IDENTIFYING CONSERVATION SOLUTIONS FOR THE YANGTZE FINLESS PORPOISE (*NEOPHOCAENA ASIAEORIENTALIS ASIAEORIENTALIS*) THROUGH COMMUNITY RESEARCH

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FINAL REPORT

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Executive Summary

The Yangtze finless porpoise (*Neophocaena asiaeorientalis asiaeorientalis*), the world's only freshwater porpoise, has experienced a severe decline in recent decades and is now classified as Critically Endangered. Further investigation of regional levels, impacts, and socio-economic drivers of potentially harmful fishing activities are recognized as important priorities for porpoise conservation research in the Yangtze. Standardized interviews with 510 fishers were conducted in 2011–2012 across three different porpoise high conservation value areas identified in the middle-lower Yangtze drainage (the Huangshi–Wuxue and Jiujiang–Anqing river sections in the Yangtze mainstem, and around East Dongting Lake and Poyang Lake). These interviews collected quantitative data on local patterns of legal and illegal fishing gear usage, local attitudes and awareness of conservation and fisheries legislation, and local livelihoods and incomes. Regular community outreach activities addressing regional fisheries legislation and porpoise conservation legislation take place across the Huangshi–Anqing region of the Yangtze mainstem and around East Dongting Lake, although such activities appear to be less well-conducted around Poyang Lake. However, local awareness about restrictions concerning fishing methods other than electrofishing is relatively low, and only a single informant across the entire survey area was aware that rolling hook long-lining, a likely major cause of porpoise mortality, is regionally prohibited. There is an urgent need for better education about legislation banning the use of rolling hook long-lines in the Yangtze mainstem, and for better education about porpoise conservation legislation around East Dongting and Poyang Lakes. In addition to ongoing support for enforcement of legislation against electrofishing, there is also an urgent need for substantially increased regional enforcement of existing legislation banning the use of rolling hook long-lines in the Yangtze mainstem, and banning the use of fixed nets in East Dongting and Poyang Lakes. There are over 8,000 licensed fishing families living in these three porpoise high conservation value areas; these families have cumulative annual earnings from fishing of over CNY 150 million, and very little experience of any alternative livelihoods. These considerations should be taken into account when deciding how, or whether, to invest in any form of larger-scale regulation of fishing activities in the middle-lower Yangtze drainage as part of a potential future porpoise conservation management plan.

1. Project Background

Asian freshwater cetaceans are probably the most threatened group of large mammals, and occur in some of the world's most densely populated human environments (Reeves et al. 2000). The middle-lower Yangtze River drainage (including the appended Dongting and Poyang lake systems) until recently contained two endemic freshwater cetaceans; however this river system also supports approximately 10% of the world's population, and has been seriously affected by overexploitation and industrialization (Dudgeon 2010). The Yangtze River dolphin (*Lipotes vexillifer*) has probably already become extinct, largely due to incidental by-catch in rolling hook long-lines, representing the first human-caused extinction of a cetacean species (Turvey et al. 2007). The Yangtze finless porpoise (*Neophocaena asiaeorientalis asiaeorientalis*), the world's only freshwater porpoise, is fully protected by Chinese national legislation as a State II Protected Animal, but has also experienced a severe decline in recent decades, from c.2550 to c.1100-1200 individuals in the Yangtze mainstem between 1984-1991 and 2006 (Zhao et al. 2008), and down to only c.500 in 2012 (Mei et al. 2014). This endemic subspecies is now one of the few cetaceans to be classified as Critically Endangered by IUCN (2014). Further conservation attention for this highly threatened taxon therefore represents one of the most urgent global priorities for cetacean conservation.

The Yangtze finless porpoise has been identified as a key conservation concern by the IWC and other organisations, due to its high perceived threat from incidental by-catch and other anthropogenic factors (e.g. Reeves et al. 2005). In particular, the most recent report by the IWC Standing Sub-Committee on Small Cetaceans (2001) recommended that:

- the magnitude and effects of finless porpoise by-catch should be investigated as a matter of priority;
- potential threats to freshwater cetaceans in general should be eliminated or greatly reduced, and adequately enforced.

