Supporting recovery of fishing livelihoods, mangroves and coral reefs in the Philippines after Typhoon Haiyan:

A Concern Worldwide Learning Paper

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Overview

This paper provides an overview of Concern's experience supporting the restoration of fishing livelihoods in the Philippines following Typhoon Haiyan. The response included the directly supporting those livelihoods and promoting recovery of the mangroves and coral reefs on which those fishing livelihoods depend. Following the Typhoon in November 2013, Concern responded with distributions of non-food items and shelter kits in Northern Iloilo. Following further assessments, an integrated livelihoods project was initiated, which ran between February and November 2014. It included three components: 1) designing and building more eco-friendly boats for small-scale fishers 2) rehabilitating essential mangroves and coral reefs and 3) strengthening local capacity for coastal resource management. Small-scale fishing communities are some of the most vulnerable in the world and face particular risks to their lives and livelihoods in the face of climate change. To the degree possible, emergency response and recovery projects following natural disasters such as Typhoon Haiyan should be designed to support rehabilitation of coastal ecosystems. The paper offers key recommendations and decision trees to support the design of similar projects in the future.

Acronyms

CAR: Concrete Artificial Reef
CPUE: Catch Per Unit of Effort
DENR: Department of Environmental & Natural Resources (Philippines)

LGU: Local Government Unit
MPA: Marine Protected Area
UPV: University of the Philippines Visayas
ZSL: Zoological Society of London

1 Background

1.1 Ocean resources and fishing livelihoods under threat

Fishing is a primary livelihood for many of the world's poorest people. In developing countries, small-scale fishing provides livelihoods to about 90 million fishers and processors, half of whom are women.[1] These small-scale fishing communities are facing increasing pressures, including population growth and associated environmental degradation. Roughly half the world's population are estimated to live within 200 kilometres of a coastline, and by 2025, that figure is likely to double.[2] Flooding, storm surges, strong winds, soil salinization, erosion and sea levels themselves are on the rise in many areas. Climate change is making meteorological hazards stronger, less predictable, and, in many regions, more frequent. As a result, a large and increasing number of people living in coastal regions – particularly the poorest – face heightened risks to their lives and marine-based livelihoods.

Overfishing occurs when fish are caught at a faster rate than they reproduce. As coastal populations increase and dietary habits evolve (i.e. more people are eating more fish), fishery resources and fishers are coming under increased pressure. Most commercial species' stocks are already maximally exploited, threatened or stressed.[3] Unfortunately, history has shown that the absence of effective management of coastal resources generally leads to severe depletion and non-renewal of fish stocks and to the collapse of entire livelihood systems.

Three ecosystems play a critical role in in the maintenance of fisheries resources in tropical regions: mangroves, coral reefs and seagrass beds. They are interconnected and need to be considered as a whole when engaging in coastal resource management, which has been described as comprising '*those activities that achieve sustainable use and management of economically and ecologically valuable resources in the coastal areas which consider interaction among and within resource systems as well as those of humans and their environment.'*[4] Effective management of coastal resources is essential for protecting fishing communities from further risk and decline.

1.2 Typhoon Haiyan

On November 8, 2013, Typhoon Haiyan (locally known as Typhoon Yolanda) crossed the Philippines archipelago from East to West. A category 5 typhoon, it hit the coastal areas of Eastern & Western Visayas Islands with winds of 250 km/h and a tidal wave of five to eight meters high. In addition to loss of life and extensive material damage on land, marine ecosystems were drastically affected. Most ecosystems have some capacity to respond to and recover from natural disasters. However, the unprecedented scale of the Typhoon's

[1] FAO & The World Fish Center (2008)
[2] Creel L (2003); UNEP (2016)
[3] FAO (2014)
[4] White A and Lopez T (1991)

destruction and the effect of overfishing in the Visayan sea before the disaster[5] meant that a more active approach to rehabilitating coastal ecosystems as well as local livelihoods was required.

2 Concern's emergency response

During the first three months following the Typhoon (November 2013 to January 2014), Concern Worldwide distributed non-food items and shelter kits to communities in Concepcion and Carles municipalities, located in the north eastern section of Iloilo Province in the Wester Visayan Region. Following this initial emergency phase, Concern shifted its approach to support the restoration of fishing livelihoods and rehabilitation of the coastal and marine resources on which they depend. This longer term recovery programme was implemented in Concepcion, Carles and Ajuy Municipalities (all in north eastern Iloilo) between February and November 2014. The recovery programme had three main components: 1) designing and building more eco-friendly boats for small-scale fishers 2) rehabilitating essential mangroves and coral reefs and 3) strengthening local capacity for coastal resource management. These are described in more detail below.

