

1 **To land or not to land: How do stakeholders perceive the zero discard policy**  
2 **in European small-scale fisheries?**

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4

5 **Abstract**

6

7 The landing obligation recently adopted by the European Union's (EU) Common Fisheries  
8 Policy aims to eradicate discards in EU fisheries. The objective of this paper is to investigate  
9 the potential social and economic impacts of the discard ban in European small-scale  
10 fisheries (SSF) and the critical factors for its successful implementation. An exhaustive  
11 systematic literature review and a stakeholder consultation were carried out in order to (i)  
12 collect detailed information about current knowledge on discards in EU SSF and gauge  
13 stakeholder perceptions about potential impacts of the discard ban in European SSF, (ii)  
14 examine the capacity of the SSF industry to implement the discard ban, and (iii) explore the  
15 limits and feasibility of implementing such a measure.

16

17 The results of this study show that little attention has been given by the scientific  
18 community to discards in EU SSF. Indeed, the systematic literature review shows that this  
19 problem is relatively unexplored in the EU. In addition, the effectiveness of a discard ban in  
20 industrial fisheries is still unclear, mainly because discard data are not systematically  
21 collected by fisheries authorities. Stakeholders mostly perceive that the new landing  
22 obligation was developed with industrial fisheries in mind and that compliance with the  
23 landing obligation in EU SSF will be difficult to achieve without high economic costs, such as  
24 those related to the handling and storage of unwanted fish on board.

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26

27 **Keywords:** Discarding, European Union, landing obligation, small-scale fisheries,  
28 stakeholders' perceptions

29 **1. Introduction**

30

31 Global marine fish catches have been stagnant over the last decades. In 2011, 70% of fish  
32 stocks were estimated to be overfished or fully fished, and only 10% of stocks considered to  
33 be underfished [1].

34 Discards, defined by FAO [2] as the *“portion of the total organic material of animal*  
35 *origin in the catch which is thrown away, or dumped at sea for whatever reason. It does not*  
36 *include plant materials and postharvest waste such as offal. The discards may be dead, or*  
37 *alive”*, have long been regarded as one of the key issues in commercial fishing in the  
38 European Union (EU), and worldwide [3-5]. Discard practices play an important role in the  
39 depletion of marine populations, and can result in future economic loss [3,6]. Since 2008,  
40 there has been a growing public outcry against discarding practices in Europe [4].

41 The implementation of a landing obligation was one of the key elements of the recent  
42 reform of the EU Common Fisheries Policy (CFP) (Regulation (EU) No 1380/2013). A phased  
43 landing obligation was formally implemented in January 2015, and by 2019 it will be in force  
44 in all EU waters, covering all fisheries that capture commercial species covered by the CFP  
45 regulation, including small-scale fisheries (SSFs).

46 The discard problem is greater in industrialized large-scale fisheries than in SSFs and  
47 the North Atlantic and Northwest Pacific fisheries account for 40% of the world’s discards  
48 [3]. Discarding occurs not only due to poor gear selectivity and associated capture of  
49 unwanted fish, but also due to the current regulation in place. Undersize fish may be  
50 discarded due to the minimum landing size regulations, overquota fish can be discarded in a

51 multi-species fishery due to quota exhaustion of one species, and less valuable size classes of  
52 target species may be discarded to make room for more valuable size classes (high grading).

53 Despite the importance of discards, data collection and estimates of discards for all  
54 commercial species in EU waters under the CFP are far from being complete and the  
55 estimates generally have low precision. This reflects the relatively low intensity of discard  
56 sampling and the high variability in the amounts of fish discarded, even within a single  
57 fishery. All estimates of quantities of fish discarded in the EU arise from scientific sampling  
58 programmes which are usually directed at demersal species often taken in “mixed fisheries”,  
59 where several commercial species are taken simultaneously by each deployment of the  
60 fishing gear [7-8]. The omission and/or use of poor quality discard data in stock assessments  
61 may also result in underestimation of exploitation rates and can lead to biased assessments  
62 and policy recommendations, hampering the achievement of sustainable use of fishery  
63 resources [9].

64

## 65 **2. The role of small-scale fisheries in the European Union**

66

67 Most of the world’s fisheries could be considered to be ‘small-scale’, although there is no  
68 universally accepted definition and sometimes defining small-scale is not straightforward  
69 [10]. Allison and Ellis [11] define SSFs as those “*that operate from shore or from small*  
70 *boats*”, in coastal and inland waters, with an average of 1-4 crew on board and strongly  
71 linked to local communities. Generally, SSFs rely on local resources and have lower  
72 overheads in terms of capital, but higher labour intensity relative to large-scale  
73 “*industrialized*” fisheries [12]. The sector also consumes less fuel and discards less than

74 larger-scale fisheries, and its catch is generally for human consumption [13]. There is also no  
75 commonly agreed definition of SSF at the European level. Nevertheless, the EU small-scale  
76 fishing fleet may be said to be composed of vessels small in size and, sometimes, with a low  
77 level of technology and capital investment per fisher. The only existing formal definition of  
78 “small-scale coastal fishing” is that used for the purposes of the European Maritime and  
79 Fisheries Fund (Regulation (CE) N° 508/2014), which defines SSF as “fishing carried out by  
80 fishing vessels of less than 12 metres and not using towed gear”. SSF are thus typically  
81 “artisanal” and coastal, using small boats, targeting multiple resource species using  
82 traditional gears.