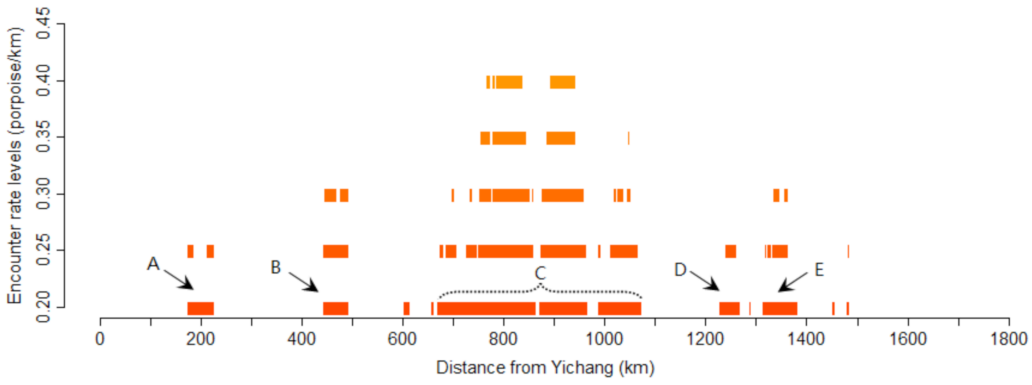


Figure 1. Distribution of regions with high porpoise encounter rates (>0.20 porpoises/km) in the Yangtze mainstem between Yichang (upstream) and Shanghai (downstream). A-E = porpoise high conservation value areas that could represent appropriate sites for future porpoise reserves (Zhao et al. 2013).

Recent research has clarified recent patterns of abundance and threat to the Yangtze finless porpoise across its range:

- Analysis of data from the 2006 boat-based Yangtze cetacean survey has identified a series of high conservation value areas in the Yangtze mainstem, where porpoise encounter rates were higher than 0.20 porpoises/km (33.9% of survey area) and 0.35 porpoises/km (7.8% of survey area) (Zhao et al. 2013; Figure 1).

- A range-wide community interview survey of Yangtze fishing communities conducted in 2008, which interviewed almost 600 fishers, found that significantly fewer informants around East Dongting and Poyang Lakes considered that porpoises had declined in these regions in comparison to informants along the Yangtze mainstem (Turvey et al. 2013). These are also the only regions where porpoise encounter rates have remained relatively constant over recent decades during boat-based surveys (Zhao et al. 2008). The two lakes should therefore also be considered as high conservation value areas for finless porpoises.

- Reporting of porpoise mortality events, carcass salvage and scientific post-mortems are still not carried out on a systematic basis by Chinese researchers. However, the 2008 interview survey also gathered extensive data on porpoise mortality events observed and reported by Yangtze fishers. This study represents the first major investigation into patterns and drivers of finless porpoise mortality in the Yangtze. Rolling hook long-lines are responsible for the greatest number of porpoise deaths in fishing gear entanglement (45.2% of all by-catch events where gear type was reported), as was also the case for the baiji. However, mortality both from vessel strikes and from other anthropogenic factors not readily identified by informants, which did not leave obvious external injuries/markings (potentially electrofishing and the effect of pollutant loads on porpoise health), represent other substantial and increasing sources of reported porpoise mortality. Further smaller-scale interview surveys in fishing communities around Poyang Lake conducted by IHB staff over the past two years suggest that fixed nets may be a major cause of porpoise mortality in this region (Wang Ding, Institute of Hydrobiology, unpublished data).

Although a series of *in situ* cetacean reserves have been established along the Yangtze mainstem, these reserves failed to prevent the probable extinction of the baiji, and the threat factors that are likely to be driving the continued decline of the finless porpoise population are still widespread across the middle-lower Yangtze region today. Ship traffic has increased five-fold since the 1980s, and at least 19,830 large vessels (>1 vessel/100 m) were counted in the Yangtze mainstem between Yichang and Shanghai in 2006 (Turvey et al. 2007). Rolling hook use is still apparently widespread, and there is no statistical difference in the proportion of reported porpoise deaths caused by rolling hooks during the past decade compared to older reports (Turvey et al. 2013).

In order to develop an effective conservation strategy for the Yangtze finless porpoise and prevent it from becoming the 'second baiji', it is imperative to identify how best to mitigate the effect of these known anthropogenic threats on

the porpoise population, to identify effective *in situ* management strategies that will maximise the effectiveness of existing conservation legislation, and potentially to identify further legislation that could further improve the likelihood of *in situ* survival of porpoises in the Yangtze system. Realistically, it is unfortunately highly unlikely that conservation efforts will be able to reduce ship traffic in the Yangtze mainstem over the next few decades, due to China's ongoing economic boom. However, targeted conservation efforts to reduce the impact of other key threat factors may be sufficient to reduce or reverse the current porpoise population decline. On the basis of our recent porpoise research projects, further investigation of regional levels, impacts, and socio-economic drivers of harmful fishing activities are recognized as important priorities for porpoise conservation research, and better regulation of illegal and harmful legal fishing activities represent urgent priorities for conservation action. It is necessary to address these threats in the immediate future.

