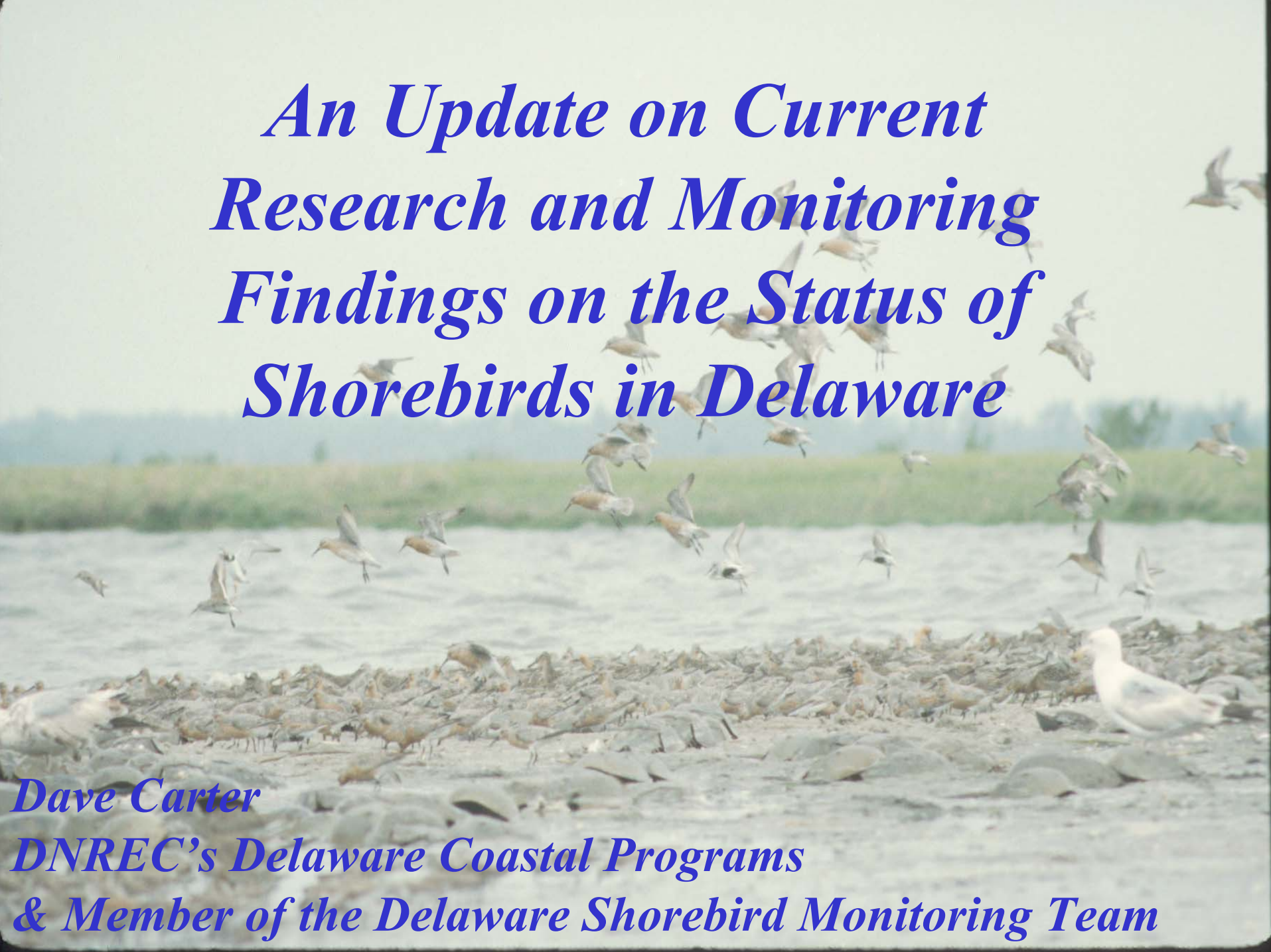


An Update on Current Research and Monitoring Findings on the Status of Shorebirds in Delaware

Dave Carter
DNREC's Delaware Coastal Programs
& Member of the Delaware Shorebird Monitoring Team

Striving for Science Based Management of Shorebirds & Horseshoe Crabs

Striking a Balance for Multiple Resource Needs

Types of Information Collected to Improve Management

- **Shorebird Population Levels & Trends** — Low Confidence
- **Shorebird Stopover Fitness - Arriving and Departing Timing & Physical Conditions** — High Confidence
- **Food Availability - Egg Density** — Moderate/High Confidence
- **Habitat Use and Characteristics** — Moderate Confidence

Notes:

- No data or analysis has been peer reviewed to date. All results and summaries are preliminary until reviewed through the ongoing efforts of the USFWS led Shorebird Technical Committee.
- Much of the analysis contracted to BTO, USGS, CEH, and Dr. Richard Weber.

Red Knot Population???

