

**REVIEW OF PROCEDURES CONCERNING ANIMALS  
INVOLVED IN TRAFFIC ACCIDENTS – INCLUDING  
OWN INVESTIGATIONS**

***Justyna Karaźniewicz<sup>1</sup>, Ireneusz Soltyszewski<sup>2</sup>,  
Tadeusz Malewski<sup>3</sup>, Józef Szarek<sup>4</sup>,  
Mariusz Felsmann<sup>5</sup>, Wojciech Grudzień<sup>6</sup>,  
Andrzej Dzikowski<sup>4\*</sup>***

<sup>1</sup> Department of Criminal Procedure

<sup>2</sup> Department of Criminalistics and Forensic Medicine  
University of Warmia and Mazury in Olsztyn, Poland

<sup>3</sup> Museum and Institute of Zoology

Polish Academy of Sciences in Warsaw, Poland

<sup>4</sup> Department of Pathophysiology, Forensic Veterinary  
Medicine and Administration

University of Warmia and Mazury in Olsztyn, Poland

<sup>5</sup> Centre for Veterinary Sciences

Nicolaus Copernicus University in Toruń, Poland

<sup>6</sup> Private Veterinary Praxis GRUDWET in Ruże near Zbójno, Poland

**Key words:** procedures for dealing with animals after car accidents, road accidents, animal protection, Polish law, veterinary forensic medicine, species determination.

**Abstract**

There is a systematic increase in the number of traffic accidents involving both domestic and free-living animals. It was found that the largest number of animals dies in May and at the turn of October and November. It is estimated that only every fourth driver reports collision in Poland. In some cases, wounded animals are slaughtered and their meat is used for consumption. In connection with road accidents involving animals, it is crucial for the law-enforcement authorities to determine the actual state of affairs in order to assess the proper course of the collision.

The paper presents comprehensive legal and veterinary aspects of the discussed issues. The own analysis was made according to the number of the road incidents in Poland with the participation of animals.

## PRZEGLĄD PROCEDUR POSTĘPOWANIA ZE ZWIERZĘTAMI UCZESTNICZĄCYMI W WYPADKACH DROGOWYCH (Z WŁĄCZENIEM BADAŃ WŁASNYCH)

*Justyna Karaźniewicz<sup>1</sup>, Ireneusz Sołtyszewski<sup>2</sup>, Tadeusz Malewski<sup>3</sup>,  
Izabella Babińska<sup>4</sup>, Józef Szarek<sup>4</sup>, Mariusz Felsmann<sup>5</sup>, Wojciech Grudzień<sup>6</sup>,  
Andrzej Dzikowski<sup>4\*</sup>*

<sup>1</sup> Katedra Procesu Karnego

<sup>2</sup> Katedra Kryminalistyki i Medycyny Sądowej  
Uniwersytet Warmińsko-Mazurski w Olsztynie, Polska

<sup>3</sup> Muzeum i Instytut Zoologii

Polska Akademia Nauk w Warszawie, Polska

<sup>4</sup> Katedra Patofizjologii, Weterynarii Sądowej i Administracji  
Uniwersytet Warmińsko-Mazurski w Olsztynie, Polska

<sup>5</sup> Centrum Weterynarii

Uniwersytet Mikołaja Kopernika w Toruniu, Polska

<sup>6</sup> Gabinet weterynaryjny GRUDWET, Ruże koło Zbójna, Polska

Słowa kluczowe: procedury postępowania ze zwierzętami po wypadkach samochodowych, wypadki drogowe, ochrona zwierząt, prawo polskie, weterynaria sądowa, oznaczanie gatunków.

### Abstrakt

Obserwuje się systematyczny wzrost wypadków komunikacyjnych z udziałem zwierząt zarówno domowych, jak i wolno żyjących. Stwierdzono, że największa liczba zwierząt ginie w maju i na przełomie października i listopada. W Polsce szacuje się, że tylko co czwarty kierowca zgłasza fakt kolizji policyjnej. W niektórych przypadkach ranne zwierzęta są dobijane, a ich mięso jest wykorzystywane do celów konsumpcyjnych. W związku z wypadkami drogowymi z udziałem zwierząt kluczowe znaczenie dla organów ścigania ma ustalenie stanu faktycznego w celu oceny przebiegu zdarzenia.

