ON THE IMPROVEMENT OF CONTROL AND SUPERVISORY ACTIVITIES OF THE STATE INSPECTORATE FOR SMALL VESSELS OF THE RUSSIAN MINISTRY FOR EMERGENCY SITUATIONS

Nikolay Nikolayevich Kopeykin, Pavel Mikhailovich Ageev, Maksim Ravilevich Sytdykov, Oleg Nikolaevich Savchuk, Oleg Alexandrovich Rybin
Saint Petersburg University of State Fire Service of EMERCOM of Russia, Moskovsky Ave., 149, Saint Petersburg, 196105, Russia

ABSTRACT

The purpose of the study was to develop methodological recommendations for determining the effectiveness of raids and patrols conducted by the inspectorial staff of the State Inspectorate for Small Vessels (SISV of EMERCOM of Russia) for reducing the number of fatalities on water bodies in order to improve control and supervisory activities.

The analysis of the existing regulatory and methodological framework, in accordance with which the assessment of the activities of the SISV of EMERCOM of Russia was organized, was chosen as the methodology for carrying out the research.

The novelty of the article consists in:

Solution of the task of analyzing the water supply of constituent entities of the Russian Federation in relation to the work of the SISV;

Identification of the dependence between the increase in the number of patrols and raids and the decrease in the number of fatalities on water bodies;

identification of the dependence of the number of deaths on the raids and patrols conducted, taking into account climatic, geographical and other conditions of the region;

An algorithm for assessing the efficiency of raids and patrols, comprehensively taking into account various indicators;

The improved methodology for assessing the effectiveness of control and supervisory activities.

The developed methodical recommendations, unlike the existing methodology, allow evaluating the quantitative and qualitative indicators of supervisory activities.
1. INTRODUCTION

The intensity of the work of the State Inspectorate for Small Vessels (SISV) for constituent entities of the Russian Federation in the field of supervision and control on water bodies has increased in recent years. The improvement of the effectiveness of the activities performed by the inspectorial staff of the SISV of EMERCOM of Russia is impossible without the in-depth analysis of the current practice, current legal framework and the criteria applied for assessment of activities.

Subdivisions of the SISV of EMERCOM of Russia for constituent entities of the Russian Federation carry out their activities in cooperation with:

- Local offices of federal agencies of the Russian Federation;
- Executive authorities of constituent entities of the Russian Federation;
- Local government authorities.

The procedure for state supervision is regulated by various laws and regulations [1-14].

In addition to emergency rescue teams of constituent entities of the Russian Federation, the forces and resources of the regional centers and main departments of EMERCOM of Russia and all the forces and resources of the departments and centers of the SISV directly and actively participate in the implementation of measures to ensure people’s safety on water bodies in Russian constituent entities, including the execution of life protection plans approved annually by governors.

Moreover, when developing the plans for the main activities of the SISV and the plans for control and supervisory activities of the SISV Centers, the measures implemented under the supervision of the heads of the Main Directorate of EMERCOM of Russia for a Russian constituent entity are directly linked to the activities of the plans to ensure people’s safety on water bodies.

A significant reduction in the number of fatalities can occur only as a result of a systematic approach to addressing the issues of ensuring people’s safety on water bodies, including the improvement of control and supervisory activities to comply with the Russian legislation on water bodies.

2. METHODS

The SISV of EMERCOM of Russia in constituent entities of the Russian Federation, in cooperation with other state bodies and organizations, regularly conduct activities on rendering assistance to people in distress on the water and preventing accidents on water bodies. Table 1 [15] shows the data on the participation of rescuers in the conduct of raids and patrols for the 5-year period of 2012-2016.
On the Improvement of Control and Supervisory Activities of the State Inspectorate for Small Vessels of the Russian Ministry for Emergency Situations

Table 1 Data on raids and patrols conducted

<table>
<thead>
<tr>
<th>Years</th>
<th>Total number of patrols and raids conducted</th>
<th>Incl. with the participation of rescuers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>85,345</td>
<td>22,926 (26.9%)</td>
</tr>
<tr>
<td>2013</td>
<td>86,006</td>
<td>24,101 (28.0%)</td>
</tr>
<tr>
<td>2014</td>
<td>93,330</td>
<td>27,232 (29.2%)</td>
</tr>
<tr>
<td>2015</td>
<td>90,041</td>
<td>26,649 (29.6%)</td>
</tr>
<tr>
<td>2016</td>
<td>85,423</td>
<td>26,353 (30.9%)</td>
</tr>
</tbody>
</table>

The quantitative indicators of fatalities remain high, although the number of people who have drowned on beaches and at the places of public entertainment is decreasing every year.