2. Conservation Activities

Finless porpoise conservation activities were carried out in 2011–2012 in three key geographical areas, representing the different porpoise high conservation value areas identified in the middle-lower Yangtze drainage (Figure 2):

- Yangtze mainstem, comprising two almost adjoining geographical regions where porpoise encounter rates ≥0.35 porpoises/km:
    - 87 km river section from Huangshi to Wuxue
    - 161 km river section from Jiujiang to Anqing
- East Dongting Lake
- Poyang Lake

Conservation research in these areas comprised a wide-scale interview survey targeting fishing communities and regional fisheries authorities between Huangshi–Wuxue and Jiujiang–Anqing, and around both East Dongting and Poyang Lakes, to gather standardized data on:

- Local patterns of legal and illegal fishing gear usage
- Local attitudes and awareness of conservation and fisheries legislation
- Livelihoods and incomes

Following completion of interviews in each fishing community, a small presentation accompanied by a five-minute Chinese-language film on Yangtze cetaceans was shown to all informants to raise awareness of finless porpoise conservation, and a well-respected representative of each community was identified as the local contact person for a porpoise conservation monitoring network coordinated by the Institute of Hydrobiology, to report any porpoise strandings or mortality events.

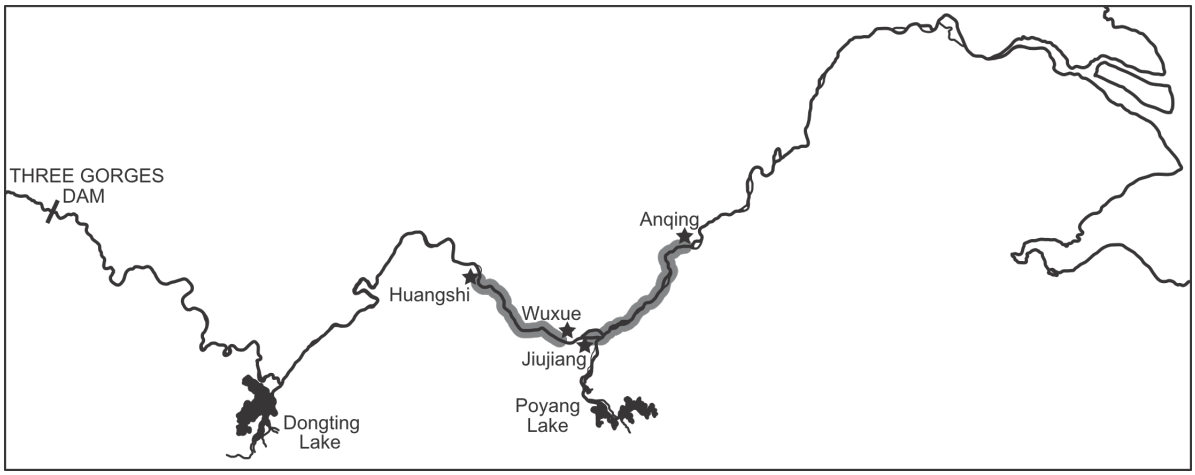


Figure 2. Middle-lower Yangtze drainage, showing location of the two top-priority porpoise conservation value areas along the Yangtze mainstem (Huangshi–Wuxue and Jiujiang–Anqing), and Dongting and Poyang Lakes.

Figure 3. Conducting questionnaire-based interviews to gather socio-economic, attitudinal and behavioural data from local informants in fishing communities around East Dongting Lake.

3. Interview Survey: Methods

Community-based interviews were carried out in 15–23 November 2011 and 23 March–20 April 2012, following a series of meetings with regional fisheries officials across the survey area. Proportional stratified random sampling of informants was employed, to enable data drawn from the survey to be considered representative of the wider study population of Yangtze fishing communities (Newing 2011). Within Chinese provinces, administrative areas are delineated by cities, which in turn are subdivided into counties. The number of licensed fishing families per county was first determined through meetings with fisheries officials in every city situated within each porpoise high conservation value area, with further meetings held with county-level fisheries administrators where necessary to complete collection of these data. A proportional sampling strategy was then determined based on the recorded numbers of fishing families in each county relative to the total number of families for each survey region, within a sampling framework aiming to collect a robust comparative sample size of c.150 interviews in total from East Dongting Lake and c.200 interviews each from both Poyang Lake and the Yangtze mainstem (Tables 1-3), although in practice it was not quite possible to conduct exactly this number of interviews. Counties where ≤5 informants were required for interview based on this proportional sampling strategy were excluded due to low data reward:travel cost of interviewing this small sample, with these informant targets assigned randomly to other counties with >5 informants already selected for sampling. Within each county, the largest and/or most accessible fishing communities were then selected to minimise travel time and field expenses for survey teams.

Within each fishing community selected for interview, informants were located either through the help of a representative of the local fisheries authority convening a small meeting in the target community, or through the interview team independently visiting target communities and talking to all available fishers present at that time; choice of informant selection method was dependent on the local fisheries authority.

