China’s Mangrove Forests: Values, Knowledge and Attitudes to Conservation

INTRODUCTION

In 2006, a working group of international mangrove experts concurred that we face the global prospect of mangrove forests being lost within the next 50 to 100 years (Duke et al., 2007). In China this loss is significant, with 45% of mangrove forest cover lost since the 1950s and with two critically endangered mangrove species endemic to China (State Forestry Administration, 2002). Mangroves are distributed naturally in Hainan, Guangdong, Guangxi, Fujian, Hong Kong, Macao and Taiwan (Fig. 1), and according to the latest survey by State Forestry Administration in 2001, the total mangrove area in mainland China was ~22 000 ha. There are 24 true mangrove species, accounting for about one-third of the total true mangrove species worldwide. All but one species (*Lumnitzera littorea*) can be found in the Qinglan Reserve of Hainan, within a mangrove area of only 1 233 ha (Wang & Wang, 2007); such high species diversity of mangroves is rare (Chen et al., 2009).

Some of the world’s most profound environmental changes are under way in China. The country’s large population, rapid economic development, and demand for natural resources have put huge pressure on the marine environment, which is dealing with massive and unprecedented threats (He et al., 2014). Large areas have been cleared, reclaimed or severely polluted. This not only seriously reduces regional marine biodiversity; it has severe social implications in a developing country for rural poor especially, and a population trying to improve its living standards. Plus of course the scale of what is happening in China has global environmental consequences.

Therefore, studying the underlying forces of these environmental threats and behaviours is extraordinarily important. In order to effectively conserve or manage an ecosystem, it is essential to understand how people value and use it, their level of knowledge and attitudes towards protection. Therefore, the aim of this small study was to understand the environmental values, level of knowledge and attitudes towards conservation of mangrove forests by Fujian Province residents.

It is fair to say that China does not have a good environmental reputation. Problems in the marine environment highlighted by international media relate to severe pollution causing public health problems,
the misreporting of fisheries catches, disputes about ownership of waters surrounding China, Chinese demand for products such as sea cucumbers and shark fins outside China, and the activities of Chinese distant-water fleets (Shen & Heino, 2014). Bearing this in mind, this short report also endeavors to help people outside China improve their understanding of the wide range of Chinese values and attitudes.

Figure 1. Mangrove distribution in China, along the coast in Hainan, Guangxi, Guangdong, Fujian, Zhejiang, Zhejiang Provinces, Hong Kong and Taiwan (Chen et al., 2009).
METHODOLOGY

Members of the public were asked to complete questionnaires in two locations within the Fujian Province in July 2014:

1. Fu Gong Village, adjacent to Fujiang Jiulongjiangkou Mangrove Provincial Reserve, Long Hai, Fujian Province.
2. Within Xiamen City at Yundang Lake, where mangroves have been planted.

The questionnaires were undertaken in Chinese (Mandarin and a local dialect) with the assistance of an interpreter, on a Saturday in Fu Gong Village, and over two evenings at Yundang Lake. It was thought that people would be more likely to take part in the research at these times, on advice that people would be less busy on a Saturday in Fu Gong, and in the evening after normal working hours when people commute or exercise alongside the lake. Questions were fixed-choice or used the Likert scale of ‘strongly disagree to strongly agree’ to measure attitudes or opinions. A total of 70 questionnaires were completed. Respondent demographics were balanced in gender (51% male and 49% female), although quite young (70% were under forty). The Victoria University of Wellington Human Ethics Committee approved this research on 10th July 2014.

A literature review was also undertaken, as were semi-structured interviews with conservation NGO workers and university staff during a six-week study tour in southern China. The findings of these interviews, largely relating to threats, conservation and management, helped to refine the questionnaire, choose the exact survey locations and inform this discussion.

Figure 2. Google Map showing location of Yundang Lake in Xiamen, the Fujiang Jiulongjiangkou Mangrove Provincial Reserve and Fu Gong Village.
RESULTS

Environmental Values

Although 27% of respondents visit a mangrove forest daily or weekly, most people surveyed very rarely (40%) or never visit a mangrove forest (16%). The majority of respondents visited mangrove forests for ‘enjoying nature’ (61%), with a few people fishing, collecting wood and plants or for other reasons. Eleven per cent of respondents stated that they depend on the mangrove forest for their livelihood.

When asked whether they care about the mangrove forest, 64% of Fu Gong Village residents strongly agreed or agreed and only 5% disagreed. In comparison, slightly less respondents around Yundang Lake strongly agreed or agreed (55%) and 10% disagreed (Fig. 3).