83 Landings from EU SSFs are worth around 2 thousand million euros annually, i.e. 25%  
84 of the revenue generated by EU fisheries; thus SSFs have a high value in the seafood supply  
85 chain [14]. The EU small-scale fleet has declined by 20% over the last decade, to just over  
86 70,000 vessels. However, they still account for around 80% of EU fishing boats and more  
87 than 40% of EU fishers (90,000) are engaged in SSFs [15], emphasizing the high social,  
88 economic and cultural importance of SSFs for coastal communities, especially in southern  
89 Europe. European small-scale vessels are on average 5-7 m in length, weigh 3 GT, and have  
90 engines with a power of 34 Kw [15]. More than 90% of the European small-scale fleet uses  
91 primarily passive gears (i.e. gears that are not towed or dragged through the water) such as  
92 drift and fixed nets, hook and lines, or pots and traps [14].

93 The need for sustainable SSFs is recognized in EU and international policy, e.g.  
94 Europe 2020, Water Framework Directive (WFD), Marine Strategy Framework Directive  
95 (MSFD), CFP, and the SSF voluntary guidelines endorsed by the Food and Agriculture  
96 Organization of the United Nations (FAO). In a vote in April 2014 on the European Maritime  
97 and Fisheries Fund (EMFF), the European Parliament recognized the importance of SSFs for

98 the sustainability of local coastal communities, particularly concerning women and youth.  
99         Given the importance of SSFs in the European context, it is of high importance to  
100 understand the reasons for, and the factors affecting, discarding, as well as the potential  
101 social and economic impacts of the landings obligation, and the best strategies to mitigate  
102 negative impacts. As such, the current paper focuses on (i) investigating the potential  
103 impacts of the discard ban in European SSFs and (ii) analysing the critical factors for the  
104 successful implementation of this measure. In order to do this, a review of the literature on  
105 discards on SSF was carried out, followed by a survey of key stakeholders to collect detailed  
106 information about current knowledge on discards and stakeholders' perceptions about  
107 potential impacts of the discard ban on European SSF, the capacity of the SSF industry to  
108 implement the discard ban, and limits and feasibility of implementing such a measure.

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### 110 **3. Methodology**

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#### 112 **3.1. Systematic literature review**

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114 A global analysis of the peer-reviewed literature was carried out to identify studies  
115 documenting the discard problem in SSF in developed countries (EU, Australia, Canada,  
116 Japan, New Zealand, Iceland, Norway, and USA) under different fisheries management  
117 regimes. Our target was to identify the relationships between discarding behaviour,  
118 management measures and fish stock status. This analysis enabled us to quantify current  
119 rates of discards in different types of SSF, and identify the fisheries characteristics related to  
120 the current discard problem. The literature review also helped to identify and summarise the  
121 technical measures that developed countries have in place to reduce/eradicate discards, as

122 well as the key factors and enabling conditions that may be important to solve the discard  
123 problem. This analysis can be used to help managers identify the incentives to successfully  
124 implement the new CFP. The literature search was limited to the impacts of discards of  
125 species caught for human consumption and which are directly and indirectly targeted by SSF.

126 A systematic search strategy was applied to identify relevant scientific papers  
127 published up to February 2016 in Scopus, by searching titles, abstracts and keywords using  
128 the following terms: “fisher\*” or “fishing”; and “discard\*”; and “artisan\*” or “small-scale” or  
129 “traditional” or “subsistence” or “local” or “industrial” or “commercial” or “large”. Although  
130 the search terms were in English, due to Scopus being indexed and having titles and  
131 abstracts available in English, no studies were excluded on the basis of being published in  
132 another language.

133

### 134 **3.2. Expert consultation**

135

136 Forty-nine “experts” were contacted, between December 2014 and October 2015, and sent  
137 an online questionnaire (See detailed content of the questionnaire in the Supplementary  
138 Material). Interviewees were selected based on their knowledge of SSFs, gear selectivity  
139 and/or discards, as inferred from their publications records and/or years of relevant work  
140 experience, while also ensuring a broad geographic coverage (all EU waters) and  
141 representation of a wide range of disciplines and sectors. Interviewees thus included  
142 fisheries scientists from different disciplines (e.g., anthropology, biology, ecology, economics  
143 and law), fishing industry stakeholders, administration officials, and representatives of non-  
144 governmental bodies (NGOs). A total of 30 experts replied to the questionnaire, i.e. a reply  
145 rate of 61%.

146 This sample size was considered sufficient to identify the impacts of the discard ban  
147 since, when conducting in-depth semi-structured interviews, the number of new concepts  
148 and/or results associated with each additional interview generally tends to diminish after 20  
149 interviews [16-19]. The people interviewed represent a range of coastal communities in the  
150 north and south across the Autonomous Community of Galicia.

151 The questionnaire first asked a set of questions to identify the specific knowledge  
152 and expertise of each expert on discards and SSF in his/her country, followed by a set of  
153 multiple choice and open-ended questions which elicited opinions about the reasons for  
154 discarding, potential social and economic impacts of the discard ban on European SSF, the  
155 capacity of the SSF industry to implement the discard ban, the feasibility of implementing  
156 the discard ban in European SSF, most successful technical measures to eradicate discards,  
157 potential incentives to increase compliance with the landing obligation, and changes and/or  
158 measures which could help to reduce discards in European SSF.

