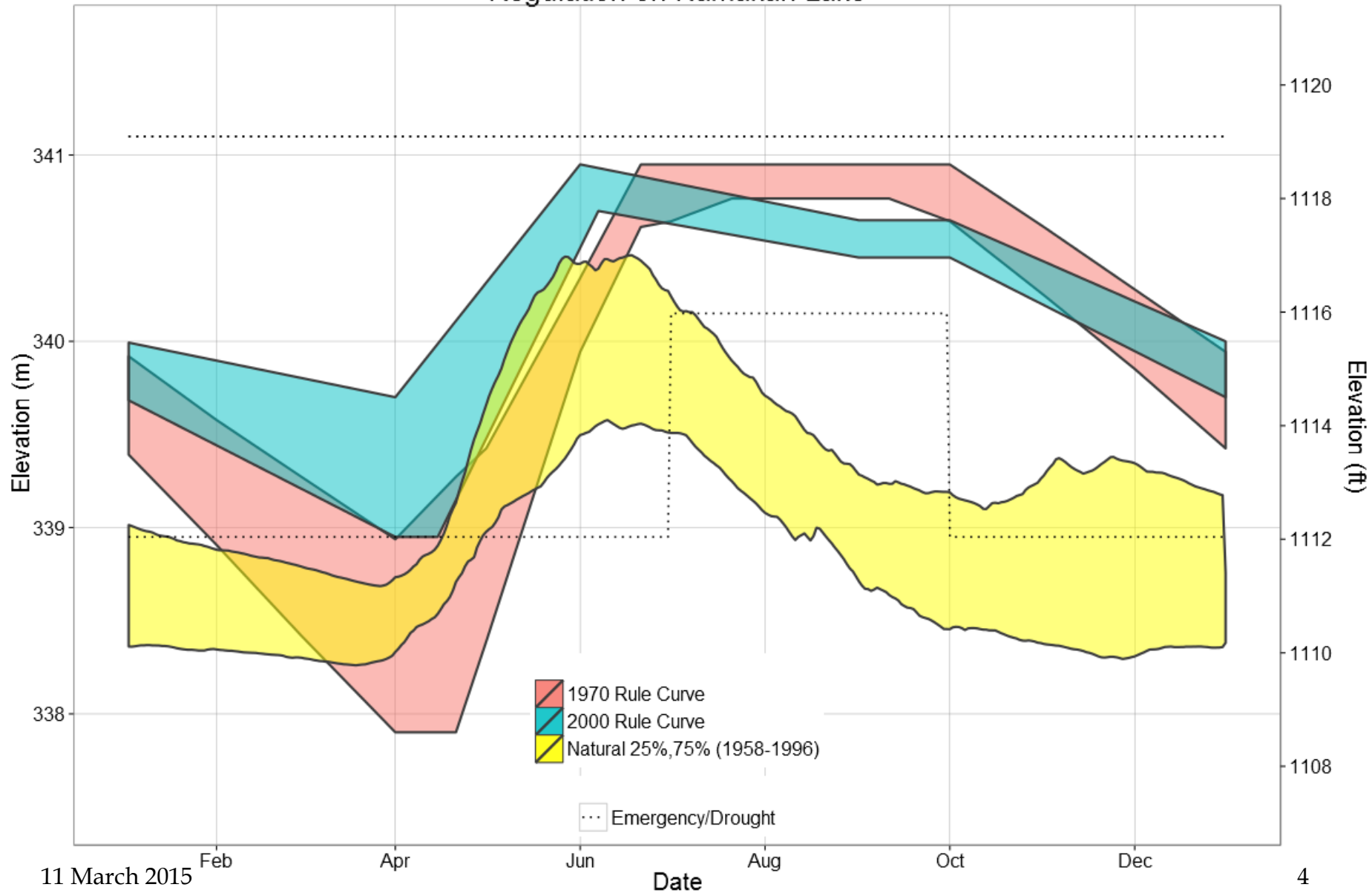
# COMPARISON OF RULE CURVES RAINY LAKE

## Regulation on Rainy Lake



# COMPARISON OF RULE CURVES FOR NAMAKAN LAKE

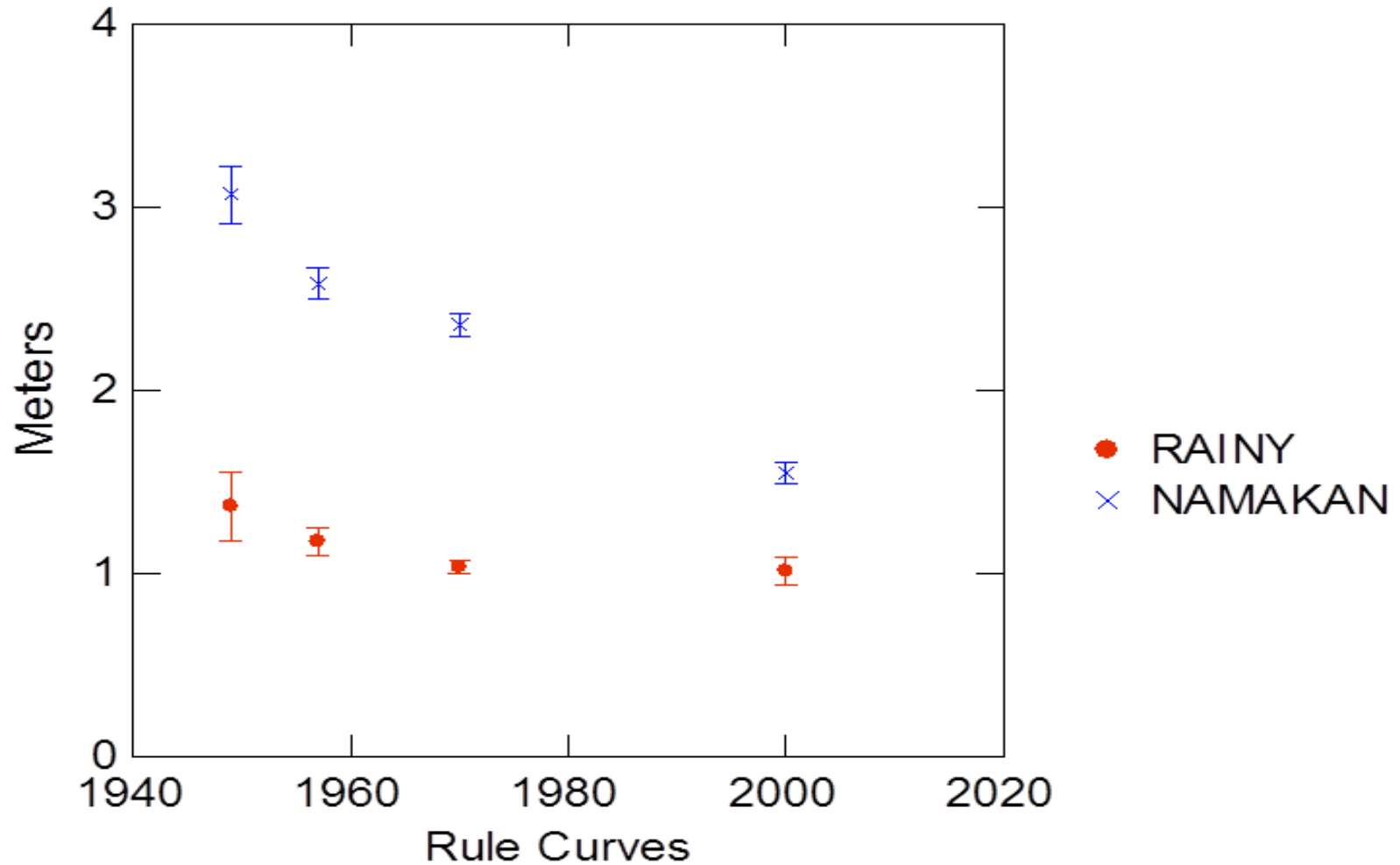
## Regulation on Namakan Lake



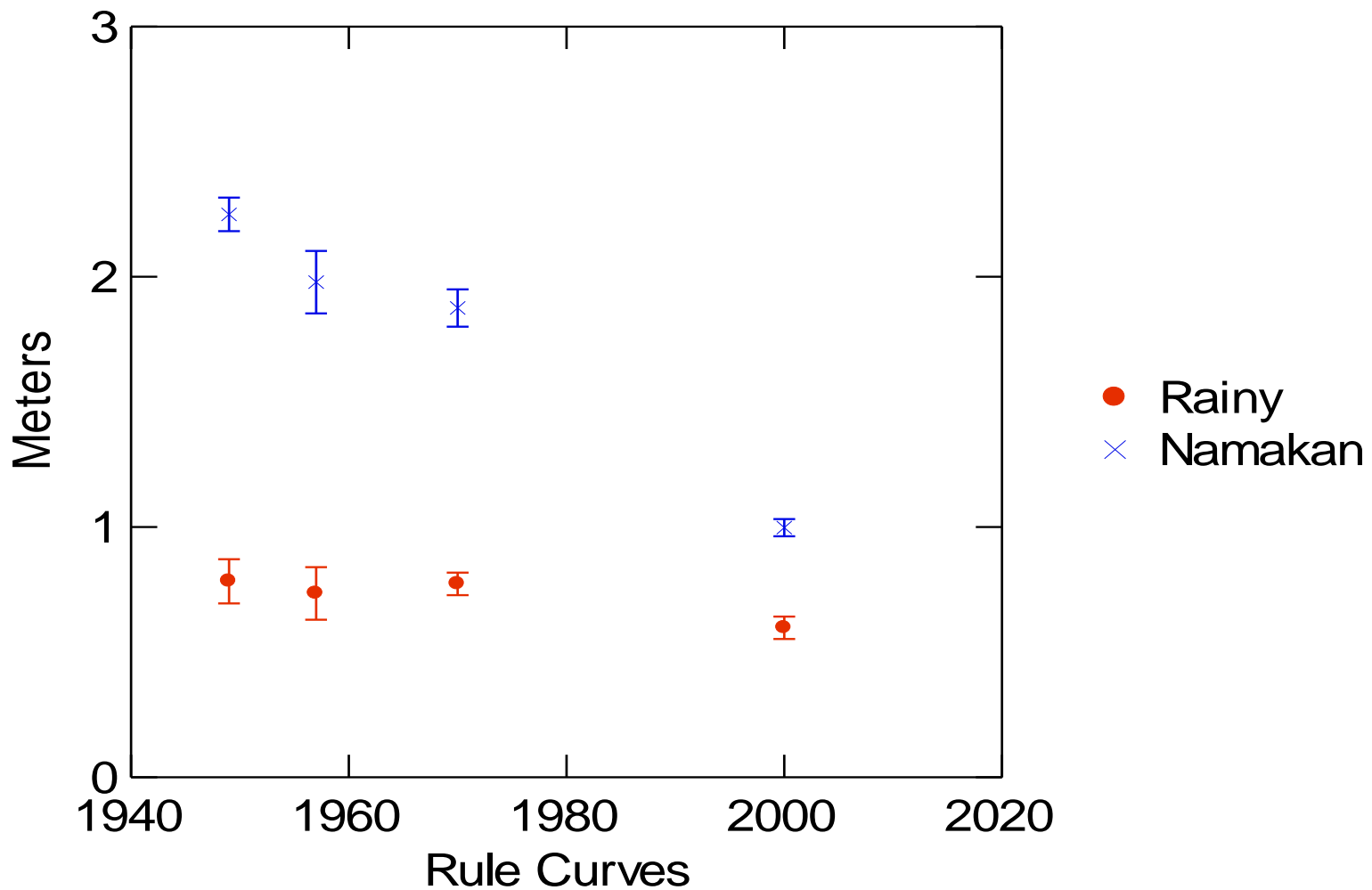
# AIMS OF 2000 RULE CURVES

- ▣ Provide a water management program for Namakan chain of lakes closer to the magnitude and timing of natural fluctuations with which the affected species and biotic communities evolved.