All respondents were interviewed one-to-one using a standard anonymous Chinese-language questionnaire comprising descriptive, structured and contrast questions, which took c. 20 minutes to complete (Figure 3). This contained questions on attitudes and awareness about local environmental legislation; usage of different fishing gear types; income associated with different fishing activities and other activities; and alternative livelihoods. Interview methods followed Zoological Society of London (ZSL) guidelines for ensuring appropriate ethical standards in projects involving data collection from people for research purposes; fieldwork protocols were approved by ZSL's Ethics Committee before fieldwork began. All respondents were informed at the outset about the study's general aims, and were assured that data would be anonymized; interviews were conducted only after participants gave verbal consent. Interviews were conducted by student volunteers from Wuhan University of Technology, who were all native Mandarin Chinese speakers.

Data were analysed separately for each of the three distinct geographical regions covered by the interview survey. A small number (n=12) of informants fished in both Poyang Lake and the adjoining section of Yangtze mainstem; these informants were included in analysis of the Poyang Lake dataset, and excluded from analysis of Yangtze mainstem dataset. Data on mean local incomes were scaled by the total number of licensed fishing families for each region, to provide estimates for the income of the entire fishing community across these regions; we note the possibility that further, unlicensed fishers are present in each region, and that these scaled estimates therefore represent minimum estimates.

Province	City	County	Main community	Licensed families	Target number/county
Hunan	Yueyang	Yueyang	Yueyang Louqu	65	14
			Matang	150	32
			Rongjiawan	125	26
			Lujiao	310	65
			Zhongzhou	35	7
		Milu	Leishi	30	6

Table 1. Number of licensed fishing families, and target numbers identified for interview, for counties in porpoise high conservation value area in East Dongting Lake.

Province	City	County	Number of communities	Licensed families	Target number/county
Jiangxi	Jiujiang	Lushan	?	15	0
		Hukou	6	183	7
		Xingzi	2	553	21
		Duchang	5	1022	39
		Yongxiu	17	852	32
	Shangrao	Poyang	8	1564	59
		Yugan	48	1097	42

Table 2. Number of licensed fishing families, and target numbers identified for interview, for counties in porpoise high conservation value area in Poyang Lake.

Province	City	County	Main community	Smaller community	Licensed families	Target number/county
Hubei	Huangshi	Huangshi	Hekouzhen	Ergang	8	
				Guniuzhou	9	
				Zhakou	11	
			Xisaishan		9	
			Unlicensed families		15	
			TOTAL:		**52**	6
		Yangxin	Fuchi		108	
			Haoji		22	
			Shacun		20	
			Canghu		38	
			Haikou		25	
			Bengzhan		18	
			Wangshu		14	
			Qipanzhou		3	
			TOTAL:		**248**	26
	Huanggang	Huanggang	Huangzhou	Ducheng-biandanzhou	unknown	
				Tangjiadu	unknown	
				Huangzhoulun	unknown	
			TOTAL:		**79**	8
		Xishui	Bahe		unknown	
			Sanhua		unknown	
			Lanxi		unknown	
			Qingquan		unknown	
			TOTAL:		**178**	19
		Qichun	Qizhou		149	
			Chidong		21	
			Guanyao		7	
			Balihu		6	
			Pengsi		2	
			TOTAL:		**185**	19
		Wuxue	Wuxue		unknown	
			Longping		unknown	
			Tian		unknown	
			TOTAL:		**39**	0
		Huangmei	Xiaochi		unknown	
			Xinkai		unknown	
			TOTAL:		**80**	9
Jiangxi	Jiujiang	Ruichang	Matou		12	
			TOTAL:		**12**	0
		Jiujiang	Xinzhou		unknown	
			Chengzi		unknown	
			Jiangzhou		unknown	
			TOTAL:		**53**	6
		Lushan	Xingang		67	
			TOTAL:		**67**	7
		Hukou	unknown		183	
			TOTAL:		**183**	19
		Pengze	Yangtze River wharf		37	
			TOTAL:		**37**	0
Anhui	Anqing	Susong	Xiaogushan		83	
			TOTAL:		**83**	9
		Wangjiang	Huayanghekou		108	
			TOTAL:		**108**	12
		Huaining	**TOTAL:**		**0**	0
		Anqing	Daguanqu	Yuanbai	unknown	
				Zhanggan	unknown	
				Shankou	unknown	
			TOTAL:		**420**	43
	Dongzhi	Dongzhi	Dadukou		79	
			Dongliu		47	
			Shengli		20	
			Xiangyu		12	
			TOTAL:		**158**	17

Table 3. Number of licensed fishing families, and target numbers identified for interview, for counties in Yangtze mainstem porpoise high conservation value areas.

4. Interview Survey: Results

4.1. Demographic and socio-economic overview

A total of 510 informants were interviewed during the survey (Table 4). These informants were mostly male, with closely similar age and economic profiles across all three study regions; informants across all three regions are highly economically dependent upon fishing as their primary or sole source of income (Table 5).

Geographical region	Licensed fishing families	Interviews
Yangtze mainstem (Huangshi–Anqing)	1,982	175
East Dongting Lake	855	136
Poyang Lake	5,286	199
Total	***8,123***	***510***

Table 4. Number of interviews conducted in porpoise high conservation value areas.

