

Research Article

Supply Chain Management of the White Leg Shrimp Business in Aceh Tamiang Regency

Riesti Triyanti^{1*}, Armen Zulham², Nensyana Shafitri³, Mira¹, Permana Ari Soejarwo³, Retno Widiastuti⁴

¹Research Center for Behavioral and Circular Economics, National Research and Innovation Agency of Indonesia, Gdg. Widya Graha Lt. 4, Jend. Gatot Subroto No. 10 Street, South Jakarta, DKI Jakarta, 12710, Indonesia

²Research Center for Cooperative, Corporation, and People's Economy, National Research and Innovation Agency of Indonesia, Gdg. Widya Graha Lt. 4, Jend. Gatot Subroto No. 10 Street, South Jakarta, DKI Jakarta, 12710, Indonesia

³Research Center for Marine and Fisheries Socio-Economics, Pasir Putih 1 Street, East Ancol, Pademangan, North Jakarta, DKI Jakarta, 14430, Indonesia

⁴Research Center for Society and Culture, National Research and Innovation Agency of Indonesia, Gdg. Widya Graha Lt. 6 & 9, Jend. Gatot Subroto No. 10 Street, South Jakarta, DKI Jakarta, 12710, Indonesia

Abstract.

This study aims to map and to analyze the white-leg shrimp supply chain and the institutions. This research was conducted in July-September 2020. Data were collected using structured interviews and in-depth interviews. The results showed that the white leg shrimp supply chain consisted of providers of production inputs, cultivators, small traders, collectors, and exporters. The need for partnerships through professional business management through contracts with off-takers will create a shrimp business system that can provide added value and competitiveness.

Keywords: Supply chain, institutions, business, white-leg shrimp, Aceh Tamiang

Corresponding Author: Riesti Triyanti; email: ries005@brin.go.id

Published 17 February 2023

Publishing services provided by Knowledge E

© Riesti Triyanti et al. This article is distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use and redistribution provided that the original author and source are credited.

Selection and Peer-review under the responsibility of the ICOSIAS 2021 Conference Committee.

1. Introduction

Indonesia is the second-largest shrimp producer in the world¹. Shrimp is the result of cultivation fisheries that are the leading commodity of Indonesian exports, contributing the highest value of shrimp exports in 2020 compared to other fishery commodities, reaching USD 2,040 million². The volume and value of shrimp exports in Indonesia have increased over the past six years, by 8.14% and 7.33%, respectively. Aceh Tamiang regency

is currently one of the white leg shrimp producers in Indonesia, previously succeeded with tiger prawn. Shrimp farm business area in Aceh Tamiang Regency reaches 3,624.5 hectares spread across four sub-districts (*Manyak Payed, Seruway, Banda Mulia, and Bendahara*), but most (86%) still use traditional technology and 2% use semi-intensive

 OPEN ACCESS

technology and 12% intensive. White leg shrimp production in Aceh Tamiang Regency in 2020 amounted to 2,329.9 tons with a production value of Rp 158 million⁴.

White leg shrimp is an easily damaged product that has special and unique handling. White leg shrimp cultivation also has a high dependence on climate and seasons. This condition makes the quantity gap of production, sometimes the production is high, but sometimes production is low. Therefore, the unique characteristics of white-leg shrimp should be considered when designing the white-leg shrimp business concept⁵. The problems in running the white-leg shrimp business upstream to downstream in Aceh Tamiang Regency include technical, economic, and institutional aspects. In the technical aspect, the problems that occur include the conversion of shrimp ponds into oil palm plantations, lack of technical guidance and business management to farmers, lack of mastery of cultivation technology, pollution of agricultural water resources, and uncertain weather, while in economic aspects there are problems, including not being able to meet market quotas, the uncertainty of market guarantees and prices, high production input prices, non-current payment systems, and lack of capital. In addition to technical and economic aspects, there are also institutional aspects, such as institutions that are not adaptive to market developments, upstream to downstream institutions, demanding access to capital to financial institutions, and competition between agricultural businesses. It also occurs in Sri Lanka⁶, Thailand⁷, as well as Bangladesh⁸. The impact felt in the white leg shrimp supply chain in Aceh Tamiang Regency is decreased productivity, increased marketing and logistics costs, delays in obtaining production inputs, and less competitive selling prices of crops.