Ensuring people’s safety on water bodies

The Water Code of the Russian Federation [16] refers the following issues to the competence of the state authorities of constituent entities of the Russian Federation in the field of water relations:

Approval of rules for the use of water bodies for navigation on small vessels;

Approval of rules for protecting people's lives on water bodies.


All of the above laws and regulations are aimed at creating an effective system for ensuring people’s safety on water bodies, which includes:

Ensuring people’s safety on beaches (in recreational areas);

Ensuring people’s safety in places of traditional (unauthorized) recreation on water bodies;

Ensuring people’s safety when sailing on small vessels;

Ensuring people’s safety during sports and festive events;

Ensuring people’s safety during freeze-up and in places of mass ice fishing.

Based on the studies conducted, the Saint Petersburg University of the State Fire Service of EMERCOM of Russia made proposals on improving people’s safety on water bodies and enhancing the control and supervisory activities.

The existing laws and regulations of the Russian Federation on ensuring people’s safety on water bodies were analyzed for this purpose. They provide for and enable to organize and implement practical measures to comprehensively ensure people’s safety on water bodies and at various levels from the government to public organizations [19].

In order to further improve the implementation of measures of control and supervisory activities, improve the quantitative and qualitative indicators of the work of the SISV of constituent entities of the Russian Federation on implementing state and technical supervision of small vessels and ensuring people’s safety on water bodies, in 2012 the changes were made to the Order of EMERCOM of Russia [20, 21] and new requirements for organizing and holding a contest were established [22].
Taking into account the fact that water areas occupy a significant part of the territory of Russia and climatic conditions are extremely diverse and variable, the problems of preventing and eliminating emergencies at sea and in inland water basins of Russia constitute a significant part of the tasks facing the Russian Unified Emergency Rescue System (RUERS). Therefore, an interim task to analyze water supply of the constituent entities of the Russian Federation was also solved with due account for climatic and geographic features, as well as population density and migration. The results of the work on the analysis of water supply of constituent entities of the Russian Federation for the period until 2020 that was performed at the State Hydrological Institute (SHI) [23] were taken into account. These results show that in recent years there have been significant changes due to a change in the main factors determining the state of water resources—changes in climate and the socio-economic situation.

In general, for the territory of Russia, specific water supply per inhabitant will increase by 12-14% in the considered period due to the predicted increase in water resources and population reduction, while the average water use coefficient will remain almost unchanged.

Thus, the analysis of water supply of constituent entities of the Russian Federation for the period until 2020 shows that its change in the coming years will not have a significant impact on the activities of the SISV of EMERCOM of Russia on the supervision of water bodies on the surface area and the efficiency of raids and patrols by the inspectorial staff of the SISV of EMERCOM of Russia in terms of reducing the number of fatalities on water bodies.

Based on the results of the studies conducted at St. Petersburg University of the State Fire Service of EMERCOM of Russia, draft Methodological Recommendations were developed to determine the efficiency of raids and patrols by the inspectorial staff of the SISV of EMERCOM of Russia in terms of reducing the number of fatalities on water bodies.

The provisions set forth in [24] were also taken into account in determining the general approach to the development of recommendations.

The algorithm for the assessment of efficiency, presented in the developed methodological recommendations, comprehensively takes into account various types of indicators.

Indicators of the assessment of the efficiency of raids and patrols conducted by the inspectorial staff of the SISV of EMERCOM of Russia in terms of reducing the number of fatalities on water bodies were previously considered in [19].

3. RESULTS

The main provisions of the Methodological Recommendations are given below.

The quantitative data of the estimated indicators of efficiency of raids and patrols conducted by the inspectorial staff are calculated as follows:

**The indicator "a"** characterizes the completeness of performance of control tasks by the number of raids and patrols planned for the year. This indicator is calculated as follows:

\[ a = \frac{A}{Z}, \]

Where: \( A \) is the number of raids and patrols conducted; \( Z \) is the number of raids and patrols, established by the control task for a year.

**The indicator "b"** characterizes the completeness of participation of the state inspectors of the SISV, who participated in the implementation of measures of control and supervisory activities. This indicator is calculated as follows:

\[ b = \frac{B}{HC}, \]
On the Improvement of Control and Supervisory Activities of the State Inspectorate for Small Vessels of the Russian Ministry for Emergency Situations

Where: B is the number of state inspectors who participated in raids and patrols; HC is headcount of state inspectors of all inspector divisions, inspector offices, patrol service groups and the department of the SISV of a constituent entity.

