Maine Lake Ice-out Dates 1807-2018

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Lake Stewards of Maine
Turner, Maine
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contents

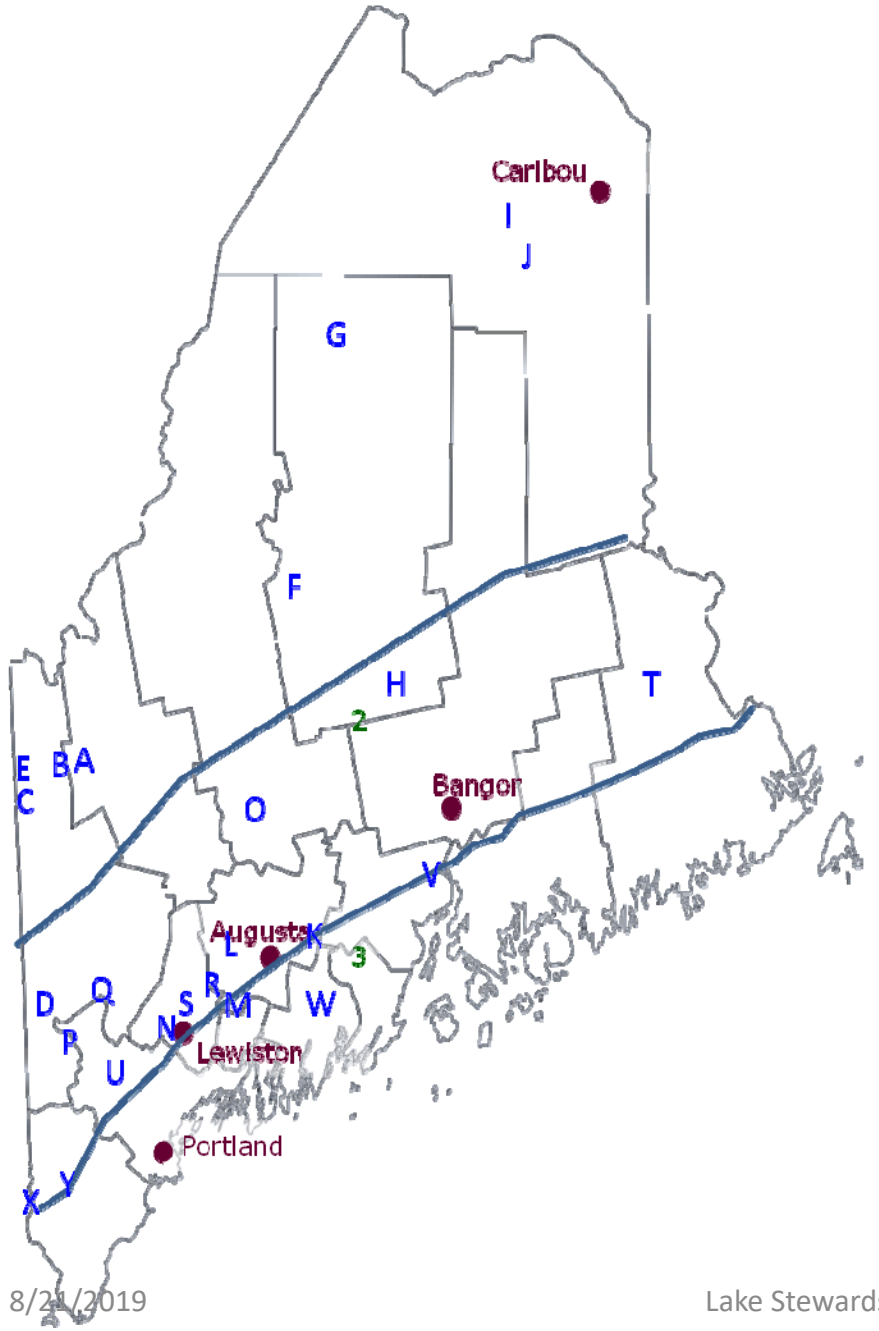
- What are we measuring?
- What is the trend since 19th century?
- Geographic and other Relationships
- What does it all Mean?

measurement vs observation

- Ice outs integrate many weather influences
- Therefore biologically significant
- Only longterm weather measure we have
  - (some weather measures available monthly for 3 regions since 1895)

…measurement

- Not always standardized; Not instrumental
- Observed for business reasons not science!
- Gratitude to Glenn Hodgkins of USGS and all who kept these records!



