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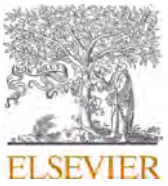

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Evaluation of the status, job satisfaction and occupational stress of Chinese nature reserve staff

Yan Gao [a], Binbin V. Li [a,b,*]

[a] Environmental Research Centre, Duke Kunshan University, 8 Duke Avenue, Kunshan, Jiangsu 215316, China
[b] Nicholas School of Environment, Duke University, Durham, NC 27708, USA

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ABSTRACT

China is one of the most biodiverse regions of the world. To better preserve its biological resources and the fragile ecosystem, China's government has established more than 2700 nature reserves, covering approximately 18% of its total land area. While there is a growing body of literature analyzing the effectiveness of nature reserves, little is known about the nature reserve staff who are on the frontlines of wildlife conservation to ensure these areas are effectively protected. This study aims to identify the current status, job satisfaction, and occupation stress of nature reserve staff in China, as well as what factors contribute to the level of satisfaction and stress. We surveyed a total of 286 staff covering 153 nature reserves in 31 provinces of mainland China. The survey results indicate that 63.6% of nature reserve staff were satisfied with their jobs and showed low occupational stress. Nonetheless, they were not satisfied with fringe benefits, payment, promotion opportunities, and operating conditions. There was also a geographic difference in the level of satisfaction and stress. Comparing different positions among nature reserve staff, we found that rangers were more male-dominated, less educated, older and had been exposed to more life-threatening situations than non-rangers. In addition, they were more likely to be contractors instead of formal employees, receive lower pay and spend less time with their families compared to non-rangers. Rangers were generally confident in their professional skills and but less confident in first aid and the use of GIS software. The rangers were less satisfied with their jobs compared to non-rangers, although the difference was not significant. Only about 58% of the nature reserve staff felt that they had received enough training. About 1/3 of the nature reserve staff would like to quit their job. The reasons include low payment and rewards, lack of infrastructure support, no law enforcement capability when encountering illegal activities and living too far from families. Finally, the model results show that more time spent with family, higher income, more training, and more affection for nature significantly contributed to the overall job satisfaction. Factors like the increase in age, more time with family, higher income, more training, and higher confidence in professional skills, were negatively correlated with the stress of nature reserve staff. Our results suggest that to improve the conditions of nature reserve staff and the management of protected areas, governments and managers need to provide enough training and increase income and rewards to recognize the contribution of nature reserve staff, as well as change the hiring mechanism to attract and keep new employees.

* Corresponding author at: Environmental Research Centre, Duke Kunshan University, 8 Duke Avenue, Kunshan, Jiangsu 215316, China.
E-mail address: bl113@duke.edu (B.V. Li).

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1. Introduction

Protected areas are the cornerstones to safeguard biodiversity and sustain ecosystem services in the face of environmental crises (Coad et al., 2019; Li and Pimm, 2020). Although the number and total area of protected areas have increased in the past decades, many of these protected areas were not effectively managed (Watson et al., 2016; Coad et al., 2019). The effectiveness of protected area management heavily relies on whether they are sufficiently funded and staffed (Coad et al., 2019). Nonetheless, more than 75% of the protected areas reported inadequate resources in budgets, staffing, or both (Coad et al., 2019). Most studies focus on how monitoring, management system, conservation planning, funding and other factors affect protected area effectiveness, while little research is done about rangers themselves (Singh et al., 2020; Moreto, 2016; Pritchard, 2015).

Park rangers play a crucial and indispensable role in conservation since they are on the frontlines combating illegal activities. Theyconduct monitoring programs to assist scientific evalution and park management by tracking the changes in wildlife and environment(Usui et al., 2014). While protected areas are under increasing threats, rangers need to conduct regular patrols and law enforcement to stop illegal logging, poaching, recreational disturbances, fires, and other damaging activities (Singh et al., 2020). Nonetheless, because of the remoteness of most protected areas and limited contact with society, their importance has been long overlooked and not recognized by both the public and their local communities (Digun-Aweto et al., 2019). Until recently, studies began to identify their circumstances, challenges and threats in different regions of the world (Singh et al., 2020; Belecky et al., 2019; Howard, 2013; Moreto, 2016; Pritchard, 2015; Poppe, 2012; Moreto et al., 2019; WWF, 2018).

The job itself differs from the iconic images of interactions with wildlife and exciting adventures, and usually involves stressful policing work and operations in harsh field conditions with high safety risks (Howard, 2013). The high risk comes not only from the working environment such as natural disasters and encountering aggressive wildlife, but also from combating illegal activities as rangers can be easily identified by the illegal poachers (Warchol and Kapla, 2012). Rangers' challenges originate from their multipleroles they need to play in managing the protected areas – they need to address social, political, legal, economic, and scientific concerns to develop and implement management strategies, while they are usually inadequately trained and equipped (Poppe, 2012; Worboys et al., 2015). Meanwhile, the shortage of staff, low and irregular compensation, and lack of diversity are also identified as main obstacles for the effective work of park staff (Welch et al., 2015).

Due to their multi-roles in managing protected areas, rangers need to master a set of professional skills including field survival, animal tracking, species identification, communication and negotiation, and the capability to deal with critical incidents (Singh et al., 2020). However, with limited and usually insufficient training, rangers are facing increasingly stressful situations when they need to enforce the environmental regulations, encountering armed intruders and poachers, managing interactions and threats from local communities, and stopping tourists from conducting environmental damages (Mendoza, 2016; Usui et al., 2014). The understanding of rangers' working conditions, their job satisfaction, and their occupational stress are crucial to improve their performance in the future, which will in turn improves park management (Eliason, 2006; Jachmann, 2008; Spira et al., 2019). Compared to other professions, there is limited research available on the job satisfaction and occupational stress of rangers. While a growing body of studies focuses on these issues of rangers have been conducted recently, they are mostly confined to the USA and Africa (Singh et al., 2020), with few research tackling similar problems in other parts of the world such as Asia (Moreto et al., 2017).