- ▣ Less than natural fluctuations were maintained on Rainy Lake in order to protect from ice damage and provide drought protection.
- ▣ A slightly higher risk of water levels above the all gates open level for both lakes was considered acceptable.

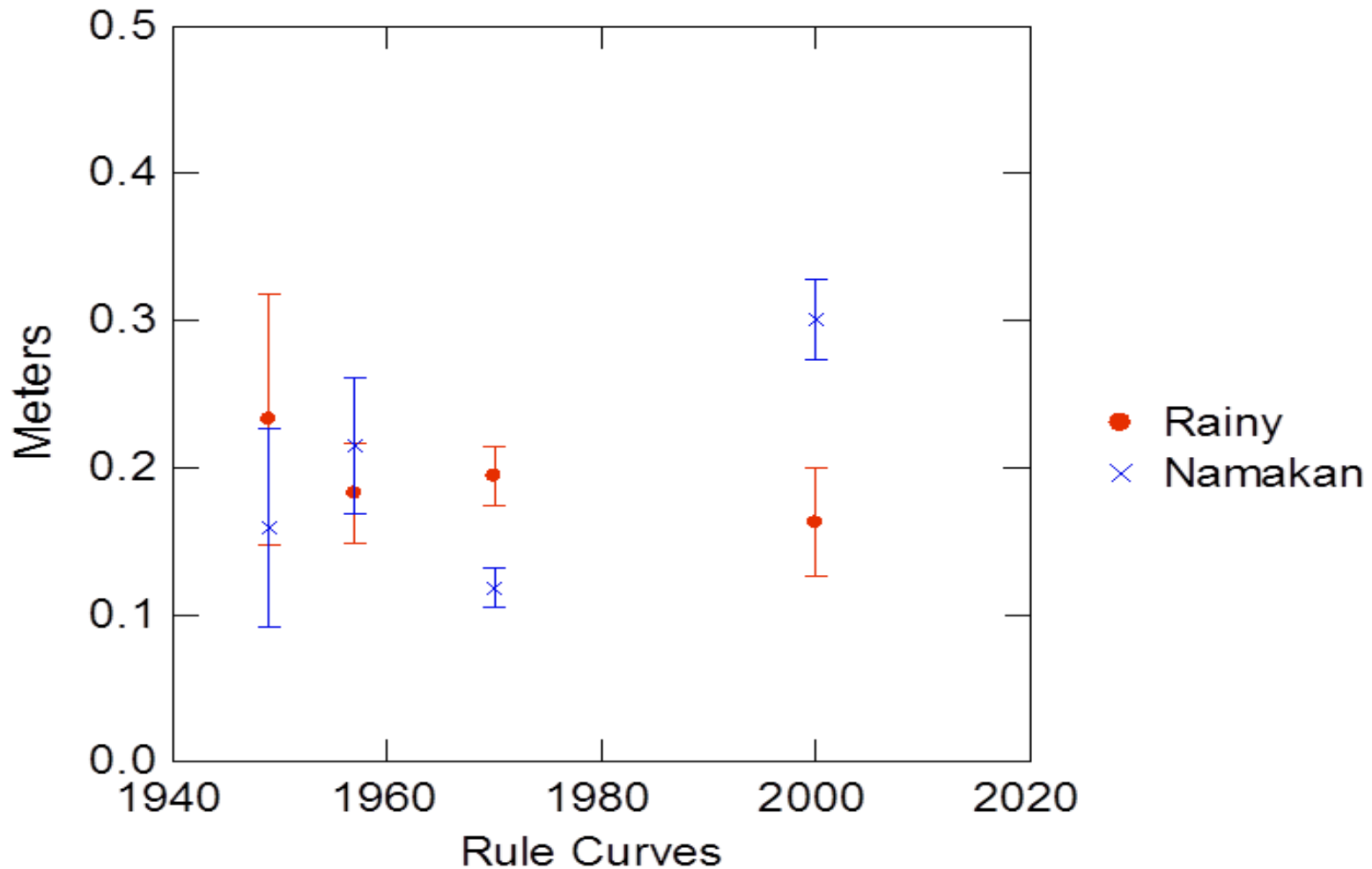
# MEAN ANNUAL FLUCTUATIONS ON RAINY AND NAMAKAN LAKES OVER THE YEARS OF REGULATION



