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The Current State of Knowledge on Mangrove Fishery Values

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Abstract.—Mangroves are widely understood to be important habitats for fisheries, supporting resident fish, crustacean, and mollusk populations as well as acting as nursery grounds for species that are targeted by offshore fisheries. There is, however, a lack of quantitative data on fisheries that operate in and around mangroves. We carried out a systematic search to gather data on mangrove fisheries from the scientific literature. We filtered the 4,358 studies returned by the search based on their title and abstract and extracted data from 169 of these. Despite the abundance of literature on mangrove fisheries, we were unable to build a data set of comparable, quantitative data of sufficient size to support numerical modeling approaches. In part, this is due to the variety of mangrove fisheries, which range from small-scale subsistence fishing for mollusks and crabs to large-scale industrialized prawn trawling. This is compounded by the broad range of reporting methods and metrics encountered in the literature. We make a number of recommendations to guide the future reporting of mangrove fisheries to allow for better quantification and comparison of fisheries values at large spatial scales.

Introduction

Situated in tropical, low energy, and primarily estuarine environments, mangroves provide a suite of benefits to fish and invertebrates, including enhanced primary productivity and refuge from predation (Laegdsgaard and Johnson 2001; Ewe et al. 2006). While it is widely accepted that mangroves play a key role in enhancing fisheries productivity, the absolute degree of enhancement as well as the temporal and spatial variation in mangrove fisheries productivity are poorly resolved. Mangroves are well studied and there is an abundance of literature on mangrove supported fisheries, so this apparent lack of quantitative evidence at a large scale arises primarily from the many disparate ways in which mangrove fisheries are reported.

One key reason for the diverse ways in which mangrove fisheries are reported is

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that mangrove fisheries are themselves extremely diverse. Mangrove fisheries range from highly specific crab and mollusk fisheries through small-scale mixed species fisheries to large-scale offshore commercial fisheries for species that use mangroves at earlier stages of their life cycle. This range of scales has an accompanying variety of fishing methods and gear types. Mangrove forests themselves are largely impenetrable to large boats or machinery so most fisheries within the mangrove are small scale. Small-scale fisheries are frequently underreported in government statistics and in the literature (FAO and World Fish Centre 2008; Costello et al. 2012). Much of the catch never enters formal markets, being consumed by fishers, their families, and the local community. Fishing may not even be a full-time occupation of many of those involved (Coates 2002). The small-scale, artisanal nature of many in-mangrove fisheries therefore presents an additional challenge to gathering consistent fisheries data.

Finally, there is considerable uncertainty over the extent of the benefits that mangroves provide to offshore fisheries. Several studies have shown correlations between fishery catches and mangrove area, but this alone does not necessarily imply causality (Manson et al. 2005). Such correlations can therefore not be used to determine the extent to which mangroves enhance fishery catches above the background level provided by other estuarine and coastal habitats. Gaining a true insight into the value of mangroves to fisheries at a large scale is therefore a significant challenge.

To gain a comprehensive overview of the current state of knowledge of mangrove fisheries values and to support a longer-term effort to model and map mangrove fisheries values (see Hutchison et al. 2015, this volume), we carried out a systematic literature search. We used a standardized, repeatable search methodology to gather literature on mangrove fisheries from online literature databases. Here, we describe the results of this literature search along with the initial results of a synthesis of some of this material.

Methods

Literature review

We followed a standardized systematic literature search process (based on Collaboration for Environmental Evidence 2013), which enabled an iterative approach of testing and refining search terms to improve both comprehensiveness and specificity. Search terms were combined into sets and searches run to return only papers with at least one term from each set. The title, abstract, and keywords of each article were searched using Web of Knowledge (www.webofknowledge.com), recording the total number of results returned. The title and abstract of the first 100 results of a search were scanned to assess the proportion of those results that were potentially relevant.

We began with two sets of search terms, one relating to mangroves and the other to fishery target groups (Table 1). The initial search returned a large number of results of which only a small percentage were relevant. Changing the term "fish*" to "fisher*" removed a number of papers that included the word "fish" but had no relevance to fisheries. However, overall relevance remained low. Removing the mangrove genera from the mangrove term list gave a significant improvement in relevance while yielding nearly as many papers.

