

ECOREGION Faroe Plateau ecosystem
STOCK Cod in Subdivision Vb₁ (Faroe Plateau)

Advice for 2014

ICES advises on the basis of the MSY approach that effort should be reduced such that fishing mortality in 2014 will be no more than $F = 0.16$, corresponding to a 69% reduction in the present fishing mortality. All catches are assumed to be landed.

Stock status

F (Fishing Mortality)			
	2010	2011	2012
MSY (F_{MSY})	⊗	⊗	⊗ Above target
Precautionary approach (F_{pa}, F_{lim})	⊙	⊙	⊙ Increased risk
SSB (Spawning-Stock Biomass)			
	2011	2012	2013
MSY ($B_{trigger}$)	⊗	⊗	⊗ Below trigger
Precautionary approach (B_{pa}, B_{lim})	⊙	⊙	⊙ Increased risk

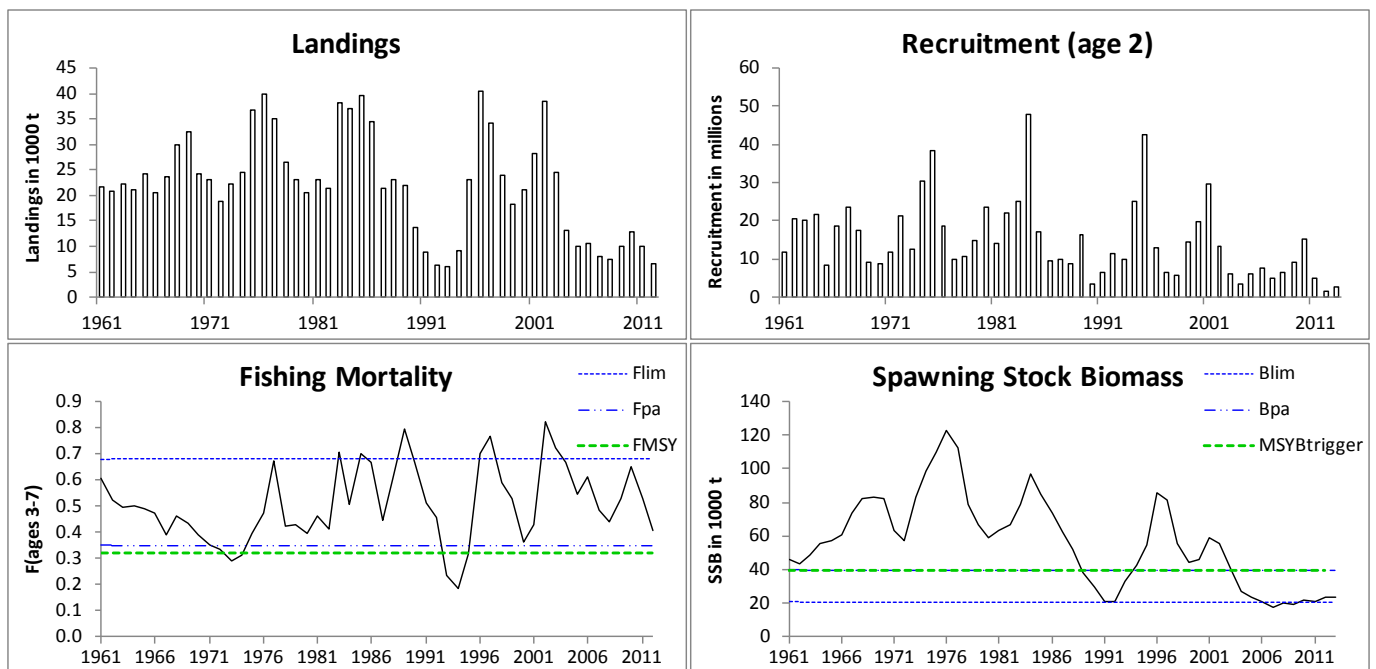
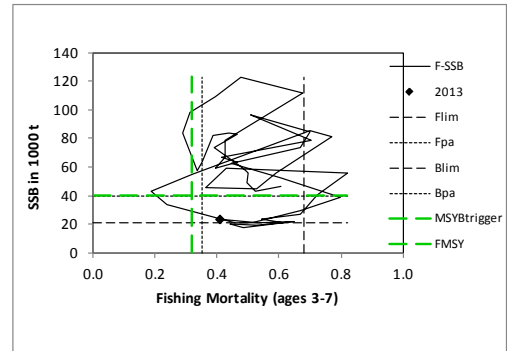


Figure 4.4.1.1 Cod in Subdivision Vb₁ (Faroe Plateau). Summary of stock assessment (weights in thousand tonnes). Top right: SSB/F for the time-series used in the assessment.