159

#### 160 **4. Global studies of discards and small-scale fisheries**

161

162 The results obtained from the literature review show that the topic of discards in SSF has  
163 attracted relatively little attention from the scientific community until recently. A total of  
164 1,004 papers have been published on the topic of discards from 1950 to 2015, of which 798  
165 are related to industrial fisheries (79.4%) and only 206 papers focused on SSF (20.5%).  
166 However, in 2015 alone, the number of papers published on the topic of discards was 58 for  
167 industrial and 27 for SSF (Figure 1A). Following the same search criteria, Figure 1B shows  
168 that papers on discards were cited 12,476 times for the 1950-2015 period, with 81.9%  
169 (10,221 citations) referring to industrial fisheries and 18% (2,255 citations) referring to SSF.

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[INSERT FIGURE 1 ABOUT HERE]

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The lack of attention paid to discards in SSF could be consistent with the perception that SSF generally have lower discard rates. Kelleher [3], in a global review of discards in marine fisheries, noted that SSF accounted for around 11% of landings and had a weighted discard rate of 3.7%. However, it may also be true that SSF discards are less well documented and it should be noted that complete data were available for fewer than half of the fisheries considered by Kelleher. For example, Villasante et al. [42] found that, when no other information was available, the discard rate for SSFs in Galicia (NW Spain) ranged between 5% and 18% depending on the type of commercial species harvested. The authors also found that the discard rate for some sedentary resources can be significantly higher, e.g., 74% for goose barnacle and 49% for razor clam, mainly due to minimum landing size restrictions.

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Given that all developed countries and/or regions with advanced discard management regimes are included in the review undertaken for the current study, we are able to identify the most active countries in the scientific understanding of the discard problem. Amongst the developed countries, EU Member States are responsible for 36% of the total publications related to discards in industrial fisheries; this percentage increases to 43% in the case of SSF.

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Over the last 10 years (2005-2015) 158 papers related to discards and SSF were published in scientific journals. The most active regions were (in this order) Europe and North America. In terms of citations, 2,125 papers about discards and SSF were cited in scientific journals over the same period, with North America, Europe, and Oceania being

194 regions the most active in terms of citations (Figure 2).

195

196 [INSERT FIGURE 2 ABOUT HERE]

197

198 Almost 15% of the total number of papers published which address the discard  
199 problem in SSF are from Latin America and the Caribbean countries, possibly because their  
200 seas are among the worlds' richest in marine biodiversity, in which SSF are of critical  
201 importance for fishing communities, and where fishing activities engage several million  
202 people [20]. The recent adoption by national governments of co-management measures as  
203 an integral part of their fisheries policies is providing increasing potential for innovation and  
204 experimentation with novel governance approaches [20]. Although discards are not a  
205 widespread problem in Latin American SSF, due to these fisheries targeting mostly sedentary  
206 species, the scientific research carried out in the region shows that co-management systems  
207 contributed significantly to improve the situation of SSF [20-22].

208

#### 209 **4.1. Technical measures adopted by developed countries to eradicate discards**

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211

212 The majority of measures to reduce discards have been introduced in large-scale fisheries. It  
213 should be pointed out that measures linked to tradable quotas, which have been partially  
214 successful in reducing discards in large-scale fisheries, may be less suitable for SSFs.

215

##### 216 ***North America (USA and Canada)***

217 The US Alaskan groundfish fishery has operated under annual species-specific total  
218 allowable catches (TACs), allocated by area, season, and gear type, which, depending on the

219 vessel size, are monitored through partial or full observer coverage [23]. A discard ban has  
220 been in place since 1998. A system of individual vessel quotas (IVQs) allocates fishing rights  
221 for commercial species [24], while non-target species are protected by fishery specific  
222 bycatch limits [23].

223         The retention of some vulnerable and commercially important bycatch species is  
224 prohibited and, if bycatch exceeds specified levels, the fishery must be relocated or closed  
225 [23,25]. Alongside these management measures, a fleet communication programme was  
226 also implemented, intended to report near real-time observations of bycatch hotspots [25].  
227 In this way, vessels stay informed and avoid these fishing areas, consequently reducing  
228 bycatch of protected species. These efforts to reduce bycatch and discards have proven to  
229 be successful since they incentivised more selective fishing [26], with reductions in the  
230 discards of Pacific cod and Pollock, Pacific halibut, sablefish and halibut (see [23-26]).

231         The British Columbia groundfish trawl fishery is managed under an ITQ system  
232 supported by extensive observer and monitoring coverage of the fishing activities. A full  
233 dockside monitoring programme is in force, which requires all vessels to inform the Fisheries  
234 Management Office at least one day before returning to port where they intend to land their  
235 catch, which will then be monitored by a dockside inspector [27]. The discarding of the main  
236 target rockfish (*Sebastes*) species is banned in this fishery, and only species which cannot be  
237 retained legally can be discarded. When fishers reach their quota, they can no longer fish in  
238 the area or, alternatively, can buy additional quota within specified limits [28].

239         To discourage high grading, the discarded catch with market value is counted against  
240 quota [26]. Furthermore, bycatch limits exist for non-target and non-quota species [28-29].  
241 A decrease was observed in discards of several rockfish target species and Condie et al. [26]  
242 argue that this was due to constraining quotas and the accounting of discard mortality by

243 on-board observers. Fishers started to target species with bigger quotas and avoided areas  
244 where species with limited quotas were more abundant [26], resulting in 50% reduction in  
245 catches of some rockfish species [30]. Bycatch limits were also successful in incentivising  
246 more selective fishing, as discard rates of spiny dogfish decreased by 5% between 1997 and  
247 2004 [26], and the annual bycatch of halibut decreased by 15% [28].