# MEAN WINTER DRAWDOWNS ON RAINY AND NAMAKAN LAKES OVER THE YEARS OF REGULATION

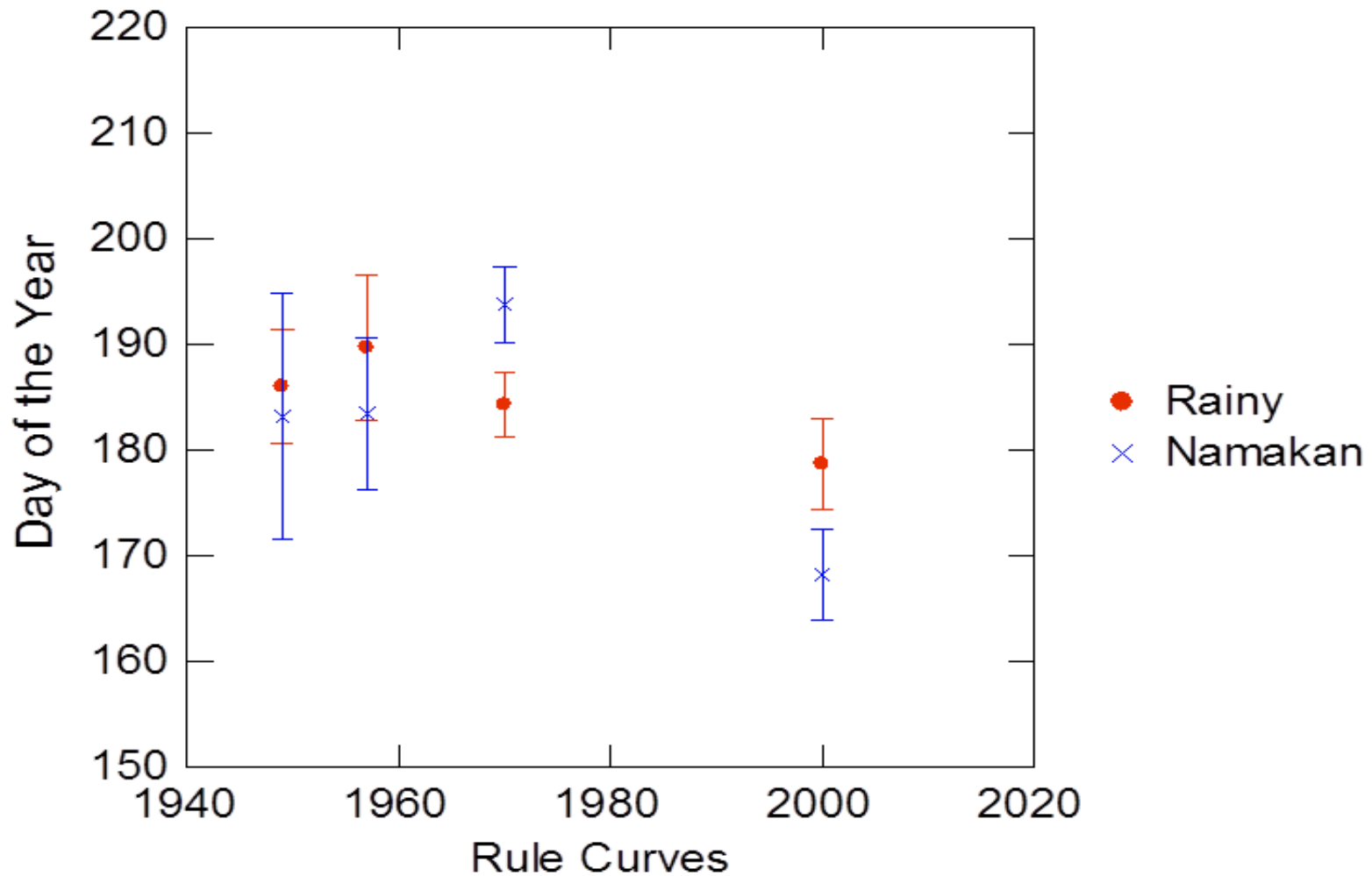


# MEAN SUMMER DRAWDOWN ON RAINY AND NAMAKAN LAKES OVER THE YEARS OF