

*If safety is in doubt, stop and
get out!*

Inland Waters Field Safety Manual

IMBRIW, INLAND WATERS SECTOR 2026

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Introduction

The scope of this manual

This is the Institute of Marine Biological Resources and Inland Waters (IMBRIW) official field safety manual. This manual is designed to provide assistance to field workers in routine field sampling, i.e., hydrological sampling, biota sampling, electrofishing, and all lotic, lentic and riparian area field work, including the installation/maintenance of gauging stations.

The above field work usually entails routine field surveys for the application of the Water Framework Directive (WFD) within the the National River Monitoring programme, for conservation-relevant sampling and inspection in lotic and lentic waters and associated riparian and coastal areas, as well as installation, set-up and maintenance for real-time environmental monitoring using automatic stations for water quantity & quality research and monitoring.

This manual is an extended and up-to-date version of the relevant Safety Section of the “Inland Waters Fish Monitoring Operations Manual -Version 1.0” (IMBRIW 2013) that was published in 2013, widely downloaded and used by many practitioners in Greece and abroad. The IMBRIW 2013 manual is still applicable and helpful, but through the current dedicated safety manual that provides information, education and training recommendations, we strive to improve and specifically promote safety practices during all field work for all inland waters and to bring readers’ attention to notable risks.

Target audience of the manual

Field work in inland waters involves certain safety risks and thus requires relevant training, standardization of field protocols, and routine safety-first practice. It also requires special consideration for biodiversity conservation, biosecurity and animal welfare.

Producing safety guidelines will help those involved in field work to greatly reduce health hazards and environmental risks during sampling. The aim is to standardize safety procedures without compromising survey protocol, sampling repeatability and effectiveness. It should be noted however with emphasis that this guidance document is by no meaning a “panacea” in guiding safe practice. Good judgment of the team in the field and their assessment of the situation at each instance is paramount. A culture of “safety first” requires repeated attention to preparedness and coordinated practice of safety procedures in the field.

This safety manual is first and foremost addressed to the HCMR's Inland Waters section scientists involved in field work, with any capacity. It could however be useful to any organisations and individuals that may be involved in inland water field work, e.g., other government research agencies, academic institutions, protected-area management bodies, environmental NGOs and free-lance contractors, technicians and/or scientists working in the private sector. With increasing policy obligations for bioassessment and environmental quality inspection in both river management and inland waters conservation, a scientifically sound and at the same time **safety first** practice of inland waters is required.

This document aims to assist in the following:

- Briefing all members of field work teams conducting sampling, on safety issues;
- Informing all interested parties and stakeholders who are directly or indirectly involved in inland waters field data collection, surveying and monitoring on these issues;
- Guiding good-practice in field work safety;
- Providing a framework for specialized training
- Provide guidance on minimizing field work impacts on the environment.

Several aspects of freshwater field work are low risk, as long as careful planning and consideration for safety issues are judiciously applied, both during the preparation and the implementation phase. Increased awareness of safety issues, training both in the field and prior to field work, and finally **adoption of a precautionary approach** is strongly advised.

Potential health and safety issues

Driving safety, in stream accidents, weather conditions and other issues

Working near or in water bodies is associated with potential health and safety risks. Training and following common sense safety procedures are crucial in minimising the probability of accidents. Because accidents are very rare in routine inland waters surveying and sampling, it is easy to become complacent and ignore some risks and dangers.

However, we should remember that accidents may easily occur in both field work and road related travel. Field experience shows that potentially dangerous aspects of field work include the following risk categories:

- Travel and vehicle related accidents to and from field sampling sites.
- Accidents during sampling, involving trauma particularly from slips and falls and the extremely unlikely event of drowning.
- Accidents concerning equipment failure or misuse.
- Accidents or health risks due to extreme weather conditions and river/wetland conditions (extreme weather events, flooding, artificial river flood-flow patterns, etc).
- Other extremely rare threats or hazards related to pollution, disease infection and conflicts with animals and people.

Greece and the adjacent Balkan and Eastern Mediterranean regions host conditions that are very similar to other southern European countries and usually pose relatively low risk for field work in streams, river corridors and wetlands. An awareness of any risks is important to avoiding dangerous situations or accidents. The following list summarizes potential issues (not presented in order of importance/likelihood of occurrence).

Driving safety: *Vehicle-related injury is a serious threat during sampling trips, either when travelling or near/at sampling sites. In Greece, most rural roads are poorly maintained and sometimes poorly signed. Additionally, access to/from sampling sites situated in remote and*

inaccessible areas where driving and maneuvering a vehicle is demanding, increases the risk of accidents.

➤ **Therefore, extreme caution should be applied when deciding whether to push forward in difficult terrain in a car;** in this case, if the car driver or the co-driver has even the remotest doubt on the safety of continuing driving to approach the sampling site, he/she should not proceed. In these cases, it is often sensible to continue on foot to scout the terrain further down the road. Patience and careful re-scheduling should be exercised.

➤ Preparation is very helpful and could reduce risks. During the preparation phase, planning on Google Maps should be organized to find the best access by road to the sampling site. Continuous communication between the different teams planning the sampling of a given site is obvious, and updated information and respect for timing and local weather changes are strongly advisable. Furthermore, it should be a routine for the first team accessing a site either visited for a first time, or facing a novel problem in a previously easily accessible site, to inform the teams planning to visit the site at a later date. Continuous coordination and information exchange between the teams in the field is required.

➤ At least two team members should be in each car, as most trips are usually long-distance trips, requiring several hours driving per day.

