A bay-wide approach to oyster stock assessment, estimates of vital rates and disease status.

NCBO Award number: NA11NMF4570226

Progress in comparison of assessment sampling gear: a “first look” at December 2011 field data.

Roger Mann
Virginia Institute of Marine Science
Gloucester Point, VA 23062
rmann@vims.edu

GIT presentation, January 23, 2012

A bay wide assessment: a collaborative effort among many investigators and institutions.

- Roger Mann, VIMS. rmann@vims.edu, 804-684-7108
- Ryan Carnegie, VIMS. carnegie@vims.edu, 804-684-7713
- James Wesson, VMRC. Jim.wesson@mrc.virginia.gov, 757-247-2121
- Mike Naylor, MD DNR. MNAYLOR@dnr.state.md.us, 410-260-8652
- Mitch Tarnowski, MD DNR. MTARNOWSKI@dnr.state.md.us , 410-260-8258
- Kennedy Paynter, UMD. paynter@umd.edu 301-405-6893
- Chris Dungan, MD DNR. cdungan@dnr.state.md.us, 410-226-5193
- Howard Townsend, NMFS, Oxford Cooperative Lab. Howard.Townsend@noaa.gov 410-226-5193

- Plus a supporting cast of many great hands in the field and lab!

VIMS | William & Mary
Virginia Institute of Marine Science

Virginia Marine Resources Commission

Maryland Department of Natural Resources

Cooperative Oxford Laboratory

MEES Marine Estuarine Environmental Sciences Graduate Program

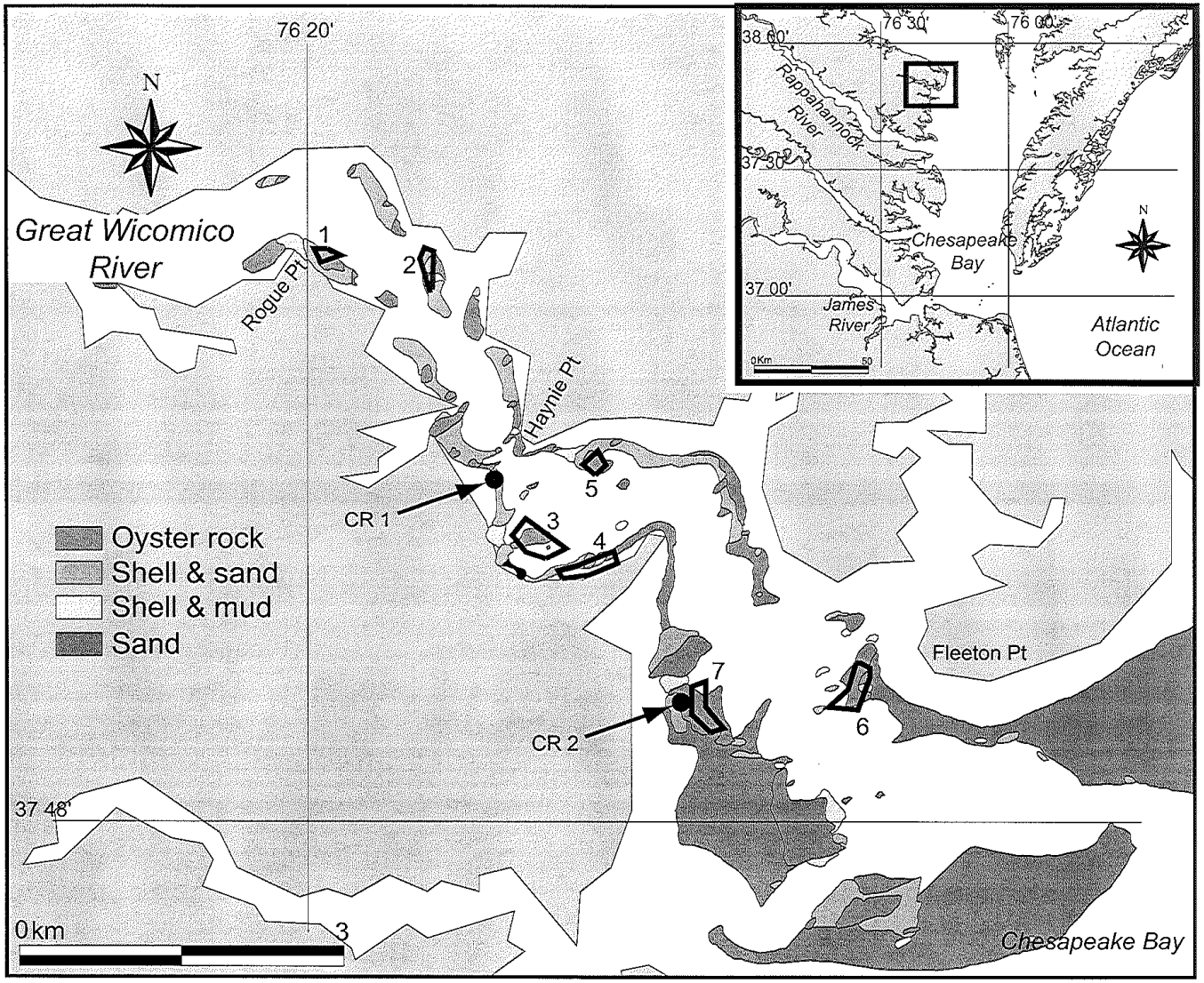
Progress to date: assessment field surveys in fall 2011

