IMPACT ASSESSMENT REPORT

Republic of Indonesia

Coastal Community Development Project (CCDP)

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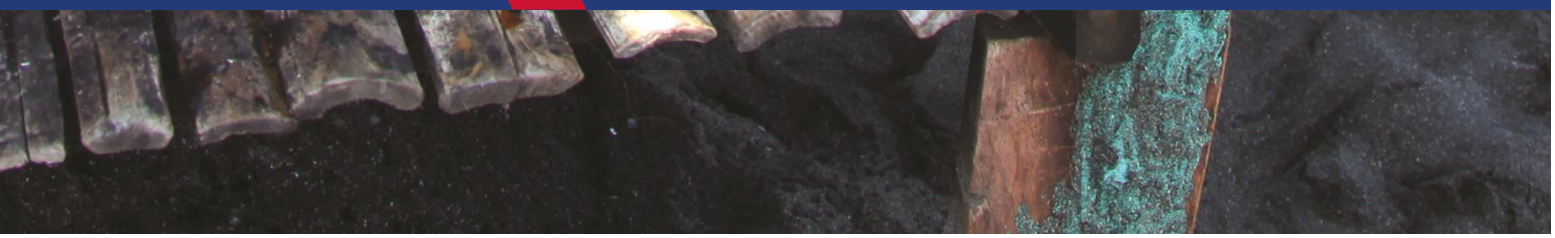

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Table of contents

Executive summary

Coastal natural resources and fisheries are essential to the livelihoods of millions in island and coastal communities across the world. This is particularly the case in eastern Indonesia, where a large share of the poor in Indonesia live. Sadly, these poor coastal communities have limited and inefficieint fishing gears, poor fishing infrastructures and limited access to profitable markets for their fish catch. This makes them unable to sustainably optimize the use and benefit of the fisheries and natural coastal resources around them. Moreover, these communities often experience significant post-harvest losses of fish and marine products due to the lack of cooling or processing equipment and facilities. At the same time, the coastal natural resources and fisheries they depend on are under attack from natural resource exploitation. Weak or non-existing fisheries governance and management plans; illegal, unreported and unregulated fishing practices (IUU), combined with natural and human-induced coastal reef and marine habitat degradation, etc. have all led to and may further lead to severe fish stock depletion. This is likely to reduce catch potential if exploitative practices are unabated (Edinger et al., 1998; FAO, 2014; Graham, 2014; Varkey et al., 2010).

To address some of these challenges the IFAD-funded Coastal Community Development Project (CCDP) was implemented in 12 districts across eastern Indonesia, between January 2013 and December 2017. CCDP had the objective of reducing poverty and enhancing sustainable and replicable economic growth among the economically active poor in coastal and small island communities in Indonesia. This was to be achieved through investments in fisheries, aquaculture, and related marketing in addition to supporting sustainable management of fisheries and natural coastal resources. The total project cost of US$43.2 million was jointly funded by IFAD, the Spanish Food Security Trust Fund, the Government of Indonesia (GoI) and project beneficiaries.

This report documents the results of an ex post impact assessment of CCDP, which was conducted between April 2018 and May 2019, as part of the IFAD 10 Impact Assessment Agenda under the auspices of IFAD's Development Effectiveness Framework (DEF). The CCDP impact assessment (IA) employed both qualitative and quantitative research methods to measure the impacts of CCDP on a number of development indicators, including household assets, incomes from fishing-related activities, fish sales and prices, in addition to fishing productivity, food security, dietary diversity and women's empowerment, among other indicators.

Household survey data were collected from 2,956 households representing three categories of households: (i) CCDP beneficiary households; (ii) those that did not directly participate in CCDP but could potentially benefit indirectly (the spillover group) due to living in the same villages as CCDP beneficiaries; and (iii) non-beneficiary households (the comparison group). Analysis of the household data was performed using statistical matching techniques, primarily the Inverse Probability Weighting (IPW) and Inverse Probability Weighted Regression Adjustment (IPWRA) treatment effects estimation methods. In addition, Difference-in-Difference estimation techniques were used to analyze the impact of CCDP on household asset indices, where recall data on major assets owned was used to measure baseline household assets.

Results found that CCDP unequivocally increased fishing productivity by 79% and market access by 28% as measured in terms of fish catch per cubic meter of vessel per day, and fish and marine product sales respectively. The benefits associated with improved market access also extended to the spillover households that did not directly participate in the CCDP interventions, highlting the economy-wide positive spillover impact that market linkage interventions can generate.

Net household income from fishing also increased by 54.2% while total household net income increased by 45.6% compared to the non-beneficiary fisher households. However, when non-fishing

households that also participated directly in CCDP were included in the analysis, no significant difference was found in the total net incomes, largely as a result of higher non-fishing incomes for the comparison group households. This result suggests that while investment in improved fishing productivity and fish and marine product market access increased the benefits from fisheries, CCDP beneficiaries that did not engage in fishing ended up with lower total net income levels compared to non-beneficiary non-fishing households, who mostly ventured into other forms of employment in the service sector. This stresses the point that in contexts where rural and structural transformation have taken root, as is the case in rural coastal communities of eastern Indonesia, it is critical to consider investments in other non-primary productive sectors such as downstream value chain activities and service sector employment, which appeared to be generating higher incomes.

With respect to women's empowerment, CCDP was able to increase women's participation in fish and marine processing by 27% as well as general participation in community groups by 84%. However, there appeared to be limited impacts on women's empowerment at the household level, as women that benefited from CCDP were found to be equally engaged in household-level savings responsibilities as their non-beneficiary counterparts. Findings on resilience to climatic and geological shocks, among other shocks, showed that CCDP beneficiaries were more prone to shocks to begin with and were less able to recover from these shocks even after participating in the project. This implies that CCDP did not significantly enhance resilience of its beneficiaries. On average, CCDP beneficiaries were 6% less likely to report being able to recover from a shock to their livelihoods.

Overall, while CCDP made several developmental inroads in terms of positive and significant impacts, especially among fishing households. Nonetheless, the project's impacts could have been amplified and broadened to also positively affect non-fishing households, had special attention and interventions been dedicated to other non-fish value chain activities, including including income generating activities in the service sector such as eco-tourism, which endogenously emerged in some cases. Greater positive impacts could also have been realized had CCDP effectively integrated resilience enhancing interventions in its design and implementation. Future coastal community development projects would be well-advised to incorporate issues of resilience or to consider standalone intervention geared at enhancing resilinece to boost impact on several economic and social impact indicators.

1. Introduction

Coastal natural resources are essential to the livelihoods of millions in island communities of the world. This is certainly true for indoneisa, the largest archipelago on earth, which boasts the second largest coastline in the world (CIA, 2018) and is home to approximately 2.5 million households that live and depend on coastal areas (BPS - Badan Pusat Statistik, 2015). Annual capture fishery and aquaculture production is estimated at 22.2 million tons of fish, which is about 11% of the world's total fish production (World Bank, 2018) and small-scale and artisanal fishers account for the bulk of production (estimated to be about 92% in 2011). It is therefore no surprise that capture fisheries and aquaculture value chains are crucial for livelihoods, food security and nutrition of many poor rural households in Indonesia, including those who do not directly engage in fishery activities (BPS, 2015; FAO, 2014).

Nevertheless, households engaging in capture fisheries and aquaculture in Indonesia face several challenges. Most fishers living in coastal villages and small islands earn a low income and experience low standards of living (FAO, 2014); they lack access to advanced fishing technology and gears (Schuhbauer & Sumaila, 2016), have limited access to financial resources (FAO, 2014) and are particularly exposed to climatic variability and extreme events such as cyclones, earthquakes, tsunamis and volcanic activity (Cheung et al., 2009; Troell et al., 2014). In addition to these challenges, coastal areas of Indonesia experience natural resource exploitation, which poses severe threats to fish stock in the region. Weak or non-existing fishery governance and management plans; illegal, unreported and unregulated fishing practices (IUU) combined with natural and human-induced coastal reef and marine habitat degradation; environmental pollution and human clearing of coastline trees and shrubs (e.g. mangrove); natural hazards, etc. have all led to and will further lead to severe fish stock depletion and reduced catch potential (Edinger et al., 1998; FAO, 2014; Graham, 2014; Varkey et al., 2010). This, in turn, implies lower fish yields (fish productivity) in the long run (Pratchett, Hoey, & Wilson, 2014).

IFAD's Coastal Community Development Project (CCDP) in Indonesia, a US$43.2 million project, had the objective of addressing several of the abovementioned challenges. CCDP's overall goal was to reduce poverty through enhanced, sustainable and replicable economic growth among the active poor in coastal and small island communities through investments in fishery, aquaculture, processing and marketing, in addition to provision of related support structures. To this end, the project aimed at addressing constraints on small-scale fishery communities by increasing fish catch, fish productivity and income through improvements in fishing gears (technology) used and fishing practices as well as increasing household participation in high-potential marine and aquaculture value chains. CCDP also aimed at rehabilitating coastal and natural resources to ensure sustainability of the environment, fish stock and economic livelihoods. The project was implemented in 181 villages within 12 districts throughout eastern Indonesia. CCDP was approved by the IFAD Executive Board in October 2012 with project implementation lasting over five years, beginning in January 2013 and ending in December 2017.

The Ministry of Marine Affairs and Fisheries, *Kementerian Kelautan Dan Perikanan* (KKP), served as the project executing agency while the CCDP activities at the district levels were implemented through collaboration between the *Dinas Kelautan Dan Perikanan* (DKP) and respective project implementation units (PIUs) working in selected villages. Village working groups (VWGs) and activity-focused groups, including capture fishers groups, aquaculture groups, enterprise groups, infrastructure groups and community-based coastal resources management (CBCRM) groups were part of the grassroots implementation architecture of the CCDP.

The CCDP was selected for rigorous ex-post impact assessment (IA) to analyze the effects of CCDP on a number of impact and outcome indicators, including economic mobility, food security and nutrition, resilience, women's empowerment and natural resources rehabilitation. The main objective of this report is to present results of the IA of key components of CCDP, which include the capture fisheries, aquaculture, fish enterprise and trade, as well as CBCRM. Assessment of the impact of these components fits into the broader set of IAs being conducted globally as part of the IFAD10 Impact Assessment Agenda (IFAD10 IAA). The IFAD10 IAA aims to provide lessons for improving the design of rural poverty reduction programmes and to measure the impact of IFAD-supported programmes on enhancing rural people's economic mobility, productive capacity, market participation, and resilience.

This IA takes place at an opportune time for IFAD, for regional and national institutions in Indonesia as well as for the scientific community. First of all, results of this IA measure the effects of the project on its key indicators in addition to understanding and assessing mechanisms that allowed CCDP to achieve these impacts and the barriers encountered. As such, results will generate lessons that can inform the designs, implementation and monitoring of new IFAD fishery and coastline rehabilitation projects but also inform replication or scaling up of the CCDP in the future (Gertler et al. 2011). Secondly, based on this IA, CCDP could serve as a best practice example for future investments in the Indonesian fishery and aquaculture sector for national and international stakeholders. It can also provide evidence for decision making and policy formulation, particularly considering the on-going formulation of the Medium Term National Development Plan (RPJMN) 2020-2025 in Indonesia. Lastly, this impact assessment is one further addition to the growing body of scientific literature that investigates the impacts of rural development projects. This is of special importance given the scant evidence on poverty alleviation through investments in the fishery and aquaculture sector (Béné et al. 2015).

The CCDP IA was conducted between May 2018 and April 2019, and used a combination of qualitative and quantitative methods. The IA started with qualitative fieldwork that entailed a scoping mission, focus group discussions and key informant interviews with relevant stakeholders. The results of these efforts were then used to inform the design of the quantitative impact assessment and to better interpret the quantitative results presented in this report. The quantitative approach mainly entailed a fishers' household survey and a complementary fishers' community survey. The household survey covered 2,802 households, of which 1,064 were direct beneficiaries of the CCDP, 678 were classified as indirect (spillover) beneficiaries, given that they lived in the same CCDP villages but were not enlisted as beneficiaries, and 1,060 were non-beneficiary control households. The community survey was administered in the same villages where the household survey respondents reside, to capture important variables at community level that might influence the kinds of impacts realized by the CCDP. The quantitative data were analyzed using non-experimental design methods, specifically propensity score matching methods.

The rest of this report is organized as follows: the next section is an exposition of the CCDP theory of change, outlining the impact pathways and expected outcomes and impacts of CCDP. The section thereafter presents research questions along with a brief description of the project coverage and targeting approach. In the fourth section, an outline of the methodology used is presented, including the data and analytical approach used to answer the research questions. The fourth section presents the results of the impact assessment, where the main findings and heterogeneous impacts of the CCDP are showcased. Finally the fifth section concludes the study with a summary of the main findings, lessons learned and policy recommendations drawn from the findings.

2. Theory of change and main research questions

CCDP theory of change

The overall goal of the CCDP was to reduce poverty and enhance economic growth in active poor coastal and small-island communities in the eastern parts of Indonesia. The CCDP theory of change envisioned that this would be achieved by increasing household incomes of beneficiary families engaged in fisheries and marine activities. Beneficiaries' returns from fishing and marine activities would increase as a result of increasing fish production and productivity (harvested from aquaculture or captured from natural water bodies) and increasing sales of fish and marine products thereof, including processed and food-safety certified fish products. These would be achieved by investing in support infrastructure, assets and inputs necessary to boost production and marketing. In addition, deliberate efforts to link the fishers with beneficial markets through setting up contracts or supporting fishers to participate in fish auctions, would lead to increased beneficial market participation. Beneficiary households were also expected to experience an increase in their food security and nutrition (dietary diversity) as a result of the increased quantity and diversity of fish available and harvested as well as due to increased incomes that would allow them to purchase more nutritious foods. At the coastal natural-resource level, marine diversity and health would increase along with the fish stock and size of fish available for capture. Through designation of marine protection areas and implementation of village-based integrated coastal management (ICM) plans, marine resource governance would improve, resulting in the rehabilitation of reef and coastline resources. In addition, coastal vegetation would increase as a result of planting mangroves leading to reduced coastline degradation, especially coastal erosion.

Production and productivity

In order to increase production and productivity of fish and marine products, CCDP established formal fishers and aquaculture groups and provided them with inputs, infrastructures and training. The fishers groups received motorized engines for fishing boats, allowing them to fish farther off the coast for higher value and more diverse catches (Pomeroy & Andrew, 2011; Schuhbauer & Sumaila, 2016), while the aquaculture groups received aquaculture infrastructure installations, fingerlings and fish feed. Additionally, the aquaculture groups received training on aquaculture and how to maintain the aquaculture installations. CCDP also provided training to fishers on efficient and safe operation of fishing gear, with the aim of increasing fish catch/harvest in a sustainable and safe manner. Through these activities and inputs, fish production and productivity were expected to increase.

Food security and dietary diversity

By increasing production and diversity of fish, it was expected that CCDP would intrinsically increase the amount of fish and marine products available for the beneficiary households to consume. This would allow them to improve their food security and nutrition, due to an increase in dietary diversity, deriving from the increased availability and diversity of fish and marine products. Moreover, due to an increase in incomes, households would be more able to purchase more quantities of food from the market and nutritious foods for that matter. This would also contribute to increased food security and dietary diversity.

