


ARTICLE

When Law Is Silent: How to Compensate for the Harm to the Health or Property in the Absence of a Particular Harm-Doer?

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(Received 04 December 2022; accepted 30 May 2023; first published online 29 January 2024)

Abstract

Legal rules aimed at compensation for the harm caused by a particular state, individual, or legal entity (for example, oil pollution of the sea due to a tanker accident) are well studied and constantly used in scientific literature and international law practice. Meanwhile, every year, the number of cases of harm when the particular guilty party cannot be established grows; this is why it is almost impossible to compensate for the harm caused. Such cases include collisions of satellites causing space debris; the consequences of climate change for agriculture, forestry, and the health of citizens; and the pollution of the World Ocean with plastic debris, ballast water, and abandoned nets.

There are more such cases at the national level. After studying acts of international environmental law, national legislation, and several examples from judicial practice, we show that compensation for the harm caused to life, health, or property in the absence of a particular harm-doer is difficult or impossible to prove. This is why actions that can prevent subjectless environmental harm are taken at the national level in certain countries by developing measures to mitigate and adapt to climate change, licensing space activities, and taking preventive measures against the formation of plastic debris and its pollution of the seas, etc. This trend should be continued, and the experience gained by certain states should be used in developing new acts of international environmental law. This will ensure the next step towards preventing environmental harm where it is impossible to establish the doer's name.

Keywords: Harm; space debris; waste; climate; fund; World Ocean

Legal regulation of tort relations dates back several millennia. Thereafter, civil law institutions developed rapidly to guarantee the receipt of compensation by citizens and their associations affected by the unlawful actions of third parties.

Meanwhile, a new legal reality has been forming in international and national law in recent years, but it has not yet been adequately studied. This means there are situations where the harm-doer is unknown to the affected party, and it is impossible or difficult to establish their identity. This includes cases where harm to the life, health, and property of citizens (property of legal entities), or where other benefits protected by law (for example, the state of the environment) are apparent, registered by authorities, and can be estimated in cash. However, it is impossible to recover compensation for this caused harm.

Similar examples are found every day: harm to crops or the health of citizens due to climate change (drought and loss of harvest; diseases due to the reduction of drinking water reserves);

destruction of the ozone layer, and strong ultraviolet radiation; transboundary air pollution and forest destruction by fire; pollution of the World Ocean, emergence of debris islands in it of an origin that cannot be established, which leads to loss of marine flora and fauna (the reduction of fish reserves, in its turn, decreases the income of fishermen and the fish processing industry); destruction of communications satellites because of their collisions with space debris in near space; etc.

Today, all these (and many other) phenomena and processes are considered fragmentarily, each one independently, and this is why all the attempts made to resolve these problems at national and international levels do not give up the appropriate result. To improve the efficiency of legal counteraction to these global threats in modern times, it is necessary to consider in more detail both preventive measures (critical analysis and development of proposals to enhance international and national legal acts) and the mechanism of compensation to affected persons for the harm arising out of torts with the impossibility of establishing the perpetrator. International and national environmental funds, whose role in preventing environmental torts has been poorly researched at the doctrinal level and insufficiently effective in practical implementation, could make a major contribution to solving this problem.

We propose to distinguish three groups of torts according to the criterion of the possibility of establishing the harm-doers and obtaining any compensation from them:

- 1) Torts in which the harm-doer is known (for example, in case of collision of two vehicles in a traffic accident);
- 2) Torts in which the harm-doer is not obvious. However, the available legal means allow for establishing and obtaining compensation from the state. An example of the first situation is the injury to a citizen who slipped on the ice in front of the entrance to their house. In this case, harm can be compensated at the expense of public utilities. In the second case, it is an act of terrorism that affects citizens. Even if the terrorists are not found, the government compensates citizens for the damage caused by them. Earthquakes and floods are a variety of the latter group – in this case, the national government declares an emergency and carries out rescue works with payment of compensation to citizens.
- 3) Torts with an unobvious harm-doer that is impossible to establish: national (or international) law is silent about the extent and the procedures for compensating citizens for the harm caused to them. Two subgroups can be distinguished in this group. In the first subgroup, we suggest including cases where it is possible to define the subject responsible for the harm, but it is not done (or it is done inefficiently) for technical or legal reasons; for example, in case of a collision of a satellite with a small piece of space debris, the owner is very difficult to identify.

In the second group of cases, it is impossible to establish a particular harm-doer. To resolve this problem, it is necessary to set new tasks of international cooperation (elimination of the islands of plastic garbage in the World Ocean, development of the legal regulation of trade in quotas for greenhouse gas emissions between countries in order to mitigate the climate threat and the resulting losses from natural disasters, etc.). This aspect of the current and possible future international cooperation is of primary interest to us.

Accordingly, in the first part of our Article, we will consider the issues of the harm caused by collisions of satellites and other objects with space debris; in the second part, we will study climate threats and methods for mitigating the consequences of global climate change for citizens and state economies; in the third part, we will discuss the issues of the harm caused to the World Ocean and its bioresources, as well as the ways and methods of organizing preventive measures against damage to its ecosystems.

A. Issues of Compensation for the Harm Caused to Satellites and Other Objects by Space Debris

1. General Description of the Issue of Space Debris

In addition to its undoubted advantages, space exploration has a range of negative consequences of technical, environmental, or civil law. The latter means that where space debris in orbit causes harm to communications satellites and other aircraft, it is impossible to establish the particular harm-doer. “Space debris” is a general term that describes all artificial materials in the universe that people do not use for research or other purposes. This waste includes remnants of orbiters or other spacecraft parts that no longer serve useful purposes but leak fuel, coolant, various colorants, blade tips, and other debris left by space expeditions.¹ The expected lifetime of space debris is about 25 years, but it depends on its position: in low-Earth orbit, it is highly probable that most of it burns in the atmosphere. Many satellite collisions with other aircraft that cause space debris have already been registered. The best known of them is the collision between the decommissioned (that is, with the status of space debris) Russian satellite Kosmos-2251 and the American telephone company satellite Iridium-33 on February 10, 2009. Their total mass was 1,500 kg. It broke into 2,000 pieces, part of which entered the Earth’s atmosphere and burned.²

According to today’s data, around 750,000 objects larger than 1 cm are orbiting Earth. At average speeds of 40,000 km/h, their collision with spacecraft is roughly equivalent to a hand grenade explosion. About 18,000 of these pieces of debris are large enough to be regularly monitored by the Earth’s surveillance systems. Space agencies can use such monitoring data to avoid collisions. With the increase in the number of objects in space, experts believe that collisions between these objects, some of which have already occurred, might become the primary source for new fragments in orbit (the Kessler effect).³ Moreover, space organizations face new difficulties in implementing the remote sensing of Earth and space exploration.

Intensive space exploration produces other harmful effects that manifest after a certain period. Launching rockets into space from launch sites in any country causes health problems for people in their immediate vicinity. Spaceships pollute the atmosphere and can pose a threat of radioactive contamination; for example, in case of accidents during their launch or subsequent collision with space debris that generates more radioactive space debris and radiation. In collisions, contaminated objects can fall to the Earth’s surface (in 1978, a Soviet satellite fell on Canada), posing a serious threat to people’s health.⁴

The formation of tiny particles of space debris, which is growing, disrupts the light and heat exchange that has developed over millions of years between Earth and the surrounding environment, causes environmental damage and destroys the Earth’s ozone layer.⁵ The guarantee of protection of life on Earth from ultraviolet radiation decreases; greenhouse gases are produced that negatively affect the Earth’s climate.⁶ At the same time, it cannot be said that the international community completely ignores this issue. Currently, technical experts are conducting studies to create special spacecraft that can maneuver and collect certain fragments of space debris. After

¹Sadonin N.E., Sushkevich N.V., *Space debris and its influence on the performance of spacecraft*, 2-10 CURRENT ISSUES OF AVIATION AND ASTRONAUTICS, 376 (2014).

²10 little-known space accidents that led to a collision of satellites (2023), <https://novate.ru/blogs/140515/31249/> (accessed February 25, 2023).

³European conference on space debris risks and mitigation (2017), http://www.esa.int/Safety_Security/Space_Debris/European_conference_on_space_debris_risks_and_mitigation (accessed February 25, 2023).

⁴Button M., *Cleaning Up Space: The Madrid Protocol to the Antarctic Treaty as a Model for Regulating Orbital Debris*, 37-2 WILLIAM AND MARY ENVIRONMENTAL LAW AND POLICY REVIEW, 545 (2013).

⁵Adushkin V.V. et al., *Assessment of hazard of small space debris for space activities and ecology of Earth*, 3 AEROSPACE FIELD, 80 (2019).