SSB has remained around B_{lim} since 2005. Fishing mortality has decreased since 2010 and now below F_{lim} , but still above F_{pa} and F_{MSY} . The 2009–2011 year classes are estimated to be below average.

Management plans

A group representing the Ministry of Fisheries, the Faroese industry, the University of the Faroe Islands, and the Faroe Marine Research Institute has developed a management plan based on general maximum sustainable yield (MSY) principles developed by ICES. The plan has not yet been approved by the authorities.

Biology

Recent work suggests that cannibalism is a controlling factor of recruitment. In periods with low ecosystem productivity, the individual growth of cod is slow, and some of them move into the near-shore nursery areas of 1-group cod, which reduces the recruitment of 2-year-old cod the following year.

Environmental influence on the stock

The productivity of the Faroe Shelf ecosystem is important to the cod stock. Cod recruitment depends both on stock size and primary production of the Faroe Shelf ecosystem. The indices of primary production on the Faroe Shelf (water depth < 130 m) have been low since 2002, except in 2004 and 2008–2010 when they were estimated to be above average. The indices of primary production over the outer areas (water depth 130–500 m) have remained high since 2000. Cod individual growth is highly correlated with the ratio of total phytoplankton production (Faroe Shelf + outer areas) to total fish biomass (cod+haddock+saithe). Over the last five decades, total fish biomass has fluctuated without any time trend, whereas the cod+haddock biomasses have decreased.

The fisheries

Cod are mainly taken in a directed cod and haddock fishery with longlines, in a directed jigging fishery, and as bycatch in the trawl fishery for saithe.

Catch distribution Total catch (2012) is 6 kt, where 59% was taken by longlines, 5% by jigging, 35% by trawlers, and less than 0.1% by other gear types. There was no industrial bycatch or unaccounted removals.

Quality considerations

The landing data are considered accurate. There are no incentives to discard fish under the effort management system. The sampling of the landings is believed to be adequate. Estimates of F in the terminal year have varied considerably.

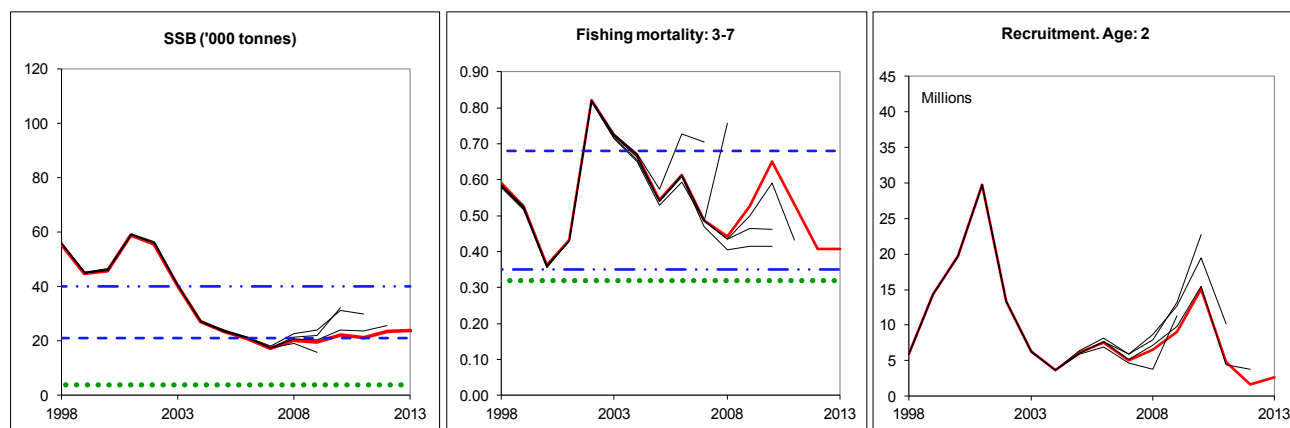


Figure 4.4.1.2 Cod in Subdivision Vb₁ (Faroe Plateau). Historical assessment results (final-year recruitment estimates included).