Many of the papers focused on fish biology and had little relevance to fisheries, so we added a third set of terms related to the action of catching or harvesting fish and invertebrates (e.g., "yield," "harvest," and "catch") or to the function of mangroves in enhancing fish populations (e.g., "survival," "nursery," and "growth"). This yielded a similar number of results but with much greater relevance. The three sets of search terms were

Table 1.—The initial sets of search terms used, and the number and relevance of the results returned using each set in Web of Knowledge. * indicates a wildcard operator such that "fisher*" would also include fisheries, fishermen, and so forth.

Mangrove terms	Fish terms	Results	Relevance
Acanthus, Acrostichum, Aegialitis, Aegiceras, Aglaia, Avicennia, Bruguiera, Camptostemon, Ceriops, Cynometra, Diospyros, Dolichandrone, Excoecaria, Heritiera, Kandelia, Lumnitzera, mangrove, *Nypa, Osbornia, Pelliciera, Pemphis, Rhizophora, Scyphiphora, Sonneratia, Tabebuia, Xylocarpus*	cockle*, crab*, finfish, fish*, oyster*, prawn*, shrimp*	5,186	16/100
Acanthus, Acrostichum, Aegialitis, Aegiceras, Aglaia, Avicennia, Bruguiera, Camptostemon, Ceriops, Cynometra, Diospyros, Dolichandrone, Excoecaria, Heritiera, Kandelia, Lumnitzera, mangrove, *Nypa, Osbornia, Pelliciera, Pemphis, Rhizophora, Scyphiphora, Sonneratia, Tabebuia, Xylocarpus*	cockle*, crab*, finfish, fisher*, oyster*, prawn*, shrimp*	3,596	18/100
mangrove*	cockle*, crab*, finfish, fisher*, oyster*, prawn*, shrimp*	3,432	28/100

therefore used for all further searches. Final fine-tuning included the addition of "valu*" (value, valuation, etc.) to capture some missing economic valuation papers. "Fisher*" was also changed back to "fish*" in the fish terms, as the action terms filtered out papers with no fishery relevance. The final set of search terms used is shown in Table 2.

Once the final set of search terms had been established, it was also used to search Scopus (www.scopus.com) and Science Direct (www.sciencedirect.com) to give the final results list. Final searches were carried out in July 2013.

Sorting results

We sorted the initial set of results using the title and abstract of each paper. Papers that were not relevant to mangrove fisheries were discarded and the rest were sorted into categories based on the subject matter of the paper. These categories are listed in Table 3, along with a brief description of each one. Data were then extracted from three categories most likely to have data on fishery catches or values: within-mangrove catch data, offshore catch data, and valuations.

Data extraction

Our initial aim was to use the data from existing publications to build a simple model based on actual catch data from fisheries in mangroves. We therefore built a database and populated this with data from the papers in the categories that were most likely to be relevant to this fishery. From each paper, we extracted

- Location data—this included the name, latitude, longitude, and country of the study site (or sites), as well as the size of the study area (the diameter of the smallest circle that could fully enclose

Table 2.—Search terms used following the addition of the third search term set, with the number and relevance of results returned using each set in Web of Knowledge.

Mangrove terms	Fish terms	Action terms	Results	Relevance
mangrove*	cockle*, crab*, finfish, fish*, oyster*, prawn*, shrimp*	aquaculture, capture, catch, farming, fisher*, fishing, gather*, growth, harvest, landing*, nursery, survival, trap*, yield	3,924	64/100
mangrove*	cockle*, crab*, finfish, fish*, oyster*, prawn*, shrimp*	aquaculture, artisanal, capture, catch, farming, fisher*, fishing, gather*, growth, harvest, landing*, nursery, refuge, survival, trap*, valu*, yield	4,044	77/100

Table 3.—The main categories into which results from the literature search were sorted, and the number of results in each category.

