# Effect of Covid-19 pandemic on shrimp farming at Navsari (Gujarat)

**Abstract**

The lockdown on account of the Coronavirus disease 2019 (COVID-19) adversely impacted the food production sector including aquaculture, globally. Unfortunately, it coincided with the major shrimp farming season in India which contributes 60% of the national annual shrimp production hence the impact was substantial. Survey was carried out among the respondents of the shrimp farming sector to evaluate the effect of COVID-19 pandemic on shrimp farming at Navsari (Gujarat). Respondents faced severe constraints in shrimp feed and seed production and supply, probiotics and medicine supply, disruptions in the supply chain and transportation, farming, harvesting, marketing and loss of employment and income for the workers due to the pandemic. These results showed that shrimp farmers in the studied area suffered from huge economic losses in pandemic situations as they do not have any shrimp crop insurance which cover losses as well as government do not provide any technical guidance to sustain in shrimp farming. It is suggested to the authorities to provide the government assistance to farmers regarding safe and hygienic supply of seed, feed, probiotics, chemicals, medicines as well as probiotics to enhance the aquaculture production. The result of such study also help to authorities to develop the plans and policies for shrimp farmers during such pandemic situation to decrease loss and to sustain in shrimp farming industry.

**Keywords:** Aquaculture, COVID-19 pandemic, Shrimp farming, Probiotics, Medicines

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## 1. Introduction

The term aquaculture broadly refers to the cultivation of aquatic organisms in controlled aquatic environments for any commercial, recreation or public purpose. The breeding, rearing and harvesting of plant and animals takes place in all types of water environment including ponds, rivers, lakes, the ocean and man-made "closed" systems on land [1]. Aquaculture is the practice of farming seafood. Aquaculture contributed 43 percent of aquatic animal food for human consumption in 2007 and is expected to grow further to meet the future demand. Global aquaculture has grown dramatically over the past 50 year to around 52.5 million tons in 2008 worth US$98.5 Billion and accounting for around 50 percent of the world's fish food supply. [2].

India is important country that produces fish through aquaculture in the world. Brackish aquaculture production in the country largely on account of shrimp farming is estimated that out of about 1.23 million ha recognized as potential areas for brackish water fish farming in the country 10% area is being farmed at percent of this area, about 80% is under traditional farming systems and the remaining is under extensive farming and semi extensive shrimp farming. Farmed shrimp accounts for 55 % of the shrimp produced globally. Shrimp farming provides direct employment to about 0.3 million people and ancillary units provide employment for 0.6 to 0.7 million people in our country [3]. The brackish water sector includes the culture of shrimp varieties primarily, the native giant tiger prawn, *Penaeus monodon* and exotic white-leg shrimp, *Litopenaeus vannamei*. Today, *Litopenaeus vannamei* species is the most extensively farmed crustacean species in the world [4].

Gujarat is one of the emerging shrimp producer State of India which has 1600 km long coastline and owns rich brackish water resources, a large suitable shrimp farming area, freezing plants, peeling sheds etc. Gujarat contributed about 2.80 percent of national shrimp production, in spite of having 2$^{nd}$ largest brackish water area only after west Bengal. The area under shrimp aquaculture in Gujarat was 2059 hectare from which it produced 6064 MT of shrimp during the year 2011-12 [5].

The corona virus disease (COVID-19) first reported from Wuhan, China in December 2019 has been declared as a public health emergency of international concern and the virus has spread to almost all the countries. It has infected approximately 22.86 million people worldwide and about 0.78 million people lost their lives as on 20$^{th}$ august 2020. In India, around 2.77 million people were diagnosed positive for COVID-19 and 53,000 people lost their lives by the end of august 2020 [6].

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The COVID-19 pandemic affecting the agricultural activities including fish and shrimp culture sector. Most of the shrimp producing countries particularly in south-east Asia have been affected due to the lockdown, quarantine rules and regulations ordered by the countries, which was assigned to reduced and control the COVID-19 pandemic spreading in the globes. The establishment of the restriction and quarantine roles has significantly reduced the domestic and international transportation that can seriously affect the shrimp supply chain in the world. Further, the labor shortage, delay in shrimp harvesting and insufficient supply for the processing of shrimp in the plants are other impacts due to corona virus outbreak [7].