Infrastructure, marketing, income and assets

One of the activities carried out under CCDP was to link beneficiaries to profitable markets through a variety of mechanisms, including the provision of marketing infrastructure and setting up contractual arrangements with buyers of fish products. Infrastructure groups were created by CCDP and tasked with identifying community-wide needs for infrastructure. In many communities, the

infrastructure groups established marketplace infrastructures, which could be used by multiple neighboring communities for selling fish and marine products, thus also generating indirect benefits for non-beneficiaries within the same localities—spillover effects. Marketing infrastructures provided included cooling facilities for vendors so that products could preserve for longer periods and could be sold fresh, thus reducing post-harvest fish losses and increasing the quality of fish sold (Akande and Diei-Ouadi 2010). Prior to project implementation, it had been observed that during fishing months, a large amount of fish catch went to waste, due to rapid fish perishability, especially among small-scale fisheries (Béné et al. 2015). Poor handling, processing, storage and distribution of fish products contribute to significant quantity and quality losses and therefore diminish fish value, often unexpectedly (Ahmed 2008, Akande and Diei-Ouadi 2010, Kumolu-Johnson and Ndimele 2011). Thus, the CCDP interventions to provide cooling equipment and infrastructure for processing (e.g. fish smokehouses) were expected to address this marketing challenge and lead to increased incomes. By investing in marketing infrastructure such as roads, fish processing and storage facilities, the project was expected to increase sales of fish and fish products and increase processing volumes.

Each CCDP community established enterprise groups, which received training on the production of higher value processed fish products and capacity strengthening on how to capture economies of scale in production and reduce transaction costs or ensure higher gross margins in sales, which could be translated to higher incomes. To increase sales potential, groups received support to attain health certification as well as halal certification of their products. This was expected to lead to increased quality and food safety of the fish and marine products produced; thereby increasing the output prices obtained as well as reducing post-harvest fish losses.

Risk management and savings

One of the challenges that households faced prior to the establishment of CCDP was volatility in incomes from fisheries. Households engaging in fishing often experienced highly irregular streams of income leading to financial management problems. Income levels could also vary considerably due to uncertainty in the amount of fish caught but also due to seasonality and market-related uncertainty linked to fish price volatility, fish perishability and post-harvest losses (FAO 2014). Such volatile patterns of income generation typically impel fishers to borrow at usurious interest rates leading to a vicious debt circle (Rosengard and Prasetyantoko 2011).

To address these issues the project established savings groups and each group was required to include a mandatory savings mechanism in its activities (i.e. to save a specified portion of the profits in a collective pot). These savings were used to reinvest in their enterprise to ensure maintenance of equipment and adequate running capital. Alternatively, the savings could be used as a loan device for group members, thereby serving the purpose of substituting high-interest loans and smoothing beneficiary incomes. In addition, through the establishment of the savings groups, households were able to receive training on financial management and bookkeeping to enhance their business management skills. These interventions were expected to lead to improved savings and investment into their business or other new business ventures. The savings mechanisms were also used for supporting group members, during times of difficulty or shocks, thus acting as a risk management (insurance) tool and enhancing their resilience to a variety of shocks and disasters, which are quite prevalent in eastern Indonesia.

Coastal resource governance and co-management

Equally important, CCDP aimed at enhancing the natural coastal resource base through the introduction of new fishing regulations and rehabilitation of the coastline, which would foster sustainable coastal resource management. Historically, projects in Indonesia have tried to combat overfishing by investing solely on conservation and this has not always worked. Using an innovative

approach, CCDP combined the conservation element with other social and economic elements, which, when implemented together, tend to create a virtuous circle that stimulates incentives for fishing communities to protect their environment while simultaneously improving their own wellbeing.

To address environmental challenges and overcome IUU fishing practices and coastal deforestation, the CCDP established CBCRM groups for each beneficiary community. The CBCRM groups received training and developed an ICM plan at the village-level, which set guidelines on no take zones/no fishing areas, mangrove replanting and other environmental activities such as the surveillance of sea protection areas and rubbish clean up. Through the CBCRM, members of the villages were encouraged to claim ownership of the coastal waters bordering their village and to enforce resource-protecting restrictions as a community. A rotational plan for fishing areas was established and enforced to ensure optimal reproduction of fish and conservation of fish species. These coastal environmental interventions were expected to enable regeneration of the resource base and make fish and marine economic activities sustainable.

Women's empowerment

It is important to note that traditionally in Indonesia, male household members are the ones who typically engage in fishing, while women engage in post-harvest handling and marketing activities, if at all. In this regard CCDP paid special attention to engaging women in post-harvest processing and marketing so as to increase women's economic participation, income and empowerment. This aspect of CCDP envisaged enhancing women's empowerment in the beneficiary communities in addition to increasing their incomes and savings.

Interlinkages and synergies

Overall, the logic of the project was innovative in that each component was strategically interlinked to create a virtuous cycle, fostering synergies and positive feedback across all components. This holistic design was expected to help remove multiple barriers to income growth faced by households and to create an enabling environment for effective project implementation. For example, the CBCRM groups, once well-trained, would contribute to economic viability of fishing groups and enterprise groups by conserving and monitoring the coastal resources necessary for each group's sustainability. Fishers groups would be able to take advantage of improved fishing technology and healthy sea life to bring in higher value catches. Enterprise groups would in turn be able to purchase from fishing groups or from other nearby fishers and add value to their fish and marine products through processing and fish preservation through cold storage or processing. Infrastructure installed by the infrastructure groups could also be used by fishers and enterprises, e.g. improved landing sites, marketing roads, physical market sites and storage facilities would allow vendors to sell quality, fresh and diverse fish for longer hours and to widen their customer base.

These connections among various project inputs and components would allow households not only to increase their incomes but to generate more regular and sustainable streams of income for themselves, in addition to providing benefits for non-beneficiaries residing in their communities through spillover effects.

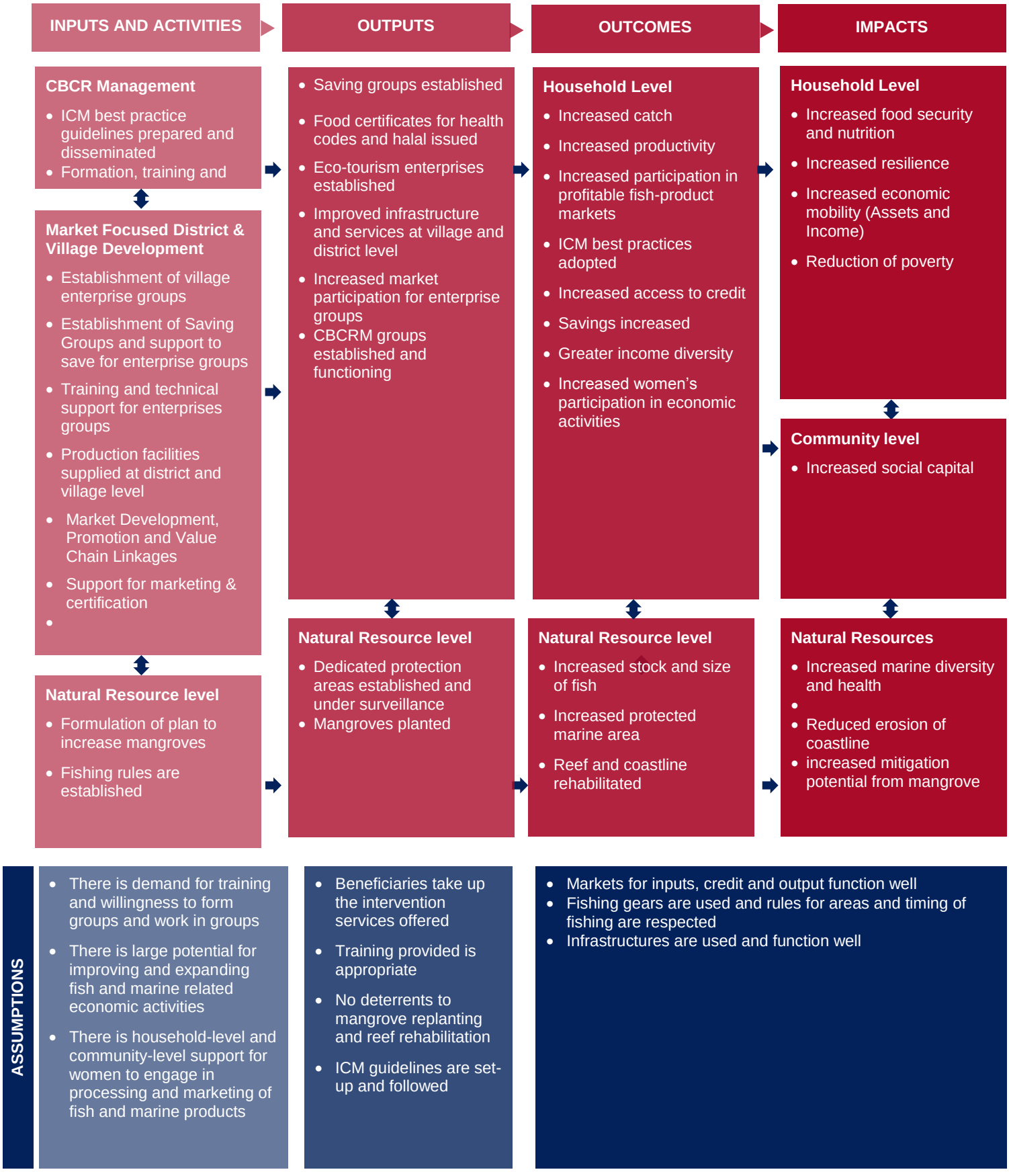
In sum, given the intricate logic and innovative implementation approach of CCDP, a number of impacts were expected as summarized below:

- Reduction of poverty and increased economic mobility as a result of increased household income and assets from higher quantity and value of fish and marine product sales;
- Reduced volatility of income and more regular streams of income;
- Increased market access for fish and marine products;

- Increased variety of fish and fish products produced, sold and consumed;
- Increased volumes of fish and marine products produced;
- Reduced post-harvest losses of fish and marine products;
- Improved nutrition (dietary diversity) and food security;
- Increased resilience to natural risks;
- Better and stronger social capital;
- Increased savings;
- Stronger social capital;
- Increased women's engagement in economic activities and increased women's empowerment

Figure 1 shows an illustration of the CCDP theory of change. The illustrations shows the assumptions underpinning the theory of change, which had to be satisfied for the project outcomes and impacts to be realized. For instance, at the design stage, it was assumed that the targeted communities would be responsive and willing to form and work in groups in order to take up the project interventions, since this was the implementation approach adopted by the CCDP. In addition, an underlying assumption was that communities would welcome participation of women in value addition activities, such as processing of fish and marine products for sale. It was also assumed that there would not be any major deterrents to the replanting of mangroves and the rehabilitation of reef resources and that village-level ICM plans would be developed and actually implemented, to achieve the goals of regenerating coastline resources. Other assumptions made include the reasonable functioning of markets for fish and marine products as well as the use of infrastructures that would be installed by CCDP.

Figure 1: CCDP's theory of change



Project coverage and targeting

The areas of project intervention were all located in eastern Indonesia, consistent with IFAD's Country Strategic Opportunities Program (COSOP) and strategy to focus on areas with a high incidence of rural poverty. The project concentrated on a limited number of districts, twelve in total, with diverse marine environments and socio/cultural contexts, containing communities which, while poor, also have good resource potential and market access.

As a first step, the project team conducted an identification exercise of all eligible areas identified using project eligibility criteria (poverty, coastal area, prevalence of income from fishery and production capacity) ending up with an initial selection of twenty-five districts. A screening matrix was then used for district selection that included variables related to the number of poor coastal communities and their potential for increasing incomes from fishing and marine operations (IFAD, 2018). This was coupled with the selection of districts to cover a variety of geographic and socio-cultural contexts to better generate lessons learned for replicating the development models being tested. The Project also applied a targeting strategy for village and household selection.

Project awareness campaigns were promoted in the eligible districts collecting requests of interest and follow up by the selected districts that had to provide documentation to show concrete interest and political will to participate. From the answers and feedback received the project ended up with a further refinement of project districts and a final selection of twelve districts.

The target group of poor households in coastal communities was identified by using the national definition of poverty and the village database of vulnerable households to identify a long-list of poor households. The size of the fishing boats owned by households was a major determining factor for the capture fishery groups. Numerous supervision visits to the various PIUs concur that this targeting approach was effective in identifying poor and vulnerable households.

Around fifteen villages in each district were, thus, selected with a total of 181 villages included in the end (an estimated 660 households within an average project village). This has added up to a total of about 119,200 households as direct beneficiaries. The household targeting strategy was designed to include five sub-groups within project-supported villages: (i) households with assets to access medium-high value marketable marine resources; (ii) households which provided labor; (iii) households with assets that allowed limited access to resources; (iv) households with very basic productive assets; the resources available to them allowed only limited opportunities to raise their incomes; and (v) households with no marine access-enabling assets and limited/unskilled labour.

Given low levels of female empowerment, the CCDP also had specific gender targets seeking: (i) 30% of project participants at all levels to be women; and (ii) at least two enterprise groups in each village to be comprised predominately of women, with women involved in key management decisions within the group.

Given the necessary condition of selecting small islands and districts with coastal villages, mainly engaged in fishery activities and with good potential and will, the pro-poor focus was one of the main determining factors in selection of project communities – all selected project villages have at least 20% of households below the poverty line. Within those communities, the focus was on the active poor – those households that were able to make effective use of the investments made under the project with the market-based approach – and on inclusion of the poor in project activities.

Replication and scaling-up of project activities and processes is also a key element which influenced the selection of districts, that were located in a range of different marine and social environments, and this resulted in the physical and social diversity and geographical spread of project districts. Adoption of such an approach influenced the structure and functioning of project management and imposed a certain level of administrative cost on project implementation. It also enabled the dispersed project districts to become regional nuclei testing a range of solutions in diverse, but predominantly poor communities. This would facilitate learning, replication and scaling up in other

areas and districts in Indonesia. The geographic dispersion of the CCDP is depicted in Figure 2 below.

Figure 2: Geographic areas in Indonesia where the CCDP project was implemented.

Research questions

Deriving directly from the theory of change of the CCDP, the impact assessment focused on the following key research questions:

1. Does the project facilitate economic mobility of the beneficiaries, as measured by higher incomes and assets at the household level (as a whole and disaggregated by type of income source and asset type)?
2. Does the project lead to more diversified income sources?
3. Does the project improve household food and nutrition security?
4. Does the project lead to beneficial fish market access (increased fish and marine product prices and sales)?
5. Does the project translate into women's empowerment (increased women's participation, economic decision making and control of assets)?
6. Does the program translate into an improvement of coastal marine resources governance and management?
7. Does the project increase resilience to shocks and increase ability to recover from shocks?

As CCDP was expected to have multi-dimensional impacts on beneficiaries' wellbeing and livelihoods, additional research questions were included to understand the mechanisms and channels through which it led to impact on the key indicators. Thus, the impact assessment investigated the following additional research questions:

a. Does the project increase production and productivity of fish and marine products?
b. Does the project reduce post-harvest losses of fish?
c. Does the project lead to increased savings and better access to credit, especially among women?
d. Does the program translate into increased social capital through greater participation in community associations by project beneficiaries?

