

# Consumer perceptions of stingrays in coastal areas of Indonesia

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Manuscript received: 3 October 2023. Revision accepted: 28 December 2023.

**Abstract.** Nawastuti D, Darwanto DH, Mulyo JH, Suadi. 2023. *Consumer perceptions of stingrays in coastal areas of Indonesia. Biodiversitas 24: 6844-6851.* Stingray populations harvested for food may pose risks to food security and conservation goals. The purpose of this research is (i) to determine the type of fish product based on how consumers obtain the product, (ii) to determine the gender of consumers based on the type of product, and (iii) ii) to determine the type of fish product for consumption purposes. Primary data were collected from Google Forms and followed by interviews with selected households. The number of respondents was 125 people from Java Island, Timor Island, Sumba Island, Adonara Island, Lembata Island, Bangka Belitung Island and Flores Island. The information obtained was investigated using Chi-square analysis to understand consumer preferences for fish consumption using an adaptation of SPSS 25 programming. The results of the research show that there are two relationships, namely (i) the type of fish product has a significant relation to fishing, the way consumers fish, the fishery products they buy and (ii) consumer gender has a significant relationship with product type because male consumers find it easier to get stingrays by fishing so they are easier to consume individually, in groups, or to sell. A proper understanding of gender differences in stingray consumption can help determine the sustainability of stingray fisheries in a region because it can be known exactly who can access sustainable food. Although there are several types of stingrays that are protected, other types of stingrays should not be consumed. The results we obtained can be useful for increasing public awareness regarding the use of fish catching and its impact on the carrying capacity of fisheries in Indonesia.

**Keywords:** Coastal areas, consumers, gender, perceptions, stingray

## INTRODUCTION

Expanding worldwide populace development likewise increments food utilization (Hlophe and Ellis 2023) and pressure on food security (Sampathkumar et al. 2023). Food varieties obtained from waters rich in micronutrients are significant for human well-being and add to the decrease of worldwide micronutrient lacks and diet-based well-being opportunities (Koehn et al. 2022). Fish is an alternative food to beef and chicken (Bostic 2018) and an important source of nutrition (Fenner 2016). Apart from being a source of animal protein, it can also generate income and enable cultural activities (Pattiselanno et al. 2023). Be that as it may, in many emerging nations, the subject of fisheries' manageability isn't the fundamental driver of shoppers' decisions. In these nations, individuals might consume imperiled species since they will most likely be unable to follow through on a top-notch cost for reasonable choices (Hasan et al. 2023). Utilization conditions and social environments that make it difficult for buyers to take part in sustainable, conscious behavior (Teufer and Grabner-Kräuter 2023) result in sustainable development is a major challenge facing society around the world today.

Responsible utilization provides a pathway to expanding individual well-being (Godfray et al. 2018; Lucas et al. 2021), so escalated collection of wild populaces for food can represent a gamble to food security

and protection objectives (Samhouri et al. 2019). In recent years, marine pointer programs have centered around assessing the natural effects of fishing at an environmental scale utilizing biological markers (Bundy et al. 2017) and there is still a lack of data on consumer attitudes (Ali et al. 2020). This is the case in several locations in Indonesia, where stingray consumption is common among fishermen, traders and consumers (Seidu et al. 2022). Indonesia, which has cultural heterogeneity (Pangaribowo et al. 2019), makes stingrays one of the popular culinary delights and is considered common so that the availability of fish in the market is considered a normal item (Arthatiani et al. 2018). Additionally, the reasonable cost of fish and the huge measure of individuals' pay influence fish utilization in the short and long term (Firmansyah et al. 2019). Consumers assume a significant part in reducing food impacts to more reasonable levels through dietary changes (Lucas et al. 2021); moreover, the future direction for the fisheries sector is still uncertain (Chan et al. 2019). The exploitation of fish resources in Indonesia is currently experiencing severe harm because of the weight of business abuse to seek momentary benefits (Daris et al. 2022).

Lifestyles that are healthier and more aware of the origins of the food obtained and environmentally friendly (Zhao and Cheah 2023) must be further enhanced by today's consumers because environmental awareness has a strong influence on buying behavior (Benos et al. 2022). Consumption is primarily driven by factors such as taste,

perceived health benefits, and accessibility. Weak food controls in developing markets (Akinwehinmi et al. 2022) combined with the complicated variety of natural and physiological elements, social foundation, and individual perspectives and rules (Sasaki 2022) require policymakers to understand the markets of wildlife for conservation to be more effective (Booth et al. 2021). This is where the requirement for a comprehension of the area and utilization drives the deficiency of biodiversity to distinguish further intercessions to relieve this deficiency of variety (Irwin and Geschke 2023).

Sustainable fisheries management for natural and social purposes in today's age of rapid ecological change requires fisheries chiefs, researchers, and partners to cooperate to track down answers for complex issues (Murphy et al. 2021). Planning methodologies that empower utilization must be socially reliable and the sustainability of this technique will depend on determining the factors that influence how to behave socially (Palacios-González and Chamorro-Mera 2021) and to increase consumer eagerness to switch to reasonable food utilization, so that suitable administrative and observing systems are expected to increment consumer trust in supportable food (Chu et al. 2023). One of the strategies we are implementing is regarding consumer preferences and the factors driving fish consumption in coastal areas are still lacking, so it is hoped that this important information can be a guide in carrying out the interventions that have been determined by the government.

