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Review Article

## Literature Review: Risk Factors Affecting Hearing Loss among Fishermen in Indonesia

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### Abstract

Indonesia is a country where most of the people work as fishermen because most of its territory is water. Fishermen are a profession that has a high risk of occupational disease in the form of hearing loss which causes losses in the form of permanent disabilities, decreased financial income and quality of life, as well as the mental health of fishermen. The purpose of this study was to identify the risk factors that cause occupational hearing loss experienced by fishermen. This research is a literature review conducted using the Google Scholar database with the keywords "Hearing Loss", "Occupational Diseases", "Fishermen", and "Indonesia". The results of this literature review show that diving and non-diver fishermen have a risk of hearing loss due to personal factors such as age, years of service, knowledge, attitudes, and behavior, while occupational factors that influence are noise intensity, length of exposure to availability of ear protection equipment, length of time, and depth of diving activity.

Keywords: hearing loss, occupational diseases, fishermen

## INTRODUCTION

Indonesia is one of the largest archipelagic and maritime countries in the world with a sea area of 3.25 million km<sup>2</sup> and an exclusive economic zone of 2.55 million km<sup>2</sup> or about 75% of the country's total area. <sup>1</sup>. Based on this, the fisheries sector has become one of the largest livelihoods in Indonesia, as evidenced in 2016 there were 965,756 households and fisheries companies scattered throughout Indonesia <sup>2</sup> and in 2018 the number of people who work as fishermen is 1,685,018 people <sup>3</sup>.

According to the ILO, every year there are 160 million workers in the formal and informal sectors who experience diseases due to the work environment around the world <sup>4</sup>. The fishing profession is an informal sector job that is included in the high-risk category so that many fishermen suffer from occupational diseases <sup>5</sup> which is caused due to exposure to hazards originating from work, work tools, materials, processes and the work environment <sup>6</sup>. The large number of fishermen groups experiencing occupational diseases is due to the weak application of occupational safety and health aspects which aim to guarantee and protect workers from occupational accidents and diseases <sup>7</sup>.

Research conducted on fishermen on the Gulf Coast, United States showed that out of 117 respondents there were 30.5% of fishermen with mild hearing loss, 18.8% moderate hearing loss, 8.1% moderate-severe hearing loss, 1.5% severe hearing loss, and 0.5% hearing loss very heavy <sup>8</sup>. Losses caused by the occurrence of hearing loss experienced by

fishermen due to work, namely that almost all hearing loss is felt to be permanent so that it can interfere with fishermen's work activities and have an impact on decreasing financial income so that it can also cause a decrease in the quality of life of fishermen which has an impact on the emergence of health problems. other. Hearing loss due to work has been shown to affect mental health due to stress due to the inability to communicate with other people <sup>9</sup>. Based on this background, the aims of this literature review is to identify risk factors that cause occupational hearing loss experienced by fishermen.

## METHODOLOGY

This literature review study was conducted to explore the risk factors that influence the incidence of occupational hearing loss experienced by fishermen. A literature search was carried out in April 2021 using a database source, namely Google Scholar. Literature search was carried out using keywords which became the main topic term, namely hearing loss "AND" occupational disease "AND" fishermen "AND" Indonesia. Researchers set limits in the search for related literature used as data, namely journals published in 2016-2021 to obtain valid and out-of-date information.

The inclusion criteria included in the selection of this literature review study were journals related to the incidence of occupational hearing loss experienced by fishermen in Indonesia, journal texts in Indonesian or English Danger. The exclusion criteria included in the selection of this literature review study were literature

review articles. The variables in this study are risk factors that affect the incidence of occupational hearing loss experienced by fishermen.

