Influences of Drawdown on Waterbird Use of Mudflats in Two Tennessee River Reservoirs

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Justification

Shorebirds

- 40 species common to NA
- TN River Valley (31)
- Travel > 12,000 km/yr

- U.S. = > 50% wetlands
- > 50% of all shorebird species are declining

Justification

Migratory Stopovers: Critical for Survival

Replenishment of Fat Reserves

Shallowly Flooded Mudflats Tennessee River Valley

INVERTEBRATES!

6 grams/day
+ 2 grams/day
8 grams/day
(Loesch et al. 2000)

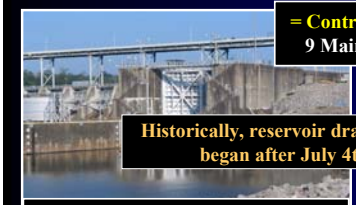
$\bar{x}$ Stopover Duration (Pectoral Sandpipers) = 8-12 days
(Lehnen & Krementz 2005)

These areas serve as "re-fueling" areas between breeding and wintering grounds

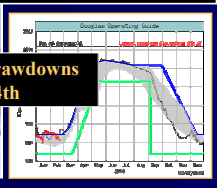
Justification

Tennessee Valley Authority (TVA)

- Manipulate Reservoir Water Levels



= Control Mudflat Availability
9 Mainstem & 40 Tributary



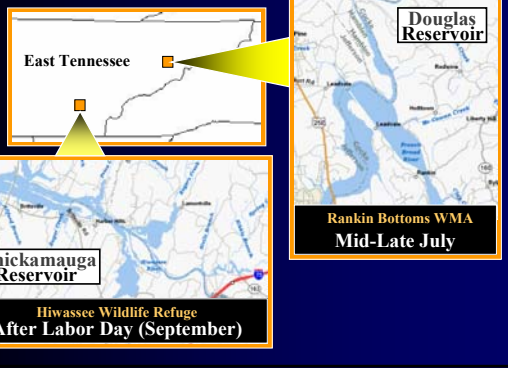
Historically, reservoir drawdowns began after July 4th

East TN – Douglas & Chickamauga

Increased Pressure to Delay until Labor Day (recreation)

2004 – Changes to Drawdown Schedules

Study Sites



Rankin Bottoms WMA
Mid-Late July

Hiwassee Wildlife Refuge
After Labor Day (September)

Objectives

Compare Waterbird Abundance on Mudflats Between Douglas and Chickamauga

Treatments: Early vs. Late Drawdown, 6 months
15 August 2005 → 13 January 2006
31 July 2006 → 12 January 2007

Sept. 13th

Nov. 8th

Sampled 4 mudflats per reservoir

(Candies Creek – Chickamauga Reservoir)

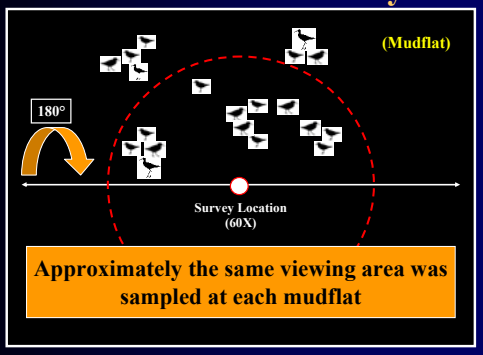
Methods

- Scan Surveys
  (one location/mudflat)
- 2X / week / mudflat

Sunrise → 5 hrs after sunrise

Species-Specific Abundance

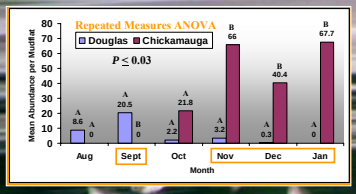
Methods: Scan Surveys



Approximately the same viewing area was sampled at each mudflat

2005 Results

Mean Daily Abundance of Shorebirds



September
Douglas > Chickamauga

Nov/Dec/Jan
Chickamauga > Douglas

No Sign. Differences b/w Sites for Other Months

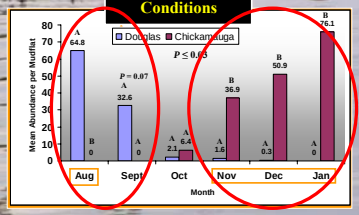
2006 Results
Mean Daily Abundance of Shorebirds

Note the Change in Mean Abundance b/w Sites Corresponding with Mudflat Conditions

