



NAFO/ICES *PANDALUS* ASSESSMENT GROUP MEETING – OCTOBER 2011

**Discarding in the shrimp fisheries in Skagerrak and the Norwegian Deep
(ICES Divs. IIIa and IVa east)**

Sten Munch-Petersen, Mats Ulmestrand, Guldborg Søvik and Ole Eigaard

In the *Pandalus* fisheries shrimps are discarded because of being un-marketable, either due to poor landing quality or too small size. However, smaller shrimps of low market value are also discarded, when the catch is high graded. This is the case when fisheries are constrained by TACs and subsequent national quotas.

Estimates of the total amount of discards in the shrimp fisheries in IIIa and IVa east are based both on onboard sampling of catches (Denmark) and indirect estimates (Sweden and Norway).

Discarding of shrimps in the Danish shrimp fishery.

It has been well known that some discarding of *Pandalus* takes place in the Danish shrimp fishery. However, only in recent years (since 2009), from the at-sea-sampling programme, has it been possible to obtain information on the size composition of the discarded shrimps as well as to quantify the amount of discards.

The fraction of small shrimp in the Danish shrimp catches are landed mainly to processing plants, which also handle the smaller shrimps (SCR doc. 11/069). Therefore, the discarded shrimp in the Danish shrimp fishery consist mainly of specimens too small for the plants or damaged, poor quality shrimp. There are no records of high grading, probably because the smaller shrimp are accepted by the Danish processing plants.

1. Estimates of total amount of discarded shrimp.

The discard samples and the corresponding samples of landed catch are raised to totals by raising the average weight ratios landed catch/discards obtained from the at-sea-sampling. This has been done on a quarterly basis (Table 1). One would expect more discards in seasons with more small shrimps. Such would be expected in the 4th and 1st quarters of the year, when larger amounts of the 0 and 1 groups are caught by the fishery. The higher amount of discards in the 1st quarter of 2009 indicates this, but the time series is too short to confirm this pattern.

Notice that, according to the sample data for 2009 and 2010, total discards in the Danish shrimp fishery seem to at a low level, around 30 t in both years.

2. Size composition of discards.

Figs. 1 & 2 compare the size compositions (% length frequencies) of the discarded shrimp with those of the landings. Only data for two years of observer trips are available, 2009 and 2010, and they reveal no clear seasonal pattern of the distributions. As expected the bulk of the discards are of small size.

Notice that in both years the discarded *Pandalus* are smaller than the landed ones as expected, but that there is also a large overlap in the size distributions in both years. In both years the modes of the discards suggest that the majority belongs to the 1 group shrimp. Especially for 2010 it is very clear that in the first quarter the bulk of the discards consist of the recruiting 1 group shrimps (Fig. 2 B). It is probable that the discard of larger shrimp consist of specimens in poor condition (damaged specimens), which do not meet the quality required for processing (boiling) at sea.

Discarding of shrimps in the Swedish shrimp fishery.

In Sweden, quota restrictions and the substantial price difference between large, boiled shrimp and medium sized fresh ones together with a voluntary system of weekly rations (different for medium and large shrimp) have resulted in high grading at sea by discarding some medium sized ones, which fetch only 14% of kg price for the (large) boiled shrimp. Because of this practice, the amount of discarded shrimp in the Swedish fishery is relatively larger than in the Danish and Norwegian fisheries. However, data from direct onboard sampling of unsorted catch are few at present. Instead, estimates of discards are obtained by an indirect method.

The amount of discards in the Swedish fisheries was estimated to 678 t in 2009 and 558 t in 2010 based on comparison of length distributions of Swedish landings and Danish catch (Figs. 3 and 4). The annual Danish length distribution in the catch is scaled to fit the yearly Swedish length distribution for the larger *Pandalus* sizes based on the assumption that there is no discarding of the most valuable larger size groups (right hand side of the curve, ≥ 21 mm CL), and that the Swedish and Danish fisheries are conducted on the same *Pandalus* grounds and same size distributions. The higher numbers in the Danish smaller size groups, compared to the Swedish numbers, are then multiplied with the mean weight of each size group, and the sum is considered as the weight of the Swedish discards of small unmarketable sizes and due to high grading. Estimations based on such Swedish high grading are shown for the last seven years in Table 3. This type of estimations is rough and the figure for e.g. 2008 is likely to be an overestimation.