We chose the fish topic for two reasons. First, fish utilization rehearsals are molded by schedules that cross with the accessibility of wild and cultivated fish (Chang 1977; Tezzo et al. 2021). Second, in Southeast Asia, South and Central America, mobulid meat is used as a cheap source of protein in traditional cooking (Croll et al. 2015). In the event that these social acts of utilization are recognized, we can more readily comprehend the progressions underway and overhaul mediations pointed toward accomplishing more practical, evenhanded, and nutritious food framework results (Tezzo et al. 2021). Albeit generally taken for local utilization, the commodity market for dried gill plates and skins has likely determined expanded fishing exertion and mechanical development, prompting expanded harvests and a decrease in neighborhood populaces (Dewar 2002). Restricted in their conceptive limit, all things considered, even low catch rates could bring about huge populace declines (Dulvy et al. 2008). The aims of this research are (i) to determine the type of fish product based on how consumers obtain the product, (ii) to determine the gender of consumers based on product type, and (iii) to determine the type of fish product for consumption purposes. The type of data used in the Google Form are nominal data, so the statistical analysis technique used is Chi-square to understand consumer preferences for fish consumption. Chi-square in particular

is used to decide if there is a connection between the free factor and the dependent variable (Sarwono 2006).

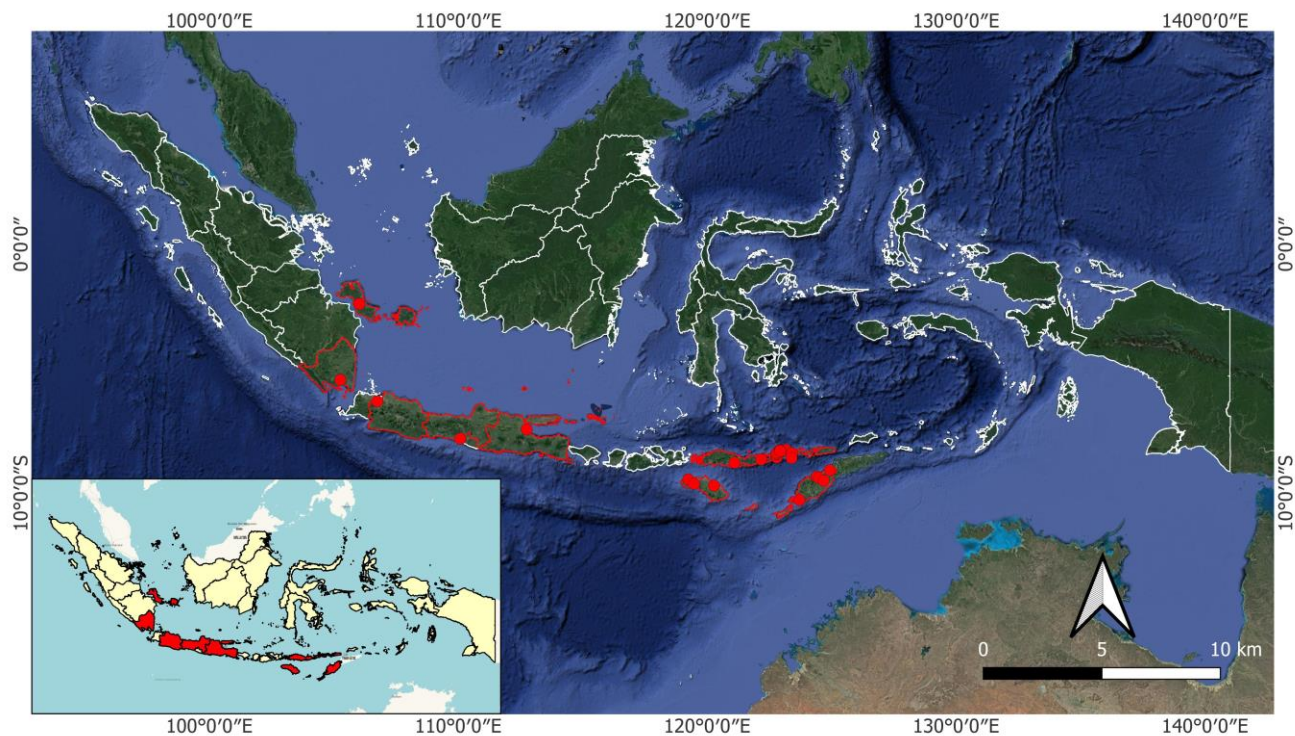
## MATERIALS AND METHODS

### Description of the study area

The research data were taken from a questionnaire using a Google Form that was distributed over a month from August to September 2021. The data entered totaled 132 respondents from Java Island, Timor Island, Sumba Island, Adonara Island, Lembata Island, Bangka Belitung Island, and Flores but there are only 125 valid data. A map of the respondents' locations is presented in Figure 1. Sampling was carried out using a snowball method, namely an approach where each participant directs it to other participants through references (Patton 2015). Snowball sample selection makes the research location random because it follows information provided by participants who have similar interests, experiences and perspectives (Leavy 2017). Part of the data was also collected through direct observation and semi-structured interviews. The questions from this research are: (i) does the type of fish product influence how consumers obtain it? (ii) does the consumer's gender influence the type of fish product consumed? and (iii) does the type of fish product influence the purpose of consumption? The limitations of this research are men or women who are over 21 years old or adults, have consumed stingrays, and live in the water conservation area of East Nusa Tenggara Province from 2014 to 2021.