Scientific basis

Assessment type	XSA using landings-at-age data and age-disaggregated indices.
Stock data category	Category 1.
Input data	Commercial catches: Mainly Faroese landings, ages and length frequencies from catch sampling. ; survey indices (FO-GFS-Q1 and FO-GFS-Q3); no commercial indices; annual maturity data from FO-GFS-Q1; natural mortalities set at 0.2.
Discards and bycatch	Discards are not included and are assumed negligible.
Indicators	Primary production index.
Other information	None.
Working group report	NWWG (ICES, 2013).

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Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
MSY Approach	MSY B _{trigger}	40 000 t.	B _{pa} .
	F _{MSY}	0.32	Provisional maximum sustainable yield, FLR stochastic simulations.
Precautionary Approach	B _{lim}	21 000 t.	Lowest observed SSB (1998 assessment).
	B _{pa}	40 000 t.	B _{lim} e ^{1.645σ} , assuming a σ of about 0.40 to account for the relatively large uncertainties in the assessment.
	F _{lim}	0.68	F _{pa} e ^{1.645σ} , assuming a σ of about 0.40 to account for the relatively large uncertainties in the assessment.
	F _{pa}	0.35	Close to F _{max} (0.34) and F _{med} (0.38) (1998 assessment).

(unchanged since: 2011)

Yield and spawning biomass per Recruit F-reference points (2012):

	Fish Mort Ages 3–7	Yield/R	SSB/R
Average last 3 years	0.53	1.37	3.12
F _{max}	0.25	1.45	5.76
F _{0.1}	0.12	1.31	9.70
F _{med}	0.40	1.41	3.95

Outlook for 2014

Basis: F (2013) = F (2010–2012) = 0.41; SSB (2014) = 20; R (2013) = 3 million; catch (2013) = 7.

Rationale	F (2014)	Catch (2014)	Basis	SSB (2015)	%SSB change¹⁾
MSY approach	0.16	3.6	F _{MSY} * SSB ₂₀₁₃ /B _{trigger}	26	26
Precautionary approach	0.35	7.1	F _{pa}	22	7
Zero catch	0	0	F = 0	30	46
<i>Status quo</i>	0.41	8.0	F _{sq}	21	2
	0.20	4.4	F _{sq} × 0.50	25	21
	0.31	6.3	F _{sq} × 0.75	23	11
	0.32	6.5	F _{MSY} = F _{pa} × 0.90	22	10
	0.37	7.4	F _{sq} × 0.90	21	6
	0.45	8.6	F _{sq} × 1.1	20	-1

Weights in thousand tonnes.

¹⁾ SSB 2015 relative to SSB 2014.

Management plan

A management system based on number of fishing days, closed areas, and other technical measures was introduced in 1996 to ensure sustainable demersal fisheries in Division Vb. This was before ICES introduced precautionary approach (PA) and MSY reference values, and at that time it was believed that the purpose was achieved if the total allowable number of fishing days was set such that on average 33% of the cod exploitable stock in numbers would be harvested annually. This translates into an average F of 0.45, above the F_{pa} and F_{MSY} of 0.35 and 0.32, respectively. ICES considers this to be inconsistent with the PA and the MSY approaches. Work is ongoing in the Faroes to move away from the F_{target} of 0.45 to be consistent with the ICES advice. This new management plan should include a stepwise reduction of the fishing mortality to F_{MSY} in 2015 and a recovery plan if the SSB declines below the B_{trigger}. The MSY B_{trigger} has been defined at 40 kt (the former B_{pa}) and F_{MSY} at 0.32. If the SSB declines below the MSY B_{trigger}, the fishing mortality will be reduced by the relationship F_{MSY} × B_{act}/B_{trigger} until the SSB has increased again above the MSY B_{trigger} and is thereafter kept at F_{MSY}.

MSY approach

ICES advises on the basis of the MSY approach to reduce fishing mortality by 69% in 2014 to 0.16. This is 49% below F_{MSY} , because SSB in 2014 is 49% below MSY $B_{trigger}$.

Precautionary approach

The fishing mortality should be kept below an F_{pa} of 0.35. This translates into a reduction in fishing mortality by 33% as compared to the average of the last three years (0.52).

Additional considerations

Management considerations

The present estimate of F_{MSY} should be regarded as provisional. Simulation studies that take the productivity of the ecosystem into account have been tried, but this model is still under development.