August
Douglas > Chickamauga

Nov/Dec/Jan
Chickamauga > Douglas

No Sign. Differences b/w Sites for Sept/Oct



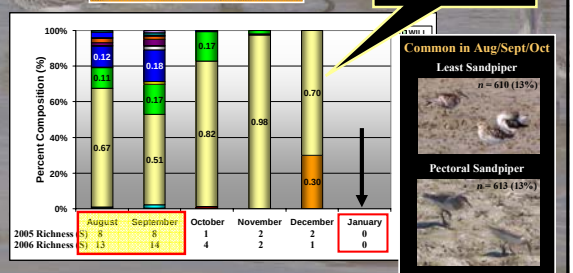
Corresponding Mudflat Conditions

	Early September	Late November
Douglas Reservoir	9-8-05 Gage = 986.4 ft	11-28-05 Gage = 953.7 ft
Chickamauga Reservoir	9-9-05 Gage = 681.8 ft	11-29-05 Gage = 676.2 ft

Results – 2005/2006 Combined
Douglas: Shorebird Species Composition

Douglas Reservoir
2005: *n* = 1100 (S = 12)
2006: *n* = 3520 (S = 16)

Killdeer
n = 2870
(62%)



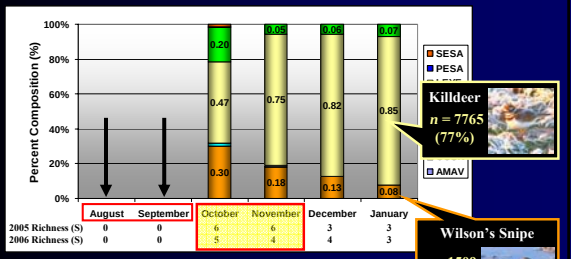
Common in Aug/Sept/Oct

Least Sandpiper
n = 610 (13%)

Pectoral Sandpiper
n = 613 (13%)

Results – 2005/2006 Combined

Chickamauga: Shorebird Species Composition



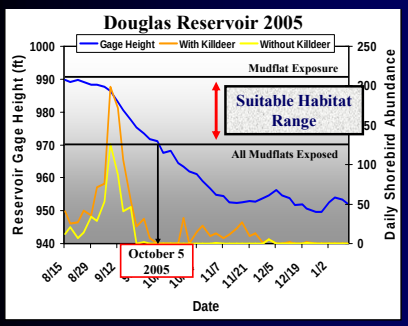
Killdeer
n = 7765
(77%)

Wilson's Snipe
n = 1509
(15%)

Chickamauga Reservoir
2005: *n* = 5609 (S = 8)
2006: *n* = 4461 (S = 7)

Douglas – 2005 Results

Correlation of Water Level & Shorebird Abundance



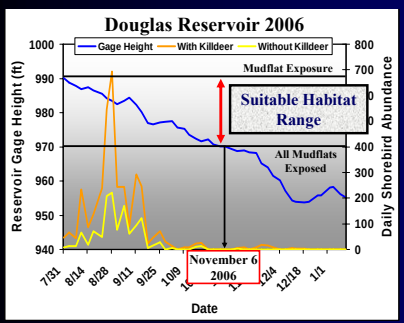
Pearson Correlation
r =(+) 0.62

R^2=0.39

39% of the variation in shorebird abundance was explained by gage height alone

Douglas – 2006 Results

Correlation of Water Level & Shorebird Abundance



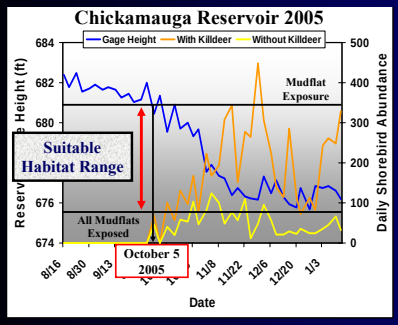
Pearson Correlation
r =(+) 0.53

R^2=0.28

28% of the variation in shorebird abundance was explained by gage height alone

Chickamauga – 2005 Results

Correlation of Water Level & Shorebird Abundance



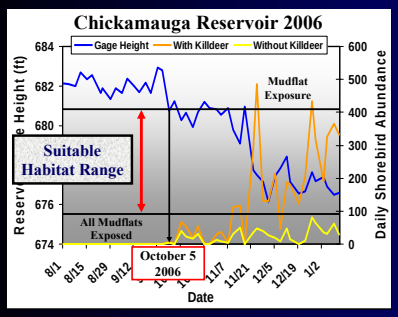
Pearson Correlation
r =(-) 0.82

R^2=0.68

68% of the variation in shorebird abundance was explained by gage height alone

Chickamauga – 2006 Results

Correlation of Water Level & Shorebird Abundance



Pearson Correlation
r =(-) 0.82

R^2=0.67

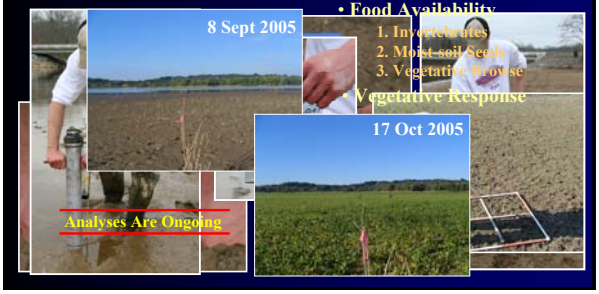
67% of the variation in shorebird abundance was explained by gage height alone