### Data analysis

Descriptive statistical methods are used to analyze local people's perceptions of the types of fish products, how to obtain them, consumer gender, and consumption purposes. For statistical analysis, data are exported to Excel and SPSS version 25. Contingency tables are used to visualize the underlying relationships between variables in a data set. Non-parametric tests are used to see whether the answers to the survey questions show a systematic relationship or not. The Chi-square independence test is used to test whether the type of fish product is significantly related to the way consumers obtain the product. In addition, the Chi-square independence test also wants to examine the relationship between consumer gender and product types on the sustainability of ray fisheries in coastal areas of Indonesia. The significance of the Chi-square test is to show the reliance on categorical elements in the dataset. It likewise gives an abundance of data that permits the determination of definite data about the measurements being determined. The Chi-square test's working null hypothesis is that the variables are independent, while the alternative hypothesis is that they are not. The null hypothesis was tested at the 95% confidence level; that is,  $\alpha = 0.05$ .



**Figure 1.** Map of Indonesian stingray consumer respondents

## RESULTS AND DISCUSSION

### Types of fish products by how consumers obtain the product

The hypothesis formulation in  $H_0$  is that the type of fish product based on how consumers obtain the product is not significantly different and the alternative hypothesis ( $H_a$ ) is that the type of fish product based on how consumers obtain the product is significantly different. The results of statistical tests using Chi-square with  $2 \times 2$  contingency show that there is a significant relationship between fish products and the method of obtaining these products,  $\chi^2 (1) = 54.343$ ,  $p = 0.001$  and the value of  $\chi^2_{table} = 3.481$  (Table 1). Based on the decision criteria, if the calculated  $\chi^2_{value} > \chi^2_{table}$  then  $H_0$  is rejected, meaning that the type of fish product based on how consumers obtain the product is significantly different.

The types of fresh stingray products available in the market are very limited both in type and quantity. In contrast to preserved stingray meat, the stock is always available in the market, both in traditional markets and online markets. If consumers want fresh fish products but these are not available in the market, then they will look for them by buying fish products from people who sell them locally or get them from partners/relatives who have just returned from fishing. The stingrays obtained by consumers in fresh form are also believed to cure diseases and increase vitality. Fish is a quality food that gives significant supplements to heart well-being and mental health; however, in certain subpopulations, devouring a lot of fish can pose health risks (Hughner et al. 2009). The influence

of various stakeholders in the market and information sources, such as family and friends, causes consumers to experience difficulties in making the right health decisions (Wang et al. 2023).

Consumers can easily find products that match their needs and wants (Andespa 2017). The myth that accompanies the fish will be one of the main sources of inclinations that drive purchasing choices to be more personal than thinking rationally about the sustainability of an ecosystem. In the past, the interaction of coastal communities with wildlife was influenced by traditional ecological knowledge based on various myths and beliefs (Permana et al. 2020). Myth is a narrative-generated mixture of reason, collective emotion, and moral ethos; whether the narrative is based on fact or not is often of little importance (Chlup 2023).

Consumer motivation can be stimulated to drive higher purchase frequencies by focusing on values that reflect inspirations emerging from moral commercialization, well-being and social advantages (Tandon et al. 2020). Many consumers do not know whether the stingrays they consume (Lopes and de Freitas 2023) are included in the list of protected animals or not. Communities value wild-caught fish (Carrassón et al. 2021) more than farmed fish because, even though cultivated fish have been introduced by the local government, their numbers are still limited and they are not traded commercially in traditional markets, especially for Eastern Indonesia. Farmed fish are mainly for group consumption (the distribution of freshwater fish seeds is done through farmer groups) and are increasingly being adopted (Mendoza et al. 2021), but yields are not yet

abundant, so they cannot be marketed in general in traditional markets. Aquaculture is the main source of fish food and one of the main pillars of global food supply (Sampathkumar et al. 2023) and has a high economic value (Hasrianti et al. 2022). Some consumers are reluctant to consume farmed fish because they think that the fish are given unusual fish food that changes the chemistry of the fish somewhat and can be a source of temporary inflammation, while others discuss that the fish live in a dirty aquarium (Bostic et al. 2018). Cultivated fish should be earth-fitting, naturally great, socially adequate, and financially practical (Hoque 2021). Thus a friendly personality assumes a significant part in forming shopper aims to take part in this cooperative utilization (Malecka et al. 2022). According to Palacios-González and Chamorro-Mera (2021), socially responsible consumption is mostly driven by emotional involvement and less by consumer perceptions of effectiveness. Correspondence instruments, for example, narrating approaches or character ways to deal with draw-in purchasers, might be successful in bringing issues to light about sustainability (Lacasse 2016).

### Consumer gender by product type

The hypothesis formulation in  $H_0$  is that the gender of consumers according to product type is not significantly different and the alternative hypothesis ( $H_a$ ) is that the gender of consumers based on product type is significantly different. The results of statistical tests using Chi-square with  $2 \times 2$  contingency show that there is a significant relationship between fish products and how to obtain these products,  $\chi^2 (1) = 4.266$ ,  $p = 0.039$  (Table 2) and the value of  $\chi^2_{table} = 3.481$ . Based on the decision criteria, if the calculated  $\chi^2_{value} > \chi^2_{table}$  then  $H_0$  is rejected, meaning that

consumer gender based on product type is significantly different.