REGULATION

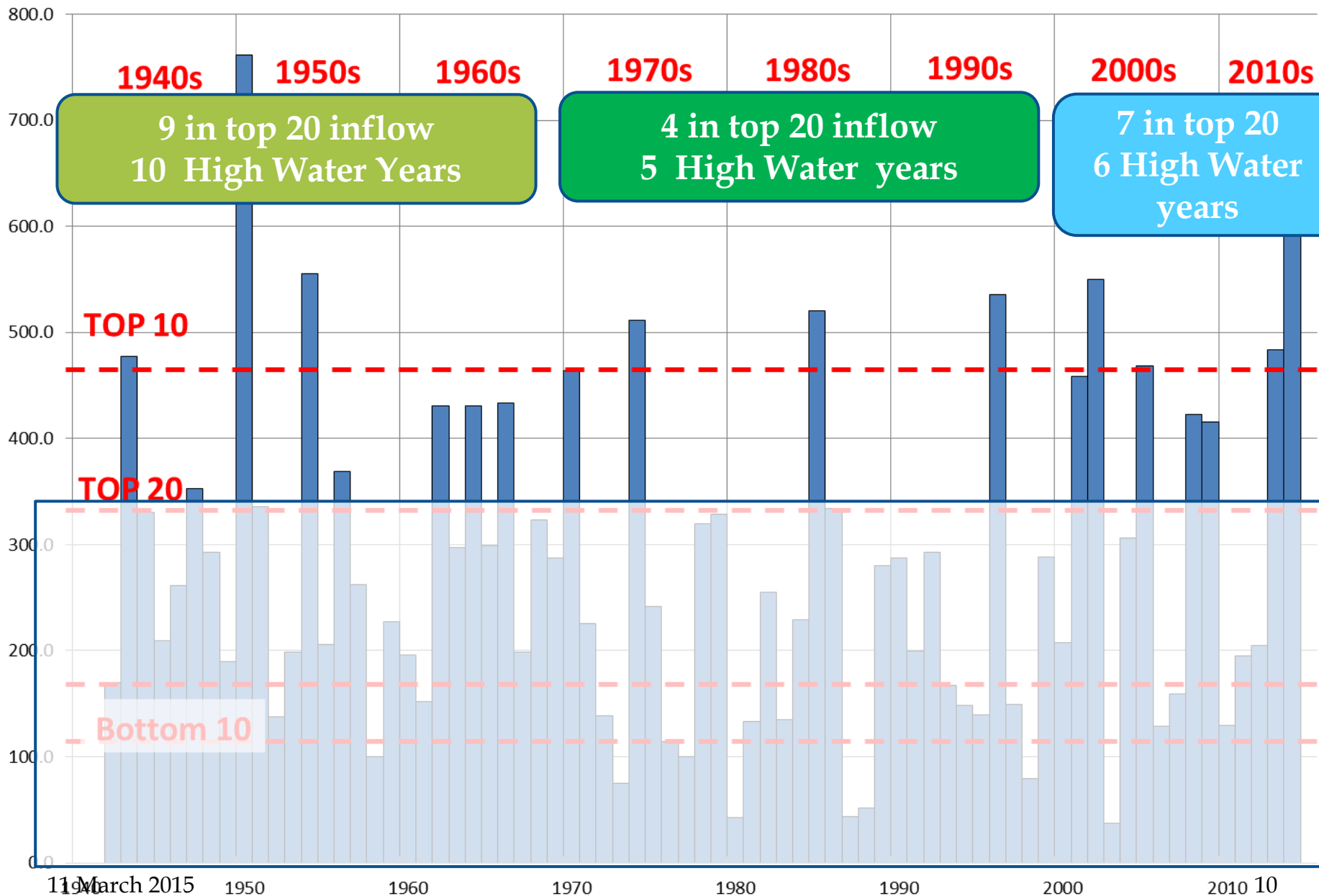




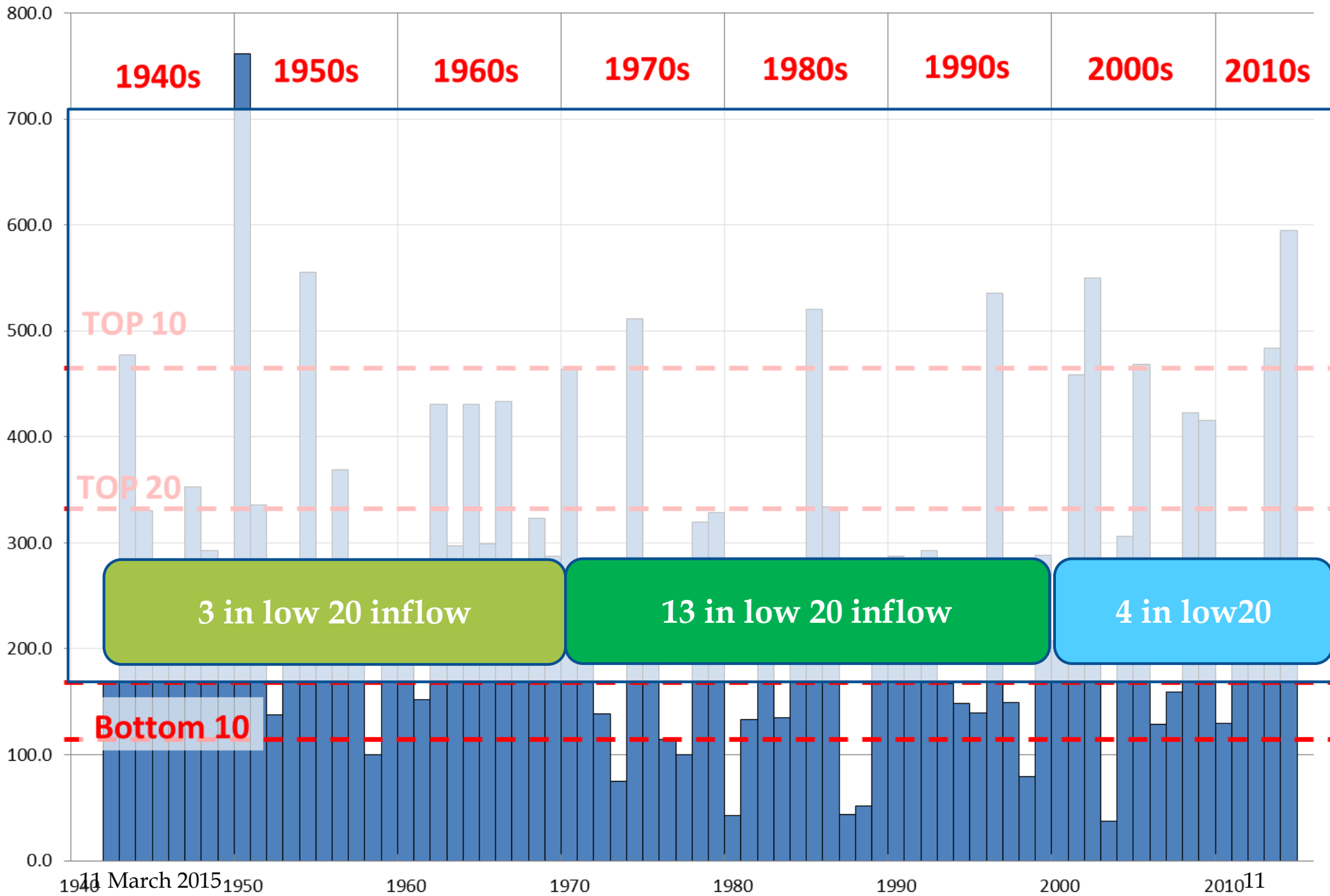
# PEAK WATER LEVEL DAY OF THE YEAR ON RAINY AND NAMAKAN LAKES OVER THE YEARS OF REGULATION