3. Impact assessment design: Data and methodology

Data

The CCDP impact assessment employed a mixed methods approach entailing both qualitative and quantitative data collection and analysis. This empirical approach allows for qualitative data to inform the design of the quantitative approach and enriches interpretation of results from the quantitative analysis. Moreover, the mixed methods approach enables triangulation of results and provides a nuanced understanding of the mechanisms and impact pathways that bring about the realized impacts.

Qualitative data

Qualitative data were collected using key informant interviews (KIIs) and focus group discussions (FGDs). Initial KIIs were conducted during a scoping mission to Jakarta and Bitung, Indonesia in April 2018, where discussions between the research team and CCDP project management staff were held to gain an understanding of the manner in which the project was rolled out and implemented. During the scoping mission, the research team also met with three groups of CCDP beneficiaries in Bitung, and conducted focus group discussions with them, to gain an understanding of their participation in the project, how they were selected into the project, and how they perceived CCDP to have affected them.

More detailed qualitative data were later collected in September 2018 to further enrich the impact assessment. This involved a total of 50 KIIs (five in each of the ten districts that were included for the quantitative districts shown in Table 1 below). The composition of the key informants that were interviewed included former CCDP project facilitators, local staff of the Ministry of Fisheries and Marine Resource (KKP), community administrative leaders and CCDP beneficiaries.

The collection of qualitative data also entailed three FGDs per district in Ambon (Laha, Seilale and Rutong villages), Bitung (Posokan, Pintu Kotam and Pasir Panjang villages), and Makassar (Bira, Untia and Parangloe villages). These were conducted just prior to collection of the quantitative data in September 2018. Participants to the FGDs were either exclusively men or women and at least one of the FGDs in each district had to consist solely of women. The FGD participants were a mix of representatives from CCDP production (capture fishers or aquaculture) groups or marketing (fish processing) groups, village-based service groups (including, community-based coastal resource management group as well as infrastructure and savings groups).

Quantitative data

A quantitative household survey was fielded in September 2018 to collect primary data from CCDP beneficiaries, CCDP "spillover" beneficiaries and control (comparison group) households. The households that directly participated in the CCDP were termed beneficiaries or the "treatment" group, while households residing in the same villages as CCDP beneficiaries but did not directly participate in the CCDP were termed "spillover" group, as they were likely to indirectly benefit from some of the CCDP interventions, in one way or another. A separate "control" or comparison group of households was drawn from separate districts and villages, which had similar characteristics as those where CCDP was implemented at baseline. **Table 1** below shows the sample size of the quantitative data collected by district and treatment status.

Table 1: Sample of households by treatment status and district

District	Treatment Status			
	CONTROL	TREATMENT	SPILLOVER	Total
Ambon	0	215	151	366
Bone Bolango	211	0	0	211
Gorontalo Utara	0	212	158	370
Kabupaten Kupang	248	0	0	248
Kota Kupang	0	215	148	363
Kubu Raya	0	209	154	363
Maluku Tengah	211	0	0	211
Mempawah	247	0	0	247
Ternate	0	198	151	349
Tidore	228	0	0	228
Total	1145	1049	762	2956

Note: The treatment districts are shown in boldface.

A separate community survey was also administered in the ten districts to capture community level variables that would be important to control for in the quantitative data analysis. This community survey was implemented by jointly interviewing a group of nine key informants in each of the 90 communities/villages that were included in the final community survey sample. Some of the variables captured through the community survey include the Global Positioning System (GPS) coordinates, community infrastructures such as roads, landing sites and fish markets, in addition to public services available in the community such as schools, health centers, community centers, energy sources, and residential water and sanitation services.

Additionally, community-level past events such as shocks (earthquakes, landslides, floods, droughts, forest fires, volcanic eruptions, conflict/violence, etc.) as well as the severity and frequency of these shocks were captured through the community survey. Experiences of unavailability of fishing inputs, and unusually high prices of fish output and inputs, at community level, were also captured.

Constructing the counterfactual

To conduct a valid ex-post impact assessment of the CCDP, it is necessary to identify and establish a valid comparison group that shared the same characteristics as the beneficiary households at baseline. Thus, a series of matching techniques were used, first to identify the sampling areas through the use of secondary data at village level. Here, the Indonesian village census – *Pendataan Potensi Desa* (PODES) dataset of 2011, which was collected by the Indonesian national statistics agency – *Badan Pusat Statistik* (BPS), was used to match districts and villages prior to data collection. This helped identify at village level, locations that were similar to the coastal villages where the CCDP was implemented. Having identified the matching districts and villages, the research team conducted a validation exercise with key informants and experts in Indonesia, with knowledge of the locations identified through the statistical matching. This process ensured that the matches were indeed valid and could be included in the sample for the household and community surveys.

After data collection, a separate statistical matching process was undertaken. Given that the CCDP was expected to have indirect beneficiary households, i.e. households in the same villages as the direct beneficiaries but who did not directly receive CCDP interventions, a valid counterfactual also had to be identified for this group of households (spillover beneficiaries). To this end, variables obtained from the household and community survey (see Table 2) were used to predict each household's probability to participate in the project, irrespective of whether the household actually participated or not. These estimated likelihoods of participation were used to match beneficiaries with control household and spillover households with their respective control households.

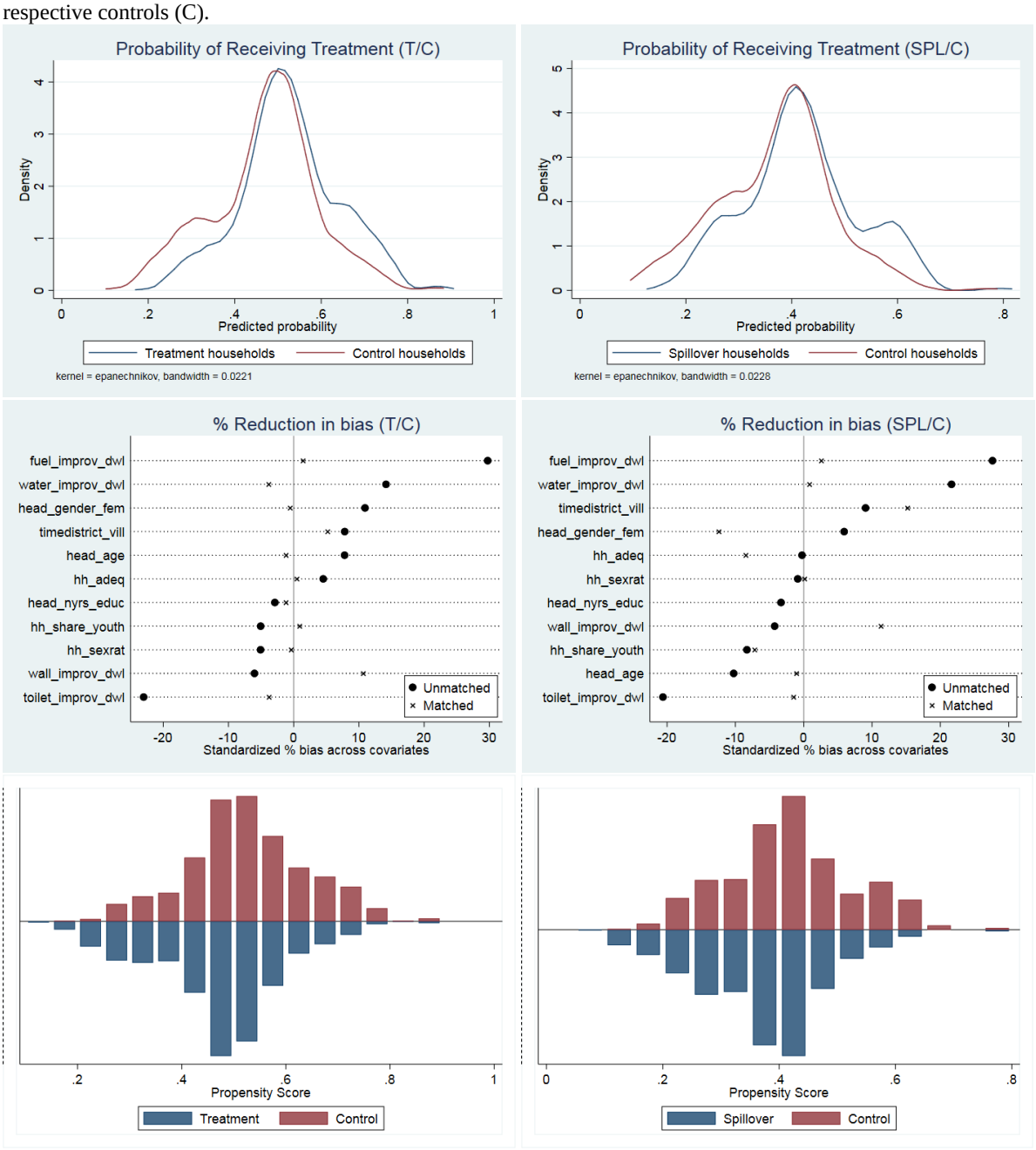
Table 2: Variables used for the propensity score matching at household level

Variable Name	Variable Label	Definition	Type of Variable	Source
hh_adeq	Household Adult Equivalent Size	Number of adults in the household	Count	Household Survey
hh_sexrat	Sex ratio (Female:Male)	Number of females divided by the number of males in the household	Discrete	Household Survey
hh_share_youth	Household's share of youth	Household Size / Nr. of HH members aged >=15 & <=24	Continous	Household Survey
head_gender_fem	Household head is female	Yes / No	Dummy (0/1)	Household Survey
head_age	Household head's age	Nr. of years	Discrete	Household Survey
head_nyrs_educ	Household head's number of years of formal education	Nr. of years	Discrete	Household Survey
wall_improv_dwl	Walls of main dwelling are made of improved quality	Main dwelling walls made of baked brick, concrete, wood or asbest.	Dummy (0/1)	Household Survey
toilet_improv_dwl	Household has improved sanitation/toilet facilities	Toilet type: flush/pour flush to piped sewer system; septic tank or pit latrine. Ventilated improved pit latrine, composting toilet or pit latrine with slab	Dummy (0/1)	Household Survey
fuel_improv_dwl	Household uses improved source of cooking fuel	Electricity, Biogas, Kerosene, LPG/Natural Gas or Solar panel as main source of cooking fuel	Dummy (0/1)	Household Survey
water_improv_dwl	Household uses improved source of drinking water	Main source of drinking water including: Piped into dwelling / yard, Public tap, Protected well in dwelling / yard, Protected public well, Bottled water, Tanker truck, Rainwater	Dummy (0/1)	Household Survey

Variable Name	Variable Label	Definition	Type of Variable	Source
timedistrict_vill	Time to reach district capital using common means of transportation	Nr. of minutes	Discrete	Community Survey

Using propensity score matching and a caliper width of 0.01, twenty treatment and fifteen spillover households were identified, for which no suitable match could be found and, therefore, had to be excluded from the analysis. The overall success of the matching exercise is depicted in **Figure 3**. The kernel density plots of the probability of receiving treatment shows that there is strong overlap between the respective two matching groups, confirming the common support assumption. **Table 3** and **Table 4** present descriptive summary statistics for all matching variables before and after matching as well as the reduction in bias achieved through the matching exercise.

Figure 3: Matching results for treatment (T) and spillover (SPL) households relative to their respective controls (C).



Overall, matching Treatment and Spillover Households with the control group separately, results in a reduction in Rubin's Bias from 47.9% to 12.6% as well as 45.2% to 21.2%, respectively. Furthermore the Rubin's Ratio is 1.51 for the matched treatment and control sample as well as 1.23 after matching spillover with control households. These statistics reinforce that the matching drastically reduces the standardized bias (Rosenbaum & Rubin, 1985; Rubin, 2001)

Table 3: Summary statistics before and after matching for Treatment/CONTROL groups

	Before matching				After matching				Reduction in Bias (%)
	Treat. Mean/SE	Control Mean/SE	p-value	Bias	Treat Mean/SE	Control Mean/SE	p-value	Bias	
HH Adult Equivalent Size	4.33	4.26	0.289	4.53	4.33	4.31	0.846	0.47	89.67
	0.05	0.05	.	.	0.05	0.05	.	.	.
Sex ratio (Female: Male)	1.18	1.22	0.309	5.09	1.20	1.20	0.933	0.40	92.21
	0.03	0.03	.	.	0.03	0.03	.	.	.
HH share of youth (15=<Age<=24)	0.16	0.17	0.217	5.06	0.17	0.17	0.935	0.89	82.33
	0.01	0.01	.	.	0.01	0.01	.	.	.
Head Female	0.06	0.02	0.000***	10.93	0.03	0.04	0.187	0.56	94.84
	0.01	0.00	.	.	0.01	0.01	.	.	.
Head Age	46.65	45.61	0.029**	7.80	46.21	46.26	0.927	1.19	84.79
	0.34	0.34	.	.	0.34	0.34	.	.	.
Head Years of Education	7.50	7.64	0.358	2.89	7.62	7.60	0.896	1.19	58.81
	0.11	0.11	.	.	0.11	0.10	.	.	.
Improved wall material	0.76	0.79	0.100*	6.01	0.77	0.76	0.789	10.65	-77.01
	0.01	0.01	.	.	0.01	0.01	.	.	.
Improved toilets	0.74	0.83	0.000***	23.01	0.79	0.79	0.921	3.79	83.53
	0.01	0.01	.	.	0.01	0.01	.	.	.
Improved fuel source	0.85	0.72	0.000***	29.75	0.79	0.78	0.989	1.42	95.23

	Before matching				After matching				Reduction in Bias (%)
	Treat. Mean/SE	Control Mean/SE	p-value	Bias	Treat Mean/SE	Control Mean/SE	p-value	Bias	
	0.01	0.01	.	.	0.01	0.01	.	.	.
Improved water source	0.86	0.80	0.001***	14.15	0.84	0.84	0.781	3.84	72.85
	0.01	0.01	.	.	0.01	0.01	.	.	.
Time to district capital (Minutes)	64.34	58.90	0.063*	7.82	59.88	58.95	0.745	5.19	33.68
	2.30	1.80	.	.	2.17	1.86	.	.	.
No. of observations	1 064.00	1 058.00	.	.	1 039.00	1 058.00	.	.	.

Point estimates are sample means. Standard errors are reported below.
Asterisks represent level of statistical significance of t-test/chi-squared test of difference in means.

