

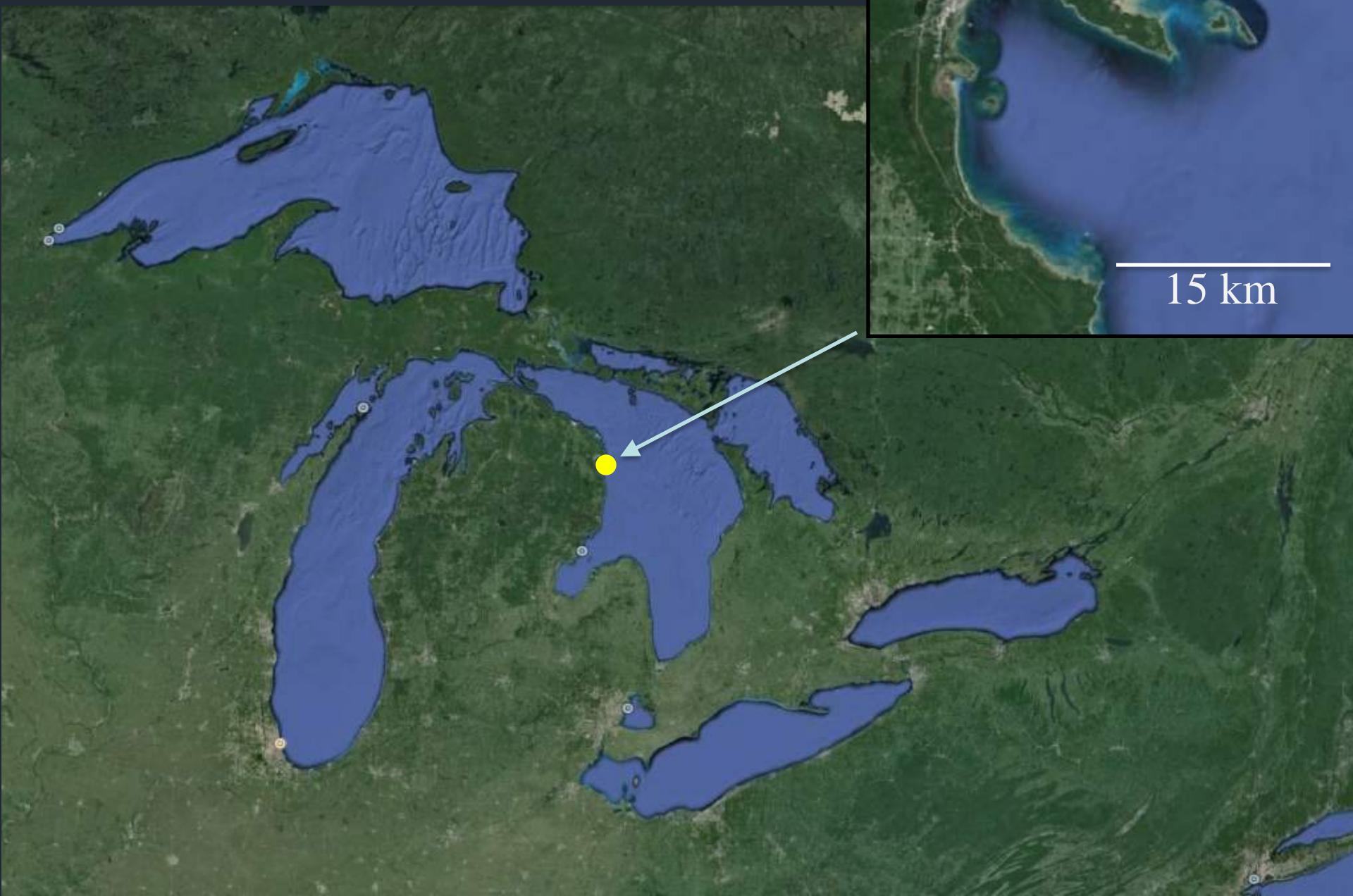
Use of Acoustic Telemetry to Evaluate Lake Trout Use of Constructed Reefs

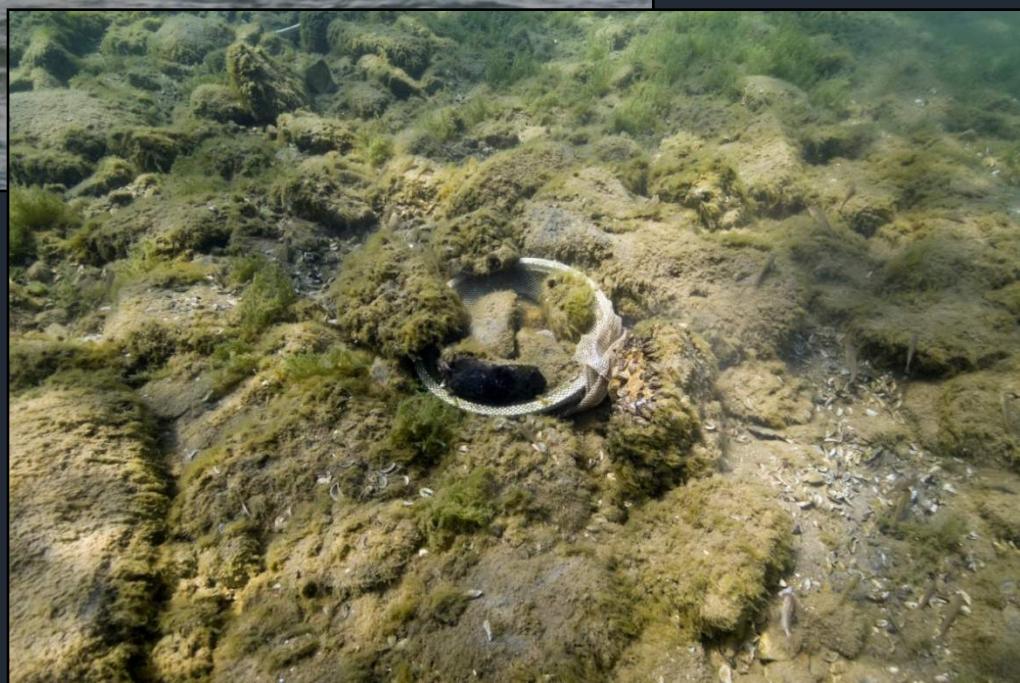
J. Ellen Marsden, Jim Johnson, Tom Binder, Natalie Dingledine,
Janice Adams, Charles C. Krueger

Univ. of Vermont, MDNR, USGS, DLZ, MDEQ, Mich. State Univ.