2.1 Building more eco-friendly boats for small-scale fishers

Thousands of fishing boats were destroyed as a result of Typhoon Haiyan. In Concepcion Municipality, it was estimated that 27% of fishers had completely lost their fishing boats and equipment and a further 30% had sustained severe damage to their boats and equipment.[6] Before the typhoon, fishers predominantly used a traditional canoe known as a 'banka', whose keel and basin is usually made from a single piece of the local 'Tipolo' tree. After the typhoon, the limited reserves of the Tipolo tree came under extreme pressure as fishers tried to replace and repair their boats.

The first component of Concern's response aimed to restore fishing livelihoods while mitigating the risk of further Tipolo tree depletion. Concern designed a boat of similar shape and performance that was made of marine plywood and required considerably less lumber.[7] Different prototypes were developed and tested in collaboration with local carpenters and presented to a representative panel of fishers and local authorities. Although other agencies developed boats made of Fibre Reinforced Plastic (FRP) after the typhoon, Concern decided not promote this design because a) it differed dramatically from the traditional design and there was insufficient time to test the new design within the project timeframe b) the rocky nature of the coast in the three municipalities could easily damage the material and c) marine plywood could be sourced relatively locally at the time of the project.

Boat production was initiated after the panel endorsed the design. Concern set up its own boatyard including five teams of six experienced boat builders who were managed by a supervisor. Concern procured and supplied the lumber and materials for standardized construction. Marine plywood of minimum ¼ inch thickness was used exclusively, and beneficiaries were expected to coat their boat with a primer in order to extend its life. Boats

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[5] Ferrer (2009)
[6] Concern assessment of 1,381 fishing units drawn from the list of fishermen registered before the Typhoon
[7] Total volume of lumber was reduced by 20% for a boat with a 12 foot keel

constructed by Concern were expected to last up to six years - slightly longer than the average lifespan of the traditional design (three to four years), but this has not been assessed. The end survey showed that the prototype design was well-received by users, with 34% rating it as ‘good’ and 64% rating it as ‘very good’. Users rated the quality of construction similarly (39% ‘good’ and 56% ‘very good’).[8]

In total, 950 boats were built by Concern and distributed to fishers across the three municipalities along with fishing gear that complied with local regulations. Concern carefully selected recipients together with the Local Government Units, ensuring all were previously registered or recognised fishers (verified by a panel). No boat or gear was provided to people who did not own a boat prior to the disaster. An engine was provided to any beneficiary who had been registered with a motor boat before the Typhoon. The list of beneficiaries was regularly shared and updated with the LGU and other actors to avoid duplication. Fishers were expected to register with the LGU and pay the standard registration fee, although the project advocated to the municipality for the establishment of reduction of the fee for the poorest fishers (those with 8ft, non-motorized fishing boat) in this exceptional circumstances. Concern was one of the only agencies doing this but felt it was critical to promoting sustainability.

Figure 1: Improved fishing boat

To offset the project’s consumption of marine plywood (estimated to be the equivalent of 400 mature trees with average height of 15 m), the project supported the reforestation of roughly 50 Ha of public forest on the highest mountain of Conception. Eight local farmers and fishermen associations successfully planted over 15,000 seedlings of indigenous species including forest and fruit trees. The Department of Environment and Natural Resources (DENR) allocated two part-time staff for technical advice, and Concern incentivised communities through a “cash for production” scheme.

[8] Concern (a): project endline with sample of 256 respondents assessing the design

2.2 Rehabilitating Mangroves and Coral Reefs

Mangroves

Mangroves are salt-tolerant trees (or forests) adapted to growing in the harsh intertidal zone of tropical coasts. Mangroves provide shelter, nursing and feeding grounds for hundreds of species of fish, shells and crustaceans. They protect sea grass beds and coral reefs from siltation by regulating the flow of sediments transferred downstream from inland to the coast. They protect the coastline from long term erosion and lessen the impact of tsunamis and storm surges.[9] They also play an important role in mitigating climate change, as they are one of the most carbon-rich forests in the tropics[10] and sequester an average of six metric tons of CO^2 equivalent every year, which is rate at least two times greater than tropical forests.[11] Unfortunately, 20% of global mangroves were lost to accommodate aquaculture between 1980 and 2005.[12] Mangrove forests are essential to ensuring wider ecosystem health, fish stocks and reducing the disaster risks faced by coastal communities.

The scale of mangrove destruction wrought by the typhoon and the impact this would have on the livelihoods of vulnerable fishers became evident early on in Concern's assessment. Mangrove rehabilitation therefore became a central element of the project. Concern conducted a survey in March 2014 (four months after the Typhoon) to assess the extent of the damage to mangrove forests, determine the most appropriate approach to rehabilitation and the resources required.[13] The survey covered nearly all the mangrove forests of Concepcion Municipality. As Concern had never carried out such an assessment before, it followed the methodology practiced by the Municipal Environment Office with additional criteria added by Concern and vetted by the Zoological Society of London (ZSL), an NGO with significant experience in the sector and within the Philippines.[14]

The mangrove survey was carried out during the milder 'neap tide' (the period of the month when there is the least difference between high and low tide) and when the tide was low and mangroves most exposed. The survey sampled quadrats of $100m^2$, repeating assessments six to ten times, depending on the size of the station, amount of covering and central and landward portions of each patch. Concern's assessments reported the quality of substrate, age and type of mangrove, exposure to waves and prior human action, the relative proportions of different mangrove species, and the presence of seedlings or wildlings nearby. The borders of the mangrove were mapped using GPS tracker.