- Land/Boat Based Red Knot Estimates of Peak Shoreline Counts

Year	Delaware	Bay Wide Estimate
1998	36,880	80,000 (Baker, et. al.)
1999	N/A (3 Nor-easters)	N/A
2000	19,646	50,000 (DE & NJ teams)
2001	32,937[1]	No Coordinated Count
2002	15,850 (20,000+)[2]	30,000 (DE & NJ teams)

Low Confidence

[1] 20,000 Red Knot flushed from roost in Milford Neck Marshes

[2] Same evening Dave Carter & Nigel Clark Counted over 20,000 Knot in Mispillion Harbor Roosting)

- Mark/resighting analysis does not give adequate statistical confidence for trend yet (c.a 28K-129K). Changes in protocol to increase individual marking will correct this problem in future.

Shorebirds Captured and Measured in Delaware (& Baywide) from 1997-2002

- Red Knot 5,965 (10,118)
- Ruddy Turnstone 3,452 (10,203)
- Sanderling 905 (7,768)

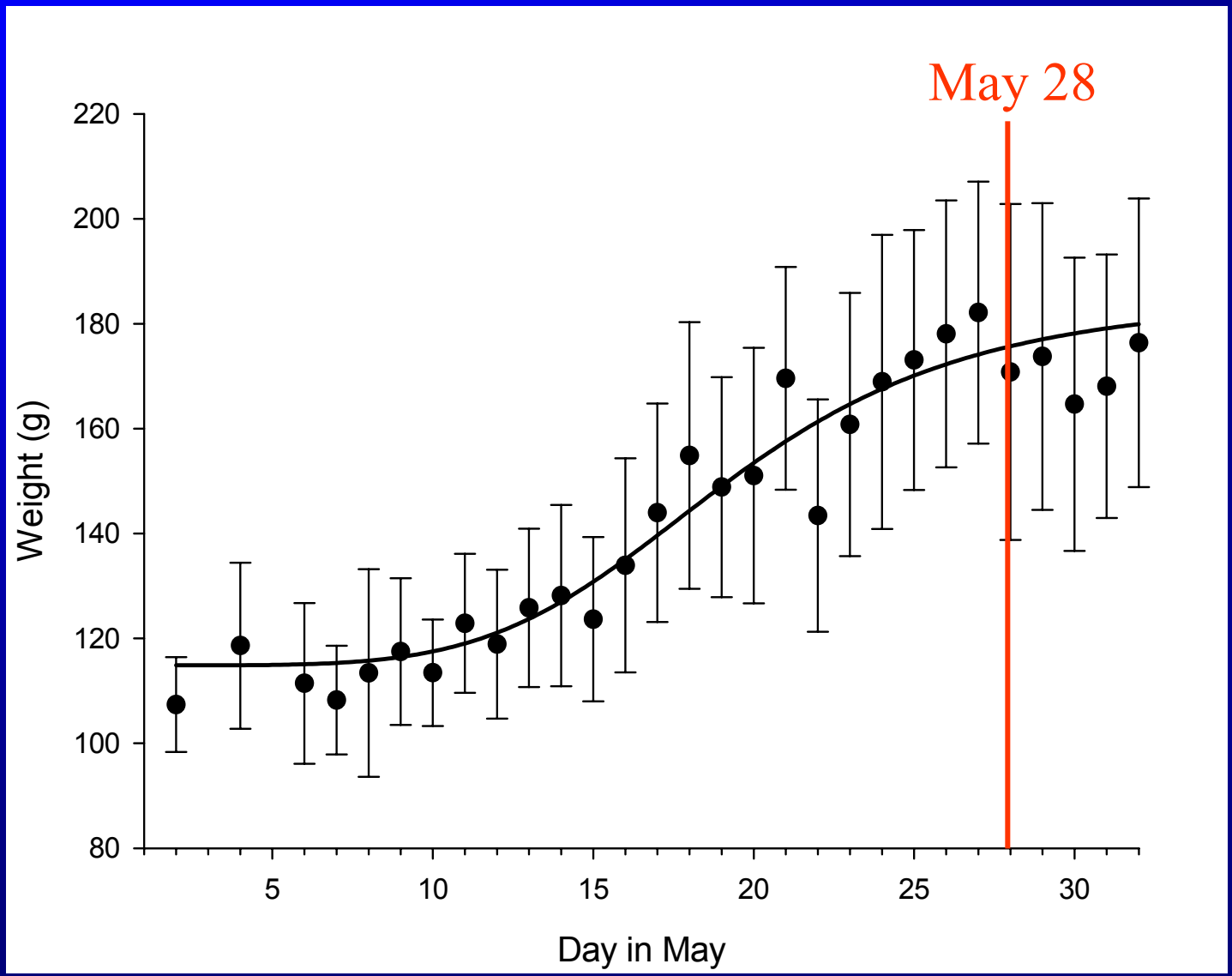
Analysis of Survival, Foraging, & Marking of Red Knot Calidris canutus

- Birds departing at weights below 180 grams have ½ the chance of surviving to the next year as those departing at a weight above 180 grams.
- Birds arriving before May 20 tend to reach 180 grams by the target departure date (May 28), those arriving after May 20 tend not to reach 180 grams by May 28.
- The number of Red Knot arriving later in May (after 20th) has increased in recent years (2001 & 2002).
- The habitat area used by Red Knot for foraging to gain weight has reduced over the past 5 years.
- Foraging rate (eggs/minute) of Red Knot, Semi-palmated Sandpiper, & Dunlin were the same, despite the Red Knot weighing ~ 5 times more than the smaller species (higher energy need). Any problems are likely to show up in the Red Knot first.