This can happen because it is easier for male consumers to get fresh stingrays by fishing so the hooked stingrays will be more easily consumed individually, in groups, or sold. Fishing for stingrays is not the main goal of fishing activities carried out by coastal communities; but it is a bycatch. When the stingrays are finally caught, they will prefer to keep them rather than release them into the sea because they are afraid of being hit by a flick of the stingray's poisonous tail, unless the young stingrays are entangled in the net and then they will be released. Some coastal communities rely heavily on wild-caught fish for individual utilization (Mendoza et al. 2021). This has a negative impact on fishermen's livelihoods, coastal culture, and the accessibility of fish for consumers (Haapasaari et al. 2019).

Female consumers prefer dried stingrays that are always available in the market, and if they find fresh stocks of stingrays on the market, they will buy them. Stingrays are cheaper than pelagic fish (skipjack, tuna) and do not have true bones, so the whole body can be used. The typical utilization of fish by women is lower than the suggested everyday admission of 100 g of creature nourishment for grown-ups in the EAT Lancet reference diet (universally acknowledged reference diet (Willett et al. 2019). Male respondents ate all the bigger fish, while female respondents ate all the more little fish (Rizaldo et al. 2023). However, Manchanda et al. (2023) uncovered that the effect of realism was more grounded on women than men, so orientation became a critical mediator in the connection between the impact of care on general supportability (counting ecological, financial and social perspectives).

**Table 1.** Chi-square test types of fish products by how consumers obtain the product

Chi-square tests					
	Value	df	Asymptotic significance (2-sided)	Exact sig. (2-sided)	Exact sig. (1-sided)
Pearson chi-square	54.343 <sup>a</sup>	1	<.001		
Continuity correction <sup>b</sup>	51.057	1	<.001		
Likelihood ratio	58.408	1	<.001		
Fisher's exact test				<.001	<.001
Linear-by-Linear Association	53.909	1	<.001		
N of Valid Cases	125				

Notes: a = 0 cells (0.0%) have an expected count of less than 5. The minimum expected count is 9.72; b = computed only for a 2x2 table

**Table 2.** Chi-square test for consumer gender by product type

Chi-square tests					
	Value	df	Asymptotic significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson chi-square	4.266 <sup>a</sup>	1	.039		
Continuity correction <sup>b</sup>	3.414	1	.065		
Likelihood ratio	4.386	1	.036		
Fisher's exact test				.050	.031
Linear-by-Linear Association	4.232	1	.040		
N of Valid Cases	125				

Notes: a = 0 cells (0.0%) have an expected count of less than 5. The minimum expected count is 12.74; b = computed only for a 2x2 table

The diversity of ways and gender goals can diverge from the anticipated gender outcomes of small-scale fisheries interventions (Lawless et al. 2021), so understanding gender differences in fish consumption can help determine the sustainability of what has been done so far. The eating patterns of women and men are also known to be very different, and men have more eating patterns (Rosenfeld and Tomiyama 2021; Rizado et al. 2023), especially in terms of consuming meat because a household's fish consumption is strongly influenced by the location and sex of the head of the household (Tamiru et al. 2023). Subsequently, the means of dealing with the investigation of food utilization opens up ways of understanding and even explores complex food framework advances in powerfully changing locales like Southeast Asia (Tezzo et al. 2021).

This is also related to the interest in consuming fish without distinguishing whether the product is fresh or preserved. Gender diversity can play a harmful role in achieving socially and culturally defined sustainability and health (Schösler et al. 2015) goals when studying or promoting fish consumption. Maintainable utilization in the food area is an attractive, however frequently troublesome, objective to accomplish, as it relies upon the cooperation of different elements, for example, market costs or customer inclinations (Vázquez-Rowe et al. 2013). Here, women assume a significant part in adding to food security, yet choices in regard to the administration of seaside fisheries are still generally taken by male local area pioneers (Rohe et al. 2018).

#### Types of fish products for consumption purposes

The results of statistical tests using Chi-square with 2×2 contingency show that there is an insignificant relationship between fish products and the method of obtaining the product,  $\chi^2(1) = 0.047$ ,  $p = 0.828$  (Table 3) and the value of  $\chi^2_{table} = 3.481$ . Based on the decision criteria, if the calculated  $\chi^2_{value} < \chi^2_{table}$  then  $H_0$  is accepted, meaning that consumer gender based on product type is not significantly different.

Consumers buy stingray products not based on a specific purpose but rather on the mere availability of side dishes. Wild animal meat is regarded as a premium product, and wildlife products are valuable commodities (Pattiselanno et al. 2019) and, if it is really needed, it can be used for health in the sense of treating disease, avoiding disease, and protecting certain body parts (Bostic et al.

2018) although it cannot be applied to everyone. Some people feel the smell and taste of stingrays are quite fishy, and even sometimes the meat consumed causes negative effects on the body, which is reinforced by Bostic et al. (2018), who state that eating fish can have an adverse effect on disease; theoretically, this is a challenge for most people.

The stingrays available on the market are very limited because the fish sold are bycatch. If consumers buy this product in the market, it is because the stock is available incidentally, while for preserved stingrays, even though the stock is always there, only certain consumers buy it. The price of this preserved fish is quite high, so consumers also buy it in limited quantities, especially for those who have families with several members and the need for side dishes in school children's dormitories. The presence of a social peculiarity, including anglers, middle people, processors, and customers (Nahuelhual et al. 2020) makes sustainability difficult in conservation areas. The existence of different cultural values between ethnic groups requires understanding the importance of the contribution of wild animals to the livelihoods of local people (Pattiselanno et al. 2019).