Climate Regions
1 Northern
2 Southern Interior
3 Coastal

Region	Lake	Town/Area	Legend
Mountains	Rangeley Lake	Rangeley	A
	Mooselookmeguntic Lake	Rangeley	B
	Richardson Lake	Magalloway Plt	C
	Kezar Lake	Lovell	D
	Aziscohos Lake	Lincoln Plt	E
Northern Maine	Moosehead Lake	Greenville	F
	Eagle Lake	Eagle Lake	G
	Sebec Lake	Sebec	H
	Portage Lake	Portage Lake	I
	Soeper (Squapan) Lake	Ashland	J
Central Maine	China Lake	China	K
	Messalonskee Lake	Oakfield	L
	Cobbosseecontee Lake	Litchfield	M
	Lake Auburn	Auburn	N
	Wesserunsett Lake	Madison	O
	Long Lake	Bridgton	P
	Pennesseewassee Lake	Norway	Q
	Cochnewagon Pond	Monmouth	R
	Sabattus Pond	Greene	S
Eastern Maine	West Grand Lake	Grand Lake Stream Plt	T
Coastal and	Sebago Lake	Casco	U
Southern Maine	Swan Lake	Frankfort	V
	Damariscotta Lake	Jefferson	W
	Wilson Lake	Acton	X
	Little Ossipee	Waterboro	Y

traits of the time series

- Volatile but few outliers
- Little correlation year to year
- Short term, may move against trend for some time
- For longest time series, changes are stat. significant by a variety of tests

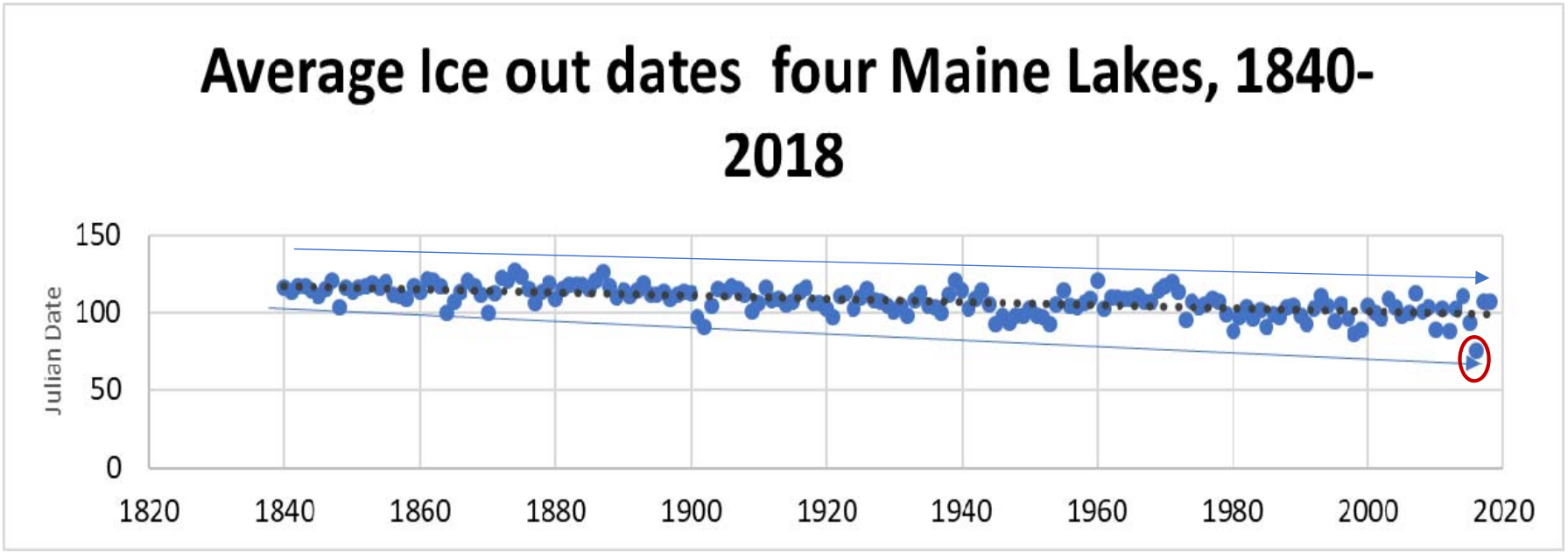
traits…

- Not synchronous: even for adjacent lakes
- Trade-off: for trends, use long series
- For studying influencing factors, must use weekly/daily data