The indicator "c" characterizes the intensity of inspectors’ work, is estimated by the number of raids and patrols conducted by one inspector on average and is calculated as follows:

\[ c = \frac{A}{HC} \]

The indicator "d" characterizes the efficiency of inspectors’ work, is estimated by the number of administrative offense reports compiled for one patrol on average, and is calculated as follows:

\[ d = \frac{D}{A} \]

where: D is the total number of administrative offense reports compiled during raids and patrols.

The indicator "e" characterizes the efficiency of inspectors’ work, is estimated by the number of administrative offense reports per inspector on average and is calculated as follows:

\[ e = \frac{D}{HC} \]

The indicator "f" characterizes the efficiency of work to prevent accidents involving small vessels. The data for the current year are compared with the data on the average number of accidents for the previous 3 years. This indicator is calculated as follows:

\[ f = \frac{F}{(F1 + F2 + F3) : 3} \]

Where: F is the number of accidents involving small vessels in the current year; F1, F2, F3 is the number of accidents involving small vessels for the previous 3 years.

The indicator "g" characterizes the efficiency of the work to prevent the loss of life during the operation of small vessels. The data for the current year are compared with the data on the average number of deaths for the preceding 3 years. This indicator is calculated as follows:

\[ g = \frac{G}{(G1 + G2 + G3) : 3} \]

Where: G is the number of people died in the operation of small vessels in the current year; G1, G2, G3 is the number of people died in the operation of small vessels for the previous 3 years.

The indicator "h" characterizes the efficiency of work to prevent the loss of life on water bodies. The data for the current year are compared with the data on the average number of fatalities for the preceding 3 years. This indicator is calculated as follows:

\[ h = \frac{H}{(H1 + H2 + H3) : 3} \]

Where: H is the number of people died on water bodies in the current year; H1, H2, H3 is the number of people died on water bodies for the previous 3 years.

The indicator "i" characterizes the degree of participation of state inspectors in the liquidation of emergencies on water bodies and is calculated as follows:
Nikolay Nikolayevich Kopeykin, Pavel Mikhailovich Ageev, Maksim Ravilevich Sytdykov, Oleg Nikolaevich Savchuk and Oleg Alexandrovich Rybin

\[
i = \frac{I}{HC},
\]

Where: \(I\) is the number of state inspectors who participated in the liquidation of emergencies on water bodies.

The indicator "j" characterizes the degree of participation and efficiency of the activity of state inspectors in implementing the measures to rescue people in distress on water bodies and is calculated as follows:

\[
j = \frac{J}{J1},
\]

Where: \(J\) is the number of people rescued by inspectors of the SISV during raids and patrols on water bodies; \(J1\) is the number of state inspectors who participated in the rescue of people in distress on the water.

The indicator "k" characterizes the legality of the actions of workers of the SISV of EMERCOM of Russia for a constituent entity of the Russian Federation, is estimated by the number of confirmed appeals of citizens against unlawful and incompetent actions of state inspectors on small vessels committed during patrols and raids and is calculated as follows:

\[
k = \frac{K}{K1},
\]

Where: \(K\) is the number of confirmed appeals of citizens against unlawful and incompetent actions of state inspectors on small vessels; \(K1\) is the number of state inspectors, to whom confirmed appeals of citizens against unlawful and incompetent actions have been made.

The final assessment of the efficiency of raids and patrols conducted by the inspectorial staff of the SISV of EMERCOM of Russia in terms of reducing the number of fatalities on water bodies is made by adding points on indicators "a", "b", "d", "e", "f", "g", "h", "i", "j". The points on the indicator "c" are divided by 10 before summation, while the points on the indicator "k" are subtracted from the total amount.

The assessment of the efficiency of raids and patrols conducted by the inspectorial staff of the SISV of EMERCOM of Russia in terms of reducing the number of fatalities on water bodies is greater the higher the point total.

4. DISCUSSION

4.1. The identification of the dependence of the number of fatalities on water bodies on the number of raids and patrols conducted

In the Russian Federation in 2016, 4,951 incidents on water bodies were registered, while 4,473 people died. Data on fatalities on water bodies of the Russian Federation in 2016 are presented in Table 2.

Of the total number of fatalities on water bodies in 2016, 1,570 people were in a state of intoxication, 2,363 – died while swimming, 125 – died because of nonobservance of safety rules on the ice, the death of 43 people was due to the exploitation of small vessels, 379 people died because they could not swim [15].