The government's aid is producing the necessary livelihood-enhancing effects to reduce the pressure of hunting pressure on remaining wildlife (Sawaki et al. 2022); however, it isn't adequate to lift most families out of neediness without any additional primary changes and intercessions (Hajdu et al. 2020). Instead of merely addressing the consumption of meat, regulations must be ecologically responsive and must take into account intricate social, political, economic, and environmental factors (Sievert et al. 2022). Seafood consumption depends on interventions aimed at the elderly and children (Birch and Memery 2020). This is important for protecting populations and ensuring the continuity of livelihoods and the nutritional security of local people (Roy et al. 2023). Interactions between humans and elasmobranchs (rays and sharks) have been a constant feature of coastal human communities (Mojetta et al. 2018). On the off chance that purchasers are given the right ecological rules through mindfulness crusades, they can assume a functioning and significant part in decreasing the natural profile of fish items through changes in behavior patterns while purchasing and consuming them (Vázquez-Rowe et al. 2013). This adversely affects anglers' occupations, seaside culture, and the accessibility of fish for purchasers.

**Table 3.** Chi-square test for types of fish products for consumption purposes

Chi-Square tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.047 <sup>a</sup>	1	.828		
Continuity Correction <sup>b</sup>	.000	1	1.000		
Likelihood Ratio	.048	1	.827		
Fisher's Exact Test				1.000	.534
Linear-by-Linear Association	.047	1	.829		
N of Valid Cases	125				

Notes: a = 0 cells (0.0%) have an expected count of less than 5. The minimum expected count is 5.40; b = computed only for a 2x2 table



Based on the results of the research and analysis that has been carried out, the conclusion that can be drawn is that male consumers will fish themselves if they want fresh fish and fresh fish is chosen for the reason of improving family nutrition. This research also contributes important managerial implications. Gender roles, as well as how products and fish are obtained, have an impact on the social, economic, and environmental consequences of their consumption patterns, according to the findings of the study. Insights from this research can be used by the government to carry out better interventions to increase awareness of the sustainability of the ray fishery.

The consumption of stingrays is unique and risky, but this activity is real in society. At present, there is no data on the consumption of stingrays, so it is not known how much growth the fish consumption market has shown. Although it seems very risky, market growth is really needed for policymakers to be able to take the first steps before emphasizing the need for a fish consumption management strategy for the sustainability of ray fisheries. Consumers who consume stingrays for nutritional reasons, myths and culture are very disturbing to the goals and benefits of conservation that have been carried out so far, but consumers cannot be completely blamed because there are still many who do not understand the meaning and sustainable impact of this consumption. Older consumers should be given insight into the impact of their consumption, and the younger generation should receive additional knowledge that can be included in local content so that they no longer consume fresh and preserved rays. Fishermen, intermediaries, processors, and traders who violate the rules because they catch and trade protected stingray species must receive sanctions in accordance with applicable regulations without a selective logging system. Cultural reasons should no longer be a shield to legalize what is done because the existence of stingrays is very important for the ecosystem in the sea. Although there are several types of stingrays that are protected, other types of stingrays should also not be consumed so that stingray fishing is sustainable. The limitation of our approach means that there are several things that need attention in the future; namely our analysis only considers two types of stingray products (fresh and preserved), and our model does not explain the known determinants of fish consumption, for example, the price of fish products, the availability of alternative protein sources, species, etc. Data on the stingray trade are challenging to obtain, so in further research, we can learn about the trade-in stingrays and the products produced.

## ACKNOWLEDGEMENTS

We take this opportunity to thank the Ministry of Research, Technology and Higher Education through its funding of the Domestic Postgraduate Education Scholarship. The authors also thank the community and all parties who have assisted in carrying out this research.