- Fall 2011 surveys by both MD DNR and VA (VMRC/VIMS) completed.
- In MD 337 stations were completed on 264 discrete oyster bars managed by DNR using a survey dredge in a defined swept area protocol to develop per unit area density estimates. Collected samples were described in terms of total sample volume, oyster demographic by category (live spat/small/market plus dead articulated valves – "boxes") and with samples by mm length frequency. 43 bars were additionally sampled for disease assay (MSX and *Perkinsus*) for the three major size classes. 30 bars were sampled for condition index (dry tissue weight / dry shell weight).
- In VA 1600 stations encompassing 175 reefs over 8300 acres, managed as public oyster grounds by VMRC, were sampled with a hydraulic patent tong. Reef areas were defined by historically boundaries and sampling stations identified within the boundaries by random location. Collected samples were described in terms of total shell volume, shell volume sub-divided as black (anoxic, buried) and brown (oxic) components, and oyster demographic by mm length frequency. 30 reefs were sampled for both disease assay in size classes, and condition.
- UMD surveyed Harris Creek and Little Choptank River. Resource area delineated with side scan sonar and ground trotting; 4 strata identified, then sampled using a stratified random design (N>1000) by grabs.

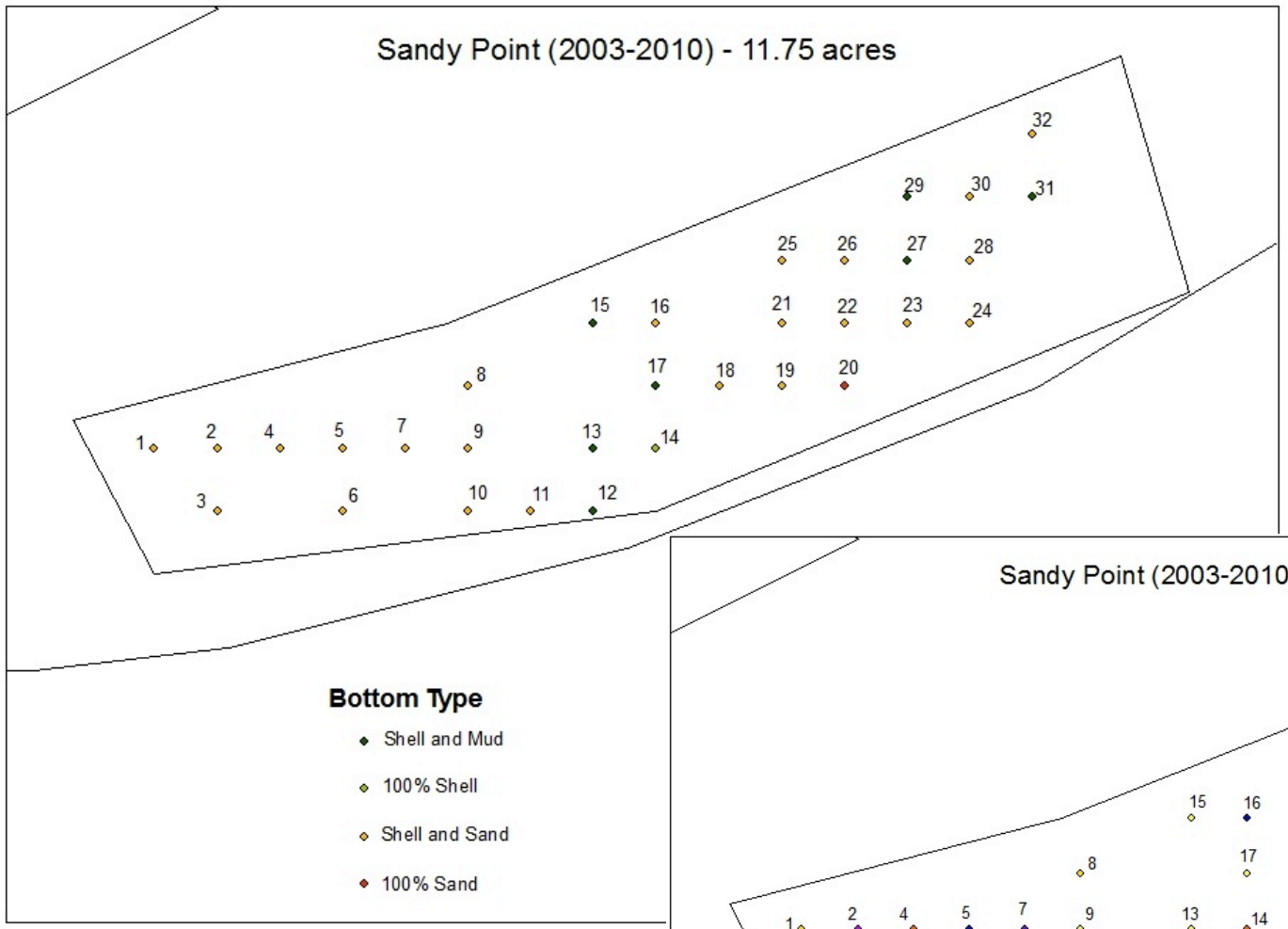
The next challenge: gear comparisons to develop a single population estimator.