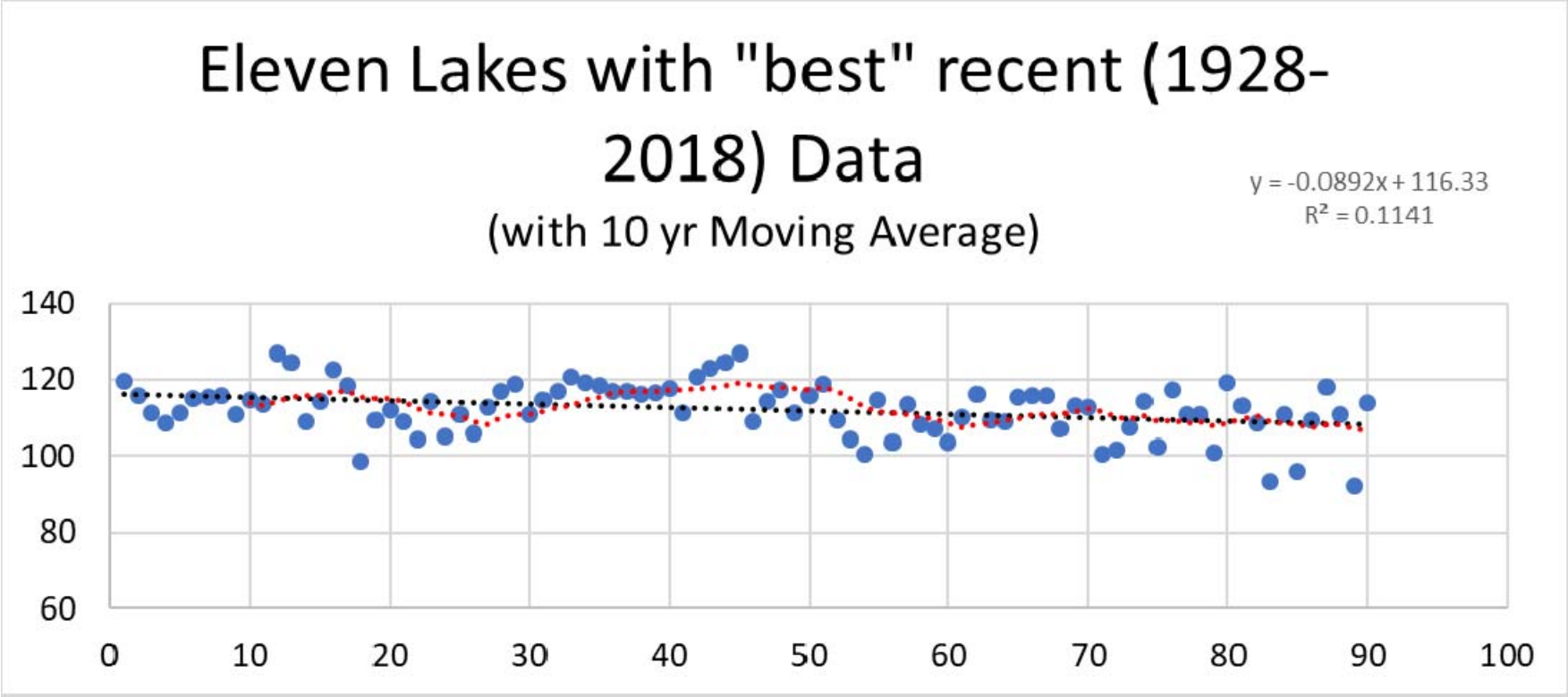
Pocasset
April
20,
22, 2:18 PM
Apr 22,
7:36,
Apr 25

