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EVALUATING THE IMPACT OF FISHING HOOKS ON COMMON CARP (*Cyprinus carpio* Linnaeus, 1758): IMPLICATIONS FOR ANIMAL WELFARE PRACTICES

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Abstract

Fishing hooks remain a fundamental tool in recreational angling, particularly in carp fishing, where concerns about welfare are increasingly relevant in catch-and-release practices. This study aimed to assess and classify puncture lesions caused by fishing hooks in Cyprinus carpio across six intensively fished Romanian recreational lakes. Between March 2022 and March 2023, 92 carp specimens were captured using standardized rigs and hook sizes (6 and 8) during routine angling sessions. Hook placement and lesion severity were recorded through immediate post-capture photography and categorized as superficial, deep, or penetrating, based on veterinary surgical criteria. Lesions were anatomically grouped into four regions: upper lip, lower lip, commissures, and areas adjacent to the mouth. The majority of lesions (60%) were deep, followed by penetrating (28%) and superficial (12%). Most hook-related injuries were located on the lower lip (52%) and mouth commissures (38%), with significantly fewer on the upper lip (6%) and surrounding areas (4%). A Chi-Square test revealed a statistically significant non-uniform distribution of lesion anatomical landmarks ($P < 0.0001$). The lesion pattern is likely influenced by carp feeding behaviour and rig mechanics. These findings underscore the need to consider anatomical and behavioural factors when developing more welfare-conscious angling practices in managed carp fishing sport or recreational facilities.

Key words*: angling, aquaculture, lesion, oral cavity, recreational fishing.*

INTRODUCTION

Fishing has been an integral part of human activity since the earliest stages of our evolution, serving not only as a primary food source but also as a foundation for trade and social behavior (Gartside & Kirkegaard, 2004). As one of the oldest human occupations, fishing has evolved from unselective gathering to more systematic and purposeful practices (Sahrhage & Lundbeck, 1992). By the time early civilizations began documenting their knowledge, many of the fundamental fishing techniques, such as the use of spears, nets, lines, and rods - had already reached forms that closely resemble those used today. These methods were present as early as 3500 BC in ancient Egypt (Gartside & Kirkegaard, 2004).
Fishing hooks, essential to line-based methods, have a long and varied history. Archaeological evidence from the Maglemosian period reveals early hooks crafted from bone, horn, or wood, initially without barbs but designed with terminal enlargements to secure them to lines (Sahrhage & Lundbeck, 1992). Modern hooks, by contrast, are typically manufactured from high-carbon steel, vanadium-alloyed steel, or stainless steel and are coated to resist corrosion (www.historyoffishing.com). Despite technological advancements, the fundamental purpose of hooks, to capture fish by penetration, remains unchanged (Edappazham et al., 2007).

Among traditional techniques, rod fishing stands out for its selectivity and low energy consumption, making it especially suitable for targeting species with localized populations. The hook remains the central component of any rod-based fishing system (Edappazham et al., 2007). One species that has gained prominence in recreational and sport fishing is the common carp *Cyprinus carpio*. Particularly in the United Kingdom, parts of Europe, and increasingly in Romania, carp fishing has developed into a specialized sport. Enthusiasts pursue large carp as trophy fish, and entire competitions are now dedicated to this species (Jakub, 2021).

However, the physiological impact of fishing practices on carp, especially the effects of hook lesions on the oral cavity, remains poorly understood. Scientific literature offers limited data on the classification and description of wounds and injuries caused by various hook types, despite the wide range of shapes and sizes used in carp fishing (Alós et al., 2008; Rapp et al., 2008). Furthermore, there is a growing need to consider fish welfare in managed angling environments, particularly where intensive, year-round sport fishing is practiced (Cooke & Sneddon, 2007). These concerns extend beyond environmental conditions to include the long-term consequences of repeated capture and hook lesions resulting from catch-and-release fishing (Thompson et al., 2018).

Therefore, the present study aims to evaluate and classify the puncture lesions caused by fishing hooks on *Cyprinus carpio* in six managed fisheries dedicated to recreational and sport fishing. These facilities have been operational for over five years and experience high angling pressure throughout all four seasons. By monitoring injuries/lesions across these sites, this study seeks to provide a clearer understanding of the impact of hook use on carp welfare and to contribute to the development of best practices in sustainable sport fishing.

