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## **THE ENVIRONMENTAL SIGNIFICANCE OF PRODUCING LEATHER FROM FISH SKINS**

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### **Аннотация**

Мақолада балиқ териси (айниқса Африка лаққаси, *Clarias gariepinus*) дан чарм олишнинг экологик аҳамияти ва саноат учун долзарблиги асосланади. Балиқ териси — ёнаки ресурс бўлиб, ундан фойдаланиш атроф-муҳитга чиқиндиларни тушишини камайтиради. Сутэмизувчи терисига нисбатан жун ажратиш босқичи талаб этилмайди, кимёвий материалар тури камайиб, материалнинг ўзига хос меряси сақланади.

**Калит сўзлар:** Балиқ териси, Африка лаққаси (*Clarias gariepinus*), ёнаки ресурс, экологик таъсир, тери топографияси, ассортимент, чиқиндини камайтириш.

### **Аннотация**

В статье обоснованы экологическая значимость и отраслевой актуальность получения кожи из рыбьей кожи (в частности, африканского сома, *Clarias gariepinus*). Рыбья кожа является побочным ресурсом; её вовлечение снижает поступление отходов в окружающую среду. В отличие от шкур млекопитающих этап депиляции не требуется, сокращается спектр применяемых химических материалов, при этом сохраняется характерный рисунок (текстура) материала.

**Ключевые слова:** кожа рыбы, африканский сом (*Clarias gariepinus*), побочный ресурс, экологическое воздействие, топография кожи, ассортимент, сокращение отходов.

### **Abstract**

The article substantiates the ecological significance and industrial relevance of producing leather from fish skin (in particular, African catfish, *Clarias gariepinus*).



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Fish skin is a by-product resource; its utilization reduces the release of waste into the environment. Unlike mammalian hides, no depilation stage is required and the range of chemicals used is reduced, while the material's characteristic pattern (texture) is preserved.

**Keywords:** fish skin, African catfish (*Clarias gariepinus*), by-product resource, environmental impact, skin topography, product range, waste reduction.

Historically, natural leather has mainly been obtained from the skins of mammals and other terrestrial animals. Processing fish skin was traditionally practiced as a craft in certain regions with developed fisheries, and these skills have been preserved at the artisanal level [1]. At the same time, large-scale industrial production of leather from fish skin has not become widespread.

Fish skin is the largest organ of the animal body and, depending on the species and age, can account for 12–24% of total body mass. Studies of fish by-products show that the combined share of skin, bone, and scales is about 30% of body weight [2]. Therefore, fish skin makes a significant contribution to the volume of waste generated by the fish-processing industry.

Under current conditions, ecological safety is a priority, and it is necessary to expand the efficient use of recyclable resources. In fish production, bones, scales, and in some cases, skin are routinely discarded (fig.), causing environmental pollution. For this reason, the leather industry is actively studying fish skin as a new type of leather raw material in order to expand the range of exclusive products. Fish skin stands out for its distinctive pattern and high wear resistance, which are associated with the dense arrangement of collagen fibers [3].

Environmental sustainability in processing fish skins can be supported in two ways:

- (1) fish skin is a by-product of the fish industry that uses raw materials which would otherwise be unused, and clean hydro- and geothermal technologies can be employed in production;
- (2) Tanning and dyeing processes applied to fish skins are generally less harmful to the hide and the atmosphere than those used for mammalian hides. Because there is no hair, the depilation step with strong chemicals is unnecessary; scales can be removed without chemical depilation.

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It should be emphasized that the application of advanced technologies to produce leather from the skins of aquatic animals helps the fashion industry reduce its environmental impact in the following ways:

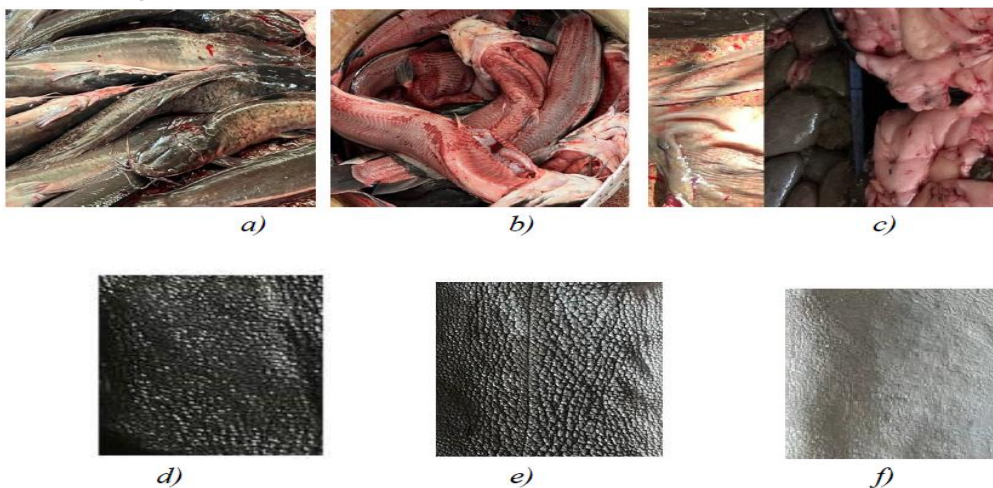
Fish skin is recovered from waste, so no “new” raw material is specially cultivated for its production, which saves natural resources and prevents additional emissions and pollution;

It is a natural, sustainable, and biodegradable product;

There are no end-of-life disposal problems since fish skin decomposes and returns to nature;

Raising cattle for the leather for the leather and meat industries—which consumes large land areas, energy, and additives and can contribute to deforestation - fisheries do not require land clearing.

The topography of fish skin, like that of mammalian hides, describes its anatomical structure by zones with different properties. The main parts are: the sides (the most valuable), the back (dorsal) part (higher density), the neck part (lower density), the tail part, and the skirt (belly) part; these zones are selected for different purposes in manufacturing.



a) African catfish; b) African catfish cleaned of by-products; c) waste generated during cleaning of African catfish; d) leather from the back (dorsal) part; e) leather from the side; f) leather from the skirt (belly) part.

Fig. African catfish, waste generated after cleaning, and leather samples obtained from its skin



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As can be seen from the figure, the topographic parts of African catfish skin have different qualities, and producing leather from it not only creates conditions for near-zero-waste technology, but also enables the production of an exclusive assortment of leather goods with diverse properties. In particular, during the cleaning step, the raw skin is freed from extra tissues and sent to subsequent processing; if the organic wastes generated in this process are properly managed, the overall ecological footprint is reduced. The back is suitable for products requiring dense structure and strength (e.g., durable equipment covers, accessories); the sides, due to their unique pattern and mechanical balance, are convenient for premium assortments (footwear, bags, gloves, accessories); and the skirt is used for light and flexible applications (small accessories, coverings, applications). Thus, topography-based selective processing expands the product range and supports the creation of low-waste technologies.

Undoubtedly, fish skin—especially the skin of African catfish (*Clarias gariepinus*)—is a valuable and environmentally preferable resource for industry. Fish skin is a by-product resource of the fish industry; its processing converts waste into value in line with the principles of the circular bioeconomy and reduces the ecological footprint.

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