In-stream accidents: Falls from slipping are the most frequent hazards in upland streams and these can be very serious. Drowning is also a possible hazard even in rather shallow fast-flowing waters and in lakes.

➤ Personnel must be well trained and cautious; the ability to wade safely in a fast-flowing stream or river is gained by practice; therefore, newcomers should be introduced gradually by the head of the team to more difficult conditions, i.e., higher flows, higher depths, and/or more slippery conditions. Only when a team member feels absolutely safe should he/she venture forward.

➤ Paramount in these conditions is that team members are focused when in the river and always having eye contact with the other members and be conscious of their position in the river and their safety status.

➤ Life-vests should be worn where deeper water and/or water flows may pose a risk, or during boat electrofishing. Life-vest or other life preservers must always be present on deck.

➤ Once again, pre-sampling planning, adaptive modification on-site during sampling, avoiding unsafe high flowing or deep sections is advised. And of course, always abort if getting into the river poses any danger for team members.

➤ Electrofishing working accidents: These rarely occur if the team is experience and trained. Dangers of electrocution are obviously priority (see below). But simple mistakes and errors in judgement can cause problems. When netting fish for example, care needs to be taken not to strike other workers with the net poles. Grievous injury can be caused in this manner, especially if the end of a net pole is pushed into the face of another member. Workers must not work if particularly tired, ill or under severe time constraints. It is alright to leave a site “half-finished” if time and safety issues interfere.

In-stream accidents: Falls from ladders used to install/maintain gauging stations.

➤ Personnel must be well trained and cautious; furthermore, ropes should to be used to minimize the impact of falling.

Weather conditions –heat waves /flood risk etc: It goes without saying that weather conditions must be monitored, especially the issue of temperature extremes, lightning storms and flood risk. Heat-wave conditions during summer or storms in spring can cause dangerous flash flood situations.

➤ Proper care must be taken in such cases; for summer work, hats, long sleeve shirts, mosquito repellants, sunscreens and a ample drinkable freshwater stock are necessary. Interrupting work during the hottest hours of the day is also advised and should be incorporated in the initial planning. Care must be taken if a heat wave is forecast.

➤ Observing storm or precipitation levels is important to avoid storm-conditions, lightning strikes and torrential flash-floods. Torrential flash flooding has claimed several lives even in small river basins in Greece. Observing water levels constantly is advised to the more experienced members and exit from the river advised in the slightest dangerous weather change.

Floods from hydro-electric installations are also a common artificial flooding problem. These hydro-peaking and managed flood flows may also be affected or increased by adverse weather conditions.

➤ In cases where the team is working below dams monitoring the water level is critical; even in the crudest of manners, e.g., by placing a vividly colored cloth on a rock and observing it for any change in position due to an increase in water depth is advised. Also, informing

dam operators of your incoming sampling. Lastly, no sampling in heavy rain; the threat of lightning is an obvious and real danger.

Shepherd guard dogs: Especially around sheep-folds or livestock; dogs may attack workers.

- Rabies has recently re-surfaced in Greece and special care must be taken of stray dogs everywhere in the country. Particular behaviour around dogs can help avoid any such incident of attack. Keeping in a group and wielding a stick are important effective behaviours in a dog-human confrontation. Never run!

Shooting/hunting: Recreational hunting is widespread; hunters often stalk for wildlife near river sampling sites (especially in riparian areas). This may be potentially dangerous during autumn and winter, especially during early morning hours or in poor visibility.

- In such cases wearing bright clothes and talking loudly when moving through vegetation, so that everyone is aware of human presence, is highly advisable.

Other animal or wildlife risks: Mosquitoes and ticks are widespread in Greece and pose specific serious threats (see below). Bees and wasp bites are common and particularly dangerous in case of allergic shock.

- The team leader must be prepared to react to such an event (first-aid, evacuation procedure). Snakes and spiders are much less of a danger; the risk is certainly minimal and exaggerated, but common sense is required. In Greece, only the viper species (Viperidae) are venomous to humans though non-aggressive, they do not pose a serious threat if simple precautions are taken. In the extremely unlikely event of a viper bite, one must seek medical assistance and keep calm. Emergency phone numbers and planned routes to the nearest medical facilities should always be at hand. It should be said that there are very few other animals that will bother humans (especially humans in a group). The extremely unlikely encounter with Brown Bear in a sensitive situation (with cubs or with food-carcass) is a possibility in riparian zones, particularly in Northern Greece. Personnel should be informed about the best way to behave in areas with relatively high bear densities (as indicated by tracks and scat).

Military minefields/ Military sensitive issues: Minefields, in some specific cases are poorly marked; they exist near the Greek-Albanian and the Greek-Turkish borders.

- When this is the case, do not stray away from main rural roads. Also, it goes without saying that any seemingly “suspicious” behaviour near military sites must be avoided.

Authority controls: During investigative sampling, especially near international borders, authority controls, including police and military controls are common.

- The team leader should keep personnel relaxed; always display official paperwork proving your scientific expedition, and cooperate with relative authorities. In protected areas it is always necessary to have previously informed management bodies and/or other relevant authorities prior to sampling.

Assault by humans: Extremely rare and unlikely in Greece. River corridors are also sometimes used for illegal cannabis cultivation and surveys could create suspicion.