China is one of the most biodiverse regions in the world while it holds 1/5 of the world's population (Li and Pimm, 2020; Liu et al., 2003; Guo and Cui, 2015). To better preserve its biodiversity and the fragile ecosystems against anthropocentric threats, China has established more than 11800 protected areas covering approximately 18% of its total land area, reaching the Aichi target 11 which aims to protect 17% of land area (Ministry of Ecology and Environment of China, 2016). Among different types of protected areas, nature reserves have been the strictest and most predominant type (Xu et al., 2019). By the end of 2019, 2740 nature reserves had been established, covering 15% of the land area (Li and Pimm, 2020). Since 2017, the reform of protected areas has identified the national park system as the key type of protected areas, together with nature reserves and natural parks. Nonetheless, most of the staff of national parks are from nature reserves that were incorporated into the new national parks system. Thus, the general performance of nature reserve staff to a great extent determines the overall effectiveness of protected areas in China. Nonetheless, from the public to the academia, there is a lack of attention on this occupation and its challenges. As China aims to further expand its protected areas and will hold COP15 of Convention on Biological Diversity in 2021 to determine the post-2020 framework, there is an urgency to understand how nature reserve staff perceive their work and identify opportunities for improvements in this occupation, thus to guarantee the effectiveness of protected areas .

Here, we present the first nation-wide systematic study on nature reserve staff. We focus on the following questions: 1) What are the general working and socio-economic situations for all staff? 2) What is the level of job satisfaction and occupational stress and what are the contributing factors? 3) Are there any differences between rangers who operate mostly in the field and non-rangers, in different regions or between national and local level reserves?

2. Material and methods

2.1. Data collection

We considered all staff at different positions in the nature reserve system, including those employed at both the national and local level nature reserves in China. We only consider mainland China because the protected area systems are different from those in Hongkong, Taiwan and Macau. We contacted all nature reserves by phones to distribute our electronic survey through their administrations. To supplement this effort, we also distributed this structured questionnaire through the internet platforms such as social

media channels to recruit more survey participants. Data were collected anonymously, and the respondents completed the survey questionnaires privately to ensure confidentiality. Additionally, respondents were assured that participation in the survey was voluntary, and the return of questionnaires represented informed consent. The survey has been approved by Duke Kunshan University Institutional Review Board (FWA0021580).

2.2. Survey instrument

The survey included five sections and took 20 mins on average to complete online. Section 1 focused on respondents' demographic information. The questions included gender, age, year of education, whether working location is the same with their hometown, marital status, the number of dependents per household, whether their family is in the same county or not, and how many days that they can stay with family per month. Section 2 gathered professional information. The items included the type of employment, years of service, monthly salary, confidence in professional skills, days working in the field per month, whether experiencing life-threatening situations and number of serious injuries during work. Section 3 assessed job satisfaction among the nature reserve employees. This survey adopted Spector's Job Satisfaction Survey (JSS), which measures the satisfaction levels from nine facets (Spector, 1985) (Table 1). To keep the survey more succinct, we only kept two questions per facet rather than four in the original design to determine the overall situation. A Likert scale was used for these questions, from "1 = strongly disagree" to "6 = strongly agree". The highest score for each facet was 12. The answers were summed to make an aggregated job satisfaction score, with a potential value ranging from 18 to 108 with 63 as the neutral score. This instrument has been proved to be sufficiently reliable and validated by psychological researchers (Auerbach et al., 2010; Danish and Usman, 2010; Batura et al., 2016).

Section 4 assessed the job stress of nature reserve staff using Cohen's Perceived Stress Scale (PSS-10) (Cohen et al., 1994). PSS is the most widely used metric to assess the perception of stress, the degree to which one feels life and work as uncontrollable, unpredictable and over-loading (Chan and La Greca, 2013). PSS-10 version consists of 10 items using a five-point scale from "0 = never" to "4 = very often" to evaluate the ability to cope with existing stressors. Furthermore, the statements were random in order, which required respondents to think about each statement and not to identify the same answer habitually. The total score of the PSS test ranged from 0 to 56 with 28 as the neutral score. Section 5 explored the employees' perceptions towards their jobs, including the working environment, management of the institution, whether the job was dangerous (Danger), how tough the working condition was (Difficulty), and other questions (see Supplementary for the survey instrument in both Chinese and English).

2.3. Definition of rangers

In total, we collected 291 responses from November 1st, 2018 to February 28th, 2019, among which 286 were completed and valid for analysis. These surveys covered 153 nature reserves in 31 provinces of mainland China, and accounted for 4.3% of the staff working in these nature reserves. We further divided these respondents into two groups: rangers and non-rangers. Ranger is a collective term that refers to all frontline staff, including wildlife wardens, forest guards, foresters, rangers, scouts, watchers and other frontline field staff (WWF, 2016). In this survey, we asked respondents to identify whether they are rangers or not. However, to ensure actual participation in regular patrolling activities or fieldwork regularly, in this study, we considered spending at least 20% of working time in the field as the threshold. Therefore, rangers were defined as respondents who reported working no less than four days per month in the field. Non-rangers are the rest of the staff working in protected areas, who are usually responsible for human resources, finance and other tasks, which do not require to be in the field.

2.4. Data analysis

We grouped different provinces into the following regions according to their environmental and economic conditions: Northeast (Heilongjiang, Jilin and Liaoning); Northern China (Beijing, Tianjin, Hebei, Shanxi and Inner Mongolia); Eastern China (Shanghai, Shandong, Anhui, Jiangsu, Zhejiang and Fujian); Southwest China (Chongqing, Sichuan, Yunnan, Guizhou and Tibet); Central China (Hunan, Hubei, Henan and Jiangxi); Southern China (Guangdong, Guangxi and Hainan) and Northwest (Xinjiang, Gansu, Qinghai, Shaanxi and Ningxia). Then we did a comparison among regions. Because of the limited sample, we pooled rangers and non-rangers together for the regional comparison. We also compared rangers and staff between different administrative levels: national nature

Table 1
Nine facets of job satisfaction.

