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Nationwide survey of the Bulgarian market highlights the need to update the official seafood list based on trade inputs

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CONTROL CONTROL

Nationwide survey of the Bulgarian market highlights the need to update the official seafood list based on trade inputs

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| 25 | Abstract |
| 26 | An extensive survey of the Bulgarian seafood market was conducted to assess the diversity of |

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fish products available and to compare the provided commercial designations (CDs) and scientific 27 names (SNs) on the products with those on the Bulgarian official seafood designations list, in light 28 of the requirements of Regulation (EU) No. 1379/2013 on seafood labelling. The survey was 29 conducted in 15 different towns belonging to three different geographical macro-areas: North, 30 North-east/South-east and South/South-west. Seventy-one points of sale, including both large and 31 local retailers, were included in the study. In total, 1611 different products were recorded on the 32 market, mostly comprising fresh, frozen and canned fish. Analysis of the product designations 33 showed the presence of 110 different CDs, most of which (n=43, 39.1%) were not associated with 34 any SN. Forty-seven (42.7%) of the 110 CD were compliant with the current EU legislation on 35 seafood labelling, reporting a descriptive common name. A highly significant difference was found 36 in the percentages of non-compliant designations of fresh (57.3%) and frozen (3.9%) product 37 categories (p-value < 0.00001). Overall, the main concerns highlighted regarded the presence on the 38 39 market of CDs and SNs not included in the official list, thus highlighting the ineffectiveness of the list in supporting fish traceability. CDs already accepted at retail and currently applied throughout 40 41 the country could represent a starting point to propose an update of the list based on trade inputs, as 42 established by the Regulation (EU) No. 1379/2013.

43 Keywords

44 Common Fisheries Policy, Seafood labelling, Bulgaria, Commercial designations, EU seafood
45 market

46 **1. Introduction**

Traceability is defined as the ability to trace and follow a food product through all stages of production, processing and distribution, in order to guarantee its forward and backward tracking through the supply chain and control safe and fair trade (Regulation EC No. 178/2002). Preserving the integrity of a traceability system is a complex and challenging endeavour especially in the seafood sector, which is recognized as the third-highest risk food category exposed to illegal practices (Reilly, 2018). Fraudulent incidents within the seafood sector primarily involve species

substitution and counterfeit and are generally elicited by inaccurate labelling or utilization of vague
or unclear commercial designations. Their occurrence, other than having a general impact on the
supply chain, affects the marine environment and possibly consumers' health (Reilly, 2018, Giusti et
al., 2018; Stawitz et al., 2017).

The Common Fisheries Policy (CFP) of the European Union (EU) was established to create an 57 effective system to monitor fishery and aquaculture sustainability and constitutes a legislative 58 framework to control seafood authenticity and enhance consumer protection and market 59 transparency. In particular, with the enactment of the Regulation (EU) No. 1379/2013, specific 60 attention was paid to the establishment of a harmonized and compulsory seafood labelling model to 61 enable informed consumer choice (D'Amico et al., 2016). More specifically, with respect to the 62 attribution of product trade names, the single Member States are required to draw up, publish and 63 periodically update a list of the commercial designations (CDs), associated with their scientific 64 65 names (SNs), accepted in their territory. According to the Article 37 of the aforesaid Regulation, the officially accepted CD may be the name of the species in the official language or languages of the 66 67 Member State concerned or, where applicable, any other name accepted or permitted locally or regionally. SNs are instead assigned in accordance with the FishBase Information System (Froese 68 and Pauly, 2000) or the Food and Agriculture Organization (FAO) Aquatic Sciences and Fisheries 69 Information System (ASFIS) database (Garibaldi & Busilacchi, 2002). On the basis of Regulation 70 (EU) No. 1379/2013, the single Member States are explicitly called upon to update their list on the 71 basis of trade inputs and in response to the expansion of the variety of species, present, in transit or 72 permanently introduced on the national market. The update is essential to guarantee the clear 73 recognition of the products by consumers and the harmonization of commercial designations within 74 national borders. The Regulation also specifies that any change to the list has to be communicated 75 76 to the Commission, which is responsible for informing the other Member States. However, since the national lists are compiled independently, this delegation system leads to a disparity in information 77 and number of designations between the lists of the different Member States. For this purpose, the 78

Commission has initially provided an information system gathering all the official national lists accepted in the Member States. A multilingual tool has also been created to facilitate the comparison of all the lists (the lists and the multilingual tool are available at the following links https://ec.europa.eu/fisheries/cfp/market/consumer-information/names_en and

83 https://mare.istc.cnr.it/fisheriesv2/home_en).

Even though the seafood sector still represents a marginal area of the Bulgarian economy, a 84 gradual and progressive growth has been observed in the last years. In fact, seafood consumption 85 estimates have gradually increased from 3 kg per capita in 1990-2000s to 4.9-5 kg per capita in 86 present days (EUMOFA, 2018; Todorov, 2019). In this respect, the number of species available for 87 purchase has consistently increased together with product imports and aquaculture rates, in spite of 88 a slight decrease in domestic Black Sea catches (Todorov, 2019; Stancheva, 2018). Currently, the 89 Bulgarian consumers' choice is widened by local marine and freshwater products (sprat, red mullet, 90 91 goby, turbot, carp, perch) and mid- and high-end marine and freshwater products, such as cod, hake, mackerel, salmon, tuna, trout and catfish, mainly deriving from European and international trade, 92 93 as well as from recently developed Bulgarian aquaculture plants (Todorov, 2019). Despite this, the 94 Official Bulgarian list first published in 2006 (Ministry of Agriculture and Forestry, 2006) and based on the principal commercial species available at that time on the national market, has never 95 been updated. The recent work of Tinacci et al., (2018), aimed at identifying fish species sold on the 96 Bulgarian market by DNA barcoding, highlighted that the Bulgarian list does not fully correspond 97 with the actual variety of fish species sold within the national territory. 98

99 This considered, in the present study, a nationwide market survey aimed at assessing the current 100 fish products availability on the Bulgarian market and at comparing the CDs and SNs found on the 101 products with those on the Bulgarian official seafood list, was conducted. Data arising from the 102 survey were analysed and used to propose a functional update of the Bulgarian official list of 103 seafood designations based on trade inputs.