Category	Description	Results
Mangrove versus nonmangrove	Comparisons between fish population in mangroves and in adjacent areas.	110
Fish counts	Fish surveys in mangroves or mangrove areas.	450
Within-mangrove catch data	Catch data from fisheries within the mangrove itself.	100
Offshore catch data	Catch data from fisheries offshore of mangrove areas.	10
Links/mechanisms	Papers assessing the links between mangroves and fisheries, and the mechanisms behind these links.	280
Aquaculture	Papers discussing aquaculture in mangrove areas (both yield from aquaculture and the impact of aquaculture on the mangroves).	285
Growth rates of mangrove species	Papers discussing growth rates of fish and invertebrate species found in mangroves, which might be useful for building models.	60
Relevant (other)	Potentially useful papers that do not fit elsewhere.	52
Reviews	Existing reviews of mangrove fisheries literature.	41
Valuations	Papers on the economic valuation of mangrove fisheries, or mangroves more generally.	59

the study site). We divided study sites into four types:

1. Discrete mangrove blocks—the study area includes one discrete block of mangrove bounded by non-mangrove areas.
2. Part of a discrete mangrove block—the study area is within a relatively small, discrete mangrove block, but only includes part of the block.
3. Within a larger mangrove area—the study is set within a large continuous mangrove area (e.g., the Sundarbans or North Brazil).
4. Larger area including multiple mangrove blocks—the study looks at a larger area, which includes multiple mangrove blocks.

Where studies gave a large area as the location, the latitude and longitude of the centroid of this area was stored in the database. Studies for which the location could not be verified were discarded.

- Mangrove species data—Where given, details about the mangrove were recorded, including the tree species present and the community composition as a percentage of each species.
- Catch data—This included the catch method/gear type, the habitat type where the catch was made (e.g., within the mangrove itself, channels within the mangrove, mangrove-fringed lagoon, bay, or estuary) and the start and end date of the study period. We also included all numerical data given about the catch.
- Species data—All the fish and invertebrate species in the catch were recorded. Where proportion or weight of individual species within the catch was given, this was also recorded. We checked fish species against FishBase (www.fishbase.org) and invertebrates against the World Register of Marine Species (www.marinespecies.org), and used currently accepted names and taxonomy where these differed from those given in the paper.

Studies generally reported catches in terms of catch per unit effort, or as catch for the whole fishery for a given time period. Figures reported as catch per unit effort include a value component (physical or monetary), a fishing power component, and a time component, while figures for the entire fishery omit the fishing power component. Where possible, units were standardized as shown in Table 4. Standardization of some units required varying degrees of assumption. Some, such as catches per trap or per fishing trip, could not be standardized and therefore could not be included in the final data sets.

Results

Search results

The final search terms returned a total of 4,358 papers from all three databases once duplicates were removed. Of these 2,766, almost two-thirds of the total set, were discarded as irrelevant. These included papers on mangrove ecology and fish biology, taxonomy and physiology, as well as a significant number of papers totally unrelated to mangrove fisheries that fitted the search terms used by coincidence. The remaining 1592 papers were sorted into categories (Table 3).

Data extraction

In this initial phase, we extracted data from papers in three categories: within-mangrove catch data, offshore catch data, and valuations. These categories were chosen as they contain the studies most likely to have data on fishery catches or values. Of the 169 papers in these three categories, 53 contained data that were included in the database. These 53 studies provided data from 82 study sites in 26 countries. These data can

Table 4.—The main reporting units encountered in the literature for the three dimensions of catch per unit effort, and the standard units that they were converted to. Assumptions required to standardize units are listed as foot notes.

Unit	Standardized unit
Physical/economic units	
g, kg, metric tons, individuals of target species[a]	kg
Currency (11 currencies used in reviewed literature)	2012 US$
Fishing power units	
Fisher, household, village	Fisher
Boat horsepower, boats[b]	Boat horsepower
Trap	Trap
m^2/ha/km^2 fished	ha fished
Time units	
Hour[c], day, month[d], year[e]	Day
Fishing trip	–

[a] Requires knowledge of average weight per individual.
[b] Requires knowledge of average fleet horsepower.
[c] Requires assumption of working hours in each day.
[d] Requires assumption of working days per month.
[e] Requires assumption of working days per year.

be broken down into a variety of different types. Table 5 shows the main data types returned by the review.