The survey initially concluded that 28% of the 114 Ha of mangroves of the municipality were irreversibly damaged, and most of this was due to wind rather than storm surge, as broken branches were above the surge level. Damage was considered irreversible where trees were uprooted, trunks were broken or defoliation was observed. However, it was observed two months later (six months after the Typhoon) that some of the completely defoliated trees had actually started sprouting new leaves. This regrowth at six months was a surprise even to

[9] McIvor et al (2012)
[10] Donato (2011)
[11] Murray (2011)
[12] FAO (2008)
[13] Concern (c)
[14] Primavera JH et al (2012)

local residents, and it is recommended that a similar timeframe for potential regrowth should be used for future assessments.

The project team and partners concluded that most of the mangrove patches did not actually require any intervention as they were healthy and large enough to produce, hold and nurse sufficient seedlings and wildlings by themselves. However, there was a need to support the less dense 'fringe' patches of mangrove - largely thin stretches along the coastline – because they would not have the ability to produce and protect new seedlings and regenerate on their own.

The project therefore decided to focus its rehabilitation efforts on the 'fringe' patches of mangrove forests. In order to carry out this work, Concern entered into a formal partnership with ZSL, who provided ongoing technical support to the project and lead a five-day training on mangrove rehabilitation for members of Peoples' Organisations and staff from Local Government Units (LGU) and Concern. Eleven POs participated in the training and prepared rehabilitation plans for their area, which were then fine-tuned and validated in the field by Concern teams.

Figure 2: Mangrove seedlings transplanted and staked

Building on the experience of ZSL and others, Concern's approach to rehabilitating the fringe mangrove forests included four key aspects. First, Concern decided not to undertake mangrove cleaning through Cash for Work (CFW) because it had caused damage due to inexpert cutting of branches and large teams walking over the mangroves. Second, it was decided to erect breakwaters made of bamboo to protect new plantations (see Box 1). Third, Concern decided to plant local mangrove species that were best adapted to the environment (mainly *Sonneratia* and *Avicaenia*) rather than the more widely available species (*Rizophora*), which does not thrive when planted in seafront and seagrass beds. POs were supported to collect wildlings of the adapted species from non-affected mangrove forests or to grow them from seed in a nursery and transplant. Finally, Concern and partners aimed to plant one seedling per square meter in a staggered pattern with each plant loosely tied to a tutor (a bamboo stick); the team also avoided planting directly in the seafront or any soft muddy substrate.

Box 1: Bamboo breakwaters to protect mangrove seedlings

Breakwaters are built structures which offer protection for seedlings from wave action and encourage sedimentation and coastal protection. Following an initial assessment of locally available materials, breakwaters were constructed from bamboo and rocks, depending on the nature of ground and availability of natural materials..

The bamboo breakwaters were four meters wide and 100 to 120m long, disposed parallel to the shore, allowing enough space between sections for boats to pass and to limit creation of rip currents. The design accounted for the fact that a waves' energy is better attenuated through a non-obstructive structure. Each breakwater section was made by erecting eight staggered rows of bamboo stakes, with 0.5m between each stake. The stakes were 2.5m high, 10 to 12cm in diameter, and planted 60cm deep in the rocky (not soft) muddy bottom. Where mangrove replanting was done near a creek, bamboo fences were constructed to protect nurseries from the accumulation of heavy debris.

Where the substrate was too hard to embed bamboo poles, Concern opted for a trapezoidal shaped breakwater made with locally available stones, using a design use previously by the ZSL. The rock breakwater had a base of 2.25m, and a small base of 1m with height of 1m. Costs for different construction methods varied, but on average were 5.4 EUR/meter for bamboo and 14.4 EUR/meter for unlined stone, which were considerably cheaper than the alternatives (26 EUR/meter for PVC coated gabion with filling material and 150 - 170 EUR/meter for a masonry

Figure 3: Bamboo breakwaters Ernesto Azuelo inspecting bamboo breakwater under construction in Igbon, Concepcion Municipality

Coral reefs

Coral reefs are structures made of calcium carbonates constructed by colonies of small animals called polyps. Coral grows in tropical seawaters, usually within 50 meters of the ocean surface to receive adequate sunlight. Coral reefs are amongst the most complex, diverse and productive ecosystems in the world, hosting 25% of marine species while occupying less than 1% of the marine environment.[15] Per km^2, a healthy reef can sustainably yield up to 35 metric tons of fish and other marine products annually.[16] Coral reefs therefore play a critical role in the livelihoods of fishing and coastal communities. If protected, reefs can provide a self-maintained buffer protecting the coast from erosion and storm waves' action.

