

Sea scallop ABC and Fishery Status Update

Dvora Hart

NEFSC, Woods Hole MA

Changes to the NEFSC sea scallop survey

Conducted since 1979 with an 8' sea scallop dredge with 2" rings and a 1.5" plastic liner to retain small scallops

Transitioning to using towed camera system (HabCam) together with dredge tows

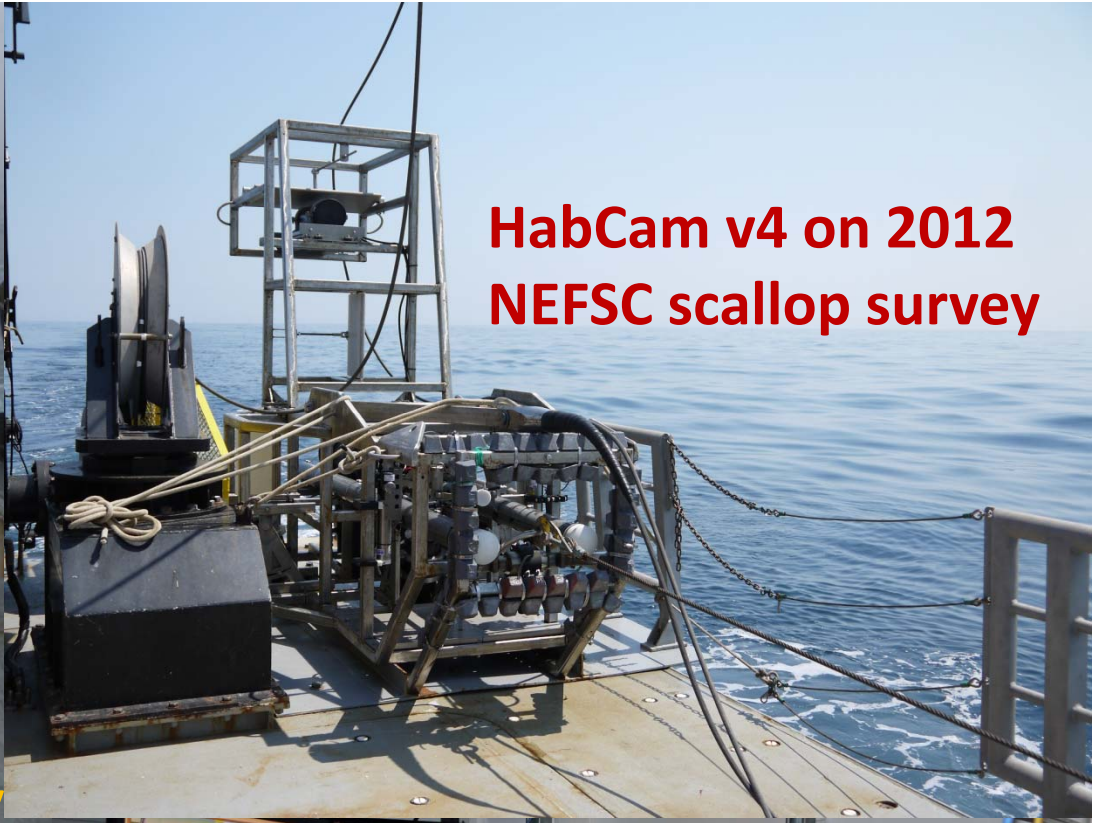
2010: Full dredge survey with 400 tows

2011: Dredge survey with 300 tows and HabCam v2 survey of Georges Bank

2012: Dredge survey with 200 tows and HabCam v4 survey of both Mid-Atlantic and Georges Bank. NEFSC dredge survey was supplemented by VIMS dredge surveys of specific areas



HabCam v2 on 2011
NEFSC scallop survey



HabCam v4 on 2012
NEFSC scallop survey

Camera, strobes, other instruments inside a steel frame Vehicle towed about 2 m off the bottom @ 6 knots, takes ~6 photos/sec together with other data from sonar and oceanographic instruments



Conducted 200 survey dredge tows and 7 million stereo image pairs from new Habcam system



For FW24, 1/200 images were examined (about 1 every 100 m). Kriging was used to extrapolate to unobserved areas

This method was reviewed and approved during the last sea scallop benchmark assessment (SARC-50)

