Non-indigenous Nile tilapia (*Oreochromis niloticus*) in coastal watersheds of southern Mississippi.

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Where to begin?

PHASE I – Distribution.

PHASE II – Dispersion and habitat association.

PHASE III – Management implications.

2000 – 2002
Funded through MDWFP Project F-129

2003 – present
Funded through MDWFP SWG Project

Special thanks: Jason Brookins, Brian Lezina, Missy Partyka, James D. Williams, David Bowles, Richard Scott, Grady Scott, Gene Robertson, Dennis Riecke, Bubba Hubbard, John Reynolds

PHASE I – Distribution.

Objective 1. Examine spatial and temporal distribution of tilapiine fishes in coastal watersheds of Mississippi.

Objective 2. Examine the influence of tilapiine fishes on the structure of the native fish assemblages.

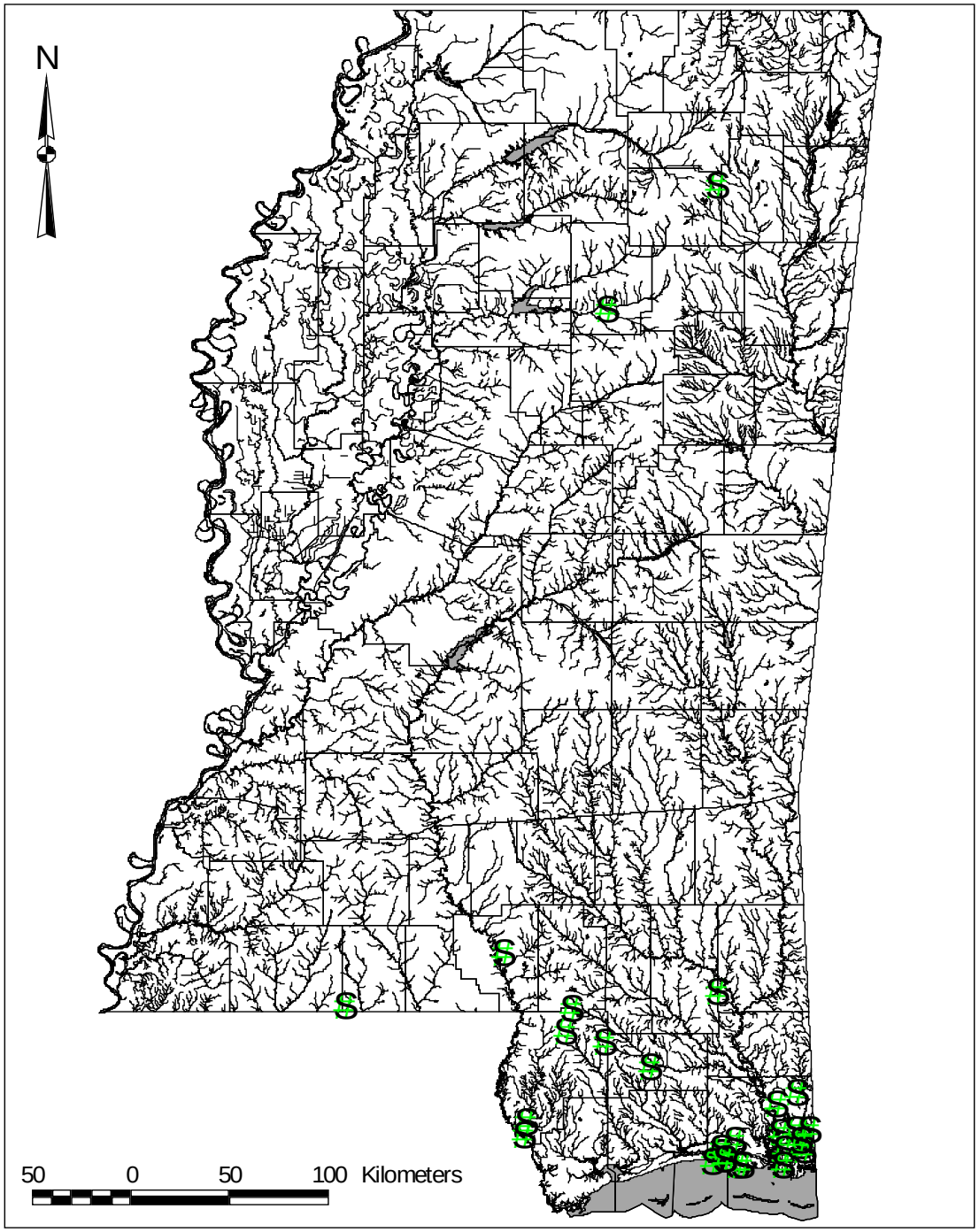
Objective 3. Quantify the degree of trophic interaction among tilapiine fishes and native freshwater fishes (e.g., sunfishes, black basses).

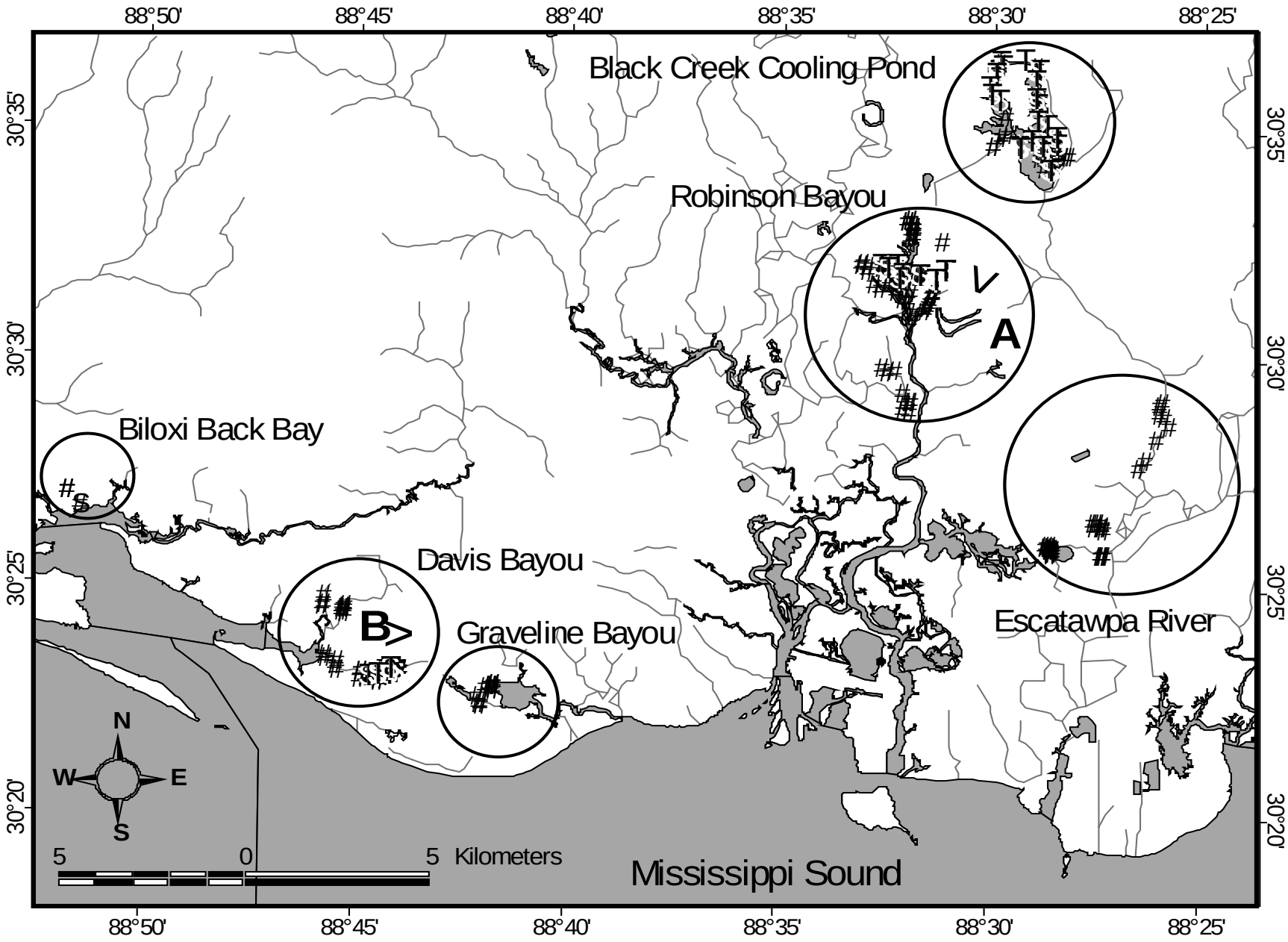
Location of facilities permitted by MDAC to culture, handle and/or process Nile tilapia (1989 -- 2000).