MATERIALS AND METHODS

The experiment was conducted between March 15, 2022, and March 15, 2023. Common carp *Cyprinus carpio*, Linnaeus 1758 specimens were captured during recreational angling sessions from six different angling facilities from Romania: Hunedoara County (3 facilities), Alba County (1 facility), Bihor County (1 facility), Cluj County (1 facility). Each captured specimen was photographed immediately to assess hook placement (i.e., puncture location). Additionally, the fish were examined for signs of previous lesions caused by earlier encounters with fishing hooks, such as chronic puncture lesions or scars. Lesion classification followed the criteria established in veterinary surgical manuals (Muste, 2010; Beteg, 2020) from the University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca. Lesions caused by hook penetration were categorized into three types:

- Superficial lesions;
- Deep lesions;
- Penetrating lesions;

Lesion locations were grouped anatomically as follows (Figure 1):

- Upper lip;
- Lower lip;
- Commissures (mouth corners);
- Areas adjacent to the oral cavity.

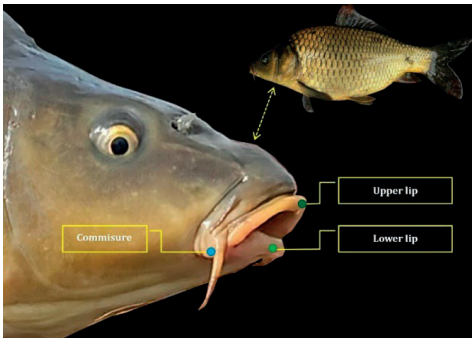

Figure 1. Common carp head detail: anatomical landmarks most susceptible to hook-induced lesions (original)

Method of fishing

Rig configuration: single J-type, wide-gape hooks (sizes 6 and 8), each equipped with a single bait (8 mm pop-up or 16-20 mm boilie); braided hooklink with a diameter of 0.14-0.20 mm; rig length approximately 10 cm (±1 cm). The rig was attached to 80 g method feeder or an ecological lead.

Chronic lesions (healed wounds from previous hook lesions) were also recorded and classified

accordingly. No atonic puncture lesions were observed during the study. All data were grouped and processed using Microsoft Excel (version 2016). Statistical analysis was performed using GraphPad Prism 8. A Chi-Square test ($P < 0.05$) was conducted to evaluate whether the distribution of lesions across the oral regions differed significantly from a uniform distribution. The null hypothesis (H_0) assumed that lesions are uniformly distributed within the mouth area, while the alternative hypothesis (H_A) posited a non-uniform distribution.

RESULTS AND DISCUSSIONS

A total of 92 *C. carpio* specimens were captured from six recreational angling facilities (comprising lakes and managed ponds). Each fish was photographed immediately post-capture to document hook placement and categorize the associated lesions. Following data collection, all individuals were released back into the water. Following the ethical guidelines and regulatory requirements of the angling facilities, any visible lesions were treated on-site using an antiseptic spray prior to release.

Having an omnivorous and opportunistic benthic feeding behavior, the common carp feeds on insects, larvae, mollusks, worms, zooplankton, algae, detritus or aquatic plants and seeds. The mouth of *C. carpio* is a subterminal, protractile and adapted for bottom-feeding. It is capable of extending forward, which allows the fish to suction-feed and manipulate food items from the substrate (Froese & Pauly, 2025).

Distribution of (chronic) lesions caused by fishing hooks

Regarding the areas of lesions caused by fishing hooks in the present experiment, it can be observed that the main area where the hook was set was the lower lip (52%), followed by the mouth commissures (38%), and the least affected areas were the upper lip (6%) followed by punctures that occurred in the vicinity of the oral cavity - other area (4%) (Figure 2). In a similar study (Kapusta, & Czarkowski, 2022) the upper lip and the mouth commissure were considered safe hooking landmarks for cyprinids.

