JUNE 2012 TRAC

Eastern GB cod, EGB haddock, and GB yellowtail flounder

NEFMC
Plymouth , MA
September 26, 2012

U.S.A. / CANADA
Allocation Shares

Allocation Shares

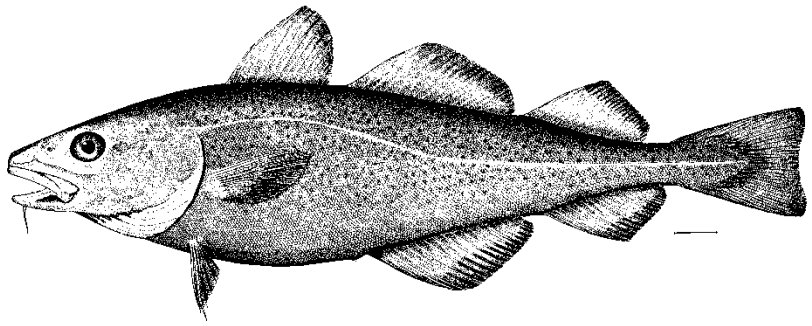
Resource Utilization

	Cod	Haddock	Yellowtail
USA	40%	45%	98%
CANADA	60%	55%	2%

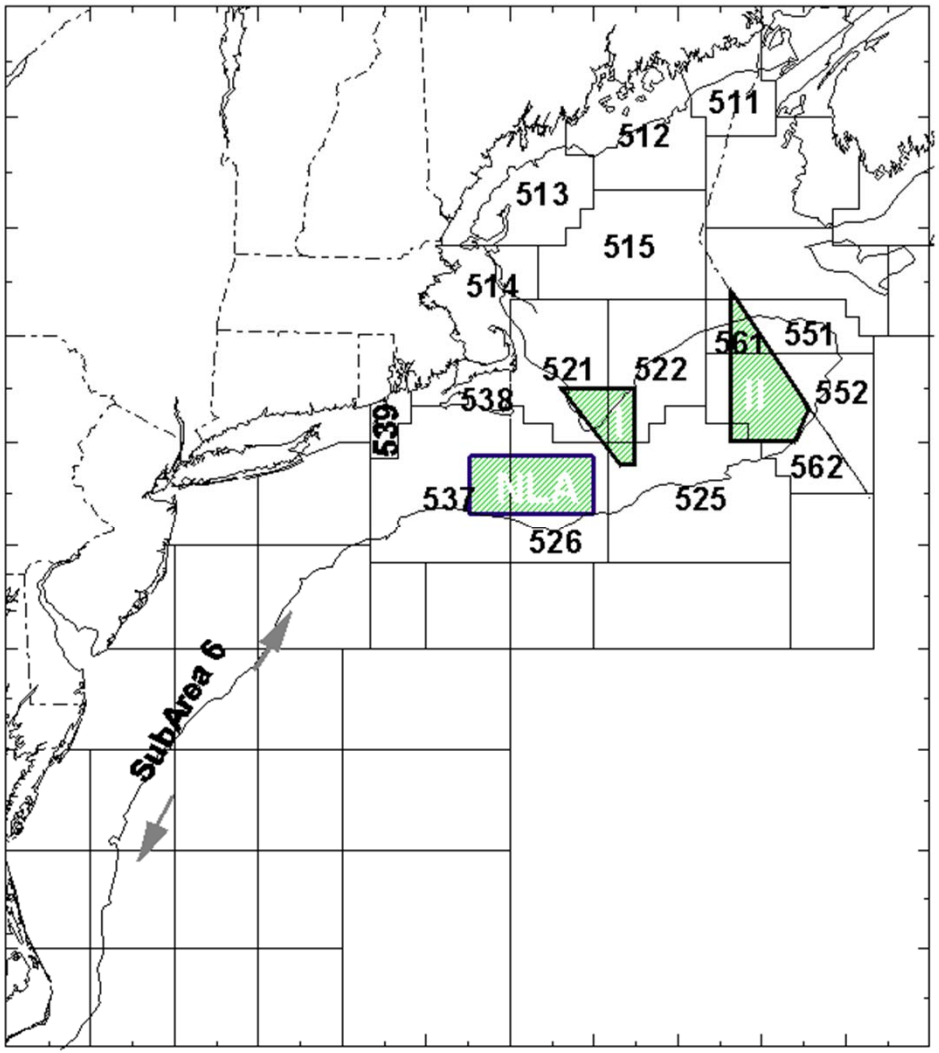
Resource Distribution | ***Allocation Shares***

	Survey Year	Cod	Haddock	Yellowtail	Fishing Year	Utilization	Distribution	Cod	Haddock	Yellowtail
USA	**2000**	18%	20%	54%	**2002**	40%	60%	27%	30%	72%
CANADA		82%	80%	46%				73%	70%	28%
USA	**2001**	14%	16%	64%	**2003**	40%	60%	24%	28%	78%
CANADA		86%	84%	36%				76%	72%	22%
USA	**2002**	12%	26%	62%	**2004**	40%	60%	23%	34%	76%
CANADA		88%	74%	38%				77%	66%	24%
USA	**2003**	18%	27%	56%	**2005**	35%	65%	26%	33%	71%
CANADA		82%	73%	44%				74%	67%	29%
USA	**2004**	14%	29%	56%	**2006**	30%	70%	22%	34%	69%
CANADA		86%	71%	44%				78%	66%	31%
USA	**2005**	21%	29%	63%	**2007**	25%	75%	26%	33%	72%
CANADA		79%	71%	37%				74%	67%	28%
USA	**2006**	26%	32%	73%	**2008**	20%	80%	29%	35%	78%
CANADA		74%	68%	27%				71%	65%	22%
USA	**2007**	29%	36%	73%	**2009**	15%	85%	31%	37%	77%
CANADA		71%	64%	27%				69%	63%	23%
USA	**2008**	23%	40%	60%	**2010**	10%	90%	25%	40.5%	64%
CANADA		77%	60%	40%				75%	59.5%	36%
USA	**2009**	17%	43%	50%	**2011**	10%	90%	19%	43%	55%
CANADA		83%	57%	50%				81%	57%	45%
USA	**2010**	22%	43%	44%	**2012**	10%	90%	24%	43%	49%
CANADA		78%	57%	56%				76%	57%	51%
USA	**2011**	13%	37%	37%	**2013**	10%	90%	16%	38%	43%
CANADA		87%	63%	63%				84%	62%	57%

Eastern GB Atlantic Cod
Management Unit



Management Unit



USA: SA 561,562

CA: SA 551,552

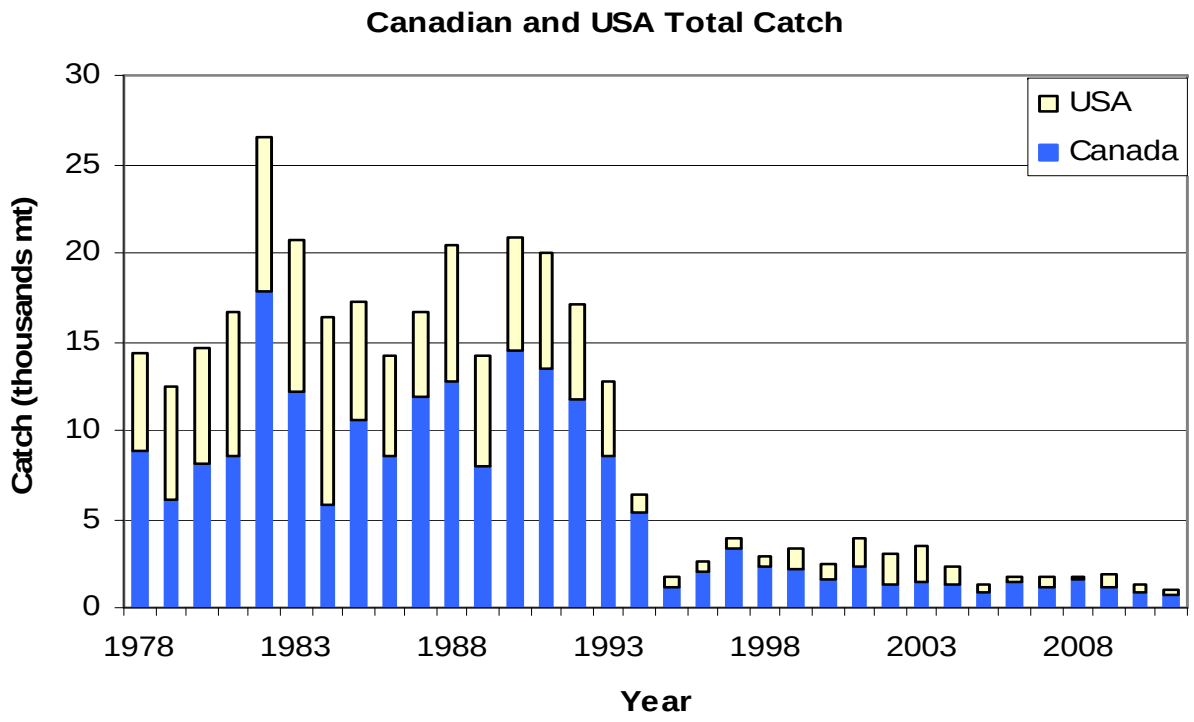
Assessment

EGB Cod

- **Two VPA formulations: split “M 0.2” & “M 0.5”**
- **Natural mortality (M) = 0.2 for all ages in “M 0.2” model, increased M for ages 6+ in “M 0.5” model after 1994**
- **Survey indices split in 1993-1994 for both models (change in sv catchability an alias for unknown mechanism that produces better fitting model)**
- **Benchmark: consider both model formulations for stock status and catch advise**
- **Retrospective: overestimate B, underestimate F.**