Thunder Bay, Lake Huron

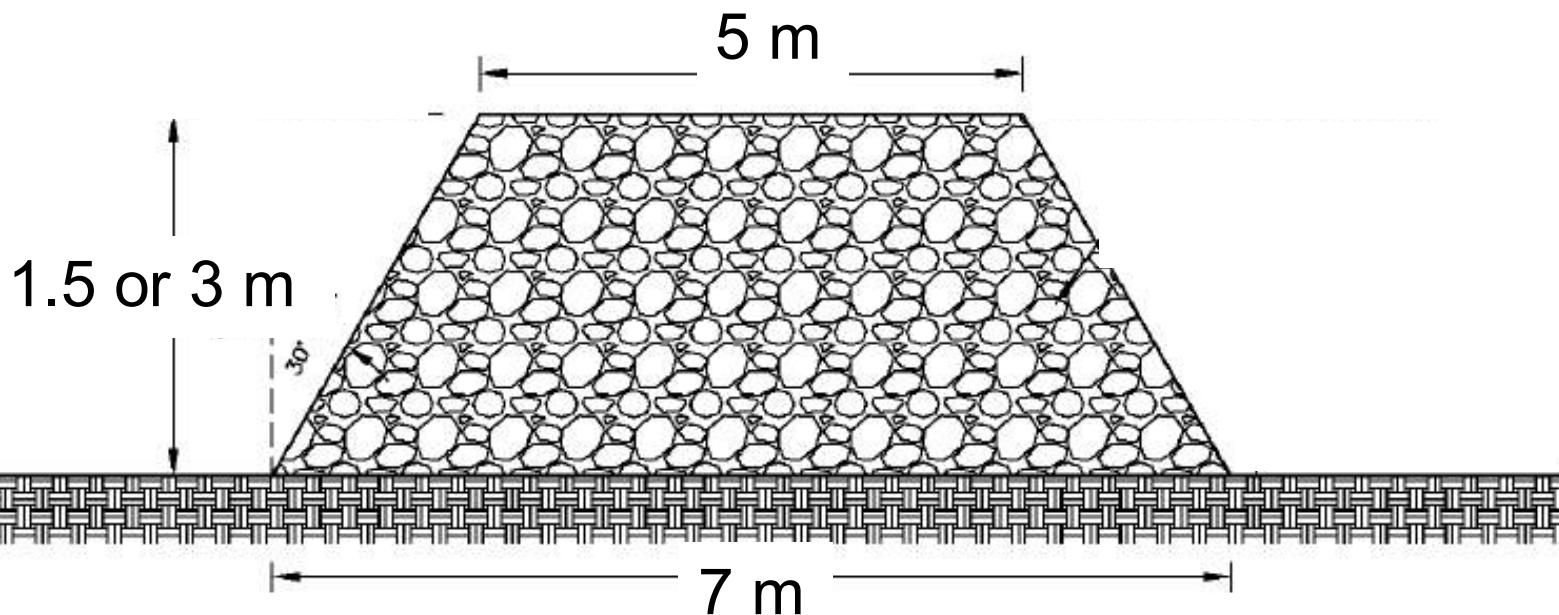




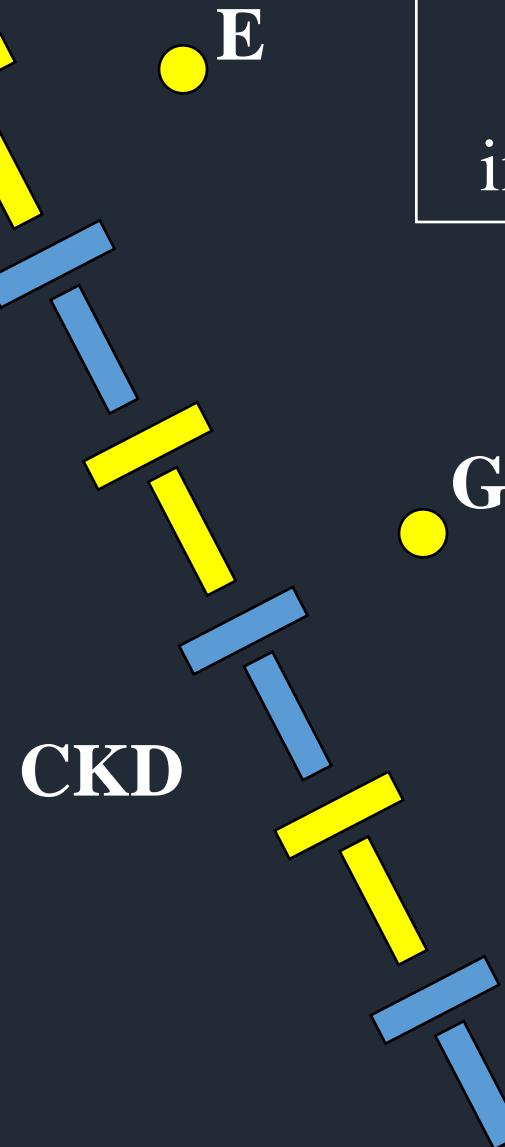
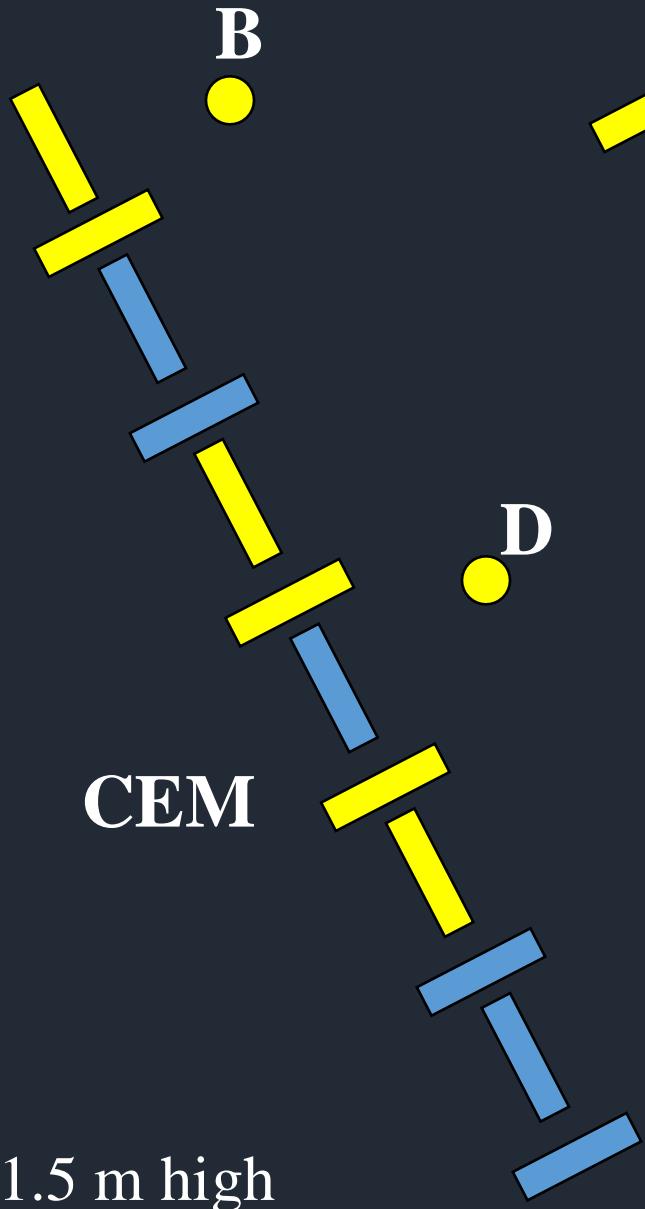


Reef experimental design:

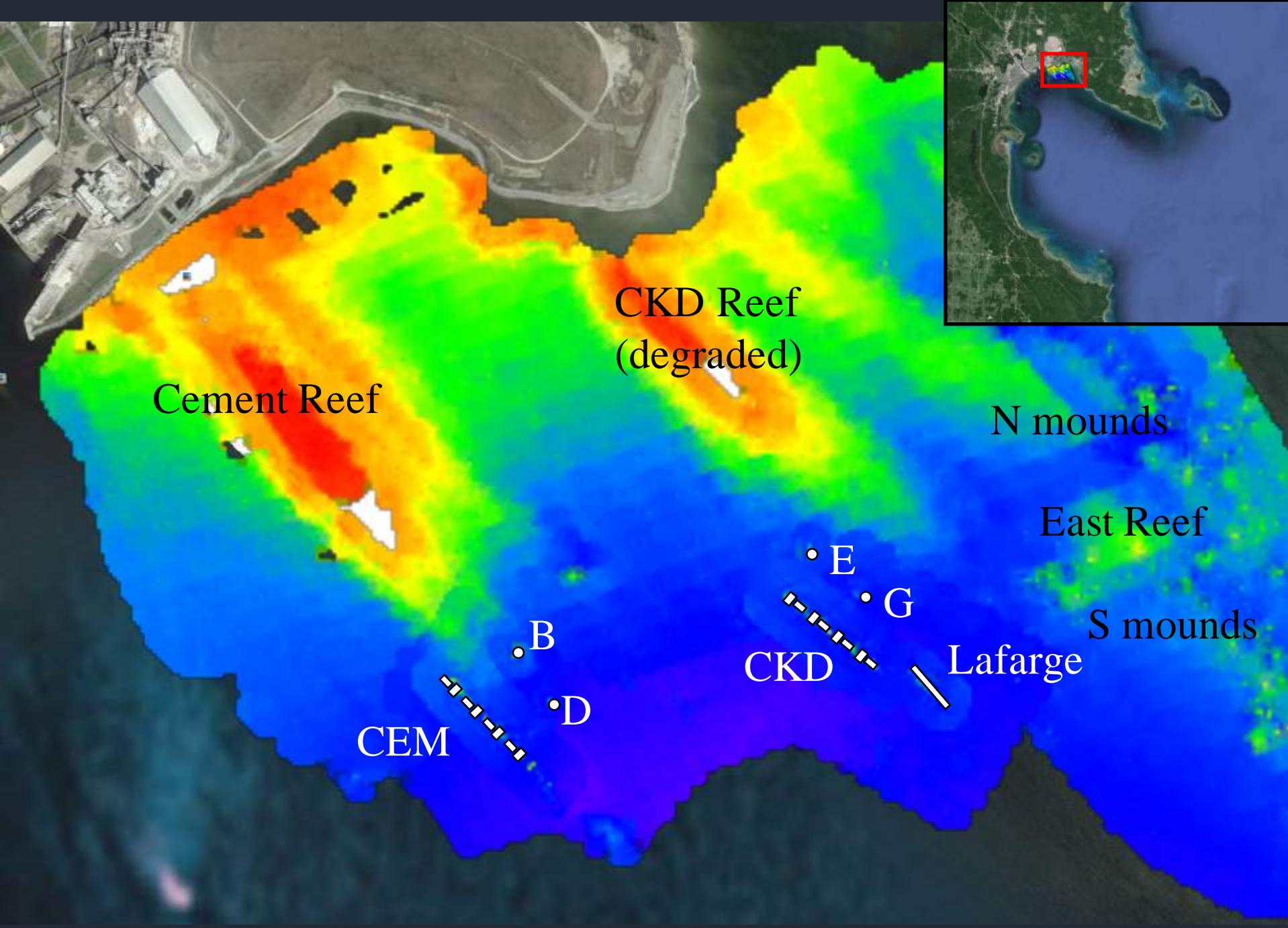
Size	Height	Orientation
7 m	1.5 m	NE-SW
30 m	3.0 m	NW-SE
90 m		