The impact of the Typhoon on the coral reefs of Concepcion was devastating. This was evident from a rapid underwater survey conducted by the LGU a few weeks after the Typhoon. Further assessments of the reef substrate conducted in April and May 2014 showed the cover of live coral had decreased by 42% in reefs exposed to the Typhoon compared to data from the same sites in 2012.[17] In contrast, the live coral cover in the one survey site that was *not* exposed to the Typhoon had actually increased by 47%.[18] Among the hard corals, the branching types were the most affected, and in some areas, one genus of branching coral (*Acropora)* was almost entirely destroyed. Colonies of *Drupella* (a genus of sea snails) were also observed on all sites and posed a serious threat to the few remaining live corals of the branching type and thus seriously threatened the equilibrium of the ecosystem.

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[15] World Wildlife Fund (accessed 2016)
[16] McClellan (2010)
[17] Concern Worldwide (b). Note, the assessment used Line Intercept Transect and Manta Tow methods, for more info see UNESCO Coastal Management Sourcebooks
[18] A "Post-Typhoon Yolanda Coral Reef Assessment" conducted by the OceanBio Laboratory Team (University of the Philippines Visayas), led by Dr Wilfredo Campos, in May 2014.

Concern decided immediate coral reef rehabilitation should be a priority in its response, and local authorities confirmed their commitment to work in partnership on the project. However, similar to the mangrove rehabilitation, Concern recognised it would need to access external technical expertise to design and implement the project. The Concern team therefore consulted existing literature, visited a similar project, and partnered with several local universities who provided the expertise of marine biologists in exchange for Concern covering travel expenses, meals and accommodation. This body of experts was able to train the Concern teams and partners in coral reef rehabilitation and helped identify the technical options for intervention and select appropriate sites.

Following Concern's assessment and consultation with the technical experts and local authorities, Concern prioritised four activities to support coral reef rehabilitation: 1) construct concrete artificial reef units to serve as "coral nurseries" and gather and transplant live coral fragments onto them 2) remove debris from the coral reefs and coastal areas and protect them from predator (Drupella) outbreaks 3) support the LGUs to delineate and enforce existing Marine Protected Areas and 4) provide community education on sustainable coastal resource management. The project aimed to transplant 10,000 live coral fragments over three severely affected coral reefs that were located inside the pre-existing Marine Protected Areas (MPA).

Coral nurseries are restoration areas that provide suitable environments for the regrowth of coral reefs. Because the typhoon had left no stable boulders or massive coral heads on the seafloor, there was no natural, stable substrate onto which the coral could be transplanted. The project, therefore, after expert consultation, decided to construct concrete artificial reef (CAR) units for this purpose. These CAR units were deployed to the sea bed with multiple sites (nails) onto which live coral fragments could be tied (See Box 2).

Figure 4: Concrete artificial reef with transplanted coral fragments

Fragments of live branching corals from around damaged reefs were collected by divers using scuba masks and snorkels and kept in nurseries built by the project. Luckily, the project had begun collecting reef fragments as early as May 2014 because by September, the availability of live coral fragments had greatly declined. Concern was able to transplant over 3,400 live coral fragments from the project nurseries, meaning no fragments had to be removed from live reefs. Local volunteers tied the fragments onto the CAR units in shallow water before they were deployed to a depth of four to eight metres.

Box 2: Constructing concrete artificial reef units for transplanting coral fragments: Concern constructed Concrete Artificial Reef (CAR) units onto which coral fragments could be transplanted. Concern decided to construct 'jackstone' type CAR units (shaped like a jack) because they are stable, are less likely to sink, provide shelter for fish without trapping them, have an efficient ratio of volume occupied per quantity of construction materials and act as a deterrent to certain illegal fishing nets.

Concern fabricated several pilot moulds and chose the design with the soundest structure that could still be carried by two persons on land. A total of 40 steel moulds were fabricated and transferred to the communities in the three target sites, where local masons were trained and provided with quality materials and constructed 600 jackstones. Holes were made in the concrete as it set so concrete nails could be attached later (after deploying on the ocean floor because affixing nails beforehand makes them difficult to transport). A unique ID code is carved in each CAR for identification and monitoring purposes.

CAR units were deployed in clusters of 5 to 8 units using a bamboo raft. Once arranged on the bottom, divers hammered 10 to 20 concrete nails in each unit and coral fragments were then attached by a cable tie to the nails. Divers recorded the number and genus of the fragments transplanted and tied a soft identity tag to each. A sample of units was surveyed two weeks after transplanting to monitor survival rates.

Coastal cleaning campaigns were organized in 15 islands to remove large debris such as tarps, clothes and abandoned nets which get tangled in the coral, cutting off sunlight and causing it to die as well as trapping fish like "ghost nets". Hundreds of volunteer participants and teams of local scuba divers collected large quantities of solid waste, which were displayed for communities and volunteers to view before disposal to demonstrate the importance of solid waste management for coral reef survival.