Weight Gain Analysis – Two Complementary Analysis

- Analysis based on the average trajectories of a particular ‘cohort’ (large group of birds) which arrive on the same, or adjacent, days.
- Analysis based on the weight gain of individual birds caught more than once in the same season.

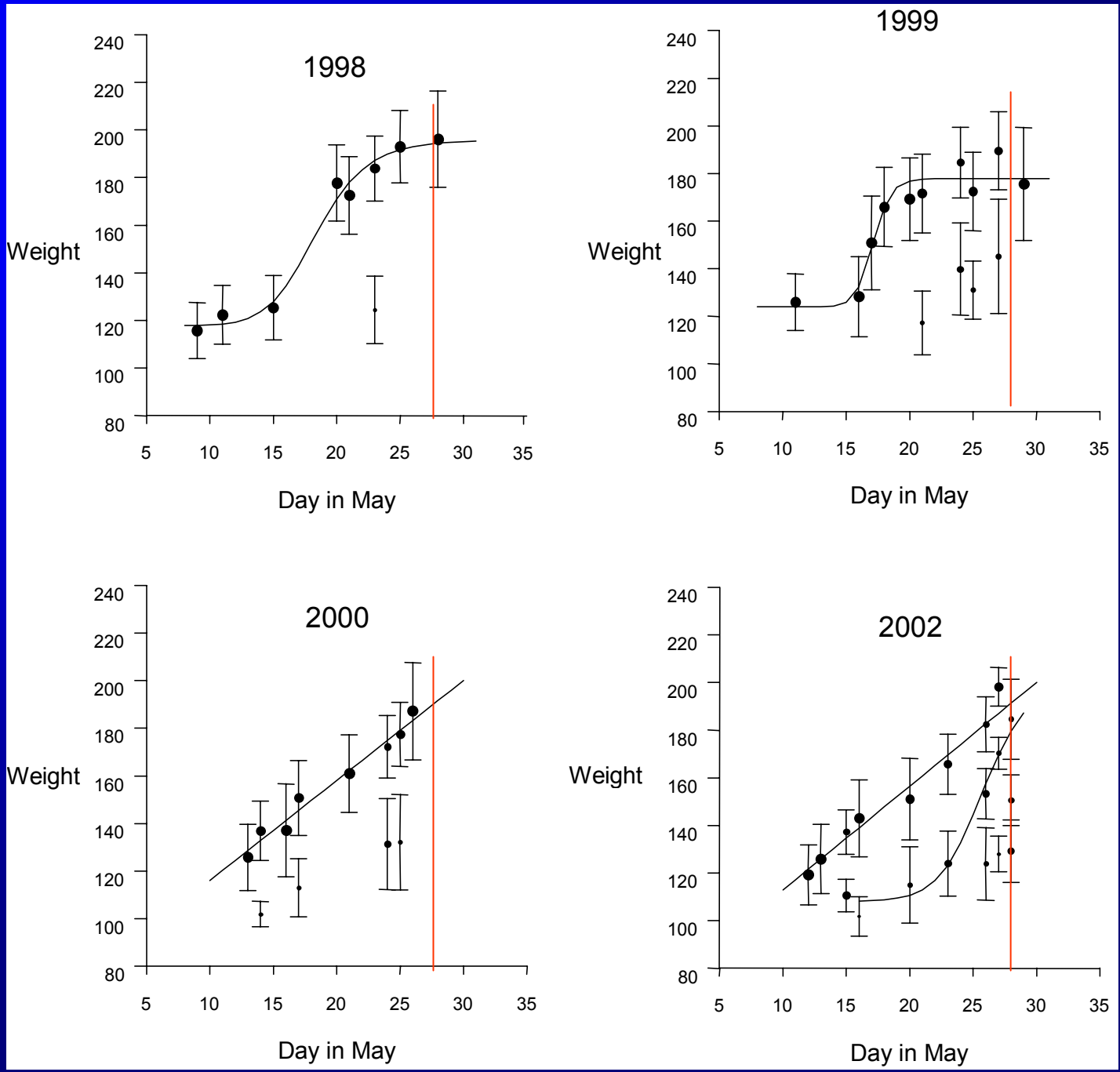
Average Weight by Day of Feeding Red Knot in Delaware Bay 1997-2002.



Mean Arrival Weight = 114.9 ± 1.6 gm.

Ave. Weight Increase = 70.3 ± 3.6 gm.

Pattern of weight change in individual cohorts of <u>Feeding</u> Red Knot



Arrival Dates of Red Knots

- Two statistically distinct periods, a main early arrival (May 6-10) and a later arrival (May 20-24).