29 reefs
constructed
in 2010-2011



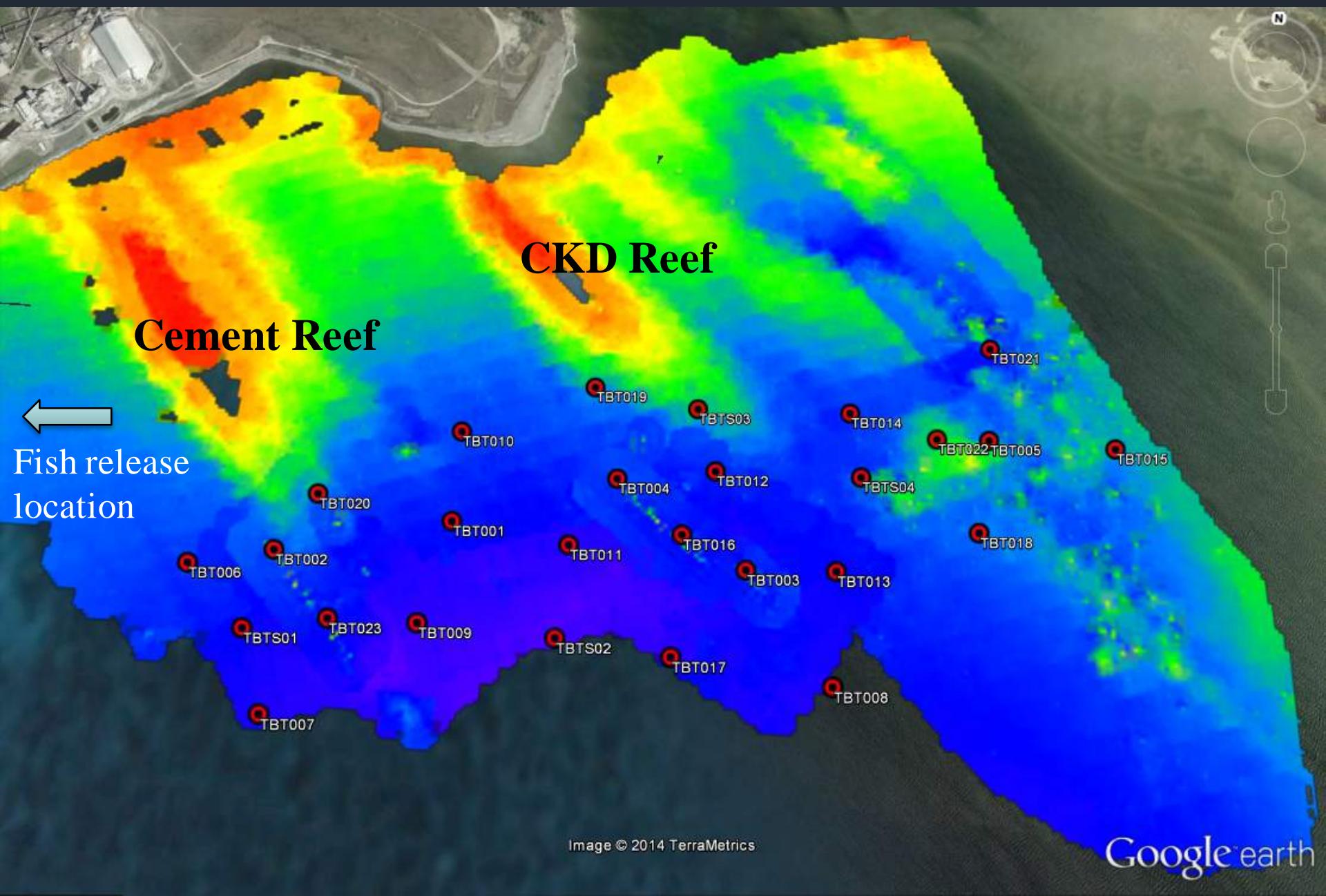
— 1.5 m high
— 3.0 m high



Objectives

- Determine whether the constructed reefs attract spawning lake trout
- Examine preferences among reef types:
 - orientation and height
 - small vs. larger
 - natural vs. constructed

Acoustic telemetry array



Acoustic Telemetry

15 females, 25 males
tagged in fall 2012
V16 tags, 3-min av. ping rate



Acoustic Telemetry

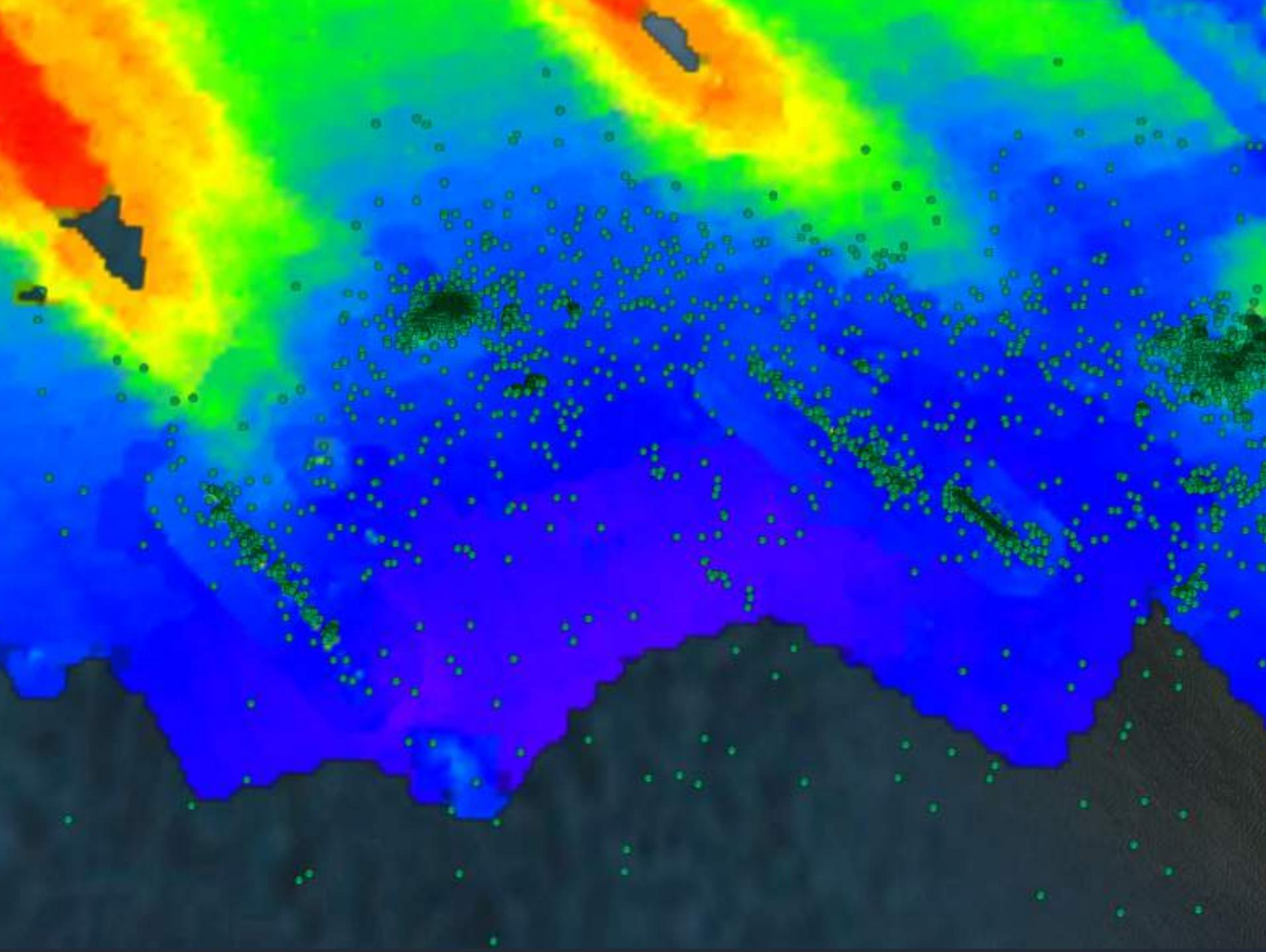
15 females, 25 males
tagged in fall 2012
V16 tags, 3-min av. ping rate