Potential Mechanisms Influencing Results

- Hydroperiod / Mudflat Acreage & Suitability
  - Available Habitat

Potential Mechanisms Influencing Results

- Hydroperiod / Mudflat Acreage & Suitability
  - Available Habitat
- Microhabitat Factors:
  - Soil Moisture/Compaction
  - Food Availability
    1. Invertebrates
    2. Moist-soil Seeds
    3. Vegetative Browse
  - Vegetative Response



Preliminary Recommendation

Correlation of Reservoir Depth and Shorebird Abundance

- Draw Down Reservoirs Sequentially
  - Provide newly exposed mudflats throughout migration in the Tennessee River Valley

Acknowledgements

- Tenn
- U.S.
- Univ

Dep isheries

TVA

WFS 536
Shorebird Identification

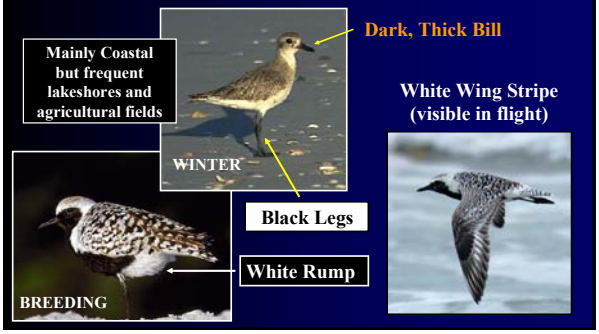
Common shorebirds migrating through Tennessee
31 species (17)

Plovers
Family Charadriidae

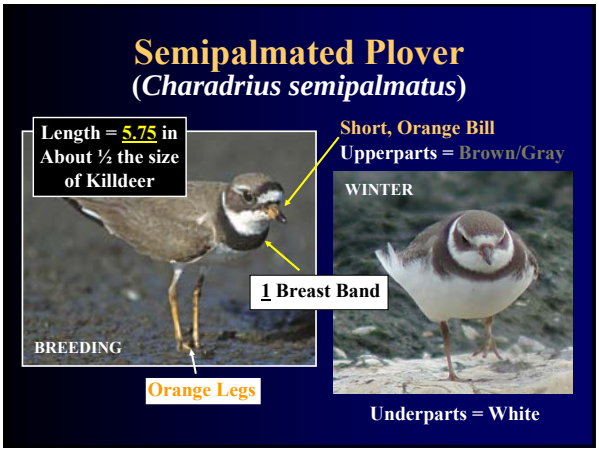
- **Required: 3 Species**

Small, plump-bodied
Short, thick bills
Forage visually
Often heard before seen (e.g., Killdeer)

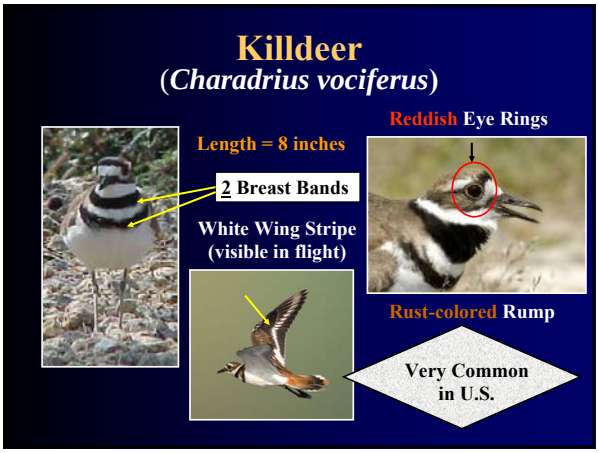
Black-bellied Plover
(*Pluvialis squatarola*)



Semipalmated Plover
(*Charadrius semipalmatus*)



Killdeer
(*Charadrius vociferus*)



Stilts & Avocets
Family Recurvirostridae

➢ Required: 2 Species

- Sleek, Graceful Waders
- Long, Slender Bills
- "Spindly" Legs

Normally forage out in shallow water (not on mudflats)