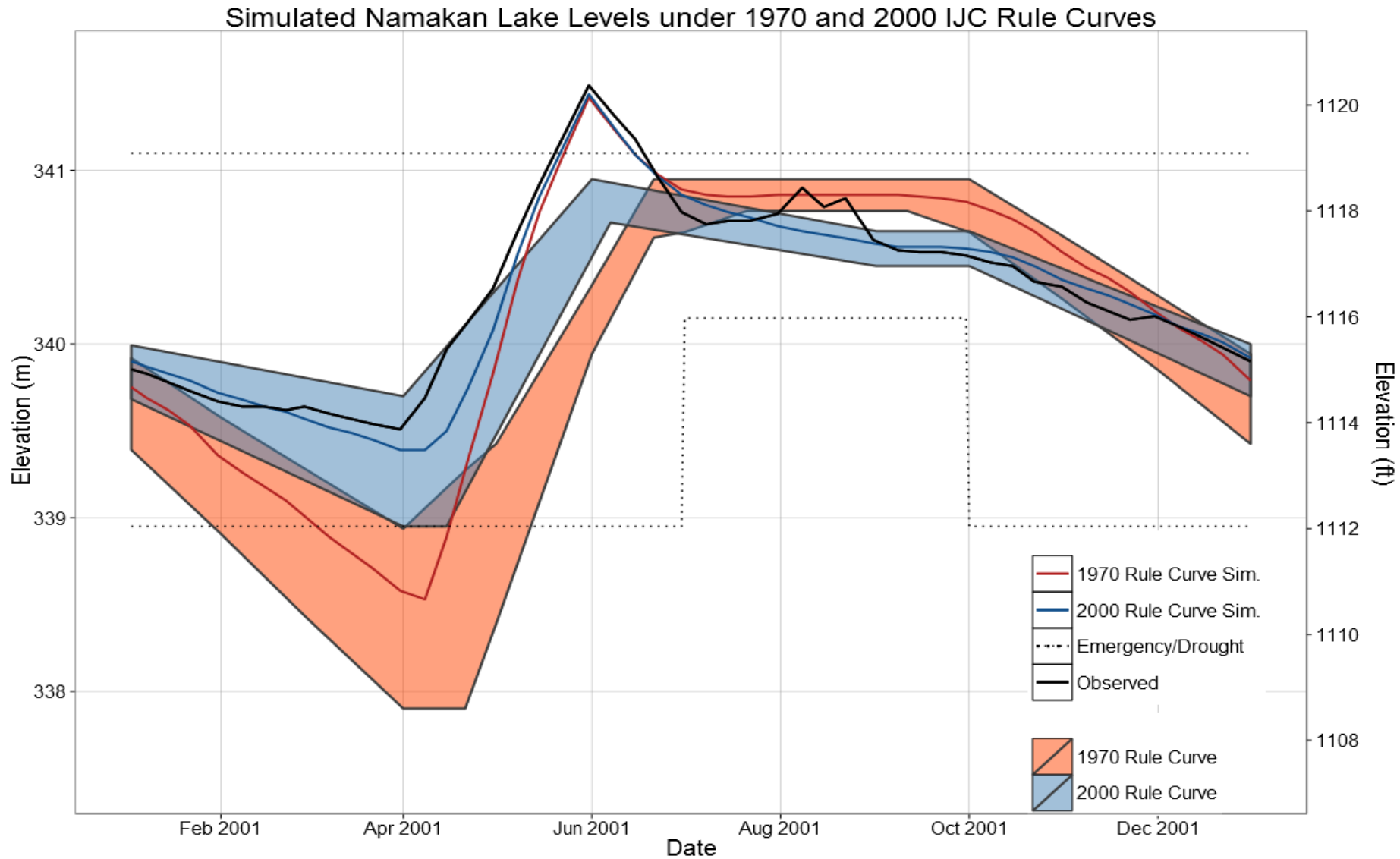
# Rainy Local Inflow May-June by year



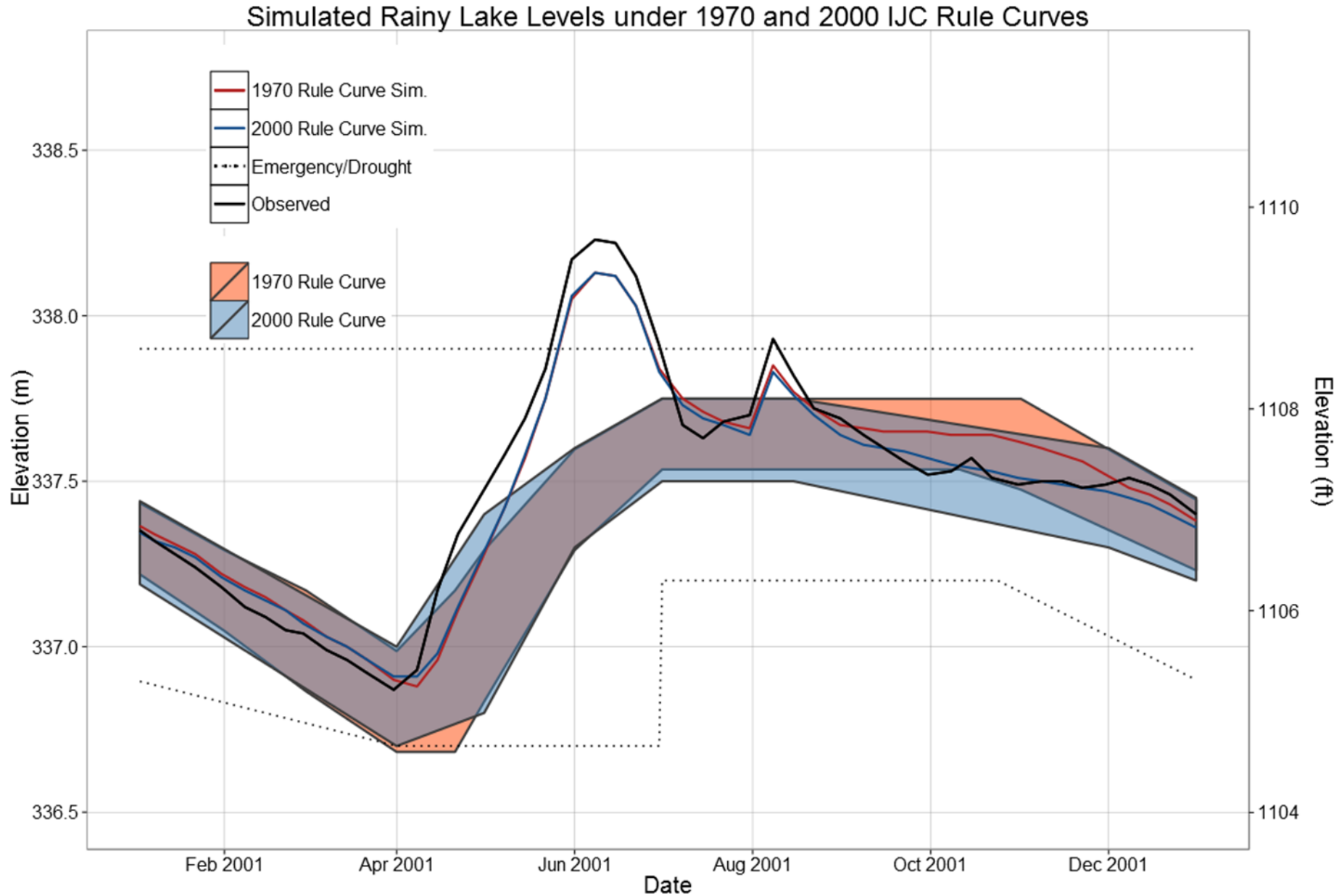
# Rainy Local Inflow May-June by year



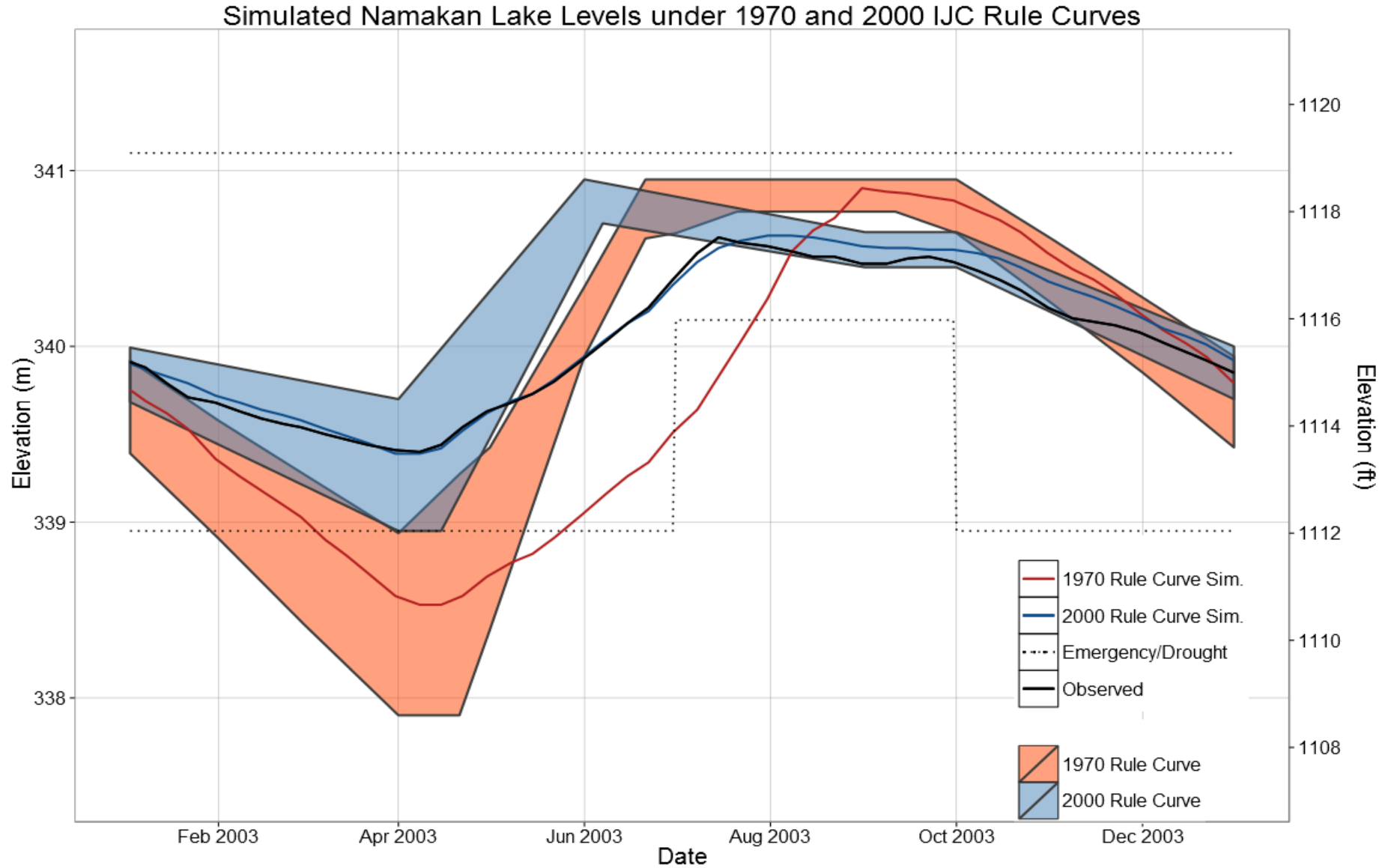
