



Resilience of Small-Scale Fisheries to COVID-19: A Case Study from North Bali, Indonesia

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Abstract

Globally, small-scale fishing communities are often left behind in terms of economic, social and political research and policymaking. This study aims to fill the gap by investigating impact on, and resilience of Indonesian fisher communities to the COVID-19 pandemic using a case study from North Bali. We developed 10 permeable vulnerability and resilience indicators to interpret COVID-19 impacts on small-scale fishers. Data was collected through semi-structured telephone interviews, in-person interviews, focus group discussion and site visits. We explored the cross-cutting indicators through three categories of health, economics, environment and potential impacts on achievement of the UN Sustainable Development Goals (SDGs). We found that fisher community resilience materialized from social networks, diversified economic opportunities and strong cultural

community-level governance, with villagers adjusting social, economic, and religious behaviors to mitigate spread of COVID-19. Economic resilience emerged through previous experience with economic downturns, job diversification and holistic local financial support systems. Environmentally, community members were familiar with conservation concepts, with existing networks of fisher groups encouraging sustainable practices, however ecological impacts are expected from the shift from deep water fisheries to more unsustainable exploitation of inshore reef fisheries and reduced coastal management. SDGs are impacted through susceptibilities in health infrastructure, minimal control of supply chain and loosely regulated fishing that expose the challenges COVID-19 brings to small-scale fishers. Policy recommendations emerging from this study suggest urgent action is required to strengthen fisher networks to (1) improve transparency and access to markets, especially domestic and direct sales, (2) support fishers in seeking assistance from relevant agencies to secure insurance, financial and other social support to secure their livelihoods, (3) integrate environmental considerations into sustainable recovery and avoid rolling back regulations as a short-term means to stimulate economic growth.

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Keywords

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1 Introduction

The virus first emerging in Wuhan, China, spread globally with a ferocity that has not been seen in recent history and exposed the fragility of social, health and economic systems worldwide. The highly infectious viral strain, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), began transmitting from human to human in late 2019 prompting the World Health Organization (WHO) to designate the outbreak as a health emergency in January 2020. As the virus now known as COVID-19 spread, the status was quickly escalated to pandemic by March 2020 (Hua and Shaw 2020; Shereen et al. 2020). In Indonesia, a national health emergency was declared in March 2020 shortly after the implementation of nationwide social restrictions, Pembatasan Sosial Skala Besar (PSBB) (Djalante et al. 2020). On April 24th 2020, an official travel ban was put in place by the Government of Indonesia to mitigate spread of the virus (Aditya and Suhartono 2020b; Garda World 2020). This ban restricted nonessential travel of citizens as well as imposed regulations affecting import and export of staple commodities in container shipments to and from Indonesia (Akhlas 2020; Rahman 2020) (Fig. 10.1). Supply chains and demand in the fisheries sector suffered from regulations imposed to mitigate virus transmission.

As the largest archipelagic nation, and the second largest fish producer in the world, Indonesia is fisheries dependent with the sector encompassing 2.56% of its GDP in 2016 (CEA 2018; FAO 2018). Most of the wild-captured fish are generated from small-scale fisheries (CEA 2018). In 2017 the Indonesian Ministry of Marine and Fishery Affairs estimated there were 2,700,000 small scale fishers in local waters (KNTI 2020). The pandemic and its socioeconomic knock-on effects are possibly the most severe challenge to Indonesian small scale fisher livelihoods in this

generation. However, Indonesia as a nation and people have a wealth of experience dealing with over 24,000 hazard events in the last 20 years. Known among development practitioners as the “supermarket of disaster hazards” because you can find almost every hazard in Indonesia, Bali and its fishers have faced direct and indirect impacts from bombing, volcano, earthquake and other hazards since 2000 (Vun et al. 2018). In this chapter we explored vulnerability and resilience of small-scale fishers during the COVID-19 pandemic in North Bali, Indonesia, aiming to gain a better understanding of how these communities are impacted and how they respond to the multiple stressors resulting from this global event.

2 Scope and Approach

2.1 Study Location Fisheries in North Bali

The focus area of this research is Les Village in Buleleng district, North Bali (Fig. 10.2). Buleleng District, the largest Province in Bali with an area of 1366 km², stretches from the North-West to the North-East of the Island. The district contains 157 km of coastline with many local economic activities reliant on its marine resources including fisheries (aquarium and food fish), aquaculture (shrimp, fish, seaweed, pearl oyster) and tourism. Seven out of ten sub-districts (Gerogak, Seririt, Banjar, Buleleng, Sawan, Kubu Tambahan and Tejakula) in Buleleng participate in some form of fisheries production (BPS Provinsi Bali 2017). Both seafood and aquarium fisheries trade can be found in the sub-districts of Gerogak and Tejakula.

2.2 Research Framework, Data Collection and Analysis

Community resilience is defined differently by different stakeholders (Patel et al. 2017). For this study, community resilience is understood to be a process of change supported by elements of diversified economic and social systems in place