W pracy przedstawiono w sposób kompleksowy prawne i weterynaryjne aspekty omawianej problematyki. Dokonano również własnej analizy liczby wypadków drogowych w Polsce z udziałem zwierząt.

### Introduction

There is a systematic increase in the number of traffic accidents involving both domestic and free-living animals being observed. It has been shown that the number of accidents concerning animals is related to the season of the year (PAWELEC 2011). Most of such accidents occur in May. This can be explained by the seasonal changes in animal shelters. The second peak of accidents number takes place in October and Novem-

ber, because then migration of animals to wintering grounds begins (FELSMANN et al. 2012). During this period of the year, males are particularly vulnerable to death under the wheels of the vehicles. This is caused by their migration and territorial expansion in search of females. It has been shown that up to 75% of road events occurring in Poland involve elks. 50% of wild boars, deer and foxes and 40% of deer and hares are also killed by cars in autumn (LISTOS et al. 2015).

In Poland, according to the art. 33 sect. 3 of the Act on the Protection of Animals (POLISH JOURNAL OF LAWS 2017/1840), the driver of a motor vehicle that hit an animal (domestic or free-living) is obliged to provide it with an appropriate assistance or notify the emergency services. A driver who could have performed such activities and did not perform them, can be punished with a custody or a fine. Unfortunately, not every driver reports such a collision to the police. Also situations when wounded animals are slayed and used for consumption are noted.

### **Phenomenon of road accidents involving animals**

Road incidents involving animals are not rare on Polish roads. The scale of this phenomenon is not completely known, primarily due to the fact that the statistics compiled by the Police Headquarters cover only the disclosed events (information of which has reached the Police authorities). On the other hand, it is estimated that only every fourth driver reports such an event, despite the notification obligation. Furthermore, a detailed and proper analysis and assessment of the events' structure is hindered by the fact that the official statistics include all events involving animals, both domestic and wild.

There is no doubt, however, that the number of road accidents in which animals take part grows up year by year. Over the last 11 years, this number has increased by over 10,000 annually (from 14,648 in 2007 to 24,770 in 2017). The data collected by the Police Headquarters show that during the last 11 years (2007–2017) there were 214,040 traffic incidents involving the at least one animal clashed. Of these events, 1,912 were traffic accidents in which 91 animals were killed, and 2,362 animals were injured. The remaining 212,128 events are classified as the road collisions. The dynamics and structure of events in the last decade are presented in the Table 1.

Table 1

Number of the road incidents in Poland with the participation of animals, and their effects in 2007–2017, investigation according to the Police Headquarters' data

| Year         | Number of incidents |                   |                | Number of animals |              |
|--------------|---------------------|-------------------|----------------|-------------------|--------------|
|              | road collisions     | traffic accidents | total          | killed            | wounded      |
| 2007         | 14,643              | 128               | 14,648         | 5                 | 166          |
| 2008         | 16,835              | 157               | 16,992         | 6                 | 208          |
| 2009         | 17,403              | 177               | 17,580         | 7                 | 218          |
| 2010         | 17,561              | 151               | 17,712         | 11                | 177          |
| 2011         | 17,515              | 164               | 17,679         | 3                 | 208          |
| 2012         | 18,689              | 168               | 18,857         | 5                 | 207          |
| 2013         | 19,338              | 180               | 19,518         | 12                | 222          |
| 2014         | 20,182              | 195               | 20,377         | 8                 | 250          |
| 2015         | 22,170              | 213               | 22,383         | 10                | 262          |
| 2016         | 23,218              | 183               | 23,401         | 14                | 214          |
| 2017         | 24,574              | 196               | 24,770         | 10                | 230          |
| <b>Total</b> | <b>212,128</b>      | <b>1,912</b>      | <b>214,040</b> | <b>91</b>         | <b>2,362</b> |

### Procedures related to road accidents involving animals

A road incident involving an animal necessitates the involvement of various entities and public judiciary authorities. Their actions provide medical assistance to people participating in the incident, as well as a veterinary assistance to animals suffering. It is also necessary to secure the place (to preserve other dangerous situations) and to restore cleanliness and order within the lane. Responsible in this regard are: the driver of a motor vehicle, the police and other entities appointed to care for wounded animals, as well as services dealing with the removal of dead animals from the road (GABERLE 2010, OFFICIAL JOURNAL OF THE POLISH POLICE HEADQUARTERS 2017/64, PAWELEC 2011).