- All personnel must behave professionally, politely, and respectfully at all times. Clearly identify yourself and explain the purpose of the work when approached. Avoid arguments, aggressive language, or confrontational behavior. Remain calm if questioned or challenged, and do not escalate tensions. Withdraw from the area and notify supervisors or authorities if a situation becomes unsafe.
- Caution should be exercised, avoiding any confrontation with locals claiming trespassing, preferably moving the sampling site further downstream or upstream in this case.

Special Considerations

Protection from Mosquitoes and other disease-transmitting insects

For over 40 years Greece enjoyed immunity from mosquito-borne diseases such as malaria, but local cases do still exist, and people are not especially careful of mosquito bites. During the last few years Malaria has resurfaced and localized incidents of West Nile virus have occurred. Important points to consider for protecting the team members from mosquito bites include:

- Using mosquito repellent.
- Whenever possible, wearing long-sleeved clothes, socks and long pants.

- Wearing clothing that helps you blend in with the background. Mosquitoes hone in on colour contrast and movement.
- Avoiding perfumes, colognes, fragrant hair sprays, lotions and soaps which may attract mosquitoes.
- Reduce your risk of exposure by not working in prime mosquito habitat during mosquito activity peak feeding hours (i.e., usually dusk and at dawn).

Protection from Weil's disease and Lyme disease

- At the field, crew must be aware of the hazard of Weil's disease (Leptospyrosis) and Lyme Disease (Lyme borreliosis).
- Weil's disease is associated with contact with contaminated river and canal waters.
- To minimise this risk properly clean and cover with waterproof plaster any wound such as scratches and cuts.
- Avoid touching your mouth, eyes and nose
- Wash and disinfect your hands before eating and drinking
- Clean clothing and equipment that has come in contact with dirty water before the next use
- Lyme disease is a tick-borne disease.
- To minimise this risk wear appropriate clothing to cover skin. Avoid clothing such as short trousers that leave legs uncovered.
- Check your body for ticks, during and after the survey.
- If a tick is found remove it as quick as possible.
- When any kind of suspicion of infection exists, seek medical attention.

Basic health and safety guidelines

Basic health and safety guidelines and considerations for all types of field surveys near and in inland water bodies, particularly river conditions, include the following:

- **In the field, the team leader is responsible for following safety procedures.** If any member of the team should identify a hazardous situation, they are to immediately notify the team leader.
- Hazardous situations or any accidents (and near misses) must also be recorded in the field protocol (and communicated immediately to other teams sampling the site) in order to inform future sampling. Notifying other teams planning to visit the site shortly is advised.
- Basic first aid training is essential for all the team members. Special focus must be given on administering assistance in cases of electrocution (when electrofishing), falls, drowning/near drowning situations, cuts, sun stroke, choking, minor and major injuries or any kind of physical trauma. Team members should be trained in cardiopulmonary resuscitation (CPR).
- A first aid kit must always be available and the route to the nearest medical facilities should always be planned. This means pre-planning and geographical awareness of the nearest Health Centre/Hospital. Contact numbers for police, ambulance and fire department should always be available and known by all involved in the field sampling.
- As the most common hazards of field surveys are cuts, slips, water-borne disease infection, heat exhaustion, hypothermia and drowning a trained response to these problems should be routine. Appropriate field clothing is required to minimize those risks. Skin coverage is sought to avoid cuts and scrapes, ticks, insect and snake bites and prolonged sun exposure.
- In low water/ambient temperatures, warm clothes should be worn under the protective equipment to prevent hypothermia. In hot temperatures, which is more often the case, care should be taken in order to avoid heat exhaustion and sunstrokes. Team members must not work if they are ill (since being sick/unwell increases risk of injury or other complications).
- Rubber anti-slip thigh boots and chest waders should be used according to the depth of the river. Life jackets are required in deeper wading conditions and must always be worn in boat surveys.
- Presence of glass or sharp metallic pieces is frequent in river beds. All personnel should be cautious when wading especially when river bed visibility is low. In case of rusty metals

further caution is required, especially if a team member is not immunised.

- In case of contact with contaminated water/water suspected for pollution, the exposed area should be thoroughly cleaned and disinfected as soon as possible. Disinfectants must always accompany a field survey tool-kit. Surgical or washing gloves should be worn in polluted waters.
- Field equipment, including waders should be disinfected between basins to avoid unintentional transfer of aquatic biota
- The survey should be carried out only when local conditions allow for safe sampling. In the case of extreme weather (i.e. heavy rain, thunderstorm, and lightning), extreme flow conditions, unstable banks and/or substratum, dense vegetation, accessibility issues and nearby activities that could interfere with the sampling process, sampling should not be attempted.
- The team should consult if any such issue arises, and only proceed when all team members are in agreement.

Some of the above are summarized in Table 1.

Table 1. Field work Health and safety do's and don'ts

Do's	Don'ts
<p>Only proceed in difficult terrain, when no real risks or safety issues arise.</p> <p>Prepare diligently the approach to a new site prior to the sampling visit.</p> <p>Be in constant conduct with other teams visiting your sites.</p> <p>Take basic health precautions – be especially vigilant around polluted water.</p> <p>Share driving when in a long-distance trip.</p> <p>Assist anyone who may have problems driving by asking them to change drivers.</p> <p>Novices should be introduced gradually to harder in-stream / sampling conditions.</p> <p>Be focused, maintain focus.</p> <p>Modify the sampling reach, or the sampling time plan, if safety issues arise.</p> <p>Be vigilant for change in water level (especially below a dam) or impending storm.</p> <p>In case of emergency, abort without second thought.</p>	<p>Overestimate your driving ability when negotiating difficult terrain.</p> <p>Overestimate your ability to drive for long hours.</p> <p>Proceed with the sampling, when very tired or feeling uncertain about your ability to cope.</p> <p>Brag to novices about your abilities (for the experience members)</p> <p>When water conditions seem very polluted and there may be risk of infection or disease.</p> <p>Sample when there are sheep and/or shepherd dogs in close proximity (rushing into sampling without patient observation).</p> <p>Sample when the weather is thunderous or may be close to thunderstorm conditions (risk of lightning strike!).</p> <p>Walk carelessly near car traffic on major or minor roads (pedestrian car strike!)</p> <p>Get lost (in the woods or unfamiliar territory).</p> <p>Hesitate to ask for help.</p>