The Indonesian Covid-19 Emergency Response

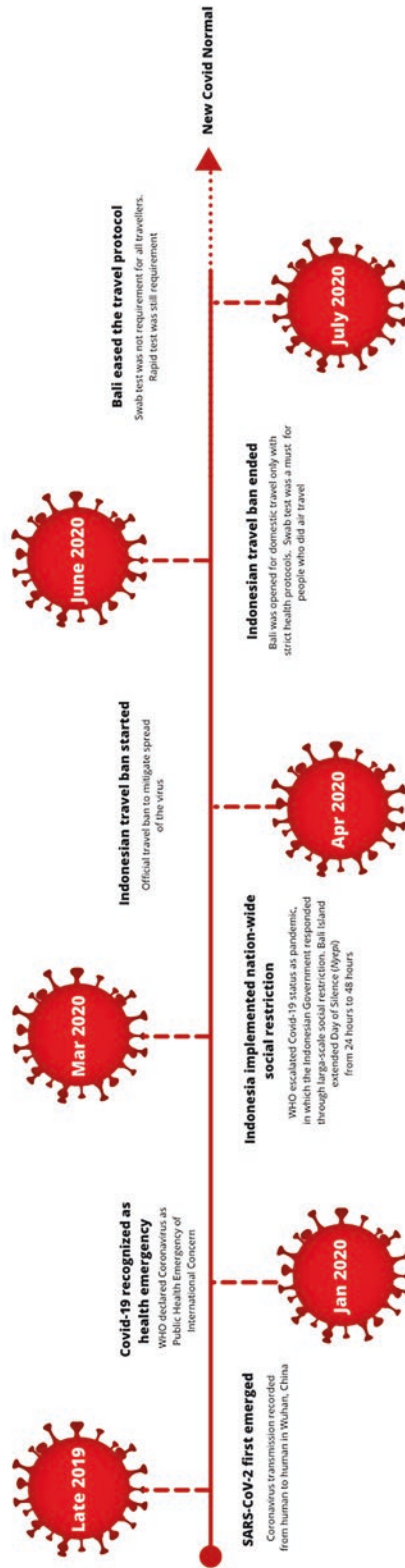


Fig. 10.1 Timeline for the Indonesian response to Covid-19

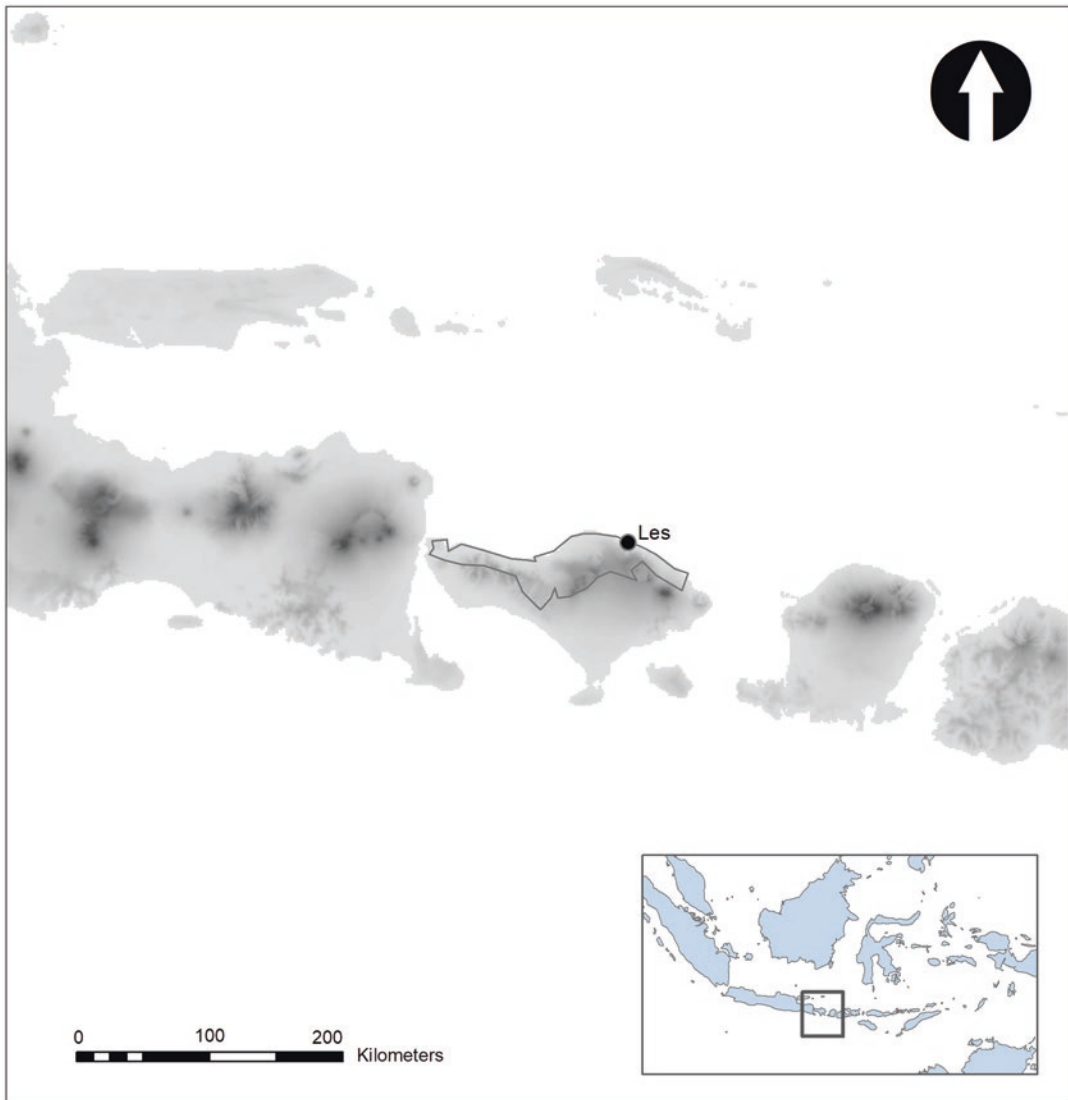


Fig. 10.2 Map of the study region, Buleleng (North Bali, Indonesia) shown in outline, with Les village identified on map

that can not only withstand initial damage, but also recover quickly from impacts, providing a pathway to thriving in post stressor scenarios. In essence, community resilience is the ability of a community to adapt, survive and potentially thrive despite stressors such as a pandemic, natural disaster, or global conflict.

To understand the multifaceted impacts of the pandemic, a cross sectoral review of literature from fisheries management, community development and COVID-19 was used to develop a

research framework. A mesh of influences supported the creation of the resilience indicators developed for this study most notably but not limited to: nine core elements of community resilience identified in Patel et al. (2017), six capital fields described in Stanford et al. (2017) FLIRES check which combines Sustainable Livelihoods Approach with RAPPFISH methodology, application of multilevel resilience lens suggested by Leite et al. (2019), COVID-19 susceptibility scale created in Peters (2020) and

forecasting of virus transmission against health-care capacity in Bali described by Wirawan and Januraga (2020). The preliminary research criteria were based on reoccurring themes throughout the spectrum of literature that indicated potential for resilience and vulnerability, incorporating the nuances of fisheries and COVID-19. The criteria were then tested through initial interviews and refined based on the relevance expressed from the local perspective, resulting in ten indicators which encapsulate resilience and vulnerability to COVID-19 in small-scale fisher communities.

The resulting analysis framework consists of 10 permeable indicators, summarized below, to capture cross-cutting elements of health, economic, social and environmental issues to enable interpretation of COVID-19 impacts on small scale fishers.

Resilience Indicators

1. **Fisher Households** – demographics of fishers, households, and the surrounding community in relation to potential spread and severity of infections

2. **Medical Infrastructure** – takes stock of government healthcare infrastructure and accessibility of services capable of dealing with potential outbreaks and general healthcare

3. **Preparedness** – explores the community experience of engaging with healthcare services prior to COVID-19 and local behavior that can impact community health

4. **Social Adaptability** – evidence of community willingness to adapt social and cultural activity to mitigate impacts of COVID-19

5. **Communication** – considers formal and informal channels used to disseminate information and messaging locally

6. **Historical Data** – examines how local knowledge, community networks and social dynamics can manifest resilience

7. **Household Income Diversification** – considers income opportunities and the diversity of livelihoods locally available

8. **Fisheries Supply and Demand** – focuses on changes in supply and demand impact on the fishing activity

9. **Fisher Income** – direct and indirect financial impacts to ability to generate income from fishing

10. **Financial habits** – saving, debt, assets and access to credit in relation to resilience to COVID-19

The fishers participating in this case study fall under the Indonesian government classification of small scale fishers, who are defined as “fishing to meet daily needs and operating with or without a fishing boat less than 10 gross tonnage (GT), in accordance with Law No. 7/2016 “Protection and Empowerment of Fishers” (Halim et al. 2019). From March to December 2020 our study followed 10 small scale fishers and their family from the village of Les in the Buleleng district of North Bali to capture changes at the community level. An interview guide with key questions built around the indicators was developed and used during monthly check-ins to track changes. Interview questions varied based on the fisher, fishing group association and their target fish. Overall, the fishers were asked what has changed with respect to social and economic norms due to COVID-19 and how the community is navigating the changes. A series of semi-structured telephone interviews were conducted from March to June as lockdowns prevented non-essential travel between villages. From June to December in-person interviews, focus group discussion and site visits were used to collect data.

There are two level of data analysis: (1) Through the lenses of vulnerability and resilience, based on 10 indicators that are broken down into the dimensions of health, economics and environment as they interact with social dynamics during COVID-19 and (2) Considering the results against the United Nations Sustainable Development Goals. The information is finally integrated within evidence-based policy recommendations.

3 Results

Results are interpreted through the ten resilience and vulnerability indicators below.

3.1 Fisher Households

At Les village in North Bali, the fishers range from 30 to 51 years old with an average 23 years of fishing experience. Nine out of the 10 fishers in the case study have attended elementary school with only 1 completing junior high school. The households are multigenerational with an average of 6 people living in a home, 2 of which under the age of 18 and 2 over the age of 57, which is the current retirement age Indonesia. The children under 18, who still live at home, are all attending school, ranging from kindergarten to high school (Fig. 10.3).

3.2 Medical Infrastructure

The nearest hospitals to Les village are located in the Bali’s main cities of Singaraja, 35 km West, and Denpasar, 80 km South (Fig. 10.4). Community health centers (Pusat Kesehatan Masyarakat also known as Puskesmas) and auxil-

iary health services (Pembantu, Mobile and Posyandu) support the main community health centers in areas outside of the hospitals immediate area of coverage (Table 10.1).