248

#### 249 **Norway**

250 The main Norwegian fisheries are regulated under a TAC system subdivided into ITQs or  
251 group quotas [23,31]. A discard ban is in place in Norwegian fisheries, meaning that all  
252 commercial species caught must be landed under this policy [31]. The fishing industry in  
253 Norway largely supports the discard ban [23].

254 Under the Norwegian discard policy, vessels which possess a quota for a certain  
255 species can see this quota reduced as a result of bycatch of that species by another metier  
256 [32]. All catches are counted against quota but if quota or bycatch is exceeded slightly,  
257 fishers can still land and retain their catches [32]. If large overages of quota or undersized  
258 fish are caught, all catch can still be legally landed, but the catch is confiscated and its sale  
259 value given to the marketing organization after the subtraction of 20% to cover for landing  
260 costs [23,33]. In addition, fishers have to change fishing grounds [32].

261 The effectiveness of the discard ban in Norway cannot be totally evaluated since  
262 discard data are not collected systematically. The EU Discarding Commission of 2004  
263 estimated that Norwegian discards were between 5-10%, slightly higher than the 2-8%  
264 estimated by the Institute of Marine Research of Norway [31]. The main reason for  
265 discarding in Norway is believed to be high-grading, because most Norwegian fisheries are  
266 regulated by quotas. An EU Commission report on discarding [31] stated that high-grading is

267 usually not eliminated by the implementation of technical measures and restrictions.

268

269 ***Iceland***

270 Fisheries in Iceland operate under an ITQ system and fishers are obliged to land all catch,  
271 with the exception of live young haddock and cod caught by handline [29]. In case fishers  
272 catch above their quota, they still have an incentive to land all the fish caught. They can  
273 either be covered by quota from the following year (up to 5% quota of the coming year)  
274 [29,33], purchase additional quota (in case of larger overages and non-target catch) [32], or  
275 land a small bycatch percentage without using quota [32].

276 The sale value of over quota and non-target catch is channelled for fisheries research  
277 [33], after 20% of the total value is subtracted to cover landing costs [29,34]. No minimum  
278 landing size is specified by Icelandic regulations. To prevent catching of small size fish, mesh  
279 size regulations are in place [35]. Additionally, the Directorate of Fisheries discourages the  
280 capture of juvenile fish by applying real-time closures to fishing grounds from which large  
281 quantities of undersized fish are caught [36].

282 Discards of the main commercial species in Iceland have declined and remain low.  
283 Discard rates of cod are below 2.2%, those for haddock are below 5%, while for saithe and  
284 golden redfish discards are negligible [35]. ICES [35] states that the country's low discard  
285 rates are a result of the flexibility embedded in its ITQ system. However, some issues still  
286 persist. Misreporting of landings may occur under the TAC system. A report by the Icelandic  
287 Directorate of Fisheries, in which export information from fish processing plants is compared  
288 to landings weight, indicates a slight mismatch between landings and exports statistics [35].  
289 Additionally, about 10,000 t of overquota and small size catch is landed annually under the  
290 permitted 5% quota overages [31]. The effectiveness of the area closures is still unclear. It is

291 argued that juveniles might not be protected by short-term closures but would be protected  
292 by successive and longer closures [35,37]. Nevertheless, in the last three decades, Icelandic  
293 authorities temporarily closed fishing areas about 2000 times, usually applying bans on  
294 bottom trawling and longlining [33].

295

### 296 ***New Zealand***

297 New Zealand fisheries are managed under a quota management system that encompasses  
298 both ITQs and annual catch entitlements (ACEs), which are a leasable form of ITQs that can  
299 be traded independently [33]. A ban on discards is in force, with exceptions for species with  
300 high survival rates [33] and specimens below MLS [29]. Compliance with discard regulations  
301 is incentivised by the permission to land overquota and bycatch species. In order to do so,  
302 fishers have the option to buy additional quota or pay a “deemed value”, i.e. a penalty  
303 corresponding to the market value and weight of catch subtracted from catch profits. The  
304 deemed value increases with the magnitude of the overage in order to discourage excessive  
305 overruns of quota.

306       The impact of the discard ban cannot be accurately assessed because there are no  
307 comprehensive data on discards in New Zealand. Nevertheless, some studies indicate that  
308 discarding still occurs, as fishers discard catch to avoid payment of deemed values [38].  
309 Information from anecdotal reports mentioned by Mace et al. [38] indicates that increasing  
310 amounts of fish are being discarded illegally. This arises from decreasing incentives to  
311 comply with regulations. Many fishers in New Zealand have sold their lucrative ITQs and  
312 bought cheaper ACEs. Furthermore, new fishers entering the industry normally buy ACEs  
313 instead of the costly ITQs, resulting in a reduced sense of ownership due to loss of property  
314 rights, which in turn discourages compliance with discard and bycatch rules and regulations

315 [38].