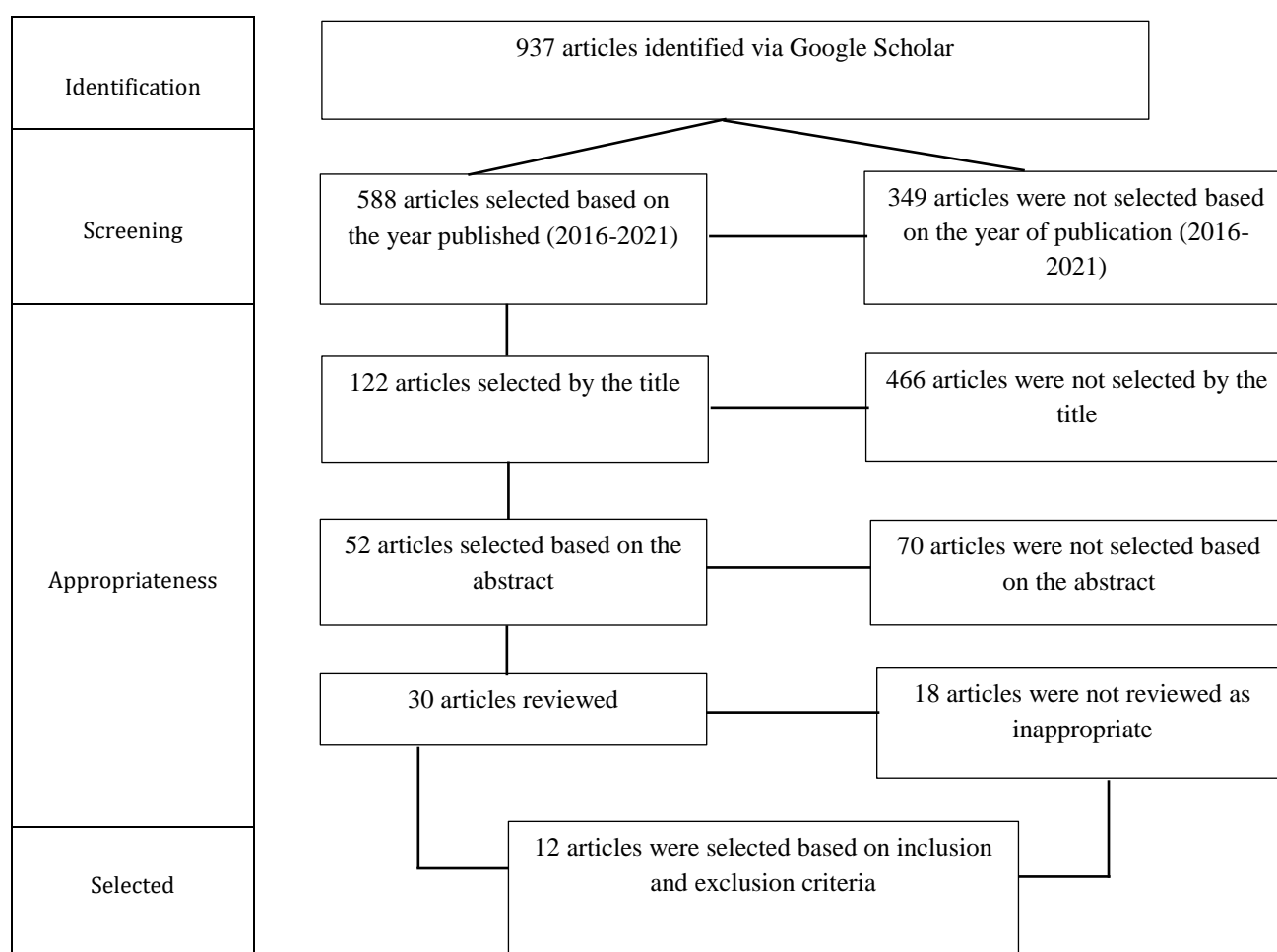
## DATA EXTRACTION

Journals were selected by researchers independently through the Google Scholar database which were searched using the keywords "Hearing Loss, Occupational Diseases, Fishermen, Indonesia" and "Hearing Loss, Occupational Disease, Fishermen, Indonesia". During data synthesis, 937 articles were obtained via Google Scholar. 349 articles were released after scanning based on the restrictions on the year the articles were published, namely 2016-2021. 466 articles were removed by reviewing the title and 70 articles were removed by reviewing the abstract. 30 articles were found relevant because they discussed occupational hearing loss

experienced by fishermen in Indonesia. During the full text analysis, out of 30 articles, another 18 articles were excluded because they did not fit the inclusion criteria. This systematic literature review finally selected 12 articles that were relevant and fit the study inclusion criteria.

