



Use practices of antimicrobials and other compounds by shrimp and fish farmers in Northern Vietnam



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ABSTRACT

Aquaculture production is increasing in Vietnam, but is hampered by frequent disease outbreaks and widespread use of various compounds used to treat the fish and shrimp. The objective of this study was to analyse factors influencing farmer use practices of antimicrobials and other compounds by a questionnaire and observational survey conducted with 60 whiteleg shrimp (*Litopenaeus vannamei*) and 25 fish farmers in three coastal provinces in Northern Vietnam. Personnel in 22 shops distributing feed and chemicals for aquaculture were interviewed about their advice on sale to the farmers. Results showed that 20 different antimicrobial products were used for disease prevention and treatment in shrimp and marine fish culture. Banned products used included chloramphenicol, enrofloxacin and malachite green. Cage fish farmers said they purchased antimicrobial tablets readily available at a local pharmacy and sold for human use. Chinese traders were the main drug suppliers to the shrimp farmers in Quang Ninh and others provinces. Their products were sold with labels and product information written in Chinese only. Farmers appeared to have little awareness and concern about the disease aetiology when applying specific antimicrobials. Up to 50% of the shrimp farmers used up to 20 different disinfectants, e.g. chlorine-based compounds, to disinfect water in storage ponds, often without knowledge of the type of disinfectants and their mode of action. A variety of probiotics, vitamins, minerals and herbal extracts were routinely used by mainly shrimp farmers to enhance shrimp immunity. There is an urgent need to provide aquaculture farmers access to diagnostic and independent disease control advisory services and quality medicated feed, since the current indiscriminate use of antimicrobials and other compounds are inefficient, costly, and hazardous to the aquatic animal and farmer's health, the environment and food safety.

1. Introduction

Aquaculture in Vietnam has developed rapidly and provides income and quality protein for national and overseas consumers, e.g. 328,000 tonnes of whiteleg shrimp (*Litopenaeus vannamei*) and 1.22 million tonnes of striped catfish (*Pangasianodon hypophthalmus*) were produced in 2015 (MARD, 2016). The rapid development and intensification of culture practices have been associated with serious disease outbreaks and economic losses. Tiger shrimp (*Penaeus monodon*) in particular, but also whiteleg shrimp culture have been experiencing major viral disease problems, e.g. caused by White Spot Syndrome Virus, Yellow Head Virus, and Taura Syndrome Virus (Dhar et al., 2004; Lightner, 2011; Hasson et al., 1995 and Sittidilokratna et al., 2008). Recently, Early Mortality Syndrome, also called Acute Hepato-Pancreatic Necrosis Syndrome, has been associated with *Vibrio*

parahaemolyticus infections, and caused up to 100% mortality in post larvae shrimp (20–30 days of age) (FAO/MARD, 2013; Tran et al., 2013). Mariculture production, e.g. floating cages, of high value fish species have shown a dramatic increase along the coast and around islands in Vietnam due to increasing demand from Vietnamese consumers. Fish species cultured in marine cages include cobia (*Rachycentron canadum*), seabass (*Lates calcarifer*), and grouper (*Epinephelus coioides*). As experienced by the shrimp industry, mariculture farmers are also experiencing major disease problems, e.g. bacterial diseases caused by *Vibrio* spp., *Streptococcus* spp. and *Flexibacter* spp. (Phan et al., 2006).

Ideally any therapeutic treatment of an infectious disease should be based on a correct diagnosis including identification of the pathogen involved before any treatment takes place. The reality for most aquaculture farmers in less developed countries like Vietnam however, is

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quite different with limited availability and access to such diagnostic services (Phu et al., 2015a; Li et al., 2016). Farmers seem to base their choices of disease prevention and treatment measures on previous experiences, anecdotal advice from shops selling and distributing antimicrobials and other chemicals, and less often taking advice from veterinarians who do not have the capacity and knowledge to provide diagnostic services (Li et al., 2016; Phu et al., 2015b). However, there is limited knowledge on how farmers perceive and diagnose diseases and what determines their choice of type of treatment, e.g. use of antimicrobials. The main Asian countries practicing aquaculture as yet do not have efficient monitoring systems to register use of antimicrobials and other chemicals nor do the individual farmers. However, there is increasing evidence that certain aquaculture producers are using substantial amounts of antimicrobials and other compounds for disease and pond management. Thuy and Loan (2011) estimated that both numbers and amounts of veterinary drugs and chemicals used in Vietnamese shrimp culture have increased significantly over the last 10 years. Tai (2012) reported more than 30 types of antimicrobials used in shrimp culture and more than 130 different antimicrobial products used in all types of Vietnamese aquaculture. Most studies on drug and chemical usage in aquaculture in Vietnam have been conducted in the Mekong Delta region (Phu et al., 2015a; Rico et al., 2013) and little is known about such use practices elsewhere in the country.