Geographical region	Informant age (mean, range)	Mean % income derived from fishing	% of informants who only earn income from fishing
Yangtze mainstem	49.1 (32–78)	94.0	80.7
East Dongting Lake	44.3 (18–71)	94.0	81.8
Poyang Lake	48.7 (23–81)	89.5	70.4

Table 5. Demographic and socio-economic characteristics of informant samples from each surveyed porpoise high conservation value area. Income data based on non-retired informants only.

4.2. Awareness of regional fisheries legislation

Fisheries legislation varies across the middle-lower Yangtze drainage. The sale and/or use of some forms of harmful and destructive fishing gears/methods are banned by national-level legislation (falü, 法律); these include explosive fishing, poison fishing, and electrofishing. At the provincial level, further legislation (fagui, 法规) bans the sale and/or use of further fishing gears/methods. For example, different types of fixed nets are illegal across the middle-lower Yangtze drainage. In contrast, rolling hook long-lines are not banned at a national scale, and are banned by provincial legislation in Hubei and Anhui Province but not in either Hunan Province or Jiangxi Province; this extremely destructive gear type is therefore only illegal in most (although not all) of the middle-lower Yangtze mainstem, but not in either of the two appended lake systems.

Across the porpoise high conservation value areas in the Yangtze mainstem, 76.0% of informants reported that they had been informed about regional fisheries legislation within the past 12 months. 89.4% of informants in this region were aware that electrofishing was illegal, with no usage of this fishing method reported by any informants in the Yangtze mainstem. 54.7% were aware that fixed nets were regionally prohibited. Of other illegal gears/methods, only

7.8% were aware that explosive fishing was illegal, and only 5.0% were aware that poison fishing was illegal. Most disconcertingly, none of the 175 informants interviewed anywhere across the Yangtze mainstem were aware that rolling hook long-lines were regionally prohibited.

In East Dongting Lake, 76.6% of informants reported that they had been informed about regional fisheries legislation within the past 12 months. 82.3% of informants in this region were aware that electrofishing was illegal, but only 39.2% were aware that fixed nets were regionally prohibited. Of other illegal gears/methods, only 18.4% were aware that explosive fishing was illegal, only 14.6% were aware that poison fishing was illegal, and only 13.3% were aware that moat fishing was regionally prohibited; only 11.4% of informants were able to name any other types of illegal fishing methods/gears. One person reported that rolling hook long-lines were illegal.

In Poyang Lake, only 55.7% of informants reported that they had been informed about regional fisheries legislation within the past 12 months. 84.6% of informants in this region were aware that electrofishing was illegal, and 59.2% were aware that fixed nets were regionally prohibited. Of other illegal gears/methods, only 0.4% were aware that either explosive fishing or poison fishing was illegal. No-one thought that use of rolling hook long-lines was illegal.

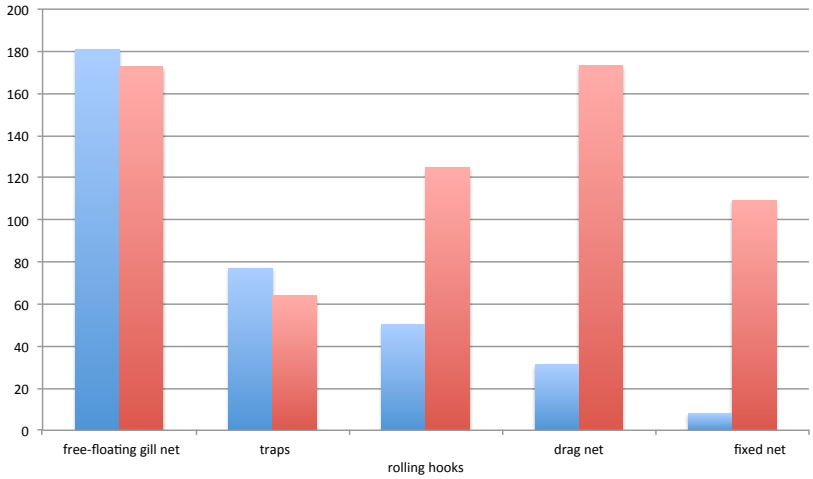
4.3. Awareness of porpoise conservation legislation

There was considerable variation across the three survey areas in terms of informant awareness and understanding of conservation legislation that has been passed to protect the Yangtze finless porpoise. Across the two porpoise high conservation value areas in the Yangtze mainstem, 73.1% of informants reported that they had been informed by local fisheries officials about porpoise-specific legislation within the past 12 months, 78.8% reported that they were aware of what this legislation consisted of, and 76.0% were able to describe the legislation reasonably accurately to interviewers. In contrast, 62.7% of informants at East Dongting Lake reported that they had been informed about such legislation within the past 12 months, but only 24.1% reported that they were aware of what this legislation consisted of, and only 20.3% were able to describe the legislation reasonably accurately. Similarly, at Poyang Lake, only 45.2% of informants reported that they had been informed about such legislation within the past 12 months, 48.7% reported that they were aware of what this legislation consisted of, and 46.1% were able to describe the legislation reasonably accurately.