⁶Davis A.G., *Space Commercialization: The Need to Immediately Renegotiate Treaties Implicating International Environmental Law*, 3 SAN DIEGO JOURNAL CLIMATE & ENERGY LAW, 371 (2012).

space, debris should enter the Earth's atmosphere, where it will burn.⁷ In 2013, the European Space Agency proposed the Clean Space initiative and ordered the first mission to remove space debris, starting in 2025. It is also proposed that special structures be installed on the spacecraft to protect them in case of a collision with fragments of space debris. The studies also cover the improvement of the efficiency of space monitoring and accurate forecasts of possible collisions with debris.⁸ Nevertheless, these measures are insufficient to prevent torts caused by the collision of satellites and other spacecraft with space debris and to compensate for the inflicted harm.

II. International Organizational and Legal Measures Aimed at Combating Space Debris

In international public law, a range of measures to combat space debris is already enshrined in international treaties adopted in recent decades. For example, some articles of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1966), establish the international responsibility of the states for national activities in outer space, including responsibility for the damage caused by such objects. According to Article IX of the Treaty, States Parties shall pursue studies of outer space to avoid its harmful contamination and adverse changes in the Earth's environment resulting from the introduction of extraterrestrial matter. However, the issue of space debris is not settled in this Treaty.

The Convention on International Liability for Damage Caused by Space Objects (1971) in Article III provides liability for damage caused by a space object belonging to a state to another object, but only if the damage is due to its fault. This formulation of the issue excludes the possibility of extension of the Convention to compensation for the harm caused to spacecraft by space debris.

The Inter-Agency Space Debris Coordination Committee now unites the executive bodies of 13 states (their space agencies), and the Space Debris Mitigation Guidelines of 2003 were developed.⁹ They propose a range of measures to reduce the amount of debris during scheduled operations, to minimize the possibility of destruction in orbit, to remove debris from orbit after the completion of space programs, and to prevent collisions in orbit. The Space Debris Mitigation Guidelines of 2007 (endorsed by the United Nations General Assembly in its Resolution) and the European Code of Conduct for Space Debris Mitigation of 2004 were also adopted.¹⁰ The Compendium of Space Debris Mitigation Standards, adopted by states and international organizations on January 26, 2018, is one of the latest documents aimed at reducing the amount of space debris. The Compendium aims to inform states of the current instruments and measures that states and international organizations have implemented and assist countries in developing similar standards. In addition to the overview of the good practices of states in preventing the formation of space debris, the document also contains provisions presenting the experience of individual countries in regulating the issues of liability for the harm caused by space debris. However, the legal status of this Compendium is only recommendatory.¹¹

Finally, in December 2020, the United Nations issued an additional resolution on reducing space threats – Resolution A/RES/75/36 – through norms, rules, and principles of responsible behaviors. In it, the United Nations General Assembly calls for states to implement measures

⁷Dron N.M., Khorolsky P.G., Dubovik L.G., *Selection of the maneuver of the garbage collection spacecraft at the stage of cleaning near-Earth space from small space debris*, 1 ENGINE BUILDING BULLETIN, 7 (2013).

⁸R.R. Kazakov & E.R. Mingaliev, *Analysis of the influence of space debris on the safety of space flights*, 3 DEFENSE COMPLEX FOR THE SCIENTIFIC AND TECHNOLOGICAL PROCESS OF RUSSIA, 80–83 (2015); I.D. Morozov, *Legal side of the issue of space debris*, 2–11 CURRENT ISSUES OF AVIATION AND ASTRONAUTICS, 469 (2015).

⁹I.A. Chernykh, *International legal aspects of ensuring the sustainability of space activities* (Candidate thesis, Peoples' Friendship, University of Russia, 2018) 67.

¹⁰The primary objectives of the Code are: a) to help prevent on-orbit break-ups and collisions of spacecraft, b) to facilitate the removal from useful densely populated orbit regions and subsequent disposal of spacecraft and orbital stages that have reached the end of mission operations, and c) to help to limit objects released during normal spacecraft operations. To reach these goals, the Code presents fundamental mitigation, safety, and protection measures for the design and operation of space systems.

¹¹D.A. Valeev, *Issue of liability for the harm caused by space debris*, 4 BULLETIN OF ECONOMICS, LAW AND SOCIOLOGY, 121 (2018).

related to transparency and increasing confidence in exploring outer space, including information exchange, visits to facilities, and international cooperation. Though the UN encourages international collaboration, defining and implementing the terms of this cooperation is left entirely to state discretion.

Therefore, the current international instruments do not cover all the aspects of the issue of space debris; they do not mention issues of financing the elimination of the existing space debris, legal consequences of collisions between space objects and space debris, compensation for damage, etc. This means that national legislation has to assume responsibility for the development of these rules and procedures and their implementation in practice, and this experience is of interest for the further development of international space law.

III. Measures to Combat Space Debris at the National Level

The national legislation of several countries (Finland, Belgium, Austria, etc.) includes rules for preventing the formation of space debris. However, there are no such legislative rules in other states, or (as in Russia) they are concentrated only in technical bylaws.¹² The analysis of the current national legislation of certain countries shows that we can now distinguish two approaches to the issue of space debris prevention.

One group of states (the United States, Canada, Japan, the United Kingdom, Australia, France, and some other countries) has already developed a range of advanced legal measures, including a spacecraft registration system. The other group of countries is at the stage of developing this national legislation and has already attained some achievements in this area (Nigeria, India, Brazil, South Korea). Based on the available experience of national legislation, Frans von der Dunk proposes the introduction of a licensing system for space entrepreneurs as well as the creation of an international guarantee fund, which is similar to the one that functions in relation to automobile transport at the national level in many countries and will compensate for the damage caused by unidentified space debris.¹³

Considering the specific experience of certain countries, we should note that the experience of the United States as a major spacefaring nation in terms of space debris prevention is of the greatest interest. The United States Government Orbital Debris Mitigation Standard Practices, adopted in 2001, is one of the first legal acts related to this issue. These guidelines were a main source for developing the Space Debris Mitigation Guidelines and subsequent international documents. NASA STD 8719.14 Process for Limiting Orbital Debris and NASA-NPR-8715.6A Procedural Requirements for Limiting Orbital Debris continue to be informative reference materials for other states. In 2015, in response to the growing demand from the private space industry, Congress passed the U.S. Commercial Space Launch Competitiveness Act, which facilitates commercial exploration and commercial extraction of space resources by citizens of the United States. Meanwhile, experts express certain doubts as to whether the owners of these space objects will be able to overcome the large-scale external effects, including the mass of “orbital debris” currently surrounding the Earth. This is why scholars from the United States propose several additions to United States legislation that recognize outer space as a global commons (such as the World Ocean): the growth of space debris negatively affects the world community rather than just one individual state.

This recognition will initiate the applicability of the National Environment Policy Act (NEPA)¹⁴ to low-orbit control. Currently, the NEPA requires federal agencies to thoroughly study the

¹²Ref., e.g., GOST R 52925-2018 Space technology items. General requirements for space vehicles for near-Earth space debris mitigation. Moscow: Standartinform, 2018.

¹³F. von der Dunk, *Space Debris and the Law*, 4 SPACE, CYBER, AND TELECOMMUNICATIONS LAW (2001). <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1003&context=spacelaw>.

¹⁴NEPA is the National Environment Policy Act of the United States of January 1, 1970, which is dedicated to environmental protection issues. This Act has served as model for the adoption of basic environmental laws in more than 100 countries.

environmental consequences of their projects before taking any action. In this regard, M.B. Runnels suggests discussing the possibility of establishing a fee for the use of orbital objects, which will finance projects for the removal of orbital debris and research related to the removal of orbital debris. Accordingly, a comprehensive solution to the problem requires the drafting of amendments to US legislation.¹⁵

In light of the decisions regarding orbital debris elimination, as discussed by Congress, federal agencies of the United States created the rules that require satellite operators to mitigate the effects of orbital debris after the completion of their missions and to eliminate expired satellites. For example, the Federal Communications Commission established a range of rules that all applicants must follow in order to obtain licenses for communication satellites. The applicants must provide the projects and strategies they will use to prevent any orbital debris after the satellite's mission is over. In the same way, the Federal Aviation Administration requires operators to submit written launch plans that include flight safety plans with a detailed description of fragments dispersal at the end of the lifespan.¹⁶

The work on establishing the requirements for space missions has also been successfully implemented in other countries. For example, Germany has exceptional product quality and safety requirements for space projects, which include mandatory requirements for space debris mitigation for all stages of space missions. These requirements comply with all the international standards developed with Germany's contribution. In turn, the French national mechanism for space debris mitigation is represented by the Decree on Technical Regulation of March 31, 2011, issued under Act No. 2008-518 of June 3, 2008 (FSOA). The Decree contains all technical requirements for any operators and consists of special sections for launch and orbital systems.

The legal acts are the national mechanism for fulfilling France's international obligations for space debris mitigation. The French Technical Regulation complies with these guidelines, as well as with ISO 24113. In the context of space debris, French law considers active removal technologies to be one of the key technologies of the future.¹⁷ They are focused on reducing the amount of large (mainly physically intact) objects. The FSOA requires licenses and permits for participation in space operations. The applicants are space operators, particularly those who independently implement the space operation. The applicants must demonstrate professional, financial, and moral guarantees and comply with technical, safety, and environmental requirements.