regions: longterm changes

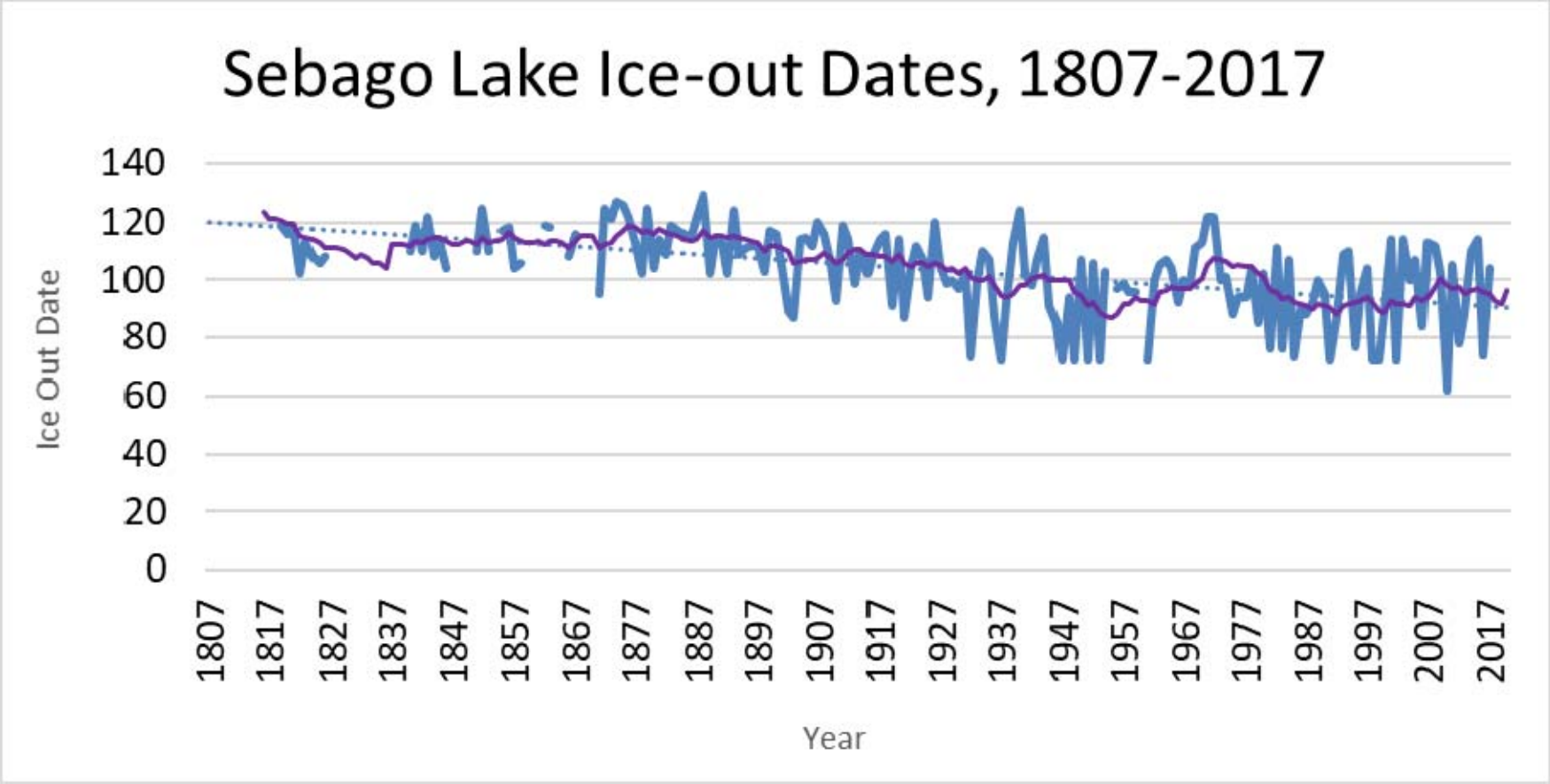
	Region				
	M	N	C	E	C&S
AVERAGES:					
1880's/90's to 2018	123.7	123.9	109.1	117.8	107.0
CHANGES:					
1880s/90s to 2000s	12.6	6.5	12.9	12.4	13.5



