Cryptosporidium in Surface and Coastal Waters

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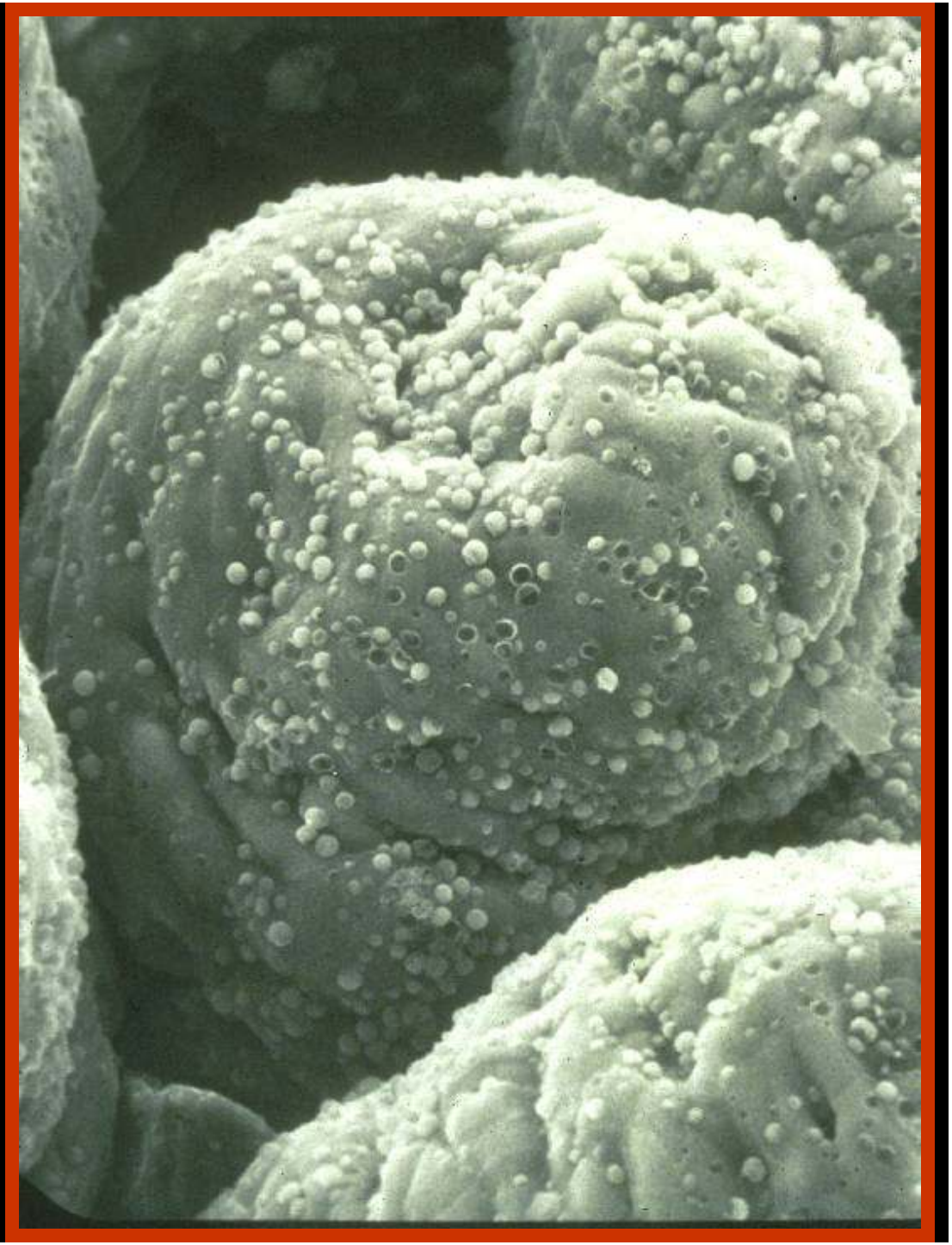
Cryptosporidiosis

Clinical signs lasting 1-2 weeks

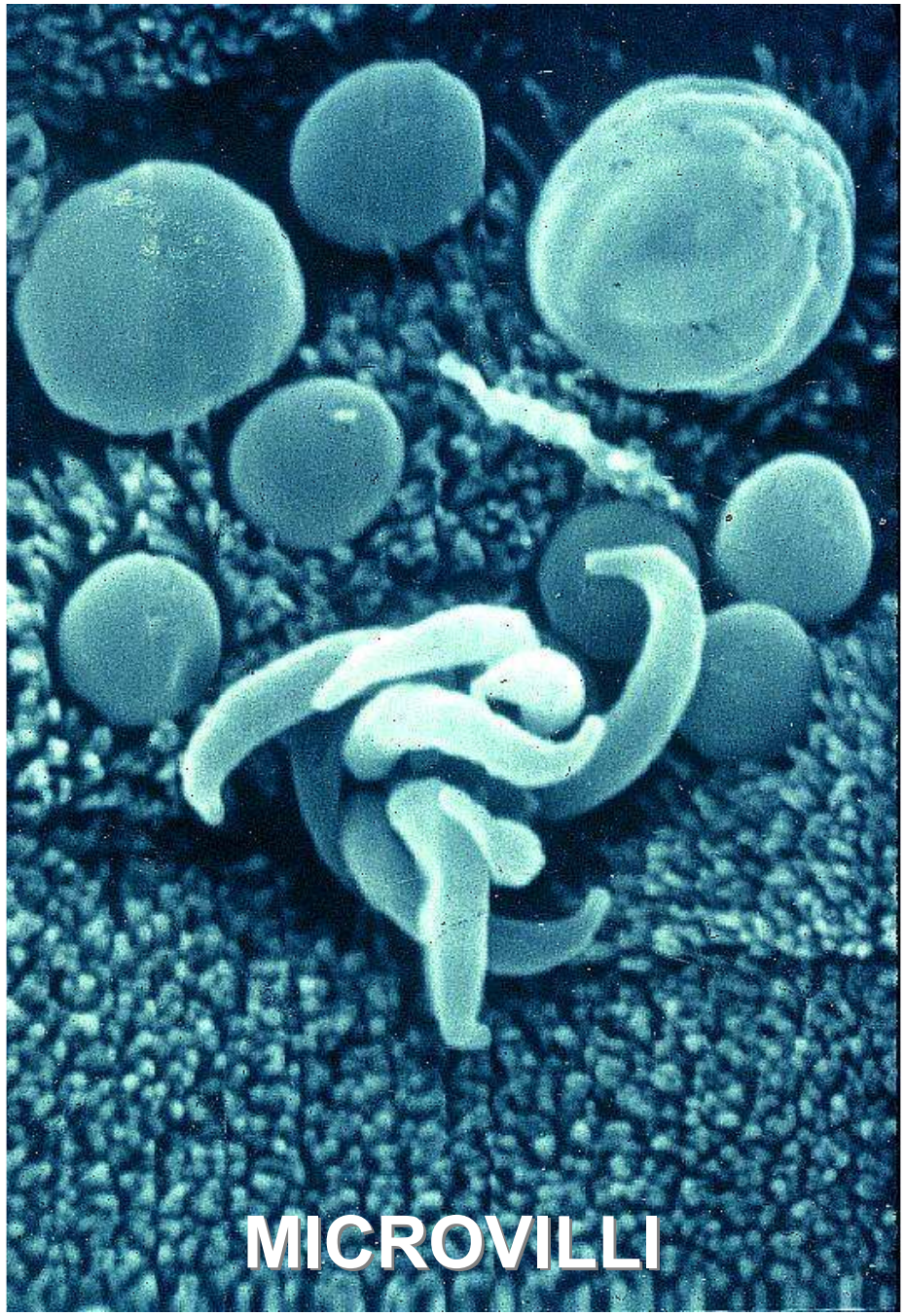
- Profuse watery diarrhea
- Frequent voluminous bowel movements
- Rapid weight loss
- Dehydration
- Abdominal pain
- Nausea
- Vomiting
- Fatigue
- Loss of appetite

