Effects of Traffic Control on Visitor Congestion in the Oze Area of Nikko National Park

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The Oze area of Nikko National Park is one of the most popular places in Japan. Many hikers visit the area during the beautiful flowering periods of Mizubasho (*Lysichiton camtshatense*), Nikko-kisuge (*Hemerocallis middendorffii*) and autumn leaves, particularly on weekends. The Ministry of Environment and related local administrations promoted the traffic control and the decentralization of visitors.

This study aims to find the effects of these efforts on the distribution of visitors.

Firstly, we analyzed the differences by the day of the week at each entrance of the area by using regression analysis over the last fifteen years. The results clearly showed the decentralization of visitors on weekdays, and the obvious ease of congestion in the northern entrances of the Oze area (Fukushima prefecture).

Next, we used multiple regression equation analysis to find the effective factors which influenced the fluctuation of visitors. We used the year, month and day of the week for the sociological factors, the weather conditions, flowering periods and autumn leaves for the natural factors and the first day, the most intensively controlled day and the last day of the controlled period for the traffic control factors. The number of visitors increased dramatically during the flowering period of Mizubasho and on weekends, while a slight increase was recorded on sunny days.

The simultaneous traffic control of sightseeing buses and private cars affected the decentralization of visitors more than the control of private cars only.

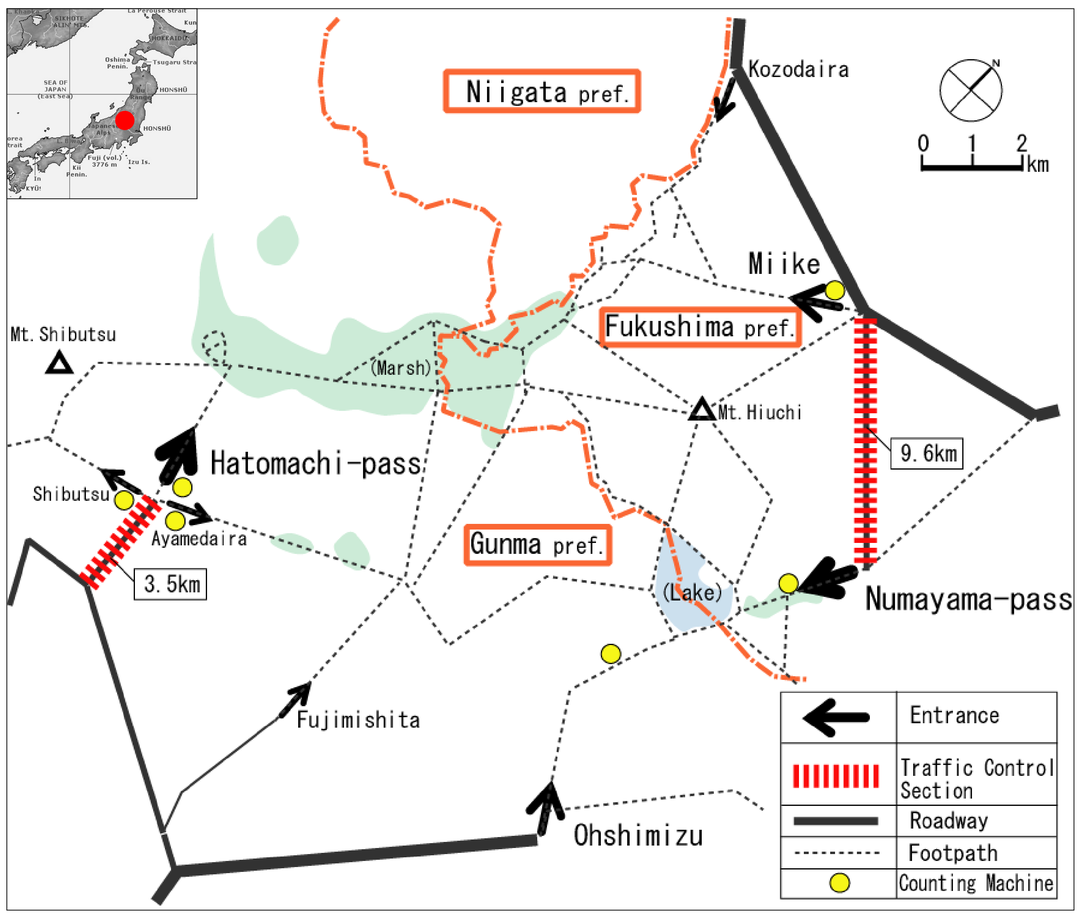

Fig.1 Map of Oze area

Fig.2 Sight-seeing buses at Hatomachi-pass parking area

Fig.3 Visitor congestion at Oze marsh

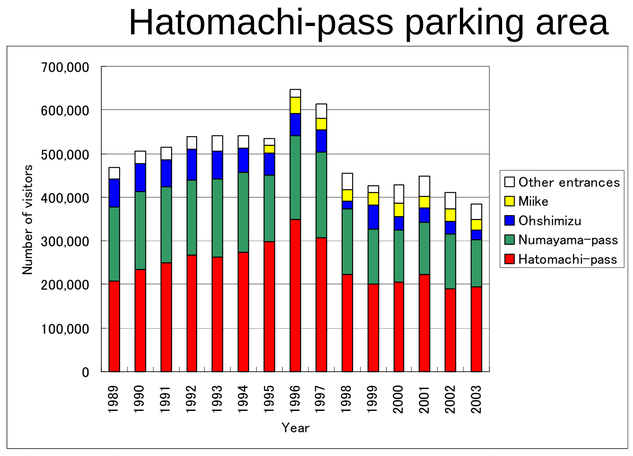

Fig.4 Change in the number of visitors (1989-2003)

