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Shrimp (*Pandalus borealis*) catch rate of Estonian vessels in Divisions 3M and 3L in 2006-2010

by

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Abstract

There have been concerns about usefulness of observer data in recent years and one recommendation for research has been to find out the misreporting of catches at neighboring divisions 3M and 3L (catches from 3L reported as taken from 3M) to elucidate the usefulness of CPUE data in stock assessments. There is total allowable catch (TAC) quota in 3L and effort regulation (available fishing days) in 3M. Estonian quota in 3L is small and that is why there is a possibility that some part of the catch taken from 3L is reported as taken from 3M. In this study the possibly misleading observations that may have effect on CPUE of two divisions were eliminated. The CPUE of shrimp in division 3M was compared between fishing trips when vessels were fishing only in 3M and when vessels were fishing in both divisions. CPUE in 3M was lower during trips when vessel was fishing only in 3M. This result indicates that catch figures and therefore also the CPUE data may have been intentionally misreported by the skipper and due to unknown reasons the observers are unable to detect that during the fishing trip.

Introduction

Estonia commenced shrimp fishery in NAFO Regulation Area in 1994. In two first years (1994 and 1995) the shrimp catch of Estonian vessels was 1081 and 2092 tons accordingly. CPUE of shrimp for Estonian and Latvian vessels was approximately 140 kg per hour, which was significantly lower compared to catch rates of other countries (Parsons *et al.*, 1998). Estonia had 4 shrimp vessels fishing for shrimp in NRA in 1994, 10 vessels in 2000 and 3 vessels in 2009.

Most common practice for Estonian fishing vessels in NAFO area is to conduct shrimp fishery both in Div. 3M and Div. 3L during the same fishing trip. Occasionally there are fishing trips when vessel conducts fishery only in Div. 3M. There was no fishing trips when vessel conducted fishery only in Div. 3L until the end of 2010. From August 2010 there are also fishing trips when vessel conducted fishery only in 3L. There is 100% observer coverage on Estonian vessels in NRA.

There have been concerns about usefulness of observer data in recent years, concerning misreporting of catches at neighboring divisions 3M and 3L (catches from 3L reported as taken from 3M), and whether the CPUE data is usable in stock assessments (Casas, 2009; NIPAG, 2007, 2009). The CPUE of shrimp in division 3M was compared between fishing trips when vessels were fishing only in 3M and when vessels were fishing in both divisions. And the CPUE of shrimp in division 3L was also compared between the trips that have different fishing strategies.

Material and methods

Data used in this study is collected by Estonian observers on board Estonian commercial shrimp vessels. CPUE data consists of raw haul-by-haul data. The data that was left out included hauls with reported engine problem, bad weather, bad trawl behavior or there might have been problem with recording the division since the start and end of the tow were recorded to be in separate divisions. The number of hauls for 3M analysis is presented in table 1. The number of hauls for 3L analysis was 33 for 2007-2009 and 113 hauls for 2010.

There were 3 vessels in the analysis that had been fishing in all years 2006-2009. CPUE data was separated into two groups according to used fishing strategy. 1st group – hauls taken during fishing trips when vessel was fishing in both divisions; 2nd group – hauls taken during fishing trip when vessel was fishing only in 3M. Kruskal-Wallis test was used to compare the CPUE data.

There was one vessel fishing only in 3L during the fishing trips in August to October 2010. The CPUE of these trips was compared to CPUE in 3L of trips from years 2007-2009 of the same vessel in the same division and in the same months.

Results and discussion

Analysis of observer data showed that factors affecting the CPUE of shrimp are evident also in observer data. The CPUE varied between months and vessels (figure 1) (KW test: 3M 2006 KW-H(11;1970) = 153,0; p = 0,00; 2007 KW-H(11;2482) = 278,9; p = 0,00; 2008 KW-H(11;2572)= 543,8; p = 0,00). Tows made at night had lower CPUE in both divisions (figure 2) (3L KW-H(1;3196)=238; p<0,00. 3M KW-H(1;1445)=18; p<0,00). Double trawls had higher CPUE in 3M (KW-H(1;3396)=33,39; p<0,00). There was no CPUE difference between single and double trawls in 3L (figure 3).

All 3 vessels had lower CPUE in 3M when they were not fishing also in 3L during the same fishing trip (figure 4) (KW test: vessel B KW-H(1;626) = 66,9; p = 0,00; vessel D KW-H(1;689) = 52,2; p = 0,00; vessel H KW-H(1;624) = 16,5; p = 0,00). The difference was significant in 2007 and 2008 (KW test: 2007 KW-H(1;679) = 131,2; p = 0,00; 2008 KW-H(1;618) = 48,1; p = 0,00), and not significant in 2006 (figure 5) (KW test: 2006 KW-H(1;373) = 2,5; p = 0,11). Similar testing was not possible for 2009 or 2010 as all fishing trips had hauls in both divisions.

CPUE of shrimp in 3M shows increasing trend in 2006-2009 if to include all fishing trips. That is contrary to the survey data that shows decline in shrimp biomass in these years (Casas, 2009). If to include only fishing trips with hauls taken only in 3M then the trend is declining (figure 6). The CPUE in division 3L was higher when vessel fished only in that division (figure 7). The CPUE of shrimp in that division has not increased from years 2007-2009 compared to 2010 (Orr *et al.*, 2010). These results indicate that there is a possibility that the reason for such discrepancy in Estonian CPUE data (figure 6 and 7) is due to misreporting of catches between 3M and 3L.

