Summary of Findings:

Visit to Yancheng 7-11 May 2018

Paul Medley

# Background

The following summary report presents the findings for the visit of Dr Paul Medley to the Baolong Group processor near Yancheng.

The visit was to review the data collection programme which has recently started to monitor the 2018 crayfish season, with the objective of carrying out a stock assessment towards the end of 2018. Various data sources have been identified, including new observer data collection which started in April 2018. The objective of this visit was to review the data collection system during its inception, as well as identify and plan the capture of additional data from the processor in particular.

# Stock Identity

In general, it is believed that about 20000t of wild caught crayfish are caught in the region per year, with around 18000t in the Doulong river basin and around 6000t purchased by the Baolong plant (i.e. around 30%). However, the Baolong plant purchases the majority of the catch in the Dafeng district around Yancheng. River connectivity between Dafeng and other districts is well-defined and limited to various canals and rivers.

Obtaining total landings for the region appears problematic. While data may be collected by Government (according to the 2016 preassement the Commodity Inspection Bureau and State Administration of Taxation of China have these data), there does not seem to be anyway to obtain the data from this source. Ideally, total landings of crayfish for this region could be obtained at least by month.

It was suggested that Dafeng could form a management unit, and this was proposed as a working hypothesis for management of the fishery. This seems reasonable, but should be tested as far as possible.

Local fishery expert Professor Xie indicated that density is evenly spread through Dafeng district and that crayfish disperse through the district, so local depletion is unlikely and in his opinion the district can be treated as a single unit. This still leaves open the question of how much migration occurs between this district and adjacent districts. The data can be used to test the homogenity of the fishery within the management unit, which should provide some evidence to test the assumption and its potential risks. Furthermore, this uncertainty might also be addressed through the harvest strategy.

100 fishers sell to the Baolong group and this probably represents all significant fishing activity on crayfish. However, fishers may not sell all their catch to Baolong, but also may sell through local markets. This unrecorded catch could be significant and undermine the stock assessment. It will need to be addressed.

Logbook data are important as they will capture catches that are not sold to Baolong group, which may represent a substantial part of the catch. Therefore there is a need to follow up on the logbooks and get as high completion as possible. In addition, it should be possible to estimate independently the total catch from the CPUE and total effort (number of traps) and area fished.

# Review of Observer Data Collection

The observer programme has been well set up, and appears to be working well. Xiaotong Yu and her team are to be commended for excellent work so far.

The length frequency sampling protocol was checked and generally seems to work well. It was decided to reduce the number of crayfish measured per landing to 20-30, which seemed adequate to characterise the catch. Each landing consisted of (usually) hauling 3 traps all of which were in the same area, so sampling more crayfish is not likely to increase significantly the effective sample size. With 5 observers sampling 2 days each 3 fishers, this should result in around 25\*5\*2\*3=750 per week, which should be sufficient to obtain a reasonable size composition for the season. All crayfish are sampled, including crayfish which would normally be discarded.

The carapace length was being measured using a ruler. More accurate and easier measurement would be taken using calipers. 0-150mm calipers accurate to 0.1mm have been ordered and will be used to measure carapace length for future data collection.

Rules for crayfish retention and discarding need to be clarified. This seems entirely based on size. The mesh size regulation (mesh size 1x1cm) would only exclude larvae and post-larvae. Otherwise Baolong rejects crayfish with total weight < 8g, sorted by grading machine. There is no MLS from Government.

It may be necessary to have a model of number of traps hauled per day (or per purchase by Baolong Group) and soak time for traps. This is likely to change through the season, but has not been recorded for the historical records. For new records, we would request this data is collected from fishers.

Similarly, fate of species caught is not explicit. Larger fish and shrimp are retained, small fish may be discarded and are unlikely to survive. Small crayfish, berried crayfish, crabs and molluscs may also be discarded, and are likely to survive. However, there is also some evidence the vast majority of the catch is essentially retained in most cases. Fishers can find uses for most of the catch, and where sorting occurs on land, even “discarded” catch my not survive.

It was requested to reduce the sampling. I resisted this request mainly because this is the first season and this may be the only opportunity to collect these data. It is likely the observer data will only be collected over the single season as the observers have other tasks, so this may be the only opportunity to get a complete picture of what fishers are catching.

The same fishers are being sampled through the season. There is a small chance the sampling will not be representative of the entire fishery throughout the period. However, this approach made it easier to get co-operation and maintain consistent sampling, and should provide a consistent index for any relative change through the season.

ETP observations are unlikely within the sampling period. It is also unlikely that this fishery is the major threat to ETP species. The presence of a wide range of entangling threats may suggest the potential impact of this fishery is small and will be difficult to detect. It was noted that otters may be returning to the area and there could be interaction with this species in future. On going monitoring of ETP / bycatch may be necessary as the environment changes.