Supply chain management and white leg shrimp institutions are essential in obtaining white leg shrimp from ponds to consumers at reasonable prices and high quality⁶ to increase productivity, reduce operational costs, and fair margin share businesses especially white leg shrimp breeders. Therefore, this study aims to map the white-leg shrimp supply chain and the institutions that play a role in the white leg shrimp business activities and to analyze supply chain management and white leg shrimp business institutions in Aceh Tamiang Regency.

2. Materials and Methods

Some researchers widely outline supply chain management theory. Supply chain management (SCM) requires managing the flow of information through the supply chain to attain the level of synchronization that

will make it more responsive to customer needs while lowering costs. Coordination of all supply chain activities, starting with raw materials and ending with a satisfied customer. Thus, a supply chain includes suppliers, manufacturers and service providers, distributors, wholesalers, and retailers who deliver the final customer's products or services. The purpose of SCM is to integrate the flow of goods and services and information along the supply chain to maximize value to customers at an efficient cost level. In addition, SCM also requires institutional integration between upstream to downstream.

This research was conducted from July to September 2020 in four districts in Aceh Tamiang Regency, namely *Banda Mulia*, *Bendahara*, *Manyak Payed*, and the *Seruway* district. The type of research conducted is qualitative research with a case study approach. The focus and purpose of research in qualitative research reference choosing data sources and data collection techniques.

Data collection was conducted through structured questionnaire-based interviews with 160 shrimp farm breeder respondents, in-depth interviews with key informants for data verification. In addition, it targeted focus group discussions with ten stakeholders involved in the white leg shrimp business, literature studies, and field observations in Aceh Tamiang Regency, especially in four sub-districts of research sites. The type of data collected refers to research objectives that include mapping and managing the supply chain and institutional supply chain of white leg shrimp and analyzing driving factors and inhibitory factors in the white leg shrimp supply chain in Aceh Tamiang Regency. This study's data was compiled, grouped, and analyzed descriptively.

3. Results and Discussion

3.1. White Leg Shrimp Supply Chain Mapping

At first, around 1982-2001, Aceh Tamiang Regency experienced glory as of the largest windu shrimp producer in Aceh Province. However, in 2001-2004, pests and diseases began to appear, which caused the death rate in shrimp maintained to increase. Market access is also difficult because of competition in the global market. In addition, the quality of the coastal and eastern seas of Aceh is decreasing due to the loss of many mangrove ecosystems, causing the community to change the commodity of shrimp that is cultivated (from tiger

prawns to white leg shrimp). The Aceh Tamiang Regency Government is committed to restoring the glory with a white leg shrimp pond revitalization program spread across four coastal sub-districts, namely Manyak Payed, Banda Mulia, Bendahara, and Seruway. Figure 1 shows the upstream, internal, and downstream supply chain of white leg shrimp in Aceh Tamiang Regency, involving several actors at each stage. There are 4 (four) types of supply chains in the white leg shrimp business in Aceh Tamiang Regency, namely:

1. Type 1: breeders (traditional, semi-intensive, intensive) retailers - local consumers,
2. Type 2: drillers (traditional, semi-intensive, intensive) – local collecting merchants – fish processors – exporters - overseas consumers,
3. Type 3: drillers (traditional, semi-intensive, intensive) – wholesalers – fish processors – exporters
-] overseas consumers,
1. Type 4: breeders (traditional, semi-intensive, intensive) -wholesalers - out-of-town traders - out-of town consumers.

Upstream supply chain, starting from the provider of fish production facilities consisting of shrimp seed providers, feed, and drug providers. The origin of shrimp seed used by farmers in Aceh Tamiang Regency comes from agents (PT. Charoen Pokphand Indonesia/PT CPI) in Aceh and local agents in Aceh Tamiang, East Aceh, and Bireun districts. The required shrimp seed specifications are PL 8 (post-larva-8) and are always available at the agent according to the required specifications, but the covid-19 pandemic causes shipments to be often late and limited to only 50% of the needs of the breeder. Benur as raw material in the cultivation of white leg shrimp is crucial to its role. The quality of the shrimp seed of PT. According to the breeder, CPI is very high, with a value of SR 95% compared to shrimp seed from local agents. The purchase system of white leg shrimp seed is a message delivery (payment is made 10-15 days after delivery of shrimp seed). An employment contract/ partnership with a feed agent (PT. CPI) is related to the use of feed, drugs, and insecticides. If the cultivator uses other feed/insecticides (other than the Pokphand brand), there will be a partnership termination. Farmers buy feed from local agents in Aceh Tamiang or Medan to meet feed needs. The required feed specifications are Irawan feed brands no 681V, 682V, 683V, 683 SP, and 684V. The constraints of feed delivery occur when it rains, so there is a delay in arriving at the cultivation business site.

