

Health status of cultured shrimp (*Penaeus monodon*) in Cox's Bazar region

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Abstract. A study was carried out for a period 8 months from March 2018 to October 2018 to observe the health status of shrimp (*Penaeus monodon*) in three Upazilas viz., Cox's Bazar Sadar, Teknaf and Maheshkhali of Cox's Bazar district through clinical and histological procedures. Data were collected through personal contact, questionnaire interview and discussion with key informants. Clinically, shrimp from Beximco shrimp farm and Aquaculture Farm Limited at Cox's Bazar Sadar Upazila, Unique Aquaculture at Teknaf Upazila were found to be healthy during summer. During rainy season, shrimps of Teknaf Upazila were affected with early mortality syndrome (EMS) like clinical signs within 30 days of stocking where major signs were lethargy, darkened shells and moulting of the carapace were present. White spot syndrome (WSS) affected shrimp were collected from Teknaf Upazila having loose cuticle and the presence of white spots inside the carapace and appendages. From histological observation the structure of shrimp muscle and hepatopancreas from Aquaculture Farm Limited, Beximco shrimp farm of Cox's Bazar Sadar Upazila and Unique Aquaculture of Teknaf Upazila were almost normal. During rainy season there were some remarkable pathological changes like parasitic cyst, vacuum, pyknotic cell, acanthocephalan parasite, hemorrhage and necrosis. Cultured shrimps in rainy season were affected more than those of summer season. However, shrimp of summer season had reduced pathological changes in hepatopancreas than those of rainy season. From clinical, histological and pathological point of view healthy shrimp were noticed in summer and moderately infected in rainy season. It could be mentioned that production and health status of shrimp were increased in summer season of Cox's Bazar area compared with other areas and season (rainy). Thus necessary measures need to be taken especially during rainy season.

Keywords: *Penaeus monodon*, Shrimp farms, Cox's Bazar

Introduction

Semi-intensive farming began in 1993 in the Cox's Bazar region with total areas include with 24,000 hectares. Most of the semi-intensive farms, particularly those in Cox's Bazar lost their first and second crop of 1994 due to disease outbreak. Even after taking considerable preventive measures in affected farms, outbreak of similar disease caused again considerable loss in first crop in 1995 and the second crop also showed similar sign. In 1996 it was discovered WSSV spread to other coastal districts affecting extensive shrimp farm (Flegel 1996). In 2001, the disease once again caused the collapse of shrimp production in both the Cox's Bazar and Khulna regions, the disease has not yet been completely eradicated and can still cause havoc for shrimp producers (DoF 2005). Major diseases of shrimp included cramped tail, soft shell, black spot, early mortality syndrome (EMS) or acute hepatopancreatic necrosis disease (AHPND), white spot syndrome (WSS) and yellow head disease (YHD). EMS is a fairly new and non-viral disease caused by bacterial agent *Vibrio parahaemolyticus* that affects shrimp health (Stentiford

et al. 2006). Farmers are using a range of chemicals to control shrimp disease. The purpose of use chemicals and drugs is to improve growth and disease resistance capacity of fish and shrimp (Hasan *et al.* 2015).

Despite the huge potential, production and productivity shrimp farming in Bangladesh are in declining trend due to frequent disease outbreak may happen because of inadequate supply of disease free seed, quality inputs, improper *gher* infrastructure and water supply, lack of farmer knowledge on appropriate improved farming methodologies and access to finance and services (DoF 2018). Clinical and histological knowledge is vital to determine the shrimp health status of *P. monodon*. Clinical signs describe behavioral, external, physical or gross pathological changes. In shrimp, the most obvious external clinical signs are white spots, black shell, black gill, and surface fouling (Hasan *et al.* 2015). Shrimp muscle and hepatopancreas in ponds and *ghers* had some remarkable pathological changes like necrosis, vacuums (Hossain *et al.* 2009). Thus proper attention should give in order obtain disease and pathogen free healthy shrimp from coastal ponds and *ghers* of Bangladesh.

Materials and Methods

Study area: The study was conducted from March to October, 2018 at three different Upazilas viz., Cox's Bazar Sadar, Teknaf and Maheshkhali of Cox's Bazar district (Fig. 1).



Fig.1. Selected Upazilas of the study area in Cox's Bazar district.

