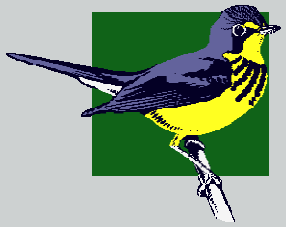
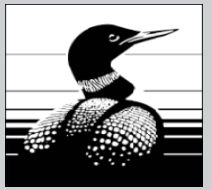
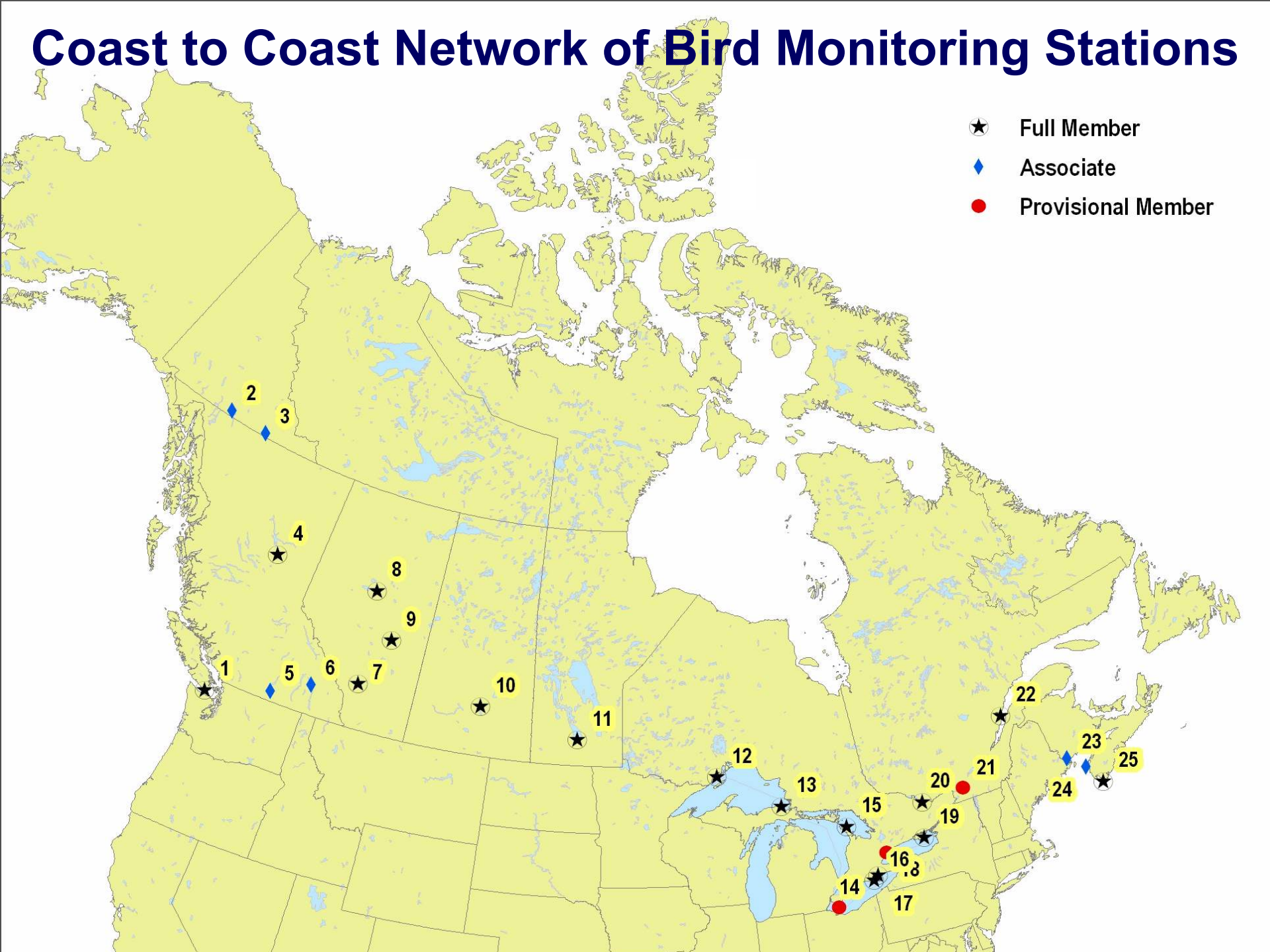


CANADIAN
MIGRATION
MONITORING
NETWORK



Coast to Coast Network of Bird Monitoring Stations



Migration Monitoring

"Monitoring can be defined as making repeat observations or measurements over time to determine a condition or track change"

Why Migration Monitoring?

- Detect change over time of population status of migrating landbirds in Canada, with a focus on "northern" species not well-monitored by other programs
- Conduct cooperative projects on bird migration and migration ecology
- Increase understanding of environmental conditions and connections

Species Selection

Analyze Landbird Migrants

Exclude

- raptors
- waterbirds
- waterfowl
- shorebirds
- irruptive/resident/nomadic species

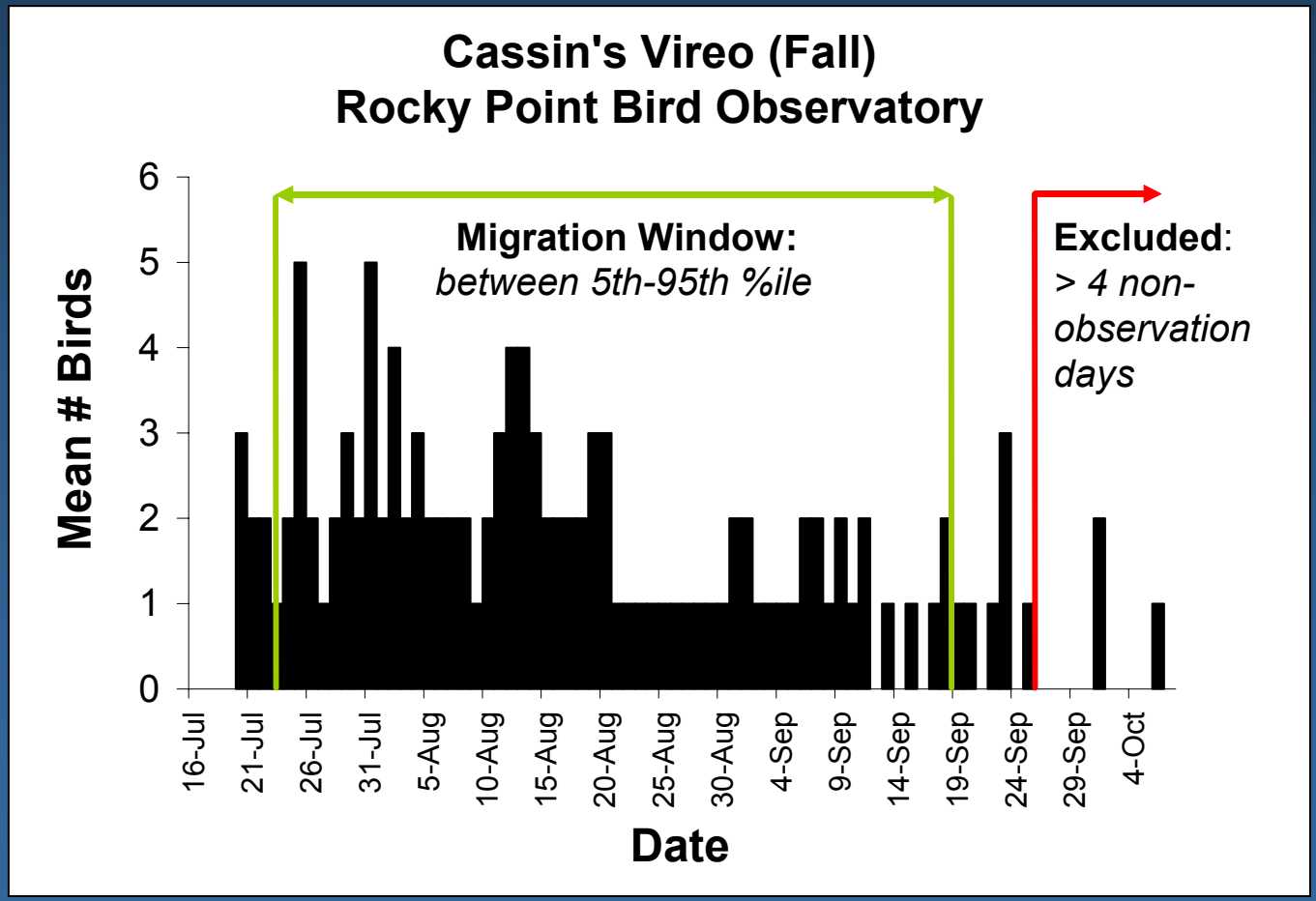
Exceptions made on station by station basis