In order to control the severe outbreak of *Drupella* (see Figure 5), the project organised collections of snails. Roughly 80 kg of snails were collected during 20 hours of diving. This was the only control method the programme was aware of, and, unfortunately, the snails are not suitable for human or animal consumption.

Figure 5: Drupella (sea snail) feeding on coral

2.3 Strengthening local capacity to manage coastal resources

Recognising that the potential impact of the project's other activities would be seriously compromised if not integrated into a broader coastal management plan,[19] Concern included activities to help communities and local authorities better understand the importance of protecting coastal resources and how to manage those resources more effectively.

Governments and communities have a number of regulatory tools they can use to better protect fish stocks and other coastal resources. The establishment of Marine Protected Areas (MPAs) and other regulations restricting how much fish can be harvested and by what means (e.g. the number of vessels allowed in the waters, the techniques and gear permitted, and the amount of fish each boat can catch and haul) are central to managing coastal resources. Their effectiveness, however, depends heavily on the regulations being understood and respected by all and being enforced by the relevant authorities.

[19] Edwards (2010)

Box 3. Marine protected areas

Marine Protected Areas are areas where fishing is more restricted or thoroughly banned. They provide an important means of promoting the recovery of fisheries and marine resources. Although there seems to be no universally agreed definition, the International Union for the Conservation of Nature a protected area [and by extension a marine protected area] is "a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." (Day et al (2012)). The benefits of well-regulated MPAs, including increased diversity, density, and average size of fish as well as potential social impacts have been well documented. (Balmford (2004), Reuchlin-Hugenholz (2015)).

A network of 31 MPAs existed across the three municipalities before the Typhoon, having been established gradually between 1999 and 2011, according to the Fishing Ordinance Manuals of the three Municipalities of Ajuy, Concepcion & Carles, Iloilo. These MPAs cover a total area of 569 Km^2 across – equivalent to roughly 13% of municipal waters – and are managed by the Municipal government. Within these MPAs, only non-destructive passive fishing gear i.e. those appropriate for small-scale hook and line fishing, was authorised. In addition, half the MPAs host a sanctuary zone, where a 'no-take' policy is mandated. However, the total 'no take' area falls short of the minimum 10% of an MPA recommended for promotion of sustainable fish reserves.

MPAs and other fishing regulations were in place in Concepcion before the Typhoon, but local authorities reported finding it more difficult to enforce the regulations post-disaster. They specifically cited an increase in fishing units in the water, which was likely due in part to agencies distributing a large number of fishing boats and nets as a component of their humanitarian response without properly coordinating with the local authorities or other stakeholders. A number of markers and guard stations had also been destroyed impeding the local authorities' management of existing MPAs.

Supporting communities and local government to manage coastal resources

In order to promote 'learning by doing', the project deliberately engaged a large number of community volunteers to carry out many of the project activities, including construction and deployment of breakwaters and artificial reefs, transplanting mangrove and coral fragments, coastal clean-up campaigns and community monitoring and enforcement activities. Volunteers from local communities and authorities and from other NGOs were unpaid but were offered a traditional meal for each day of work. This helped reduce costs while mobilising and building skills within the community to improve coastal resource management over the longer term.

To promote better management of MPAs, Concern supported the LGU to facilitate workshops in 13 barangays (the smallest administrative unit in the Philippines), teaching coastal communities the principles of MPAs and enforcement mechanisms. Other workshops were carried out with a range of stakeholders, and these resulted in a large number of MPA management plans being updated and consolidated. To demarcate MPAs and facilitate safe boat-access for rehabilitation work, Concern fabricated and deployed mooring buoys.[20] Concern also supported several fisher associations to re-establish guard houses, which were used to shelter volunteer watchmen who reported illegal fishing vessels to a local patrol boat. Two guard houses were built - one on stilts (see figure 6), and the second on a floating platform made of steel. Concern also constructed two new patrol boats, with each municipality contributing some of the costs. These were used to apprehend illegal fishing vessels, and it is estimated that the total amount collected in penalty fees roughly covered the expenses incurred for staff time and fuel.

Each boat constructed by Concern dispalyed its name and registration number and was painted according to the official colour code established by the municipality, which facilitated the work of the municipal fish patrol units. Concern was one of the few agencies who opted for this, rather than painting the boats the colour of the agency logo.

Figure 6: Guard station

Communities also nominated fish wardens who were given the authority to apprehend and/or document illegal fishers. The project trained these deputised fish wardens on the municipal fisheries codes and ordinances and how to safely report or apprehend violators. In some municipalities, LGUs offered financial incentives to the wardens on a monthly or 'per citation' basis to improve regulation of illegal fishing vessels. As explained above, the project's stipulation that all recipients of Concern-produced boats register (or register) with the LGU also helped the local authorities to better manage the number of active fishing vessels.