4.4. Fishing gear usage and incomes

An extremely wide range of different named fishing gear types were reported by informants across the three survey areas, and with considerable use of region-specific local names for descriptively similar gears. For ease of analysis, these gear types were assigned to seven functional categories, reflecting similar patterns of usage and likely potential threats to porpoises: free-floating nets, fixed nets, drag nets, rolling hook long-lines, traps, electrofishing, and

(a)



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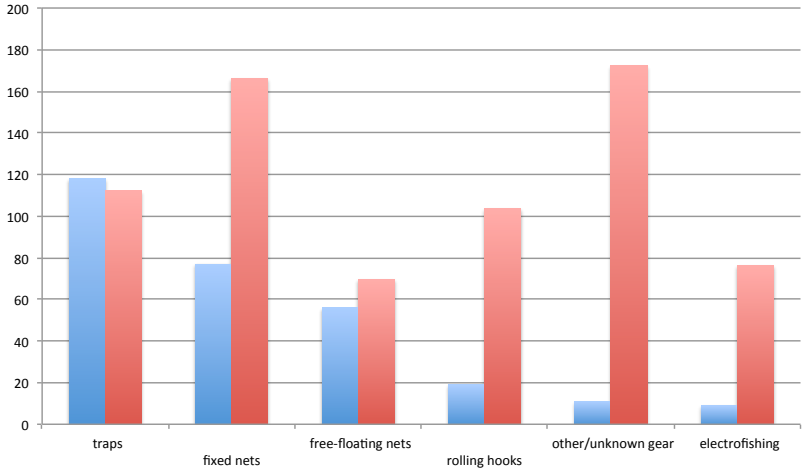

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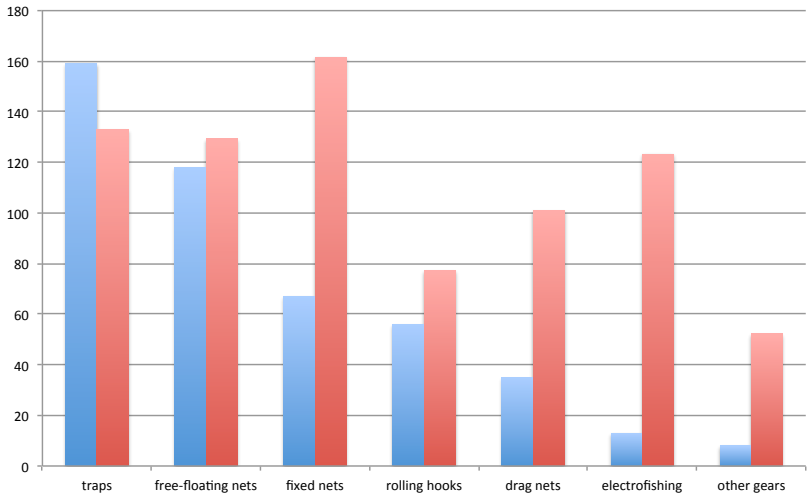

Figure 4. Numbers of informants using different categories of fishing gear (blue), and mean annual income (in CNY) for each gear type (red), in (a) the Yangtze mainstem, (b) East Dongting Lake, and (c) Poyang Lake. Note that order of gear types is arranged from locally commonest to rarest for each region. Mean annual income per gear type shown divided by 100 for the Yangtze mainstem and Poyang Lake, and divided by 50 for East Dongting Lake, to allow comparison on same axes.

unknown/other. Further subdivision of gear types, e.g. into different categories of free-floating nets (according to parameters such as variation in mesh size), was not consistently possible due to variation in reported descriptions of these gears. The number of informants using each of these gear categories, and the relative income associated with use of each gear type, varied substantially between the three survey areas; in particular, traps and fixed nets are far more widely used in the two appended lakes compared to the Yangtze mainstem (Figure 4). We consider that these reported levels of gear usage are likely to be broadly accurate with the exception of electrofishing, the use of which is heavily policed across the Yangtze drainage in contrast to other nationally or regionally prohibited fishing activities (see Section 4.2 above); directly reported levels of electrofishing must therefore be interpreted as (extreme) underestimates.

Data were also collected on the mean annual income of each non-retired informant, the proportion of this income obtained from fishing, and the proportion of this fishing income associated with the use of different gear types. It was therefore possible to calculate both an estimate of the mean annual income obtained from fishing in artisanal fishing communities across each of the three study areas (Table 6), and also of the mean annual income associated with the use of different gear types for each of these areas (Table 7; Figure 4).