Facet	Description
Pay	Satisfaction with pay and pay raises
Promotion	Satisfaction with promotion opportunities
Supervision	Satisfaction with person's immediate supervision
Fringe benefits	Satisfaction with the range of benefits in addition to their salaries, such as insurance, subsidized meals etc.
Rewards	Satisfaction with appreciation, recognition and rewards for good performance
Operating procedures	Satisfaction with operating policies and procedures
Co-workers	Satisfaction with co-workers
Nature of work	Satisfaction with the type of work done
Communication	Satisfaction with communication within the organization

reserve and local reserves. We used Pearson's chi-squared test ($\chi 2$) and Wilcoxon test to evaluate the statistical difference. For multiple group comparisons, we applied the Kruskal Wallis test and Tukey HSD post-hoc tests. To understand what factors influence job satisfaction and perceived stress, we applied the Generalized Linear Model (GLM) which included socio-economic factors, personal and family variables, job perception etc. To avoid collinearity, we removed highly correlated variables. The best model was identified with the lowest AIC. We conducted all the analysis using JMP Pro 14 (SAS Institute Inc., Cary, NC, 1989–2019).

3. Results

3.1. Distribution of respondents

Responses covered all the provinces in mainland China. Nonetheless, three provinces dominated, receiving about 43% of all responses: 23.8% of the responses were from Sichuan Province, 12.2% were from Yunnan Province and 7.0% were from Gansu Province (Fig. 1). There were relatively fewer responses from Xinjiang, Tibet, and Qinghai which have low human density and most of the largest nature reserves in China. The Southwest region of China contributed most of the responses, accounting for 42.3% of the dataset. Other regions were relatively even in their numbers (Fig. 1).

3.2. Comparison between rangers and non-ranger workers

3.2.1. Demographic status of respondents

The majority of the respondents were males (82.9%). The mean age of the respondents was 39.4 ± 9.2 years old, ranging from 18 to 62 yrs old. About 75.2% of respondents had at least high school education and 79.5% of respondents were married. For their households, the average number of dependents in a family was 3.9 ± 1.6, including both children and elders who were financially supported by them. Nonetheless, only about two-thirds (67.8%) of the respondents lived together with their family in the same county and the average number of days per month that they can stay with their families was about 12.5 ± 9.5 days.

Rangers were more male-dominated, less educated and older than non-rangers. The percentage of males was significantly higher in rangers (88.1% v.s. 70.6%, χ^2 test, $p < 0.01$) while they received significantly fewer years of education (Wilcoxon test, $p < 0.05$). The average years of education that a ranger received was 14.5 ± 3.0 yrs, compared to 15.4 ± 3.0 years for non-ranger workers. Although there was no significant difference in age, rangers tended to have a higher proportion of the older population compared to non-rangers. More than half (54.7%) of the rangers were more than 40 years old while it was only 43.5% of the non-rangers (χ^2 test, $p < 0.1$).

Rangers spent only about 11 days per month with their families, four fewer days compared to non-rangers (11.2 ± 8.5 vs. 15.5 ± 11.1 days/month; Wilcoxon text, Z = 2.70, $p < 0.01$), although there was no significant difference whether their families lived in the same county or not between these two groups. Rangers and non-rangers were also similar in their marital status and number of dependents (Wilcoxon text, $p > 0.1$).

3.2.2. Occupation characteristics

In this survey, 217 respondents (75.9%) worked in the national nature reserves while the other respondents worked in provincial levels of nature reserves (Table 1). Furthermore, 81.1% of the workers reported themselves as permanent staff. Overall, the reserve

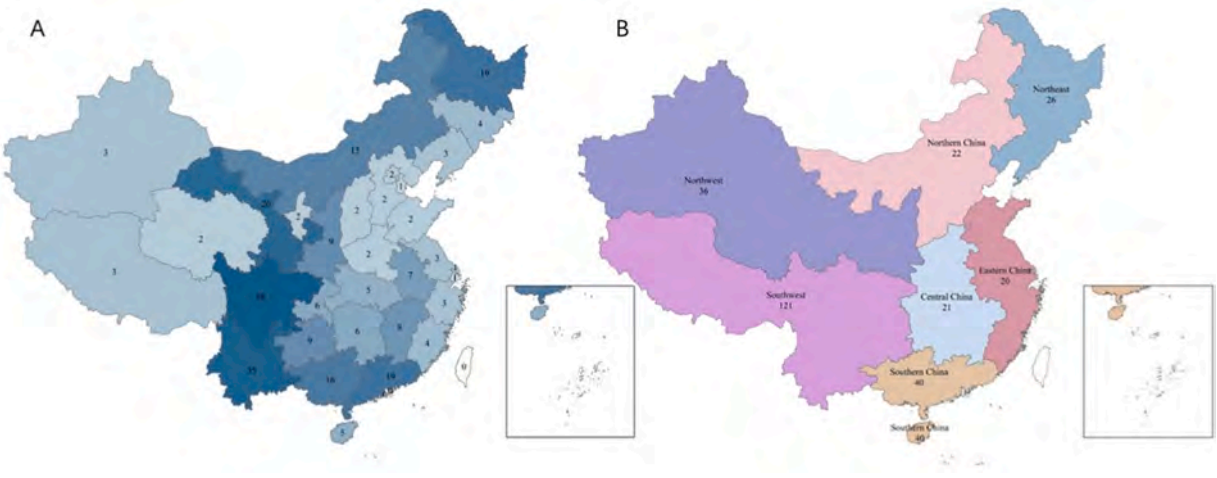

Fig. 1. Distribution of survey respondents by A) provinces and B) regions. Mainland China is divided into the following regions according to its environmental and economic conditions: Northeast (Heilongjiang, Jilin and Liaoning); Northern China (Beijing, Tianjin, Hebei, Shanxi and Inner Mongolia); Eastern China (Shanghai, Shandong, Anhui, Jiangsu, Zhejiang and Fujian); Southwest China (Chongqing, Sichuan, Yunnan, Guizhou and Tibet); Central China (Hunan, Hubei, Henan and Jiangxi); Southern China (Guangdong, Guangxi and Hainan) and Northwest (Xinjiang, Gansu, Qinghai, Shaanxi and Ningxia).