The COVID-19 pandemic will severely dampen global shrimp production in 2020, with worldwide demand for fresh and frozen shrimp declining significantly. In Asia, the early season's farming activities slowed down considerably with lower density of stocks and delayed stocking of ponds in most producing countries. As of early May 2020, pond stocking in India's largest vannamei producing state Andhra, declined by 60 percent compared to the same period of last year. The aquaculture season in Asia, which generally begins in April, is now pushed towards June/July. In addition to raw material shortages in the producing countries, social distancing rules and other control measures adopted to combat the COVID-19 pandemic continue to hamper processing and shipments of the existing import orders [8]. After the India's lockdown in March put the summer shrimp season in jeopardy, researchers estimate that the shrimp industry could face a $1.5 billion loss for 2020-2021 [8].

India's annual shrimp feed requirement is about 12-13 lakh tones, most of it is produced by 8-10 major companies located mostly in the state of Andhra Pradesh and Tamil Nadu, and few from Gujarat, Haryana and West Bengal. Barring the minor glitches during the first week of lockdown, feed mills resumed their production to the near normal period except the issues related to labour and transportation which hindered the timely supply. Since feed mills are totally dependent on the demand from farming operations, poor stocking activity, both in term of farming area and stocking densities in the farms led to the scaling down of feed production. Further, lockdown affected the movement of raw materials such as fish meal, soybean meal and other specialized inputs such as fish oil, krill meal etc., compelling the feed mills to curtail their production capacities. Similarly, shrimp healthcare products including nutritional supplements, probiotics and pond management inputs are crucial for successful shrimp farming. Based on the reports on marketing trends, lockdown is expected to reduce the sale of feed and healthcare products and employment. Professional support from the input dealers in the areas of feed, health and pond management to farmers was also interrupted due to restrictions in their movement, under lockdown [9]. It is important to highlighting the fact that

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informal supply chains are facing greater impacts due to the lack of formal contractual relationship (no established cold chain or insurance, among others). Another consequence of the virus outbreak, linked to global trade, is the cancellation of key seafood trade events across the world [10].

## 2. Materials and Methods

**Study area:** The study was conducted in Onjal, Karadi, Samapor, Matwad, Menther-Bhat villages of Navsari, Gujarat (Fig. 1).The areas have been identified as shrimp farming areas and hence selected for the study.

**Survey methodology:** The information regarding impact assessment of COVID-19 on shrimp farming was collected from respondents through questionnaire which was prepared to follow the [11] and data were collected through personal interview of shrimp farmers .Total 64 respondents were interviewed and analyzed for current study.

**Data processing and analysis:** The data which were collected from study area were processed, analysed and graphical interpretated by Microsoft Excel 2010.

## 3. Results and Discussion

The pandemic related disruption adversely affected the shrimp farming in study area. Overall impacts of COVID19 pandemic and pandemic induced lockdown on the shrimp farming were estimated based on the response of the farmers.

### 3.1 Problems faced by the farmers in shrimp farming

#### 3.1.1 Seed supply

The results (Fig.2) indicated that (n=39) respondents faced problems in unavailability of seed during COVID-19 lockdown. The impact of COVID-19 lockdown adversely affected the shrimp hatcheries. The seed produced by the shrimp hatcheries before lockdown which should have been ideally sold to the farmers during lockdown but could not be sold due to total disruption in transportation. As result most of the shrimp hatchery discarded the available seed stock. The16 billion larvae were produced in India by March 2020, of which some 1 to 1.5 billion PL were discarded by the hatchery operators during lockdown due to decreasing demand by the farmers (CIBA, 2020). Respondent (n=43) faced problem of high cost. Respondents (n=28) faced problem in breakdown of seed supply chain. Most of the hatchery prepare the seed but due to the sudden lockdown seeds are not transported in shrimp farming regions. Non-availability of seed and feed due to cost transportation increased resulted severe constraints of seed in shrimp farming business reported by [12].

#### 3.1.2 Feed supply

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The results (Fig.3) revealed that the respondents (n=25) met problems with unavailability of feed. During covid-19 pandemic lockdown transportation was closed and all interstate and intra state transportation were disturbed. Feed is an important criteria for sustainability of shrimp farming. Respondents (n=12) have faced the hurdle of the scarcity of feed supply as feed mills were closed during lockdown. Respondents (n=14) faced problem in high cost of feed supply due to the demand of feed in shrimp farming during covid-19 pandemic. Similar results were found by [12, 13].

