The Uptake of Mercury and Relationship to Food Habits of Fish in the South River and South Fork Shenandoah River

G. W. Murphy, T. J. Newcomb, and D. J. Orth

Dept. of Fisheries and Wildlife Sciences

Virginia Tech

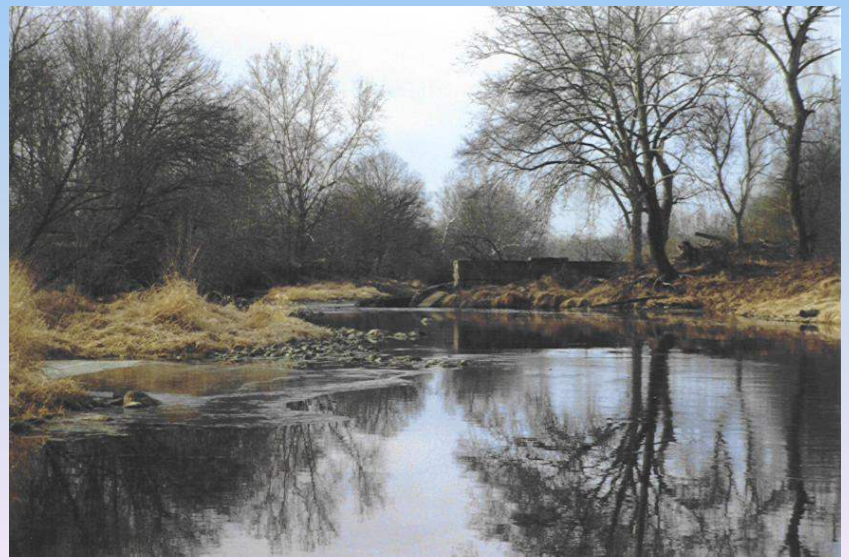
February Update

Study Justification

- Documented increase of mercury levels in fish
- Diet is potentially the **greatest factor** affecting the bioaccumulation of mercury by fish
- Food habits of most fish are generally well known, however no documentation exists from South River and South Fork
- Study will provide a better understanding of the processes and pathways affecting mercury uptake by fish

Today's Focus

1. Update on food habits
2. Outline of Phase II plans



Lynwood, VA

Dooms, VA

Objective

- Determine diet composition of target fish species in study and reference reaches

