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## Geographic assessment of obstacles on European rivers for water sports tourism

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**Abstract.** Experts predict that the global market of water sports tourism is expected to reach almost \$ 850 billion by 2032, with an average annual growth of almost 17% over the next 10 years. At the moment, not a single segment of the world tourism has such a high growth rate. At the same time, we should not forget that water tourism is one of the most technically complex

sports. If in other types a tourist can stop on almost any difficult part of the route in order to recuperate, find the best solution, the fast water flow does not allow this. The guarantee of correct actions can be given only by the worked out reaction of each tourist individually and the crew of the tourist vessel as a whole. Therefore, the purpose of the research is professional, incl., assessment of water obstacles, which is extremely important for the safety of tourist sports trips, that are often carried out on the verge of the physical and technical geographical capabilities of their participants. The goal was achieved through the use of such scientific research methods as analytical-statistical, comparative-geographical, reference and field expeditionary research. The authors have established that water tourism is a rafting of tourists in water areas on various means of rafting – inflatable boats (rafts), kayaks, catamarans, canoes and others with overcoming various obstacles on the water relief – rapids, riffles, river bars and boils, and even waterfalls of different heights. The nature, number and variety of water obstacles determine the technical complexity of the water tourist route. Therefore, the task of scientists is to develop criteria for assessing the complexity of water obstacles so that tourists-athletes, when overcoming them, can compare their tourist experience, technical capabilities of their vessel in order to decide whether they can safely overcome a particular obstacle (go through the route). The authors analyzed a number of classifications for determining the complexity of water obstacles – International, American, S. Chernik's classification. These classifications differ in the initial categories of complexity assessment of water obstacles and are close enough when assessing more complex obstacles from category IV to VI of complexity. The analysis showed that the international classification is best used in assessing the complexity of local water obstacles (rapids). Instead, either the American classification or the S. Chernik's classification should be used to assess long water sports routes. Europe has a fairly dense river system and a significant number of rivers suitable for water tourist trips. The maximum category of complexity of European rivers is the sixth (according to any of the classifications). Such level of complexity can be found on the rivers of the Scandinavian Peninsula, the Balkan Peninsula, and the North Caucasus. The potential for the development of water sports tourism is not evenly distributed between European countries. A special place in this regard is occupied by the countries of the Balkan Peninsula, since rivers of all categories of complexity are represented here – from the easiest to the most complex. For tourists-athletes of high qualification, the Scandinavian Peninsula rivers can serve as a training ground.

*Keywords:* adventure tourism, sports tourism, water tourism, water obstacles, complexity of water obstacles.

## Географічна оцінка перешкод річок Європи для водного спортивного туризму

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**Анотація.** В статті виконано загальну фахову та географічну оцінку перешкод, які зустрічаються на річках Європи, для потреб водного спортивного туризму. Визначено, що водний туризм – це сплав туристів-спортсменів водними акваторіями на різно-

манітних засобах сплаву – рафтах, байдарках, катамаранах, каяках тощо з подоланням перешкод водного рельєфу – порогів, шивер, перекатів, притисків і, навіть, водоспадів різної висоти. При цьому, характер, кількість та різноманітність таких перешкод визначають технічну складність водного туристського маршруту. Також слід враховувати, що водний туризм залишається одним із найбільш технічно складних видів спорту. Тому метою дослідження є фахова, в т.ч. географічна, оцінка водних перешкод, яка має надзвичайно велике значення для безпеки туристських спортивних походів, які часто здійснюються на межі фізичних та технічних можливостей їх учасників. Проаналізовано ряд класифікацій визначення складності водних перешкод – міжнародну, американську, класифікацію С. Черніка. З'ясовано, що класифікації різняться на початкових категоріях оцінки водних перешкод та є достатньо близькими при оцінці більш складних перешкод від IV до VI категорії складності. Виявлено, що міжнародну класифікацію краще застосовувати при оцінці складності локальних водних перешкод (порогів). Натомість, для оцінки протяжних водних спортивних маршрутів слід застосовувати або американську класифікацію, або класифікацію С. Черніка. Встановлено, що Європа має густу річкову систему та значну кількість річок, придатних для проведення водних туристських походів. Максимальна категорія складності річок Європи – найвища шоста (за будь-якою з класифікацій). Таку категорію складності мають річки Скандинавського півострова, Балканського півострова. Між країнами Європи потенціал для розвитку водного спортивного туризму розподіляється не рівномірно. Особливе місце у цьому відношенні посідають країни Балканського півострова, оскільки тут представлені річки всіх категорій складності – від простих до найскладніших. Для туристів-спортсменів високої кваліфікації полігоном можуть слугувати річки Скандинавського півострова.

*Ключові слова: пригодницький туризм, спортивний туризм, водний туризм, водні перешкоди, складність водних перешкод.*

## Introduction

The World Tourism Organization (UNWTO) defines *sports tourism* as a type of tourist activity relating to the travel experience of a tourist who either observes as a spectator or takes an active part in a sporting event, which usually involves commercial and non-commercial activities of a competitive nature (UNWTO, 2019). Some tourism professionals define *sports tourism*, as trips to participate in sporting events and support favorite teams (at the Olympic Games, world championships and cups, Europe, rally, etc.) (Malska et al., 2004).