Table 4: Summary statistics before and after matching for Spillover/CONTROL groups

		Before matching					After matching					Reduction in Bias (%)
		Spillover. Mean/SE	Control Mean/SE	p-value	Bias		Spillover. Mean/SE	Control Mean/SE	p-value	Bias		
HH Adult Equivalent Size		4.24	4.26	0.846	0.24		4.29	4.27	0.769	8.49		-3 399.10
		0.06	0.05	.	.		0.06	0.05	.	.		.
Sex ratio (Female: Male)		1.22	1.22	0.933	0.88		1.22	1.22	0.878	0.12		86.75
		0.04	0.03	.	.		0.04	0.03	.	.		.
HH share of youth (15=<Age<=24)		0.15	0.17	0.081*	8.32		0.17	0.17	0.918	7.19		13.57
		0.01	0.01	.	.		0.01	0.01	.	.		.
Head Female		0.05	0.02	0.001***	5.92		0.02	0.03	0.196	12.43		-109.92

	Before matching				After matching				Reduction in Bias (%)
	Spillover. Mean/SE	Control Mean/SE	p-value	Bias	Spillover. Mean/SE	Control Mean/SE	p-value	Bias	
	0.01	0.00	.	.	0.01	0.01	.	.	.
Head Age	44.38	45.61	0.028**	10.25	45.27	45.16	0.856	1.07	89.60
	0.46	0.34	.	.	0.47	0.34	.	.	.
Head Years of Education	7.51	7.64	0.447	3.32	7.65	7.62	0.870	3.43	-3.21
	0.14	0.11	.	.	0.14	0.10	.	.	.
Improved wall material	0.77	0.79	0.402	4.25	0.77	0.77	0.736	11.29	-165.57
	0.02	0.01	.	.	0.02	0.01	.	.	.
Improved toilets	0.75	0.83	0.000***	20.61	0.81	0.80	0.886	1.49	92.75
	0.02	0.01	.	.	0.02	0.01	.	.	.
Improved fuel source	0.84	0.72	0.000***	27.64	0.76	0.77	0.945	2.57	90.70
	0.01	0.01	.	.	0.02	0.01	.	.	.
Improved water source	0.88	0.80	0.000***	21.64	0.85	0.84	0.465	0.83	96.17
	0.01	0.01	.	.	0.01	0.01	.	.	.
Time to district capital (Minutes)	66.15	58.90	0.028**	9.05	57.88	59.33	0.652	15.19	-67.76
	3.02	1.80	.	.	2.75	1.84	.	.	.
No. of observations	679	1 058	.	.	664	1 058	.	.	.

Note: Point estimates are sample means. Standard errors are reported below.
Asterisks represent level of statistical significance of t-test/chi-squared test of difference in means.

Questionnaire and impact indicators

A detailed household survey questionnaire was developed to collect primary data on the livelihood activities of the CCDP beneficiaries as well as the spillover and comparison group households. The questionnaire primarily captured data on fisheries and aquaculture activities of the households, characteristics of their fishing gears, fishing boats and technologies used by the fishers as well as the kinds of fish and quantities caught during the peak and low seasons. For aquaculture fishers, the questionnaire collected data on the aquaculture infrastructure used such as cages, rafts and nets, in addition to the types of inputs used such as fingerlings and fish feed. Data on labor use and how fishers organized their fishing/aquaculture activities, including whether they fished in groups or not and whether they sold their fish catch in groups or as individuals and where they sold their fish (whether fresh or after processing), etc. were all captured by the questionnaire.

Additional variables captured by the questionnaire include household-level variables such as income sources (including non-fishing activities), diet composition and food insecurity experiences. Variables on household assets, including productive assets (fishing assets, farming assets, etc.), housing assets, durable assets, savings, and access to credit were also collected through the questionnaire. As is standard with most household surveys, the questionnaire captured household demographic variables, including the ages, sex, education levels and ethnicity of the individuals in the households interviewed. Variables designed to measure resilience to a variety of shocks as well as measure women's empowerment were also captured through the household survey questionnaire.

In addition to the household survey questionnaire, a community level survey questionnaire was designed and used to collect data on a number of community-level variables. This questionnaire captured variables such as the types of infrastructure and public services available in the communities, the various development projects implemented in the community, as well as variables on shocks/events that the communities experiences and the development and social groups operating in the communities. The community-level survey questionnaire allowed for the collection of important community-level variables useful for matching as well as for controlling for as part of data analysis.

Economic Mobility

Impact indicators that were used in the analysis were derived from the household-level data collected using the household survey questionnaire. The impact indicators include a variety of economic mobility indicators, such as net income from fishing, and total net income, which were computed using the Rural Income Generating Activities (RIGA) methodology (Carletto, Covarrubias, Davis, Krausova, & Winters, 2007). Total net income entailed summing the incomes from fishing, fish and marine product processing, as well as income from other sources such as agricultural income, transfers (remittances, gifts, subsidies, etc.) and other non-fish income and subtracting all associated costs such as costs of production (including inputs, capital and labor) and costs of processing and marketing (such as transport costs, packaging costs, storage costs, etc.).

A related but separate measure used to capture economic mobility was labor participation, measured in terms of the sector or specific activity that the household members engaged in. This could be participation in primary-level production activities within the fish value chains, e.g. fishing or aquaculture, or secondary-level activities in the fish value chain, such as processing, vending of fish or providing support services around the fish value chain (e.g. mending of nets and boats). Other non-fishing activities were also captured in this regard, including income shares from a variety of non-fishing wage income, agriculture/forestry and income generating activities.

Asset indices formed another set of economic mobility impact indicators. These included an overall household asset index that captured all the assets reported by the households interviewed as well as

disaggregated versions of the household asset index, including the productive assets index, the housing asset index and the durable household assets index, the fishing assets index and the livestock assets index. The asset indices were captured for 2018 (the interview year) as well as for five years before, the latter of which was largely considered a recall indicator given that the households had to try and remember the assets they had five years before. It is important to note that while this recall indicator is likely to present measurement error due to memory challenges for the household respondent, this was minimized by focusing on large assets, which literature demonstrates, is less likely to suffer from recall bias (Filmer & Pritchett, 2001; Moser, 2009; Moser & Felton, 2007). The recall indicator was primarily used to construct an indicator measuring change in assets owned over the duration of the CCDP, thus offering more insights on the type of impacts CCDP had on household assets. In general, both the income and asset indicators were used to measure CCDP's impact on economic mobility of the households interviewed.

Food insecurity and dietary diversity

Food security is another impact indicator that was analyzed. This was measured using the Food Insecurity Experience Scale (FIES), which has been developed by the Food and Agriculture Organization of the United Nations (FAO) (Cafiero, Viviani, & Nord, 2018; Food and Agriculture Organisation, 2016). A series of eight simple questions included in the household survey questionnaire were used to capture this indicator and assess the household's experience of various dimensions of food insecurity.

To measure impact on nutrition, household dietary diversity was captured as another important impact indicator, through a detailed seven-day recall, food group consumption module in the household survey questionnaire. This captured not only the standard food groups usually collected by the Demographic and Health Surveys (DHS) but also specific fish and marine food products, which were hypothesized to have likely increased as a result of CCDP. These included consumption of fish, shellfish, processed fish product, and seaweed.

Fishing productivity

Several indicators were constructed to measure fishing productivity. The main impact indicator chosen for assessing impact on fish productivity were the amount of fish caught in kilograms per month per cubic meter of fishing vessel. This reflects the catch per unit effort (CPUE), which is a standard measure of fishing productivity in the literature (Squires, 1988; Squires & Vestergaard, 2015). Another measure of CPUE that was used is the amount of fish caught, in kilograms, per laborer per cubic meter of fishing vessel.

Market Access

Proxy indicators for beneficial market access were used, including the value of fish and marine product sales, the prices of fish and marine products received by the fishers as well as the time taken to travel to the fish markets of choice. Access to fishing gears and fish inputs from the market was also considered as one of the proxies for input market access.

Resilience

To measure impact on resilience among the CCDP beneficiaries, a number of resilience indicators were constructed using data collected from the household survey. The resilience indicators were computed using the responses to experiences of shock events to assess the level of ability to recover from a set of shocks that the households experienced. These indicators take into account the frequency and intensity or severity of the shocks experienced.

Women's empowerment

To gain insights on women's empowerment resulting from CCDP interventions, women's participation in community organizations as well as in fish and marine product processing were analyzed. Another indicator used to analyze women's empowerment in the coastal communities was decision making.

Youth empowerment

To begin providing some understanding on how CCDP might have generated impacts on youth, participation indicators were assessed. This included the participation of youth in community organizations and participation in social groups, within the community.

Sustainable environmental management and awareness

Given that the CCDP integrated environmental awareness and sustainable management of natural coastal resources, the impact assessment endeavored to measure impact on this area. As such an indicator on environmental management awareness was developed, mainly focusing on awareness of the use of explosives and poison for fishing in the community. Other measures that were computed include existence of an integrated coastal management plan and the use of rotational fishing rules in the community.

Impact estimation

Non-experimental methods were used to estimate the impact of CCDP on the outcome variables of interest. Specifically, the household dataset was subjected to a battery of matching treatment effects techniques, including Inverse Probability Weighting (IPW), Inverse Probability Weighted Regression Adjustment (IPWRA) and Augmented Inverse Probability Weighting (AIPW). For the IPWRA estimation, control variables that were included in the model specification are village-level experiences of shocks, including flooding in the last five years, earthquake(s) during the last five years, and population size of the village.

In addition, for the assets indices, which included recall data on assets, owned from the baseline period, Difference-in-Difference (DiD) estimations were performed. Other than the DiD estimation results on CCDP's impact on household asset indices, the rest of the results reported in this impact assessment are derived from the IPW estimator for the average treatment effect (ATE) of the CCDP. Thus a brief exposition on the IPW estimator is given in the following.

Formally, the IPW estimator can be expressed mathematically as,

$$ATE = \boldsymbol{E}\left(y_{i,CCDP} - y_{i,No\ CCDP}\right) \quad \forall i \qquad (1)$$

where $\boldsymbol{E}$ is the expectation operator, $y_{i,CCDP}$ is the outcome of interest (e.g. fishing income) observed for each individual *i* in the population, under the state where each individual receives support from CCDP, while $y_{i,No\ CCDP}$ is the same outcome variable of interest when each individual does not receive support (treatment) of the CCDP. The reality is that it is impossible to observe both outcomes for each individual *i* in the two states of CCDP treatment and non-treatment. Thus, it necessitates the use of a valid counterfactual (comparison individuals) to estimate the value of the outcome variable for each individual *i* in the state under which they do not receive CCDP treatment, which would then allow for estimation of the CCDP ATE (impact).

Of interest is the potential outcomes mean (POM), which is the average probable outcome (e.g. fishing income) for a given level of treatment (CCDP support in this case). Let CCDP be an indicator

variable that takes on two values; CCDP = 1 when individual receives CCDP support and CCDP = 0 when individual does not receive CCDP support. Then the POM can be expressed mathematically as:

$$POM_{CCDP} = \boldsymbol{E}(y_{CCDP}) \quad (2)$$

A potential-outcome model can then be defined, which specifies that the observed outcome variable (e.g. fishing income) takes on specific values under the two different CCDP treatment states:

$$Y = (1 - CCDP)y_{No\ CCDP} + CCDPy_{CCDP} \quad (3)$$

Functional forms that can be estimated econometrically can then be specified for the potential-outcome model, thus:

$$y_{No\ CCDP} = \boldsymbol{x}'\beta_0 + \varepsilon_0 \quad (4)$$

$$y_{CCDP} = \boldsymbol{x}'\beta_1 + \varepsilon_1 \quad (5)$$

where $\boldsymbol{x}$ is a vector of covariates that significantly affect the outcome, while $\beta_0$and $\beta_1$are parameter estimates that will be estimated in the regression. As usual, the unobservable error terms are denoted by ε_0 andε_1. To ensure consistency of the estimator, the error terms are assumed to be uncorrelated with$\boldsymbol{x}$. A separate and equally important assumption is that the error terms are not correlated with any covariates that determine selection of individuals into the CCDP treatment. Let these covariates that determine selection into the project be expressed by a vector $\boldsymbol{w}$ such that:

$$CCDP = \begin{cases} 1 \text{ if } \boldsymbol{w}'\gamma + \mu > 0 \\ 0 \text{ otherwise} \end{cases} \quad (6)$$

where γ is a vector of parameter estimates, μ is an error term that is neither correlated to $\boldsymbol{x}$ nor$\boldsymbol{w}$. Assumptions that are necessary to allow for identification of the impact of the CCDP treatment using the IPW estimator are, (i) the overlap assumption, which ensures that each observation can potentially receive treatment (i.e. every individual has a positive probability of being selected or not being selected into CCDP treatment); (ii) the conditional independence assumption that after controlling for observables, the potential outcomes are not dependent on selection into CCDP treatment, and (iii) that the potential outcome and selection into CCDP treatment for each observation in the population are not correlated with those of other individuals.

Given that the analysis also sought to test the impact of CCDP on spillover individuals, i.e. households that resided in the same CCDP villages but did not directly participate in the CCDP, the same estimator and framework can be applied to that situation as well, whereby the spillover treatment is being in a CCDP village but not necessarily participating actively in a CCDP intervention activity. In this set up, the difference in POM between the control (comparison group) and the CCDP village resident that does not directly participate in CCDP is the CCDP spillover effect.

4. Profile of the project area and sample

CCDP was implemented in 181 villages spread across twelve districts that are located in nine provinces of eastern Indonesia (see Table 5). The project locations consisted of fishing communities (mostly island coastal communities) with populations that were among the poorest in rural Indonesia. According to national welfare statistics, poverty rates[1] in these rural communities ranged between 37.6% and 7.6% in 2018 compared to the national rural poverty incidence rate of 13.1% (BPS, 2019). While east, central and west Java (all non-CCDP provinces) had the largest absolute number of poor people in 2018, the poverty incidence rates in the CCDP project areas, expressed in percentage terms, were higher or comparable to those in the Java provinces.

Table 5. CCDP project area characteristics

Province	Districts	Number of CCDP Villages	Rural Poverty incidence in 2018	Marine Fisheries Production for Sale in 2017 (tons)
NUSA TENGGARA BARAT	1 - Lombok Barat	15	13.7%	3,185.1
NUSA TENGGARA TIMUR	1 - Kupang	16	24.7%	-
KALIMANTAN BARAT	1 - Kubu Raya	14	8.8%	2,932.12
SULAWESI UTARA	1 - Bitung	17	10.6%	51,908.9
SULAWESI SELATAN	2 - Makassar, Parepare	27	12.2%	4,5546.4
GORONTALO	1 - Gorontalo Utara	16	23.9%	3,219.0
MALUKU	2 - Ambon, Maluku Tenggara	29	26.6%	-
MALUKU UTARA	1 - Ternate	17	7.6%	11,291.0
PAPUA	2 - Merauke, Kpulauan Yapen	30	36.7%	-
Total	12	181	-	-

Note: estimates of rural poverty and marine fisheries production are calculated at the provincial and rural levels.
Marine fisheries statistics for some of the locations are not available (-)
Source: Authors compilation using data from BPS (2019b) and IFAD (2018)

The Java provinces are most populous overall and are relatively more urban in nature, with the rural parts having proximal access to urban centers (BPS - Badan Pusat Statistik, 2018). In contrast to the densely populated provinces of Java, the CCDP communities are mostly rural with lower population densities. They have a larger share of young people and are characterized with higher population growth rates as compared to the national rural average. Population growth rates were estimated to be

[1] Poverty rates are based on provincial poverty lines, which are divided between rural and urban areas; these are computed by the national statistical agency, BPS.

highest in Kalimantan, Maluku, and Papua (2.0%) compared to Nusa Tenggara, Sulawesi (1.4%), and the national average rate (1.3%) (BPS, 2019b).