Puskesmas, are government mandated community health clinics which provide primary health care services at the sub-district level. Auxiliary health services that support Puskesmas include: Puskesmas Pembantu, Mobile Puskesmas and Posyandu which help to diversify delivery of health services and increase reach. The Puskesmas Pembantu is a smaller version of the standard health center that provides health services only during limited hours, usually from morning to midday. A Mobile Puskesmas is a car or a motorbike equipped with medical equipment and medication which travels once or twice a week to more remote villages. Posyandu (Pos Pelayanan Terpadu) is a specialized health service provider that focuses on specific health services such as maternity-child care, family planning, enhancement of nutrition intake, vaccination, education in basic sanitation and disease prevention information.

Fig. 10.3 Summary of Fisher Household resilience indicator

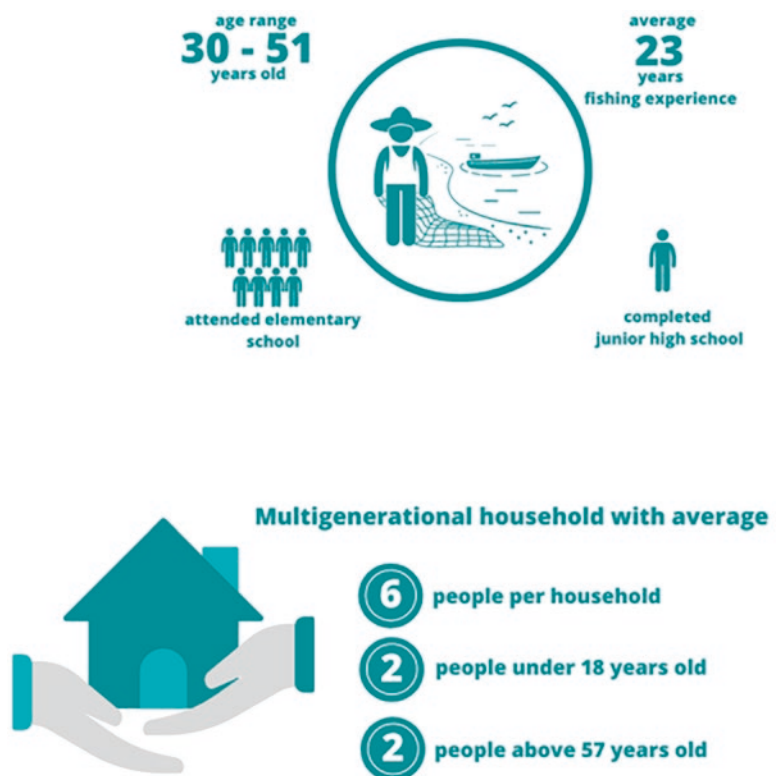


Fig. 10.4 Distance from the study site (Les, North Bali) to major hospitals

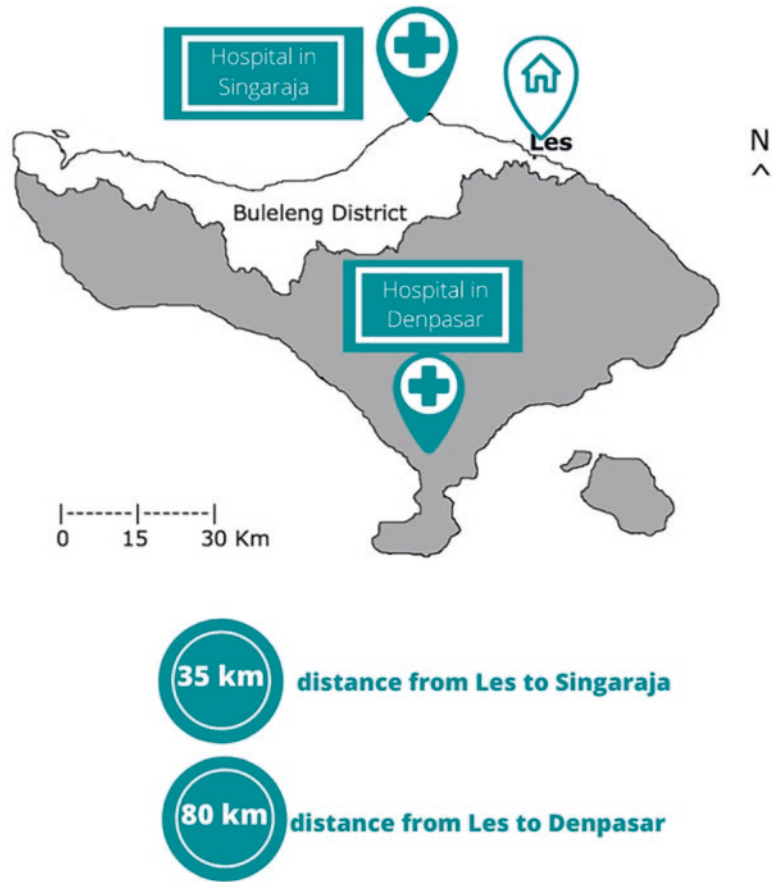


Table 10.1 Population and health access in Tejakula Sub-district (BPS Kabupaten Buleleng 2019) highlighting access to healthcare in relation to population (healthcare facility/1000 population). Grey row illustrates healthcare comparative provision at the study site of Les

Location	Population	Health Facility (per 1000 population)					Paramedic (per 1000 population)	
		Puskesmas	Puskesmas Pembantu	Mobile Puskesmas	Posyandu	General Practitioner	Midwife	Nurse
Tejakula Subdistrict	61342	0.03	0.13	0.11	1.06	0.03	0.28	0.05
Les	8040	0.00	0.12	0.00	1.12	0.12	0.12	0.25

3.3 Preparedness

The Balinese government promotes prevention practices (BPBD Provinsi Bali 2020), which are in line with World Health Organization recommendations. Fishers in this study have a history of maintaining health insurance and utilizing the

nearest health providers whether it be hospital, Puskesmas or auxiliary health support services before the pandemic. Indonesia has a National Health Insurance program JKN (Jaminan Kesehatan Nasional) administered by the Healthcare and Social Security Agency (BPJS). For the employed workers the premium is split by

employer and employee (Heriyanto 2018). The fishers from Les with stable alternative employment (60%) other than fishing, had employer provided health insurance (BPJS Kesehatan). The remaining fishers (40%) have the Indonesian Health Card (KIS), which is a fully subsidized health insurance program under BPJS provided by the Indonesian government to ensure that all Indonesian citizens are protected by comprehensive, fair and equitable health insurance for low income members (Heriyanto 2018).

3.4 Social Adaptability

In Les adjustments to economic, social and religious norms were imposed on locals. The wet markets reduced operating hours from 12 to 8 h daily, as they were identified as potential infection hotspots from end of March to mid-May. Only residents were allowed in and out of the community during April and everyone who passed the checkpoints were required to wash hands. From May essential travel between villages was allowed but the government monitored travel in and out of the community until June.

Celebrations and community gatherings were cancelled during March and April as Bali worked to understand the prevalence of the virus on the island (Erviani 2020; Winterflood 2020). Schools were closed in March once the pandemic risk was recognized by the national government (Dagur 2020). Island-wide schools were closed but, depending on local resources, the classes were moved online to some degree. The elementary schools in Les transitioned online, with the parents responsible for picking up and dropping off assignments once a week. Middle school and high school students had a similar system, picking up and dropping off assignments once a week and studying remotely.

3.5 Communication

Community captures information about the pandemic through personal communication, local government messaging and social media. The

local government disseminates information via signage placed around the community as well as announcements from the Puskesmas. The community was initially made aware of recommended prevention protocol by the local government and Puskesmas through weekly loud-speaker announcements in the morning at the local wet market. Government further reinforces health protocol through banners which are displayed along main roads, police stations and schools in the village. The local Pecalang (traditional community guards) along with police remind and monitor villagers to follow mask wearing protocol at traffic junctions.