staff had a relatively low recruitment rate. Only 68 respondents (23.4%) had working experiences in the nature reserve for fewer than 3 years. The average duration of service for reserve staff was 11.6 ± 9.2 years. About three-fourths of the respondents had life-threatening situations before. The top three occasions were threatened by local community members (reported by 41.5% of the respondents), chased or attacked by wildlife (28.9%) and confronted by armed poachers (26.8%).

Rangers were more likely to be contractors instead of official staff compared to non-rangers (Table 1). While about ¼ of rangers were contractors, it was only about 10% for non-rangers (χ^2 =5.93, $p < 0.05$). We also asked the respondents to answer the number of total staff and their employment types in their nature reserves. On average, about 85% of contractors were rangers, only about 45% of permanent employees took the ranger job. Rangers usually worked in protected areas longer than non-ranger workers (Wilcoxon test, $Z = -2.01$, $p < 0.05$). As expected, rangers spent a greater amount of time in the field, with an average of 11 days and a median of 10 days per month, ranging from 4 to 28 days. About 81.6% of rangers reported life-threatening situations which was higher than the average for all staff, e.g. threatened by local residents (43.3%), chased or attacked by wild animals (35.3%), confronting armed poachers (32.8%) and hurt by hunting traps (23.3%). About 26.4% of rangers reported that they experienced at least one injury during work. Nonetheless, rangers generally had lower pay than non-rangers, though the difference was not significant (Table 1, Wilcoxon test, $Z = 1.10$, $p > 0.1$).

Most staff (58%) believed that they generally received enough training and their nature reserves received enough support from the government, with no significant differences between these two groups (Wilcoxon test, $p > 0.1$) (Table 1). Rangers showed more affection for nature than the non-rangers (Wilcoxon test, $Z = -3.71$, $p < 0.01$). Nevertheless, rangers perceived their jobs at a higher level of danger with more difficult conditions comparing to non-rangers (Wilcoxon test, $p < 0.01$) (Table 1).

The top reasons that respondents would like to work in the nature reserve were affection for nature and wildlife (71.0%), following assignment from the government (43.4%), the ability to stop destruction activities towards nature (40.2%) and stable and guaranteed income (34.3%). While rangers followed the same ranking, more non-rangers chose the stable and guaranteed income as the reason than the ability to stop the destruction of nature. However, about a third of the respondents indicated that they would want to quit their current jobs. The top reasons that they did not like the job were the low payment and no rewards (60.4% of the respondents), difficult working conditions with poor infrastructure and equipment (52.1%), no law enforcement rights when encountering illegal activities such as poaching (49.0%) and being too far from home and family (38.5%). About ¼ of the respondents concluded that danger (25.9%) and lack of emphasis from the government (24.8%) also were the disadvantages of this job. Rangers had a lower proportion (29%) of people who would like to quit compared to non-rangers (34%) with no difference in the ranking of the top reasons. Nonetheless, only about 10% of rangers would like their children to do the same job while it was only 6% for non-ranges.

3.2.3. *Confidence in professional skills*

The average total score for perceived professional skills was 24.6 ± 5.1 for rangers. In general, rangers were most confident in using the navigation system (4.02 ± 1.04), followed by setting up infrared cameras (3.87 ± 1.24), identifying animal species and plants species (3.71 ± 0.95, 3.42 ± 0.92), identifying animal tracks (3.37 ± 1.01) (Fig. 2). Meanwhile, rangers reported less confidence in first aid skills (3.29 ± 0.94). The familiarity of using mapping software such as GIS got the lowest score (2.95 ± 1.18), which was the only skill that smaller than the neutral value 3. Only 10.9% of the rangers reported the highest level of confidence in GIS, while more than four times (43.2%) of the rangers reported the highest level of confidence in the navigation system.

3.2.4. *Level of job satisfaction and occupational stress*

About 63.6% of respondents were generally satisfied with their job. The average score for overall job satisfaction of nature reserve