**3.1.3 Probiotics supply**

The results (Fig.4) explained that respondents (n=11) admitted problem in unavailability of probiotics while same number of respondents faced problems of breakdown of supply chain. On other side, respondents (n=6) faced problem in high cost. The global lockdown has put much pressure on the supply chain of transportation. Till date no data was found on this. This study is done first time particularly in this study area.

**3.1.4 Medicine and chemical supply**

The results (Fig.5) revealed that respondents (n=11) faced problem in unavailability of medicine and chemical supply while respondents (n=7) faced problems of breakdown of supply chain. Due to the covid-19 pandemic lockdown transportations were closed all over the country. Till date no data was found on this. This study is done first time particularly in this study area.

**3.2 Problems in harvesting**

The results (Fig.6) showed that the most of the respondents (n=55) confronted problem in harvesting due to the lack of unavailability of workers. During COVID-19 pandemic lockdown all the migrant workers have returned to their home/state due to fear of infection and lack of salary. There are respondents (n=17) reported that they didn't have any accessories such as gear. Findings of current study revealed that farmers faced problems in shrimp harvesting due to unavailability of labour that evident by [6] which reported that manpower shortage at farm and non-availability of skilled technician at shrimp hatcheries due to pandemic restrictions in the movement or transportation.

**3.3 Problems in post-harvesting preservation**

The results (Fig.7) denoted that the most of the respondents admitted problems in preservation. Respondents (n=40) have inadequate storage facilities. Respondents (n=13) have inadequate ice facilities due to the lack of transportation. Respondents (n=1) faced problems in breakdown of cold chain due to the covid-19 pandemic lockdown. Findings of present study supported by [6].

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### 3.4 Problems in transportation

The results (Fig.8) revealed that the most of the respondents (n=18) accepted problems in transport facilities. Inadequate facilities are seen during lockdown. During lockdown, all the public transportations are closed. Respondents (n=24) faced problem in high transportation cost. Same number of respondents have inadequate manpower at study area as Government implemented strict rules for the transportation during pandemic lockdown 2020. Similar findings were noted by [7, 14].

### 3.5 Problems in marketing

The results (Fig.9) specified that during marketing of shrimp, farmers faced problems like fluctuation in price (n=58), low price offered by buyer (n=51), decreased domestic demand (n=1), close of domestic market (n=2), decreased international demand (n=17), close of international market (n=13) and delayed in payment or no advanced payment (n=32). R1234 espondents experienced fluctuation in price, maybe it happened because all the import and export of farmed shrimp are closed. Respondents faced these problems mainly due to restriction in importing seed production, the supply of farm inputs, processing and marketing of shrimp. According to [15] investigated the most common issue of low market pricing which was the source of concern for shrimp farmers, especially in the wake of the pandemic similarly shrimp prices in the local and worldwide markets fluctuate dramatically because of inconsistencies in the supply chain [16]. In pandemic lockdown period for COVID-19 the restrictions on transportation and other human activities are imposed which is resulted that wholesale fish market was totally closed and significantly impacted on shrimp sale and income of shrimp farmers.

### 3.6 Disease infestation in shrimp

Majority 67% respondents observed disease in shrimp while 33% respondents did not found disease in shrimp during COVID-19 lockdown (Table 1). COVID-19 pandemic lockdown affected the transportations and the supply chain of probiotics, medicine and chemicals. Till date no data was found on this. This study is done first time particularly in this study area.

### 3.7 Availability of sufficient farm workers

63% respondents have lacking of sufficient farm workers during/after lockdown while 37% respondents have sufficient farm workers (Table 1). Shrimp farming has two major seasons in India viz., summer crop (March-April to June-July) and the winter crop (July-August to November-December). Unfortunately, the lockdown coincided with the main cropping season. Most of the farmers were not able to do stocking in March-April due to

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uncertainty of good quality seed and lacking of farm workers. Similar results were published by [17].

**3.8 Government assistance for farming**

Majority 100% respondents did not have any government assistance for farming during this study (Table 1). Findings of present study are supported by [13].

