2006 年の IQ 制導入に伴う日本のミナミマグロ延縄操業パターンの 2007 年の変化

Change in operation pattern of Japanese SBT longliners in 2007 resulting from the introduction of the individual quota system in 2006.

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要約

日本延縄船によるミナミマグロの漁獲データは、CCSBT におけるミナミマグロの資源評価において最も重要なものである。2006 年に日本はえ縄の国内漁業管理制度が変更されたことに対して、その操業パターンの変化を調べた。2007 年には、2001-2005 年平均値に対して隻数 60%、使用鈎数 52%、ミナミマグロ漁獲尾数 50%に減少した。漁期の撤廃によって新たに操業データが得られた月・海区もあるが、一つの 5x5 度月区画の操業回数は 39.9%と大きく減少した。ミナミマグロの体長組成は以前と大きく異なった。2007 年に見られた違いは、漁業管理制度の変更に伴うだけでなくミナミマグロ資源の年齢構成や他の社会学的要因によっても複雑に影響を受けたと考えられ、また顕在化していない違いが生じているかもしれない。複雑な要素を全て解明しようとするよりは、むしろ、延縄操業から得られる情報の不確実性を認識し、小規模な延縄操業に見合った資源評価への役立て方を考えるべきだろう。

Summary

The Japanese longline data is the most important scientific data for the stock assessment of southern bluefin tuna (SBT) in the CCSBT. Changes in operation pattern of Japanese SBT longliners in 2007 resulting the enforce of the individual quota system in 2006 were investigated. In 2007, the numbers decreased to 60% in vessel number, 52% in hooks used and 50% in SBT caught comparing to the average of 2001-2005. Due to the lift of the seasonal area closure, there were some area and month newly operated in these years, but the number of operations per 5x5 degree square in a month decreased largely to 39.9%. Size of SBT caught in 2007 were changed largely from those in 2001-2005. Changes observed in 2007 is considered to be the results not only by the change of fishery regulation system but also by the changes of age composition of SBT stock and complex socio-economical factors. There might be any changes which could not be detected. It is more practical way to use the Japanese longline data for the stock assessment by taking into account of its small scale operations of Japanese longliners and of its uncertainty which will be unsolvable in the near future, rather than try to understand quite a complex factors completely.

Introduction

日本延縄船によるミナミマグロの漁獲データは、CCSBT におけるミナミマグロの資源評価に

おいて最も重要なものである。日本水産庁は 2006 年にミナミマグロ延縄漁業への管理方法を変更した。すなわち、個別漁獲枠を導入し、また時期による漁場制限を撤廃した。このような漁業の管理措置の変更が操業パターンにどのような影響を及ぼすのかは、注意深くモニターしなくてはならない。我々はモニタリングを継続しており、これまで分析結果を、2006 年 9 月の第 11 回 CCSBT 拡大科学委員会、2007 年 5 月に実施された第 2 回 CPUE ワークショップ、2007 年 9 月の第 12 回 CCSBT 拡大科学委員会に提出してきた（CCSBT-ESC/0609/44, CCSBT-CPUE/0705/05, CCSBT-ESC/0709/39）。本文書は、それらに引き続いて、2007 年末までの日本延縄船の操業パターンを分析するものである。

The Japanese longline data is the most important scientific data for the stock assessment of southern bluefin tuna (SBT) in the CCSBT. Fisheries Agency of Japan changed the regulation rule for Japanese longliners for SBT in 2006; the individual quota (IQ) system has enforced and seasonal area closure was stopped. Any changes on their operational pattern caused by changing of the regulation rules for the fishery are needed to be monitored carefully. We have kept the monitoring and results of the analyses have already been reported in the 11th CCSBT Extended Scientific Committee in 2006, the CPUE Workshop held in May 2007, and the 12th CCSBT Extended Scientific Committee in 2007 (CCSBT-ESC/0609/44, CCSBT-CPUE/0705/05, CCSBT-ESC/0709/39). This paper succeeds those papers and up dated using the data up to the end of 2007.