Database contains 97 records for aquaculture facilities.

61 facilities permitted for tilapia (including 5 out-of-state).

27 of the 61 noted as “active producers”.




88°50'
88°45'
88°40'
88°35'
88°30'
88°25'
30°35'
30°30'
30°25'
30°20'
Black Creek Cooling Pond
Robinson Bayou
Biloxi Back Bay
Davis Bayou
Graveline Bayou
Escatawpa River
Mississippi Sound
N
W
E
S
5
0
5 Kilometers

Fixed monthly stations.

2 – Robinson Bayou
4 – Simmons Bayou

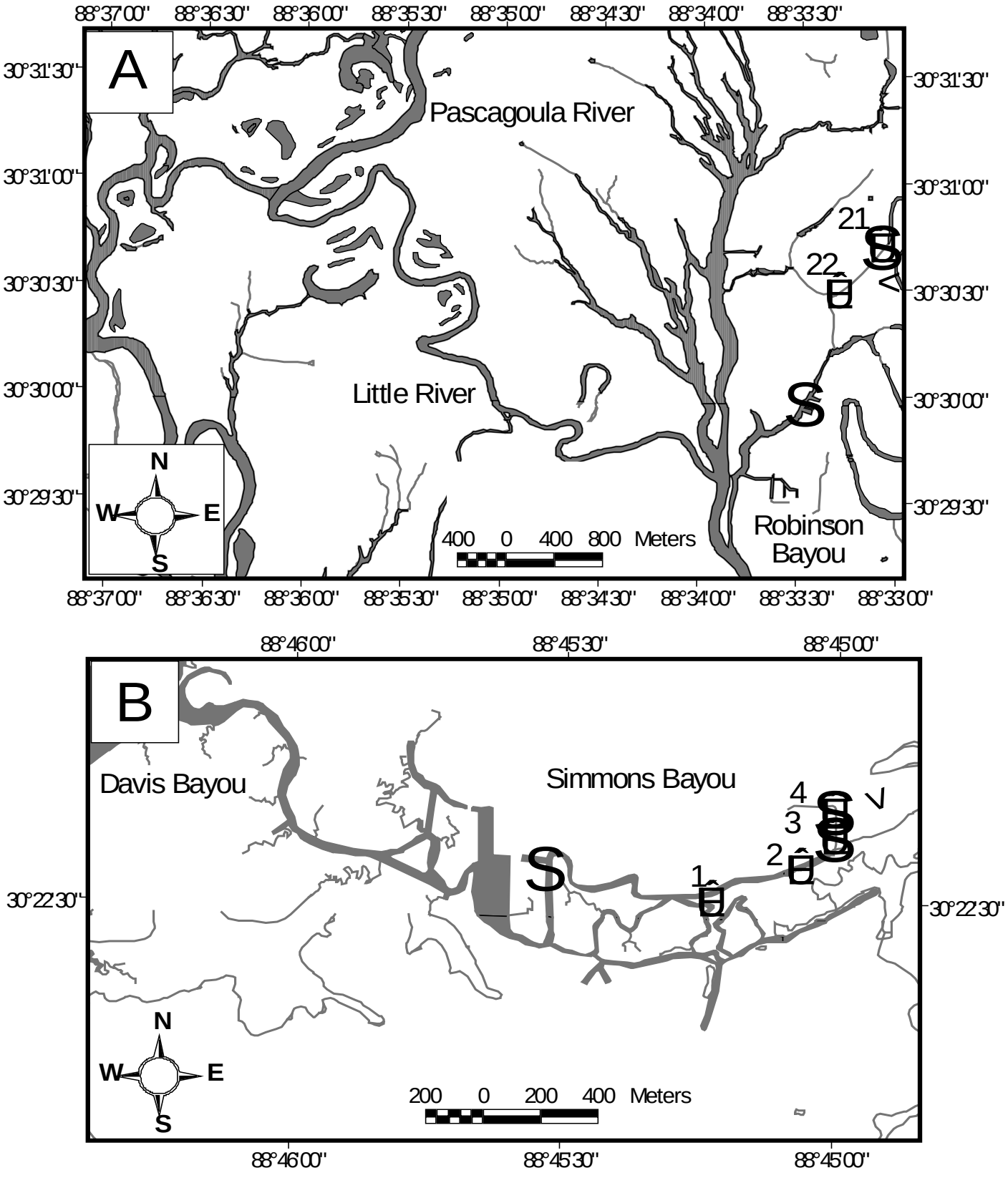
(primarily with seines)

