

FINAL REPORT TO  
THE RUFFORD SMALL GRANT FOUNDATION

SCALY-SIDED MERGANSER  
IN CHANGBAI MOUNTAINS, CHINA

-Breeding Pair Survey in 2009

-Nest Site Selection Study

-Brood Survey in 2009

-Threats

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## **PART ONE - INTRODUCTION**

The Scaly-sided Merganser is recognized as a globally threatened species. The Changbai Mountain range (China side) is a key breeding ground of this bird. As lacking of studies and investigation, the current status of the Scaly-sided Merganser in this area is not much clear. For the conservation of this species, we need to carry out systemic surveys and monitoring programs on the breeding population in Changbai Mountains. In 2008, supported by the Rufford Small Grants Foundation, we have made surveys on the population of Scaly-sided Merganser in this range in spring and summer. In 2009, we have successfully secured the fund from RSG a second time. On the base of the surveys in 2008, our this project, *Studies on Scaly-sided Merganser breeding population and habitat selection in the Changbai Mountains*, is going on to investigate the population, distribution and threats of the Scaly-sided Merganser in this range, as well as study on some aspects of their habitat selection.

In the first ten days of April, 2009, we have made some test surveys in some Scaly-sided Merganser habitats. As the abnormal climate and late coming spring season, as well as the advice from Dr. Diana Solovyova, we timely adjusted our implement plan and made repeat surveys of these stretches later. From Apr. 14 to May 6, 13 different river stretches in total 639 km were surveyed on the breeding pairs of the Scaly-sided Mergansers. After this survey, we spent a month to seek the natural cavities. In this period of time, the continuously raining took us many difficulties to our work. But we still found seven natural cavities which are used as nests by Scaly-sided Mergansers, by climbing more than 50 trees and checking the cavities. During the second half of August 2009, even a little bit late, we still made the summer survey on the Scaly-sided Merganser brood densities in different stretches. In summer, we surveyed 290km in 9 rivers and counted 49 broods, 392 individuals of Scaly-sided Mergansers.

We would like to take this opportunity to thank Dr. Baz Hughes for his long term supervising on our program and Dr. Diana Solovyova for her guidance in methodology.

## **PART TWO - SPRING SURVEY**

### **Survey Area**

The area of this survey covers 41°~43°N, 125°~129°E. Aiming at figure out the southwestern boundary of breeding distribution area of the Scaly-sided Merganser in Changbai Mountain range, we newly made five survey stretches, four in the Yalu and one in Tumen river systems.

The Yalu river is a boundary river between North Korea and China. As the special geographic condition, it always firstly breaks the ice-cover in early spring. Some of its stretches in lower reach even are unfrozen in winter. Every year, some Scaly-sided Mergansers stop firstly in these stretches in early spring. In 2008, we have surveyed the Linjiang stretch in the middle reach of this river. Even we found some flocks of Scaly-sided Mergansers at the end of March, but we have not found any breeding pairs and broods in the following surveys in this stretch. So we suppose that this stretch is an important stopover site of Scaly-sided Merganser. But we once got information that some

ducklings of the Scaly-sided Merganser once were seen in Yalu river. So we set two survey stretches in both the upper and lower reaches of this river in this spring.



Map 1\_\_The Study Area and River Stretches Surveyed in Spring, 2009

Table 1\_\_River Stretches and Survey Date in Spring, 2009

Survey date	River name	Survey distance, km
Apr.14~16	Manjiang	51
Apr. 19~20	Yalu River_Changbai Stretch	270
Apr. 21	Hunjiang Upper Reach	34
Apr. 22	Hunjiang Lower reach	29
Apr. 23	Yalu River_Jian Stretch	40
Apr. 25	Toudao Songhuajiang	19
Apr.26	Erdao Songhuajiang	29
Apr. 27	Fuer River	36
Apr. 28	Songjiang	26
Apr.29	Erdaobaihe	12
Apr. 30	Hongqihe	32
May 03	Xilinhe	27
May-05~06	Songjianghe	34
<b>Total</b>	<b>13 stretches</b>	<b>639</b>

The Hunjiang river is an small source river of the Yalu river in lower reach. We got information that some Scaly-sided Mergansers once were seen in previous years, so we also set two survey stretches in this river.

The Hongqihe river is a source in the upper reach of the Tumen river. This is the first time we survey the Tumen river system and we do find that there are but fewer Scaly-sided Mergansers distribute in this river system.

## Method

All the river stretches were surveyed with rubber boat except two in the boundary river of Yalu because of bad security situation there. Fortunately, there is a road very close along the river. So we can drive slowly when we can observed the river surface with binocular and walk on the bank when it is far away from the river. In the surveys, we counted all the birds of Scaly-sided Mergansers only passed by the surveyors. In judging and correcting the breeding pairs, of Scaly-sided Mergansers, we use the same method used in 2008 under the guidance of Dr. Diana Solovyova.