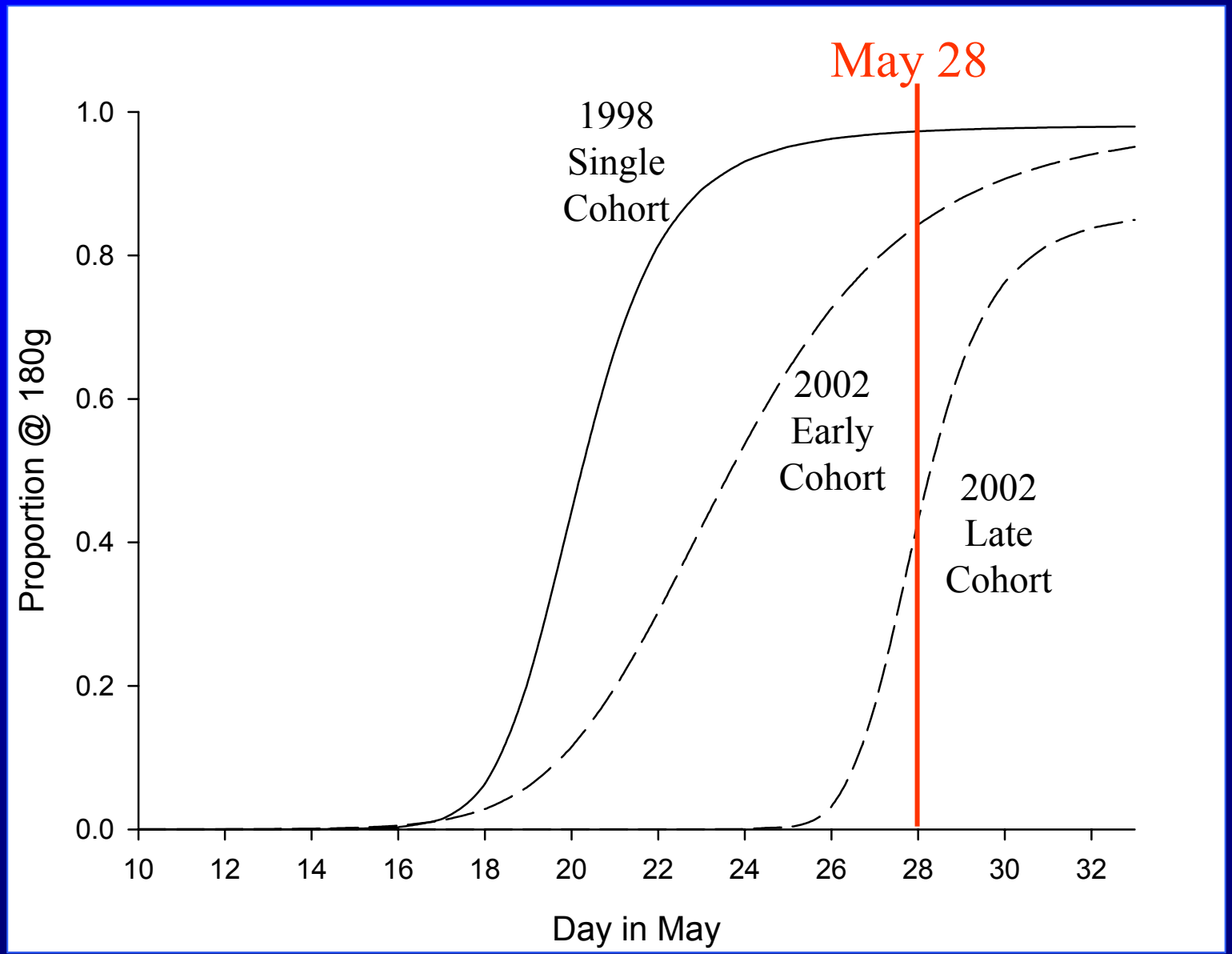
Year	% Late Arrival[1]
1998	17%
1999[2]	43%
2000	50%
2001	30%
2002[3]	44%

[1] Both cohorts are believed to arrived later in 2001 & 2002.

[2] Weather identified as problem.