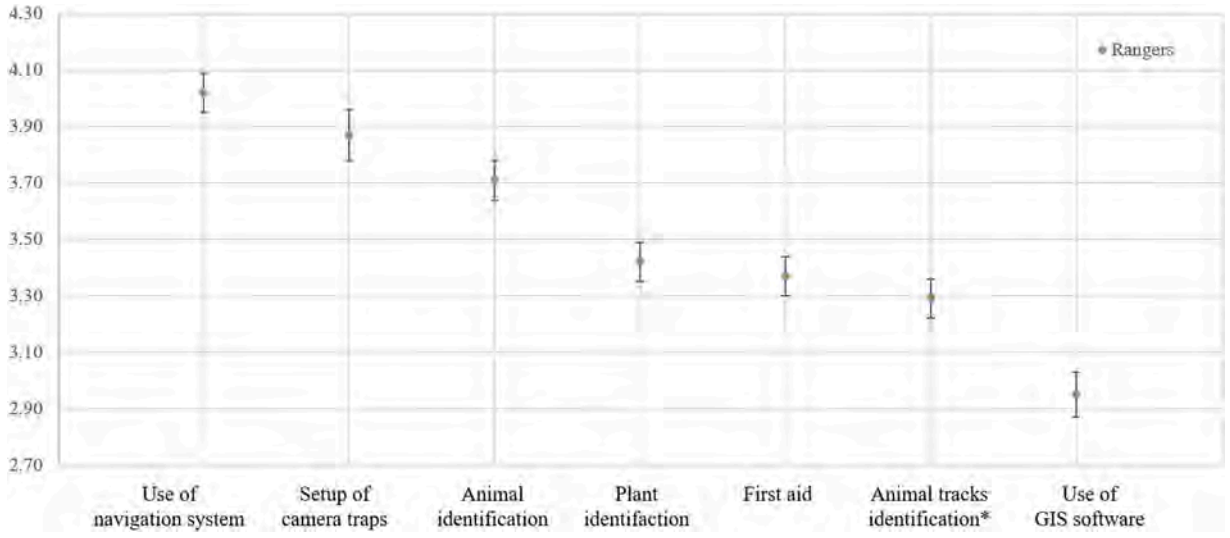

Fig. 2. Average scores of different skills. Error bars stand for standard errors.

workers was 66.2 ± 12.8 and the median was 66, both of which were higher than the neutral score (63.0) (Wilcoxon, Z = 5685.5, $p < 0.05$). Nature reserve staff most satisfied with their coworkers (average score of 9.2), followed by the nature of work (8.8), supervision (8.6), communication (8.4) and rewards (7.2) (Fig. 3). They were least satisfied with fringe benefits (5.4), followed by payment (6.0), promotion (6.1) and operating conditions (6.6), which were all significantly lower than the neutral value (7.0) (Wilcoxon, $p < 0.01$). More than 40.0% of respondents chose "strongly agree" to the question that "I like the people I work with." However, only 2.4% of respondents chose the same answer and thought the benefits were good.

The rangers were less satisfied with their jobs compared to non-rangers, though the difference was not significant (66.0 ± 12.7 vs. 66.7 ± 13.1, Wilcoxon, Z = 0.01, $p > 0.1$). They were especially not satisfied with their payments and working conditions compared to non-rangers ($p < 0.05$). Though not significant, they showed lower scores for promotion and fringe benefits as well. However, rangers were more satisfied with their colleagues than non-rangers ($p < 0.1$).

The nature reserve staff as a whole had a low perceived stress level. The average perceived stress score (17.3 ± 6.0) was significantly lower than the neutral level (28) (Wilcoxon test, Z = −20185.0, $p < 0.01$). There was no significant difference in the work stress level between the rangers and the non-ranger workers (17.1 ± 6.2 vs. 17.6 ± 5.6, Wilcoxon test, Z = 0.14, $p > 0.1$).

3.3. Differences between national and local nature reserves

There were no significant differences in job satisfaction and perceived stress levels between national and local nature reserves, although local nature reserve staff and rangers showed higher perceived stress and less satisfaction. The age, gender and education of rangers were similar between these two types of reserves. Nonetheless, local nature reserves hired a much higher proportion of rangers from local areas (73.5% for local reserves vs. 57.9% for national nature reserves, $\chi^2 = 3.945$, $p = 0.047$), which may indicate that local reserves may not have enough resources to attract and keep people outside to work in their institution. Meanwhile, rangers in local reserves tended to work a shorter period (9.3 ± 7.2 yrs) than national ones (13.2 ± 9.8 yrs)(Wilcoxon test, Z = −2.37, $p = 0.018$). No significant differences were found in the proportion of permanent staff, income, bonus, days in the field, the number of life-threatening situations, confidence in professional skills, or other aspects. Nonetheless, rangers in national nature reserves tended to spend more days in the field, fewer days with their family, When considering all staff, national nature reserve staff showed a significantly higher recognition that they received enough training (Wilcoxon test, Z = −2.23, p = 0.026).

3.4. Differences among regions

Staff from Southern, Southwest and Northwest China were generally younger with an average age below 40 (Table 2). Nature reserve staff from Southern China and Eastern China on average were more educated, with an average of 16.0 years and 15.9 years of education respectively. In comparison, respondents from Northeast China were least educated with only 13.5 years. Around 70% of nature reserve staff were local in Central, Eastern and Northeast China and more than 80% of their families lived in the same county. Comparatively, only half of the staff working in Northwest China were local and 56% of staff had their family lived in the same county. Besides, they had the least time spent with their families per month, which was 8.7 days on average and only about half of the time compared to Northeast China. Staff in most of the regions had an average of service years of more than 10 years, except for the Northeast with 8.8 years. Employees from Eastern China, reported the highest monthly salary with an average of 4551.0 RMB/month, which was 64.4% higher than that of employees from Northeast China (2769.9 RMB/month). The differences in salaries may result from discrepancies in regional development level and the amount of transfer payment for key ecological function areas and other conservation policies, which is a major financial source to hire temporary rangers. Although the monthly payment could be low, staff from most regions could get an annual bonus of more than 10,000 RMB. The exceptions were Northeast, Northwest and Northern China with less than 5000 RMB.