The most prevalent source of information is personal interactions using phones and face-to-face communication with friends, family and neighbors who often pass along updates from wet market announcements. The villagers are familiar with social media, commonly used to coordinate events and share news about family and friends. The most used social media platform among fisher households is Facebook. During COVID -19 Facebook posts about news, government announcements and local awareness videos are shared, but infrequently.

3.6 Historical Data

Local fishers hunt for both aquarium and a range of food fish. There are numerous fisher groups in Les and adjacent villages where many fishers are affiliated with more than one fisher group. In North Bali, the most caught food fish are Grouper, Snapper, Fusilier, Mackerel, Scad, Squid, Octopus and Tuna. Traditionally, a variety of fish for consumption can be caught year-round and, depending on the target species, some months are better than others. Most fishers believe that later in the year, from October to December, is the best time to catch the most sought-after food fish. Whereas, the season for aquarium fishing is from March to November, however there is no clear consensus among fishers on fishing seasons.

The practice of marine aquarium fish collection in Les village took off in the 1980s after locals were encouraged by middlemen looking to

export endemic species abroad. The sudden high demand for aquarium fish coupled with unsustainable fishing practices introduced by an influx of more experienced non-local fishers lead to the depletion of local fish stocks and damage of coral reefs by the early 2000s (Frey 2013; Muswar et al. 2019; Pasaribu-Guzina 2013). To counteract the damage to the environment various non-governmental organizations stepped in to help protect the coral reefs and fish stock by introducing sustainable fishing methods around North Bali.

3.7 Household Income Diversification

Fishers in Les are familiar with juggling multiple jobs simultaneously. Pre-Covid all the fishers had at least one alternative income source. Additional income comes from permanent and periodic secondary livelihoods such as alternative target fishing, construction, service, hospitality and tourism with households averaging six members balancing 2–3 income streams. Excluding the fishers, households maintained two additional semi-steady sources of income by working in a rotation of construction, restaurants, and shops.

3.8 Fisheries Supply and Demand

Before COVID-19 middlemen collected aquarium and seafood fish daily and shipped to end customers regularly. However, during COVID-19, the aquarium fish middlemen operate with inconsistent schedules, based on the amount of cargo space for export available. The middlemen during COVID-19 typically purchase fish for 3 days in a row followed by closures for up to a week or longer until cargo space is available again. Aquarium fishing trips have reduced from an average of 24 days a month to 11 days a month in response to a lack of demand.

Food fish is more stable than aquarium fish demand, but there are new market forces creating challenges in selling daily catch. There is a resurgence of fishing for consumption by novice fish-

ers causing an abundance of reef fish at local markets. Additionally, local seafood demand connected to tourism has disappeared and a lack of cold storage has increased instability. The middlemen are hesitant to purchase the daily catch at pre-COVID-19 prices and have adjusted for this risk by purchasing the fish in the same quantity but at a reduced price. The increased abundance of reef fish available in the local market has driven down both demand and price simultaneously.

3.9 Fisher Income

Fisher monthly incomes, before COVID-19, ranged from ~100.00–280.00 USD (1.5–4 million IDR) depending on their skill, ocean conditions, and demand. Income from aquarium trade, compared to previous years, has experiencing a 41% decrease in daily income since April 2020 until the time of writing (December 2020). The value of the seafood caught locally depreciated by as much as 50% in April and May and stabilized at 25% lower than before COVID-19 from June 2020 to date. However, the income earned from seafood fishing varies greatly depending on the target fish. The range of daily income earned among the fishers has reduced from ~17.00–70.00 USD (250 K to one million IDR) to 3.50–17USD (50 K–250 K IDR). This downturn in fish value is most evident in higher value fish, such as tuna, with a price reduction of nearly 50%, dropping from ~2.40 to 1.18 USD (35 K to 17 K IDR) per kg. Before the pandemic, when the weather permitted, tuna fishers could typically earn up to 70.00 USD (one million IDR) per night. The reduction in daily income of fishers in 2020 is illustrated in Fig. 10.5.

3.10 Financial Habits

Commonly the fishers and households in the community work for a daily income. Financial planning beyond daily needs, religious ceremonies and fees related to children's education is not

common practice among fishers. Half of the fisher households habitually save money in a bank, while the remaining fishers choose to save cash in other secure locations or not at all. However, all the fishers expressed difficulty in managing expenses during COVID-19 with 70% claiming it is impossible to save money during the pandemic.

In Indonesia, aside from traditional banks, villages also have access to credit through community financial institutions called Lembaga Perkreditan Desa more commonly known as LPD. LPD is a village government-run savings and loans financial institution. Five out of ten fishers have some form of business-related debt, that predated the pandemic, that they are now responsible for paying off. In the village there are various sources of financial support available that can provide loans to fishers. Sixty percent of the fishers occasionally take out loans to make payments on debt. Additional options to secure credit are available in the village, those the fishers access include fisher groups, friends, family, middlemen, local stores and banks.

4 Discussion

In early 2020 debates surfaced among governments, media, and the public around tradeoffs between health responses to manage the virus and negative economic impacts (Eichenbaum et al. 2020; Fetzer et al. 2020; McFall-Johnsen 2020; Vaitilingam 2020; Verner 2020). Based on this paradigm the indicators in this study are examined through health, economic as well as environment impacts as these are interconnected to fishers' livelihood and Sustainable Development Goals. Although findings are encapsulated in health, environment and economic sections, many indicators are crosscutting shaping resilience and vulnerability simultaneously. For example, increase in villagers fishing provides food security but can also jeopardize local biodiversity by overfishing reef fish. Likewise, a vulnerable health infrastructure can be supported through strong social adaptability to adhere to COVID-19 protocol. Nevertheless, health protocol such as social distancing limits local coastal management leading to build up of trash and unchecked fishing practices.

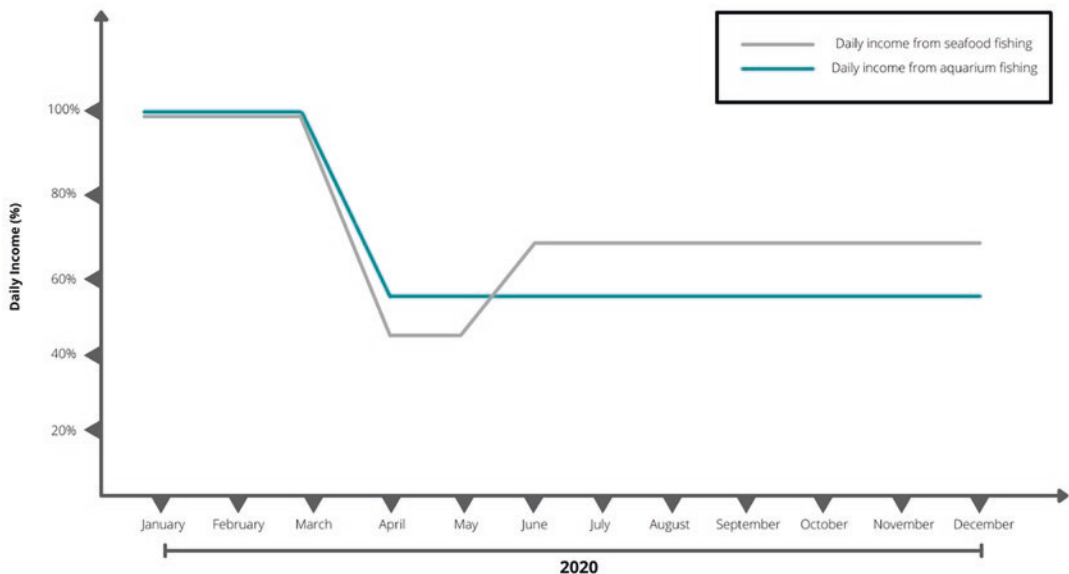


Fig. 10.5 Reduction in daily income of fishers from seafood and aquarium fishing in 2020, based on interviews in Les village, Bali, Indonesia

4.1 Community Vulnerability

4.1.1 Health

The potential for the Indonesian health care system to become overwhelmed from outbreaks is high, based on the low number of medical professionals, infrastructure, and services available in relation to the population (Wirawan and Januraga 2020). In Les, for example, only a single GP attends a population of 8040 (Table 10.1) compared to an average of 3.5 per 1000 population across the OECD. In addition, fisheries as a business, is a high-risk activity in terms of COVID-19 exposure, often requiring extended interaction with other fishers and buyers. The fisher's households with an average of 6 people living together also poses high risk for spread, and challenges to isolate, if someone becomes ill.