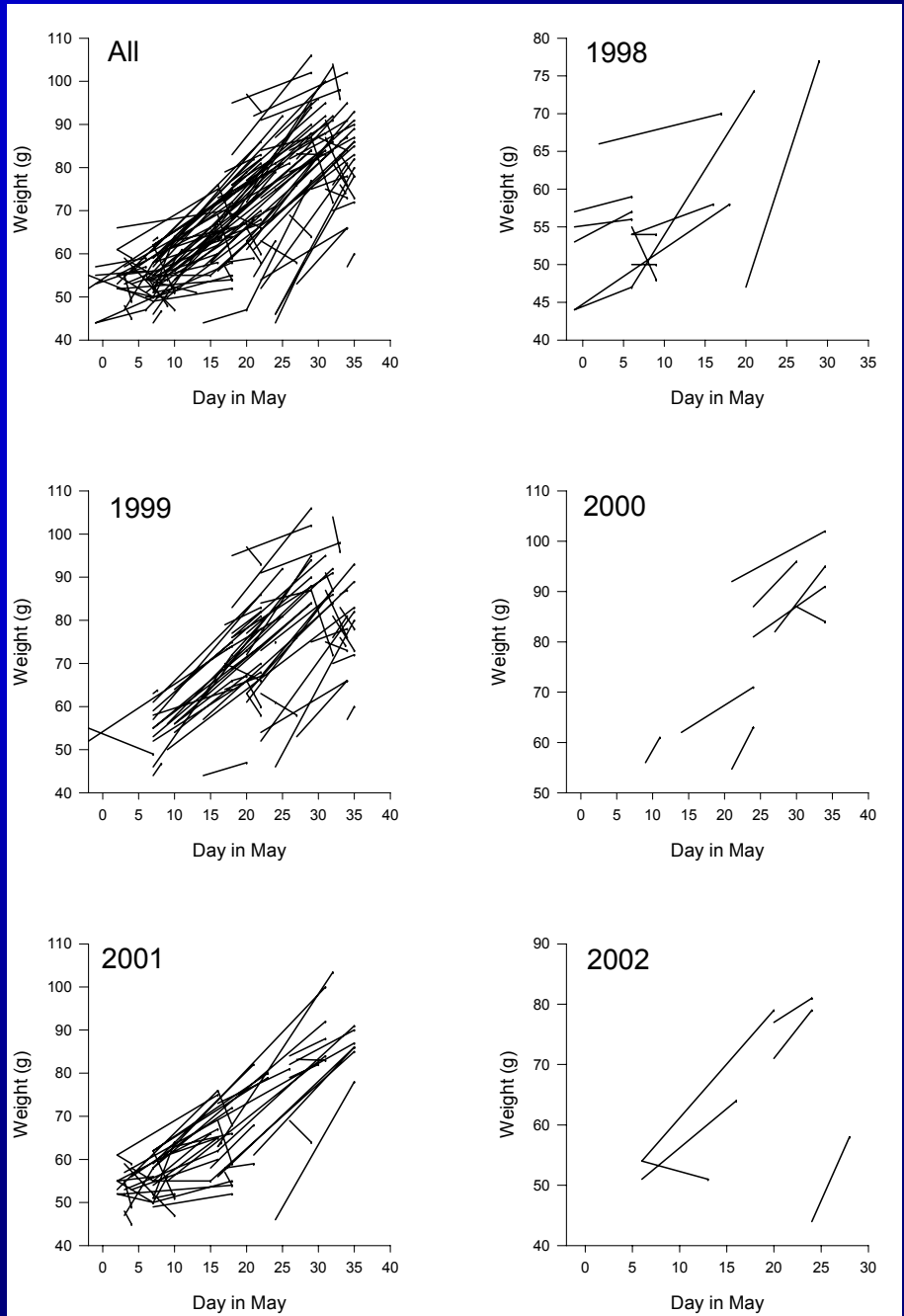
[3] Data suggest many of these actually arrived around May 26/27.

Cumulative Proportion of Birds in each cohort reaching 180 Grams by departure date. Solid line 1998, Dashed lines 2002 (two cohorts).



Rate of Weight Gain of Individual Red Knot Captured More Than Once

- Total of 125 recaptured in same year (~1.5% of captured birds).
- Total weight gained did not differ significantly by years.
- Late arriving birds increased in weight to a similar degree of early arrivals by putting on weight at a rate as much as 3X higher than early cohort.
- Late birds that fatten at high rate may suffer reduced breeding success or other, indirect, physiological costs.