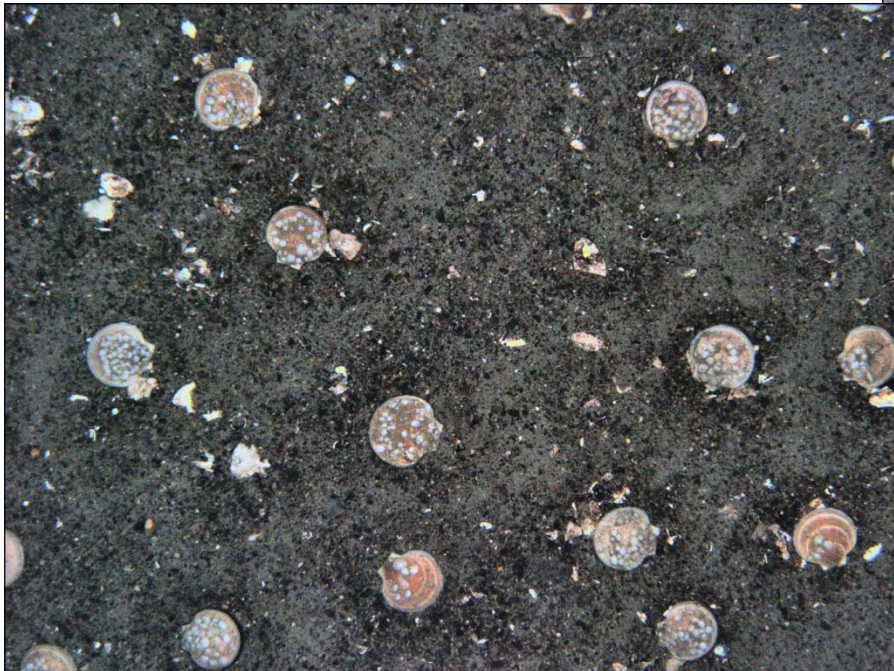
One year old scallops in Elephant Trunk



Two year old scallops in Hudson Canyon S. AA



High scallop densities in Great South Channel





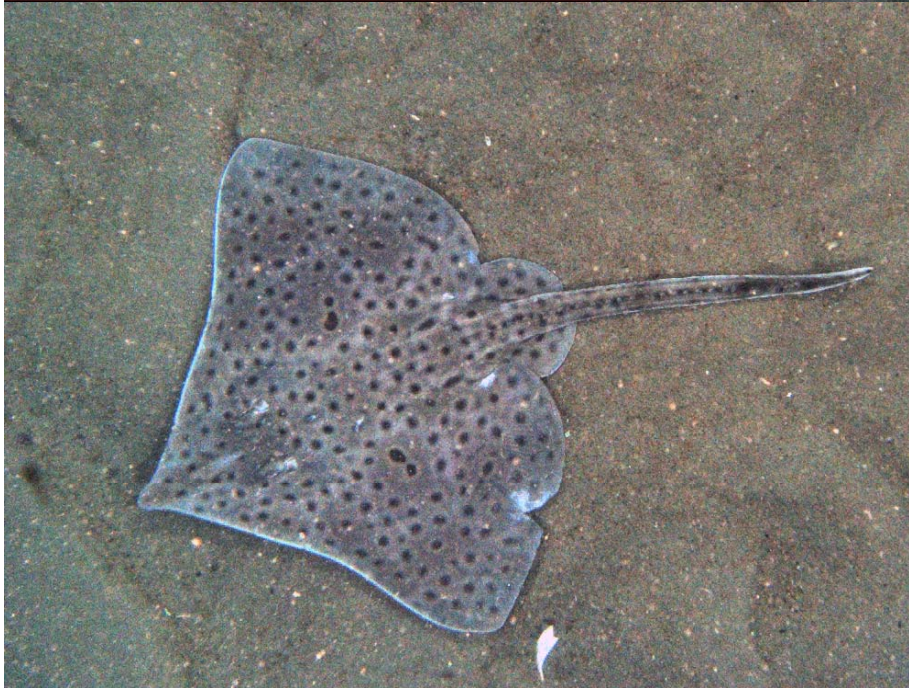