Bali, with a population of 4,300,000 (Wirawan and Januraga 2020) before COVID-19, had a total of 6948 hospital beds available on the island with only 446 of those being intensive care unit beds (Wirawan and Januraga 2020). Medical infrastructure, for a population of 61,342 in the Tejakula Sub-district, includes only two Puskesmas and no major hospitals within the sub-district (BPS Kabupaten Buleleng 2019). Before COVID-19 the management of the health system in rural areas was already challenging with staff in the health system network undertaking dual practice, supplementing the lower salary paid to public servants with private practices (Syah et al. 2015). The local dedicated staff of the community health centers often split work between public and private health providers adding to the fragility of an already limited health infrastructure. The high workload of the general practitioners at Puskesmas is a concern since they commonly have double duties as managers and clinicians treating dozens of patients in a day. Due to the low numbers of general practitioners in rural areas the government authorizes midwives and nurses to provide primary care at Puskesmas and auxiliary units (Syah et al. 2015). Children health services in Les were paused during lockdowns, from April to June 2020. Except for prescheduled vaccines, the interruption of the Posyandu service meant that health checks for

infants, and toddlers key services, were not available for community members until June 2020.

The local Puskesmas most notable communication channel with the community is to announce weekly updates and COVID-19 protocol by loud-speaker at the traditional markets in the morning. This announcement from the market is then passed along the community by word of mouth. While this is effective in reaching many people at once, it leaves lots of room for misunderstandings. Currently the wives of the fishermen in the village believe that it safer to buy food and products at the side of the road around the village than in the wet market. The increasing trend of vendors selling produce on the roads, rather than the market, minimizes the number of community members that hear the announcement directly.

4.1.2 Economic

The aquarium fish catch is primarily exported to aquarium businesses abroad, whereas the seafood catch is split between local/regional consumption and export of the higher value fish such as tuna. COVID-19 lockdowns impeded the ability to supply fish abroad because of logistical challenges. A reduction in demand, limited access to buyers and abundance in local supply has damaged small-scale fisheries livelihoods.

As the local fishers explain, the supply chain traditionally has been reliant on the ability of the middlemen to access regional and international markets. The fishers have no direct access to the local collectors or retailers to sell the aquarium fish, so they are economically reliant on middlemen. Tuna which is often sold directly to middlemen that in turn sell to the hotels, restaurants and exporters are purchasing infrequently, or not at all because of lack of cold storage. Daily fishing income decreased by as much as 50% during lockdown, and in the months following the initial lockdown the daily income stabilized at 20–30% lower than income before COVID-19 (Fig. 10.5).

In response to the decline in demand from middlemen the frequency of aquarium fishing has reduced as there is no access to buyers otherwise. Some tuna fishers have chosen to stop fishing altogether until the price of tuna or demand rises to a point that is economically viable, con-

sidering effort and the cost of fuel. Reef fish can be caught and sold daily to local buyers in the village or eaten. Consequently, fishers increased the number of days in a month spent targeting reef fish, creating an abundance in local markets and pushing the value of fish per catch down. The reduction in value of reef fish forces the fishers to collect bigger catches to maintain pre COVID-19 income levels.

4.1.3 Environment

Local risk to the environment that COVID-19 brings is an influx of unemployed adults returning to the village after losing jobs in the tourism and service industry in the city. Fishing activities now have an extra emphasis on catching reef fish for local consumption compared to before COVID-19. This is due to the reduction in demand for traditional catch and unemployed family members returning to their home village and becoming novice fishers to contribute to their households. There has been a significant increase in fishing activity nearshore, with 40% of the participants increasing the number of days in a month they fish for reef fish. Moreover, novice fishers do not have experience of how coral reef ecosystem degradation at Les village has affected biodiversity. The fishers may understand the message of conservation and see its merits but oppose it because it threatens their livelihoods and way of life (Jentoft 2020). The experienced permanent fishers have seen the connection between population decline of targeted species and local extinction of some reef fish such as Blue Tang, Emperor Angel and Blue-face Angel (LINI 2015). Pandemic fishers are a trend island-wide with the pressure on reef fisheries unlikely to reduce until the tourism sector returns.

Even before the pandemic, trash in the ocean had been a global eight million metric ton (NOAA 2021) problem annually. In 2015 Indonesia was identified as the world's second largest contributor to ocean plastic (Jambeck et al. 2015) which directly affects beaches around Bali with tons of plastic arriving annually with the wet season (Mogul 2021). Covid-19 has exacerbated this with the production of personal protective equipment, takeout and delivery packaging. The global

plastic packaging market size is projected to grow from USD 909.2 billion in 2019 to 1012.6 billion by 2021, annual growth rate of 5.5% (Adyel 2020). The pandemic has also limited social gatherings, including beach and underwater clean ups, that communities in North Bali periodically do during non-Covid times. Most communities have not organized a beach cleanup since late 2019 meaning trash has accumulated in many areas, this is additional to reduced ecosystem monitoring and coupled with increased fishing pressure.

4.2 Community Resilience

4.2.1 Health

The various local partial lockdowns from March to June 2020 affected everything from religious ceremonies at temples to the full closure of popular tourist beaches. The Balinese government leveraged strong cultural ties (Aditya and Suhartono 2020a) and community governance in the nearly 1500 villages to limit COVID -19 transmissions. Across the island traditional guards known as Pecalang in Bali, who normally maintain village security and customary ceremonies (Christensen 2013) have been mobilized to monitor travel between communities and enforce other temporary closures such as beaches (Pangestika 2020). Religious leaders along with worshipers have embraced social distancing by limiting access to temples and temporarily stopping ceremonies. During the partial lockdown beginning in April the temples were only open to the priest, with community members encouraged to pray at home. Youth groups supported the effort and coordinated volunteers to secure access points in and out of the village daily. Fishers from the community also supported the youth and Pecalang by joining guard duty.

Many of the vendors who normally have stalls in the traditional market have relocated to roadside locations in recognition that the customers were hesitant to enter markets, due to inability to social distance, and fears of increased risk of infection. There is now a substantial increase in mobile vendors selling items out of their cars,

trucks and even motorbikes along the main roads adjacent to the traditional market. After months of partial lockdown, ending in June 2020, without any major outbreaks the official restrictions have eased allowing daily life to resume with the new normal protocols such as social distancing, mask wearing and remote learning for children. Locals can visit the temple again and the fisher groups are actively organizing around local coastal management issues but limiting physical interaction to distribution of aid to support group's members and biannual meetings connected to major religious ceremonies.

4.2.2 Economic

Small scale fishers in the village are tackling the economic impact of COVID -19 head on. The fishers and many in the community are comfortable with wearing different professional hats, collaborating, and supporting each other during tough times. On average the fishers have 23 years of experience and can trace their tradition of fishing back 3 generations. This legacy of fishing indicates that most fishers have experienced several economic shocks such as the Bali bombing, Mt. Agung erupting and now COVID -19 (Laula and Paddock 2020).