104 **2. Materials and Methods**

2.1 Selection of survey geographical areas and retail channels 105

In order to perform an extensive market survey throughout the national territory, the country was 106 preliminarily divided into three macro-areas based on the classification proposed by Popescu (2011) 107 and corresponding to: 1) North region (NR) bounded externally by the course of Danube, 2) North-108 east to South-east region (NE-SER) mainly extending along the Black Sea coastline and partially 109 overlooking the border with Turkey 3) South to South-west region (S-SWR) including the Country 110 capital city and overlooking the border with Greece (Figure 1). Then, 15 provincial capital cities 111 (five per macro-area) were selected for the survey according to their size and to the presence of 112 fishery and/or aquaculture activities. In particular, Vidin, Pleven, Veliko Tarnovo, Ruse, Silistra 113 were selected for the NR, Dobrich, Shumen, Varna, Sliven, Burgas for the NE-SER and Kardjiali, 114 Haskovo, Plovdiv, Blagoevgrad, Sofia for the S-SWR. 115

The selection of the retail channels was carried out through a preliminary online search 116 117 highlighting a variable distribution of large and local fishery retailers according to fishery and aquaculture activities relevance within the three macro-areas (Popescu, 2011). The following retail 118 119 channels to the final consumers (as defined by the Article 5 of the Regulation (EU) No. 1379/2013) 120 were included in the survey: large-scale retail trade, local grocery stores and local fish markets located in each selected city. Restaurants, caterers, and ready to eat local vendors were not included. 121 Seventy-one points of sales consisting of 49 wholesale markets, hypermarkets and supermarkets 122 belonging to four different large retail chains, 11 local grocery stores and 11 local fish markets were 123 finally selected (Table 1). 124

125

2.2 Data collection and analysis

During the survey, carried out from April to July 2019, all the fish products presented on sale 126 within each point of sale were checked. In particular, the product category (fresh, frozen, canned, 127 marinated, breaded precooked, dried, alive fish, smoked, salted) as well as the CD and the SN were 128 recorded for each product and organized in an excel sheet. The data were subsequently analysed to: 129 1) calculate the total number of products and the number of products for each category for 130

distribution channel and per macro-area; 2) perform a descriptive analysis of the CDs; 3) calculate
the total number of designations (commercial and scientific) used for describing the products and
the CD frequency rates. In addition, compliance with the requirements of the Regulation (EU) No.
1379/2013 was also assessed.

135 **2.3** Statistical analysis

Statistical analyses were performed using chi-square test (SPSS for Windows, Version 16.0. Chicago, SPSS Inc.) and the significance assessed at p<0.05. The following parameters were compared: 1) proportions of sample typologies across areas and retail channel types; 2) proportions of CD compliances; 3)proportions of CD- and SN- identified samples were compared across areas, retail channel types and sample typologies.

141 **3. Results and discussion**

142 **3.1** Products by area and retail channel.

In the survey, 1611 different seafood products were recorded, with an overall average number of 143 22.7 different products per vendor with slight differences within the three surveyed macro-areas 144 (24.4 in NE-SER, 22.4 in S-SWR and 20.7 in NR). Highly significant differences ($\chi^2 = 78.9$, 145 p<0.001) were found in the overall number of products within each category sold at different retail 146 channels (large retail, local grocery and local fish market) included in the survey. The highest 147 number of products was observed in large retail channels (n=1281 products, 79.6% of total 148 products)in which all product categories were sold, whereas fewer products were observed in fish 149 markets (n=178, 11%) and grocery stores (n=152, 9.4%). This distribution trend is plausibly related 150 to the significant turmoil that the Bulgarian retail sector has experienced in the latest years, with the 151 domestic supermarkets chains and local grocery distribution downscaling their business in favour of 152 large hypermarkets and supermarket chains belonging to foreign companies (Export Enterprises SA, 153 154 2019). This is also confirmed by the fact that the large-scale retail trade was widely and homogeneously distributed within the national territory, while local grocery stores and fish markets 155 were mainly concentrated in the NE-SER cities (Table 1), especially along the coast. 156

With regards to products categories, fresh fish made up the largest proportion of the products (n= 157 596, 37%), followed by canned fish (n=473, 29.4%) and frozen products (n=405, 25.1%). The other 158 categories (marinated, breaded precooked, dried, alive fish, smoked, salted) were less or marginally 159 observed (Table 2). These outcomes agree with a recent survey conducted by Stancheva, (2018) 160 which showed that Bulgarian consumers seem primarily orientated towards fresh/frozen and tinned 161 products. Nonetheless significant differences among the product number per categories among the 162 three macro-areas were observed (χ^2 = 14.8, p<0.01) (Figure 2 and Table 1SM). In fact, in NE-SER, 163 a relevant increase in the mean percentage of fresh products per vendor (42%) and a decrease in 164 canned products percentage (26%), compared to the overall rate, were highlighted. The higher 165 prevalence of fresh products recorded in the five cities included in NE-SER (Dobrich, Shumen, 166 Varna, Sliven, Burgas) could be explained by virtue of their fishing activity and the presence of 167 recently growing marine aquaculture plants. Therefore, this outcome could be plausibly attributed to 168 169 the local catching activities and to the growing need to diversify the market offer in relation to the rise of Bulgarian restaurant sector and seafood demand on the Black Sea coastline (Todorov, 2019; 170 171 FAO, 2020). Considering the remaining categories, the average frequency rate appeared stable within the three macro-areas except for salted products, only marginally recorded during the survey 172 and not found in NE-SER (Figure 2; Table1SM). 173

174 3.2. CDs recorded on the market and compliance with the Regulation (EU) No. 1379/2013.

175 *3.2.1 Descriptive analysis of the CDs.*

Seventy-one of the 110 CDs (65.4%) consisted only of a common name referring to a group of
species (e.g. Сьомга/Salmon; рибаТон/Tuna fish; Треска/cod, Хек/hake). In other 22 of 110 CDs
(20%) the name was accompanied by an adjective referring to the geographical origin (e.g.
Атлантическа сьомга/Atlantic Salmon; Норвежка сьомга/Norway salmon), in 11 CDs (11%) by
an adjective related to a specific morphological character (e.g. Червена сьомга/Red salmon;
Розова сьомга/Pink salmon), while the remaining 6 CDs were general terms, terms referring to the

product processing, terms not related to any specific products or terms referring to specifictraditional specialties.

Bulgarian commercial designations were used for 89% (98/110) of the terms collected from the 184 market. In the remaining 11% (12/110), terms of Russian (n=6 CDs), Ukrainian (n=4 CDs), Greek 185 (n=1 CD) and Portuguese (n=1 CD) origin were found. In particular, the Russian terms referred 186 both to freshwater (Сулка/Pike perch) and marine fish (Сельодка/herring: Сайда (Saida)/Saithe: 187 Минтай (Mintai)/pollack; Бротола/Brotola; Сайра (Saira)/Pacific saury); the Ukrainian terms were 188 used to describe four marine fish of local interest (Шпроти/Sprat; Batyc/ Thornback ray; 189 Кольос/chub mackerel; Салака/Herring) three of which are fished along the Black Sea coastline 190 and likely directly imported to Bulgaria (GAIN, 2019); the term Ципура (Tsipura) has been directly 191 transferred from the Greek language to refer to the gilthead seabream (Sparus aurata) which 192 represents one of the main fish products imported from Greece to Bulgaria. Finally, the term 193 194 Бакаляро/bacaliaro, derived from Bacalao, has been directly transferred from Portuguese to Bulgarian language to describe a typical salted-dried fish product mostly imported from Spain to 195 196 Bulgaria.