Electrofishing

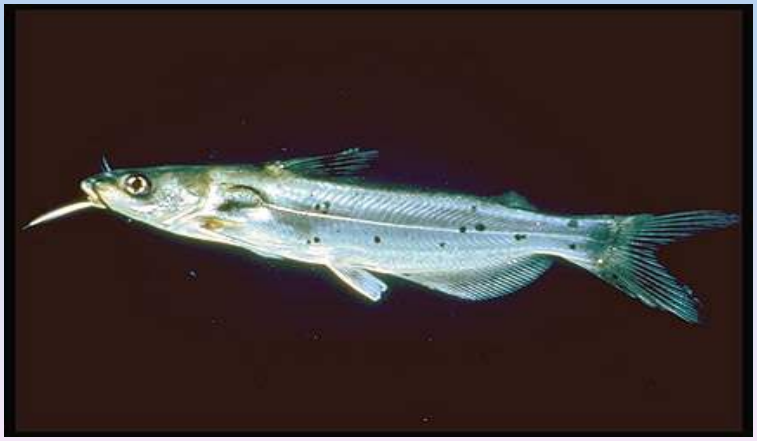
White sucker

Target Fish Species

White sucker

Smallmouth bass

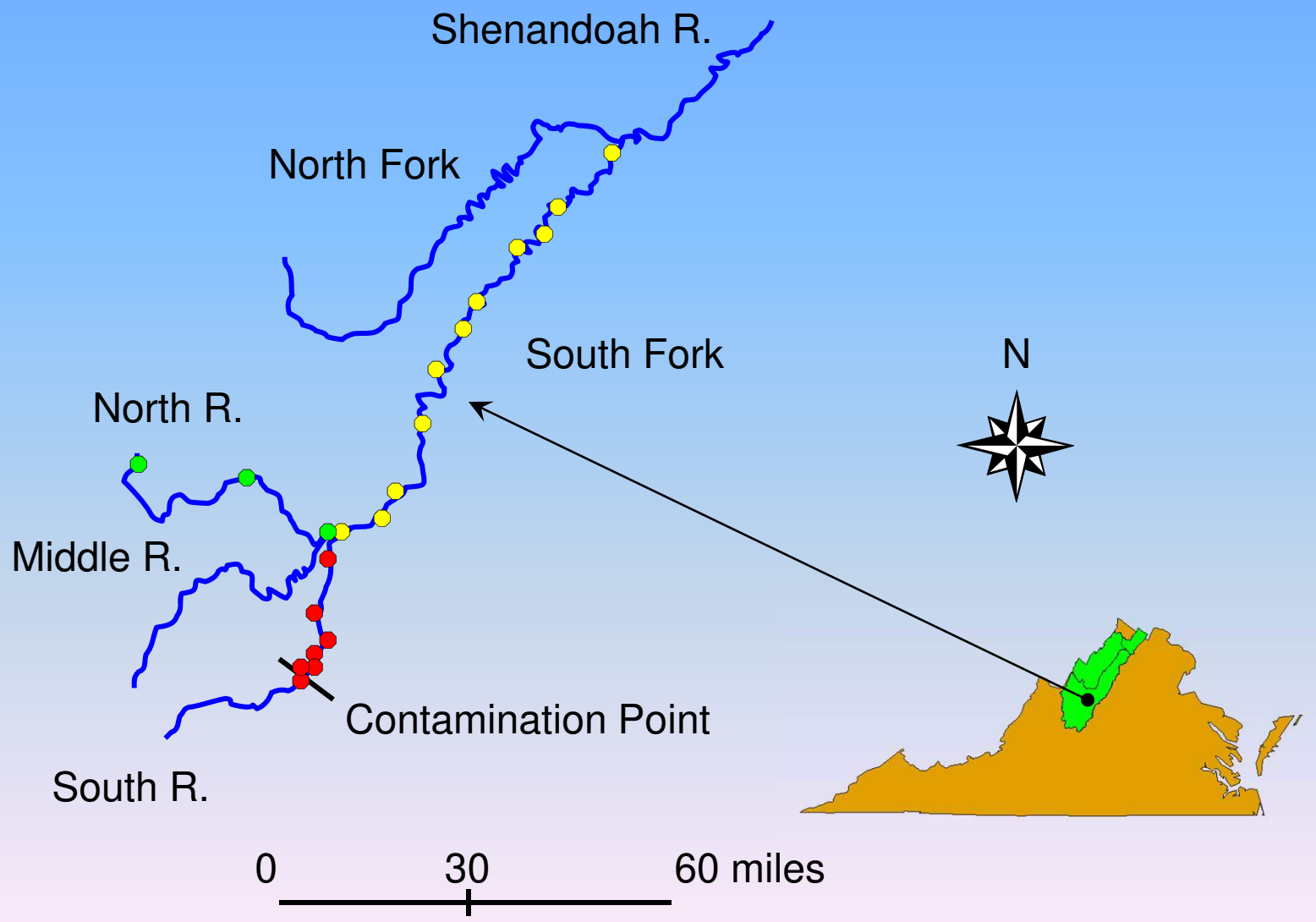
Channel catfish



Redbreast sunfish

Jenkins and Burkhead 1993

Study & Reference Reaches



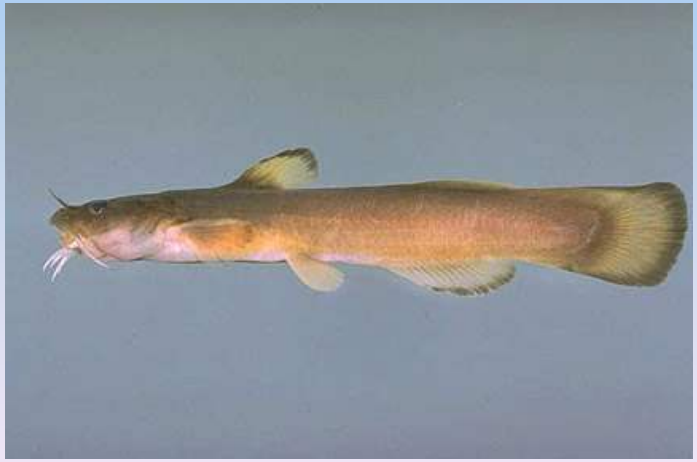
Sampling Methods

- Seasonal collections
- Electrofishers & hoopnets
- Goal = 30/species/reach
- Maximized size range
- Recorded measurements
- Removed “stomach” & otoliths

Laboratory Methods

- Food identification:
  - inverts (order)
  - fish (species)
- Weighed to 0.001 g
- Preserved in EtOH
- Calculated diet composition using % by weight