Population Counts

- Count Methods:
  - Daily **Banding**
  - Daily Count ("**Census**")
  - **Visual Migration Count**
- Daily **Estimated Totals** **(ET)**
- Details of protocols vary among stations, but **standardized over long-term**

Migration Window

"Period when most individuals of a species migrate through an area"

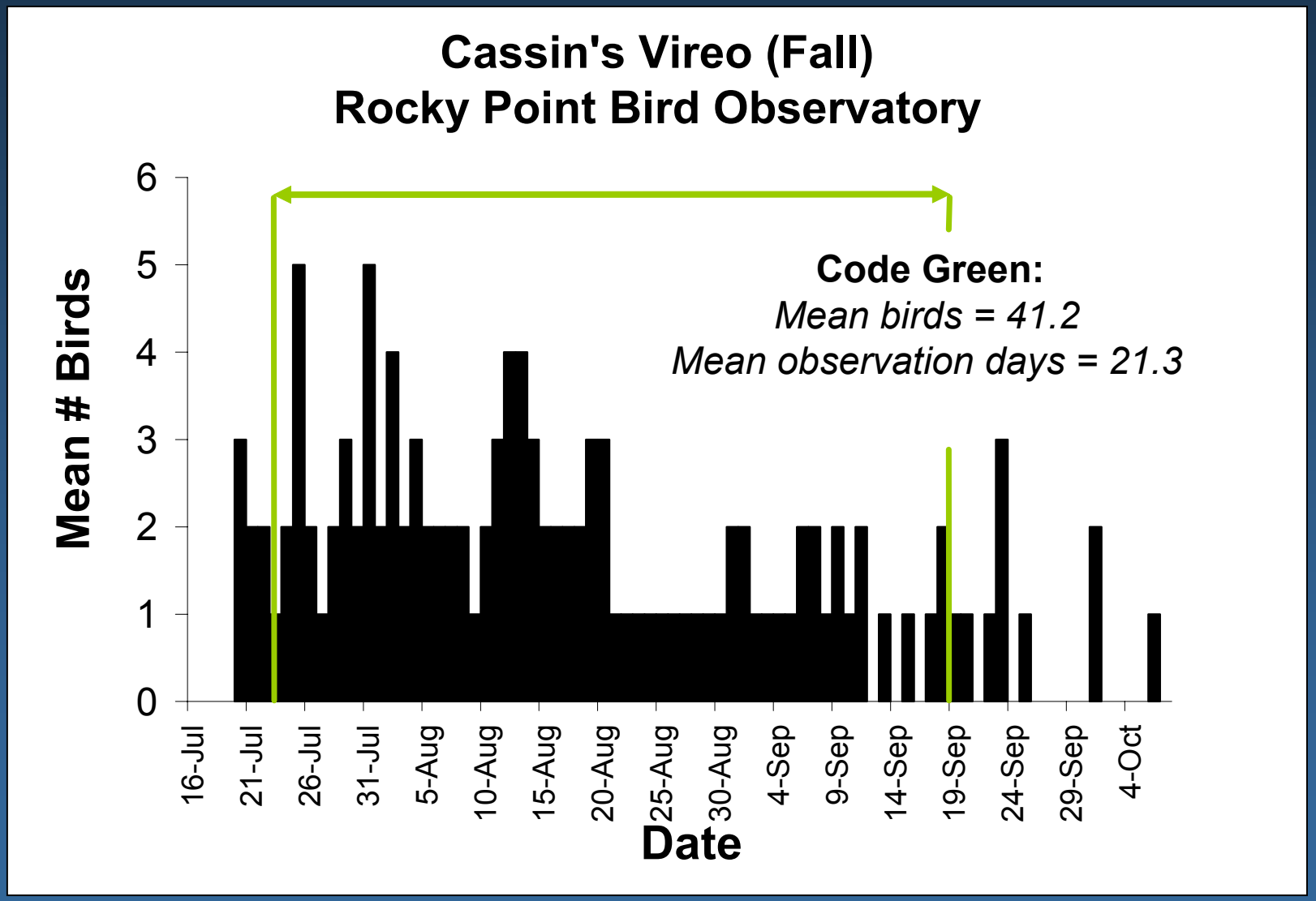


Data Quantity

Measure of the amount of data available for analysis within the migration window

Code	Mean Birds		Mean Observation Days
Red	< 10	***or***	< 5
Orange	≥ 10	***and***	≥ 5
Blue	≥ 20	***and***	≥ 10
Green	≥ 25	***and***	≥ 20

Data Quantity



Population Trend Analyses

Minimum 5 yrs in standard database format

Estimate annual population indices

adjust daily counts for variation associated with date using multiple regression.

Estimate trends in annual indices

< 10 yrs data: log-linear regression

> 10 yrs data: polynomial regression:

1^{st}-8^{th} order (LPBO)

1^{st} -2^{nd} order (< 15 yrs)

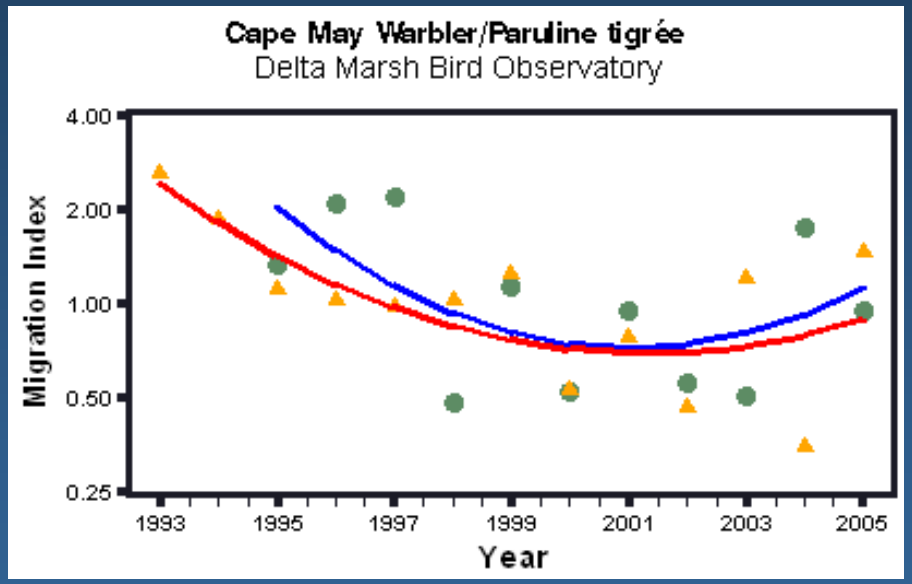
Number of years included in the analysis of population trends, up to 2005