Material and method

2007 年の RTMP データを用いた。比較のため、漁業管理が変更される前の 5 年間（2001-2005 年）ならびに変更後の 2006 年の RTMP データも解析した。ある月の緯度 5 度、経度 5 度区画をセルと称し、解析の単位とした。

The RTMP data in 2007 were used. RTMP data in 2001-2005, five years data before the regulation rule changed, and RTMP data in 2006 after the rule changed were also used. Five degree longitude, five degree latitude in a month is defined as one “cell”.

Result

1. 2007 年の漁獲、努力量、サイズの概要　Summary of the catch, effort and size in 2007

図 1 に、CCSBT 統計海区 4-9 海区における、2001 年からの毎年の隻数、使用鈎数、ミナミマグロ漁獲尾数を、2001-2005 年の平均値に対する相対値で示す。値は 2006 年に急減し、2007 年には 60%（隻数）、52%（釣鈎数）、50%（ミナミマグロ尾数）にまで減少した。隻数の減少はやや緩やかで、船別の操業回数や漁獲尾数が減少したこととなる。

図 2 に、統計海区別の隻数、使用鈎数、ミナミマグロ漁獲尾数の内訳を示す。2001 年から 2006 年までには、9 海区の割合が増加し、4 海区、7 海区の割合が低下してきた。2007 年には、2006

年よりも 8 海区の割合が増加し、7 海区の割合もわずかに増加した。その分、9 海区の割合が減少した。

図 3 にミナミマグロの体長組成を示す。2007 年の体長組成は 2006 年のものと同様だが、それ以前とは異なっている。

Figure 1 shows relative values of the numbers of vessels, hooks used and SBT caught to the mean values in 2001-2005 in the CCSBT statistical area (Area) between 4 and 9. These values decreased in 2006. In 2007, these further decreased to 60% in vessel number, 52% in hooks used and 50% in SBT caught. The decrease of the number of vessels was moderate than those of hooks used and SBT caught.

Figure 2 shows the numbers of vessels, hooks used and SBT caught by Area. From 2001 to 2006, proportions in Area 9 had been increased and those in Area 4 and Area 7 had been decreased. In 2007, proportions in Area 8 was increased, that in Area 7 was slightly increased and that in Area 9 was decreased compare to 2006.

Figure 3 shows fork length frequency of SBT. That in 2007 was similar to in 2006, but was different to the previous years.

2. 操業時空間の変化 Changes of the time and space operated

図 4 に、4-9 海区内の操業のあったセル（5x5 度・月）の数の変化を示す。2007 年の合計セル数は、2001-2005 年よりも多いが、2006 年よりは少ない。2001-2005 年と比較してセル数が変化したのは、9 海区で増加したことであるが、増加は 2004 年から継続している。

表 1 に、年、月、海区別のセル数を示す。表 2 には、その操業回数を示す。2001-2005 年に比較して 2007 年に新たに操業が行われた、または増加したのは（操業回数>10 かつセル数>1）、5 海区 7-9 月、6 海区 4-6 月、8 海区 7-8 月、9 海区 4 月と 9-10 月であった。これらの多くは 2006 年にも操業が行われていた。5,6 海区はニュージーランドとのジョイントベンチャーで操業が行われていることを考えると新たなものではないかもしれない。これらから、2007 年に特有であったのは 9 海区 4 月である。

図 5 に、1 セル当たりの操業回数を示す。総漁獲枠が半減し、セル数は増加したことから、1 セル当たりの操業回数は 2001-2005 年平均値の 39.9%と大きく減少した。

Figure 4 shows the change of the number of cell in Area 4-9. The total number of cell in 2007 was larger than in 2001-2005, but smaller than in 2006. The change was increased in Area 9, but it has been increasing since 2004.

Table 1 shows the number of cell by year, month and Area. Table 2 shows the number of operations. In 2007, comparing to 2001-2005, Area/month that newly operated or cell increased (number of operation > 10 and the number of cell > 1) were Area 5 in July-September, Area 6 in April-June, Area 8 in July-August and Area 9 in April and

September-October. Most of these were operated in 2006. Area 5 and Area 6 in the season may not new one by taking into consideration of joint venture vessels in New Zealand. Therefore, Area 9 in April is the new one operated in these several years.