Supporting fish catch monitoring

In the months following Typhoon Yolanda, there were some indications that the fish industry had begun to recover. However, post distribution monitoring conducted by Concern Worldwide in Concepcion in May 2014 revealed 87% of returning fishermen (n=177 fishers) reported catching less than they had during the same season prior to the Typhoon. A more

[20] Concern used permanent moorings as anchors have been shown to be destructive in coral and sea grass bottoms.

detailed follow on end-line survey was conducted in October 2014, which included more detailed questions showed that the average number of fishing trips decreased from 5.9 before the Typhoon to 5.2 after the Typhoon.[21] Fishers explained this was largely due to unsuitable weather conditions post-Typhoon. The average reported yield also decreased from 8.6 kg/ trip to 4.8 kg/ trip, with 55% of fishermen declaring they were catching less per trip after the Typhoon.

Surveys such as those conducted by Concern have a key limitation in that they rely on fishermen' recall and are therefore subjective. A more reliable and standardised approach used throughout the world is Fish Catch Monitoring (see Box 3). In order to promote and institutionalise more rigorous monitoring of fish stocks recovery, the project organised a training in fish catch monitoring by the University of the Philippines-Visayas (UPV) for a group of community enumerators elected from within their local Fishermen Associations. Staff from the municipality were also trained in coding and analysis of the fish catch data. UPV also provided a series of technical support visits to the LGU to support them code and analyse the data. The final report of the Fish Catch Monitoring (covering three months, from September to December 2014) revealed a decrease in the mean catch rate in 2014, compared with 2012, all categories included.[22]

Box 3. Fish Catch Monitoring

Fish Catch Monitoring is the extensive systematic collection of standardized information about fish catch (quantities and species), fishing gear, fishing effort (number of fishers per boat, time spent fishing), and fishing grounds. The output is the catch per unit of effort (CPUE) or catch rate monitored in Kg/fisher/day or Kg/fishing trip. The purpose of fish monitoring is to track the change in fish catches over time illustrating the results of management practices or natural events. Declines in CPUE may identify fish populations which are not sustainable after harvesting. Steady increases in CPUE may identify a recovering fish stock.

3 Conclusion

The project made some significant accomplishments during its short period of implementation. Key learning from the project includes:

Small-scale fishers represent an increasingly vulnerable population in coastal contexts. The risks posed to their livelihoods, safety and well-being should be assessed in any development or emergency programme undertaken in coastal areas. This is particularly the case in the face of population growth, environmental degradation and climate change.

While emergency programmes should be focused first and foremost on saving lives, striving to ‘do no harm’ to the coastal resources on which the livelihoods of the

[21] Concern Worldwide (a); based on a sample of 695 fishers from Concepcion and Carles municipalities.
[22] University of the Philippine Viyasa, 2015

emergency-affected population depends should also be a central aim. This includes coordinating closely with local authorities to ensure any distributions of boats or fishing gear are in compliance with local regulations and supporting local authorities to enforce existing regulations post-disaster. Any emergency interventions should avoid causing further damage to essential elements of coastal ecosystems, particularly mangroves and coral reefs, which are critical to fish stocks.

When distributing fishing boats or gear after a disaster, coordination with local government and other stakeholders is critical. This is to ensure any goods distributed are compliant with local fishing regulations and that local authorities can control the number of vessels fishing and reduce the risk of overfishing and harmful practice. Fishing gear and boats should not be distributed to people unless they owned such equipment prior to the disaster. It is important the government, non-governmental agencies, the UN and other actors commit to such a policy and harmonise their approaches to prevent the proliferation of boats, which can lead to local conflicts and often wasted resources.

Where possible, interventions focused on distributing boats should explore opportunities to swiftly improve the existing boat design in collaboration with local fishers. While this may not be possible during the emergency phase, during recovery activities, the opportunity to replace a fleet with boats using, for example, materials that are more sustainably sourced or are longer-lasting. Such innovative designs should be developed jointly with local fishers and be tested by the end-users.

The establishment of a boatyard supervised by Concern enabled the efficient construction of 950 boats by local carpenters. This was much faster than going through the standard procurement processes and allowed the project to have optimal control of the quality and pace of construction with the input of a variety of local craftspeople.

Mangrove regeneration may happen as late as six months after a disaster rather than four months, as previously thought – future assessments should wait a full six months before declaring mangroves 'irreversibly damaged'. Regrowth observed at six months in Concepcion surprised even local residents. This realisation at six months post-Typhoon lead to the programme team to conclude that irreversible damage was, in fact, confined largely to the 'fringe' areas – narrow strips along the edges of the mangrove forests that were not robust enough to foster regrowth. The meant the project could focus its efforts on the fringe areas, leaving the main sections of mangrove forest to regenerate on their own.

Concrete artificial reefs offer a viable substrate for transplanting coral where natural structures have been destroyed. Key considerations include choosing shapes that maximise surface area while still being light enough to deploy easily and that allow free movement of fish. It is important to trial different designs in each context before moving to mass production.