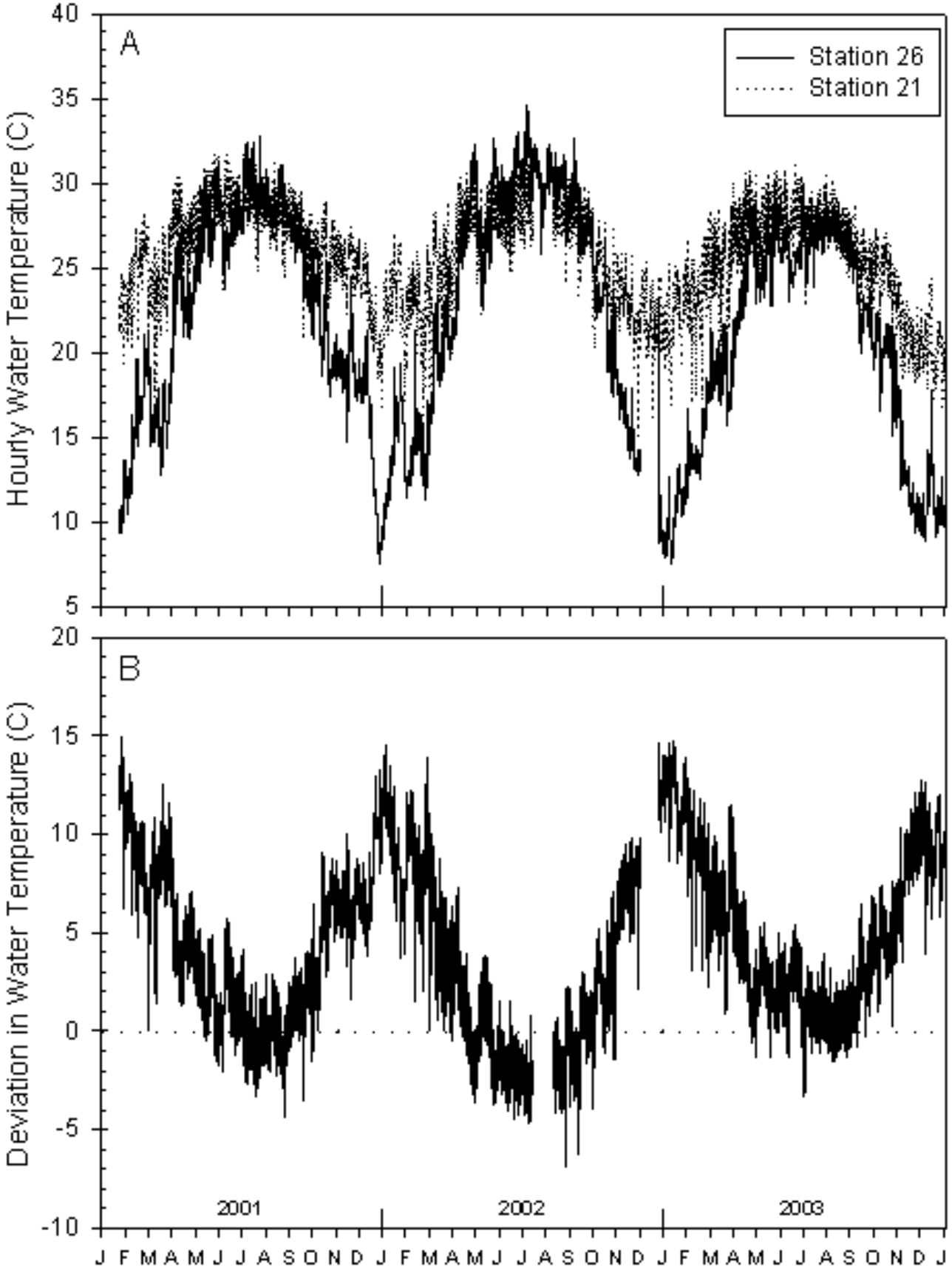
Semi-random monthly sampling.

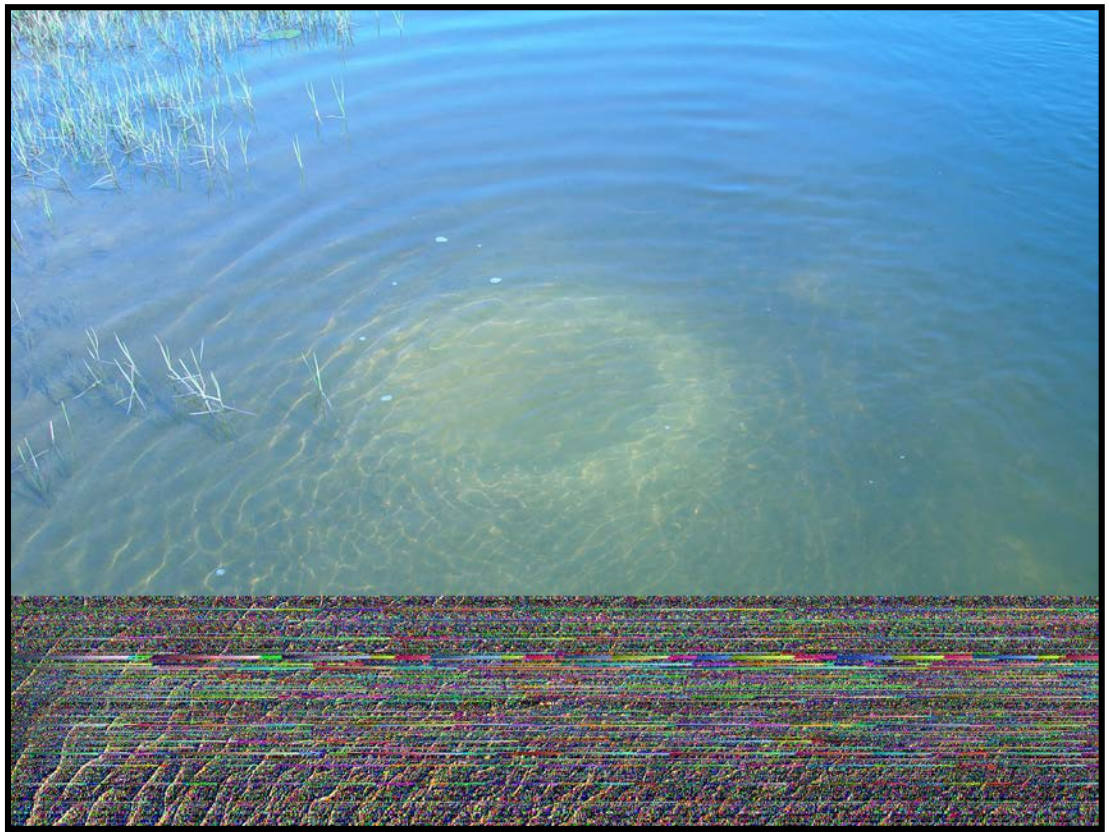
(seines, hook and line, trammel nets, modified crab traps)