The Swedish *Pandalus* fishers claim that this estimation of discards is an overestimation as they may choose different *Pandalus* grounds with less small shrimps compared to the grounds that Danish *Pandalus* fleet fish. Furthermore, an increasing part of the Swedish *Pandalus* fleet voluntarily use 45 mm mesh size instead of the legislated 35 mm in order to avoid catching small shrimps.

Since 2008 Sweden has conducted an at-sea-sampling programme to get information of the catch composition and discarding level in the *Pandalus* fishery. Fishermen's handling of the shrimp catches on board the vessel make it sometimes difficult to estimate the discarded weight and/or get samples of the discarded fraction of the catch. When possible, unsorted samples of the catch are collected and used to estimate the discards given the weight and size composition of the landings together with knowledge of the selective properties of the size sorting sieves used. Figure 5 shows the estimates of discards from this at-sea-sampling compared to the above-mentioned adjustment of Danish/Swedish size

compositions. These results also indicate that the method above is an overestimation of the Swedish discarding rate.

Discarding of shrimps in the Norwegian shrimp fishery.

Norwegian discards are estimated by comparing length frequency distributions from sorted landings (sampling initiated in 2007) with length frequency distributions of unprocessed commercial catches (sampling initiated in 2005). The length frequency distributions are compared in the same manner as described above for the Swedish and Danish distributions.

Norwegian discards in Skagerrak have been estimated in this manner for 2007-2010. In 2010 discards from Skagerrak were also estimated applying the Danish discards-to-landings proportion to the Norwegian landings. In 2007-2009 there were too few samples from the Norwegian Deep to estimate discards from this area. In 2010, sampling frequency improved, and discards have been estimated for both areas.

In 2007 discards in Skagerrak were estimated to 526 t. In 2008 the comparison of length frequency distributions of landings and catches gave negative discards, so instead the length distributions from sorted landings were compared with Danish landings, assuming that the fishing took place on the same fishing grounds and that the level of discarding in the Danish fishery was low. The estimated Skagerrak discards in 2008 of 1 408 t was probably much too high. The assumption of the Norwegian and Danish fleet fishing on the same fishing grounds may possibly not have been valid. Discards in 2009 were estimated to 115 t.

In 2010 annual discards from Skagerrak were estimated to 95 t based on comparisons of length frequency distributions (Fig. 5). Discards consist of shrimp smaller than 13 mm CL, as well as some larger shrimp, which may be damaged, poor quality shrimps (see above). Using the Danish numbers, annual discards from Skagerrak were estimated to 63 t. The estimated annual discards from the Norwegian Deep were negative (-39 t), due to the length frequency distribution of sorted landings having a larger peak for 2-year old shrimp compared with the length frequency distribution of unprocessed catches (Fig. 6). This could be due to samples coming from different locations. As there is no Danish at-sea-sampling-programme in the Norwegian Deep, discards cannot be estimated using Danish discard sampling.

Although high-grading cannot be ruled out, the Norwegian discards are probably mainly made up of non-marketable shrimp. Estimations based on the Danish numbers are considered most reliable and the Norwegian discards from 2010 are therefore set to 63 t.

Length distributions per quarters suggest that the 1-group is discarded in quarters 1 -3, and the 0-group is discarded in quarter 4 (Figs. 5, 6).

References.

Munch-Petersen S., Eigaard O., Søvik, G. and M. Ulmestrand. 2011. The Northern shrimp (*Pandalus borealis*) Stock in Skagerrak and the Norwegian Deep (ICES Divisions IIIa and IVa East). NAFO SCR Doc. 11/069, 25 pp.

Table 1. Estimated discards (t) and corresponding landings (t) in the Danish shrimp fishery, per quarter.

Year	1 quarter			2 quarter			3 quarter			4 quarter			annual total		
	discards	landings	Catch	discards	landings	Catch	discards	landings	Catch	discards	landings	catch	discards	landings	catch
2009	10.5	600.2	610.7	10.4	557.3	567.7	9.5	437.5	447.0	5.7	560.3	565.9	36.1	2155.2	2191.4
2010	19.3	401.6	420.9	5.2	295.6	300.8	3.1	296.5	299.6	2.4	234.9	237.3	29.9	1228.7	1258.6

Table 2. Estimated discards (t) and corresponding landings (t) in the Norwegian shrimp fishery in 2010, per area and quarter.