**3.9 Organization or institutions provide guideline to sustain in shrimp farming**

53% respondents did not find any government assistance for farming while 47% respondents found government assistance for farming during this study (Table 1). According to [18], there were no significant changes found in technical guidance regarding shrimp farming.

**3.10 Alternative for livelihood**

Study showed that victimised farmers (45%) thinking to adopt alternative livelihood to sustain the life while 55% farmers were not thinking the same (Table 1). Similar findings were recorded by [13].

**3.11 Insurance policy covered the COVID-19 pandemic**

Majority of respondents (100%) neither have any crop insurance nor covered COVID-19 pandemic losses. Most of the farmers did not have crop insurance policy because they were thinking that it is difficult and time-consuming process (Table 1). With support of this study [19] reported that 91.7% respondents were not having risk coverage insurance. Insurance policy is one of the major factor. Most of the farmers faced huge economic losses in pandemic situations and not recovered from it due to ignorance of an insurance policy.

**4. Conclusion**

On the basis of results it is clearly concluded that Panic situation aroused due to COVID-19 pandemic which badly impacted the aquaculture sector. Shrimp farming operation were negatively affected due to delay in the farming inputs like seed, feed, medicine, chemicals and probiotics. The quarantine rules and regulations in nationwide during pandemic affected transport facilities, migration of labour cause the unavailability of workers and stop the national or international market and marketing facilities resulted negative effect on shrimp marketing and pricing. The overall shrimp production and income was greatly reduced and that of the livelihood was noticeably threatened during the COVID-19 pandemic. The study recommended that procurement of shrimps for domestic consumption is needed at government fixed price. The small farmers should be provided viable insurance cover to mitigate risk in shrimp farming. The state government should take initiatives to support the farmers and ensure uninterrupted operation in aquaculture sector.

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**Competing interests**

Authors have declared that no competing interests exist.

**Authors' Contributions**

The first author a (NPS) helped in sample analysis and manuscript writing while author b (NCU) was involved as research guide and helped in manuscript reviewing and editing whereas third author c (URP) is involved in fish samples collection. All authors read and approved the final manuscript.

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Table 1. Farmers' detail during COVID19 pandemic

| Sr. No. | Details | Respondents' response | |
|---|---|---|---|
| | | Yes (%) | No (%) |
| 1. | Disease infestation in shrimp | 67% | 33% |
| 2. | Availability of sufficient farm workers | 37% | 63% |
| 3. | Government assistance for farming | --- | 100% |
| 4. | Organization or institutions provide guideline to sustain in shrimp farming | 47% | 53% |
| 5. | Alternative for livelihood | 45% | 55% |
| 6. | Insurance policy covered the COVID-19 pandemic | --- | 100% |

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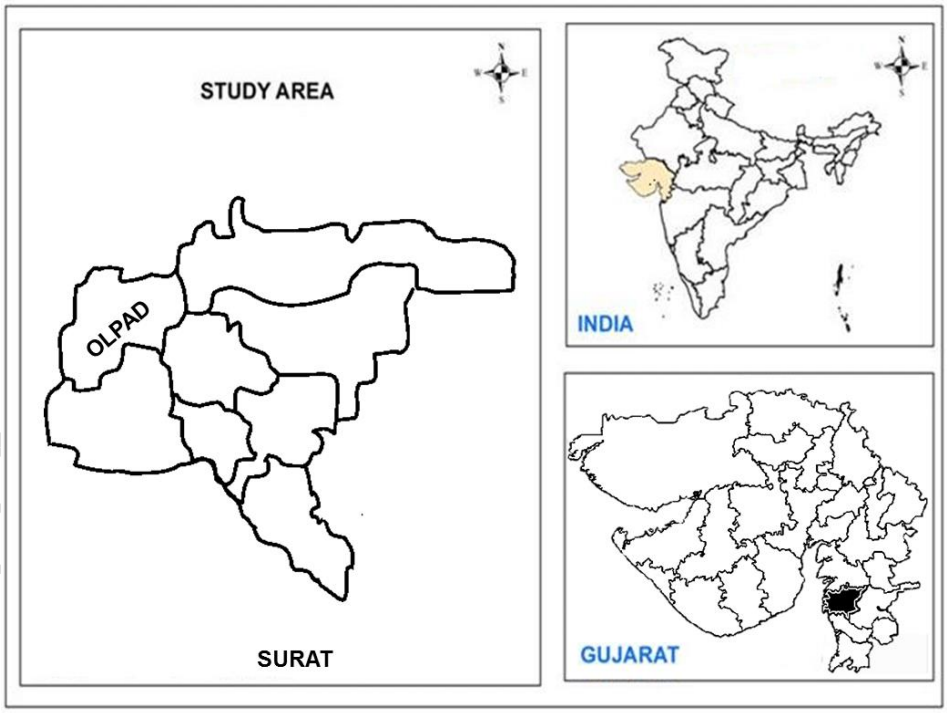