In post-Soviet countries, *sports tourism is considered to be a* type of active recreational and tourist activity, which is carried out in the natural environment, and consists of passing tourist sports routes with overcoming various obstacles (passes, peaks, rapids, canyons, caves, etc.) by various means of transportation using special applied techniques and equipment (Kolotukha, 2019). At the same time, sports tourism in Ukraine and other post-Soviet countries is currently a non-Olympic sport, which is included in the sports classifications of these countries with the corresponding sports categories and titles. People engaged in sports tourism are motivated to improve their sports skills and receive appropriate sports awards. Sportsmanship has its own specifics. This is the mastery of various tourist equipment and tactics, which is used to successfully overcome the routes of tourist hikes and the distances of tourist competitions. Today, tourist sports trips and competitions in Ukraine can be organized from the following types of tourism: hiking, skiing, mountain, water, bicycle, car, motorcycle, speleological, sailing, as well as represent their combinations. In this type of sport, the International Federation of Sports Tourism (IFST) was created, which

currently unites 9 countries (Ukraine, Lithuania, Latvia, Belarus, Russia, Moldova, Kazakhstan, Kyrgyzstan, Uzbekistan) and takes care of global issues of the development of the tourism and sports movement. In Ukraine, the Sports Tourism Federation of Ukraine is responsible for the development of sports tourism.

Similar direction of tourism in the economically developed countries of the world is developing at the amateur level and acts as a type of active, often extreme, recreation. In Europe, USA, Canada, Australia, New Zealand and a number of other countries this type of tourism also exists, but is not a type of sport. Tourist teams are not formed here and the official competitions are not held. In this case, we are talking about the so-called extreme, *adventure tourism*, traveling through «wild» natural areas, which today are increasingly «saturated» with a cognitive component, the spirit of discovering the previously unknown. Moreover, the choice of the method and means of transportation depends precisely on the set cognitive goal. The presence of an attractive cognitive goal of «discovery», often forms on the basis of historical and local history materials or the study of natural phenomena, leads to the fact that this type of tourism is often defined as adventure tourism. According to the requirements of the Global Adventure Travel Trade Association, any tourist activity should be classified as adventure tourism if it includes at least two of the three features: physical activity, cultural exchange or interaction or immersion in the natural environment (GATTA, 2013).

Therefore, it is obvious that adventure tourism should be considered a terminological analogue of sports tourism, which, according to the conclusions of UNWTO experts made based on the results of large-scale research, belongs to the group of the most popular tourist destinations of recent years. Actually

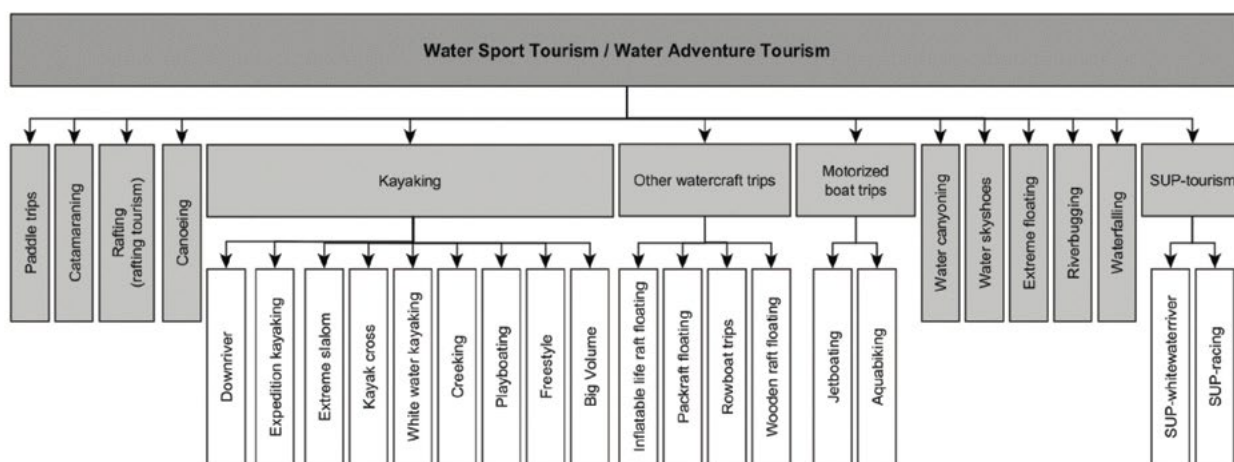
adventure tourism began to gain popularity after the Second World War – then for the first time tourists began to use «for peaceful purposes» various items from military equipment: tents, rafts, jeeps. Very quickly, this direction acquired all the signs of a real industry – specialized tourist companies, equipment manufacturers, thematic media, websites and even self-regulatory bodies (federations, associations, clubs, etc.) appeared. Today, adventure tourism is already a fairly large market niche for world tourism. Some countries (New Zealand, Nepal and India), thanks to the offer of adventure tours, provide themselves with up to 40% of the planned inbound tourist flow. Latin America – Mexico, Brazil and Africa – Kenya, Namibia are also actively developing this direction. Adventure tourism has high rates of development in European countries as well. According to experts, in the coming years this niche of the tourism industry will develop rapidly and demonstrate excellent growth dynamics.

Perhaps the most popular direction of sports (adventure) tourism, today, along with trekking, is **water sports tourism**. Ukrainian tourism specialist O. Kolotukha defines **water tourism as a** type of sports tourism, rafting tourists in water areas (rivers, lakes, canals) on various means of rafting – inflatable boats (rafts), canoes, catamarans, kayaks and others with overcoming various obstacles on the water relief (Kolotukha O., 2006). Until the recent times canoeing was considered a classic subcategory of water tourism, but the latter are gradually being replaced by other means of rafting. The most common subcategory of water tourism are becoming rafting, kayaking and catamaranning – rafting on 2-4-6-seater catamarans by mountain and plains rivers.

According to the Water Adventure Tourism Market Outlook (2022-2032) – Future Market Insights report, the global water adventure tourism market is expected to reach US\$845.8 billion by 2032, up from US\$156.9 billion in 2022, with an average annual growth of 16.9% over the forecast period (The European market, 2021). There is no such high growth rate in any segment of the world tourism, which indicates an extremely high popularity.