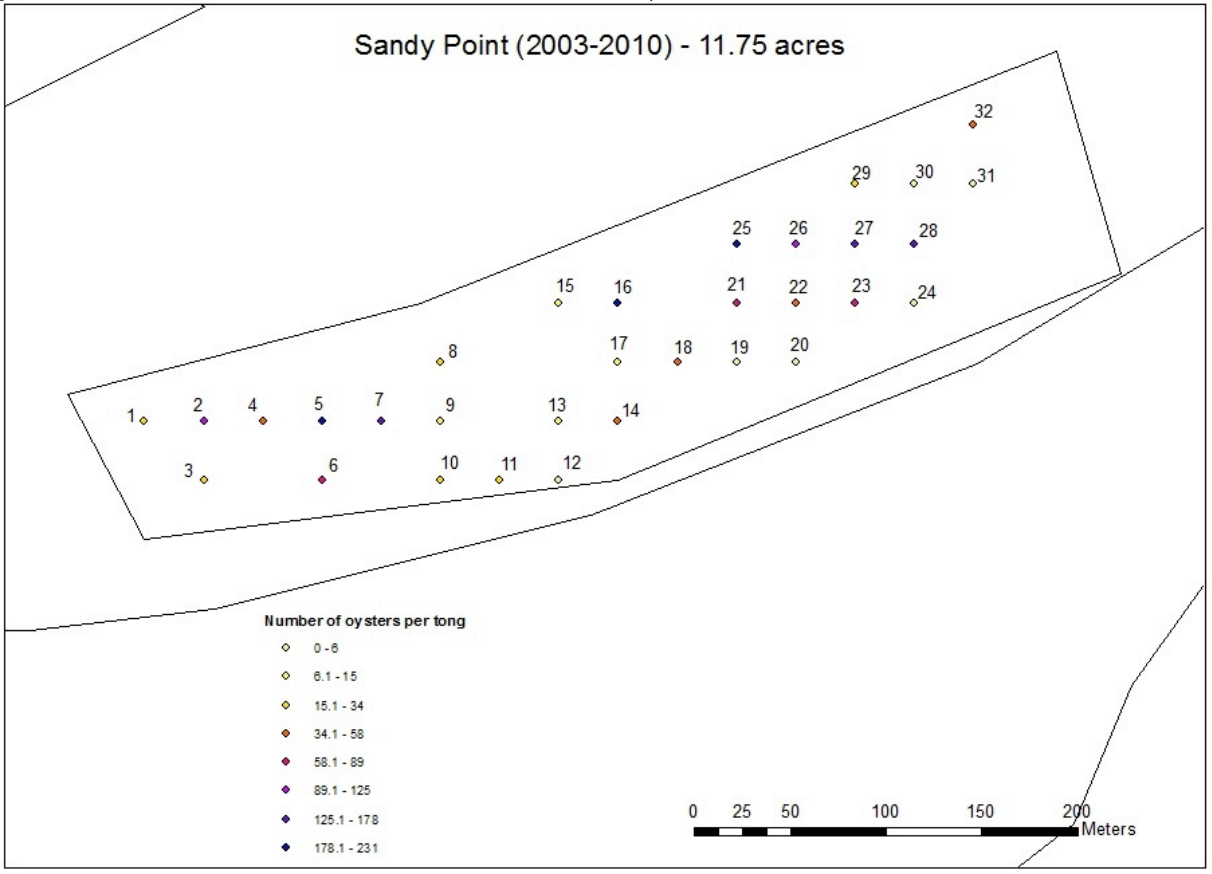
- Dredges: cover large area per tow, integrate density over that area – but may be <100% efficiency, must not to be filled, and swept area estimation is critical.
- Hydraulic patent tongs: defined but small sampling area, larger n values required, efficiency probably more stable.
- Both - care in sampling design on non homogenous habitats.
- December 13, 2011 comparison study on 4 reefs in Great Wicomico River, VA.
  - Study design: identify regions of "uniformity" from prior surveys by VMRC/ VIMS.
  - 4 parallel dredge tows across reef in swept area mode using MD DNR dredge, process as per MD protocol.
  - 10 patent tong deployments in polygon defined by the dredge tows, process as per VA protocol.
  - Measure everything, compare!

This is the first analysis of the data!