316

317 ***Mediterranean Sea***

318 Mediterranean fisheries represent an important and vital sector of EU fisheries, accounting  
319 for 46% of total EU fishing vessels, landing around 12 % of total EU landings; with Italy, Spain  
320 and Greece responsible for most of the landings, respectively 48%, 20% and 16% [6].  
321 Unreported removals and discards represented important portions of total removals in the  
322 Mediterranean Sea [39]. A study utilizing data collected reveals a high difference in discard  
323 levels between the Mediterranean Sea and other regions in the EU. Overall, the variation in  
324 discard ratios for a number of commonly-discarded species is often greater between regions  
325 than between fisheries [40-41]. Coll et al. [39] recently estimated the average discard rate in  
326 the Mediterranean and reported that discarding by bottom trawls ranged from 14 to 57% of  
327 official landings, depending on regions and time period. Other fleets, such as those  
328 deploying gillnets (25-30%) and artisanal gears (45%), show high discard rates in  
329 Mediterranean Spain (namely, the Balearic Islands and Andalucía) and discards from the  
330 artisanal fishery in the Gulf of Cádiz may have experienced an increase from the 1990s to  
331 2010 [33].

332         Some concerns have been raised about the effective implementation of the landing  
333 obligation for regulated species in the Mediterranean Sea [6]. Ideally, discard management  
334 should take account of the local/regional characteristics of each SSF, involve coordination  
335 and participation between/with stakeholders, consider the ecological cost of landing fish  
336 that previously would have been discarded. However, the CFP currently lacks such flexibility  
337 and the high logistical, surveillance, monitoring and ecological costs of implementing the  
338 landing obligation could produce a negative outcome despite the good intentions behind the

339 objective pursued, the willingness of the fishing industry to reduce discards and the  
340 profitable use of the resource by its proposed end users. This may lead to the measure  
341 proving non-viable in the Mediterranean Sea and ensuing consequent failure to reduce  
342 discards [40].

343

## 344 **5. European expert perceptions and opinions**

345

346 Out of the thirty respondents, most were experts in SSFs from southern European countries  
347 (75%), mostly from France, Greece, Italy, Portugal and Spain, while the remaining 25% were  
348 from Northern European countries, mostly Denmark, Germany, Norway, Sweden, and the  
349 United Kingdom. In addition, our survey collected information from experts with different  
350 backgrounds, interests and responsibilities, with 23% (n=7) of respondents currently working  
351 in public research institutes, 17% (n=5) at regional/national administrations specialized in  
352 fisheries, and 20% (n=6) each from academia, the fishing industry and NGOs. Most  
353 respondents were male, with a high level of formal education, over 10 year experience  
354 working with SSFs, and training in SSFs and/or discards (Table 1).

355

356 [INSERT TABLE 1 ABOUT HERE]

357

### 358 **5.1. Suitability of the landings obligation for SSF**

359

360 Table 2 shows experts' opinions about the landing obligation, their views about incentives  
361 that could contribute to reduce discards in SSF and opinions on the socioeconomic  
362 consequences of the zero discard policy on the small-scale fishing activities. Results show

363 that most experts did not see any advantage in adopting the discard ban in SSF, with most  
364 pointing out that the discard problem in SSF is in general low, which is consistent with global  
365 estimates of discards from SSF [3], but discards can be high when quotas are exhausted.

366 It is worth noting that, excluding representatives from NGOs, most experts saw no  
367 advantage in implementing the discard ban in SSF. This was the opinion of all experts from  
368 academia, who mostly think that discards in SSF are already very low, and find that the ban  
369 will be very hard to enforce given the very large number of small fishing vessels in the EU  
370 and the current lack of surveillance at sea for this sector.

371 Experts' opinions about small-scale fishers' willingness to comply with the ban were  
372 divided, with just over half thinking that fishers will not be willing to comply with the rule  
373 Representatives of fishers were mostly of the opinion that fishers will not be willing to  
374 comply - this was also the opinion of academics and administration representatives - while  
375 representatives from NGOs and public research institutes were mostly of the opposite  
376 opinion. Reasons offered for the former point of view were imperfect enforcement, lack of  
377 economic incentives to comply with the ban, lack of knowledge on how to proceed, slow  
378 reaction to any change in current fishing practices, lack of preparation of ports to deal with  
379 the new landing obligation, lack of space on-board fishing vessels to keep all catches, and  
380 additional costs and time at work. These factors are then some of the key factors that the  
381 European Commission should consider when implementing the discard ban in SSFs.

382 The introduction of the "*de minimis*"<sup>1</sup> exemptions under Article 15 of the Basic

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<sup>1</sup> The "*de minimis*" exemption shall apply in two specific cases. First, whenever the scientific evidence indicates that increases in selectivity are very difficult to achieve. Second, to avoid disproportionate costs of handling unwanted catches, for those fishing gears where unwanted catches per fishing gear do not represent more than a certain percentage, to be established in a plan, of total annual catch of that gear.

383 Regulation (Reg. (CE) N° 1380/2013) seems not to be a solution for SSFs, with most experts  
384 being of the opinion that these exemptions will not solve the problem of the landing  
385 obligation for SSFs. In fact, all academics and administrators shared this opinion. Most  
386 experts stated that these exemptions would not solve the discard problem in the EU SSFs  
387 because they have been developed for industrial fisheries and, in particular, for cases where  
388 selectivity is difficult to increase without high costs, or for cases where there would be  
389 disproportionate costs of handling unwanted catches.

390 Opinions diverge regarding the capacity of small-scale fishers to hold on board catch  
391 which would previously have been discarded, as well as about their capacity to adapt their  
392 vessel. All representatives of fishers were of the opinion that fishers will not be able to hold  
393 additional catch on board, or have the financial capacity to afford to adapt the vessel.  
394 Academics, administration and representatives from NGOs were also mostly of this opinion.