SMALL INTESTINE

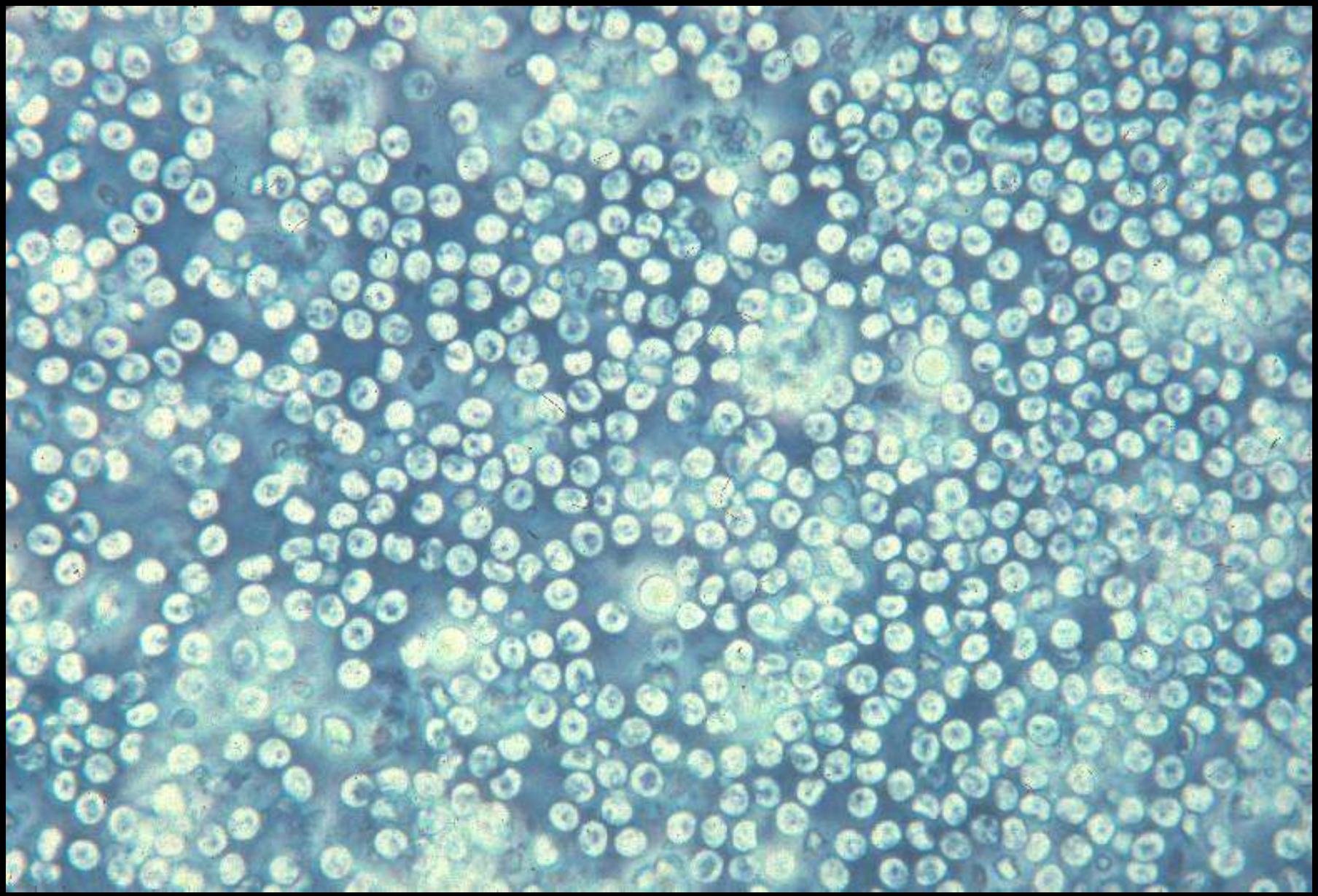
CRYPTOSPORIDIUM PARVUM



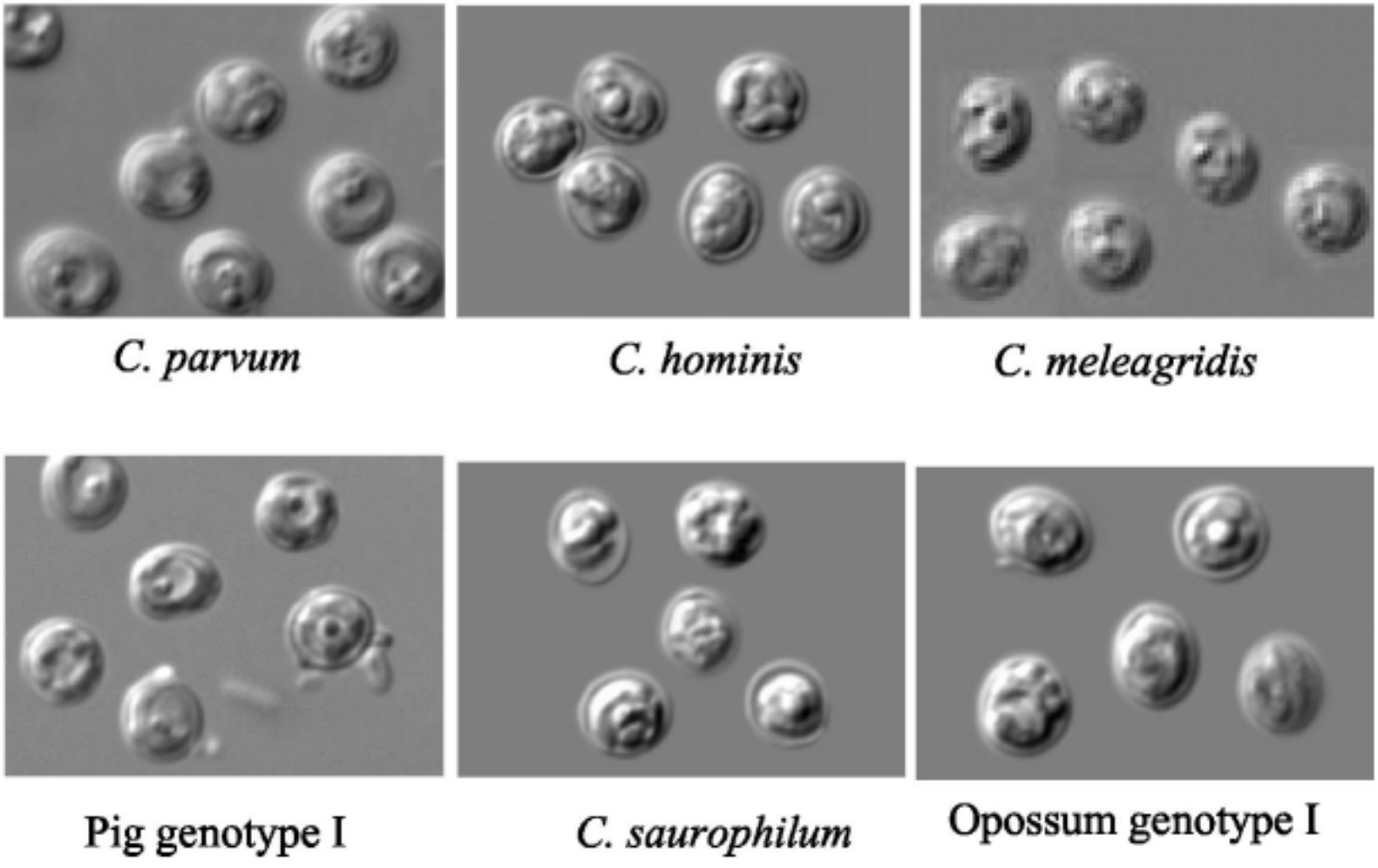
INTESTINAL STAGES OF CRYPTOSPORIDIUM



DIARRHEA CONTAINING OOCYSTS



Differential Interference Contrast DIC



Xiao et al., 2004

PCR


CAUTION: Sample blocks may be very hot !
ATTENTION: Les blocs peuvent être très chauds !
A
Block Status
Heating
Cooling
B
Instant Incubate
Block
Power
MJ RESEARCH
PTC-200
Peltier Thermal Cycler
DNA Engine
Select
1
2
3
4
5
6
7
8
9
.
0
-
Proceed
Cancel
Pause
Stop

GENE SEQUENCING

AGGTCTCTAATCTTCAGTGCAC
CGTTCTTCCAATTCCGGAATCA
ACGTTCAGTGCCACGTTTCGTG
CCACGTTCAGTGCCACGTACGT
CATTCCACGTCAGTGCACGTAC
GTCATTCAGTGCCACGTAGGTC
TCTAATCTTCAGTGCACCGTTCT
TCCAATTCCGGAATCACGTTCA
GTGCCATCACGTTCGTTCGTGC
CACGTTCA

Cryptosporidium: species and hosts

18 Species	Major Hosts	Minor Hosts
C. andersoni	Cattle, Camel ……	-
C. baileyi	Chicken, Turkey……	3 Avian Orders Human
C. bovis	Cattle ……	-
C. canis	Dog ……	Human
C. fayeri	Kangaroo …….	-
C. felis	Cat ……	Human, Cattle
C. galli	Chicken, Passeriformes	-
C. hominis	Human, monkey.……	Dugong, Sheep
C. meleagridis	Turkey,Human ……	Parrot
C. molnari	Fish ……	-
C. muris	Rodent ……	Human,hyrax,Mtn goat
C. parvum	Cattle, Human ……	Rodents, Ruminants -
C. ryanae	Cattle …….	-
C. scophthalmi	Fish ……	-
C. serpentis	Snake ……	Lizard
C. suis	Pig ……	Human, Cattle
C. varani	Lizard……	Snakes
C. wrairi	Guinea pig ……	-