Most informants (>60%) in both the Yangtze mainstem and Poyang Lake reported that their incomes have been relatively stable for the past five years, meaning that extrapolations based on the mean annual income data obtained for these two regions for 2011–2012 are likely to represent meaningful proxies for both wider-scale and current socio-economic patterns in these regions. However, we note that only 14.6% of informants at East Dongting Lake reported that their incomes have been stable for the past five years, indicating that data from this region may not be as reliable for making wider socio-economic inferences.

4.5. Alternative livelihoods

The great majority of all informants (92.7% along the Yangtze mainstem, 75.9% from East Dongting Lake, and 80.3% from Poyang Lake) stated that they wanted to continue earning a living from fishing, rather than switching to an alternative career. A small number of informants proposed alternative livelihoods that they might be interested in: aquaculture (n=25), shipping or sand dredging (n=11), town/city business jobs (n=7), manual labour (n=3), farming (n=3), driver (n=2), or small business (n=1). However, very few informants had any experience of other livelihoods; for example, only 7.5% of informants had any previous experience of either aquaculture or farming, mainly as alternative jobs during the annual April–June fishing ban.

Geographical region	Mean annual fishing income / informant (CNY)	Total annual fishing income region (CNY)
Yangtze mainstem (Huangshi–Anqing)	27,825	55,149,150
East Dongting Lake	26,151	22,359,498
Poyang Lake	14,391	76,073,243
Total		**153,581,891**

Table 6. Mean annual income derived from fishing in artisanal fishing communities in 2011–2012 across each surveyed porpoise high conservation value area, and total annual fishing income across each region extrapolated from the number of licensed fishing families (see Tables 1-4). Estimates based on assumption of one licensed fishing vessel per family (confirmed for the Yangtze mainstem and Poyang Lake, assumed for East Dongting Lake).

Gear type	Yangtze mainstem		East Dongting Lake		Poyang Lake		Total	
	Users *total (%)*	Income, CNY *total (mean)*	Users *total (%)*	Income, CNY *total (mean)*	Users *total (%)*	Income, CNY *total (mean)*	Users *total (%)*	Income, CNY *total*
Free-floating net	1,755 (88.6%)	35,415,203 (20,174)	704 (41.2%)	2,454,793 (6,973)	3,134 (59.3%)	20,263,044 (6,465)	5,593 (68.9%)	58,133,040
Fixed net	91 (4.6%)	989,958 (10,926)	453 (52.9%)	8,048,222 (17,780)	1,780 (33.7%)	14,374,201 (8,077)	2,324 (28.6%)	23,412,381
Drag net	351 (17.7%)	6,081,320 (17,321)	—	—	930 (17.6%)	4,691,657 (5,046)	1,281 (15.8%)	10,772,977
Rolling hooks	578 (29.1%)	7,213,608 (12,489)	119 (14.0%)	1,236,418 (10,351)	1,488 (28.1%)	5,735,576 (3,856)	2,185 (26.9%)	14,185,602
Traps	861 (43.4%)	5,455,823 (20,174)	641 (75.0%)	8,238,019 (12,847)	4,223 (79.9%)	28,104,785 (6,654)	5,725 (70.5%)	41,798,627

Table 7. Levels of regional usage and associated total and mean income for each of the five main fishing gear types used in artisanal fishing communities in 2011–2012 across the three porpoise high conservation value areas. Estimates based on assumption of one licensed fishing vessel per family (confirmed for the Yangtze mainstem and Poyang Lake, assumed for East Dongting Lake).

5. Interview Survey: Conservation Management Recommendations

5.1. Community-level ("bottom-up") activities

Local fisheries officials appear to be providing regular community outreach activities in fishing communities across the Huangshi–Anqing region of the Yangtze mainstem and around East Dongting Lake, as the great majority (≥76%) of informants in these two regions reported that they had been directly informed about regional fisheries legislation within the past 12 months, and almost as many informants (>62%) reported that they had been informed about porpoise conservation legislation during the same time period. Community outreach activities by local fisheries officials around Poyang Lake appear to be somewhat less well-conducted, as only around half of informants in this region reported that they had been directly informed about either type of legislation within the past 12 months.

However, the primary focus of these outreach activities appears to be raising awareness about electrofishing as an illegal activity, as local awareness of restrictions concerning other gear types or fishing methods was substantially lower. Even taking into account the fact that provincial legislation varies across our survey area, it is particularly concerning that only a single informant across our entire interview sample of 510 informants considered that rolling hook long-lines, the gear type that may be responsible for the greatest number of Yangtze finless porpoise mortalities (Turvey et al. 2013), were illegal. Similarly, although >75% of informants along the Yangtze mainstem were familiar with porpoise conservation legislation, less than 50% of informants around Poyang Lake and less than 25% of informants around East Dongting Lake had a reasonable understanding of what this legislation actually consisted of.