Sensitisation activities that are practical and visual and employ a 'learning by doing approach' are more likely to result in positive behaviour change. Although many coastal communities have lived their entire lives near the water, many have not seen what is happening under the surface of the sea. We learned that most people in our target area, including our staff, had never seen the sea bottom and most did not know that coral is a living organism. In particular, involving community volunteers in activities such as transplanting coral or mangrove wildlings (including activities under the water) and combining this with education session on best practice, the project was able to gain community support for improved coast resource management.

A thorough review of the legal frameworks and existing regulations on fishing and marine protected areas is critical before a project starts. Training of key government staff and community members and leaders in these legal frameworks and enforcement mechanisms also helps mobilise communities to protect their coastal resources.

NGOs may not have all the technical skills required for coastal resource management – establishing strategic partnerships with technical institutes should be considered and budget for from the start of the project. Concern recognised early that it did not have the expertise in this area and therefore set up formal partnerships with the University of the Philippines, the London Zoological Society and the Municipal Environmental Management offices of Concepcion and Carles.

Fish catch monitoring is an important means of assessing the impact of a coastal resource management programme over time and what aspect of the project need to be adjusted. Concern and other NGOs should consider from the outset how they can support such monitoring systems already underway by the government or other bodies.

In the future, a stronger gender analysis of fishing communities and economies is recommended as it may ultimately improve the impact of such programmes. Concern's response focused largely on the 'fishermen' of Concepcion and assumed that benefits would accrue to the entire household, which included women. However, a better understanding of how female headed households were earning a livelihood and how they and other women in the fishing community might be better supported could be beneficial.

The following decision trees may help humanitarian and development actors design interventions to restore livelihoods following a coastal disaster such as a typhoon, a tsunami or a storm surge.