Figure 1. Map of the study area (Navsari, Gujarat)

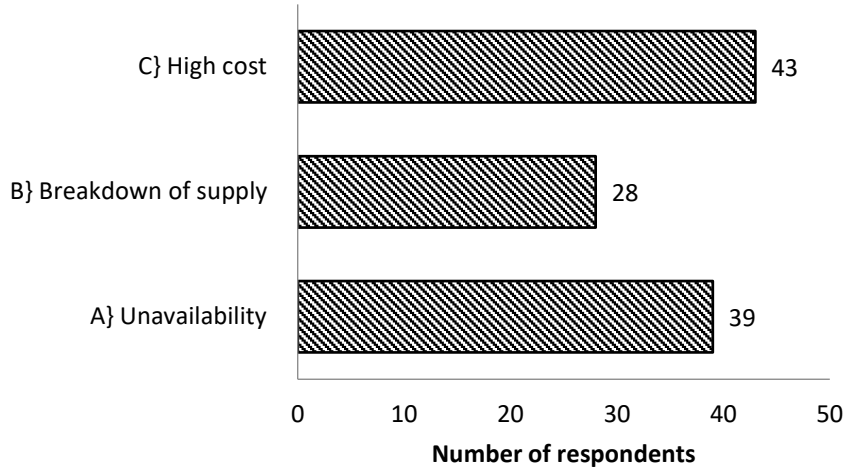


Figure 2. Problem of seed supply in studied area

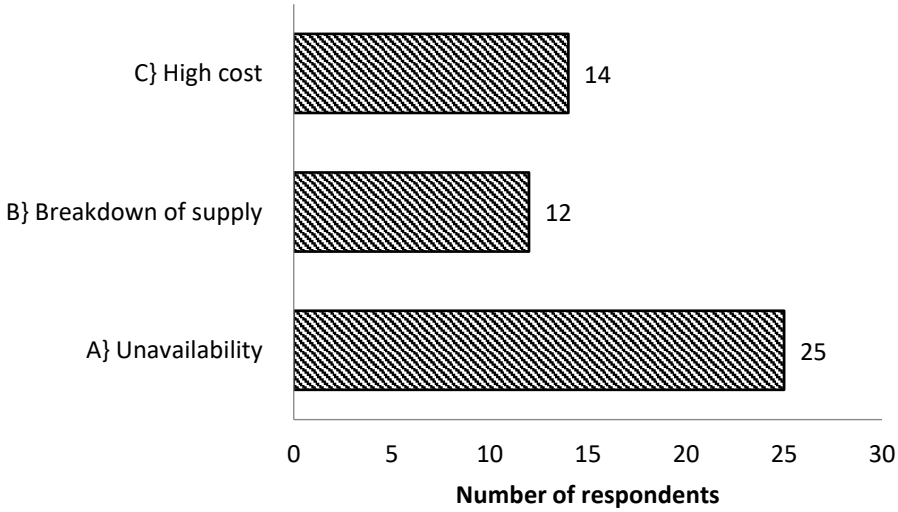


Figure 3. Problem in feed supply in studied area

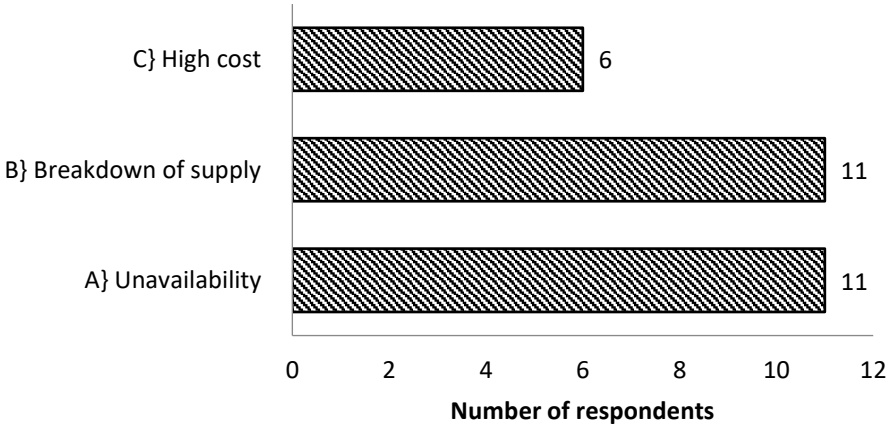