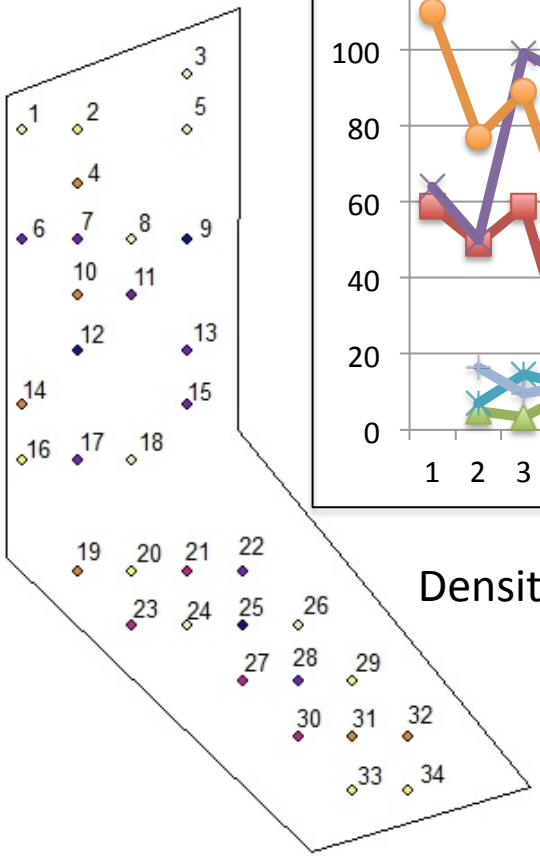
Sites by number: 1 – Rogue Point; 2 – Harcum Flats; ***3 – Shell Bar; 4 – Sandy Point***; 5 – Haynie Point; 6 – Fleet Point; ***7 – Cranes Creek***.

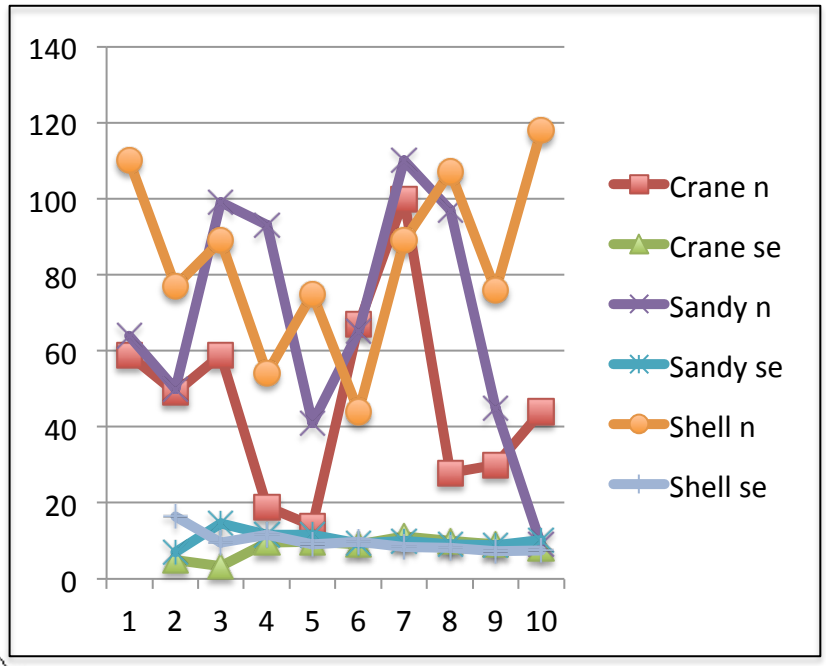

Sandy Point (2003-2010) - 11.75 acres
32
29
30
31
25
26
27
28
15
16
21
22
23
24
8
17
18
19
20
1
2
4
5
7
9
13
14
3
6
10
11
12
Bottom Type
Shell and Mud
100% Shell
Shell and Sand
100% Sand


Sandy Point (2003-2010) - 11.75 acres
32
29
30
31
25
26
27
28
15
16
21
22
23
24
8
17
18
19
20
1
2
4
5
7
9
13
14
3
6
10
11
12
Number of oysters per tong
0 - 6
6.1 - 15
15.1 - 34
34.1 - 58
58.1 - 89
89.1 - 125
125.1 - 178
178.1 - 231
0
25
50
100
150
200
Meters

MD DNR swept area dredge

VMRC patent tong





Density oysters v sample number

Table 1: Mean and standard deviation density estimates for shell, spat, small, market and total oysters: dredge and patent tong.