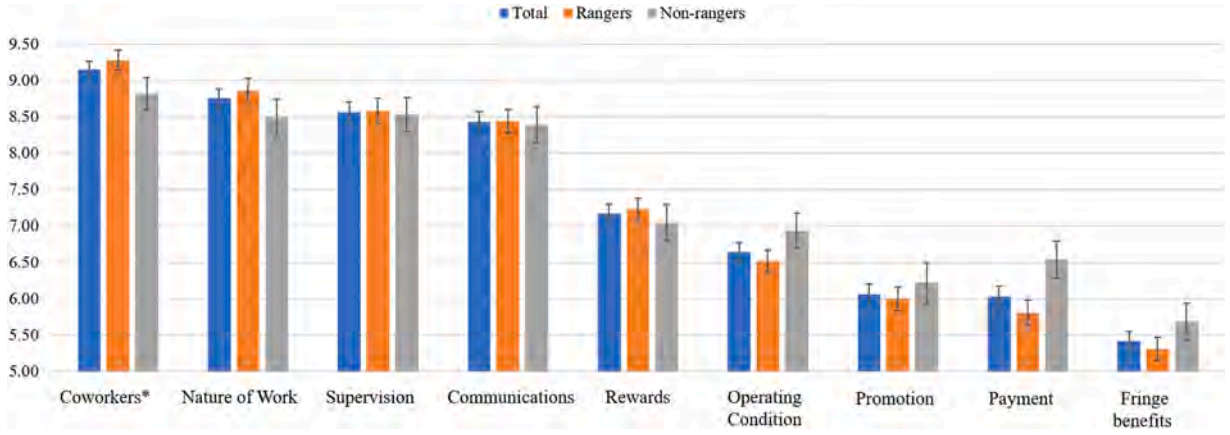

Fig. 3. Job Satisfaction scores for subscales. Error bars stand for standard errors.

Table 2
Comparison between rangers and non-rangers.

Items		Total	Rangers	Non-rangers
Number of Respondents		286	201	85
Level of NRs	National	217	152	65
	Local	69	49	20
Type of employment	Official staff	232	156	76
	Contractors	54	45	9
Mean year of service		11.6 ± 9.2	12.3 ± 9.4	10.0 ± 8.6
Mean monthly salary		4035	3944	4248
Days in the field per month		8.16	11.2	0.87
Life-threatening situation	Yes	213	164	49
	No	73	37	36
Times of serious injury during work		0.41	0.54	0.12
Enough Training		3.7 ± 1.0	3.7 ± 1.1	3.7 ± 0.8
Nature affection		4.0 ± 0.9	4.2 ± 0.9	3.8 ± 0.9
Government support		3.8 ± 1.0	3.8 ± 1.1	3.7 ± 1.1
Danger		3.7 ± 1.0	3.9 ± 1.0	3.2 ± 1.0
Difficult conditions		3.9 ± 1.0	4.1 ± 0.9	3.6 ± 1.1
Whether wish child do the same work	Yes	26	21	5
	No	103	71	32
	Follow child's own decision	157	109	48
Leave the current job	Yes	88	59	29
	No	165	119	46
	Doesn't matter	33	23	10

Staff in Eastern, Northern, Northwest and Northeast China reported more days in the field per month as well as higher scores of professional skill confidence, although the percentage of rangers in the responses were not necessarily the highest among all regions (Table 2). Respondents from all regions perceived their working conditions as difficult and challenging (Difficulty > 3) with some degree of danger (Danger > 3), except Northern China which had a mean score of 3.0 for danger. Staff working in the Northwest reported the highest degree of danger and challenging working conditions. People in the Northwest reported the highest perceived level of danger and hardness when working Meanwhile, higher perceived government support appeared in Southwest, Northwest, Central, and Southern China.

The job satisfaction and perceived stress were significantly different among regions (Kruskal-Wallis Test, $\chi^2 = 14.1$ for JSS, $\chi^2 = 14.3$ for PSS, $p < 0.05$) (Table 3). In general, respondents in the Northeast reported the highest levels of job satisfaction while the lowest score was in perceived stress. Nonetheless, they were less satisfied with their fringe benefit and income than the other regions (Fig. 4). Participants from Northwest and Southwest reported much lower scores in job satisfaction than Northeast (Tukey-Kramer HSD, $p < 0.05$). Workers in Central and Southwest China reported significantly higher levels of stress in work, especially compared with the Northeast (Tukey-Kramer HSD, $p < 0.05$).

Table 3
Variables comparison among different regions.

Region	Central	East	Northeast	North	Northwest	South	Southwest
% ranger	62%	68%	90%	67%	55%	81%	72%
Age/yrs old	41.5	40.8	41.2	40.3	39.7	37.3	38.8
Education/yrs	15.0	15.9	13.5	14.4	14.7	16.0	14.5
Local	67%	65%	69%	68%	50%	55%	57%
Same county	81%	80%	88%	68%	56%	68%	63%
Days with family/month	14.0	11.6	15.3	13.3	8.7	12.9	12.5
Year of service	13.4	12.5	8.8	10.0	13.6	9.9	12.0
Monthly pay/RMB	3798.9	4551.0	2767.9	4331.5	4067.4	4450.2	4054.0
Bonus/RMB per year	17342.5	15790.0	1727.3	4386.4	4071.4	11770.9	14623.3
Days in the field/month	7.0	9.0	10.0	10.4	9.2	5.6	8.0
Confidence in professional skills	21.6	23.9	24.4	24.3	25.8	21.5	23.2
Life threatening situation	0.3	0.2	0.4	0.4	0.1	0.3	0.2
Injuries	0.3	0.5	0.2	0.2	0.4	0.4	0.5
Enough training	3.6	3.6	4.0	3.9	3.7	3.7	3.7
Danger	3.4	3.8	3.6	3.0	4.0	3.4	3.9
Difficulty in working conditions	4.1	3.9	3.7	3.5	4.3	3.8	4.0
Government Support	4.0	3.4	3.3	3.2	3.7	3.9	3.9
Nature Affection	4.0	4.1	4.2	3.7	4.2	3.9	4.0
Job satisfaction scores	66.7	67.3	72.7	65.9	63.0	68.9	64.7
Perceived stress scores	19.1	17.4	13.7	16.4	17.5	17.2	17.8