Figure 5 shows the number of operations per cell. Because the allocation of TAC to Japan was reduced by half and the number of cell operated was increased, the number of operations per cell was decreased to 39.9% of the mean of 2001-2005.

3. 船の一貫性 Vessel consistency

表 3 に、2007 年の RTMP 参加船（かつミナミマグロを漁獲した船）が 2001-2005 年とどれほど共通しているかを示す。2007 年の 133 隻中、132 隻は 2001-2005 年に RTMP においてミナミマグロ操業を実施したことがあり、4 年または 5 年間実施した船が 96 隻（72%）と大きな割合を占めた。2006 年と 2007 年では 117 隻が共通していた。

Table 3 shows the consistency of the vessels that participated the RTMP in 2007 (and caught any SBT) with those in 2001-2005. Among 133 vessels in 2007, 132 vessels have caught SBT in 2001-2005 RTMP and most of them (96 vessels, 72%) have caught SBT in four or five years. 117 vessels were same between 2006 and 2007.

Discussion

IQ 制導入以前の 2001-2005 年と比較して、2007 年には操業時空間（セル数）が増加し、隻数、合計操業回数、ミナミマグロ漁獲尾数、1 セル当たりの操業回数が大きく減少した。操業海区の内訳や魚のサイズも大きく変化していた。船は共通したものがほとんどで、操業のあった時空間も多くの場合では 2001-2005 年と共通していた。

これらの変化に対して原因を考えてみると、まず、新たな操業セルが生じた主な原因は漁期が撤廃されたからであろう。隻数、操業回数、ミナミマグロ漁獲尾数の減少は、総漁獲枠の半減によるところが大きい。海区内訳の変化、特に 4 海区、7 海区の割合の減少に続く増加は、ミナミマグロ資源の年齢構成の変化（低レベルの加入魚とその後の回復）を反映したものだろう。

反対に、様々な要素の観点から、生じた可能性のある現象を考えてみる。ミナミマグロ資源の年齢構成の変化（小型魚の増加）が、小型魚が主体の海区、時期（4 海区、7 海区、8 海区の 8 月）への操業の増加をもたらしたと考えられ、また新たな操業セルが生じたこととも関連していよう。漁獲枠の減少は、隻数、操業回数、ミナミマグロ漁獲尾数の減少をもたらした。これらの変化は漁獲データの解析でも容易に検出できる。

しかし他の要素から想定される変化は特段認められなかった。例えば、操業隻数の減少、特に漁期の撤廃によって操業可能な時期範囲が広がったことに伴う同一時期に操業する隻数の減少は、船間の情報交換による好漁場の探索能力を低下させたと考えられる。また、近年の燃油高騰は、漁場の探索能力をさらに弱めたと思われる。しかし変化が認められなかったのは、そのような変化がないのか、それとも漁業データからは検出ができないだけなのか、判断できない。

IQ 制の導入による影響についても、その評価は困難である。ある船は限定された IQ の範囲で、漁獲するミナミマグロの価値を最大限にするために大型魚のみを狙って操業したかもしれない。別の船は、小型魚であっても可能な限り短期間にミナミマグロの IQ を消化し、メバチやキハダ操業にすばやく切り替える戦略を選択したかもしれない。

延縄漁船の行動を全て詳細に理解するためには、ミナミマグロのみならず、メバチやキハダの資源状況、海洋環境も正確に理解する必要があるが、それ以外の要素、例えば各魚種の現在の価格、将来の予測価格、燃料費やエサ代、人件費、流通システムの特性といった社会学的、人為的な要素も理解する必要がある。しかしそのような複雑な過程を全て解明するのは著しく困難なことである。むしろ、延縄操業から得られる情報の不確実性を認識し、小規模な延縄操業に見合った資源評価への役立て方をすべきであり、必要であれば他の調査を実施するほうが現実的であろう。

Comparing to 2001-2005 before the IQ system was enforced, the number of time and space operated (cell) was increased, and the number of vessels, operations in total, SBT caught and operation per cell decreased largely in 2007. Composition of the number of operations by Area and size of SBT caught were changed largely in 2007. Most of the vessels engaged, as well as most of the time and space operated, were same in 2007 to 2001-2005.