10 Stations with ≥ 10 years data in spring and/or fall

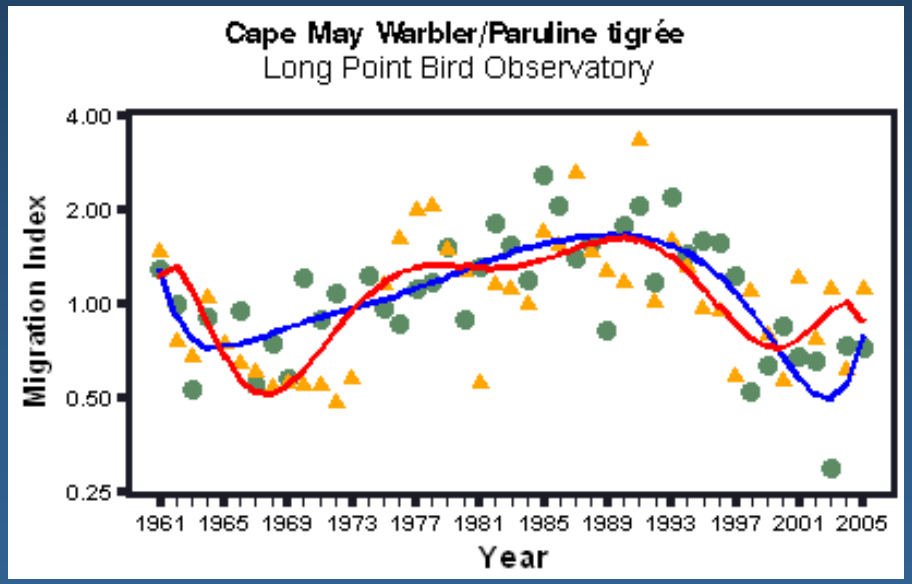
Site/Station	Total Years	
	Spring	Fall
RPBO	-	8
MNO	-	**10**
BBO	**14**	**14**
IBS	-	**11**
LSLBO	**11**	**12**
LMBO	**12**	**13**
DMBO	**11**	**13**
BPBO	6	6
HBO-SELK	**10**	8
HBO-RUTH	8	7
HBO-ROCK	5	6
IPBO	9	-
LPBO	**45**	**45**
PEPtBO	8	5
TCBO	**15**	**15**
OOT	-	**10**
ABO-BP	9	9
ABO-SI	5	9
WPBO		
PIBO	3	3
TTPBRS	2	2
MBO	2	2

Population Trends and Trajectories

Over 130 species monitored during spring and/or fall



Spring: -10.95%/yr, ns (🔴);
Fall: **-8.05%/yr, p < 0.05** (🟠)



Spring: -0.75%/yr, ns (🟠)
Fall: 1.00%/yr, ns (🟢)

Population Trends – Online

http://www.bsc-eoc.org/monitoring/cmmn_plots.jsp

BIRD STUDIES CANADA
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BirdLife INTERNATIONAL

Canadian Migration Monitoring Network

Bird population trends

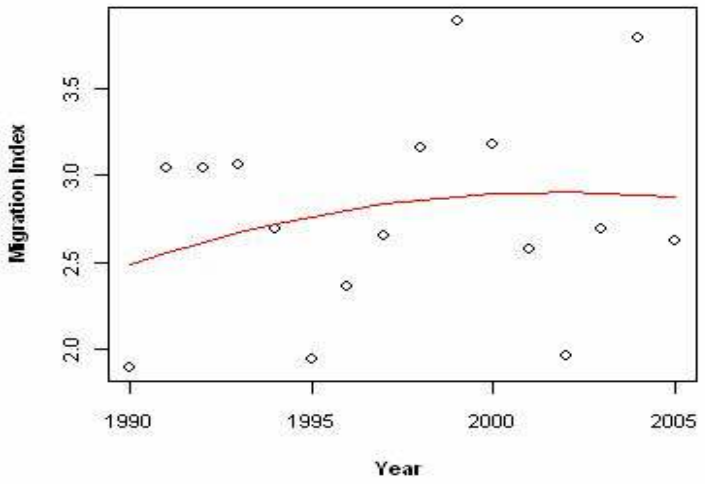
Haldimand Bird Observatory - Selkirk
Inglewood Bird Sanctuary
Innis Point Bird Observatory
Last Mountain Bird Observatory
Lesser Slave Lake Bird Observatory
Long Point Bird Observatory

Alder Flycatcher
American Goldfinch
American Pipit
American Redstart
American Robin
American Tree Sparrow

Season: Spring | Earliest year: 1990 | Latest year: 2005 | Trend line: Third degree polynomial | Go

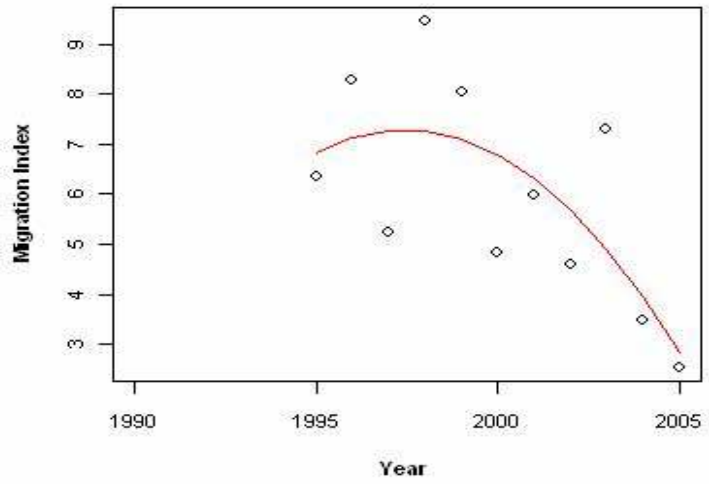
Long Point Bird Observatory (spring)
American Redstart

$R^2 = 0.052$, $P = 0.7063$



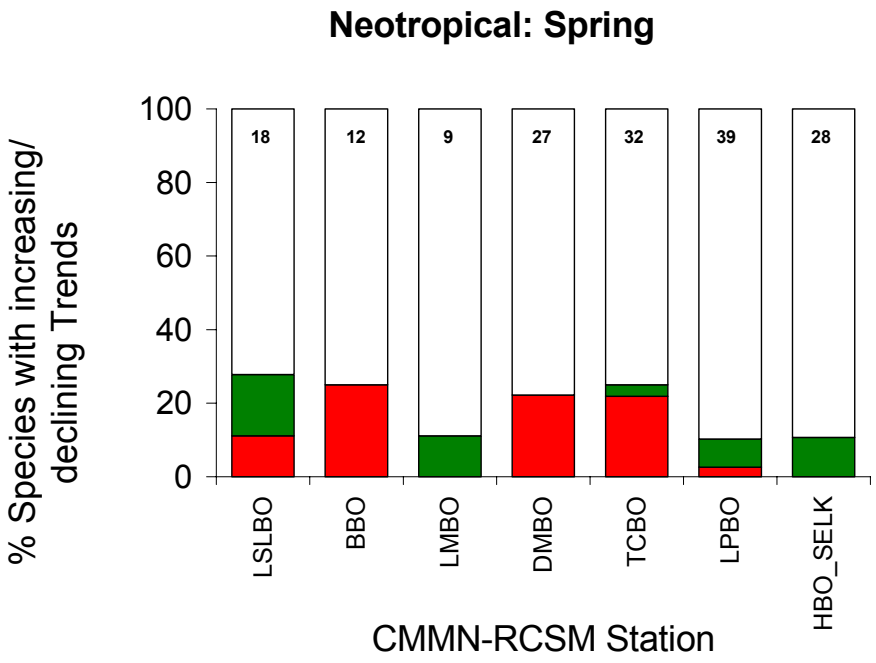
Thunder Cape Bird Observatory (spring)
American Redstart