Figure 1 describes the process of selecting articles according to the guidelines from the Preferred Reporting Literature Reviews and Meta-analysis (PRISMA). The initial search returned a total of 937 articles showing high relevance to the topic under review. After duplicating articles and filtering published years, titles and abstracts, 30 articles entered the next stage, namely full text review and eligibility based on inclusion and exclusion criteria determined by the researcher. The 12 research articles that met the requirements were then reviewed for quality and synthesized in this final literature review report.

Figure 1 PRISM Flowchart for Literature Review



## RESULTS

The results of this review literature is indicate that the profession of fishermen in Indonesia is divided into two, namely fishermen who fish with and without diving. Both groups of the fishing profession have a risk of experiencing the same occupational disease, one of which is hearing loss in the form of a decreased hearing threshold. 97.50% of fishermen experienced hearing loss with several levels of severity, namely 52.50% mild level, 43.75% moderate level and 1.25% high severity level <sup>10</sup>. The hearing loss

experienced by fishermen is caused by several factors. Risk factors that can cause fishermen to experience hearing loss can come from personal factors and work factors..

Personal factors that come from within fishermen who are at risk of causing hearing loss based on research conducted on fishermen who use motorized boats in Barombong village and fishermen in Palopo city, namely age and years of work <sup>11,10</sup>. Other research conducted on traditional diving fishermen shows that personal factors that affect hearing loss in the form of a decrease in threshold are fishermen's knowledge of the causes and symptoms of barotrauma and

diving methods as well as fishermen's attitudes regarding occupational safety and health aspects.<sup>12,13</sup> 39.5% of the 15 respondents of traditional diving fishermen in Ambon City who experience hearing loss in the form of a decrease in hearing threshold are due to poor occupational safety and health behavior during diving activities such as not doing equalization techniques while diving<sup>20,14</sup>.

Job factors that are at risk of causing hearing loss are noise from ship engines and compressor engines, which generally have a noise intensity of > 85 dBA.<sup>15,11,10,16</sup> High noise intensity when combined with long exposure time, frequency and long exposure period will increase the risk and exacerbate the degree of hearing loss in fishermen<sup>17</sup>. Another factor related to the occurrence of hearing loss felt

by fishermen due to noise exposure is the unavailability of ear protection in the form of earplugs<sup>15</sup>. To get a more diverse catch of marine products, most fishermen do diving activities in the sea. Diving activities can increase the risk of hearing loss if done with inappropriate methods. The length of time or duration, frequency and depth of dives can affect hearing loss<sup>18,19,20</sup>.

## TABLE OF THE REVIEWED ARTICLES

After the researcher selects and extracts the data for each article obtained, a detailed description of the name of the researcher, title, research design, respondents, research strengths and results, and research limitations are summarized in Table 1.