## REFERENCES

- Akinwehinmi O, Ogundari K, Amos TT. 2022. Consumers' food control risk perception and preference for food safety certification in emerging food markets. *J Agricult Econ* 73 (3): 690-708. DOI: 10.1111/1477-9552.12474.
- Ali L, Grey E, Singh D, Mohammed A, Tripathi V, Gobin J, Ramnarine I. 2020. An evaluation of the public's knowledge, attitudes and practices (KAP) in Trinidad and Tobago regarding sharks and shark consumption. *PloS One* 15 (6): 1-24. DOI: 10.1371/journal.pone.0234499.
- Andespa R. 2017. Hubungan perbedaan gender terhadap keputusan dalam membeli produk pakaian jadi. *Open Science Framework* 7 (6): 182-191. DOI: 10.31227/osf.io/a25wk. [Indonesian]
- Arthathiani FY, Kusnadi N, Harianto H. 2018. Analysis of fish consumption patterns and fish demand model based on household's characteristics in Indonesia. *Jurnal Sosial Ekonomi Kelautan dan Perikanan* 13 (021): 73-86. DOI: 10.15578/jsekp.v13i1.6967. [Indonesian]
- Benos T, Burkert M, Hüttl-Maack V, Petropoulou E. 2022. When mindful consumption meets short food supply chains: empirical evidence on how higher-level motivations influence consumers. *Sustain Prod Consum* 33: 520-30. DOI: 10.1016/j.spc.2022.07.028.
- Birch D, Memery J. 2020. Exploring the influence of family on adolescents' seafood consumption choices. *Intl J Consumer Stud* 44 (5): 499-510. DOI: 10.1111/ijcs.12581.
- Booth H, Squires D, Yulianto I, Simeon B, Muhsin, Adrianto L, Milner-Gulland EJ. 2021. Estimating economic losses to small-scale fishers from shark conservation: a hedonic price analysis. *Conserv Sci Pract* 3 (9): 1-17. DOI: 10.1111/csp2.494.
- Bostic SM, Sobal J, Bisogni CA. 2018. Social representations of fish and seafood among midlife rural adults: benefits, risks, and involvement. *Food Pol* 76: 99-108. DOI: 10.1016/j.foodpol.2018.03.010.
- Bundy A, Chuenpagdee R, Boldt JL, de Fatima Borges M, Camara ML, Coll M, Diallo I, Fox C, Fulton EA, Gazihan A, Jarre A, Jouffre D, Kleinsner KM, Knight B, Link J, Matiku PP, Masski H, Moutopoulos DK, Piroddi C, Raid T, Sobrino I, Tam J, Thiao D, Torres MA, Tsagarakis KM, Gro I, Shin YJ. 2017. Strong fisheries management and governance positively impact ecosystem status. *Fish Fish* 18 (3): 412-39. DOI: 10.1111/faf.12184.
- Carrassón M, Soler-Membrives A, Constenla M, Escobar C, R. Flos, J. M. Gil, V. Luzón, F. Piferer, L. Reig. 2021. Information impact on consumers' perceptions towards aquaculture: Dismantling the myth about feeds for farmed fish. *Aquaculture* 544: 737137. DOI: 10.1016/j.aquaculture.2021.737137.
- Chan CY, Tran N, Pethiyagoda S, Crissman CC, Sulser TB, Phillips MJ. 2019. Prospects and challenges of fish for food security in Africa. *Glob Food Secur* 20: 17-25. DOI: 10.1016/j.gfs.2018.12.002.
- Chang KC. 1977. *Introduction: Food in Chinese Culture*. New Haven, CT USA and London, UK.
- Chlup R. 2023. Conspiracy narratives as a type of social myth. *Intl J Phys Cult Soc* 1-23. DOI: 10.1007/s10767-023-09454-1.
- Chu M, Anders S, Deng Q, Contador CA, Cisternas F, Caine C, Zhu Y, Shuyuan Y, Bo H, Zhiguang L, Lap Ah T, Hon Ming L. 2023. The future of sustainable food consumption in China. *Food Energy Secur* 12 (2): 1-16. DOI: 10.1002/fes3.405.
- Croll DA, Dewar H, Dulvy NK, Fernando D, Francis MP. 2015. Vulnerabilities and fisheries impacts: the uncertain future of manta and devil rays. *Aquat Conserv Mar Freshw Ecosyst* 26 (2016): 562-75. DOI: 10.1002/aqc.2591.
- Daris L, Massiseng ANA, Fachri ME, Jaya J, Zaenab St.. 2022. The Impact of fishermen's conflict on the sustainability of crab (*Portunus pelagicus*) resources in the coastal areas of Maros District, South Sulawesi, Indonesia. *Biodiversitas* 23 (10): 5278-89. DOI: 10.13057/biodiv/d23i037.
- Dewar H. 2002. Preliminary report: manta harvest in Lamakera. Report from the Pflieger Institute of Environmental Research and the Nature Conservancy 3: 1-3.
- Dulvy NK, Baum JK, Clarke S, Compagno LJ, Cortes E, Domingo A, Fordham S, Sarah F, Malcolm PF, Claudine G, Jimmy M, John AM, Alen S, John DS, Sarah V. 2008. You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. *Aquat Conserv: Mar Freshw Ecosyst* 18: 459-82. DOI: 10.1002/aqc.