Water tourism is the most dynamic type of sports tourism – the means of rafting and the technique of passing obstacles are changing, but also the nature and set of obstacles passed by tourist groups on the routes are changing. At the same time, water tourism remains the most technically difficult type of tourism. If in other types a tourist (tourist group) can stop on almost any difficult part of the route in order to recuperate, find the best solution, the fast water flow does not allow this. The guarantee of correct actions can be given only by the worked out reaction of each tourist individually and the crew of the tourist vessel as a whole.

The main means of rafting in water tourism are kayaks (frame-inflatable and inflatable), catamarans, inflatable boats and inflatable rafts. In recent years, they have added canoes, packrafts, SUP boards, motorized boats and other means of rafting. Such a variety of transportation means in water areas determines a large palette of subcategories of water tourism. Structural analysis of water sports tourism made it possible to determine, to date, about 30 of its subcategories and sub-subspecies (Fig. 1). The typology of the component structure of water sports tourism in the world proves that this system is currently emerging. It is extremely dynamic and is able to develop this important direction of active recreational and tourist activities.



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Fig. 1. Categorical structure of water sports tourism

## Materials and research methods

Sports water tourism mainly uses resources close to extreme, on the verge of human capabilities to overcome them (for this particular person, group of tourists) or close to it. Therefore, the authors allocate such a complex of resources into a separate category – *sports recreational and tourist resources* (Kolotukha, 2006). The technical complexity of the tourist sports route for any type of tourism is determined by the nature, number and variety of obstacles that have a dispersed nature. These are local tourist and sports facilities, to overcome which a tourist sports trip is carried out. The variable nature of such obstacles is determined by the level of qualification and technical skill of tourists, and it is necessary to overcome this obstacle with a proper guarantee of safety of the participants. The characteristics of technical complexity include the difficulty of the obstacles to be overcome (local and extended obstacles), as well as the characteristics of the travel area, the autonomy of the tourist group on the route, the novelty of the route, and others. Sports recreation and tourism resources are classified, first of all, by the types of sports tourism in which they are involved, and the difficulty of overcoming them (the category of difficulty of individual obstacles). In this sense, it is important to use in the assessment and systematization of resources for water sports tourism, developed by O. Kolotukha, a *spatial-resource scientific approach to tourist and geographical research*, the essence of which is to apply the principles of a geospatial approach to the study of tourism, which complements the resource approach, since resources are a property of the territory. First of all, rivers in their active phase and their individual natural objects act as a resource in water sports tourism. These tourist and sports facilities (obstacles, attraction objects) are «strung» on the line of the tourist and sports route, which is the river. Each category of difficulty of the route corresponds to a certain set of obstacles by type, quantity and category of difficulty. The network of tourist and sports routes forms a certain tourist and sports destination. Tourist and sports area destinations form tourist and sports regions of a higher level and fill the tourist and sports space, which, in turn, is a component of the common tourist space.

In addition, the *reference method* for assessing the possibilities of the territory for sports tourism purposes was used, which consists of three concepts: the reference type of tourism, the reference category of route complexity and the reference route. The method allows you to determine the most convenient and logical type of tourism, the most appropriate category of difficul-

ty of the route and the most interesting and attractive route, on each territory suitable for organizing sports tourist trips, for each tourist group (Kolotukha, 2019).

To compare obstacles and tourist routes of the same complexity in different geographical areas in order to develop common approaches and methods for their assessment, a *comparative geographical method* was used.

Important in terms of the development of routes of tourist sports trips, which after their passage and drawing up reports became benchmarks, and the certification of local and outspread obstacles, becomes the *method of field expeditionary research*. The rivers of the Ukrainian Carpathians and Central Ukraine became the testing grounds for such research for the authors.

The final stage of our research is the justification of priority directions for improving the system of sports tourism in Europe and Ukraine. At this stage, a *strategy for the development of sports basing on marketing techniques* is developed. The application of marketing methods serves as a scientific and informational basis for the development of the main components of tourism policy. Expert summarization of the prerequisites for the results of the assessment, the analysis of the indicators of the sports tourism development, the optimal territorial specialization of the regions, the trends of the regional development of sports tourism allows to determine and justify the appropriate measures of the policy of the European states regarding its development. The result of research on this stage will be the formation of promising programs for the development of sports tourism at the global and state levels, legislative initiatives, as well as the justification of priority areas for improving the structure and territorial organization of sports tourism in Europe and Ukraine.

## Results and their analysis

The object of our research was the resource and tourist potential for the development of water sports tourism in Europe, the subject – is a comprehensive assessment of this potential.

Water sports tourism in Europe has a sufficient resource base. However, the number of rivers where rafting is possible, is limited. The assessment of the river, regarding the possibilities of water tourism, depends on the type of vessel on which the tourist group rafts, the level and volume of water during a tourist trip, on the density and nature of obstacles. One river, depending on those criteria, can have different evaluations of difficulty. Moreover, the increase or decrease of the average water level makes it difficult to pass

some obstacles and makes it easier to pass others. By today's standards, sports rafting is possible in rivers with the volume from 5 cubic meters of water per second and with a channel slope of up to 100 m per 1 km. Waterfall chutes up to 30 m high, as well as hydraulic jump waves and holes with such geometric dimensions that do not exceed twice the length of the vessel, are subject to passage.

Hence, the category of complexity (CoC) of the water tourist route is determined by the minimum number of local water obstacles. **Water obstacles** are a set of factors, the action of which can lead to a change in the trajectory of the vessel in the water flow. The movement of the vessel is influenced primarily by the flow inhomogeneity associated with irregularities of the bottom, shores, as well as large stones and outcrops of bedrock in the channel (Kolotukha, 2019). In the tourist classification of water obstacles, rapids, riffles, river bars and boils are most common. Recently, the tourists started to overcome waterfalls of different heights.