Regarding environmental safety, the applicants must provide, among other data, risk management plans and environmental impact studies that indicate how they will avoid, reduce, or compensate for the adverse environmental impact. The FSOA does not clearly define space debris; however, it is described as non-functional objects of human origin, including fragments in Earth's orbit or entering the Earth's atmosphere. France applied an ambitious approach, including mitigation of space debris and its effects in its regulatory framework related to the use of outer space. Among the legal innovations that interest us, we can point out the need to obtain a license, for which the holders of licenses must provide the licensing authority with plans and measures preventing the risk of collision of space objects.

However, most national laws do not prescribe that activities in outer space must be carried out in a special way regarding space debris and the safety of space missions. This probably occurs because monitoring compliance with international requirements and rules is difficult.¹⁸

¹⁵M.B. Runnels, *On Clearing Earth's Orbital Debris & Enforcing the Outer Space Treaty in the U.S.* (2022) https://www.americanbar.org/groups/business_law/publications/blt/2022/01/orbital-debris/ (accessed February 25, 2023).

¹⁶E.M. Nevala, *Waste in Space: Remediating Space Debris Through the Doctrine of Abandonment and the Law of Capture*, 66-6 AMERICAN UNIVERSITY LAW REVIEW, 1508-09 (2017).

¹⁷U.M. Bohlmann & G. Petrovici, *Developing planetary sustainability: Legal challenges of Space 4.0.*, e10 GLOBAL SUSTAINABILITY 2, 6-7 (2019)

¹⁸NET ZERO SPACE. Sustainable outer space by 2030. Fostering Better and More Interoperable Norms: Comparing Existing Binding National Requirements Relating to Space Debris. Recommendations For Enhanced Regulations and Public Policy with Regard to Space Debris Mitigation and Remediation. WHITE PAPER, November 2022, P.13.

Nevertheless, the environmental legislation of most countries enshrines two very important principles that can also be applied to outer space, making it possible (in the case of their inclusion in international treaties) to reduce the threat of growing volumes of space debris – these are the “polluter pays” principle and the precautionary principle that has repeatedly proved to be effective in the national practice of environmental protection.

For example, the precautionary principle requires launching states to exercise extreme caution when launching objects into outer space, particularly when there is significant uncertainty about the result. Therefore, if the launch involves the danger of space debris causing irreparable damage, the precautionary principle will require the launching state and the non-governmental operator to take additional precautionary measures during the launch of the space object if it can generate space debris. This precaution will, at least, require the state and the operator to follow the Space Debris Mitigation Guidelines based on normal operating procedures. The state and the operator will bear responsibility for any breach of the precautionary principle, which will be a stimulus to reduce the risk of space debris.¹⁹

Therefore, at the moment, the issue of the harm caused to spacecraft and people by space debris is still far from being solved. At the international level, no appropriate legal regulation prevents the harm caused by space debris and its monetary compensation in tort relations. At the national level, several economically developed countries have taken some steps to create a system to prevent space torts. However, no mechanism for compensating spacecraft owners damaged by space debris collisions has been established. The reason is that there is no specific tortfeasor in this case since it is impossible to identify the owner of thousands of spacecraft pieces. Accordingly, nobody can be held liable in tort. In addition, it is extremely difficult to establish causal relationships between space debris objects and the space object from which they originate and the owner of this former space object.

IV. Practical Recommendations for Enhancing the International Legal Mechanism to Combat Space Debris

Summarizing this available experience and taking into account the danger of the studied threat, we suggest the following range of recommendations:

- 1) It is necessary to determine which international document must be dedicated to the issue of space debris management. At the moment, experts are discussing two options: the development of a single international document for the elimination of space debris or the development of a system of bilateral agreements.²⁰ It is also quite possible that an additional protocol to the Convention on International Liability for Damage Caused by Space Objects (1971) will be prepared. We believe that developing an additional convention on space debris management is the most promising option, considering the peculiarities of the issue.
- 2) It is necessary to determine the terminology and ways of space debris management in this international instrument. Space debris is thought to be a unique variety of the generic category of “waste,” and many legal issues can be addressed using international and national developments relating to “Earth waste.” In particular, we suggest that the right of ownership to waste be assigned to the person who produces it. Many large fragments of space debris are of material value, and as technology develops, they can be returned to Earth. If states abandon their rights to them, they will be destroyed. Considering that the greater part of space debris cannot be identified as belonging to a particular state, the

¹⁹P.B. Larsen, *Solving the Space Debris Crisis*, 83 JOURNAL OF AIR LAW AND COMMERCE, 491 (2018).

²⁰S.M. Popova, *Improvement of the potential of the international space law and policy to ensure responsible, safe and peaceful use of outer space*, 3–4 LAW AND STATE, 81 (2018).

proposed international convention can use the framework of common ownership of space debris by the countries launching satellites and other spacecraft. It is they who must bear the burden of expenses for the elimination of this waste as the owners.²¹

- 3) It is necessary to create a separate agency under the UN (or expand the functions of the Committee on Space), which could receive certain contributions from the states participating in space missions and spend them on measures to combat space debris (through research grants), to coordinate launches of spacecraft collecting such debris, to coordinate and develop the system of outer space monitoring, to maintain a unified register of not only all launched spacecraft but also large debris fragments of space debris, etc. A universal package of measures to encourage insurance companies to provide insurance coverage against collision risks between spacecraft and space debris deserves a separate discussion.
- 4) In scientific literature, it is proposed that an international fund be established to which countries carrying out aerospace activities could transfer money to be spent on measures to reduce the volume of space debris. It could also compensate countries and private companies affected by space debris.²² This will enable the implementation of one of the fundamental principles of international environmental law – the polluter pays. In addition, this can involve using the potential of the Global Environment Facility, which participates in solving international environmental problems and is in close contact with the UN and other organizations. If this strategy is successful, the first part of the issue under study, the prevention of the formation of space debris, and the other part, the payment of compensation to the persons affected in tort relations in case of no specific tortfeasor, will be resolved.
- 5) In theory, the solution to any “garbage problem” implies a reduced volume of the garbage generated. This requires the imposition of additional duties (entailing additional expenses) on the states and private companies launching spacecraft in relation to the planning of disposal of satellites that exhaust their resources. Though the resistance of private businesses to the new rules is inevitable, this is the only possibility to reduce the volume of debris instead of combating its consequences. Concerning Earth waste, several countries have successfully implemented this option within the framework of the circular economy concept, and its main provisions are also applicable to space.²³ In addition to adopting international legal rules to mitigate new pollution of near-Earth space, it is necessary to develop procedures to eliminate the available objects of space debris internationally.²⁴ Only then will it be possible to discuss an integrated approach to resolving this issue.
- 6) The impact of space debris causes economic and environmental harm. It is widely believed that burning fragments of space debris in the atmosphere and their fall into the World Ocean is harmless, but this position is very doubtful.²⁵
- 7) In contrast to the documents adopted before, the proposed international convention must resolve the issues of liability of states and private companies for violation of the rules for a reduction of the volume of space debris (for example, the launch of spacecraft that cannot return to Earth are doomed to become debris).

²¹The procedure for distribution of such costs between them requires special discussion.

²²D.A. Valeev, *Issue of liability for the harm caused by space debris*, 4 BULLETIN OF ECONOMICS, LAW AND SOCIOLOGY, 119–122 (2018).

²³C. Mottier, *One Giant Heap for Mankind: The Need for National Legislation or Agency Action to Regulate Private Sector Contributions to Orbital Debris*, 31-3 PACE ENVIRONMENTAL LAW REVIEW, 878 (2014).

²⁴L.V. Danilova, *Liability for pollution of near-Earth space*, 2-10 CURRENT ISSUES OF AVIATION AND ASTRONAUTICS, 268 (2014).

²⁵S.M. Steele, *Space Debris: A Basis for Actively Removing Objects Under an International Legal Order*, 8-2 AMERICAN JOURNAL OF AEROSPACE ENGINEERING, 55 (2022).

- 8) Along with international cooperation, there is a positive experience for certain states, particularly the practice of licensing spacecraft launches in France and some other countries. Voluntary study and dissemination of this experience to other spacefaring nations, with the introduction of compulsory licensing of space activities, would increase the responsibility of these states and the private companies launching spacecraft for various purposes.
- 9) Several principles of national environmental law have proven effective, the application of which gained considerable national experience in many countries: this should be extended to international space law. The precautionary principle is one of them. It is already used in the International Law of the Sea and can potentially solve space debris issues. This principle is especially useful when scientific evidence is insufficient to make balanced decisions that have a significant potential impact on human health and the environment. Applying this principle in international space law will mean that spacefaring nations will be obliged to avoid those space activities that include a reasonable risk of the emergence of new items of space debris.