The driver who has hit the animal is obliged, if it is possible and safe for him, to provide the injured creature with appropriate assistance, or to notify one of the public emergency services which, within the scope of their tasks, have to take action. The Polish legislation indicates a wide catalog of these entities, including: veterinary surgeons, members of the Polish Hunting Association, members of social organizations protecting animals, police officers, railway security guards, municipal guards, border guards,

foresters, National Park's inspectors, State hunting guards, hunting guards, and state fishery guards (POLISH JOURNAL OF LAWS 2017/1840).

There is no doubt that the police is the authority notified in the most of cases. The tasks of a police officer include securing a place in order to avoid another dangerous events, as well as carrying out the necessary procedural steps consisting in protecting forensic traces against their loss, destruction or distortion (PAWELEC 2011, WITKOWSKA 2013). Activities related to visual inspection include the vehicles involved. It is particularly important in a situation in of an event which caused injuries or death not only to animals, but also to persons (drivers or passengers) or even to a death of a person. Such a situation is called a road accident, which from the point of view of Polish Criminal Code is a crime.

According to the art. 177 of the Polish Criminal Code (POLISH JOURNAL OF LAWS 2017/2204), the criminal liability shall be borne by the person who, by a violation of safety rules in traffic, causes an accident, in which another person suffered injuries or health disorder lasting over 7 days. Criminal liability in this case occurs even when the violation of traffic-safety rules was unintentional. The perpetrator of the accident shall be liable to imprisonment of up to 3 years, and if a death or serious injury of a person occurred as a result of the event – imprisonment for a period of time from 6 months to 8 years.

Detailed inspection and determination of the cause of the accident, and the mode of participation of an animal in such an event is therefore crucial. It should be treated from the point of view of further activities, related to conducting of criminal. It also determines the scope of possible criminal responsibility.

It should be noted that – depending on: the impact force, the vehicle's speed and weight, as well as on animal's weight – the result may be a wounding the animal, which still would be able to escape. Without proper inspection and traces' protection, neither determining the cause of the accident, nor identifying the animal (eg. reading data from a microchip in relation to dogs, ferrets or cats) would be possible.

The duties of a police officer at the place of an event involving animals include calling other rescue and technical services, whose task is to help the injured people and animals, and to clean up the road (OFFICIAL JOURNAL OF THE POLISH POLICE HEADQUARTERS 2017/64).

Provisions of the Road Traffic Act (POLISH JOURNAL OF LAWS 2017/1260, 1926 and 2018/79, 106, 138, 317) provide an obligation for a police officer to inform an entity responsible for keeping the road, in order to remove an obstacle. Duties related to maintaining order on the road belong to the road administrator. This applies not only to situations in which an event

results in the animal's death, but also those resulting in the animal's injury, in which this creature is still being on the road or within the lane, due to its injuries (POLISH JOURNAL OF LAWS 2017/2222). In such a situation, it is necessary to ensure that the cadaver is removed from the road, or that the injured animal is transported to provide the veterinary assistance.

### **Health state of an animal**

In order to determine next procedural stages dealing with the animal-related incidents, the condition of the animal is crucial. In case of a wounded animal, it is necessary to decide whether its treatment is possible, or if an euthanasia is necessary (DAVIES 1989, KIELBOWICZ 2004, LOCKWOOD 2000, ZIMMERMAN 1986). The necessity of the immediate euthanasia means an objective fact that the animal can continue to live only suffering and enduring pain, in adverse prognosis. Moral responsibility is then to shorten the suffering of the animal (POLISH JOURNAL OF LAWS 2017/1840). Such a condition should be ascertained, if possible, by a veterinary surgeon. When the situation on the road enforces a quick action, in order to end the animal's pain, the necessity of euthanasia may be also stated by other entities, including: members of the Polish Hunting Association, members of social organizations protecting animals, police officers, railway security guards, municipal guards, border guards, foresters, National Park's inspectors, State hunting guards, hunting guards, and state fishery guards.