Trichoptera



Ictaluridae

Jenkins and Burkhead 1993

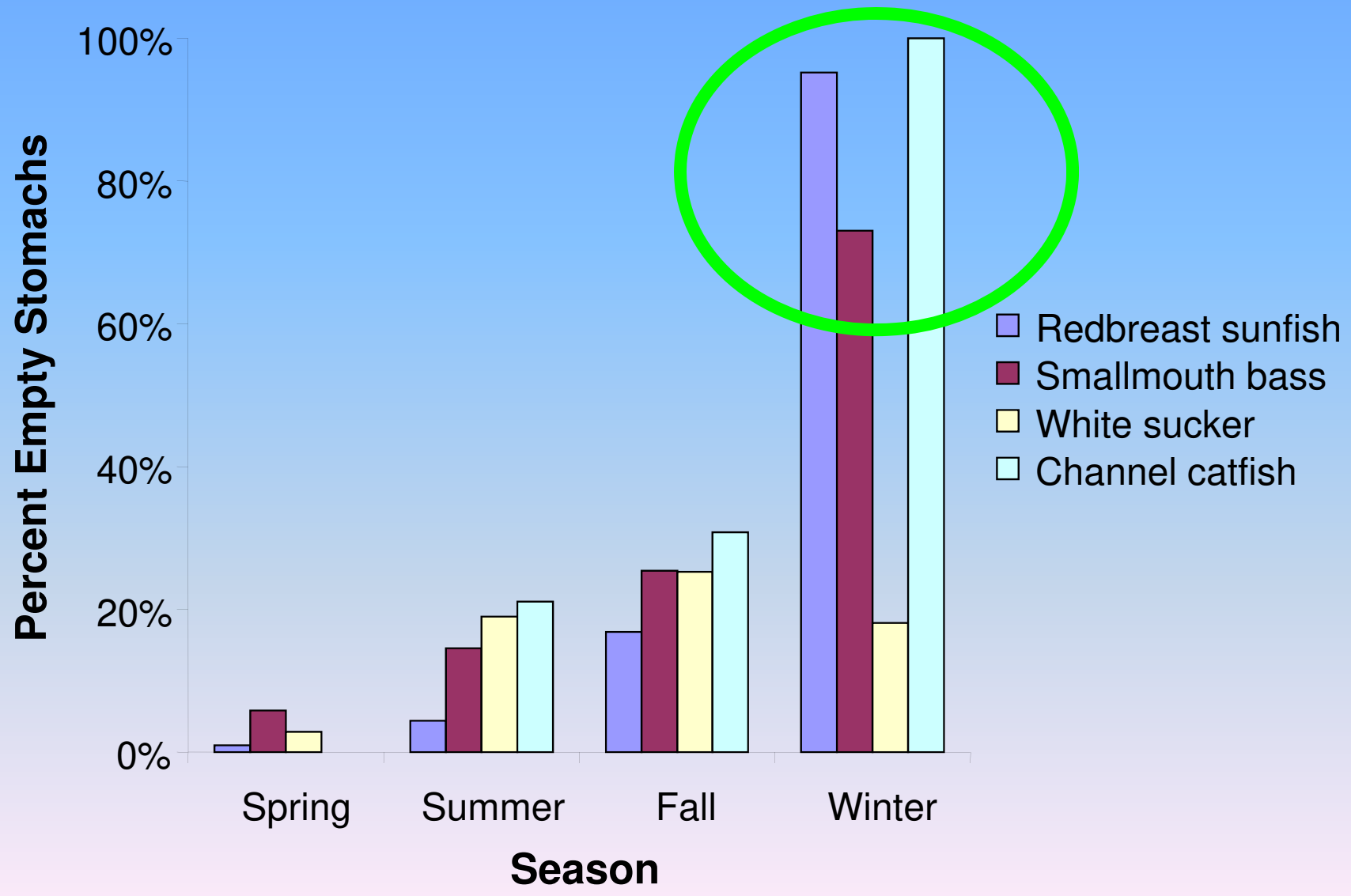
Results
Waynesboro, VA

Achieved collection goal 31 of 40 attempts

Collected total of 1,276 fish

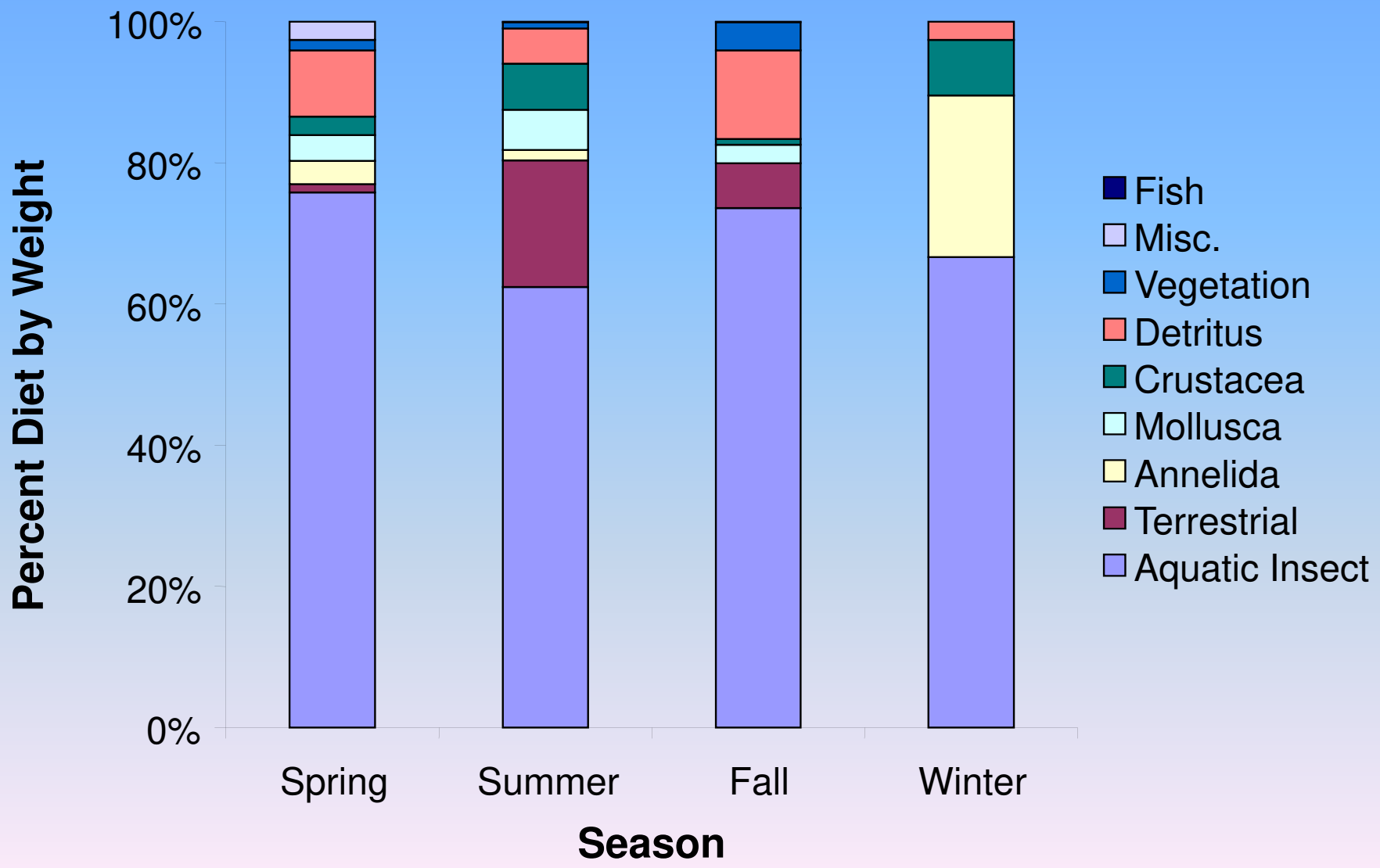
	Species	South River	South Fork	North River
Spring	channel catfish	.	1	.
	redbreast sunfish	34	39	30
	smallmouth bass	35	56	30
	white sucker	35	30	30
Summer	channel catfish	.	38	.
	redbreast sunfish	32	35	24
	smallmouth bass	42	58	31
	white sucker	35	30	30
Fall	channel catfish	.	26	.
	redbreast sunfish	34	42	31
	smallmouth bass	44	49	37
	white sucker	32	27	32
Winter	channel catfish	.	2	.
	redbreast sunfish	31	30	23
	smallmouth bass	20	37	21
	white sucker	35	18	30