## Densities

In this survey, total 251 individuals, 87 corrected breeding pairs of Scaly-sided Merganser were counted. The densities of Scaly-sided Merganser breeding pair and individual over all the stretches we surveyed are  $0.21 \pm 0.25$  pairs/km and  $0.64 \pm 0.89$  birds/km respectively. Please see Table 2 and Table 3.

**Table 2\_\_Numbers of the Scaly-sided Mergansers Counted in the Spring Survey, 2009**

<b>River</b>	<b>Pairs</b>	<b>Trios</b>	<b>Single males</b>	<b>Single females</b>	<b>Birds in flocks</b>
Manjiang	11	4	2	1	10
Yalu_Changbai	2	0	2	1	0
Hunjiang_Upper	0	0	0	0	0
Hunjiang_Lower	0	0	0	2	0
Yalu_Jian	1	0	0	0	0
Toudao_S_jiang	6	2	1	1	31
Erdao_S_jiang	2	0	1	1	4
Fuer River	17	3	8	4	29
Songjiang	0	0	1	0	0
Erdaobaihe	3	0	0	0	0
Hongqihe	1	0	1	0	0
Xilinhe	3	1	0	0	3
Songjianghe	11	1	1	0	0
<b>Total</b>	<b>57</b>	<b>11</b>	<b>17</b>	<b>10</b>	<b>77</b>

Table 3\_\_Scaly-sided Merganser Density (bird/km) and

River	Individuals	Estimated Pairs	Pair Density	Bird Density
Manjiang	47	18	0.353	0.922
Yalu_Changbai	7	2	0.007	0.026
Hunjiang_Upper	0	0	0.000	0.000
Hunjiang_Lower	2	0	0.000	0.069
Yalu_Jian	2	1	0.025	0.050
Toudao_S_jiang	51	10	0.526	2.684
Erdao_S_jiang	10	5	0.172	0.345
Fuer River	84	29	0.806	2.333
Songjiang	1	0	0.000	0.038
Erdaobaihe	6	3	0.250	0.500
Hongqihe	3	2	0.063	0.094
Xilinhe	12	4	0.111	0.444
Songjianghe	26	13	0.382	0.765
<b>Total/Mean</b>	<b>251</b>	<b>87</b>	<b>0.21</b>	<b>0.64</b>

Breeding Density (pairs/km) in Spring, 2009

Table 4\_Comparison of Scaly-sided Merganser Densities in Spring of 2008 and 2009

River	Individuals		Survey Distance		Pair Density		Bird Density	
	2008	2009	2008	2009	2008	2009	2008	2009
Manjiang	25	47	34	51	0.353	0.353	0.735	0.922
Yalu_Changbai	3	7	32	270	0.094	0.007	0.094	0.026
Hunjiang_Upper	---	0	---	34	---	0.000	---	0.000
Hunjiang_Lower	---	2	---	29	---	0.000	---	0.069
Yalu_Jian	---	2	---	40	---	0.025	---	0.050
Toudao_S_jiang	87	51	38	19	0.711	0.526	2.289	2.684
Erdao_S_jiang	8	10	29	29	0.103	0.172	0.276	0.345
Fuer River	75	84	33	36	1.030	0.806	2.273	2.333
Songjiang	33	1	26	26	0.538	0.000	1.269	0.038
Erdaobaihe	---	6	---	12	---	0.250	---	0.500
Hongqihe	---	3	---	32	---	0.063	---	0.094
Xilinhe	---	12	---	27	---	0.111	---	0.444
Songjianghe	31	26	29.5	34	0.305	0.382	1.051	0.765
Mudanjiang	4	---	21	---	0	---	0	0.190
Zhuerduohe	0	---	26	---	0	---	0	0
<b>Total/Mean</b>	<b>266</b>	<b>251</b>	<b>268.5</b>	<b>639</b>	<b>0.35</b>	<b>0.21</b>	<b>0.91</b>	<b>0.64</b>

The comparison of Scaly-sided Merganser densities between 2008 and 2009 are given in Table 4 and Chart 1. There is not obvious difference between the total numbers of Scaly-sided Merganser counted in spring of 2008 and 2009, but densities. This is because we increased the survey distance in Yalu River and newly surveyed two stretches in Hunjiang. These river stretches attribute very little to the densities. If we neglect the four stretches of the Hunjiang and Yalu rivers, the means of pair density and bird density in spring of 2009 are 0.30 and 0.90 respectively- almost the same as that of 2008 in bird density and a little bit lower in pair density than that of 2008. From Table 4, we can find that the Fuer river and the Toudao Songhuajiang still are the rivers with the highest densities. In both this two rivers, the bird densities kept steady but the breeding pair densities decreased. We found more flocked individuals of Scaly-sided Merganser in both of this two rivers in this spring. The biggest differences occurred in Songjiang. We surveyed this stretch and recorded 33 birds on Apr. 18 in 2008, but only 1 on Apr. 28 in 2009. We supposed that they did not come to this site or possibly have already left this site when we surveyed this stretch in 2009.