Catch

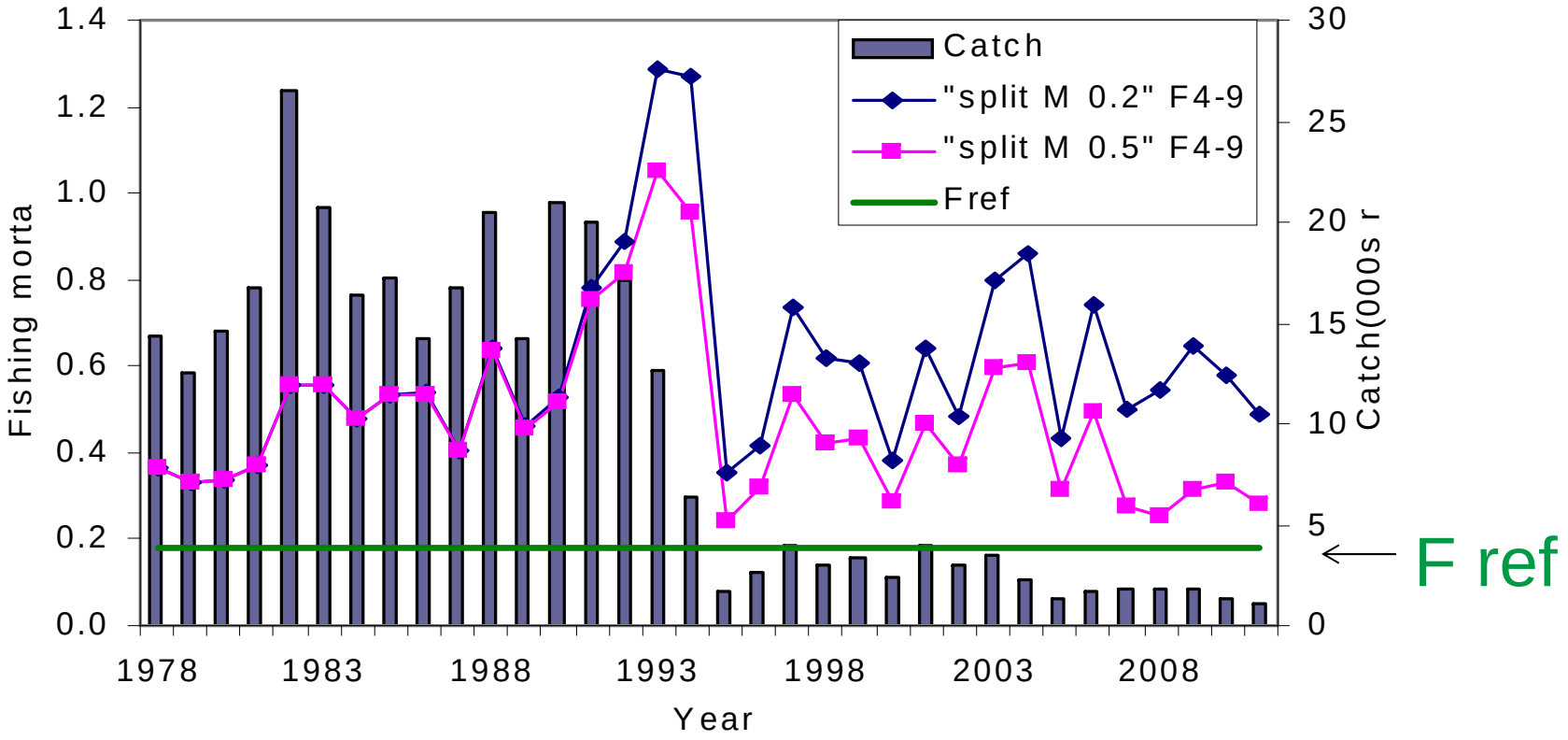
EGB Cod



- **USA+CA 2011 total catch: 1,037 mt (CY)**
- **USA 2011 catch 294 mt : 267 mt lndngs; 27 mt discards**
- **Canadian 2011 catch 743 mt: 702 mt lndngs; 42 mt discards**
- **US: 82% of 200mt quota (FY) , CA: 87% of 850 mt quota (CY)**

Fishing Mortality

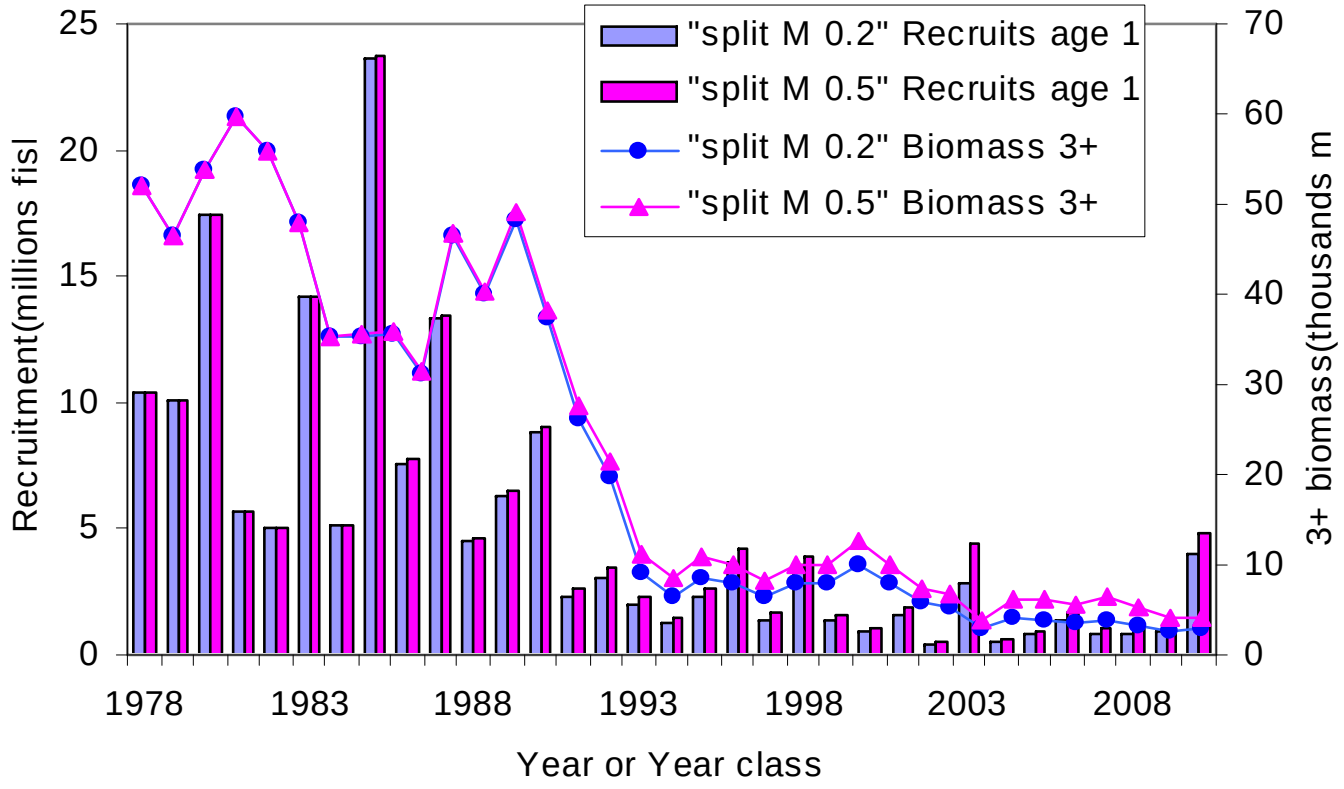
EGB Cod



- **2011 F= 0.49 (M 0.2) / 0.28 (M 0.5).**
- **Among lowest F on record ; still above F_{ref}**
- **F > F_{ref} (0.18) for entire time series**

3+ Biomass (lines)

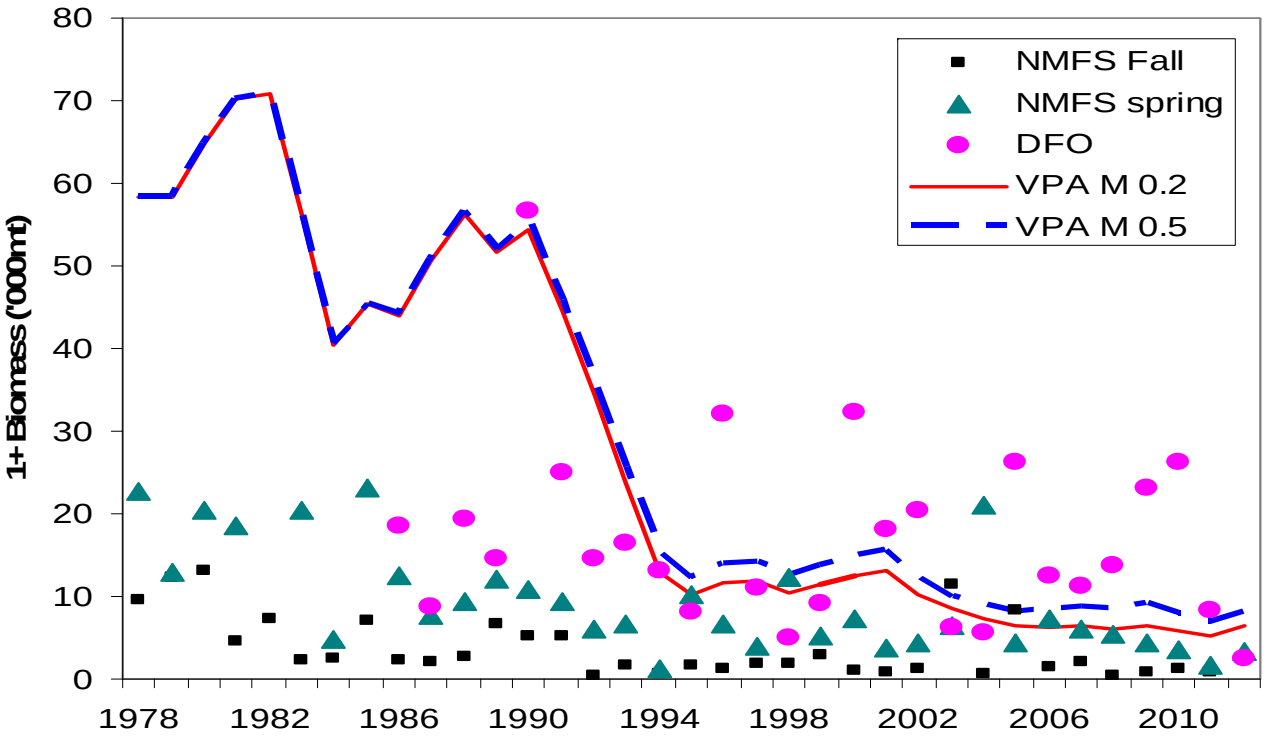
EGB Cod



- **2,845 mt (split M 0.2) / 4,192 mt (split M 0.5) - 2012**
- **Inc. in 2004-07 due to 2003 year class, now dec.**
- **Biomass is 2nd lowest in both models**

Survey & VPA 1+ Biomass

EGB Cod

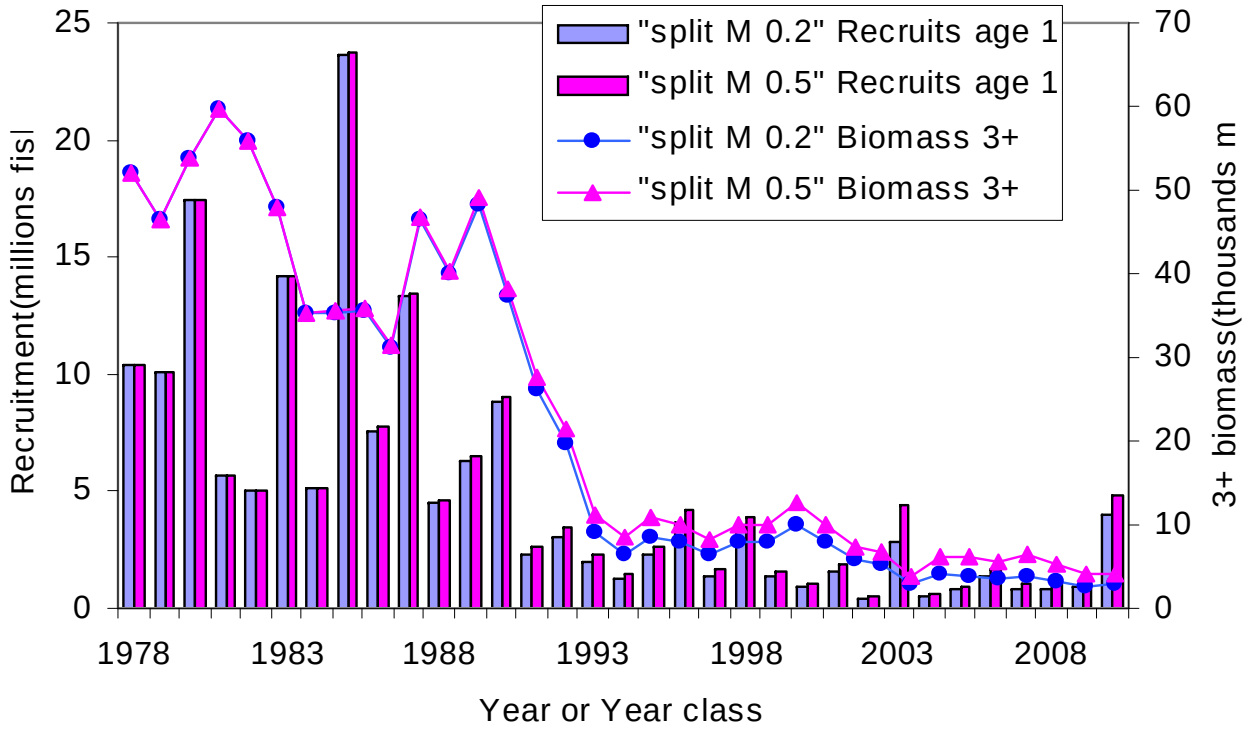


1+ popn. biomass & SV biomass indices:

- **fluctuating at low values since 1994**
- **2012 spring NEFSC and DFO among lowest in TS**

Recruitment (bars)

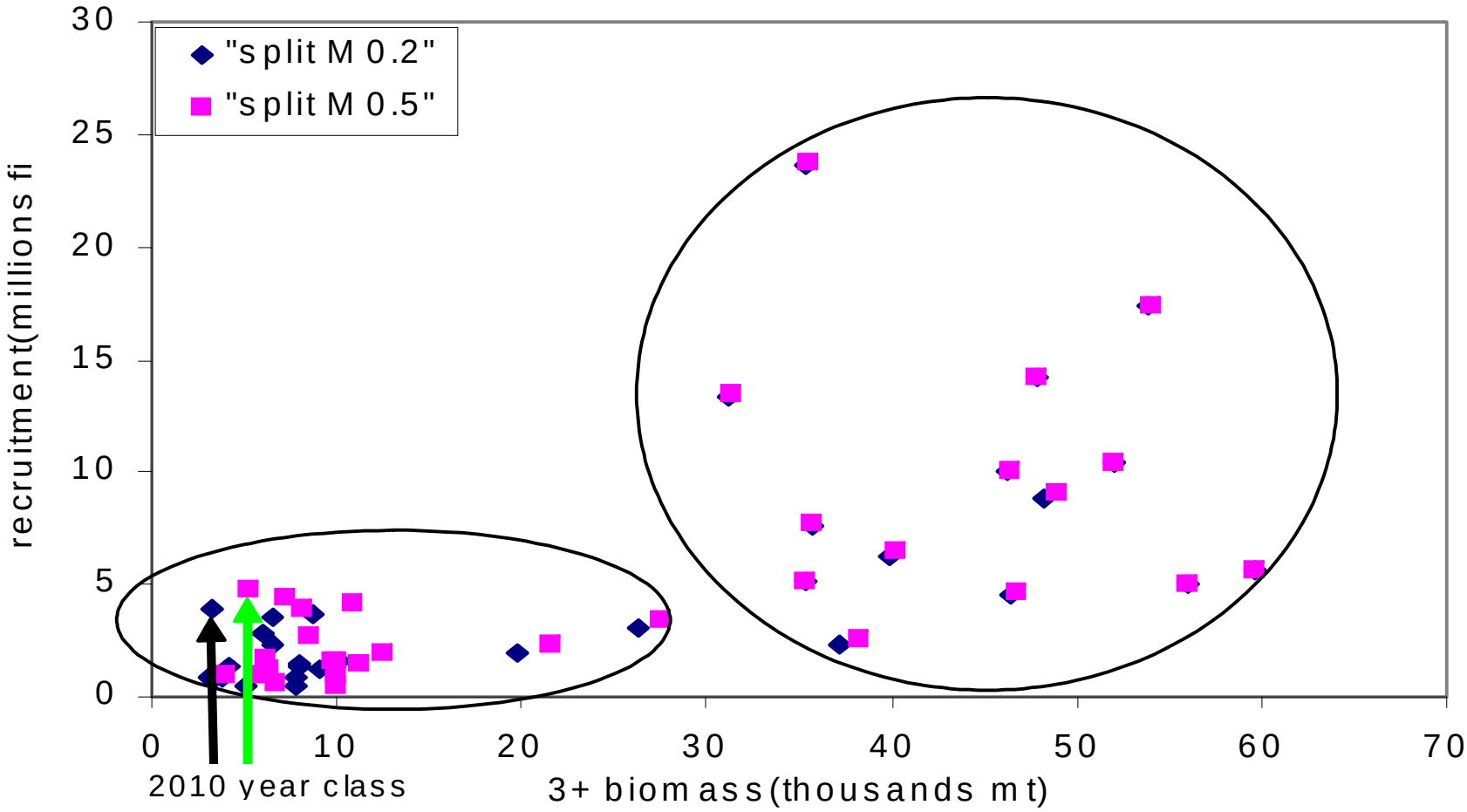
EGB Cod



- **Poor rct since 1990 yc**
- **5 of 7 lowest rcts occurred since 2003 yc**
- **2010 yc ~ 2003 but estimate highly uncertain**

Stock Recruitment

EGB Cod



Remain at low productivity; low weights at age

Rct event more likely > 30,000 mt SSB

Catch Projections

- In recent years, catches based on the two formulations have not reduced fishing mortality below Fref and have not had the expected effect on age 3+ biomass or SSB.

  Given the retrospective bias, TRAC recommends basing 2013 catches on the *adjusted* projection rather than the unadjusted projection results.

Harvest Strategy : TMGC adopted a strategy to maintain a low to neutral risk of exceeding the fishing mortality limit reference, **F_{ref} = 0.18 (**established in 2002 by the TMGC).

When stock conditions are poor, fishing mortality rates should be further ***reduced*** to promote rebuilding.

2013 Catch Projection

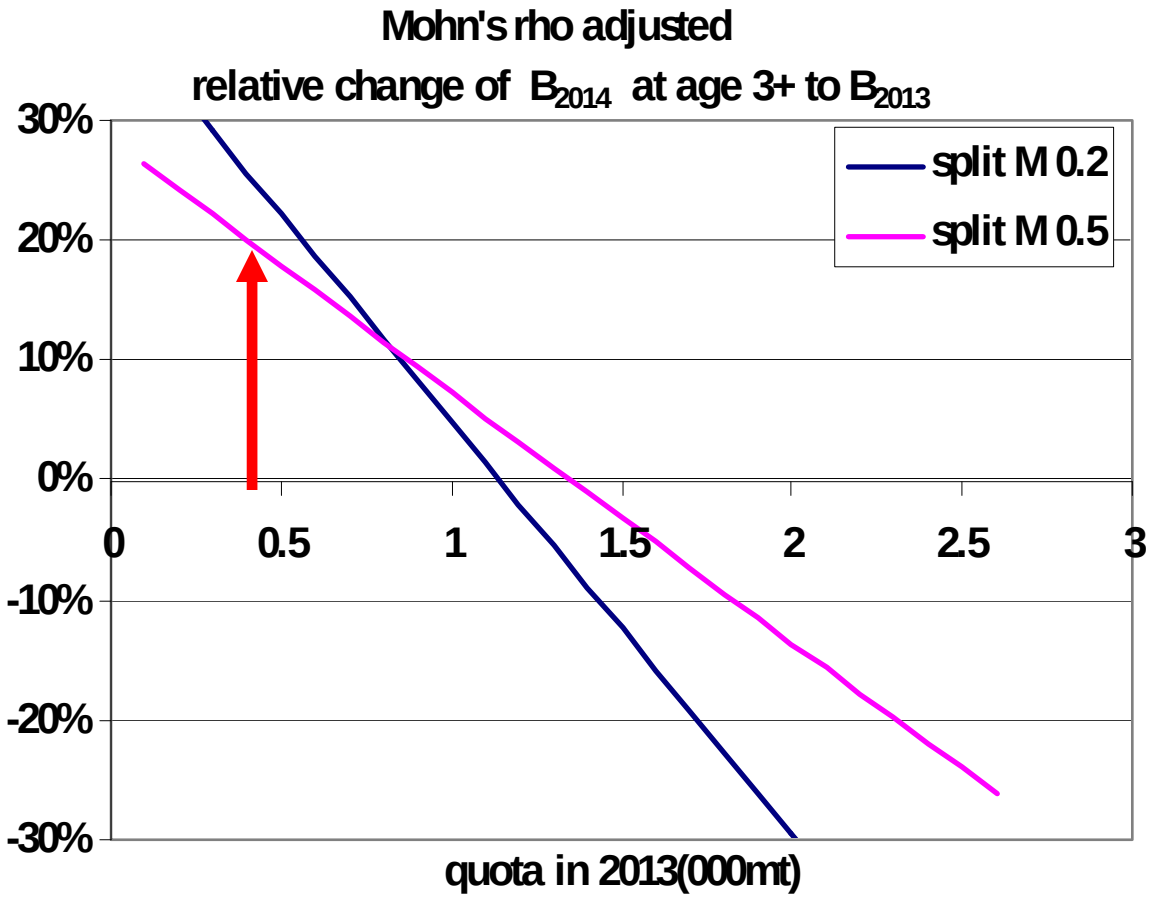
Probability of exceeding F_{ref} in 2013:	0.25	0.5	0.75
"Split M 0.2"	750 mt	875 mt	1,025mt
"Split M 0.5"	1,175 mt	1,400 mt	1,625 mt
"Split M 0.2": Rho adjusted	325 mt	400 mt	475 mt
"Split M 0.5": Rho adjusted	625 mt	775 mt	875 mt

- Under the rho adjusted "split M 0.2" assumption, a 50% probability of not exceeding Fref implies a catch less than 400 mt, and of less than 775 mt under the rho adjusted "split M 0.5" model.

Neutral risk (50%) that biomass will not increase by:	0%	10%	20%
"Split M 0.2"	2,475 mt	1,775 mt	1,050 mt
"Split M 0.5"	2,475 mt	1,525 mt	575 mt
"Split M 0.2": Rho adjusted	1,175 mt	900 mt	575 mt
"Split M 0.5": Rho adjusted	1,450 mt	900 mt	400 mt

- Achieving a 20% increase in SSB between 2013 and 2014 implies catches less than 575 mt under the rho adjusted "split M 0.2" scenario, and of less than 400 mt under the rho adjusted "split M 0.5" scenario.

Catch Projection Summary



- Not exceeding F_{ref} and achieving a 20% increase in biomass, therefore, implies catches of less than 400 mt.

Catch Projection Summary

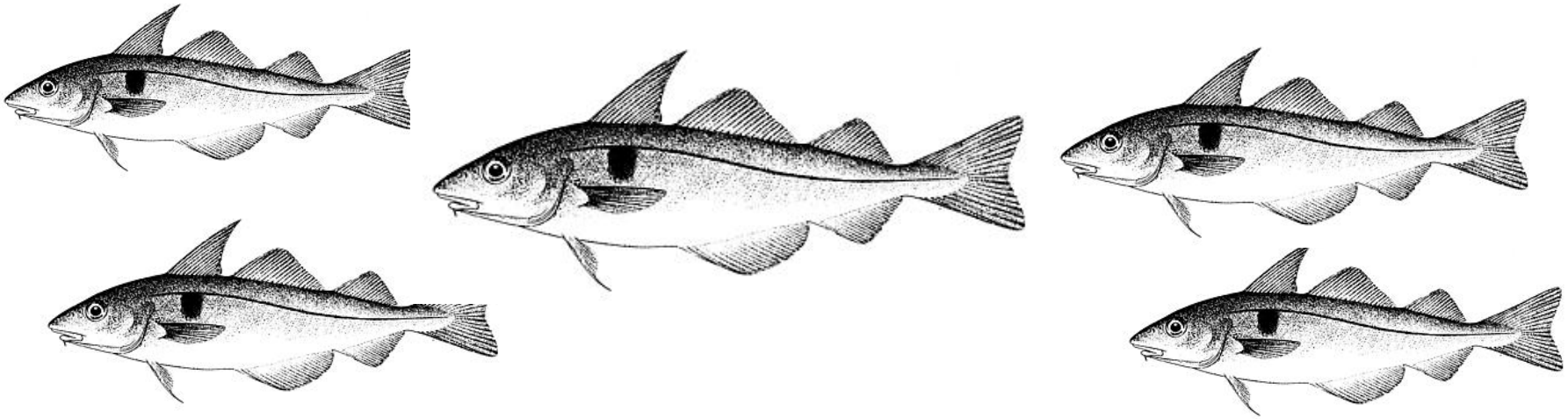
	Rho adjusted probability of exceeding F_{ref} in 2013		Rho adjusted neutral risk that spawning stock increase in 2014 will not exceed:	
Catch 2013	Split M=0.2	Split M=0.5	Split M=0.2	Split M=0.5
325	25%	25% or less	30%	20% or more
400	50%		20% or more	
475	75%			10% to 20%
575				
625			10% to 20%	
750		50% or less		
775				
875		75%		
900				
1025			5% to 10%	5% to 10%
1050				
1175			0%	
1400			-10% to -15%	0%
1450				
1525			-15% to -25%	-5% to -10%
1625				
1775			-25%	-10%
2475			<-30%	-25%

- Not exceeding F_{ref} and achieving a 20% increase in biomass, therefore, implies catches of less than 400 mt.