Percent empty stomachs increased by season

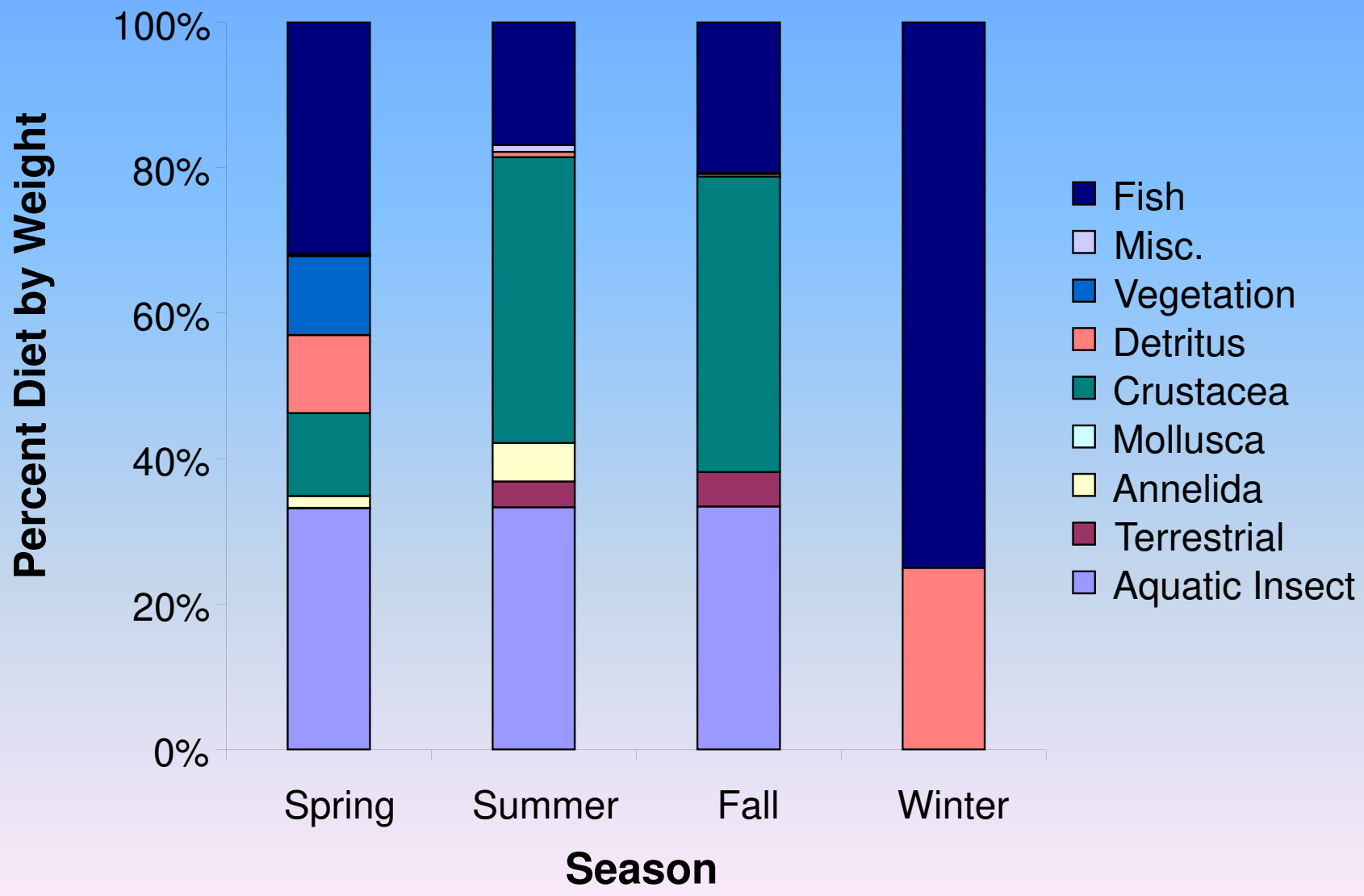


South River
Grottoes, VA

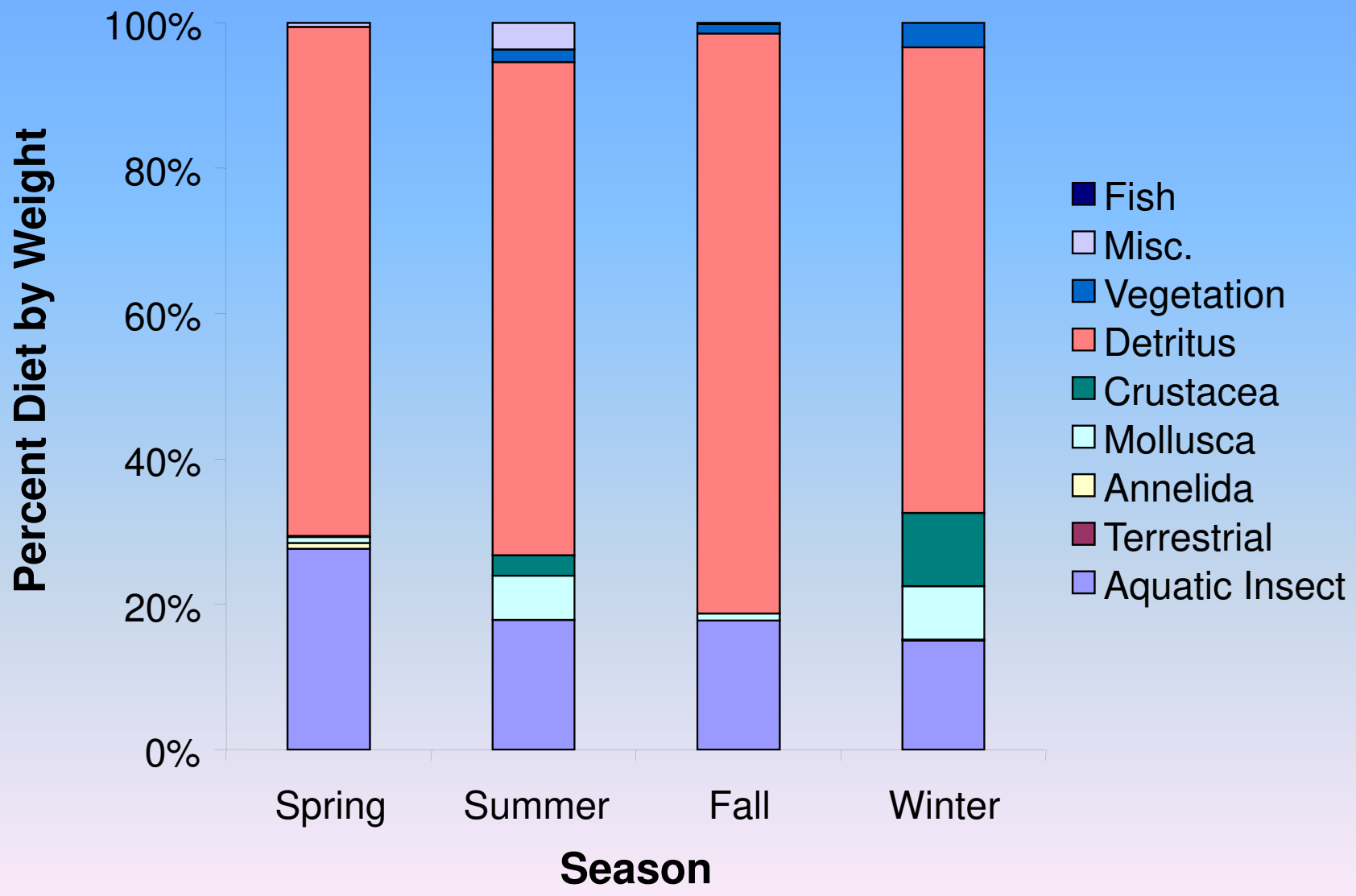
South River redbreast sunfish mainly consuming aquatic insects