# SIMULATED 2001 INFLOWS ON THE NAMAKAN CHAIN OF LAKES



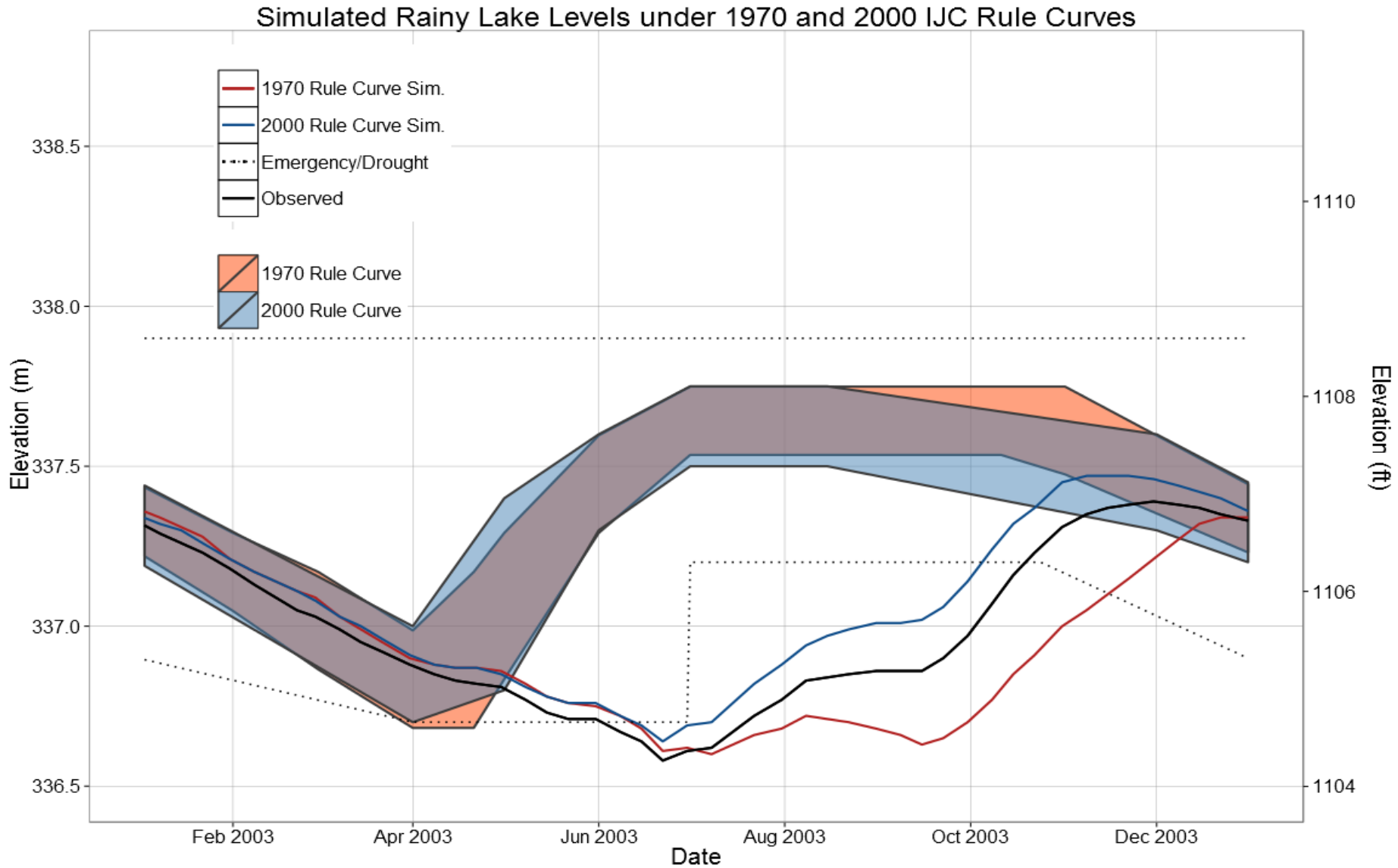
# SIMULATED 2001 INFLOWS ON RAINY LAKE



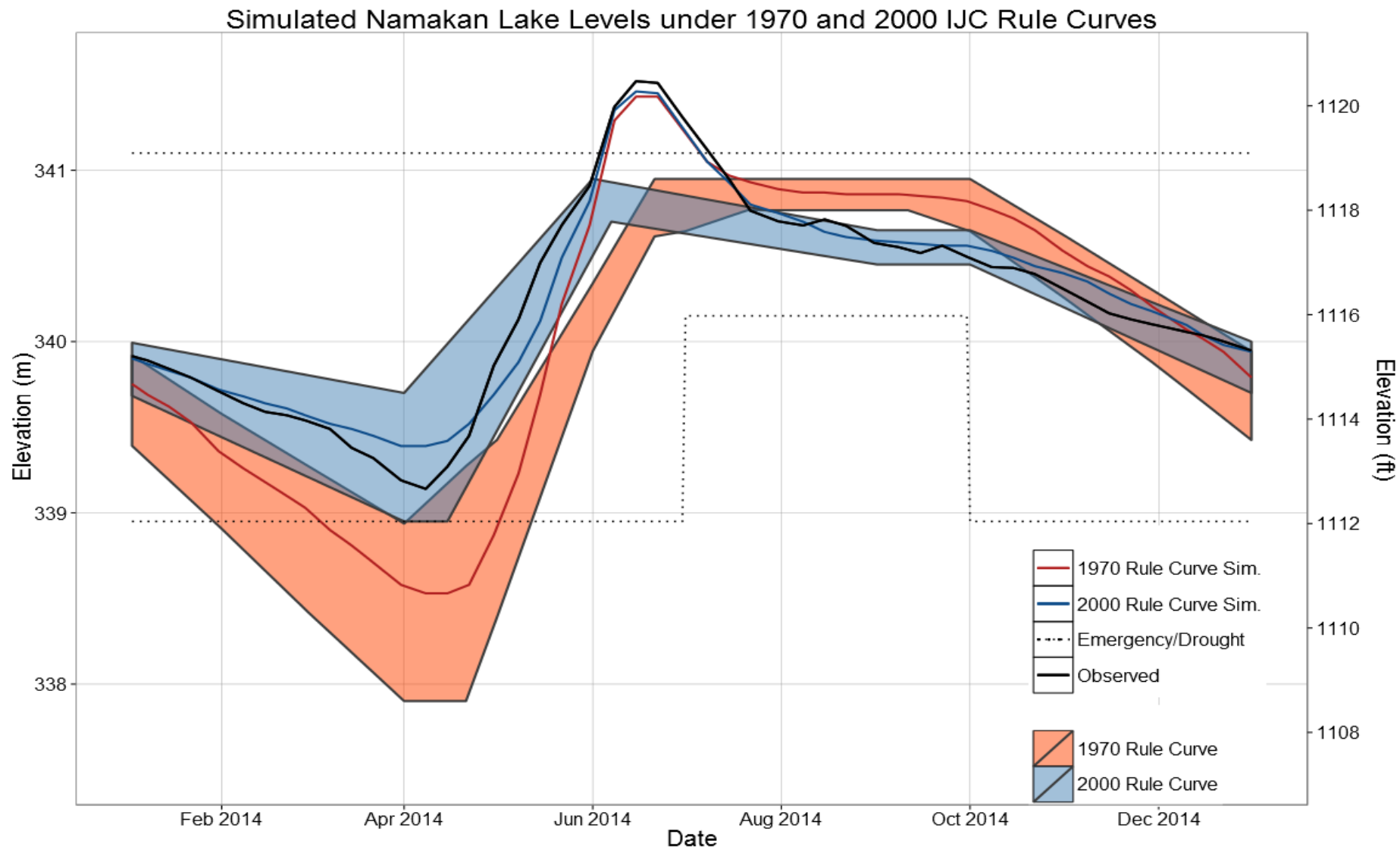
# SIMULATED 2003 INFLOWS ON NAMAKAN CHAIN OF LAKES