B. Issues of Compensation for the Harm Caused to the Life, Health, or Property of Citizens by Global Climate Change

1. Essence of Climate Threats and Positions of National Courts in the Protection of Climate Civil Rights

The issue of global climate change and its negative consequences for the environment, life, health, and the property of citizens is one of the most discussed in international legal science. At the moment, in international and national law, there are sufficiently well-developed mechanisms of compensation for the harm caused by violation of the requirements of the national environmental legislation (for example, the emission of harmful substances in excess of the established limits) and the harm caused by an emergency natural or person-made accident or disaster. There are even cases of compensation for the harm caused by one state to another due to a hostile impact on the state of its environment.²⁶

However, despite this well-developed compensation framework for local consequences of human activity on nature, more complex cases of the harm caused to nature and the health of citizens are poorly regulated by national legislation and poorly protected in judicial practice. As in the case of space debris, climate torts have two aspects: the issue of their prevention and the issue of compensation for the harm caused to the life, health, and property of citizens (property of legal entities) as a result of torts with the impossibility of establishing the tortfeasor. Meanwhile, all countries register many manifestations of global climate change causing harm annually. These manifestations are mainly related to drought, agricultural losses, and damage to the fishing and forestry industries (especially when pests not characteristic of a particular climatic zone appear in the forests).²⁷ This circumstance has led to an expected trend in judicial practice associated with attempts to link the occurrence of damage from hurricanes and other natural disasters to the activities of energy or other industrial companies that emit greenhouse gases. However, all first attempts to restrict their activities in court were unsuccessful.²⁸ Attempts to recover from the climate harm caused by the US automotive industry were equally unsuccessful.²⁹

²⁶For example, according to the decision of the UN Compensation Commission, Iraq, which occupied Kuwait in 1990–1991, was obligated to pay Kuwait \$52.4 billion, including for the harm caused to the environment during the war

²⁷R.K. Craig, *Stationarity is dead – long live transformation: Five principles for climate change adaptation law*, 34 HARVARD ENVIRONMENTAL LAW REVIEW 26 (2010).

²⁸J. Jaffe, *The Political Question Doctrine: An Update in Response to Recent Case Law*, 38 ECOLOGY LAW QUARTERLY, 1035–36 (2011).

²⁹T.J. Boutros, Lanza Jr. & D. Lanza, *Global Warming Tort Litigation: The Real Public Nuisance*, 35 ECOLOGY LAW CURRENTS, 84 (2008).

Scholars of the United States explain this failure by the fact that the filed claims were based on the thesis that certain industries (the oil, electric, utility, and automotive sectors) are allowed to emit too much CO₂ and other greenhouse gases, and in this regard should be required to reduce their emissions. However, federal courts do not possess the institutional expertise to make such complex policy determinations. To adjudicate a “public nuisance” claim based on global warming, the courts would be required to sort through and balance an array of competing interests—including environmental, industrial, commercial, foreign policy, security, and consumer choice concerns—and decide how much CO₂ and other greenhouse gases the targeted industries should be allowed to emit. It is simply not the role of the courts to engage in such policymaking.³⁰

This is why claims against national governments regarding the lack of effectiveness of their work in reducing greenhouse gas emissions were more successful. For example, in 2015, a Dutch environmental group, the Urgenda Foundation and 900 Dutch citizens sued the Dutch government, stating that its recent revision of goals to reduce greenhouse gas emissions violated its constitutional obligations. The court upheld this claim and obliged the Dutch government to limit greenhouse gas emissions to 25% below 1990 levels by 2020, finding the government’s existing pledge to reduce emissions by 17% insufficient to meet the goals of the Paris Agreement of keeping average annual temperature increases within two degrees Celsius of pre-industrial conditions. The court concluded that the state must take climate change mitigation measures due to the severity of the consequences of climate change and the resulting risks and cited, among other principles, the “no harm” principle of international law. Though the court did not directly prescribe any ways to reduce emissions, it pointed to two possibilities – emissions trading and tax measures. This decision is quite innovative in the available judicial practice of separation of powers because it ordered the government to tighten the emission restrictions.³¹

Some proceedings at the beginning of 2023 were pending before the US courts. They included a lawsuit challenging the law of the State of California that required all new cars and light trucks sold in California to be zero-emission vehicles by 2035. The plaintiffs thought the law would have a disproportionate adverse impact on the low-income categories of citizens and make it difficult for them to access reliable vehicles. In addition, this law was inconsistent with the state’s legitimate interests in reducing greenhouse gas emissions.³²

In another case, sixteen Puerto Rico municipalities filed suit, holding fossil fuel oil and gas companies liable for losses from the 2017 hurricanes and ongoing economic losses since 2017. In particular, the municipalities alleged that the defendants were responsible for 40.01% of all global industrial greenhouse gas emissions from 1965 to 2017. These emissions caused climate change and increased the intensity of Hurricanes Irma and Maria.³³

In a third case, the Attorney General and several other officials of New Jersey (US) sued the fossil fuel producer Exxon Mobil Corp. for losses due to the (alleged) considerable role of the defendant in climate change and damage to the State of New Jersey. According to the plaintiffs, the company’s emissions resulted in devastating climate change in the state, causing additional expenditure for protecting people, businesses, infrastructure, and natural resources, as well as rising sea levels, drought, and ocean acidification.³⁴

Summarizing the available judicial practice in climate cases, experts distinguish the five most significant trends (areas) in climate cases: forcing governments to fulfill their legislative and political climate obligations; linking the consequences of resource extraction to climate change;

³⁰*Ibid.* at 86.

³¹The Status of Climate Change Litigation – A Global Review. United Nations Environment Programme, May 2017. p. 15.

³²The Two Hundred for Homeownership v. California Air Resources Board (2022) <http://climatecasechart.com/case/the-two-hundred-for-homeownership-v-california-air-resources-board/> (accessed February 25, 2023).

³³Municipalities of Puerto Rico v. Exxon Mobil Corp (2022) <http://climatecasechart.com/case/municipalities-of-puerto-rico-v-exxon-mobil-corp/> (accessed February 25, 2023).

³⁴Platkin v. Exxon Mobil Corp. (2022) <http://climatecasechart.com/case/platkin-v-exxon-mobil-corp/> (accessed February 25, 2023).

establishing that specific emissions are the direct cause of particular adverse effects of climate change; establishing responsibility for failures (or efforts) to adapt to climate change; and applying the public trust doctrine to climate change. It should be noted that some court cases go beyond these “classical” frameworks. A typical example is the climate claims of small indigenous peoples, raising the question of the relationship and interrelation of environmental harm, climate change, and human rights guarantees.

In December 2005, a tribe of Inuit living in the Arctic filed a petition with the Inter-American Commission on Human Rights, accusing the United States of violating its human rights obligations by failing to reduce its emissions of greenhouse gases. The petition detailed the effects of rising Arctic temperatures on the ability of the Inuit to enjoy a wide variety of human rights, including the right to life. However, their asserted claims were dismissed.³⁵

Maldives unsuccessfully raised the issue of the linkage between harm and violations of human rights by climate change at the international level, stating that rising sea levels and other effects of climate change threaten the human rights of the residents of small islands. These residents’ right to life would be harmed by the increased frequency and severity of flooding; their property rights would be affected by the loss of homes and other possessions because of inundation; enjoyment of their rights to health, food, water, and housing would be infringed by rising waters and temperatures; and the loss of the country itself would destroy their collective right to self-determination.³⁶

However, does it follow from these failures that there is a need to abandon the claims for compensation for climate harm? It does not seem so. This is more likely to imply the need for theoretical research and a search for ways to develop judicial redress in connection with climate change.³⁷ This will require further development of the evidence theory, judicial environmental expert review, and the science of climatology. The latter’s achievements allow us to prove the causal relationship between greenhouse gas emissions, climate change, and caused harm.

Special attention must be paid to whether compensation for the harm caused by greenhouse gas emissions produced in one state may be awarded to the affected citizens in another. This will require the development of a new theory of international legal environmental liability. In its development, deciding how to consider individual enterprises or states’ relatively small contribution to climate change and what formula to use to recover compensation for the caused harm will be necessary. Moreover, the atmosphere contains greenhouse gases stretching back hundreds of years, and it is not clear how to distinguish today’s contribution from the previous pollution, given that the movement of greenhouse gases cannot be traced.³⁸

II. Role of International Environmental Funds in Compensating for Climate Harm the Doer of Which is Impossible to Establish

The issue of tort liability resulting from harm caused to persons due to climate change has not yet been convincingly resolved at the national level because of the lack of specific tortfeasors. One of the options to this question can be the development of a system of international and national environmental funds, with the expansion of the sources of their financing and the establishment of the possibility of making payments to citizens and organizations affected by climate change and the negative processes generated by it in international treaties.

³⁵J.H. Knox, *Linking Human Rights and Climate Change at the United Nations*, 33 HARVARD ENVIRONMENTAL LAW REVIEW, 482 (2009).