Surgical classification on the observed lesions

From a surgical perspective, the lesions observed in the experiment were distributed as follows: deep tissue lesions were the most frequently encountered, accounting for 60% of all cases. These were followed by penetrating lesions, which comprised 28% of the total lesions. Only a small proportion of specimens exhibited superficial lesions (12%), as illustrated in Figure 3. Deep and penetrating lesions often involve significant tissue trauma, posing a greater risk of infection and long-term physiological impact. In many instances, scarring caused by fishing hooks leads to permanent tissue alteration, especially in fish released in catch-and-release facilities, where repeated captures may compound lesion severity (Meka, 2004). The depth and nature of hook-induced lesions are influenced by several interrelated factors, including hook size, type (e.g., barbed vs. barbless), the specific rig configuration, and the angler's behavior during the hook-set phase (Czarkowski & Kapusta, 2019). Angler experience also plays a critical role in determining the force and precision with which the hook is set, potentially minimizing or exacerbating tissue trauma (Lennox et al., 2015). A better understanding of these variables can inform more welfare-oriented practices in recreational and experimental fishing, guiding both rig design and fish handling protocols to reduce post-release morbidity and enhance survival outcomes (Czarkowski et al., 2023).

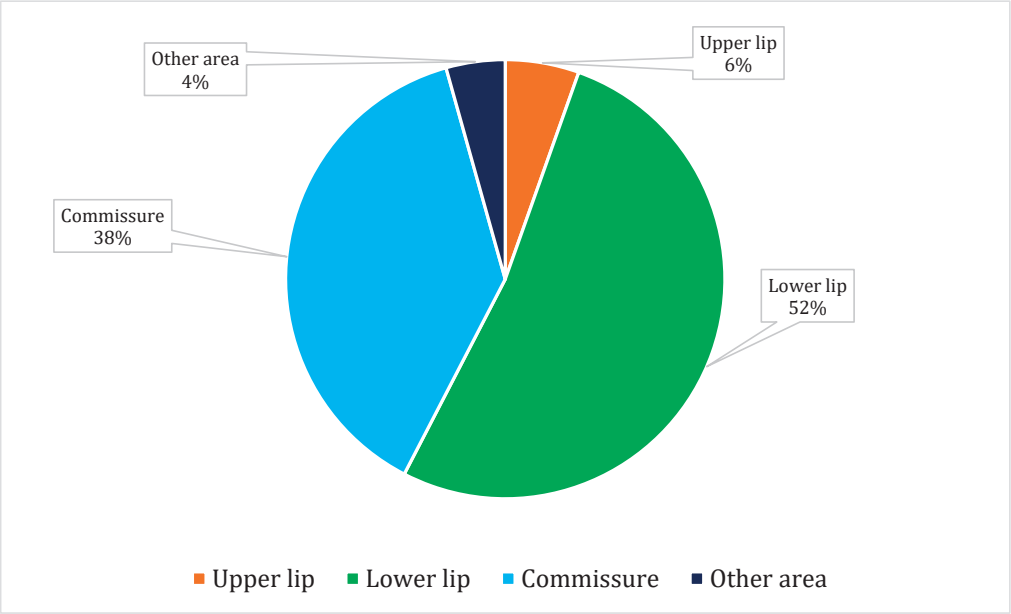

Figure 2. The distribution of anatomo-topographic landmarks of lesions produced by fishing hooks