![Agree or disagree with statement - “I care about the mangrove forest”](image)

Figure 3. Percentage of respondents that strongly agree / agree, strongly disagree / disagree, or are neutral on the statement “I care about the mangrove forest”.

Environmental Knowledge

Both Yundang Lake and Fu Gong Village respondents most often identified pollution (e.g. from industry, sewage and agriculture), and the removal of mangroves for land development, as biggest threats to
mangrove forests. This is followed by rubbish/waste, removal of mangroves for shrimp and aquaculture ponds, and plant pests and diseases. Figure 3 shows that Fu Gong Village respondents perceived more threats to mangrove forests than Yundang Lake respondents, indicating greater awareness. The largest differences are in the perception of threats from land development, plant pests and disease, and fishing and gathering shellfish.

Figure 4. Respondents’ perceptions of the biggest threats to mangrove forests in Fujian province, China.
Figure 5. Percentage of respondents at Yundang Lake and Fu Gong Village that strongly agree / agree, strongly disagree / disagree, or are neutral on the importance of mangrove forest ecosystem services.
Using the Likert scale, respondents were asked whether they agreed that mangrove forests were important for a range of ecosystem services (acknowledged in scientific literature). In general, Fu Gong Village respondents consider that mangrove forests are more important for a range of ecosystem services than Yundang Lake respondents (that is, a higher proportion of respondents strongly agreed or agreed that the mangrove forest was important for nine of twelve specified ecosystem services) (Fig. 5). Fu Gong Village respondents consider mangrove forests most important for bird habitat (85 % strongly agreed or agreed), juvenile fish habitat, land protection, marine water quality, scenery and enjoyment of nature, whereas Yundang Lake respondents consider mangrove forests most important for storm protection (77 % strongly agreed or agreed), bird habitat, scenery and tourism. Over half of respondents strongly disagreed or disagreed that mangrove forests are important for fishing (58 % and 54 %).

Figure 6 shows the proportion of respondents that agree, disagree or are neutral on the statement “mangrove forests are healthier today than 20 years ago”. It demonstrates that most people do not know or do not have an opinion on this statement (58 % at Yundang and 46 % at Fu Gong), where they are living in the city or adjacent to the mangrove reserve. More Fu Gong Village respondents believe mangrove forests are healthier (39 %) than Yundang Lake respondents (16 %), and a higher proportion of Yundang Lake respondents believe mangrove forests are less healthy now than 20 years ago (26 % compared to 15 %).

Figure 6. Percentage of respondents that strongly agree / agree, strongly disagree / disagree, or are neutral on the statement “Mangrove forests are healthier today than 20 years ago”. Inner circle Yundang Lake respondents and outer circle Fu Gong Village respondents.
Attitudes Towards Management

Respondents were asked for their opinions on conservation, the use of the mangrove forests and restoration. Positively, ninety-six per cent of respondents strongly agreed / agreed that all mangrove forests should be protected, 4 % were neutral, and no one disagreed. Further, 89 % of respondents strongly disagreed or disagreed that mangrove forests should be cleared for development and other uses (10 % were neutral and only 1 % strongly agreed / agreed that they should be cleared).

Respondents were asked for their opinions, using the Likert scale, on whether people should be permitted to use mangrove forests for fishing and gathering seafood, wood and plants (that is whether limited or sustainable use should be allowed). Attitudes toward restoration activities were also sought. It can be seen in Figure 7 that respondents in Yundang Lake and Fu Gong Village had similar attitudes towards both of these activities and that there is no strong consensus. A similar proportion of people agree and disagree on limited use of mangrove forests, with slightly more Yundang Lake respondents agreeing with limited use and slightly more Fu Gong Village respondents disagreeing. Sixty-five per cent of Yundang Lake and 69 % of Fu Gong Village respondents strongly agreed or agreed that more mangrove trees should be planted.

![Figure 7](image)

Figure 7. Percentage of respondents that strongly agree / agree, strongly disagree / disagree, or are neutral on statements that people should be permitted limited use of mangrove forests and more mangrove trees should be planted.
DISCUSSION

Environmental Values

With a deep history stretching back four millennia containing three major philosophical traditions: Daoism, Buddhism, and Confucianism (e.g. Grumbine & Xu, 2011 for a discussion of traditional Chinese values), plus many different ethnic traditional values (e.g. see Fei, 1989), the roots of Chinese environmental values are complex and different to Western ones. However despite this long history and underlying Eastern values that sometimes encourage living in harmony with nature, China has a longstanding record of over-exploitation and environmental degradation (Harris, 2004).