As before, the main reasons for the death of people on water bodies in 2016 were swimming in unequipped or banned areas where there were no rescuers and there was no observation over those who swim, as well as swimming in a state of intoxication.
On the Improvement of Control and Supervisory Activities of the State Inspectorate for Small Vessels of the Russian Ministry for Emergency Situations

Table 2 Data on fatalities on water bodies of the Russian Federation in 2016

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Number of fatalities (people)</th>
<th>Percentage of the total number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>when swimming (total)</td>
<td>2,363</td>
<td>52.8</td>
</tr>
<tr>
<td>among them – on beaches and in places of mass recreation permitted for use by the SISV of EMERCOM of Russia</td>
<td>11</td>
<td>0.2</td>
</tr>
<tr>
<td>in unequipped places</td>
<td>2,352</td>
<td>52.6</td>
</tr>
<tr>
<td>in a state of intoxication</td>
<td>1,570</td>
<td>35.1</td>
</tr>
<tr>
<td>death caused by the accidents involving small vessels</td>
<td>43</td>
<td>1</td>
</tr>
<tr>
<td>in total on water bodies of the Russian Federation</td>
<td>4,473</td>
<td>100</td>
</tr>
</tbody>
</table>

Taking into account the results of the conducted analysis of laws and regulations of the Russian Federation, the proposals on enhancing people’s safety on water bodies and improving control and supervisory activities, contained in the developed draft methodology presented in Section 3, one important issue can be raised and solved: "How, where and when does the activity of the SISV of EMERCOM of Russia directly affect a change towards a decrease in the water-related death rate"?

To solve this issue, let us divide it into parts, based on the following statistical data of 2016 given in Table 2:

Part 1: 52.6% of people die when swimming in unequipped places.

How can the number of raids and patrols affect the change in the death rate in unequipped places? Can the mathematical dependence of this change be composed? The answer is no, it cannot.

Certainly, inspectors of the SISV make their contribution to the solution of this issue by identifying unauthorized places and informing local authorities about them; however, only rescuers of rescue stations and rescue services, the need for deployment of which has already been identified in the course of implementing the President's instruction, can prevent fatalities in such places.

Part 2: 35.1% of people die due to the violation of swimming rules (swimming in a state of intoxication).

Ensuring public order on beaches and in unequipped places of mass recreation is a task of the police. In accordance with the Code of Administrative Offenses of the Russian Federation [3], SISV inspectors have no right to bring public disturbers to administrative responsibility. In addition, even when patrolling in the beach area, patrol vessels of the SISV cannot and should not enter its water area. The only exception is the prevention of the immediate danger to life and health of beach visitors, but this is an exceptional case and it cannot be linked to any dependency that can be used to calculate the efficiency of raids and patrols.

Despite the foregoing, SISV inspectors play a major role in saving people on beaches; even if they violate the rules or are in a state of intoxication. Thus, the quality of preparation of rescue stations and services for beach season, the availability of life-saving appliances, equipment, and property in accordance with established rules depend on SISV inspectors. Conscientiously fulfilling their duties during the technical inspection of beaches, SISV inspectors ensure rescuers’ future effective activities on the provision of assistance to persons in distress on the water.

Part 3: 1% of people die in the operation of small vessels.
In accordance with the Regulation on the SISV of EMERCOM of Russia [7], the main tasks of the SISV are as follows:

State and technical supervision of small vessels and bases (facilities) for their parking and their use in inland waters and in the territorial sea of the Russian Federation (hereinafter – water bodies);

Ensuring people’s safety on water bodies within its competence.

Therefore, the reduction or increase in the number of fatalities in the operation of small vessels can directly depend on the quality of the performance of the state function of supervision over the use of small vessels and bases (facilities) for their parking in inland waters and in the territorial sea of the Russian Federation.

The accident rate of vessels depends on many factors (particular design of a vessel, the suitability of the design of a vessel to the navigation area, the technical condition of a vessel, the boatmaster’s professionalism, hydrometeorological conditions, etc.), but in this case only the fact of the accident is of interest. It is thought that this is right, since even the fact that poor quality of technical inspection conducted by the SISV became one of the causes of the accident is not related to the quantitative indicators of the dependence on the number of patrols and raids conducted.

Let us try to determine the dependence of the number of fatalities on water bodies on the number of raids and patrols conducted.

If the accident occurred, fatalities could be prevented only by conducting timely rescue operations. Taking into account that a visual method is the most acceptable way of detecting a drowning person from a patrol vessel of the SISV, the following algorithm for calculating the critical rescue distance during search and rescue operations can be used:

\[ S = 0.095 \cdot V, \]

Where \( S \) is the distance from a patrol vessel to a drowning person, km; \( V \) is the speed of a patrol vessel, km/h.