Figure 4. Problem in probiotic supply

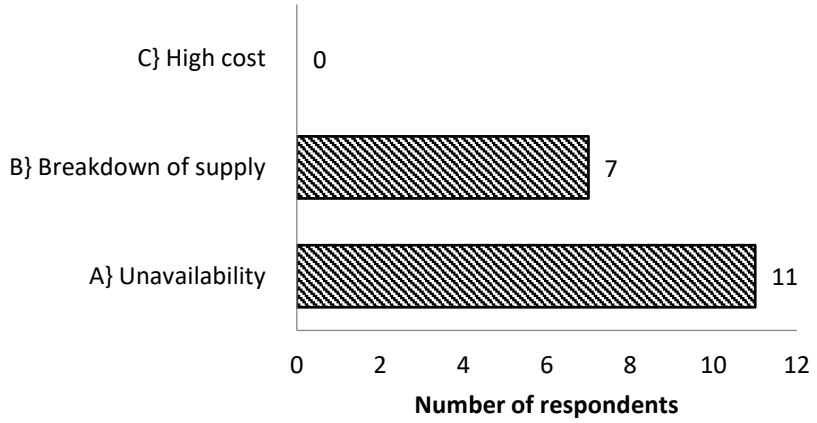


Figure 5. Problem in medicine and chemicals supply

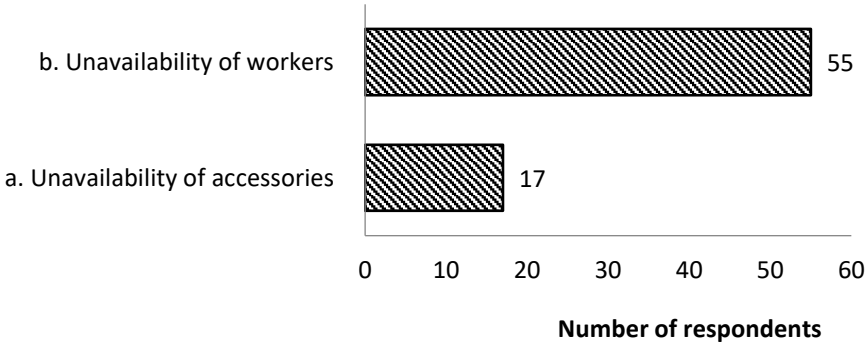


Figure 6. Problem during the crop harvesting