Safety guidelines for electrofishing

The combination of electricity and water is potentially hazardous for the operators. In addition to the basic risks associated with all types of river field surveys, the possibility of electrical shock, temporary incapacitation and electrical burns needs to be taken into account. Those risks are greatly minimised if the appropriate working procedures are followed. In this section we will go over the main safety concerns and the health and safety guidelines that everyone should be familiar with before using electrofishing equipment.

Staff should be in good health condition and fit for the task. People suffering from known heart conditions should not participate in electrofishing surveys.

If new equipment is used, trained members need to revisit training. For safety reasons a minimum of three people should carry out the electrofishing surveys; in most cases more participants are required depending on the size of the water body and scope of the sampling or research project.

Protective equipment

Protective gear made of non-conducting materials, should be worn by all members of the staff.

- Thigh or chest waders made from non-conducting material are an absolute must. They should be frequently inspected for leakage. If leakage occurs, the staff member must exit the water.
- In some cases, protective rubber gloves covering hands and forearms should be used.
- Life jackets are recommended in high depths or flows and during boat electrofishing; a life vest or emergency floating device must be at hand, on deck.
- Clothing should not have any metallic components that may influence the electrical field or parts that are sticking out and may become entangled with cables or nets.

Electrical health & safety summary

The following rules apply:

- Do not allow unprotected parts of the body to come into contact with the water when electrofishing equipment is operating.
- Only those parts of the equipment (electrofisher's anode, dip nets, buckets) that are covered by non-conducting material should be touched with bare hands. Under no circumstances

should anyone touch the water during operation unless the electrofishing gear is verified to be switched off or they are wearing rubber gloves.

- Only the operator in charge of the hand-held electrode (HHE) can remove debris from the electrode by hand and only after being sure that the fishing circuit is de-energized with all stop buttons in the locked off position; do not leave electrodes unattended when they are connected to a live power source.
- Under no circumstances, allow the electrode head to leave the water before the safety control circuit switch is released.
- Avoid simultaneous use of more than one set of electrofishing equipment at any one site. This kind of sampling is rarely capable of being standardized (or repeatable) so it is therefore inappropriate for monitoring routines as well.
- All personnel must be fully familiar with the operation of the equipment before being allowed to use it for electrofishing.
- Avoid to make any electrical connections or refuel the generator (Direct Current engine) the system should always be turned off and allowed to cool.
- Operation manuals for each type of fishing gear must be available to those involved with its use.
- When going out on the field, proper training from an experienced electrofishing operator-trainer is required in health and safety guidelines, principles of electrofishing, use of electrofishing equipment, first aid training.

Some of the above are summarized in Table 2 (adapted from Goodchild 1991, Meador et al., 1993).

Table 2. Electrofishing Health and safety do's and don'ts

Do's	Don'ts
<p>Review training and standardization aspects of electrofishing operation before a sampling campaign.</p> <p>Refuel generators when the system is off, and surfaces have cooled down.</p> <p>Make electrical connections/disconnections when the system is switched off.</p> <p>Keep hands out of the water during the survey.</p> <p>Leave the water immediately in the event of a leakage.</p> <p>Prepare a first aid kit and refresh it often.</p> <p>Instruct and revise training of all members in first aid; including responses to drowning.</p> <p>Rest often during electrofishing.</p> <p>Be alert and conscious.</p>	<p>Operate electrofishing equipment alone.</p> <p>Operate under inclement weather conditions (moderate to heavy rain, lightning, thunderstorm potential).</p> <p>Operate/ do field work when the crew is extremely tired.</p> <p>Operate when people or animals are near/in the water.</p> <p>Operate near electricity poles or other areas where electricity may enter water.</p> <p>Operate near hydro-peaking areas down-stream of discharge channels or dams where frequent flood pulses occur.</p> <p>Be hurried or sloppy in working around any kind of deep-water situation.</p>

Biosecurity & Prevention of Aquatic Biota Unintentional Transfer

Field surveys in inland waters may unintentionally contribute to the transfer of non-native aquatic organisms, pathogens and propagules between river basins, lakes, wetlands and freshwater ecoregions. Scientific personnel working with sampling equipment, boats, electrofishing gear, nets, waders, vehicles and other field materials may inadvertently transport invasive alien species, fish diseases, parasites, algae, aquatic plants, invertebrates or microscopic organisms from one water body to another. Even very small quantities of water, mud, plant fragments, fish eggs, larvae or sediments attached to equipment may be sufficient to introduce non-native organisms or pathogens into previously unaffected areas.

The spread of invasive alien species and aquatic pathogens is internationally recognized as one of the major threats to freshwater biodiversity, ecosystem integrity and fisheries conservation. Freshwater field teams therefore have a professional and ethical responsibility to minimize the risk of accidental biological contamination during monitoring and research activities. Particular caution is required when surveys involve movement between distinct hydrological basins, isolated lakes, reservoirs, fish farms or among different freshwater ecoregions.

