

Research Note

Inaccuracy of Labeling and Visual Inspection for Microsporidian Parasites in Anglerfish *Lophius litulon* (Jordan, 1902) Collected from Chinese Retail Markets in Sardinia, Italy

DOMENICO MELONI,^{1*} COSTANTINO ARCA,² AND PIERLUIGI PIRAS³

¹Department of Veterinary Medicine, University of Sassari, Via Vienna 2, 07100, Sassari, Italy; ²Professional Veterinarian, Professional Register of the Nuoro Province, Via Gramsci 59, 08100 Nuoro, Italy; and ³National Health Service, Local Unit n.7, Food Hygiene Department, Via Costituente, 09013, Carbonia, Italy

MS 14-521: Received 4 November 2014/Accepted 13 February 2015

ABSTRACT

The aim of the present study was to evaluate the accuracy of labeling and the efficacy of visual inspection to detect the lesions by visible parasites in anglerfish *Lophius litulon*. One hundred samples were collected over a 2-year period (2011 to 2012) from Chinese retail markets in Sardinia, Italy. To assess the conformity of the items with the trade name, a preliminary visual inspection of the samples by a simple morphological analysis was performed. According to the Council Regulations (EC) 104/2000, 1224/2009, and 2074/2005, the Italian labels were examined to verify the appropriate indication of relevant information on traceability (trade name, scientific name, geographical area, and production method), and the samples of *L. litulon* were subjected to visual inspection to detect “visible parasites.” Altogether, a high percentage of mismatching (70%) between the scientific name and trade name was pointed out. Moreover, 60% of the samples were visibly infected by *Spraguea lophii*, a microsporidian parasite of the nervous tissue that forms typical lesions (xenomas) in the fish flesh near the vertebral column. Although *S. lophii* is not pathogenic to humans, the presence of xenomas can decompose the fish flesh and render it unfit for human consumption. The high percentage of mislabeling, together with the inaccuracy in the visual inspection by Chinese food business operators highlighted the need to improve the European Union control system of fishery products imported from China and marketed in Europe.

The European Union (EU) is, by far, the largest single market for imported fishery products. In 2012, its imports were valued at US\$47.0 billion, representing 36% of total world imports. Preliminary data for 2013 show its imports growing at 8% relative to 2012 and to more than US\$50 billion (16). The fishery products imported in Europe, the majority of which are either frozen or prepared products, come from more than 120 countries from all over the world: Norway and China are the main EU suppliers. Norway showed significant increases in the volume of seafood products exported to the EU, with mainly salmon and cod. China confirms its leading role as a processing country for white fish (15). Innovations and improvements in processing, transportation, distribution, marketing, and food science and technology have facilitated the trade and consumption of an expanded variety of species and product forms (16). There are over 1,200 species traded in Europe, with great diversity in appearance, presentation, quality, and safety that must be known and recognized properly by consumers (15). This requires first and foremost, appropriate methods of labeling, traceability, and official control on the production and placing on the market (27). Mislabeling can show in

different forms, as well as at any stage in the supply chain (23). A part of mislabeling that occurs is probably unintentional, as fishery species identities may be easily incorrect. Confusion may also arise because various fishery species can be referred to by common slang names in different regions (4). However, fishery products often arrive on the market through production and marketing chains that lack transparency and accountability, thus providing opportunities for large amounts of illegally caught fish to reach retailers and consumers. In market countries in which effective systems to require traceability and proof of legal origin are lacking, mislabeling allows illegal fishing to remain profitable (30). In Europe in 2001, Commission Regulation (EC) 2065 (7) provided detailed rules for consumer information about certain fishery and aquaculture products through improved marking or labeling at the retail level. Subsequently, Council Regulation (EC) 1224/2009 (12) stated that member states shall ensure that the information related to the trade name, the scientific name, the relevant geographical area, and the production method is available to the consumer at the retail stage sale. These requirements are indicated on the label or by an appropriate mark of the fisheries and aquaculture products offered for retail sale, including imported products. Recently, Council Regulation (EC) 404/2012 (14) stated that the scientific