Black-necked Stilt
(*Himantopus mexicanus*)

Length = 13 in

Long and Very Thin Black Bill

✓ Black Cap With White Spot Above Eye

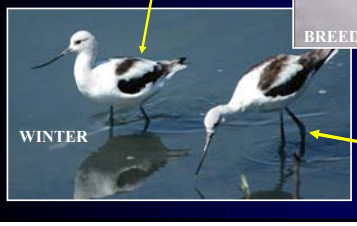
IN FLIGHT
Legs Extend Well Past Tail

American Avocet
(*Recurvirostra americana*)

Length = 15 in

Very Thin, "Upturned" Bill

White Back Bordered by 2 Longitudinal Black Stripes



✓ White Rump & Tail

Long, Blue/Gray Legs

Family Scolopacidae
Sandpipers and Phalaropes

➢ Required: 15 Species

- Inhabit Mudflats and Sandy Shorelines
- Many Adapted for High-Speed Flight

✓ Very Diverse Group

Greater Yellowlegs
(*Tringa melanoleuca*)

Length = 11 in

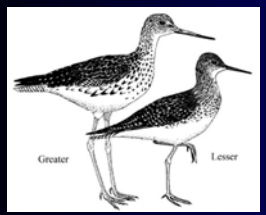
Long, Thin Bill Curved Slightly Upward

Bill Length = 1.5X's Length of Head

Lesser Yellowlegs
(*Tringa flavipes*)

Length = 8.75 in

- Bill Not Upturned
- Similar Flecking



Roughly Half the Size of Greater Yellowlegs

Bill Length = Length of Head

Solitary Sandpiper
(*Tringa solitaria*)

Length = 7 in

Usually Solitary and Often Bobs Tail

BOLD White Eye Ring

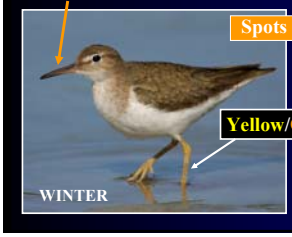
✓ Short, Olive-Colored Legs
✓ White Underside

Spotted Sandpiper
(*Actitis macularius*)

✓ Distinctive, "Fluttery" Flight
✓ Bobs tail during feeding

Length = 6.25 in

Orangish Tone to Bill



Spots on Chest

Yellow/Orange Legs

WINTER

Little, If Any Flecking on Back

Semipalmated Sandpiper
(*Calidris pusilla*)

Length = 5 in

- Overall Grayish in Color
- Thin, White Wing Stripe
- Thin, Dark Bill

Dark (Black) Legs

(Very Small Shorebird)

Least Sandpiper
(*Calidris minutilla*)

Very Common in east TN

✓ Very Small Shorebird
(Smallest in NA)

Overall, Brownish in Color with White Underparts

• Thin, White Wing Stripe

Very Thin, Dark Bill (Slightly Decurved)

Pectoral Sandpiper
(*Calidris melanotos*)

Very Similar to Least in Appearance but Significantly Larger (~Killdeer-size)

• Orange Bill

Distinct Division Between Brown Breast and White Belly

Dunlin
(*Calidris alpina*)

Length = 7 in

✓ White Wing Stripe

Thin, Dark Bill with Droop at Tip

Black Legs

Medium-Sized Shorebird

Long-billed Dowitcher
(*Limnodromus scolopaceus*)

Length = 10 in

- ✓ Long Straight Bill
- ✓ Dull Yellow Legs

Tail Barred Black and White

Call: Single Sharp "Keek"

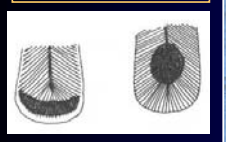
Barred Upper Chest AND Red Belly

Short-billed Dowitcher
(*Limnodromus griseus*)

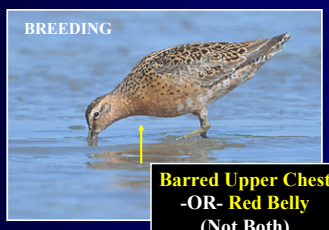
Length = 9.5 in

- ✓ Long Straight Bill
- ✓ Dull Yellow Legs

Call: Quick Mellow "tu-tu-tu"



BARS SPOTS



Barred Upper Chest -OR- Red Belly (Not Both)

✓ Similar Winter Plumage

Wilson's Snipe
(*Gallinago delicata*)

Length = 9 in

"Stocky" Appearance With Short, Olive-Colored Legs

- Brownish Appearance
- Pointed Wings and a Rapid Zigzag Flight
- Very Long, Straight Bill

Found in "marshy" habitat

American Woodcock
(*Scolopax minor*)