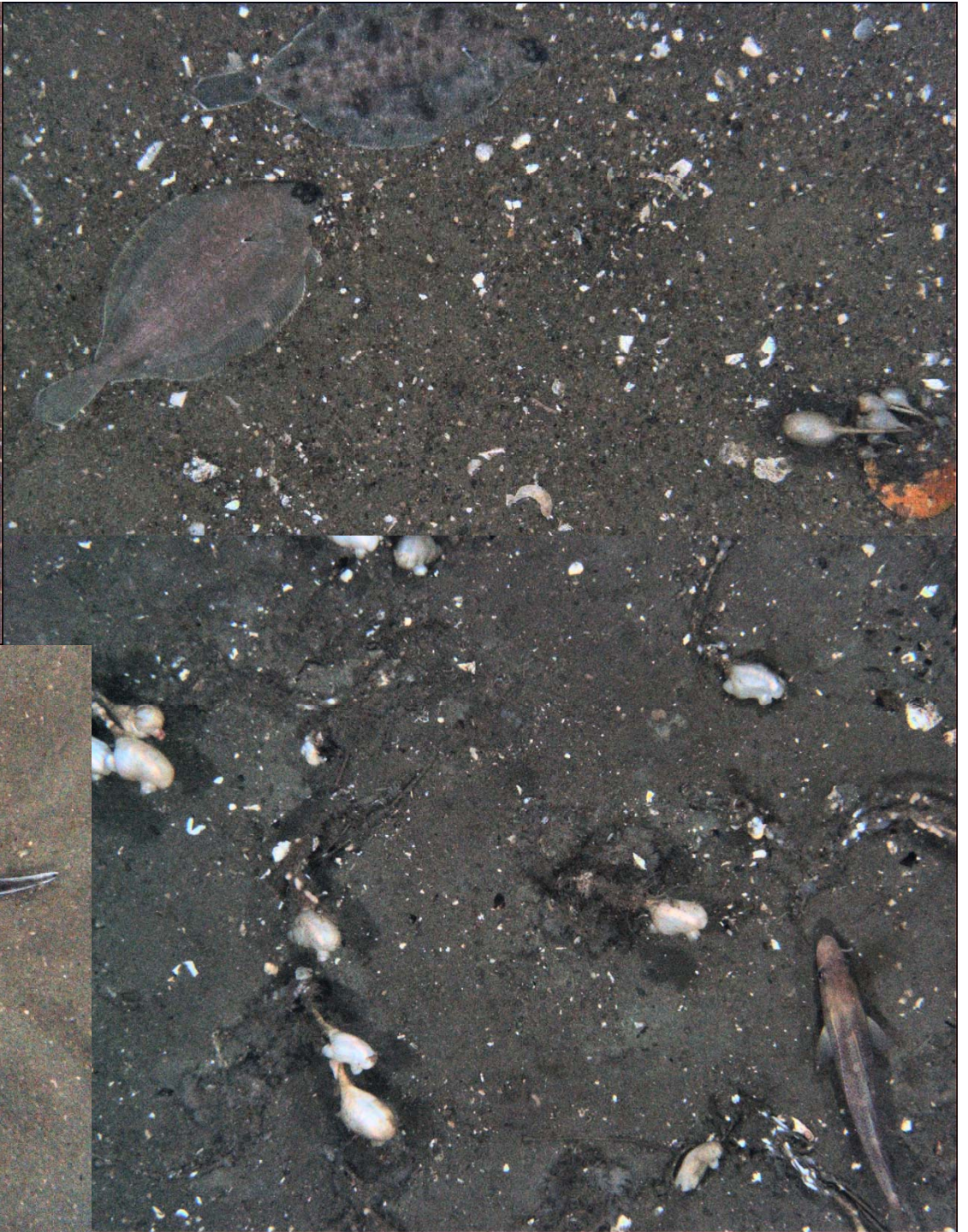
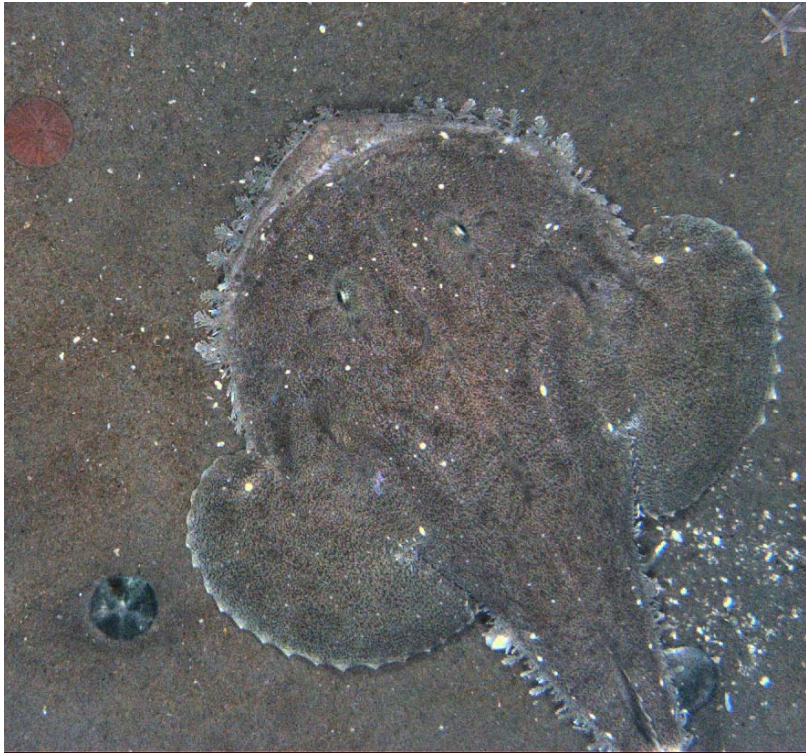
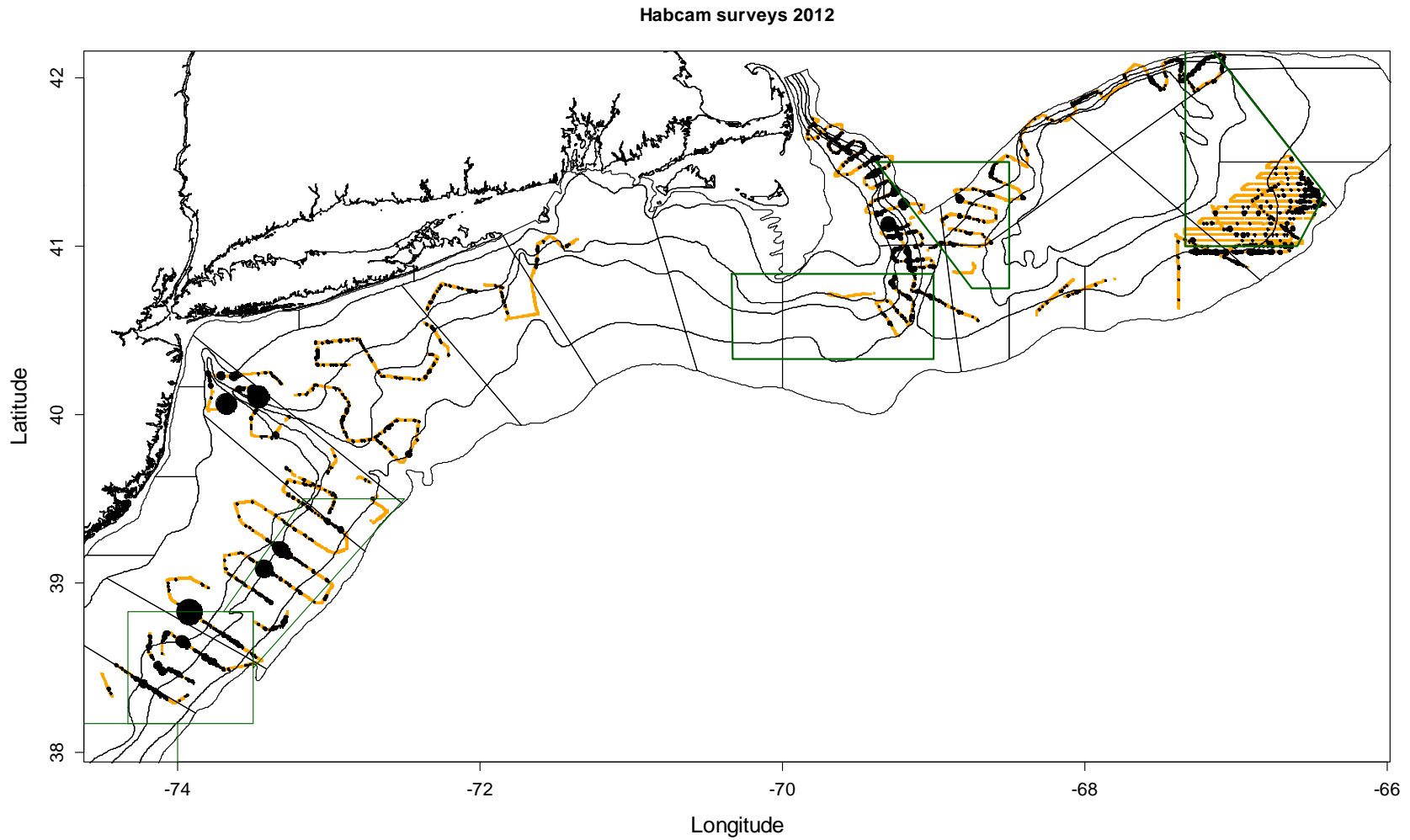
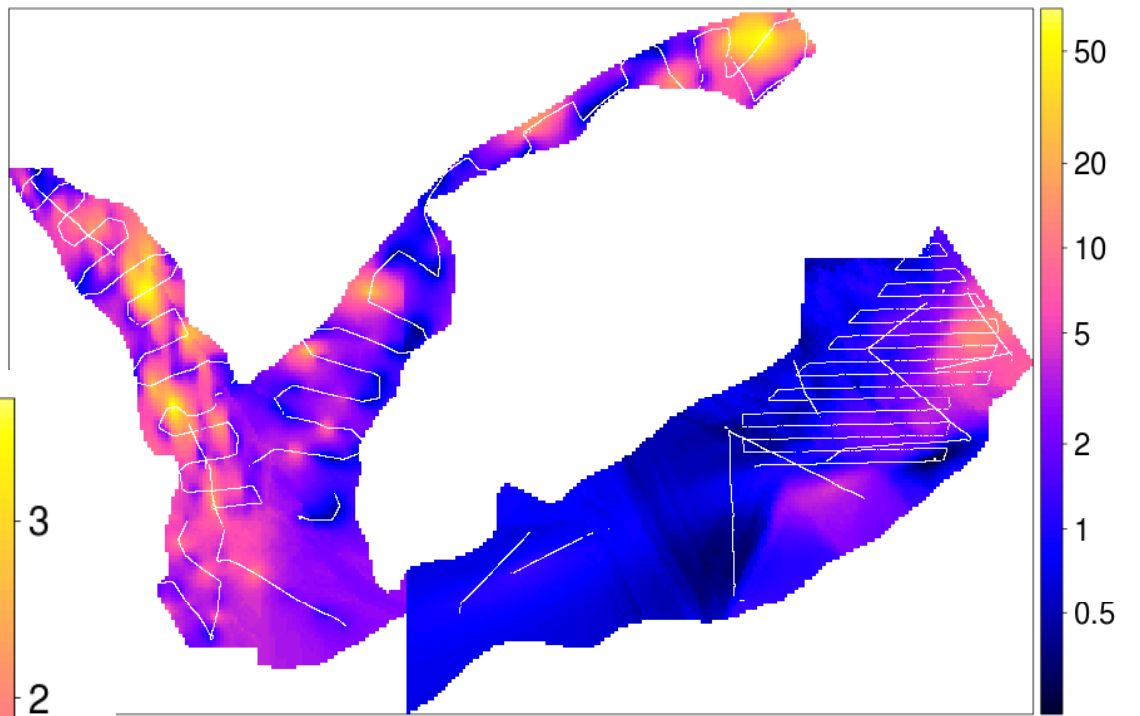
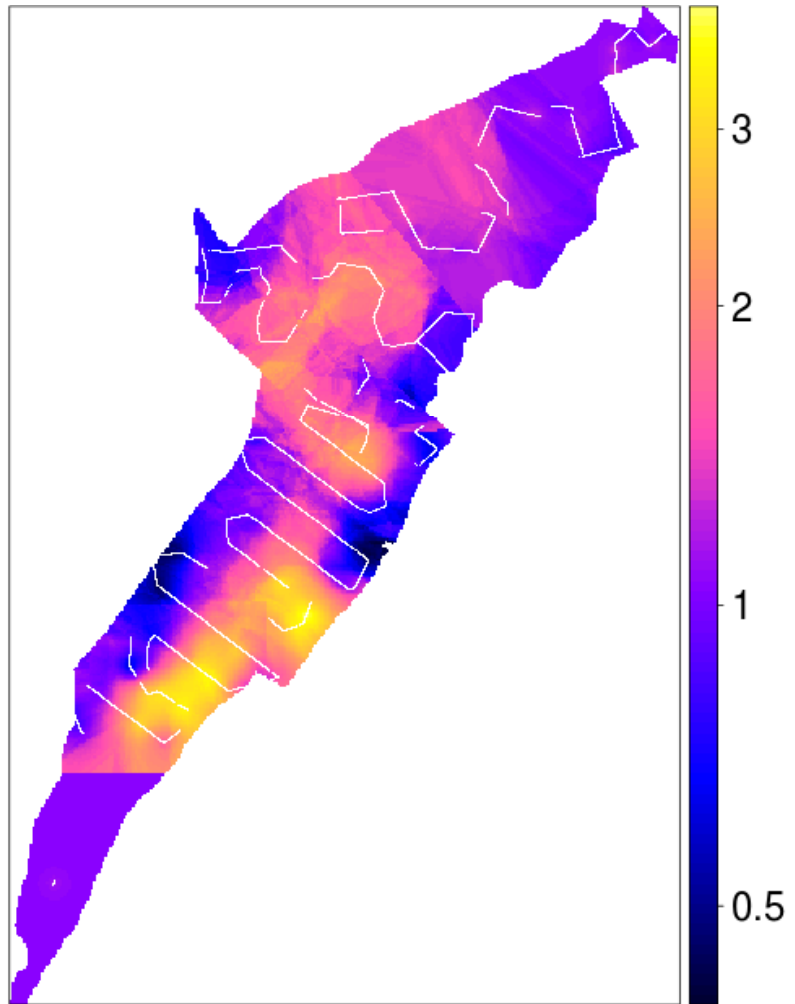