- Fenner D. 2016. Criticism of marine protected areas by fisheries scientists. *Mar Pollut Bull* 108 (1-2): 12-14. DOI: 10.1016/j.marpolbul.2016.05.026.
- Firmansyah, Oktavilia S, Prayogi R, Abdulah R. 2019. Indonesian fish consumption: an analysis of dynamic panel regression model. *IOP Conf Ser: Earth Environ Sci* 246: 8-12. DOI: 10.1088/1755-1315/246/1/012005.
- Godfray H CJ, Aveyard P, Garnett T, Hall JW, Key TJ, Lorimer J, Pierrehumbert RT, Scarborough P, Springmann M, Jebb SA. 2018. Meat consumption, health, and the environment. *Science* 361 (6399): 1-8. DOI: 10.1126/science.aam5324.
- Haapasaari P, Ignatius S, Pihlajamäki M, Sarkki S, Tuomisto JT, Delaney A. 2019. How to improve governance of a complex social-ecological problem? Dioxins in baltic salmon and herring. *J Environ Pol Plan* 21 (6): 649-61. DOI: 10.1080/1523908X.2019.1661236.
- Hajdu F, Granlund S, Neves D, Hochfeld T, Amuakwa-Mensah F, Sandström E. 2020. Cash transfers for sustainable rural livelihoods? Examining the long-term productive effects of the child support grant in South Africa. *World Dev Perspect* 19: 100227. DOI: 10.1016/j.wdp.2020.100227.
- Hasan MdR, Chaplin JA, Spencer PB, Braccini M. 2023. Consumption of shark products: the interface of sustainability, trade (mis)labelling, human health and human rights. *Fish Fish* 2023: 777-95. DOI: 10.1111/faf.12768.
- Hasrianti MA, Surianti, Putri ARS, Akbar AH. 2022. Analysis of nutritional content and heavy metals of suckermouth catfish (*Pterygoplichthys pardalis*) in Lake Sidenreng, South Sulawesi, Indonesia. *Biodiversitas* 23 (7): 3539-44. DOI: 10.13057/biodiv/d230729.
- Hlophe SL, Ellis D. 2023. Changing consumer attitudes to make the corporate social responsibility investment in sustainable fish production a worthwhile investment to corporates. *Corporate Soc Responsibility Environ* 2023: 1-13. DOI: 10.1002/csr.2573.
- Hoque MZ. 2021. Sustainability indicators for sustainably-farmed fish in Bangladesh. *Sustain Prod Consumption* 27: 115-27. DOI: 10.1016/j.spc.2020.10.020.
- Hughner RS, Maher JK, Childs NM, Nganje WE. 2009. Fish: Friend or foe? Food policy and subpopulation warnings for consumers. *Food Pol* 34 (2): 185-97. DOI: 10.1016/j.foodpol.2008.09.002.
- Irwin A, Geschke A. 2023. A consumption-based analysis of extinction risk in Australia. *Conserv Lett* 2022: 1-12. DOI: 10.1111/conl.12942.
- Koehn JZ, Allison EH, Villeda K, Chen Z, Nixon N, Crigler E, Zhao L, Michelle C, Bapu V, Shakuntala HT, Joeri S, Christina CH, Neil A. 2022. Fishing for health: Do the world's national policies for fisheries and aquaculture align with those for nutrition? *Fish Fish* 23 (1): 125-142. DOI: 10.1111/faf.12603.
- Lacasse K. 2016. Don't be satisfied, identify! Strengthening positive spillover by connecting pro-environmental behaviors to an 'environmentalist' label. *J Environ Psychol* 48: 149-58. DOI: 10.1016/j.jenvp.2016.09.006.
- Lawless S, Cohen PJ, Mangubhai S, Kleiber D, Morrison TH. 2021. Gender equality is diluted in commitments made to small-scale fisheries. *World Dev* 140: 105348. DOI: 10.1016/j.worlddev.2020.105348.
- Leavy P. 2017. Research Design: Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches. Edited by Patricia Leavy. The Guilford Press, New York and London.
- Lopes IG, de Freitas TM. 2023. Fish consumption in Brazil: State of the art and effects of the covid-19 pandemic. *Aquaculture* 574: 739615. DOI: 10.1016/j.aquaculture.2023.739615.
- Lucas E, Guo M, Guillén-Gosálbez G. 2021. Optimising diets to reach absolute planetary environmental sustainability through consumers. *Sustain Prod Consumption* 28: 877-92. DOI: 10.1016/j.spc.2021.07.003.
- Malecka A, Mitrega M, Pfäfar G. 2022. Segmentation of collaborative consumption consumers: social identity theory perspective. *Intl J Consumption Stud* 46 (6): 2445-65. DOI: 10.1111/ijcs.12798.
- Manchanda P, Arora N, Nazir O, Islam JU. 2023. Cultivating sustainability consciousness through mindfulness: an application of theory of mindful-consumption. *J Retail Consumer Serv* 75 (July): 103527. DOI: 10.1016/j.jretconser.2023.103527.
- Mendoza JN, Mattalia G, Prüse B, Kochalski S, Ciriaco A, Pieroni A, Sökand R. 2021. Wild fish are a blessing': Changes in fishing practices and folk fish cuisine around Laguna Lake, Northern Philippines. *J Ethn Foods* 8 (1): 1-11. DOI: 10.1186/s42779-021-00106-3.
- Mojetta AR, Travaglini A, Scacco U, Bottaro M. 2018. Where sharks met humans: the Mediterranean Sea, history and myth of an ancient interaction between two dominant predators. *Reg Stud Mar Sci* 21: 30-38. DOI: 10.1016/j.rsma.2017.10.001.
- Murphy R, Cunningham C, Harris BP, Brown C. 2021. Qualitative and quantitative fisher perceptions to complement natural science data for managing fisheries. *Fisheries* 46 (5): 209-19. DOI: 10.1002/fsh.10568.
- Nahuelhual L, Saavedra G, Mellado MA, Vergara XV, Vallejos T. 2020. A social-ecological trap perspective to explain the emergence and persistence of illegal fishing in small-scale fisheries. *Mar Stud* 19: 105-17. DOI: 10.1007/s40152-019-00154-1.
- Palacios-González MM, Chamorro-Mera A. 2021. Analysis of the predictive variables of socially responsible consumption. *Business Strategy Dev* 5: 187-96. DOI: 10.1002/bsd2.189.
- Pangaribowo EH, Tsegai D, Sukamdi. 2019. Women's bargaining power and household expenditure in Indonesia: the role of gender-differentiated assets and social capital. *GeoJournal* 84 (4): 939-60. DOI: 10.1007/s10708-018-9901-4.
- Pattiselanno F, Apituley JRM, Arobaya AYS, Koibur JF. 2019. Short communication: using wildlife for local livelihood - experiences from the bird's head peninsula, West Papua, Indonesia. *Biodiversitas* 20 (7): 1839-45. DOI: 10.13057/biodiv/d200708.
- Pattiselanno F, Tokede MJ, Arobaya AYS, Mardiatmoko G, Pattiselanno AE. 2023. Hunting introduced species in Indonesia New Guinea. *Biodiversitas* 24 (5): 3045-50. DOI: 10.13057/biodiv/d240560.
- Patton MQ. 2015. Qualitative Research and Evaluation Methods. 4<sup>th</sup> ed. SAGE, Thousand Oaks, California.
- Permana S, Partasasmita R, Iskandar J, Rohmatullayaly EN, Iskandar BS, Malone N. 2020. Traditional conservation and human-primate conflict in Ujungjaya Village community, Ujung Kulon, Banten, Indonesia. *Biodiversitas* 21 (2): 521-29. DOI: 10.13057/biodiv/d210213.
- Rizaldo QV, Khaing WW, Belton B. 2023. Small fish consumption in rural Myanmar. *Mar Stud* 22 (2): 1-11. DOI: 10.1007/s40152-023-00304-6.
- Rohe J, Schlüter A, Ferse SCA. 2018. A gender lens on women's harvesting activities and interactions with local marine governance in a south pacific fishing community. *Mar Stud* 17 (2): 155-62. DOI: 10.1007/s40152-018-0106-8.
- Rosenfeld DL, Tomiyama AJ. 2021. Gender differences in meat consumption and openness to vegetarianism. *Appetite* 166: 105475. DOI: 10.1016/j.appet.2021.105475.
- Roy A, Naskar M, Sinha A, Manna RK, Sahu SK, Ekka A, Das BK. 2023. Determinants Influencing fishermen's willingness-to-participate and willingness-to-pay for conservation of small indigenous fishes: a model-based insight from Indian sundarbans. *Front Sustain Food Syst* 7: 1-10. DOI: 10.3389/fsufs.2023.1215091.
- Samhouri JF, Ramanujam E, Bizzarro JJ, Carter H, Sayce K, Shen S. 2019. An ecosystem-based risk assessment for california fisheries co-developed by scientists, managers, and stakeholders. *Biol Conserv* 231: 103-21. DOI: 10.1016/j.biocon.2018.12.027.
- Sampathkumar K, Yu H, Loo SCJ. 2023. Valorisation of industrial food waste into sustainable aquaculture feeds. *Future Food* 7: 100240. DOI: 10.1016/j.fufo.2023.100240.
- Sarwono J. 2006. Metode Penelitian Kuantitatif dan Kualitatif. Graha Ilmu, Yogyakarta. [Indonesian]
- Sasaki K. 2022. Diversity of Japanese consumers' requirements, sensory perceptions, and eating preferences for meat. *Anim Sci J* 93 (1): 1-7. DOI: 10.1111/asj.13705.
- Sawaki S, Taran D, Taran F, Bomoi R, Rumateray M. 2022. Hunting of wild animals by Saubeba community in Manokwari, West Papua, Indonesia. *Biodiversitas* 23 (5): 2411-2416. DOI: 10.13057/biodiv/d230519.
- Schösler H, de Boer J, Boersema JJ, Aiking H. 2015. Meat and masculinity among young Chinese, Turkish and Dutch adults in the Netherlands. *Appetite* 89: 152-59. DOI: 10.1016/j.appet.2015.02.013.
- Seidu I, Brobbey LK, Danquah E, Oppong SK, van Beuningen D, Seidu M, Dulvy NK. 2022. Fishing for survival: importance of shark fisheries for the livelihoods of coastal communities in Western Ghana. *Fish Res* 246: 106157. DOI: 10.1016/j.fishres.2021.106157.
- Sievert K, Chen V, Voisin R, Johnson H, Parker C, Lawrence M, Baker P. 2022. Meat production and consumption for a healthy and sustainable Australian food system: Policy options and political dimensions.