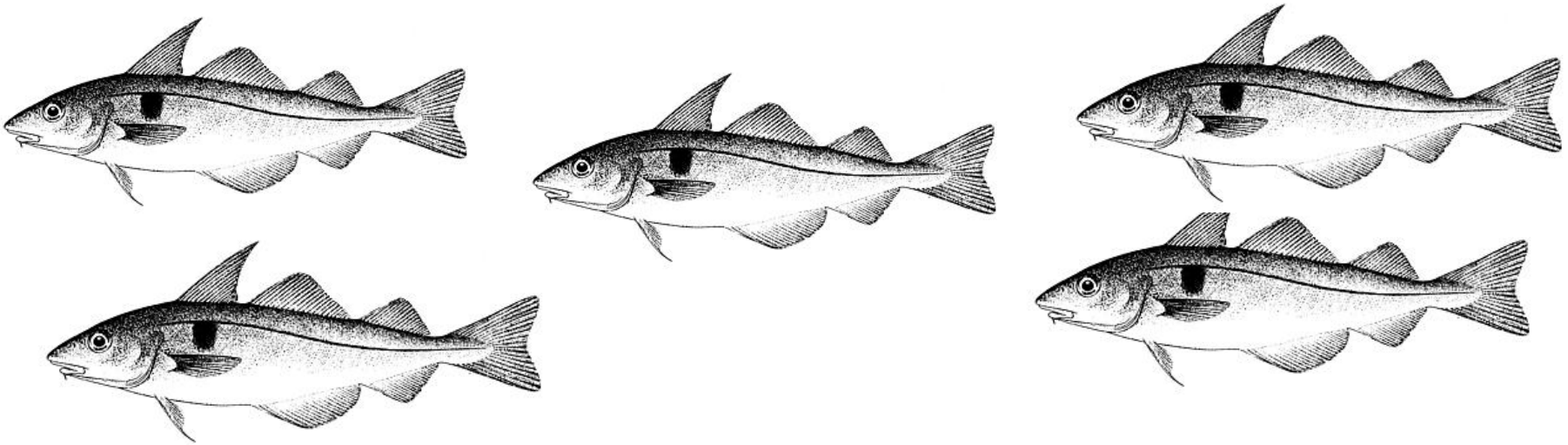
Summary

- F reduced but still above F_{ref}
- Recent recruitment generally poor
- 2003 and 2010 year classes highest since 2000 but 2010 estimate is highly uncertain
- Reduced weights at age
- Low biomass (2nd lowest) – hampers improved recruitment
- Low numbers of 7+ fish
- Rebuilding will not occur without improved recruitment
- TRAC recommends considering both models and using bias adjusted projection results

- Not exceeding F_{ref} and achieving a 20% increase in biomass implies catches of less than 400 mt.