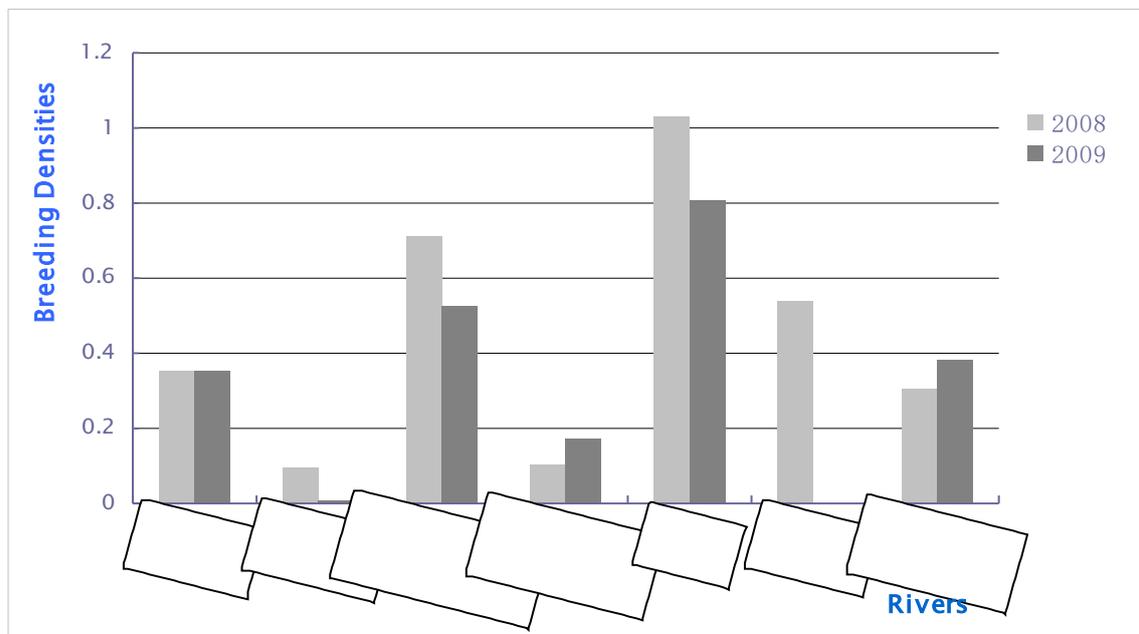


Chart 1\_Scaly-sided Merganser Pair Densities in 7 Rivers Surveyed in 2008 & 2009

### Sex-Age Structure

In this survey, we totally counted 77 individuals of Scaly-sided Merganser in 11 flocks. When making breeding pair estimation, we count all the flocked birds as sub-adults or non-breeding individuals. The data of the flock composition were given in Table 5. The proportion of flocked birds was 30.68%, much higher than that in year of 2008 - 18.8%.

**Table 5\_\_ Scaly-sided Merganser Flocks Counted in Breeding Survey**

<b>River</b>	<b>Flock Components</b>	<b>Flocked Birds Unknown Sex-Age</b>
Manjiang	2 s-ad males+4 females	
Manjiang	1 male +3 females	
Toudao_S_jiang	5 s-ad males+3 females	
Toudao_S_jiang	3 s-ad males+3 females	
Toudao_S_jiang		9
Toudao_S_jiang	3 males+5 females	
Erdao_S_jiang	1 s-ad males+3 females	
Fuerhe	5 s-ad males+5 females	
Fuerhe	1 ad+3 s-ad males+ 5females	
Fuerhe		10
Xilinhe	3 females	
<b>Total</b>	<b>58 (24 males+34 females)</b>	<b>19</b>

In this survey, neither pairs nor trios composed by sub-adult males were encountered. We counted 19 sub-adult males and 90 adult males. The sub adult males were 17.43% to all males and 7.57% to the total numbers of the Scaly-sided Mergansers we counted. We counted 11 trios. The trio proportion is 12.64%, a little bit lower than that in year of 2008 - 14.71%. In all the 251 birds, we counted 109 males and 123 females. The sex ratio is 1:1.30, almost the same as that in year of 2008 - 1:1.20.

