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## Research Article

# Occupational Traumatism of Members of Vessel's Crew on Fishing Fleet in the Northern Water's Basin

## Abstract

The development of the fishing fleet is particularly important because of the need to provide the population with quality seafood. Specificity of work of the floating crew of the fishing fleet is characterized by frequent changes of factors affecting the health status in general.

The analysis of traumatism of members of vessel's crew on fishing fleet of the Northern Water's Basin have been based on 320 occupational traumas on board of vessels with temporary loss of ability to work.

On vessels of fishing fleet frequency of traumatism disability was 67.7 per 1,000 workers. It is the lowest in the group of fishermen to 30 years, 1.2 times less than that of the fishermen 30-39 and older age groups, and almost 3 times less than that of crew over 50 years. Among those affected from members of vessel's crew in all cases were male. The average age of the victims was 32.2 years. Members of vessel's crew of service of fish products processing receives damage in 3.9 times more frequently the service of operation of the vessel ("deck") and 6.2 times then the service of technical operation of the vessel ("engine-room"). The highest frequency of traumatism was from masters of fish processing (275.9). The works of increased danger on fishing vessels are servicing and repair mechanisms of the engine room; with trawl; maintenance of deck machinery; handling by the crew; moving the ladders and decks; with hatch covers. Alcohol intoxication at the time of injury was recorded in 4.1% of the fishermen (2.8). In flight fishermen get damaged 5.0 times more frequently than in port. When sailing in the Arctic fishermen traumatism rate is 3.5 times higher than in temperate latitudes. Fishermen have to work in conditions of icing decks, tools and equipment, low light jobs because of the frequent fogs, they are forced to wear warm clothes that full range of motion, reduces audibility and accuracy of manufacturing operations. The main type of damage to the fishermen there are fractures, traumatic amputation of the fingers mostly and wounds. Severe disease in view of fishermen are traumatic damages of fingers. They are particularly unfavorable in terms of vocational rehabilitation and future employment due to loss of hand function.

## Introduction

The development of the fishing fleet is particularly important because of the need to provide the population with quality seafood. Enhancement of fishing vessel, caused by technical progress, changes the content and nature of work of fishermen [1-3]. In the present conditions for fulfill production tasks fishermen on vessels making less physical effort, because the most difficult and time-consuming work processes take place automatically, and machinery and systems [4-7].

Specificity of work's condition of members of vessel's crew of the fishing fleet is characterized by frequent changes of factors affecting the health status in general. By virtue of "hunting" of fishermen and external factors affecting the

production environment is particularly strong [8-10]. For the fishing fleet is particularly relevant socio-hygienic problems are: health maintenance organizations in the areas of fishing, providing qualified medical care for diseases and injuries, continuous clinical supervision fishermen forces of coastal and marine treatment and prevention services, rehabilitation of the sea, social and hygienic problems of families living of members of vessel's crew [11-14].

Analysis of occupational traumatism of fishermen showed that its share in the overall structure of disability and morbidity of this population of industrial workers is up to 20.0% in cases and 25.0% of disability days. On the number of accidents among fishermen is largely influenced by the experience of work: 34.0% of the cases have occurred with the

fishermen, who have a professional experience of up to 3 years, including 21% – those working on vessels less than a year. In the members of vessel's crew of the fishing fleet at a fraction of lung occupational injuries without incapacity accounted 57.5% of traumatized [15–18]. Different accidents occur mainly during work connected with the raising, lowering and trawl repairs (42%), fish processing (26%) and handling operations (11%) [19–22]. Fractures make up 23.9% of damages, bruises – 30.3%, wounds – 18.5%. About half of all accidents on fishing vessels occur when performing time-consuming, little mechanized processes, mainly related to mining and processing of fish [23–25]. As a result of scientific studies, the proportion of small traumatism in general occupational injuries is significant and reaches 55.0% of all accidents [26–27]. Fishermen observed a particularly high proportion of hand and finger traumas – 81.7% of cases. Brush and fingers injured mostly at handlers of fish (48.5%), members of the machine and trawl teams (37.3%). In the circumstances of the occurrence of injury were as follows: when working with a trawl – 26.7%; when working in the engine room – 11.2%, with loading and unloading – 8.5% of all injuries.