The solution done by the breeder is to replace the feed with other brands, such as Global feed, KJV / Kaiohji.

Maintenance of white leg shrimp in Aceh Tamiang Regency is carried out for five months or two times a year. Production of 3.2 tons with a size of 40 or 5.6 tons with a size of 47 for a land area of 1.2 hectares. The selling price of shrimp is IDR 79,000.00/kg (for size 40) and IDR 71,300.00/kg (for size 47). A sorting system does harvest by buyers/traders—a maximum of 3 times sorters to avoid mistakes. Buyers of farmed shrimp from Aceh Tamiang Regency are local traders from sub-districts in Aceh Tamiang, large collecting traders from Langsa, and tauke from Medan. The actors in the production stage are breeders, retailers, and collecting merchants (small and large).

The internal supply chain is a continuation of the upstream supply chain. In the internal supply chain, there is processing and packaging of farmed shrimp in Aceh Tamiang into frozen shrimp. The processing process is carried out in Medan Industrial Area (KIM). Although, currently, there is no processing and cold-storage unit for white leg shrimp located in Aceh Tamiang Regency, white leg shrimp processing and packaging activities for export and delivery purposes outside the city are carried out at the Medan Fish Processing Unit.

The downstream supply chain is the end of the white-leg shrimp supply chain. At this stage, the distribution of white leg shrimp to the end consumer who needs logistics services can guarantee the quality and quality of shrimp to be maintained. The cold chain system is crucial because white leg shrimp is a fishery product that is easily damaged, so it requires special handling. The end consumer of white leg shrimp from retailers is local consumers around Aceh Tamiang, who usually buy white leg shrimp with sizes equally 70 or somewhat mushy. In addition, white leg shrimp from Medan is also sent to various cities in Indonesia and for export purposes. For white leg shrimp with sizes, 40-47 were sent to overseas consumers: China, Japan, Europe, and the United States.

Recently, several studies investigated shrimp supply chain facilitates making strategic decisions and plays a crucial role in supply chain performance. Several important factors have an indispensable influence on the shrimp supply chain, such as the quality of the product in distribution and maintenance of the cold chain and also optimizing the total cost of the whole network^{9, 10, 11, 12, 13}.

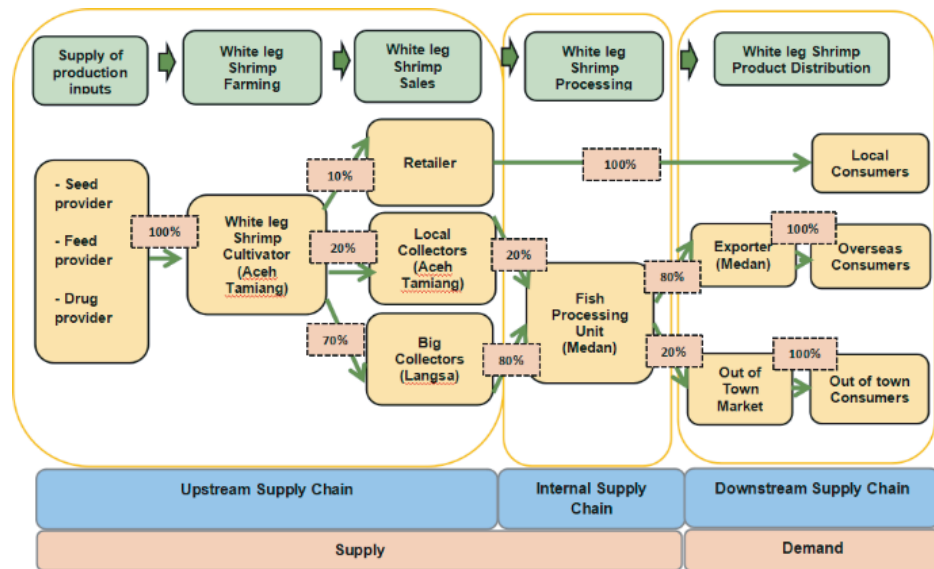


Figure 1: White leg shrimp supply chain in Aceh Tamiang Regency.