2012 – 23 fish remained at
least one day

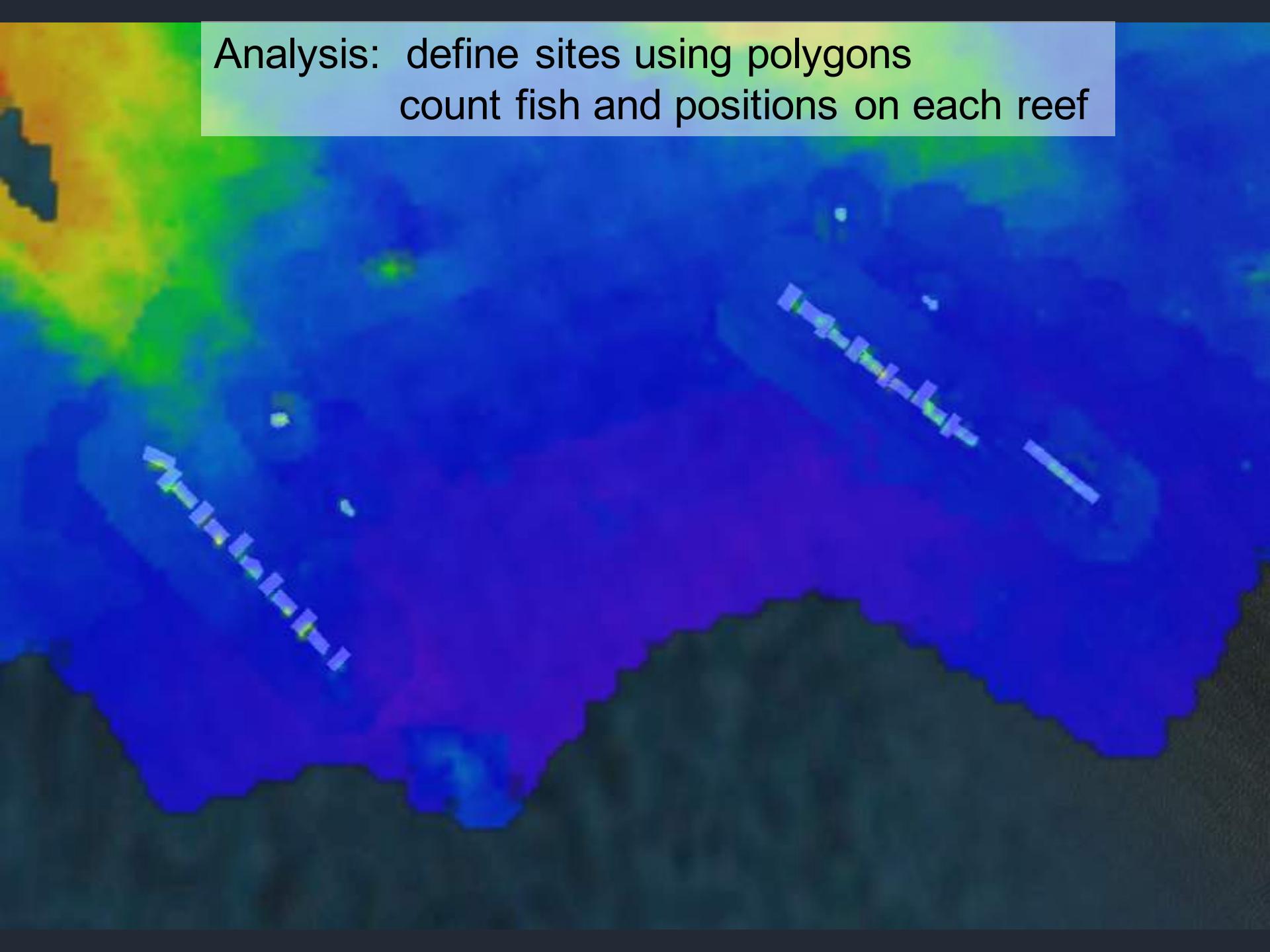
2013 – 22 fish returned

2014 – 17 fish returned





Analysis: define sites using polygons
count fish and positions on each reef



Average number of **positions** on each reef

Number of positions

1,000

900