South River smallmouth bass mainly consuming aquatic insects, crayfish, and fish

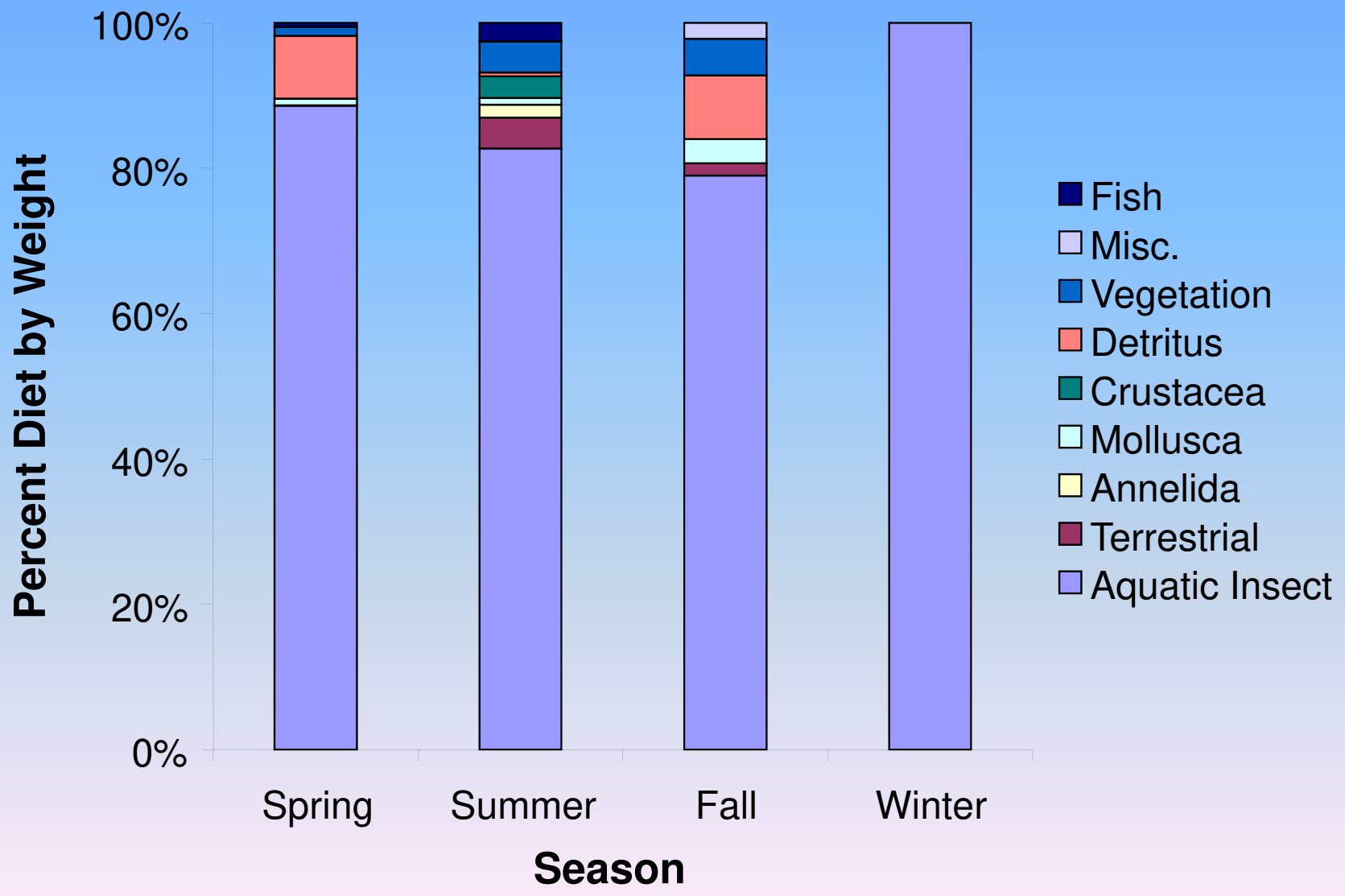


South River white sucker mainly consuming detritus and aquatic insects

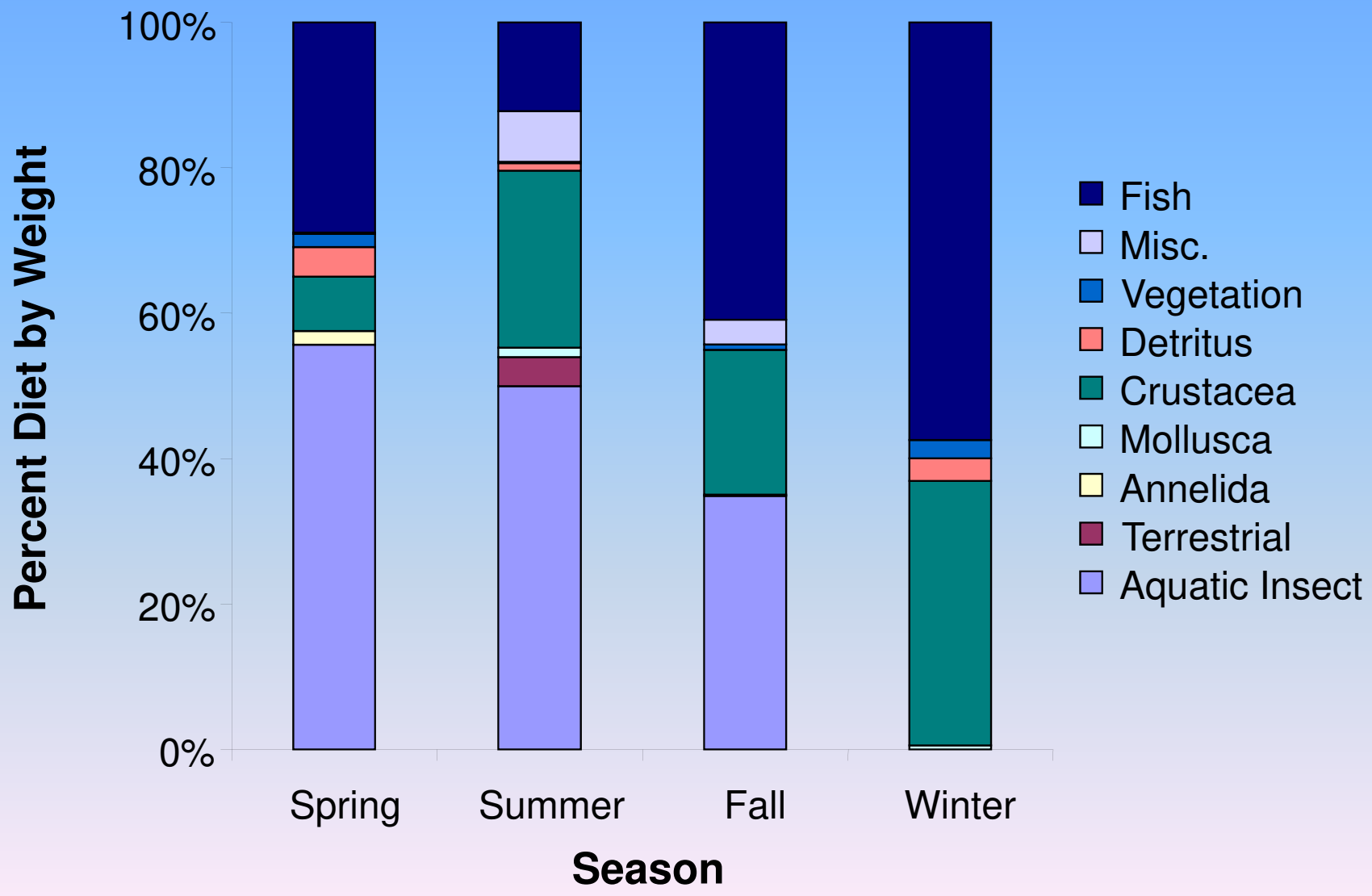


South Fork
Shenandoah River
Bentonville, VA

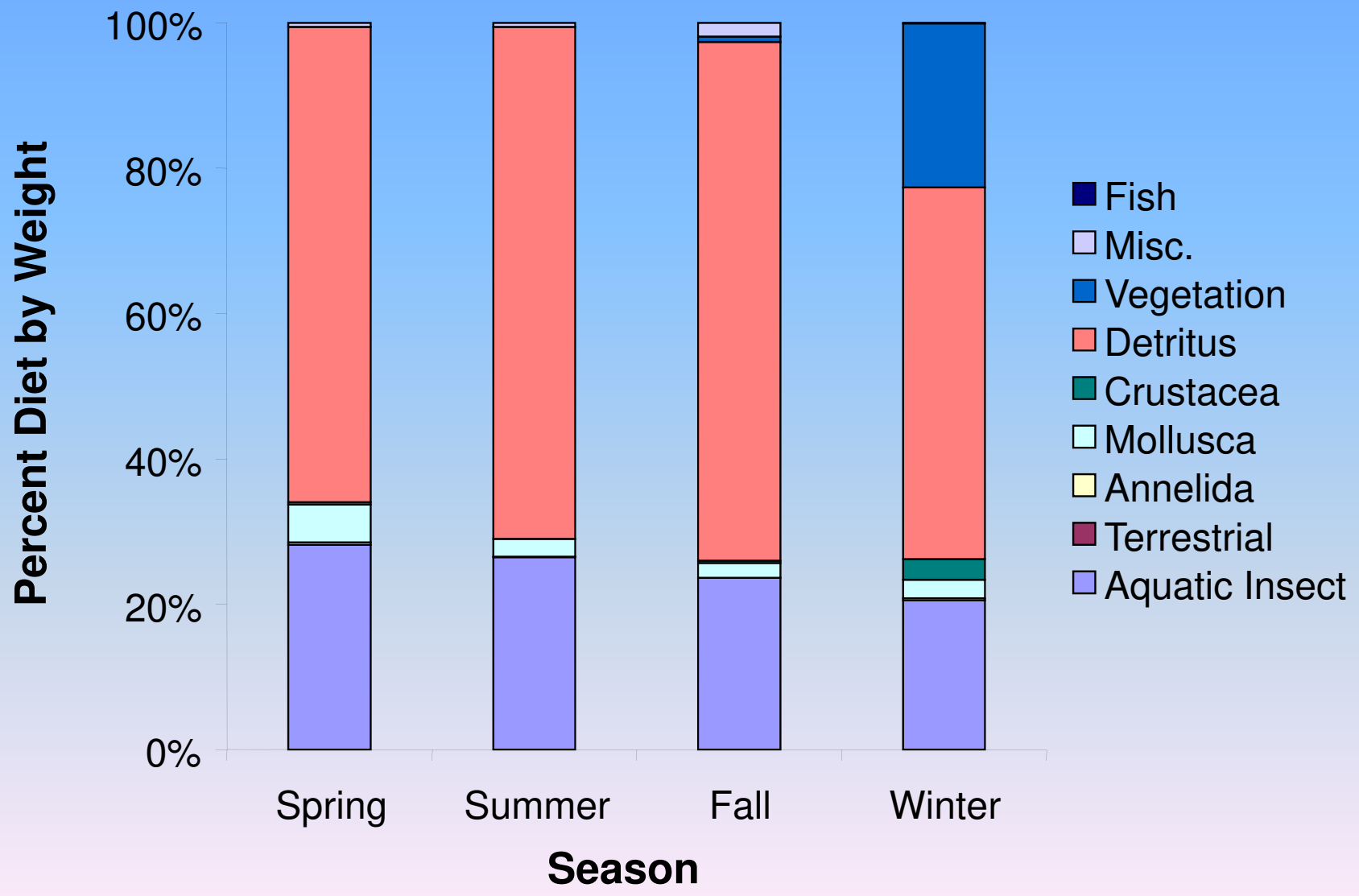
South Fork redbreast sunfish mainly consuming aquatic insects