**Table 1: Research on the Risk Factors for Occupational Hearing Loss in Fishermen in Indonesia**

No	Title	Authors	Objective	Methods	Location and Sample	Results
1	Audiometric Profile of Fishermen using Motor Boat in Barombong Village, Makassar	Anwar, Savitri dan Dyah, 2019	Provides an overview of the factors causing the prevalence and degree of hearing loss in fishermen in Barombong village, Makassar	<i>Cross sectional</i>	Barombong Village, Massar. 40 fishermen	A significant decrease in hearing power is due to factors of age, years of service and the intensity of the noise from the motor boats used for fishing.
2	Various Factors That Influence Middle Ear Barotrauma on Traditional Divers (Study in the Balaesang Tanjung Area, Donggala Regency)	Martinus, Hadisaputro dan Munasik, 2019	To determine the influence of host and environmental factors that cause middle ear barotrauma	<i>Cross sectional</i>	Balaesang Tanjung, Donggala. 78 traditional diving fishermen	Dive time $\geq$ 7 minutes; The frequency of dives $\geq$ 4 days / week and never getting health education is related to the incidence of middle ear barotrauma in traditional diving fishermen
3	Diving Frequency Increase the Risk Barotrauma in Traditional Fisherman-Divers	Fatimah, Andarini dan Astari, 2019	Identify the correlation between the frequency of diving and dive rest time with the incidence of barotrauma	<i>Case control</i>	Tasipi Island. 174 traditional diving fishermen	There is a significant relationship between the frequency of diving and the incidence of barotrauma (p value - 0.000), that is, fishermen who dive twice a day have a 5.48 times higher risk of experiencing barotrauma (OR = 5.48), while the resting time while diving has no relationship with the incidence of barotrauma ear
4	Risk Factors of Ear Barotrauma for Fishermen Divers in Watu Ulo Hamlet, Sumberejo Village, Ambulu District, Jember Regency	Navisah, Ma'rufi dan Sujoso, 2016	Identify the risk factors associated with the incidence of barotrauma	<i>Cross sectional</i>	Watu Ulo Hamlet, Sumberejo Village, Ambulu District, Jember Regency. 34 traditional diving	There is a significant relationship between depth and duration or duration of diving with the incidence of ear barotrauma, while other variables such as age, years of service, frequency of

					fishermen	diving and resting time do not have a significant relationship.
5	Safety Factors Affecting the Health Status of Traditional Fisherman in the Coastal Area Surabaya	Arini <i>et al.</i> , 2020	Analyze safety factors related to the health status of traditional fishermen	Cross sectional	Surabaya. 35 traditional diving fishermen	There is a significant relationship between the equalization technique and the incidence of barotrauma experienced by traditional diving fishermen.
6	The Correlation between Knowledge and Hearing Loss Due to Gathering of Traditional Divers on the Bugis Campus: Case Report	Rahman, Kurniawati dan Apriani, 2020	Identify the correlation between knowledge and hearing loss in traditional diving fishermen	Quantitative	Tanjung Pinang. 38 traditional diving fishermen	There is a relationship between knowledge and the incidence of hearing loss due to diving experienced by traditional diving fishermen
7	Analysis of the Correlation between Noise Level and Hearing Loss in Fishermen in Pontap Village, Palopo City, South Sulawesi Province in 2016	Tasik, 2018	Identify and assess hearing loss caused by noise, age, years of service and length of work	<i>Cross sectional</i>	South Sulawesi. 75 fishermen	There is a significant relationship between noise intensity, age, and years of service with the incidence of decreased hearing threshold or hearing loss felt by fishermen
8	The Correlation between Noise and the Use of Ear Plugs with Hearing Disorders on Fishermen	Sholihah dan Hanafi, 2017	Knowing the correlation between boat engine noise and the use of earplugs on hearing loss in fishermen	<i>Cross sectional</i>	Laut Utara Island, South Kalimantan 186 nelayan	There is a significant relationship between noise intensity that exceeds the threshold value > 85 dBA and the use of ear protection equipment in the form of earplugs with the incidence of decreased hearing threshold experienced by fishermen.
9	Identification of Occupational Health and Safety Hazards in Fishermen's Activities	Vinezia, 2021	Identify potential occupational safety and health hazards to fishermen	Secondary data analysis	11 articles, 1 government book policy, and 6 manuals health	Fishermen are at risk of hearing loss caused by noise coming from boat engines and compressor engines with noise intensity up to 99.7 dBA
10	Factors Related to Hearing Disorder on Traditional Fishermen in Namrole Sub-District South Buru Regency	Sangaji <i>et al.</i> , 2020	Identifying factors associated with hearing loss in traditional fishermen	Descriptive quantitative	Maluku. 35 traditional diving fishermen	Diving depth has a significant relationship with hearing loss experienced by traditional fishermen
11	Safety Behaviour and Healthy Diving: A	Kusnanto <i>et al.</i> , 2020	Describe the occupational safety and health	Qualitative	Maluku. 15 traditional	Fishermen who experience hearing loss in the form of a