Quality and use of antimicrobials and other veterinary compounds in aquaculture are meant to be assured and approved by different authorities, e.g. in Vietnam by the Ministry of Agriculture and Rural Development (Phu et al., 2015b; MARD, 2014). In 2012, a total of 2913 products were registered for use in Vietnamese aquaculture, including 813 so-called veterinary drugs (Tai, 2012; MARD, 2014). The approval of such high numbers of products for use in aquaculture is highly resource demanding and it was recently documented that a number of antimicrobial products used in Vietnamese striped catfish culture were of inferior quality (Phu, 2015b). Furthermore, veterinary drugs may also be imported illegally from neighbouring countries. Effective quality assurance and regulatory authoritative systems of antimicrobial and other compound usage in aquaculture is essential to ensure farmers' access to quality drugs, allowing for effective disease treatment and the provision of safe foods to consumers with no antimicrobial residues.

The objective of this study was to obtain information about the main factors determining the use of antimicrobials and other compounds in disease and farm management in whiteleg shrimp and marine finfish aquaculture in three coastal provinces in Northern Vietnam. Based on this knowledge, we discuss the main challenges faced by the farmers and propose how these may be addressed to develop responsible use of antimicrobials and other compounds in aquaculture assuring effective prevention and treatment of diseases and the safety of aquaculture products.

2. Materials and methods

2.1. Study sites and aquaculture farmers

The study was conducted in Hai Phong, Quang Ninh and Nghe An provinces in main aquaculture districts as registered by the local Departments of Agriculture and Rural Development (Fig. 1). Around Cat Ba island off the coast of Hai Phong city, 12 intensive cage farms stocking more than 25 marine fish/m³ were randomly selected to represent typical marine cage culture farms operating around the island. At the time of the study, a total of 571 families were operating their own floating fish farms around Cat Ba island as their main income generating activity with cage numbers ranging from 15 to 50 cages per farm. Workers on the farms were all family members. In addition, 13 family-operated farms were selected practicing on-land culture in earthen ponds (Thuy Nguyen district, Hai Phong city) with brackish water intake from the coast during high tide. Feed consisted of wild-caught marine trash fish and was freshly prepared by the individual

farmers.

In Quang Ninh province, intensive whiteleg shrimp is cultured totalling 2200 ha, mainly practiced around Mong Cai city close to the Chinese border. Shrimps are raised in earthen ponds (0.64–15 ha) with slopes of the pond dykes often being lined with plastic. Fifteen intensive farms with a stocking density of more than 80 shrimp/m³ and 15 semi-intensive (25–30 shrimp/m³) farms owned and managed by families were selected for interviews. A few larger shrimp farms owned by local Vietnamese companies were also operating, but unwilling to participate in the study. In Nghe An province, 30 households operating intensive culture of whiteleg shrimp were randomly selected from a list of 1053 farmers provided by the local Department of Aquaculture as registered in 2012. Characteristics and livelihood conditions of the family-operated farms studied were similar in the two provinces.

A questionnaire and observational survey were conducted from August to September 2012 with the aquaculture farmers in the selected provinces. In addition, a number of shops selling feed, chemicals and other items to aquaculture farmers were visited for questionnaire interviews and observations. A small follow-up study was conducted from May to July 2014 visiting the shrimp farmers to obtain information about their economic losses due to diseases.

2.2. Farmer interviews and observational survey

A questionnaire was developed for face-to-face interview of farm owners. On-farm observations by the interviewers were done to supplement the information collected during the interviews. Both interviews and on-farm observations were conducted in Hai Phong, Quang Ninh and Nghe An provinces by the first author of this paper together with two trained assistants. The following subject areas were addressed in the questionnaire: general information on aquaculture management practices, i.e. name of farmer, culture area, cultured species, culture system, feeding practices; type and seasonality of diseases and associated economic losses; types and use practices of antimicrobials and other compounds (i.e. disinfectants, probiotics, herbal products, vitamins and minerals). The term antimicrobial is used throughout the manuscript and includes antibiotics and chemically synthesized compounds used to treat bacterial diseases. Where possible, direct observations and records were made of the type and storage conditions of feed and chemicals present at the farm together with medication practices.

2.3. Feed and chemical shops

Feed, chemicals and other compounds used by aquaculture farmers in Northern Vietnam are provided and distributed by so-called feed and chemical shops that are typically located in district towns. These premises are owned by Vietnamese families except a few shops owned by Chinese. Products sold may be produced by Vietnamese companies or produced outside Vietnam and then imported by local companies supplying the products to the shops. It was not possible to obtain information about the total number of shops in the study areas, but according to information from the local Departments of Agriculture and Rural Development between 20 and 30 shops operated in each of the three provinces. Some shrimp farmers also operated their own small shops selling feed and chemicals to nearby shrimp farms. All shops were registered by provincial and district government authorities and were occasionally inspected, e.g. to check on appropriate and safe storage conditions of chemical products.

Based on information provided by the farmers during the interviews, two larger shops in Hai Phong city were selected that sold products to brackish water fish and shrimp farms in Thuy Nguyen district. In both Quang Ninh and Nghe An provinces, 10 feed and chemical shops were visited that provided products to the provincial shrimp farmers. During visits to the shops, information was collected about types of antimicrobials, chemicals and other compounds sold,

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