Cryptosporidium: species in humans

18 Species	Major Hosts	Minor Hosts
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C. baileyi	Chicken, Turkey……	3 Avian Orders Human
C. bovis	Cattle ……	-
C. canis	Dog ……	Human (Cattle)
C. fayeri	Kangaroo……	-
C. felis	Cat ……	Human, Cattle
C. galli	Chicken, Passeriformes	-
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C. meleagridis	Turkey,Human ……	Parrot
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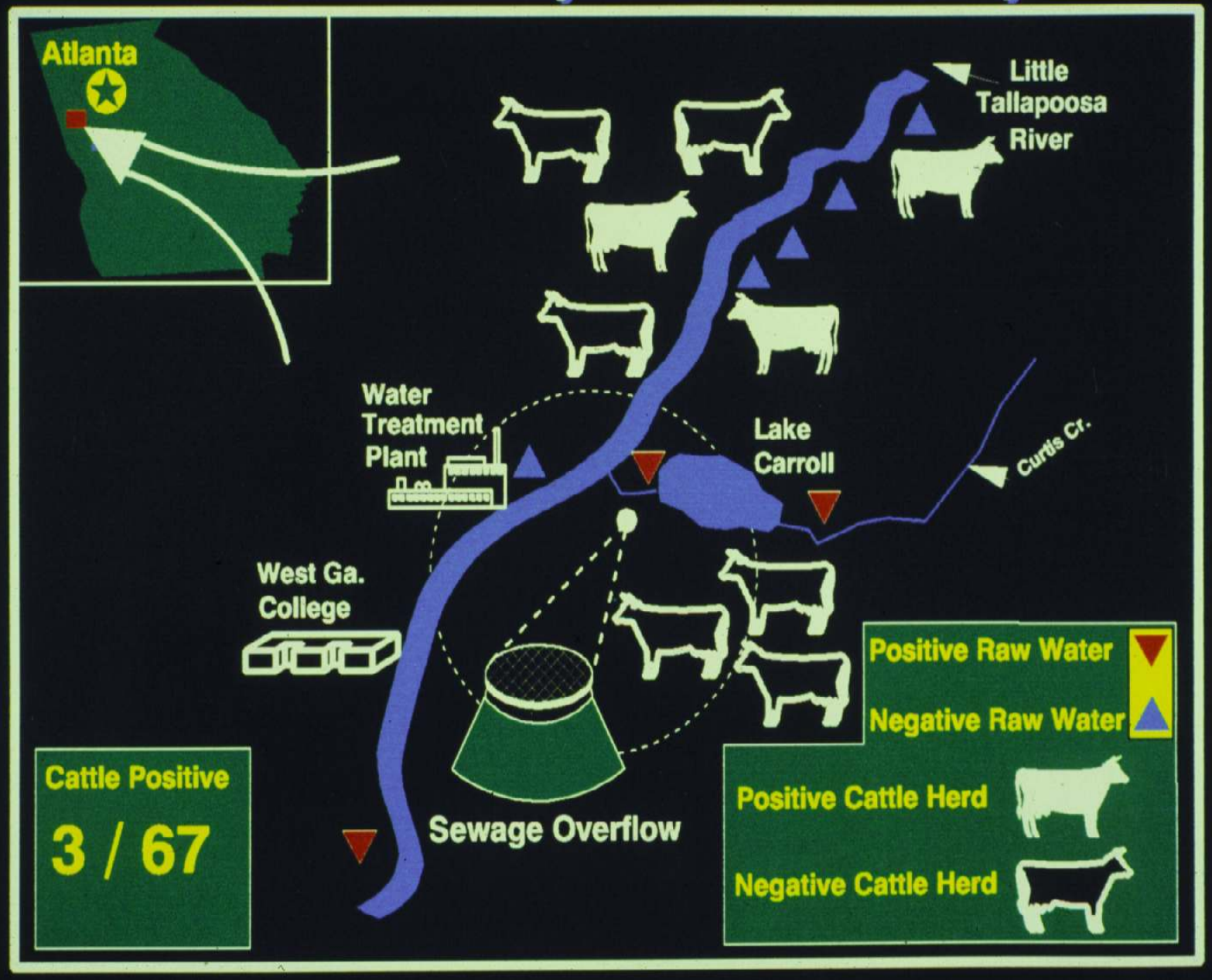
C. suis	Pig ……	Human, Cattle
C. varani	Lizard……	Snakes
C. wrairi	Guinea pig ……	-

DRINKING WATER OUTBREAKS

LOCATION	DATE	CASES	SOURCE
TEXAS	1984	2000	WELL
NEW MEXICO	1986	78	SURFACE
UK	1986	16	RIVER
TEXAS	1987	600	WATER SYSTEM
GEORGIA	1987	13,000	RIVER
UK	1989	516	RIVER
PENNSYLVANIA	1991	551	WELL
SWEDEN	1991	600	MUNICIPAL
UK	1991	47	RIVER
UK	1991	44	MUNICIPAL

Carroll County River/Cattle Survey



DRINKING WATER OUTBREAKS

LOCATION	DATE	CASES	SOURCE
OREGON	1992	15,000	SPRING/RIVER
UK	1992	125	MUNICIPAL
WISCONSIN	1993	403,000	LAKE
WASHINGTON	1993	7	WELL
MINNESOTA	1993	27	LAKE
UK	1993	43	PRIVATE
NEVADA	1994	78	LAKE
FLORIDA	1995	72	CONTAM AT TAP
MASSACHUSETS	1995	>10,000	RESERVOIR
BRIT.COLUMBIA	1996	2000	RESERVOIR

TIME

APRIL 19,1993

THE WATERWORKS FLU

A tiny parasite gets the blame for making thousands of Milwaukeeans miserable

By J. MADELEINE NASH CHICAGO

ONLY THE MICROBIO[illegible] happy last [illegible]

first outbreak of cryptosporidiosis in this country, nor is it likely to be the last. Indeed, Walter Jakubowski, a parasitology expert for the Environmental Pro[illegible] Agency, believes that mos[illegible] is now contamin[illegible] "It's so [illegible]

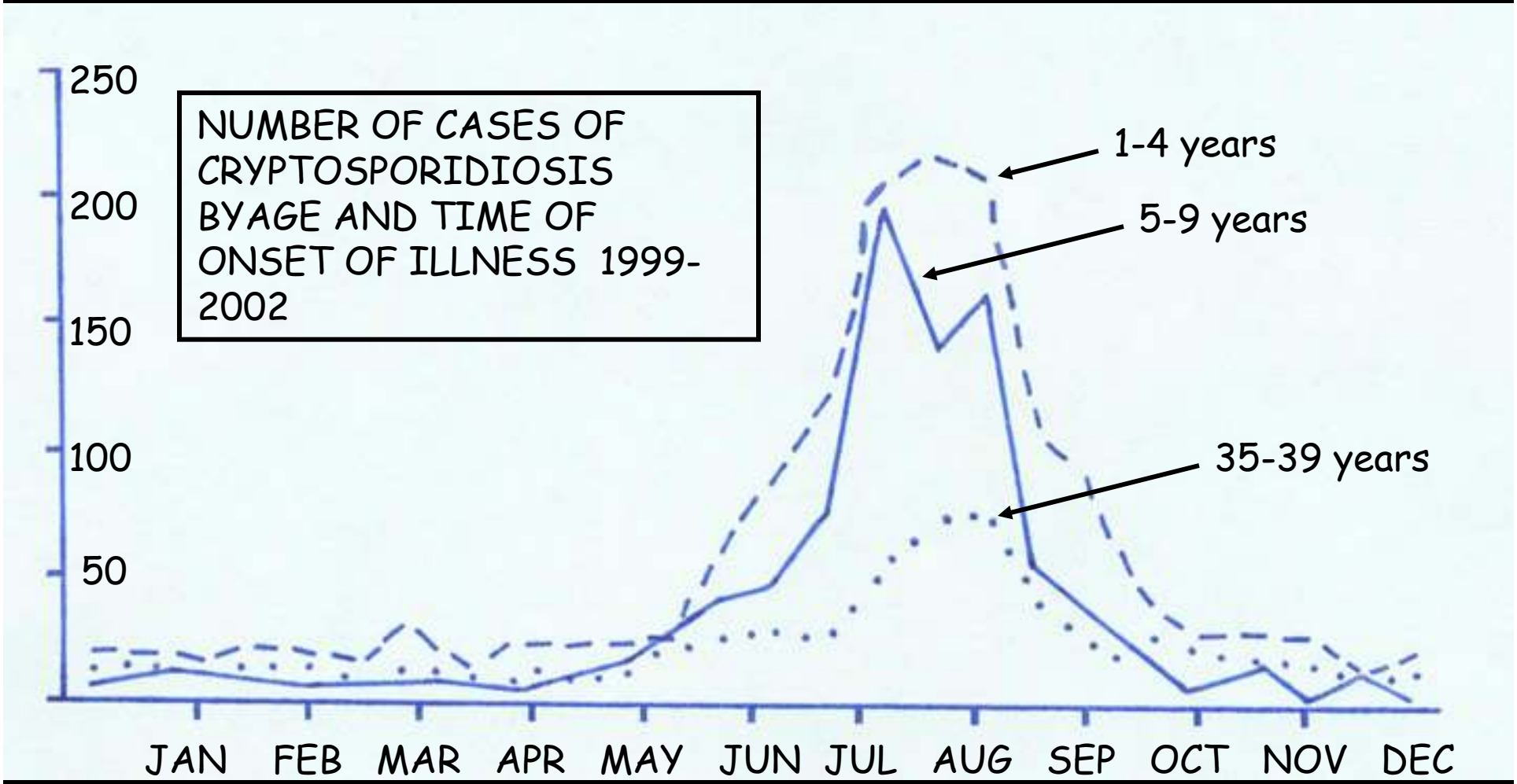
located about [illegible] river's [illegible]

[illegible]ons of [illegible]oan can be re- [illegible]ltration. Unlike bac- [illegible]y are not readily killed by chlo- [illegible]ne. Furthermore, the tests that water-purification plants routinely rely on to