**Rapid** – a stony section of the river with a sharp slope of the channel and a significant speed of water flow. Rapids are formed in places of gradual erosion of the riverbed, where the material that composes it is not heterogeneous, and where the outcrops of bedrock, fragments of rocks or large stones clutter up the river flow. Rapids have a relatively small length – up to several hundred meters. Areas above and below the rapid have a smaller gradient drop and flow rate. In every rapid, you can distinguish the culmination of the main or highly distinguishable water chute, although two or more levels of water drop can also exist. Several rapids, located one after another, can form their *cascade*. Examples of rapids on the rivers of Ukraine are the rapids called Pre-Carpathian on the Prut River, Upper and Lower Hook on the River Chorny Chermosh, Integral and Pervomaisky on the Southern Bug River and several others (Fig. 2).



Fig. 2. Rapid Pervomaisky on the Southern Bug River, Central Ukraine (catamaran-4)

**Shivera (riffle)** is an obstacle on a section of the river with a significant slope, and surface and under-water stones located relatively evenly along the entire channel, and randomly placed small chutes and hydraulic jump waves. Its length can variate between few hundred meters and a couple of kilometers. Riffles are found almost on every river of the II category of complexity or higher (Fig. 3).



Fig. 3. Shivera on the Sinyukha River, Central Ukraine (kayak-3)

**River bar** is a simpler obstacle, a sedimentary formation composed of rocks of various sizes – from sand to large pebbles. It is characterized by a shallow and fast water current. River bars are common to almost all European rivers (Fig. 4).



Fig. 4. River bar on the River Southern Bug, Central Ukraine (catamaran-4)

**The boil** is a rush of water on a steep rocky shore. They are characteristic of mountain rivers with canyon-like shores.

In addition to the listed main obstacles on water routes, there may be obstacles from trees, strainers and sweepers, strong headwinds and other natural obstacles.

Artificial anthropogenic obstacles can also be found in sufficient quantity on the rivers of Europe.

These are low sections of bridges, water and ferry cables, water drops near watermills, dams, etc.

The nature, number and variety of tourist and sports facilities (obstacles) determine the technical complexity of the water tourist route. At the same time, professional, including geographical, assessment of obstacles is extremely important for the safety of tourist sports trips, which are often carried out on the verge of physical and technical capabilities of their participants. Therefore, the task of scientists is to develop criteria for assessing the complexity of water obstacles so that tourists-athletes, when overcoming them, can compare their tourist experience, the technical capabilities of their vessel in order to decide whether they can safely overcome a particular obstacle.

In this sense, the case that took place with Ukrainian highly qualified sports tourists on the Sjoa River in Norway in 2010 is indicative. With insufficient information and evaluating the river only from satellite images, the athletes «did not see» such an obstacle, rare enough for rivers, as a syphon (part of a terrestrial river bed that disappears into the rocks and then reappears). The tourist group rafted on two-piece catamarans. The tragedy occurred near the Ridderspranget gorge (syphon) (Fig. 5). As a result of the incident, three catamarans turned over and six people ended up in the water. Four of them died, two were saved. The sportsmen of the highest qualification, – masters of sport, world champions in water tourism – died tragically.



Fig. 5. The place of death of Ukrainian water tourists on the river Sjoa in Norway in 2010 (Source: <http://www.vg.no/nyheter/innenriks/artikkel.php?artid=10035131> (photo)

The need for classifications to determine the complexity of water obstacles, the creation of passports of tourist routes, the assessment of the hydrological properties of rivers in a particular season are vital aspects of the development of water sports tourism. The category of difficulty of a water obstacle is determined by what level of qualification and technical skill is needed for its safe passage, as well as the level of danger to health and risk to life to which a crew member who has fallen into the water is exposed. The category of difficulty of water obstacles may vary depending on the water level.

The world uses different classifications for determining the complexity of water obstacles – International, American, S. Chernik adopted in Ukraine since 2017. The most popular in the world is the *International Classification of Water Obstacles* (Table 1) (International Scale, 2015).

Table 1. International Classification of Water Obstacles

Class	Characteristics of the obstacle
I	A river with class I rapids is basically flat water, which is usually calm and only has small waves or riffles. There are hardly any rocks or significant obstacles. It is denoted easy because a beginner, who has mastered basic paddling strokes, can canoe or kayak with little or no supervision.
II	This next grade of rapids features small to medium waves, short bends, and a few obstructions that a person at novice level can safely negotiate. A Class II rapid that is close to the difficulty of III is denoted II+. Generally, these rivers are straightforward and self-rescue is possible.
III	Rapids classed III are considered intermediate level difficulty. When this difficulty is at the lower end of the class, it is denoted III- and when at the upper end, it is III+. The characteristics are medium but irregular waves with obstructions like small falls or drops, counter currents and eddies. These can succeed in flipping a canoe if care is not taken. Self-rescue is possible in grade III rivers, even though it may require some help.
IV	Class IV rapids are advanced level and should only be navigated by those who have the required skills. The waves are large, irregularly sized and turbulent, but they are relatively predictable and are a delight for the experienced canoeist. Other features of grade IV rivers include eddies, holes, falls and other obstacles that can be dangerous. Like the previous two classes, they can also be further graded as IV- or IV+. However, self-rescues are difficult to perform in these rapids. It is therefore highly recommended to scout such rapids ahead of time and to travel in a group, even for skilled paddlers.
V	This class is denoted Expert level. Class V rivers are characterized by a combination of the following: rapids that are turbulent or continuous and span a long distance, steep gradients with abrupt drops, large unpredictable waves, and the presence of holes. Due to the nature of these waters, it is often dangerous to swim in them. Apart from the fact that self-rescue is really difficult, rescuing another injured party is also challenging. Scouting the rapids is therefore very important, so is going with multiple canoes. Class V rivers are further classified 5.0-5.9, based on the perceived progression of difficulty.
VI	Only daredevils brave these rapids as they pose an extraordinary danger and a minor paddling mistake can be fatal. The mighty waves are turbulent and erratic. In addition, the rivers have obstructions that require a lot of skill and preparation to negotiate. These rivers have hardly been negotiated and the rapids are considered. It is nearly impossible to rescue anyone who gets into trouble here.