395

396 [INSERT TABLE 2 ABOUT HERE]

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## 398 **5.2. Social and economic impacts of the discards ban on SSFs**

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400 The adoption to the new zero-discard policy in European SSFs will lead to several  
401 socioeconomic impacts. Experts were unanimous in identifying economic losses to the  
402 fishing industry and a consequent struggle for fishers to continue fishing as the main social  
403 and economic impacts of the discard ban in SSFs (Table 2). Representatives from the fishing  
404 industry also identified economic losses for other sectors which provide/require goods and  
405 services from the SSF sector, and losses of direct and indirect jobs, as other major impacts of  
406 the discard ban.

407 A few experts provided an estimated value of the economic impacts of the zero  
408 discard policy, although these impacts are difficult to estimate at this early stage. No studies  
409 have been carried out on the economic impact of such a measure, making it difficult for  
410 fishers to make long-term business plans. Some experts estimated an economic impact in  
411 the range of 10-15% of the yearly turnover, pointing out that it is a high loss for small-scale  
412 fishers. For example, in Galicia (NW Spain), the annual direct and indirect economic losses  
413 were estimated to be in the range €30-50 million and could result in direct and indirect loss  
414 of 7,000 jobs in the SSF sector.

415

### 416 **5.3. Measures to reduce discards in small-scale fisheries**

417

418 Experts were asked to rate the ability of a selected list of incentives to reduce discards in  
419 SSFs and increase compliance with the zero discard policy by small-scale fishers. Several  
420 incentives were identified by all groups as important. Specifically, changing the fisheries  
421 management system from one based on the TAC regulation to one based on the control of  
422 the fishing effort, higher enforcement of fishery rules and regulations in general, changing  
423 seafood markets and the system of selling seafood products, promoting the sale and  
424 consumption of local seafood products, and raising fishers' awareness of the waste of fish  
425 arising from discarding (Table 2).

426 It is also important to note that academics, administration and scientists from public  
427 research institutes were all of the opinion that changes in the technical features of fishing  
428 vessels will not help to reduce discards, while representatives of both NGOs and the fishing  
429 industry were of the opposite opinion and think that this type of technical measure could  
430 contribute to reduce discards.

431 Most experts perceived that changes in the seafood markets could reduce discards in  
432 SSFs. For example, the adoption of market-oriented measures such as the promotion and  
433 valorisation of underutilized species can help reduce discards, creating a market for such  
434 species. Increasing public awareness about the discard problem could increase consumers'  
435 willingness to pay for sustainable fishery products. Working to increase consumer  
436 acceptance of abundant but currently less well-known and less valuable species, could help  
437 adjust the demand to the supply and significantly contribute to reduce discards. The seafood  
438 market could drive consumer demand towards such less known species in order to  
439 accommodate what is caught rather than continuing to focus on a handful of popular  
440 species, as well as stimulating the consumption of local seafood. However, creating markets  
441 for new species could also potentially increase the stress on marine ecosystems and indeed  
442 is something that the new regulation specifically aims to avoid.

443 Difficulties pointed out by fishers to comply with the discard ban highlighted the  
444 need for the adoption of a complex variety of measures. Incentives to reduce discarding in  
445 SSF in the EU could include a rebalancing of access to quota, preferential allocation of fishing  
446 opportunities to fishers who use more selective gear types or who voluntarily go beyond the  
447 minimum monitoring and reporting requirements applicable for their fleet segment.

448

## 449 **6. Conclusions**

450

451 Despite the increased recognition of the importance of SSFs, there is a need to ensure that  
452 policy-makers receive good scientific data and information on which to base decisions and  
453 thus ensure coherent policy [5]. The review also confirms that the discard rate in the North  
454 Atlantic SSFs is, in general, low, which is consistent with previous global estimates [3,42].

455 However, information on discard rates is lacking for many SSFs and high discard rates have  
456 been documented in Mediterranean SSFs. Furthermore, given the influence of regulations  
457 and perverse market incentives, discarding can occur in fisheries targeted by any gear type.

458 The majority of existing measures to reduce discards have been introduced in large-  
459 scale fisheries. The effectiveness of a discard ban in industrial fisheries is still unclear mainly  
460 because discard data is not systematically collected by fisheries authorities. It should be  
461 borne in mind that measures linked to tradable quotas, which have been partially successful  
462 in reducing discards in large-scale fisheries, may be less suitable to SSF. Evidence from the  
463 literature review and experts' perceptions reported here indicate that that these measures  
464 were mainly developed and implemented for industrial fisheries and, in particular, for  
465 fisheries in which an improvement in selectivity would be difficult to achieve without high  
466 economic costs such as those related to the handling of discards on board.

467 The new CFP aims to reduce/eradicate discards in all EU fisheries, including SSFs. The  
468 main mechanism to achieve this goal is to make it compulsory to land all commercial species  
469 subjected to catches limits, as well as some species managed by minimum landing size.  
470 However, the heterogeneous biological, socioeconomic and institutional characteristics of  
471 SSFs in European waters raise serious concerns over the prospects for successful  
472 implementation of the discard ban. In order to achieve a successful implementation of this  
473 measure, the EU needs to take into consideration stakeholders' views and involve them, in a  
474 meaningful and transparent way, in the management of their own activity, and consider the  
475 potential high ecological cost of landing fish that would previously have been discarded [5-  
476 6,43-44].