³⁶*Ibid.* at 486.

³⁷For the details refer to: D. Vincent, *AES v. Steadfast and the Concept of Foreseeability in Climate Change Litigation*, 44 ENVIRONMENTAL LAW, 201–24 (2014); T. Koivurova, *International Legal Avenues to Address the Plight of Victims of Climate Change: Problems and Prospects*, 22 JOURNAL OF ENVIRONMENTAL LAW AND LITIGATION, 269–77 (2007).

³⁸M. Gerhart, *Climate Change and the Endangered Species Act: The Difficulty of Proving Causation*, 36 ECOLOGY LAW QUARTERLY, 187–90 (2009).

At the moment, the system and the main areas of the activities of international environmental funds are described below:

- 1) The Environmental Fund, established in 1973 by the UN General Assembly, is one of the most famous international funds and is the core financial fund of the UN Environment Program (UNEP). This fund functions due to contributions from the UN member states, and its main focus is financing environmental projects on the 2030 Agenda. Currently, 85% of the Fund is used to finance thematic programs. A special mention should be made of the subprogram of identification of new emerging environmental issues (such as through the Frontiers series). If we refer to the official reports, we find that climate protection issues are constantly the central focus of its administrators. For example, in 2016, the Frontiers' report included a Loss and Damage chapter, which described the adverse effects of climate change that cannot be avoided through mitigation and adaptation measures. The 2017 report considered climate change's influence on people's relocation to other places. The 2018/2019 report identified shortcomings in the climate adaptation strategy, and in 2022, the authors of the report considered the influence of climate on the change of the fire regime as well as the influence of climate on the life cycle of plants and animals. Certainly, the Fund's financing is not limited to this; it extends to other projects.³⁹
- 2) The Green Climate Fund was created in 2010 by the countries that signed the United Nations Framework Convention on Climate Change. It has the status of a financial mechanism for its implementation. Its task is to finance climate projects in order to achieve the ambitious goals of the 2015 Paris Climate Agreement. The investments of the Fund aim to achieve the maximum impact on developing countries, supporting paradigm shifts in both the mitigation of the effects of climate change and their adaptation. The Fund finances these two strategies on a 50:50 basis. It also focuses on financing adaptation projects for particularly vulnerable countries, including least developed countries, small island developing states, and African states.⁴⁰
- 3) The Global Environment Facility (GEF) is a multi-faceted fund to combat large-scale environmental problems, including biodiversity loss, climate change, and pollution of water reservoirs and land surfaces. Its grants are intended to support developing countries in fulfilling assumed international environmental obligations. The GEF bridges governments, indigenous peoples, and civil society representatives interested in settling environmental issues. For the past 30 years, the GEF has provided more than \$22 billion in grants and blended finance (\$120 billion in co-financing) and implemented more than 5,000 national and regional projects.⁴¹
- 4) The Adaptation Fund finances specific programs for the adaptation to climate change in developing countries. Since 2010, the Adaptation Fund has committed about \$850 million to 123 adaptation and climate resilience improvement projects.⁴²
- 5) Regulation (EU) 2021/241 of the European Parliament and of the Council of 12 February 2021 established the Recovery and Resilience Facility. On its establishment, the Regulation states that the EU member states support the green transition and contribute to achieving the Union's 2030 climate targets set out in Point (11) of Article 2 of Regulation (EU) 2018/1999. Thus, EU countries moved toward complying with the objective of EU climate neutrality by 2050, thereby contributing to upward economic and social convergence, restoring and promoting sustainable growth and the integration of the economies of the

³⁹Environment Fund (2023) <https://www.unep.org/about-un-environment-programme/funding-and-partnerships/environment-fund> (accessed February 25, 2023).

⁴⁰Green Climate Fund (2023) <https://www.greenclimate.fund/projects> (accessed February 25, 2023).

⁴¹Global Environment Facility (2023) <https://www.thegef.org/who-we-are/funding> (accessed February 25, 2023).

⁴²Adaptation Fund (2023) <https://www.adaptation-fund.org/about/governance/> (accessed February 25, 2023).

Union, and fostering the creation of high-quality employment. To achieve that general objective, the specific objective of the Facility shall be to provide Member States with financial support to achieve the milestones and targets of reforms and investments as set out in their recovery and resilience plans. That specific objective shall be pursued in close cooperation with the Member States concerned. Support from the Facility shall not, unless in duly justified cases, substitute recurring national budgetary expenditure and shall respect the principle of additionality of Union funding.

- 6) The German Federal Environmental Foundation (DBU) finances innovative environmental projects focusing on small and medium-sized companies. Its environmental funding activities focus on technology and research, nature protection, environmental communication, and the protection of cultural values. The foundation was established in 1990 and began its work in 1991. As of June 2022, it has supported over 10,600 projects with a funding volume of around 1.96 billion euros. The foundation's current capital is 2.39 billion euros. Funded projects should achieve sustainable effects, give impulses, and lead to a "multiplier effect." It is the objective of the DBU to contribute to the solution of current environmental problems, particularly those resulting from unsustainable business practices and lifestyles. It sees the crucial challenges primarily in climate change, biodiversity loss, unsustainable use of natural resources, and harmful emissions. The funding topics are linked to current scientific findings on the Planetary Boundaries and the United Nations' Sustainable Development Goals.⁴³
- 7) Dozens of public environmental funds have recently been established. They have different funding sources and areas of activity, including financing various climate projects. These non-governmental funds also include the Global Environment Centre Foundation (Japan).⁴⁴

The conducted overview shows that the current system of environmental funds, in general, copes with the settlement of issues of financing the prevention of climate change (and, accordingly, the harm caused by this change); however, it is hardly aimed at addressing another aspect of the issue under study – the determination of the mechanism for compensation for harm where it is impossible to establish the tortfeasor. This requires further discussion of the mechanism for financing these funds and the procedure for their payment of compensation, which is beyond the scope of this article.

Nevertheless, we believe that the first step in developing the compensation mechanism for the harm to citizens resulting from climate change could be achieved by expanding the list of the grounds and procedures for recognizing natural emergencies caused by climate change.

This is impossible at the current level of development of science and technology; however, this is the area of the future. Considering that climate problems are common to all countries, developments relating to these compensation mechanisms are obviously not enough at the national level. Settlement of this issue will likely require expansion of the jurisdiction of the UN International Court of Justice (to consider disputes between states on compensation for the harm resulting from climate change caused by violation of international treaties or customary law), as well as the adoption of an international treaty (an additional protocol to the current 1992 UN Framework Convention on Climate Change) on the mechanism of compensation for the harm caused by states that lead to climate change.⁴⁵ Though few people now believe that climate change's influence on citizens' health will be proven, it should be noted that, until recently, the

⁴³Deutsche Bundesstiftung Umwelt DBU (2023) <https://www.dbu.de/english> (accessed February 25, 2023).

⁴⁴Global Environment Centre Foundation (2023) <https://gec.jp/> (accessed February 25, 2023).

⁴⁵This international treaty should be based on the principle that the contribution of all states to the formation of greenhouse gases is known (or can be established fairly accurately). This is why states issuing permits for emission of harmful substances must also assume the duty to compensate for the caused harm. They must have joint and several liability in proportion to their impact on the climate and accept environmental refugees on the basis of the volume of their greenhouse gas emissions

recognition of environmental diseases seemed impossible.⁴⁶ Finally, as in the case of compensation for harm from space debris, there is still potential for developing insurance cover against climate harm risks.⁴⁷

The above measures can help to reduce the annual damage caused by climate change, which may reach \$1 trillion by 2040.⁴⁸ Suppose the world community decides to start developing an international treaty on compensation for climate harm. In that case, it will be necessary to formulate a new understanding of climate human rights and the mechanism for their protection, including the rights of climate refugees. This new international treaty must be developed based on achieving the most progressive national legislation and current judicial practice in climate cases (available on the Sabin Center website, USA).⁴⁹

III. Main Areas of Addressing Climate Issues at the Level of the European Union, Russia, and in Other Acts of National Legislation

Without trying to cover all countries and their climate laws, we will attempt to show the main areas of national climate regulation aimed at mitigating the risk (climate change prevention) and compensating for the resulting losses.