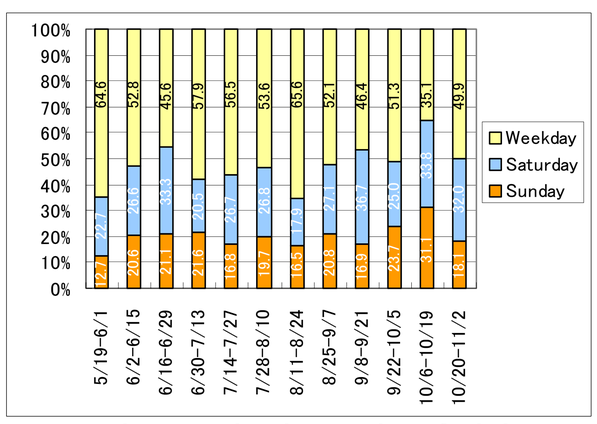

Fig.5 Change in the ratio of visitors: Day of the week (2001)

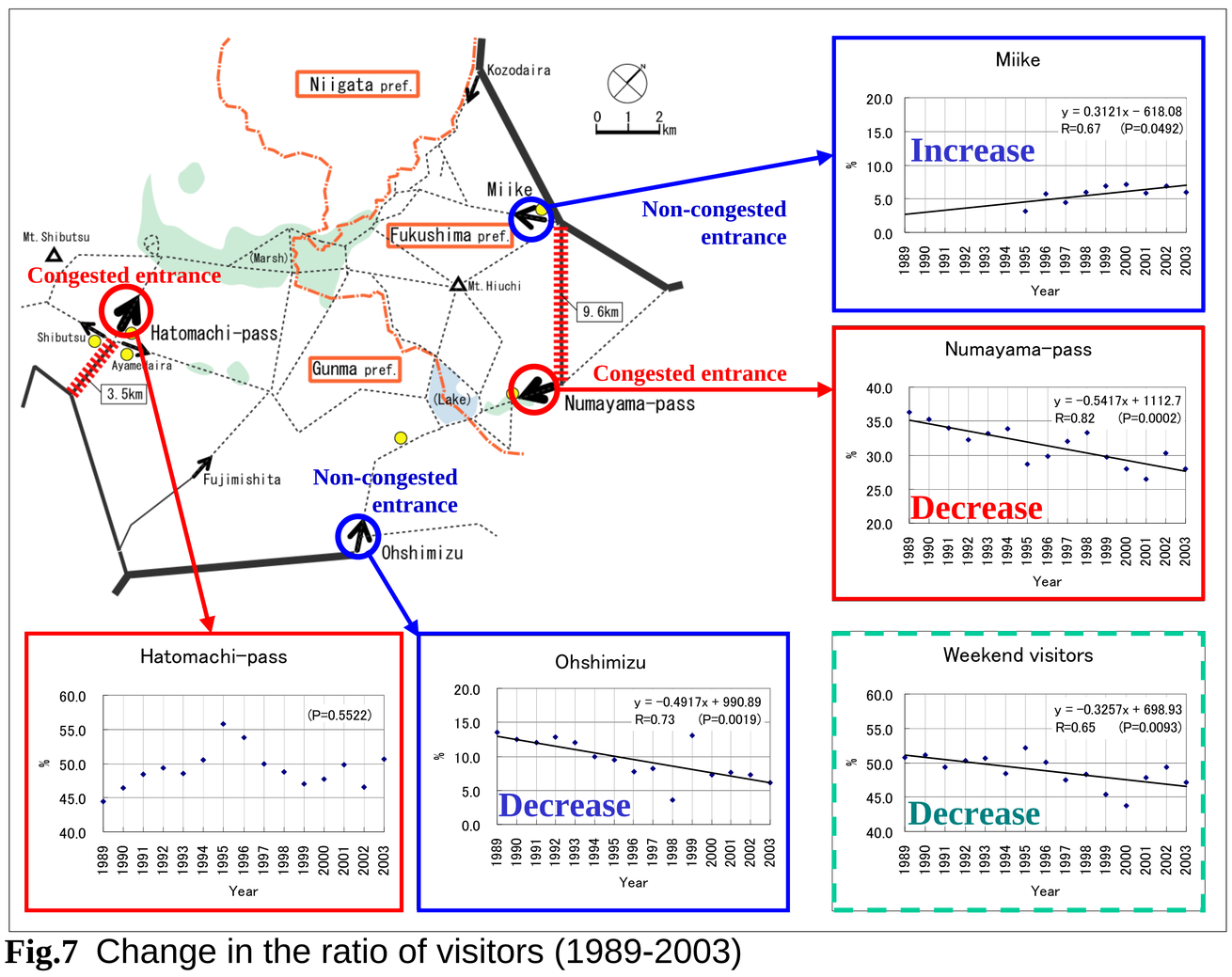

Fig.7 Change in the ratio of visitors (1989-2003)