Also, in 2017, the CCDP provinces accounted for more than 18% of total national fish production for sale (BPS - Badan Pusat Statistik, 2019a). The CCDP provinces with larger shares of fish production for sale were Sulawesi Utara and Maluku Utara. The commercial fish production includes operations of large companies (both international and domestic); nonetheless, artisanal fishers who were the target beneficiaries of CCDP significantly contribute to the total production recorded in national fisheries statistics.

Although the project area encompassed 181 villages in the 12 districts described above, the CCDP impact assessment collected data from five of the 12 districts and covered 45 of the 181 villages. These villages included in the impact assessment constitute the project sites that received earlier support from CCDP, starting in 2013/14.

In addition to collecting data from the 45 CCDP villages, the impact assessment survey also collected data from 45 additional villages, which were not part of the CCDP project area. This was to create a valid counterfactual in order to enable statistical comparison and thereby assess the impact of CCDP. The 45 comparison villages were chosen based on a number of characteristics which were similar to those of the CCDP project areas, at baseline (in 2011). Village-level data from the PODES 2011 survey were used to match the CCDP project areas and these data revealed close similarities in the characteristics of the CCDP and comparison villages.

5. Results

In this section, results of the quantitative analysis of CCDP's impact on a number of development outcomes of interests are presented. The results are augmented with findings from the qualitative data, were apposite. While the bulk of the analysis used a variety of matching techniques, the narrative on the results focuses on reporting the impact estimates generated from the IPW matching technique. Most of the other results[2] were generally consistent and therefore served to provide a reasonable degree of confidence in the estimates generated from the IPW matching technique.

Impact on economic mobility

Total Household Net Income

The results show that CCDP had a positive impact on total household net income among CCDP beneficiaries that engaged in fishing. When compared to fisher households that did not participate in the project, CCDP fisher households had higher total household net incomes per year. Table **6** shows the estimated impacts of CCDP on total household net income among fishers.

Table 6 Impact of CCDP on total household net income (fisher households only)

	N	Treatment POM	Control POM	ATE/SE
Total net household income (USD)	1 333	18 774.91	12 288.08	6 486.83**
	.	.	.	(2 735.65)
Total net household income (USD) (winsorized)	1 333	15 766.56	10 829.29	4 937.26***
	.	.	.	(1 524.87)
Total net household income (USD) per adult equivalent	1 333	4 577.84	3 058.62	1 519.23**
	.	.	.	(749.54)
Total net household income (USD) per adult equivalent (winsorized)	1 333	3 811.46	2 734.36	1 077.10***
	.	.	.	(392.29)

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1
Note: The sample size declines from 1,333 to 1,316 when taking logs due to dropping non-positive income values, as logs of non-positive values do not exist.

On average, CCDP beneficiary fisher households were found to be earning approximately US$15,767 per year, which was about US$4,937 (45.6%) more than the comparison group households. This translates to roughly US$1,077 (39.4%) more per adult equivalent per year[3]. This is also equivalent to an increase in income of about US$2.95 per adult equivalent per day.

Similar results were found when estimation was done on total household gross income. These results are shown in the appendix in table A1. However, when the analysis was done including the sample of households that engaged in non-fishing activities, the results tended to show no statistically significant differences in income between the CCDP beneficiary households and non-beneficiary comparison group households. **Table 7** shows these results on total household income based on the full sample, including non-fishing households.

[2] These other result are available from the authors upon request
[3] As a reference point, Indonesia's GDP per capita in 2017 was US$3,846 in current currency terms.

Table 7 Estimated impact of CCDP on total household net income (full sample, including non-fishing households)

Variable	N	Treatment POM	Control POM	ATE/SE
Tot. net HH income (USD)	2 087	11 282.13	10 789.65	492.48
	.	.	.	(1 557.55)
Tot. net HH income (USD) (winsorized)	2 087	9 428.89	9 987.91	-559.01
	.	.	.	(873.81)
Tot. net HH income (USD) per adult EQ	2 087	2 762.68	2 749.63	13.05
	.	.	.	(409.26)
Tot. net HH income (USD) per adult EQ (winsorized)	2 087	2 307.20	2 557.72	-250.52
	.	.	.	(224.76)

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Income from Fishing

To further interrogate the results on CCDP's impact on income, analysis was performed on fishing income. Since CCDP interventions were mostly focused on the fisheries sector and related value chain income generating activities, this specific assessment of CCDP's impact on fishing income was deemed appropriate. Here the picture was quite consistently positive as shown in **Table 8**.

Table 8 Impact of CCDP on income from fishing

	Treatment POM	Control POM	ATE/SE
Tot. net income that HH receives from fishing (USD) (winsorized)	14 744.24	10 446.96	4 297.28**
	.	.	(1 682.81)
Tot. net income that HH receives from fishing (USD) per adult EQ (winsorized)	3 574.17	2 626.72	947.45**
	.	.	(430.39)
Total net income that HH receives from fishing (USD) (winsorized&log).	8.39	8.39	0.01
	.	.	(0.10)
Total net income that HH receives from fishing (USD) per adult equivalent (log).	7.00	6.99	0.00
	.	.	(0.10)

Sample size (N) = 1,333 (When log transformations are performed, sample size reduces to 1,307 due to non-positive incomes among the dropped observations)
Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

CCDP fisher households were found to be earning on average, US$14,744 per year, which was about USD$4,297 (41%) more per year than the comparison fisher households. This translates to about US$974 more per adult equivalent per year.

Wage Employment and Non-fishing Income

A unique feature of the rural coastal settings in which CCDP was implemented is that there is a certain level of rural and economic transformation that has already taken root. This is evinced by the presence of a number of non-primary wage-employment opportunities that various households engaged in. Given this context, the analysis of CCDP's impact purposely looked into how beneficiary households might have been affected in terms of their wage employment opportunities and remuneration.

Table 9 shows the results of this analysis and first reveals that approximately 30% (27%) of the CCDP beneficiary households (comparison group households) had at least one member who was engaged in regular wage employment. This entailed jobs such as working as a local government officer, teacher, clerk or secretary or guard/home service provider. In essence and statistical terms, both the CCDP and non-CCDP households were equally likely to have a member participating in these kinds of jobs, implying that CCDP interventions did not in any way enhance the likelihood of households engaging in regular wage employment compared to the non-beneficiary comparison group.

It is important to note from **Table 9** that 26% of CCDP beneficiary households had a member engaged in casual wage employment while only 17% of non-beneficiary households had such a member. This form of employment often entailed community piece jobs such as part-time manual labor for loading and off-loading goods on boats or forestry/agricultural work. In this regard, given that wages in casual employment tended to be lower than regular employment, this would likely have a negative impact on the final incomes earned by CCDP households compared to non-CCDP households. **Table 9** also reveals that 18% of the share of household income received by CCDP beneficiaries actually came from wage employment and not fisheries related activities, while this was only 8% for the non-beneficiary households. This result also has a significant bearing on the kinds of impacts on income and other measures of economic mobility that could be expected from a fisheries-focused project such as the CCDP. It also brings to the fore, the premise that tailoring investments to enable economic mobility of the rural poor in settings that have already experienced some level of rural and economic transformation is, perhaps, more complex and requires a broader perspective on the areas of investment and possible pathways for economic mobility. As such, some investments may have had to be linked to or entail non-agricultural and non-fisheries sectors to generate greater positive impacts.

Table 9: Impact of CCDP on wage employment outcomes

Variable	N	Treatment POM	Control POM	ATE/SE
Household has a member engaged in regular wage employment	2 087	**0.30**	**0.27**	0.03
	.	**.**	**.**	(0.02)
Household has a member engaged in casual wage employment	2 087	**0.26**	**0.17**	0.08***
	.	**.**	**.**	(0.02)
Share of total income from wage employment	2 087	**0.18**	**0.08**	0.10***
	.	.	.	(0.01)

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Qualitative evidence support the above notion in that for some of the geographic areas where CCDP promoted planting of mangroves and regeneration of the coastal resources, eco-tourism endogenously emerged. Eco-tourism and other service jobs/income-generating activities were cited as providing important sources of income, albeit not within the fish value chain. Quantitative analysis of the household survey data also shows that several households were earning sizeable incomes from non-fishing activities and, in most cases, CCDP beneficiaries would earn less compared to the comparison group households (**Table 10**). In particular, income from crop and livestock products was significantly higher among non-CCDP households as was income from processing of fisheries and marine products.

Table 10 Impact of CCDP on non-fishing income among fisher households

Variable	N	Treatment POM	Control POM	ATE/SE
Total net income from sales of livestock and products (USD) (winsorized)	520	63.51	106.64	-43.13**
	.	.	.	(19.19)
Total net income from sales of livestock and products (USD) (winsorized&log).	382	3.09	3.70	-0.61***
	.	.	.	(0.18)
Total net income from sales of livestock and products (USD) per adult EQ (winsorized)	520	16.46	27.25	-10.79*
	.	.	.	(5.93)
Total net income of crop production (USD) (winsorized)	622	434.01	431.07	2.93
	.	.	.	(62.08)
Total net income of crop production (USD) (winsorized&log).	548	5.15	5.59	-0.43***
	.	.	.	(0.13)
Total net income of crop production (USD) per adult EQ (winsorized)	622	104.26	112.07	-7.81
	.	.	.	(15.37)
Total annual net income from self-employment (USD) (winsorized)	338	1 221.58	1 485.51	-263.93
	.	.	.	(231.88)
Total annual net income from self-employment (USD) (winsorized&log).	338	6.16	6.43	-0.27
	.	.	.	(0.17)
Total annual net income from self-employment (USD) per adult EQ (winsorized)	338	288.85	336.32	-47.47
	.	.	.	(52.18)
Household total net income from processing marine products (USD) (winsorized)	55	363.58	1 241.20	-877.62**
	.	.	.	(387.01)
Household total net income from processing marine products (USD) (winsorized&log).	51	4.46	5.52	-1.06*

Variable	N	Treatment POM	Control POM	ATE/SE
	.	.	.	(0.58)
Household total net income from processing marine products (USD) per adult EQ (winsorized)	55	80.54	275.12	-194.58**
	.	.	.	(81.37)

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Income Diversification

Additional analysis was done to assess the impact of CCDP on diversification of income sources. Using the Gini-Simpson and the Berger-Parker indices as measures of diversity, it was found that CCDP actually encouraged the fisher households to specialize in fishing. Thus, CCDP fishers had fewer sources of income than the comparison group households (**Table 11**).

Table 11 Impact of CCDP on income source diversity

Variable	Treatment POM	Control POM	ATE/SE
Income diversity (Gini-Simpson index)	0.21	0.24	-0.03**
	.	.	0.01
Income diversity (Berger-Parker index)	1.23	1.27	-0.04**
	.	.	0.02

Sample size (N) = 1,333
Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Household Assets

To further understand CCDP's impact on economic mobility, analyses were performed on changes in household assets. Two different approaches were used to assess the impact of CCDP on household asset holdings. The first was a difference-in-difference estimation approach, which considers the difference in the change in asset indices between baseline (in 2013) and end-line (in 2017) for the CCDP and non-CCDP households – hence the name difference-in-difference. This approach is deemed more rigorous as it not only matched CCDP and non-CCDP households but also looked at the trajectory of assets over time. The second approach used was standard matching techniques that allowed comparison of CCDP and non-CCDP household asset holdings at each (cross-sectional) time point. The results reveal that CCDP beneficiaries started off with lower levels of assets in general but effectively caught up with or surpassed their counterparts by the time CCDP had closed, particularly in terms of durable assets and fisheries assets. **Table 12** shows that the increase in durable assets experienced by CCDP beneficiaries was approximately 33.4% higher than the increase experienced by the comparison group (0.81 increase in the asset index compared to 0.61). The fisheries assets of CCDP beneficiaries also increased to more or less the same level as the non-CCDP households (0.02 compared to 0.01, which is equivalent to a 160% increase).

Table 12: Impact of CCDP on changes in household asset indices (durable and fishing assets)

	Before			After			Difference-in-difference
	Treatment	Control	Diff	Treatment	Control	Diff	DiD
Durable assets (PCA)	1.13	1.23	-0.104	1.94	1.84	0.099	**0.204*****
Change in durable asset index (PCA)	-	-	-	**0.81**	**0.61**	**0.204**	
Durable assets (MCA)	0.24	0.31	-0.069	0.27	0.35	-0.081	-0.012
Change in durable asset index (MCA)	-	-	-	**0.03**	**0.04**	**-0.012**	
Fishing Assets (PCA)	0.19	0.23	-0.034	0.29	0.30	-0.011	0.024
Change in fishing asset index (PCA)	-	-	-	**0.10**	**0.07**	**0.024**	
Fishing Assets (MCA)	0.05	0.06	-0.016	0.07	0.07	0.000	**0.016****
Change in fishing asset index (MCA)	-	-	-	**0.02**	**0.01**	**0.016**	

Note: First 7 variables are created before matching, using the control group to predict factors
After matching, indices are created on the matched sample, using the control baseline distribution to predict factors
All indices are created only with items for which recall data exist
Difference-in-difference (DiD) estimations are only done using the matched sample (i.e. in the common support)
Significance levels: *** p<0.01, **p<0.05, *p<0.1

A look at the results of the analysis using standard matching techniques corroborates the findings from the foregoing analysis. CCDP beneficiaries started off with less durable assets in 2013 and in principle managed to catch up and have the same level of assets as the non-beneficiary comparison households by 2018. **Table 13** shows that in 2013, the durable asset index for CCDP beneficiaries was approximately 0.03 points lower than that of non-beneficiaries but was no less different by 2018.

Table 13: Impact of CCDP on durable household assets

	N	Treatment POM	Control POM	ATE/SE
HH durable asset index 2018 (MCA),just assets	1 333	0.31	0.31	0.00
	.	.	.	0.00
HH durable asset index 2018 (MCA),assets + improved dwelling	1 333	0.28	0.28	-0.00
	.	.	.	0.00
HH durable asset index 2018 (MCA),assets + improved dwelling + Own any land	1 333	0.28	0.28	-0.00
	.	.	.	0.00
HH durable asset index 2018 (MCA),assets for which recall exists	1 333	0.49	0.50	-0.01

	N	Treatment POM	Control POM	ATE/SE
	.	.	.	0.01
HH durable asset index 2018 (PCA), just assets	1 333	1.73	1.69	0.05
	.	.	.	0.05
HH durable asset index 2018 (PCA),assets for which recall exists	1 333	1.55	1.53	0.02
	.	.	.	0.05
HH durable asset index 2018 (PCA),assets + improved dwelling	1 333	2.87	2.83	0.04
	.	.	.	0.04
HH durable asset index 2013 (PCA)	1 275	1.03	1.17	-0.14***
	.	.	.	0.05
HH durable asset index 2013 (MCA)	1 275	0.61	0.64	-0.03***
	.	.	.	0.01

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Table 14 shows results on the impact of CCDP on a variety of fishing asset indices and reveals that at end-line, CCDP beneficiaries had not accumulated more fishing assets than non-beneficiaries. Analysis using asset indices that largely focused on the number of fishing asset items show that the CCDP beneficiaries still had fewer number of asset items, such as the number of fishing gear and the number of fishing boats/vessels. At first glance, this appeared to be counterintuitive given that the CCDP beneficiaries were supported with fishing assets and inputs. Triangulating this result with the qualitative evidence suggests that this was an artefact of the way CCDP provided assets or infrastructure support for fishing; mainly through groups and not at individual level. Thus, while access to fishing assets had increased for the CCDP beneficiaries, this was primarily through the fishing groups that CCDP established. As such, the household fishing assets owned at the individual household level had not increased.