Causes of these changes would be as follows. Occurrence of the new time-and-space operated in these years is due to the lift of the seasonal area closure. Decreases of the numbers of vessels, total operation and total SBT caught would be due to reduction of TAC allocation for Japan by half in the large part. Changes in the composition of the number of operations by Area, especially decrease followed by increase in 2007 in Area 4 and Area 7, would be due to the change of age composition of SBT stock (low recruitment year classes and recovery thereafter).

Look at from the opposite point of view, phenomena which may be caused by any factors are considered. The change of the age composition of SBT (increase of small size fish) had made the number of operations increased in Area and month in which small size SBT were caught mainly (Area 4, Area 7, Area 8 in August), and had made the occurrence of new cells in these several years. Reduction of TAC allocation by half had made the decrease of the numbers of vessels, operations and SBT caught. These are changes which are able to detect easily by analysis of fishery data.

However, other changes which may be occurred by other factors were not observed. For example, the decrease of the number of vessels operated in an area simultaneously may reduce the ability to find a good fishing area by exchange their information among vessels. Expansion of the range of the fishing season by the lift of the seasonal area closure would have made the number of vessels operated in an area simultaneously decreased and enhance this. Drastic increase of fuel price in recent years would have weakened the power of search for good fishing area. We cannot interpret the reason of

no changes observed whether there was no change or we cannot detect such a change from the fishing data.

Evaluation of influences by enforcing the IQ system, is difficult. Some vessels might operated targeting for large size SBT in order to maximize their economic gain in their limited IQ. But, there might be another type of vessels in different strategy that operated targeting for any size SBT including small size and consume their IQ as soon as possible in order to move for other areas and operate for bigeye and yellowfin tunas.

If we need to understand the behaviors of longline vessels completely, we need to understand the stock status of not only SBT but also bigeye and yellowfin tunas and oceanic environment accurately and precisely. In addition, we also need to understand other socio-economical factors , such as market prices of various species at present and future, costs for fuel, bait and labors, and characteristics of market and distribution systems. But, complete understanding of such a complex process is quite difficult and impracticable. Rather, it is reasonable that seeking a way using for the stock assessment by taking into account of its small scale operations of Japanese longliners and of its uncertainty which will be unsolvable in the near future. It is also a practical way to seek for other fishery data or researches which will be useful for stock assessment.

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Table 1. Number of 5x5 degree square where longline operations conducted by year, month and area

		Year						
Area	Month	2001	2002	2003	2004	2005	2006	2007
4	4			1	2	2		2
	5	2	2	3	2	2	2	3
	6	4	3	4	5	5	3	5
	7	4	6	4	6	6	4	6
	8				3	1	1	1
	10			4				1
	11			4				
	12			4				
5	7				1	1	2	2
	8						3	3
	9							2
6	4							2
	5	1						2
	6	2					1	1
	7	1						
7	4	9	5	6	2	2		2
	5	6	6	2	2	2	3	2
	6	4	3	2	2	2	2	2
	7	4	6	1			1	
	9	2		2			2	
	10	2	3	1	1			1
	11	2	3		1			1
8	5			1	3	5	1	
	6				4	5		
	7						5	8
	8						8	8
	9	11	12	11	13	5	7	6
	10	10	13	13	9	7	8	8
	11	10	13	9	9	8	8	7
	12			7	8	4	7	6
9	4							5
	5	14	17	14	19	25	21	16
	6	20	14	17	23	20	18	18
	7	17	11	15	19	19	21	16
	8	9			12	13	15	8
	9						11	5
	10						7	4
	11						4	2

Shadow denotes the value in 2006 or 2007 of which much larger than that in 2005.