* Author for correspondence. Tel: 0039 079 229 570; Fax: 0039 079 229 458; E-mail: dmeloni@uniss.it.

name of the species may be provided to the consumer at the retail level by means of commercial information, such as billboards or posters. According to Council Regulation (EC) 854/2004 (10), fishery products are submitted to official controls on the production and placing on the market, including at least the following elements: organoleptic examinations, freshness indicators, histamine, residues and contaminants, microbiological checks, poisonous fishery products, and random visual inspections to verify compliance with community legislation on parasites. Food business operators must cooperate with relevant competent authorities so as to permit them to carry out official controls. According to Council Regulation (EC) 853/2004 (9), food business operators must ensure that fishery products have been subjected to a visual examination for the purpose of detecting visible parasites before being placed on the market. They must not place fishery products that are obviously contaminated with parasites on the market for human consumption. In particular, the Council Regulation (EC) 2074/2005 (11) lays down detailed rules to do visual inspection of the whole fish abdominal cavity to detect "visible parasites" (a parasite or a group of parasites that has a dimension, color, or texture clearly distinguishable from fish tissues) and to ensure that no contaminated fish reach the consumers. Parasites recovered in fishery products can be related to fishborne parasitic zoonoses (e.g., anisakiasis and diphyllbothriasis) or not. The accuracy of the visual inspection methods largely depends on the training and skills of food business operators and official inspectors (22). The EU inspection methods seem to be specifically designed to detect fishborne parasitic zoonoses (e.g., anisakiasis) but are not completely adequate to detect "non-fishborne zoonoses parasites" with a prevalent location in deep muscles, as with some mixosporidians and microsporidians (10). In particular, the presence of microsporidian parasites in fish flesh causes serious and permanent alterations of the main organoleptic characters, for example, texture, color, and smell. Because of the repulsive appearance, these fishery products become not suitable for consumption. The parasite cells soon swell and turn into small nodules of white color, some millimeters in diameter, called xenomas. In the fish flesh, it is easy to observe the xenomas, especially near the vertebral spine: they can be individual or combined to form cluster structures (24). Microsporidian parasites can be observed in the nervous tissues of both aquaculture and fishery products. In particular, parasites of the genus *Spraguea* are often found in anglerfish of the genus *Lophius* (18). These lesions in the muscular tissues of *Lophius vomerinus* and *Lophius litulon* imported to Italy from Namibia, South Africa, and China have been previously described (18, 24). *L. litulon* is caught by Japanese, Chinese, and Korean fisheries, primarily during winter months when this fish command a high market price. Although the catch of anglerfish is very small compared with that of other commercially important species in Japan, China, and Korea (34), *L. litulon* is widely marketed internationally (3). In Italy, it is usually imported frozen and is mainly marketed in Chinese ethnic supermarkets (5). These well-organized

commercial systems, once only addressed to Chinese people (29, 32), are nowadays also frequented by non-Chinese citizens (5). Chinese products have been often involved in several food safety concerns surrounding some foods exported from China, and incorrect labeling or mislabeling is one of the most common infringements in the United States (19). In Europe, Chinese products are the goods with the highest percentage of the EU Rapid Alert System for Food and Feed notifications in the period between 2011 and 2013; however, the notifications made against Chinese food products for mislabeling are very few (5). Previous studies carried out in Chinese supermarkets in Italy highlighted problems related to poor hygiene in fresh food handling, language barriers, poor preparation of operators (1), and inaccuracy of labeling (2, 20). The difficulties of communication, as well as the lack of understanding and knowledge of food safety principles, are a major obstacle to the cooperation with relevant competent authorities. The Chinese community in Sardinia is the fourth largest (21) in terms of residents (3,048) after Romanian (12,037), Moroccan (4,250), Senegalese (3,472), and the number of Chinese ethnic supermarkets is constantly increasing. Nevertheless, there is a lack of data about traceability and hygienic status of fishery products imported from China and marketed in Sardinia. The double aim of this work was (i) to evaluate the accuracy of labeling according to the current legislation and (ii) to evaluate the efficacy of visual inspection carried out by food business operators and relevant competent authorities to detect the lesions by visible parasites in anglerfish *L. litulon* collected from Chinese retail markets in Sardinia, Italy.