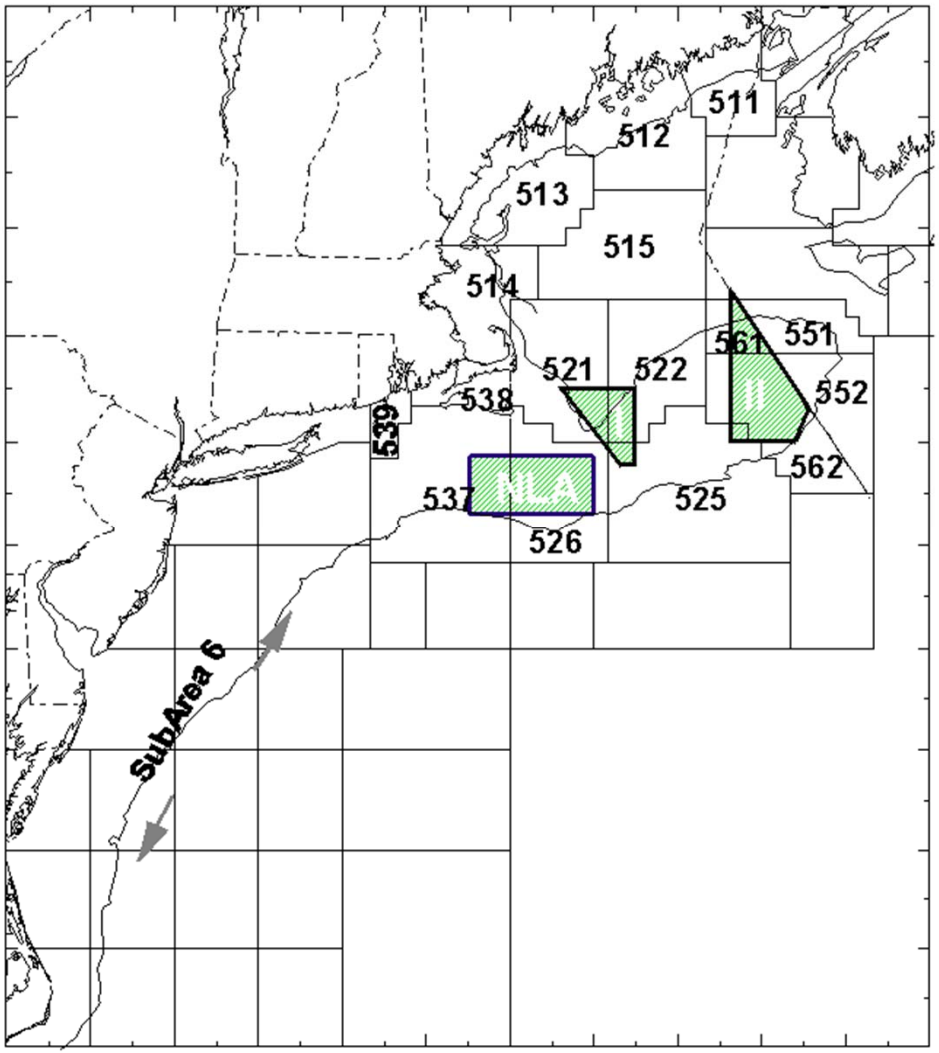


Eastern GB Haddock Management Unit



Management Unit

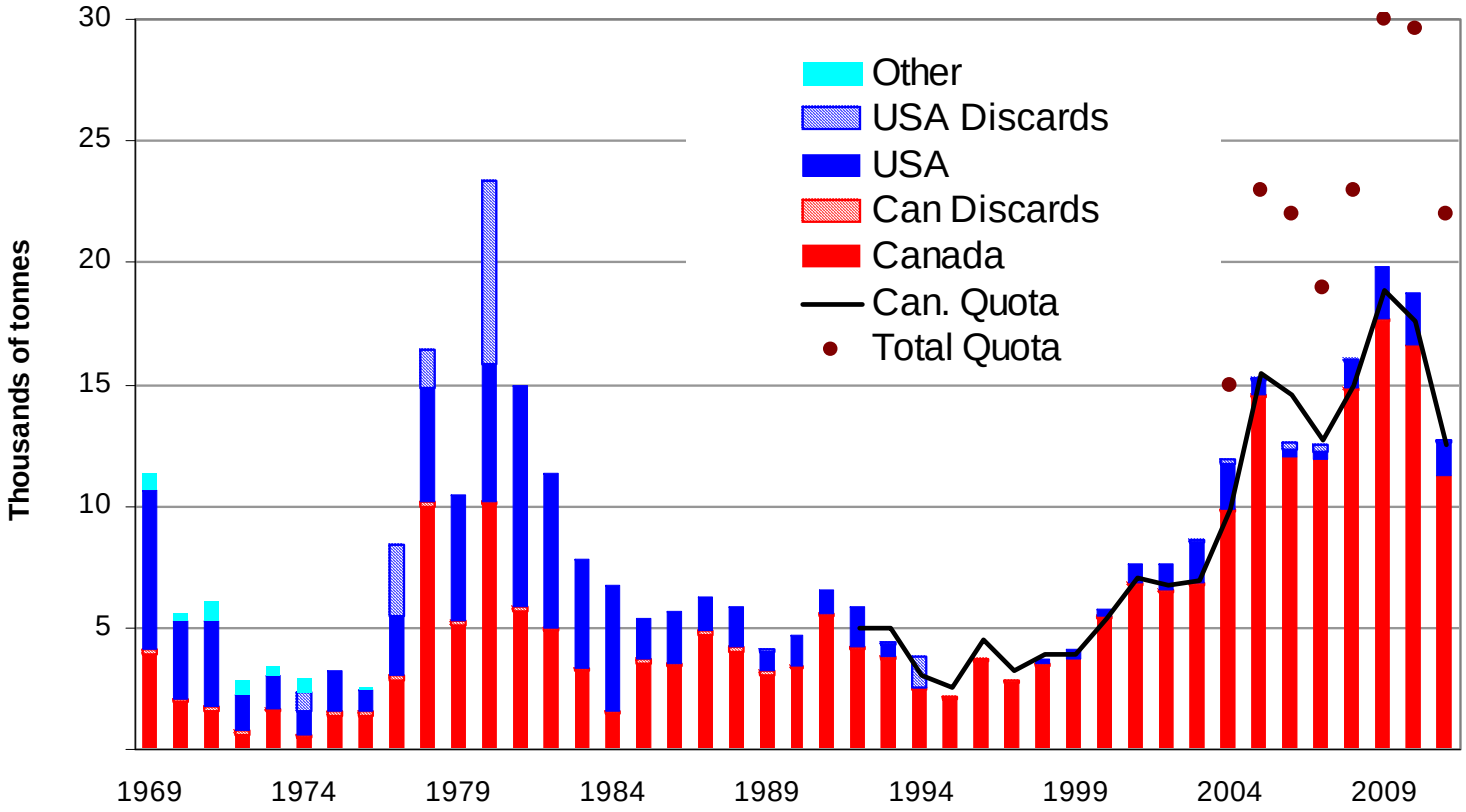
EGB
Haddock



USA: SA 561,562
CA: SA 551,552

Catch

EGB Haddock



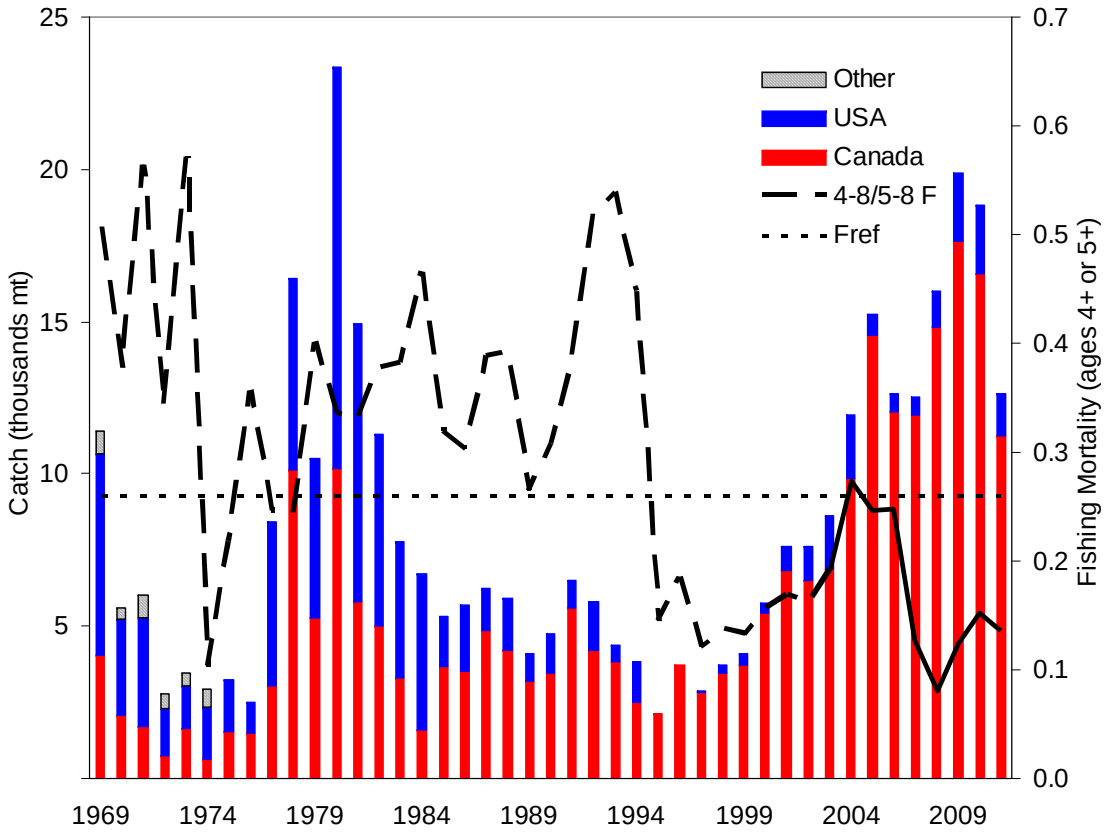
CY: Total 2011 catch: 12,655 mt

US: 1,409 mt ; Canada: 11,247 mt

FY: Quota taken: US ~ 12%, CA ~ 90%

Fishing Mortality (line)

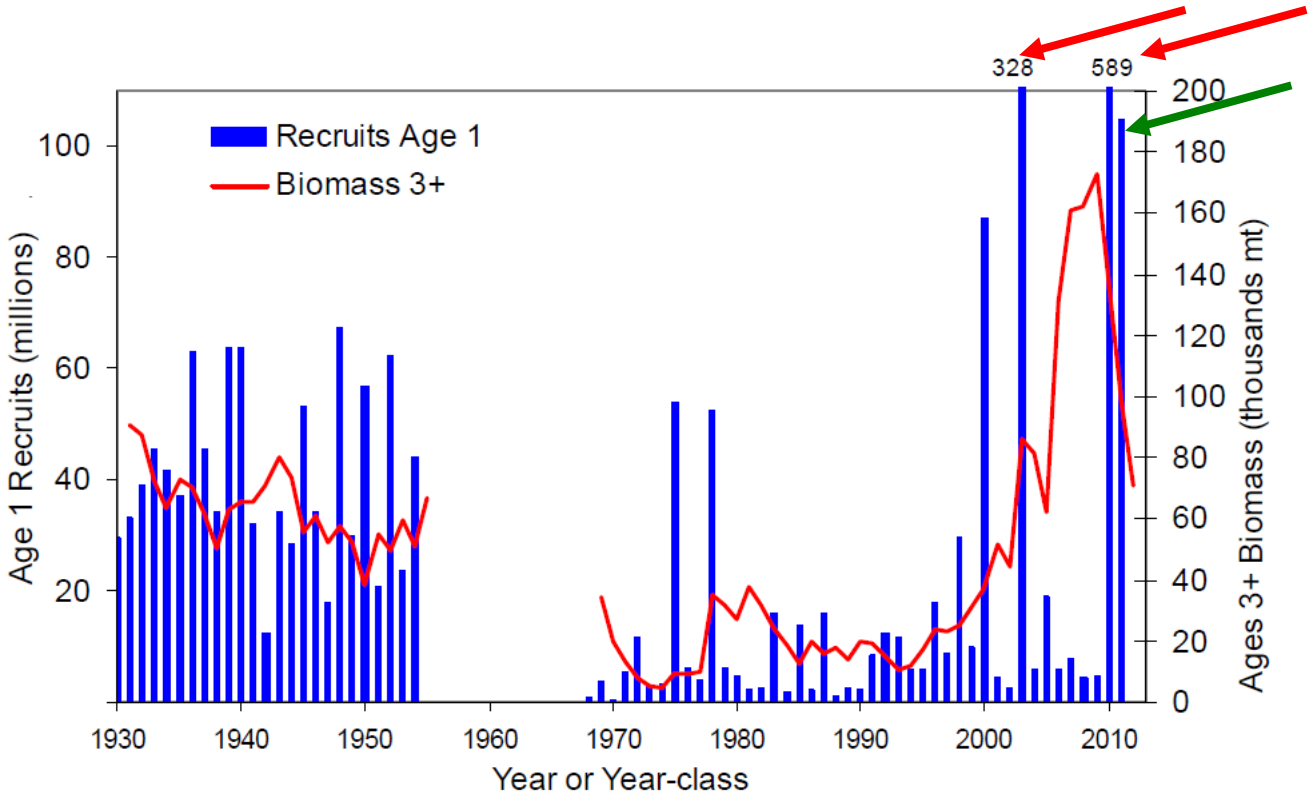
EGB Haddock



2011 F = 0.14, below or near Fref since 1995

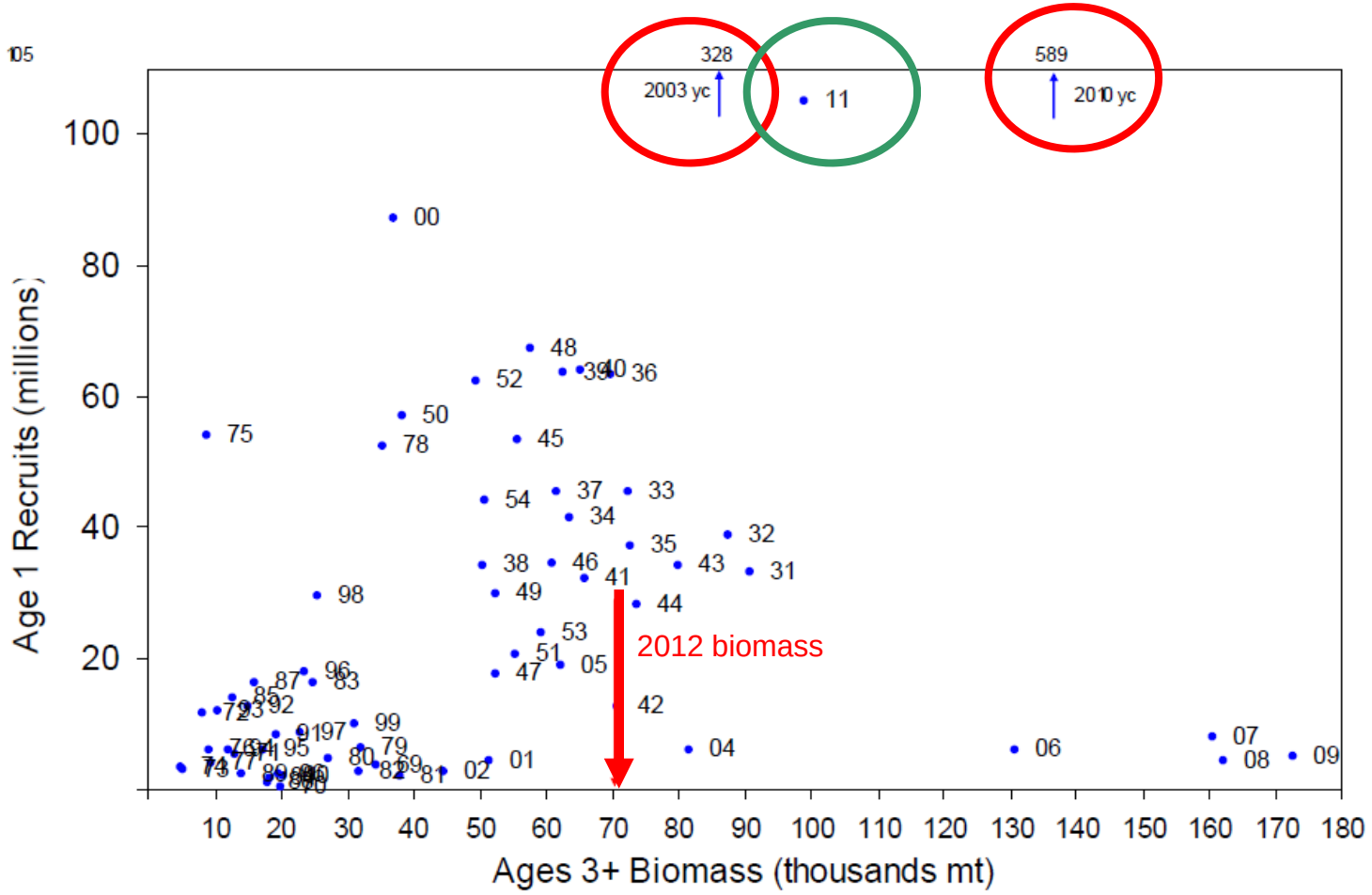
F now estimated as average of ages 5-8

Biomass & Recruitment – Historical perspective



- Adult (3+) biomass decreased to 62,200 mt in 2005 and subsequently increased to 172,700 mt in 2009 due to the influx of the large 2003 year class.
- At the beginning of 2012, adult biomass had decreased to 70,700 mt.
- 2003 and 2010 year classes are exceptionally large; 2011 year class is very strong

