2000 REVIEW OF THE FISHERY MANAGEMENT PLAN FOR WINTER FLOUNDER
(Pseudopleuronectes americanus)

Prepared by

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2000

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I. Status of Fishery Management Plan

The Interstate Fishery Management Plan for Inshore Stocks of Winter Flounder was adopted by the Commission in May 1992. An implementation strategy was also adopted at that time and printed separately as Addendum I to the plan. The Winter Flounder Management Board is responsible for monitoring plan implementation.

The plan contains specific fishery management and habitat protection / enhancement measures to meet the following goals: to maintain winter flounder stocks in sufficient abundance to support stable, productive commercial and recreational fisheries; to preserve, maintain, and enhance habitat and environmental quality necessary for optimal growth and reproduction; to the extent possible, minimize incompatibility in management practices between this and other northwest Atlantic management plans, recognizing that winter flounder stocks vary biologically and may justify differing strategies; to the extent possible, minimize conflicts between competing uses of the winter flounder resource.

The designated management unit for the plan includes the state waters of Maine through Delaware. States declaring an interest in the plan include: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey and Delaware. States required to comply with the plan include all the states identified above and the state of Pennsylvania.

II. Status of Stocks

Two inshore Management Units are identified: **Gulf of Maine** (GOM) - waters north of Cape Cod; **Southern New England/Mid-Atlantic** (SNE/MA) - waters south of Cape Cod to the Delaware-Maryland border. Previously, the SNE and MA areas were considered as separate units but were combined during the 1995 assessment because growth data and tagging studies showed more similarity between the SNE and MA regions. This change was reviewed and accepted by the Stock Assessment Review Committee (SARC 21) in 1995. Another change accepted by the SARC was lowering the natural mortality estimate from M = 0.35 to M = 0.2. This change was based on updated catch and age data which showed the presence of older fish (up to 16 years old) in the exploited population, leading the technical committee to adopt the conventionally accepted M = 0.2.

The Technical Committee met in January 1998 to assess the status of both the SNE/MA and GOM stock units. The committee attempted to construct the catch at age matrix for updating the 1995 VPA for the SNE/MA unit but was unable due to a lack of samples from two commercial market categories in 1995 and 1996. In addition, several other market categories were poorly sampled during 1995-96. The committee concluded that the commercial length frequency sampling was insufficient for characterizing the commercial landings at age for the SNE/MA.

Given the level of uncertainty in the commercial landings at age, and uncertainty in the less precisely estimated commercial and recreational discard at age matrices, the committee concluded that an age-based assessment would be inappropriate at that time.

The committee decided to assess the SNE/MA unit using the ASPIC model (**A S**urplus **P**roduction model **I**ncorporating **C**ovariates) which is a biomass dynamic model that assumes logistic growth and does not require either age data or estimates of natural mortality. It is based on the Schaefer model, is non-equilibrium and requires the use of survey biomass indices and catch. The model estimates the following parameters: 1) the ratio of starting biomass to the biomass that yields maximum sustainable yield (B1R); 2) survey index catchability coefficients (q_i); 3) the maximum stock yield (MSY); and 4) the intrinsic rate of growth (r). The model calculates fishing mortality (F_{bio} = catch in biomass/average stock biomass), fishing mortality that achieves maximum sustainable yield (F_{msy} = r/2), biomass that yields maximum sustainable yield (B_{msy} = K/2), and the carrying capacity (K = 4MSY/r). The fishing mortality rate derived from this model is a biomass removal rate and is not directly comparable to the age-based reference points in the current FMP. The model assumes that all biomass is fully exploitable. In the case of winter flounder, partially recruited age-groups contribute to the total stock biomass, thus the estimate of F_{bio} is sensitive to the contribution of yearclasses before they fully recruit to the fishery.