- Sustain Prod Consumption 33: 674-85. DOI: 10.1016/j.spc.2022.08.007.
- Tamiru M, Alkhtib A, Ahmedsham M, Worku Z, Tadese DA, Teka TA, Geda F, Burton E. 2023. Fish consumption and quality by peri-urban households among fish farmers and public servants in Ethiopia. *Ecohydrol Hydrobiol* 23 (3): 498-506. DOI: 10.1016/j.ecohyd.2023.02.005.
- Tandon A, Dhir A, Kaur P, Kushwah S, Salo J. 2020. Why do people buy organic food? the moderating role of environmental concerns and trust. *J Retailing Consumer Serv* 57: 102247. DOI: 10.1016/j.jretconser.2020.102247.
- Teufer B, Grabner-Kräuter S. 2023. How consumer networks contribute to sustainable mindful consumption and well-being. *J Consumer Affairs* April: 757-84. DOI: 10.1111/joca.12536.
- Tezzo X, Aung HM, Belton B, Oosterveer P, Bush SR. 2021. Consumption practices in transition: rural-urban migration and the food fish system in Myanmar. *Geoforum* 127: 33-45. DOI: 10.1016/j.geoforum.2021.09.013.
- Vázquez-Rowe I, Villanueva-Rey P, Moreira MT, Feijoo G. 2013. The role of consumer purchase and post-purchase decision-making in sustainable seafood consumption: A Spanish case study using carbon footprinting. *Food Pol* 41: 94-102. DOI: 10.1016/j.foodpol.2013.04.009.
- Wang Y, Neilson LC, Ji S. 2023. Mindfulness through Agency in health consumption: Empirical evidence from committed dietary supplement consumers. *J Consumer Affairs* 871-905. DOI: 10.1111/joca.12508.
- Willett W, Rockström J, Loken B et al. 2019. Food in the anthropocene: the EAT-lancet commission on healthy diets from sustainable food systems. *Lancet* 393 (10170): 447-92. DOI: 10.1016/S0140-6736(18)31788-4.
- Zhao S, Cheah KSL. 2023. The challenges of Malaysian private universities in reaching sustainable education toward responsible consumption. *Clean Responsible Consumption* 10 (March): 100130. DOI: 10.1016/j.clrc.2023.100130.