Quarter		Skagerrak ¹	Skagerrak ²	Norwegian Deep
1	discards	26	37	-88
	landings	775	776	621
	catch	801	813	
2	discards	32	12	26
	landings	709	710	512
	catch	741	723	538
3	discards	24	7	7
	landings	709	710	415
	catch	733	718	422
4	discards	41	6	1
	landings	624	625	309
	catch	665	631	310
annual	discards	95	4513	-39
	landings	2817	2817	1856
	catch	2912	7330	

Skagerrak¹ - discards based on comparisons of Norwegian length frequency distributions

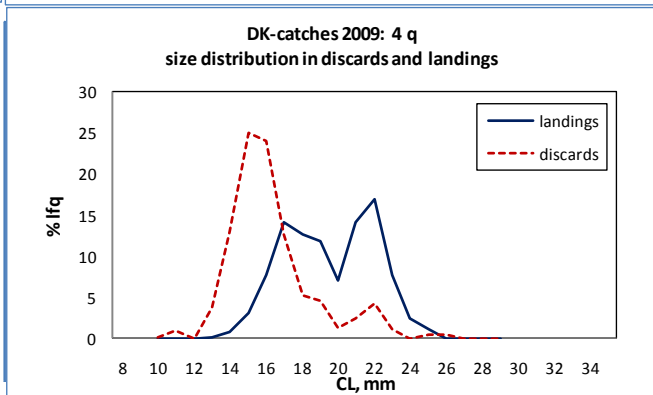
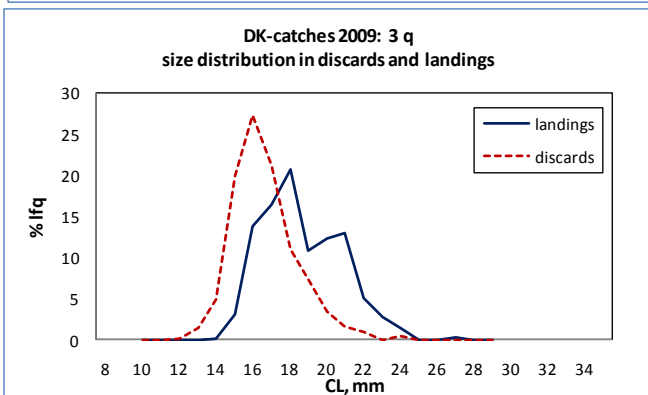
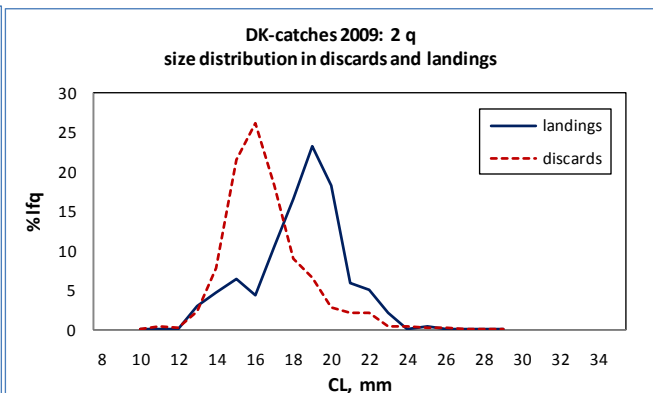
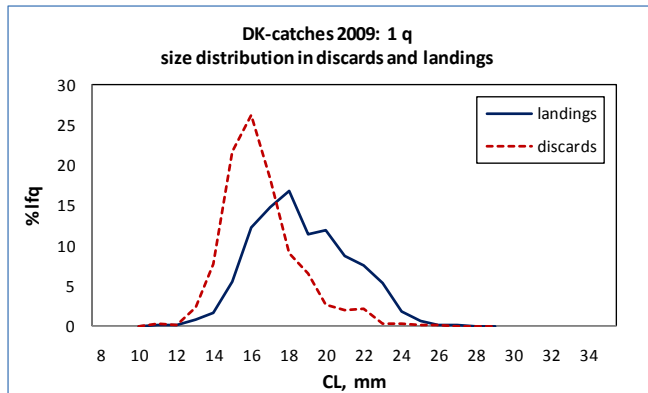
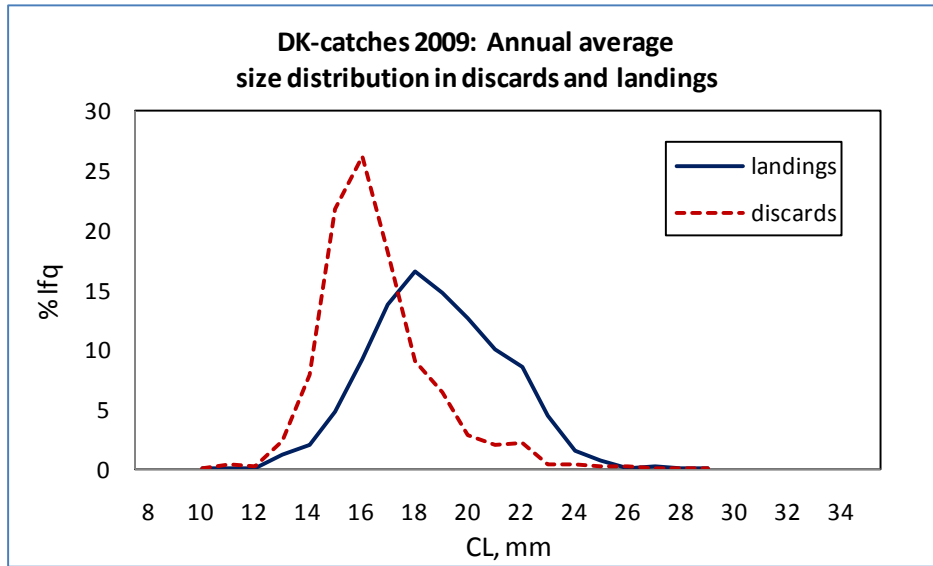
Skagerrak² - discards based on Danish proportions between landings and discards