Potentially transferable organisms may include:

- invasive aquatic plants and algae;
- fish pathogens, fungi and parasites;
- alien fungal pathogens (such as *Ceratocystis platani* which is killing *Platanus orientalis* trees)
- crayfish plague;
- amphibian pathogens;
- invasive mollusks and crustaceans;
- fish eggs and larvae;
- and microscopic organisms associated with mud, sediments or standing water.

All personnel involved in inland waters fieldwork should adopt a precautionary biosecurity approach. Biosecurity procedures should form an integral part of routine field operations and should be treated with the same level of importance as all other health and safety procedures.

General biosecurity principles

The following principles should guide all inland waters field operations:

- Avoid unnecessary transfer of water, mud, vegetation or sediments between sampling sites.
- Clean and disinfect all equipment after use and before entering another water body or basin.
- Whenever possible, organize sampling progression from least impacted to most impacted sites.
- Apply enhanced precautions when moving between isolated catchments, protected areas or highly sensitive ecosystems.
- Inspect all equipment carefully for attached biological material before departing from each site.
- Maintain a written cleaning and disinfection protocol for all field campaigns.
- Ensure that all personnel are trained in biosecurity procedures and understand their responsibilities.

Biogeographical Considerations in Freshwater Biosecurity

The ecological impacts associated with the human-assisted spread of non-native aquatic organisms, whether involving alien species introduced from abroad or translocations within the country, must always be evaluated within a biogeographical context. Greece is divided into eight broadly defined freshwater ecoregions, each representing distinct evolutionary, ecological and biogeographical units. These ecoregional boundaries provide one of the most fundamental natural reference frameworks for evaluating the risks associated with biological transfers among inland waters. Movement of aquatic organisms across freshwater ecoregional boundaries may therefore constitute a serious and highly unnatural translocation event, with potentially important ecological and conservation consequences.

A second critical level of concern involves assisted movement between distinct hydrological basins, including river catchments and isolated lake basins separated by watershed boundaries. Such drainage basins represent long-term evolutionary units for freshwater biota, often supporting genetically distinct populations, endemic taxa and locally adapted ecological assemblages. Human-assisted transfer of organisms between basins may disrupt these natural evolutionary patterns and contribute to ecological homogenization, pathogen spread and biodiversity loss.

Finally, even organism transfers within the same river basin should not automatically be considered ecologically benign. In particular, translocations from downstream to upstream sections of a catchment may circumvent natural dispersal barriers and introduce species, pathogens or genotypes into areas

where they did not historically occur. Such intra-basin transfers may also represent significant ecological disturbance events and should be avoided whenever possible.

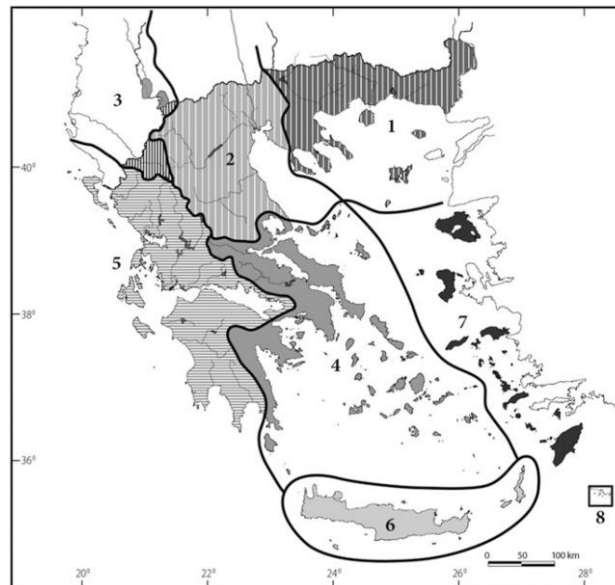


Figure 1. Greece's 8 distinct freshwater ecoregions; these boundaries are basic broad-scale natural biogeographical barriers (Zogaris and Economou 2017). Any artificial movement/translocation of aquatic organisms beyond these boundaries can be extremely disruptive to the local biota and may disrupt evolutionary processes. With each ecoregion is a large number of river and lake basins each forms its unique biogeographical unit; these finer-scale boundaries must also be respected.

Equipment requiring cleaning and disinfection

Biosecurity procedures should apply to all equipment that comes into contact with water, sediments or wet substrates, including:

- electrofishing equipment and cables;
- dip nets and seine nets;
- boats, trailers and anchors;
- waders and boots;
- ropes and measuring tapes;
- buckets, tanks and live wells;
- water quality probes and sensors;
- vehicles entering riverbeds or wetlands;
- and all other reusable field equipment.

Cleaning and disinfection procedures

Cleaning should begin immediately after completion of sampling and before equipment is transferred to another site. All visible mud, sediments, plant material and organic debris should first be physically removed using brushes, brooms, freshwater rinsing or pressurized washing (commonly available at petrol stations).

Special care is required not to spread tree fungal propagules of infected riparian Plane trees (*Platanus orientalis*) suffering from the alien fungus *Ceratocystis platani*. Transferring microscopic bark particles, deadwood or sawdust can spread this disease into uninfected areas (e.g. currently areas in northeast Greece and certain mountain areas and the islands).