Only 47 (42.7%) out of the 110 CDs (see section 3.2.2) were compliant with the Regulation 197 requirements. Nevertheless, the 68 remaining CDs records were found compliant with the definition 198 of "food name" provided by the Regulation EU No. 1169/2011 (Art 11) intended as "the legal name 199 or customary name, or, descriptive name" allowing the product's characterization by the consumer. 200 Relevant exceptions were represented by the few CDs using vague descriptive terms (Бяла 201 риба/white fish), terms referred to processing (Чироз/dried fish), terms directly belonging to the 202 name of a traditional local or imported dish (Килка/kilka fried buttered sprat; Бакаляро/bakaliaro), 203 or terms not directly associated with any fish product (Капитан/Captain). In all these cases the CDs 204 applied were not informative enough for the recognition of the product by the consumer at the time 205 of purchase. Examples of common names referring to a group of species highlighted through the 206 survey are: Риба Тон (Tuna fish) for three different Thunnus species (T. albacares, T. alalunga, T. 207

obesus) and Скумрия (Mackerel) for three different Scomber sp. species (S. colias, S. japonicus, S. 208 scombrus). In this regard, the most complex scenario was highlighted within the Gadiformes order, 209 with respect to the use of Треска (cod) and Хек (hake) as common names. The term Треска was 210 indeed recorded to be applied in association with three different species belonging to the family 211 Gadidae, namely Gadus chalcogrammus, Gadus morhua, Gadus macrocephalus, and the 212 taxonomically distant species Alepocephalus bairdii, belonging to the Osmeridae family. Similarly, 213 the term Xek (hake) was associated with the genus Merluccius sp., and several species belonging to 214 the Merluccidae family (Merluccius hubbsi, Merluccius productus and Merluccius gavi gavi, the 215 latter still indicated with the obsolete SNMerluccius gavi). The same term was thus applied in 216 association with the species SN Gadus chalcogrammus, Micromesistius australis (Gadidae) and 217 Alepocephalus bairdii (Osmeridae). The use of vague common names such as cod/Tpecka, 218 hake/Xex, should be further clarified in order to provide the market with effective and unambiguous 219 220 CDs. In fact, the overlapping and ambiguous use of the two general terms Tpecka and Xek for the CD of species belonging to separate and distant taxonomical Families and characterized by an 221 222 heterogeneous commercial value may contribute to consumers' confusion on fish value and to 223 market exposure to deceitful incidents for economic gain (Lowell et al., 2015; Xiong et al., 2016).

3.2.2 CDs and SNs found on the products. The compulsory association of a CD and a SN is imposed for live fish, fresh and frozen raw products (whole or filleted) and, among processed seafood, for salted, dried and smoked products. Contrariwise, all the other processed seafood falls out of the scope of the regulation. For them, the declaration of the SN is exclusively subject to the will of the Food Business Operator (FBO), although strongly advocated by the European Parliament to elicit an informed consumers' choice (Tinacci et al., 2019; Giusti et al., 2019; D'Amico et al., 2016; European Parliament Resolution No. 2016/2532).

A total of 110 different CDs were used for the 1611 products: 43 CDs were not associated with any SN, 28 CDs were associated with SNs attributable to a species or a genus, and the remaining 39 were used both alone and in association to a species/genus SNs (Table 1SM). CDs associated with a

SN were reported on 1202 products (74% of the total) while in the remaining 409 (26%) only the 234 CD was available (Table 3). The 1202 products presenting both CD and SN mostly belonged to 235 canned fish (n=463, 38.8%) and frozen fish (n=354, 29.4%), followed by fresh fish (n=235, 19.5%), 236 and, to a lesser extent, by marinated fish (n=41, 3.2%), breaded precooked fish based products 237 (n=37, 3.2%), dried fish (n=17, 1.4%), smoked (n=1) and salted (n=1) products. The 1202 products 238 were described by a total of 67 different CDs associated with 66 different SN consisting of 64 239 species SNs (Table 2SM) and 2 genus SNs (Oncorhynchus sp. and Merluccius sp. recorded in 10 240 and 2 products, respectively). Four-hundred and nine products in which the CD alone was available 241 on the label were described by means of 83 different CDs mainly represented by fresh products (n= 242 340, 83.0%) and marginally by the following categories: marinated (n=17, 4.1%), frozen (n=16, 243 3.9%), alive fish (n=15, 3.7%), canned products (n=10, 2.4%), smoked (n=7, 1.7%) and salted fish 244 (n=4, 1.0%) (Table 3, Table 1SM). As regards fishery products falling into the scope of the 245 246 Regulation (EU) No. 1379/2013 (Article 35 and Annex I), overall labelling non-compliances were observed for 382 of 1029 product (37.1%). In particular, a high non-compliance percentage was 247 248 highlighted for fresh products (340 of 596, 57.3%) opposite to a significantly lower non-compliance rate ($\gamma 2=296.6574$. The p-value < 0.00001) highlighted for frozen products (3.9%). High non-249 compliance rates were also highlighted for product categories minimally represented on the market 250 as: live fish (15 of 15, 100%), smoked products (7 of 8, 87.5%), salted products (4 of 5, 80%). 251 Details of labelling non-compliances in all retail channels, within the three macro-areas and product 252 categories are reported in Figure 3. Furthermore, the chi-squared analysis highlighted significant 253 differences in the non-compliances distribution both in terms of retail channels ($\chi^2 = 38.9$, p-value 254 <0.01) and geographical macro-areas (χ^2 =18.4, p-value <0.001). In this respect, an overall higher 255 non-compliances percentage was recorded at local fish markets (81%) mainly due to the lack of 256 SNs related to fresh products exposed at purchase. In addition, the greater percentage of non-257 compliance on fresh products was found in the NE-SER macro-area where the fisheries sector has 258 significant importance in the local economy and, particularly, for freshwater products, and marine 259

species of national interest, which plausibly came from local aquaculture or local fishing production. The same products were also found non-compliant when offered for sale as frozen or alive fish. All these evidences contributed to underline a lack of insufficient training of sector operators in terms of correct labelling and presentation of fish products for sale.

Contrariwise, an opposite trend was observed for canned, breaded precooked and marinated 264 products. In fact, although falling out of the requirements listed in the Article 35 of the Regulation 265 (EU) No. 1379/2013, the voluntary association of a CD with a SN was highlighted in a high 266 products percentage corresponding to 98%, 100% and 74.5% respectively. According to Todorov, 267 (2019) these product categories, albeit affected by a relevant demand decrease in the latest years, 268 are often imported from neighbour European countries already prepacked and labelled to be directly 269 presented for sale. Therefore, such a high degree of voluntary compliance with Regulation (EU) No. 270 1379/2013 terms on imported products, may reflect the growing level of awareness by European 271 272 FBOs towards the protection of consumers' rights pursuing the European Parliament Resolution No 2016/2532. Similar evidences have been recently highlighted for anchovies and herring products 273 (Giusti et al., 2019; Tinacci et al., 2019). 274

275 *3.3 CD frequency rates.*

The CD frequency rate (overall, for CDs associated with SNs and for CDs found alone) was 276 calculated to highlight the CDs most frequently applied at retail. Overall, CD frequency rates 277 highlighted values ranging from 0.01 to 2.14 products/vendor;. In general, the present survey 278 confirmed consumption and import data collected in the 5-year period 2013-2017 by Todorov, 279 (2019). Our analysis indeed, in accordance with the author, highlighted the expansion of the 280 Bulgarian seafood market, originally mainly addressed to freshwater fish species, towards marine 281 Mediterranean, Atlantic and Pacific species belonging to Clupeids, Salmonids Scombrids, Gadids 282 and Merluccids, all of them well represented at purchase both as fresh and variously processed 283 products. Moreover, Todorov, (2019) highlighted a relatively large import volume of sardine, 284 herring, hake, salmon and trout and an increasing import rate of fresh and frozen mackerel products 285

to satisfy the national market demand. The products most frequently recorded at retail were also in
agreement with the most sought-after species emerged from Stancheva, (2018) and from a report of
the European Market Observatory on EU consumer habits regarding fishery and aquaculture
products (EUMOFA, 2017).