Table 3. Estimated high grading and discards (t) and corresponding landings in the Swedish shrimp fishery during 2005 to 2010.

	2005	2006	2007	2008	2009	2010
Boiled landings	1,077	973	1,049	1,041	1,374	1,123
Raw landings	1,180	1,515	1,396	1,438	1,109	657
Landings (t)	2,257	2,488	2,445	2,479	2,483	1,780
High grading						
Raw	1,696	1,198	1,124	2,003	671	463
Discards (small)	?	?	?	?	7	95
Catch (t)	3,953	3,686	3,569	4,482	3,161	2,338

Fig. 1. Length distribution in landings and discards in the Danish shrimp fishery, 2009.

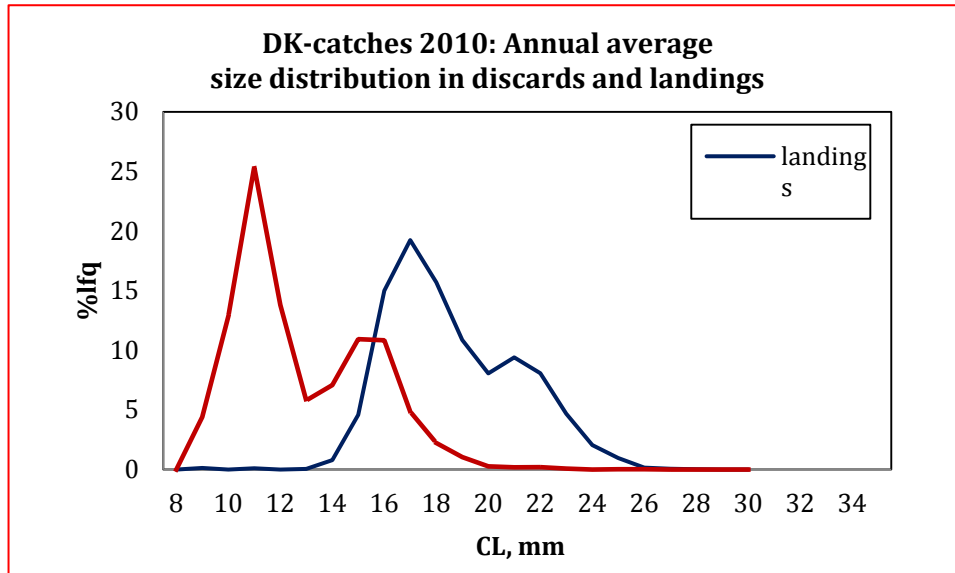