Data collection: Data were collected through questionnaire interview with shrimp farmers considering two farms from each Upazila (Table I). For questionnaire interview a set of questionnaire was developed composed of open form of questions. A total 36 farmers were personally interviewed including 6 key informants.

Sample collection: Shrimp samples were collected from ponds and *ghers* of three sampling stations (Upazilas) at two months' interval. For clinical signs collected shrimp were examined

by naked eye to observe any superficial injury, infection, and other abnormalities in live condition. For histological observation samples were collected from hepatopancreas and muscle of shrimp fixed in Davidson fixative (1:10). Then samples were dehydrated, cleared and infiltration through an Automatic Tissue Processors (Citade 11000), sectioned and stained with hematoxylin and eosin. The sections were examined under a compound photomicroscope. Record of hepatopancreas and muscle were done farm wise and season wise.

Table I. Target groups of the study areas

Name of the Upazilas	Name of the farms/ghers	Sampling areas	Target groups	Sample number for histology	
				Summer	Rainy
Cox's Bazar Sadar	Beximco Shrimp Farm	Khuroshkhul	Farmers	10	10
	Aquaculture Farm Limited	Khuroshkhul	Farmers	10	10
Teknaf	Unique Aquaculture	Nhila	Farmers	10	10
	MKA Shrimp Farm	Nhila	Farmers	10	10
Maheshkhali	Zaman's Gher	Boro-Maheshkhali	Farmers	10	10
	Rabiul's Gher	Boro-Maheshkhali	Farmers	10	10
Sub-Total				60	60

Results

Clinical observation: Clinically normal and healthy shrimp were in Beximco shrimp farm at Cox's Bazar and Unique Aquaculture at Teknaf Upazila and Zaman's *gher* of Maheshkhali Upazila during summer (Figs. 2A, 2B and 2C). On the other hand, during rainy season shrimps from Unique Aquaculture of Teknaf Upazila were affected with clinical signs related to early mortality syndrome (EMS). Major signs included lethargy, darkened shells and moulting of the carapace (Fig. 2H). Shrimp infected with white spot syndrome (WSS) were observed in MKA Shrimp Farm from Teknaf Upazila showing lethargy, loose cuticle, often reddish discolouration and the presence of white spots in the inside surface of the carapace, appendages, and cuticle over the abdominal segments (Fig. 2D). Shrimp from Rabiul's *gher* at Maheshkhali Upazila had reddish discoloration on the body surface (Fig. 2I). Black shell disease was recorded shrimp from MKA shrimp farm of Teknaf Upazila during rainy season (Fig. 2E). Yellow head disease (YHD) were evident in shrimp from Aquaculture Farm Limited of Cox's Bazar Sadar Upazila during rainy season had some remarkable clinical changes such as yellowish cephalothorax, gills, swollen digestive gland, head appeared yellow (Fig. 2F). *Zoothamnium* affected shrimp was noticed from Aquaculture Farm Limited of Cox's Bazar Sadar Upazila during rainy season (Fig. 2G).

Histopathological observation: Structure of muscle of shrimp varied with season, such as during summer muscle of shrimp from Aquaculture Farm Limited, Beximco shrimp farm of Cox's Bazar Sadar Upazila and Unique Aquaculture of Teknaf Upazila were almost normal (Figs. 3 and 4). However, the muscle of shrimp from MKA shrimp farm and Zaman's *gher*, Rabiul's *gher* of had some remarkable pathological changes like necrosis, hemorrhage and presence of parasites (Fig. 5). On the other hand, during rainy season muscle of shrimp from