Chart of Habcam path (orange) with scallop observations (black)

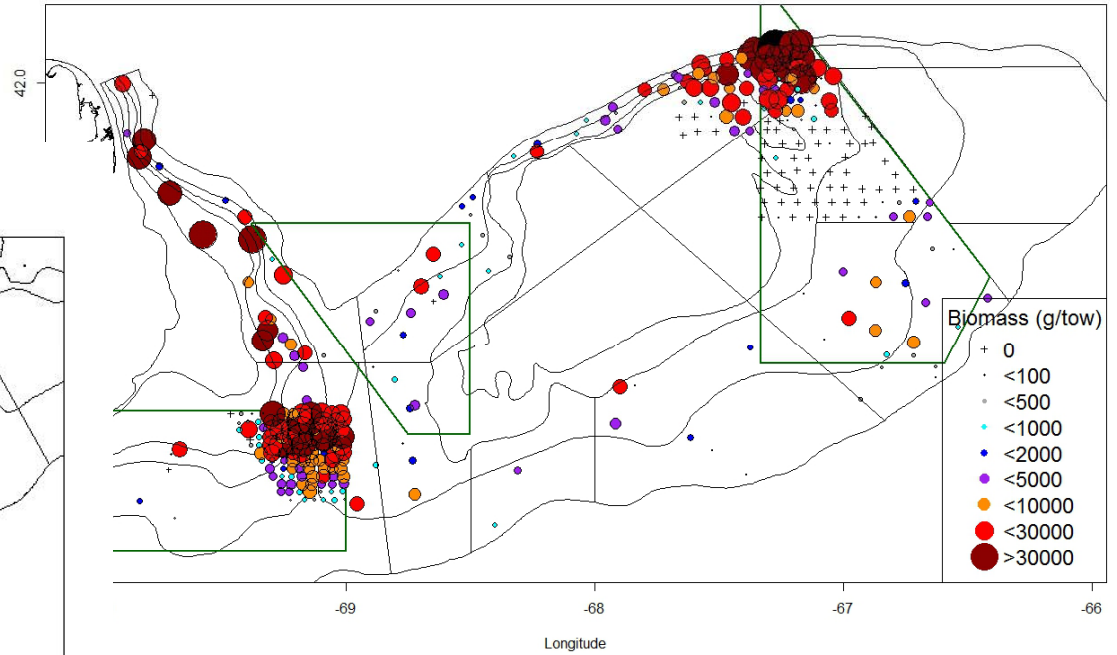
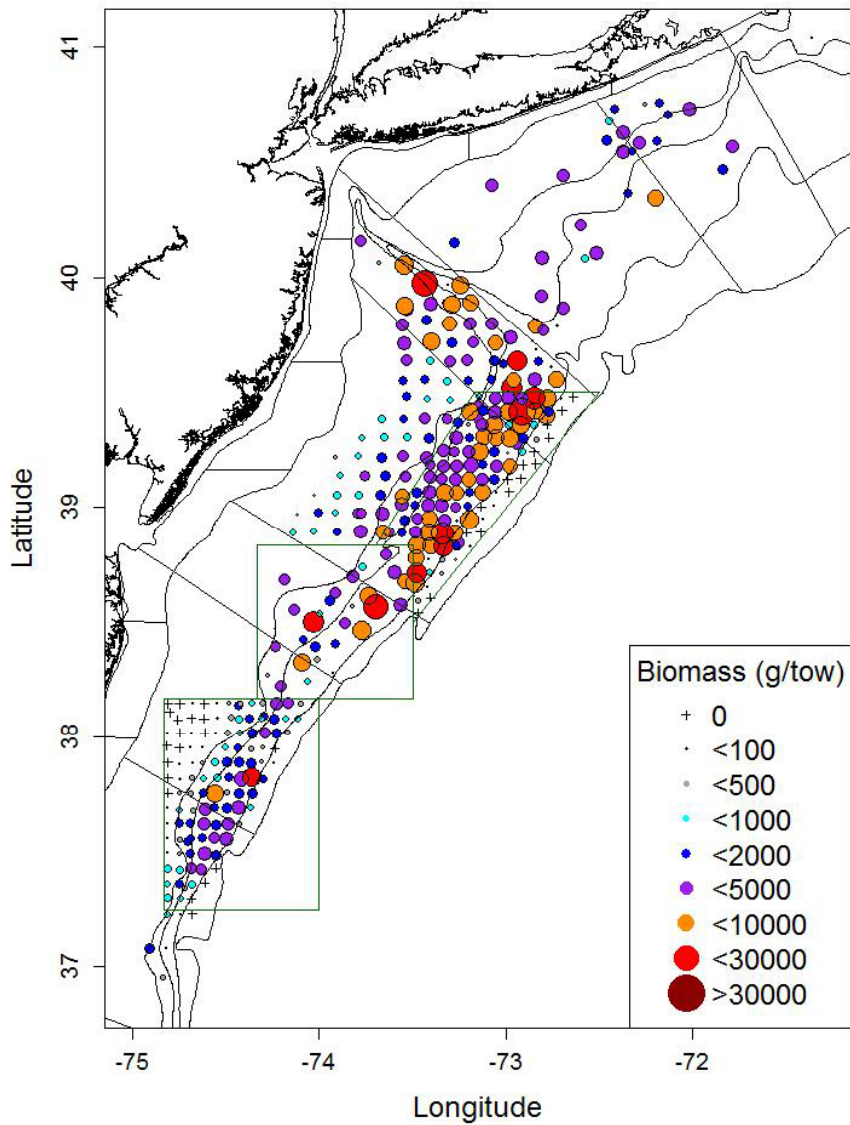


HabCam Kriging methodology

- Stock units are divided into subareas and scallop density is calculated for each subarea to allow for varying spatial structures across with stock units
 - Georges Bank is divided into 9 subareas
 - Mid Atlantic is divided into 6 subareas
- Image data for each subarea are extracted including all adjacent images with 20km of the subarea perimeter to minimize edge effect in estimation
 - Data are aggregated to a 1km grid and log-transformed
 - The sample variogram for each subarea is bootstrapped using spatially stratified subsets of the subarea data
 - A variogram model is fit to each sample variogram
 - The aggregated data and variogram model are used to calculate block-kriged estimates to a 1km resolution within the subarea and back-transformed with a correction for transformation bias
 - The sample variogram and spatial distribution of the aggregated data within the subarea are used to calculate the effective sample size and confidence interval for each subarea