The frequency rate calculated only on CDs associated with SNs records showed frequency rates 290 similar to the overall values highlighting that the products presenting the overall highest frequency 291 rate were generally found on sale with a complete designation and thus generally compliant with the 292 European Regulation (Section 3.2). A relevant exception was represented by the Cyprinidae family, 293 for which the CD+SN frequency rate dramatically fell. In this respect, the majority of Cyprinids 294 products were indeed associated with a high CD frequency rate. Similarly, locally farmed 295 freshwater fish (African catfish/Африкански сом and Бял амур/White amur) together with local 296 marine (Морски език/Sole, Халибут/Halibut, Писия/Plaice and Mullet/Кефал) and fresh water 297 298 fish (Костур/Perch, Щука/Pike, Сулка/Pike perch, Бяла мряна/white barbel) showed that frequency rates calculated on CDs alone exceeded the overall values. In all the cases, the products, 299 300 sold both at large and local retails or at fish markets sale counters, belonged to fresh or alive 301 category. Data are available in Table 2SM.

Finally, the calculation of partial frequency rates of CDs without a scientific identification led to 302 emphasize, for fresh and alive products, sold in bulk, on the sales counter of all commercial 303 channels, a general non-compliance with the Regulation (EU) No.1379/2013 which imposes for 304 non-packaged products to display all the mandatory information for fish product identification 305 through the use posters, billboard and sales tag. These data, together with those highlighted in 306 section 3.3, confirmed the evidence gathered in the previous study conducted by Tinacci et al., 307 (2018) on seafood labelling compliance sold on the Bulgarian market and were in agreement with 308 309 the data collected in a similar study conducted in Sardinia on not pre-packaged products sold within different retail channels (Esposito & Meloni, 2017). In fact, in both studies a high frequency of 310 missing or incomplete indication of SNs had been reported for such products. 311

The comparison of the frequencies of CDs alone and of the CDs found in association with SNs 312 highlighted a different species distribution according to the three macro-areas (NR, NE-SER, S-313 SWR) (Table 2SM). This could be in relation to the fish resources of the territories and import 314 trends. In particular: in NE-SER, higher CDs frequencies of marine species of national interest 315 (sprat (Sprattus sprattus), Mediterranean Horse Mackerel (Trachurus mediterraneus), Horse 316 mackerel (Trachurus trachurus), Flathead Grey Mullet (Mugil cephalus), Bonito (Sarda sarda), 317 Bluefish (Pomatomus saltatrix), Turbot (Scophtalmus maximus) and Gobies (Gobiidae) were 318 highlighted as a result of the local fishing activities (FAO, 2020); in S-SWR, higher CDs record 319 frequencies of fresh water farmed species (sturgeon and rainbow trout), plausibly attributable to the 320 greater presence of dedicated aquaculture facilities in the area (PROJECT BG0713EFF-511-321 220270) and of imported marine species (seabass, seabream, red porgy,) belonging to the Greek and 322 Turkish fishing and aquaculture activities both reported as the main exporter to Bulgaria for these 323 324 kind of products (Turkish Statistical Institute, 2017) were verified. Finally, in NR, relatively higher CDs frequencies rate describing freshwater local wild or cultured freshwater species (rainbow trout, 325 carp, catfish, Danube peak and pike) were highlighted, in accordance with fishery national 326 production data (PROJECT BG0713EFF-511-22027). This area is in fact the principal basin of 327 small and medium-sized inland aquaculture plants for the production of common freshwater 328 species. 329

330 *3.4 Main deficiencies of the Bulgaria seafood list and proposal for its update*

The comparison of the data collected in this study and the current Bulgarian seafood list highlighted the presence of: 1) a total of 50 CDs associated with SNs, in which both the CD and the SN registered on the market were not included in the official list; 2) 22 CDs recorded alone and not listed among the Official CDs reported in the ministerial document. The comparison between the SNs reported on the list and the 66 SNs retrieved on the market highlighted the presence of 34 species SNs and 2 genus SNs not included in the document and described by 60 different CD+SN designations (Table 4; Table 3SM). Furthermore, the comparison highlighted minor issues

concerning: 1) the association of a SN (valid or obsolete) included in the list with a CD not included
in the list (12 CDs); 2) the editing of officially accepted CDs by adding or removing an adjective
related to the fish origin or to specific morphological features (5 CDs); 3) the extended use of CDs
already existing in the official list in association with a valid SN not included among the official
records (6 CDs) (Table 4).

The survey results confirmed the current presence of the majority of the species already verified 343 as commercial leading products on the Bulgarian market (EUMOFA, 2017; Tinacci et al., 2018). 344 Moreover, the analysis of the CDs describing alone the fresh products sold at retail contributed to 345 complete the panorama of fish species currently present on the national market for which an update 346 of the list is necessary. CDs and CD+SN combinations reported in Table 4 and Table 2SM might 347 represent an objective starting point for the selection of new designations to be included in the 348 Official Bulgarian list by allowing the identification of a basket of fish species not yet characterized 349 350 through the use of CDs and SNs already recognized, on the national market, by the final consumer and FBOs. 351

Nevertheless, harmonizing seafood labelling and providing a system of CDs punctual updated in 352 relation to the exponential growth of the number of species available on the market seems 353 impossible, Thus, the choice of a CD for several related species may still represent a sustainable 354 compromise in association with the addition to the generic name of references to the geographical 355 area or morphological peculiarities of the different species (Tinacci et al., 2019). Thus, the selection 356 of specific descriptive terms referring to the geographic origin and or morphological features in 357 association to one or a limited number of species belonging to a common genus would be desirable 358 to elicit a clear and immediate identification of the product by the consumer. 359

4.Conclusions

This survey confirmed the ineffectiveness of the current official list of Bulgarian seafood designations in describing the products present at retail and the need to provide a substantial revision to meet the offer of an expanding market and harmonize the terms applied for products

identification. This work highlighted also high non-compliances rates to the Regulation (EU) No.
1379/2013 requirements on the labelling of fresh raw, alive, smoked and salted products due to the
absence of the scientific name declaration. Thus, an effective training of FBO (both at large and
local retail level) is necessary, especially on how to correctly display raw products on fish counters
in order to properly inform the final consumer. Finally, the present survey could represent a starting
point for a more oriented sampling aimed at molecularly identify by DNA barcoding techniques
products lacking scientific names (Tinacci et al., 2018; Lewis & Boyle, 2017; Martinsohn, 2013).