One of the expected benefits of the effort management system was more stability for the fishing fleet. The fleets were expected to target the most abundant fish species, thus reducing the fishing mortality on stocks that are at low levels. However, low prices on saithe and haddock and high prices for cod have kept the fishing mortality high on cod; the economic factors seem to be more important than the relative abundance of the stocks in determining which species is targeted. When considering future management, protection mechanisms should be included to ensure that appropriate action is taken when one or more stocks or fisheries develop in an unfavourable way.

It is not easy to control fishing mortality by effort management if catchability varies. For baited hook gear, catchability may be related to the amount of food available in the ecosystem (Steingrund *et al.*, 2009). Therefore, during the current low-productive period, fishing mortality may increase even though the number of fishing days is decreased.

Regulations and their effects

An effort management system was implemented 1 June 1996. Fishing days are allocated to all fleets fishing in waters < 380 m depth for the period 1 September–31 August. In addition the majority of the waters < ca. 200 m depth are closed to trawlers, and are mainly utilized by longliners. The main spawning areas for cod are closed for nearly all fishing gears during spawning time. In 2011, additional areas were closed to protect incoming year classes of cod.

Changes in fishing technology and fishing patterns

The effort management system can lead to improvement of fishing technology and efficiency. Presently, ICES is not able to quantify these changes.

Comparison with last year's assessment and advice

The perception of the status of the stock with respect to reference points and trends in this year's assessment is similar to that of last year's assessment. Comparing the 2011 estimates in last year's assessment (2012) with this year's assessment (2013) shows that recruitment has been revised upwards by 11%, the spawning-stock biomass revised downwards by 8%, and the fishing mortality revised upwards by 23%.

The basis of the advice is the same as last year.

Sources

ICES. 2013. Report of the North-Western Working Group, 25 April–2 May 2013. ICES CM 2013/ACOM:07.

Steingrund, P., Clementsen, D. H., and Mouritsen, R. 2009. Higher food abundance reduces the catchability of cod (*Gadus morhua*) to longlines on the Faroe Plateau. *Fisheries Research*, 100: 230–239.

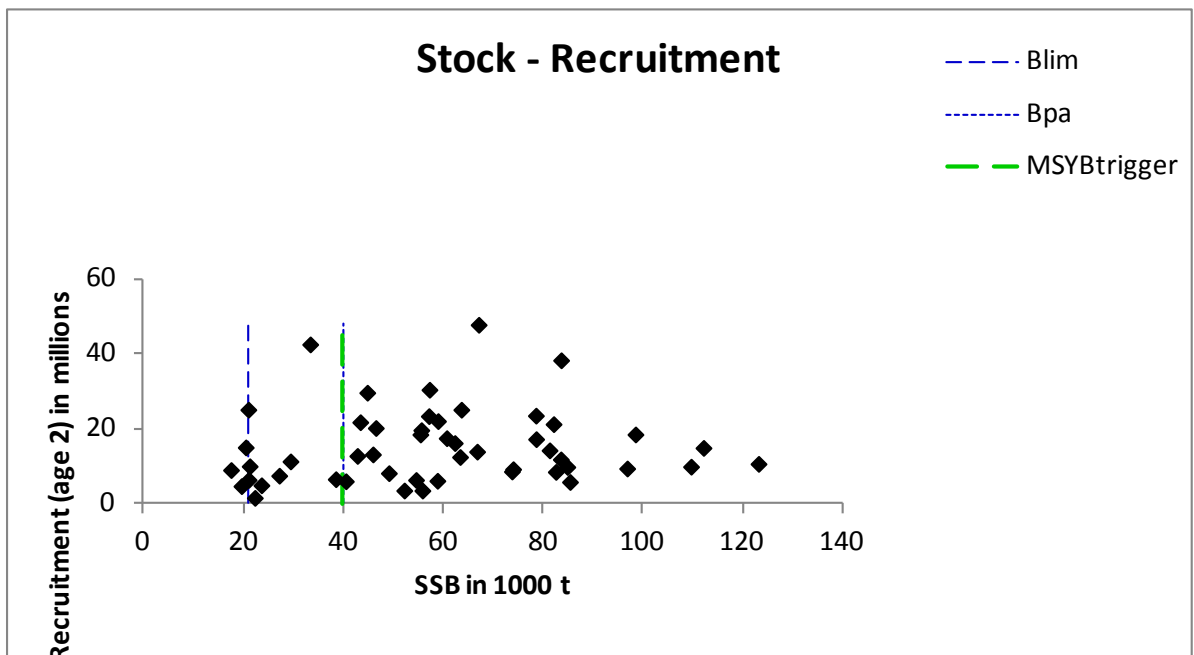


Figure 4.4.1.3 Cod in Subdivision Vb₁ (Faroe Plateau). Stock–recruitment plot.