Members of vessel's crew of trawler fleet often occur as complications received minor injuries, festering and inflammatory diseases of the hand and fingers (17.9% of cases) [28]. Traumas are applied mainly bones of fish, fishermen often prick fingers and hands faulty cable. Of the 66.9% of injured are treated in large floating bases; 31.8% – in the large freezer trawlers fishing on the shore; including in national – 1.2% and foreign ports – 0.1% [29–31]. Average treatment time with occupational injuries fishermen were 27.4 days; injuries on the way to work – 22.6 days; domestic injuries – 13.5 days [32].

## Material and Methods

Northern Water's Basin includes Barents, Norwegian, North seas and high latitudes of the Atlantic Ocean. Fishing is carried out in any time of the day there. Control groups amounts members of vessel's crew of sea transport fleet, providing transportation of cargoes in the same latitudes and members of vessel's crew of river transport fleet operates in the waters of the large northern rivers Onega, Northern Dvina, Mezen and Pechora, flowing into the Arctic Ocean.

The analysis of traumatism of members of vessel's crew of fishing fleet in the Northern Water's Basin have been based on 320 occupational injuries on board of vessels with temporary loss of ability to work during the period 20 years. Control groups consisted of 1 367 occupational damages received by members of crew of sea transport vessels and 377 occupational damages – of river transport vessels during the same period of time.

The age structure of the crews of the Northern Water's Basin and data obtained on the basis of medical documentation, namely: a) regular reports written by the vessels' medical staff; b) vessels' medical journals; c) medical files of the discharged patients; d) fragments of patients' medical records; e) medical records of the patients; f) reports on causes of temporary

disability; g) occurrences of accidents happening on board of vessel. Diagnoses stating alcohol intoxication were given on the basis of statements of the ambulance doctors, ER doctors, teams of surgeons, and results of blood alcohol content examinations. In all the cases, diagnosis "alcohol intoxication" was a secondary diagnosis. Traumatism affecting members of crew on vessels under alcoholic intoxication is reflected in the documentation of accidents at work. While working on these documents, the following methodological approaches were used: systematic, comprehensive, integrative, functional, dynamic, process, regulatory, quantitative, administrative, and situational. It were also employed methods of comparison such as grouping, absolute and relative values, averaging and continuous observation.

## Results

On vessels of the fishing fleet happened 320 cases of work-related injuries with disability (injury frequency 67.7). A comparison of intensive indicators of injury by age showed that the most safe young fishermen (under 30 years). The frequency of accidents in this group is 1.2 times less than the fishermen more than 30–39 years and older and almost 3 times less than that of the floating composition over 50 years. The victims on vessels in all cases men: 20–29 years – 43.4% of the 30–39 years – 32.3% ( $P < 0.05$ ); 40–49 years – 13.8%; 50 years and older – 7.7%, up to 20 years – 2.8%; the average age of 32.2 years.

Traumatism of fishermen of various essential services of the vessel is also uneven. The bulk of the injured, were the representatives the service of operation of the vessel – 43.3% of cases; the service of technical operation of the vessel – 28.4%; the service of processing of fish products – 16.7%, the service of production of fish – 9.6%, the service of household – 1.5%, the service of health care – 0.5%. The members of vessel's crew the service of fish products processing service receives damage in 3.9 times more frequently than the service of operation of the vessel («deck») and 6.2 times then the service of technical operation of the vessel («engine-room»).

The high frequency of traumatism among «deck» teams is due to the specifics of work of members of vessel's crew. Masters of fish production, masters of fish processing, master of fish canning, boatswains work in heavy traffic loads, mooring operations, non-uniform illumination of the deck and mechanisms, perform a large number of small mechanized, monotonous manual work [Table 1].

Fish extraction is carried on the deck at any time, including nighttime, under all weather conditions, providing a continuous manufacturing process. It is for these reasons that the highest rate of occupational injuries in these occupational groups: masters of fish processing ( $P < 0.001$ ); masters of fish production ( $P < 0.001$ ); masters of fish canning ( $P < 0.001$ ); sailors ( $P < 0.001$ ) and mechanics ( $P < 0.001$ ).

It is important to note that the traumatism of members of vessel's crew on fishing fleet is inversely proportional to the length of service. The highest injury frequency fishermen with

little experience (3 years). With the growth of professional skills the numbers of injuries have consistently decreases. So, for example, on fishing vessels more than 15 years, the number of injuries is 2.8 times less than in the first three years of operation.

The works of increased danger on fishing vessels are servicing and repair mechanisms of the engine room; with trawl; maintenance of deck machinery; handling by the crew; moving the ladders and decks; with hatch covers [Table 2].