3.2. White leg Shrimp Business Institutional Mapping

Institutions that play a role in the white-leg shrimp business in Aceh Tamiang Regency consist of financial and business institutions. The availability of fisheries institutions, according to Table 1, there is one bank unit, two units of village unit cooperatives, six units of savings and loan cooperatives, seven units of BUMDes, and seven money lenders spread across four coastal districts in Aceh Tamiang Regency.

Financial institutions in Aceh Tamiang Regency are relatively limited because not all institutions support fishery business, especially white leg shrimp cultivation. Commercial banks are still limited and have not provided guarantees for white-leg shrimp breeders because they belong to uncertain activities. BUMDes scattered throughout the village (except Matang Seuping) have not focused on fisheries. Coastal communities in Aceh Tamiang Regency are still dependent on money lenders that often provide high-interest rates. The absence of financial institutions that can provide financial access to the white-leg shrimp business requires serious attention from the Aceh Tamiang Regency Government.

White leg shrimp business institute in Aceh Tamiang Regency refers to the agribusiness system which includes: (1) subsystem of production facilities provider (upstream), (2) subsystem of the production process (on- farm), (3) subsystem of processing results (downstream),

TABLE 1: The number of existing financial groups in Aceh Tamiang Regency, 2019.

		Existing financial groups				
District	Village	Bank	Money Lender	Cooperative	Saving and loan cooperative	Village-owned enterprises (BUMDes)
Banda Mulia	Matang Seuping	-	-	1	-	-
	Alue Nunang	-	1	-	-	-
Benda hara	Seunebok Aceh	1	-	-	-	1
	Bandar Khalifah	-	-	-	-	1
Seruway	Kampung Baru	-	-	-	-	1
	Sungai Kuruk III	-	4	-	2	1
Manyak Payed	Ujung Tanjung	-	2	1	4	1
	Alue Sentang	-	-	-	-	1
Total		1	7	2	6	6

(4) supporting system, and (5) marketing subsystems. Various institutions interact reciprocally, both inside and outside the business area. However, not all institutions exist in the white leg shrimp business area in Aceh Tamiang Regency, primarily related to the processing and marketing of white leg shrimp.

Institutional providers of production facilities consist of feed providers, seeds, medicines available inside and outside the business district, for institutional providers of production inputs in the business area classified as small scale and the umpteenth hand actor of the producer. Input production agents and cultivator groups support the production. They are available within the white leg shrimp business area. Fish processors units, cold storage providers, exporters, and logistics service providers are available outside the business area, namely Medan. In the business process of white leg shrimp, supporting institutions such as BUMDes and banking are also available in Aceh Tamiang Regency. The existence of BUMDes is needed to mobilize the potential of the

White Leg Shrimp Business

village and help in poverty alleviation efforts¹⁴. Cultivator groups must build a work network and mutually beneficial partnerships with various white-leg shrimp business people. BUMDes can directly manage the white leg shrimp cultivation business unit or through a revenue-sharing system with cultivator groups. In addition, BUMDes business types in the form of savings and loan business units can provide investment and operatic capital for fisheries farmers in the form of soft loans.

TABLE 2: Availability of Existing White leg Shrimp Business Institutions in Aceh Tamiang Regency, 2020.

Types of institution	Availability		
	Inside the business districts	Outside the business districts	Inside and outside the business districts
Feed providers	-	-	√
Seeds providers	-	-	√
Medicine providers	-	-	√
Fish production agent	√	-	-
Cultivator's groups	√	-	-
Fish processor units	-	√	-
Cold storage providers	-	√	-
Fish marketer	-	-	√
Exporters	-	√	-
Logistics services production	-	√	-
BUMDes	√	-	-
Financial institutions	√	-	-

3.3. Supply chain and institutional white leg shrimp management

Problems in the white leg shrimp business in Aceh Tamiang Regency occur from pre-production, production, ordering, post-harvest handling, and logistics activities. In the pre-production process, the problem is that seeds and feed are often not available; a partnership between the producer and the production input provider is a solution to the most

complex problem at the shrimp production stage. In addition, the solution is to manage water reservoirs and waste, also forming partnerships with cultivator groups and capital distributors. Finally, at the end of the supply chain, there are problems in the downstream, namely low shrimp quality and low shrimp purchase price; this can be done by investing and partnering with marketers and shrimp processors and providing packaging and distribution services (logistics) through the establishment of

marketers and fisheries processing associations and white leg shrimp logistics provider associations (Table 3).