### **PART THREE - NEST STUDY**

#### **Wild Nests**

After the spring survey, we spent a month seeking the wild nests of the Scaly-sided Merganser at several forestry farms of Songjianghe Forestry Bureau from May 10 to June 15. We bought a system of professional climbing tools and they were absolutely fresh to us. We have to spent a week to practice and master this system and make out how to efficiently hang on the rope across the right limbs on top of trees. Finally, we made it. Then we went through woods looking for big broad-leaved trees with natural cavities. After climbing 53 trees, we newly found 13 natural cavities used as nests by wild ducks, except the Scaly-sided Merganser nest we have monitored since 2006. Besides the Scaly-sided Merganser, Mandarin Ducks may also make their nests in the tree cavities of the same kind in these area. We have to make judgement to all the cavities we checked to determine what ducks setup nests in them, by directly observation, trace analysis and information feedback. Among these 13 cavities, there are 4 cavities are being occupied by Scaly-sided Mergansers and another 4 by Mandarin Ducks. Two cavities are judged as old nests of Scaly-sided Mergansers by analysing the feather traces inside or near the cavities (the white downy of Scaly-sided Merganser on the bark near the opening of one cavity), as well as the confirmation by the local people. We can only make sure 3 cavities once were used by wild ducks, because we found some unhatched eggs and shells in

them. But we could not tell whether they were Scaly-sided Mergansers or Mandarin Ducks without special tests. The status of the tree cavities used as duck nests found in 2009 is given in Table 6. The cavity S\_3 was occupied by a Scaly-sided Merganser in this year. We checked this nest on May 21. As the depth of this cavity is as deep as 89 cm, and we could not touch the eggs, so we used a piece of mirror to reflect the situation of this nest. There were at least 12 eggs in the nest. After three days, when we past by the river stretch near cavity 5 in the morning, we found a female Scaly-sided Merganser sitting lonely on the bank. We re-checked this cavity, there were only two broken eggs (very small embryos) and some shells left. The nest was full of very strong effluvium. We suspected that it was destroyed by other animal.

### Nest Site Selection

We have measured some parameters of attributes describing the Scaly-sided Merganser nest cavities we have found. Up to now, we totally found 7 Scaly-sided Merganser nest cavities. With our existing climbing tools, we could not touch those nest cavities at the top on limbs, so we did not measure the data about the inside of 2 cavities (S\_1 & S\_5) at the far ends on limbs. Because we have monitored cavity S\_1 with CCTV camera since 2007, so we made estimation to this cavity.

**Table 6\_Wild Nests of Wild Ducks Found in 2009**

Cavity No.	Location	Occupier	Occupation Status in 2009	Judging Method
S_1 *	41°58'12.50"N 127°30'46.64"E	SSM***	Not Occupied	Direct observe
S_2	42°14'18.30"N 127°33'1.80"E	SSM	Occupied	Direct observe
S_3 **	42°11'27.50"N 127°29'34.30"E	SSM	Occupied	Direct observe
S_4	42°11'40.00"N 127°29'49.20"E	SSM	Not Occupied	Feather trace
S_5	42°13'18.40"N 127°26'34.50"E	SSM	Not Occupied	Confirmed by L.P
S_6	42°11'52.50"N 127°28'36.80"E	SSM	Occupied	Direct observe
S_7	42°11'34.13"N 127°29'29.11"E	SSM	Occupied	Direct observe
M_1	42°11'44.20"N 127°29'54.90"E	MD	Occupied	Direct observe
M_2	42°11'38.30"N 127°30'0.40"E	MD	Occupied	Direct observe
M_3	42°11'38.29"N 127°30'11.82"E	MD	Occupied	Direct observe
M_4	42°11'30.82"N 127°29'47.42"E	MD	Occupied	Direct observe
U_1	41°58'59.40"N 127°31'13.40"E	unknown	Not Occupied	
U_2	41°51'40.81"N 127°42'47.02"E	unknown	Not Occupied	
U_3	41°58'0.93"N 127°33'40.55"E	unknown	Not Occupied	

\* This cavity has been monitored since 2006. It had been occupied by Scaly-sided Merganser as nest every year before 2009, but not in 2009. We suspect the environmental change is the main reason affecting. The river stretch nearest was cut-off for a newly constructed hydropower station.

\*\* Abandoned. Eggs possibly were eaten by animal. Only two broken eggs and some shells left in the nest and the hen was found not sitting in the nest but on the river bank lonely nearby in the morning.

\*\*\* SSM---Scaly-sided Merganser. MD---Mandarin Duck

In cavity S\_7, as the protrudent cavity wall, we could not measure the data at the bottom. For the sake of statistic analysis, we replace these missed data with means of the variables. The collected data of the Scaly-sided Merganser nest cavities are given in Table 7.