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375

Figures captures

Figure 1: Bulgaria Statistical Regions. The three geographical macro-area were obtained by merging contiguous statistical regions proposed by Popescu (2011) as follow: North Region (NR): North-western + North-central region; North-east/South-east Region, (NE-SER): North-eastern + South-eastern Region; South/South-west Region (S-SWR): South central + South-Western region. The name of the Provincial cities included in the study are indicated. Image modified from Popescu, (2011).

Figure 2: Percentage of the nine commercial product categories/vendor highlighted on the market during the survey within the different pinpointed macro-areas.

Figure 3: Details of labelling non-compliances in retail channels for the three macro-areas
 and product categories

387 **References**

388

| 389 | Barendse, J., Roel, A., Longo, C., Andriessen, L., Webster, L. M., Ogden, R., & Neat, F. (2019). DNA | | | | |
|-----|---|--|--|--|--|
| 390 | barcoding validates species labelling of certified seafood. Current Biology, 29(6), 198-199. | | | | |
| 391 | https://doi.org/10.1016/j.cub.2019.02.014 | | | | |
| 392 | D'Amico, P., Armani, A., Gianfaldoni, D., & Guidi, A. (2016). New provisions for the labelling of fishery | | | | |
| 393 | and aquaculture products: Difficulties in the implementation of Regulation (EU) n. 1379/2013. Marine | | | | |
| 394 | Policy, 71, 147-156. https://doi.org/10.1016/j.marpol.2016.05.026 | | | | |
| 395 | EUMOFA. (2018). Case study - Fisheries and aquaculture in Bulgaria and Romania, in MONTHLY | | | | |
| 396 | $HIGHLIGHTS \mid NO.5/2018 \ https://www.eumofa.eu/documents/20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/119445/MH+5+2018.pdf/aa0b6293-20178/11945/MH+5+2018.pdf/aa0b6293-20178/11945/MH+5+2018.pdf/aa0b6293-20178/11945/MH+5+2018.pdf/aa0b6293-20178/11945/MH+5+2018.pdf/aa0b6293-20178/11945/MH+5+2018.pdf/aa0b6293-20178/11945/MH+5+2018.pdf/aa0b6293-20178/11945/MH+5+2018.pdf/aa0b6293-20178/11945/11950000000000000000000000000000000000$ | | | | |
| 397 | 8d1e-4618-ae4a-6ae7b3fffc2f. Accessed 13 October 2019 | | | | |
| 398 | EUMOFA. (2017). EU consumer habits regarding fishery and aquaculture products. | | | | |
| 399 | http://agricultura.gencat.cat/web/.content/de_departament/de02_estadistiques_observatoris/27_butlletins/02_ | | | | |
| 400 | butlletins_nd/documents_nd/fitxers_estatics_nd/2017/0189_2017_Pesca_UE-consum-peix-aquicultura- | | | | |
| 401 | 2016.pdf Accessed 15 October 2019. | | | | |
| 402 | Esposito, G., & Meloni, D. (2017). A case-study on compliance to the EU new requirements for the | | | | |
| 403 | labelling of fisheries and aquaculture products reveals difficulties in implementing Regulation (EU) n. | | | | |
| 404 | 1379/2013 in some large-scale retail stores in Sardinia (Italy). Regional Studies in Marine Science, 9, 56-61. | | | | |
| 405 | https://doi.org/10.1016/j.rsma.2016.11.007 | | | | |
| 406 | European Parliament Resolution 2016/2532 European Parliament Resolution No 2016/2532 (RSP) of 12 | | | | |
| 407 | May 2016 on traceability of fishery and aquaculture products in restaurants and retail. | | | | |
| 408 | http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+TA+P8-TA-2016- | | | | |
| 409 | 0222+0+DOC+PDF+V0//EN. Accessed 15 October 2019 | | | | |
| 410 | Export Enterprises SA. (2019) Bulgarian market: distribution. <u>https://import-</u> | | | | |
| 411 | export.societegenerale.fr/en/country/bulgaria/market-distribution. Accessed 8 January 2020. | | | | |
| 412 | FAO, (2020) Fishery and Aquaculture Country Profiles, The Republic of Bulgaria. | | | | |
| 413 | http://www.fao.org/fishery/facp/BGR/en. Accessed 8 January 2020 | | | | |
| 414 | Froese, R., & Pauly, D. (2000). FishBase 2000: concepts designs and data sources (Vol. 1594). Los | | | | |
| 415 | Banos, Philippines: WorldFish | | | | |
| 416 | Garibaldi, L., & Busilacchi, S. (2002) ASFIS list of species for fishery statistics purposes, ASFIS | | | | |
| 417 | Reference Series No. 15. Rome, FAO, 258p. | | | | |
| 418 | Giusti, A., Ricci, E., Guarducci, M., Gasperetti, L., Davidovich, N., Guidi, A., Armani, A. (2018). | | | | |
| 419 | Emerging risks in the European seafood chain: Molecular identification of toxic Lagocephalus spp. in fresh | | | | |
| 420 | and processed products. Food Control, 91, 311-320. https://doi.org/10.1016/j.foodcont.2018.04.013 | | | | |
| 421 | Giusti, A., Tinacci, L., Sotelo, C. G., Acutis, P. L., Ielasi, N., & Armani, A. (2019). Authentication of | | | | |
| 422 | ready-to-eat anchovy products sold on the Italian market by BLAST analysis of a highly informative | | | | |
| 423 | cytochrome b gene fragment. Food control, 97, 50-57. https://doi.org/10.1016/j.foodcont.2018.10.018 | | | | |
| 424 | | | | | |
| | | | | | |

Lewis, S. G., & Boyle, M. (2017). The expanding role of traceability in seafood: tools and key initiatives. 425 426 Journal of Food science, 82(1), 13-21. https://doi.org/10.1111/1750-3841.13743 Lowell, B., Mustain, P., Ortenzi, K., & Warner, K. (2015). One name, one fish: Why seafood names 427 matter. https://usa.oceana.org/OneNameOneFish. Accessed 30 October 2019 428 429 Martinsohn, J. (2013). Using new analytical approaches to verify the origin of fish. In P. Brereton. New analytical approaches for verifying the origin of food. 1st Ed. Woodhead Publishing Series in Food Science, 430 Technology and Nutrition, (pp. 189-215). Woodhead Publishing Imprint. Elsevier. 431 432 Ministry of Agriculture and Forestry. (2006). Decree n. 4 of 13.01.2006 on the conditions and order for 433 the first sale of fish and other aquatic organisms. Official Gazette, 14, 14.02.2006, 73-80 434 Popescu (2011). Fisheries in Bulgaria. European Parliament Note of Directorate General for Internal B: 435 Policies Policy Department Structural and Cohesion Policies Fisheries. http://www.europarl.europa.eu/RegData/etudes/note/join/2011/460049/IPOL-436 PECH NT(2011)460049_EN.pdf. Accessed 30 October 2019. 437 Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying 438 439 down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. Official Journal, L 31, 1.2.2002, 1-24 440 Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the 441 provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 442 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, 443 Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European 444 445 Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission 446 Regulation (EC) No 608/2004. Official Journal, L 304, 22.11.2011, 18-63 447 Regulation (EU) No 1379/2013 of the European Parliament and of the Council of 11 December 2013 on 448 the common organisation of the markets in fishery and aquaculture products, amending Council Regulations 449 (EC) No 1184/2006 and (EC) No 1224/2009 and repealing Council Regulation (EC) No 104/2000. Official 450 Journal, L 354, 28.12.2013, 1-21 Reilly, A. (2018). Overview of Food Fraud in the fisheries sector. FIAM/C1165. FAO, Rome, 2018. 451 http://www.fao.org/3/i8791en/I8791EN.pdf Accessed 15 October 2019. 452 Stancheva, M. (2018, November). A survey on fish consumption in Bulgaria. International Symposium 453 On Animal Science (ISAS) 2018; 22nd - 23rd November 2018, Faculty of Agriculture, Belgrade-Zemun, 454 455 Serbia. 456 https://www.researchgate.net/publication/329210059 A SURVEY OF FISH CONSUMPTION IN BUL 457 GARIA. Accessed 15 October 2019. Stawitz, C. C., Siple, M. C., Munsch, S. H., Lee, Q., & Derby, S. R. (2017). Financial and ecological 458 implications of mislabeling. 459 global seafood **Conservation** Letters, 10(6), 681-689.