TABLE 3: Supply Chain Management and Business Institutional of White-leg Shrimp in Aceh Tamiang Regency, 2020.

Problems	Supply Chain Management	Business Management	Institutions
The inlet and outlet water lines are one	Management of water, waste, and sediment reservoirs covering an area of 20% of the cultivated land area	Formation of the shrimp cultivation corporation	
Water sources polluted by chicken farming and charcoal industry			
Low shrimp quality	Providing packaging and distribution services (logistics)	Formation of logistics service providers association	
No seeds and feed are available	Invest and partner with production input providers.	Formation of production input provider association	
The Purchase Price of Cultivated Shrimp is Low	Invest and partner with shrimp marketers and processors	Establishment of fishery products marketers and processors association	
Lack of mastery of cultivation technology	Forming a fishery cultivation corporation	Formation of the shrimp cultivation corporation	
The lack of business capital for cultivators	Forming partnerships with capital suppliers	Financial institutions and sources of financing	

The application of the white leg shrimp supply chain management on production, marketing, post-harvest handling, and integrated transportation ensures the smooth running of white leg shrimp commodities effectively and efficiently reflected by low logistics costs on time and good shrimp quality¹⁵.

The supply chain supports the empowerment of business actors through the cultivation corporation in developing the white leg shrimp aquaculture business. Form of economic cooperation of a group of shrimp farmers in a business-oriented area where business ownership assets remain the property of the cultivators. Corporations to be superior to existing business models such as public, private partnerships, contract farming, joint ventures, and profit-sharing^{16, 17, 18, 19, 20}. In addition, the government can intervene in the form of improvements in the management of the white leg shrimp supply chain by improving the competence of each supply chain institution so that it can be optimal in its position²¹. The corporation will encourage business efficiency, quality standardization, effectiveness, and fishery resource management efficiency.

4. Conclusions

The conclusions and policy recommendations of this research are as follows: (1) Integrated supply chain from upstream to downstream to a mapping of supply chain and institutional business of white leg shrimp in Aceh Tamiang Regency; (2) Conducting investment and partnership activities through the establishment of institutional associations (providers of production inputs, processing of fishery products, marketing of fishery products, and logistics services) and white leg shrimp breeder corporations to solve the problems of supply chain management and business institutions; and (3) Involving all stakeholders is strategy to development white leg supply chain from upstream to downstream.

Policy recommendations that can be made based on this research are: (1) the determination of zoning plans and spatial plans of white leg shrimp cultivation areas, land provision, and capacity building of white leg shrimp breeders; (2) revitalization of mangrove forests as the leading ecosystem that plays a role in the cultivation of white leg shrimp; (3) acceleration of land certification of white leg shrimp breeders; (4) the provision of infrastructure in the form of production roads, power grids, and pond irrigation; (5) institutional strengthening of upstream to downstream business associations; (6) revitalization of BUMDes; (7) provision of capital business of shrimp cultivation business white leg; and (8)

empowerment of white leg shrimp breeders through white leg shrimp breeder corporations.

Acknowledgments

This activity is funded by the APBN - BBRSEKP budget year 2020. Thank you to the Head of the Center for Socioeconomic Research of Marine and Fisheries, who provided support for this activity, and the Aceh Tamiang Fisheries Extension official for their help in collecting data in several villages in Aceh Tamiang.