Injuries of fishermen are applied mostly by blunt objects (50.6). The amount of damage caused by acute and thermal

**Table 1:** Frequency of Traumatism of Members of Vessel's Crew on Fishing, Sea Transport, and River Transport Fleets Depending on Vessel's Marine Specialists of 1,000 employees (P±m)

Vessel's marine specialists / Fleet	Fishing	Sea Transport	River Transport
Motorists	32,8±0,9	367,9±2,5	105,1±2,2
Sailors	87,6±1,5	337,3±2,2	83,2±1,9
Boatswain	74,5±1,5	319,7±1,9	--
Chefs, bakers	21,9±0,8	225,6±2,1	63,5±1,7
Mechanics	63,5±1,7	166,4±1,8	155,5±2,6
Navigators	15,5±0,4	129,2±1,6	177,4±2,8
Captains	52,6±1,2	100,7±1,4	33,7±1,3
Bartender, orderlies	--	96,4±1,4	--
I captain's assistants	--	26,3±0,7	--
Skippers	--	--	203,7±2,9
Masters of fish processing	275,9±2,6	--	--
Masters of fish production	179,6±2,6	--	--
Masters of fish canning	153,3±2,0	--	--

**Table 2:** Frequency of Traumatism of Members of Vessel's Crew on Fishing, Sea Transport, and River Transport Fleets in the Performance of Marine Operations on 1,000 employees (P±m)

Types of vessel's marine works / Fleet	Fishing	Sea Transport	River Transport
Works on maintenance and repair mechanisms of the engine room	37,7±1,0	24,8±5,4	89,8±2,1
Galley works	--	73,4±1,1	85,4±2,0
Cargo handling	11,8±0,6	45,7±1,0	8,8±0,7
Maintenance of deck machinery works	25,0±0,4	69,2±0,6	36,1±1,3
Getting around the decks and ladders	10,2±0,3	44,8±0,9	28,5±1,2
Mooring works	3,9±0,3	30,2±0,8	74,5±1,8
Machine operations	2,4±0,2	9,6±0,5	--
Works with hatch covers	7,8±0,5	7,0±0,4	9,0±0,6
Works at the control	--	3,5±0,2	15,3±0,8
Boat works	5,2±0,3	3,1±0,3	8,8±0,6
Maintenance works on the team	--	2,6±0,2	--
Works on cleaning of holds	--	2,6±0,2	--
Outboard training vessels	--	0,2±0,01	2,2±0,4
Works with trawl	28,9±0,9	--	--
Processing fish	5,5±0,4	--	--

agents is much lower (2.8 and 0.2 respectively). Alcohol intoxication at the time of injury is fixed at 13 fishermen (4.06%). These lesions produced exclusively at the parking lot in the fishing ports.

Variation of injury frequency on fishermen in depending on the weekly cycle is very low - the maximum on Wednesday (12.5), the minimum on Sunday (7.4). On fishing vessels maximum number of damage occur in the autumn, when the fishing is carried out in the most adverse weather conditions and all constructive working environment risks and uncertainties relate to the fullest. Autumn low temperatures, strong winds, pitching deck of the bay water in conjunction with the imperfection of construction machinery and equipment, administration faults, mistakes of a subjective nature, strength and unevenness of the production process creates dangerous situations for injuries to the fishing vessel. During this period, nearly one-third of all injuries for the year (19.9), summer and winter, their numbers the same way - by 25.9% (17.5), spring - 18.7% (12.5).

Fishermen get damaged while flights in 5.0 times more than during parking at the port (51.7 and 10.3). This is due to the fact that on fishing fleet a significant part of works of service vessel when docked in the port carried out not by members of the crew, but performed by port workers, including loading, unloading and maintenance. Fishermen were injured in 3.5 times more often when sailing in the Arctic, than in the temperate latitudes (43.6). In the northern regions the high injury rate associated with fishing heavy industrial processes. Often members of vessel's crew have to work in conditions of icing decks, tools and equipment, low light work areas due to frequent fogs. Fishermen are forced to wear warm clothing that constrains movement, reduces the audibility and accuracy of technological operations.

Fishermen often get monotrauma (52.8), than polytrauma (14.5). Among the latter there are only multiple and combined, and no combination.

On an outpatient basis were treated 72.5% of fishermen with injuries. Of need hospital treatment for injuries was 22.8. Hospitalization of fishermen with damages to floating base or territorial medical institution, if it is needed, was carried out in the first 12 hours after injury in all cases.