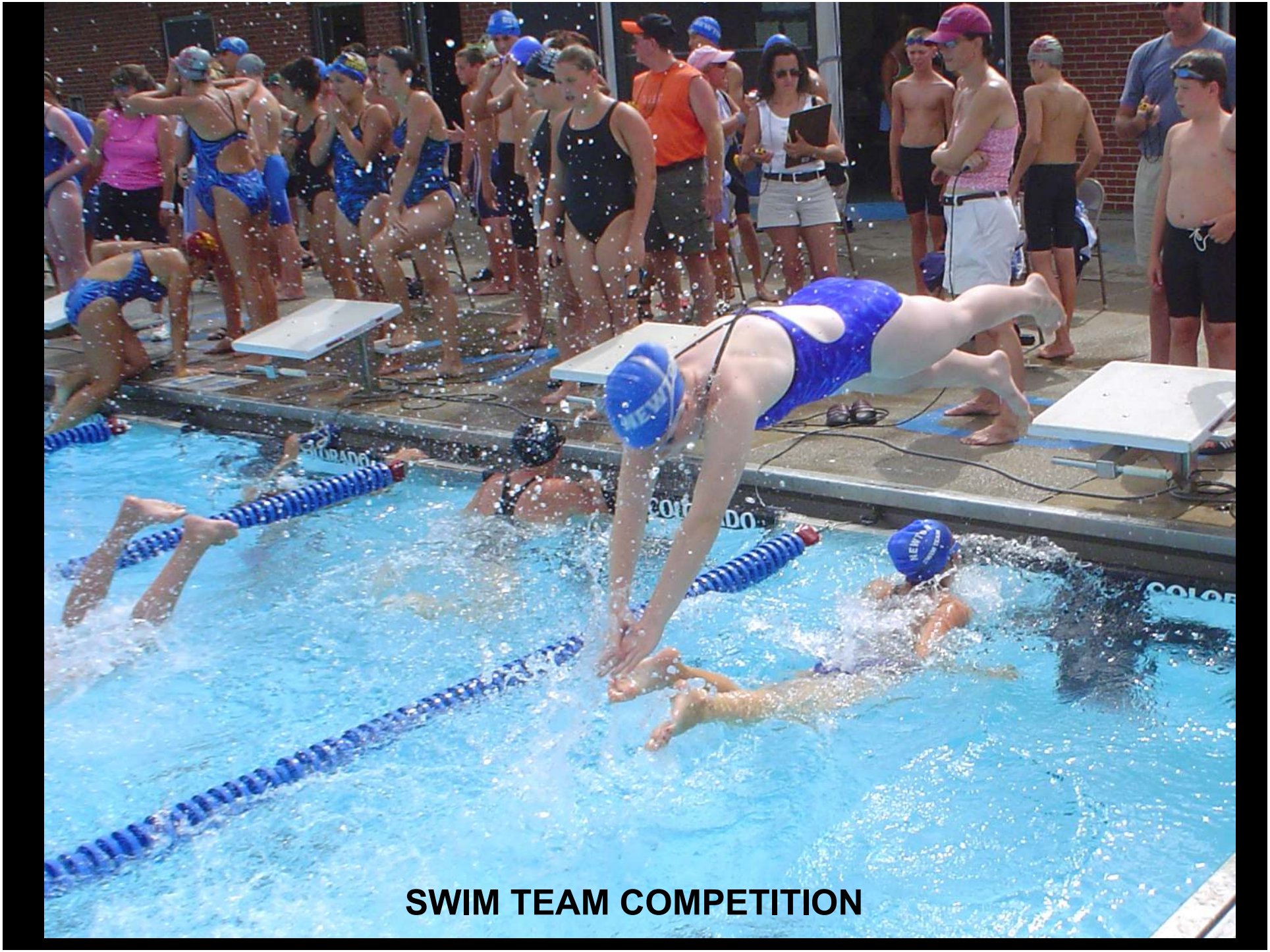
Municipal water was taboo, so city residents lined up to fill jugs with clean well water

MILWAUKEE
409,000 PEOPLE
INFCTED

Seasonality of cryptosporidiosis in the US



Hlavsa et al, 2005



SWIM TEAM COMPETITION

Florida 1 Exceptionally clean, no flies 54%

FL-2

53%

North Carolina 2

72%

Maryland 1

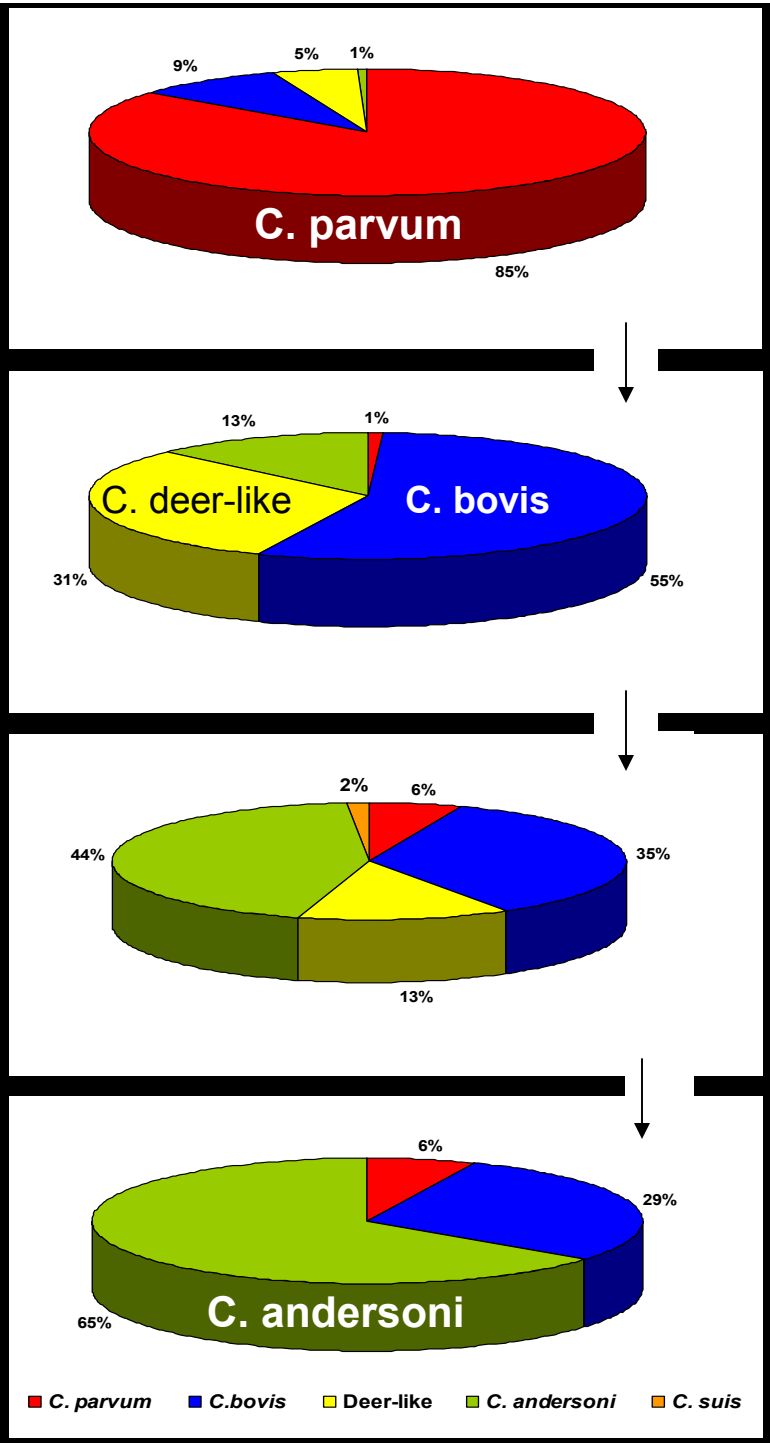
Pens cleaned daily

Fans keep air moving

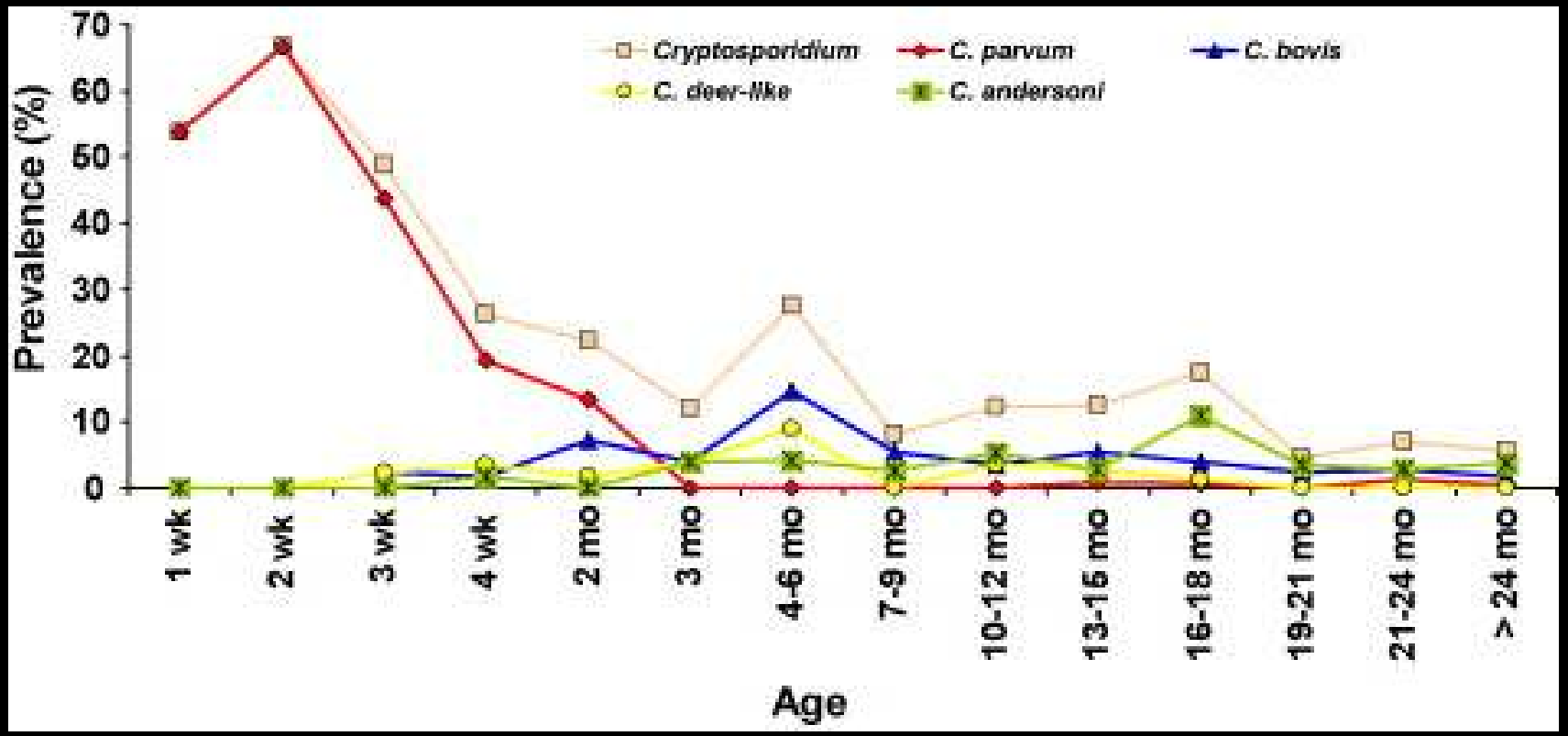
52%

Age	Number examined	Percent positive	Percent *C. parvum*
>2 mo	393	41%	35%
2-11 mo	447	26%	0.3%
12-24 mo	571	12%	0.4%
>24 mo	541	6%	0.4%