According to the international classification, in order to determine the complexity of a river or its section, it is necessary to take into account several points: the presence of a particular obstacle, the possibility of determining the line of movement of a tourist vessel in the water flow and further consequences as a result of a violation of the line of movement.

As a rule, according to the international classification, the river is divided into areas of approximately the same complexity. Although, it is often necessary to indicate the complexity of a particular rapid if it exceeds the complexity of the surrounding area. The complexity of a particular rapid is indicated in the form of an index. For example II means that the section as a whole is of the II category of complexity, but contains a rapid or waterfall of the IV category of complexity. It should be noted that each category is not a separate location, but a certain range, and two rivers of the same category do not certainly have the same complexity. For a more ac-

curate description, the «half» or «third» of the category is sometimes used: III-, III, III+, IV- etc., or double designation: III-IV. The classification corresponds to the water level at which this river is rafted most often.

*The American version of the International Classification of Water Obstacles*, which can be considered a type of International one, is presented in Table 2 (Safety Code, 2015). The American system proposes to assess the complexity of the entire river, as opposed to assessing individual obstacles, as in the international classification, because when the rapids become longer and more continuous, the problem increases. There is a difference between crossing a single Category IV rapid and dealing with an entire Category IV of river when the water is cold or if the river itself is remote and difficult to access. Therefore, the rating of rivers should take into account many factors, including the difficulty of individual rapids, the remoteness of the river, danger, etc.

**Table 2.** American classification of water obstacles

<b>Obstacle class</b>	<b>The nature of the obstacle</b>
<b>Class I.</b> <i>Easy</i>	Fast moving water with riffles and small waves. Few obstructions, all obvious and easily missed with little training. Risk to swimmers is slight; self-rescue is easy.
<b>Class II.</b> <i>Novice</i>	Straightforward rapids with wide, clear channels which are evident without scouting. Occasional maneuvering may be required, but rocks and medium-sized waves are easily avoided by trained paddlers. Swimmers are seldom injured and group assistance, while helpful, is seldom needed. Rapids that are at the upper end of this difficulty range are designated Class II+.
<b>Class III.</b> <i>Intermediate</i>	Rapids with moderate, irregular waves which may be difficult to avoid and which can swamp an open canoe. Complex maneuvers in fast current and good boat control in tight passages or around ledges are often required; large waves or strainers may be present but are easily avoided. Strong eddies and powerful current effects can be found, particularly on large-volume rivers. Scouting is advisable for inexperienced parties. Injuries while swimming are rare; self-rescue is usually easy, but group assistance may be required to avoid long swims. Rapids that are at the lower or upper end of this difficulty range are designated Class III- or Class III+ respectively.
<b>Class IV.</b> <i>Advanced</i>	Intense, powerful but predictable rapids requiring precise boat handling in turbulent water. Depending on the character of the river, it may feature large, unavoidable waves and holes or constricted passages demanding fast maneuvers under pressure. A fast, reliable eddy turn may be needed to initiate maneuvers, scout rapids, or rest. Rapids may require «must make» moves above dangerous hazards. Scouting may be necessary the first time down. Risk of injury to swimmers is moderate to high, and water conditions may make self-rescue difficult. Group assistance for rescue is often essential but requires practiced skills. For kayakers, a strong roll is highly recommended. Rapids that are at the lower or upper end of this difficulty range are designated Class IV- or Class IV+ respectively.
<b>Class V.</b> <i>Expert</i>	Extremely long, obstructed, or very violent rapids which expose a paddler to added risk. Drops may contain large, unavoidable waves and holes or steep, congested chutes with complex, demanding routes. Rapids may continue for long distances between pools, demanding a high level of fitness. What eddies exist may be small, turbulent, or difficult to reach. At the high end of the scale, several of these factors may be combined. Scouting is recommended but may be difficult. Swims are dangerous, and rescue is often difficult even for experts. Proper equipment, extensive experience, and practiced rescue skills are essential. Because of the large range of difficulty that exists beyond Class IV, Class V is an open-ended, multiple-level scale designated by class 5.0, 5.1, 5.2, etc. Each of these levels is an order of magnitude more difficult than the last. That is, going from Class 5.0 to Class 5.1 is a similar order of magnitude as increasing from Class IV to Class 5.0.
<b>Class VI.</b> <i>Extreme and Exploratory Rapids</i>	Runs of this classification are rarely attempted and often exemplify the extremes of difficulty, unpredictability and danger. The consequences of errors are severe and rescue may be impossible. For teams of experts only, at favorable water levels, after close personal inspection and taking all precautions. After a Class VI rapid has been run many times, its rating may be changed to an appropriate Class 5.x rating.

In 2017, the Water Tourism Commission of the Sports Tourism Federation of Ukraine switched to *the classification of water obstacles by the tourist S. Chernik*, which has 13 gradations of obstacles. At the same time, the first three categories do not have subcategories, and the next

more complex ones (4-6) are divided into 3 subcategories (A, B, C). The classification also adds a category 6\* (super-difficult obstacle), which corresponds to class VI (extreme and exploratory rapids) in International (American) classification (Table 3).