- 1) The concept of risk is one of the key legal categories in the area of compensation for harm caused by climate change, where it is impossible to identify the harm-doer. In our view, climate risk should be understood as an environmental threat involving the possibility of a potential impact of natural disasters that are caused by past human economic activity and are likely to cause damage to the life, health, or property of citizens (property of legal entities) on the socio-economic system of one or more states. For example, in 2015, the Volgograd Region in the Russian Federation faced a severe drought, which damaged crops, forests, water bodies, aquatic bioresources, etc. Though the Russian authorities provided no official confirmation of the causal links between greenhouse gas emissions, climate change, and drought, we cannot exclude the possibility of abnormal natural disasters for this particular area exactly for this reason. An exceptional legal act developed by the regional authorities and dedicated to the issues of the adaptation of the region to climate change is an indirect confirmation of this conclusion.⁵⁰ Similar work is carried out successfully in other countries, such as Spain. Accordingly, developing documents with measures for adaptation to natural disasters caused by climate change at the national and regional levels will facilitate the mitigation (or even prevention) of the negative effects of these disasters, which will also reduce the risk of harm to citizens of the country.
- 2) The European Union has achieved the most success in developing a strategy for combating climate change. Following Regulation (EU) 2021/1119 of June 30, 2021, on achieving climate neutrality, the EU and its Member States have set an ambitious goal of achieving net-zero greenhouse gas emissions by 2050, mainly by regulating emissions and removing greenhouse gases from across the entire Union, investing in green technologies, and protecting the

⁴⁶By now, Minamata and Itai-itai diseases have become common names, and there is probably no doubt in their environmental causality. Similar examples of “environmental causality” can be given also for a range of respiratory diseases, allergies, etc. Ref. M. Shimbun, 50 years of official recognition of itai-itai disease. <https://inosmi.ru/history/20180512/242204685.html> (accessed February 25, 2023).

⁴⁷Bruggeman, Faure & Heldt, *Insurance Against Catastrophe: Government Stimulation of Insurance Markets for Catastrophic Events*, 23 DUKE ENVIRONMENTAL LAW & POLICY REFORM, 185–241 (2012).

⁴⁸He Q., *Mitigation of Climate Change Risks and Regulation by Insurance: A Feasible Proposal for China*, 43-2 BOSTON COLLEGE ENVIRONMENTAL AFFAIRS LAW REVIEW, 320 (2016).

⁴⁹Sabin Center for Climate Change Law (2023) <http://climatecasechart.com/> (accessed February 25, 2023).

⁵⁰Resolution of the Administration of [the] Volgograd Region No. 248 of April 27, 2022, “On the Approval of the Regional Plan of Adaptation to Climate Change in the Territory of Volgograd Region.” Found in the Legal Reference System “Garant”, accessed February 25, 2023.

environment. The document states that greenhouse gas emissions must be urgently reduced, particularly the likelihood of extreme weather events. It is also necessary to address the growing climate-related risks to health, including more frequent and intense heatwaves, wildfires and floods, food and water safety, security threats, and the emergence and spread of infectious diseases. With this purpose, the Regulation establishes a binding objective of climate neutrality in the European Union by 2050 in pursuit of the long-term goals of the Paris Agreement. It enshrines a framework for reversing and gradually reducing anthropogenic greenhouse gas emissions. The mechanism for achieving greenhouse gas emission reduction targets currently implemented in the EU may also be of interest internationally; it can be used to develop new nature protection agreements.

- 3) Implementing a circular economy at international and national levels is essential for effectively counteracting global climate change and reducing greenhouse gas emissions. According to the European Green Deal authors,⁵¹ the closed-loop economy action plan involves transitioning to new technologies in all sectors, especially resource-intensive ones (textiles, construction, electronics, and plastics). In addition, the European Commission will pay particular attention to addressing intentionally added microplastics and unintentionally released plastics. The circular economy action plan (CEAP) will also include a range of measures to encourage businesses to provide consumers with reusable, durable, and repairable materials and products. New business models based on the lease of goods and services and shared use will play a particular role as long as they are sustainable and affordable. Creating a single reliable and integrated market for secondary raw materials and byproducts is no less important for promising use at the international level, which will require deep cooperation in all value chains. The latter measure is especially relevant regarding electronic waste that contains many valuable materials and elements. However, the transition to a circular economy, involving, among other things, rapid waste reduction and new processing technologies, can only be implemented on an international scale. No matter how successful the EU's attempts are, without the similar achievements of China, India, Russia, and other countries, this effect will be limited; it will require the development of an international treaty that considers the EU's experience. This measure will reduce the amount of waste and greenhouse gases and contribute to mitigating the threat, thus creating guarantees of no harm due to climate change.
- 5) The sale of quotas for greenhouse gas emissions among states is one of the most effective tools in combating average annual temperature increases; it also serves as one of the essential guarantees of human environmental rights.⁵² Today, trade in quotas have not yet become widespread for numerous reasons. In our view, the development of a framework agreement for the sale of quotas for emissions, which the UN could recommend to the participants of the Paris Agreement, could be a stimulus for the development of trade in quotas. However, developing this agreement will inevitably result in discussing several aspects of its content, which will be covered by international and national law. We note that there are 18 emissions trading schemes worldwide, and their number grows yearly; they include European, Swiss, Kazakhstan, and some other emissions trading systems,⁵³ each with its own significant features. We also observe attempts to harmonize various trading systems in quotas for greenhouse gas emissions. An example is the Agreement between the European Union and the Swiss Confederation on the linking of their greenhouse gas

⁵¹Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the regions. The European Green Deal. Brussels, Dec. 11, 2019.

⁵²D.B. Hunter, *The Paris Agreement and Global Climate Litigation after the Trump Withdrawal*, 34 MARYLAND JOURNAL OF INTERNATIONAL LAW, 232–33 (2019).

⁵³V. Caciagli, *Emission Trading Schemes and Carbon Markets in the NDCs: Their Contribution to the Paris Agreement*, in THEORY AND PRACTICE OF CLIMATE ADAPTATION (F. Alves, W.L. Filho & U. Azeiteiro, eds., 2018), 541–50.

emissions trading systems of December 7, 2017, which speaks in favor of international cooperation and the possibility of concluding a framework agreement on the trade in quotas.

Therefore, we can observe a different level of development in two areas concerning the climate issue: the prevention of climate change and compensation payments for the harm caused by climate torts. In contrast to the issue of combating space debris, the climate field has a sufficiently large number of international and national legal acts dedicated to preventing climate change and the resulting harm to life, health, and property. At the same time, despite numerous claims (mainly in courts of the United States), there is still no effective compensation mechanism in international and national law for the harm caused by climate change.

This is due to the complexity of proving causal links between today's emissions of individual industrial enterprises and the amount of greenhouse gases accumulated for the years after the Industrial Revolution. Meanwhile, the judicial practice of certain countries shows the effectiveness of claims against the authorities regarding the insufficiency of their efforts to combat climate change. The analysis of national legislation shows that it is focused on the mitigation and adaptation to climate change rather than creating a compensation mechanism for climate harm; that is, it is preventive to a certain degree.

In the same area of preventing climate change and climate harm, we can observe particular achievements of the international community, especially in coordinating efforts to reduce greenhouse gas emissions (the 2015 Paris Climate Agreement). Meanwhile, the concept of climate risk requires further doctrinal development; international cooperation must be continued in terms of regulating trade in quotas for greenhouse gas emissions, developing the mechanism of financing climate projects from specialized environmental funds, encouraging the transition to circular economy standards that reduce greenhouse gas emissions, etc.

III. Issues of Compensation for the Harm Caused to the World Ocean

1. General Description of the Issue of the Pollution of the World Ocean

Protecting the marine environment today represents one of humanity's most pressing challenges. The world's ocean plays an important role in maintaining the thermal balance of the planet by absorbing carbon dioxide. It is one of the most important components of the Earth's biosphere. However, anthropogenic impact, including climate change, increases atmospheric carbon dioxide (CO₂) levels and ocean temperatures, which leads to ice melting at the North and South Poles and increases water acidity.

The rising ocean temperatures threaten the lives of millions of marine organisms that do not have time to adapt to the occurring changes and die out. Coral reefs are destroyed, marine algae die, and coastal ecosystems are affected by contamination.⁵⁴ In recent years, there have been increasingly more talks about acoustic ocean pollution related to anthropogenic noise from seismic exploration, drilling, shipping, and echolocation.⁵⁵

Abandoned nets (trawls) cause great harm to aquatic bioresources; millions of fish, birds, and turtles die because they become trapped in them.⁵⁶ Moreover, according to the United Nations, about 6.4 million tons of garbage are discharged into the seas yearly. As a result, fisheries in Scotland, for example, lose about £10 million annually. Indirect damage from marine debris also

⁵⁴S.C. Doney, *Climate Change Impacts on Marine Ecosystems*, 4 ANNUAL REVIEW OF MARINE SCIENCE, 12 (2012).

⁵⁵S.A. Patin, *Anthropogenic impact on the marine ecosystems and bioresources: Sources, consequences, problems*, 154 Trudy VNIRO, 89 (2015).

⁵⁶A.A. Maiss, Ya.Yu. Blinovskaya & M.V. Vysotskaya, *Lost fishing gear: Assessment, environmental consequences and solutions*, 11 ACHIEVEMENTS OF MODERN NATURAL SCIENCE, 187 (2018).

results from tourists not visiting beaches where the sea deposits garbage.⁵⁷ There is still the question of who should compensate for the harm to nature and the health of people if terrorists blow up an oil tanker or an underwater oil pipeline in neutral waters beyond the jurisdiction of a particular state. It is already recognized that oil production in the sea provokes earthquakes, and such cases are already known in Maykop and Central Asia.⁵⁸

The discharge of ships' ballast water is still urgent; for example, the number of carnivorous comb jellies brought into the Black Sea from the Atlantic Ocean increased significantly in 1989. It caused enormous damage to the fishing industry, which, in turn, led to serious economic losses.⁵⁹ There are many similar examples.