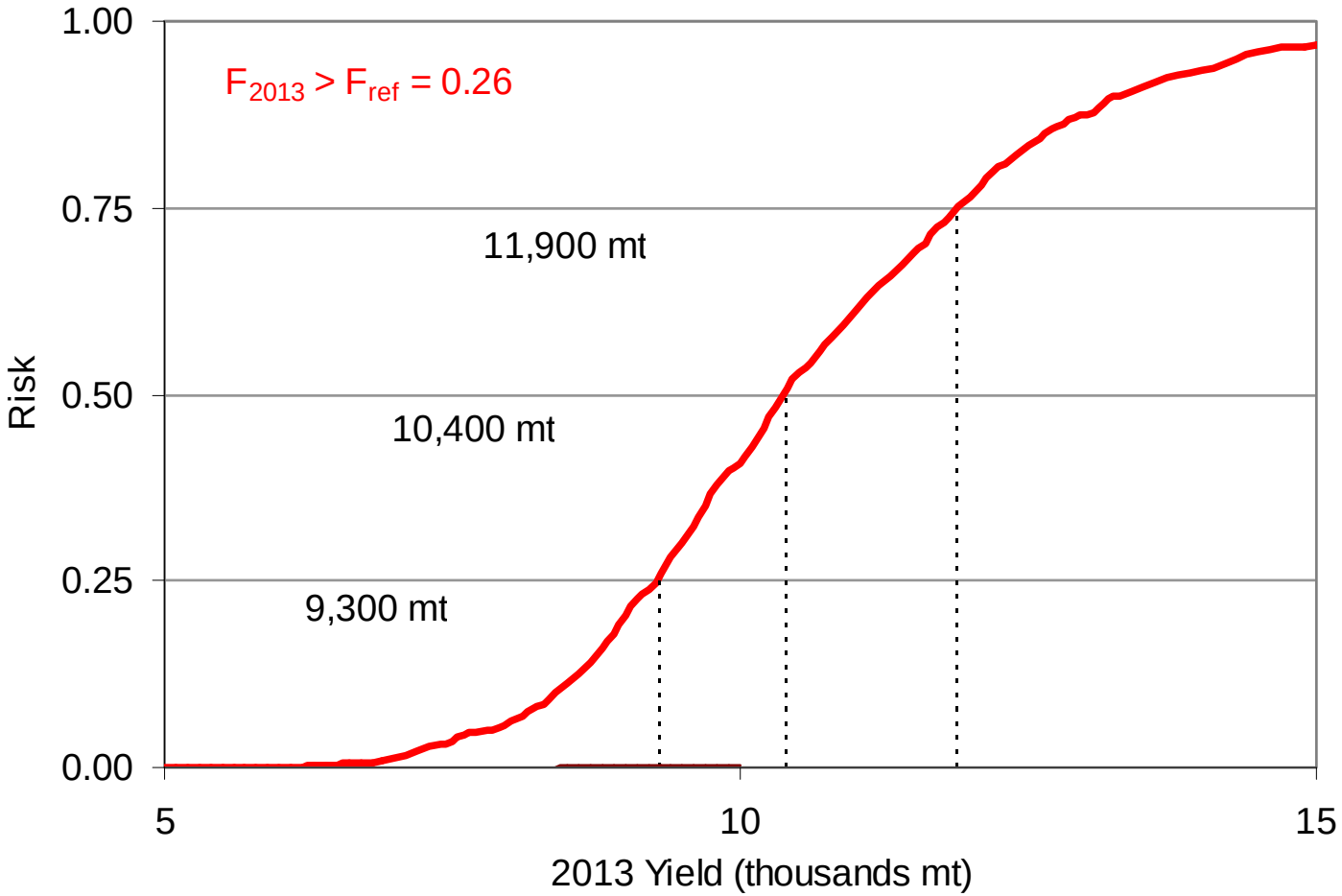
EGB Haddock: Recruitment



- Recruitment is highly variable but has generally been higher when adult biomass has been above 40,000 mt, which has been the case since 2001.
- 2012 3+ biomass estimated at 70,700 mt.
- 2003 yc estimated to be 328 M and 2010 yc preliminary estimate of 589 M at age 1

Projection

F_{ref} catch for 2013

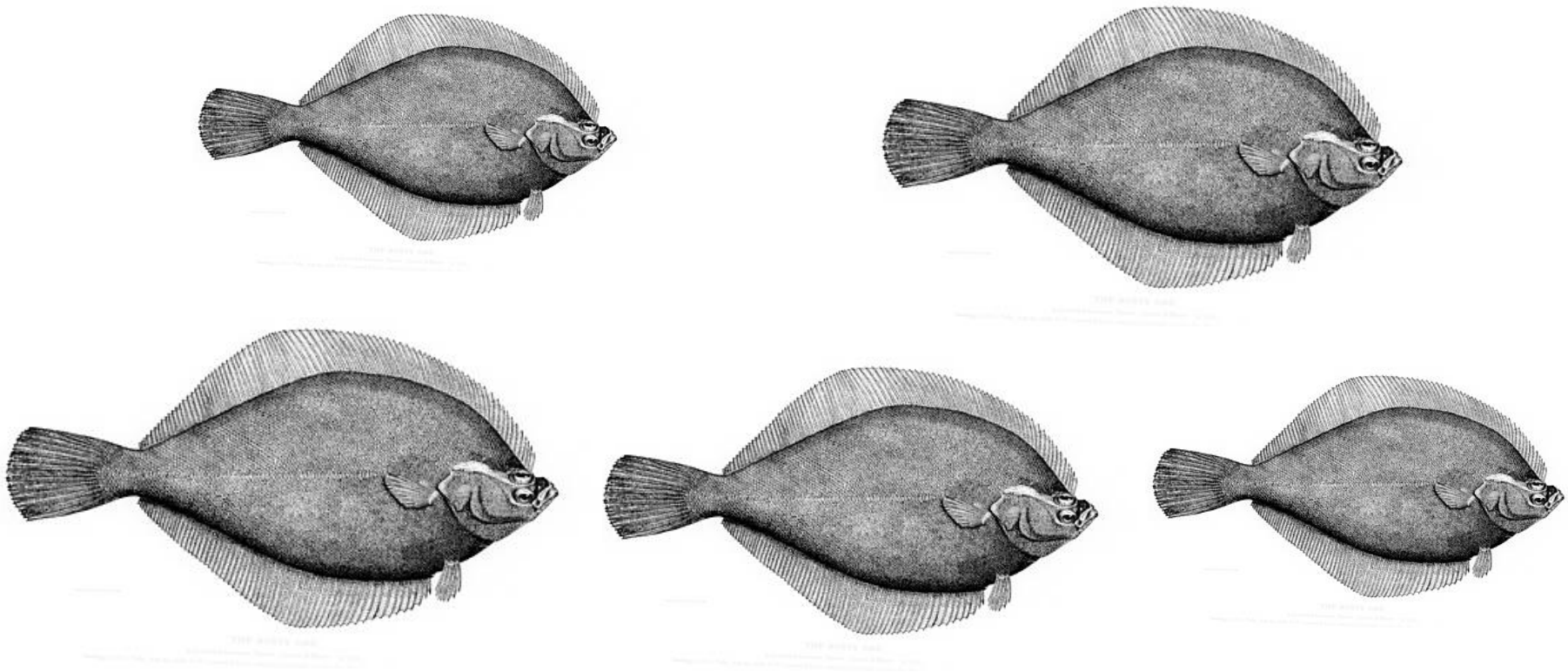


- Assuming a 2012 catch equal to the 16,000 mt total quota, a combined Canada/USA catch of 10,400 mt in 2013 results in a neutral risk (50%) that the 2013 fishing mortality rate would exceed Fref = 0.26
- No biomass decline expected for 2014 (not presented)
- Used 2003 year class values for 2010 year class projection inputs.
- Assumed no growth for 2003 year class (9+) and reduced availability of ages 9+ to fishery

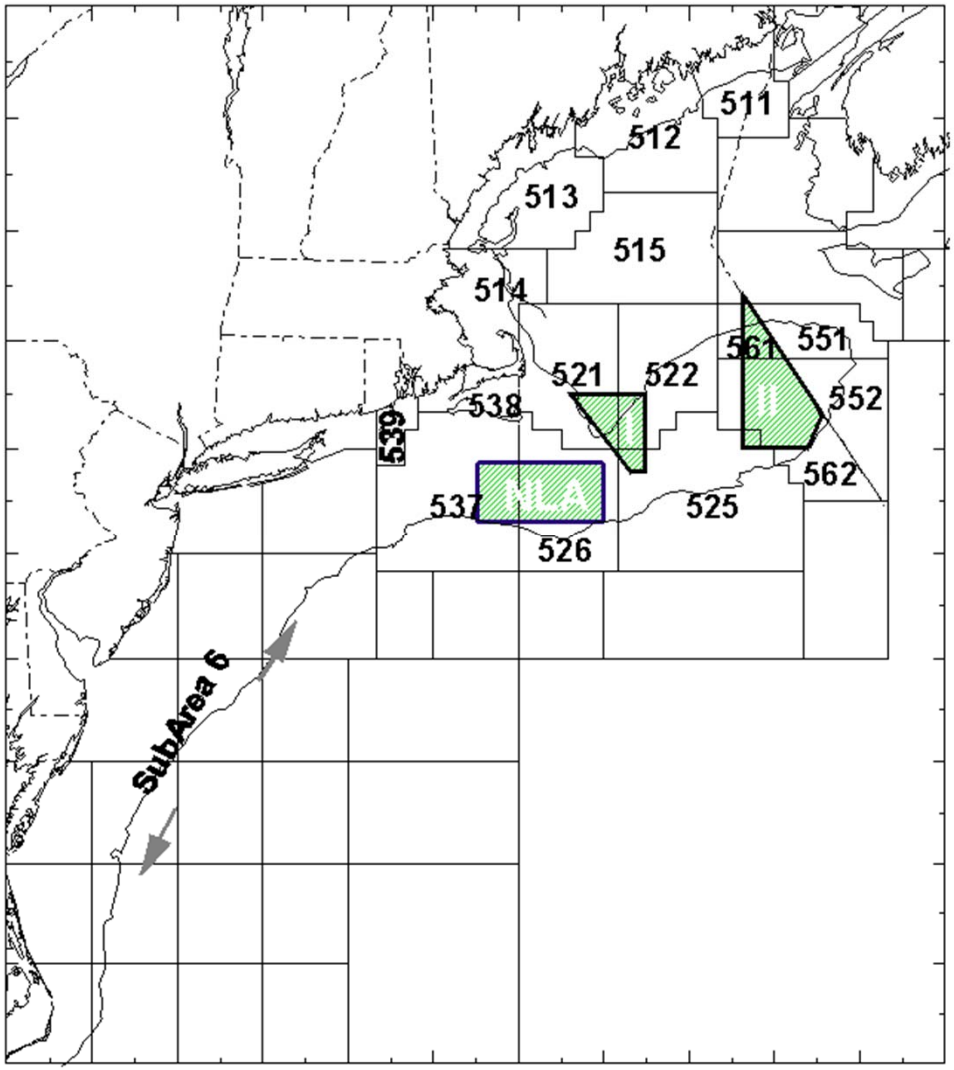
Summary

- Exploitation well below F_{ref} during 2007 – 2011, 2011 F= 0.14 (F_{ref} = 0.26)
- Preliminary estimate of 2010 year class is exceptional at 589 million and 2011 year class is strong
- Except for the strong 2000 and 2011 year classes and the exceptional 2003 and 2010 year classes, recruitment since 1990 has fluctuated between 2.1 and 29.4 million fish at age 1
- Adult biomass is projected to be 306,200 mt (a record-high) at the beginning of 2014
- F_{ref} catch is 10,400 mt
- Fishing up to F_{ref} does not pose conservation concerns for haddock
- Fish condition has been below series average since 2003