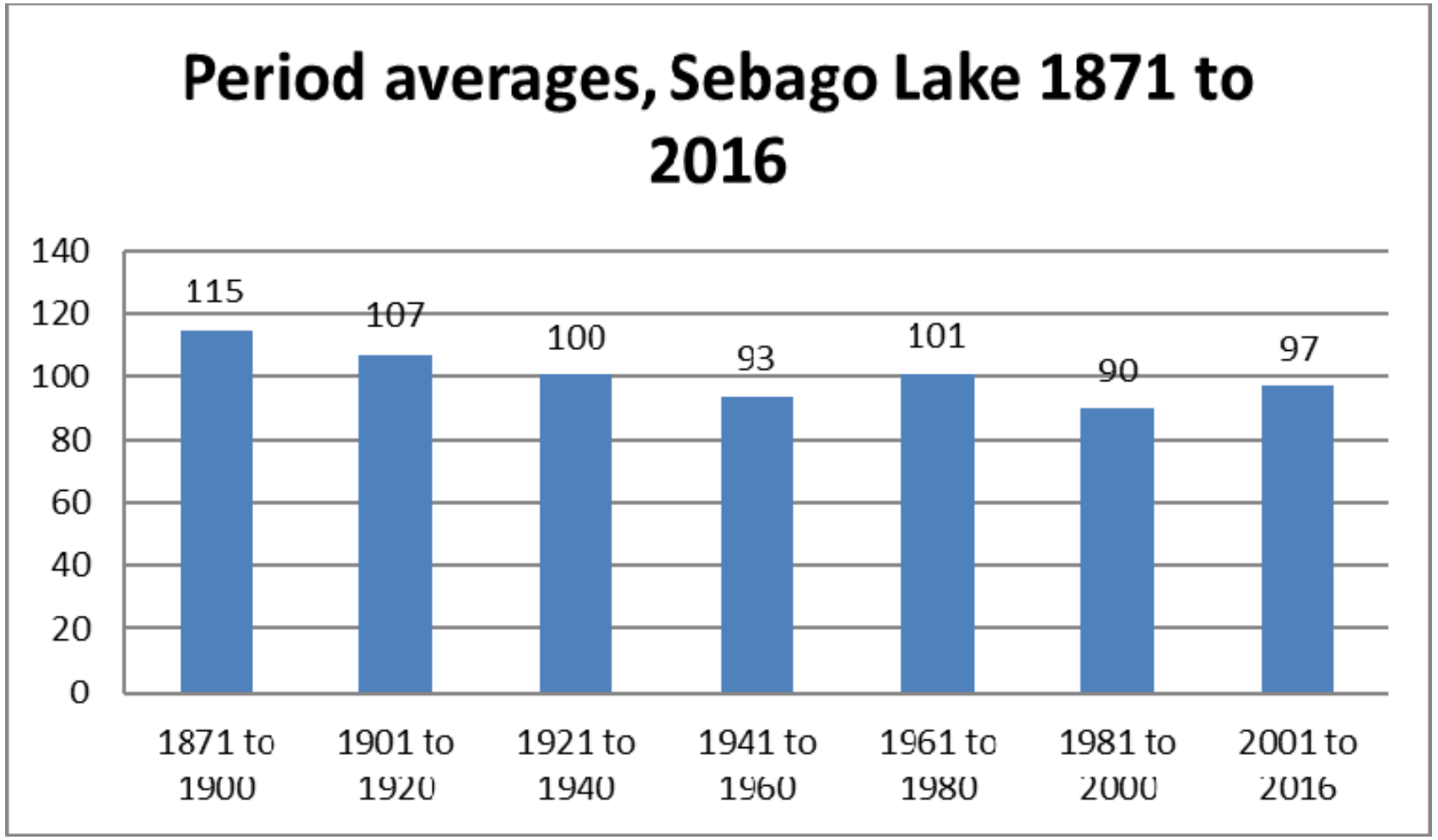
Cobbossee, L. Auburn, Sebago, Damariscotta
Red is 2016 --alltime record


Eleven Lakes with "best" recent (1928-2018) Data
(with 10 yr Moving Average)
y = -0.0892x + 116.33
R² = 0.1141
140
120
100
80
60
0
10
20
30
40
50
60
70
80
90
100