When a drowning person, who can float on the water, is detected, the critical time of the rescue operation depends on the hydrometeorological situation, the temperature of water and air, the physical characteristics of a drowning person and his/her ability to float on the water. For calculations, the authors have chosen the optimal time equal to 3 minutes, during which a drowning person can float on the water, the probability of rescuing is equal to 0.997. Then the conditional coefficient is equal to 0.095.

For example, take a patrol vessel of Kalmar type (\( V = 80 \) km/h) [25], then:

\[ S = 0.095 \times 80 = 7.6 \text{ (km)}. \]

The distance calculated by the formula can be less if under some conditions the visibility range calculated by the formula [26] is less:

\[ VR = 3.57 \times (e^{1/2} + h^{1/2}), \]

Where the coefficient 3.57 is used to calculate the visibility range in kilometers without account for refraction. To calculate the visibility range in nautical miles, the formula uses the coefficient 2.08, while to calculate the visibility range in kilometers, refraction equal to 3.85 is taken into account; \( e \) is the height of the observer’s eye above the water surface, m; \( h \) is the height of the observed object above the water surface, m (\( h = 0 \), \( VR \) is the range of visibility of the horizon).

Hence, the patrol vessel can prevent the death of a boatmaster and passengers of a sinking small vessel in the area limited to a radius of 7.6 km, which can be called a death prevention radius or a rescuing radius. Thus, if the number of vessels and the intensity of patrolling in the
water area will be such that at any time there will be patrol vessels at the distance equal to or less than a rescuing radius, the number of deaths will tend to zero.

From the foregoing, one can draw another conclusion.

To reduce the number of fatalities in the event of an accident of small vessels, their number should be equal to the quotient obtained from dividing the total area of the water body by the average area of rescuing one patrol vessel. In this case, people will not die with a probability of 0.997.

5. CONCLUSION

In the course of the work, an attempt was made to solve the intermediate task of analyzing water supply of constituent entities of the Russian Federation, taking into account climatic and geographic features, as well as population density and migration. The analysis of water supply of constituent entities of the Russian Federation for the period until 2020 has shown that its change in the coming years will not have a significant impact on the activities of the SISV of EMERCOM of Russia on the supervision on the surface area of water bodies.

Besides, there is no direct correlation between an increase in the number of patrols and raids and a decrease in the number of fatalities on water bodies, including when comparing statistical data on the number of people died and places of their death.

Studies have shown that compilation of the dependence of the number of fatalities on water bodies on the number of raids and patrols conducted by the inspectorial staff of the SISV with due account for the climatic, geographical and other conditions of the region is impossible and does not reflect the actual cause of fatalities on water bodies of the Russian Federation and the ways of solving this problem.

Based on the results of the conducted studies, methodological recommendations on determining the efficiency of raids and patrols by the inspectorial staff of the SISV of EMERCOM of Russia were developed in terms of reducing the number of fatalities on water bodies.

The proposed algorithm for assessing the efficiency takes into account various types of indicators in an integrated manner.

The practical application of the provisions of the developed methodology in addition to the current guidelines and regulations will allow objectively reflecting and assessing the work of state inspectors and, accordingly, meeting the requirements of the Administrative Regulations [14].

The issue of the efficiency of state inspectors’ work considered in the article is important, but not the only one in the framework of control and supervisory activities of the SISV of EMERCOM of Russia. There is a need for in-depth analysis of accompanying issues concerning in particular:

- Development of the regulatory and legal framework;
- Optimization of structure and staffing level;
- Development of logistical support.

The issues of the activities of subdivisions of the SISV of EMERCOM of Russia in the Arctic are a special direction of further scientific work in the area under study.
REFERENCES


[10] Prikaz MChS Rossii ot 05.05.2005 g. No. 380 "Ob utverzhdenii Perechnya dolzhnostnykh lits Gosudarstvennoi inspektii po malomernym sudam MChS Rossii, upolnomochennykh


[14] Prikaz MChS Rossii ot 18.10.2012 g. No. 607 "Ob utverzhdenii Administrativnogo reglamenta MChS ispolneniya gosudarstvennoi funktsii po nadzoru vo vnutrennikh vodakh i v territorialnom more Rossii, podnadzornymi malomernymi sudami i bazami (sooruzheniyami) dlya ikh stoyanok” [Order of EMERCOM of Russia No. 607 "On Approval of the Administrative Regulations of EMERCOM for the Execution of the State Function for Supervision over the Use of Small Vessels and Bases (Facilities) for Their Parking in Inland Waters and in the Territorial Sea of the Russian Federation"]. https://rg.ru/2013/05/24/reglament-dok.html.