	Qualitative Study in the Traditional Diverse Fishermen		behavior of traditional diving fishermen in a factual manner		diving fishermen	decrease in hearing threshold due to poor occupational health and safety behavior, such as the use of compressors and failure of equalization techniques when fishermen are diving
12	The Correlation between Knowledge and Attitude with the Barotrauma Incident at the Kadatua Divers Without Scuba	Pinto <i>et al.</i> , 2020	Identify the relationship between knowledge and attitudes with the incidence of barotrauma in non-scuba diving fishermen	<i>Cross sectional</i>	Tekonea Raya Village, Konawe Islands Regency.  36 traditional diving fishermen without scuba	There is a significant relationship between knowledge and attitudes regarding the correct diving method and the incidence of barotrauma experienced by 69.4% of respondents

## DISCUSSION

Fishermen are informal jobs that aim to catch marine products so that based on the fishing method, the fishing profession is divided into two, namely fishermen who catch fish using the hook or net method, and fishermen who catch fish using the diving method.<sup>21</sup> The fishing profession has become one of the professions that have high risks related to safety and health, one of which is due to physical hazards, namely noise caused by work activities that can cause hearing loss.<sup>22</sup> Based on the research results, the risk factors that cause hearing loss in fishermen are divided into personal factors and occupational factors.

Age is one of the risk factors in fishermen which is proven to be related to a history of occupational diseases caused by biological changes exacerbated by exposure to hazards from the workplace<sup>23</sup>. This theory is in accordance with the results of research conducted by Tasik, that 68.18% of fishermen with hearing loss are more than 40 years old<sup>11</sup>. This statement is reinforced by other research which shows that fishermen who are <40 years old do not suffer from work-related hearing loss, while fishermen who are more than 40 years old have moderate to high levels of hearing loss.<sup>10</sup> There is a relationship between the age of fishermen and hearing loss due to changes in the structure of the cochlea and vestibulocochlear nerves due to atrophy and degeneration of the supporting hair cells in the cortiary organs.<sup>24</sup> Cochlear degeneration will make it easier to decrease the hearing threshold if exposed to noise, this is evident from the results of the statistical analysis of odds ratio of 2.429 which shows that workers aged > 40 years have a 2.429 times higher risk of lowering the hearing threshold than workers aged ≤ 40 years.<sup>25</sup>

Another factor behind the relationship between age and the incidence of occupational diseases such as hearing loss is that older workers tend to feel more experienced and do not easily accept changes related to improvements in working methods so that they have unsafe work behaviors<sup>26</sup>. As a result, older workers are more at risk of being exposed to hazards in the workplace so that the chances of experiencing work-related illnesses increase.

Another personal factor that can increase the risk of work-related hearing loss is work mass. Fishermen who have worked for > 10 years are proven to have hearing loss<sup>11,10</sup>. Based on research conducted on workers exposed to noise, working years > 15 years have a 9.09 times greater risk of experiencing hearing loss<sup>27</sup>. There is a correlation between work tenure and the incidence of hearing loss due to work, because the longer a person's work period is, the longer he is exposed to a hazard from his workplace<sup>28</sup>. Workers who are exposed to noise during the work period of 10 - 15 years will cause the corti hair cells to tear, causing total destruction of the corpus organs, resulting in a permanent increase in the hearing threshold<sup>29</sup>.

Fishermen's knowledge of occupational safety and health is another personal factor that can cause work-related hearing loss to be felt by fishermen. This is in accordance with the two results of two studies which prove that 52.78% of the 36 Kadatua diving fishermen without scuba and 71.07% of the 38 traditional diving fishermen on the Bugis Campus who experience hearing loss have less knowledge of techniques and the consequences of diving. does not comply with occupational safety and health standards<sup>12,13</sup>. Knowledge plays a very important role in shaping a person's behavior. Fishermen with a high level of knowledge related to K3 aspects tend to have the right attitude to address hazards in the work environment<sup>30</sup>, so that fishermen are able to identify the types of hazards that exist in their workplaces and be able to establish control measures to minimize their risk of experiencing occupational diseases. The knowledge that divers fishermen need to have to reduce the risk of hearing loss is about equalization techniques<sup>31</sup> because besides being caused by noise exposure, hearing loss experienced by fishermen can also be caused due to middle ear barotrauma which is caused by inadequate equalization between middle ear space pressure and ambient pressure due to diving too fast at a certain depth<sup>32</sup>. During diving, the middle ear pressure becomes less and less and the Eustachian tube must be open to balance this pressure, for that fishermen need to have knowledge to perform equalization techniques<sup>20,33</sup>. This technique is used to open the Eustachian tubes so that air can enter the ear cavity by blowing air through the closed nose.