The largest data type is catch per unit time, which is largely made up of studies that report the annual catch for an entire fishery within a bay, lagoon, or administrative area. As such, the reporting units are relatively simple, generally giving kilograms per year or individuals per year for some higher-value species such as crabs and mollusks. Value per unit time similarly included mostly annual data on entire fisheries. Catch and value per unit area similarly include whole-fishery statistics, but with the added information of the area that the fishery covers. Studies reporting catch and value for entire fisheries often gave data for multiple years, hence the large discrepancy between the numbers of data in these categories and the numbers of study sites. Catch per unit effort is more complex due to the wide variety of measures of effort (Table 5), many of which cannot easily be compared. The data on density or abundance of fishery species is not directly relevant to this study, as our aim was to gather data on actual catches by commercial fisheries rather than fish abundance.

Fishery types

The data were further divided by the different fishery types that operate in mangroves. If studies reported the species caught in the fishery they were reporting on, we also included this in the database. We used this to categorize fisheries into three main types.

- Inshore mixed species fisheries: These are generally small-scale fisheries, catching a mix of fish, crustaceans, and mollusks. They operate mostly with the mangroves or just offshore. They also tend to be close to settlements as fishers travel on foot or by small boat, often human-powered, limiting the area that they can exploit. Catches are mostly sold in local markets or consumed by the fisher and their family.

Table 5.—The main data types returned by the literature review. For each data type, the table shows the total number of data of that type, the number of study sites with data of that type, the number of countries those sites fall in and the number of studies those data are drawn from. Note that numbers are not additive as many sites have multiple data types.

Data types	Number of data	Study sites	Countries	Studies	Units
Catch per unit area	7	5	4	5	kg/ha/year
Catch per unit effort	67	22	15	20	individuals/fisher/d, g/fisher/d, kg/hour of trawling, kg/1,000 m^2 trawled, metric tons/engine hp/year, kg/net/hour, individuals/trap/d, kg/boat/trip
Catch per unit time	214	43	17	24	kg/year, individuals/year
Value per unit area	27	17	7	9	currency/ha/year
Value per unit effort	5	3	3	3	currency/fisher/d, currency/hour of trawling, currency/net/h, currency/trip
Value per unit time	49	15	13	13	currency/year
Density/abundance/biomass of target species	63	17	6	7	Individuals/m^2, individuals/ha, burrows/100 m^2, g/m^2
Net profit from fishery	26	10	8	10	Currency/year

- Inshore crab and mollusk species: These fisheries are also generally small scale but are more specifically targeted towards single high-value species or species groups. Examples include the mud crab *Scylla serrata* in the Indo-Pacific (e.g., Lebata et al. 2007), the mangrove crab *Ucides cordatus* in South America (e.g., Diele et al. 2005), mangrove cockles *Anadara* spp., and oysters (*Crassostrea* and *Saccostrea* spp.).
- Offshore fisheries: These are larger-scale industrial fisheries operating outside the mangroves and sometimes many miles offshore. This makes them harder to link directly to mangroves, but many of the high-value species that they target are associated with mangroves in their juvenile life history stages. Penaeid prawns have the most well-studied mangrove link (e.g., Rönnbäck et al. 2002; Vance et al. 2002), but other species that use mangroves in clude Barramundi *Lates calcarifer* and various species of snapper (Lutjanidae), mullet (Mugilidae), and sea catfish (Ariidae).

Our aim in this review was to gather data on all of these fishery types. However, because offshore fisheries operate outside the mangroves themselves, fewer papers on this fishery class were identified in our literature search (Table 3) as we only gathered papers with the word “mangrove” in the title, abstract, or keywords. As a result, although we do have some data on these mangrove-linked fisheries, our results are biased towards the fisheries taking place in and around the mangroves themselves.