477 The CFP currently lacks such flexibility and the high logistical, surveillance and  
478 monitoring costs of implementing the landing obligation could produce a negative outcome

479 despite the good intentions behind the objective pursued, the willingness of the fishing  
480 industry to reduce discards and the profitable use of the resource by its proposed end users  
481 [5-6, 41-45]. This could make the measure non-viable, for instance in the Mediterranean Sea  
482 [46] or in the EU SSFs [42], and consequently fail to reduce discards.

483

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485

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504 **References**

505

506 [1] Food and Agriculture Organization of the United Nations (FAO) The State of World

507 Fisheries and Aquaculture 2014. FAO; 2014. Rome.

508 [2] Food and Agriculture Organization of the United Nations (FAO) A global assessment of

509 fisheries bycatch and discards. FAO Fisheries Technical Paper Nº 339, FAO. 1996;

510 Rome.

511 [3] Kelleher K. Discards in the world's marine fisheries. An update. FAO Fisheries Technical

512 Paper Nº 470. 2005; Rome, FAO, 131 p.

513 [4] Borges L. The evolution of a discard policy in Europe. Fish Fish. 2015; 16: 534-40.

514 [5] Veiga P, Pita C, Rangel, M, Gonçalves JM, Campos A. et al. The EU landing obligation and

515 European small-scale fisheries: what are the odds for success? Mar Policy. 2016; 64:64-

516 71.

517 [6] Bellido JM, Carbonell Quetglas A, Garcia Rodriguez M, García Jiménez T. et al. The

518 obligation to land all catches – consequences for the Mediterranean. European

519 Parliament. Directorate-General for Internal Policies Policy Department b: structural

520 and Cohesion Policies, 2014; 52 p.

521 [7] European Commission (EC). Communication from the Commission to the Council and the

522 European Parliament on a Community Action Plan to reduce discards of fish. COM

523 (2002) 656 final, Brussels.

524 [8] European Commission (EC). Discarding: Key challenge in Fisheries Policy Reform; High

525 Level Meeting on banning discards-Commission of the European Communities,

526 Brussels (2011), Brussels.

- 527 [9] Aarts G, Poos JJ. Comprehensive discard reconstruction and abundance estimation using  
528 flexible selectivity functions. *ICES J Mar Sci.* 2009; 4: 763-71.
- 529 [10] Chuenpagdee R, Jentoft S. Rethinking small-scale fisheries governance. In: Smith H,  
530 Suarez de Vivero J, Agardy T. *Routledge Handbook of ocean resources management*;  
531 2015. p. 241-254.
- 532 [11] Allison EH, Ellis F. The livelihoods approach and management of small-scale fisheries.  
533 *Mar Policy.* 2001; 25: 377-88.
- 534 [12] Salas S, Chuenpagdee R, Seijo JC, Charles A. Challenges in the assessment and  
535 management of small-scale fisheries in Latin America and the Caribbean. *Fish Res.*  
536 2007; 87: 5-16.
- 537 [13] Jacquet J, Pauly D. Funding priorities: big barriers to small-scale fisheries. *Conserv*  
538 *Policy.* 2008; 4: 832-35.
- 539 [14] Eurostat. Your key to European statistics. Available on-line at  
540 <http://ec.europa.eu/eurostat/data/database>. (Accessed July 26th, 2015); 2015.
- 541 [15] Macfadyen G, Salz P, Cappell R. Characteristics of small-scale coastal fisheries in Europe.  
542 Policy Department: Structural and Cohesion Policies, European Parliament, Fisheries,  
543 2011; 162 p.
- 544 [16] Ritchie J, Lewis J, Elam, G. 2003. Designing and selecting samples. In Ritchie J, Lewis J.  
545 (Eds.) *Qualitative research practice. A guide for social science students and*  
546 *researchers.* Thousand Oaks, CA: Sage; 2003; p. 77-108.

- 547 [17] Jette D, Grover L, Carol P. A qualitative study of clinical decision making in  
548 recommending discharge placement from the acute care setting. *J Phy. The. Sci.* 2003;  
549 83(3):224-36.
- 550 [18] Morgan MG. Risk communication: a mental models approach. Cambridge University  
551 Press, Cambridge, New York; 2002, 76 p.
- 552 [19] Green J, Thorogood, N. Qualitative methods for health research (2nd Ed.). Thousand  
553 Oaks, CA: Sage; 2009.
- 554 [20] Villasante S. Österblom H. The role of cooperation for improved stewardship of marine  
555 social-ecological systems in Latin America. *Ecol Soc.* 2015; 20(1): 8.
- 556 [21] Gelcich S, Hughes T, Olsson P, Folke C, Defeo O. et al. Navigating transformations in  
557 governance of Chilean marine coastal resources. *P Natl Acad Sci USA.* 2010; 107:  
558 16794-99.
- 559 [22] Gutiérrez N L, Hilborn R, Defeo O. Leadership, social capital and incentives promote  
560 successful fisheries. *Nature.* 2011; 470: 386-89.
- 561 [23] Graham N, Ferro RS, Karp WA, MaMullen G. Fishing practice, gear design, and the  
562 ecosystem approach—three case studies demonstrating the effect of management  
563 strategy on gear selectivity and discards. *ICES J Mar Sci.* 2007; 64: 744-50.
- 564 [24] Sigler MF, Lunsford CR. Effects of individual quotas on catching efficiency and spawning  
565 potential in the Alaska sablefish fishery. *Canadian J Fish Aquat Sci.* 2001; 58: 1300-12.
- 566 [25] Gilman EL, Dalzell P, Martin S. Fleet communication to abate fisheries bycatch. *Mar*  
567 *Policy.* 2006; 30: 360-66.