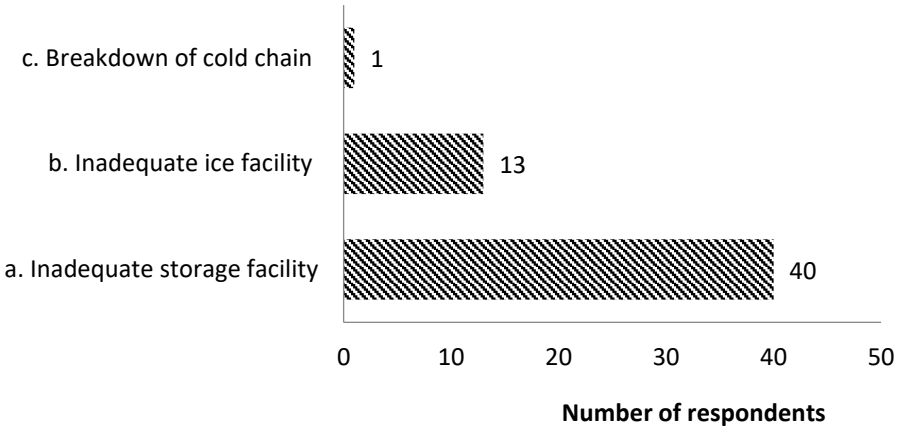


Figure 7. Problems in post-harvesting preservation of the crop

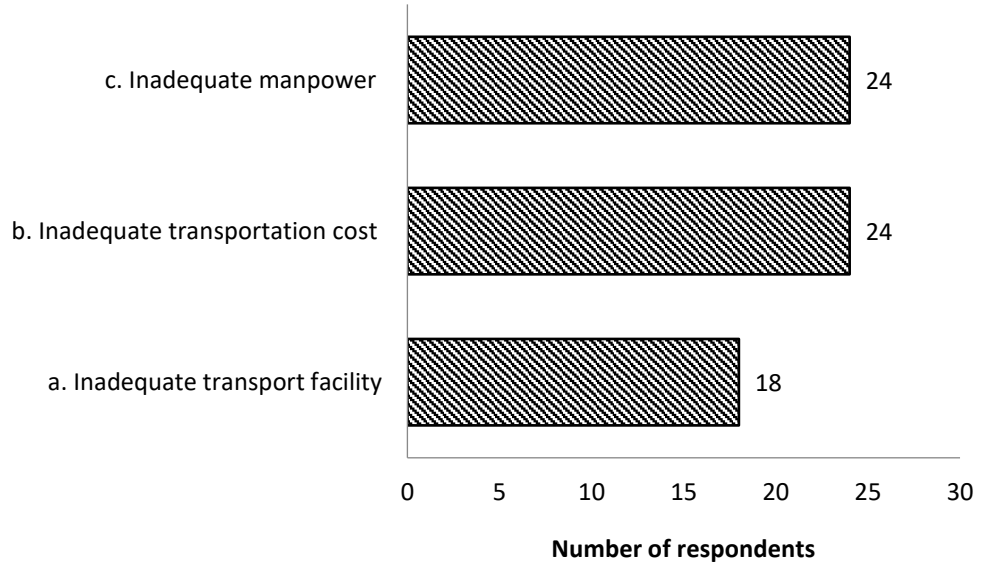


Figure 8. Problems in yield transportation

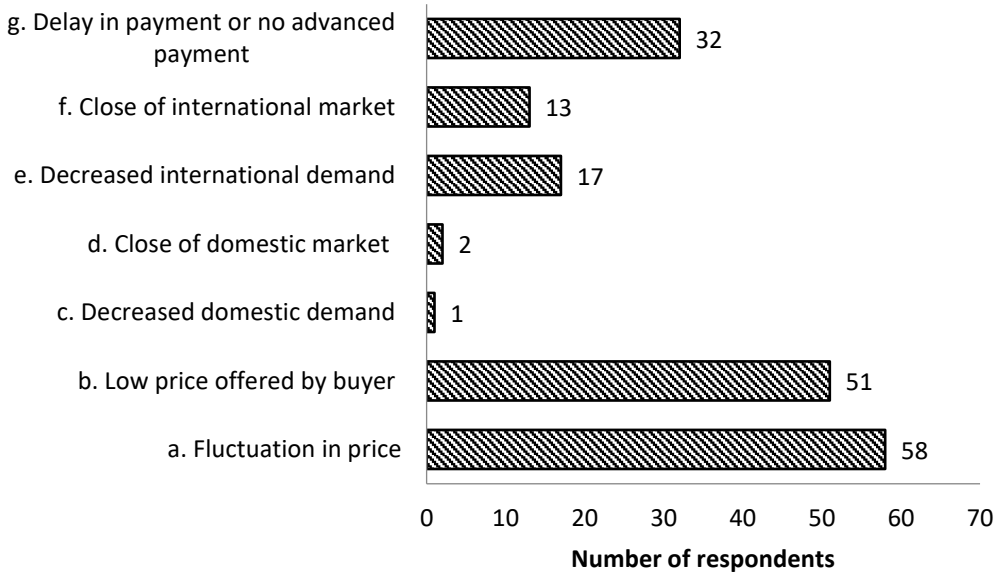


Figure 9. Problems in shrimp marketing