We are aware that a number of important recreational fisheries also use mangrove areas and would probably represent a fourth distinct category. These can be extremely valuable to national economies; for example, fishing for Bonefish *Albula vulpes*, Permit *Trachinotus falcatus*, and Tarpon *Megalops atlanticus* was worth US$56.5 million to Belize in 2007 (Fedler and Hayes 2008) and $141 million to The Bahamas in 2008 (Fedler 2010). The search terms used in our literature review were geared towards small-scale commercial fisheries, so despite their considerable value, recreational fisheries were not considered in this review.

Preliminary data

Table 6 shows a summary of the values for each of the three fishery types. Inshore mixed species and offshore prawn fisheries both had reasonable numbers of catch data while inshore crab fisheries were less well represented. Reports on inshore mollusk fisheries were available but primarily reported catch per unit effort rather than total catch for the fishery so were not considered further. All three fishery types had a large range of catches, with inshore mixed fisheries having a particularly large range due to a high-yielding fishery in Vietnam (de Graaf and Xuan 1998). Value data were scarcer but showed even more dramatic ranges than the catch data.

The data represent a reasonable geographical spread, especially for inshore mixed species fisheries (Figure 1). Data on crab and prawn fisheries were concentrated in the Indo-Pacific, and there was no data for either of these fisheries from Africa. West Africa is very data-poor in general, with just one data point for a mixed-species fishery in Ghana (Koranteng et al. 2000).

Discussion

Our findings give an indication of the vast body of literature available describing and quantifying the value of mangrove fisheries worldwide, with our initial assessment identifying more than 1,500 published papers relating to mangroves and fisheries. The scientific literature is likely to be a critical source of such information given that many national fishery reporting processes tend to focus on larger-scale commercial fisheries and probably ignore or underreport many mangrove fisheries. Researchers working on the ground in mangrove countries are likely to have the best access to local fisheries reports and statistics, but these data rarely seem to be making the transition from government or nongovernmental organization reports into the scientific literature. As the scientific literature is the most readily available data source to international researchers, reporting local fishery data here would be a key step to allow that data to have an impact through large-scale studies such as this one.

Despite the volume of publications on mangrove fisheries, we found insufficient data to inform the numerical modeling of mangrove fisheries values. Indeed, less than a third of the 169 studies that appeared most promising based on title and abstract actually yielded data on fishery catches. Once these data were collated and divided into data types and fishery types, no category contained more than 16 comparable values (Table 6). The database is likely to yield some further useful information as some of the other categories of paper are reviewed, but we anticipate rapidly diminishing returns from exploring the less relevant categories. The challenge of finding comparable data on mangrove fisheries therefore remains a significant barrier to the development of a model for mangrove fishery values.

A key challenge in drawing together comparable data are the variety of mangrove fishery types. Fisheries vary in target species, scale, and the sector of society involved.

Table 6.—Summary of catch and value data extracted from the literature by fishery type. For each fishery class, the numbers of data on both fishery catch and fishery value are shown, along with the median and range of those catch and value data. Inshore mollusc fisheries were omitted due to insufficient data.

	Catch (kg/ha/year)			Value (US$/ha/year)		
Fishery type	*N*	Median	Range	*N*	Median	Range
Inshore mixed species	16	120.1	20.9–1,195	13	106.1	0.2–2,164.1
Inshore crab	5	45.1	4.1–232.8	1	–	423.4
Offshore prawns	12	122.3	9.3–180.1	2	–	24.3–1,394

This makes modeling challenging, as different fishery types will have different drivers of catch volume and value. For example, the environmental factors that determine the number of prawns produced by a mangrove forest may be different to those determining the number of crabs. Similarly, the socioeconomic variables that determine the fishing effort in a particular fishery will vary with fishery scale and the sectors of society involved. In small-scale fisheries in Southeast Asia, Coates (2002) found that 63–93% of households living near fisheries were involved in fishing, but only a small proportion of these included a professional fisher. In this context, fishing effort would likely be directly proportional to population density, with the entire catch being consumed by fisher's families and communities. By contrast, large-scale industrial fisheries are carried out entirely by professional fishers and have large boats that enable them to operate far from population centers to target high-value species in remote fishing grounds. Their catch is likely to be exported overseas, with little of it being locally consumed. Fishing effort in these fisheries will bear little relation to population density except on very broad scales, instead being primarily driven by the location of the target species.