The main type of damage to the fishermen are fractures (26.9), components ( $P < 0.001$ ) and all traumas that occur in 3 times often than traumatic amputations (8.8) and wounds (7.9) [Table 3]. Heavy kind of pathology for fishermen were traumatic amputation mostly of fingers of a brush ( $P < 0.001$ ). These damages were especially unfavorable in respect of vocational rehabilitation and further employment due to loss of hand function. Bruises of have a members of vessel's crew occur significantly less frequently ( $P < 0.001$ ).

In the analysis of traumas by fishermen features of localization of damage. Brush damage make up the largest group - 35.8% of all fishermen injuries. This is due to the large proportion of manual labor on fishing vessels. Maintenance

of deck machinery and mechanisms to work with the trawl, fish processing requires a large number of delicate operations, which are currently performed manually. While fishing in storm conditions, the bay of deck with water all the production potential hazard on traumatism usually ends accidents. It should be noted that the brush traumas are characterized by their severity: among these main groups constitute damage broken fingers and wrist, traumatic amputations and wounds. Ranking second place is occupied by a knee damages that occur 2.3 times less than the hand traumas that fishermen in the vast majority were accompanied by fractures (91.0% of all cases). On fishing vessels at the members of vessel's crew when the production orders are often originate closed head damages: brain concussion; brain bruises, accompanied by subarachnoid hemorrhage, fractures of the jaw and head wounds. With the same frequency foot traumas happen. However, at this localization proportion of fractures is reduced to 63.4% of cases. For injuries of the foot also occurs traumatic amputation of phalanges, severe bruises. Traumas to the thorax are not often meeting in the overall structure and make up only 4.7% of the cases, but are distinguished by their severity. Closed damages of the chest, accompanied by fractures of the ribs, are the most typical kind of injuries - 71.6%, and in half of the cases occurring fractures 2 or more ribs. Damage to the spinal column of members of vessel's crew of fishing vessels are classified as serious traumas. Fishermen with injuries of the spine occurred vertebral fractures in 7 cases, and in 4 they were accompanied by spinal cord injury. On the seventh rank place in frequency located thigh injury, which in three cases were accompanied by fractures of the femur. One fisherman there was a severe injury with a large intramuscular hematoma. Damage to the organ of vision of members of vessel's crew on fishing fleet is accompanied by bruises, wounds, foreign bodies [Table 4].

Open fractures of various localizations occur 4.4 times then closed ones and constitute 18.4% of the fractures on fishing vessels. Needs in the surgical treatment of 1000 employees is 5.0 cases. Prolonged isolation of fishing vessels from coastal bases retards timing of providing qualified and specialized care that is not but affected the outcome of injury. Therefore, members of vessel's crew have a high rate of complications (15.8). Analysis of the structure of accidents of fishermen

**Table 3:** Structure of Traumatism of Members of Vessel's Crew on Fishing, Sea Transport, and River Transport Fleets in Appearance of Damage in % (P±m)

Appearance of Damage / Fleet	Fishing	Sea Transport	River Transport
Fractures	39,8±2,0	43,5±1,0	28,7±1,7
Bruises	6,8±1,0	16,7±0,8	20,1±1,6
Wounds	11,7±1,4	14,3±0,7	18,7±1,5
Other types of damage	21,8±1,7	9,4±0,6	11,7±1,3
Burns	2,2±0,6	5,5±0,5	10,2±1,2
Traumatic brain injuries	4,9±0,9	4,7±0,4	3,7±0,7
Traumatic amputations	12,8±1,4	4,3±0,4	6,1±0,9
Dislocations	-	1,1±0,1	0,8±0,3
Frostbittens	-	0,6±0,2	-
Total:	100,0	100,0	100,0

**Table 4:** Frequency of Traumatism of Members of Vessel's Crew on Fishing, Sea Transport, and River Transport Fleets Depending on the Localization of 1,000 employees (P±m)

Localization / Fleet	Fishing	Sea Transport	River Transport
Brush	29,3±1,2	53,2±0,6	24,1±0,7
Foot	6,6±0,8	28,3±0,7	5,0±0,7
Shin	12,5±1,0	24,3±0,5	5,0±0,7
Head	6,6±0,3	23,7±0,5	5,5±0,6
Forearm	7,9±0,9	16,6±0,5	1,3±0,5
Organ of vision	3,3±0,8	8,1±0,4	1,8±0,5
Rib cage	7,2±0,9	10,3±0,4	3,3±0,3
Knee-joint	5,9±0,8	9,6±0,3	0,4±0,2
Spine	3,3±0,8	7,7±0,4	2,4±0,3
Shoulder	-	5,3±0,3	3,3±0,3
Hip	1,3±0,4	5,0±0,3	1,8±0,2
Collarbone	-	3,1±0,2	-
Bones of the pelvis	1,3±0,4	1,3±0,2	1,3±0,2
Abdomen	-	1,3±0,2	-
Neck	-	-	0,4±0,1

outcomes showed that ended in recovery and return to work with a degree in 76.3% of the victims, the definition of disability of II group - 0,8%, III group - 1.5%, fatally - 21.5% (14, 5), while the number of disability days averaged 60.8 days, day bed with hospitalization - 44.1.