**Table 7\_Attributes of Scaly-sided Merganser Nest Cavities**

Parameter Cavity	S_1	S_2	S_3	S_4	S_5	S_6	S_7
SOT ①*	poplar	elm	poplar	elm	poplar	elm	elm
DBH(cm)	108	93	89	80	130	61	70
HAB ②	farm	farm	forest	forest	farm	forest	forest
ALT(m)	843	746	714	727	710	720	691
DTR(m)	1170	100	120	160	80	90	20
HOC(m)	18	19	11	12	14	14	16
OCD ③	none	none	none	yes	none	none	none
GRD (°) ④	<45	<45	>45	<45	<45	>45	>45
SP ⑤	mid	mid	mid	mid	top	top	mid
ASP ⑥	N	NE	NW	W	NE	E	SE
POC ⑦	limb	limb	trunk	trunk	limb	trunk	trunk
DOC(cm)	100	60	89	53		35	
DAO(cm×cm)**	18×22	15×15	19×20	17×25	17×20	17×25	12×21
DAB(cm×cm)	40×45	28×33	35×40	32×56		35×35	
COD ⑧	N	N	NW	NE	E	S	E
ACO (°) ⑨	<90	>90	90	>90	<90	>90	90

**SOT**:Species of tree. **DBH**:Diameter at breast height. **HAB**: Habitat. **ALT**:Altitude. **DTR**: Distance to the nearest river stretch. **HOC**: Hight of the cavity. **OCD**: Obstacle of trees higher than the cavity in cavity direction in 10m from the cavity. **GRD**: Grading. **SP**: Slope position. **ASP**: Aspect. **POC**: Position of the cavity on the tree. **DOC**: Depth of the cavity. **DAO**: Diameter of the cavity opening. **DAB**: Diameter at the bottom. **COD**: Cavity opening direction. **ACO**: Angle of the cavity opening with the horizontal.

\* In statistic analysis, we treat the descriptive variables to numeric as following:

① poplar=1, elm=2 ②farm=1, forest=2 ③none=1, yes=2 ④<45°=1, > 45°=2 ⑤mid=1, top=2  
⑥ & ⑧E=1, NE=2, N=3, NW =4, W=5, SW=6, S=7, SE=8 ⑦limb=1, trunk=2 ⑨<90=1, 90=2, >90=3

\*\* In statistic analysis, we divide the variables of DAO & DAB into DAO\_S, DAO\_L, DAB\_S and DAB\_L which represent the shorter diameters and longer diameters at the opening and bottom of a cavity respectively.

**Table 8\_The Descriptive of Each Variable**

Variables	N	Mean	Std. Deviation
SOT	7	1.57	.535
DBH	7	90.14	23.362
HAB	7	1.57	.534
ALT	7	735.86	50.118
DTR	7	248.57	408.511
HOC	7	14.86	2.968
OCD	7	1.14	.378
GRD	7	1.43	.535
SP	7	1.29	.488
ASP	7	3.57	2.370
POC	7	1.57	.535
DOC	5	67.40	26.651
DAO S	7	16.43	2.299
DAO L	7	21.14	3.437
DAB S	5	34.00	4.416
DAB L	5	41.80	9.203
COD	7	3.00	2.082
ACO	7	2.14	.900

We analysed all these data of Scaly-sided Merganser nest cavities with Factor Analysis (SPSS 16 software) trying to find some key factors affecting on the Scaly-sided Merganser to select nest site, as well as made an integrative judging to each Scaly-sided Merganser nest cavity. This judgement may be described as which cavity is most likely be selected by Scaly-sided Mergansers. The descriptive statistics of each parameter are given in Table 8.

With factor analysis, we extracted 6 components according to Table 9. From Table 10, we may find the 1<sup>st</sup> component could represent the variables of position of cavity, habitat surrounding the tree, slope grading under the tree and the diameter at breast hight. The 2<sup>nd</sup> could represent species of the cavity tree, angle of the cavity opening, depth of the cavity. The 3<sup>rd</sup> component could represent the longer diameter at the bottom of the cavity and whether there are obstacles higher than the cavity in 10 m in the direction of the cavity opening. The 4<sup>th</sup> may mostly reflect the variables of the distance from the tree to the nearest river stretch and the altitude. The 5<sup>th</sup> could reflect the shorter diameter at the bottom, and the 6<sup>th</sup> the slope position.