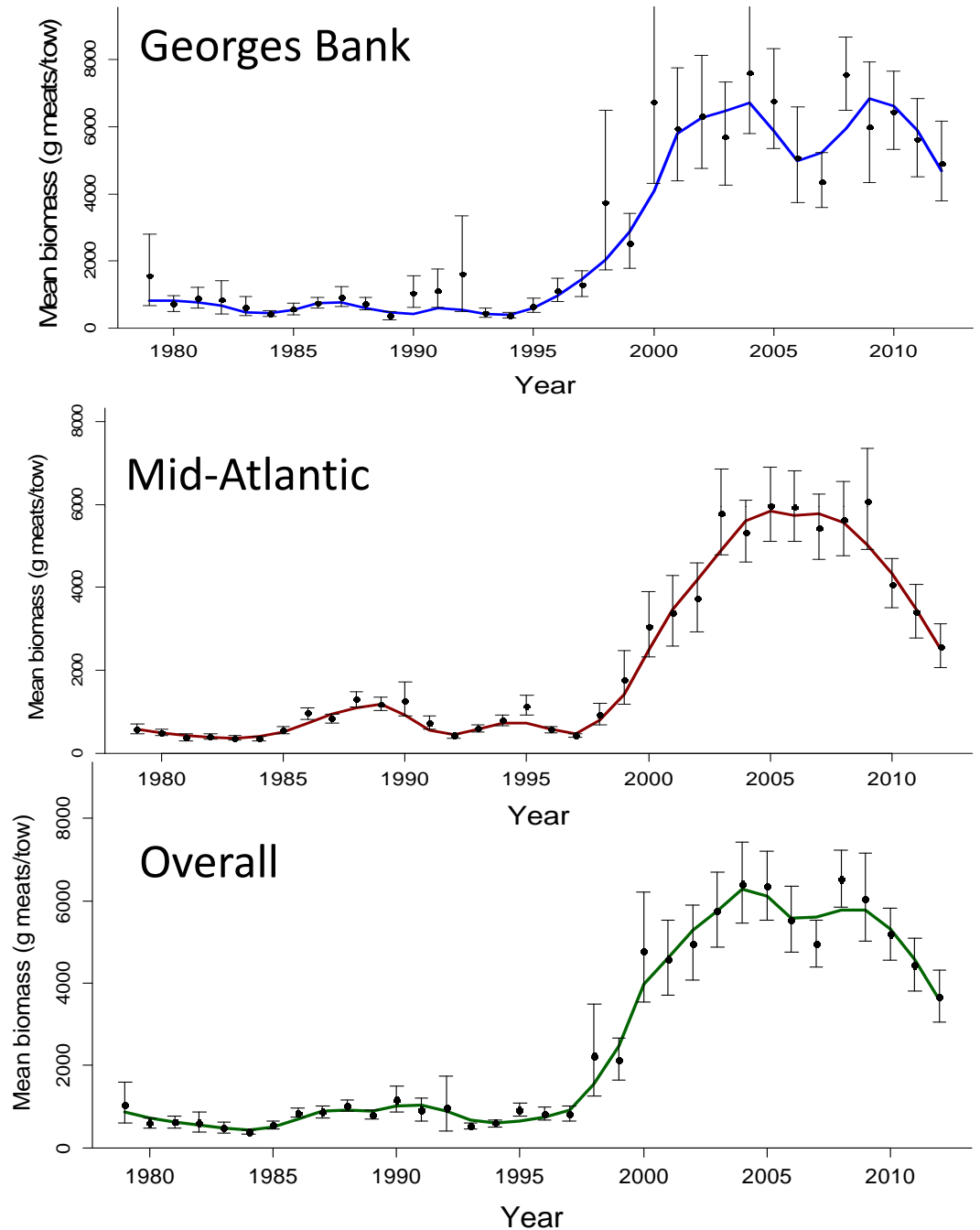


Charts of kriged biomass estimates



**Dredge survey biomass
charts including VIMS
cooperative surveys**

Dredge survey biomass indices have been declining over the past several years, especially in the Mid-Atlantic and in the access areas of both regions



Summary of 2012 Survey Results										
	Dredge		SMAST Video		Habcam		Mean	SE	IVM	SE
MidAtlantic	Bms(mt)	SE	Bms(mt)	SE	Bms(mt)	SE				
Delmarva	2299	220	4762	674	3005	798	3355	356	2566	202
HCSAA	6791	530	6532	1082	7139	642	6821	455	6882	382
ET	4570	803	7021	1419	8130	847	6574	612	6366	539
VB	102	55	NS	NS	NS	NS	102	55	102	55
NYB	11803	2084	4673	810	8750	1015	8408	819	6728	606
LI	13196	1273	13053	1147	10351	185	12200	575	10476	181
Stratum21	2077	265	2632	709	1540	426	2083	290	1992	214
Block Island	NS	NS	1803	463	821	NA	1803	463	1803	463
MidAtl	40837	2648	40476	2516	39736	1736	41346	1418	36915	1068
									40169	1257
Georges Bank										
CL1ACC	4431	716	5789	1180	3054	356	4425	475	3494	307
CL1NA	1768	729	6990	3572	10230	877	6330	1250	5266	554
CL-2(N)	11207	1233	14921	4036	8183	2240	11437	1593	10799	1044
CL-2(S)	7007	1110	6014	1000	7404	707	6808	551	6955	512
NLS-Access	8598	699	4401	722	4434	324	5811	352	5062	273
NLS-NA	23	13	2412	857	NS	NS	2412	857	2412	857
SCC	12420	1353	10873	2610	10230	877	11174	1023	10878	708
SCH	6924	1011	11370	3649	14195	1201	10830	1324	10002	757
NEP	4004	1163	3933	983	5836	481	4591	532	5291	405
SEP	1027	124	2226	390	7111	NA	2226	390	2226	390
Georges Bank	57408	2916	68930	7345	70677	2994	65672	2953	62385	1988
									64248	2009
Total	98246	3939	109406	7764	110413	3460	107018	3276	99299	2257
									104417	2370

CASA – Scallop assessment model

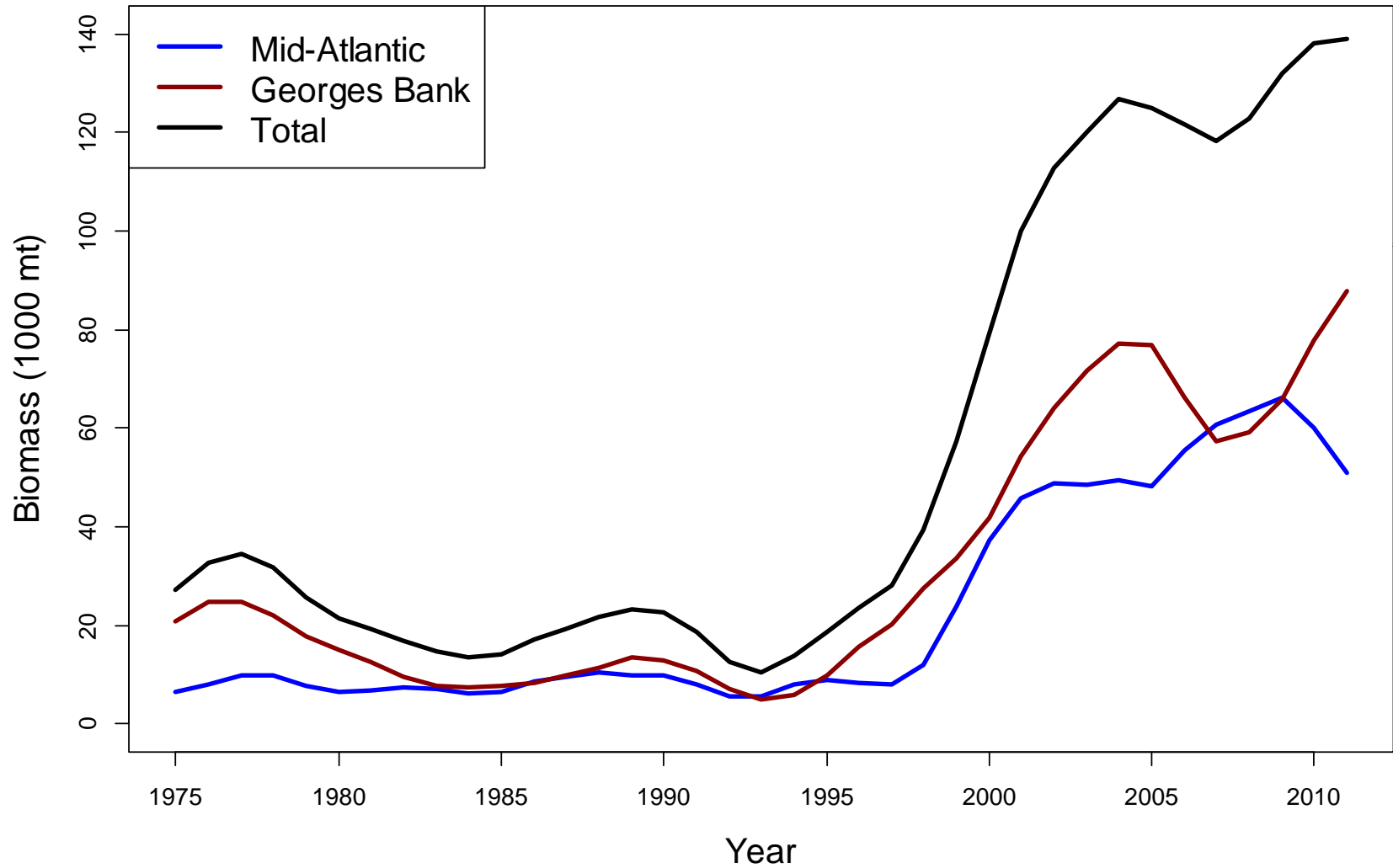
Estimates realized scallop fishing mortality and biomass. Forward projecting catch-at-size model, somewhat similar to statistical catch-at-age models

2011 Update – Configuration remains the same as SARC-50 assessment, but two more years of data were added for commercial catch, commercial shell heights (from observer data), and survey data

The 2011 Habcam Georges Bank survey was not used in CASA, but can be used as an independent verification