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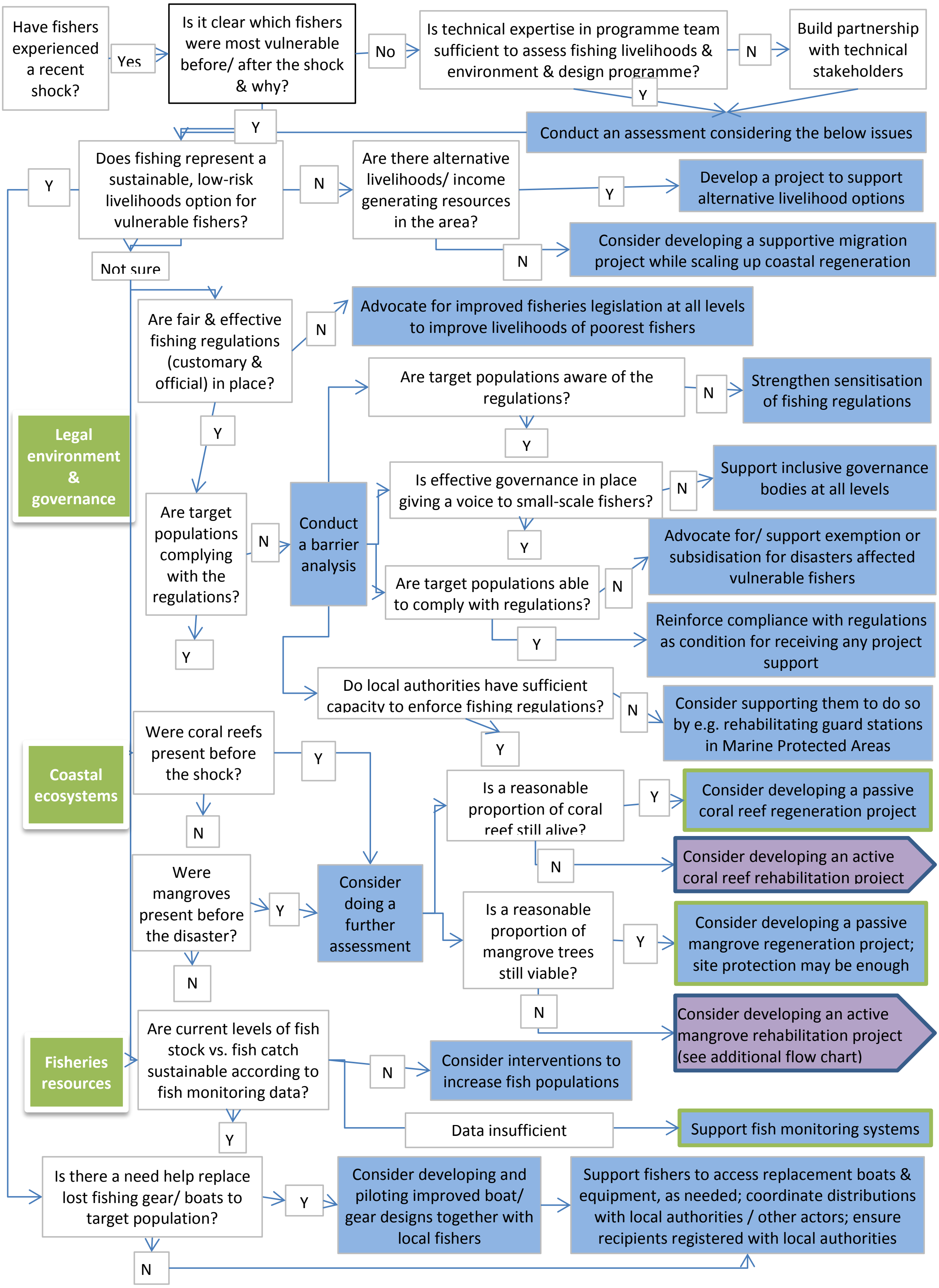
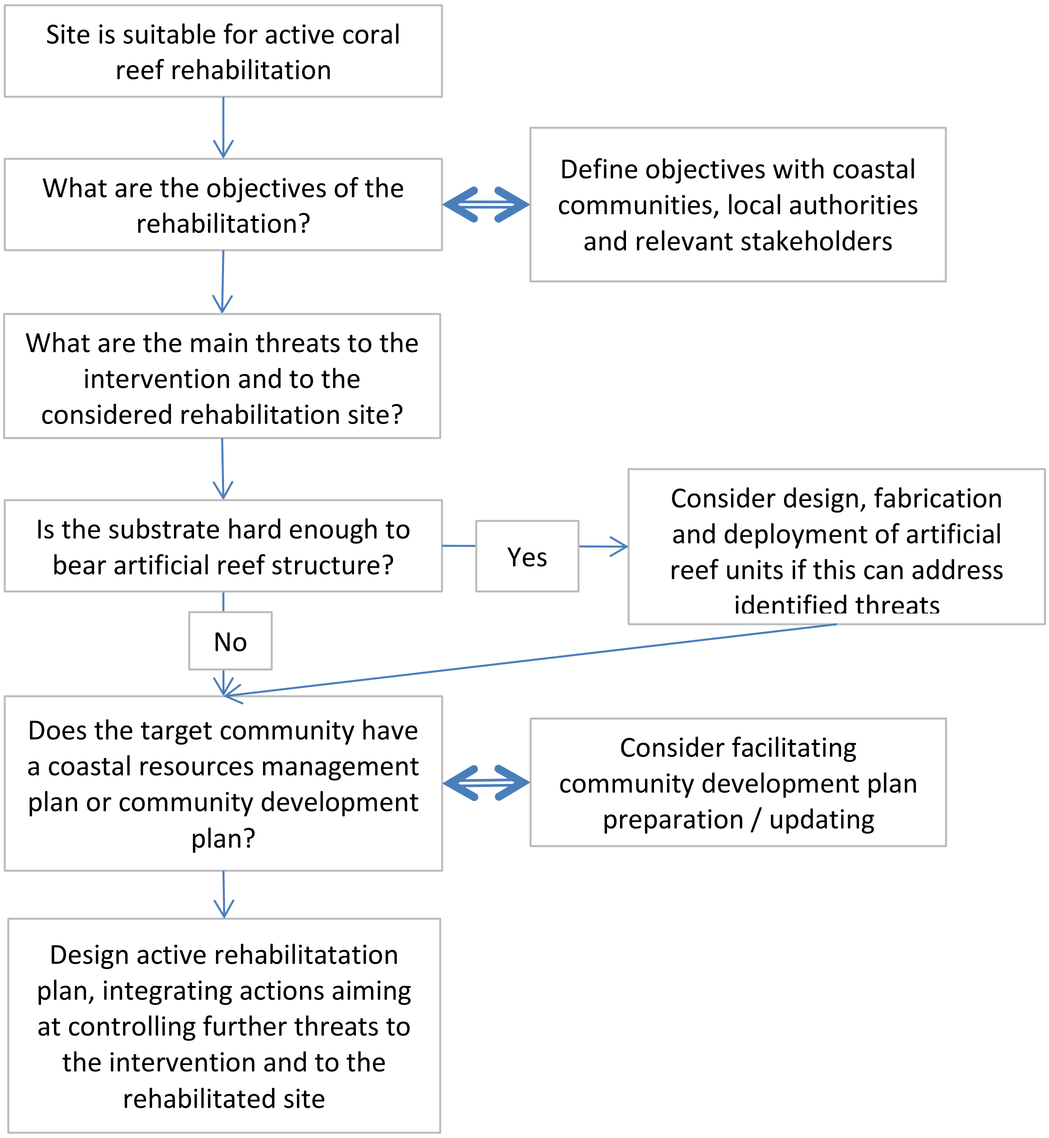
Annexes: Decision trees for restoring fishing livelihoods after a disaster

Decision tree 1: Selecting main project components



Decision tree 2: Designing activities for coral reef rehabilitation



Decision tree 3: Designing activities for mangrove rehabilitation