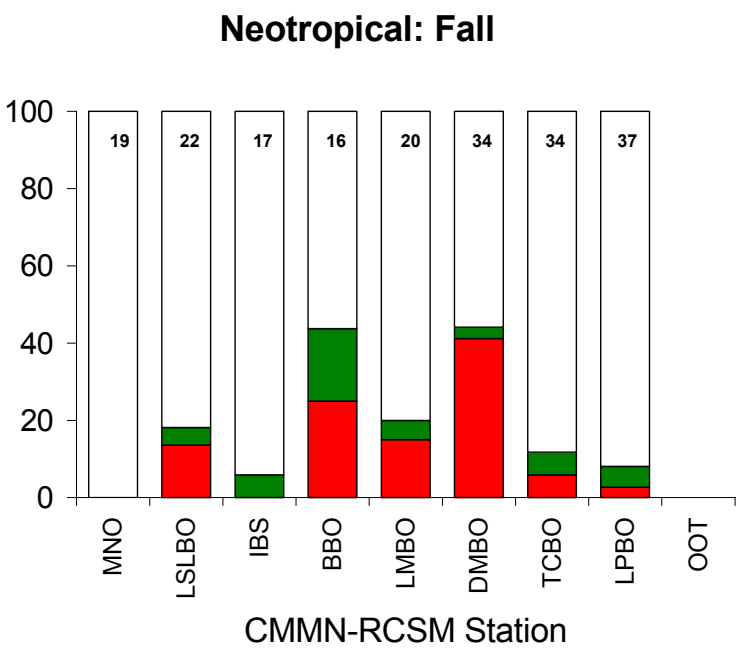
$R^2 = 0.503$, $P = 0.0611$



Population Trends

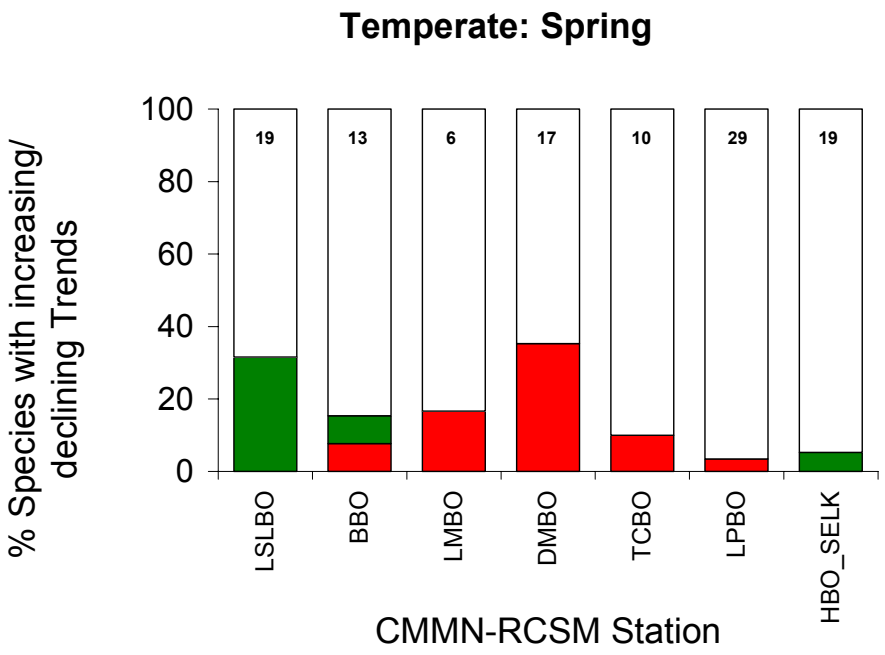
Summary by Migration Strategy (10 Year Trends)

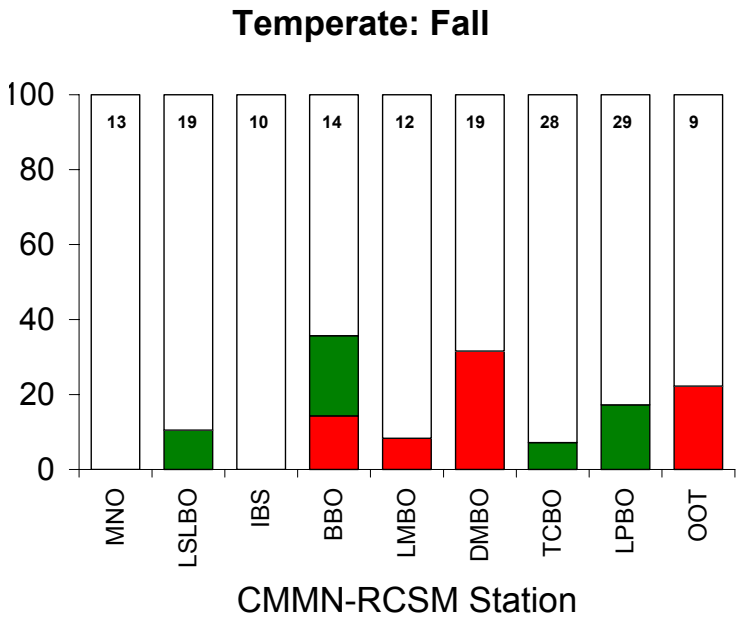




Population Trends

Summary by Migration Strategy (10 Year Trends)





Annual Index Correlations

Using the past 10 years of data, tested the correlation of annual indices among stations with sufficient data.

Used a subset of 17 species to compare:

1. Whether adjacent stations show a larger number of species with correlated annual indices than more distant stations
2. Whether there is a geographic pattern of significant correlations among stations for particular species