A: Annual average



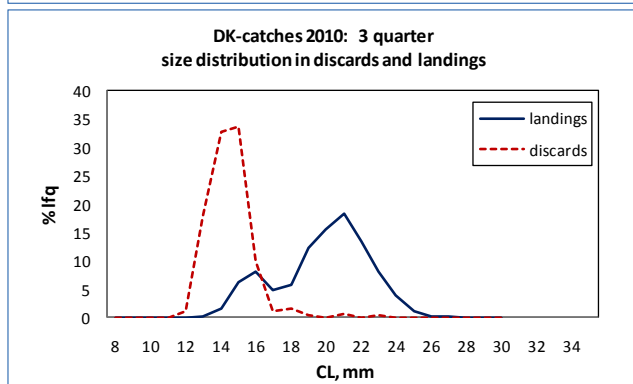
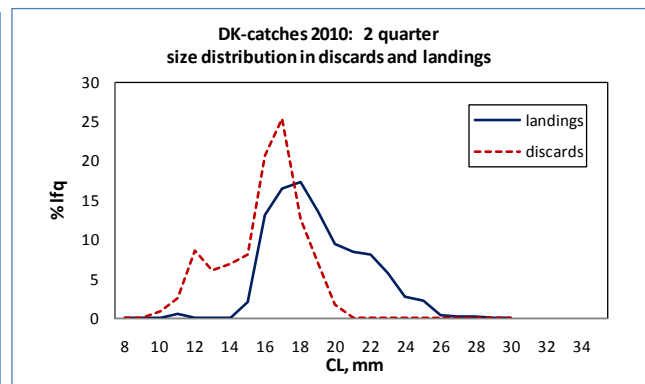
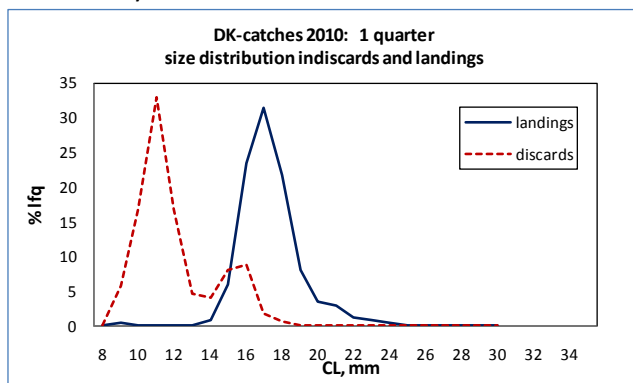
B. Quarterly distributions

Fig. 2. Length distribution in landings and discards in the Danish shrimp fishery. 2010. No data from the 4th quarter.

A: Annual average



B. Quarterly distributions



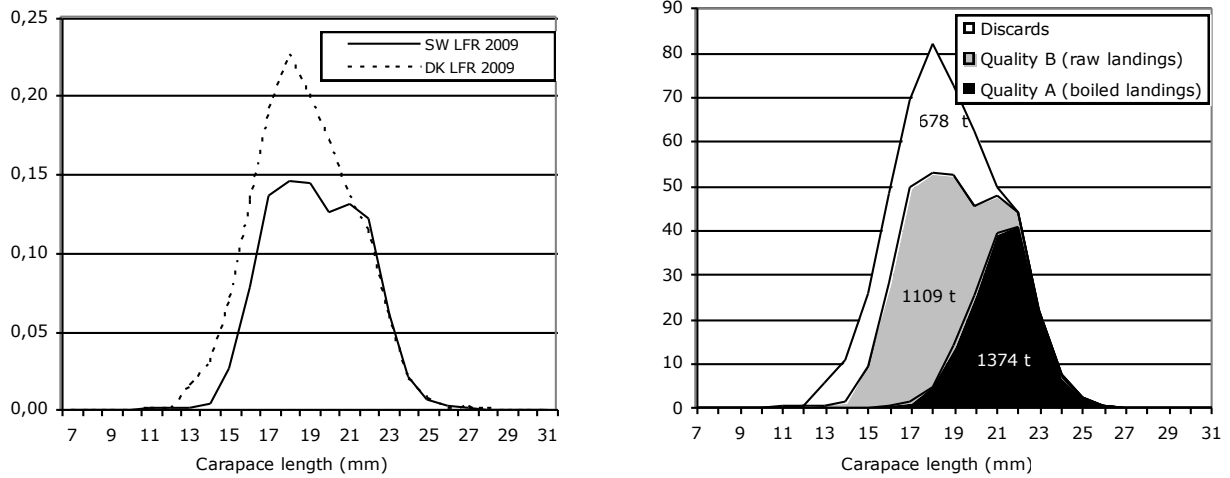


Fig. 3. Size distribution of Danish catch adjusted to Swedish landings (≥ 21 mm) in 2009 (left) and Swedish landings separated into boiled and raw *Pandalus* and estimated discards during 2009 (right).