MATERIALS AND METHODS

Sample collection. One hundred samples of frozen anglerfish (*L. litulon*) packaged in bags were collected over a 2-year period (2011 to 2012) from small-size (1 to 5 employees) and medium-size (5 to 15 employees) Chinese retail markets located in two provinces of Sardinia, Italy, namely the Sassari and Olbia-Tempio, where there are large Chinese communities. Frozen anglerfish (*L. litulon*) were thawed in chill storage (4°C) overnight, and then they were washed with tap water. To assess the conformity of the collected anglerfish items with the trade name, a preliminary visual inspection of the samples by a simple morphological analysis was performed.

Traceability and accuracy of Italian labeling. Relevant information on traceability (trade name, scientific name, geographical area, and production method) was examined according to Council Regulations (EC) 104/2000 (6) and 1224/2009 (12). In accordance with D'Amico et al. (5), the accuracy of Italian labels was assessed according to the Italian governmental list of fish species trade names "Assignment of the Italian trade name to fish species of commercial interest, in accordance with Council Regulations (EC) 104/2000 and 2065/2001" (25) and its latest amendment (26).

Visual inspection to detect visible parasites. According to the Council Regulation (EC) 2074/2005 (11), all the samples of anglerfish *L. litulon* were subjected to visual inspection to detect visible parasites (a parasite or a group of parasites that has a dimension, color, or texture clearly distinguishable from fish tissues). Visual inspection of anglerfish samples was performed on

the whole fish abdominal cavity and edible parts (musculature) intended for human consumption.

RESULTS

Identification of the samples. The preliminary visual inspection allowed us to verify that all the samples were of fish muscle tissues and belonged to the genus *Lophius*. The examined anglerfish (measuring 30 to 60 cm) were presented partially peeled and without heads. Anglerfish weight ranged from 150 g (small) to 430 to 450 g (large). The distinctive characters of the species *L. litulon* are represented by an illicium, terminating in a thin and elongated strip-shaped spearhead (3). The second dorsal fin presents nine soft rays. The back is dark brownish, with the presence of a thin yellowish reticulated structure.

Traceability and accuracy of Italian labeling. According to Commission Regulation (EU) 1169/2011 (13), in those products that come from Third-World countries, the relevant information on traceability must be reported in a language easily understood by the consumers of the member states, where the products are marketed. An Italian label was found on 95% of all the anglerfish samples, while 100% of the samples presented a Chinese label. In 25% of the samples, an English label was reported. The presence of relevant information on traceability is reported in Table 1. Scientific name: According to Council Regulation (EC) 1224/2009 (12), the scientific name of fishery products must be available to the consumer at retail stage sale and may be provided by means of commercial information, such as billboards or posters (14). In our survey, all the samples presented a correct scientific name (*L. litulon*) that was reported on the label, correctly written, taxonomically acceptable, and approved by FishBase (available at: <http://www.fishbase.org/>). Trade name: According to the Council Regulations (EC) 104/2000 (6) and 2065/2001 (7), in 2002, the Italian government produced the official list of fish species trade names for all the fishery species marketed in Italy and continuously updated and amended (26). For six species members of the genus *Lophius* (*L. budegassa*, *L. piscatorius*, *L. americanus*, *L. litulon*, *L. vomerinus*, and *L. gastrophysus*), the Italian government indicated five different trade names. No trade name was provided for the species *Lophius vaillanti*. An Italian trade name was reported for 90% of the samples presenting an Italian label. In the remaining samples, no Italian trade names were reported. In only 30% of the cases did the scientific name and trade name correspond (e.g., *L. litulon* and “*Rana Pescatrice Orientale*”). In 70%, there was not correspondence, and the trade name was incomplete with respect to that reported in the Italian Ministerial Decree. The designation of “*Rana Pescatrice*” (Italian trade name of *L. budegassa* and *L. piscatorius*) was completely mismatched with the scientific name of *L. litulon*. Similar mismatches in anglerfish imported from China were reported in a previous survey carried out in Italy by D’Amico et al. (5). Production method: The indication of the production method was always reported in all the anglerfish samples. This species is not reared in aquaculture,