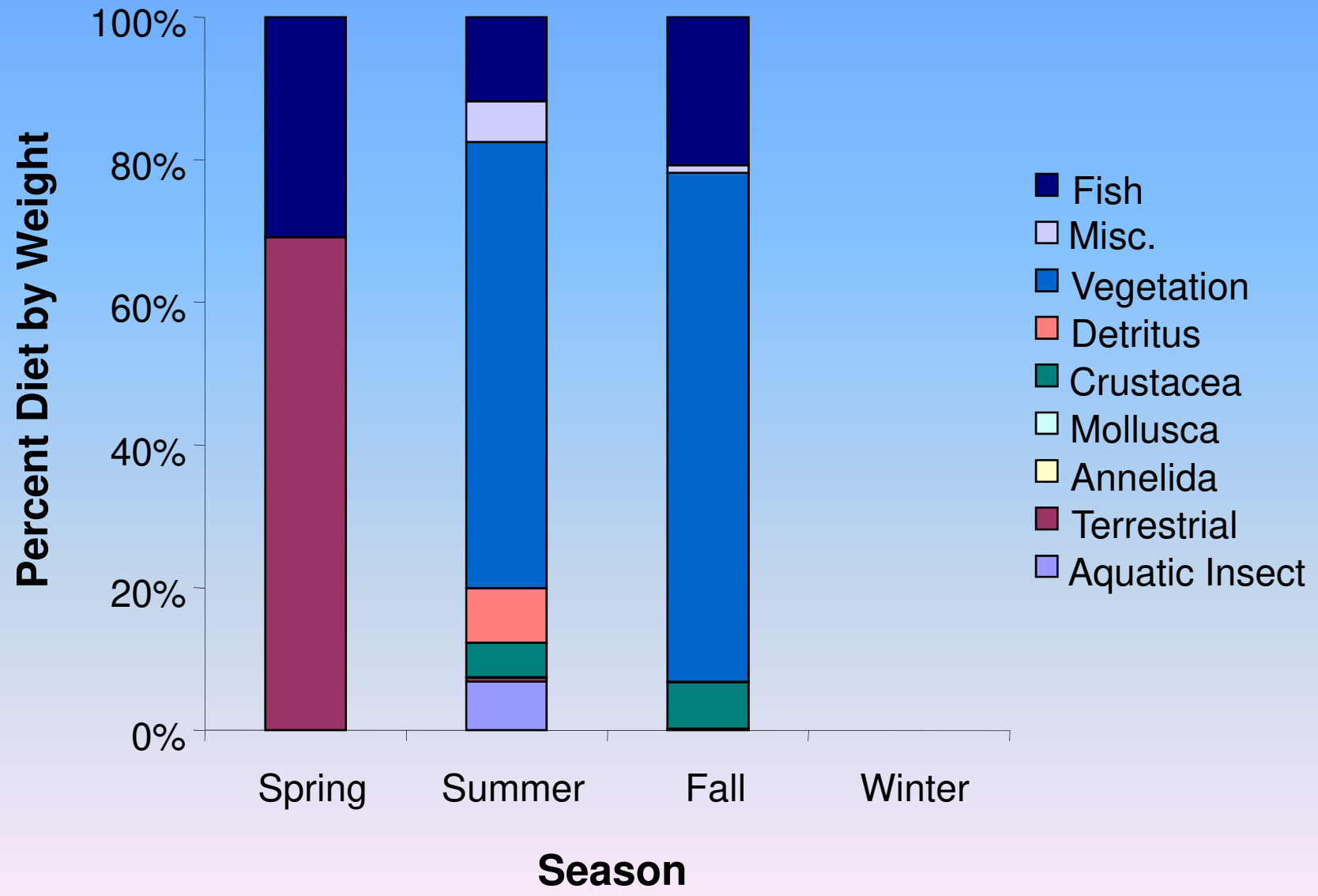
South Fork smallmouth bass mainly consuming aquatic insects, crayfish, and fish