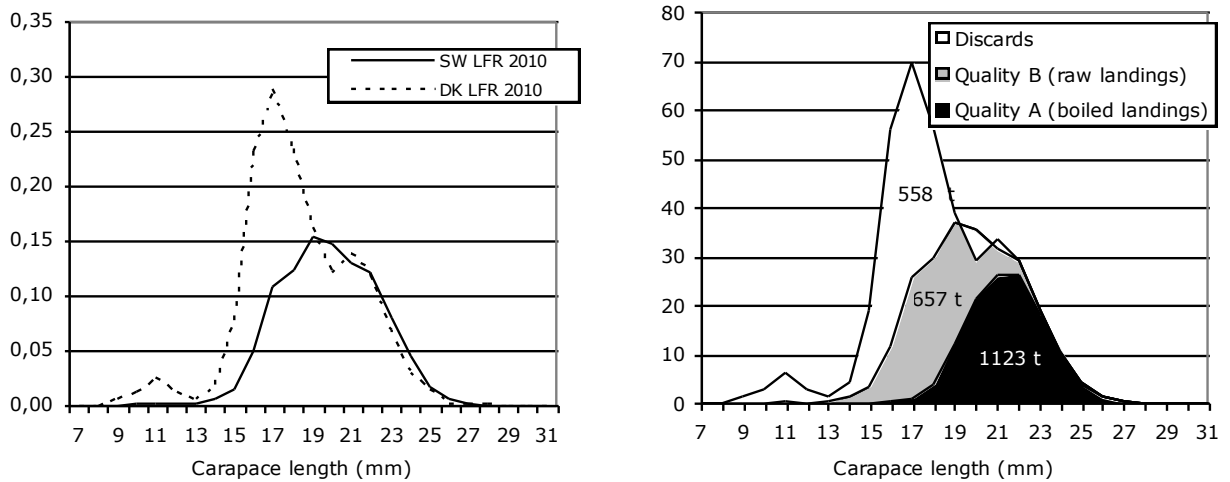


Fig. 4. Size distribution of Danish catch adjusted to Swedish landings (≥ 21 mm) in 2010 (left) and Swedish landings separated into boiled and raw *Pandalus* and estimated discards during 2010 (right).

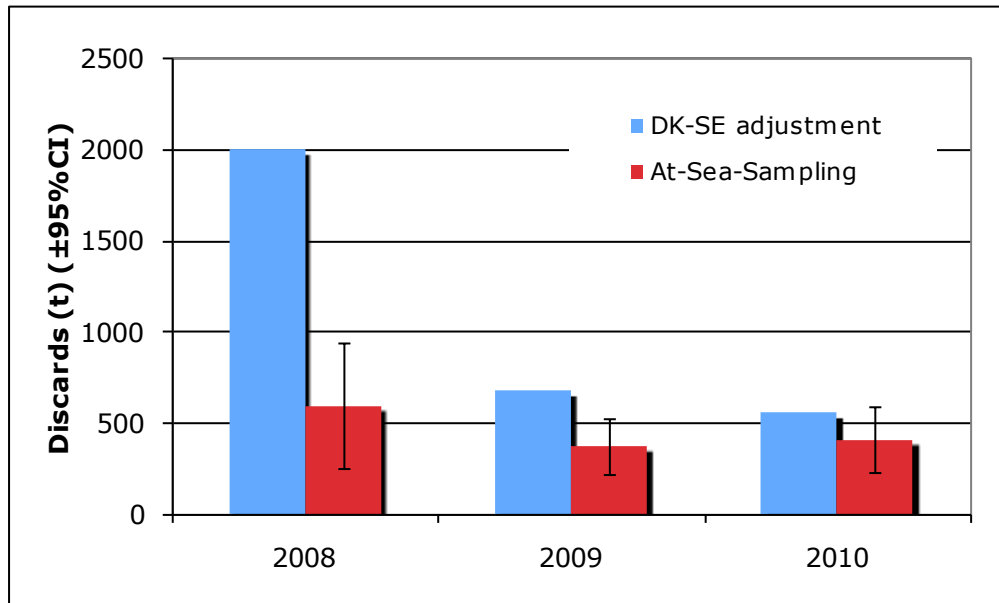


Figure 5. Estimates of the Swedish discards of *Pandalus* from at-sea-sampling and from comparing Swedish and Danish length frequencies 2008 to 2010.