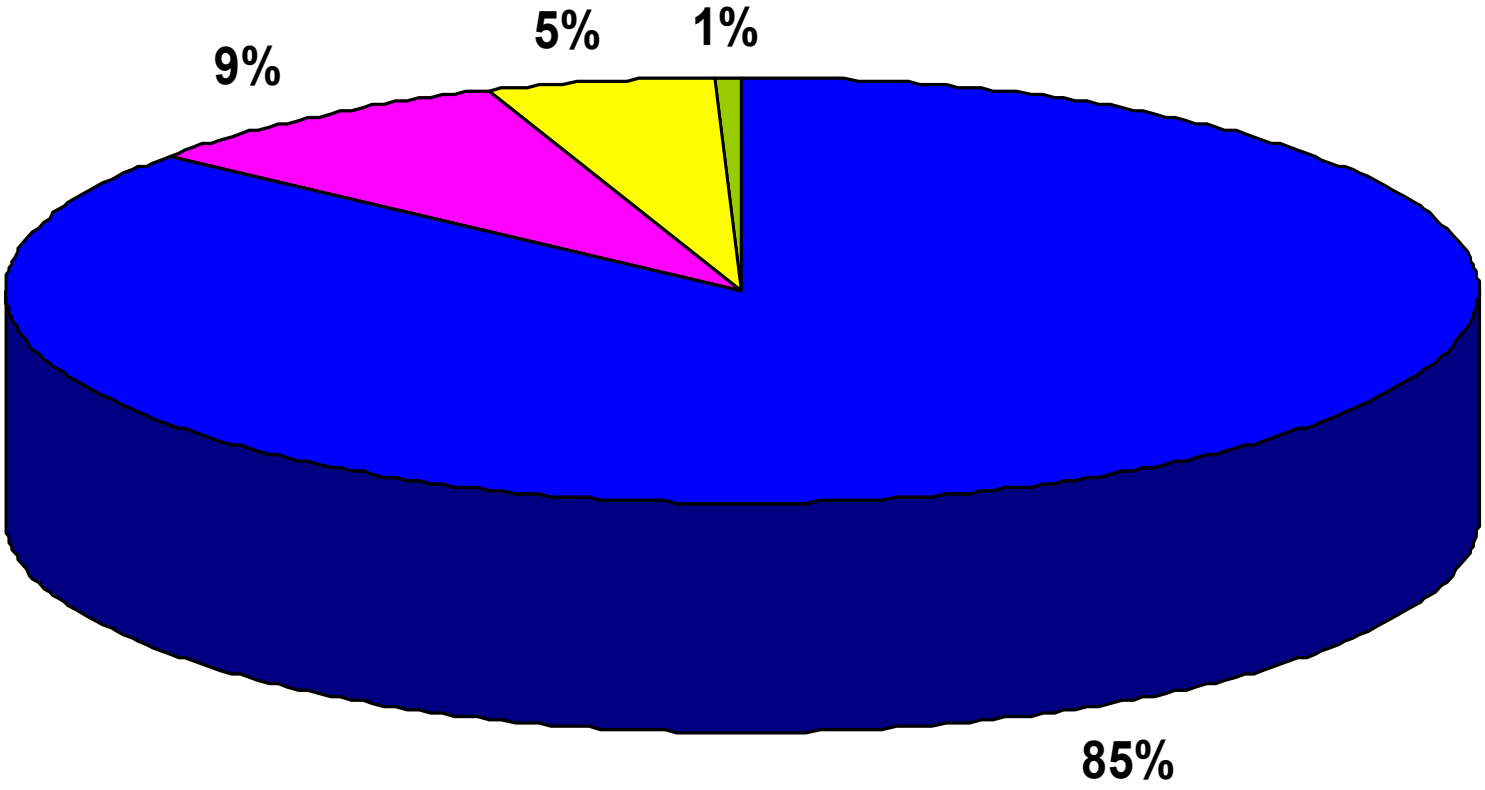
Total 1952



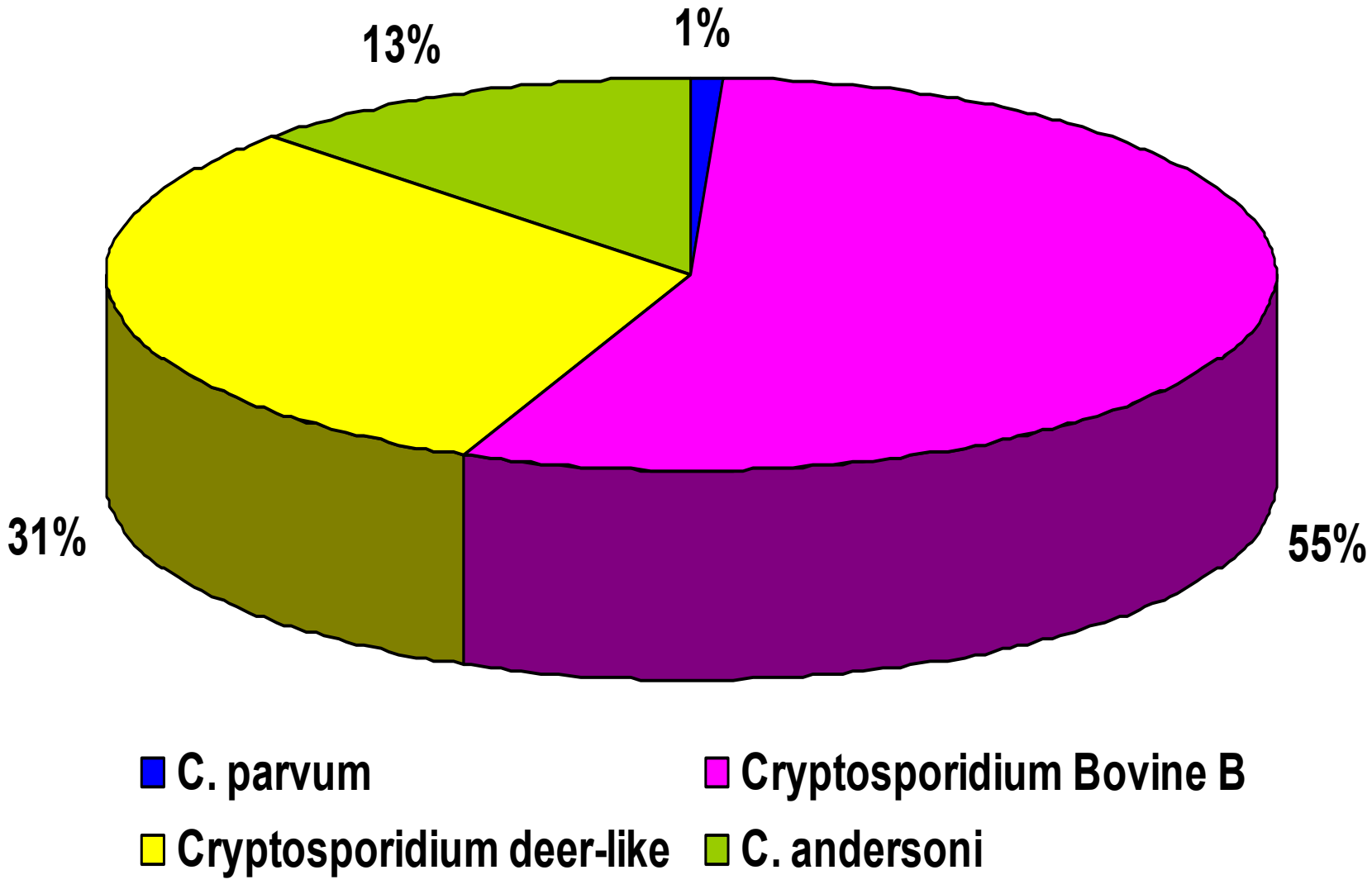
Prevalence of Cryptosporidium vs Age in Dairy Cattle on 15 Farms in 7 States