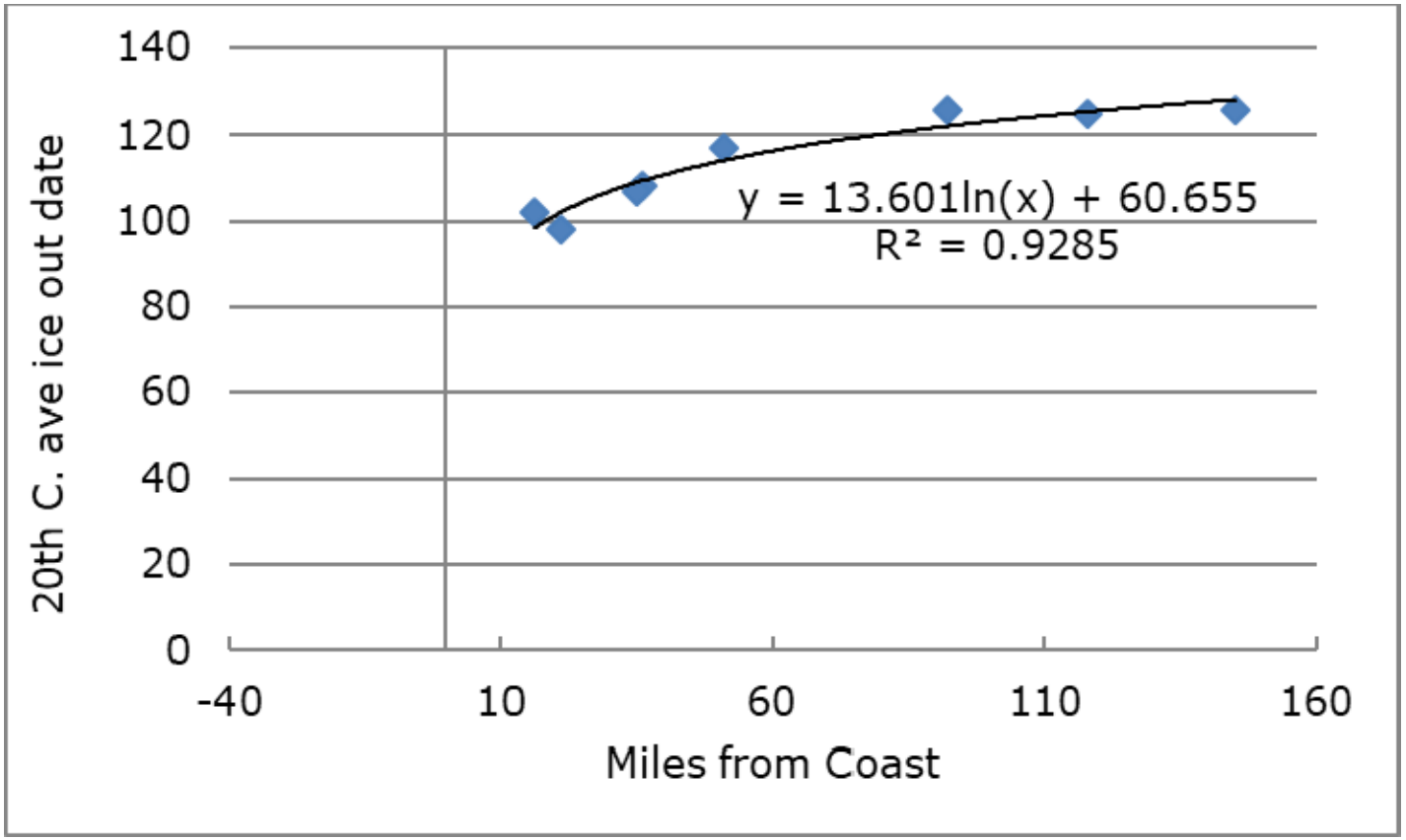
our oldest time series : ain't it beautiful?



trend? watch what period you analyze!