Following physical cleaning, equipment should be disinfected using products approved for aquatic biosecurity purposes. Commonly used disinfectants include:

- Aquatic disinfectants;
- diluted sodium hypochlorite solutions;
- ethanol solutions for small instruments and tools;
- or other approved disinfectants applied according to manufacturer specifications.
- when cleaning with hoses or pressurized water, use hot water if possible.

Personnel must carefully follow all safety instructions, dilution requirements and recommended contact times for disinfectants. Particular attention should be given to absorbent or difficult-to-clean materials such as felt soles, ropes, nets, propellers and boat compartments.

Where practical, equipment should additionally be:

- thoroughly dried before reuse;
- exposed to direct sunlight;
- or left unused for an adequate drying period between catchments.

Complete drying is usually effective against many aquatic invasive organisms and pathogens and should be considered an important component of biosecurity practice.

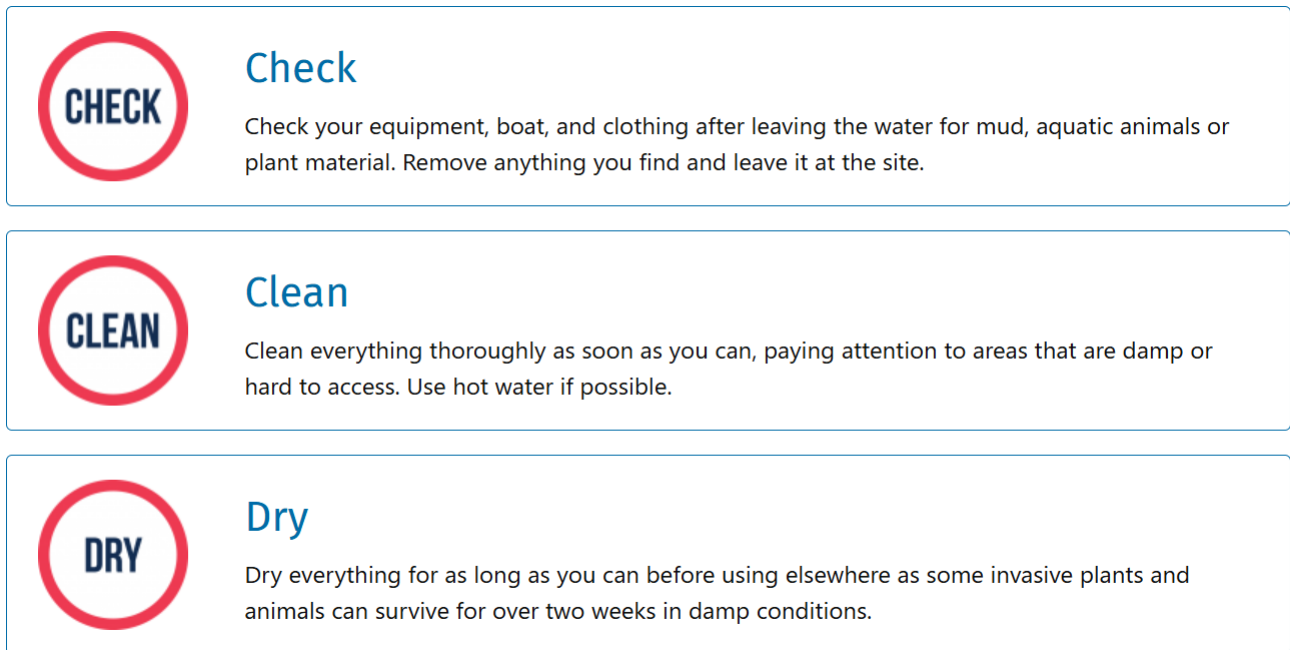


Figure 2. Promotional campaign from the UK. Similar approaches have been developed in other jurisdictions (Source: <https://www.nonnativespecies.org/what-can-i-do/check-clean-dry>)

Operational biosecurity protocol

Field teams should maintain a standardized and transparent biosecurity protocol including:

- documented cleaning and disinfection procedures;
- designation of responsible personnel;
- inspection of equipment before departure from each site;
- recording of sampling sequences and basin transitions;
- maintenance logs for boats and electrofishing equipment;
- and documentation of disinfectants and cleaning schedules used during field campaigns.

Team leaders are responsible for ensuring that biosecurity procedures are implemented consistently throughout all field operations. Compliance should be reviewed routinely, particularly during intensive monitoring programmes involving multiple catchments or protected freshwater systems.

Failure to implement appropriate biosecurity measures may contribute to long-term ecological damage, biodiversity loss, biotic homogenization and the spread of invasive species and aquatic

diseases. Prevention of accidental biological transfer is therefore an essential component of responsible freshwater scientific field practice.

Safety Guidelines for River Discharge Measurements

Introduction

River discharge measurements are among the most hazardous routine activities in inland waters field work because they frequently require personnel to work directly within flowing water under potentially unstable hydraulic conditions. Discharge gauging often involves repeated movement across channels, deployment of instruments in high-velocity flows, use of cables or winches, and work during elevated flow events.

Personnel conducting discharge measurements must understand that even relatively shallow water can become dangerous when current velocities are high, substrate conditions are unstable or flow conditions change rapidly. A conservative and precautionary approach must always be adopted.

The safety of personnel takes absolute priority over data collection objectives. Measurements should never be attempted under conditions where personnel safety cannot be assured.