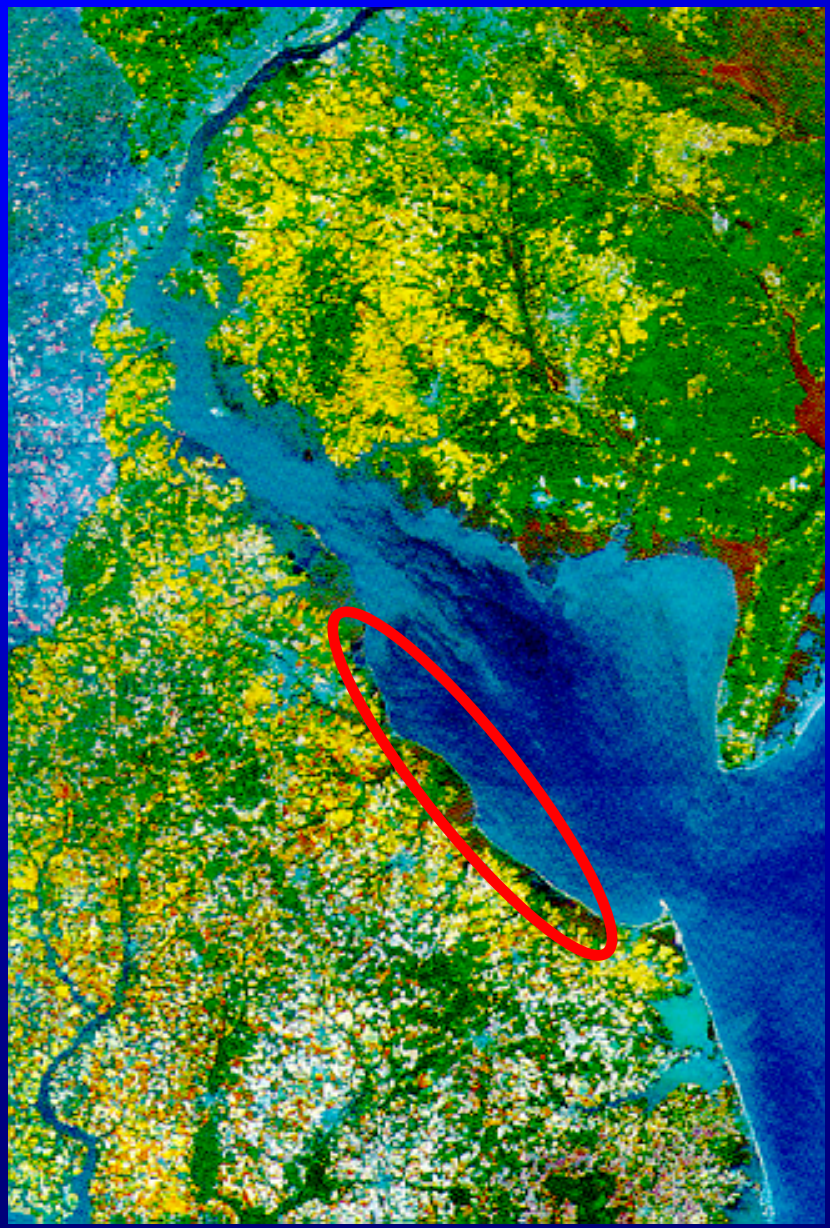
Monitoring of Food Supply (Horseshoe Crab Egg Density)

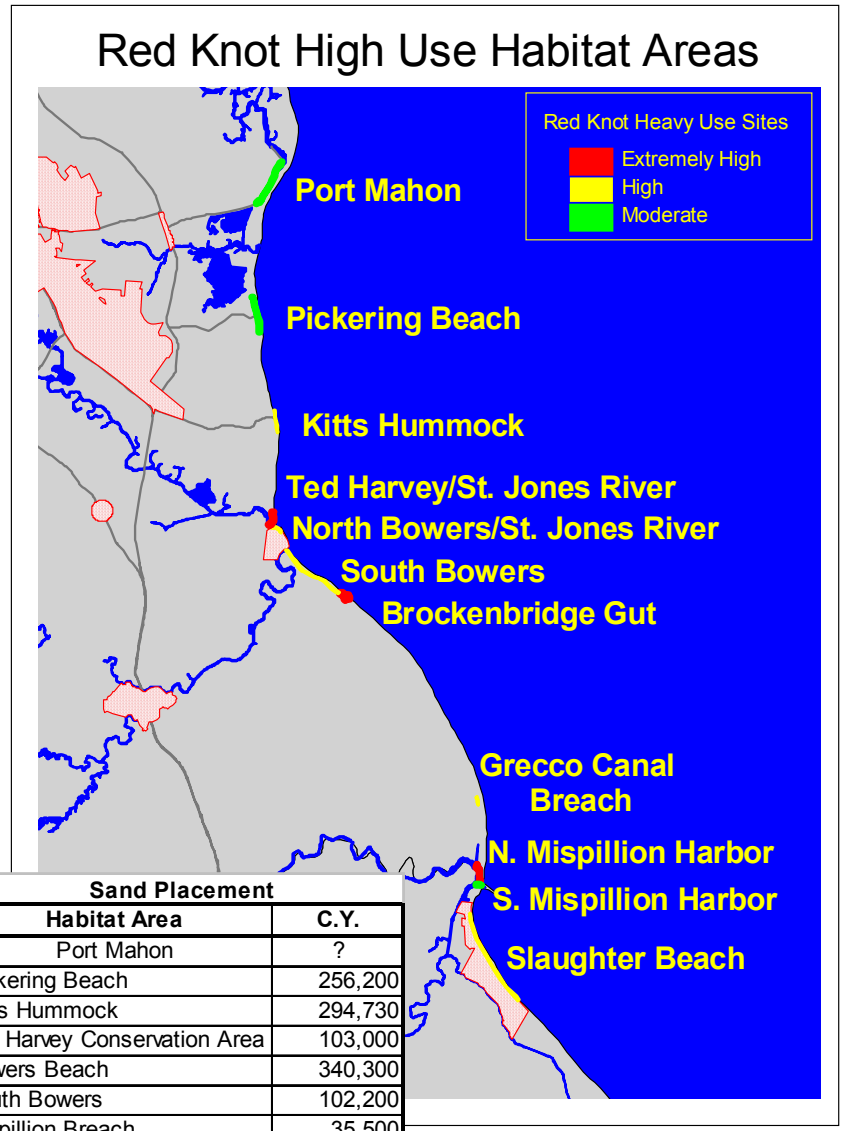
Peak May Egg Density/Square Meter in Top 5 Cm. Of Beach (Average of Multiple Vertical Transects)

Beach	2001	2002
Mispillion Harbor	265,164	268,984
Port Mahon[1]	66,740	5,598
Kitts Hummock	22,679	5,996
Pickering Beach	30,418	6,348
North Bowers	3,401	2,202

[1] Sample site experienced significant erosion between years.