Total stock biomass of the SNE/MA unit declined from 43,500 metric tons (mt) in 1981 to a low of 8,400 mt in 1992. Biomass has since increased to 20,500 mt in 1997. This is below the B_{msy} estimate of 25,830 mt (80% CL: 19,530 to 39,060 mt). The trend and magnitude of biomass estimates in this model are similar to estimates from the SARC 21 VPA. Fishing mortality (F_{bio}) increased from 0.37 in 1981 to 0.63 in 1984 and fluctuated around this level until 1991. F_{bio} declined from 0.76 in 1991 to 0.18 in 1996. The trend in F_{bio} is similar to the trend in fully recruited F (F_{full}) from the SARC 21 VPA (1985-93) and the Committee's 1996 projection analyses. F_{bio} in 1996 is 0.18 and is below the F_{msy} estimate of 0.32 (80% CL: 0.17 to 0.45). The increase in biomass in the stock coincides with recent good recruitment and suggests that the unexploitable portion of biomass has increased in recent years, i.e. the drop in F_{bio} may be greater than the decline in F on the fully recruited portion of the stock (F_{full}).

F_{bio} incorporates the fishing mortality rate on both fully recruited and partially recruited cohorts, weighted by the biomass of each cohort. Thus trends in F_{bio} may not directly reflect trends in fully recruited F because of the percent biomass contributed by partially recruited age classes varies with yearclass size, particularly when the age structure of the population is truncated. A method was used to equilibrate F_{bio} to F_{full} by the committee in order to evaluate the reduction in F relevant to the FMP's interim goals and target. For the SNE/MA unit, F_{full} was estimated to be 0.36 in 1996, above both the interim target (F_{30} = 0.30) and the rebuilding target (F_{40} = 0.21). The committee then applied the NEFMC's Multispecies Monitoring Committee expected reduction of 22% in nominal effort from fishing year 1996 to 1998 due to Framework 20 ot the Multispecies FMP and the Vessel Capacity Reduction Program. Assuming no shift in effort onto winter flounder, fishing mortality was projected to decline to 0.27 in 1998, resulting in a 22% shortfall from the January 1, 1999 F_{40} target of 0.21.

State and federal trawl surveys indicate similar trends in stock biomass. The NEFSC fall

biomass index declined from 1969 through 1975, rapidly increased to a record high in 1981, before steadily declining to a record low in 1993. This index has increased slightly in recent years but remains at a low level. The MADMF spring biomass index was at a high level from 1978-84 before declining to a record low in 1991. The index has since increased and remains stable near levels seen in the mid-80's. RIDFW indices showed a similar trend: high biomass in the early 1980's followed by a steady decline to record lows in the early 1990's. Biomass temporarily increased in 1994-95, but has declined again. The CTDEP biomass index (1985-96) was at a low level from 1985-87 before increasing to a record high in 1990. This index decreased to a record low in 1995 but rebounded to a high level the following year. The CTDEP index follows the same trend as the other surveys but appears to lag them in time.

Trends in recruitment vary according to survey and may reflect geographic differences in stock strength. Based upon examination of survey indices, recruitment appears good to moderate for the 1992-94 yearclasses, and poor for the 1995 yearclass in most surveys. The RIDFW survey indicates poor recruitment after the 1992 yearclass. Estimates of the 1996 yearclass size vary among young-of-the-year surveys as well. The 1996 yearclass appears strong in the CTDEP and NYDEC surveys, average in the MADMF seine survey, and poor in the RIDFW and DE DFW surveys.

Data for the GOM unit are insufficient to conduct an age-based assessment. In January 1998, the committee examined trends in research survey indices and used the ASPIC model to assess this stock. Total stock biomass declined from 19,600 mt in 1979, to a low of 6,000 mt in 1991. Biomass has since increased to 8,900 mt in 1997. This is well below the B_{msy} estimate of 32,870 mt (80% CL: 13,070 to 203,700 mt), and is below the lower confidence level of B_{msy}. Fishing mortality (F_{bio}) fluctuated around 0.30 from 1981 through 1991, before declining to 0.09 in 1994. Fishing mortality has remained near that level in recent years. F_{bio} in 1996 was 0.09 and is below the F_{msy} estimate of 0.11 (80% CL: 0.07 to 0.17). The decline in F_{bio} may be due to an increase in unexploitable stock biomass by recent recruitment of age-2 fish rather than a decline in fully recruited F (F_{full}). Since the F_{bio} estimates can not be directly compared to the biological reference points and because this stock has never been assessed with an age-based assessment, the F_{full} equivalent to F_{bio} can not be estimated. The fishing mortality targets for this stock (F_{25} = 1.00; F_{30} = 0.78; F_{40} = 0.49) were estimated using the BIOREF model with M = 0.35. Natural mortality for this stock is currently estimated to be 0.2, but the biological reference points have not been recalculated. The biological reference points should be significantly less than the current ones: the new F_{40} will likely be in the range of 0.15 to 0.25.