460 https://doi.org/10.1111/conl.12328

461 Tinacci, L., Guardone, L., Rubio, J. C. P., Riina, M. V., Stratev, D., Guidi, A., & Armani, A. (2019a).
462 Labelling compliance and species identification of herring products sold at large scale retail level within the
463 Italian market. *Food Control*, 106, 106707. https://doi.org/10.1016/j.foodcont.2019.106707

Tinacci, L., Giusti, A., Guardone, L., Luisi, E., & Armani, A. (2019b). The new Italian official list of
seafood trade names (annex I of ministerial decree n. 19105 of September the 22nd, 2017): Strengths and
weaknesses in the framework of the current complex seafood scenario. *Food Control*, 96, 68-75.
https://doi.org/10.1016/j.foodcont.2018.09.002

Tinacci, L., Stratev, D., Vashin, I., Chiavaccini, I., Susini, F., Guidi, A., & Armani, A. (2018a). Seafood
labelling compliance with European legislation and species identification by DNA barcoding: A first survey
on the Bulgarian market. *Food control*, 90, 180-188. https://doi.org/10.1016/j.foodcont.2018.03.007

Tinacci, L., Guidi, A., Toto, A., Guardone, L., Giusti, A., D'Amico, P., & Armani, A. (2018b). DNA 471 barcoding for the verification of supplier's compliance in the seafood chain: How the lab can support 472 473 companies traceability. Journal of 2 in ensuring Italian Food Safety, (7). https://doi.org/10.4081/ijfs.2018.6894 474

Todorov, A. (2019). GAIN Report Number: BU1914. Fish and Seafood Market Brief –
Bulgaria.Published on 1st April, 2019.
<u>https://apps.fas.usda.gov/newgainapi/api/report/downloadreportbyfilename=Fish%20and%20Seafo</u>

478 <u>od%20Market%20Brief%20-%20Bulgaria_Sofia_Bulgaria_4-11-2017.pdf</u>. Accessed 15 October 2019.

Turkish Statistical Institute, (2017). Overview of the Turkish fisheries and aquaculture sector.
 <u>https://www.eurofish.dk/turkey. Accessed 8 January 2020</u>

Xiong, X., D'Amico, P., Guardone, L., Castigliego, L., Guidi, A., Gianfaldoni, D., & Armani, A. (2016).
The uncertainty of seafood labeling in China: A case study on Cod, Salmon and Tuna. *Marine Policy*, 68, 123-135. https://doi.org/10.1016/j.marpol.2016.02.024

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| Journal Pre-proof | | | | | | |
|-------------------|----------------|--------------|---------------------|-------------------|-------|--|
| Maana Anaa | City | | Retail channel type | | | |
| Macro-Area | City | Large retail | Local retail | Local fish market | Total | |
| | Vidin | 2 | 1 | 2 | 5 | |
| - | Pleven | 4 | 2 | 0 | 6 | |
| ND | Veliko Tarnovo | 4 | 1 | 0 | 5 | |
| NK - | Ruse | 4 | 0 | 0 | 4 | |
| - | Silistra | 2 | 0 | 1 | 3 | |
| | Area Subtotal | 16 | 4 | 3 | 23 | |
| | Dobrich | 3 | 2 | 0 | 5 | |
| - | Shumen | 3 | 1 | 3 | 7 | |
| NE CED | Varna | 4 | 1 | 1 | 6 | |
| NE-SEK - | Sliven | 3 | 3 | 1 | 7 | |
| - | Burgas | 4 | 0 | 1 | 5 | |
| | Area subtotal | 17 | 7 | 6 | 30 | |
| | Kardjiali | 2 | 0 | 0 | 2 | |
| - | Haskovo | 2 | 0 | 1 | 3 | |
| | Plovdiv | 4 | 0 | 0 | 4 | |
| 2-2 M K - | Blagoevgrad | 4 | 0 | 1 | 5 | |
| - | Sofia | 4 | 0 | 0 | 4 | |
| | Area Subtotal | 16 | 0 | 2 | 18 | |

Table 1: Number of different retail channels surveyed in each macro-area. NR: North Region; NE-SER: North-east/South-east Region; S-SWR: South/South-west Region

| Journal Pre-proof | | | | | | | |
|---------------------|--------------------|---------------------|--------------------------------|-------|--|--|--|
| Retail channel type | | | | | | | |
| Product type | Largeretail (N=49) | Local retail (N=11) | Local fish market (N=11) | Total | | | |
| Fresh | 382 | 49 | 165 | 596 | | | |
| Frozen | 358 | 41 | 6 | 405 | | | |
| Canned | 418 | 53 | 2 | 473 | | | |
| Marinated | 44 | 8 | 3 | 55 | | | |
| Smoked | 5 | 1 | 2 | 8 | | | |
| Salted | 5 | 0 | 0 | 5 | | | |
| Dried | 17 | 0 | 0 | 17 | | | |
| Breaded precooked | 37 | 0 | 0 | 37 | | | |
| Alive | 15 | 0 | 0 | 15 | | | |
| Total | 1281 | 152 | 178 | 1611 | | | |

Table 2. Number, overall and within different retail channels, of products belonging to different categories checked in the survey.