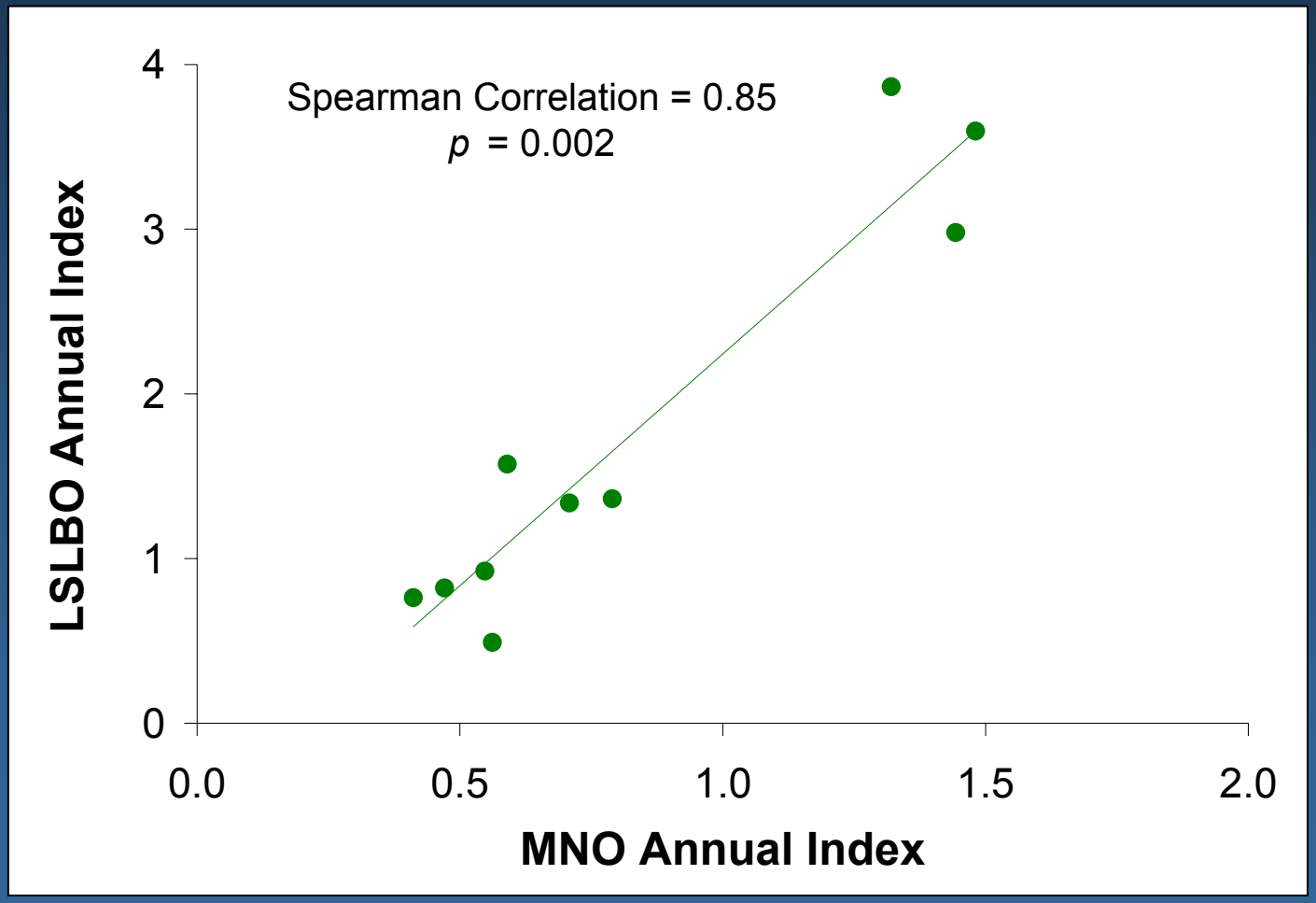
Annual Index Correlations

Subset of 17 species:

Species Code	Species Name (English)	Species Name (French)	Migration Strategy
LEFL	Least Flycatcher	Moucherolle tchébec	Neotropical
REVI	Red-eyed Vireo	Viréo aux yeux rouges	Neotropical
SWTH	Swainson's Thrush	Grive à dos olive	Neotropical
TEWA	Tennessee Warbler	Paruline obscure	Neotropical
YWAR	Yellow Warbler	Paruline jaune	Neotropical
BLPW	Blackpoll Warbler	Paruline rayée	Neotropical
AMRE	American Redstart	Paruline flamboyante	Neotropical
NOWA	Northern Waterthrush	Paruline des ruisseaux	Neotropical
COYE	Common Yellowthroat	Paruline masquée	Neotropical
WIWA	Wilson's Warbler	Paruline à calotte noire	Neotropical
LISP	Lincoln's Sparrow	Bruant de Lincoln	Neotropical
RCKI	Ruby-crowned Kinglet	Regulus calendula	Temperate
AMRO	American Robin	Turdus migratorius	Temperate
UYRW	Yellow-rumped Warbler	Paruline à croupion jaune	Temperate
CHSP	Chipping Sparrow	Bruant familier	Temperate
WTSP	White-throated Sparrow	Bruant à gorge blanche	Temperate
UDEJ	Dark-eyed Junco	Junco ardoisé	Temperate

Annual Index Correlations

Chipping Sparrow



Annual Index Correlations

MNO: 10 Years

Season	Species Code	LSLBO	BBO	IBS	LMBO	DMBO	TCBO	LPBO	OOT
Fall	AMRE	0.02	0.09	-0.13	**-0.62**	-0.25	0.26	**-0.76**	
	AMRO	**0.61**	0.09	**-0.72**		0.20	-0.21	-0.01	0.37
	BLPW	**0.53**	0.26	**0.75**	-0.08	0.13	0.22	0.44	
	CHSP	**0.85**		0.20	0.07	**-0.58**	**-0.71**	-0.37	
	COYE	0.10	-0.10		0.20	0.15	0.09	-0.25	
	LEFL	-0.09	**-0.47**	0.16	0.21	**0.55**	0.14	0.04	
	LISP	-0.24		**-0.53**	0.42	**-0.58**	-0.28	**-0.65**	
	NOWA	-0.44	**0.52**	0.15	0.26	0.37	0.28	**0.52**	
	RCKI	**0.78**	0.31	0.18	0.25	-0.35	0.03	0.20	
	SWTH	**-0.76**	-0.39	-0.42	**-0.55**	-0.13	-0.03	-0.19	
	TEWA	**0.70**	**-0.48**	0.05	**0.55**	0.09	0.24	**0.60**	
	UDEJ	0.39	0.24	0.42	0.12	0.35	0.13	-0.14	-0.13
	UYRW	0.25	0.12	**0.48**	0.31	0.16	-0.31	-0.04	-0.14
	WIWA	-0.21	-0.36	0.42	0.19	**-0.68**	0.14	-0.32	
	WTSP	0.05	-0.01	0.30	0.02	-0.14	-0.38	0.38	
	YWAR	0.09	**0.55**	-0.15	0.44	0.35	-0.26	**0.61**	