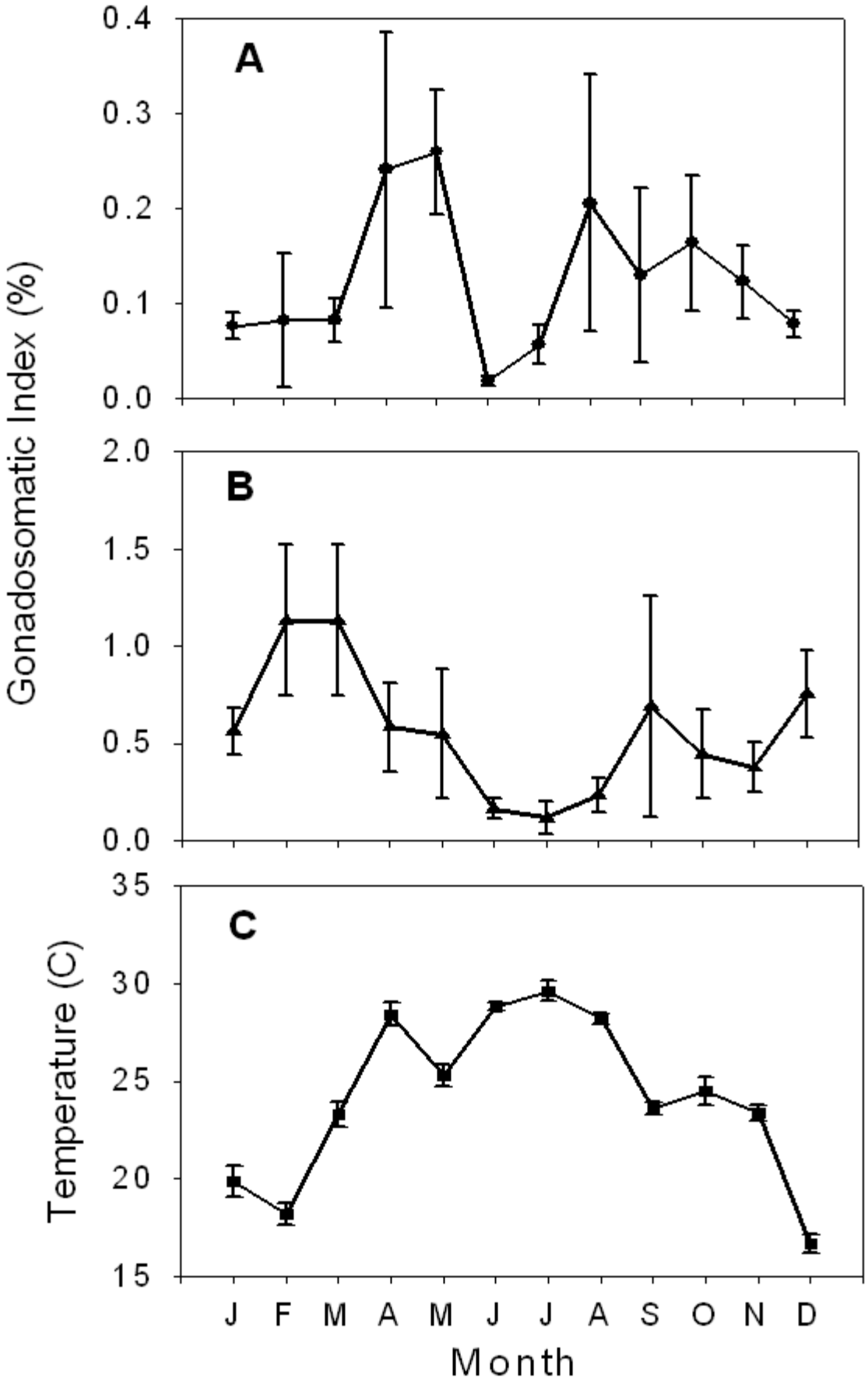
Robinson Bayou area

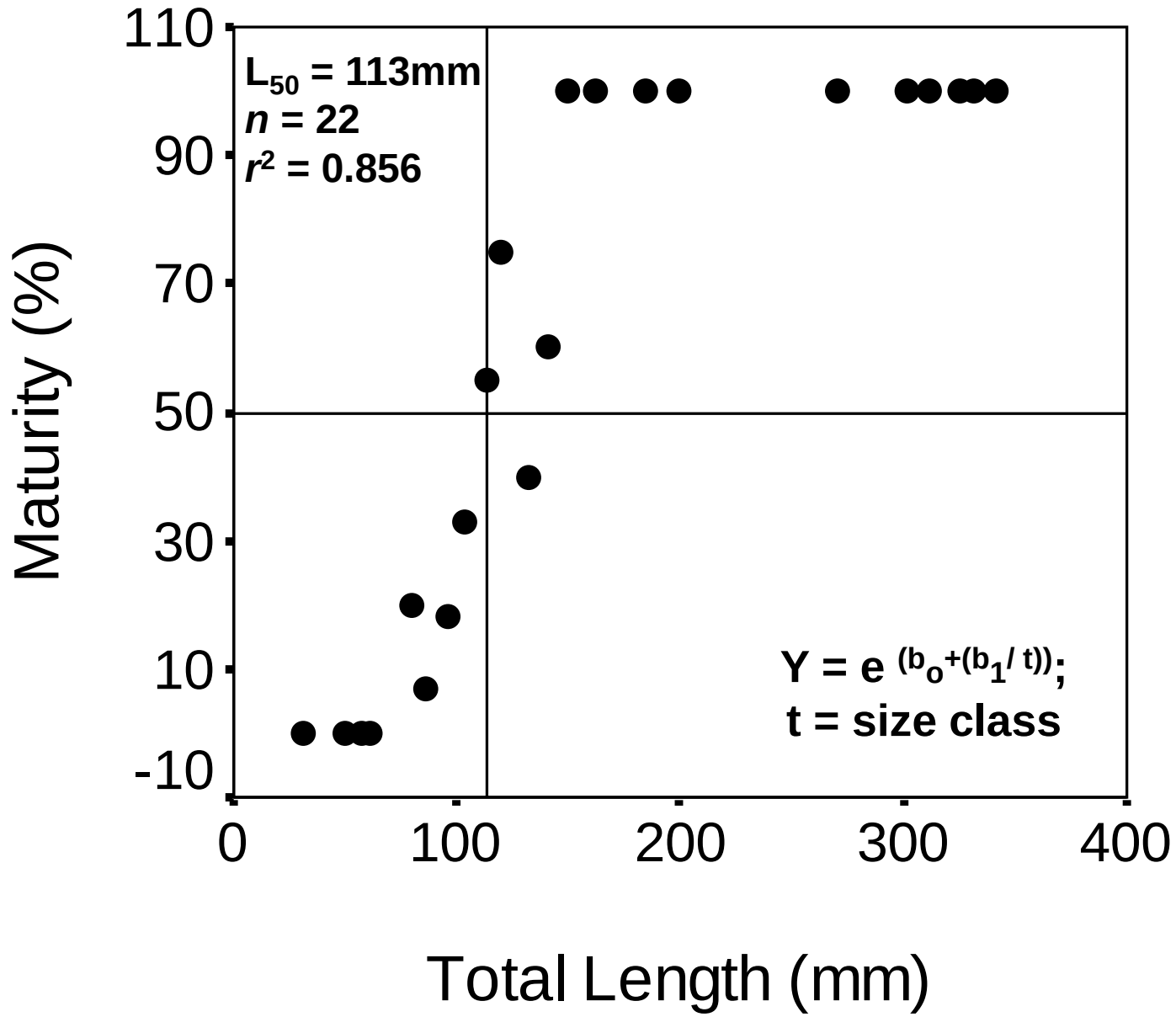
Simmons Bayou area

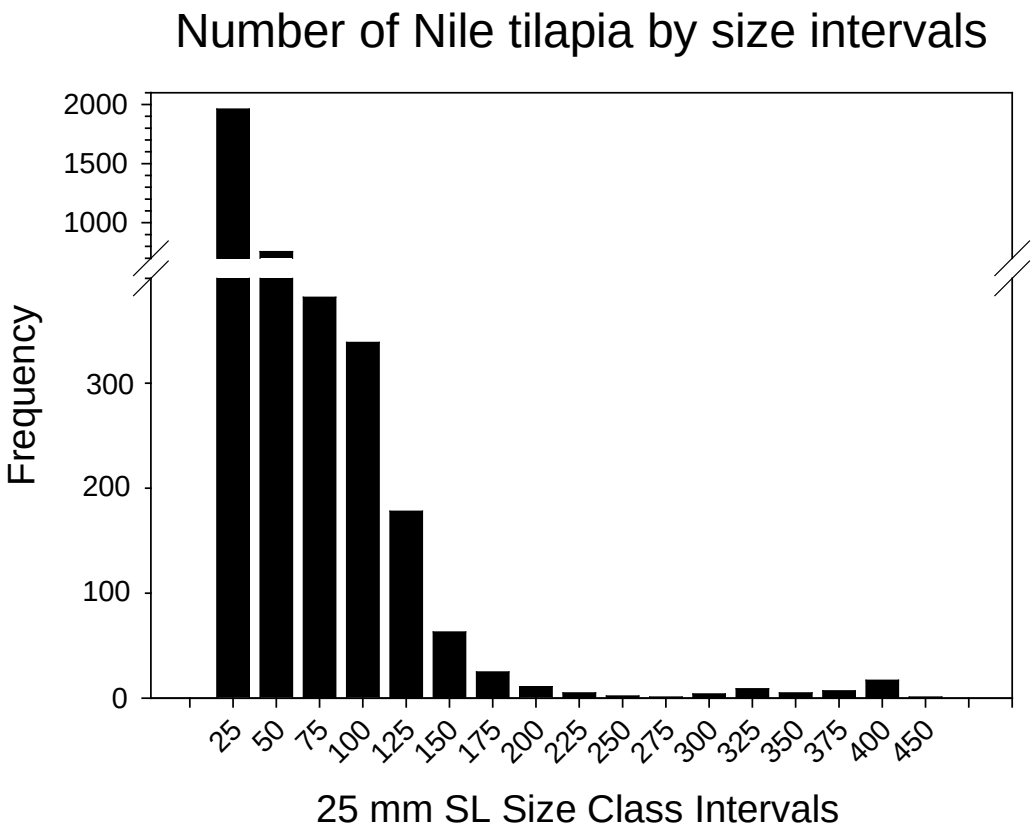

A
Pascagoula River
Little River
Robinson Bayou
21
22
N
W
E
S
400 0 400 800 Meters
88°37'00"
88°36'30"
88°36'00"
88°35'30"
88°35'00"
88°34'30"
88°34'00"
88°33'30"
88°33'00"
30°31'30"
30°31'00"
30°30'30"