Harris’s (2004) review of Chinese survey results found that the highest priorities of the Chinese are poverty alleviation, economic development, economic growth, and wealth creation. He describes the pervasive Chinese environmental value as an anthropocentric one - the environment being valued for its instrumental role in protecting and promoting human interests, which is similar to many developing and developed countries. Views of environmental protection and sustainable development are not yet widespread at the grassroots (Harris, 2004). Considering that ninety-six per cent of respondents in the current study strongly agreed / agreed that all mangrove forests should be protected, and no one disagreed, perhaps grassroots views of environmental protection have spread in the last 10 years since Harris’s 2004 report.

Of course there are environmental values in China and in general, previous surveys have found that different kinds of people have different attitudes toward the environment. Environmental awareness is rising, particularly in urban areas (Oksenberg & Economy, 1998) and among the elite and highly educated. Poor and less educated people living in rural villages are often the least inclined toward environmental protection. More people are being adversely affected by environmental problems, and there is more education about the environment (Harris, 2006). He et al. (2011) examined the environmental awareness of Chinese students aged 16 to 20 years old and found attitudes that are strongly protective of the environment and demonstrate environmentally responsible behavior. People are demanding change, especially those suffering from the worst pollution (Harris, 2006).

Environmental attitudes are directed toward different problems. Domestic issues (e.g. sanitation and drinking water) are important to most people, local issues (e.g. water and air pollution) are also important to people affected by them and national issues (e.g. acid rain and deforestation) are much less important to people. The vast majority of Chinese are concerned about their home and maybe their neighborhood;
basically, Chinese people say that they care about problems that affect them directly (Harris, 2006). These different environmental values are somewhat evident in the questionnaire results. Most respondents (64%) at Fu Gong Village, situated adjacent to a mangrove reserve care about the mangrove forest. However, a large proportion of residents at Xiamen City also stated they cared about mangrove forests (55%).

**Environmental Knowledge**

China has been aware of some of its environmental issues since the early 1970s and since 1983 environmental education has been taught in Chinese schools (Tian, 2004). However, previous studies have concluded that, in general, most Chinese have limited environmental knowledge (Harris, 2006). For example, He et al. (2011) found a relatively low level of knowledge of environmental facts among Chinese students aged 16 to 20 years old. This is demonstrated in this study by the mixed responses and large number of people that did not know or were neutral on whether Fujian’s mangrove forests are healthier than 20 years ago. To be fair this is quite a difficult question. It is also evident in the lack of understanding that mangrove forests are important for fisheries. Respondents seem to understand that mangrove forests are important habitats for juvenile fish, but perhaps do not make the link between juvenile habitats and healthy fisheries. It is positive that He et al.’s (2011) students expressed a strong willingness to become more environmental friendly than they have been. But for people to be environmentally friendly, they need to understand the environment.

There are regional differences in knowledge and attitudes though, with spatial connection and local experience major factors in perceiving the severity of environmental problems (Blake, 2001; Duan & Fortner, 2005; He et al., 2011). This is evident in the understanding of major threats to mangrove forests and in the level of knowledge of mangrove forest ecosystem services in the current study. Many more Fu Gong Village residents were aware that plant pests and diseases are a major ongoing and widespread threat to China’s mangrove forests. Fu Gong Village respondents also consider mangrove forests more important for a range of ecosystem services, when compared with Yundang Lake respondents.

There are still many threats to Chinese mangroves. Urban and aquaculture wastewater discharge, oil pollution, biological invasion, insect outbreak and the influence of water transportation remain serious threats (Wang et al., 2002; Qiang & Lin 2004, Liu et al., 2006, Wang & Wang, 2007). The diversity and richness benthic animals, birds and fishes have declined in several polluted mangrove forests (Cai et al. 2000; Lin et al. 2007; Ma et al. 2003; Wang et al. 2002). Both Yundang Lake and Fu Gong Village respondents perceive pollution and the removal of mangroves for land development as the biggest threats to mangrove forests. Pollution is perhaps the most widespread current major threat, so this
indicates a good level of awareness of China’s massive pollution problem. However as mangrove forests are now largely protected in China, removal of forests for land development is more a significant recent past threat. This may indicate the public is aware of massive mangrove loss, but not of current conservation efforts. Mangrove forests were extensively reclaimed for rice fields in the 1960s and 1970s to meet food demands of the growing population. In the 1980s mangroves were further cleared for aquaculture ponds (Li & Lee, 1997). Much of this damage has already been done. This is not to say that areas of mangrove forest, even those protected, are not still being cleared or reclaimed for development (Fig. 8.)