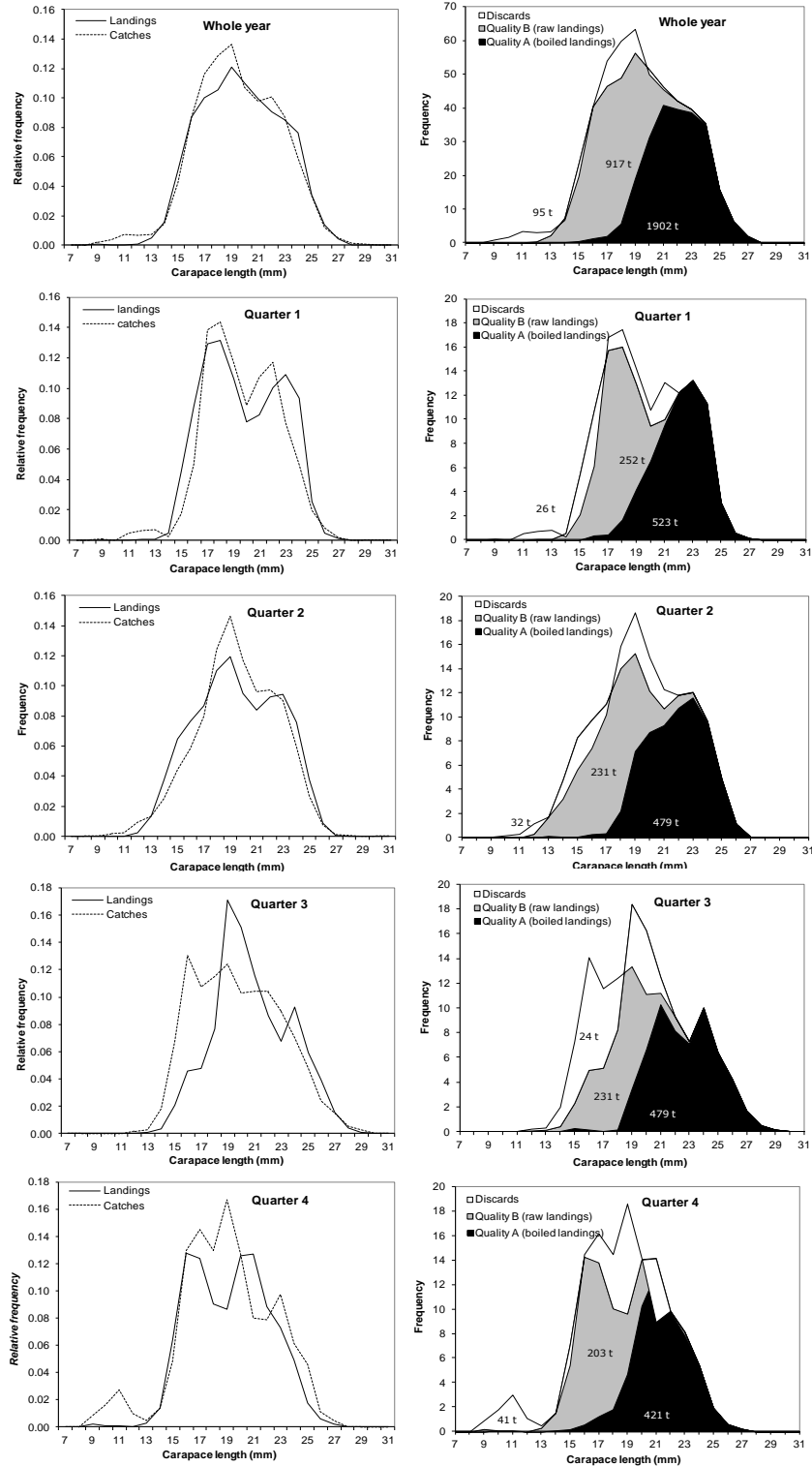


Fig. 6. Norwegian 2010 length frequency distributions from unsorted commercial catches and sorted landings from Skagerrak adjusted to each other for CL > 21 mm (left), and size distribution of Skagerrak landings, separated into boiled and raw shrimps, and estimated discards (right). Annual and quarterly figures.