## Discussion

Fishery fleet offers different types of vessels with different degrees of mechanization of fishing and fish processing. Fishing is carried out in the Barents, Norwegian, North seas and high latitudes of the Atlantic Ocean at any time of the day. Flights last for 4-5 months or longer. Swimming in the open sea often takes place in stormy conditions. With a large storm rough of sea and high wind speeds, workers exposed deck entanglement water, shock and run of from the deck.

On modern fishing vessel is not possible to completely solve the problems of safe and accident-free work, to achieve high production standards. In the fishing industry fleet vessels can meet a number of design flaws. These include: lack of normal maintenance, routine inspections and repair the width of walkways; absence or poor performance of individual fences dangerous places; inconvenient access to places of service of some mechanisms; poor design of ladders; lack of mechanization of heavy and labor-intensive work. There are significant deficiencies in the organization of work of the members of vessel's crew on the ocean fishing vessels.

The reasons for the high level of injuries among members of vessel's crew with little work experience should be considered as insufficient professional experience, haste, poor technical training in matters of safety. Later fishermen dulled sense of vigilance on safety in the work places, there is a disregard for

the requirements of providing safe working methods. The most likely reason for the increase of traumatism in the members of vessel's crew fishing vessel with a large professional experience should be considered addictive to the production risk. As a result of many years of practice of work with a high probability of traumas and, nevertheless, a positive ending cases of violation of the rules and safety regulations of members of vessel's crew disappears sense of danger and is produced by disregard for the requirements governing the safe methods of work. Among the reasons should also be noted underestimation fishermen of occupational hazards, control the weakening of the administration for the implementation of the rules of safety of crew members with more seniority, deficiencies in technical training and instruction of the members of vessel's crew of the group.

## Conclusions

1. On vessels of fishing fleet frequency of traumatism disability was 67.7 per 1,000 workers. It is the lowest in the group of fishermen to 30 years, 1.2 times less than that of the fishermen 30–39 and older age groups, and almost 3 times less than that of crew over 50 years. Among those affected by the courts in all cases were male: aged 20–29 years – 43.4% of the cases, 30–39 years – 32.3%, 40–49 years – 13.8%, 50 years and older – 7.7%, to 20 years – 2.8%. The average age of the victims was 32.2 years.

2. Groups at risk for traumatism of fishermen are essential services vessels: the service of operation of the vessel – 43.3% of cases; the service of technical operation of the vessel – 28.4%; the service of processing of fish products – 16.7%, the service of production of fish – 9.6%, the service of household – 1.5%, the service of health care – 0.5%. Members of vessel's crew of service of processing fish products receive damages in 3.9 times more frequently than service of operation of the vessel ("deck") and 6.2 times then the service of technical operation of the vessel ("engine-room"). The highest frequency of traumatism was from masters of fish processing (275.9), masters of fish production (179.6), masters of fish canning (153.3), sailors (87.6) and mechanics (63.5).

3. The works of increased danger on fishing vessels are servicing and repair mechanisms of the engine room; with trawl; maintenance of deck machinery; handling by the crew; moving the ladders and decks; with hatch covers. Alcohol intoxication at the time of injury was recorded in 4.1% of the fishermen (2.8).

4. In flight fishermen get damaged 5.0 times more frequently than in port. When sailing in the Arctic fishermen traumatism rate is 3.5 times higher than in temperate latitudes. Fishermen have to work in conditions of icing decks, tools and equipment, low light jobs because of the frequent fogs, they are forced to wear warm clothes that full range of motion, reduces audibility and accuracy of manufacturing operations.

5. The main type of damage to the fishermen there are fractures, traumatic amputation of the fingers mostly and wounds. Severe disease in view of fishermen are traumatic

damages of fingers. They are particularly unfavorable in terms of vocational rehabilitation and future employment due to loss of hand function.

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