Length = 8.25 in

More of a Grayish Overall Appearance

Found in Woodlands/Shrubby Fields

- Very Long, Straight Bill
- Stocky and Short-legged

Black Nape Crossed by Pale Lines

Other Resources:

U.S. Geological Survey (USGS)
Bird Identification Center
http://www.mbr-pwrc.usgs.gov/id/framlst/infocenter.html

Shorebird Photo Quiz
http://www.geocities.com/Yosemite/4413/sb_quiz.html

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Shorebird Management

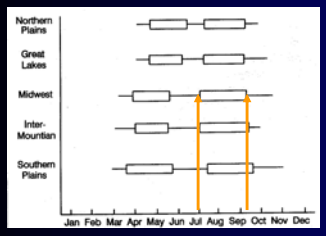
What to consider...

1. **REGIONAL MIGRATION CHRONOLOGIES**
   - WHEN SHOULD I MANAGE?
   - WHEN CAN I MANAGE TO BENEFIT THE GREATEST NUMBER OF SPECIES?

2. **WHERE YOUR AREA LIES ALONG THE MIGRATION ROUTE**
   - WHAT TYPE OF HABITAT WILL I BE PROVIDING?
   - WINTERING, MIGRATORY, BREEDING?

3. **HOW TO MEET HABITAT REQUIREMENTS OF A DIVERSE GROUP OF BIRDS**
   - HOW DO I INCORPORATE HABITAT FOR MULTIPLE SPECIES?

Migration Chronologies

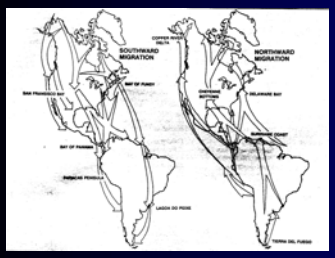


HISTORICALLY, WHEN DO THEY MIGRATE THROUGH YOUR AREA

PEAK MIGRATION
"Get the most bang for your buck!!"

Tennessee peak: late July → early September

Where do you lie along the migration route?



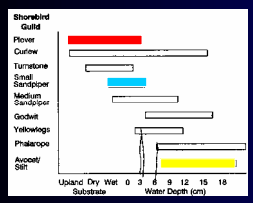
WILL YOU PROVIDE:

1. WINTERING
2. MIGRATORY
3. BREEDING

LMAV STOPOVER DURATION: ~10 days

For migratory habitat...timing is EVERYTHING!

Shorebirds: a very diverse group



Sandpipers

Avocets/Stilts

Plovers

Water level manipulations should work to provide multiple habitat types

COASTAL HABITATS

More "PREDICTABLE" habitats

Larger aggregations of shorebirds

PROBLEMS:
1. Human Recreation
2. Development
3. Boating
4. Dogs
5. Prey Depletion

Management Goal: REDUCE DISTURBANCE

- Preserve and protect habitats (land acquisition and easements)
- Post roosting/nesting areas
- Limit human access (create buffer zones at high tide)
- Ensure persistance of food resources (horseshoe crabs)

INTERIOR HABITATS

Less "predictable", dynamic systems

Habitat conditions vary temporally and spatially with precipitation

PROBLEMS:
1. Water Availability
2. Invasive Plants
3. Disease Outbreaks

Management Goal: Incorporate the needs of shorebirds into current waterfowl management activities

-Sequential drawdown of multiple impoundments (provides microhabitats for multiple spp. and continuous food supply)

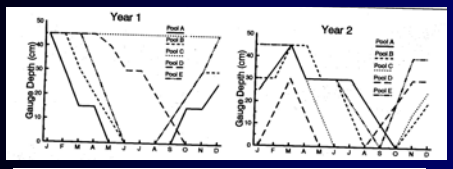


Table 2.4 Potential scenario of drawdown and flooding manipulations and shorebird use during migration for a complex of five pools during two annual cycles

	Spring		Fall	
YEAR 1	***Manipulation***	***Shorebird Use***	***Manipulation***	***Shorebird Use***
Pool A	early drawdown	moderate	late reflooding	low
Pool B	late drawdown	high	early flooding	moderate
Pool C	maintained flooding	low	maintained flooding	low
Pool D	partial late drawdown	moderate	early drawdown	high
Pool E	late drawdown	high	early flooding	moderate
YEAR 2				
Pool A	partial early drawdown	moderate	early drawdown	high
Pool B	partial late drawdown	moderate	early drawdown	high
Pool C	late drawdown	high	late flooding	low
Pool D	early drawdown	moderate	early flooding	low
Pool E	partial early drawdown	moderate	early drawdown	high