Table 4.4.1.1 Cod in Subdivision Vb₁ (Faroe Plateau). ICES advice, management, and landings.

Fishing Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ICES landings
1987	No increase in F	< 31		21.4
1988	No increase in F (Revised estimate)	< 29 (23)		23.2
1989	No increase in F	< 19		22.1
1990	No increase in F	< 20		13.5
1991	TAC	< 16		8.8
1992	No increase in F	< 20		6.4
1993	No fishing	0		6.1
1994	No fishing	0	8.5/12.5 ^{1,2}	9.0
1995	No fishing	0	12.5 ¹	23.0
1996	F at lowest possible level	-	20 ²	40.4
1997	80% of F(95)	< 24	-	34.3
1998	30% reduction in effort from 1996/97	-	-	24.0
1999	F less than proposed F _{pa} (0.35)	< 19		18.3
2000	F less than proposed F _{pa} (0.35)	< 20		21.0
2001	F less than proposed F _{pa} (0.35)	< 16		28.2
2002	75% of F(2000)	< 22		38.5
2003	75% of F(2001)	< 32		24.5
2004	25% reduction in effort	-		13.2
2005	Rebuilding plan involving large reduction	-		9.9
2006	Rebuilding plan involving large reduction	-		10.5
2007	Rebuilding plan involving large reduction in effort	-		8.1
2008	No fishing. Development of a rebuilding plan.	0		7.5
2009	No fishing. Development of a rebuilding plan.	0		10.0
2010	No fishing. Development of a rebuilding plan.	0		12.8
2011	Reduce F to below F _{pa}	< 16		9.9
2012	MSY framework, reduce F by 30%	< 10		11.3
2013	MSY approach, F < 0.20	4.8		11.5
2014	MSY approach, reduce F by 69 %	3.6		

Fishing year: 1 September–31 August the following year.

Weights in thousand tonnes.

¹⁾ In the quota year 1 September–31 August the following year.

²⁾ The TAC was increased during the quota year.

Table 4.4.1.2 Faroe Plateau cod (Subdivision Vb₁). Nominal catch statistics (in tonnes) per country.

	Denmark	Faroe Islands	France	Germany	Iceland	Norway	Greenland	Portugal	UK (E/W/N)	UK (Scotland)	United Kingdom	Total
1986	8	34,492	4	8		83	-		-	-	-	34,595
1987	30	21,303	17	12		21	-		8	-	-	21,391
1988	10	22,272	17	5		163	-		-	-	-	22,467
1989	-	20,535	-	7		285	-		-	-	-	20,827
1990	-	12,232	-	24		124	-		-	-	-	12,380
1991	-	8,203	- ¹	16		89	-		1	-	-	8,309
1992	-	5,938	3 ²	12		39	-		74	-	-	6,066
1993	-	5,744	1 ²	+		57	-		186	-	-	5,988
1994	-	8,724	-	2		36	-		56	-	-	8,818
1995	-	19,079	2 ²	2		38	-		43	-	-	19,164
1996	-	39,406	1 ²	+		507	-		126	-	-	40,040
1997	-	33,556	-	+		410	-		61 ²	-	-	34,027
1998	-	23,308	- [*]	-		405	-		27 ²	-	-	23,740
1999	-	19,156	- [*]	39		450	-		51	-	-	19,696
2000			1	2		374	-		18	-	-	395
2001		29,762	9 ²	9		531 [*]	-		50	-	-	30,361
2002		40,602	20	6	5	573			42	-	-	41,248
2003		30,259	14	7		447			15	-	-	30,742
2004		17,540	2	3 ²		414		1	15	-	-	17,975
2005		13,556	-			201			24	-	-	13,781
2006		11,629	7	1 ²		49	5		1	-	-	11,692
2007		9,905	1 ²			71	7		3	358	-	10,345
2008		9,394	1			40				383	-	9,818
2009		10,736	1			14	7			300	-	11,058
2010		13,878	1			10				312	-	14,201
2011		11,497	-								-	11,497
2012 [*]		7,671	0		29						-	7,700

^{*} Preliminary, ¹⁾ Included in Vb2, ²⁾ Reported as Vb.