800

700

600

500

400

300

200

100

-

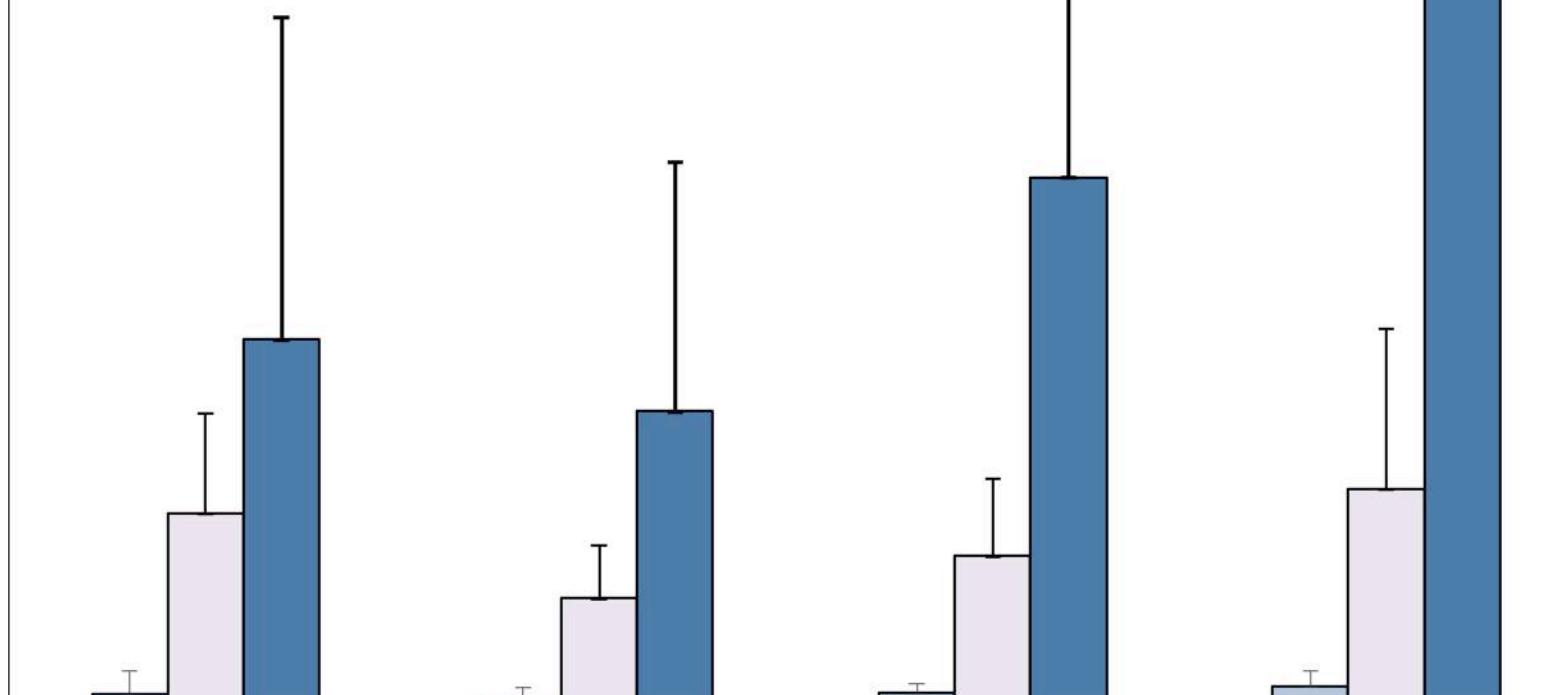
NW 1.5 m

SW 1.5 m

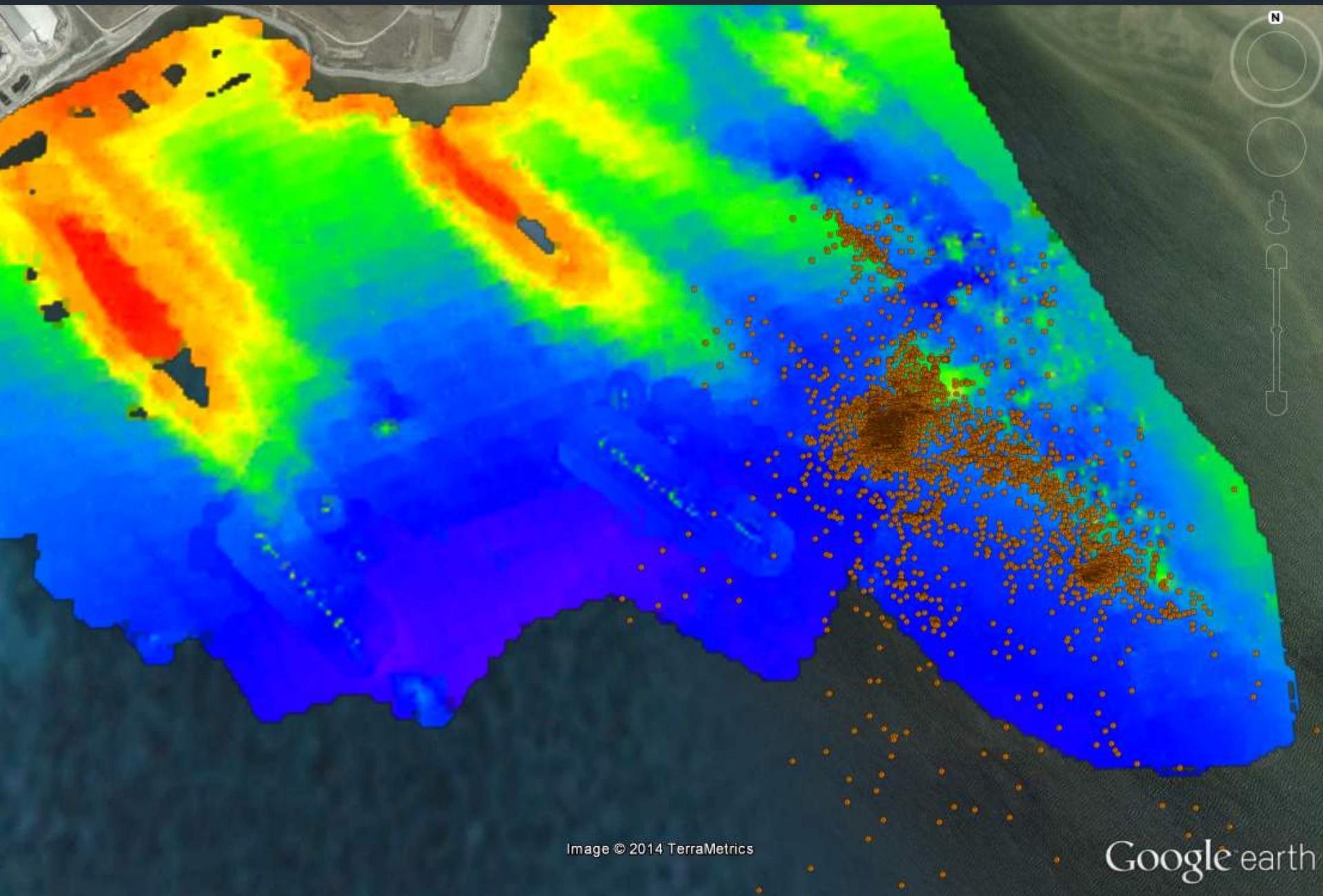
NW 3 m

SW 3 m

■ 2012 ■ 2013 ■ 2014

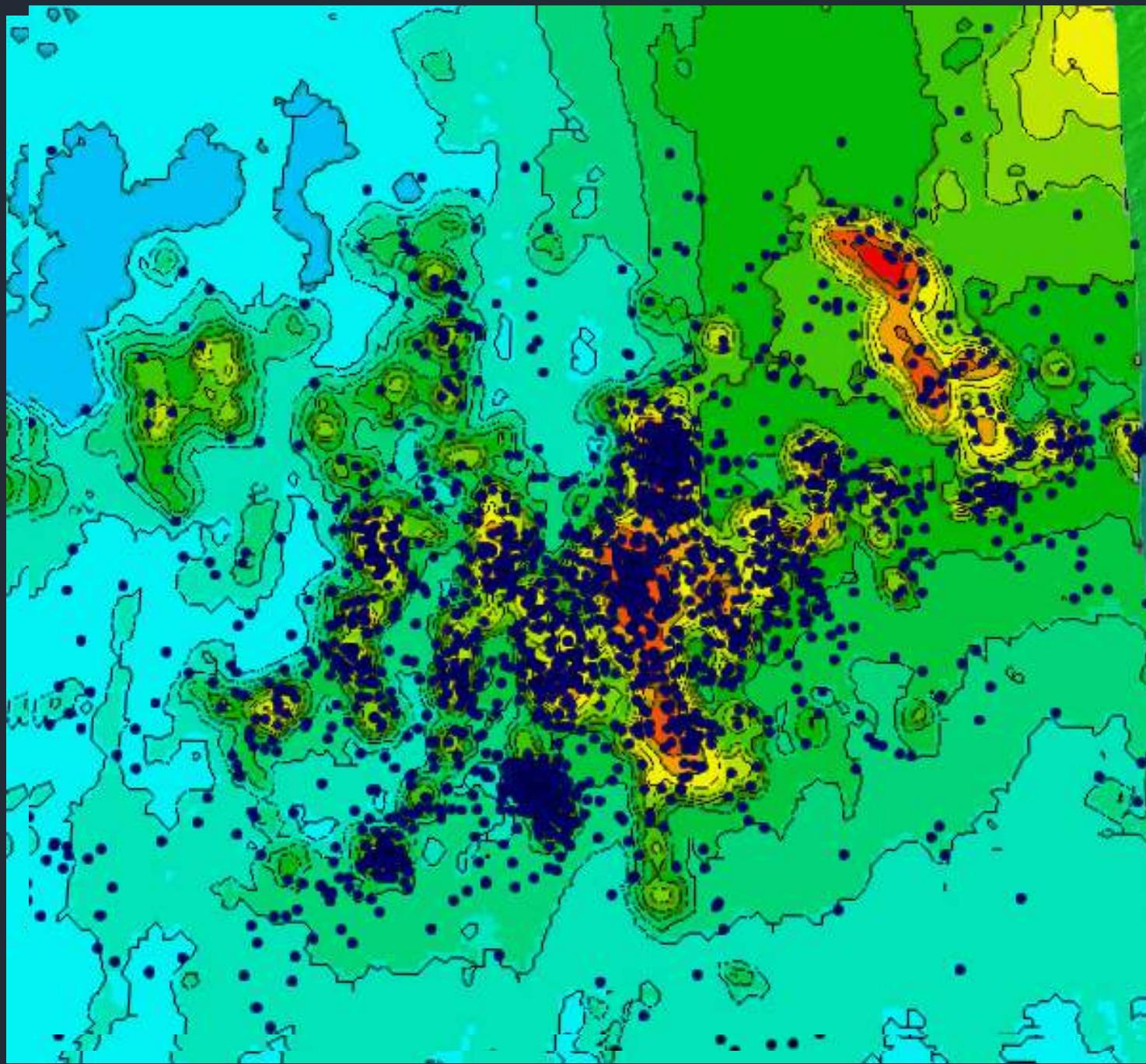


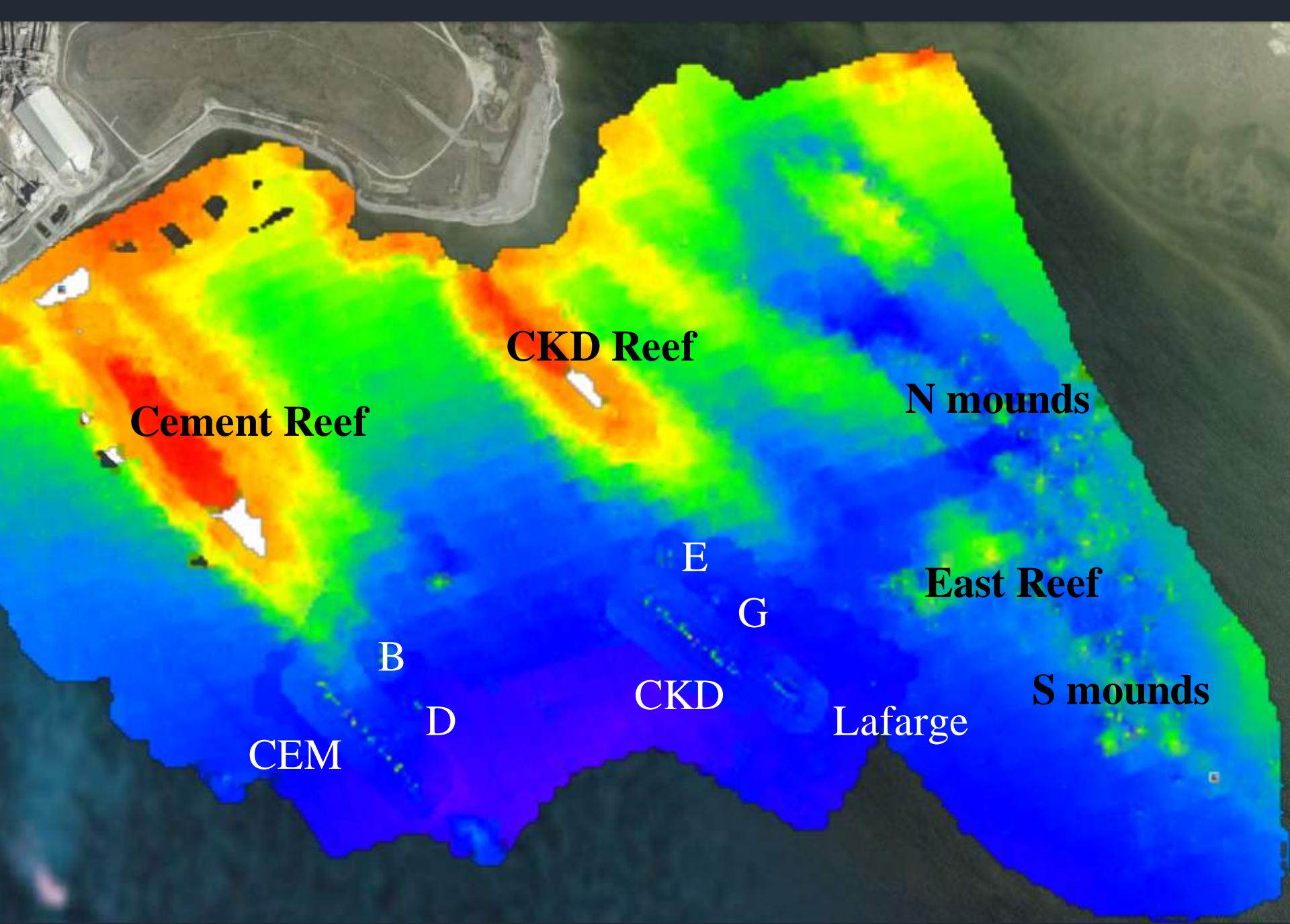
2012 – fish 29497 (male)