Shortly, the list of threats of harm to the seas in the absence of a particular guilty person will grow. Already, scientific literature includes a discussion on the options available for the actions of the Baltic Sea states to eliminate the consequences of pollution of their seas due to dumping by the victors of the Second World War. They had captured chemical weapons in the Baltic and the North Sea in the late 40s, which created risks for the health of their citizens and aquatic bioresources.⁶⁰ The exact places of their dumping are unknown, and the potential extent of harm to aquatic ecosystems is difficult to estimate.

The list of the above cases of harm caused to the World Ocean continues. Their common feature is the lack of a particular harm-doer (delinquent) who could compensate for the harm caused to the sea waters and bioresources (environmental harm) as well as the harm caused to the fish processing industry, tourism, etc. (economic harm). There is also the question of who should pay for the collection and burial (processing) of plastic and other garbage washed ashore in a specific state and for cleaning beaches from oil and other pollution that costs hundreds of thousands of dollars.⁶¹ Since the owner of this plastic and other garbage is unknown, the coastal state and its entrepreneurs bear the costs. However, this violates one of the fundamental principles of international law: the polluter pays. Along with economic losses related to pollution of the marine environment, there are cultural and aesthetic costs, which are difficult to measure.

2. *International Legal Means to Counteract the Pollution of the World Ocean*

Nonetheless, it cannot be said that the international community ignores the problem of protecting the world's oceans. Over the past decades, several dozen conventions dedicated to protecting sea waters from pollution have been adopted (the 1982 UN Convention on the Law of the Sea, the 1969 Convention on Civil Liability for Oil Pollution Damage, etc.). The provisions of these conventions are repeatedly applied in practice; for example, in cases of accidents involving individual tankers⁶² or oil platforms.⁶³ Further, it is prohibited to test nuclear weapons in the

⁵⁷E.A. Korshenko, E.B. Gafforova, A.I. Korshenko, *Development of environmental entrepreneurship in the area of using marine waste*, 3 NATIONAL INTERESTS: PRIORITIES AND SAFETY, 60–61 (2016).

⁵⁸L.A. Bagrova et al., *The Black Sea in the era of global challenges*, 9 GEOPOLITICS AND ECOGEOGNOMICS OF REGIONS, 105 (2013).

⁵⁹K.B. Valiullina, *International legal regulation and control in the field of introduction of alien aquatic organisms and pathogens as a result of the discharge of ships "ballast water"*, 158-2 PROCEEDINGS OF KAZAN UNIVERSITY. HUMANITIES SERIES, 546 (2016).

⁶⁰T.G. Ezhova, *International legal protection of the Baltic Sea from pollution* (Candidate thesis, Moscow State Law University, 2014) 4.

⁶¹Tharpe Y.L., *International Environmental Law: Turning the Tide on Marine Pollution*, 20 UNIVERSITY OF MIAMI INTER-AMERICAN LAW REVIEW, 592–93 (1989).

⁶²For example, in March 1989, the Exxon Valdez tanker crashed off the coast of Alaska, spilling more than 10 million gallons into the sea, covering 28,000 sq km. Many fish, marine animals, and birds died. Exxon was fined more than \$500, plus expenses incurred directly for water treatment.

⁶³As a result of the accident at the Deepwater Horizon oil platform in the Gulf of Mexico in 2010, more than 5 million barrels of oil were spilled, and the oil slick area was 75,000 sq km. BP compensated for the harm in the amount \$7.8 billion.

waters of the World Ocean. Also, the fight against international poaching is conducted quite effectively.

However, the issue of compensation for the harm when the person who causes it is unknown (and is impossible to establish) is not settled appropriately in these international documents. In this regard, doctrinal discussion of the current situation and further settlement within international law is required. The doctrinal justification for the need for a new approach can be the supplementation of the concept of the common heritage of mankind that applies to the world's oceans, the Moon, and other celestial bodies. In our view, the possibility to use this heritage (benefit) must also have another side (burden) related to the need to spend funds on the protection of ecological systems of the World Ocean as an object of the common heritage of mankind in the interests of both present and future generations of people. This concept of "universal compensation for harm to the World Ocean" (it could be enshrined using additions to the United Nations Convention on the Law of the Sea) must establish the principle of joint and several liability of countries who use marine resources for the state of the World Ocean. Prevention of this harm and payment of compensation (for example, to the coastal territories of states) will require the creation of a special environmental fund (or expansion of authorities of the current Global Environment Facility) to restore marine ecosystems, develop scientific and technical research, and monitor the state of sea waters. Since the 1992 International Fund for Compensation for Oil Pollution Damage has been operating for many years, there are cases where the person who caused harm to sea waters is known.

The money from this new fund will allow financing marine expeditions to eliminate the "islands of plastic garbage" in the ocean and to clear it of fishing nets and other dangerous garbage that threatens the state of marine and coastal bioresources. Another area of its work must include compensating persons affected by environmental torts where it is impossible to hold the tortfeasor liable.

In the development of new international documents on the protection of ecosystems in the World Ocean (and to resolve the issue of compensation for harm to the World Ocean where it is impossible to identify the harm-doer), it is necessary to use the experience of certain states who have already realized the scale of the problem and taken steps to reduce the negative impact of economic activities on marine ecosystems. In addition, this experience can be used both for developing international environmental law and as a model for other countries. Since it is impossible to list all national laws that are in one way or another dedicated to the protection of water and aquatic bioresources of the World Ocean, we will limit ourselves to the analysis of the most promising of them.

2.1. Fight against Ocean Pollution with Plastic Waste

To reduce the pollution of the World Ocean from the dumping of solid household waste, coastal states (and others) need to change their state policy in waste management, including plastic waste. The EU and the United States pursue the most consistent policy in this field. The EU has dedicated several important Directives on this issue. First, Directive (EU) 2018/852 of the European Parliament and of the Council of May 30, 2018, amends Directive 94/62/EC on packaging and packaging waste, which states that the purpose of waste management in the EU is the improvement of efficient and rational utilization of natural resources and the transition towards a circular economy and development of renewable energy sources. It also specifies a range of other environmental purposes.

The Directive explicitly emphasizes the importance of encouraging EU member states to increase the share of reusable packaging placed on the market, to reuse packaging, and to develop biodegradable packaging materials. The presence of packaging waste in the marine environment entails subverting the priority order of the waste hierarchy and means the inefficiency of its reuse and recycling policy. This approach is developed in Directive (EU) 2019/904 of the European Parliament and of the Council of June 5, 2019, on reducing the impact of certain plastic products on the environment in the context of the CEAP.

The Directive specifies that the EU member states must ensure environmentally sound waste management to reduce marine litter by developing a separate waste collection system. To reduce the load on marine ecosystems, plastic waste is subject to overall EU waste management measures and targets, such as the recycling target for plastic packaging waste and the need to ensure that, by 2030, all plastic packaging is recycled.

Directives and other legal acts of the EU order the development of materials that have the same functionality as traditional plastics but have a lower environmental impact, thereby reducing the EU's dependence on fossil fuels. In the EU, 150,000–500,000 tonnes of plastic waste reach the oceans yearly. This is a small share of the total marine litter in the world. Nevertheless, plastic waste from European sources reaches especially vulnerable marine areas, such as the Mediterranean Sea and part of the Arctic Ocean.

The EU pays particular attention to the issue of reducing the formation of microplastics – tiny fragments of plastic smaller than 5 mm that are accumulated in the seas, where their small size facilitates their absorption by marine flora and fauna. In the EU, 75,000–300,000 tonnes of microplastics are discharged into the environment yearly. One of the solutions to this problem is the further growth of the market share of plastics with biodegradable properties. However, while it provides new possibilities, it also entails risks. Without clear labeling for consumers and appropriate waste collection and treatment, this can lead to an increase in plastic products that are thrown away and creates problems for their recycling. Finally, ongoing work improves the understanding and measurement of marine litter, an important but often ignored way to support effective measures preventing its increase. Actions are planned to remove part of the plastics floating in the oceans, and innovative technologies for their removal are emerging.

Undoubtedly, international actions will remain key for eliminating the most significant sources of plastic litter in the oceans. Oceans and seas are the common good and the common heritage. If the current trend is not reversed, it can have consequences for future generations in the form of degradation of marine ecosystems and threats to human health. Creating reliable systems to prevent and manage waste formation, especially in countries with emerging market economies, is important for preventing new plastics from reaching the seas. Here, the experience gained by the EU can be quite useful.⁶⁴

It is necessary to carry out studies to determine the primary sources of discharges and how waste management infrastructure can most effectively prevent them. Moreover, there is a need to examine the long-term impacts of marine debris on the national economies of the countries with whom the abovementioned work is undertaken and the global economy. The work with representatives of other countries must result in one or more new international agreements that include provisions to mitigate the discharge of land-based solid waste into the marine environment and issues related to the provision of technical assistance and investment in waste management infrastructure to reduce such discharges if it is appropriate.