30°30'00"
30°29'30"
B
Davis Bayou
Simmons Bayou
1
2
3
4
200 0 200 400 Meters
88°46'00"
88°45'30"
88°45'00"
30°22'30"

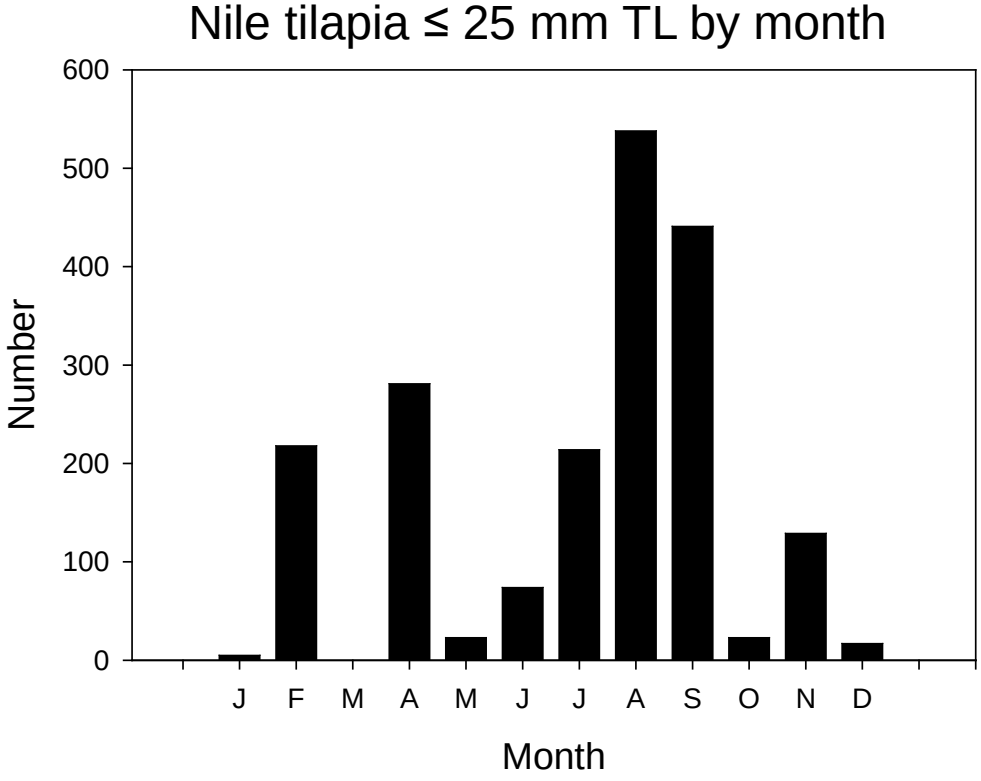

A
Station 26
Station 21
Hourly Water Temperature (C)
40
35
30
25
20
15
10
5
B
Deviation in Water Temperature (C)
20
15
10
5
0
-5
-10
2001
2002
2003
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J