**Table 3.** Classification of water obstacles (by S. Chernik adopted in Ukraine since 2017)

The category of difficulty is specified	Characteristics of the obstacle
1	An «easy» obstacle. Accessible for persons who do not have tourist experience. Riffle, current, low waves, no need to choose a trajectory and scouting. Typical for routes of I Category of complexity.
2	A «simple» obstacle. Waves, simple riffles, rapid, boil, small water speed and slope. The trajectory of movement is visible from the water. The defining obstacle for routes of II category of complexity.
3	The obstacle of «average» difficulty. Local rapid with a calm area at the exit, riffle, few stones in the channel, strainers. The trajectory of movement is visible from the water. The defining obstacle for routes of III category of complexity.
4A	A «difficult» obstacle. Extended riffle or rapid with a large number of stones, holes and standing hydraulic jump waves. Gorge, boils, individual stones and chutes. At the end of the obstacle there are quite long relatively calm sections of the river. Scouting is advisable, elements of protective gears are recommended, due to the fact that the trajectory of movement is implicitly expressed. The defining obstacle for routes of IV category of complexity.
4B	The same as the previous one, but the waves are oblique or pulsating. The waves on the river with big volume, not allowing to secure the vessel with a lifeline. The trajectory is ambiguous, scouting is required, but is carried out without much difficulty. Key areas are secured. The defining obstacle for routes of IV category of complexity.
4C	Extended or cascading rapid or riffle. A large number of stones, with foamy holes or boils on big volume rivers. The line is determined after preliminary scouting. Group assistance for rescue is required. The defining obstacle for routes of IV category of complexity.
5A	A «hard» obstacle. Technically complicated extended rapid or riffle in areas with a large slope and water flow, large holes and hydraulic jump waves, a complex trajectory. At the end of the obstacle there is a short section of fast current where mooring is possible. Canyon with IV category of complexity. Strong boil. Mandatory scouting and group assistance, due to the possibility of an emergency. Determining obstacle routes of V category of complexity.
5B	The same as the previous one, but foamy holes and eddies are able to hold the rower who has fallen out, as well as the entire vessel. An obstacle may include a waterfall chute. A thorough scouting is possible for choosing potential rescue locations and trajectories. Deviation from the optimal trajectory threatens the destruction of the vessel. Determining obstacle routes of V category of complexity.
5C	The same as the previous one, but longer. The obstacle is cascading, or several obstacles have merged into one over a large body of water. There are several key places. It is necessary to review and organize several points of group assistance. Determining obstacle routes of V category of complexity.
6A	«Very difficult», dangerous obstacle. The same as the previous one, but very long. The obstacle is cascading, or several obstacles have merged into one over a large body of water. There are several key places. It is necessary to review and organize several points of group assistance. Determining obstacle routes of V category of complexity.
6B	The same as the previous one, but very long. Canyon areas with a complex organization of protection and obstacle scouting. As a rule, waterfall chutes and powerful holes as the obstacle. The trajectory is complex and passes through several key places. The obstacle is a real danger if the trajectory is not followed. Scouting and group assistance are required. Determining obstacle routes of V category of complexity.
6C	The same as the previous one. An obstacle previously passed by a small number of crews, or not passed. It takes place at the limit of the capabilities of the vessel and the crew, as a rule, at the optimal water level in the river. Scouting and protection are difficult and very time consuming. An extremely dangerous obstacle. An extra-class obstacle.
6*	A «super difficult» obstacle. Very difficult for any class of vessels. It has not been previously traversed or has been traversed in isolated cases, extremely dangerous for the lives of crew members (falls, waterfalls, spillways, gorges). Typical for trailing routes of VI category of complexity



Consequently, *the category of complexity of the water tourist route* depends on the number and technical complexity of key obstacles, length, duration, and a few other determining factors – a large number of long obstacles, the complexity of scouting and safety gear, the remoteness of the river, the gradient drop, the complexity of the relief, which makes scouting and passage more difficult, harsh natural conditions, etc.

Routes of water trips should be, as a rule, continuous, without breaks caused by moving between sections of the river, staying in a settlement without the need. In cases of connection of parts of the route (rivers), the use of transport within the given area is allowed, if it is justified by the logic of the trip, the infrastructure of the area, which does not violate its integrity. An example is the route of the IV category of complexity of the Chorna Tysa River – the Prut River in the Ukrainian Carpathians (with a move after passing the Chorna Tysa River to the Prut River).

International and American classifications of water obstacles do not stipulate such parameters of the tourist route as length and duration. In post-Soviet countries, where sports tourism is an official sport, in the Methodology of S. Chernik, the classification parameters of the route determine the normative (minimum) length and duration of hikes from I to VI categories of complexity. Thus, the normative (minimum) length for all categories is the same – from 100 km. The normative (minimum) duration ranges from 4 days for the I category of complexity to 10 days for the V-VI category of complexity. At the same time, the length and duration parameters can vary both in one and the other direction. For comparison, in Ukraine, the I category of difficulty used to have a length of 150 km and a duration of 6 days.

Let's consider the assessment of the complexity of tourist water routes using the example of Ukraine. The category of difficulty of tourist water routes in Ukraine is determined based on the current Itineraries of tourist and sports trips in Ukraine and is approved by the relevant List (List, 2002). The list of classified and standard tourist sports routes and obstacles is subject to regular revision in connection with climate changes, changes in the structure and number of obstacles on rivers (slides, landslides, earthquakes, floods, ameliorative, construction and other works, controlled spillways, etc.), and with the change in the means of rafting and the growth of the skill of athletes. The list includes the most popular categorical water routes of Ukraine. The category of complexity corresponds only to the recommended rafting season. In addition, a significant rise in the

water level due to abnormal weather conditions can increase the category of complexity of the obstacle indicated in the table.

**Europe** has a fairly dense river system and a significant number of rivers suitable for water tourist trips on foldable and inflatable boats of different classes. In total, there are about 830 rivers with a length of more than 100 km in Europe, and only 41 large ones (with a length of more than 500 km).

The maximum category of complexity of European rivers is the sixth (according to any of the classifications).