# Data Entry and Management

Observer data entry is being carried out in MS Excel by two persons. It may be necessary to spread this load to more persons as the season progresses. Data will be combined into a single file and then exported to be read into R. Data entry forms with some error checking have been created for the observer data and purchase record data.

Other issues that were noted were:

* Need to ensure zeroes are entered when the observation is 0. It should not be left blank (which implies NA).
* Check dates are entered properly (as an Excel date which is a real number).
* All bycatch are currently recorded as retained. The vast majority of the catch does appear to be retained, but it is not clear from the data. More rigorous recording of the catch, particularly indicating zeroes, is being undertaken.
* A lookup table of species with chinese, english and latin names is required.

Xiaotong Yu agreed to send data to Paul Medley on a monthly basis to check progress and for errors that can be corrected as data are compiled. Three tables linked by a foreign key will be created to read into R to manage the data and analyses. It was decided to produce simple statistical summaries, graphs and similar output using RMarkdown in RStudio to improve transparency and allow the data, method and results to be shared more easily.

# Protocol for Observers

The protocol for observer data collection was reviewed. It appears that the observers are technically very proficient and are doing a very good job. Particularly important in this sort of data collection is to have a good relationship with the fishers. The relationship appears very good and the fishers are very co-operative and helpful. The following additional procedures have been adopted:

* It is necessary to return berried females immediately after capture. Therefore berried females are weighed and measured and returned at the landing site, while ensuring their weight is added to the total weight.
* Carapace width is measured for crabs, forklength for finfish, and total length for shrimp.
* Moulting (soft shell) crayfish were observed and are now recorded.
* Calipers are now used for carapace length measurement. Rulers are used for all other measurements.

# Baolong Group Data

Baolong Group keep fisher purchase records, but these are only on paper. An example book of one month’s purchase records were provided for inspection. The data links quantity purchased by date to individual fishers. These data will be invaluable.

It has been suggested that purchase records are entered routinely on computer in future, and some record of fishing effort is also recorded alongside the purchase catch. Number of traps hauled to obtain the catch sold seems the most appropriate measure, so this has been added to the data form. Soak time data was considered too difficult to request at this time, and can be inferred from the “number of traps” data.

Baolong Group also keep production data of total production by commercial category. These data will be useful, but may need additional information for their interpretation (e.g. morphometric data).

# Logbook Data

Fishers have been requested to maintain logbooks recording dates, hauls and catch. It is unclear how successful the logbooks will be as none have been completed yet. While the first season of implementation may not yield very good results, this may still be one of the best methods for longterm monitoring. Even a small proportion of successful logbooks completed during the season should provide a better estimate of CPUE and total catch in the district.

# Other Data

The most important environmental factor affecting crayfish population dynamics and the fishery is likely to be water temerature. Temperature is reported in the scientific literature as being linked to crayfish activity and reproduction. As the traps rely on activity levels (they are unbaited), temperature will affect both catch rates and population processes, such as recruitment and growth.

It was decided to collect water temperature data. A single site index was agreed as most feasible, that would capture the main environmental dynamics. This site has been identified and data collection initiated.

# Implications for modelling

Total catch is a potential problem. It is likely that we will need to treat Dafeng district as a separate management unit, and apply statistical tests to the data to see whether this assumption is reasonable.

It is probably not necessary to separate sexes at this stage. If sex ratios in the catches are significantly different through the season, this may need to be revisisted. However, if possible, a two-sex population model will be avoided in the first assessment unless it becomes very inaccurate.

Growth or shape differences between the sexes are not apparent (Figure 1), and the sex ratio is close to 50:50 (52% of the sample were female), so it is likely, given the small data set, that we would combine the sexes into a single population model. The only reason to model different sexes might be if the sex have different catchabilities through reproduction, evidenced by a change in sex ratio at size and through the season.

Figure Log carapace length (x-axis) plotted against Log total weight for crayfish P. clarkii. The weight is related to the square of the length rather than cube, suggesting the length increases at a greater rate than the height or width. There is no discernible difference between males and females.

# Next Tasks

It is recommended that the following tasks are carried out co-ordinated by Xiaotong Yu:

* A lookup table of species with chinese, english and latin names is being developed and maintained.
* Check logbooks are being completed correctly by as many fishers as possible.
* Historical data entry of Baolong purchase records for 2017.
* Current computer entry of Baolong purchase records for 2018 with additional field for number of traps hauled – additional requested information from fishers.
* Baolong Processor production data – total production by date broken down by commercial size category (count per pound, peeled/whole).
* Link fishers to their location so that we have the relative position of fishers in the waterways. This will be useful for looking at spatial patterns and testing stock assumptions.
* Submit monthly data to Paul Medley for checking.
* Need to update fisher register with licence ticket number used in the Baolong Purchase records.
* Need to map spatial distribution of waterways and fisher areas. This has been done in AutoCAD, so the data need to be extracted for analysis.