**Table 9\_Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
	1	6.375	35.417	35.417	6.375	35.417	35.417	4.463	24.794
2	3.473	19.296	54.713	3.473	19.296	54.713	3.756	20.867	45.661
3	2.967	16.482	71.195	2.967	16.482	71.195	2.965	16.473	62.134
4	2.192	12.178	83.373	2.192	12.178	83.373	2.792	15.510	77.644
5	1.909	10.606	93.979	1.909	10.606	93.979	2.205	12.249	89.893
6	1.084	6.021	100.000	1.084	6.021	100.000	1.819	10.107	100.000
7	3.383E-16	1.879E-15	100.000						
...	...	...	...	...	...	...	...	...	...
18	-5.244E-16	-2.913E-15	100.000						
Extraction Method: Principal Component Analysis.									

With the factor score and the percentage to the variance of each factor extracted , we got the calculation formula to make an integrative ranking judge to all the 7 nest cavities:

$$zF=24.79*fac1+20.87*fac2+16.47*fac3+15.51*fac4+12.25*fac5+10.11*fac6$$

The judge result is given in Table 11.

We presumed that the higher a cavity ranks, it would be more preferably selected by the Scaly-sided Merganser. But as lacking of samples of Scaly-sided Merganser nest cavities, we can not provide a method to test. According to our experiences of looking for the wild nests of the Scaly-sided Merganser in this year, we feel the following factors could be more important for a Scaly-sided Merganser selecting natural tree cavity to nest:

**Table 10\_Rotated Component Matrix of Factor Analysis**

	Component					
	1	2	3	4	5	6
POC	.917	.229	.251	-.207	-.016	-.031
HAB	.917	.229	.251	-.207	-.016	-.031
GRD	.901	-.011	-.404	-.141	-.058	.052
DBH	-.741	-.656	.046	-.062	.102	.061
HOC	-.572	.242	-.476	.469	-.390	-.128
SOT	.180	.912	.058	-.116	-.342	.034
ACO	.239	.912	.063	-.245	.180	-.120
DOC	-.128	-.754	-.071	.338	.011	-.543
DAB_L	.052	-.161	.963	.128	-.123	-.113
OCD	.023	.339	.927	-.094	.059	-.117
DAO_L	.555	.058	.587	.341	.096	.467
DTR	-.249	-.316	.082	.891	.116	-.157
ALT	-.404	-.126	.019	.853	.225	-.206
DAB_S	.306	-.618	.046	.689	.074	.202
DAO_S	-.023	-.354	.211	.156	.897	.030
ASP	.433	-.122	.303	-.090	-.717	-.429
COD	.411	.377	-.361	.265	.657	.238
SP	-.045	-.062	-.168	-.186	.204	.943
Extraction Method: Principal Component Analysis.						
Rotation Method: Varimax with Kaiser Normalization.						
a. Rotation converged in 10 iterations.						

**Table 11\_The Result of Integration Judge to the Scaly-sided Merganser Nest Cavities**

Cavity	S_1	S_2	S_3	S_4	S_5	S_6	S_7
Rank	3	6	4	2	7	1	5

1. Obstacles - The sprout branches or branches of other trees cover or surrounding the cavity opening may increase the difficulty for a Scaly-sided Merganser entering into the cavity. We checked many cavities surrounded by branches, even other factors, such as the diameter of opening, depth, and location are suitable, but none of them are occupied by Scaly-sided Mergansers or Mandarin Ducks. The high trees nearby in the direction of the cavity opening could be also obstacles to Scaly-sided Mergansers. Except the cavity S\_4, all the other 6 cavities are higher than the plants nearby and clear of obstacles in the

cavities directions. About 6 m away from cavity S\_4, stands a tree higher than S\_4 in the direction of its opening. But there is much space between the higher tree's crown and the cavity S\_4. So Scaly-sided Merganser can still fly bypass this obstacle. Cavities S\_1, S\_2 and S\_5 are on the trees standing at the edges of farms. They can be found in far distance very easily.

2. Distance to the nearest river stretch - The cavity S\_1 we monitored from 2006 is 1.17 km away from the nearest stretch. It had been used as nest by Scaly-sided Merganser for many years, but it is abandoned in this spring. The nearest stretch was cut off for the construction of a new water-power station. We suppose this is the direct reason. The same river still flows in upper reach and lower reach where are only about 2 or 3 km away from the cavity S\_1. It would rather abandon this nest site than fly a little bit longer. There must be some reason for this. Except cavity S\_1, all the other 6 cavities are found near rivers - 95 m in average distance to the nearest river.

3. The matter at the bottom - We checked some nest cavities. The matter at the bottom is mainly a little of humid rotten wood chipping. It is said that in Heilongjiang province, somebody put some sawdusts into a Scaly-sided Merganser nest cavity to elevate the bottom, but this cavity has never been used again by Scaly-sided Merganser after that.