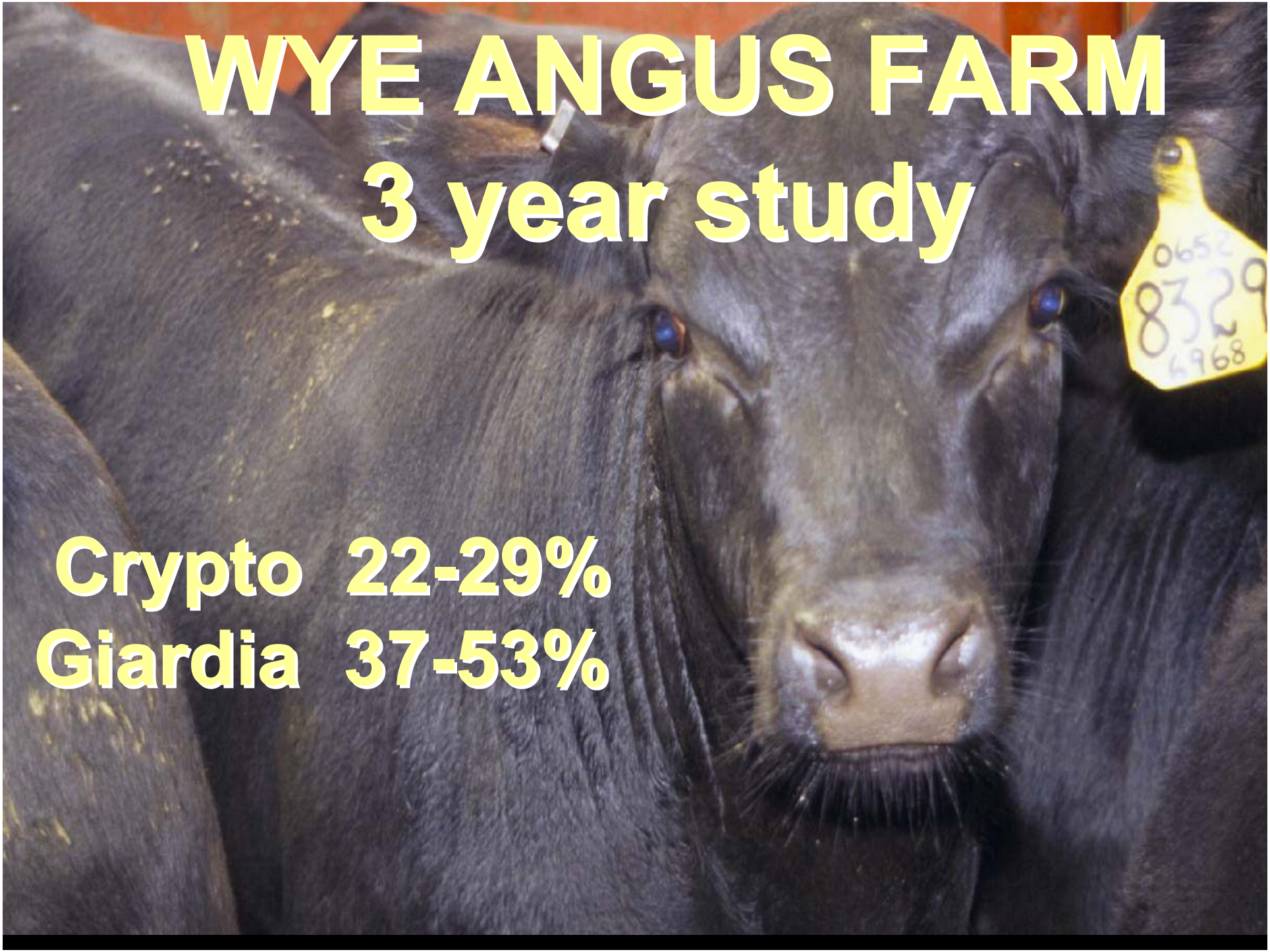


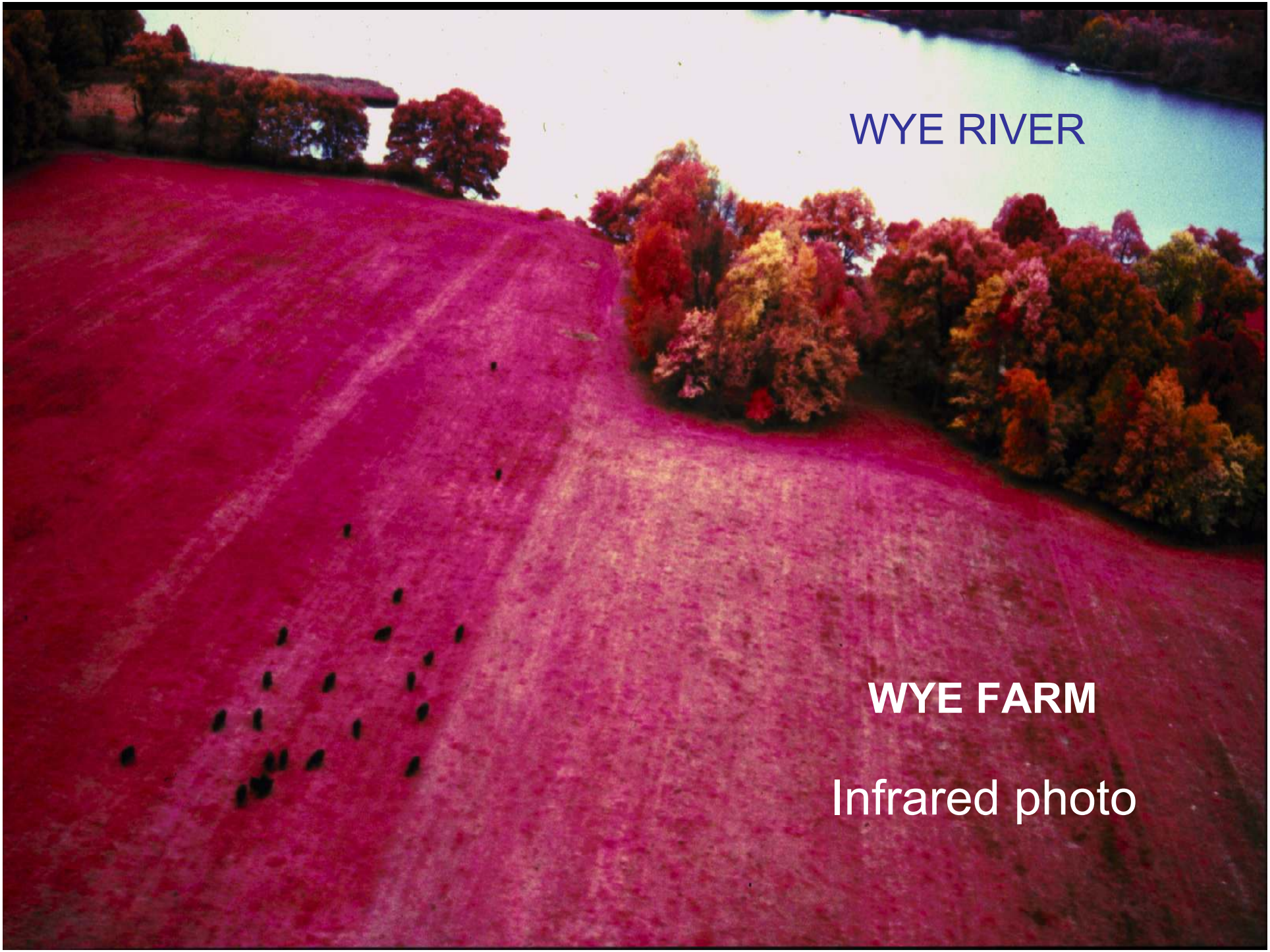
PRE-WEANED CALVES

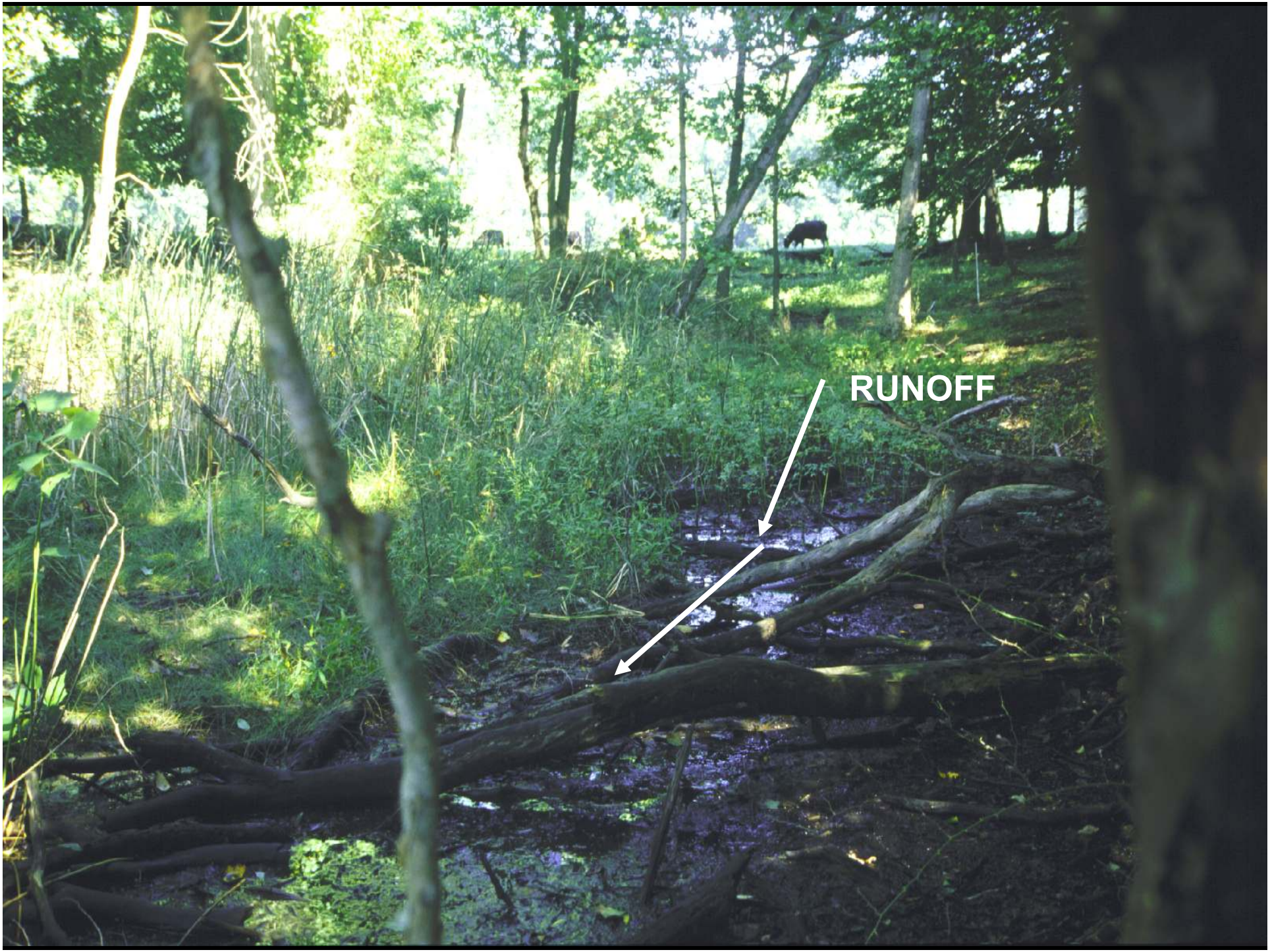


POST-WEANED CALVES

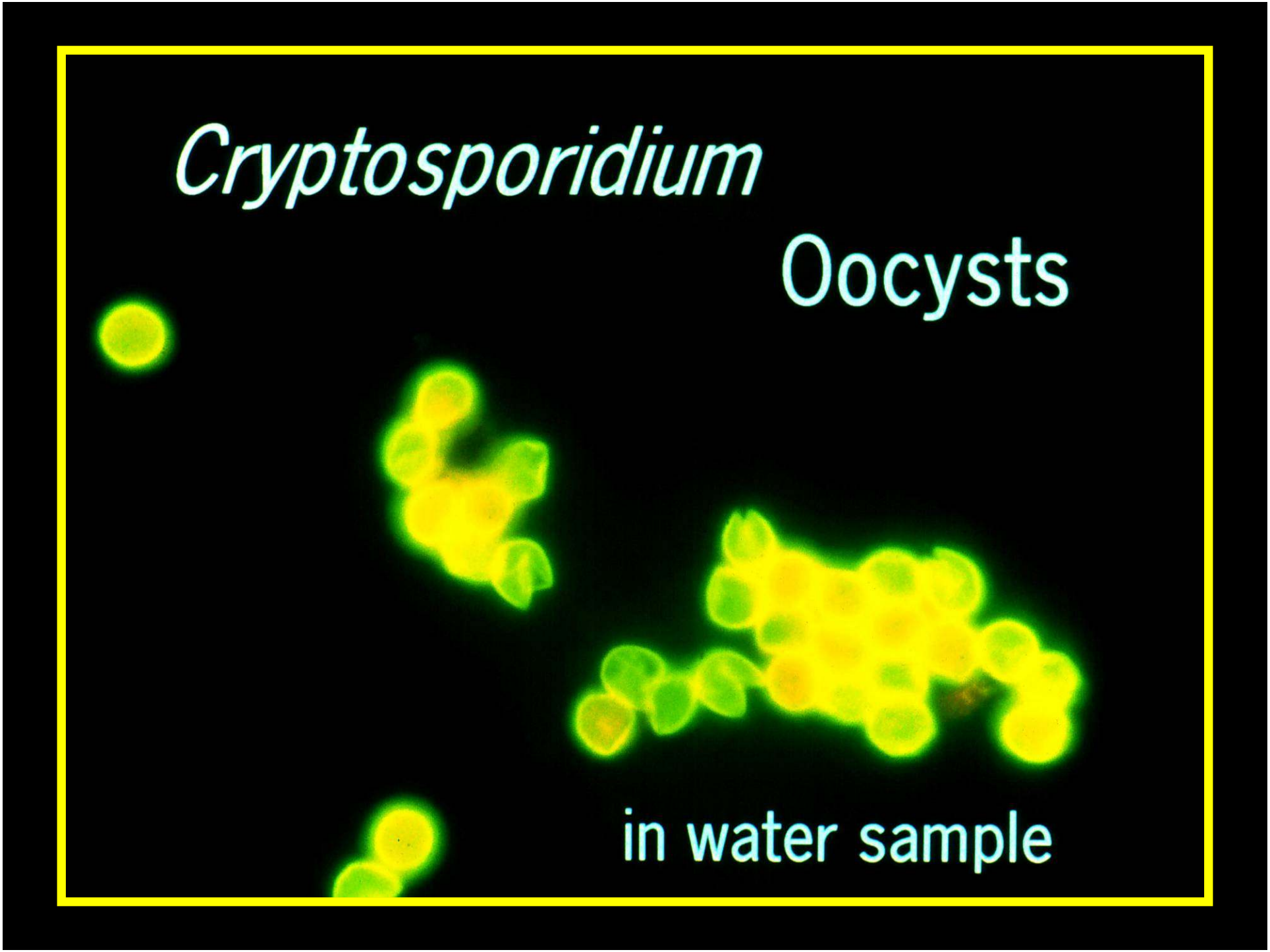


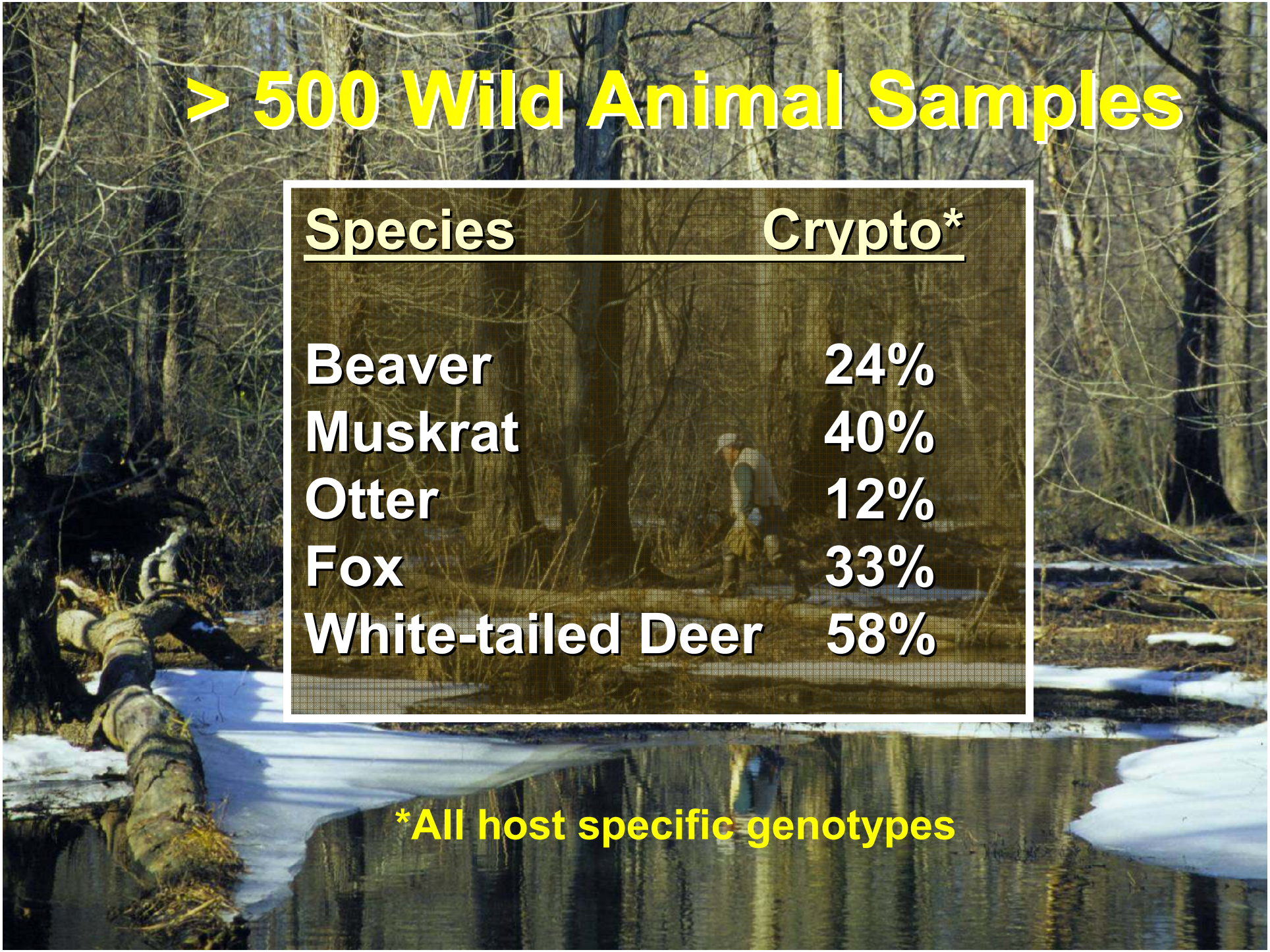

WYE ANGUS FARM
3 year study
Crypto 22-29%
Giardia 37-53%


WYE RIVER
WYE FARM
Infrared photo


RUNOFF


RUNOFF
WYE RIVER


Cryptosporidium
Oocysts
in water sample

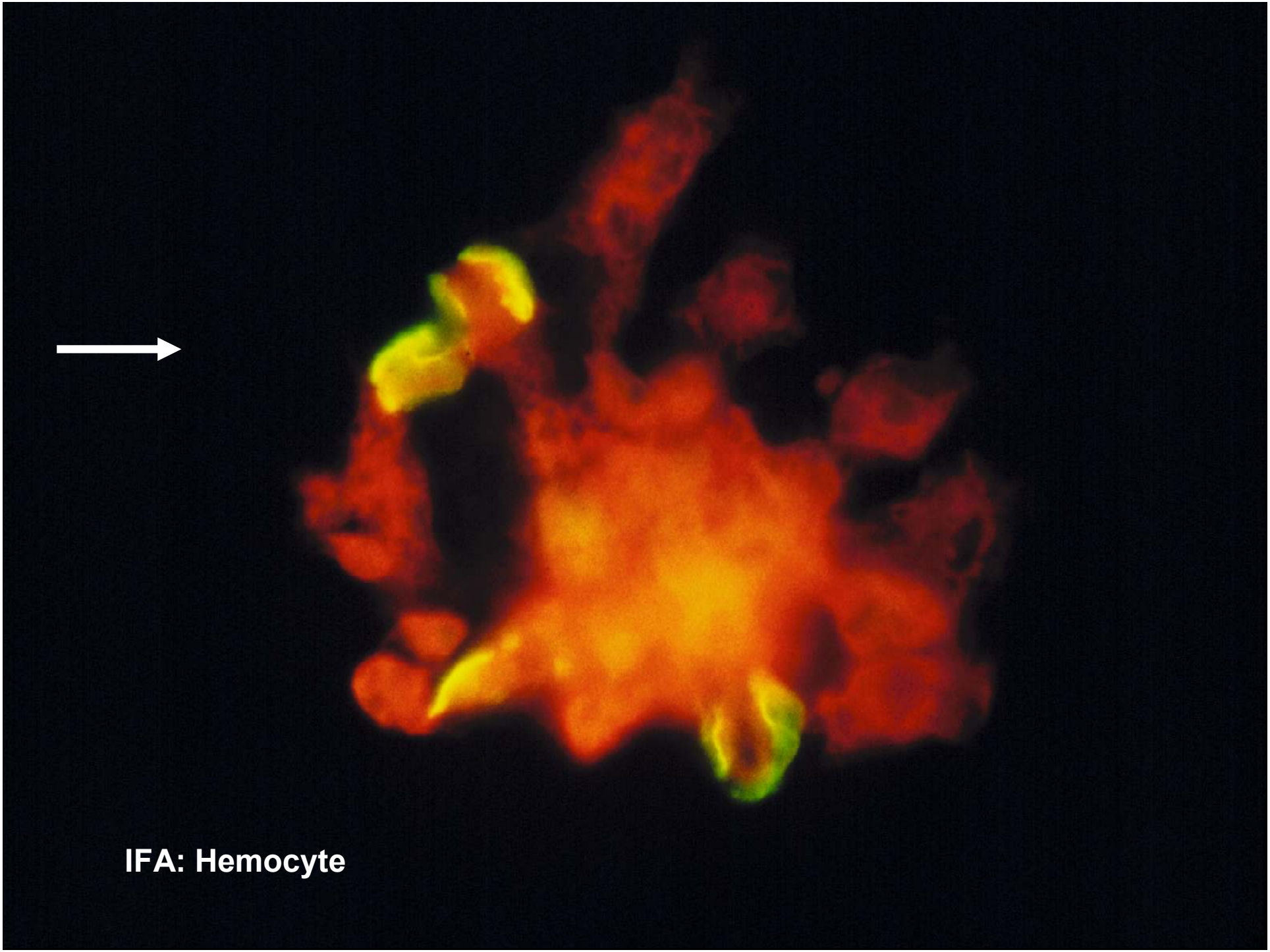

> 500 Wild Animal Samples

Species	Crypto*
Beaver	24%
Muskrat	40%