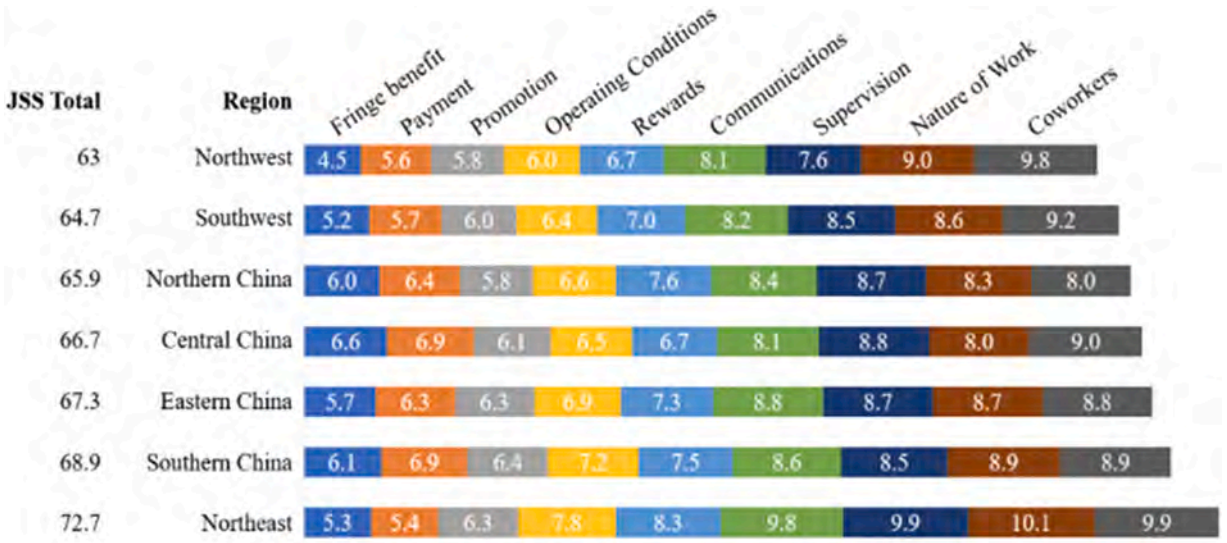

Fig. 4. Job satisfaction among different regions.

3.5. *Predictors of job satisfaction and working stress*

The final model with the lowest AIC for job satisfaction included the factors of age, days with family/month, years of service, income, how respondents perceived whether they received enough training and government support, the level of nature affection and their geographic regions (Table 4). More time spent with family, higher income, more training and more affection for nature significantly contributed to the overall job satisfaction ($p < 0.05$). Nonetheless, the satisfaction decreased as a staff stayed longer in the job. The longer a staff worked in the nature reserve, the less satisfied he or she became ($p < 0.05$). Interestingly, the amount of government support showed a negative correlation with job satisfaction.

The best model of perceived stress included the variables of age, education, days with family/month, years of service, income, training, government support, and confidence in professional skills. With the increase of age, more time with family, higher income, more training and confidence in professional skills, there was lower stress for nature reserve staff ($p < 0.05$). Nonetheless, the stress increased for more educated staff with a longer service period and more perceived government support ($p < 0.05$). Whether the respondent was a ranger or not did contribute to either of the models.

Table 4
Model results for job satisfaction and perceived stress.

Job Satisfaction			
Factors	Estimate	SE	*p*
Age	0.0017	0.0011	0.1127
Days with Family/Month	0.0017	0.0008	0.0340
Year of Service	-0.0047	0.0011	< 0.0001
Income	0.0000	0.0000	0.0001
Training	0.0245	0.0076	0.0012
Government Support	-0.0324	0.0068	< 0.0001
Nature Affection	0.0524	0.0087	< 0.0001
Central China	0.0175	0.0244	0.4751
Eastern China	-0.0087	0.0249	0.7265
Northeast	0.0672	0.0229	0.0036
Northern China	-0.0367	0.0248	0.1363
Northwest	-0.0502	0.0201	0.0120
Southern China	0.0323	0.0187	0.0855
Perceived Stress			
Factors	Estimate	SE	*p*
Age	-0.0093	0.0022	0.0000
Days with Family/Month	-0.0053	0.0016	0.0010
Year of Service	0.0117	0.0021	0.0000
Income	-2.42E-06	0.0000	0.7889
Training	-0.0512	0.0157	0.0011
Government Support	0.0553	0.0136	0.0000
Years of Edu	0.0099	0.0052	0.0528
Confidence in professional Skills	-0.0091	0.0031	0.0031

4. Discussion

Our results showed that nature reserve staff were generally satisfied with their jobs and the perceived stress was relatively low. Although both rangers and non-rangers are employed by nature reserves, their working locations, conditions, and tasks are very different, which causes disparities in job perception, satisfaction and stress. Rangers usually work in remote and undeveloped areas, while non-rangers work in the headquarters or main offices, mostly located in towns. Especially, because rangers cannot return home daily and usually need to work a week to 20 days in a row every month, the time spent with family is very limited. The majority of the rangers (66.2%) spent fewer than 10 days with their family, which was lower than the regional average for Asia (76%) (WWF, 2016). Our results also support that the number of days that a reserve staff spends with their family hugely influences job satisfaction, similar to previous findings (Spira et al., 2019; Eliason, 2006). Moreover, as education resources are usually lacking in remote areas or small towns, many nature reserve staff have to send their children and spouse to other cities away from their county, leading to further separation from their family members.