We therefore recommend the following urgent community-level awareness-raising activities:

- There is an urgent need for better education about provincial-level legislation banning the use of rolling hook long-lines across porpoise high conservation value areas in the Yangtze mainstem, where use of this gear type is prohibited

- Better education about other national-level and provincial-level legislation banning the use of other gear types and fishing methods is also needed across all porpoise high conservation value areas

- There is an urgent need for better education about porpoise conservation legislation around East Dongting and Poyang Lakes, and in particular around East Dongting Lake

We recommend that the establishment of community-level porpoise grassroots NGOs, or the strengthening of existing regional NGOs such as the Yangtze Finless Porpoise Conservation Society at East Dongting Lake, could constitute an effective mechanism for increasing community awareness about both porpoise conservation and regional fisheries legislation.

5.2. Management-level ("top-down") activities

Due to the apparently high level of community education and regional enforcement of electrofishing legislation, very few informants reported that they conduct this illegal fishing practice; although this is highly unlikely to represent a truthful representation of "underground" illegal fishing activities, it was not possible to use our community interview approach to gather accurate data on true levels of electrofishing that are carried out across porpoise high conservation value areas. In contrast, apparently due to the lower levels of education or enforcement, we were able to collect extensive data on usage patterns of other nationally or regionally prohibited fishing practices. In particular, almost 30% of informants across porpoise high conservation value areas in the Yangtze mainstem reported that they use regionally banned rolling hook long-lines. A similar percentage of informants across the entire survey region reported that they use prohibited fixed nets, which are used by large numbers of fishers in both East Dongting Lake (>50%) and Poyang Lake (>30%).

In addition to ongoing support for enforcement of legislation against electrofishing, we therefore recommend the following urgent fisheries enforcement activities:

- There is an urgent need for substantially increased regional enforcement of existing provincial-level legislation banning the use of rolling hook long-lines across porpoise high conservation value areas in the Yangtze mainstem

- There is an urgent need for substantially increased regional enforcement of existing provincial-level legislation banning the use of different types of fixed nets, in particular in East Dongting and Poyang Lakes

We also strongly recommend that:

- Provincial-level legislation should be changed to make rolling hook long-lining illegal around East Dongting and Poyang Lakes, as well as across all of the Yangtze mainstem

We note that the establishment or strengthening of local conservation porpoise-focused NGOs across porpoise high conservation value areas could also assist with local-scale supervision of fisheries law enforcement.

5.3. Socio-economic considerations for reducing fishing pressure on Yangtze finless porpoises

Our data on incomes associated with fishing activities and the use of different gear types across each porpoise high conservation value area provides an essential first step towards understanding how to manage potential fisheries impacts on Yangtze finless porpoises within a socio-economic framework.

At present, there is a three-month fishing ban in the middle-lower Yangtze drainage from April–June each year. More extensive fishing restrictions may

provide benefits for porpoise conservation, and would undoubtedly have major additional benefits for Yangtze fish stocks, which are currently under extreme pressure from overexploitation. If it was considered that fishing should cease entirely across all identified porpoise high conservation value areas, then a financial offset of over CNY 150 million in total (equivalent to almost GBP £17 million, or almost USD $25 million) would have to be provided to fishing communities across these regions, to compensate for loss of estimated annual earnings associated with their current fishing activities (Table 6). This estimate of income associated with fishing activities only covers part of the range of the Yangtze finless porpoise, and so reduction or elimination of fishing impacts across its entire range from Yichang to Shanghai would be substantially more expensive. As very few people in these fishing communities have any experience of alternative livelihoods, this approach should be combined with community-level consultations to identify appropriate alternative sources of income, and with subsequent training schemes to provide the necessary skills required for identified career alternatives. It should also be noted that the great majority of informants across all of the porpoise high conservation value areas do not want to give up fishing as their primary source of income.

These data can also be used to assess the economic implications of changing the legislation concerning use of specific gear types, or of strengthening enforcement of existing legislation of prohibited gear types. For example, we estimate that rolling hook long-lines currently generate a total income of over CNY 14 million (equivalent to over GBP £1.5 million, or approximately USD $2.3 million) across porpoise high conservation value areas (Table 7); alternative sources of income may therefore also have to be identified for fishers currently using this gear type, if attempts to prohibit its use are to be successful.

We recognize that these financial estimates represent only broad approximations based on extrapolation from our relatively restricted informant dataset, and may be affected by a number of potential biases. However, they represent an important baseline for starting to consider potential porpoise conservation management interventions within a financial framework, an essential process for assessing the feasibility of any such future interventions. We strongly suggest that the considerations above should be taken into account when deciding how, or whether, to invest in any form of larger-scale regulation of fishing activities in the middle-lower Yangtze drainage, especially given the limited current evidence that fisheries interactions are a primary driver of population decline in the Yangtze finless porpoise (Turvey et al. 2013).

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