Most of the rivers in Europe belong mainly to one climatic type – snowmelt (glacial) with spring flooding. However, due to the variety of landscapes, the rivers of different regions of Europe differ greatly in terms of the gradient of the channel, the nature of the current, the presence and complexity of obstacles, seasonal regime, etc., which makes it possible to divide them into three groups according to tourist and sports complexity: **lowland rivers, upland rivers, mountain rivers.**

The first group – *lowland rivers* – includes lowland rivers and plains of Europe. These are rivers such as the Danube, Rhine, Elbe, Odra, Vistula, Dnipro, etc. with their numerous tributaries. These rivers have a mixed supply of water, and although snowmelt is the primary source of spring flooding, groundwater and rainwater also play a significant role. The water level changes slightly during the tourist rafting season. The gradient of the channel does not exceed a few centimeters per kilometer, the current is weak, its speed does not exceed 2-4 km/h.

Kayaks, canoes, inflatable boats, and collapsible inflatable catamarans are recommended for most lowland rivers. The seasonality of rafting is from March to November inclusive.

The second group of rivers is the *upland river*. They include rivers flowing within the Iberian Peninsula, the Massif Central, the Dnipro Upland, Podil. They are often tributaries of large plain rivers of Europe, rivers of the Iberian and Apennine peninsulas, Great Britain, Finland, tributaries of the Dniester, etc. The channels of these rivers cross the outcrops of rocks of different stability, due to which numerous rapids and river bars are formed in them. The gradient of the channels of these rivers is much greater than that of the lowland rivers – from 0.4 to 1 m/km of the channel. Water source is mixed. But their snow nutrition is in the first place, causing a spring flood during the snowmelt. Prolonged rains can also cause significant flooding. The flow of many rivers is largely regulated by dams, so their water level changes lit-

tle during the rafting season under normal conditions. The rivers of this group make it possible to conduct water trips up to the II-III category of complexity. The recommended rafting period is from March to November inclusive.

Passing the routes through the upland rivers gives tourists-athletes some basic technical and tactical training for the further growth of sportsmanship. Educational and training events and competitions can be held on the same rivers. Routes along the mentioned rivers often pass in the zone of intensive economic activity. Therefore, to natural obstacles during their passage, can be also added the bypassing of dams, the passage of vessels through artificial obstacle formed by local residents in order to direct the main stream of water into the mill drain, etc. Both kayaks and catamarans are recommended for the routes, but they should be carefully prepared, ensuring resistance to tears.

**Mountain rivers** belong to the third group – the rivers that are already well known by tourists, such as rivers of the Alps, the Pyrenees, the Scandinavian mountains, the Carpathians, the mountains of the Balkan Peninsula. Often this became possible with the development of relatively new rafting and kayaking techniques.

The mountain rivers of Europe are distinguished by a high flow velocity, a high-speed current reaching 10-15 km/h, powerful rapids and protracted riffles. The gradient of the channel in the upper course reaches 10 m/km or more. The water source comes mainly from precipitations and spring flooding during snowmelt and rain floods. Long, heavy rains can cause flooding at any time of the year. The water level can vary significantly during the season and depends on the amount of snow in the mountains, rain and air temperature. The best time for crossing such rivers is from the end of April to the first decade of May, during the spring flood, when the snowmelt is most intense. This applies, first of all, to short rivers and small tributaries, which are suitable for passage only for a few weeks and even days in spring (creeking). At the same time, there are rivers where rafting is possible during the entire warm period of the year from April to October.

Mountain rivers can be crossed on kayaks, catamarans, rafts, and canoes. Depending on the season and the type of vessels, routes on mountain rivers are classified from IV to VI category of complexity (Table 4). Several European rivers can be an excellent training ground for off-season training for trips of the highest categories of complexity in other regions of the world.

**Table 4.** The complexity levels of the rivers in Europe

№	European country	River	Category of obstacles complexity
1.	Norway	1. Driva 2. Jori 3. Grøvu 4. Sjoa 5. Bovre 6. Otta	VI VI (short river) VI (short river) VI (short river) V-VI (short river) III-VI
2.	Sweden	1. Kaitumälven-Kalixälven 2. Kultsjöån 3. Pite älv/Piteälven 4. Vindelälven	VI VI (short river) V-VI V-VI
3.	Bosnia and Herzegovina	1. Neretva 2. Vrbas	IV-VI IV
4.	Montenegro	1. Moraca 2. Tara	IV-VI IV
5.	Italy	1. Eisack/Isarco 2. Aurino 3. Rienza 4. Noce 5. Dora Baltea	V V V IV-V III
6.	Finland	1. Kuusinkijoki – Oulankajoki – Kitkajoki 2. Naatamajoki 3. Juutunajoki	V V V
7.	Slovenia	1. Soča 2. Sava	V III

8.	Romania	1. Jiu 2. Buzău	IV-V III
9.	Spain	1. Río Gállego 2. Río Cabriel 3. Noguera Pallaresa 4. Río Esera 5. Ebro 6. Río Deza 7. Genil 8. Río Ulla 9. Río Miño	IV III+-IV III-IV III-IV III-IV II-IV II-III II-III II-III
10.	United Kingdom: <i>Scotland</i>  <i>Wales</i>  <i>England</i> <i>Northern Ireland</i>	1. Findhorn 2. Garry  1. Tryweryn 2. Dee  1. Derwent 1. Blackwater 2. Bann	IV III-IV  II-IV II  II II II
11.	France	1. Le Chalaux 2. Verdon 3. Arve	IV IV III
12.	Switzerland	1. Lütshine 2. Vorderrhein 3. Simme 4. Aare	III-IV III III III
13.	Ukraine	1. Black Cheremosh – White Chere- mosh – Prut 2. Southern Bug	IV III
14.	Iceland	1. East Glacial River 2. West Glacial River 3. Hvita River 4. Svarta River	IV (short river) II (short river) II II
15.	Slovakia	Belá	IV
16.	Austria	1. Inn 2. Sanna 3. Salza 4. Saalach	III III III III
17.	Bulgaria	1. Struma 2. Iskar 3. Arda	III III III
18.	Croatia	1. Cetina 2. Zrmanja	III III
19.	Germany	1. Isar	III
20.	Poland	1. Dunajec	III
21.	Albania	1. Vjosa	III
22.	Ireland	1. Barrow 2. Liffey 3. Shannow 4. Lagan	II II II II
23.	Portugal	1. Tâmega 2. Paiva 3. Minho	II II II
24.	Czech Republic	1. Sázava	II
25.	Greece	1. Ionas	II