In China, nature reserves are regarded as "public service units" (Shiye Danwei), which are affiliated with the government, instead of being state organs per se (Guttman et al., 2018). Thus, permanent nature reserve staff are not hired as civil servants in the state organs, who usually have better payment and benefits. Nonetheless, as "Shiye Danwei" is still affiliated with the government, employees in these institutions still have a more stable income compared to working for private sectors, which has attracted many people to work in nature reserves. However, there is always a very limited quota on how many permanent staff a nature reserve can have, considering the responsibility and workload in managing a protected area. To be hired as permanent staff, candidates need to go through a national examination with fierce competition. New employees are usually well-educated fresh graduates who outcompete others during the exam, which emphasizes broad knowledge on history, culture, politics, economics, etc. Unfortunately, most of the new hires lack the passion, professional background, or physical fitness to work in the field. On the other hand, locals, veterans, or other people with good fitness and field experience usually cannot pass the exam or be recruited as permanent staff. Thus, they could be only hired as contractors with a lower salary. Many protected areas face the aging issue of their ranger teams. They could not hire enough young rangers who can be supported with decent salaries and benefits, at the same time have their permanent positions being filled with staff who are unwilling to work in the field. The mismatch between the needs from nature reserves and the hiring process leads to a shortage of capable rangers. More importantly, rangers or even nature reserve staff as a whole is not well recognized or appreciated by the public and working in the field is treated as an inferior occupation. The ranger population is also dominated by males. A stereotype of only males with intensive labor work and low societal status further impedes the recruitment of young people into this sector, leading to an aging population of rangers. The average age of rangers was 39.8 yrs old, similar to the global average (40.9) (Belecky et al., 2019) and the low recruitment of young people leads to longer service time of rangers in nature reserves.

Different economic development levels, ecosystem types and terrain could contribute to the differences in rangers' status and their perception. Payment is among the least satisfying aspects for a ranger, especially for Northeast, Northwest and Southwest China. On the contrary, the Southern and Eastern parts of China are more developed and richer, which leads to higher income for rangers and attracts more educated employees. Nonetheless, rangers were not satisfied with the fringe benefits in most regions including Eastern China. Although the Northeast region has the least payment and most days working in the field per month compared to other regions, it shows a much higher overall satisfaction towards the job, which could be contributed by the fact that most of the staff are from local areas and have their family close by (Spira et al., 2019; Eliason, 2006). On the contrary, Northwest has only 50% of their staff as locals and the staff spent the least amount of time with their families; additionally, since this region usually has tough environmental conditions, more frequent extreme weathers, a vast wilderness with limited roads, higher perceived danger, the rangers in this region have lowest job satisfaction.

One key factor for job satisfaction and stress is the amount of training to prepare nature reserve staff for their jobs. About 42% of our respondents did not believe they had received sufficient training. Although rangers overall reported higher confidence in the professional skills, they were less confident in first aid skills, which means that their lives could be endangered during emergencies like being bitten by snakes or major bleeding due to accidental falls. This lack of confidence and training should be addressed by more systematic design and implementation of training programs when new employees are hired and throughout their careers. Nonetheless, with limited funding and capacity, most nature reserves, especially local nature reserves, may not be able to accomplish the tranings on their own, indicating a need of support from higher management institutions such as provincial or state Forestry and Grassland Administrations.

Nature reserve employees expressed the least amount of satisfaction with promotional opportunities, salary, and fringe benefits. These findings are consistent with previous studies that workers report low job satisfaction if the job lacks promotion and advancement opportunities, or adequate salaries (Canrinus et al., 2012). Studies have found that public employment had not been transparent on the promotion process (Cao, 2001). Only about 75% of the nature reserves in our survey were reported with a performance evaluation system. Moreover, respondents in our study indicated many systems lack quantitative performance indicators and do not emphasize the field performances or patrolling efforts, leading to a lack of incentives or participation in fieldwork. The local government budget is the primary financing mechanism for reserve construction and management; therefore, many protected areas, especially local reserves, lack funding support for staffing and patrols (Jim and Xu, 2004; Yeh, 2013). The average income of the respondents is 4035 yuan per month, which is much lower than the monthly salary, 6193 yuan, of all public service units (National Bureau of Statistics of China, 2019). With the expansion of protected areas and the poverty alleviation program, about 370,000 locals were hired as temporary rangers from just 2016–2017. These rangers usually need to patrol relatively fewer days per month than the normal rangers. How to make these rangers become more responsible and motivated about the work become another issue.

The respondents of this study did not expose to a high level of work-related stress. A growing body of research revealed that a

natural setting can relieve stress and anxiety, which may lead to low-reported occupational stress (Brymer et al., 2010; Capaldi et al., 2014; Pearson and Craig, 2014). Nature affection also contributes to the motivation to be a nature reserve staff and their job satisfaction in our study. The top threat during work was from local residents instead of from professional poaching gangs. Because of the ban on guns in China, compared with other countries, poachers are less aggressive, although some of them still illegally own guns. 41.4% of respondents reported that they had been attacked or threatened by neighboring community members while about 26.8% of respondents encountered poachers with sharp weapons. However, because nature reserve staff are not qualified to carry guns and could only carry out administrative law enforcement on their own, they could only pose limited deterrence to illegal activities.

The government support level was a negative predictor of job satisfaction and a positive predictor of work stress. It is unintuitive to link governmental support with job satisfaction and occupational stress of employees in nature reserves. The attention and stress from the central government pertaining to ecological protection may account for this result. During the 19th National Congress of the Communist Party of China, President Xi Jinping highlighted the importance of sustainable development and ecological civilization, which urged the government to place special emphasis on environmental protection, including wildlife conservation and nature reserve protection. With the pressure from the central government, the local governments actively complied to achieve the goals. Therefore, when the workers in nature reserves were given support or attention, they felt tension and pressure rather than appreciation.

The findings in this study should be viewed in light of two key limitations. First, most of the rangers who carry out intensive fieldwork or have less education may not be able to take the survey due to limited internet access or do not understand how to access and take the survey, which could cause a biased estimate. Second, our sample is biased towards the Southwest region, thus our results could be influenced more by this area. Thus, we caution against over-interpretation of our results.

Although our results revealed a high percentage of job satisfaction and low occupation stress among nature reserve staff, still about 1/3 of respondents would like to quit the job. The challenges facing these staff especially rangers that they are facing greatly influence the recruitment and service time of new employees. Many protected areas in China experience the aging population of their staff especially the rangers. Thus, the improvement in training, income, performance evaluation system, law enforcement mechanism and hiring process could potentially change the situations for the frontline practitioners.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.gecco.2021.e01731.

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