2.2. *Protection of Bioresources of the World Ocean*

The second area of national legislation attractive for the development of international environmental law includes legal acts on the protection of bioresources of the World Ocean. Thousands of legal acts of all maritime (coastal) states are dedicated to this issue, and it is impossible to assess them within the framework of one Article. Hence, we identify only the most important trends and prospects.

Protecting marine bioresources is one of the priorities in the nature protection policy of the EU countries. One of its areas is establishing an EU list of vessels engaged in illegal, unreported, and unregulated fishing (Regulation (EU) No. 468/2010). There are special procedures for identifying

⁶⁴Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A European Strategy for Plastics in a Circular Economy. Brussels, Jan. 16, 2018.

and listing these vessels, which is an important measure in the fight against international poaching in the World Ocean as it makes it possible to identify violators of the rules of environmental law.

Regarding regulated fishing, Regulation (EU) 2019/1241 of the European Parliament and of the Council of June 20, 2019, on conserving fisheries resources and protecting marine ecosystems through technical measures, establishes particular technical standards and limits for fishing. This framework should cover the taking and landing of fishery resources, the operation of fishing gear, and the interaction of fishing activities with marine ecosystems. Technical measures should specifically contribute to the protection of juveniles and spawning aggregations of marine species through the use of selective fishing gear and measures for the avoidance of unwanted catches.

A separate area for protecting marine bioresources is the establishment of restrictions or prohibitions on fishing certain species of aquatic bioresources. A typical example is Council Regulation (EU) 2018/1308 of September 28, 2018, amending Regulation (EU) 2018/120 as regards fishing opportunities for European sea bass, according to which total commercial and recreational removals in 2018 should be no more than 880 tonnes to ensure the recovery of its stock. There are similar prohibitions in other countries. For example, the Marine Mammal Protection Act, enacted in the United States on October 21, 1972, was the first legislation to mandate an ecosystem-based approach to wildlife protection, establishing prohibitions on taking marine mammals and introducing a moratorium on their importation and exportation.

Reducing the extraction of aquatic bioresources through commercial aquaculture development on shore is a measure that is no less important for their preservation. The strategic guidelines for a more sustainable and competitive EU aquaculture from 2021 to 2030 are dedicated to this issue. They aim to build resilience and competitiveness in the EU aquaculture sector, ensuring the supply of nutritious and healthy food to the population, reducing the EU's dependency on seafood imports, creating economic opportunities and jobs, and moving towards sustainable development. European countries outside the EU, for example, Georgia, can also take measures to develop and protect marine aquaculture.⁶⁵

The efforts of individual countries to protect the environment in their territorial waters are very important for protecting the World Ocean. The Marine Strategy for the Dutch Part of the North Sea 2012–20 (Part 3) is very interesting. It includes a program of measures to improve the health of the sea as part of the strategy for its sustainable use. The European Marine Strategy Framework Directive (MSFD) obliges EU member states to develop a strategy to achieve and/or maintain good environmental status in their marine waters (that is, the Dutch part of the North Sea) and to implement the measures, ensuring the achievement of the set goals. Eleven descriptors of environmental protection were developed for this purpose, and the degree of the quality of the environment is determined on their basis. These descriptors include biodiversity, commercially exploited fish populations, sea-floor integrity, hydrographical conditions, contaminants and eutrophication, litter, underwater noise, etc. The value of these documents consists of studying the environmental status of certain parts of the World Ocean, which can be used for more global environmental monitoring and planning, including assessing the condition of aquatic bioresources.

The protection of marine bioresources against invasive species is an urgent environmental issue for the conservation of marine bioresources; it is the subject of Commission Delegated Regulation (EU) 2018/968 of April 30, 2018, supplementing Regulation (EU) No. 1143/2014 of the European Parliament and the Council about risk assessments of invasive alien species. Assessing the degree of risk from these species is one of the most complicated issues.

The effectiveness of the measures to protect the ecosystems of the world's oceans can be ensured by access to particular environmental funds. See, for example, (EU) 2021/1139 of the European Parliament and of the Council of July 7, 2021, establishing the European Maritime,

⁶⁵Order No. 2-1004 of 2021 of the Minister of Environmental Protection and Agriculture of Georgia on the Marine Aquaculture Environment Protection Program. <https://leap.unep.org/countries/ge/national-legislation/order-no-2-1004-2021-minister-environmental-protection-and> (accessed February 25, 2023).

Fisheries and Aquaculture Fund (EMFAF) and amending Regulation (EU) 2017/1004. In particular, the EMFAF was established for the period from January 1, 2021, to December 31, 2027, to channel funding from the Union budget to support the Common Fisheries Policy (CFP), the Union's maritime policy, and the Union's international commitments in the field of ocean governance. Such funding is a key enabler for sustainable fisheries and the conservation of marine biological resources and food security through the supply of seafood products; the growth of a sustainable blue economy; and healthy, safe, secure, clean, and sustainably managed seas and oceans. This area is important because a sustainable blue economy boosts investments, jobs, and growth in the EU, fosters research and innovation, and contributes to energy security through ocean energy.

Therefore, the current theory and practice of protecting ecological systems in the World Ocean make it possible to distinguish two trends. On the one hand, international legal acts, EU directives, and laws of certain countries are focused on adopting preventive measures to reduce the pollution of the World Ocean, which also causes the mitigation of the risk of harm in a situation without any specific tortfeasor. Therefore, the national stimulation of reducing the production and use of disposable packaging, the development of biodegradable packaging materials, the transition to a closed-loop economy, and several other measures that have shown that their effectiveness in the EU is of interest from the perspective of enhancing national legislation of other countries (which will contribute to the general decrease in anthropogenic pressure on marine ecosystems). On the other hand, this experience is of interest to developing international environmental law; for example, by recreating economic incentives for producers to abandon plastic packaging. The experience of the EU countries in combating microplastics, introducing biodegradable materials, regulating fishing, and creating special nature protection funds is no less interesting.

Developing a compensation mechanism for citizens and legal entities that suffer harm due to environmental torts, with the impossibility of establishing the harm-doer, is at an early stage of its formation. The existing international and national funds are aimed at financing measures to prevent the pollution of the World Ocean (which we consider very important); however, they almost completely ignore the issue of paying compensation to persons affected by the pollution of water resources of the ocean in cases where there is no specific tortfeasor. This aspect of tort liability requires further development at international and national levels.

C. Conclusion

This research concludes that international environmental law faces the issue of compensation for environmental harm caused to objects within international areas when no specific harm-doer can be identified. We demonstrated this issue in three examples: space debris, climate change, and harm caused to the World Ocean. The common features of all three objects of international law are that they lie beyond the scope of national jurisdiction and have insufficient legal protection; thus, it is impossible to identify a specific harm-doer (delinquent). It is equally impossible in collisions of satellites and space debris, drought, and damage to crops resulting from climate change, as well as the death of fish and pollution of the world's oceans due to plastic waste and other harmful substances. Given that it is impossible to identify the sources of harm in all these cases, the compensation mechanism through a system of international environmental funds can be shared.

It is necessary to continue discussing the mechanism of the legal establishment of the procedure for tortfeasor determination where it is associated with technical or legal difficulties (for example, the owner of large fragments of space debris or abandoned spacecraft). The resolution of this issue will reduce the scope of torts without any perpetrator (tortfeasor), increase the degree of guarantees of the rights of affected citizens and legal entities, and make the tort liability mechanism more effective. In addition, it is necessary to resolve the issue of the expansion of

activities of international and national environmental funds and discussion of the mechanism of payments of compensation to persons affected by “subjectless torts.” In our view, only a combination of international and national law can change the current situation and create an effective mechanism to counteract the illogical situation of lack of compensation to persons affected by environmental torts in cases of no specific tortfeasor. Moreover, the interaction mechanism between the international and national levels of regulation of the issue of tort liability needs coordination, which will improve national measures preventing harm to the world’s ecosystems (waste reduction, licensing, etc.). A certain aspect of the issue is beyond the framework of international environmental law. It refers to the concerns of individual states about the reasonability of contributing funds to prevent harm to international objects (including the World Ocean). By contrast, measures by other states may not follow this. This can be interpreted as an unjustified benefit of some states at the expense of others, which hampers international cooperation and reduces the effectiveness of countries’ joint efforts to protect international spaces. This issue has no solution today; it requires further consultations within the framework of the United Nations and several other international organizations.

Acknowledgements. None.

Competing Interests. The authors have no conflict of interest.

Funding Statement. No sources of external funding were used in the writing of this article.