A
B
C
Gonadosomatic Index (%)
Temperature (C)
Month
0.4
0.3
0.2
0.1
0.0
2.0
1.5
1.0
0.5
0.0
35
30
25
20
15
J F M A M J J A S O N D


110
90
70
50
30
10
-10
Maturity (%)
L_{50} = 113mm
n = 22
r^2 = 0.856
$Y = e^{(b_o+(b_1/t))}$;
t = size class
0
100
200
300
400
Total Length (mm)


Number of Nile tilapia by size intervals
Frequency
2000
1500
1000
300
200
100
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
450
25 mm SL Size Class Intervals


Nile tilapia ≤ 25 mm TL by month
Number
600
500
400
300
200
100
0
J
F
M
A
M
J
J
A
S
O
N
D
Month

- Year-round spawning at low levels
- Peaks in Mar-May and in Aug-Sept
- Multiple broods
- Smallest female w/mature oocytes is 79.9 mm TL: 50% maturity in females is 113 mm TL
- BF correlated w/TL and EBW

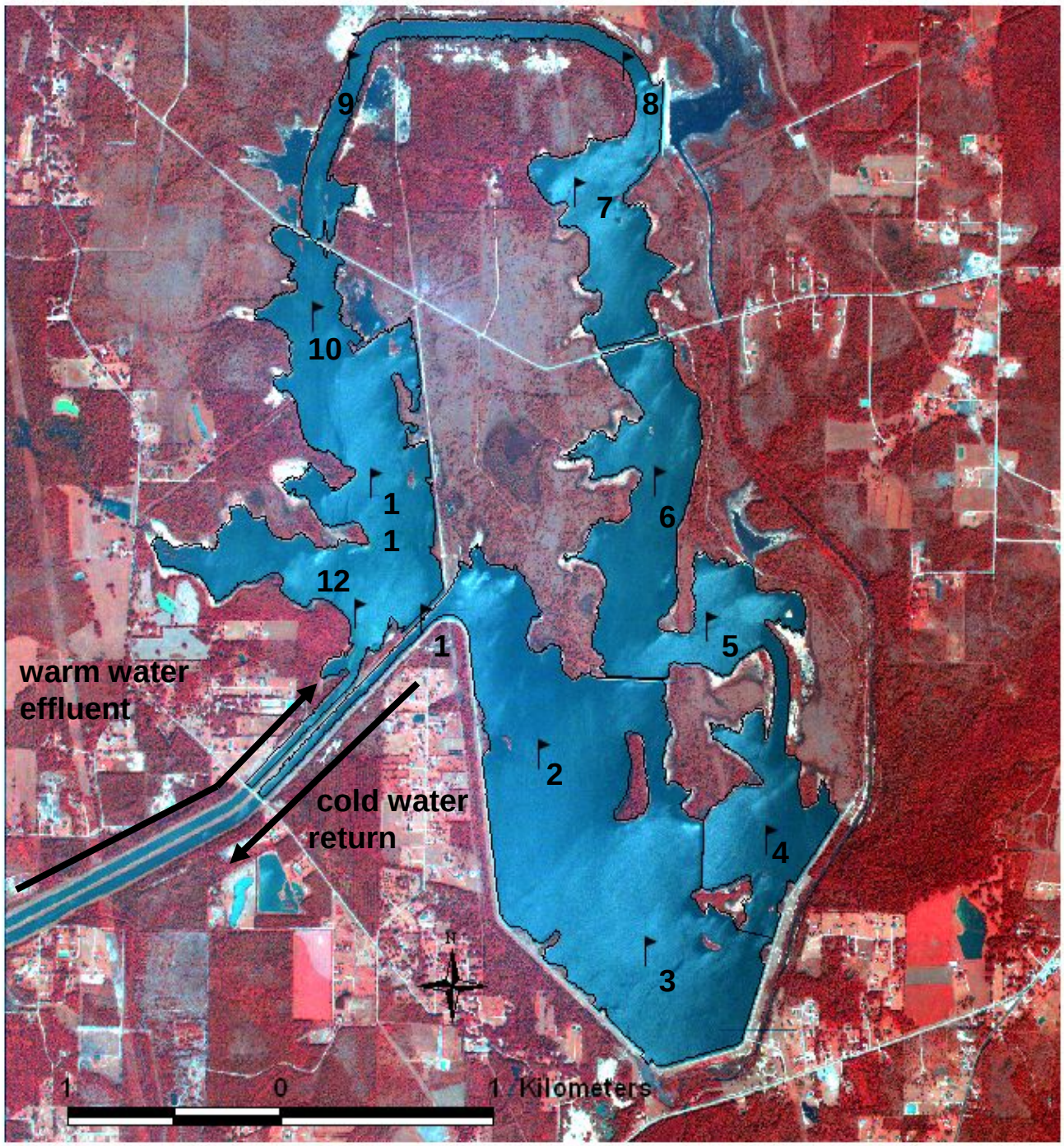
PREY ITEMS

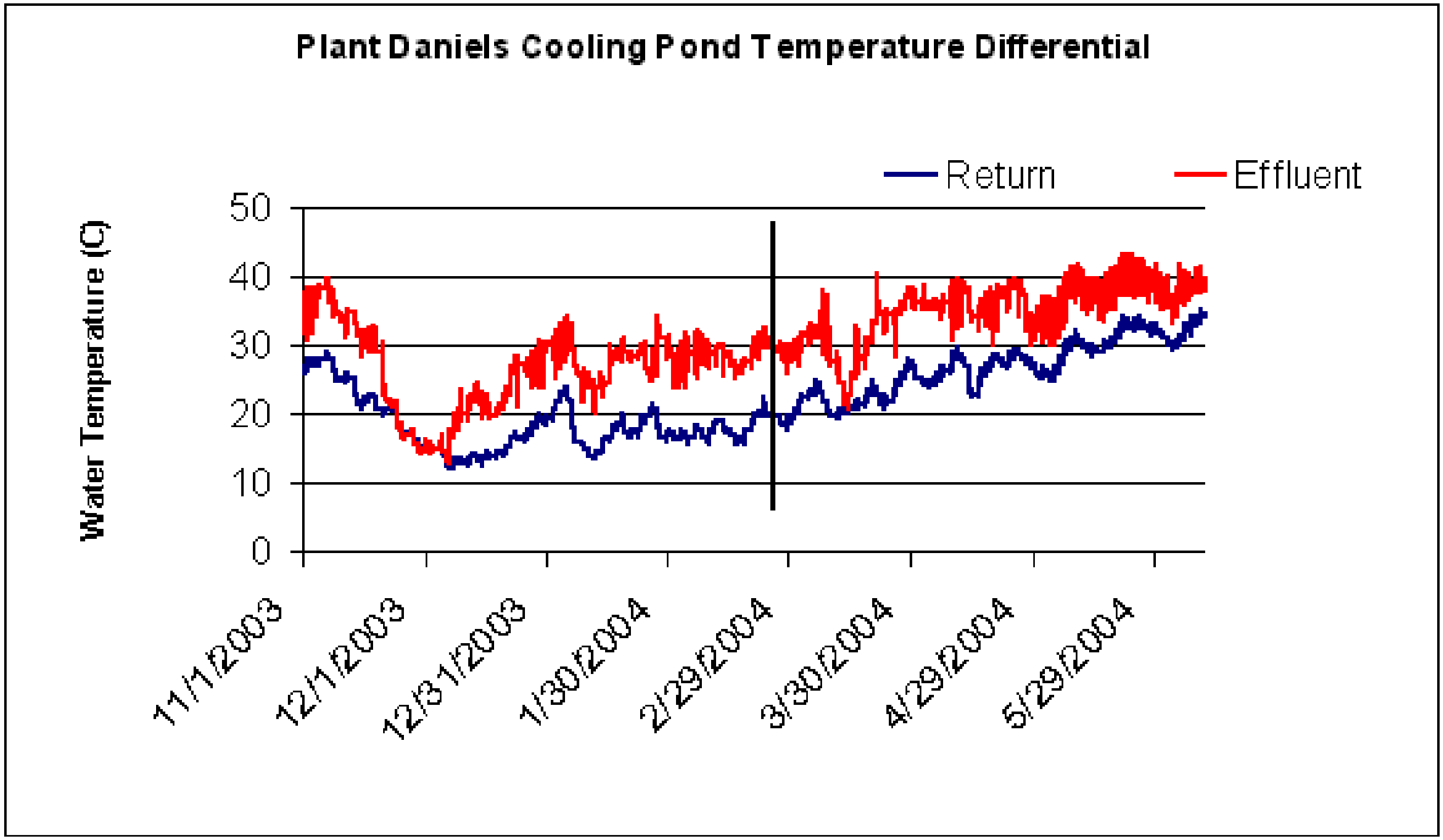
- Amorphus debris, detritus, sand grains, mud clumps