Table 2. Number of operations by year, month and area

Area	Month	Year 2001	2002	2003	2004	2005	2006	2007
4	4			2	23	13		39
	5	87	56	347	447	731	530	55
	6	559	1017	1015	1179	1122	457	324
	7	509	807	911	1110	732	115	75
	8				10	1	3	2
	10			96				2
	11			120				
	12			47				
5	7				2	6	11	22
	8						27	34
	9							17
6	4							13
	5	11						31
	6	13					1	22
	7	1						
7	4	905	842	648	530	603		27
	5	1741	1731	1032	646	397	180	352
	6	1058	588	254	2	3	66	92
	7	145	44	1			46	
	9	71		47			6	
	10	85	369	1	6			1
	11	7	183		13			2
8	5			1	411	651	12	
	6				104	13		
	7						76	103
	8						407	773
	9	1305	1335	961	489	551	270	630
	10	1332	755	842	589	687	343	379
	11	1260	321	825	904	821	518	750
	12			316	618	488	259	115
9	4							66
	5	2384	2314	2564	2383	1897	905	160
	6	2508	2362	2672	2826	2537	1163	575
	7	1944	325	586	2832	2802	1513	683
	8	49			522	1261	1738	755
	9						1033	623
	10						262	183
	11						24	5

Shadow denotes the value in 2006 or 2007 of which much larger than that in 2005.

Table 4. Number of vessels that caught SBT in RTMP of 2006 and 2007 by the number of years participated in RTMP in past years (2001–2005)

Number of years participate in the RTMP during 2001–2005	Vessels in 2006 RTMP	Vessels in 2007 RTMP
0 years	5	1
1 years	7	10
2 years	15	16
3 years	9	10
4 years	20	22
5 years	67	74
Total	123	133

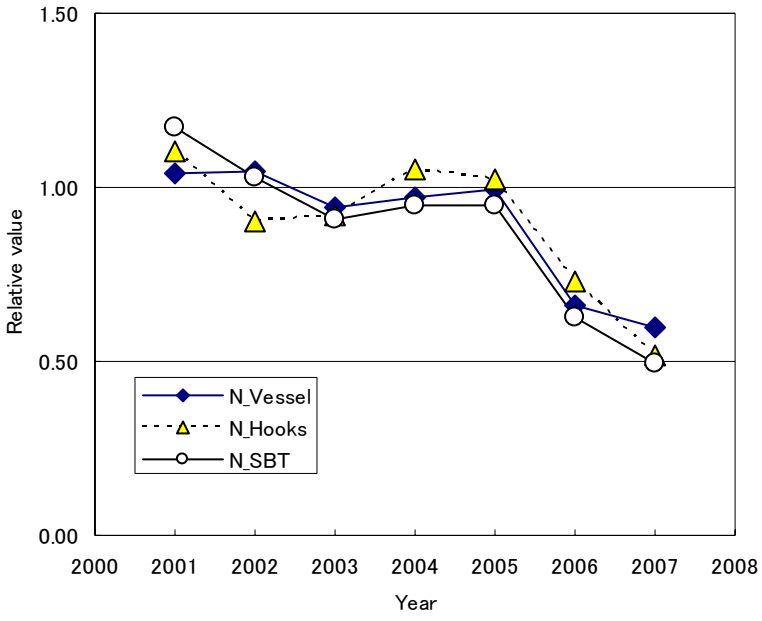

Fig.1. Changes of the number of operation, the number of vessels and the number of SBT caught during 2001 to 2007. Y axis is the relative value to the average of 2001-2005.