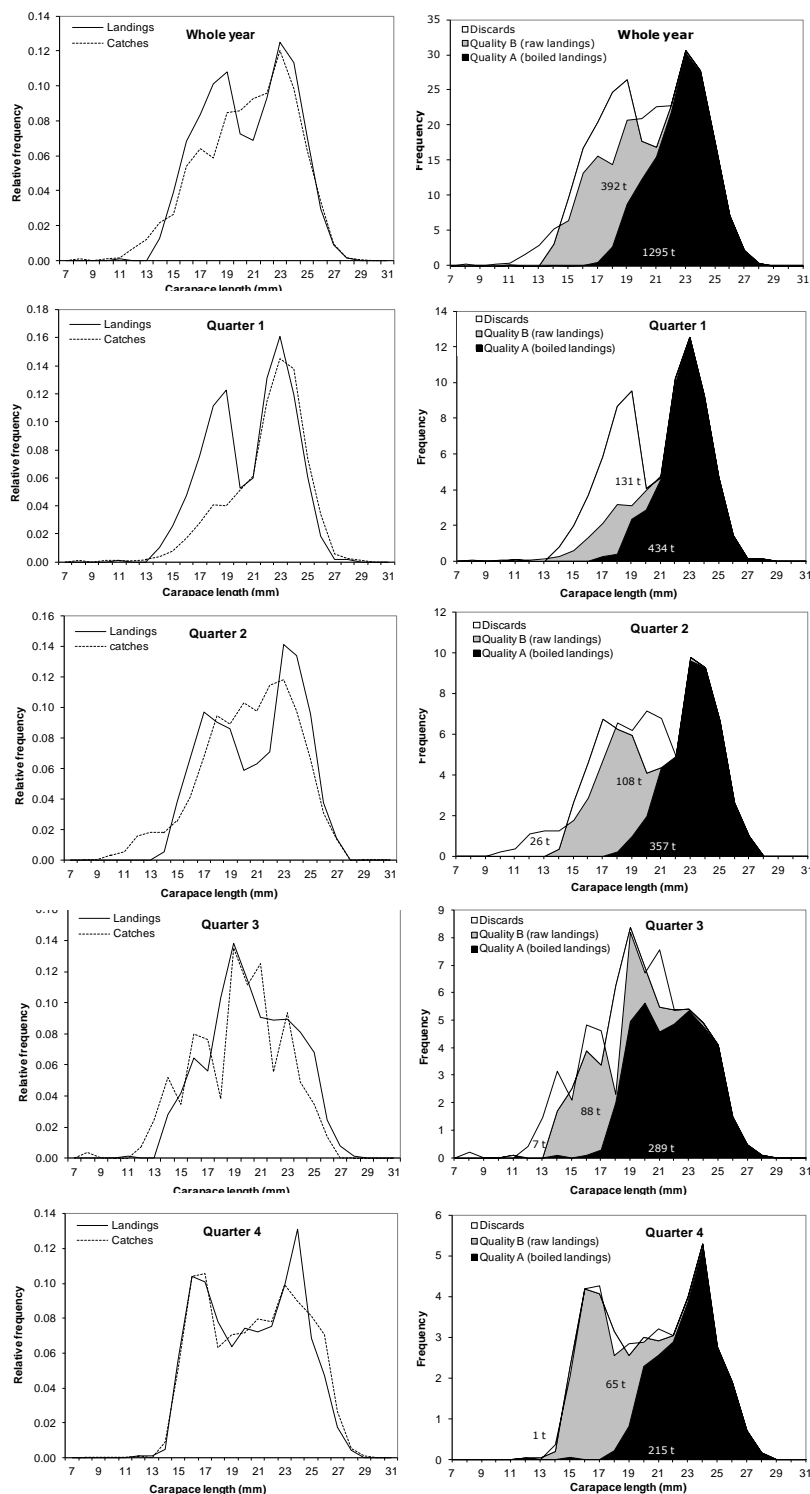


Fig. 6 (continued). Norwegian 2010 length frequency distributions from unsorted commercial catches and sorted landings from the Norwegian Deep adjusted to each other for CL > 21 mm (left), and size distribution of Norwegian Deep landings, separated into boiled and raw shrimps, and estimated discards (right). Annual and quarterly figures.