The fact which of the authorized entities shall make such a decision is dependent on various factors, including: the animal's health state and its behavior (eg. aggression that poses a direct threat to human life or health and safety on the road). Regardless of the acting organ, the euthanasia shall be done in a proper way, involving minimum physical and mental suffering. This is done by an anesthetic application (by a veterinary surgeon) or by shooting an animal (by a person authorized to use a firearm – in most cases a police officer) (BENETATO et al. 2011, DAVIES 1989, ELWOOD 2011, FORBES 2004, LOCKWOOD 2000, NEWBERY and MUNRO 2011, POLISH JOURNAL OF LAWS 2017 / 1840, ZIMMERMAN 1986).

If there is no need to immediate decision on animal's life (by shooting), the veterinary surgeon is summoned. After an inspection of the wounded animal, he decides whether to proceed the treatment, or to withdraw from the treatment and conduct the euthanasia (BENETATO et al. 2011, DAVIES 1989, NEWBERY and MUNRO 2011).

In Poland, the municipalities have a legal obligation to develop, accept and implement a Homeless-Animal Care Program and prevent the home-

lessness of animals in their area. This applies also to animals injured in road accidents (PAWELEC 2011). As a part of the implementation of the tasks resulting from the Program, the commune is obliged to provide 24-hour veterinary care (in case of road accidents involving animals and other situations involving the public need of a veterinary treatment). In the contract concluded with the veterinarian, the procedures for dealing with the event of a road accident in which the animal was injured are concretized.

Being notified on the need to travel to a traffic accident, the veterinarian shall immediately proceed to the place of the accident. He is obliged to diagnose, supply the animal and – if the legitimacy of its treatment is recognized – to transport it to an ambulatory or a clinic to carry out the necessary health and life-saving procedures (OFFICIAL JOURNAL OF THE POLISH POLICE HEADQUARTERS 2017/64).

However, with regard to the treatment of wild animals, it is often necessary to transport them to a specialized wild animal rehabilitation center, where treatment and rehabilitation of free-living creatures are conducted, in order to restore them to the natural environment (POLISH JOURNAL OF LAWS 2018/142). Such health centers are created and maintained on the basis of the permission of the General Director for the Protection of Environment. This permission defines, among others, a list of animal species that can be treated and rehabilitated in the mentioned center.

### **Cleaning the road**

If an animal died as a result of a road accident (directly or as a result of a wounded animal's euthanasia), it is necessary to remove a cadaver from the road. From the legal point of view, one is dealing with corpses of animals – this term is defined as dead animals or killed for purposes other than human consumption (POLISH JOURNAL OF LAWS 2017/1855). The administrator of the road is responsible for handling the animal's cadavers. The Public Roads Act (POLISH JOURNAL OF LAWS 2017/2222) states that the manager of national roads is the General Director of National Roads and Motorways; provincial – voivodship's board; *powiat* – *powiat's* management; municipalities – commune head (*wójt*, mayor, or city-mayor). These entities have the obligation to lead the lane to the state of safety for its users, and in which the road order is ensured. Detailed regulations regarding the tasks of the voivodship, *powiat*, commune or General Directorate of National Roads and Motorways specify the responsibilities of managers in this regard.

Duties related to the removal of the effects of a road incident involving an animal are within the scope of the own tasks of the municipalities. They include, i.a., matters of maintaining cleanliness and order (POLISH JOURNAL OF LAWS 2017/1875). The commune is therefore obliged to ensure cleanliness and order in its area, and to create conditions necessary for their maintenance. The catalog of tasks of the commune includes the need to ensure the collection, transport and disposal of animal corpses (of homeless and wild animals) and their parts, as well as co-operation with the companies operating in this field (POLISH JOURNAL OF LAWS 2017/1289).

Due to the fact that depending on the road category, there are various entities responsible for performance of these tasks, it is possible to conclude agreements between managers of particular types of roads. For practical reasons, the management of public roads can be transferred between the administrators, indicating in the agreement the scope of such entrustment and rules for making mutual financial settlements.