General Safety Principles

The following general principles apply to all river discharge measurements:

- Field teams must conduct a site-specific risk assessment prior to entering the river.
- Personnel should never work alone during discharge measurements.
- Measurements should be postponed or cancelled if hydrological or weather conditions are unsafe.
- Team leaders or more experienced team members should continuously reassess safety conditions during measurements.
- Personnel must maintain constant visual and verbal communication.
- Measurements should avoid unnecessary exposure to fast currents, deep water or unstable banks.

- Any team member has the authority to stop operations if unsafe conditions arise.

Hydrological and Hydraulic Hazards

River discharge measurements may expose personnel to:

- rapid flow velocities;
- sudden increases in discharge;
- unstable or mobile substrates;
- deep pools and undercut banks;
- slippery rocks and algae-covered surfaces;
- debris transport;
- entanglement hazards;
- hydraulic jumps or recirculating flows;
- cold-water exposure and hypothermia;
- hydropeaking below dams;
- flash flooding;
- and fatigue associated with prolonged wading.

Wading Safety During Discharge Measurements

Wading discharge measurements require particularly careful judgement.

The following precautions are recommended:

- Personnel should move slowly and deliberately, ensuring stable footing and maintaining multiple points of support (e.g., both feet and a wading staff) whenever possible.
- Movement should preferably occur facing upstream.
- Measurements should not proceed if footing is unstable or if visibility of the streambed is poor.
- Large boulders, woody debris and algae-covered surfaces should be treated as high-risk hazards.

- Personnel should immediately exit the river if water levels rise, turbidity rapidly increases or weather conditions deteriorate.

Whenever possible, discharge measurements should be planned during stable flow conditions and always during daylight hours.

High Flow Conditions

High-flow measurements represent some of the highest-risk activities in hydrological field work.

During elevated flow conditions:

- conservative judgement is essential;
- personnel exposure time should be minimized;
- escape routes should be identified before beginning work;
- and continuous monitoring of upstream conditions is required.

No discharge measurement is worth risking injury or loss of life.

Measurements should immediately cease if:

- debris transport increases;
- banks become unstable;
- water level rise is observed;
- lightning develops;
- or personnel stability becomes uncertain.

As a conservative **indicative** guideline, wading measurements should generally not be attempted when the product of water depth (m) and flow velocity (m/s) exceeds approximately 0.6 m²/s (e.g. depth of 0.6m and flow velocity of 1m/s), and/or **flow conditions compromise personnel stability**.

Nevertheless, numeric absolute safety threshold cannot be universally applied since site-specific conditions, substrate characteristics, turbulence, debris load, and staff experience affect significantly the measurement risk and therefore shall always be considered in the final risk assessment.

Moreover, all of the above precautions as well as the dynamic field safety evaluation process presented in the next chapter should be also considered prior to any measurement.

Safety Guidelines for Installation and Maintenance of Automatic Water Monitoring Stations

Automatic hydrological and water-quality monitoring stations are frequently installed on bridges, riverbanks, culverts and other hydraulic structures crossing rivers and streams. Installation and maintenance activities may expose personnel to significant hazards associated with working at height, traffic, flowing water, confined access areas and adverse weather conditions.

A precautionary and site-specific safety approach must always be followed during installation, inspection and maintenance of monitoring stations.

General safety principles

The following general principles apply:

- Installation and maintenance activities should never be performed by a single person.
- Personnel should conduct a site-specific risk assessment before beginning work.
- Traffic conditions, bridge geometry, accessibility and river conditions must be evaluated beforehand.
- Weather forecasts and flood conditions should always be checked prior to field deployment.
- Work should preferably be conducted during daylight and stable hydrological conditions.
- Personnel should maintain continuous communication throughout operations.
- Team leaders should ensure that all equipment is properly secured before deployment over water.

Working on bridges and elevated structures

Special caution is required when working from bridges or elevated hydraulic structures.

The following precautions are recommended:

- Personnel working near bridge edges or over water should use appropriate fall-protection measures whenever required by local regulations or site conditions.
- Ladders must be properly secured and positioned on stable surfaces before use.
- Personnel should avoid overreaching while handling instruments, cables or sensors.
- Tools and equipment should be secured to prevent accidental dropping into the river or onto roadways below.
- Bridge railings, parapets and structural elements should never be assumed safe for anchoring unless verified.
- Personnel should remain constantly aware of vehicle traffic, especially on narrow bridges or roads with limited visibility.
- High-visibility clothing should be worn whenever work is conducted near traffic.

River and flood-related hazards

Installation sites may become hazardous during elevated flows or flood events.

Personnel should:

- avoid installation or maintenance during flood conditions or rapidly rising water levels;
- continuously monitor upstream weather and flow conditions;
- identify safe escape routes prior to beginning work;
- avoid standing directly below suspended equipment or winched instruments;
- and immediately suspend operations if conditions deteriorate.

Special caution is required at stations located below dams or within flashy Mediterranean catchments where rapid water-level rise may occur with little warning.

The installation and maintenance of water quality stations that involve entering the river, apart from the above, is subject to all the precaution and risk assessment procedures referred to the chapters: ‘Safety Guidelines for River Discharge Measurements’ and ‘Risk Assessment and Dynamic Field Safety Evaluation’ of this manual.

Risk Assessment and Dynamic Field Safety Evaluation

All inland waters field surveys should be preceded by a risk assessment process. The purpose of risk assessment is to identify potential hazards associated with the planned field activities, evaluate the likelihood and severity of possible incidents, and implement appropriate mitigation measures before entering the field. Risk assessment should not be viewed as a bureaucratic exercise, but rather as an essential operational tool for reducing any potential for accidents and improving preparedness.