State (MA) and federal survey indices have shown similar trends in stock biomass, declining from time series highs in 1979 to record lows in the late 1980's. Biomass has since fluctuated without trend. The MADMF spring survey has shown record high recruitment of age-2 fish since 1992. The increase in age-2 indices may reflect true high recruitment of age-2 fish (age-1 indices are at or above the time series average for 1992, 1993, 1995 and 1996), or it may reflect higher survival of ages 1 and 2 due to improved selectivity resulting from implementation of state and federal regulations such as mesh size increases, Nordmore grate implementation, certification of small mesh fisheries, etc. However, these large yearclasses do not follow through to older age groups since indices of age-3 and older fish are among the lowest in the time series. This strongly suggests that the fully recruited fishing mortality has not declined on

this stock. Another explanation would be that the catchability coefficient (q) in the spring MADMF survey has increased for age-2 fish and declined for older ages. This however, is unlikely since there has been no change in survey methodology throughout the time period.

III. Status of Fishery

Commercial landings from the SNE/MA averaged 8,500 mt from 1964-72 before declining to around 4,800 mt throughout the mid to late 1970's. Commercial landings increased in the early 1980's to a record high of 11,176 mt in 1981 and remained at high levels through 1985. Landings rapidly declined after 1985 and have averaged near 2,500 mt in recent years. Commercial landings in 1997 were projected to be 3,058 mt. Landings by distance from shore (<3 mi; 3-12 mi; >3 mi) were unavailable for 1994-96 because of the switch from the NEFSC's weigh-out system to the Vessel Trip Reports (logbooks). Commercial landings from the EEZ (>3mi) averaged 86% of total commercial landings from 1989-93. State and federal management measures implemented since 1993 are unlikely to have significantly changed the percentage of total commercial landings from the EEZ.

Recreational landings from the SNE/MA peaked at 5,772 mt in 1984 before declining to a record low of 383 mt in 1992. Landings have fluctuated between 543 and 661 mt in recent years. Recreational landings as a percentage of total landings increased from 20% in 1982 to 44% in 1988, then declined to 20% in 1990 remaining near that level in recent years. On average, recreational landings have comprised 27% of the total landings (1981-96).

Commercial landings from the GOM stock fluctuated around 1,000 mt from 1964-75. Landings rapidly increased to a peak of 2,703 mt in 1982 and then declined to a time series low of 534 mt in 1994. Landings have increased slightly in recent years, 695 mt in 1995 and 698 mt in 1996. Landings in 1997 are projected to decrease to 493 mt, a record low.

Recreational landings from the GOM fluctuated around 2,000 mt during the early 1980's before declining to under 100 mt in 1991. Recreational landings have remained below 100 mt in recent years. On average, recreational landings have comprised 40% (range 25-60%) of the total catch from 1979-90. The percent total contribution of recreational landings to total landings dropped to 9% in 1991 and has remained near that level through 1996 (range 5-13%).

Table 1. Commercial landings (in pounds) of winter flounder by state, 1960-99 (source: NMFS commercial landings data).

Year	MA	RI	NY	NJ	DE	MD	VA	NC	SC	GA	FLEC	Total
1960												
1961												
1962												
1963												
1964												
1965												
1966												
1967												
1968												
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1970												
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1996												
1997												
1998												
1999												

Table 2. Winter flounder recreational landings (numbers A + B1 fish) by state, 1981-99 (source: pers. comm. NMFS Fish. Stats. & Econ. Div.).