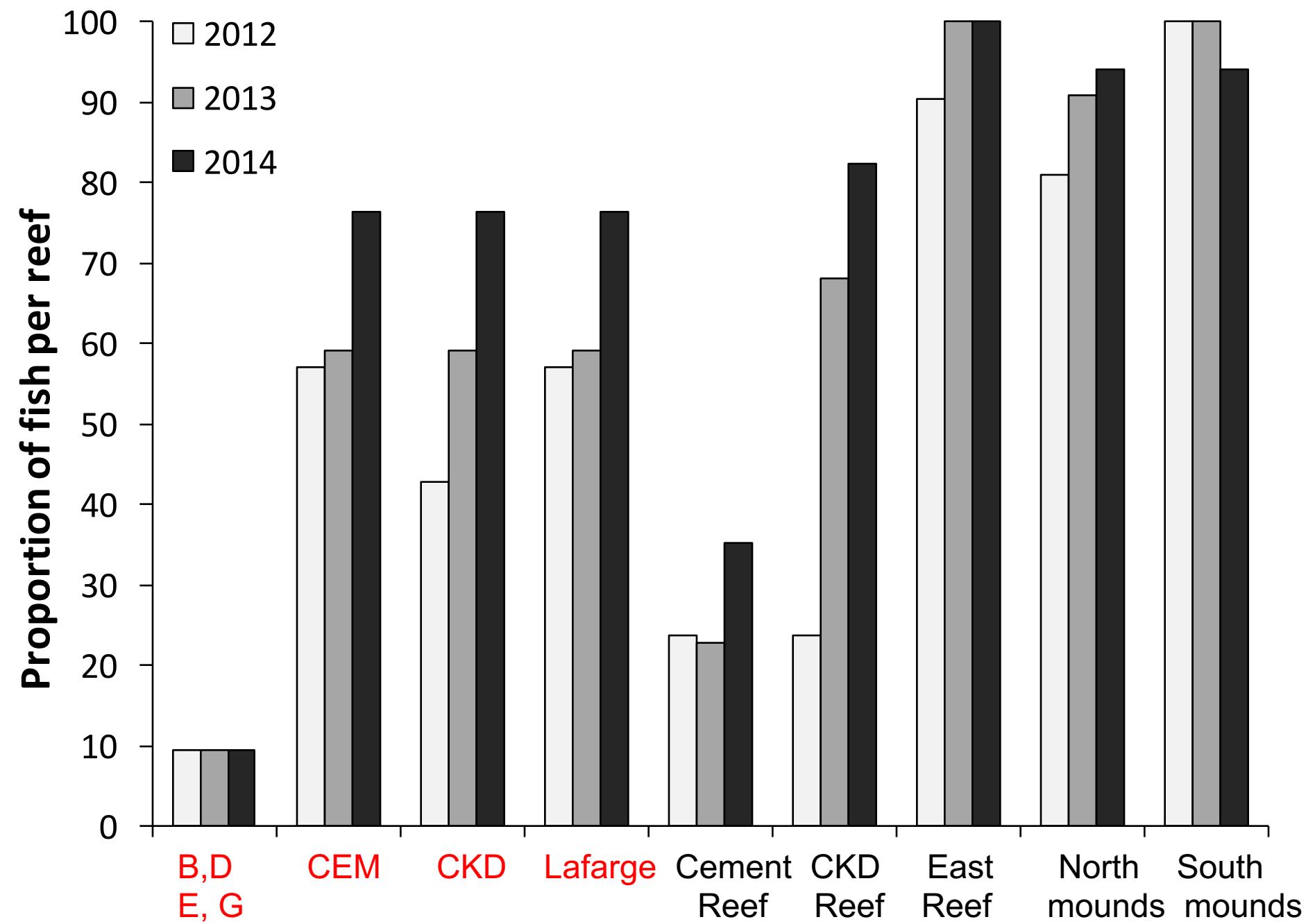
East Reef



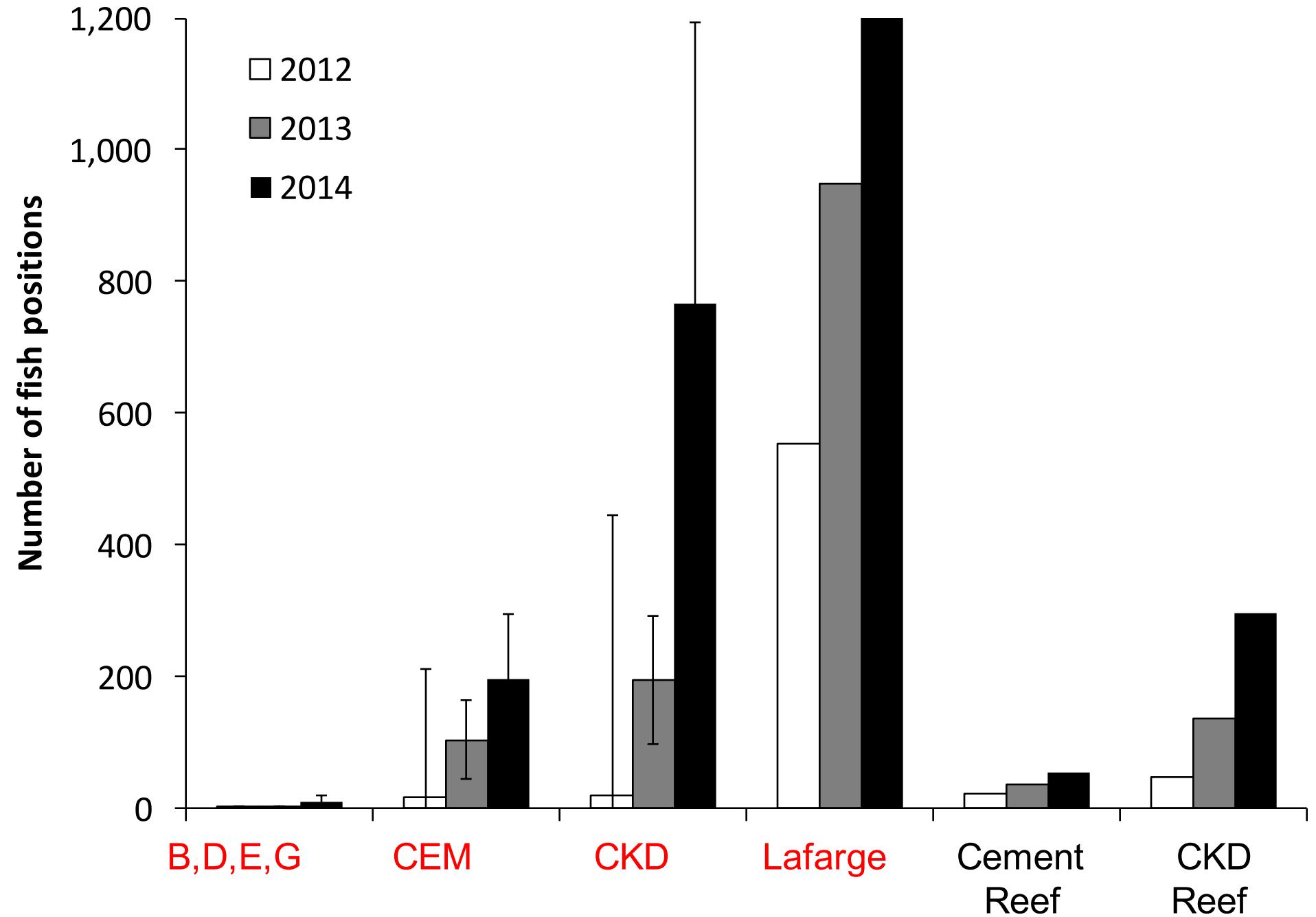




Proportion of fish on each reef



Number of **positions** on each reef



Number of **positions** on each reef

Number of fish positions

35,000

30,000

25,000

20,000

15,000

10,000

5,000

□ 2012

■ 2013

■ 2014

B,D
E,G

CEM

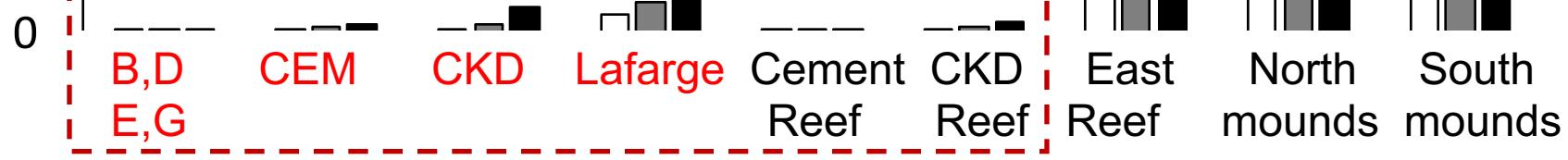
CKD

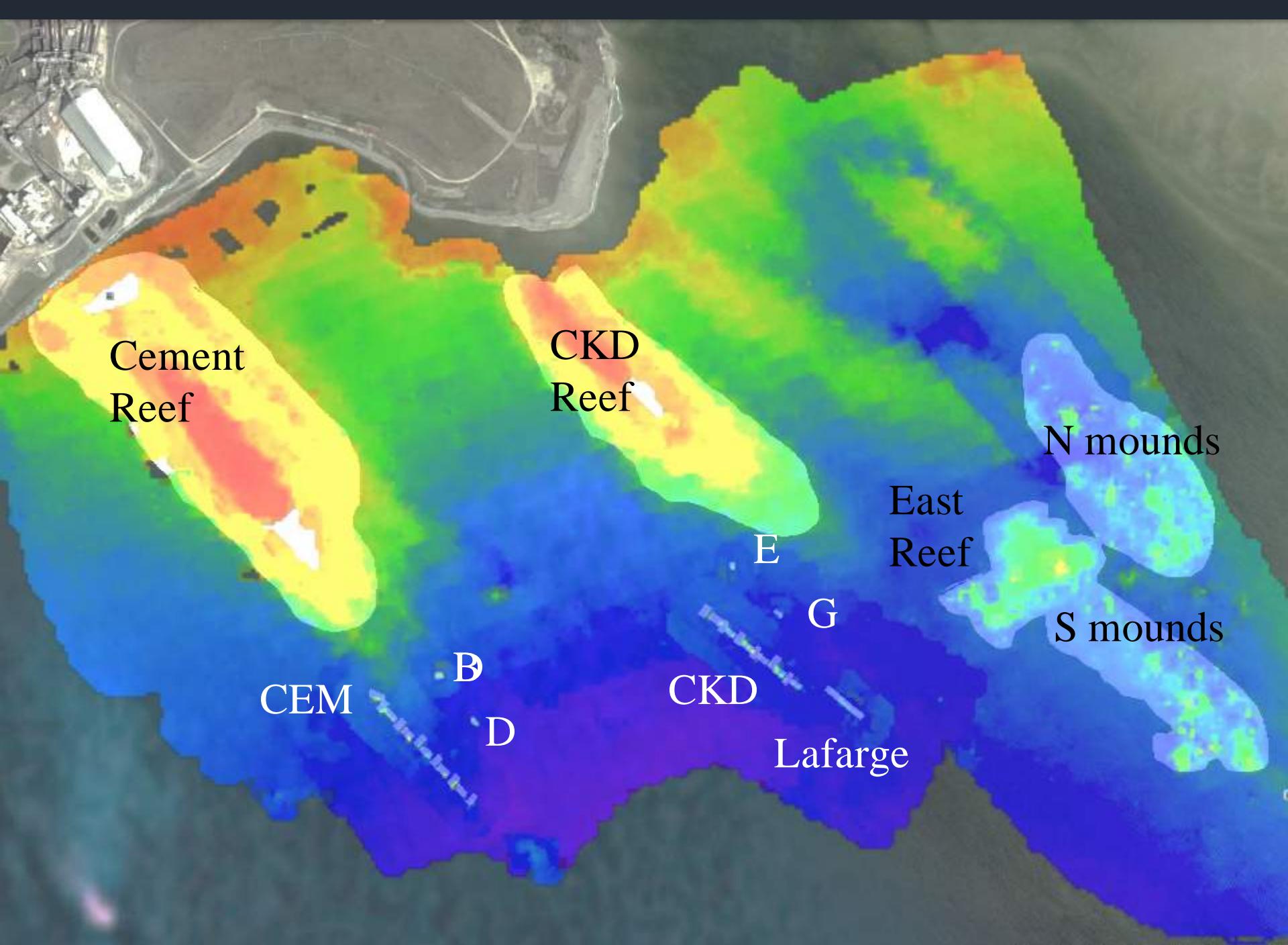
Lafarge
Reef

Cement