References

- [1] Food and Agriculture Organization of United Nations. (2021). FAO Global Fish Trade Statistics. Available from: <http://www.fao.org/fishery/statistics/global-commodities-production/en>

- [2] Direktorat Jenderal Perikanan Budidaya. Kebijakan KKP terkait Pengelolaan Perikanan Budidaya dengan Pendekatan Ekosistem. Webinar BBRSEKP "Optimalisasi Perikanan Budidaya Melalui Pendekatan Ekosistem" tanggal 28 Juli 2021 [in Indonesian]
- [3] International Trade Center [ITC] Trade Map. Prospects for Diversification for a Product Exported by Indonesia: Shrimp and Prawn. Retrieved from: https://www.trademap.org/ProductRev_SelProductCountry.
- [4] Badan Pusat Statistik [BPS] Kabupaten Aceh Tamiang. (2021). Kabupaten Aceh Tamiang dalam Angka 2019. Aceh Tamiang, ID: BPS [in Indonesian]
- [5] Widyaningrum D. Key performance indicators (KPIs) on White leg shrimp supply chain performance (preliminary research). IOP Conf. Series: Materials Science and Engineering. 403 (012046). <https://doi.org/10.1088/1757-899X/403/1/012046>.
- [6] Galappaththi EK, Kodithuwakku SS, Galappaththi IM. Can environment management integrate into supply chain management? Information sharing via shrimp aquaculture cooperatives in northwestern Sri Lanka. *Mar Policy*. 2016;68:187–94.
- [7] Pungchompoo S, Duniyakul Y. Effects of Collaborative Factors on Supply Chain Performance Measurement in Thai Frozen Shrimp Supply Chain. IEEE. 4th International Conference on Industrial Engineering and Applications. NTUST Taiwan. *White Leg Shrimp Business* <https://doi.org/10.1109/IEA.2017.7939193>.
- [8] Islam SB, Habib MM. Supply Chain Management in Fishing Industry: A Case Study. *Int. Journal of Supply Chain Management*. 2013;2(2):40–50.
- [9] Fathollahi-Fard AM, Gholian-Jouybari F, Paydar MM, Hajiaghahi-Keshteli M. A bi-objective stochastic closed-loop supply chain network design problem considering downside risk. *Ind Eng Manage Syst*. 2017;16:342–62.
- [10] Lin DY, Wu MH. Pricing and inventory problem in SSC: A case study of Taiwan's white shrimp industry. *Aquaculture*. 2016;456:24–35.
- [11] Buritica NC, Escobar JW, Sa'nchez LV. Designing a sustainable supply network by using mathematical programming: a case of the fish industry. *Int J Ind Syst Eng*. 2017;27(1):48–72.
- [12] Anggrahini D, Karningsih PD, Sulistiyono M. Managing quality risk in a frozen shrimp supply chain: a case study. *Procedia Manuf*. 2015;4:252–60.
- [13] Mosallanezhad B, Hajiaghahi-Keshteli M, Triki C. Shrimp closed-loop supply chain network design. *Soft Comput*. 2021;25(11):7399–422.
- [14] Syahyuti. (2011). *Gampang-Gampang Susah Mengorganisasikan Petani*, Bogor, IPB Pres. [in Indonesian]

- [15] Yusuf R, Rosyidah L, Zamroni A, Apriliani T. Rantai Pasok dan Sistem Logistik Udang White leg di Kabupaten Pinrang, Provinsi Sulawesi Selatan [in Indonesian]. *Buletin Ilmiah Marina*. 2020;6(1):25–35.
- [16] Kassam L, Dorward A. Comparative Assessment of the poverty impacts of pond and cage aquaculture in Ghana. *Aquaculture*. 2017;470:110–22.
- [17] Singh S. (2006). Corporate Farming in India: Is It Must for Agricultural Development? Working Paper No: 2006-11-06.
- [18] Vermeulen S, Cotula L. Making the Most of Agricultural Investment: A Survey of Business Models that Provide Opportunities for Smallholders. London, Rome, Bern: IIED/FAO/IFAD/SDC; 2010.
- [19] Swain PK, Kumar P, Kumar CP. Corporate Farming Vis - a - Vis Contract Farming in India: A Critical Perspective. *Int. Journal of Management and Social Science Research*. 2012;1(3):60–70.
- [20] Oellermann LK. Aquaculture. In: Goble BJ, van der Elst RP, Oellermann LK, editors. *Ugu Lwethu - Our coast. A Profile of Coastal Kwazulu- Natal*. Department of Agriculture and Environmental Affairs and the Oceanographic Research Institute. Cedara; 2014. pp. 128–9.
- [21] Deswati R, Rosyidah L, Apriliani T. Pengaruh Manajemen Rantai Pasok Terhadap Performa Usaha Budi Daya Udang White leg di Provinsi Bali dan Jawa Timur [in Indonesian]. *Buletin Ilmiah Marina*. 2020;6(2):113–24.