Habitat Use and Characteristics in Delaware





Sand Placement	
Habitat Area	**C.Y.**
Port Mahon	?
Pickering Beach	256,200
Kitts Hummock	294,730
Ted Harvey Conservation Area	103,000
Bowers Beach	340,300
South Bowers	102,200
Mispillion Breach	35,500
Slaughter Beach	784,300

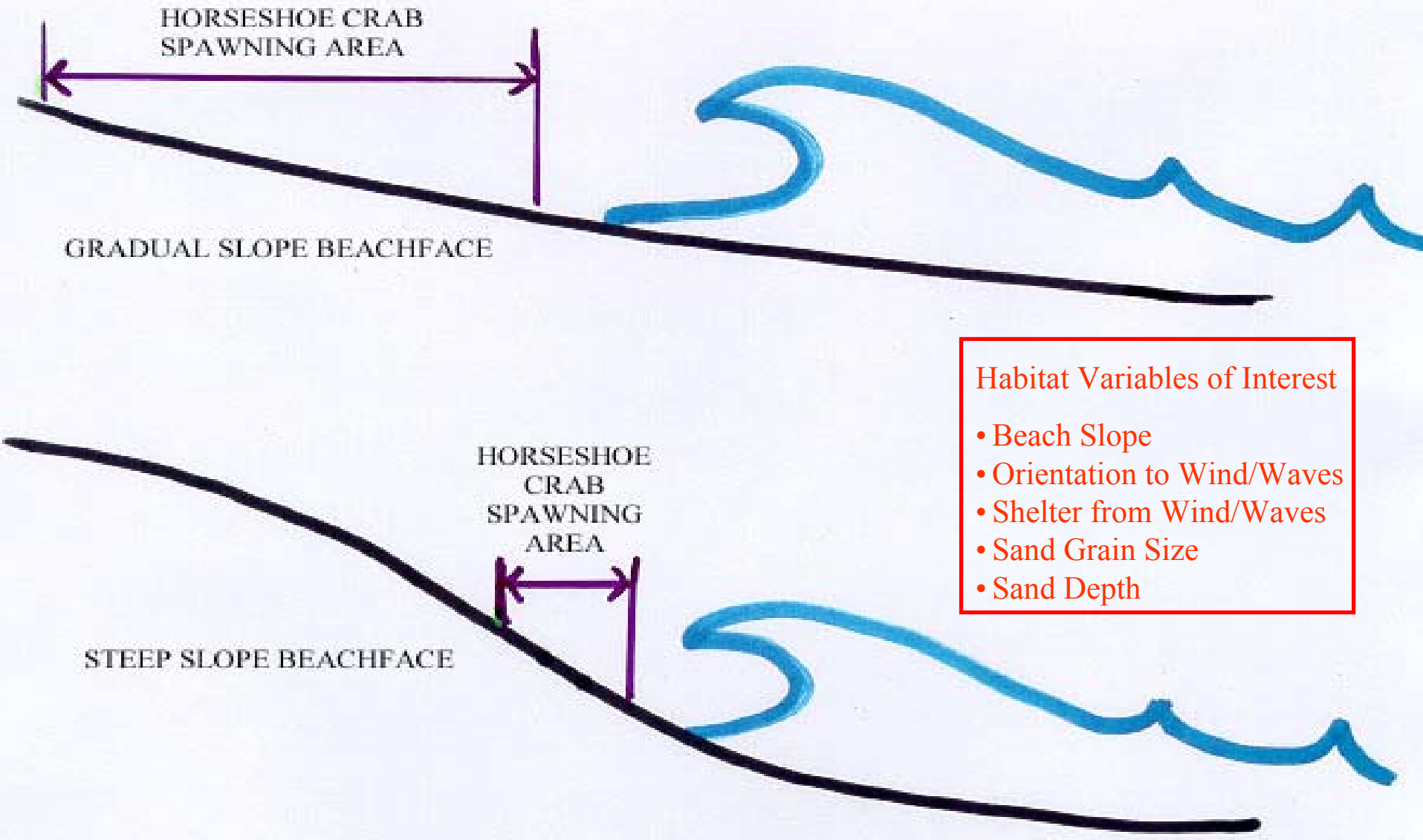
Shorebird Disturbance at Key Areas

ATV's
Brockenbridge/South Bowers

New Construction
St. Jones River/Bowers

Proposed Marina
Mispillion Harbor

Bird Watcher/General Public Disturbance Everywhere Birds Concentrate in Delaware



Habitat Variables of Interest

- Beach Slope
- Orientation to Wind/Waves
- Shelter from Wind/Waves
- Sand Grain Size
- Sand Depth