Otter	12%
Fox	33%
White-tailed Deer	58%

*All host specific genotypes


WYE RIVER, MARYLAND


WYE RIVER, MARYLAND

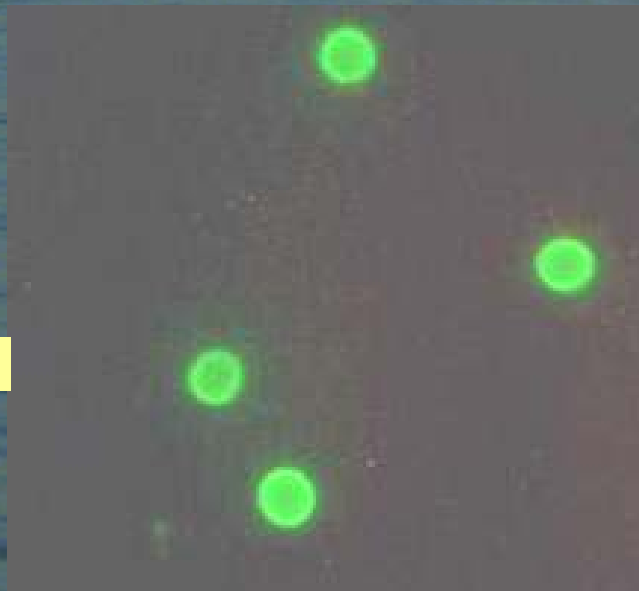

IFA: Hemocyte

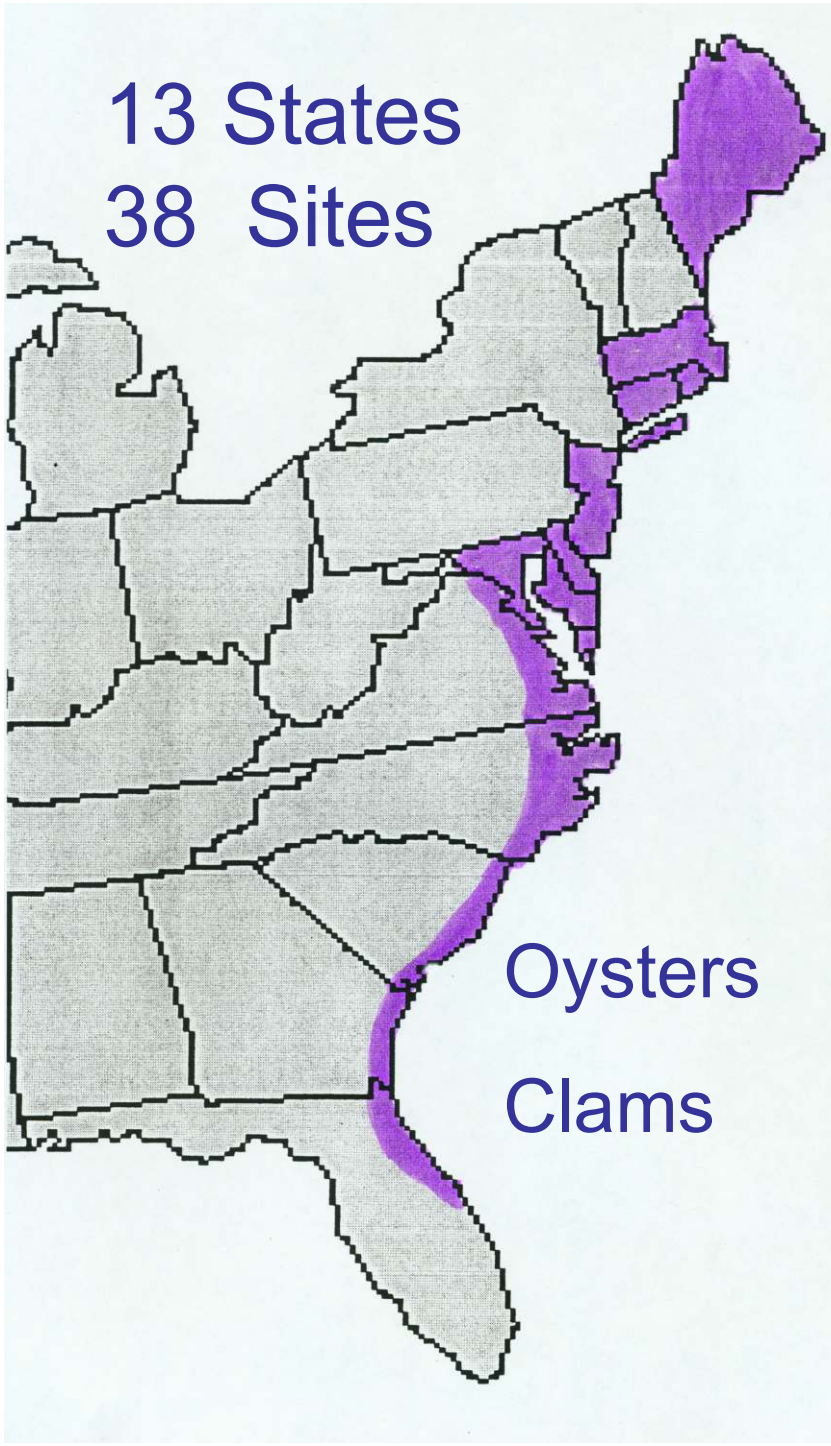
Cryptosporidium in Rivers entering Chesapeake Bay

- ***C. parvum*** **isolated from eastern oysters, *Crassostrea virginica***
  - **13 sites in Chesapeake Bay, MD**
  - **9 sites open to shellfish harvest**
  - **– Within tissues**
  - **– Gill surfaces**
  - **– Hemocytes**

Results of a 3 year study of oysters in Chesapeake Bay

- 8 collections/ 7 sites
- Oocysts *of C. parvum* found in:
  - 20% of 1590 oysters
  - hard clams
  - bent mussels
- Highest percentage of positive shellfish within 1 month of rainfall event





Atlantic Coast Shellfish Survey

	IFA / PCR
Maine	+
Massachusetts	+
Connecticut	+
Rhode Island	+
New York	+
New Jersey	+
Delaware	-
Maryland	+
Virginia	+
North Carolina	+
South Carolina	+
Georgia	-
Florida	+

Worldwide Reports

cockles mussels oysters clams

Ireland
England
Spain

Italy
Portugal
Netherlands