South Fork white sucker mainly eating detritus and aquatic insects

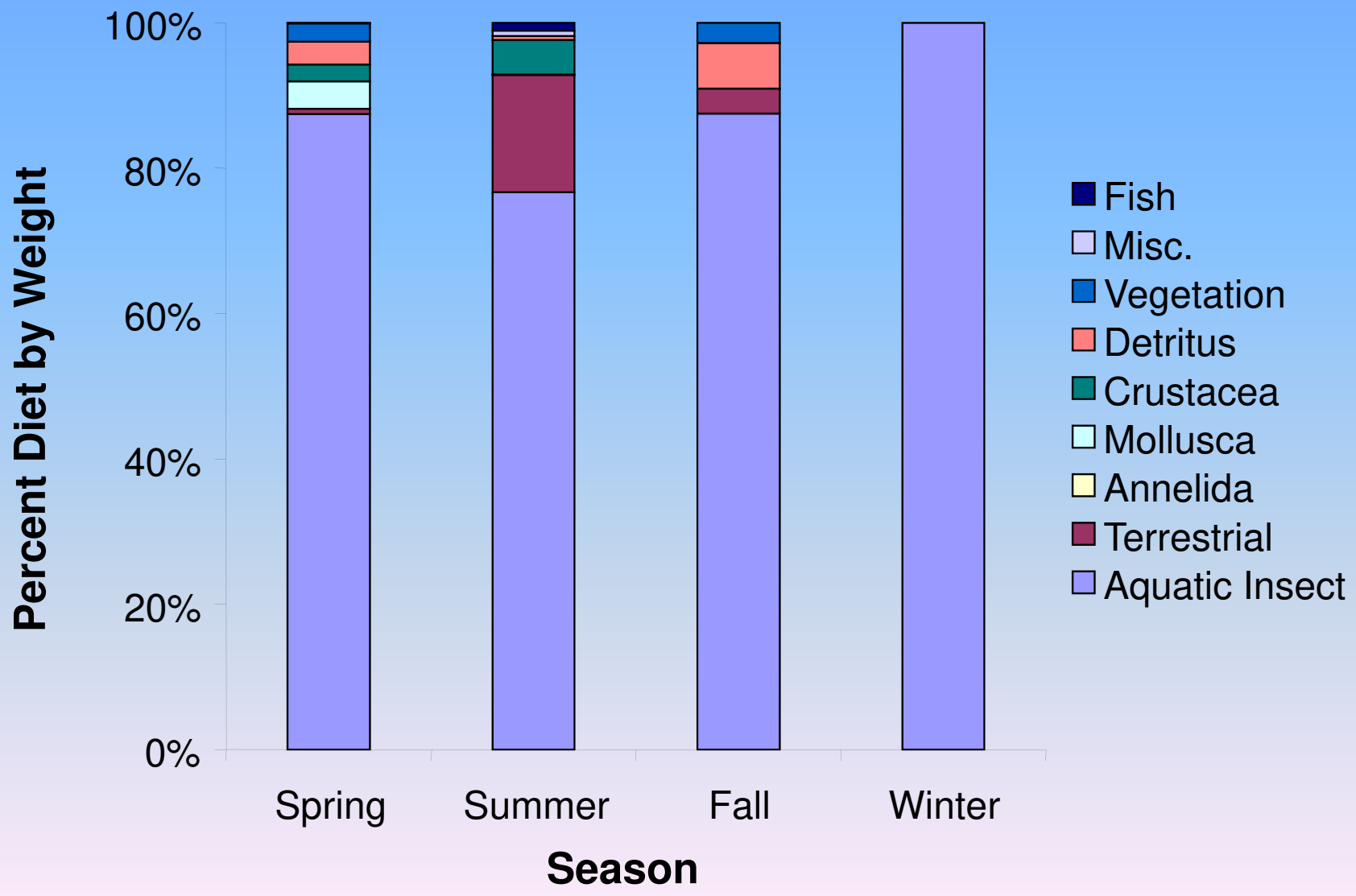


South Fork channel catfish mainly consuming algae and fish

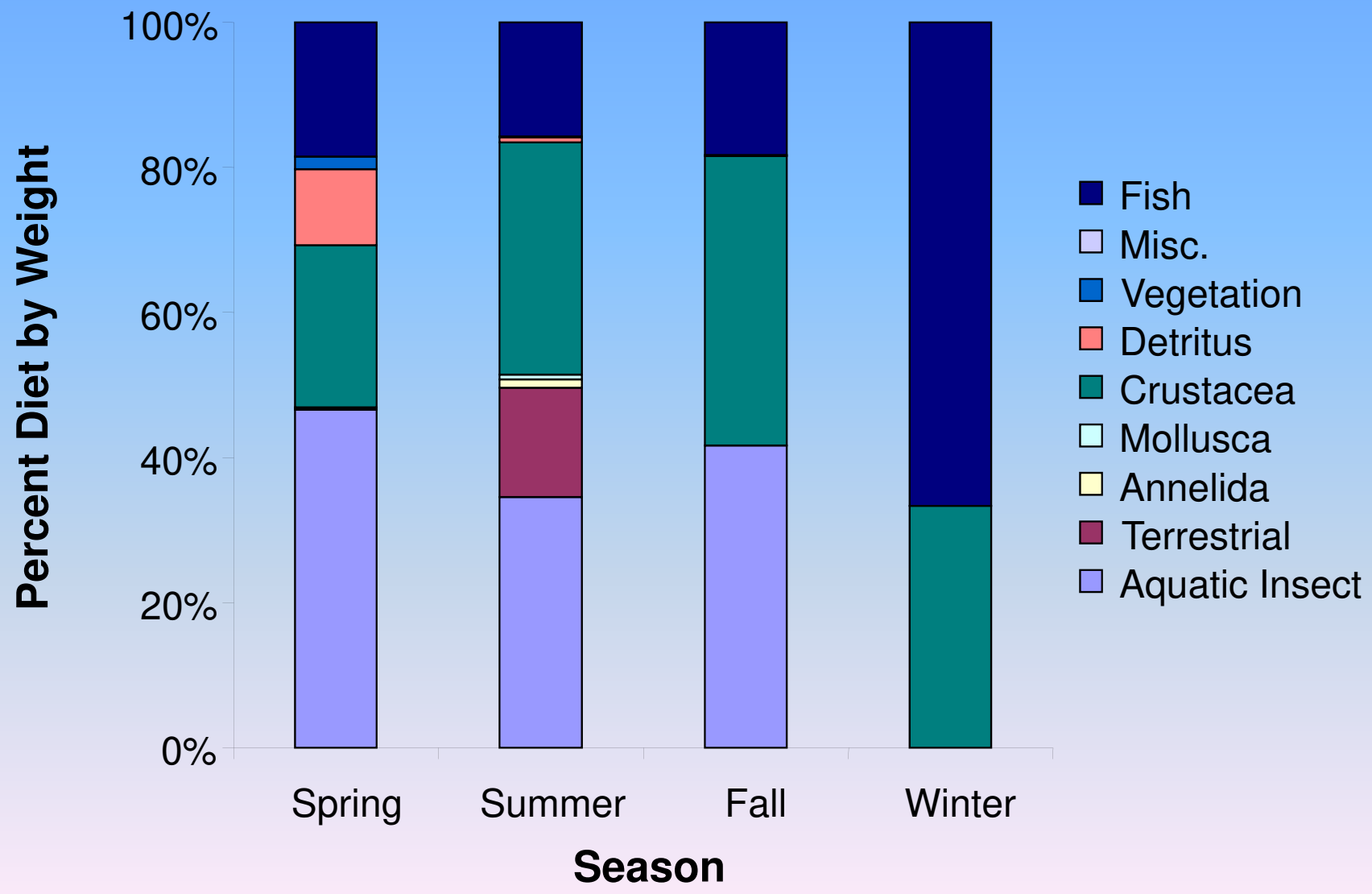


North River
Grottoes, VA

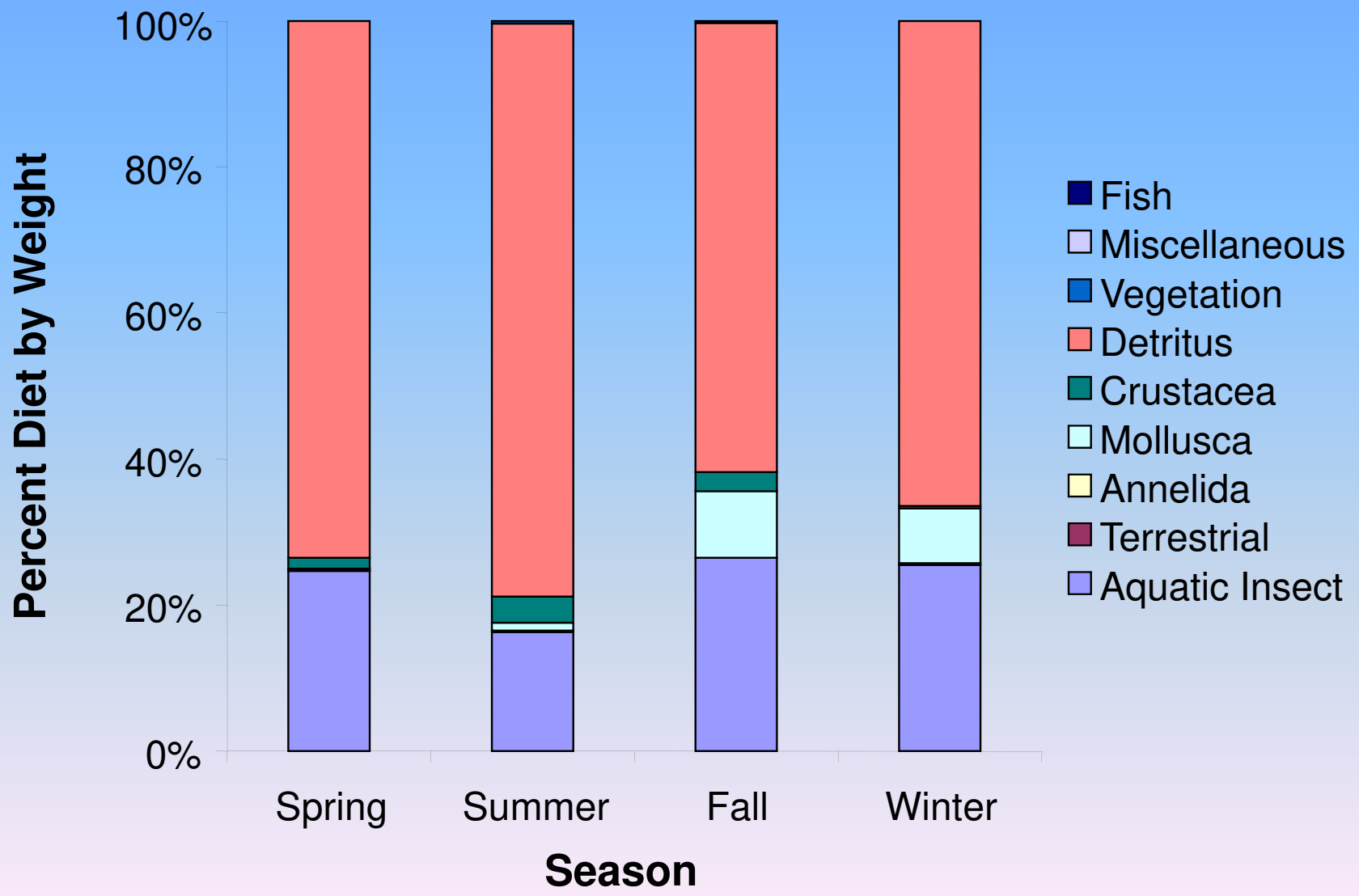
North River redbreast sunfish mainly consuming aquatic insects