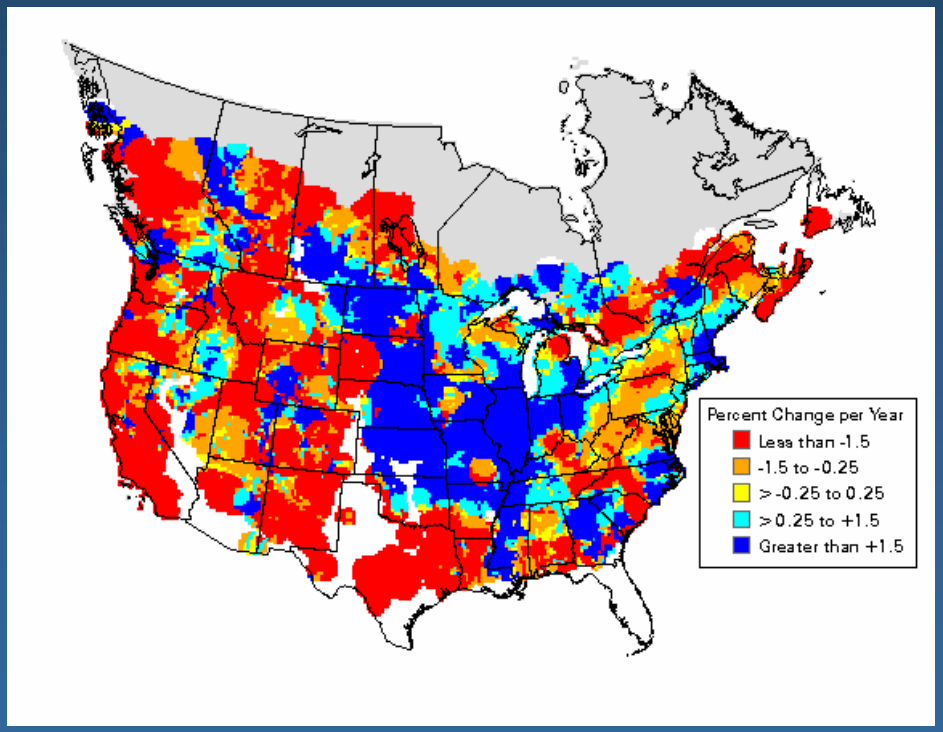
Annual Index Correlations

HBO-SELKIRK: 10 Years

Season	Species Code	LSLBO	BBO	LMBO	DMBO	TCBO	LPBO
Spring	AMRE	0.10			-0.35	-0.43	-0.19
	CHSP	0.41	**-0.71**	0.04	**-0.48**	0.27	**0.76**
	COYE	**-0.86**	-0.37		**-0.64**	**-0.68**	-0.07
	LEFL	0.09	-0.02	-0.01	-0.04	**0.50**	0.01
	LISP	0.14	0.07	-0.15	-0.21	0.27	0.35
	RCKI	0.26			0.19	0.36	**0.64**
	REVI	0.05	-0.02		0.39	0.24	0.25
	SWTH	**-0.51**	0.30	**0.64**	0.22	0.08	-0.13
	UDEJ				0.20		0.10
	UYRW	-0.36	0.43	-0.36	0.03	0.41	**0.56**
	WIWA				0.02	0.32	**-0.45**
	WTSP	0.03	0.25	0.36	**0.54**	**0.53**	0.18

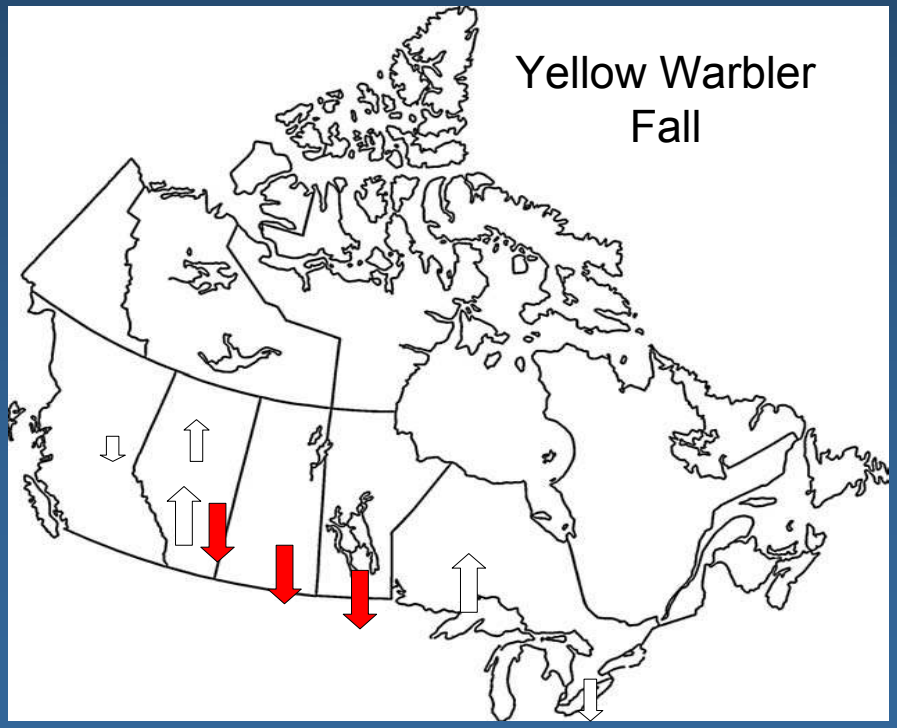
Annual Index Correlations and Trends

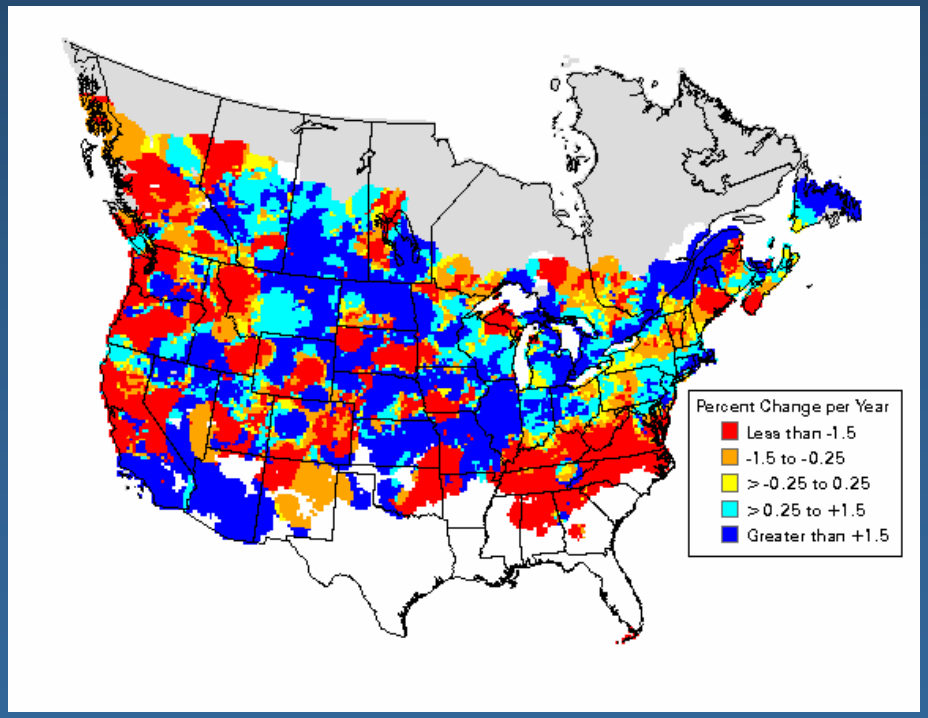
Station	Season	Species Code	LSLBO	IBS	LMBO	DMBO	TCBO	LPBO
MNO	Fall	CHSP	**0.85**	0.20	0.07	**-0.58**	**-0.71**	-0.37