The aquarium fishing season in North Bali typically runs from March to November with these months the most profitable for local aquarium fishers. Unfortunately, in March 2020, global lockdowns impeded Bali fishery exports as the fishing season began, causing an unexpected slump in demand. Although 90% of the fishers participating in this study consider aquarium fishing as their primary livelihood, as a coping mechanism, when faced with previous economic downturns they diversified their income streams. Fishers began targeting food instead of aquarium fish, since there was still a local demand, and taking on day labor opportunities such as construction. Likewise, other working household members transition between tourism, hospitality and other local opportunities available. The average fisher household had three out of six family members employed before COVID-19. As the full impact of the pandemic set in the average number of family members

working fluctuated from three to two working adults, with a significant amount of turnover among those who managed to stay employed. Despite the loss of one income source the households have been able to consistently secure alternative forms of day labor.

An additional layer of resilience for the fishers in our study comes from the various options available to secure credit locally. The village economy has different forms of credit available that allows the fishers to take out loans with favorable and flexible terms that considers local context. The fisher groups are the most common sought-after provider of small loans because of understanding of the sectors challenges. An example of this flexibility during the pandemic is the decision by some of the fisher groups to defer full payments and only collected the interest on outstanding loans.

4.2.3 Environment

The village of Les is fortunate to have had many interventions from local government and non-governmental organizations working with the community to improve coastal management over the course of decades. The traditional fishers have experienced the impact of overfishing and understand the importance of sustainable practices. Past overfishing led to the introduction of more sustainable fishing methods, using barrier and scoop nets, from the early 2000s until today (Frey 2013; Pasaribu-Guzina 2013). Scattered along North Bali there are many coral restoration projects which also help to build a local knowledge with firsthand experience in ecosystem management. Further capacity building on coastal management continues to provide knowledge on destructive fishing practices and coral reef restoration to the fisher groups. Most recent intervention took place in December 2020 implemented by the Indonesian government. The Indonesia Coral Reef Garden was launched in Bali installing artificial structures around the island with 7.4 hectares of reef restoration spread across the Buleleng district, engaging thousands of locals in conservation while injecting temporary income to mitigate the impacts of COVID-19.

Globally tourism has slowed down because of COVID-19, and this translated to a severe drop in arrivals in Bali. Based on projections in 2018 Bali was expected to have 18.2 million tourists visit the island in 2020 (Wood 2018), however the actual number of arrivals was 1.05 million (Statista 2021). According to a National Geographic article published in 2019 the average tourist produces 1.7 kg of trash compared to a local with 0.5 kg of trash per day—and only 50% of that trash is managed properly (Siddharta 2019). The benefit from a reduction of tourist numbers is the decrease of trash produced locally since 2020, but further research is needed to understand the full impact that included increased single use plastic and a reduced focus on coastal management.

5 Conclusion

Resilience materialized from social networks, diversified economic opportunities and strong cultural community level governance with villagers adjusting social, economic, and religious behaviors to mitigate spread of COVID-19. Transformation of activities to adjust to the new ‘COVID-19 normal’ have been supported by religious, government and informal networks creating a community culture built around following health protocols. The ability to utilize social capital and mobilize villagers in implementation of health safety protocols provided a level of stability during difficult times. Mobilization of the Pecalang Balinese traditional guards incorporated the islands cultural governance system, and with it the trust and support of the local communities. The Indonesian health insurance system has been socialized to most of the community and, with that, familiarity, and confidence in the health system.

Economic Resilience has materialized at community level by leveraging previous experience with economic downturns, job diversification and a holistic local financial support system. The experience from previous economic shocks have made transitioning between livelihoods a familiar practice among the fishers, with many even

developing a network of friends they can contact for day labor when fishing is not an option. The fisher groups also support members with favorable terms for loans in times of need providing cushion and further establishing camaraderie within the community.

In terms of the environment, community members are familiar with the concept of conservation and aware of the importance of fisheries management. There is a knowledge base of sustainable fishing practices, and a network of fisher groups that encourage sustainable practices. This is evidenced by fishers and locals in the community coming together during COVID-19 to remove nets left by less experienced and outside fishers, however local interventions such as this have become less frequent with social distancing measures in place. The shift to closer inshore reef fisheries is likely to have had an impact, however long-term impacts are currently unknown. Trash has been a big problem in Bali for many years especially evident on beaches and in the ocean. The reduction in tourists has reduced the amount of trash produced on the island, but the increased use of single use plastic and personal protective equipment pose a threat to coastal ecosystems in the future.

5.1 Implications on the United Nations Sustainable Development Goals (SDGs)

It is of interest to understand how the SDGs might be impacted by the global pandemic from the perspective of small-scale fishers. Based on community vulnerability analysis we found several SDGs potentially impacted (Table 10.2), including SDG1 (Efforts to eradicate poverty), SDG2 (Zero hunger food security and nutrition), SDG3 (Good health and wellbeing), SDG8 (Decent work and economic growth) and SDG 14 (Life below water). The key impacts are through susceptibilities in health infrastructure, minimal control of supply chain and loosely regulated fishing that expose the challenges COVID -19 brings to small scale fishers.

Health vulnerabilities surface around the fragility of the medical infrastructure, and extremely low capacity to respond in case of a COVID-19 outbreak. The allocation of infrastructure and the focus of medical practitioners on the pandemic causes other services to be pushed aside, and could set back Indonesia's overall progress on health (SDG3). In addition, the limited communication strategy using loudspeakers and signage can lead to misunderstandings that damage trust between the government and citizens at a time when compliance is most needed.

Many economic weaknesses to COVID-19 stem from the supply chain and the reliance on tourism (SDG8). Access to buyers is heavily influenced by middlemen, tourism, and international exports that leave the fishers in a weak position to collectively negotiate prices and manage fish stock (SDG2). The lack of budgeting practices at a household level poses a risk to prolonged economic slowdown as savings and credit are used up (SDG1). The compounding effect of low or no savings, with little bargaining power, leaves fishers economically defenseless.

Novice fishers pose a risk of introducing unsustainable and destructive fishing practices to the coastal environment (SDG14). The focus on COVID-19 has taken attention away from standard coastal monitoring and conservation efforts, such as monthly beach cleans to remove plastic pressure on local reefs which have not happened

regularly since the COVID-19 lockdowns were introduced in 2020.

5.2 Policy Considerations

All actions taken to manage the pandemic come with tradeoffs. Most government responses to balance impact of their policies erred on the side of caution with health protocols throttling leniency to maintain economic activity. The most common responses to the pandemic, according to the Oxford COVID-19 Government Response Tracker (Hale et al. 2020), include school closing, travel restrictions, bans on social gatherings, emergency investment in healthcare, new forms of social welfare provision, augment health systems and management of economic consequences of these actions. By the end of 2020 Indonesia appears to have followed suit with the common government responses to address social and economic challenges. According to the World Bank Social Protection and Jobs Responses to COVID-19 report (Gentilini et al. 2020), Indonesia has implemented elements of social assistance such as cash transfers, social insurance and supporting labor market through training. Some of the policies implemented included relaxing terms of loans for informal workers and tax for all workers, eliminating tax completely for lower income earners (WIEGO 2020). However, these high-level solutions may not

Table 10.2 United Nations Sustainable Development Goals (UN SDGs) associated with Resilience Indicators in this study

Resilience Indicators	Health		Economic		Environment		SDGs
	Resilience	Vulnerable	Resilience	Vulnerable	Resilience	Vulnerable	
Fisher Households		x					3
Medical Infrastructure		x					3
Preparedness	x						3
Social Adaptability	x			x	x		3, 8, 14
Communication		x					3
Historical Data			x			x	8, 14
Household Income Diversification			x				8
Fisheries Supply and Demand				x			8, 2
Fisher Income				x	x		2, 14
Financial Habits				x			1

always align with the local context. There is a need to understand specific types of vulnerabilities and allow health officials to plan and allocate accordingly (Peters 2020). Small scale fishers are deeply entrenched in the community, providing food security and stewardship of local marine resources. These fishers need to be engaged when designing responses to not only match their vulnerabilities but leverage resilience.