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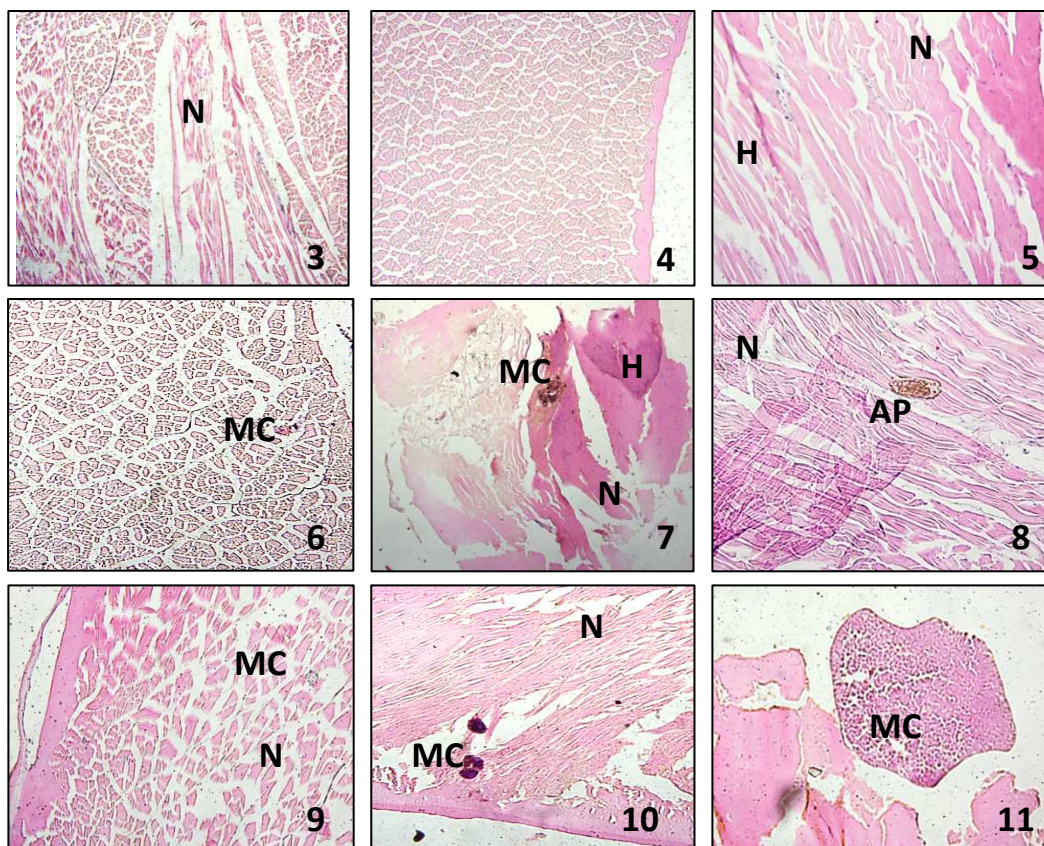
Aquaculture Farm Limited, Beximco shrimp farm and Rabiul's *gher*, Zaman's *gher* as well as Unique Aquaculture, MKA shrimp farm had necrosis, vacuums and presence of parasites (Figs. 6, 7 and 10). In Rabiul's *gher* microsporidian cyst were observed in both the seasons (Fig. 11).



Fig. 2. Clinical observation of sampled shrimp in the study areas. A, B and C. Normal healthy shrimp from Beximco Shrimp Farm of Cox's Bazar Sadar Upazila, Unique Aquaculture of Teknaf and Zaman's *gher* of Maheshkhali during summer; D. WSSV affected shrimp from MKA Shrimp farm of Teknaf Upazila during rainy season; E. Black shell disease affected shrimp from Teknaf during rainy season; F. YHD affected shrimp from Cox's Bazar Sadar Upazila during rainy season; G. *Zoothamnium* affected shrimp from Aquaculture Farm Limited of Cox's Bazar Sadar during rainy season; H. EMS affected shrimp from Unique Aquaculture of Teknaf Upazila during rainy season and I. Reddish coloration of shrimp after harvest from Rabiul's *gher*, Maheshkhali Upazila during rainy season.