Table 14: Impact of CCDP on fishing assets

	N	Treatment POM	Control POM	ATE/SE
Fish asset index 2018, MCA, Just Fish Assets	1 333	0.05	0.05	-0.00*
	.	.	.	0.00
Fish asset index 2018, MCA, Any asset + Any Boat +Any Canoe	1 333	0.04	0.04	-0.00
	.	.	.	0.00
Fish asset index 2018, MCA, Just assets for which recall exists	1 333	0.30	0.30	0.01***
	.	.	.	0.00
Fish asset index of HH 2018, PCA, Number of assets	1 333	0.93	0.93	-0.00

	N	Treatment POM	Control POM	ATE/SE
	.	.	.	0.09
Fish asset index of HH 2018, PCA, Number of assets + number of boats	1 333	1.31	1.24	0.07
	.	.	.	0.08
Fish asset index of HH 2018, PCA, Number of assets + m3 of boats	1 333	1.01	0.96	0.05
	.	.	.	0.09
Fish asset Index HH 2018, PCA, Number of assets; only items also recall exists	1 333	0.34	0.31	0.03
	.	.	.	0.14
Fish asset index of HH 2013 (MCA), only Asset	1 258	0.32	0.32	0.00
	.	.	.	0.00
Fish asset index of HH 2013 (PCA), just N of Assets.	1 258	0.18	0.19	-0.01
	.	.	.	0.05

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

With respect to other household assets the analysis showed that CCDP households experienced a decrease in livestock assets compared to non-beneficiaries. On average, livestock assets owned by CCDP beneficiaries (as measured by tropical livestock units (TLU)) declined by 0.1 units, which translates to a 23.8% decrease, compared to the non-beneficiary comparison households (see **Table 15**).

Table 15: Impact of CCDP on livestock assets

	N	Treatment POM	Control POM	ATE/SE
Livestock asset index of HH 2018 (MCA)	1 333	0.45	0.46	-0.00
	.	.	.	0.00
Livestock asset index of HH 2018 (PCA)	1 333	0.32	0.33	-0.02
	.	.	.	0.04
Livestock asset index BASELINE (MCA)	1 333	0.77	0.80	-0.03***
	.	.	.	0.01
Number of type of livestock owned by household	1 333	0.49	0.49	-0.01
	.	.	.	0.04
Number of type of livestock owned by household in 2013	358	1.17	1.42	-0.25***
	.	.	.	0.06
Number of livestock owned (Simple sum of different livestock)	1 333	4.23	3.57	0.66

	N	Treatment POM	Control POM	ATE/SE
	.	.	.	0.46
Total number of livestock owned in TLU	1 333	0.21	0.37	-0.16***
	.	.	.	0.06

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

One explanation for this finding is that, as CCDP beneficiaries began to focus more on fishery activities and invest their resources in acquiring assets for fishing they likely encountered a tradeoff and were forced to invest less of their scarce resources in livestock. Another explanation is that the CCDP households were more likely to invest in durable household assets than livestock, once they accumulated some wealth, simply because investing in livestock would also require allocating time to take care of the livestock whereas durable household assets would not impose this requirement on the CCDP beneficiaries' time. This argument was supported by the finding that CCDP beneficiaries witnessed an increase in their durable assets, compared to the non-beneficiary households. While these explanations are not in any way definitive, it would stand to reason that tradeoffs arise as CCDP households increase their investments and time commitment to fishing. Overall, the results on household assets reveal an important dimension to economic mobility as measured by asset indices – the fact that depending on the type of and approach to support fishers, different tradeoffs may be experienced by the beneficiaries.

In summary, the results on economic mobility among CCDP beneficiaries paint a somewhat lackluster portrait. On the one hand, durable assets, total net income and fishing income increased among fisher households. On the other hand, livestock assets and fishing assets all declined compared to the comparison group. Moreover, when the full sample was analyzed, including those who did not engage in fishing, there were no detectable impacts on net income as a result of CCDP. This raises a number of points to consider, regarding the type of interventions and benefits that emerged. Given the coastal community contexts where CCDP was implemented other investment areas may need to be included or considered separately as more effective avenues for economic mobility. This is likely due to overall macro-economy wide dynamics that may offer better options for households outside the primary production sectors such as fisheries.

Impact on productive fishing capacity

Regarding fishing activities, CCDP fishers were 11% more likely to fish in groups, which was expected as CCDP's mode of operation was to establish and work with fisher groups. It was also ascertained that if the fishers operated in the same group over time (i.e. stayed in the same fisher group for multiple fishing trips as opposed to being group indiscriminate) they were 24% more likely to be registered and 16% more likely to have group savings from their fish incomes.

Interestingly, it was found that CCDP fisher engaged in fishing for slightly fewer number of months per year (10.4 months as opposed to 10.9 months) and nearly two days less per fishing month[4] (see Table **16**). This implies that they were more efficient, as they were also found to be catching more quantities of fish than the comparison (control) group. However, their fishing trips lasted about a tenth of a day longer than the comparison group, but went on nearly two less fishing trips per month. These dynamics in fishing behaviors reflect increased productive fishing capacity in the sense that

[4] A fishing month is one during which fishers actually go fishing for at least a day. On average, CCDP fisher households went fishing for 10.4 months of the year while non-CCDP fisher households fished for 10.9 months of the year, on average.

the CCDP fishers were ultimately able to spend longer periods of time and catch more fish per fishing trip, thus engaging in fishing for less total time, overall.

Table 16: Impact of CCDP on fishing behavior, activities and productive capacity

	N	Treatment POM	Control POM	ATE/SE
Number of months per year that household or group went fishing	**1 333**	**10.27**	**10.89**	**-0.62*****
	.	**.**	**.**	**(0.16)**
Number of complete days that household spent fishing per fishing month	**1 333**	**20.01**	**21.72**	**-1.72*****
	.	**.**	**.**	**(0.45)**
Number of days that one fishing trip lasted per fishing month	**1 333**	**1.26**	**1.15**	**0.11*****
	.	**.**	**.**	**(0.04)**
Average number of fishing trips per fishing month	**1 333**	**18.96**	**20.70**	**-1.74*****
	.	**.**	**.**	**(0.48)**
Total cubic meters per fishing boats	1 333	7.70	6.49	1.20
	.	.	.	(2.23)
Average number of fish species caught	1 333	2.19	2.39	-0.21***
	.	.	.	(0.08)
Household goes fishing in a group	1 333	0.24	0.13	0.11***
	.	.	.	0.02
Average number of fishers going fishing together per fishing month	1 333	2.06	1.79	0.27*
	.	.	.	(0.16)
HH's fishing group is registered	111	0.62	0.38	0.24***
	.	.	.	0.09
HH's fishing group has savings together	111	0.25	0.09	0.16**
	.	.	.	0.07
HH's fishing group size	111	8.36	6.43	1.93
	.	.	.	1.59

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

An interesting observation regarding the fishing behaviors of CCDP beneficiaries is that they tended to catch less fish types than the comparison group. In addition, CCDP beneficiaries were able increase catch for specific types of fish, especially squid *Cumi Cumi* (796 kg more) and yellow-fin tuna *Madidihang/Tune ekor kuning* (748 kg more) but then decreased their catch of other fish species such as sea bream *kurisi* (85kg less) as depicted in Table **17**. This finding suggests both substitution effects and specialization in fishing as a result of CCDP interventions. While the initial thinking was

that enabling fishers to capture fish in a more efficient way would allow them to diversify their fish catch, it turned out that they in fact began to specialize and catch specific fish species that were of higher value and in demand.

Table 17: Mean quantity of fish species caught (kg per fishing month)

Fish species/family caught (kg/fishing month)	N	Treatment POM	Control POM	ATE/SE
Cakalang (Skipjack tuna - *Katsuwonus pelamis*)	343	825.38	1 746.19	-920.81*
	.	.	.	471.70
Selar (Big-eye scad - *Selar crumenophthalmus*)	250	1 101.91	533.24	568.67*
	.	.	.	292.66
Kerapu (Grouper - *Epinephelus poecilonotus*)	233	204.28	308.88	-104.60
	.	.	.	159.17
Tongkol (Mackerel tuna - *Euthynnus affinis*)	205	1 750.37	1 912.05	-161.68
	.	.	.	709.70
Layang (Short-fin scad - *Decapterus macrosoma*)	195	6 369.92	4 003.50	2 366.41
	.	.	.	2 359.50
Madidihang/Tune ekor kuning (Yellow-fin tuna - *Thunnus albacares Bonnaterre*)	157	1 254.80	506.48	748.32**
	.	.	.	352.19
Udang (Prawns/shrimp - *Litopenaeus vannamei/ Penaeus monodon*)	111	303.44	270.95	32.49
	.	.	.	114.41
Kurisi (Ornate threadfin sea bream - *Nemipterus hexodon*)	40	131.22	139.01	-7.79
	.	.	.	31.32
Cumi Cumi (Bigfin reef squid - *Sepioteuthis lessoniana*)	60	977.56	91.52	886.04***
	.	.	.	299.17
Mackerel/Tenggiri (Spanish mackerels - *Scomberomorus commerson*)	52	880.45	319.26	561.18
	.	.	.	467.90
Kuwe (Malabar tervally - *Carangoides malabaricus*)	115	184.05	1 906.67	-1 722.62
	.	.	.	1 348.90
Mackerel (*Scombridae*)	95	511.23	544.30	-33.07
	.	.	.	208.72
Kakap Merah (Red snapper - *Lutjanus bitaeniatus*)	129	349.48	202.31	147.16

Fish species/family caught (kg/fishing month)	N	Treatment POM	Control POM	ATE/SE
	.	.	.	152.55
Teri (Whitebait/anchovy – *Engraulidae - coilia*)	62	3 252.62	2 904.20	344.77
	.	.	.	1 915.79

Notes: These estimates are derived from the sample of fishers only and do not include households engaged in other non-fishing activities supported by CCDP.
Sample sizes vary for each estimation of impact on fish or marine product price as estimation could only be performed for those who sold the respective type of fish or marine product. In some cases sample sizes are small, thus warranting caution in interpretation of the results.
Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Another finding that did not align with the hypothesized impact was that CCDP fishers did not increase the quantity of fish they caught. In fact, the absolute magnitude of fish caught by CCDP fishers was approximately 109kg less per fishing month (although this difference was not statistically significant). Contrary to common belief that providing improved fishing equipment to the fishers would lead to increased fish production, CCDP fishers chose to simply increase productivity without increasing absolute production levels. **Table 18** shows that CCDP fishers caught on average 32 Kg more fish per number of fishing days per cubic meters of fishing vessel (boat). Using an alternative measure of fishing productivity, it was found that CCDP fishers caught 609 Kg more fish per cubic meter of fishing vessel per month. This is equivalent to a 79% productivity increase attributable to the CCDP interventions. Testing this result's robustness across a number of different measures of fishing productivity produced consistently strong effects of productivity increases with large magnitudes; thus reinforcing the evidence of positive and large productivity increases among CCDP fishers.

Table 18: Fishing Production and Productivity

	Treatment POM	Control POM	ATE/SE
Total quantity of all fish species caught per fishing month (Kg)	**2 335.32**	**2 444.67**	**-109.34**
	.	**.**	**(605.77)**
Avg. Qty. caught per month / (Number of days fishing per month * m3 of boat used)	65.83	33.76	32.08***
	.	.	(8.22)
Avg. Qty. caught per month / m3 of boat used	**1 378.15**	**768.87**	**609.28*** **
	.	**.**	**(171.89)**
Avg. Qty. caught per month / Number of fishers going fishing	780.45	654.98	125.47
	.	.	(81.00)
Avg. Qty. caught per month / (Number of fishers * Number of days fishing)	35.11	27.97	7.13**
	.	.	(3.13)
Avg. Qty. caught per month / (Number of fisher going fishing* m3 of boat used)	**868.97**	**451.61**	**417.36*** **

	Treatment POM	Control POM	ATE/SE
	.	.	**(99.57)**
Quantity of fish caught per month / (Number. of fishers * m^3 of boat used* Number of days spent fishing)	42.04	22.62	19.42***
	.	.	(4.63)
Number of observations: N = 1,333			

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Of particular importance is that total fish production levels did not increase and this is a testament to the way CCDP integrated coastal resource management interventions, such as establishment of marine protection areas, formulation and implementation of village-based integrated coastal management (ICM) plans and capacity strengthening of fishers on sustainable fisheries resources management. This proves that it is possible to promote fisheries productivity without inducing overfishing when sustainable fisheries resources management practices are an integral part of the project, as was the case with CCDP.

On production costs, CCDP fishers incurred higher total fishing costs than non-CCDP fishers. This was to be expected and was primarily driven by increased fuel use (61% higher fuel costs), as CCDP fishers were now able to travel further afar from the coast, after receiving motors for their boats. Interestingly, while CCDP fishers were 14% more likely to buy ice for keeping their fish fresh for longer periods of time, the average cost of ice purchased by CCDP fishers was lower (but not significantly lower) than that of non-CCDP fishers. **Table 19** shows a comparison of the breakdown of production costs between the CCDP fishers and non-CCDP fishers.

Table 19: Impact of CCDP on Costs of fishing

	Treatment POM	Control POM	ATE/SE
Total costs for labor (USD)	473.27	421.15	52.12
	.	.	206.84
Total cost for fuel (USD)	**2 255.93**	**1 405.13**	**850.80*** **
	.	**.**	**322.38**
HH bought any ice for fishing	**0.63**	**0.49**	**0.14*** **
	.	**.**	**0.03**
Total cost of ice (USD)	314.08	394.63	-80.55
	.	.	98.04
Total cost of other inputs (USD)	698.75	958.71	-259.96
	.	.	195.00
Total cost (USD)	3 742.03	3 179.62	562.41
	.	.	640.47
Number of observations: N = 1,333			

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Impact on market participation

A major focus area of CCDP was to increase beneficial market access for the beneficiaries. This was done by setting up memoranda of understanding (MOUs) with off-taker buyers of fish and marine products, as well as constructing marketing infrastructure in the form of fish processing and handling facilities (smokehouses and warehouses). Results of the impact assessment shown in **Table 20** reveal that these efforts paid off significantly. CCDP beneficiaries were able to attain 28% higher value of fish and marine product sales compared to non-beneficiary households (approximately US$949 extra per fishing month). As part of the process, CCDP beneficiaries received higher prices for their fish; about US$ 0.64 per kg more, which translates to a 35% increase in fish prices on average, for all types of fish sold.