Le channels, of produc

| Journal Pre-proof | | | | | | |
|-------------------|--|--------------|--------------|-------------------|-------|--|
| Designation at | Designation at Product Retail channels | | | | | |
| retail | category | Large retail | Local retail | Local fish market | Total | |
| | Fresh | 235 | 16 | 5 | 257 | |
| - | Frozen | 354 | 35 | 0 | 389 | |
| | Canned | 411 | 52 | 0 | 463 | |
| | Marinated | 35 | 3 | 0 | 41 | |
| CD associated | Smoked | 0 | 1 | 0 | 1 | |
| with SN | Salted | 1 | 0 | 0 | 1 | |
| | Dried | 17 | 0 | 0 | 17 | |
| | Breaded | 27 | 0 | 0 | 37 | |
| | precooked | 57 | | | 57 | |
| | Alive | 0 | 0 | 0 | 0 | |
| Sub-total CD+SN | | 1090 | 107 | 5 | 1202 | |
| | Fresh | 147 | 33 | 160 | 340 | |
| | Frozen | 4 | 6 | 6 | 16 | |
| | Canned | 7 | 1 | 2 | 10 | |
| | Marinated | 9 | 5 | 3 | 17 | |
| CD alona | Smoked | 5 | 0 | 2 | 7 | |
| CD alone | Salted | 4 | 0 | 0 | 4 | |
| | Dried | 0 | 0 | 0 | 0 | |
| | Breaded | 0 | 0 | 0 | 0 | |
| | precooked | 0 | 0 | 0 | 0 | |
| | Alive | 15 | 0 | 0 | 15 | |
| Sub-total CD alon | e | 191 | 45 | 173 | 409 | |

Table 3: Overall CDs number in different product categories found within the three retail channels included in the survey.

| Journal Pre-proof | | | | | |
|-----------------------|----------------------|------------------------------|----------------------------|-----------------------|---|
| CD record | English term | SNs associated | Valid SN | Overall Freq. rate | Comparison with Official Bulgarian list |
| Трицона | Herring | Clupea harengus | Clupea harengus | 1.7% | SN associated with a CD not included in the official list |
| Балтийска херинга | Baltic herring | Clupea harengus membras | Clupea harengus | 18.6% | Editing of an existing CD (Херинга) |
| | | Clupea harengus | | 1.7% | SN associated with a CD not included in the official list |
| Салака (Ukranian) | Herring | Clupea harengus balticus | - Clupea harengus | 6.8% | Obsolete SN associated with a CD not included in the official list |
| | | Clupea harengus membras | | 20.3% | Obsolete SN associated with a CD not included in the official list |
| Бейби херинга | Baby herring | Clupea harengus | Clupea harengus | 8.5% | SN associated with CD edited from an approved CD |
| Сельодка (Russian) | Herring | Clupea harengus | Clupea harengus | 40.7% | SN associated with CD not included in the official list |
| Капитан | (Captain) Herring | Clupea harengus membras | Clupea harengus | 23.7% | Obsolete SN associated with a CD not included in the official list |
| Чироз | Dried fish | Clupea harengus membras | Clupea harengus | 28.8% | Obsolete SN associated with a CD not included in the official list |
| Балтийска Цаца | Baltic sprat | Sprattus balticus | Sprattus sprattus | 3.4% | Obsolete SN associated with CD edited from an approved CD |
| Килка | Sprat | Sprattus sprattus sulinus | Sprattus sprattus | 1.7% | SN associated to CD not included in the official list |
| Сардина | Sardine | Sardinella logiceps | Sardinella logiceps | 3.4% | Extension of use of CD already associated to a valid SN |
| | | Sardina pilchardus | Sardina pilchardus | 20.3% | SN associated to CD not included in the official list |
| Аншоа | Anchovy | Engraulis encrasicolus | Engraulis encrasicolus | 16.9% | Both CD and SN absent |
| | | Engraulis ringens | Engraulis ringens | 11.9% | Both CD and SN absent |
| Сафрид | Horse | Trachurus trachurus | Trachurus trachurus | 61% | Extension of use of CD already associated to a valid SN |
| | mackerel/scad | Trachurus mediterraneus | Trachurus mediterraneus | 1.7% | SN associated with CD edited from an approved CD |
| Скумрия | Mackerel | Scomber scombrus | Scomber scombrus | 88.1% | SN associated with CD edited from an |

| | | Journal Pre-p | proof | | |
|------------------------|----------------|-----------------------------|------------------------------|-------|--|
| | | | | | approved CD |
| | | Scomber japonicus | Scomber japonicus | 67.8% | SN associated with CD edited from an approved CD |
| | | Scomber colias | Scomber colias | 64.4% | Both CD and SN absent |
| Бяла рибаТон | White tuna | Thunnus alalunga | Thunnus alalunga | 10.2% | SN associated to a CD not included in the list |
| Жълтопер тон | Yellowfin tuna | Thunnus albacares | Thunnus albacares | 8.5% | Both CD and SN absent |
| | | Katsuwonus pelamis | Katsuwonus pelamis | 76.3% | Extension of use of CD already |
| Риба Тон | Tuna | Thunnus albacares | Thunnus albacares | 81.4% | associated to different valid SN (<i>Thunnus thynnus</i> , <i>Thunnus obesus</i>) |
| | | Thunnus alalunga | Thunnus alalunga | 6.8% | Extension of use of CD already associated to different valid SN |
| | | Theragra chalcogramma | Gadus chalcogrammus | 44.1% | Extension of use of |
| Треска | Cod | Gadus macrocephalus | Gadus macrocephalus | 6.8% | associated to |
| | | Alepocephalus bairdii | Alepocephalus bairdii | 8.5% | unicient value Siv |
| Морска треска | Sea cod | Theragra chalcogramma | Gadus chalcogrammus | | Editing of CD present in the list and already associated to different valid SN |
| Тихоокеанска треска | Pacific cod | Gadus macrocephalus | Gadus macrocephalus | 8.5% | Editing of CD present in the list and already associated to different valid SN |
| |) | Micromesistius australis | Micromesistius australis | 6.8% | Extension of use of CD already |
| Мерлуза | Hake | Macruronus magellanicus | Macruronus novaezelandiae | 15.3% | associated to different valid SN |
| | | Merluccius hubbsi | Merluccius hubbsi | 18.6% | |
| Сайда | Saithe | Pollachius virens | Pollachius virens | 20.3% | SN associated to a CD not included in the list |
| | | Merluccius sp. | Merluccius sp. | 3.4% | Both CD and SN absent |
| | | Merluccius australis | Merluccius australis | 1.7% | Both CD and SN absent |
| | | Merluccius gayi | Merluccius gayi gayi | 5.1% | Both CD and SN absent |
| Хек | Hake | Merluccius hubbsi | Merluccius hubbsi | 20.3% | Both CD and SN absent |
| | | Merluccius productus | Merluccius productus | 15.3% | Both CD and SN absent |
| | | Theragra chalcogramma | Gadus chalcogrammus | 54.2% | Both CD and SN absent |
| | | Alepocephalus bairdii | Alepocephalus bairdii | 11.3% | Both CD and SN absent |
| Нототения | Nototenia | Merluccius hubbsi | Merluccius hubbsi | 1.7% | Both CD and SN |