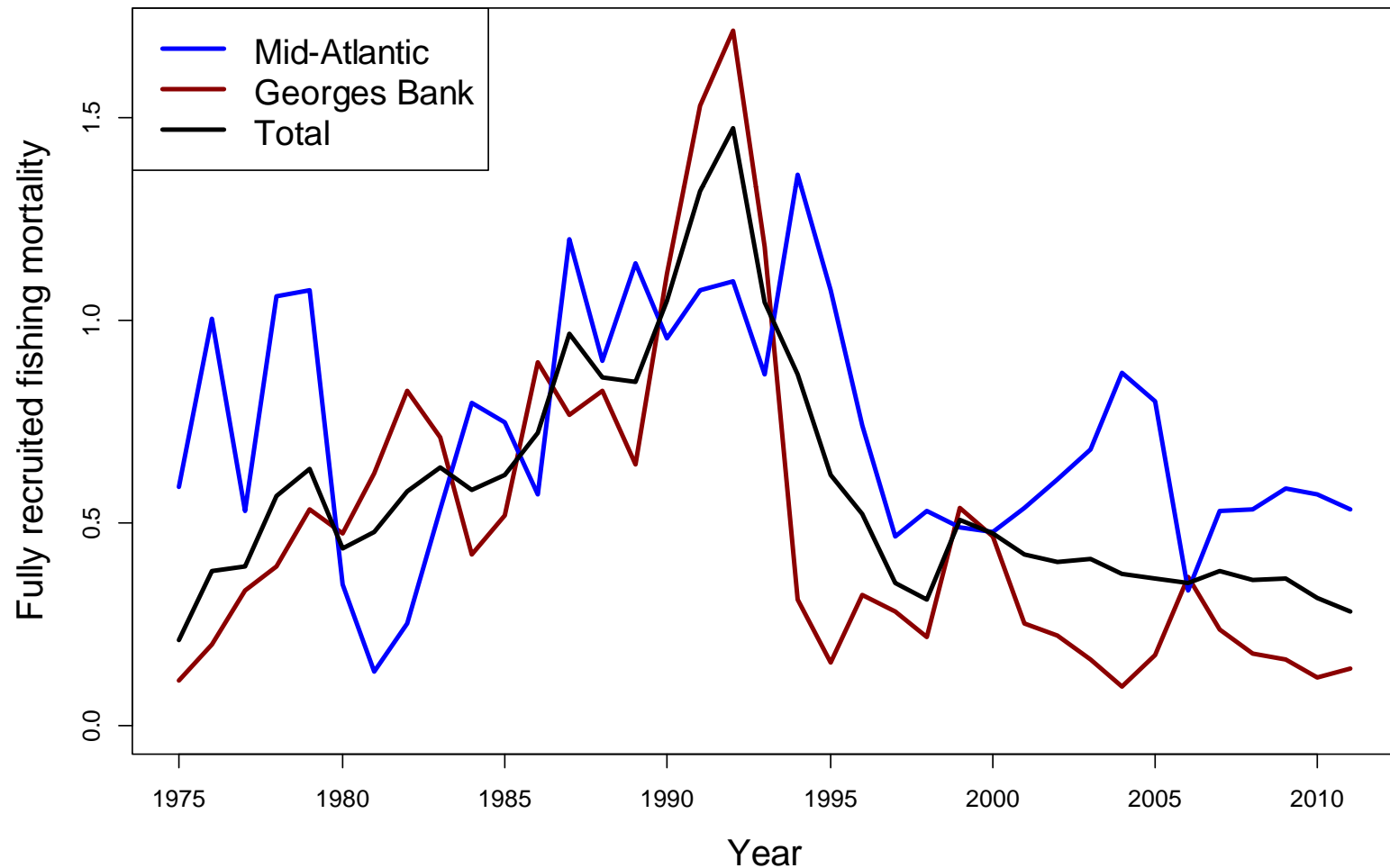
Biomass Estimates

Decrease in Mid-Atlantic since 2009, but increase on Georges Bank



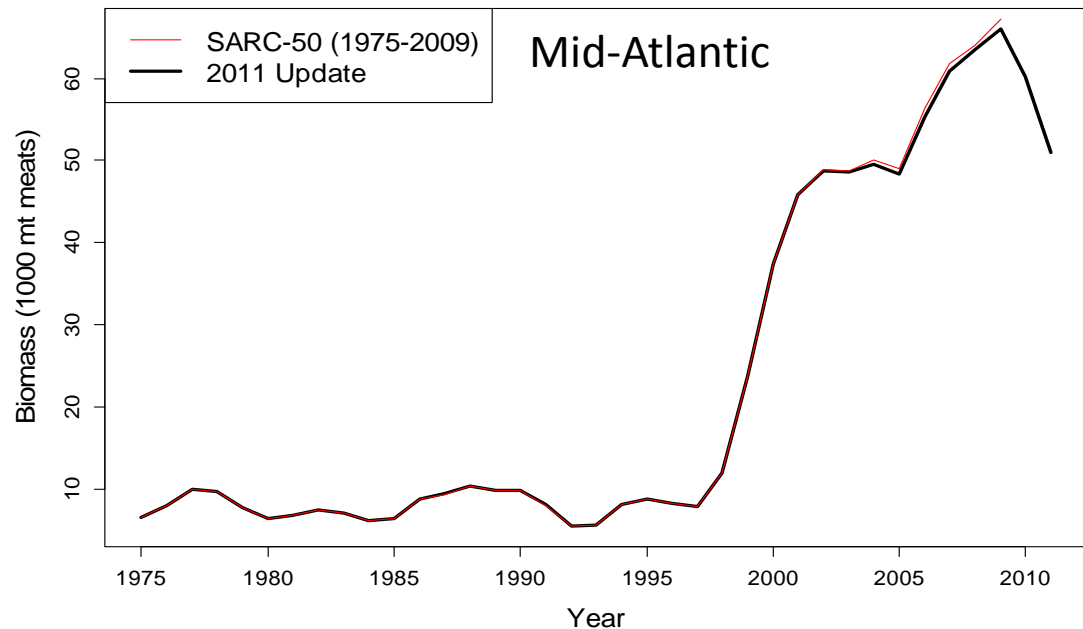
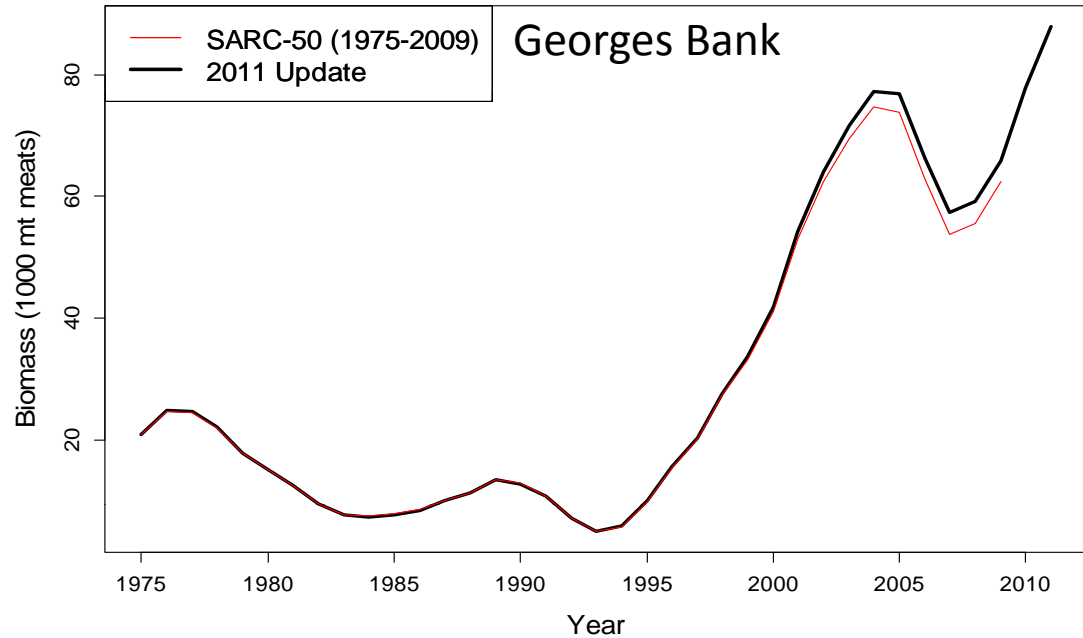
Fishing Mortality Estimates