Table 20: Impact of CCDP on key market access indicators

	N	Treatment POM	Control POM	ATE/SE
Fish caught was sold	1 333	0.97	0.94	0.03***
	.	.	.	(0.01)
Total value of fish sales per fishing month (USD)	**1 271**	**3 316.42**	**2 367.29**	**949.13****
	.	**.**	**.**	**(476.29)**
Average price received per KG for selling fish, all types (USD)	**1 267**	**2.45**	**1.82**	**0.64*****
	.	**.**	**.**	**(0.11)**
Total quantity of fish sold per fishing month (Kg)	1 271	2 219.56	2 465.81	-246.25
	.	.	.	(600.94)
Average number of buyers to whom fish were sold	1 271	1.00	1.01	-0.01***
	.	.	.	(0.00)
Average time needed to transport fish to buyers (hours)	1 271	0.47	0.30	0.17***
	.	.	.	(0.04)

Notes: These estimates are derived from the sample of fishers only and do not include households engaged in other non-fishing activities supported by CCDP.
Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

While the number of buyers sold to, remained at about one buyer per fisher, the statistically significant estimate shown in **Table 20** suggests a minor reduction in the number of buyers among CCDP fishers compared to the non-CCDP fishers. In essence, CCDP beneficiaries were now selling to slightly fewer fish buyers, likely due to MOUs or contracts with buyers they had entered into, thus keeping their end of the deal to exclusively supply fish to these buyers.

Interestingly, CCDP fishers were not found to be selling more quantities of fish, even though they were now benefiting from higher fish prices and value of fish sales. In fact, the quantity of fish they sold was lower than that of non-CCDP fishers. This is in line with the finding presented earlier on production that CCDP fishers caught less absolute quantities of fish. In a sense, this had positive implications for coastal resources conservation and sustainable marine resources management and is

likely a result of CCDPs efforts to integrate community-based coastal resources management interventions among its beneficiaries. Thus, the increased commercial activity around fisheries, witnessed as a result of CCDP did not cause overfishing.

Results also show that CCDP fishers experienced a 5% reduction in postharvest losses of their fish, likely due to increased processing as well as increased access to cooler boxes and other fish preservation mechanisms that were provided by CCDP. It is also evident that CCDP beneficiaries began to sell more of the fish they caught and as such consumed a lower share of their catch. As shown in **Table 21** CCDP fishers sold 89% of their catch compared to 82% for the non-CCDP fishers; also they kept 9% of their catch for home consumption, while the non-CCDP fishers kept and consumed 14%.

Table 21: Uses of fish catch and postharvest losses (shares)

	Treatment POM	Control POM	ATE/SE
Reported fish losses after landing: Postharvest losses	0.02	0.07	-0.05***
	.	.	0.01
Average Share of fish catch lost after landing per fishing month	0.00	0.00	-0.00***
	.	.	0.00
Average Share of fish used for home consumption	0.09	0.14	-0.04***
	.	.	0.01
Average Share of fish catch sold	0.89	0.82	0.07***
	.	.	0.01
Average Share of fish used for other purposes	0.01	0.04	-0.03***
	.	.	0.00
Number of observations: N = 1,333			

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Further in-depth analysis of market access among CCDP beneficiaries revealed that CCDP fisher beneficiaries were now selling their fish further away from their homes or fishing locales (see **Table 20**). CCDP fishers no longer sold their fish at the landing site/beach or at home but rather, traveled to auctions and larger village markets outside their own village, where they received significantly higher prices. **Table 22** shows that CCDP fishers approximately twice more likely to sell their fish at a local market outside their village and more than seven times more likely to sell their fish at an auction, compared to non-CCDP fishers. In contrast, the non-CCDP fishers mostly sold their fish at the beach, in their neighborhood and from their homes. As a result of this new market access, the CCDP beneficiaries incurred higher transport costs and spent more time reaching their fish markets compared to non-beneficiary households.

Table 22: Location of fish sales, associated marketing transport costs and travel time to market

	Treatment POM	Control POM	ATE/SE
Fish sold at: Landing Place (Governmental)	0.03	0.09	-0.06***
	.	.	0.01
Fish sold at: Beach	**0.14**	**0.25**	**-0.11*** **
	.	.	0.02
Fish sold at: Auction	**0.15**	**0.02**	**0.13*** **
	.	.	0.02
Fish sold at: Village Market (Within Own Village)	0.04	0.06	-0.01
	.	.	0.01
Fish sold at: Local Market Outside Own Village	**0.28**	**0.10**	**0.19*** **
	.	.	0.02
Fish sold at: In The Neighborhood	0.26	0.37	-0.11***
	.	.	0.03
Fish sold at: Home/house	**0.11**	**0.15**	**-0.04** **
	.	.	0.02
Number of observations: N = 1,271			

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Impact on food security and dietary diversity

Turning to the impact of CCDP on food security and dietary diversity, results show what appear to be at first glance conflicting findings. CCDP beneficiaries were found to be reporting higher levels of food insecurity experiences, as measured by the Food insecurity experience scale (FIES). **Table 23** shows that the CCDP beneficiaries reported close to two (1.95) responses indicating experiencing food insecurity relative to an average of 1.31 responses for the non-CCDP comparison households.

Table 23: Impact of CCDP on experience of food insecurity

	Treatment POM	Control POM	ATE/SE	Food Insecurity Severity Continuum
Tot. number of YES answers to FIES	1.95	1.31	0.64***	
	.	.	0.12	
FIES: WORRIED NOT ENOUGH FOOD	0.52	0.41	0.10***	Uncertainty regarding ability to obtain food
	.	.	0.03	
FIES: UNABLE TO EAT HEALTHY	0.35	0.18	0.16***	Compromising on food quality and variety
	.	.	0.03	
FIES: ATE FEW KINDS OF FOODS	0.38	0.24	0.14***	
	.	.	0.03	
FIES: SKIPPED A MEAL	0.13	0.11	0.02	Reducing food quantities, skipping meals
	.	.	0.02	
FIES: ATE LESS	0.27	0.19	0.08***	
	.	.	0.02	

	Treatment POM	Control POM	ATE/SE	Food Insecurity Severity Continuum
FIES: RAN OUT OF FOOD	0.14	0.14	-0.00	Experiencing hunger
	.	.	0.02	
FIES: HUNGRY BUT DID NOT EAT	0.09	0.06	0.03**	
	.	.	0.01	
FIES: WENT WHOLE DAY WITHOUT EATING	0.06	0.01	0.05***	
	.	.	0.01	

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

While this result was statistically significant for several of the individual items on the FIES, it is important to point out that on average this surmounts to about six out of eight responses where CCDP beneficiaries did not indicate some level of food insecurity. In other words, there appears to be food security for the most part for both CCDP and non-CCDP households. Thus, the marginally higher food insecurity reported by CCDP beneficiaries is in relative terms. When one looks at the percentages of responses reporting experiencing different types of food insecurity, a clear pattern emerges, with higher percentages being reported, up to 52%, for indicators that pertain to uncertainty regarding ability to obtain food (the top rows of the table) and significantly lower percentages, as low as 6% in the case of CCDP beneficiaries, on actually experiencing hunger (the bottom rows of the table). The last column in **Table 23** gives an indication of the food insecurity severity continuum associated with each item response of the FIES.

Table 24 shows the results on the impact of CCDP on household dietary diversity. The findings show that the CCDP beneficiaries actually had a higher level of dietary diversity, with their diets composed of approximately nine out of twelve food groups, compared to 8.45 food groups for the non-CCDP comparison households. Again, the differences are marginal although statistically significant. What is perhaps interesting to note from the results is that CCDP households were found to be consuming less cereals and grains yet consuming more processed fish and shellfish (in addition to consuming more fruit and other protein-based foods). The fact the CCDP households were now consuming more processed fish and shellfish products supports the notion that through increased fish productivity and processing arising from the CCDP interventions, beneficiaries were more likely to consume the same fish and seafood products that they produced for the market. Perhaps also interesting is the finding that CCDP beneficiaries were more likely to be consuming oil-fatty foods, sugars and sweets as well as condiments. This insinuates that as a result of increasing incomes, the fisher households that benefited from CCDP were likely to increase their consumption of food stuffs

that are associated with obesity. While these results are in no way definitive, it is an issue that may need to be considered when mainstreaming nutrition in future projects.

Table 24: Impact of CCDP on Household Dietary Diversity

	Treatment POM	Control POM	ATE/SE
HDDS past 7 days (12 Food Categories)	9.00	8.45	0.54***
	.	.	(0.08)
During last 7 days household consumed: Cereals and Grains	0.69	0.82	-0.13***
	.	.	(0.02)
During last 7 days household consumed: Roots and Tubers	0.60	0.54	0.06***
	.	.	(0.02)
During last 7 days household consumed: Legumes / Nuts	0.46	0.50	-0.04*
	.	.	(0.02)
During last 7 days household consumed: Vegetables	0.97	0.97	-0.00
	.	.	(0.01)
During last 7 days household consumed: Fruits	0.76	0.63	0.12***
	.	.	(0.02)
During last 7 days household consumed: Processed Fish	0.31	0.25	0.06***
	.	.	(0.02)
During last 7 days household consumed: Shell Fish	0.09	0.03	0.06***
	.	.	(0.01)
During last 7 days household consumed: Fish	0.98	0.99	-0.01*
	.	.	(0.00)
During last 7 days household consumed: Seaweed	0.03	0.01	0.02***
	.	.	(0.01)
During last 7 days household consumed: Meat	0.19	0.15	0.04**
	.	.	0.02
During last 7 days household consumed: Liver, kidney, heart and/or other organ meats	0.04	0.02	0.02**
	.	.	0.01
During last 7 days household consumed: Eggs	0.81	0.70	0.12***
	.	.	0.02
During last 7 days household consumed: Milk and other dairy products	0.56	0.38	0.19***

	Treatment POM	Control POM	ATE/SE
	.	.	0.02
During last 7 days household consumed: Oil/fat/butter	0.98	0.91	0.07***
	.	.	0.01
During last 7 days household consumed: Sugar, or sweet	0.99	0.92	0.07***
	.	.	0.01
During last 7 days household consumed: Condiments /Spices	0.99	0.94	0.05***
	.	.	0.01
Number of observations: N = 2,087			

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Impact on environmental sustainability

The analysis revealed that CCDP had a significant impact on the use of instruments designed to improve governance of community coastal resources and thereby increase environmental sustainability. While the indicators used to measure impacts on this area do not directly measure sustainability, they provide some useful insights on how the CCDP made strides towards incorporating interventions to enhance coastal and marine resources governance and management at the community level. Table **25** shows that CCDP fisher beneficiaries were more likely to be aware of people in the village using explosives for fishing and thus more likely to report such cases to the authorities. Nonetheless, there did not seem to be a difference between the CCDP fishers and non-CCDP fishers with respect to the awareness of people using poisons for fishing or the implementation of rules for fishing at the community level.

Table 25 Impact of CCDP on environmental awareness and environmental governance issues

	N	Treatment POM	Control POM	ATE/SE
Aware of people in village that use EXPLOSIVES for fishing	1 333	0.04	0.02	0.03***
	.	.	.	0.01
Aware of people in village that use POISON for fishing	1 333	0.04	0.03	0.01
	.	.	.	0.01
Rules for fishing established in community	1 333	0.02	0.02	0.00
	.	.	.	0.01

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Impact on resilience

The impact of CCDP on a number of resilience indicators was also investigated. This included the ability of households to recover from a variety of shocks, including climatic and geological shocks, which are prominent in many of the communities where CCDP was implemented. Findings from the

impact assessment suggest that CCDP beneficiaries were more likely to experience shocks to begin with and were equally unable to recover from the shocks (see **Table 26**). Evidence from the qualitative data also show that a number of CCDP beneficiaries experienced damages to their fishing vessels and assets, to the extent that some ended up leaving the fishing sector altogether to seek employment elsewhere, particularly in the services sector.

Table 26: Impact of CCDP on resilience indicators

	N	Treatment POM	Control POM	ATE/SE
HH experienced any shock	1 333	0.65	0.51	0.13***
	.	.	.	(0.03)
Average incidence of shock interacted with perceived severity of shock	1 333	0.58	0.36	0.22***
	.	.	.	(0.02)
Ability to recover from shocks	741	2.19	2.28	-0.09
	.	.	.	(0.07)

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1
Note: The analysis of ability to recover is only performed for those who actually reported experiencing at least one shock.

Further analysis of the impacts on resilience that included all households (not just the fisher households) shows that overall; the CCDP beneficiaries were in fact 6% less able to recover from shocks. **Table 27** presents these results, were the full sample was included in the analysis.

Table 27 Impact of CCDP on resilience (full sample analysis)

	N	Treatment POM	Control POM	ATE/SE
HH experienced any shock	2 087	0.58	0.50	0.08***
	.	.	.	(0.02)
Average incidence of shock interacted with perceived severity of shock	2 087	0.56	0.36	0.20***
	.	.	.	(0.02)
Ability to recover from shocks	1 122	2.15	2.28	-0.13**
	.	.	.	(0.06)

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1
Note: The analysis of ability to recover is only performed for those who actually reported experiencing at least one shock.

While it is clear from the analysis is that the project targeted coastal communities that were more vulnerable and more likely to experience shocks, which in a sense could be viewed as effective targeting of beneficiaries by CCDP. Nonetheless, CCDP did not positively enhance resilience of these beneficiaries and their communities. These results underscore the importance of carefully integrating specific interventions to enhance resilience in such contexts, especially given that coastal communities in eastern Indonesian islands are more prone to climatic and geological shocks. Thus, the shocks experienced by CCDP beneficiaries are likely to have negated some of the positive impacts, which may have otherwise been realized as a result of CCDP.

It is perhaps also important to consider whether separate and significantly larger interventions that focus on enhancing resilience are needed in similar contexts as opposed to merely integrating small resilience enhancing components or elements within projects like CCDP, as these might not suffice. This is an important empirical question, which may not be fully answered by the current impact assessment but is worth exploring, in the light of the magnitude of some of the shocks experienced by coastal communities in Indonesia.

Impact on women's empowerment

Turning to issues of social inclusion and in particular women's empowerment, the impact estimates show that women who were beneficiaries of CCDP were 84% more likely to participate in any community group or association compared to non-beneficiaries. In addition, CCDP beneficiary households were 27% more likely to have women engaging in fish and marine processing for income generation (see **Table 28**). While these indicators are clearly not comprehensive enough to capture all dimensions of women's empowerment, they offer useful insights on the mechanisms through which CCDP began to increase women's participation and empowerment in economic activities.

Table 28: Impact of CCDP on Women's empowerment

	N	Treatment POM	Control POM	ATE/SE
Any female in HH participates actively in any community group	2 087	0.45	0.25	0.21***
	.	.	.	(0.02)
Any female participating to any social group	2 087	0.38	0.24	0.14***
	.	.	.	(0.02)
Only female participating to any social group	2 087	0.10	0.07	0.03***
	.	.	.	(0.01)
Any female participating to any CCDP group	2 087	0.16	0.03	0.13***
	.	.	.	(0.01)
Household has at least one female among those involved in processing marine products	161	0.99	0.78	0.21***
	.	.	.	(0.05)
Only females are among those involved in processing fish and marine products	161	0.82	0.64	0.17**
	.	.	.	(0.07)
At least one female household member is among those engaging in fishing	1 343	0.02	0.01	0.00
	.	.	.	(0.01)
Only females are among those engaging in fishing in the household	1 343	0.00	0.00	-0.00**
	.	.	.	(0.00)
Female is among those responsible for any household savings	758	0.61	0.65	-0.04
	.	.	.	(0.04)

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

It is also interesting to note that no impacts were generated in terms of increased women's responsibility over household savings. Thus, while key informants interviewed during qualitative data collection, reported that women who benefited from CCDP were actively participating in savings groups within their fish and marine processing groups, their role in household-level savings was no different from that of non-beneficiaries. Descriptive statistics also show that over 60 percent of women were in some way responsible for savings at household level, be they in CCDP beneficiary or non-CCDP households. This implies that in general women were involved in savings activities to a large extent in Indonesia. Therefore, CCDP did not cause an additional increase in the share of women involved in savings activities/responsibilities at the household levels, potentially implying that more careful mainstreaming of gender was needed at project level for CCDP to empower women in a transformative way.