The policy recommendations that emerge from this study suggest the urgent need to strengthen fishing communities with targeted policies. We suggest action to strengthen fisher networks with the aims of:

- *Improving transparency and access to markets, especially domestic and direct sales.*
The small-scale fishers are removed from buyers by layers of middlemen which take percentages from sales. While middlemen do add value in marketing, the lack of transparency in supply chains reduces competition among middlemen and the negotiation power of fishers. By improving supply chain transparency small scale fishers can take a more active role in supply and demand of fish.
- *Support fishers in seeking assistance from relevant agencies to secure insurance, financial and other social support to secure their livelihoods.*
The extended economic slow-down caused by COVID-19 has drained savings and/or increased the debt of fisher households. The number of small-scale fishers in Indonesia is an estimate which means these informal workers are also at risk of being excluded from government support programs. One pathway for meeting the needs of small-scale fishers would be for local government to provide the fisher groups formal recognition. This would not only be beneficial in getting a clearer idea of numbers of fishers but also information on ecosystem health, fishing practices and local supply chain.
- *Integrate environmental considerations into sustainable recovery and avoid rolling back regulations as a short term means to stimulate economic growth.*

The recently passed Job Creation Act in late 2020 has been met with calls for annulment. Fishers, environmentalist, and law experts claim ‘that the new law also threatens the degradation of Indonesia’s coastal and marine ecosystems for the sake of infrastructure development and tourism’, ‘giving concession or permit to foreign fishing vessels in territorial waters is a very ill-advised policy’ and ‘with the passage of the Job Creation Act, we are looking at ecological apocalypse’, among other strong criticisms (Gokkon 2020). Additionally, waste management has taken back seat to COVID-19 focused policy. Strengthening the waste management systems should be included in the COVID-19 recovery strategy as the increase in associated plastic waste will eventually find its way to the ocean. Addressing this could also be the opportunity to create green jobs.

References

- Aditya, A., & Suhartono, H., 2020a. How Bali escaped being virus hot spot with local traditions. <https://www.bloomberg.com/news/articles/2020-05-14/how-bali-escaped-being-a-virus-hot-spot-with-village-traditions>. Accessed 14 June 2020.
- Aditya, A., & Suhartono, H., 2020b. Indonesia bans annual holiday exodus to combat virus spread. <https://www.bloomberg.com/news/articles/2020-04-21/indonesia-bans-mass-travel-ahead-of-eid-festival-to-combat-virus>. Accessed 23 April 2020.
- Adyel, T. M., 2020. Accumulation of plastic waste during COVID-19. *Science Magazine* Vol. 369 Issue 6509
- Akhlas, A. W. 2020. Trade data point to severe economic contraction in Q2: Economists. Accessed <https://www.thejakartapost.com/news/2020/06/16/trade-data-point-to-severe-economic-contraction-in-q2-economists.html>. Accessed 25 July 2020.
- BPBD Provinsi Bali. 2020. *Provinsi Bali Tanggap Covid-19*. <https://infocorona.baliprov.go.id/>. Accessed 10 October 2020.
- BPS Kabupaten Buleleng. 2019. *Kecamatan Tejakula dalam angka 2019*. <https://bulelengkab.bps.go.id/publication/download.html?nrbvfeve=NzU4MzcwMGY3MWE2MWFhZTZQyMjRiMTA&xzmn=aHR0cHM6Ly9idWxlbGVuZ2thYi5icHMuZ28uaWQvcHVibGljYXRpb-24vMjA0OS8wOS8zMC83NTgzNzAw-ZjcxYTYxYWFINDIYNGIxMDMva2VjYW1h>

- dGFuLXRlamFrdWxhLWRhbGFtLWFuZ2thLTI-wMTkuaHRtbA%3D%3D&twoafnoarfeau=MjAyMC0wNS0yNSAxMDoyMT0zOQ%3D%3D. Accessed 25 May 2020.
- BPS Provinsi Bali. 2017. *Provinsi Bali dalam angka 2017*. <https://bali.bps.go.id/publication/2017/08/11/85bf7f9f0d2826ed2a8b2f74/provinsi-bali-dalam-angka-2017.html>. Accessed 26 June 2020.
- CEA. 2018. *Trends in marine resources and fisheries management in Indonesia*. <https://www.packard.org/wp-content/uploads/2018/08/Indonesia-Marine-Full-Report-08.07.2018.pdf>. Accessed 24 April 2020.
- Christensen, P., 2013. Keeping the peace. <https://www.bali-advertiser.biz/pecalang/>. Accessed 23 October 2020.
- Dagur, R., 2020. Widodo imposes lockdown on Indonesian schools, universities. <https://www.ucanews.com/news/widodo-imposes-lockdown-on-indonesian-schools-universities/87463#>. Accessed 23 April 2020
- Djalante, R., Lassa, J., Setiamarga, D., Sudjatma, A., Indrawan, M., Haryanto, B.,... Warsilah, H., 2020. Review and analysis of current responses to COVID-19 in Indonesia: Period of January to March 2020. *Progress in Disaster Science*, 6, 100091. <https://doi.org/10.1016/j.pdisas.2020.100091>
- Eichenbaum, M., Rebelo, S., Trabandt, M., 2020. The trade-off between economic and health outcomes of the COVID-19 epidemic. <https://voxeu.org/article/trade-between-economic-and-health-outcomes-covid-19-epidemic>. Accessed 13 April 2021
- Erviyani, N. K., 2020. No 'ogoh-ogoh' parades, large crowds during Nyepi this year. <https://www.thejakartapost.com/news/2020/03/24/no-ogoh-ogoh-parades-large-crowds-during-nyepi-this-year.html>. Accessed 25 March 2020.
- FAO. 2018. *The state of world fisheries and aquaculture 2018*. <http://www.fao.org/3/i9540en/I9540EN.pdf>. Accessed 27 March 2020.
- Fetzer, T., Witte, M., Hensel, L., Jachimowicz, J., Haushofer, J., Ivchenko, A., ... Yoeli, E., 2020. Perceptions of an insufficient government response at the onset of the COVID-19 pandemic are associated with lower well-being. <https://doi.org/10.31234/osf.io/3kfmh>
- Frey, J., 2013. A community-based approach to sustainable aquarium fishing on coral reefs, Bali, Indonesia. https://mspace.lib.umanitoba.ca/bitstream/handle/1993/15162/frey_james.pdf?sequence=1. Accessed 14 May 2020.
- Garda World. 2020. Indonesia: Government bans all air travel April 24—June 1 due to COVID-19. <https://www.garda.com/crisis24/news-alerts/335586/indonesia-government-bans-all-air-travel-april-24-june-1-due-to-covid-19-update-19>. Accessed 27 July 2020.
- Gentilini, U., Almenfi, M., Dale, P., Palacios, R., Natarajan, H., Rabadan, G. A., ... Santos, I., 2020. Social protection and jobs responses to COVID-19: A real time review of country measures. <http://documents1.worldbank.org/curated/en/295321600473897712/pdf/Social-Protection-and-Jobs-Responses-to-COVID-19-A-Real-Time-Review-of-Country-Measures--September-18-2020.pdf>. Accessed 10 March 2021
- Gokkon, B. 2020. Indonesia's new deregulation law to hurt small fishers, coastal communities. <https://news.mongabay.com/2020/10/indonesias-new-deregulation-law-to-hurt-small-fishers-coastal-communities/>. Accessed 13 April 2021
- Hale, T., Baby, T., Angrist, N., Cameron-Blake, E., Hallas, L., Kira, B., ... Webster, S., 2020. Variation in Government responses to COVID-19. <https://www.bsg.ox.ac.uk/covidtracker>. Accessed 10 March 2021
- Halim, A., Wiryawan, B., Loneragan, N. R., Hordyk, A., Sondita, M. F. A., White, A. T.,... Yuni, C., 2019. Developing a functional definition of small-scale fisheries in support of marine capture fisheries management in Indonesia. *Marine Policy*, 100, 238-248. <https://doi.org/10.1016/j.marpol.2018.11.044>
- Heriyanto, D., 2018. Q&A: BPJS Kesehatan, health for all Indonesians. <https://www.thejakartapost.com/academia/2018/04/06/qa-bpjs-kesehatan-health-for-all-indonesians.html>. Accessed 7 March 2021.
- Hua, J., & Shaw, R., 2020. Corona virus (Covid-19) "infodemic" and emerging issues through a data lens: The case of china. *International journal of environmental research and public health*, 17(7), 2309. <https://doi.org/10.3390/ijerph17072309>
- Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., Narayan, R., Law, K. L., 2015. Plastic waste inputs from land into the ocean. *Science Magazine* Vol. 347 Issue 6223
- Jentoft, S., 2020. Life above water: small-scale fisheries as a human experience. *Maritime Studies* 19.4: 389-397
- KNTI. 2020. Covid-19 outbreak: Socio-economic impact on small-scale fisher and aquaculture in Indonesia. <https://focusweb.org/covid-19-outbreak-socio-economic-impact-on-small-scale-fisher-and-aquaculture-in-indonesia/>. Accessed 19 May 2020
- Laula, N., & Paddock, R. C., 2020. With tourists gone, Bali workers return to farms and fishing. <https://www.nytimes.com/2020/07/20/world/asia/bali-tourism-coronavirus.html>. Accessed 7 August 2020.
- Leite, M., Ross, H., & Berkes, F., 2019. Interactions between individual, household, and fishing community resilience in southeast Brazil. *Ecology and Society*, 24(3), 2. <https://doi.org/10.5751/ES-10910-240302>
- LINI. 2015. *A survey of marine aquarium fishers' livelihoods in North Bali*. <https://www.aquariumfish.org/wp-content/uploads/LINI-report-A-survey-of-marine-aquarium-fishers-livelihoods-in-North-Bali.pdf>. Accessed 14 May 2020.
- McFall-Johnsen, M., 2020. The coronavirus pandemic presents an unprecedented challenge to the world's nations: Choose between economy and health. <https://www.businessinsider.com/coronavirus-forces-nations-to-choose-between-economy-and-health-2020-3?r=US&IR=T>. Accessed 13 April 2021
- Mogul, R., 2021. Bali's Kuta Beach cleared of tons of plastic waste. <https://edition.cnn.com/travel/article/bali-beach-trash-intl-hnk/index.html>. Accessed 13 April 2021