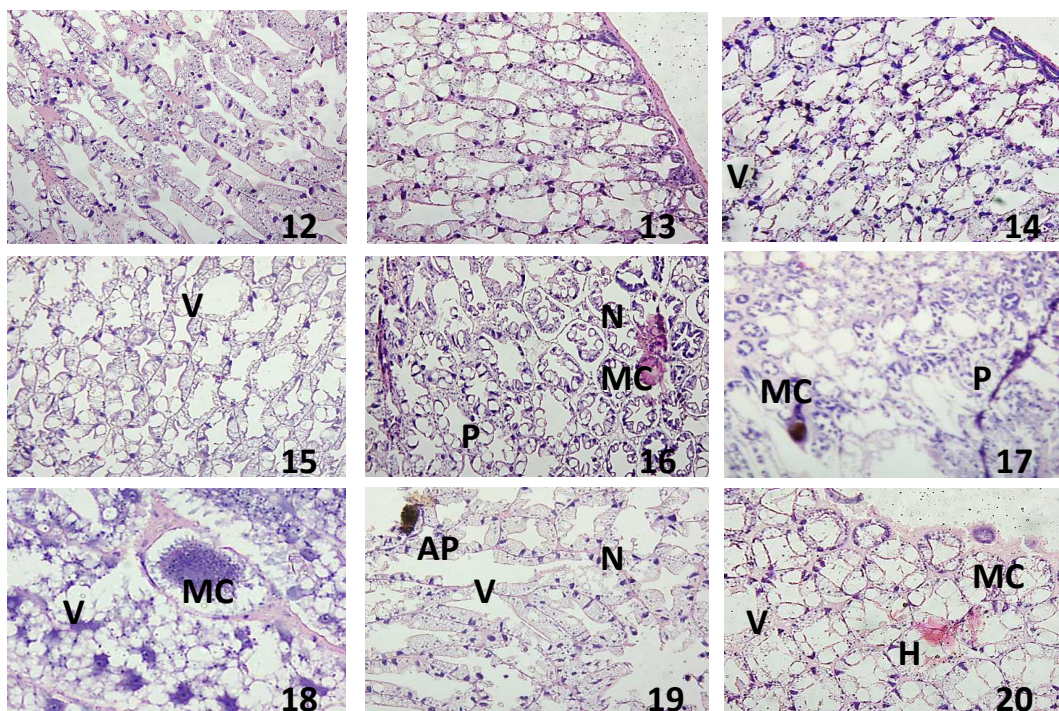
The structure of hepatopancreas also varied with season. Almost normal hepatopancreas were found in most of the investigated farms of Cox's Bazar Sadar and Teknaf Upazila during summer (Figs. 12 and 13). However, there were minor pathology like vacuum and necrosis in MKA shrimp farm, Zaman and Rabiul's *gher* during summer. During rainy season vacuums, necrosis, pyknotic cell, microsporidian cyst and hemorrhage were found in farms of

Maheshkhali, Cox's Bazar Sadar and Teknaf Upazilas (Figs. 17, 18 and 20). Shrimp collected from Zaman's *gher* had the acanthocephalan parasites, necrosis and vacuums during rainy season (Fig. 19).



- Figs. 3 and 4.** Cross section of almost normal muscle of shrimp from Aquaculture Farm Limited and Beximco shrimp farm, Cox's Bazar Sadar having necrosis (N) during summer. H & E x45.
- Fig. 5.** Photomicrograph of muscle of shrimp from MKA shrimp farm, Teknaf having hemorrhage (H) and necrosis (N) during summer. H & E x125.
- Fig. 6.** Section of shrimp muscle from Rabiul's *gher*, Maheshkhali having microsporidian cyst (MC) during summer season. H & E x45.
- Fig. 7.** Photomicrograph of muscle of shrimp from Aquaculture farm Limited, Cox's Bazar having microsporidian cyst (MC) necrosis (N) and hemorrhage (H) during rainy season. H&Ex 45.
- Fig. 8.** Section of shrimp muscle from MKA shrimp farm, Teknaf having acanthocephalan parasite (AP) and necrosis (N) during rainy season. H & E x45.
- Fig. 9.** Photomicrograph of muscle of shrimp from Beximco shrimp farm, Cox's Bazar Sadar having microsporidian cyst (MC) necrosis (N) during rainy season. H & E x45.
- Fig. 10.** Photomicrograph of muscle of shrimp from Unique aquaculture, Teknaf having necrosis (N) and microsporidian cyst (MC) during rainy season. H & E x125.
- Fig. 11.** Section shrimp muscle from Rabiul's *gher*, Maheshkhali having microsporidian cyst (MC). H & E x 45.