- Hydrozoa, rotifers, nematodes, bryozoan, insect stages and parts
- Microcrustaceans: cladocera, copepods, ostracods
- No stomach → intestine 1.3 to 7.6x TL

PHASE II – Dispersion and habitat association.

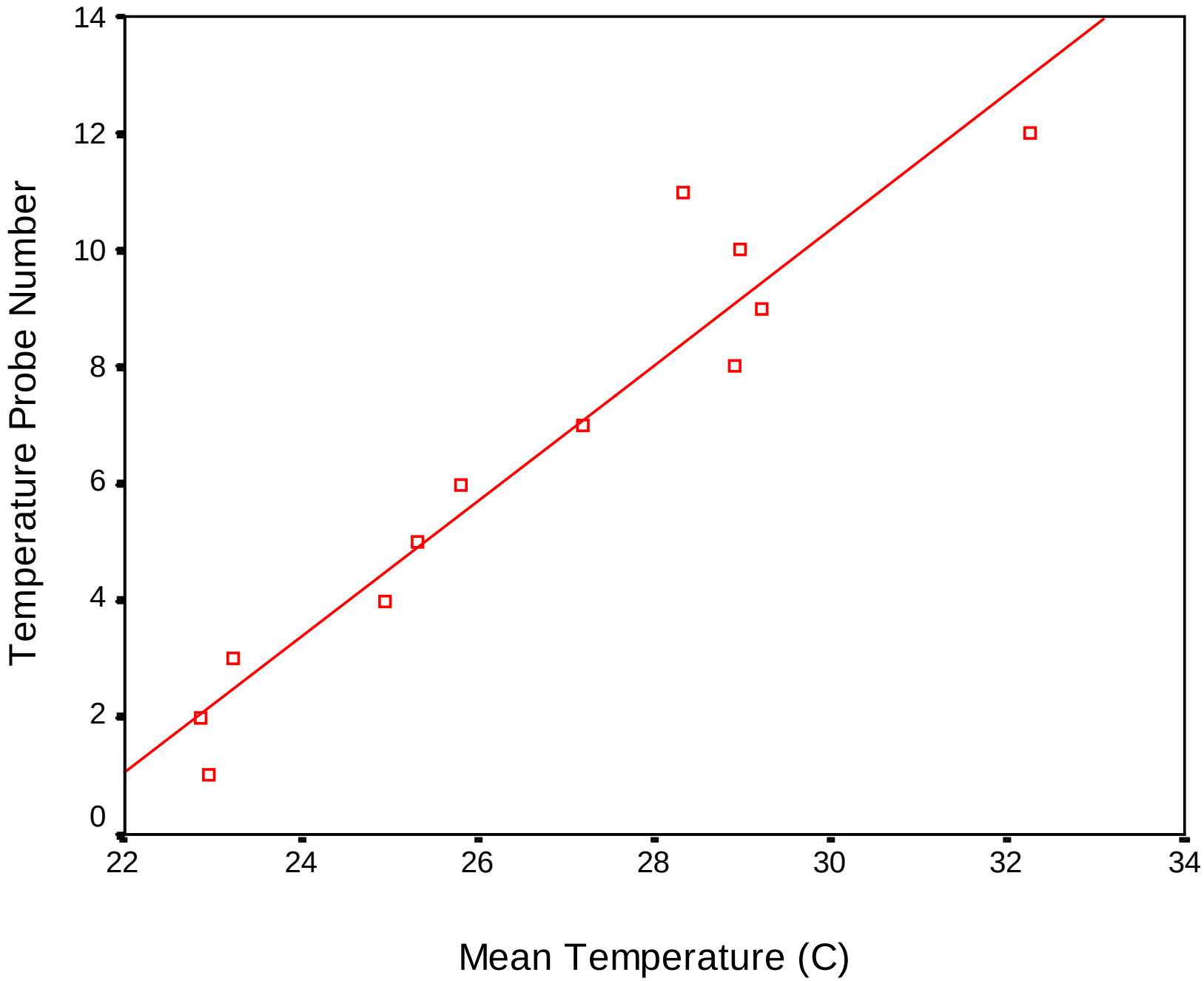
Objective 1. Examine movement patterns through telemetry – Plant Daniels (YEAR I).

Objective 2. Field verification – Biotelemetry of cichlids in the wild within the Pascagoula system to identify movement patterns (i.e., population contraction/expansion on a seasonal basis) and the use of thermal refugia in a natural setting (YEAR II).


9
8
7
10
1
1
6
12
1
5
warm water
effluent
2
cold water
return
4
N
3
1
0
1 Kilometers



Hourly water temperatures for temperature probe # 1 (return canal) and #12 (effluent). Vertical black line in the middle of the graph denotes the date when implanted Nile tilapia were re-released into the Plant Daniels Cooling Pond.