The road's administrator is obliged to ensure that the animal corpse is transported to appropriate installations and devices intended for its disposal. Entrepreneurs planning to conduct activities of this kind are required to apply for a permit to the competent authority (in the case of municipalities – to the *wójt*, mayor or city-mayor, in the case of a *powiat* – to the *starosta*, and in the case of the voivodship – to the voivodship's marshal).

Procedures for handling the bio-hazard waste, such as animal corpse, are specified in the Regulation No. 1069/2009 (OFFICIAL JOURNAL OF THE EU 2009/300.1). In practice, the activity of cadavar collecting transporting and disposing of them is carried out by the existing network of private enterprises and business establishments. Road managers conclude relevant agreements under which they entrust to such enterprises tasks related to the removal of animal corpse bodies and its disposal by incineration.

### **Veterinary forensic medicine court experts**

There is a need to detect the causes of a traffic accident in a detailed way, namely its course, consequences and the role of its individual participants, including animals. This is crucial when making a proper legal qualification of an event (collision, traffic accident) and defining the basis and scope of liability, not only punitive, but also in the form of compensation.

Making such arrangements by bodies conducting criminal proceedings requires special knowledge – above average, based on the scientific findings. Therefore, it is often necessary to appoint an expert, not only experts

for reconstruction of an accident, or vehicle-technique experts, but also veterinary medicine experts (HARRIS 1998, LISTOS et al. 2016, SZAREK 2005).

The reasons for appointment of an expert are set out in the art. 193 of the Polish Criminal Procedure Code (POLISH JOURNAL OF LAWS 2017/1904, 2405 and 2018/5, 106, 138, 201), which indicates that the trial body is obliged to consult an expert in any situation where it requires special knowledge. This expert should help in stating the circumstances relevant to the resolution of the case. Special information include such factual or practical knowledge that goes beyond an average skills or knowledge. Therefore, it is not the knowledge available to any adult person with appropriate life experience and education (GABERLE 2010, SZAREK and PRZEŹDZIECKA 2000).

An expert appointment enforces by a decision (issued by the body conducting the proceedings) on admitting an evidence from an expert opinion. It may indicate either an individual expert, or a scientific institute, or a specialist institution (employing proficient specialists). The facilitation for the trial body is the running of judicial expert lists by the regional courts. This list is divided according to particular branches of science, and include data on the specialization of specific experts.

However, it is not only a permanent court expert who is required to be an expert witness, but also any person who has adequate special knowledge and will be appointed in such a capacity by a procedural body (so-called *ad hoc* expert).

In relation to veterinary experts, who assess road accidents involving animals, the procedural bodies appoint mostly permanent court experts. In the decision on the admission of evidence from an expert opinion, the authority indicates, i.a., the subject matter and scope of expertise. If necessary, it also issues specific questions and the date of delivery of the opinion and its form (written or oral). An expert is made available to access the case's files.

The expert's basic duty is to prepare an opinion in the scope, time and form determined by the legal authority. He is obliged to perform his duties with all diligence and impartiality. A properly prepared opinion, meeting all the procedural requirements of the evidence, should be full (exhaustive scope indicated by the authority), clear and internally consistent. Experts can be confronted if they have submitted various opinions in criminal proceedings, which are contradictory in essential elements – in order to clarify these contradictions.

The evidential importance of an expert opinion in criminal proceeding is evidenced by the fact that submitting a false opinion is a crime, punishable by imprisonment from one to 10 years.

## Veterinary forensic research

For comprehensive examinations, whole animal corpses or their fragments are delivered, such as: head, limbs, ribs, spine sections or fragments of muscles without bone elements. It is relevant in scope of the decision on the expert's opinion, to determine the species of the animal and the cause and time of death (HARRIS 1998, LYNN et al. 1994, OTTINGER et al. 2012, PORTER 1971, PROCTOR 2009). This is the data of key importance. It is also important to show whether, based on the attached materials as well as the materials obtained from the post-mortem section, it can be determined whether the death occurred in a dependent manner or independent of human activity (OTTINGER et al. 2012, SZAREK 2005).