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- Figs. 12 & 13.** Cross section of almost normal hepatopancreas of shrimp from Aquaculture Farm Limited, Cox'sBazar Sadar and Unique Aquaculture of Teknaf upazila during summer. H & E x 125.
- Fig. 14.** Photomicrograph of hepatopancreas of shrimp from MKA shrimp farm, having vacuum (V) during summer. H & E x 125.
- Fig. 15.** Section of hepatopancreas of shrimp from Rabiul's gher, Maheshkhali having vacuum (V) during summer season. H & E x 125.
- Fig. 16.** Section of hepatopancreas of shrimp from Aquaculture farm Limited, Cox's Bazar having Pyknotic cell (P), necrosis (N) and microsporidian cyst (MC) during rainy season. H & E x 125.
- Fig. 17.** Photomicrograph hepatopancreas of shrimp from MKA shrimp farm, Teknaf having microsporidian cyst (MC) and pyknotic cell (P) during rainy season. H & E x 125.
- Fig. 18.** Photomicrograph of hepatopancreas of shrimp from Beximco shrimp farm, Cox's Bazar Sadar having microsporidian cyst (MC) and vacuum (V) during rainy season. H & E x 430.
- Fig. 19.** Photomicrograph of hepatopancreas of shrimp from Zaman's gher, Maheshkhali having acanthocephalan parasite (AP), necrosis (N) and vacuum (V) rainy season. H & E x 125.
- Fig. 20.** Section of hepatopancreas of shrimp from Unique Aquaculture, Teknaf having microsporidian cyst (MC) vacuum (V) and hemorrhage (H) during rainy season. H & E x 125.

Structure of muscle of shrimp also varied with seasons. In summer, muscle of shrimp from Aquaculture Farm Limited, Beximco shrimp farm of Cox's Bazar Sadar Upazila and Unique

Aquaculture of Teknaf Upazila were almost normal (Figs. 3 and 4). But the muscle of shrimp from MKA shrimp farm of Teknaf Upazila and Zaman's *gher*, Rabiul's *gher* of Maheshkhali Upazila had some remarkable pathological changes like necrosis, hemorrhage and parasites. On the other hand, during rainy season muscle of shrimp from Aquaculture Farm Limited, Beximco shrimp farm and Rabiul's *gher*, Zaman's *gheras* as well as Unique Aquaculture and MKA shrimp farm had necrosis, vacuums and parasites. In Rabiul's *gher* microsporidian cyst were observed in both the seasons (Figs. 10 and 11).

Variations were evident in the structure of hepatopancreas as well. Hepatopancreas were almost normal in most of the investigated farms of Cox's Bazar Sadar and Teknaf Upazila during summer (Figs. 12 and 13). However, there were minor pathology like vacuum, necrosis in MKA shrimp farm, Zaman and Rabiul's *gher* during summer. Whereas, during rainy season vacuums, necrosis, pyknotic cell, microsporidian cyst and hemorrhage were found in farms of Maheshkhali, Cox's Bazar Sadar and Teknaf Upazilas. Shrimp collected from Zaman's *gher* of Maheshkhali Upazila had the acanthocephalan parasites, necrosis and vacuums during rainy season (Fig. 19).

Production of shrimp: In the present study, shrimp production was recorded from 1050 kg/ha to 11,795 kg/ha in the study areas. The highest production was recorded from Aquaculture Farm Limited at Cox's Bazar Sadar and the lowest was from Zaman's *gher* at Maheshkhali Upazila.

Discussion

From the present study, clinically normal and healthy shrimp were noticed from Beximco Shrimp Farm and Aquaculture Farm Limited at Cox's Bazar Sadar, Unique Aquaculture at Teknaf during summer. On the other hand, during rainy season it was observed that, shrimps from Unique Aquaculture of Teknaf were affected with EMS like clinical signs within 30 days of stocking. The clinical signs were lethargy, darkened shells and moulting of the carapace. Islam (2013) mentioned that clinically shrimp of different investigated areas were different in appearance. Some shrimp of Cox's Bazar region were yellowish, brownish or darker than normal appearance. According to Hasan (2014) clinically shrimp of coastal regions including both Khulna and Cox's Bazar were normal and healthy except some yellowish in controlled *ghers*, whereas, in chemically treated ponds were slight yellowish fade and discolored. Hossain (2017) mentioned that clinically shrimp of Khulna region were normal and healthy except some yellowish color in controlled *ghers*. Shrimp from Rampal were slight greenish fade in control *gher*, however, yellow fade colour were seen in treated *gher* (Hasan *et al.* 2015).