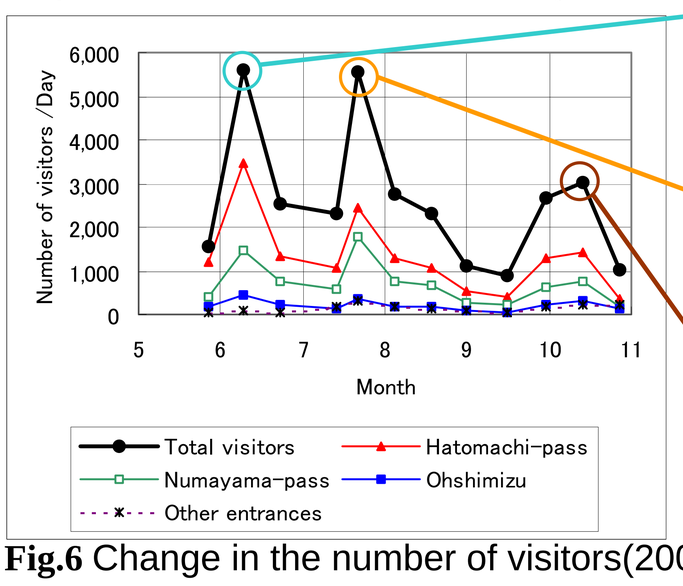

Fig.6 Change in the number of visitors(2001)

Table 1 Change in congestion ratio (Hatomachi-pass／Ohshimizu)

	Non-controlled day	First day	Controlled day	Most intensively controlled day	Last day
Controlled time	–	19:00～	All day	All day	～12:00
Controlled vehicle	–	Private cars	Private cars	Private cars and sightseeing buses	Private cars
Number of days	132	34	230	15	37
Median	8.12	6.32	7.59	5.55	5.69
Average	9.35	6.88	9.08	5.21	5.78
Standard deviation	6.65	2.61	5.31	1.22	2.44
P value	—	0.0226 *	0.6665	0.0005 **	0.00002 **

* :p<0.05 ** : p<0.01

Table 2 Results of analysis using quantification theory I by Hayasi (Sociological factors)

Variables		Number of visitors at Hatomachi-pass Category weight	range	Number of visitors at Ohshimizu Category weight	range	Hatomachi-pass／Ohshimizu Category weight	range
Year	2001	135.71		66.20		−1.37	
	2002	−91.54		38.05		−2.21	
	2003	0.00	227.25	0.00	66.20	0.00	2.21
Month	May,June	1,362.40		111.46		2.66	
	July,Aug	493.93		66.68		−1.42	
	Sep,Oct	0.00	1,362.40	0.00	111.46	0.00	4.08
Day of the week	Sunday	727.46		182.54		−3.54	
	Saturday	1,232.37		283.34		−3.42	
	Weekday	0.00	1,232.37	0.00	283.34	0.00	3.54
Mult.Corr.Coef.			0.631 **		0.618 **		0.355 **

**:p<0.01

Table 3 Results of multiple regression equation analysis(PSS)

Variables		Number of visitors at Hatomachi-pass	Number of visitors at Ohshimizu	Hatomachi-pass／Ohshimizu
Sociological factors				
Year	2001	243.5 **	88.7 **	−1.9 *
	2002		48.5 **	−2.5 **
Month	May,June	643.5 **	71.2 **	
	July,Aug	173.4	52.4 **	−2.6 **
Day of the week	Sunday	597.5 **	196.7 **	−3.7 **
	Saturday	692.2 **	179.3 **	−3.2 **
Natural factors				
Temperature				
Wind velocity		152.6 *		
Precipitation		−3.5	−0.8 *	
Solar irradiance		42.0 **	5.7 **	−0.2 *
Mizubasho season		1,075.6 **	68.4 **	4.3 **
Nikkokisuge season		433.9 **	34.6 *	2.7 **
Autumn leaves		496.6 **	67.8 **	
Traffic control factors				
First day				−2.9 *
Controlled day		564.8 **	39.6 *	
Most intensively controlled day		2,264.7 **	499.0 **	−3.2
Last day			−86.1 **	
Constant		−296.2 **	−50.3 *	12.9 **
PSS		0.178×10^9	0.653×10^7	0.175×10^5
Corrected Mult.Corr.Coef.		0.853	0.801	0.413

* :P<0.05 ** :p<0.01