Annual Index Correlations and Trends

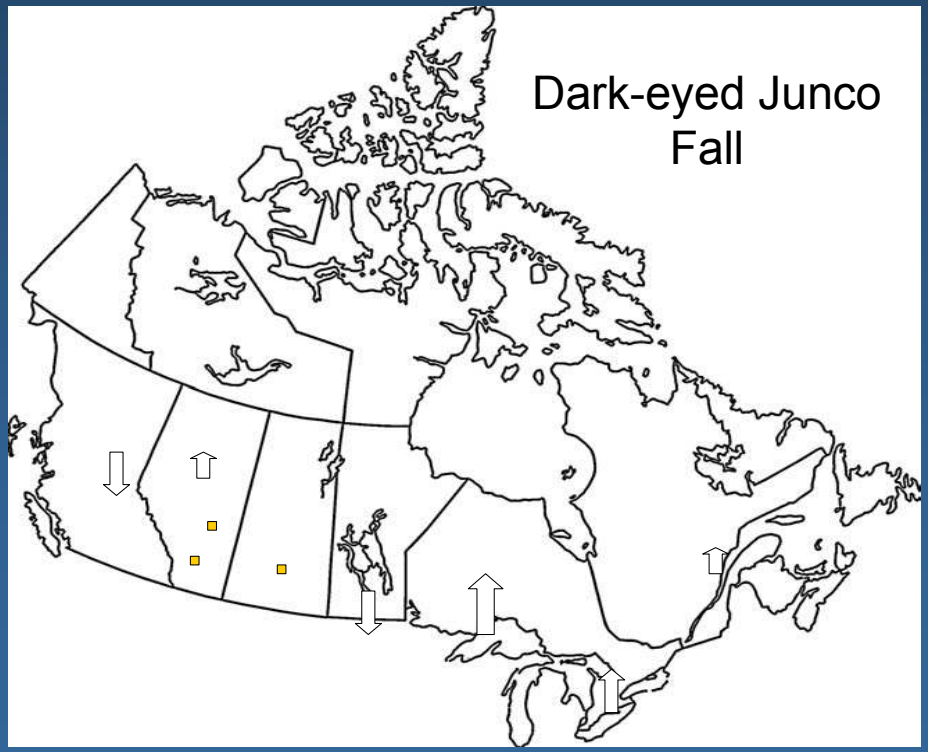
Station	Season	Species Code	MNO	LSLBO	BBO	IBS	DMBO	TCBO	LPBO
LMBO	Fall	YWAR	0.44	-0.16	**0.90**	**-0.55**	**0.84**	**-0.71**	0.39

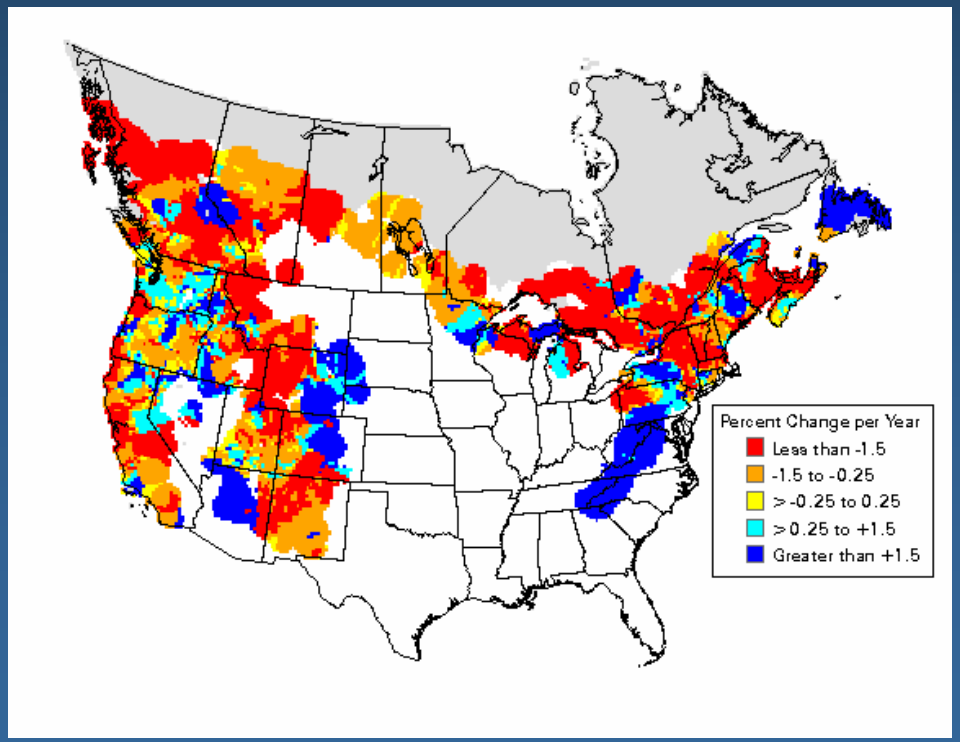




Annual Index Correlations and Trends

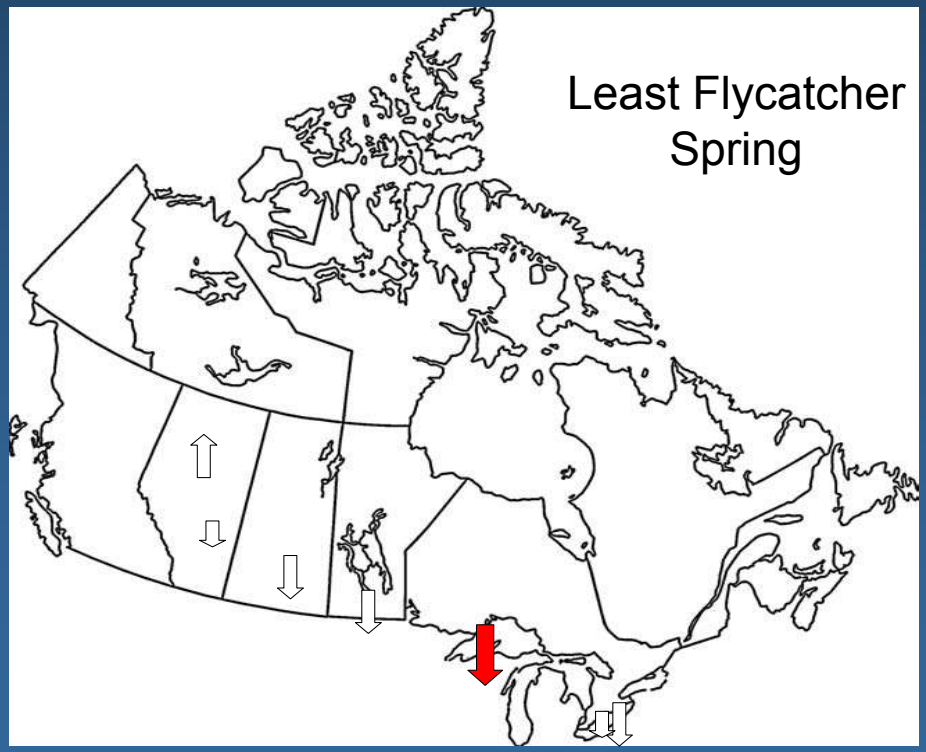
Station	Season	Species Code	MNO	BBO	IBS	LMBO	DMBO	TCBO	LPBO	OOT
LSLBO	Fall	UDEJ	0.39	**0.54**	0.01	**0.60**	**0.70**	**0.49**	**0.47**	0.04