During summer histological structure of muscle of shrimp from Aquaculture Farm Limited, Beximco shrimp farm of Cox's Bazar Sadar and Unique Aquaculture of Teknaf were almost normal. But the muscle of shrimp from MKA shrimp farm of Teknaf and Zaman's *gher*, Rabiul's *gher* of Maheshkhali had some remarkable pathological changes like necrosis, hemorrhage and parasites. On the other hand, during rainy season muscle of shrimp from Aquaculture Farm Limited, Beximco shrimp farm of Cox's Bazar Sadar and Rabiul's *gher*, Zaman's *gher* of Maheshkhali as well as Unique Aquaculture, MKA shrimp farm of Teknaf had necrosis, vacuums and parasites. Hasan *et al.* (2015) mentioned that muscle of control shrimp (without drugs) of all investigated areas of Cox's Bazar and Khulna regions were almost normal except there were some vacuums. According to Islam (2013) almost similar histological

observations that the treated muscle of shrimp of shrimp from Cox's Bazar and Khulna regions had remarkable pathological changes like necrosis, vacuums and pyknotic cells. On the other hand, structure of hepatopancreas of shrimp were almost normal in most of the investigated farms of Cox's Bazar Sadar and Teknaf during summer. However, there were minor pathology like vacuum, necrosis in MKA shrimp farm of Teknaf, Zaman and Rabiul's *gher* of Maheshkhali during summer. Whereas, during rainy season vacuums, necrosis, pyknotic cell, microsporidian cyst and hemorrhage were found in farms of Maheshkhali, Cox's Bazar Sadar and Teknaf. Shrimp hepatopancreas from Zaman's *gher* of Maheshkhali had acanthocephalan parasites, necrosis and vacuums during rainy season. Hossain (2017) mentioned that hepatopancreas of shrimp were normal in the summer season at Khulna regions. There were some remarkable pathological changes like vacuums, necrosis and hemorrhage from Botiaghata, Dacope and Rupsa during rainy season. Islam (2013) observed that midgut of control shrimp (without drugs) of Cox's Bazar region were almost normal in structure. The author further mentioned that in case of Fakirhat and Khulna midgut of controlled shrimp there were some vacuums, necrosis and pyknotic cells.

From the present study, several types diseases are observed from the collected shrimp. EMS affected shrimp was seen from Teknaf during rainy season. WSS affected shrimp was recorded from Teknaf during rainy season. Normal healthy shrimp was collected from Teknaf during summer season. Black shell disease affected shrimp collected from Teknaf during rainy season. YHD affected shrimp was seen from Cox's Bazar Sadar during rainy season. *Zoothamnium* affected shrimp was collected from Cox's Bazar Sadar during rainy season. On the other hand, normal healthy shrimp was collected from Zaman's *gher* of Maheshkhali during summer season. Reddish coloration of shrimp after post-harvest was seen from Maheshkhali during rainy season. Clinically, histologically and disease point of view it would be mentioned that shrimp of rainy season were more affected compared with summer season. This would be due to abnormal water quality parameters during the period. Thus more precautionary measures should be taken during the period i.e., rainy season. Overall condition of shrimp from Cox's Bazar Sadar areas were healthy whereas shrimp from Maheshkhali areas had average health status and shrimp from Teknaf areas shrimp had poor health condition. From clinical observation, Teknaf shrimps were affected with EMS, and WSD affected had white spots and slight discoloration in the treated ponds, Cox's Bazar Sadar shrimps were affected with EMS and *Zoothamnium* algae. YHD affected shrimp was seen from Cox's Bazar Sadar during rainy season were some remarkable clinical changes such as yellowish colour of cephalothorax and general bleaching of the body, yellow gills and head. Hasan (2014) observed that several shrimp diseases like White spot disease (WSD), Bacterial disease, Cotton Shrimp disease and Black gill disease provided impact on shrimp production. Whereas, in Cox's Bazar region shrimp culture was affected by different viral diseases such as WSD, Monodon Baculovirus (MBV), Bacterial Diseases and Surface Fouling diseases. Islam (2013) observed that, more or less similar shrimp disease was recorded in coastal regions of Bangladesh such as WSD, Bacterial and Fungal diseases. Hossain (2017) reported that in Khulna region several shrimp diseases like White spot disease (WSD), Bacterial disease, Cotton shrimp disease, Surface fouling disease provided impact on shrimp production.

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