Scatterplot depicting linear relationship of temperature gradient according to temperature probes (n = 12) deployed at Plant Daniels Cooling Pond.


½" Elbs.
½" Couplers
½ T's

Map depicting locations of release and relocations for ultrasonic tag 74 3368
24 February through 21 April, 2004

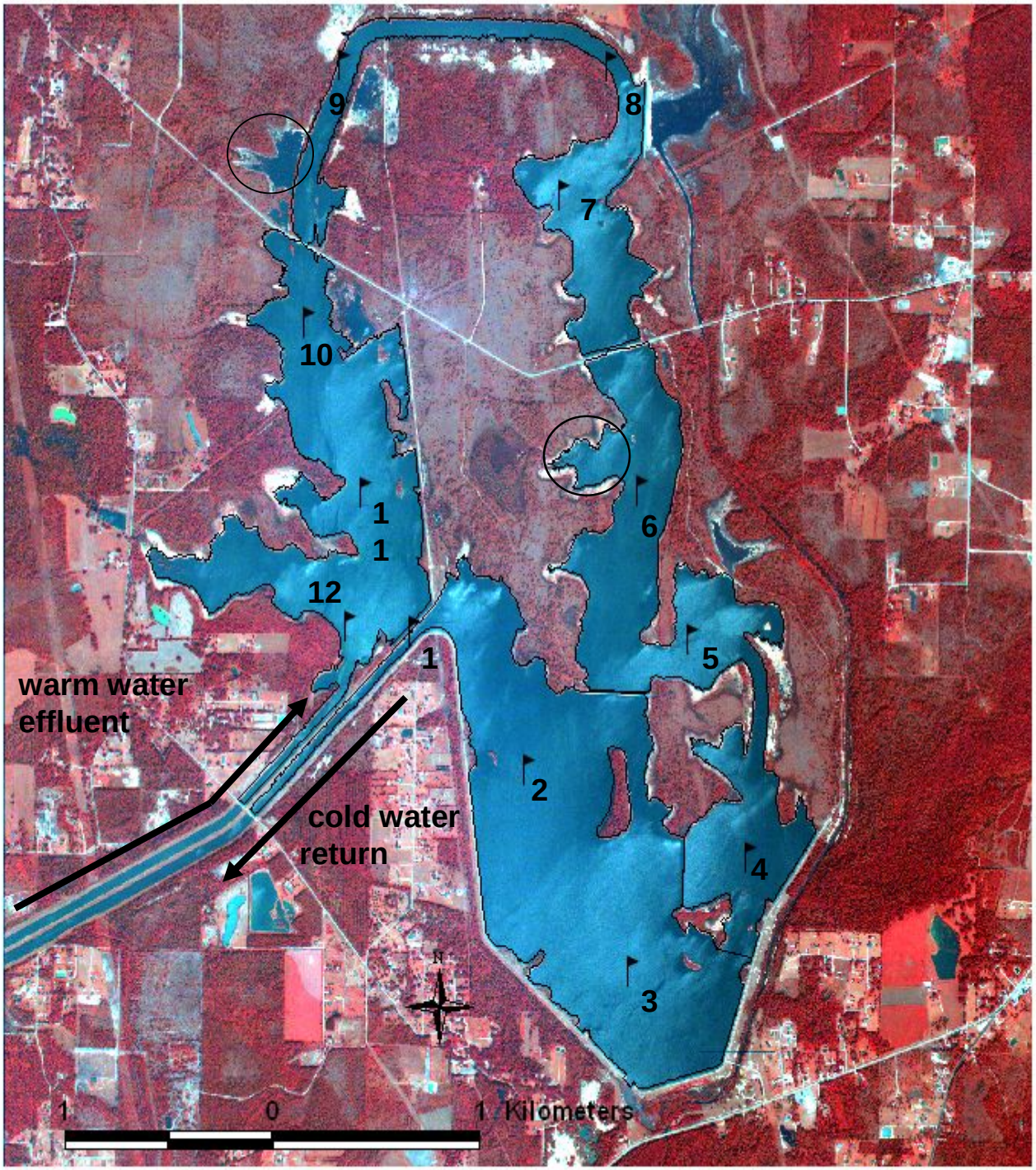
Map depicting locations of release and relocations for ultrasonic tag 75 3378 24 February through 21 April, 2004.

Mean water temperature and standard deviation for 12 temperature probes between 24 February – 21 April, 2004 (above horizontal line) and between 24 April – 10 June, 2004 (below horizontal line). Probe number corresponds to probe numbers on Figure 1. Bold values indicate probes that correspond to 95% C.I. of the pooled mean temperature (1 meter) for relocations during the two respective time periods.

	Temperature Probe Number											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
average	23.50	23.35	23.69	**25.44**	**25.72**	**26.32**	27.82	29.56	29.64	29.70	28.73	32.83
standard deviation	2.86	2.79	2.82	**3.08**	**3.01**	**3.08**	3.09	3.27	3.47	3.39	3.45	4.18

	Temperature Probe Number											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
average	**30.07**	**29.90**	**30.35**	**31.79**	**31.98**	**32.42**	33.68	35.44	35.83	35.30	34.81	37.63
standard deviation	**2.41**	**2.32**	**2.24**	**2.41**	**2.40**	**2.58**	2.62	2.58	2.61	2.53	2.45	2.74

Lateral refuge



PHASE III – Management implications.

Advocate a plan that promotes an integrated committee composed of representatives from those agencies charged with protecting, maintaining and regulating the State's aquatic natural resources (i.e., MDEQ, MDWFP, MDAC). Members of this advisory committee should not function in an adversarial manner, but rather members should strive to work together on developing mutually agreeable strategies, protocols and procedures to promote responsible use of the resources based on a long-term vision.

Adapt and enforce regulatory plans that prevent release and establishment of non-indigenous taxa. Incorporated within this strategy is to promote an open line of communication among state and federal agencies, the general public and industry regarding the issue of release of non-indigenous taxa and potential problems that may result following their establishment.

Promote the development of a management plan that incorporates an emergency protocol for flood prone areas (coastal counties). What can be done at facilities that will minimize release from culture facilities when faced with natural disaster?

Develop monitoring programs that may lead to early detection and, if possible, elimination of incipient invaders should be instituted, particularly if the population can be prevented from increasing in number of total individuals.

Do nothing. Initially the least costly of all options but potentially could manifest as the most costly because of the potential loss of resources through direct elimination, reduced growth and change in community structure, and/or loss of ecological services attributed to the loss of native taxa. Essentially, the cost of doing nothing results in the loss of ecological services gained by maintaining the biological integrity of our landscapes which in turn, results in natural, functioning ecosystems.


SONKIA
10
MADE IN JAPAN
30 m
20
NON-METALLIC
30
0m
40