GB Yellowtail Flounder

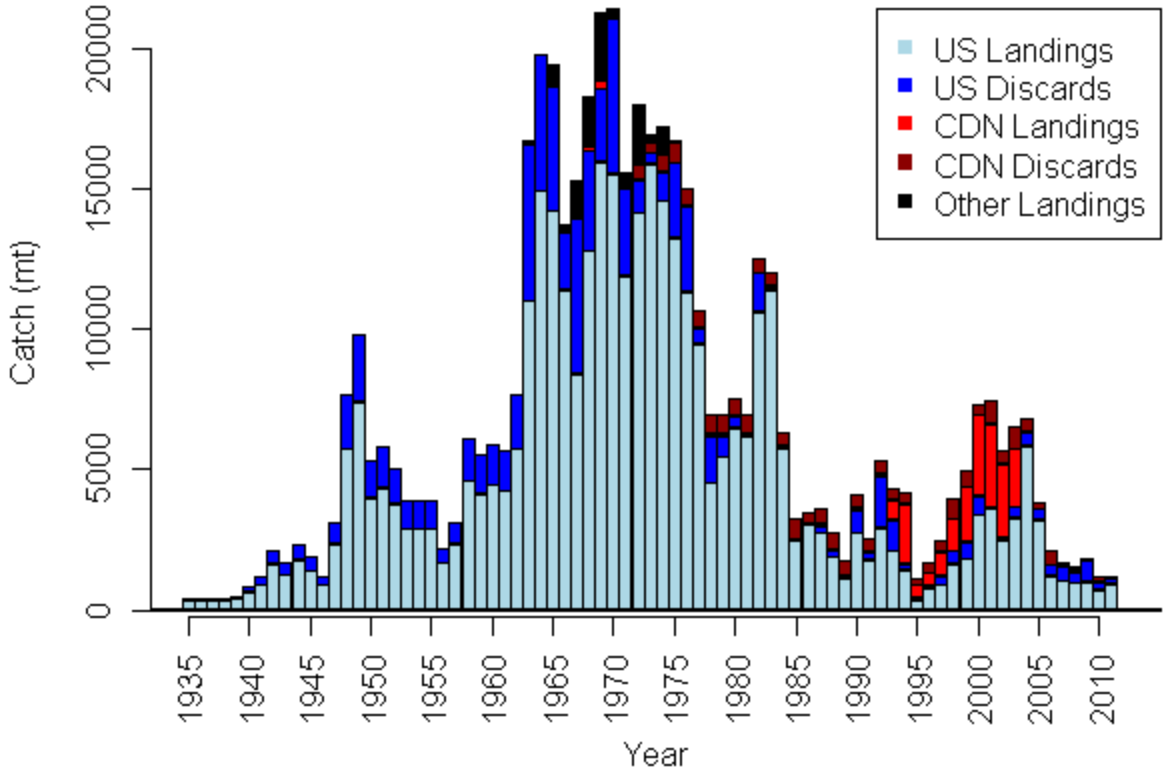


Georges Bank Yellowtail flounder



USA catches:
SA 522,525,561,562

CA catches:
SA 551,552

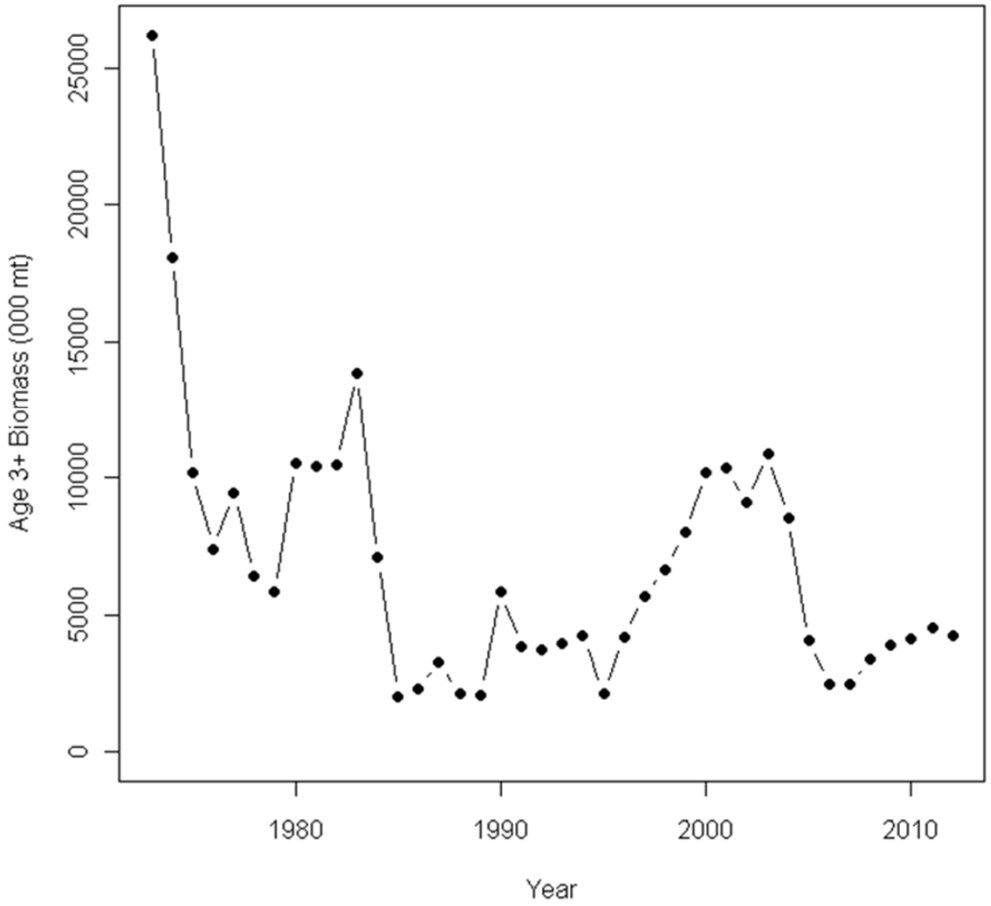


Combined Canada and USA catches in 2011 were 1,169 mt

- < 1% increase from 1,160 mt in 2010 ; discards 21% of catch
- US catch: 1096 mt (904 mt lndgs, 192 mt discards) FY quota: 95%
- CA catch: 73 mt (22 mt lndgs; 50 mt discards) CY quota: 9%

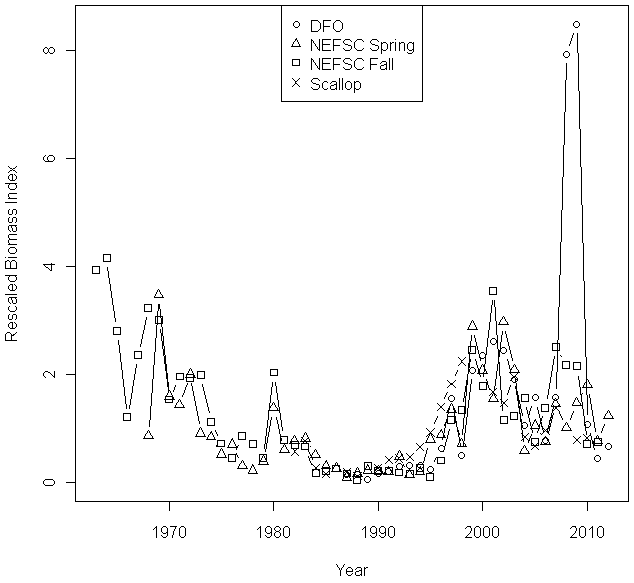
3+ Biomass

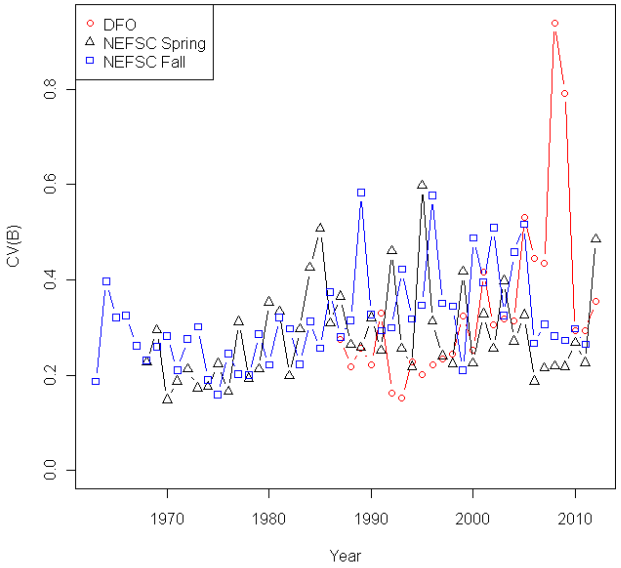
1995: 2,100 mt,
2003: 10,900 mt,
2006: 2,700 mt
2011: 4,500 mt,
2012: 4,300 mt (Jan.1)