To provide assistance and relevant knowledge, it is generally necessary to appoint a team of experts from various fields of forensic sciences (BENETATO et al. 2011, HARRIS 1998, SZAREK 2005). Their task will be to perform external examinations of the evidence, necropsy and laboratory tests. It should be emphasized that the necropsy is supplemented with X-ray and CT scans (BUSZEWICZ and DYLEWSKA 2016, LISTOS et al. 2016.). In turn, as part of laboratory tests, identification and histopathological examinations are performed (LISTOS et al. 2016, MCEVEN 2012).

### Animal corpse necropsy

The purpose of inspecting the evidence is to determine: the species, breed, sex, color, as well as the age of the individual (LISTOS 2016, LOCKWOOD 2000, SZAREK 2005). Specific signs are indicated. In this process, eg., haematomae or ecchymoses in skin and subcutaneous tissue, blood and clots in the nasal cavity, fractures within the teeth, craniofacial bones, limbs and ribs can be found. An important role in determining the causes of death is radiological examination of X-ray or CT. After an external examination, the corpse is opened. It is required to open at least three major body cavities, i.e. skull, abdominal cavity and chest. In the case of animals suffering from traffic accidents, special techniques are used to examine soft tissues and bones of the spine and limbs. After that, internal organs are to be examined. A characteristic image of the changes accompanying a strong injury are, among others: haematomae, bloody infiltration of tissues (mainly skin, subcutaneous tissue and muscles), and bone fractures. If internal examination did not allow to determine the cause of death, additional tests, eg., histopathological examinations are to be carried out (OTTINGER et al. 2012, BANKROFT and GAMBLE 2008).

## Determination of animal species

Specification in the case of delivery of a complete animal corpse for examination is not a problem. Species identification is carried out on the basis of morphological characteristics such as external appearance and characteristic construction features (LISTOS et al. 2016, PORTER 1971, SZAREK and PRZEŹDZIECKA 2000). Identification of a wild boar (*Sus scrofa*) is possible on the basis of bristles covering both the head and distal parts of limbs. In addition, wild boars have black cloven hoofs, while in domestic pigs they are white (MAYER 2009). In the case of animal corpse fragments examination, the determination of the species is based primarily on anatomical structure differences and the appearance of bones, e.g., in the humerus of wild boars there is the supratrochlear foramen (MAYER 2009).

If the macroscopic examination is impossible, laboratory testing is necessary. The first group of tests consists of immunoassays based on the specific reaction of species-specific antigens with appropriate antibodies, e.g., in precipitation. A serum directed against a protein of a particular species causes a reaction that results in a precipitate of the antigen-antibody complex. The precipitation reaction is conducted in an agar gel (MAREK et al. 1964). The disadvantage of this method is the possibility of cross-reactivity or positive reaction of antibodies against antigens from closely related species, e.g., wild boars and pigs.

In turn, the ELISA (enzyme-linked immunosorbent assay) enables the protein detection in the biological material using species-specific polyclonal or monoclonal antibodies conjugated with a suitable enzyme (LEQUIN 2005).

For an identification of animal species also molecular techniques are used. RAPD (random amplification of polymorphic DNA), AFLP (amplified fragment-length polymorphism), and RFLP (restriction fragment-length polymorphism) (LYNN et al. 1994) are rarely used, due to their low reproducibility and interpretation problems.

The development of molecular biology has created new possibilities in terms of both species and individual identification. Used is the fragment of the gene coding the first subunit of cytochrome oxidase (COI, *coxI*) of 648 bp in the genome of the mitochondrial genome (DNA barcoding) (TAVARES and BAKER 2008). This fragment is sufficiently short for sequencing, while it is characterized by low intraspecies variability and a large interspecies variation (YANG et al. 2014). The received and processed data is placed in a special open-access BOLD database ([www.boldsystems.org](http://www.boldsystems.org)) (RATNASINGHAM and HEBERT 2007). It is confirmed that 98% of currently classified species can be distinguished using this method (BENG et al. 2016).

## Conclusions

The road incidents involving animals does often cause serious consequences like emergence of danger on the road, significant material damage to the vehicle, and above all – emergence of the life or health of the driver and other road users (eg. passengers, by-passers). It is also dangerous to animals.