Modest decrease in overall F, mostly driven by the increased abundance on Georges Bank and decreases in the Mid-Atlantic



Comparisons between SARC-50 and updated estimates of biomass

Estimates appear to be fairly stable
CASA 2011 Georges Bank estimate very close to Habcam estimate (within 2%)

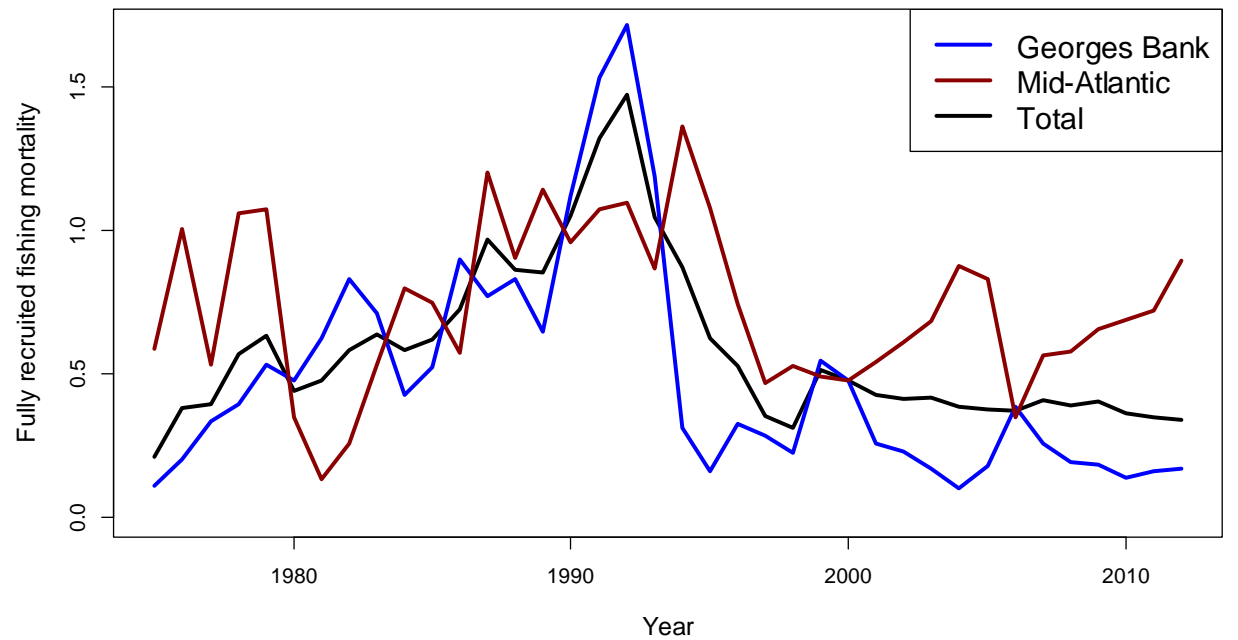
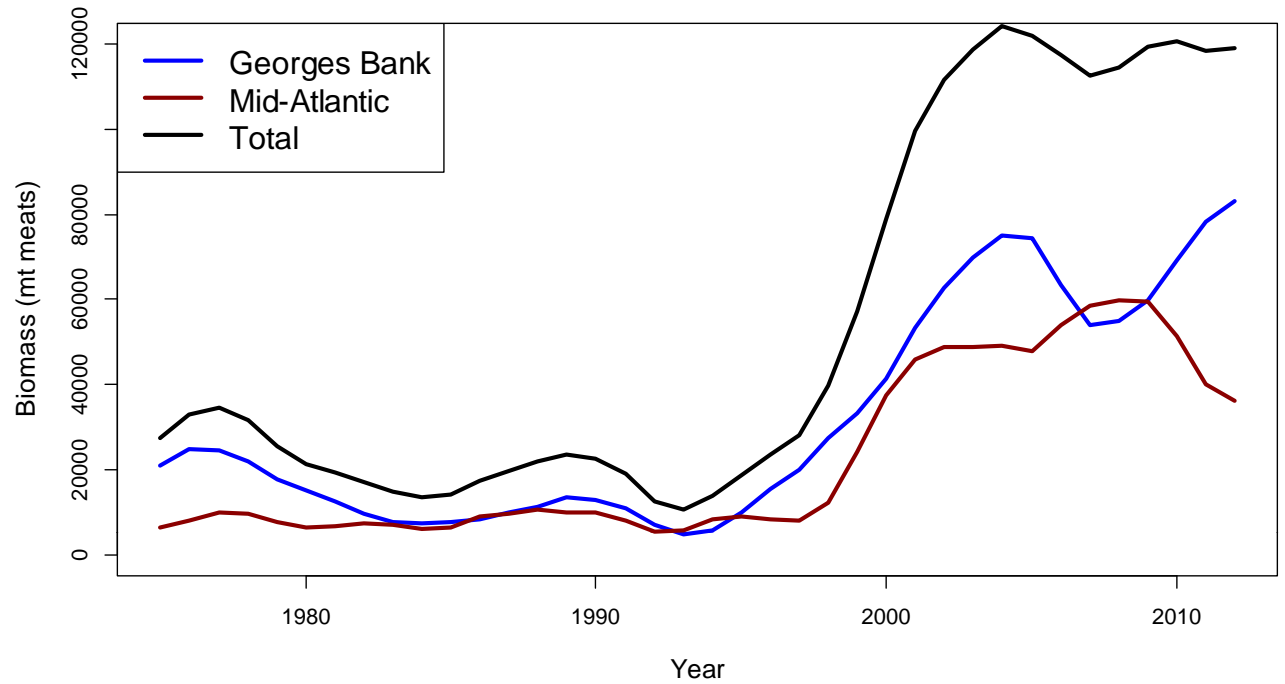


CASA models were updated through 2012 using 2012 dredge and video surveys. Also, total landings for 2012 were assumed to be the same as 2011 except that 2000 mt more was assumed to be from Georges Bank and 2000 mt less from the Mid-Atlantic

Other data, such as commercial shell heights (from observer data) will not be available until next year

HabCam data was not used

New model estimates show declining biomass and increasing fishing mortality in the Mid-Atlantic