We have attempted to overcome this challenge through the use of our three broad fishery classes (inshore mixed species, inshore crab and mollusk, and offshore fisheries), which attempt to group fisheries by both target species and scale. This is an imperfect solution; to group only truly similar fisheries would require a classification with

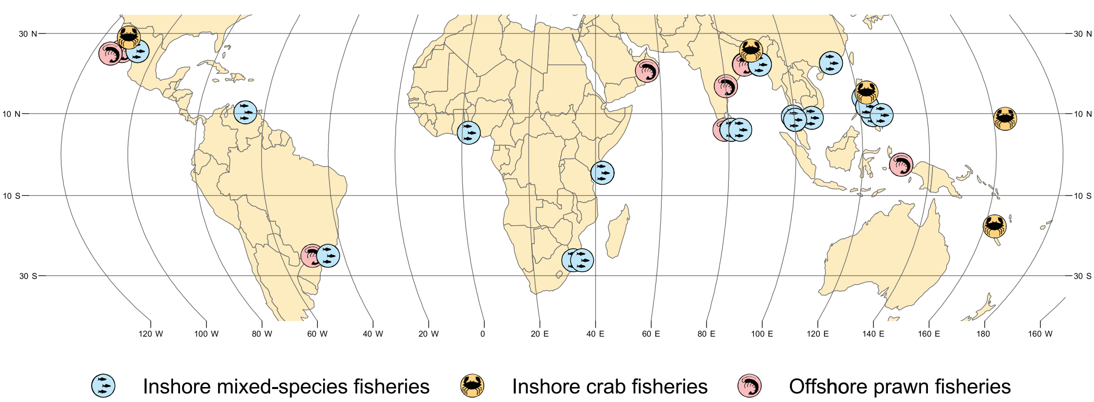

Figure 1.—A map showing the location of data points extracted from the studies returned by the literature review, by fishery type.

multiple dimensions, including boat and gear types and economic, social, and cultural factors (FAO and World Fish Centre 2008), in addition to the target species and scale dimensions that we have used. Each further division of the data, however, reduces the size of the data set that can be used for modeling. Even with our simple three-class system, our largest data set for a single fishery type has just 16 values, making modeling difficult.

The data that we have collated show a large range in both catch and economic value. This is partly the result of the variation in fishery types, even within our categories, but may also genuinely reflect large variation in the catch and value of similar fisheries at different sites. This variability in catch between sites results partly from the mangrove forests themselves; mangroves range from small shrubs on desert margins with low freshwater and nutrient input to 40-m-tall forests in areas with high rainfall and abundant nutrients, with a corresponding variation in the benefits that they provide to fisheries. A further large part of the variation is due to socioeconomic factors. A mangrove in a remote location that is fished by a small village will have a lower catch than one closer to a large city, due to the lower fishing effort. High population density will also give high demand for fish and easy access to markets, driving up the value of the catch. This is demonstrated by the fishery in Mai Po marshes in Hong Kong, which was valued at over $2,000/ha (Qin et al. 2000).

The offshore fishery class poses an additional challenge. Because the fishing grounds are outside the mangroves (in some cases by tens or hundreds of kilometers), it is difficult to directly attribute the catch of those fisheries to the mangroves themselves. Species that have strong evidence of dependence on mangroves include penaeid prawns (Manson et al. 2005) and several snapper species (Kimirei et al. 2013), but even these species use other estuarine and intertidal habitats as well as mangroves. It would be possible to calculate the enhancement that mangroves nursery grounds provide to fisheries by comparing the density of juveniles in mangrove areas with that in areas without mangroves. This analysis has been carried out for oyster reefs (Peterson et al. 2003) and for sea grasses (Blandon and zu Ermgassen 2014a, 2014b), but our literature review did not return sufficient data to do this for mangroves.