# SIMULATED 2003 INFLOWS ON RAINY LAKE

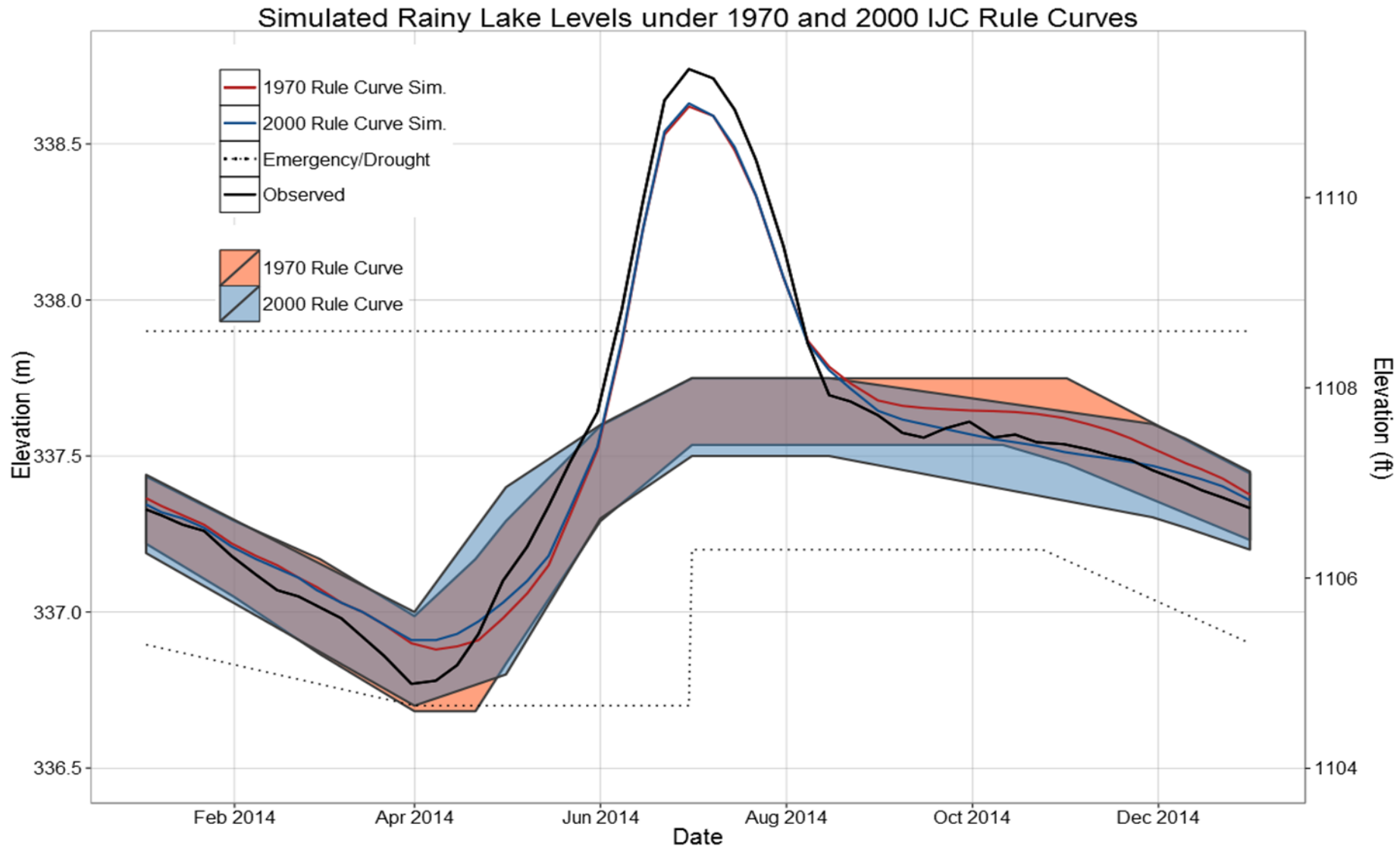


# SIMULATED 2014 INFLOWS ON NAMAKAN CHAIN OF LAKES





# SIMULATED 2014 INFLOWS ON RAINY LAKE



# NAMAKAN CHAIN OF LAKES RULE CURVE VIOLATIONS

## Annual Summary of Rule Curve Violations

Namakan Chain of Lakes violations (days)									
	Observed_2000curve			modeled_2000curve			modeled_1970curve		
	Above URC	Above AGO	Below LRC	Above URC	Above AGO	Below LRC	Above URC	Above AGO	Below LRC
2000	0	0	0	0	0	10	0	0	45
2001	91	28	0	56	24	0	65	22	0
2002	40	5	0	0	0	4	0	0	38
2003	0	0	67	0	0	72	0	0	107
2004	9	0	0	0	0	10	0	0	26
2005	27	0	0	0	0	4	0	0	6
2006	0	0	22	0	0	10	0	0	29
2007	50	0	26	40	0	32	26	0	59
2008	72	26	0	54	10	0	56	6	0
2009	11	0	0	7	0	0	50	0	0
2010	7	0	48	0	0	60	0	0	82
2011	0	0	5	0	0	10	0	0	26
2012	0	0	0	0	0	10	0	0	43
2013	0	0	5	0	0	1	1	0	0
2014	59	36	0	58	31	0	61	30	4
<b>Totals</b>	<b>366</b>	<b>95</b>	<b>173</b>	<b>215</b>	<b>65</b>	<b>223</b>	<b>259</b>	<b>58</b>	<b>465</b>
Percentages	<b>6.7%</b>	<b>1.7%</b>	<b>3.2%</b>	<b>3.9%</b>	<b>1.2%</b>	<b>4.1%</b>	<b>4.7%</b>	<b>1.1%</b>	<b>8.5%</b>

# RAINY LAKE RULE CURVE VIOLATIONS

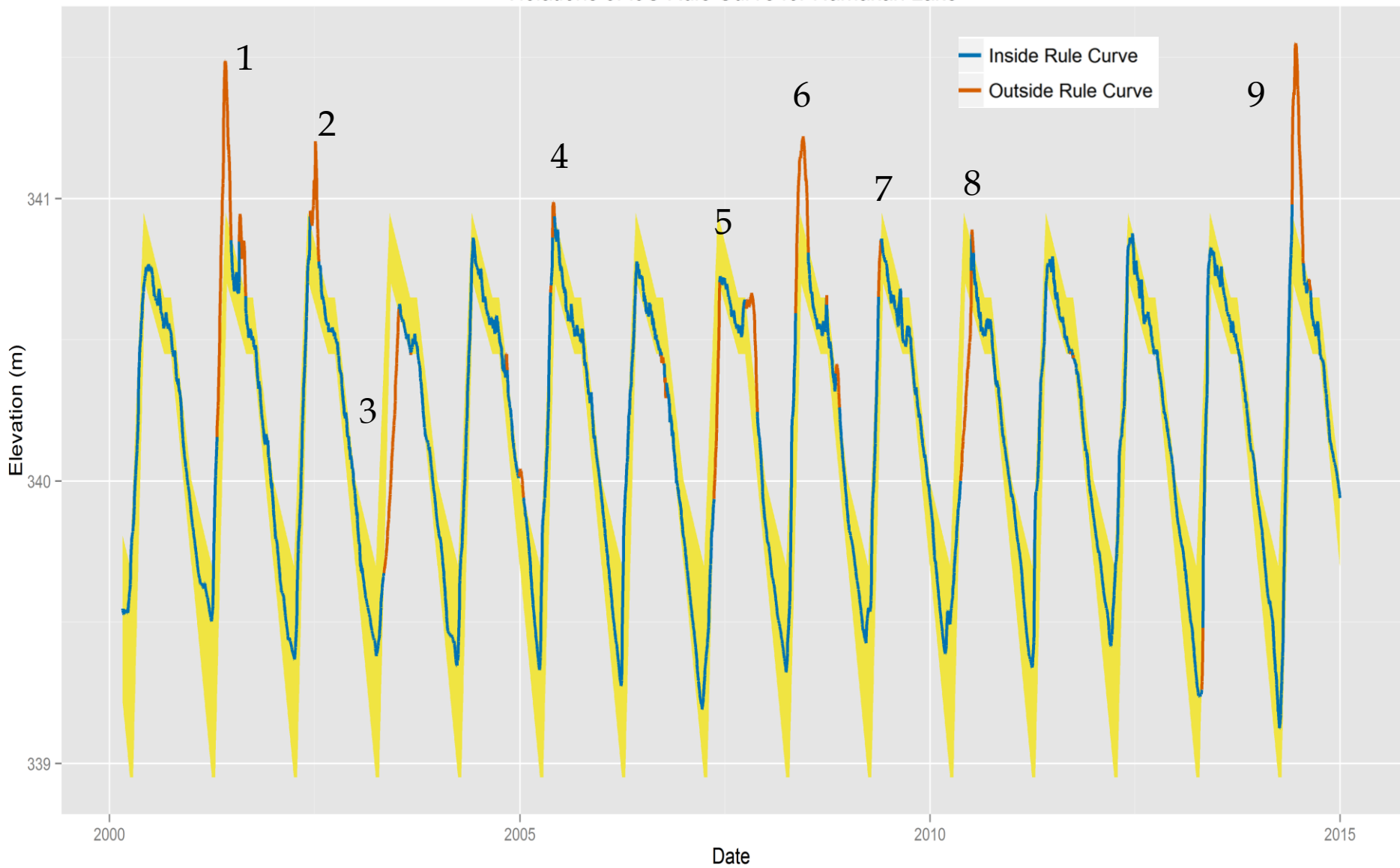
## Annual Summary of Rule Curve Violations

Rainy Lake Violations (days)									
	Observed_2000curve			modeled_2000curve			modeled_1970curve		
	Above URC	Above AGO	Below LRC	Above URC	Above AGO	Below LRC	Above URC	Above AGO	Below LRC
2000	3	0	0	0	0	0	0	0	0
2001	99	46	0	70	32	0	81	32	0
2002	48	43	0	50	41	0	51	41	29
2003	0	0	189	0	0	172	0	0	224
2004	0	0	0	0	0	0	2	0	0
2005	41	18	0	28	0	0	28	0	0
2006	0	0	125	0	0	121	0	0	129
2007	0	0	113	0	0	164	0	0	212
2008	72	41	0	53	27	0	54	27	0
2009	61	0	0	36	0	0	43	0	0
2010	0	0	58	0	0	64	0	0	74
2011	8	0	98	0	0	89	0	0	108
2012	7	0	59	0	0	56	0	0	89
2013	40	19	0	28	0	0	28	0	0
2014	76	63	0	78	59	0	79	59	0
<b>Totals</b>	<b>455</b>	<b>230</b>	<b>642</b>	<b>343</b>	<b>159</b>	<b>666</b>	<b>366</b>	<b>159</b>	<b>865</b>
<b>Percentages</b>	<b>8.3%</b>	<b>4.2%</b>	<b>11.7%</b>	<b>6.3%</b>	<b>2.9%</b>	<b>12.2%</b>	<b>6.7%</b>	<b>2.9%</b>	<b>15.8%</b>