		DNR dredge data, n = 4					VMRC patent tong data, n = 10				
		shell	spat	small	market	total	shell	spat	small	market	total
Cranes Creek	mean	10.5	6.6	25.7	6.2	***38.6***	11.1	7.8	34.2	4.9	***46.9***
	sd	2.1	0.9	5.4	2.1	***7.7***	7.9	6.4	17.3	4.5	***25.9***
	per L shell	0.0	0.6	2.5	0.6	***3.7***	0.0	0.7	3.1	0.4	***4.2***
Sandy Point	mean	4.0	7.8	10.4	2.3	***20.5***	12.1	17.3	44.8	5.2	***67.3***
	sd	1.4	2.5	5.4	1.0	***8.8***	5.2	9.6	22.7	2.5	***32.1***
	per L shell	0.0	2.0	2.6	0.6	***5.1***	0.0	1.4	3.7	0.4	***5.6***
Shell Bar (shell)	mean	1.8	5.0	6.0	1.3	***12.2***	17.4	31.5	68.7	5.8	***106.0***
	sd	0.7	2.5	3.0	1.1	***5.7***	7.4	29.3	51.5	3.4	***74.6***
	per L shell	0.0	2.8	3.3	0.7	***6.8***	0.0	1.8	3.9	0.3	***6.1***
Shell Bar (shell+mud)	mean	2.2	5.2	6.2	1.8	***13.1***	17.1	20.3	57.1	6.5	***83.9***
	sd	0.9	3.3	2.7	1.1	***6.0***	2.8	11.2	16.8	3.7	***23.8***
	per L shell	0.0	2.3	2.8	0.8	***5.9***	0.0	1.2	3.3	0.4	***4.9***

Table 2. Dredge v patent tong estimates expressed as dredge efficiency:
by absolute "***density***": (dredge density.m^{-2}/tong density. m^{-2}) x 100%
corrected by "***per L shell***": (dredge density per L shell/tong density per L shell) x 100%

	shell	spat	small	market	total
density					
Cranes Creek	94.4%	85.0%	75.3%	126.8%	***82.3%***
Sandy Point	33.0%	45.1%	23.3%	43.5%	***30.4%***
Shell Bar	10.4%	15.8%	8.7%	21.7%	***11.5%***
Shell Bar Mud	13.1%	25.6%	10.8%	27.5%	***15.7%***
per L shell					
CranesCreek		90.0%	79.7%	134.3%	***87.1%***
Sandy Point		136.9%	70.6%	132.1%	***92.4%***
Shell Bar		152.1%	84.0%	209.3%	***111.1%***
Shell Bar Mud		195.3%	82.4%	210.1%	***119.6%***

“First look” suggestions – emphasizing that I have yet to share these data with co-investigators!!!!!!

- Absolute estimates of density at Cranes Creek are in good agreement, but there are notably higher estimates by tong at the Sandy Point and Shell Bar sites – why are they so variable?
- The tong samples down through the reef surface to the underlying anoxic shell/sediment complex, BUT the dredge samples the surface layer (no black shell). The depth of the shell layer is thus implicated.
- Note the higher absolute shell density estimates at Sandy Point and Shell Bar sites. Cranes Creek was subject to intense fishing effort on the day of our study, possibly providing a “loose” shell base that was equally sampled by tong and dredge, whereas other sites had well consolidated shell that was difficulty to penetrate in one dredge tow but not a tong deployment (the tong weighs in excess of 70kg).
- When the data is corrected to expression as oysters per unit volume of shell the value are generally in good agreement at all stations. Examine the dredge efficiency estimates in the lower section of Table 2.
- Additional discussion with collaborators will prove fruitful – we need to consider the nature of the shell base in developing between gear conversion estimators.
- Stay tuned!