Figure 8. Reclamation within the Fujiang Jiulongjiangkou Mangrove Provincial Reserve, Fujian Province.

Attitudes to Management

The concept of environmental protection was formally introduced to China in 1973 at the first National Conference on Environmental Protection and in 1983 environmental protection was established as a basic national policy (Chen, 2009). Mai Po Wetland in Hong Kong was the first mangrove reserve in China, established in 1976 and listed as Ramsar Site in 1995 (Li & Lee, 1997). China has since made rapid progress in mangrove conservation. To 2009, 34 mangrove nature reserves have been established in China, and the total protected area was >18 000 ha, accounting for >80% of the total mangrove area in China (Chen et al., 2009). This is a significant achievement.
Chinese citizens are growing more aware of the need for environmental protection due to increased perception and cognition of local and regional environmental degradation (Ma & Guo, 2000). This study supports this statement; almost all respondents agreed that mangrove forests should be protected and no one disagreed. Mixed responses were received on whether people should be allowed to fish or gather seafood, wood or plants in mangrove forests. This is understandable as how to maintain a good balance of sustainable uses and ecological conservation is always difficult. In China, some reserves are strictly protected (Fig. X) and others allow tourism and sustainable utilisation (e.g. oyster culture in Shankou, Guangxi) carried out through management plans. Tam & Wong (2002) report a number of problems with both kinds of reserves: (1) inadequate size; (2) lack of buffer zones; (3) scarce ecological baseline information; (4) insufficient resources and manpower; (5) unclear government policy and too many departments involved (6) ineffective management and enforcement; (7) not enough involvement of local communities; and (8) lack of public education. So regardless of the reserves main purpose, for conservation to be successful, it is critical to understand the ecosystem, to have the support and involvement of local communities, and to have effective management and sufficient resources.

However, in a review, Harris (2006) found that in surveys people often admit that they are not concerned or bothered enough about the environment to accept personal responsibility for preventing protecting it. They generally expect others, particularly the government, to take care of environmental protection. But, of course there are groups of dedicated citizens that do volunteer their time to protect and restore the environment. For example, in 2013 1100 China Mangrove Conservation Network volunteers planted almost 180,000 mangrove plants (Fig 9.), 90 people undertook volunteer environmental monitoring and over 400 people along the southern coast sent in picture of mangroves (either good work happening or pollution/damage for the record).
In addition to the establishment of mangrove natural reserves, great efforts in mangrove reforestation have been made since the early 1990s (Zheng et al., 2003). To 2002, ~2 678 ha of mangroves have been replanted, although only 57% of them were successful restored, which is quite low. This appears to be due to planting being undertaken without fully understanding the environmental conditions required, and because mono-species are often used; reducing biodiversity and increasing susceptibility to disease and insect-outbreak. This is because most of these reforestation projects are aimed mainly for the appearance of the planted trees and for the high survival rates (Chen et al., 2009). Respondents in Yundang Lake and Fu Gong generally support restoration efforts, although 35 % and 31 % of people are still neutral / don’t know or don’t believe more mangrove trees should be planted.

Conclusions

Some of the world’s most profound environmental changes are under way in China. Large areas of mangrove forest been cleared, reclaimed or severely polluted. While this seriously reduces regional marine biodiversity it also has severe social implications in a developing country. China’s mangrove forests are important ecosystems offering a range of environmental services. To effectively undertake conservation it’s critical to understand how people value and use it, their level of knowledge and attitudes
towards protection. That was the aim of this study. Seventy Fujian province residents at Yundang Lake, Xiamen and in Fu Gong Village adjacent to a provincial mangrove reserve completed questionnaires.

From this study, the following is evident:

- Fujian province residents care about mangrove forests whether they live in the city or a small village.
- There is general awareness of mangrove forest ecosystem services, and major threats to mangrove forests. Fu Gong residents have a higher level of environmental knowledge in regards to mangrove forests, probably owing to their close proximity to a provincial reserve.
- Ninety-six per cent of people surveyed believe all mangrove forests should be protected, and mixed results were received on whether sustainable or limited use should be permitted.
- Most people think that more mangrove trees should be planted.

China faces significant marine conservation challenges, but its effort in mangrove forest protection offers hope. The results of this study support this protection and restoration. Environmental education is key, as is the support of local people in conservation programmes. Of course Chinese people have a wide range of environmental values, but this is not always portrayed in the international media. It is hoped this small study provides another insight to the values and attitudes of Fujian Province residents to mangrove forests.
REFERENCES