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD		Total
1981	69384	108401	5643405	217046	655366	5979492	1012734				13685828
1982	4417	41556	8528921	661889	1044875	2547633	2660632				
1983	161613	82915	3037573	530708	627722	4943476	1033979		7030	1228	
1984	8461	121457	2511406	462369	1168713	7384229	3069974				
1985	5434	32350	3430239	1399691	1037205	5769112	4627836		437	3998	
1986	80654	43791	897857	2044417	584858	3462414	578324				
1987	2432	21265	2488639	553724	822565	4981483	338367			39236	
1988	296732	29577	1031807	345050	659841	4832592	992788	1544		5732	
1989	314373	29797	2018144	219416	537817	1890647	466351			724	
1990	472178	11496	289647	200908	417930	1262123	482475	2009			
1991	39731	183	161314	101281	339013	1705245	615040				
1992	25320	16605	145907	8097	123382	490535	136228				
1993	71477	17849	262131	13431	73643	629046	1059030			808	
1994	4221	22847	176420	28721	68343	331124	714793	389		731	
1995	290	8952	109908	21230	175642	641603	512124				
1996	391	7941	103124	48132	89263	604764	822739				
1997	26820	10569	73108	55383	163081	397191	536410		7668	619	
1998	1032	28959	96981	38260	235182	78167	169094	125			
1999		10895	60353	73786	67311	135668	375618				

Table 3. Winter flounder recreational landings (pounds A + B1 fish) by state, 1981-99 (source: pers. comm. NMFS Fish. Stats. & Econ. Div.).

Year	MA	NJ	DE	MD	VA	NC	SC	GA	FLEC	Total
1981										
1982										
1983										
1984										
1985										
1986										
1987										
1988										
1989										
1990										
1991										
1992										
1993										
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1996										
1997										
1998										
1999										

IV. Status of Assessment Advice

Assessments for both the SNE/MA and Gulf of Maine winter flounder stocks were last reviewed by the SARC in 1995 (SAW 21). The most recent assessment of the stocks occurred in January 1998 and the results are included in Section III. A surplus production model was used to assess both stocks and provide preliminary biomass-based reference points. Although a VPA could not be performed for the SNE/MA stock in January 1998, efforts continue to update the VPA for SAW 28 (December 1998). Possible sources of uncertainty in the assessment include area of capture data in recent years (1994-96), geographic differences in age and growth, aging methodology, effects of recent management measures, incomplete biological sampling in 1995-96, unvalidated commercial discard data, low recreational sampling levels, lack of age samples from recreational fishery and out of date maturity data.

V. Status of Research and Monitoring

Several states (MA, RI, CT, NY, NJ, DE) and NMFS conduct trawl surveys in which winter flounder are taken. Indices of abundance and estimates of fishing rate are produced from most surveys. Separate young-of-the-year surveys in several states provide early indices of recruitment within each management area. Fishery dependent indices of stock condition are also available from MRFSS and commercial sampling / statistics programs.

VI. Status of Management Measures and Issues

The FMP calls for harvest control strategies which will achieve the target management reference point (F_{40}) in three steps. All states were initially required to have implemented measures to achieve F_{25} and achieve this goal one year after adoption of the Plan.
By January 1, 1995 measures to achieve F_{30} were in place, and by January 1, 1999, the plan required that F_{40} be achieved. All states currently have plans that were approved by the Winter Flounder Management Board in 1995, however, changes in the most recent stock assessment (1995) concluded that none of the states were achieving a fishing mortality rate corresponding to F_{30} at that time. Subsequent analyses in early January 1997, including a preliminary projection analysis, indicated that fishing mortality on a coastwide basis was slightly higher than the F_{30} target for the Southern New England - Mid-Atlantic stock complex. Fishing mortality in the GOM was presumed to be higher and the spawning stock biomass was at a low level, indicating that the GOM unit may be in greater need of rebuilding than the SNE/MA unit.

The New England Fishery Management Council's Amendment 5 of the Groundfish Plan included winter flounder and required a 12" minimum size and 5.5" (S. of Cape Cod) or 6" (GOM) mesh for directed groundfish trips. Vessels fishing with smaller mesh in the regulated mesh areas while in an exempted small mesh area were limited to 10% groundfish species, by weight, up to a maximum of 500 lbs. The Plan also called for a 50% reduction in fishing effort in 10% increments over five years. Effort reduction under the Groundfish Plan was initiated in May 1994. At the end of 1994, the Council passed emergency regulations that closed prime fishing areas on Georges Bank (Areas I & II), Nantucket Shoals (Nantucket Lightship) and addressed redirection of effort into the GOM and SNE. At the same time, development of Amendment 7 started. Amendment 7 extended days at sea controls and required that any fishing by an EEZ-permitted vessel be conducted with not less than 6" mesh (diamond or square) in SNE waters east of 72° 30'.