Attitude is the initial response in a person to react to a certain situation before deciding to take an action. The results of statistical analysis carried out on traditional diving fishermen of the Kaudata tribe showed that there was a significant relationship between attitudes and the incidence of hearing loss in the form of barotrauma as evidenced by  $p$ -value = 0.011 ( $<0.05$ )<sup>12</sup>. This research is further strengthened by the results of other studies conducted by Kalalo, Kaunang and Kawatu which show that fishermen who have poor attitudes about occupational safety and health aspects have a 1,467 times higher risk of experiencing work accidents compared to fishermen who have good attitudes<sup>34</sup>. Attitude has a positive and significant relationship with commitment<sup>35</sup>, so that the better the attitude of the fishermen regarding occupational safety and health, the stronger the commitment they have to behave in a safe work. Work behavior is a direct causative factor that can lead to accidents and occupational diseases<sup>36</sup>. This theory is in accordance with the results of research conducted on 15 traditional diving fishermen which showed that fishermen who experienced hearing loss due to diving activities were due to unsafe work behavior related to diving techniques. This is because traditional diving fishermen tend to have weak knowledge and attitudes regarding occupational safety and health aspects, so that the working methods of diving are more influenced by habits acquired from generation to generation<sup>14</sup>. Knowledge and attitudes are the main factors that can influence a person's behavior, so that improvements in knowledge and attitudes will be directly proportional to better behavior change<sup>37</sup>.

Factors from outside the fishermen that can cause hearing loss are the exposure to noise received by fishermen from boat engines and compressors. Noise is unwanted sound that can lead to audiometric and non-audiometric complaints. The intensity of noise in the workplace that exceeds the threshold value will result in audiometric complaints in the form of a decrease in hearing threshold to permanent deafness<sup>15,11,10,16</sup>. Based on applicable regulations in Indonesia, the threshold value used for the noise level in the work environment for 8 hours per day is 85 dBA so that fishermen who are exposed to noise that exceeds the threshold value will result in a decrease in the hearing threshold<sup>4,38</sup>. The length of exposure and the period of exposure to noise will exacerbate the degree of hearing loss experienced by fishermen<sup>17</sup>. Fishermen who are exposed to noise for a long duration have a higher risk of experiencing a decrease in hearing threshold to deafness<sup>39</sup>.

Non-compliance with the use of ear protection while on a boat that makes noise is a risk factor for the occurrence of hearing loss in fishermen. This is in line with the results of the study, namely 65.2% of the 186 fishermen who did not use ear protection equipment in the form of earplugs had hearing loss due to noise exposure as evidenced by statistical analysis  $p$  value = 0.046 ( $p <0.05$ )<sup>15</sup>. Ear protection equipment in the form of earplugs is proven to reduce the noise exposure received by fishermen by 30 to 40 dBA<sup>40</sup>. The frequency and depth of diving performed by traditional diving fishermen will also affect the occurrence of ear barotrauma which can cause hearing loss<sup>18,19,20</sup>. This is in accordance with research on the description of hearing loss in diving activities, namely the longer and the deeper the dive, the greater the risk of hearing loss<sup>41</sup>.

## CONCLUSIONS

Fishermen are at risk of experiencing work-related hearing loss due to exposure to noise from boat engines and improper diving techniques. There are two risk factors that can cause hearing loss in fishermen, namely personal factors such as age, years of service, knowledge, attitudes and

behavior of fishermen, while other risk factors are occupational factors in the form of noise intensity from boat engines and compressor engines, long exposure to noise, availability of ear protection equipment, length of time and depth of diving performed by fishermen.

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## CONFLICTS OF INTEREST

The author states that there is no conflict of interest for this article.

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