Table 4.4.1.3 Faroe Plateau cod (Subdivision Vb₁). Officially reported catches as well as the corrections done to obtain the catches, which were used in the assessment.

	Faroes catches:				Catches reported as Vb2:			Foreign catches:				Used in the assessment	
	Officially reported	in Vb1	Corrections in Vb1	on Faroe-Iceland ridge	in IA within Faroe area jurisdiction	UK (E/W/N)	UK (Scotland)	UK	French ²	Greenland ²	Russia ²		UK ²
1986	34595												34595
1987	21391												21391
1988	22467					715							23182
1989	20827					1229				12			22068
1990	12380					1090 -		205		17			13692
1991	8309					351 -		90					8750
1992	6066					154 +		176					6396
1993	5988						1	118					6107
1994	8818						1	227					9046
1995	19164	3330 ⁵				-		551					23045
1996	40040					-		382					40422
1997	34027					-		277					34304
1998	23740					-		265					24005
1999	19696				-1600	-		210					18306
2000	395	21793 [*]			-1400	-		245					21033
2001	30361		-1766		-700	-		288					28183
2002	41248		-2409		-600	-		218 -					38457
2003	30742		-1795		-4700	-		254 -					24501
2004	17975		-1041		-4000	-		244 -					13178
2005	13781		-804		-4200			1129 -					9906
2006	11692		-690		-800			278					10480
2007	10345		-588		-1800			53			6		8016
2008	9818		-557		-1828			32					7465
2009	11058		-637		-487			38			26	4	10002
2010	14201		-823		-680			54			5		12757
2011	11497		-682		-918						3		9900
2012	7700 [*]		-455		-760						5		6490

¹⁾ Preliminary, ¹⁾ In order to be consistent with procedures used previous years, ²⁾ Reported to Faroes Coastal Guard, ³⁾ expected misreporting/discard.

Table 4.4.1.4

Faroe Plateau cod (Subdivision Vb₁). Summary of the stock assessment. * Prediction.

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3–7
1961	12019	46439	21598	0.6059
1962	20654	43326	20967	0.5226
1963	20290	49054	22215	0.4944
1964	21834	55362	21078	0.5017
1965	8269	57057	24212	0.4909
1966	18566	60629	20418	0.4743
1967	23451	73934	23562	0.3900
1968	17582	82484	29930	0.4642
1969	9325	83487	32371	0.4375
1970	8608	82035	24183	0.3882
1971	11928	63308	23010	0.3526
1972	21320	57180	18727	0.3358
1973	12573	83547	22228	0.2886
1974	30480	98434	24581	0.3139
1975	38319	109566	36775	0.3947
1976	18575	123077	39799	0.4749
1977	9995	112057	34927	0.6757
1978	10748	78497	26585	0.4259
1979	14998	66723	23112	0.4273
1980	23583	58887	20513	0.3945
1981	14001	63562	22963	0.4648
1982	22128	67033	21489	0.4138
1983	25162	78543	38133	0.7056
1984	47768	96774	36979	0.5081
1985	17323	84788	39484	0.7013
1986	9513	73696	34595	0.6691
1987	9918	62247	21391	0.4452
1988	8716	52136	23182	0.6073
1989	16283	38417	22068	0.7961
1990	3650	29351	13692	0.6670
1991	6665	21179	8750	0.5133
1992	11398	20912	6396	0.4583
1993	10103	33301	6107	0.2376
1994	25168	42738	9046	0.1855
1995	42544	54495	23045	0.3206
1996	12861	85325	40422	0.7006
1997	6455	81232	34304	0.7689
1998	5924	55547	24005	0.5898
1999	14344	44726	18306	0.5275
2000	19716	45857	21033	0.3633
2001	29691	58765	28183	0.4312
2002	13259	55766	38457	0.8207
2003	6245	40436	24501	0.7244
2004	3641	27094	13178	0.6679
2005	6113	23528	9906	0.5441
2006	7600	20967	10480	0.6145
2007	5041	17443	8016	0.4861
2008	6499	20391	7465	0.4412
2009	9100	19533	10002	0.5271
2010	15126	22211	12757	0.6505
2011	4819	21369	9900	0.5306
2012	1693	23561	6490	0.4074
2013*	2678	23747		
Average	14986	56448	21943	0.5047