CASA 2012 Estimates

	MA	GB	Total
Biomass (kmt)	36	83	119
Fishing mort.	0.89	0.18	0.34

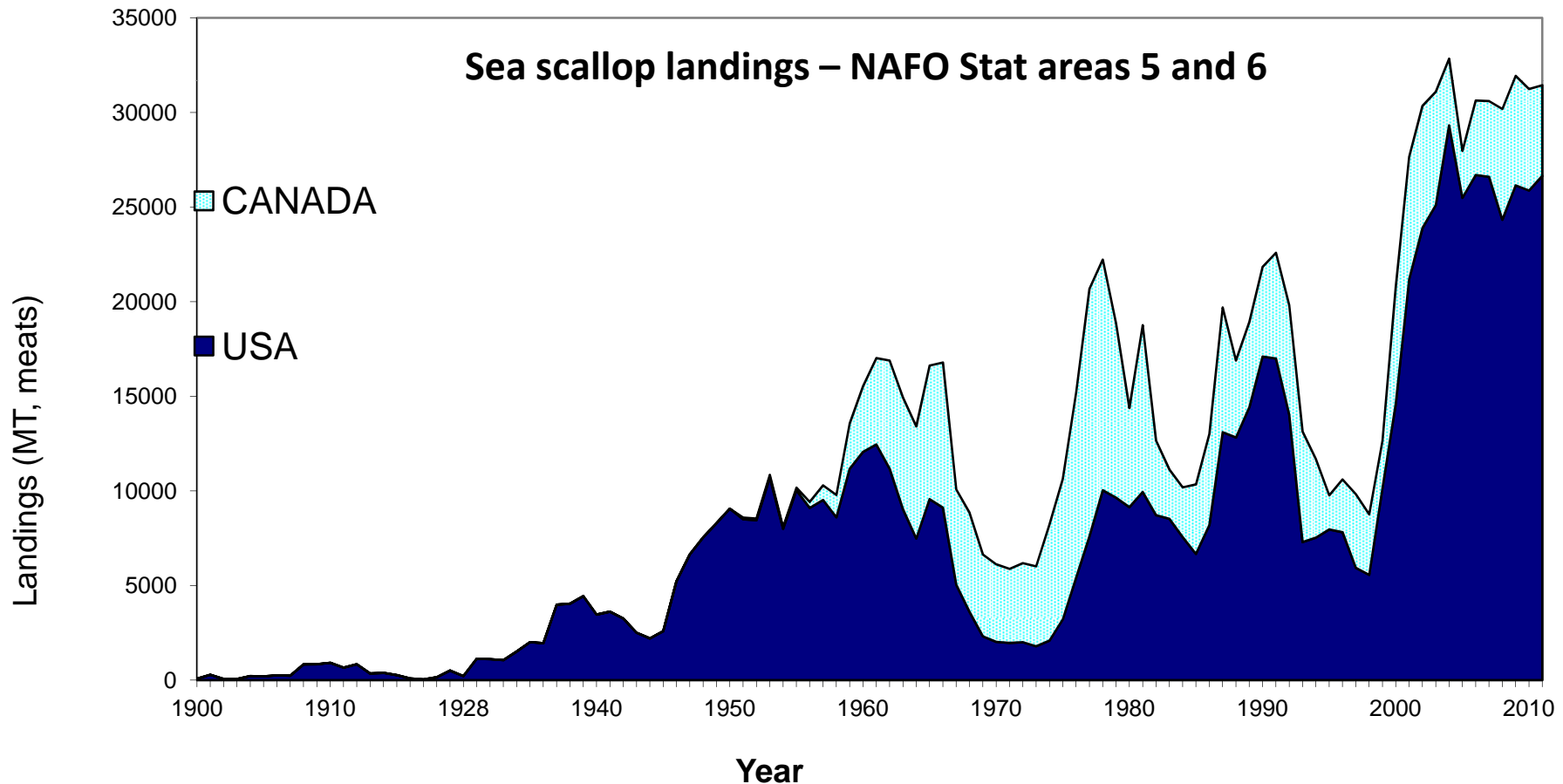
Overall F is above target but below threshold

High fishing mortality in MA is a concern

Biomass estimate is 9% above survey estimates

PDT used mean of surveys (107 kmt) rather than CASA estimate because 2012 CASA run is preliminary, and because MA biomass may be overestimated in CASA

Estimated MSY: 24,975 mt – possibly overestimated
Mean landings 2003-2011: 26,272 mt, above MSY and about twice mean historical landings

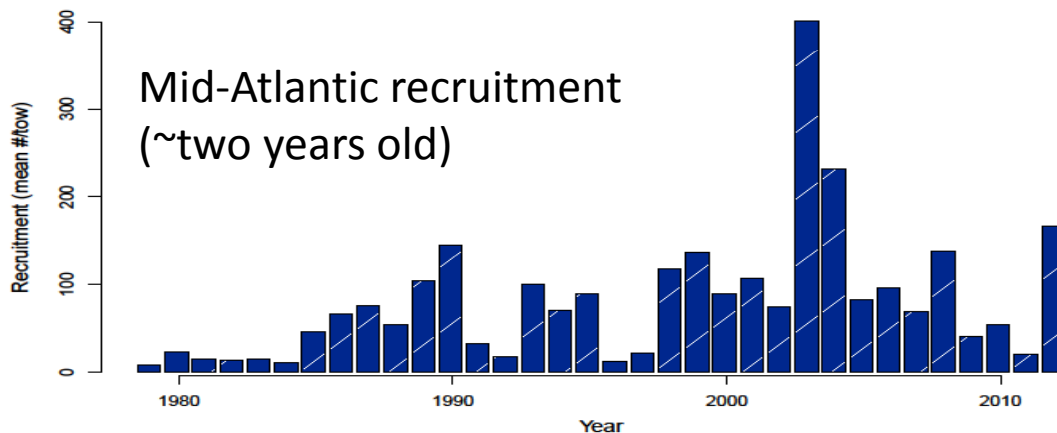
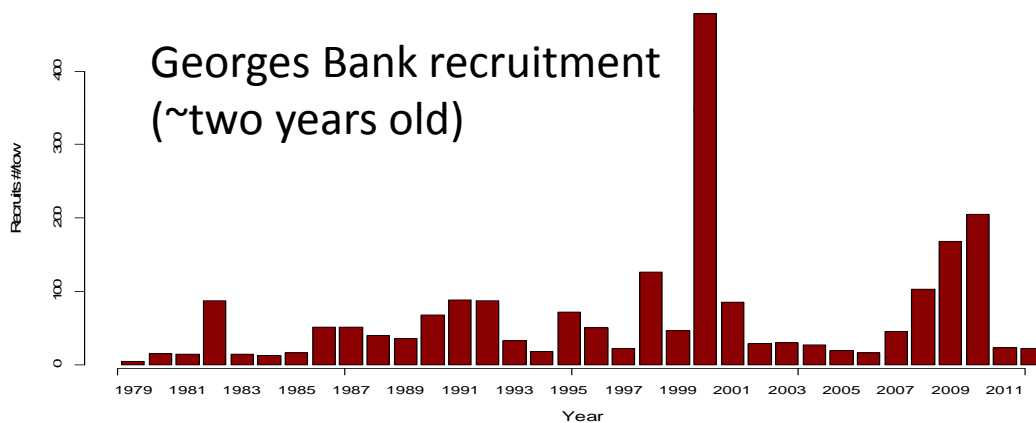


High recent landings have been due to:

(1) Unusually high recruitment in the Mid-Atlantic

(2) Windfall harvest in Georges Bank access areas

(3) In last few years, deficit harvesting



Large year classes observed in 2012 will not reach harvestable size until 2015-2016

Under a fixed fishing mortality policy, landings can vary substantially depending on the realized recruitment

Assuming overfishing is prohibited, then a stable landings stream can only be achieved by reducing fishing mortality in years that landings would be above average under the standard target F , or by closing areas that will not be opened, or at least fully fished, until landings would otherwise drop

Some cautionary notes (from 2010 presentation)

Estimate of MSY assumes that the high recent recruitment in the Mid-Atlantic can be sustained by keeping the biomass high. If the Mid-Atlantic reverts to a more unproductive state, long-term MSY may be much lower

Retrospective pattern in Mid-Atlantic suggests that about 10-20% of the mortality is unaccounted for (incidental, discard, natural mortality all possibilities)

Recruitment in the Mid-Atlantic in 2009 and probably 2010 were poor – potentially a bad sign

Although recruitment on Georges Bank has been strong the last three years, scallop recruitment in this region tends to be cyclical - some years of weak recruitment may be due

Because 2009 fishing mortality bordered on overfishing, allocations for 2011-2012 will probably need to be less than 2009

ABC and OFL calculations for 2013-2015

ABC is based on $F = 0.32$ applied to all areas uniformly

OFL is based on $F = 0.38$ applied to all areas uniformly

Used SAMS (Scallop Area Management Simulator) for calculations this year, rather than using a spreadsheet as in the past. Recruitment stochastic based on historical time series – no extra recruitment was added to 2013 in the Mid-Atlantic because of observations of large numbers of one year old pre-recruits (matters little for 2013-2014)

ABC and OFLs for 2014-2015 assume likely management measures for 2013 and (for the 2015 estimate) 2014

ABC and OFL calculations for 2013-2015

All units are mt meats

Discards include incidental fishing mortality + dead discards

ABC/ACL

Year	ExplBms	Landings	Discards	Total
2013	75612	21004	6366	27370
2014	83214	23697	6656	30353
2015	94666	27185	7210	34395

OFL

Year	ExplBms	Landings	Discards	Total
2013	75612	24161	7394	31555
2014	83214	27335	7775	35110
2015	94666	30085	7989	38074