Reef

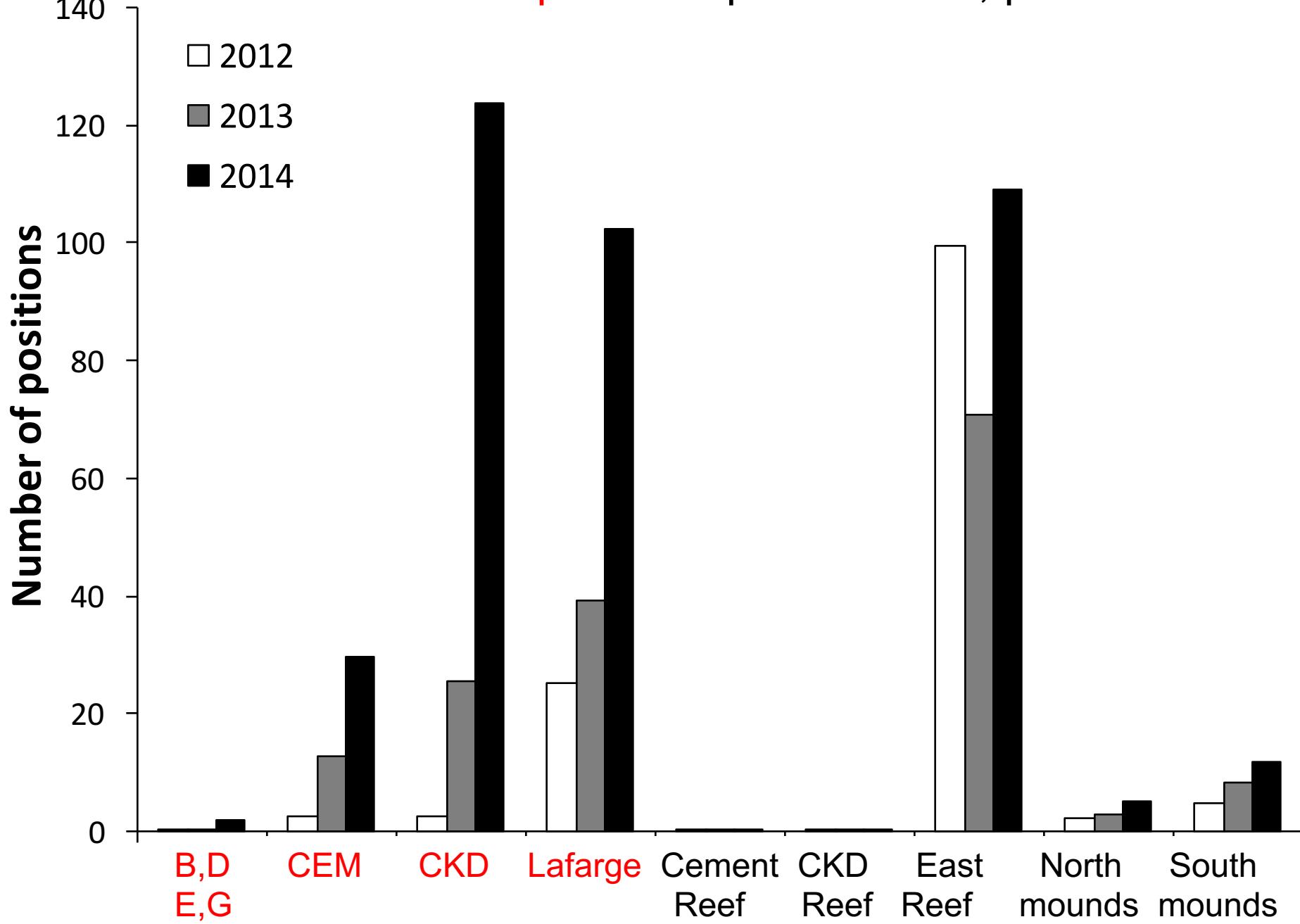
CKD
Reef

East
North
South
mounds
mounds

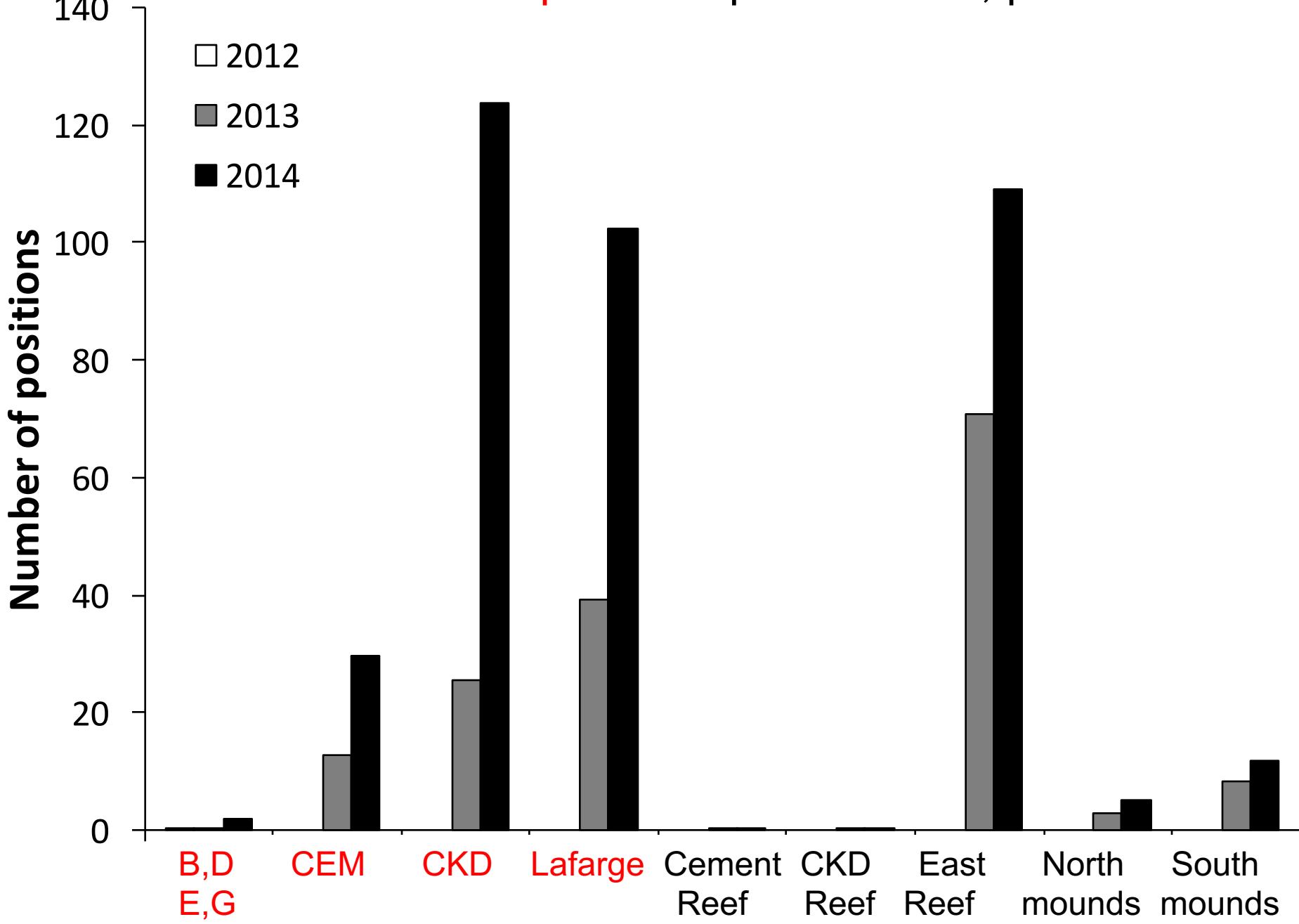




Number of positions per unit area, per fish



Number of positions per unit area, per fish



Artificial reefs for lake trout spawning - if we build it, will they like it?

It takes time

- density of spawners increased over time
- residence on constructed reefs increased over time

Size matters?