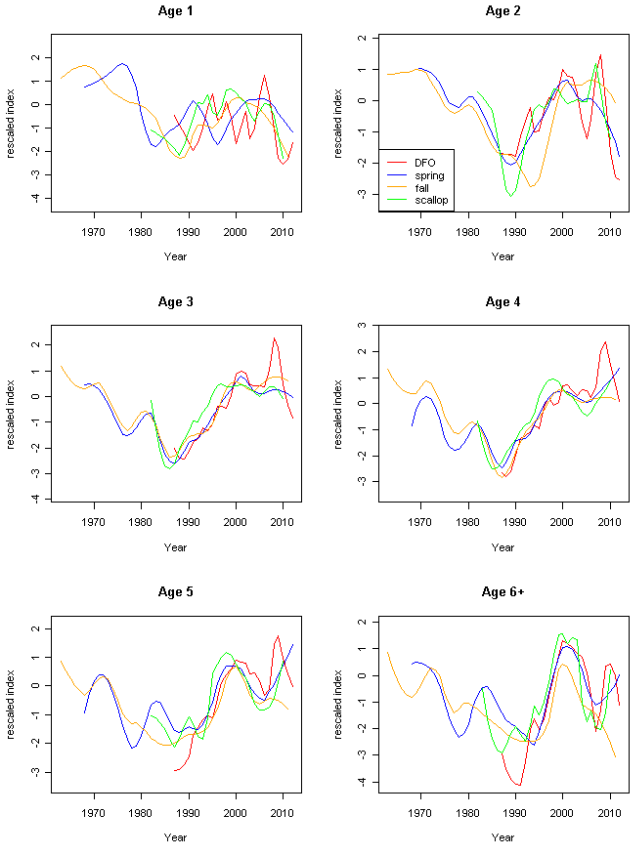


Surveys

- Continued agreement among surveys
- No outliers in most recent year





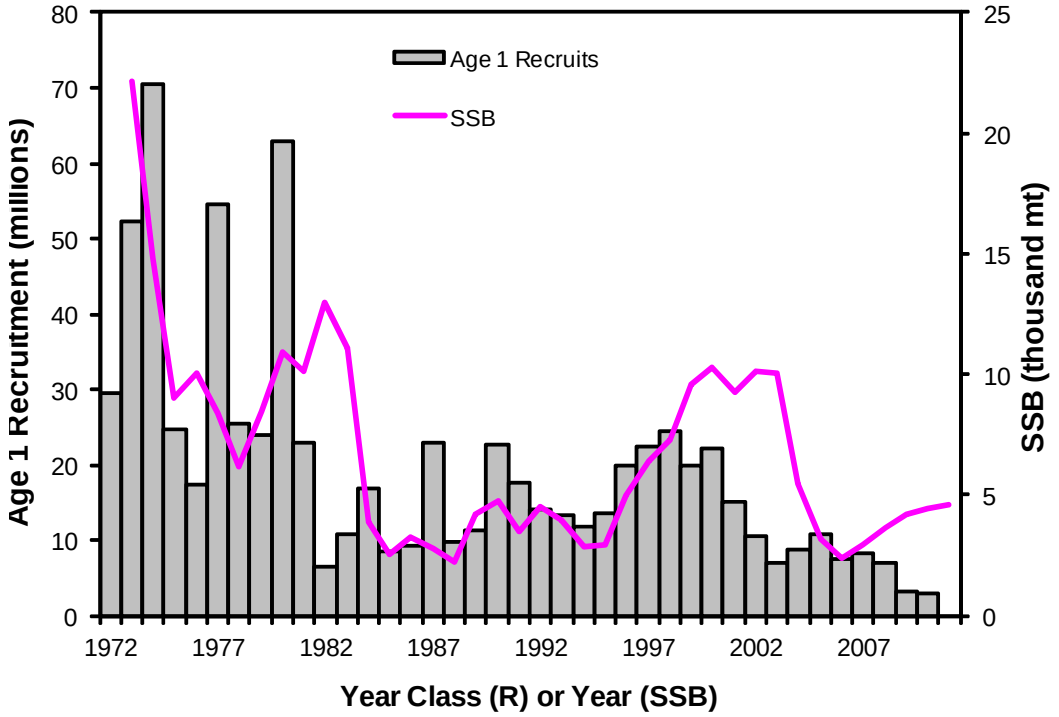


SSB and Recruitment

2011

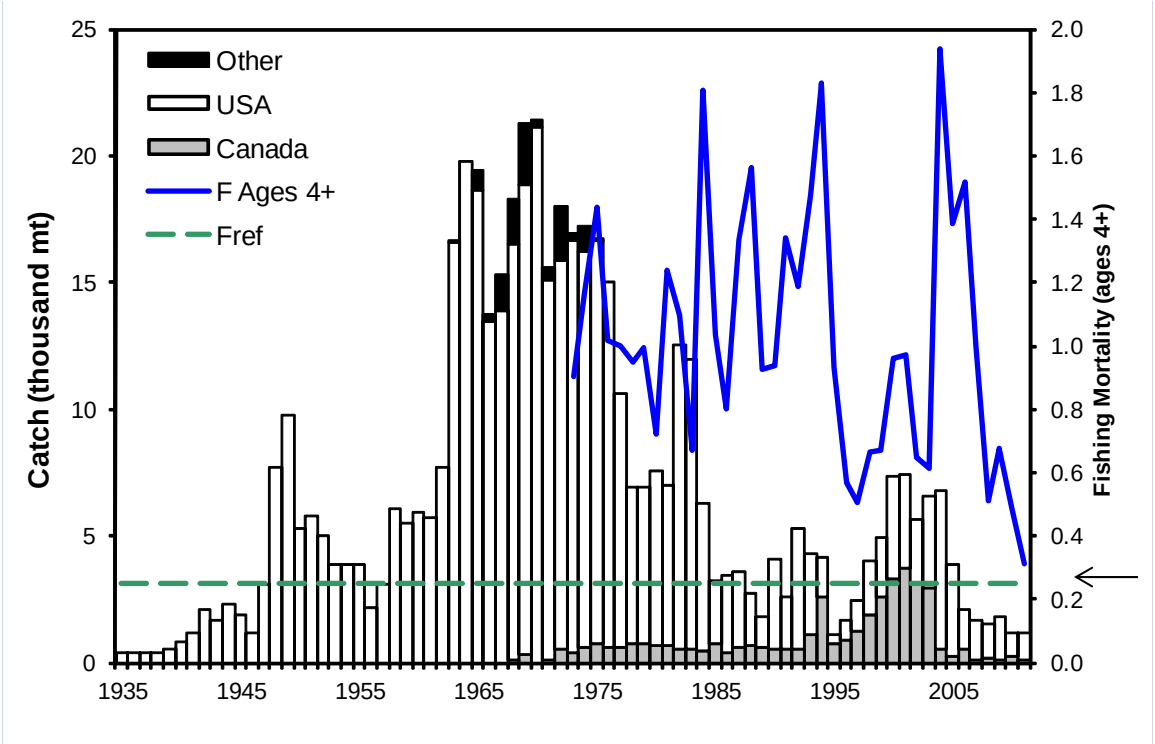
SSB ~4,600 mt

(1,700 mt -adjusted)



- 1973-2011 avg. rct :19.5 million,<avg since 2002
- 2005 yc (10.8)
- 2009-2010 (3.1 – 3.0 mil.), lowest in TS
- 2010 yc : adjusted ~ 1.7 mil. recruits

Fishing mortality



1973-1994 : F > 1.0 , 1996-2003: 0.51-0.97

2004-2007 : > 1.0 , 2008-2010 >0.5

2011: 0.31 , (0.62 rho adj.)

The Split Series formulation was approved at the last benchmark assessment and is used to estimate current stock size and fishing mortality.

In recent years, catch projections based on this model have not reduced fishing mortality below F_{ref} and have not had the expected effect on age 3+ biomass or SSB.

If the 2013 catch quota is set based on unadjusted model projections, this pattern of failing to achieve management objectives seems likely to continue given the model's retrospective pattern.

TRAC recommends basing 2013 catches on the *adjusted* model projection results, not the unadjusted.

Harvest Strategy : TMGC adopted a strategy to maintain a low to neutral risk of exceeding the fishing mortality limit reference, **F_{ref} = 0.25** (established in 2002 by the TMGC).

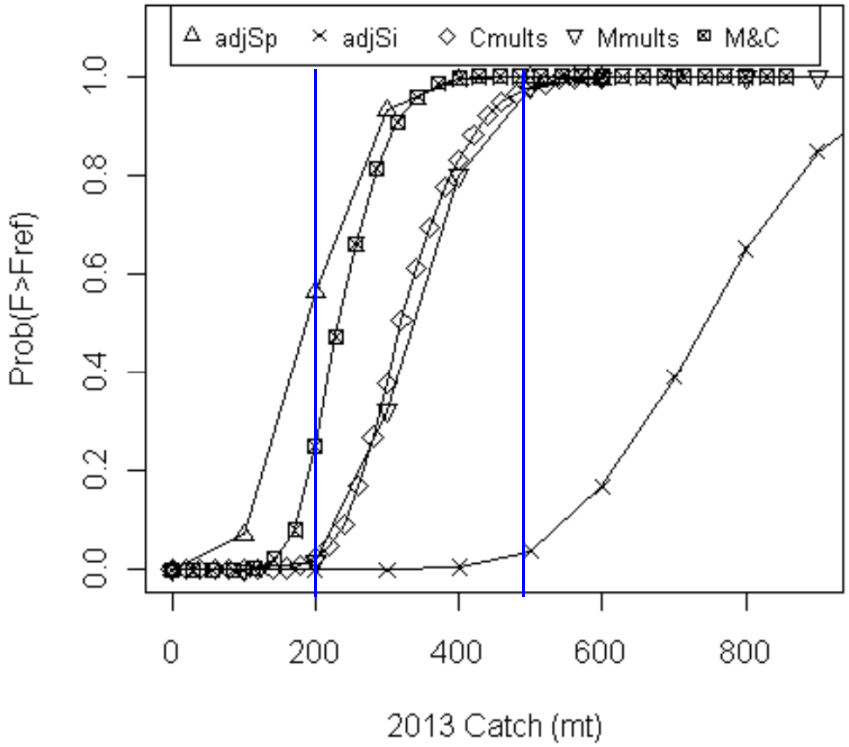
When stock conditions are poor, fishing mortality rates should be further ***reduced*** to promote rebuilding.

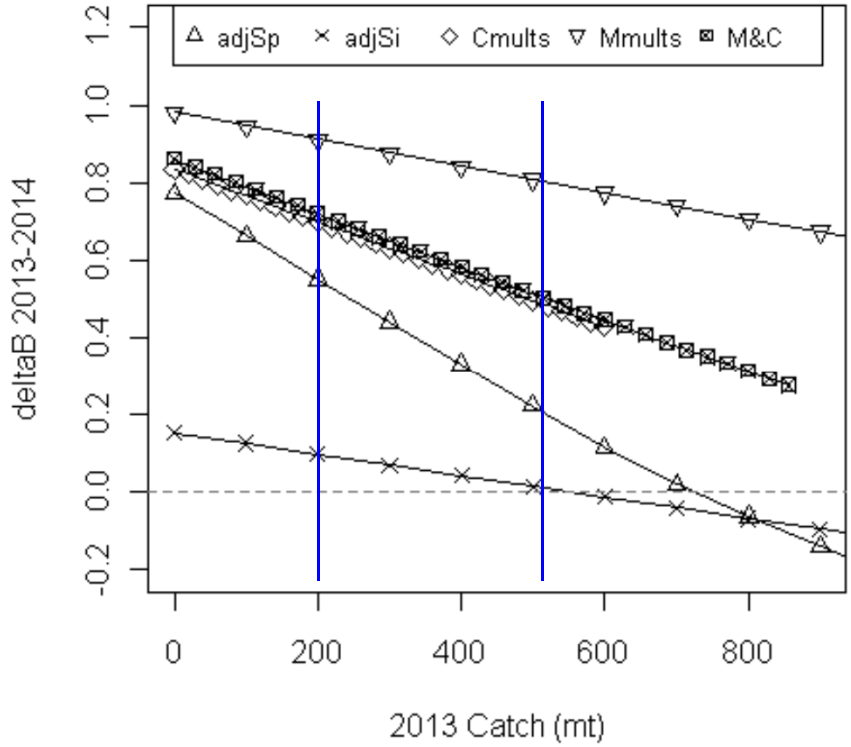
Given the increased magnitude of the retrospective bias 5 sensitivity analyses were presented to address the retrospective bias in characterizing the uncertainty and risk in the catch advice.

	Split	adjSp	Single	adjSi	Cmults	Mmults	M&C
200 mt quota							
$P(F>F_{ref})$	0.00	0.56	0.00	0.00	0.03	0.02	0.25
F2013	0.05	0.27	0.01	0.06	0.15	0.15	0.21
deltaB	36%	55%	9%	10%	70%	91%	72%
B2013	4163	881	14900	3441	7497	1931	4270
P(B inc)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(B inc 10%)	1.00	1.00	0.47	0.55	1.00	1.00	1.00
500 mt quota							
$P(F>F_{ref})$	0.01	1.00	0.00	0.04	0.98	0.98	1.00
F2013	0.14	0.80	0.04	0.16	0.42	0.39	0.61
deltaB	29%	22%	7%	1%	50%	81%	51%
B2013	4163	881	14900	3441	7497	1931	4270
P(B inc)	1.00	1.00	1.00	0.76	1.00	1.00	1.00
P(B inc 10%)	1.00	1.00	0.20	0.00	1.00	1.00	1.00

200 mt: high P , F < Fref & biomass inc

500 mt: F< Fref 1/5, B inc. 4/5





Risk of exceeding Fref Relative change in B

200 mt: high P , F < Fref & biomass inc

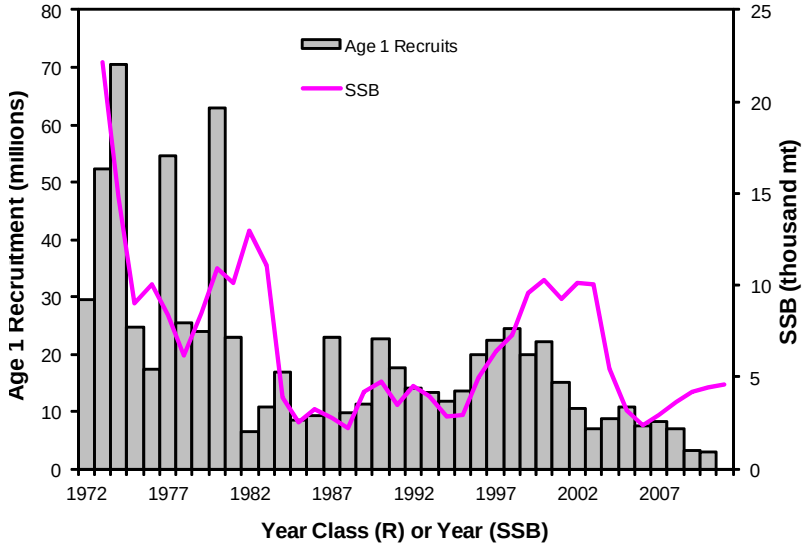
500 mt: F< Fref 1/5, B inc. 4/5

Projection: Caveats

- Benchmark model projection: assume 10 yr avg. rct for 2012 = 7.3 million

- Bias corrected projections (all ages): 2012 rct ~ 2.7 million, results in high probability of increased biomass, 2013-2014 (1/2 B =2012 yc)

- Alternative projection: based on 5 yr avg. rct. (5.2 mil.) adjusted 1.9 mil. results in probability of increased biomass from 2013-2014 ~ 0.0



- Projections presented *may* be optimistic;

- 200 mt (F=0.26) ; 500 mt (F=0.8) ; 600 mt (F=1.03) (10yr avg.rct)

Summary

- Catch in 2011 well below quota
- Surveys up slightly from last year
- F_{2011} > Fref
- Biomass increasing, but still low
- Recruitment poor recently
- Major retrospective issue
- 2013 catch advice 200 mt or 400-500 mt