4. Angle of the cavity opening - The angle of the cavity opening to the ground should be important. If it is elevation, it would be easy for the rain water to get into the cavity and this could affect the hatching of eggs. The opening angles of cavities S\_2, S\_4 and S\_6 are bigger than 90°, but only the angle of S\_2 is about or a little bigger than 135°. The angles of S\_4 and S\_6 are about 120°. The angles of the other 4 cavities (S\_1, S\_3, S\_5 and S\_7) are perpendicular or depressed. The correlation among the opening angle, nest humidity and the incubation rate should be focused in future study.

5. The diameters of the opening and the bottom - We suppose that the shorter diameter of an opening may affect a Scaly-sided Merganser entering into the cavity. A big opening could possibly cause the quick loss of thermo in the nest. We once checked a cavity on the trunk of an elm tree in last spring. The diameter is about 30cm and the depth 45cm, opening perpendicular. This cavity tree is located at the forest edge and only 10m to the river and the cavity is very obvious to be seen from the middle of river. But there were not any signs of being occupied by Scaly-sided Merganser or Mandarin Duck in this cavity. The diameter at the bottom may affect the coziness of a hen when she sits in the nest. Our factor analysis result (Table 9) shows that the shorter diameter of opening and the longer diameter of the bottom are the main factors for Scaly-sided Merganser to select nest site. The means of diameters at openings and bottoms are 16.43cm×21.14cm and 34cm×41.80cm.

## PART FOUR - SUMMER SURVEY

Table 12\_Result of Summer Survey on Scaly-sided Merganser Brood in 2009

River	Distance	Survey Date	Individuals	Estimated Broods
Xilinha	27	Aug. 16	32	4
Manjiang	51	Aug. 17~18	150	19
Songjianghe	34	Aug. 19	78	11
Fuerhe	36	Aug. 20	106	12
Erdao_S-jiang	29	Aug. 21	15	2
Erdaobaihe	12	Aug. 22	0	0
Hongqihe	32	Aug. 23	11	1
Hunjiang_Lower	29	Aug. 25	0	0
Yalu_Jian	40	Aug. 26	0	0
<b>Total</b>	<b>290</b>		<b>392</b>	<b>49</b>

Table 13\_Comparison of Scaly-sided Merganser Densities in Summer of 2008 and 2009

River	Individuals		Brood #		Bird Density		Brood Density		Distance	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Xilinha	42	32	5	4	1.400	1.185	0.167	0.148	30	27
Manjiang	98	150	5	19	3.267	2.941	0.433	0.373	30	51
Songjianghe	171	78	19	11	4.275	2.294	0.475	0.324	40	34
Fuer River	105	106	13	12	2.234	2.944	0.277	0.333	47	36
Erdao_S-jiang	12	15	2	2	0.414	0.517	0.069	0.069	29	29
Toudao_S-jiang	13		2		0.342		0.053		38	
Songjiang	4		1		0.154		0.038		26	
Erdaobaihe		0		0		0		0		12
Hongqihe		11		1		0.344		0.031		32
Yalu_Linjiang	0		0		0		0		32	
Yalu_Jian		0		0		0		0		40
Hunjiang_Lower		0		0		0		0		29
Mudanjiang	0		0		0		0		21	
Zhuerdohe	0		0		0		0		26	
Gudonghe	0		0		0		0		37	
<b>Total/Mean</b>	<b>445</b>	<b>392</b>	<b>55</b>	<b>49</b>	<b>1.099</b>	<b>1.136</b>	<b>0.139</b>	<b>0.142</b>	<b>356</b>	<b>290</b>

During the second half of August, we made repeat surveys on the brood densities in 9 river stretches. The data of survey result and the comparison to the last year are given in Table 12 and 13. In summer survey, we totally counted 35 broods and 4 amalgamated broods. These amalgamated broods were found in sizes of 17, 22, 29 and 34 in Manjiang, Songjianghe and Fuerhe. We calculated the average size of 35 Scaly-sided Merganser

broods, and used this mean to estimate the brood numbers composed each amalgamated broods. The mean brood size is  $7.49 \pm 2.98$ , a little bit less than that of last year -  $7.83 \pm 2.92$ .

We estimated that the 4 amalgamated broods were composed by 14 Scaly-sided Merganser broods. The bird and brood densities of Scaly-sided Merganser in summer of 2009 in Changbai Mountains are  $1.136 \pm 1.26$  birds/km and  $0.142 \pm 0.158$  broods/km. From Table 13, we can find that both the bird and the brood densities of Scaly-sided Merganser in summer of 2009 are a little bit higher than those of 2008. This is because we surveyed more sparse rivers to the Scaly-sided Merganser densities in the summer of 2008. From Chart 2, we can find that only in Songjianghe, the brood density decreased significantly in 2009. We assumed that the enhanced people disturbance is the main reason to this decreasing. Two big profitable boat-drifting companies were established along the middle reach of this river.