Field work in rivers, streams, lakes, reservoirs and wetlands and their riparian zones is inherently dynamic. Environmental conditions may change rapidly due to weather, water level fluctuations, hydropeaking below dams, terrain instability, equipment malfunction or human factors such as fatigue and errors in judgment and timing. Therefore, risk assessment must be considered an ongoing process throughout the duration of planning and during field operations.

Pre-field risk assessment

Prior to departure, the team leader and participating personnel should evaluate:

- **site accessibility and terrain conditions;**
- weather forecasts and flood risk;
- hydrological conditions and expected water levels;
- hydropeaking schedules or dam-release risks where applicable;
- remoteness and access to emergency services;
- communication coverage and emergency contact procedures;
- equipment suitability and operational condition;
- staffing levels and personnel experience;
- expected biological, chemical or physical hazards;
- expected/potential human-related hazards or issues;
- wildlife, livestock or other countryside hazards;

- fatigue, driving duration and overall logistical demands.

Potential hazards should be categorized according to:

- likelihood of occurrence;
- potential severity of injury or damage;
- and the feasibility of mitigation measures.

Examples of mitigation measures may include:

- modification of the sampling reach;
- postponement of sampling;
- additional personnel or safety equipment;
- other equipment needs;
- use of personal flotation devices;
- adjustment of working hours;
- or complete cancellation of field operations.

Dynamic on-site risk reassessment

Conditions observed in the field may differ substantially from those anticipated during planning. For this reason, team leaders and all personnel should continuously reassess environmental and operational conditions throughout the survey.

Dynamic risk reassessment should include continuous evaluation of:

- changes in water level or flow velocity;
- rainfall intensity and storm development;
- visibility and footing conditions;
- physical and mental fatigue of team members;
- equipment performance and possible malfunctions;
- access and evacuation routes;
- and the behaviour of livestock, wildlife or members of the public.

Special caution is required below dams and hydroelectric facilities, where rapid increases in discharge and water level may occur with little warning. Prior communication with relevant authorities is advised.

Authority to abort or modify sampling

The safety of personnel always takes precedence over sampling objectives, possible gear damage/loss or project schedules. Any team member who identifies unsafe conditions or feels unable to safely continue operations has both the right and the responsibility to immediately communicate these concerns to the team leader.

Field operations should be modified, suspended or completely aborted whenever:

- weather conditions deteriorate;
- water levels or flows become unsafe;
- lightning or flood risk develops;
- personnel fatigue compromises judgement or physical ability;
- equipment safety becomes uncertain;
- communication systems fail;
- or any other unforeseen hazard emerges.

The decision to abort sampling should be respected without criticism or hesitation. Adoption of a precautionary approach is strongly encouraged, since many serious field accidents occur when personnel continue operations despite increasing environmental or operational risk.

Training

The most effective precaution against hazards and accidents during inland waters field work is proper training. All personnel participating in field surveys must receive occupational health and safety training appropriate to the type of work being undertaken before entering the field.

Training must be regarded as a continuous educational process and not as a one-time requirement, since field conditions, equipment, personnel responsibilities and environmental risks change over time, training is an important part of the routine of field work.

Particular emphasis should be placed on cultivating a strong safety culture among all personnel. Team members must understand that field safety depends not only on technical competence, but also on good communication, situational awareness, teamwork and the flexibility/willingness to stop or modify operations whenever unsafe or uncertain conditions arise.

Participation in electrofishing operations requires specific training and obtaining competency certification by experienced personnel is advised. Professional certification is available and should be had by all members involved.

Boat-based surveys additionally require formal boat safety training and familiarity with water rescue procedures. Personnel operating vehicles in difficult terrain or remote areas should also be appropriately trained and experienced in rough road, and off-road or adverse-condition driving.

Training programmes should combine both formal instruction and supervised field experience. **Newly participating personnel should initially work under the guidance of experienced team leaders and progressively undertake more demanding tasks only after demonstrating competence and confidence in the field.**

Training relevant to inland waters field surveys may include the following:

- Occupational health and safety induction training.

- Field safety and risk assessment procedures.
- First aid and cardiopulmonary resuscitation (CPR).
- Electrofishing theory, operation and emergency procedures.
- Boat handling and water safety training.
- Wading safety and swift-water awareness.
- Safe use and maintenance of scientific equipment and generators.
- Vehicle and remote-area driving safety.
- Communication and emergency response procedures.
- Heat stress, hypothermia and weather-related risk awareness.
- Biosecurity and equipment disinfection procedures.
- Wildlife awareness and management of encounters with dogs, snakes or other animals.
- Manual handling and lifting techniques.
- Navigation and orientation in remote areas.
- Procedures for working near dams and hydropeaking zones.

Prior to each field campaign, team leaders should conduct a briefing, covering:

- ✓ the objectives of the survey,
- ✓ expected field conditions,
- ✓ identified hazards,
- ✓ emergency procedures,
- ✓ communication protocols,
- ✓ access routes and evacuation plans,
- ✓ responsibilities of each team member, and
- ✓ any site-specific safety considerations.

Refresher training should be conducted periodically, especially before intensive seasonal sampling campaigns or when new equipment or methodologies are introduced. Safety procedures and emergency responses should also be reviewed after incidents, near-misses or significant changes in field protocols.

Ultimately, safe field operations depend on the combination of adequate training, good preparation, sound professional judgment and a precautionary approach in the field. No scientific objective or sampling target should take precedence over the safety and well-being of personnel.

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