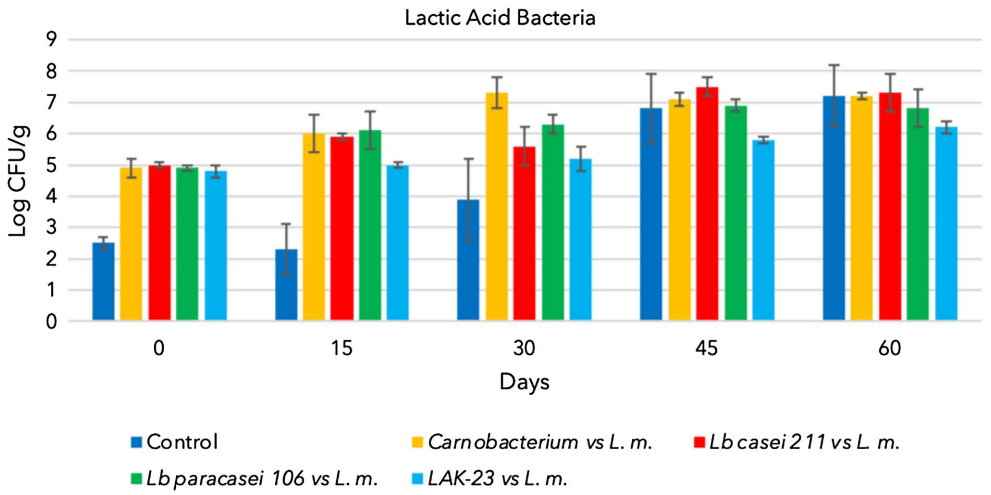

FIGURE 2 | Evolution of lactic acid bacteria in cold-smoked sea bass with or without bioprotective starter added, stored at 6 ± 2°C.

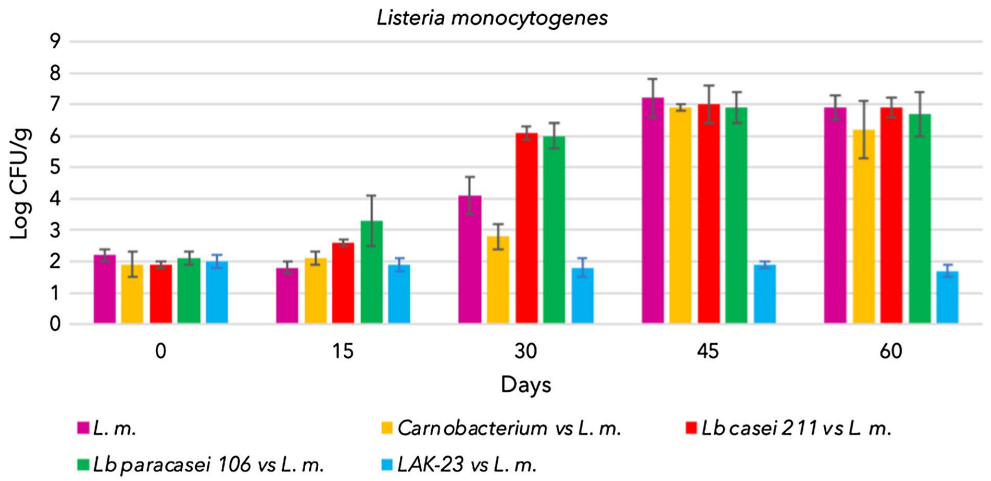

FIGURE 3 | Evolution of *Listeria monocytogenes* intentionally inoculated in cold-smoked sea bass with or without bioprotective starter added, stored at 6 ± 2°C.

malonaldehyde/g. Consequently, all samples of cold-smoked sea bass were considered acceptable, given the low TBARS values. Moreover, the tasters in the panel did not perceive hints of rancidity.

Cold-smoked seabass is a fishery product that, at the end of production, is usually free from *L. monocytogenes*. However, in the case of contamination in the production chain, this pathogen can multiply during the product shelf life. In fact, cold-smoked seabass shows the ideal growth characteristics for *L. monocytogenes*: a pH > 5, as shown by the physicochemical analysis carried out in this study, and an Aw of approximately 0.96, as also reported in a study conducted by Aymerich et al. (2019) in cold-smoked salmon. Even the storage temperature plays a fundamental role. In general, cold-smoked sea bass is a ready-to-eat (RTE) product that needs to be stored constantly at +4°C. However, it is possible that during its shelf life, the product could face thermal abuse, further supporting the growth of *L. monocytogenes*. In our study, this condition was tested by keeping the seabass at 6 ± 2°C for the entire period (60 days).

In addition to the pH, Aw and temperature, the salt content is also important. Cold-smoked seabass, similar to other similar products, has a salt content of 3.5% (NaCl), but this level is not enough to limit *L. monocytogenes* growth since the pathogen can easily multiply in matrices containing up to 10–12% NaCl. As demonstrated by Vaz-Velho et al. (2005), variation in the salt content of smoked fish samples is unlikely to affect *L. monocytogenes* growth.

Therefore, the use of the selected LAB as bioprotective starter cultures presents a valid way to prevent or limit the development of pathogens such as *L. monocytogenes*. *L. monocytogenes* was reduced in whole milk by different *Lactobacillus* strains

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