- smaller reefs ignored, largest reef consistently attracted fish

Assumptions about natural spawning reefs were wrong

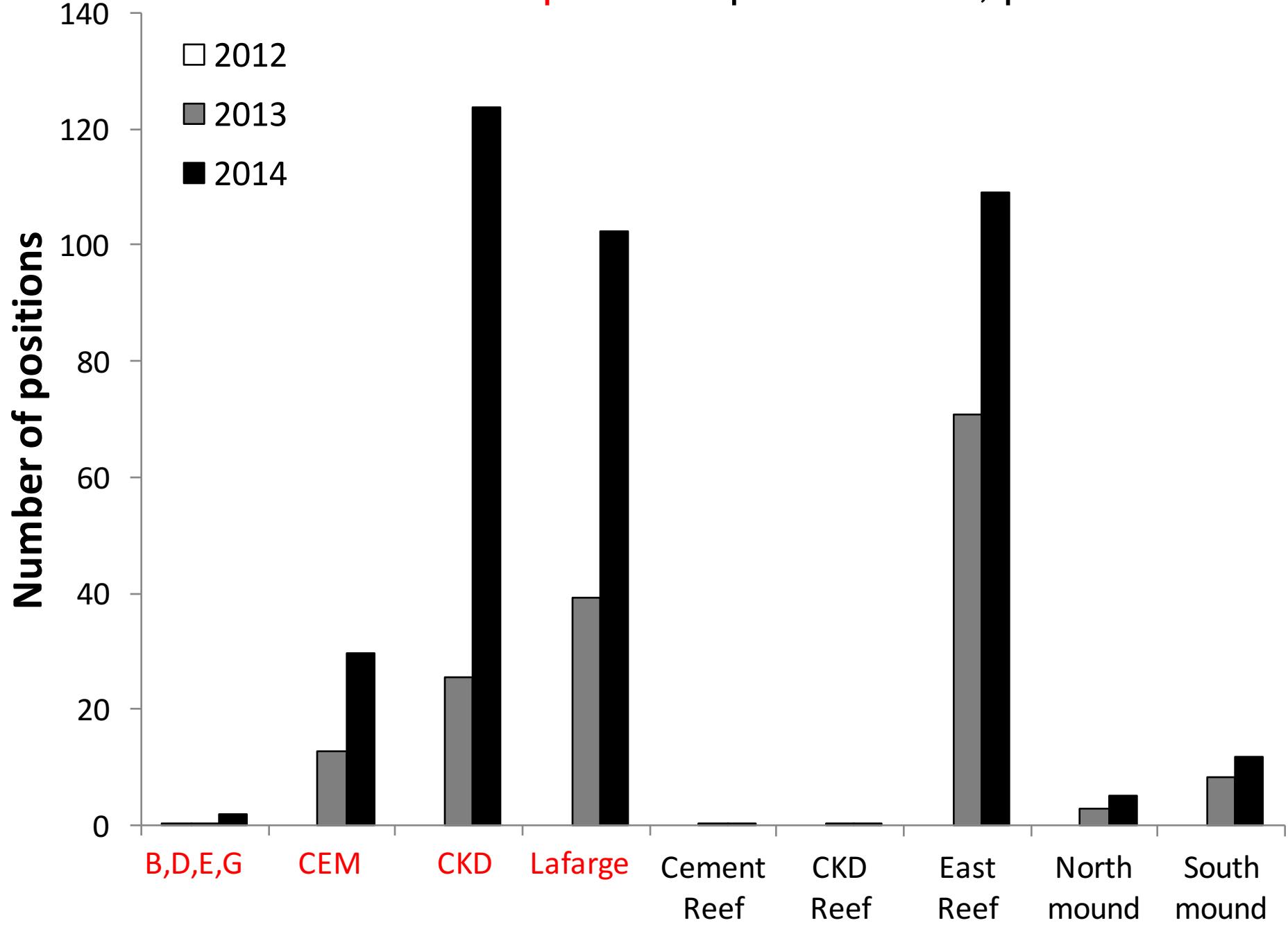
Project Team and Partners

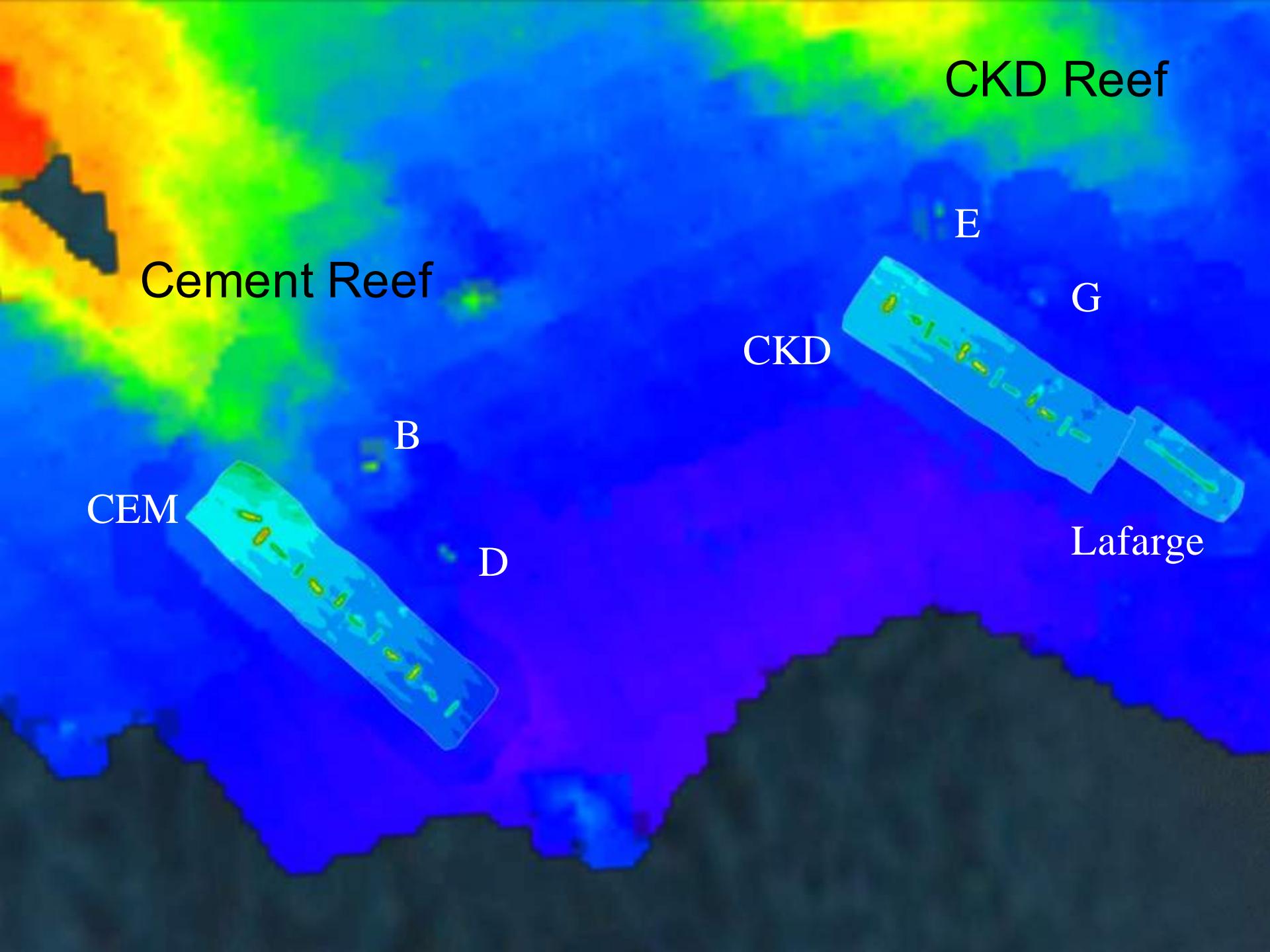
- MDEQ
- MDNR
- USFWS
- Lafarge
- GLATOS / GLFC / USGS Hammond Bay Biological Station
- Thunder Bay National Marine Sanctuary
- DLZ Michigan
- Durocher Marine
- Army Corps of Engineers





Number of positions per unit area, per fish





CKD Reef

Cement Reef

E

G

CKD

B

CEM

D

Lafarge

Acoustic Telemetry – next questions

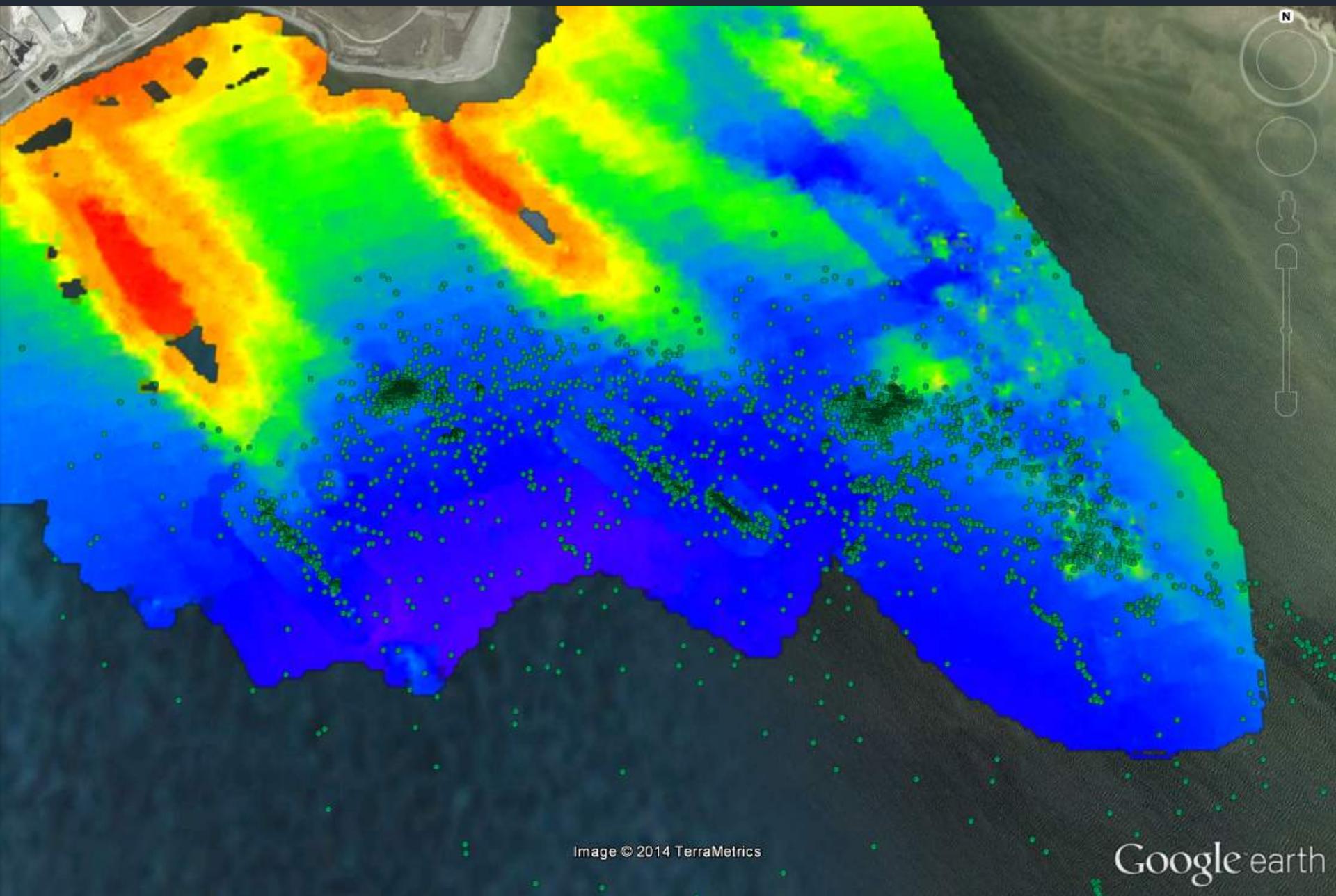
Do lake trout return to the same sites each year?

Do males stay longer at spawning sites than females?

How many sites are visited by each sex?

Are there spawning sites we have not yet identified?

2012 – fish 29511 (hatchery male)



2012 – fish 29518 (wild male)

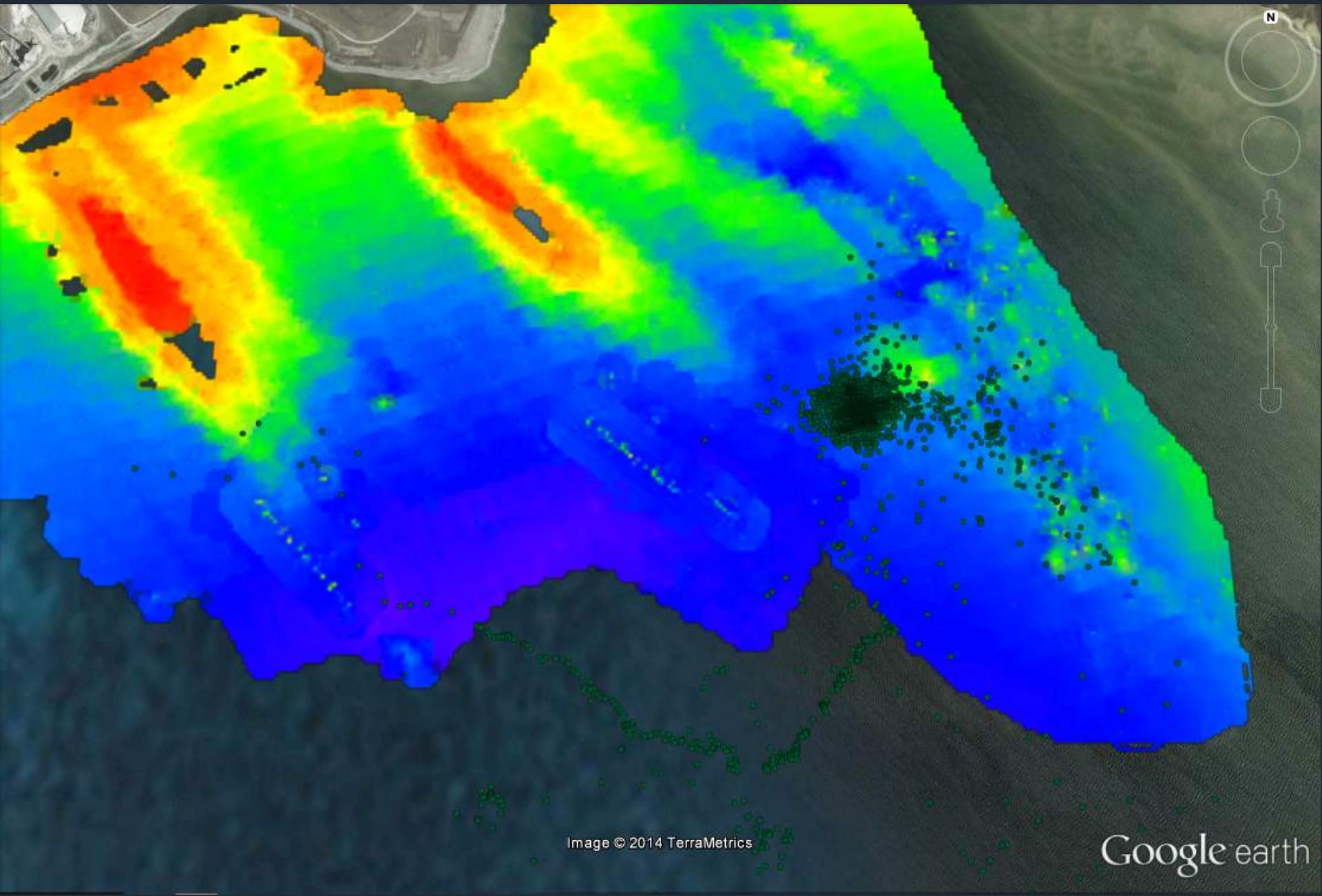


Image © 2014 TerraMetrics

Google earth

egg and fry sampling