In general, the mountain rivers of Europe can be recommended only to groups that have experience of expeditions to rivers with rapids of at least III category of complexity. These groups are required to master the techniques of rowing, launching and mooring to the shore, the ability to interact in white-water, and to have skills in organizing rescue operations. Passing extremely difficult obstacles such as the Mostizzolo Gorge on the Noce River in Italy, the waterfalls of the rivers of Norway and Sweden, the Probiy waterfall on the Prut River in Ukraine (obstacle 6A difficulty category, height of water drop over 8 m) should be carried out only during competitions or in conditions of ensuring the support of rescue services.

Having carried out a comprehensive analysis, the authors of the article summarized the resource potential of water sports tourism in Europe. From a geographical point of view, rivers of the highest, VI category of complexity, are represented mainly on the Scandinavian (Norway, Sweden) and Balkan peninsulas (Bosnia and Herzegovina, Montenegro).

A significant number of rivers of the V category of complexity are represented in the Scandinavian countries (Finland, Norway, Sweden), on the Apennine Peninsula (Italy), on the Balkan Peninsula (Bosnia and Herzegovina, Slovenia, Montenegro) and in the Southern Carpathians (Romania).

Rivers of IV complexity prevail on the Iberian Peninsula (Spain). They are also represented in Great Britain (Scotland, Wales), France, Switzerland, Iceland. Among the countries of Eastern Europe, Romania, Slovakia and Ukraine also have rivers of this category.

The research conducted by the authors proves that Europe has a powerful potential of rivers of the III and II categories of complexity. These are the mountains and upland rivers in many countries. It is appropriate to single out Spain, Switzerland, Austria, Great Britain, France, Ukraine, Germany, and Poland. There are many such rivers on the Balkan Peninsula (Albania, Bulgaria, Croatia).

According to the authors, the potential for the development of water sports tourism is not evenly distributed between European countries. A special place in this regard is occupied by the countries of the Balkan Peninsula. This part of Europe has the most significant resource potential, as there are rivers of various categories of complexity (from II to VI) in sufficient quantity.

Water tourism has almost the largest number of subcategories, and it relates to the trend that, in addition to traditional means of overcoming water tourist routes, new types of overcoming water obstacles are

also emerging. For instance, the use of new means of transportation on already traditional routes – rafts, kayaks, SUP boards, packrafts, trips on other watercrafts (inflatable boats, catarafts, etc.), trips on motorized boats (water jets, jets, aquabikes), etc. New subcategories of water tourism arose by overcoming certain natural obstacles – canyons, waterfalls, underground flooded cavities, etc.

In Ukraine and the post-Soviet countries, such subcategories of water tourism as *catamaraning*, *expedition rafting and kayaking*, *SUP-white-water*, *packrafting*, *expeditions on other watercrafts (inflatable boats, rafts, etc.)* have organically become part of classic water sports-tourism with the passage of classified water sports-tourism routes on the rivers of the world.

Such subcategories as *water canyoning*, *waterfall kayaking and river bugging* are developing in Europe as separate types of extreme active recreation.

Tourist rafting, rowing kayaking are developing on many European rivers as types of active leisure recreation. Based on this, a specialized infrastructure of active water tourism has been created, and small businesses have been involved.

Such subcategories of water tourism as rafting, kayaking, rowing slalom, SUP-tourism, aquabiking as separate types of tourist and sports activities are being developed within the framework of international sports federations and associations in the areas of competitive tourism, participation in international projects of the Camel Whitewater raft format, World Cups with races on rafts, kayaks, water bikes, SUP boards, etc.

## Conclusions

Adventure tourism should be considered a terminological analogue of water sports tourism, which in the post-Soviet territories is considered a type of active recreational and tourist activity and, today, is a non-Olympic sport.

The authors have established that *water tourism* is a type of sports tourism, it is a rafting of tourists in water areas (rivers, lakes, canals) on various means of rafting – inflatable boats (rafts), kayaks, catamarans, canoes and others with overcoming various obstacles on the water relief. Water tourism is the most dynamic type of sports tourism and at the same time remains the most technically complex type of sports tourism.

*Water obstacles* are a set of factors, the action of which can lead to a change in the trajectory of the vessel in the water flow. The movement of the vessel is influenced primarily by the flow inhomogeneity as-

sociated with irregularities of the bottom, shores, as well as large stones and outcrops of bedrock in the channel. In the tourist classification of water obstacles, rapids, riffles, river bars and boils are most common. Recently, the tourists started to overcome waterfalls of different heights.

The nature, number and variety of water obstacles determine the technical complexity of the water tourist route. At the same time, professional, including geographical, assessment of obstacles is extremely important for the safety of tourist sports trips, which are often carried out on the verge of physical and technical capabilities of their participants. Therefore, the task of scientists is to develop criteria for assessing the complexity of water obstacles so that athletes, when overcoming them, can compare their tourist experience, technical capabilities of their vessel in order to decide whether they can safely overcome a particular obstacle (go through the route).

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