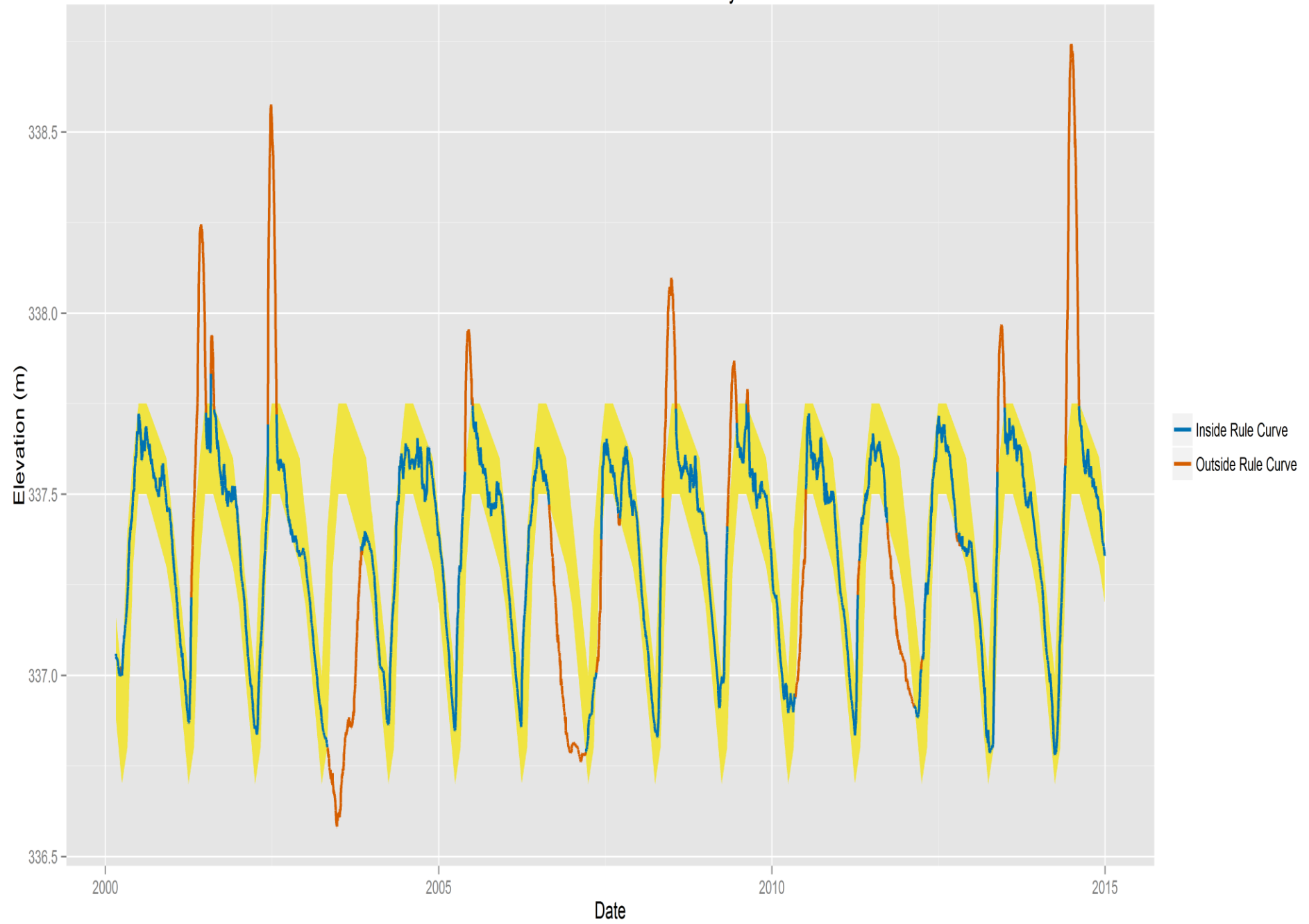
# IN CONCLUSION

- ▣ Since 2000 high or low inflows have seen water levels violate the rule curves **12 times on Rainy Lake** and **9 times on the Namakan** chain of lakes
- ▣ If the 1970 rule curves had been followed the number of violations would have been the **same** during extremely **high inflows** and **worse** during extremely **low inflows**.
- ▣ When inflows are not extreme the rule curves are **meeting their objective**, particularly during dry conditions.

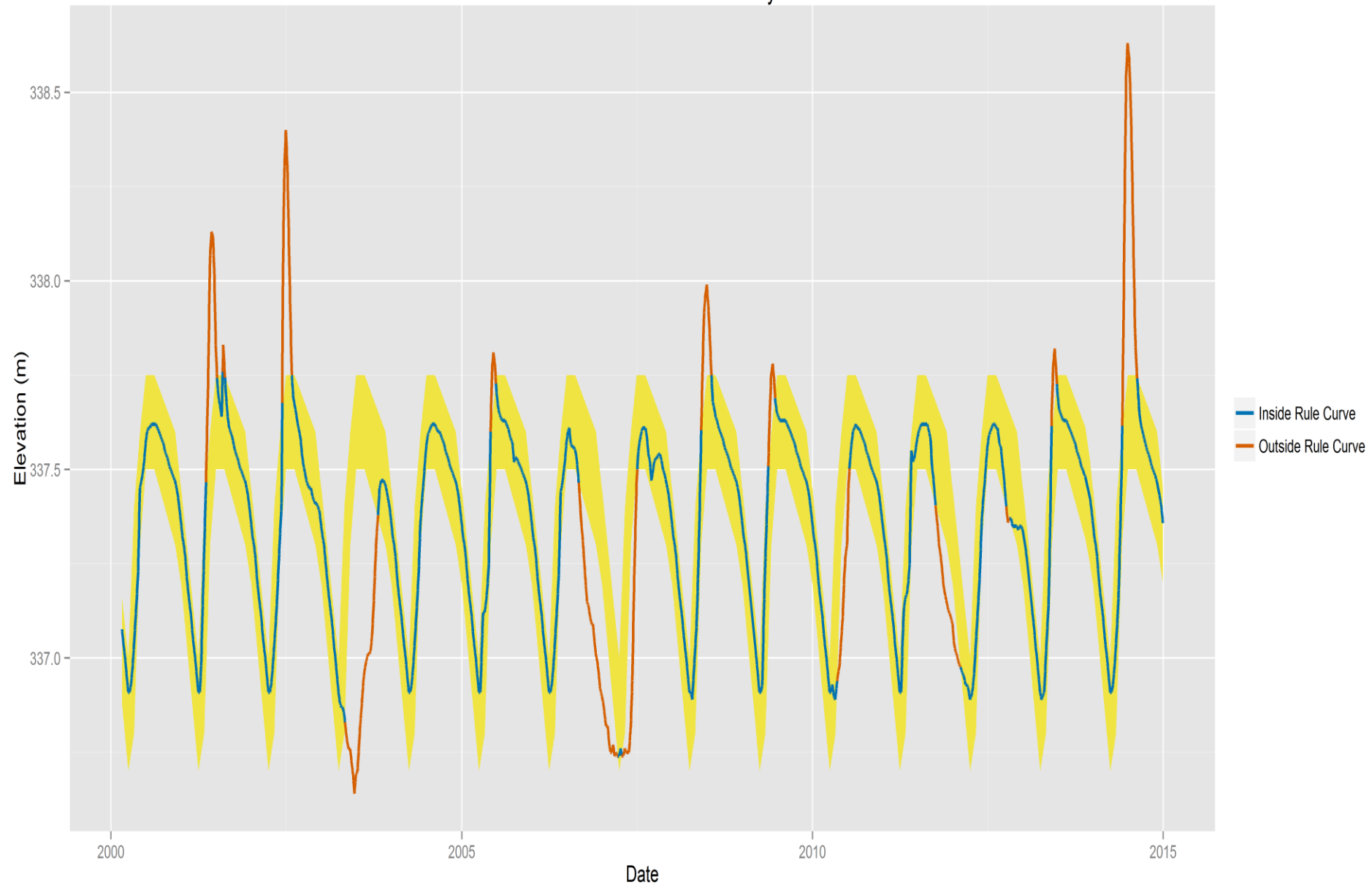
Violations of IJC Rule Curve for Namakan Lake



Violations of IJC Rule Curve for Rainy Lake



Violations of IJC Rule Curve for Rainy Lake



# Violations of IJC Rule Curve for Rainy Lake