TABLE 1. Accuracy of Italian labeling in anglerfish samples collected from Chinese markets in Sardinia, Italy

Relevant information on traceability	Percentage (%)
Presence of an Italian label	95
Absence of an Italian label	5
Scientific name	
Present and correctly written	100
Commercial designation	
Not reported	10
Reported	90
Correspondence with the scientific name	30
No correspondence with the scientific name	70
Production method	
Reported and correctly written	100
Geographical area of catch or production	
Reported and correctly written	100

and it is generally wild caught by trawling. Geographical area of catch or production: All the samples of *L. litulon* (100%) were caught in the Food and Agriculture Organization of the United Nations Major Fishing Area 61 (Pacific and Northwest). This area is a world leader for the amount of fish caught (16).

Visual inspection to detect visible parasites. From the 100 *L. litulon* included in our survey, 60% of the samples were visibly infected by a microsporidian parasite of the nervous tissue. The visual examination of the fish flesh allowed us to observe the typical xenomas near the vertebral column. By means of a simple morphological analysis, the anglerfish samples results indicated infection by *Spraguea lophii*, a protozoan belonging to the phylum *Microspora*, order *Microsporidia*, and family *Glugeidae*. *S. lophii* is often found in the muscular tissues of *L. piscatorius*, and *L. budegassa* caught along the coasts of the Mediterranean, the Atlantic, and the North Sea, in *L. americanus* caught in the northern Atlantic, and in *L. gastrophysus* caught along the coast of Brazil (24). Moreover, the typical lesions by *S. lophii* have been previously described in samples of *L. vomerinus* and *L. litulon* imported from Africa and Asia (18, 24). In our survey, the locations of the *S. lophii* infections were extremely similar to those described from both European and American lophiids (18). *S. lophii* infected the large extracranial ganglions of the spinal nerves of the vertebral column: the parasite cells swell up and turn into white xenomas, a few millimeters in diameter, to form well-developed cluster structures (Fig. 1). The presence of xenomas causes impressive alterations in the organoleptic characters of the fish flesh. Because of the disgusting appearance, the infected anglerfish samples should be considered not suitable for human consumption.

DISCUSSION

As reported by other authors in previous surveys (5), mislabeling of fishery products imported from China still