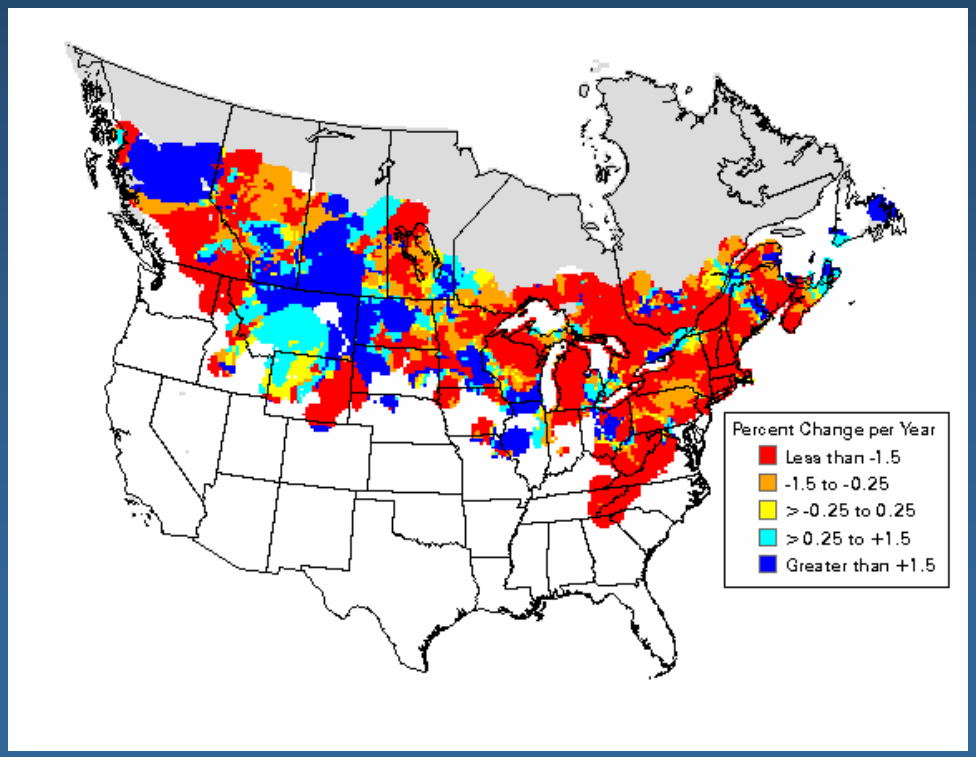




Annual Index Correlations and Trends

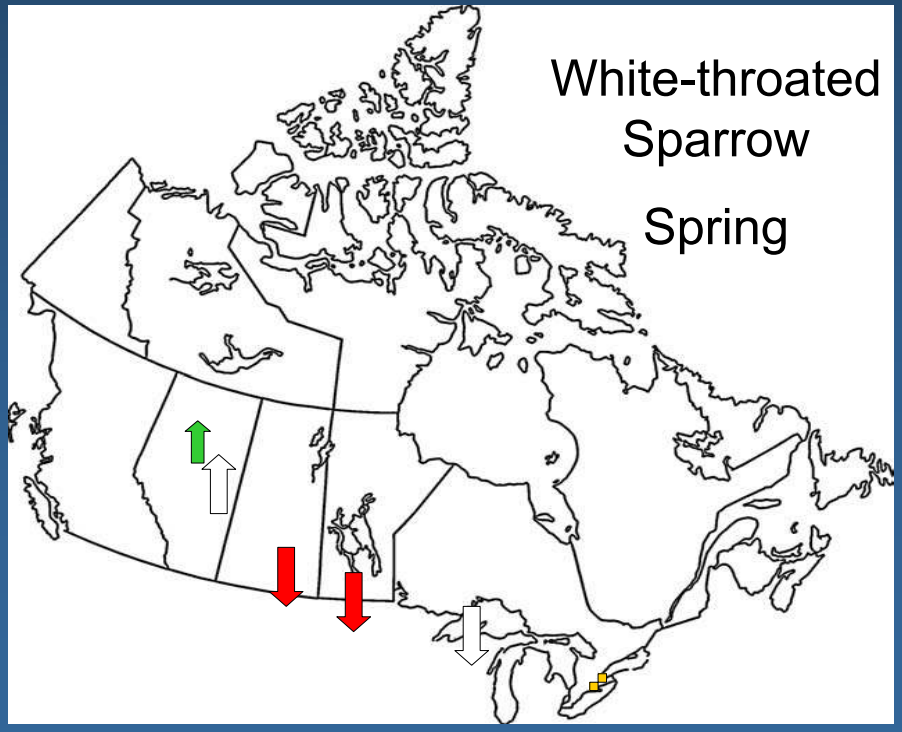
Station	Season	Species Code	LSLBO	LMBO	DMBO	TCBO	LPBO	HBO-SELK
BBO	Spring	LEFL	-0.16	**0.68**	**0.54**	0.41	0.19	-0.02

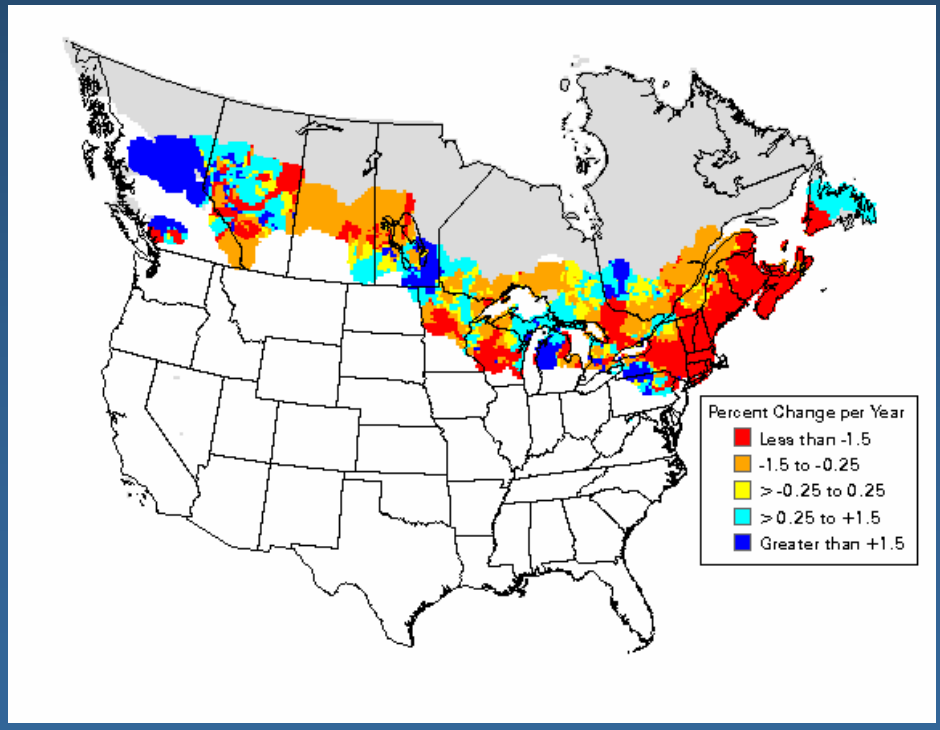




Annual Index Correlations and Trends

Season	Species Code	Station	LSLBO	BBO	LMBO	DMBO	TCBO	LPBO	HBO-SELK
Spring	WTSP	BBO	**0.66**		**-0.48**	-0.27	0.07	-0.38	0.25
		LSLBO		**0.66**	-0.31	**-0.59**	-0.39	-0.22	0.03
		TCBO	-0.39	0.07	**0.55**	**0.77**		0.16	**0.53**





Variation in Trends

1. **Sampling different populations?**
   - Isotope analysis to define catchment areas

2. **Changes in sampling methodology** and/or **effort**

3. **Differences between count methods**
   - ET / Banding / Visual Migration

4. **Variation in weather patterns** and effect on daily count

5. **Habitat change over time**

6. **Data Quantity** and how to analyze rare species

Next Steps

1. **Update analyses** with 2006 data/technical report

2. **Isotope Analysis** to determine breeding origin

3. Combine station indices to **produce regional or national population trends**?

4. Test **effect of weather** on station analyses?

5. Test **effect of count method** on population trends?

6. **Age ratios**:
   reflect productivity or survivorship?
   used to interpret population trends?