- 568 [26] Condie HM, Grant A, Catchpole TL. Incentivising selective fishing under a policy to ban  
569 discards; lessons from European and global fisheries. *Mar Policy*. 2014; 45: 287-92.
- 570 [27] Rice J. The British Columbian rockfish trawl fishery. In: Swan J, Grebova LD. (Eds.)  
571 Report and Documentation of the International Workshop of International fisheries  
572 instruments and factors of unsustainability and overexploitation in fisheries. Italy:  
573 Mauritius: Rome, FAO. 2003; p. 161-187.
- 574 [28] Grafton RQ, Nelson HW, Turris B. How to resolve the class II common property  
575 problem? The Case of British Columbia's Multi-Species Groundfish Trawl. Australian  
576 National University, Economics and Environment Network Working Paper N° EEN0506.  
577 Canberra. 2005; 25 p.
- 578 [29] Sanchirico JN, Holland D, Quigley K, Fina M. Catch-quota balancing in multispecies  
579 individual fishing quotas. *Mar Policy*. 2006; 30: 767-85.
- 580 [30] Branch TA, Hilborn R. Matching catches to quotas in a multispecies trawl fishery:  
581 targeting and avoidance behaviour under individual transferable quotas. *Can J Fish*  
582 *Aquat Sci*. 2008; 65: 1435-46.
- 583 [31] MRAG. Impact assessment of discard policy for specific fisheries. European Commission  
584 Studies and Pilot Projects for Carrying out the Common Fisheries Policy. N°  
585 FISH/2006/17 – Lot 1, Brussels. 2007; 289 p.
- 586 [32] Johnsen PJ, Eliassen S. Solving complex fisheries management problems: what the EU can  
587 learn from the Nordic experiences of reduction of discards. *Mar Policy*. 2011; 35(2):  
588 130-39.

- 589 [33] Gezelius SS. Management responses to the problem of incidental catch in fishing: a  
590 comparative analysis of the EU, Norway, and the Faeroe Islands. *Mar Policy*. 2008; 32:  
591 360-68.
- 592 [34] Hutton T, Thèbaud O, Fulton B, Pascoe S, Innes J et al. Use of economic incentives to  
593 manage fisheries bycatch: an application to key sectors in Australia's Southern and  
594 Eastern scale fish and shark fisheries. Cleveland, Australia. 2010; 174 p.
- 595 [35] International Council for the Exploration of the Sea (ICES) Report of the North-Western  
596 Working Group (NWWG), 24 April-1 May 2014, ICES HQ, Copenhagen, Denmark. ICES  
597 CM 2014/ACOM: 07, 2014; 902 p.
- 598 [36] MFA. Icelandic fisheries, Fisheries Management. Reykjavik: Information Centre of the  
599 Icelandic Ministry of Fisheries and Agriculture. Available on-line at:  
600 <http://fisheries.is/management/fisheries-management> (Accessed January 6<sup>th</sup>, 2015); 2015.
- 601 [37] International Council for the Exploration of the Sea (ICES) Report of the ICES Advisory  
602 Committee. ICES Advice. Available online at: <http://www.ices.dk/advice/icesadvice.asp>  
603 (Accessed January 6<sup>th</sup>, 2015); 2011.
- 604 [38] Mace PM, Sullivan KJ, Cryer M. The evolution of New Zealand's fisheries science and  
605 management systems under ITQs. *ICES J Mar Sci*. 2014; 71(2): 204-15.
- 606 [39] Coll M, Gahamon N, Sarda F, Palomera I, Tudela S et al. Improved trawl selectivity:  
607 effects on the ecosystem in the South Catalan Sea (NW Mediterranean). *Mar Ecol Prog*  
608 *Ser*. 2014; 355: 131-47.

- 609 [40] Garcia Rivera S, Sánchez Lizaso JL, Bellido Millan JM. A quantitative and qualitative  
610 assessment of the discard ban in European Mediterranean waters. Mar Policy. 2015;  
611 53: 149-58.
- 612 [41] Ulhman, SS, van Helmond AT, Stefánsdóttir K, Sigurðardóttir S, Haralabous J et al.  
613 Discarded fish in European waters: general patterns and contrasts. ICES J Mar Sci.  
614 2013; 71: 1235-245.
- 615 [42] Villasante S, Pierce GJ, Pita C, Pazos Guimeráns C, Garcia Rodrigues J. et al. Fishers'  
616 perceptions about the EU discards policy and its economic impact on small-scale  
617 fisheries in Galicia (North West Spain). 2016; (accepted).
- 618 [43] Da Rocha J-M, Cerveño S, Villasante S. The Common Fisheries Policy: An enforcement  
619 problem. Mar Policy. 2012; 36: 1309-314.
- 620 [44] Carpenter G, Kleijans R, Villasante S, O'Leary G. Landing the blame: the influence of EU  
621 member States on quota setting. Mar Policy. 2016; 64: 9-15.
- 622 [45] Carpenter G, O'Leary BC, Villasante S. Keep fisheries catches sustainable. Nature 2016;  
623 531:448.
- 624 [46] Sardà F, Coll M, Heymans JJ, Stergiou KI. Overlooked impacts and challenges of the new  
625 European discard ban. Fish Fish. 2015; 16: 175-80.

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