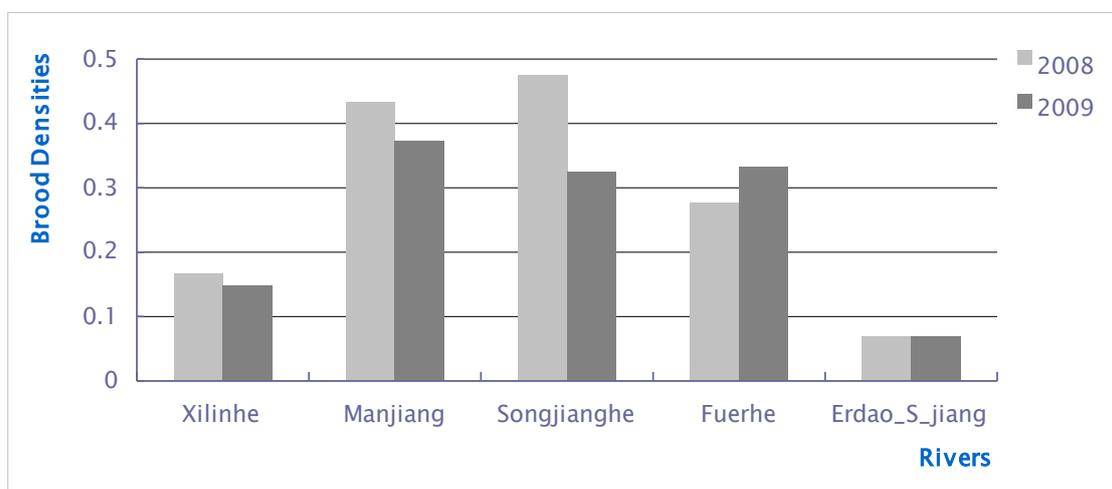


Chart 2\_Scaly-sided Merganser Brood Densities in 5 Rivers Surveyed in 2008 & 2009

## PART FIVE - THREATS

At present, the most important threat to the Scaly-sided Merganser in Changbai Mountains is habitat degrading and lossing caused by people disturbance and destroys to the habitat.

### **Profitable Rubber-boat Drifting**

Most profitable rubber-boat drifting companies were established in the breeding ground of Scaly-sided Merganser. Every year, these drifting places attract huge visitors in summer. Most of the visitors do not know this globally threatened species and most of them are very strange to the wildlife emerged in the river. They may chase or even attack the Scaly-sided Merganser sometimes. Even worse, in all the rubber-boat drifting places, there were not any warning words or marks or even any oral warning to visitors for not chasing and attacking the wildlife they meet when drifting. Up to now, more than 30% of the rivers in Changbai Mountains have profitable rubber-boat drifting activities. To our best knowledge, the total length of the rubber-boat drifting stretches may approach 100km - 1/3 of the the best habitat of Scaly -sided Merganser in Changbai Mountains. We estimated that the total length of the Scaly-sided Merganser habitat in Changbai

Mountains possibly is not longer than 1000km and the best habitat may not exceed 300km.

### **Digging Sands**

With the enhancing development to the Changbai Mountain, sand become a very short resources. Under the driving of profits, many people invest to dig sands from rivers. Even we could not prove it (some Scaly-sided Mergansers still live at the remnant sites of digging sands) , but we still suspect digging sands destroys the river bed and might affects the fish community structure, further more might affects the food of Scaly-sided Merganser.

### **Killed by Net**

Pic 1 and 2 describe a trap net used by local people to catch fishes and frogs. As its shape is much like a sleeve, so it is named as sleeve net. Even we have not seen for ourselves how this net may catch Scaly-sided Merganser ((especially ducklings), but we can often hear the stories of how this kind of nets caught the broods of Scaly-sided Merganser.



**Pic 1\_A Sleeve net**



**Pic 2\_A Sleeve net**

## **PART SIX - CONCLUSION**

Our survey results show that the numbers of Scaly-sided Merganser in Changbai Mountain Range decreased a little in 2009, comparing with that in 2008. The abnormal climate in this year might be a reason, but the main reason still comes from the enhancing development to the Changbai Mountain.

According to our studies on the Scaly-sided Merganser in Changbai Mountain range, we estimated that the Scaly-sided Merganser habitat in Changbai Mountain range could be not longer than 1000km. So if we use this digit as a base of estimation, we could give out the estimation of the Scaly-sided Merganser population in Changbai Mountain range in 2009 - 160~260 pairs, 120~164 broods. We suspect this result is still over estimated.