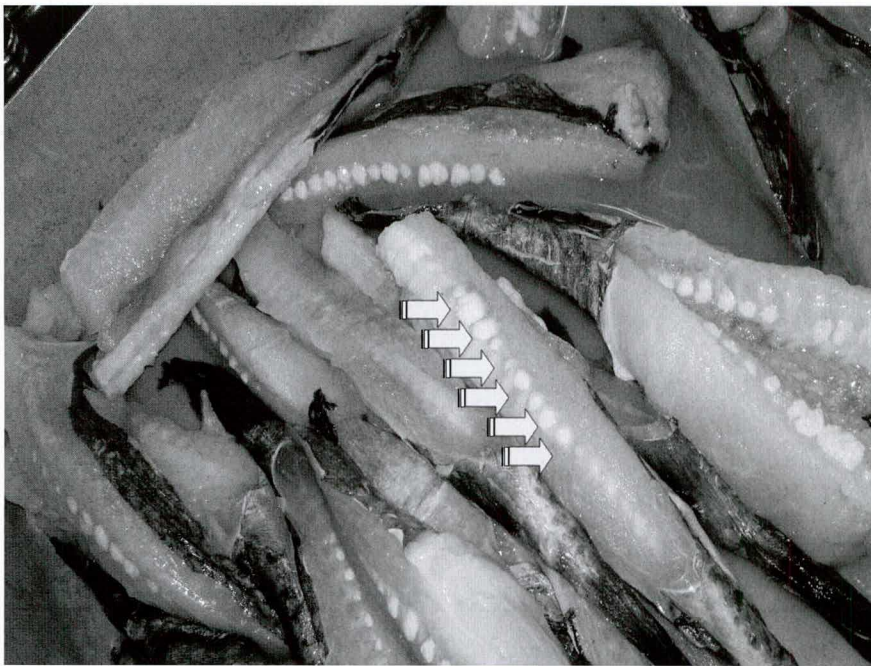


FIGURE 1. Widespread presence of xenomas caused by *Spraguea lophii* in *Lophius litulon* samples.

remains of great concern. The main problems are related to the respect of EU framework in terms of relevant information on traceability (6, 12). Mislabeling might be unintentional; however, in consideration of the recent food safety concerns involving some foods exported from China, including fishery products (28, 31), mislabeling allows illegal fishing to remain profitable (30) by marketing toxic species, fish of poor quality, or infected with parasites. Despite the indication of an Italian trade name on 90% of the Italian labels, a high percentage of mismatching (70%) between trade and scientific names highlighted an excess of approximation in the formulation of the Italian labels. In accordance with Council Regulations (EC) 852/2004 (8) and 853/2004 (9), when visible parasites are found in edible parts by visual inspection, the food business operators must ensure that no “obviously contaminated” fish reaches the consumer. Food business operators may hygienically apply normal sorting or preparatory processing procedures, including trimming of raw materials being particularly susceptible to parasites (17). In our survey, 60% of the samples of *L. litulon* were clearly infected by *S. lophii*, highlighting the inaccuracy in the visual inspection of anglerfish samples before being placed on the market. However, the official inspectors cannot easily highlight the presence of xenomas by *S. Lophii* because of the following: the widespread habit of marketing exclusively the edible part of anglerfish (the body without the head); the prevalent location in deep muscles of microsporidian lesions; and the EU visual inspection methods. *S. lophii* was confirmed as strongly associated with *Lophiids*: according to previous studies (24), the vital functions of the host did not seem affected by the presence of the parasite, and hosts infected with *S. lophii* apparently do not show signs of disease, although the impressive infection lasts for a long time. However, the presence of xenomas can decompose the fish flesh and render it unfit for human consumption. According to the Codex Alimentarius, the defect level linked to

texture change into the fish flesh resulting from parasites occurs when more than 5% of the sample unit by weight is affected (17). Although *S. lophii* is unanimously considered not to be pathogenic to humans, it should be taken into account that the spores of microsporidians are common in urbanized environments, and several microsporidians have been identified as opportunistic pathogens, particularly in immunocompromised patients (33). Manfredi et al. (24) highlighted the possible production of heat-resistant allergens by *S. lophii*: their emission into fish flesh should cause forms of allergy or anaphylactic shock in humans. In conclusion, the high percentage of mislabeling, together with the inaccuracy in the visual inspection of Chinese products before being placed on the European markets, confirmed the unresolved issues related to food safety in China and at the same time, the weakness of the EU control system of fishery products imported from this country. As reported by D’Amico et al. (5), at the European border inspection posts, only documentary controls are carried out systematically. Physical and material checking is randomly performed on a variable percentage, ranging between 0 and 100%.