The procedures for dealing with animals involved in road traffic accidents are presented in the present work. They regard both to the human management of injured animals, and the comprehensive assistance of veterinary surgeons as experts in establishing the factual state of an event. The legal provisions, that are constantly evolving, help in this respect, taking into account the wider and more effective protection of animals against suffering inflicted by men.

Translated by Andrzej Dzikowski

Accepted for print 10.05.2018

## References

- BANCROFT J.D., GAMBLE M. 2008. *Theory and practice of histological techniques*. Philadelphia, Churchill Livingstone, Elsevier.
- BENETATO M.A., REISMAN R., MCCOBB E. 2011. *The veterinarian's role in animal cruelty cases*. J. Am. Vet. Med. Assoc., 238: 31–34.
- BENG K., TOMLINSON K., SHEN X., SURGET-GROB Y., HUGHES A., CORLETT R., SLIK J. 2016. *The utility of DNA metabarcoding for studying the response of arthropod diversity and composition to land-use change in the tropics*. Sci. Rep., 6: 24965.
- BUSZEWICZ G., DYLEWSKA M. 2016. *Radiological and forensic veterinary analysis of gunshot cases in eastern Poland*. Med. Weter., 72: 453–457.
- DAVIES E. 1989. *The veterinary surgeon as a law enforcement officer*. Vet. Rec., 124: 101–102.
- ELWOOD R.W. 2011. *Pain and suffering in invertebrates?* ILAR Journal, 52(2): 175–184.
- FELSMANN M.Z., SZAREK J., FELSMANN M., BABIŃSKA I. 2012. *Factors affecting temporary cavity generation during gunshot wound formation in animals: new aspects in the light of flow mechanics; a review*. Vet. Med.-Czech, 57: 569–574.
- FORBES N. 2004. *An exacting science: the veterinary surgeon as expert witness*. In Practice, 26: 503–506.
- GABERLE A. 2010. *Dowody w sądowym procesie karnym. Teoria i praktyka*. Oficyna, Warszawa.
- HARRIS J.M. 1998. *The role of the practicing veterinarian as an expert witness*. Seminars in Avian and Exotic Pet Medicine, 7: 176–181.
- KIELBOWICZ Z. 2004. *Pomoc doraźna i leczenie pourazowych keratopatii u małych zwierząt*. Magazyn Weterynaryjny, 13(87): 29–31.
- LEQUIN R. 2005. *Enzyme Immunoassay (EIA)/Enzyme-Linked Immunosorbent Assay (ELISA)*. Clin. Chem., 51: 2415–2418.
- LISTOS P., GRZYŃSKA M., KOWALCZYK M. 2015. *Analysis of cases of forensic veterinary opinions produced in a research and teaching unit*. J. Forensic Leg. Med., 36: 84–89.
- LISTOS P., GRZYŃSKA M., KOWALCZYK M. 2016. *Badanie pośmiertne w aspekcie weterynarii sądowej*. Życie Wet., 91: 106–109.