Impact on youth empowerment

Similar to the preceding analysis of women's empowerment, analysis was done to assess the level of youth participation and empowerment and whether CCDP generated any impacts in this respect. **Table 29** presents the results of this analysis.

Table 29: Impact of CCDP on youth participation

	N	Treatment POM	Control POM	ATE/SE
Household has at least one youth actively participating in any community group	1 333	0.18	0.06	0.13***
	.	.	.	(0.02)
Household has at least one youth participating to any social group	1 333	0.18	0.06	0.12***
	.	.	.	(0.02)
Household has at least one youth involved in processing marine products	55	0.08	0.04	0.04
	.	.	.	(0.05)
Household as at least one youth engaging in fishing	1 333	0.05	0.06	-0.01
	.	.	.	(0.01)
Household has only youth among those engaging in fishing	75	0.12	0.26	-0.14**
	.	.	.	(0.07)

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

From the analysis, it was found that CCDP fisher households were more than twice as likely to have youth actively participating in any community group compared to the non-CCDP fisher households. In addition, youth that were members of CCDP fisher households were more than twice as likely to participate in any social group in the community. However, youth from CCDP fisher households were not any more likely to be processing fish and marine products or engaging in fishing, relative to the youth from non-CCDP fisher households. This is likely due to the fact that CCDP did not explicitly target any specific interventions on youth. The fact that the CCDP fisher households had youth who were found to be more likely to participate in community groups is perhaps an indirect effect arising from the youth emulating their older household members.

Impact on inclusive access to financial services

While the theory of change for CCDP anticipated that the beneficiaries would benefit from increased savings or access credit from financial institutions as a result of working in project fisher groups or processing/savings groups, the results of the impact assessment find no difference between CCDP beneficiaries and comparison group in this regard. The lack of a difference could be attributed to the relatively high availability of rural financial services in general, in the coastal communities where CCDP was implemented. This is in contrast to settings in other developing countries where the level of rural transformation might be relatively lower and access to rural financial services may be limited. It could also be the case that, because CCDP did not primarily focus on rural financial inclusion, there simply were no detectable impacts on savings and credit use. **Table 30** shows the results on CCDP's lack of impact on savings and credit use.

Table 30: Impact of CCDP on financial inclusion indicators

	N	Treatment POM	Control POM	ATE/SE
Household applied for loan in the past 12 months	1 333	0.17	0.17	-0.01
	.	.	.	(0.02)
Household obtained loan in the past 12 months	1 333	0.24	0.23	0.02
	.	.	.	(0.02)
Application for at least one loan has been rejected	229	0.12	0.10	0.02
	.	.	.	(0.05)
Total value of all original loans (USD)	307	1 157.36	1 374.36	-217.00
	.	.	.	(171.95)
Total value that HH needs to pay at the end of all loan's (USD)	307	1 399.97	1 602.04	-202.07
	.	.	.	(215.03)

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Heterogeneous impacts of CCDP

The findings on the average impact of CCDP on fish and marine product prices received, which were presented earlier in **Table 20**, revealed that CCDP beneficiaries were able to benefit from a 35% increase in fish prices due to marketing interventions implemented by the project. To further elucidate the main sources of this impact, prices of the major fish type/species caught by the fishers were disaggregated and analyzed. **Table 31**, below, shows the results of the disaggregated analysis and reveals that prices of bigeye scad and skipjack tuna received by CCDP beneficiaries were 77% and 56% higher, respectively, while prices of shrimp and grouper fish were 25% and 19% higher, respectively. While these price increases account for the bulk of the gains in average fish prices for the CCDP beneficiaries, it is impressive to see that several other fish prices were higher for the CCDP beneficiaries compared to the non-CCDP comparison fishers. This positive impact on prices is directly attributable to the efforts of CCDP in brokering marketing arrangements and facilitating access to more lucrative fish and marine product markets for the beneficiaries.

Table 31: Impact of CCDP on prices of fish and marine products received by fishers and processors

	N	Treatment POM	Control POM	ATE/SE
Price per KG received from selling: Cakalang (USD)	333	1.86	1.19	0.67***
	.	.	.	(0.13)
Price per KG received from selling: Selar (USD)	235	1.68	0.95	0.73*
	.	.	.	(0.43)
Price per KG received from selling: Kerapu (USD)	200	2.65	2.23	0.42**
	.	.	.	(0.21)
Price per KG received from selling: Layang (USD)	180	1.03	0.92	0.12*
	.	.	.	(0.06)
Price per KG received from selling: Madidihang/Tune ekor kuning (USD)	154	2.62	2.36	0.26
	.	.	.	(0.26)
Price per KG received from selling: Udang (USD)	103	3.83	3.06	0.77***
	.	.	.	(0.21)
Price per KG received from selling: Cumi Cumi (USD)	47	2.24	1.15	1.09***
	.	.	.	(0.34)
Price per KG received from selling: Mackerel/Tenggiri (USD)	52	3.50	1.88	1.62***
	.	.	.	(0.49)
Price per KG received from selling: Kuwe (USD)	105	2.64	1.41	1.23***
	.	.	.	(0.37)
Price per KG received from selling: Mackerel (USD)	89	1.21	1.59	-0.38**
	.	.	.	(0.19)
Price per KG received from selling: Kakap Merah (USD)	115	2.87	2.19	0.68***
	.	.	.	(0.22)

Note: Sample sizes vary for all estimations of impact on fish or marine product price as estimation could only be performed for those who actually sold the respective type of fish or marine product. In some cases sample sizes are small, thus warranting caution in interpretation of the results.
Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

Market spillover effects of CCDP

Given that data on spillover-group households were also collected, it was possible to assess if CCDP generated any spillover effects to benefit households living in the same villages as the CCDP beneficiaries, even though they did not directly participate in the project. In general, the analysis mostly found limited spillover effects in the CCDP villages with the exception of a few areas of

interest.[5] For example, it was found that market access among spillover households significantly increased. Spillover households were able to also benefit from better access to fish and marine product markets and were receiving higher fish prices and value of fish sales, similar to the CCDP fisher beneficiaries. It is likely that through seeing the benefits of CCDP beneficiaries' participation in more lucrative markets, the spillover fisher households began to emulate the marketing strategies of the CCDP beneficiaries and as a result reaped similar benefits. Also, market information flows through community networks combined with general equilibrium effects tied to fish price transmission across markets, may have happened, thus facilitating the spillover benefits at the market level. Qualitative key informant interviews suggest that this was indeed the case. This is corroborated by qualitative data from the focus group discussions at community level, where it was noted that once CCDP managed to broker MOUs and marketing contracts for CCDP fishers, the buyers began to extend their market offers to the rest of the fishers in the same villages, irrespective of whether they were direct beneficiaries of CCDP or not. To some extent, this phenomenon is to be expected since benefits from market interventions tend to be economy-wide in nature. **Table 32** shows the positive impacts of CCDP on prices received by spillover-group fishers who lived in the same villages as the CCDP beneficiaries.

Table 32: Indirect market access impacts of CCDP on fishers residing in the same villages as CCDP beneficiaries

	N	Spillover POM	Control POM	ATE/SE
HH sold any fish, crop and/or processed goods	1 149	0.97	0.98	-0.01
	.	.	.	(0.01)
Average number of buyers while selling goods	1 088	1.00	1.02	-0.01***
	.	.	.	(0.00)
Overall average time needed to transport any goods to market (hours)	1 088	0.40	0.31	0.09**
	.	.	.	(0.04)
Average number of fish buyers sold to	1 082	1.00	1.01	-0.01***
	.	.	.	(0.00)
Average time needed to transport fish to buyer's (hours)	1 082	0.41	0.31	0.10**
	.	.	.	(0.04)
Tot. Value of Fish Sales (USD)	1 149	39 117.96	20 863.17	18 254.79***
	.	.	.	(6 842.73)
Total value of fish used for sales (USD) (winsorized)	1 149	36 275.91	19 041.78	17 234.13***
	.	.	.	(5 753.92)

Standard errors are shown in parentheses. Significance levels: *** p<0.01, **p<0.05, *p<0.1

As noted above, there were not too many other spillover effects that were detected for CCDP. Nonetheless, a caveat that needs to be mentioned is that certain positive externalities resulting from CCDP interventions, particularly those pertaining to sustainable coastal resources management, may

[5] For brevity, results from the comprehensive and indepth quantitative analysis of the spillover household data are not fully presented in this report. However, these can be provided by the authors upon request.

have occurred but were difficult to capture using the household survey data collected. This is simply because survey data are generally not best suited to adequately capture community-level environmental externalities. Moreover, different modeling approaches such as the use of local economy-wide computable general equilibrium models may be needed to better understand spillover effects of a project. It is nonetheless, likely that if positive environmental impacts were detected for CCDP beneficiaries, e.g. the ability to avoid overfishing, the associated environmental benefits would probably accrue to the spillover group households as well.

6. Conclusion and lessons learnt

This report presented the results of an ex post impact assessment of the CCDP, an IFAD-funded fish value chain project, which was implemented in the coastal communities of eastern Indonesia between 2013 and 2017. Impact was measured against a number of development indicators, including on economic mobility, fish production and productivity, fish and marine product market access, resilience, as well as women's and youth empowerment, food security, and nutrition, among other indicators.

Overall, results showed that CCDP had numerous positive impacts on fisher households that benefited from the project interventions. In particular, fishers who received CCDP support were able to increase their fishing productivity (as measured in terms of catch per unit effort) by 79 percent without increasing their overall total fish production. Thus, CCDP was able to prevent overfishing while promoting commercialization of fish and marine products. In part, this was achieved because CCDP was able to effectively integrate sustainable fisheries practices and coastal resources management interventions through community-based approaches. This was also achieved through a substitution effect, whereby CCDP fishers began to fish for higher value fish and marine products, while reducing their catch of other fish types.

In addition, CCDP was able to increase markets access for its beneficiaries by 35 percent and 28 percent as measured by fish prices and value of fish sales, respectively. This strong market access impact was also observed among fisher households that were not direct beneficiaries of CCDP but resided in the same villages as the CCDP fisher households. This attests to the positive spillover effects of CCDP on non-beneficiaries residing in the same villages. The strong positive impacts on market access in turn led to increases in incomes from fishing among the CCDP fishers and spillover fishers compared to the comparison group (non-CCDP) fishers.

While the positive productivity and commercialization impacts registered by CCDP beneficiaries and spillover (indirect) beneficiaries are praiseworthy, it is important to highlight the fact that when analysis was performed including households that engaged in other non-fishing economic activities, such as wage employment and services sector jobs, CCDP beneficiaries were then found to have 17 percent lower total net incomes compared to the comparison group households. This is because some of the comparison households engaged in more lucrative non-fishing activities, especially in the downstream value chain and services sectors. Qualitative evidence supported this finding that incomes from non-fishing activities were relatively more lucrative that fishing, e.g. in eco-tourism and other trade and services economic activities that endogenously emerged, thus offering higher incomes compared to traditional artisanal fishing. This finding highlights an important aspect, that labor participation in non-fishing activities, especially in the services sectors, should be supported as an alternative and/or complementary investment area in contexts where rural and structural transformation have taken root, as is the case in coastal communities of eastern Indonesia. In essence, it is possible that had CCDP not engaged some of its beneficiary households in fishing, they may have eventually chosen to move out of fishing and entered these non-fishing sectors where returns to labor are higher. Additional qualitative evidence also shows that a few CCDP beneficiaries ended up leaving the fish sector, even after originally engaging in fishing as CCDP beneficiaries. While these instances were few, it was found that they were now engaging in other services sector jobs e.g. provision of boat transportation or trading of various goods.

A separate and equally important lesson learned, which can be drawn from this impact assessment, is on mainstreaming resilience and social inclusion (gender and youth), into coastal community development projects. The analysis of CCDP's impact on resilience found that beneficiaries were no

more resilient than the comparison group households. Indeed the CCDP beneficiaries seemed to be more prone to shocks and reported being less able to recover from the shocks, when non-fishing beneficiaries were included in the analysis. This emphasizes the need to better integrate resilience in project design and implementation or the need to consider separate and larger projects that are entirely focused on enhancing resilience, especially in contexts where shocks are and will increasingly become prevalent, such as coastal communities of eastern Indonesia. Future project designs would be well-advised to carefully think through how resilience might be enhanced in order to prevent negation of otherwise positive project impacts.

On the issue of women's and youth empowerment, while some positive impacts were registered by CCDP as it relates to increasing the participation of women in community-level groups or associations as well as increased participation in fish and marine product processing, it appears there is much room for improvement. The fact that the same women beneficiaries were found to be no more involved in household-level savings or decision making implies that the gains achieved at the processing group level were not necessarily transferred to gains in empowerment at the household level. Furthermore, CCDP did not explicitly mainstream youth inclusion and as such it was not surprising that not many impacts were recorded on youth empowerment.

Finally, it is encouraging to see that while nutrition was not the primary focus of CCDP, there were positive impacts recorded on nutrition. Household dietary diversity was found to be higher among households benefiting from CCDP compared to non-beneficiaries and this was primarily due to an increase in household consumption of fish and marine products. This highlights the positive impacts that can be generated on nutrition, even when the main focus of the project is commercialization of fisheries and increased engagement in the fish value chain.

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Appendix

Table A1. Impact of CCDP on Total Household Gross Income (for fisher households only)

	N	Treatment POM	Control POM	ATE/SE
Tot. gross HH income (USD)	1 333	29 099.44	23 723.14	5 376.29
	.	.	.	3 805.90
Tot. gross HH income (USD) Trimmed(1 99)	1 312	23 046.45	16 809.40	6 237.05***
	.	.	.	2 131.39
Tot. gross HH income (USD) (winsorized)	1 333	26 616.00	21 059.94	5 556.06**
	.	.	.	2 755.37
Tot. gross HH income (USD) per adult EQ	1 333	7 155.27	5 630.54	1 524.73
	.	.	.	966.33
Tot. gross HH income (USD) per adult EQ (winsorized)	1 333	6 513.25	5 136.18	1 377.07**
	.	.	.	700.73
Tot. gross HH income (USD) per adult EQ (trimmed)	1 312	5 677.55	4 274.28	1 403.27**
	.	.	.	558.94
Tot. gross HH income (USD) (log)	1 333	9.26	9.00	0.26***
	.	.	.	0.08
Tot. gross HH income (USD) (winsorized&log).	1 333	9.25	9.00	0.25***
	.	.	.	0.07
Tot. gross HH income (USD) (trimmed&log).	1 312	9.20	8.96	0.24***
	.	.	.	0.07
Tot. gross HH income (USD) per adult equivalent (log).	1 333	7.85	7.60	0.25***
	.	.	.	0.08

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