- Muswar, H. S., Satria, A., & Dharmawan, A. H., 2019. *Political Ecology Analysis on Marine Aquarium Fish Eco-labelling in Les Village, Bali, Indonesia*. https://www.researchgate.net/publication/330999059_Political_Ecology_Analysis_on_Marine_Aquarium_Fish_Eco-labelling_in_Les_Village_Bali_Indonesia. Accessed 14 May 2020
- NOAA, 2021. A guide to plastic in the ocean. <https://oceanservice.noaa.gov/hazards/marinedebris/plastics-in-the-ocean.html>. Accessed 13 April 2021
- Pangestika, D., 2020. Bali relies on local customs in facing COVID-19 outbreak: Governor. <https://www.thejakartapost.com/news/2020/05/12/bali-relies-on-local-customs-in-facing-covid-19-outbreak-governor.html>. Accessed 14 May 2020.
- Pasaribu-Guzina, S. S. M., 2013. Assessment of an environmentally-friendly method of aquarium fishing associated with revenues of fishers in Tejakula sub-district, Buleleng region, Bali, Indonesia. https://central.bac-lac.gc.ca/item?id=TC-BRC-641&op=pdf&app=Library&oclc_number=I033223847. Accessed 14 May 2020.
- Patel, S. S., Rogers, M. B., Amlôt, R., & Rubin, G. J., 2017. What do we mean by 'community resilience'? A systematic literature review of how it is defined in the literature. *PLoS currents*, 9. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5693357/>. Accessed 14 May 2020
- Peters, D. J., 2020. Community susceptibility and resiliency to COVID-19 across the rural-urban continuum in the US. *Journal of Rural Health*. https://ruralopoids.soc.iastate.edu/wp-content/uploads/sites/210/2020/06/Peters_2020_JRuralHealth_COVID19.pdf. Accessed 13 April 2021
- Rahman, D. F., 2020. Bulog struggles to import staple food as producing countries cap exports. <https://www.thejakartapost.com/news/2020/04/13/bulog-struggles-to-import-staple-food-as-producing-countries-cap-exports.html>. Accessed 23 April 2020.
- Shereen, M. A., Khan, S., Kazmi, A., Bashir, N., & Siddique, R., 2020. COVID-19 infection: origin, transmission, and characteristics of human coronaviruses. *Journal of Advanced Research*. <https://doi.org/10.1016/j.jare.2020.03.005>
- Siddharta, A. T., 2019. Bali fights for its beautiful beaches by rethinking waste, plastic trash. <https://www.nationalgeographic.com/science/article/bali-fights-for-its-beautiful-beaches-by-rethinking-waste-plastic-trash>. Accessed 13 April 2021
- Stanford, R. J., Wiryawan, B., Bengen, D. G., Febriamansyah, R., & Haluan, J., 2017. The fisheries livelihoods resilience check (FLIRES check): A tool for evaluating resilience in fisher communities. *Fish and Fisheries*, 18(6), 1011-1025. <https://doi.org/10.1111/faf.12220>
- Statista. 2021. Number of foreign tourist arrivals to Bali, Indonesia from 2011 to 2020 (in millions). <https://www.statista.com/statistics/976842/foreign-tourist-arrivals-numbers-bali-indonesia/>. Accessed 13 April 2021
- Syah, N. A., Roberts, C., Jones, A., Trevena, L., & Kumar, K., 2015. Perceptions of Indonesian general practitioners in maintaining standards of medical practice at a time of health reform. *Family practice*, 32(5), 584-590. <https://doi.org/10.1093/fampra/cm057>
- Vaitilingam, R., 2020. How does economic policy interact with public health measures for COVID-19?. <https://review.chicagobooth.edu/economics/2020/article/how-does-economic-policy-interact-public-health-measures-covid-19>. Accessed 13 April 2021
- Verner, E., 2020. Public health interventions in the COVID-19 pandemic can help the economy recover. <https://www.bostonglobe.com/2020/04/13/opinion/public-health-interventions-covid-19-pandemic-can-help-economy-recover/>. Accessed 13 April 2021
- Vun, J., Stanton-Geddes, Z., Sudarmo, S. P., Kryspin-Watson, J., 2018. Safeguarding Indonesia's development from increasing disaster risks. <https://blogs.worldbank.org/eastasiapacific/safeguarding-indonesia-development-increasing-disaster-risks#:~:text=The%20country%20is%20known%20as%20having%20a%20%E2%80%98supermarket%E2%80%99,million%20people%2C%20and%20damaged%20over%204.3%20million%20houses>. Accessed 13 April 2021
- WIEGO. 2020. Government responses to COVID-19 crisis. <https://www.wiego.org/government-responses-covid-19-crisis>. Accessed 10 March 2021
- Winterflood, J., 2020. Culture vs Corona: How Balinese Hindus are responding to restrictions on ceremonial life. <https://coconuts.co/bali/features/culture-vs-corona-how-balinese-hindus-are-responding-to-restrictions-on-ceremonial-life/>. Accessed 23 April 2020.
- Wirawan, I. M. A., & Januraga, P. P. (2020). Forecasting COVID-19 Transmission and Healthcare Capacity in Bali, Indonesia. *Journal of Preventive Medicine and Public Health*, 53(3), 158. <https://doi.org/10.3961/jpmph.20.152>
- Wood, R., 2018. Bali set to host 18.2 million visitor in 2020, more than 4 times its population. <https://www.hospitalitynet.org/news/4089844.html>. Accessed 13 April 2021