REFERENCES

1. Armani, A., L. Castigliero, D. Gianfaldoni, and A. Guidi. 2011. L’insicurezza Alimentare della nuova ristorazione cinese. *Ind. Aliment.* 50(514):7–11.
2. Armani, A., P. D’Amico, L. Castigliero, G. Sheng, D. Gianfaldoni, D and A. Guidi. 2012. Mislabeling of an “unlabelable” seafood sold on the European market: the jellyfish. *Food Control* 26:247–251.
3. Armani, A., G. Gandini, P. Manzoni, P. D’Amico, and V. Tepedino. 2013. Le rane pescatrici: guida al riconoscimento delle specie appartenenti al gen. *Lophius* della Famiglia *Lophidae*. *Quad. n.4 di Eurofishmarket* 20:1–25.
4. Buck, E. H. 2009. Seafood marketing: combating fraud and deception. Available at: <http://www.nationalaglawcenter.org/assets/crs>. Accessed 29 May 2014.
5. D’Amico, P., A. Armani, L. Castigliero, G. Sheng, D. Gianfaldoni, and A. Guidi. 2014. Seafood traceability issues in Chinese food

- business activities in the light of the European provisions. *Food Control* 35:7–13.
6. European Commission. 2000. European Council Regulation No 104/2000 on the common organization of the markets in fishery and aquaculture products. *Off. J. Eur. Communities* L 17:22–52.
 7. European Commission. 2001. Commission Regulation (EC) No 2065/2001 laying down detailed rules for the application of Council Regulation (EC) No 104/2000 as regards informing consumers about fishery and aquaculture products. *Off. J. Eur. Communities* L 278: 6–8.
 8. European Commission. 2004. Council Regulation (EC) No 852/2004 of the European Parliament and of the Council on the hygiene of foodstuffs. *Off. J. Eur. Union* L 139:1–54.
 9. European Commission. 2004. Council Regulation (EC) No 853/2004 of the European Parliament and of the Council laying down specific hygiene rules for on the hygiene of foodstuffs. *Off. J. Eur. Union* L 139:55.
 10. European Commission. 2004. Council Regulation (EC) No 854/2004 of the European Parliament and of the Council laying down specific rules for the organization of official controls on products of animal origin intended for human consumption. *Off. J. Eur. Union* L 226:83–127.
 11. European Commission. 2005. Council Regulation (EC) No 2074/2005 laying down implementing measures for certain products under Regulation (EC) No 853/2004 of the European Parliament and of the Council and for the organisation of official controls under Regulation (EC) No 854/2004 of the European Parliament and of the Council and Regulation (EC) No 882/2004 of the European Parliament and of the Council, derogating from Regulation (EC) No 852/2004 of the European Parliament and of the Council and amending Regulations (EC) No 853/2004 and (EC) No 854/2004. *Off. J. Eur. Union* L 338: 27–59.
 12. European Commission. 2009. Commission Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy. *Off. J. Eur. Union* L 343:1–50.
 13. European Commission. 2011. Commission Regulation (EU) 1169/2011 of the European Parliament and of the Council on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004. *Off. J. Eur. Union* L 304:18.
 14. European Commission. 2012. Commission implementing Regulation (EU) No 404/2012 establishing the standard import values for determining the entry price of certain fruit and vegetables. *Off. J. Eur. Union* L 124:34–56.
 15. European Market Observatory for Fisheries and Aquaculture Products. 2014. The EU fish market: 2014 edition. Available at: <http://ec.europa.eu/fisheries/market-observatory>. Accessed 28 May 2014.
 16. Food and Agriculture Organization of the United Nations. 2014. The state of world fisheries and aquaculture 2014: opportunities and challenges. Available at: <http://www.fao.org>. Accessed 26 May 2014.
 17. Food Standards Agency United Kingdom. 2012. Guidance on the term “obviously contaminated” in relation to parasites in fishery products. Available at: <http://www.multimedia.food.gov.uk/multimedia/pdfs/obviouslycontaminated>. Accessed 4 February 2015.