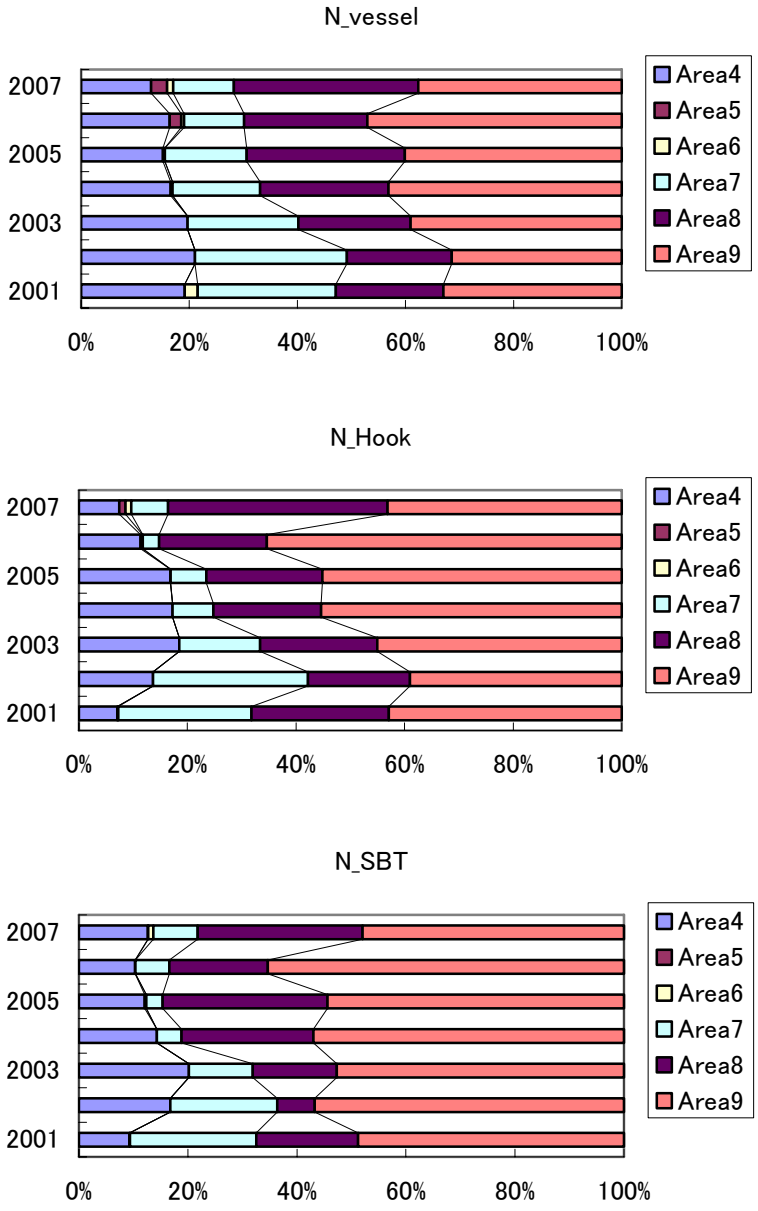

Fig.2. Proportions by Area for the number of vessels, the number of hooks used and the number of SBT caught during 2001 to 2007.

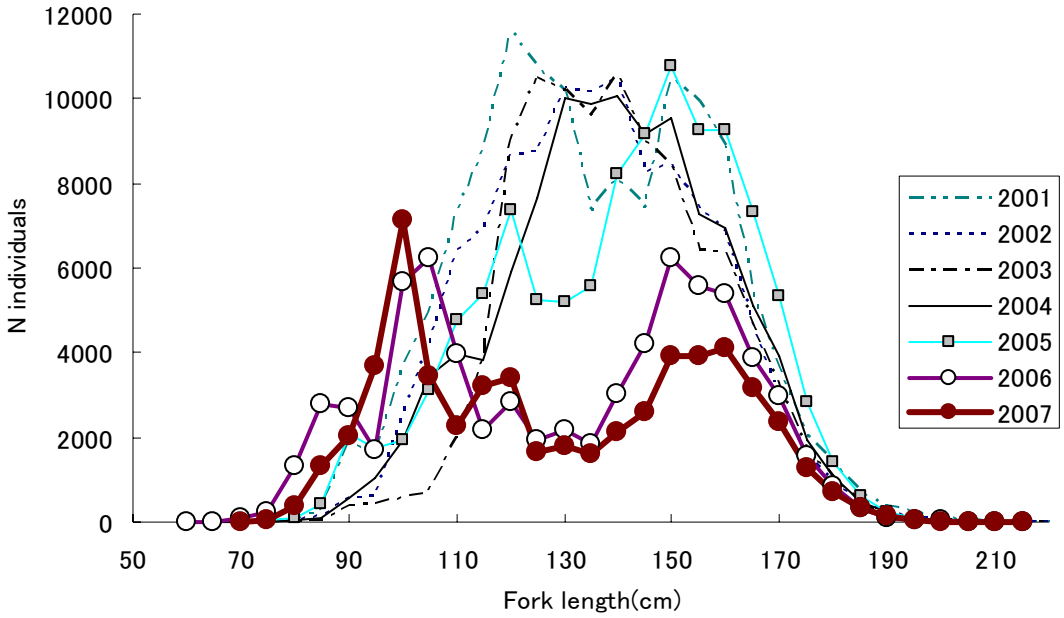

Fig.3. Length frequency distributions of SBT by year during 2001-2007 (all Areas).