VII. Current State-by-State Implementation of FMP Compliance Requirements as of August 1, 1997

By January 1, 1995, the states of ME, NH, MA, RI, CT, NY, NJ, PA, and DE were required to: 1) report to ASMFC concerning habitat protection efforts with other in-state agencies; and 2) implement an approved plan to achieve a minimum 30% MSP. Since Pennsylvania does not have a winter flounder fishery, they were not included in the following table of fishery restrictions. Habitat protection measures however, were required of all states including Pennsylvania.

By July 1, 1997, the above mentioned states excluding Pennsylvania, were required to submit a plan to achieve a minimum 40% MSP. Addendum 2 to the FMP (approved in February 1998) revised this date to August 1, 1998 and changed the implementation date to May 1, 1999.

VIII. Recommendations of FMP Review Team

<u>Regulatory Recommendations</u>
The New England Fishery Management Council should continue to monitor the effectiveness of

management strategies to reduce winter flounder exploitation in federal waters. States should revise plans to meet new reference points as described in the next stock assessment.

Amendments

No amendments to the current plan are in development. Addendum 2 was approved on February 3, 1998 and revised the implementation schedule laid out in Addendum 1.

Research and Monitoring Recommendations

Coastwide

Focus research on quantifying mortality associated with habitat loss and alteration, contamination by toxics and power plant entrainment and impingement.

Research studies should be designed to provide reliable estimates of anthropogenic mortality from sources other than fishing. Both mortality sources should then be incorporated into fisheries yield/recruit models to simultaneously evaluate these dual mortality factors.

Conduct studies of flounder populations in impacted areas to fully quantify physiological adaptation to habitat alteration, and interactive effects, on an individual and population level.

Update or conduct regional maturity studies. This may require a workshop to ensure the use of standardized criteria among regional studies.

Process archived age samples from surveys and commercial landings. Processing pre-1985 samples will allow the extension of the SARC 21 VPA back in time and will eliminate the need for MADMF and RIDFW to use pooled-age keys for the 1978-89 period. Processing NEFSC survey samples for the GOM stock will provide another source of information on recruitment and mortality for comparison with the MADMF survey.

Improve sampling of commercial landings of winter flounder.

Expand sea sampling in order to validate commercial discard estimates from Vessel Trip Reports.

Maintain or increase sampling levels and collect age information from MRFSS samples.

Landings data should be collected in a manner that allows dis-aggregation of total landings into state landings by fishing zone.

Biological sampling of catches via sea and port sampling should be improved within state waters and the EEZ.

Conduct mesh selectivity studies using a range of mesh sizes equal to and greater than 5.5 inches (square and diamond).

Conduct evaluation studies on selectivity devices such as a raised foot-rope trawl to reduce bycatch of winter flounder.

Southern New England - Mid-Atlantic Stock Complex

Maintain or increase sampling levels and collect age information from MRFSS samples.

Expand sea sampling for estimation of commercial discards.

Develop a geographically more comprehensive data set to calculate maturity at age, reflecting any differential availability of mature fish to inshore and offshore surveys.

Include years prior to 1985 and after 1993 in the catch at age analysis.

Evaluate size-selectivity performance of survey gear compared to typical commercial gear, and implications for estimation of commercial discards from research survey length frequency information.

Consider effects of catch-and-release components of recreational fishery on discard at age.

Examine other biological reference points and rebuilding strategies in projection models.

Evaluate effects of smoothed length-frequency distributions on the relationship between survey and commercial catches at length.

Evaluate the feasibility of virtual population analysis based only on ages fully recruited to landings (i.e. no discards).

Examine the implications of stock mixing from data from the Great South Channel region.

Gulf of Maine Stock

Process archived age samples from NEFSC surveys and commercial landings, and develop an analytical age based assessment.

Examine growth variations within the Gulf of Maine, using results from the Gulf of Maine Biological Sampling Survey (1993-94).

Further examine the stock boundaries to determine if Bay of Fundy winter flounder should be included in the Gulf of Maine stock complex.

Update age-based biological reference points or define new biomass-based reference points.

Table 4. Current state regulations for winter flounder as of February 1998.