 18. Freeman, M. A., H. Yokoyama, and K. Ogawa. 2004. A microsporidian parasite of the genus *Spraguea* in the nervous tissues of the Japanese anglerfish *Lophius litulon*. *Folia Parasitol.* 51:167–176.
 19. Gale, F., and J. C. Buzby. 2009. Imports from China and food safety issue. Economic Information Bulletin, EIB-52. U.S. Department of Agriculture, Washington, DC.
 20. Guidi, A., A. Armani, L. Castigliego, X. N. Li, F. Fanzone, S. Fusco, E. Facibeni, and D. Gianfaldoni. 2010. Labeling of ethnic food in the Prato Chinese community. *Vet. Res. Commun.* 34:163–166.
 21. Istituto Nazionale di Statistica. 2013. Rapporto Istat—La popolazione straniera residente in Italia al 31° dicembre 2013. Available at: <http://www.demo.istat.it/index.html>. Accessed 4 February 2015.
 22. Levsen, A., B. T. Lunestad, and B. Berland. 2005. Low detection efficiency of candling as a commonly recommended inspection method for nematode larvae in the flesh of pelagic fish. *J. Food Prot.* 68:828–832.
 23. Logan, C. A., S. E. Alter, A. J. Haupt, K. Tomalty, and S. R. Palumbi. 2008. An impediment to consumer choice: overfished species are sold as Pacific red snapper. *Biol. Conserv.* 141:1591–1599.
 24. Manfredi, M. T., G. Gandini, F. Garzella, G. De Santis. 2004. Segnalazione di *Spraguea lophii* in rana pescatrice (Actinoperigii, Lophidae). *Ittiopatologia* 1:135–139.
 25. Ministerial Decree of the Italian Minister of Agriculture, Food and Forestry. 2002. Regulations concerning the labeling of fish products and control system. *Official Gazette of the Italian Republic*, No. 84 of 10 April 2002.
 26. Ministerial Decree of the Italian Minister of Agriculture, Food and Forestry. 2011. Assignment of the Italian trade name to fish species of commercial interest, in accordance with Regulation (EC) 104/2000, and Title I of Regulation (EC) 2065/2001. *Official Gazette of the Italian Republic*, No. 208 of 07 September 2011.
 27. Ogden, R. 2008. Fisheries forensics: the use of DNA tools for improving compliance, traceability and enforcement in the fishing industry. *Fish Fish.* 9:462–472.
 28. Ortega, D. L., H. H. Wang, L. Wu, and N. J. Olynka. 2011. Modeling heterogeneity in consumer preferences for select food safety attributes in China. *Food Policy* 36:318–324.
 29. Pollini, S. 2010. Il controllo sanitario nelle attività alimentari condotte da cinesi negli esercizi di competenza della U.F. Igiene Alimenti e Nutrizione. In Proceedings of the conference department of prevention UF training education and health promotion, local health unit n. 4 of Prato. Prato, 15 December 2010.
 30. Pramod, G., K. Nakamura, T. J. Pitcher, and L. Delagran. 2014. Estimates of illegal and unreported fish in seafood imports to the USA. *Mar. Policy* 48:102–113.
 31. Qiao, G., T. Guo, and K. K. Klein. 2012. Melamine and other food safety and health scares in China: comparing households with and without young children. *Food Control* 26:378–386.
 32. Vallone, L., M. A. Marzano, A. Armani, L. Castigliego, X. N. Li, A. Guidi, D. Gianfaldoni, and I. Dragoni. 2009. Qualità igienico-sanitaria di prodotti alimentari cinesi presenti sul mercato italiano, p. 422–424. In Proceedings of the Twenty-Third Congress of the Italian Society of Veterinary Science 2009, Vol. 63. SISVET, Brescia, Italy.
 33. Weiss, L. M. 2001. Microsporidia: emerging pathogenic protists. *Acta Trop.* 78:89–102.
 34. Yoneda, M., M. Tokimura, H. Fujita, N. Takeshita, K. Takeshita, M. Matsuyama, and S. Matsuura. 2001. Reproductive cycle, fecundity, and seasonal distribution of the anglerfish *Lophius litulon* in the East China and Yellow Seas. *Fish. Bull.* 99:356–370.

Copyright of Journal of Food Protection is the property of Allen Press Publishing Services Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.