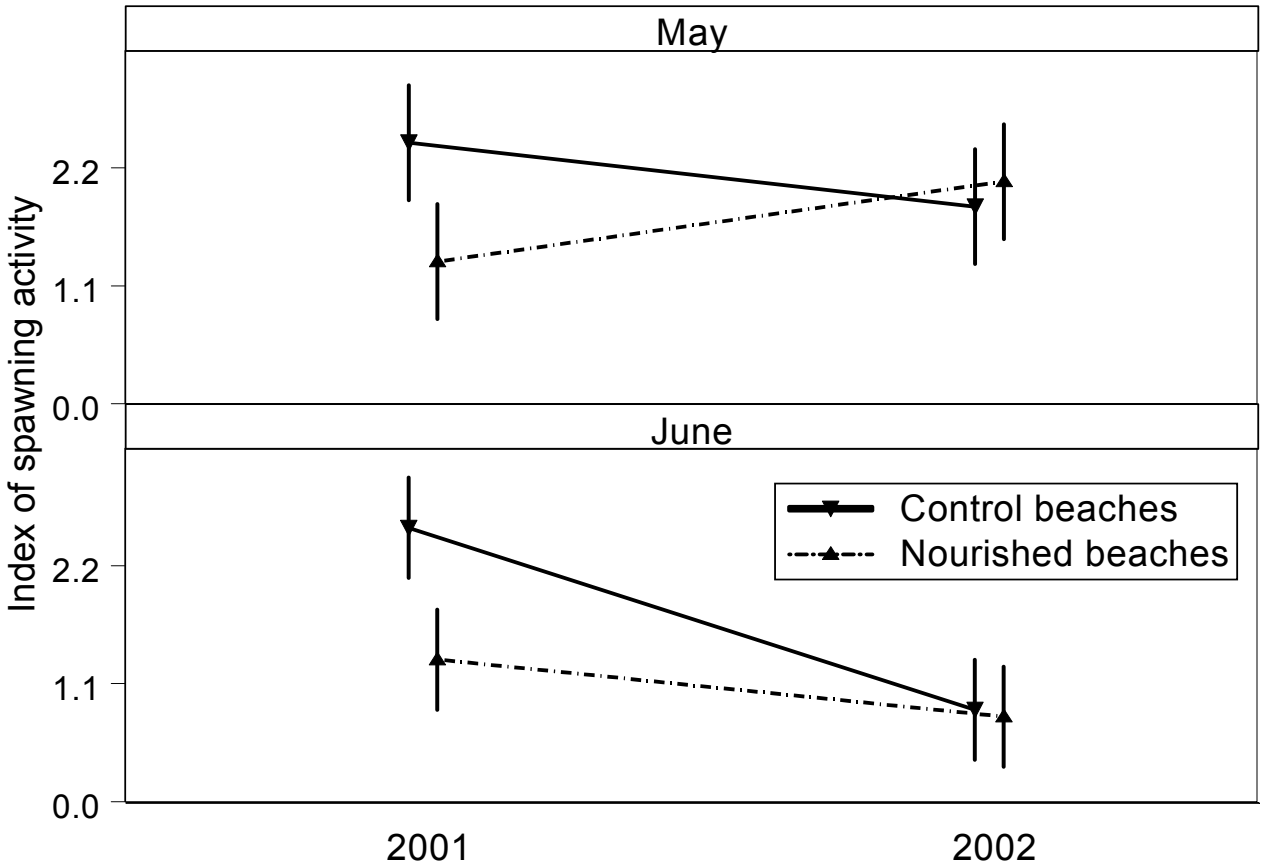

Port Mahon 1973

Port Mahon 2001


Bowers Beach 1975

Bowers Beach 1997

Comparison of spawning activity (no. of spawning females per m2) on recently nourished beaches (North Bowers and Pickering) and control beaches (Ted Harvey and Kitts Hummock)




Mispillion Harbor

Mispillion Harbor


25 3 86

Summary

- **NJ data, and to lesser degree of confidence DE data, suggest a decline in the Western Hemisphere Red Knot population.**
- **More Red Knot are not reaching target weight, but analysis indicates this is likely related to later arrival on Delaware Bay.**
- **Birds that do not achieve target weight (180 gm) have 1/2 the probability of returning the next year as birds that do reach target weight.**
- **The rate of weight gain by Red Knot has not changed significantly between 1997-2002.**

Summary

- **The available habitat with sufficient egg density appears to have been reduced but no clear reason is known. Possible hypothesis include; 1) reduced spawning, 2) shoreline change/habitat loss, and 3) various types of human disturbance.**
- **No clear reason why Red Knot are arriving later. Possible hypothesis include; 1) change in weather (low likelihood), 2) reduction in quality of staging site between Tierra del Fuego & Delaware, and 3) progressive effects of increased stress from reduced number of Del. Bay beaches with adequate superabundance of eggs concentrating birds into smaller habitat areas at higher density.**
- **Regardless of cause of problems, a multiple object approach that maximizes eggs during the migration, reduces disturbance (stress), and enhances future foraging and roosting habitats is needed in Delaware.**