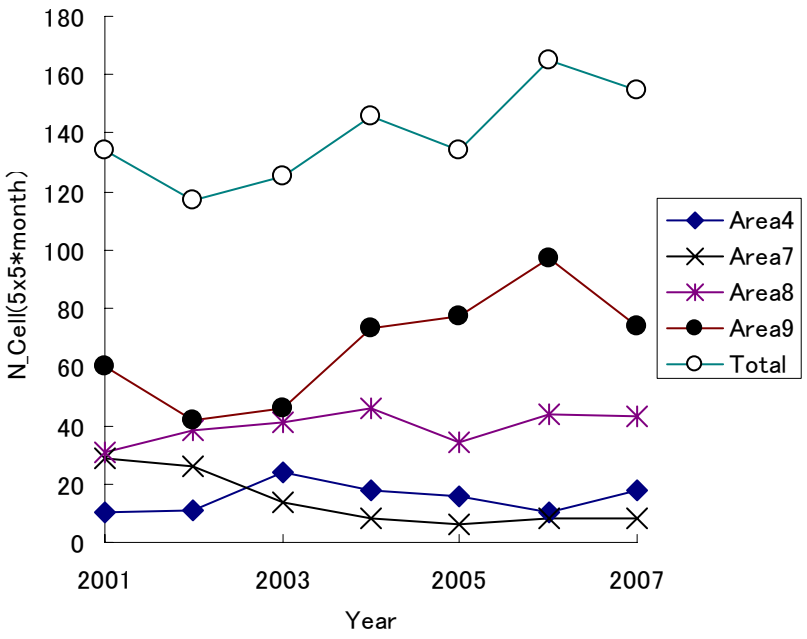

Fig.4. Changes of the number of cells (5 degrees latitude and longitude and month) during 2001-2007 in Area 4-9.

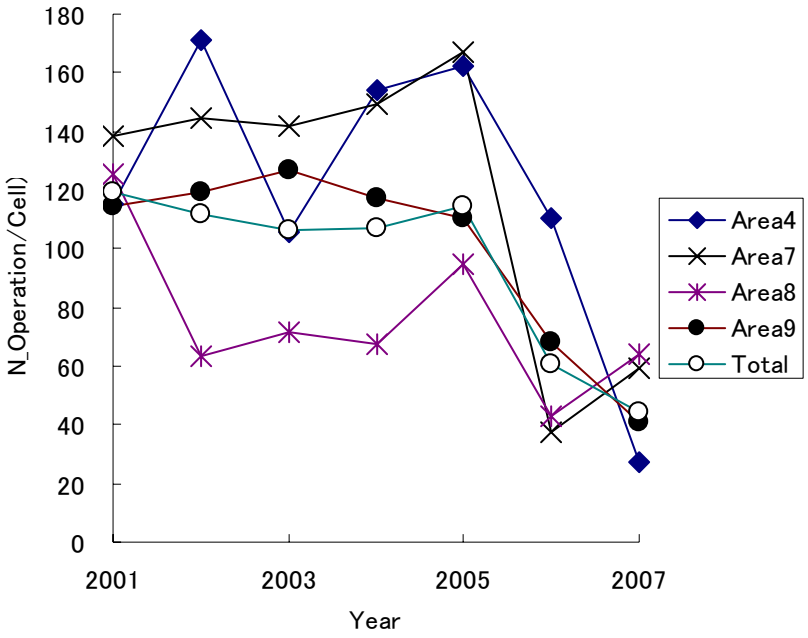

Fig.5. Changes of the number of operations per cell during 2001-2007 in Area 4-9