distance from coast counts



Rangeley, Moosehead, Portage, Cobbossee, L. Auburn, W. Grand, Sebago, and Damariscotta

winter severity does too

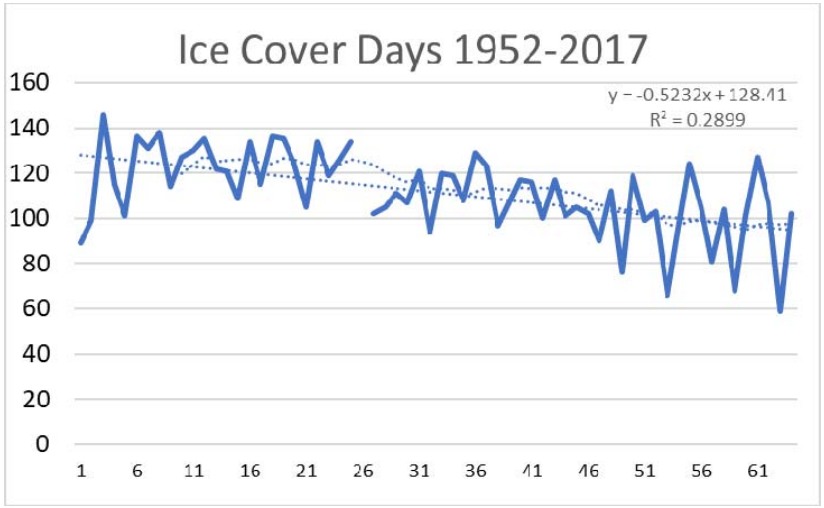
Table 9. Simple Correlation coefficients,

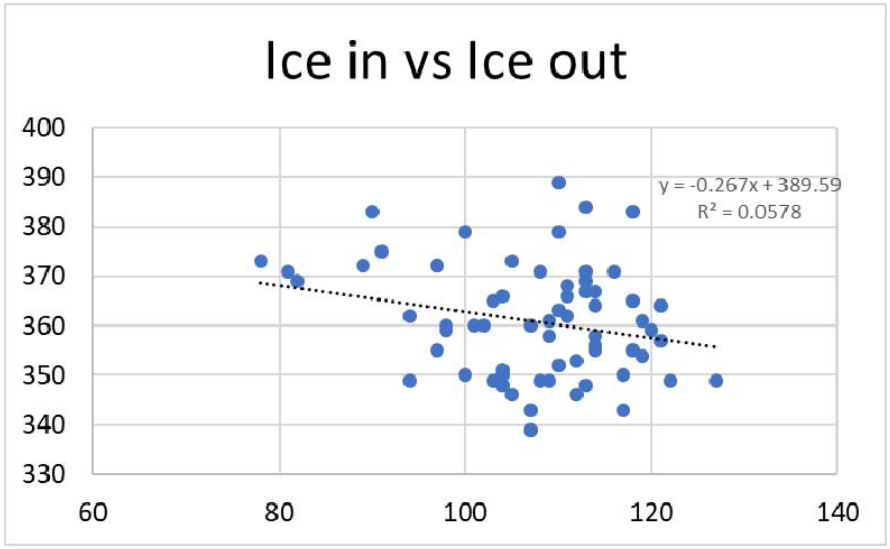
Lake Ice out dates and MDIFW Winter Severity Index

Lake	WSI Station	Correlation
Portage	Garfield Plantat	0.49
Moosehead	Beaver Cove	0.51
Auburn	Buckfield	0.68
Cobbossee	Manchester	0.55
Sebago	Gray	0.63

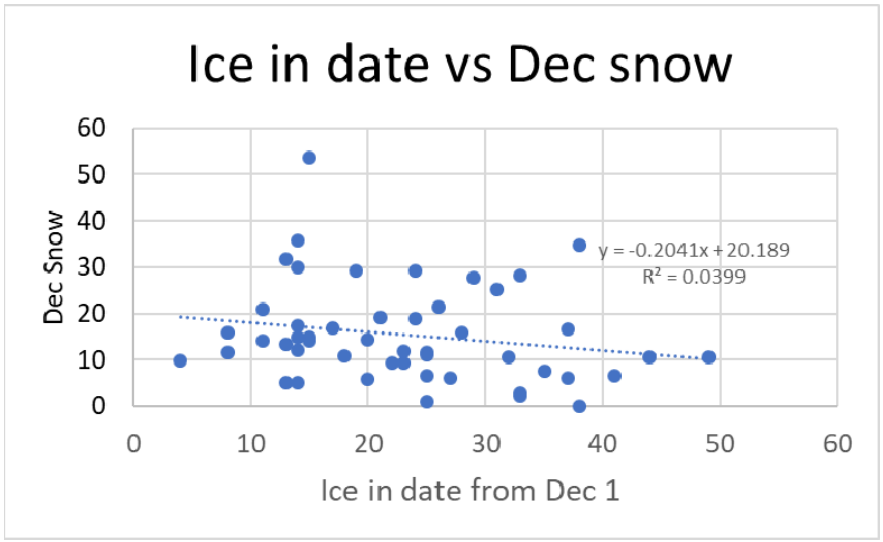
Data courtesy of Kyle Ravanna and Lee Kantar,