Commercial			
State	Minimum Size Limit	Cod-end Mesh	Closed Areas and/or Seasons
ME	12"	6.0"	
NH	12"	6.0" (to take, transport or posses winter flounder or other groundfish)	No mobile gear allowed in state waters
MA[1]	12"	6.0" square or diamond; 100 lb limit for all flounder species for mesh < 6.0";	Year round night closure to mobile gear; Gulf of Maine spawning closure and inshore net areas closed to all gear from: 2/1 - 5/31; Year round prohibition of commercial netting in inshore net area and Buzzards Bay; Year round prohibition of commercial harvest of winter flounder in Mount Hope Bay; at least 12 other seasonal/area/gear closures
RI	12"	6.0" (except fyke nets)	Open 3/1 in CMLMA[2] until 1/2 quota (89,000 lbs. in 1997) is reached; reopens 10/1 to 11/15, or until quota is met; 100 - 300 lb. trip limit in CMLMA
CT	12"	4.5" from 7/1-11/14; 5.5" from 11/15-6/30 (diamond mesh)	Closed: 3/1 - 4/14; 100 lb limit for small-mesh (≤5.5") regulated fisheries
NY	12"	5.5" (diamond) 6.0" (square) 100 lb. mesh trigger	Fyke nets closed: 3/23-9/30; Pound/trap nets: 6/15-7/25; All other comm. gear closed: 6/14-11/30
NJ	12"	5.0"	Trawling prohibited < 2 miles; Fyke nets closed: 2/20-9/30; All other comm. gear closed: 6/1-11/30
DE	10"	None	Trawling prohibited

[1] Massachusetts also has a maximum vessel size limit of 72 feet length overall.
[2] Coastal Marine Life Management Area - Narragansett Bay, coastal salt ponds, and Little Narragansett Bay; quota varies yearly and was proposed to be 53,900 for 1998.

Table 4. State regulations for winter flounder as of February 1998 (cont.).

Recreational				
State	Minimum Size Limit	Bag Limit	Closed Areas and/or Seasons	Last Update
ME	12"	None	None	3/2/98
NH	12"	None	None	2/12/98
MA	12"	10; 4 in Mt. Hope Bay during open season	Closed: 3/1 - 4/30; Mt. Hope Bay only: closed 5/20 - 9/27 and 10/29 - 4/12	3/3/98
RI	12"	4 [3]	Open: 4/12/98 to 5/18/98; and 9/27/98 to 10/27/98	3/6/98
CT	12"	8	None	3/6/98
NY [4]	11"	15	All state waters closed from 7/1 to 9/14 and from 12/1 to 3rd Saturday in March	2/12/98
NJ	10"	None	Closed: Jan 1 - Feb 28 and June 1 - Sep 14	2/26/98
DE	10"	None	None	2/27/98

[3] Unlawful to sell recreational catch.

[4] Winter flounder may not at any time be taken for commercial purposes aboard party and charter vessels.

Table 5. Numbers of recreational releases (B2 fish) of Atlantic croaker by state, 1981-99 (source: pers. comm. NMFS, Fish. Stats. and Econ. Div.).

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	Total
1981	2276	69959	826176	39526	108488	2539397	187756				
1982		7468	1011549	53039	177780	640546	1206227				
1983	912	17445	408148	156544	148770	1680369	468296				
1984	719	20810	251653	151767	156808	3780800	795762		1335		
1985	4887		598305	200803	244579	2539456	1670782			701	
1986	2844	3916	321363	660518	62027	1412179	128936				
1987		3192	776258	152791	159090	1807054	77190	268		45731	
1988		2744	277963	110222	178173	1755862	597447				
1989	131352	10483	334932	72037	166502	1790974	70451		4455	9426	
1990	75318	2595	116602	74952	154317	680449	386341		2450		
1991		4041	80664	37381	85140	835673	556729	273			
1992		1249	59890	11400	21463	222239	281513				
1993	47056	5227	135422	11352	13824	727803	513787				
1994	1965	6251	136855	14518	25381	333203	433484	332			
1995		5924	96465	28434	26297	422273	273318	1295			
1996		4272	113883	16561	15992	847125	238319			596	
1997		10866	158581	32801	22925	206117	370478	260	20682		
1998		11662	57052	17119	85199	104065	193406	147			
1999	943	5670	46097	32200	24810	151850	190971			3469	