North River smallmouth bass mainly consuming insects, crayfish, and fish



North River white sucker mainly eating detritus and aquatic insects



Food Habits Summary

- Redbreast sunfish diet consists mainly of aquatic insects and appears similar in all reaches
- Smallmouth bass diet consists mainly of aquatic insects, crayfish, and fish and appears similar in all reaches
- White sucker diet consists mainly of detritus and aquatic insects and appears similar in all reaches
- Channel catfish diet consists mainly of algae and fish

Grand Summary

- Completed Phase I fish sampling
- Completed laboratory identification of stomach contents
- Preliminary diet data analysis

Next Steps

- Group size classes
- Statistical analysis:
  - seasons
  - size classes
  - reaches
- Draft Phase I final report

Phase II
Dooms, VA

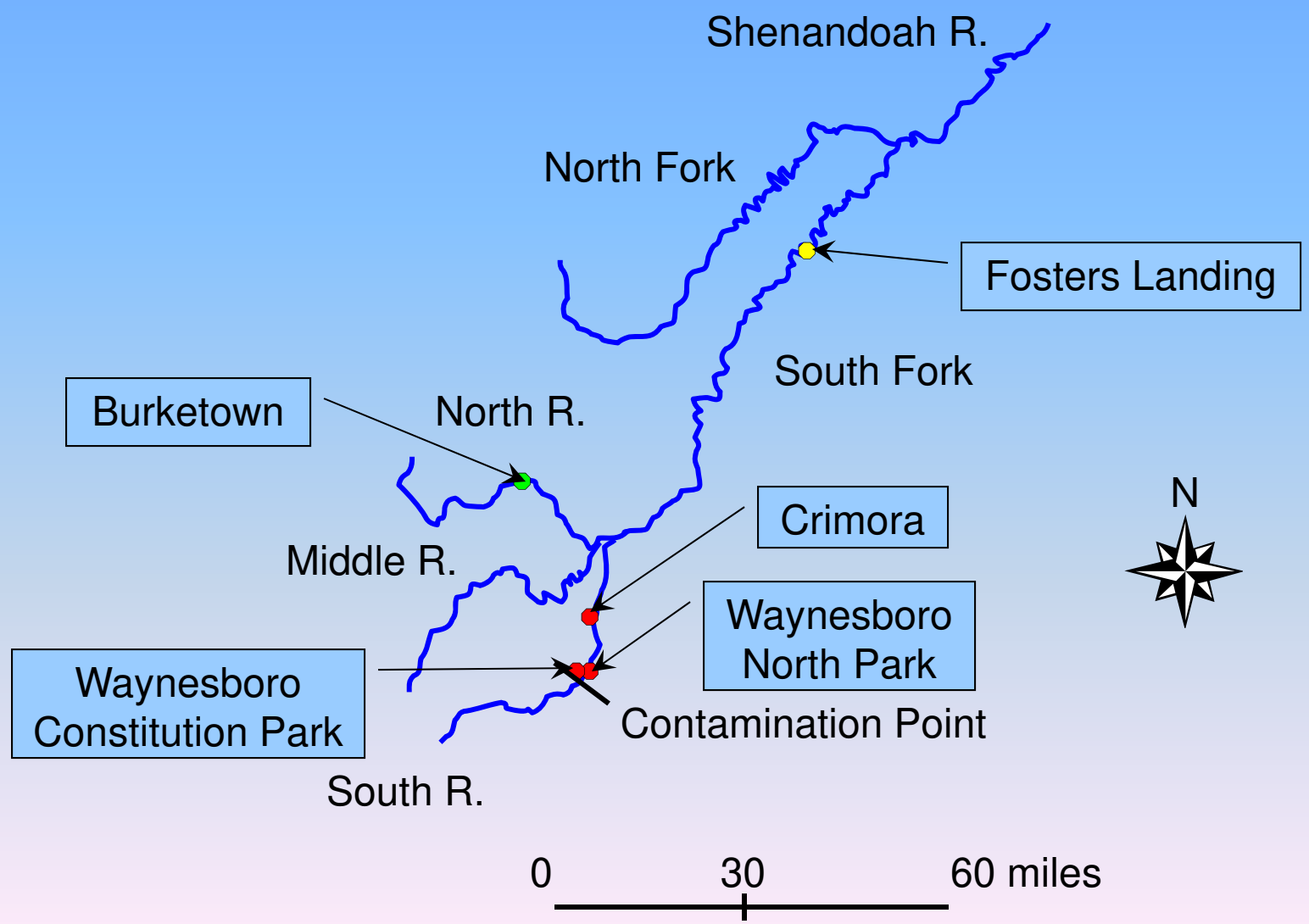
Objective

- Evaluate total mercury (THg) and methylmercury (MeHg) concentrations in common food items utilized by target fish species in study and reference reaches

Centrarchidae

Ephemeroptera

Tentative Food Sampling Sites



Food Collection Methods

- Electrofishers, nets, traps, and invertebrate samplers
- Clean methods
- Composite samples
  - fish (n=5)
  - inverts (>2g)
- Water samples

Laboratory Analysis

- Frontier Geosciences, Inc.
- THg = HNO_3/H_2SO_4, CVAFS
  - 0.45 ng/g
  - $157.50
- MeHg = KOH/Methanol, CVAFS
  - 1.2 ng/g
  - $252.00
- TAT = 28 days

Tentative Collection List

Insects:
Ephemeroptera
Trichoptera
Plecoptera
Diptera
Odonata
Lepidoptera
Coleoptera
Hemiptera
Megaloptera
Terr. Coleoptera

Fish:
Ictaluridae
Centrarchidae
Cyprinidae
Percidae

Other:
Crayfish
Detritus
Annelida
Asian clam
Gastropoda
Algae

Acknowledgements

South River Science Team

Committee Members

Volunteers

Questions?

Cost Analysis

Sites	Samples	Seasons	THg (80%) $157.50	MeHg (20%) $252.00	Dry Ice ~$2.00/lbs.	Shipping ~$35.00/lot	Estimated Total Costs
3	6	4	$9,072.00	$3,628.80	$240.00	$420.00	$13,360.80
3	8	4	$12,096.00	$4,838.40	$240.00	$420.00	$17,594.40
3	10	4	$15,120.00	$6,048.00	$240.00	$420.00	$21,828.00
4	6	4	$12,096.00	$4,838.40	$320.00	$560.00	$17,814.40
4	8	4	$16,128.00	$6,451.20	$320.00	$560.00	$23,459.20
4	10	4	$20,160.00	$8,064.00	$320.00	$560.00	$29,104.00
5	6	4	$15,120.00	$6,048.00	$400.00	$700.00	$22,268.00
5	8	4	$20,160.00	$8,064.00	$400.00	$700.00	$29,324.00
5	10	4	$25,200.00	$10,080.00	$400.00	$700.00	$36,380.00