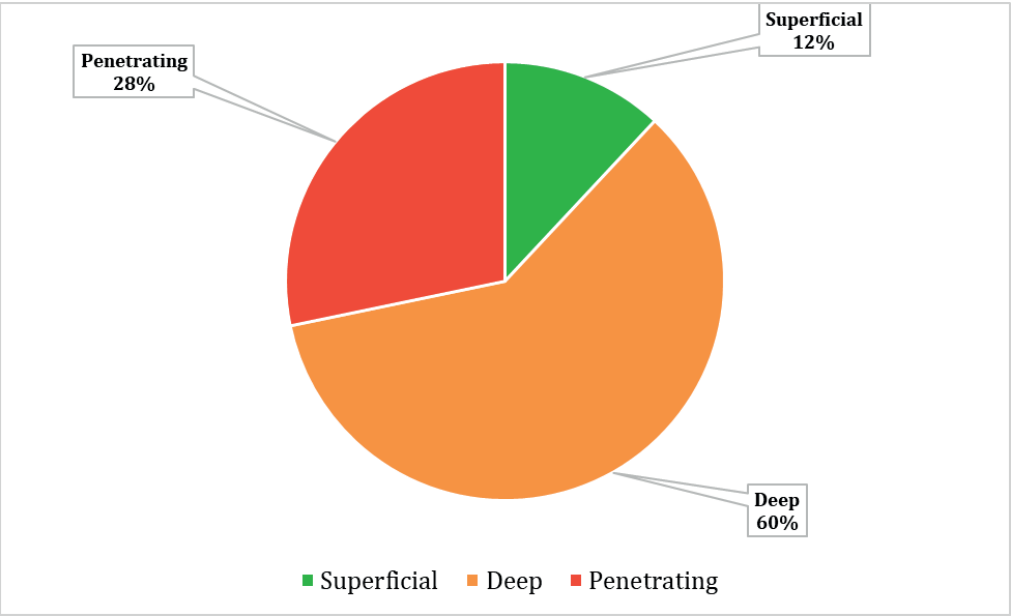

Figure 3. Classification of lesions based on surgical practices

From a veterinary surgical perspective, the puncture lesions observed in this study can be classified based on their depth and severity into three main categories. The majority of lesions (60%) were identified as deep lesions, characterized by damage extending beyond the superficial epithelial layers into the underlying connective tissues, yet without full transfixion of the oral structures. These lesions often suggest significant mechanical force at the time

of hook engagement and are more likely to be associated with inflammatory responses or delayed healing if not properly treated. Penetrating lesions accounted for 28% of the observed cases and were defined by full-thickness lesions that may breach the mucosal barrier and potentially involve adjacent anatomical compartments, posing a higher risk for secondary infection and tissue compromise. The least frequent lesion type, representing 12% of the sample, consisted of superficial lesions confined to the mucosal surface. These are generally considered minor and carry a lower risk of long-term tissue damage or behavioural alteration. This distribution of lesions types underscores the varying degrees of tissue trauma associated with recreational angling and highlights the importance of minimizing deep and penetrating lesions to enhance post-release welfare in *C. carpio*.

Figure 4 presents the results of the Chi-Square test, which indicate a statistically significant deviation from a uniform distribution of lesions across the oral region (χ^2, $P < 0.0001$), leading to the rejection of the null hypothesis. The observed pattern of lesions reveals that most hook-induced lesions are localized on the lower lip and the mouth commissures.

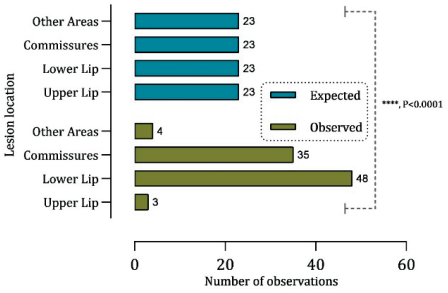

Figure 4. Anatomical topography of the observed lesions

CONCLUSIONS

The results of this study highlight a clear pattern in the distribution and severity of lesions caused by fishing hooks in *Cyprinus carpio*. Over 50% of the observed lesions were located on the lower lip, followed by a significant proportion (38%) at the lip commissures. Lesions to the upper lip accounted for only 6%, while the lowest incidence was recorded in areas outside the oral cavity, such as the operculum, nostrils, and barbels. The predominance of hook penetration in the lower lip of *C. carpio* could be attributed to a combination of anatomical, behavioural, and mechanical factors. As a benthic feeder, the common carp typically forages along the substrate with its head angled downward, utilizing its sub-terminal and protractile mouth to suction in food items. This feeding position/posture naturally positions the lower lip as the initial point of contact with baited hooks (hair rig in this case). Additionally, modern angling techniques (especially the use of hair rigs and in-line lead systems) are designed to optimize hook engagement during bait expulsion. This may cause the hook to rotate and lodge preferentially in the lower lip. From an anatomical perspective, the lower lip presents a structurally firmer and more protrusive surface compared to the upper lip, offering greater resistance to hook penetration and improving the likelihood of secure anchorage.

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