A final challenge comes from the geographical and temporal spread of the data. Geographically, we found a reasonable spread of data for mixed species fisheries, although West Africa and South America were both quite data poor. For the other fishery types, however, there were very few data points in South America and none in Africa. Africa was particularly data poor while South America had a number of studies of mangrove crab fisheries, but these did not report the total fishery catch so could not be used. The temporal spread of the data is also a challenge. Fisheries are highly dynamic, with year-to-year variation due to environmental factors as well as human impacts such as overfishing. Data from a 10-year-old study may therefore bear little relation to the state of a fishery today. This should be taken into consideration if these or similar data are used in future analyses.

From our evaluation of the literature, we can make a number of recommendations to scientists working on mangrove fisheries, which would assist in future efforts to review mangrove fisheries values at a large scale:

- Report total catch in addition to catch per unit effort: Catch per unit effort (CPUE) is a key metric in fisheries ecology, but its primary use is in stock assessment. For understanding the value of a particular fishery or the habitat that supports it, the total catch from the fish ery is more useful. The ideal case would be to report both or to report at least catch per unit effort and the total effort for the fishery, from which total catch can be calculated. The area of habitat from which the catch is taken is also helpful.

- Use standard units where possible: A few studies reported catches in individuals or dozens rather than in units of weight. Similarly, studies that reported CPUE included effort units such as catch per net, per trap, or per individual. It may be possible for authors to give sufficient information to convert these into more standard units. For example, for catches reported in individuals of a target species, this would just require a mean weight. There have been efforts to develop standardized units for CPUE (e.g., Salthaug and Godø 2001; Maunder and Punt 2004), but these mostly cover large-scale commercial, boat-based fisheries where boat power can serve as a unit of effort. Units from smaller-scale fisheries are more difficult to standardize, but providing information on the average time spent fishing, the mean number of traps or nets per fisherman, and the number of fishers working in an area would move some way towards this.
- Accurate location is crucial: We discarded a number of studies because they did not give sufficient detail on the study location. Ideally, location should be illustrated on a map showing the sampling points and the limits of the study area. As a minimum, latitude and longitude for the center of the study area should be given. It is also helpful if papers give the size of the study area and the total area of mangrove within it.
- Provide summary statistics for time series: Many papers give data on their studied fishery over a number of years. To use this data in a synthesis, it is necessary to condense the time series to a single value and the best way of doing this depends on the nature of the variability. For example, if the variation is due to environmental stochasticity, then the mean value over the entire study period is likely to give the best summary, whereas if there is a steady declining trend, it would be better to use the most recent value. If the study author has insights into the drivers and direction of any observed trend in catch, it is useful if these are expressed, such that the interpretation of summary statistics is not left to those less familiar with the site.
- Include data from local sources: In reading a number of papers, it was apparent that the authors had used local fishery data, most often from regional or national government bodies but also sometimes from nongovernmental organization reports. This data were not always referenced in a way that allowed us to find it, and even when it was correctly referenced, it was often not available online, meaning that we were unable to access it. Researchers working on the ground with access to these local data sources can dramatically enhance the value of those data and provide an important service to the international research community by, at minimum, reporting the key summary statistics of their data in their research papers.

Next steps

The importance of mangrove to fisheries is already well recognized. To move beyond this recognition towards practical implementation of management measures that might safeguard or even enhance such values, we need a more quantitative understanding of how and why mangrove fisheries values vary. This knowledge can be derived from primary research at an individual site or at a larger scale by a thorough meta-analysis. It is the latter approach we seek to support through summarizing data on fisheries values from the literature.

This work has already proved valuable in helping to determine some of the key drivers of mangrove fisheries, which we used to develop a simple qualitative model for mangrove fishery value (Hutchison et al. 2015). In the future, we hope to move towards a quantitative model by parameterizing our existing model using values from the literature. To do this, we will need to overcome the challenge of the variation in data types. Further research may yield greater insight into potential conversions of our existing data into standard units, which can then be used in further analysis. There is also scope to increase the data set by including gray literature sources and government fisheries reports. Overall, however, this work has shown that even with a comprehensive systematic literature search, data are often not present in ways that allow their use in larger scale analyses. As a result, building a global data set of comparable data on mangrove fisheries remains a challenge.

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