- LISTOS P., KOMSTA R., ŁOPUSZYŃSKI W., GRZYŃSKA M., TERESIŃSKI G., CHAGOWSKI W., BUSZEWICZ G., DYLEWSKA M. 2016. *Radiological and forensic veterinary analysis of gunshot cases in eastern Poland*. Med. Weter., 72, 453–457.
- LOCKWOOD R. 2000. *Animal cruelty and human violence: the veterinarian's role in making the connection – the American experience*. Can. Vet. J., 41: 876–878.
- LYNN R., ALFORD C., CASKEY T. 1994. *DNA analysis in forensics, disease and animal/plant identification*. Curr. Op. Biotechn., 5(1): 29–33.
- MAREK Z., JAEGERMANN K., TUROWSKA B. 1964. *Determination of the species's protein content by means of precipitation in an electric field in an agar gel (electroimmunoprecipitation)*. Folia Med. Cracov., 6: 83–91.
- MAYER J. 2009. *Biology of wild pigs: wild pig physical characteristics*. In: *Wild pigs: biology, damage, control techniques and management*. Eds. J.J. MAYER, I.L. BRISBIN. Savannah River National Laboratory, Aiken, USA, pp. 31–50.
- MCEVEN B.J. 2012. *Trends in domestic animal medico-legal pathology cases submitted to a veterinary diagnostic laboratory 1998–2010*. J. Forensic Sci., 57: 1231–1233.
- NEWBERY S., MUNRO R. 2011. *Forensic veterinary medicine: 1. Investigation involving live animals*. In Practice, 33: 220–227.
- OFFICIAL JOURNAL OF THE EU 2009/300.1. Regulation (EC) No. 1069/2009 of the European Parliament and of the Council of October 21<sup>st</sup>, 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No 1774 / 2002 (Animal by-products Regulation).
- OFFICIAL JOURNAL OF THE POLISH POLICE HEADQUARTERS 2017/64. Regulation No. 30 of the Police Commander-in-Chief of September 22<sup>nd</sup>, 2017, on the Road Duties.
- OTTINGER T., GAVIER-WIDEN D., SEGERSTAD C.H., RASMUSSEN B. 2012. *Development of veterinary forensic pathology from crime scene to court*. J. Comp. Pathol., 146: 61.
- PAWELEC K.J. 2011. *Dowody w sprawach przestępstw i wykroczeń drogowych*. LexisNexis, Warszawa.
- POLISH JOURNAL OF LAWS 2017/1260, 1926 and 2018/79, 106, 138, 317. Act of June 20<sup>th</sup>, 1997 on the Road Traffic.
- POLISH JOURNAL OF LAWS 2017/1289. Act of September 13<sup>rd</sup>, 1996 on the Maintaining of Cleanliness and Order in Municipalities.
- POLISH JOURNAL OF LAWS 2017/1840. Act of August 21<sup>st</sup>, 1997 on the Protection of Animals.
- POLISH JOURNAL OF LAWS 2017/1855. Act of March 11<sup>th</sup>, 2004 on the Protection of Animal Health and Animal Infectious Diseases Combat.
- POLISH JOURNAL OF LAWS 2017/1875. Act of March 8<sup>th</sup>, 1990 on Municipal Self-Government.
- POLISH JOURNAL OF LAWS 2017/1904, 2405 and 2018/5, 106, 138, 201. Act of June 6<sup>th</sup>, 1997. The Criminal Procedure Code.
- POLISH JOURNAL OF LAWS 2017/2204. Act of June 6<sup>th</sup>, 1997, The Criminal Code.
- POLISH JOURNAL OF LAWS 2017/2222. Act of March 21<sup>st</sup>, 1985 on the Public Roads.
- POLISH JOURNAL OF LAWS 2018/142. Act of April 16<sup>th</sup>, 2004 on the Environmental Protection.
- PORTER A.R.W. 1971. *The veterinary surgeon as a witness*. Vet. Rec., 89: 505–509.
- PROCTOR K.W., KELCH W.J., NEW J.C. JR. 2009. *Estimating the time of death in domestic canines*. J. Forensic Sci., 54: 1433–1437.
- RATNASINGHAM S., HEBERT P. 2007. *BOLD: the barcode of life data system*. Mol. Ecol. Not., 7: 355–367.
- SZAREK J. 2005 *Lekarz weterynarii jako biegły*. Wydawnictwo Uniwersytetu Warmińsko-Mazurskiego, Olsztyn, Poland.
- SZAREK J., PRZEŹDZIECKA D. 2000. *Lekarz weterynarii jako biegły sądowy*. Magazyn Weterynaryjny, 9: 50–51.
- TAVARES E., BAKER A. 2008. *Single mitochondrial gene barcodes reliably identify sister-species in diverse clades of birds*. BMC Evol. Biol., 8(1): 1.
- WITKOWSKA K. 2013. *Ogłędziny. Aspekty procesowe i kryminalistyczne*. Wolters Kluwer, Warszawa.

- ZIMMERMAN M. 1986. *Physiological mechanisms of pain and its treatment*. Klinische Anaesthesi-ol. Intensivether., 32: 1–19.
- YANG L., TAN Z., WANG D., XUE L., GUAN M., HUANG T., LI R. 2014. *Species identification through mitochondrial rRNA genetic analysis*. Sci. Rep., 4: 4089.