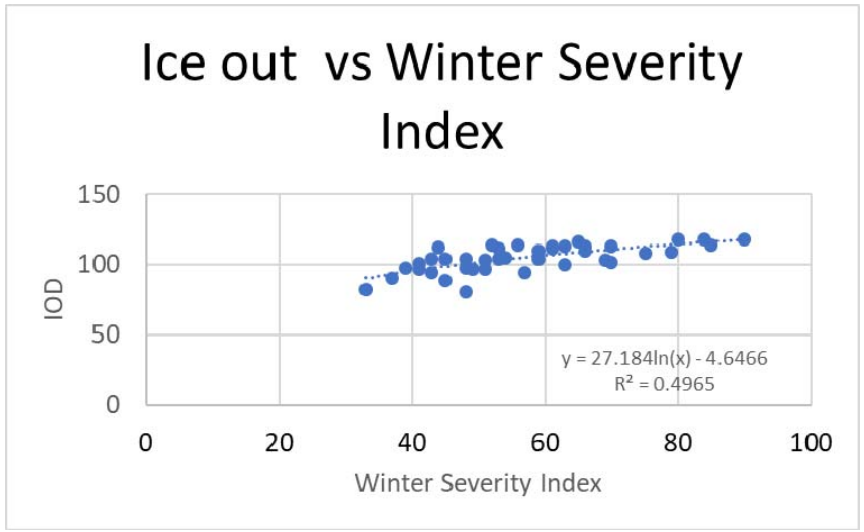
Maine Dept of Inland Fisheries and Wildlife





Ice Cover --Lake Auburn, 1952 to 2017





what's it all mean?

- **Changes in ice-free days** : several weeks since late 19th c.
  - Fish habitat
  - Phenology
  - Migratory waterfowl
  - Stratification & "plankton" ecosystems
- **As proxy for climate**
  - Significant changes in waters and ice-free days, for trivial changes in ave. annual temps.
  - Ecological Significance?

Backup

numerous factors are involved, so temperature dependence is weak

Lake	Month	Initial Yrs	R2 on regression	Temperature Location
Moosehead Lake	Apr	1895	0.33	CD 1
	Apr	1962	0.43	Brassua Dam
Portage	Apr	1939	0.39	Caribou
Rangeley	Apr	1970	0.62	Rangeley
	Apr	1970	0.57	CD 1
West Grand	Mar Apr	1962	0.35	Grand Lake Stream
L. Auburn	Mar Apr	1893	0.49	Lewiston
Sebago	March	1895	0.35	Portland
	Jan-Mar Ave	1895	0.53	"
Damariscotta	Apr	1895	0.33	CD 3
Cobbosseecontee	Mar Apr	1895	0.47	CD 2

are ice outs synchronous? rarely. look at the yellow box!

	Rangeley	Moosehead	Sebec	Portage	Maranacook	Cobbossee	L Auburn	Sabbatus Po	W. Grand	Sebago	Damariscotta
Rang	1.00										
Mhd	0.93	1.00									
Sebec	0.83	0.91	1.00								
Port	0.75	0.77	0.69	1.00							
Mar	0.66	0.71	0.75	0.45	1.00						
Cobb	0.17	0.15	0.15	0.10	0.18	1.00					
LAUB	0.74	0.79	0.83	0.54	0.87	0.16	1.00				
SAB	0.54	0.58	0.65	0.47	0.63	0.12	0.72	1.00			
W Grd	0.72	0.79	0.82	0.58	0.81	0.10	0.88	0.67	1.00		
Sebago	0.48	0.55	0.59	0.30	0.61	0.03	0.70	0.48	0.65	1.00	
Dam	0.12	0.09	0.09	0.12	0.10	0.86	0.06	0.00	0.03	-0.06	1.00

11 Lakes with best data 1928-2017