| Journal Pre-proof | | | | | |
|---------------------------------|---------------------|------------------------------|--------------------------------|--------|--------------------------|
| | | | | | absent |
| | | Merluccius hubbsi | Merluccius hubbsi | 8.5% | Both CD and SN |
| Бяла риба | White fish | Theragra | Gadus | 22.70/ | Both CD and SN |
| | | chalcogramma | chalcogrammus | 23.7% | absent |
| Бакаляро (Portuguese origin) | "Bacaliaro" Hake | Merluccius hubbsi | Merluccius hubbsi | 1.7% | Both CD and SN absent |
| | | Theragra chalcogramma | Gadus chalcogrammus | 54.2% | Both CD and SN absent |
| Минтай (Russian origin) | Cod | Pollachius virens | Pollachius virens | 8.5% | Both CD and SN absent |
| | | Macruronus novaezelandiae | Macruronus novaezelandiae | 8.5% | Both CD and SN absent |
| Хоки | | Macruronus | Macruronus novaezelandiae | 13.6% | Both CD and SN absent |
| Новозеландски | New Zealand | Macruronus | Macruronus | 5.10/ | Both CD and SN |
| макруронус | macruronus | novaezelandiae | novaezelandiae | 5.1% | absent |
| Хек - Аляска | Alaska Hake | Merluccius productus | <i>Merluccius</i> productus | 3.4% | Both CD and SN absent |
| Аржентински хек | Argentine Hake | Merluccius hubbsi | Merluccius hubbsi | 30.5% | Both CD and SN absent |
| | | Oncorhynchus | Oncorhynchus | 8.5% | Both CD and SN |
| Сьомга | Salmon | Salmo salar | Salmo salar | 13.6% | Both CD and SN |
| Атлантическа сьомга | Atlantic salmon | Salmo salar | Salmo salar | 66.1% | Both CD and SN absent |
| Норвежка сьомга | Norvegian salmon | Salmo salar | Salmo salar | 8.5% | Both CD and SN absent |
| | The state | Oncorhynchus mykiss | Oncorhynchus mykiss | 11.9% | Both CD and SN absent |
| Пъстърва | I rout | Salmo gairdneri irideus | Oncorhynchus mykiss | 10.2% | Both CD and SN absent |
| Дъгова пъстърва | Rainbow trout | Oncorhynchus mykiss | Oncorhynchus mykiss | 57.6% | Both CD and SN absent |
| Сьомгова | | Oncorhynchus mykiss | Oncorhynchus mykiss | 13.6% | Both CD and SN absent |
| пъстърва | Salmon trout | Salmo gairdneri irideus | Oncorhynchus mykiss | 5.1% | Both CD and SN absent |
| Сребриста сьомга | Silver salmon | Oncorhynchus kisutch | Oncorhynchus kisutch | 1.7% | Both CD and SN absent |
| Розова сьомга | Pink salmon | Oncorhynchus gorbuscha | Oncorhynchus gorbuscha | 5.1% | Both CD and SN absent |
| Куча сьомга | Chum salmon | Oncorhynchus keta | Oncorhynchus keta | 18.6% | Both CD and SN absent |
| - | | Oncorhynchus sp | Oncorhynchus sp | 16.9% | Both CD and SN absent |
| Тихоокеанска сьомга | Pacific salmon | Oncorhynchus keta | Oncorhynchus keta | 18.6% | Both CD and SN absent |
| | | Oncorhynchus nerka | Oncorhynchus nerka | 1.7% | Both CD and SN absent |
| Кета | Keta | Oncorhynchus keta | Oncorhynchus keta | 1.7% | Both CD and SN absent |
| Червена сьомга | Red salmon | Oncorhynchus nerka | Oncorhynchus nerka | 3.4% | Both CD and SN absent |
| Ципура (Greek origin) | Seabream | Sparus aurata | Sparus aurata | 64.4% | Both CD and SN absent |

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|---------------------------|------------------------|---------------------------|-------------------------------|-------|--|
| Фагри | Red Porgy | Pagrus coeruleostictus | Pagrus caeruleostictus | 1.7% | Both CD and SN absent |
| Лаврак | European seabass | Dicentrarchus labrax | Dicentrarchus labrax | 37.3% | Both CD and SN absent |
| Чернокоп | Bluefish | Pomatomus saltatrix | Pomatomus saltatrix | 1.7% | SN associated to a different CD (Лефер) |
| Зарган | Garfish | Scomberesox saurus | Scomberesox saurus | 16.9% | Both CD and SN absent |
| Унаги | Unagi /Eel | Anguilla japonica | Anguilla japonica | 1.7% | Both CD and SN absent |
| Лакедра (Greek origin) | Lunar-tailed bigeye | Priacanthus hamrur | Priacanthus hamrur | 1.7% | Both CD and SN absent |
| | | Prionace glauca | Prionace glauca | 23.7% | Both CD and SN absent |
| A | Short | Isurus oxyrinchus | Isurus oxyrinchus | 15.3% | Both CD and SN absent |
| Акула | Shark | Squalus acanthias | Squalus acanthias | 1.7% | SN associated to a specific CD (черноморски региоа Акула) |
| Тилапия | Tilapia | Oreochromis niloticus | Oreochromis niloticus | 8.5% | Both CD and SN absent |
| Нилски костур | Nile Perch | Lates niloticus | Lates niloticus | 8.5% | Both CD and SN absent |
| Пангасиу | Pangasius | Pangasius hypophtalmus | Pangasianodon hypophtalmus | 39.0% | Both CD and SN absent |
| Морски кефал | Flathead greymullet | ND | - | 2.1% | Absent |
| Илария | Leaping mullet | ND | - | 2.1% | Absent |
| Халибут | Halibut | ND | - | 2.1% | Absent |
| Попче | Goby | ND | - | 14.6% | Absent |
| Попче/Кая | Goby/Kaya | ND | - | 4.2% | Absent |
| Махи махи | Mahi Mahi | ND | - | 2.1% | Absent |
| Риба меч | Swordfish | ND | - | 14.6% | Absent |
| Марлин | Marlin | ND | - | 2.1% | Absent |
| Минокоп | Shidrum | ND | - | 4.2% | Absent |
| Фриса | Black Sea Roach | ND | - | 4.2% | Absent |
| Червена риба | Red Fish | ND | - | 2.1% | Absent |
| Скат | Scat | ND | - | 2.1% | Absent |
| Есетра | Sturgeon | ND | _ | 12.5% | Absent |
| Обикновен сом | Common | ND | - | 2.1% | Absent |
| Африкански сом | African catfish | ND | - | 22.9% | Absent |
| Лунавска мояна | Danube Barbel | ND | - | 2.1% | Absent |
| Облен | Danube bleak | ND | _ | 2.1% | Absent |
| Пелена риба | Icefish | ND | | 2.1% | Absent |
| Кликач | Antartic | ND | _ | 2.1% | Absent |
| Мойва | Capelin | ND | | 2.1% | Absent |
| Полярна | Polar Trout | ND | - | 2.1% | Absent |
| Сарпа | Salema | ND | - | 2.1% | Absent |

Table 4: List of CDs (associated to SN or alone) not included in the Official Bulgarian list.



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- A survey on the Bulgarian seafood market for assessing fish products availability was conducted
- Products availability was then compared with the current seafood official list
- The ineffectiveness of the list in describing products available on the market was highlighted
- Main concerns regarded the presence on the market of CD and SN not included in the list
- CD already applied throughout the country represent a starting point to propose an updating of the list

Authors declare no conflict of interest

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