Conclusions

1. Presented results demonstrate that CPUE data from trips when fishing takes place in both divisions 3M and 3L during the same fishing trip are not reliable for use in stock assessment. No such conclusion could be made on data, gathered from trips to only one division.

Acknowledgements

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Table 1. Number of all hauls, excluded hauls and hauls used in analysis of shrimp 3M CPUE of Estonian vessels in 2006-2009.

Year	Division	Vessel	Number of all hauls	Number of excluded hauls	Number of hauls in final analysis
2006	**3L**	A	17	2	
		B	19	2	14
		C	49	4	
		D	134	2	37
		H	151	18	79
	3M	A	45	3	
		B	47		25
		C	535	56	
		D	709	62	134
		H	634	16	191
2007	**3L**	B	16		10
		C	82	1	
		D	194	64	74
		H	179	6	103
		F	38		
	3M	B	593	5	206
		C	322	9	
		D	590	248	117
		H	686	17	247
		F	291	2	
2008	**3L**	B	112	8	60
		C	43		
		D	137	11	67
		H	154	8	81
		F	91	54	
	3M	B	694	70	215
		C	262	104	
		D	789	232	244
		H	305	25	114
		F	522	109	
2009	**3L**	B	248	5	151
		D	183	1	106
		H	79	3	44
	3M	B	265	9	148
		D	132	4	64
		H	83		57
Total 2006-2009			9430	1160	2588

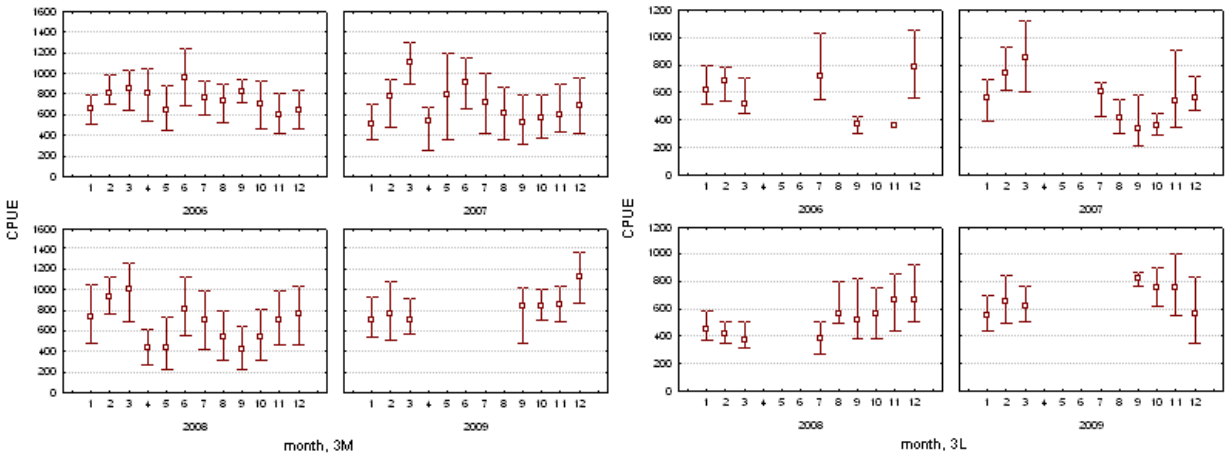

Figure 1. Shrimp CPUE of Estonian vessels by months. Median and quartiles.

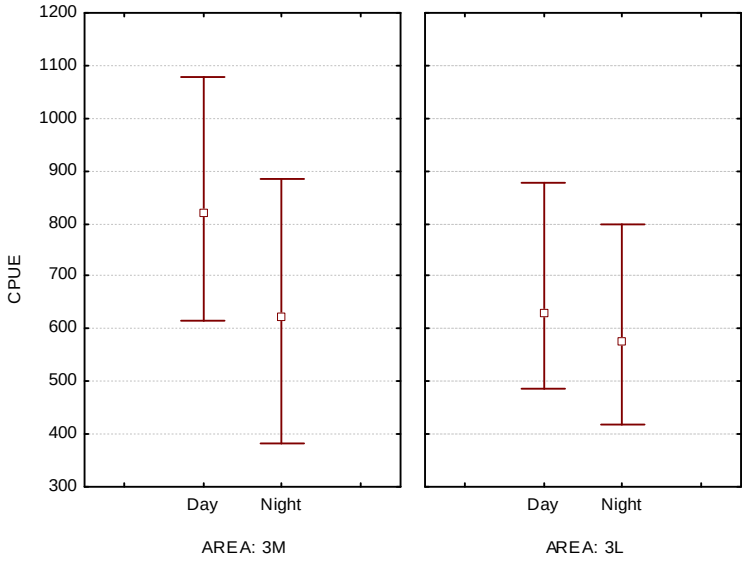

Figure 2. Shrimp CPUE of Estonian vessels in hauls taken at night and at day in 2006-2009. Day is local time 7am-9pm. Median and quartiles.

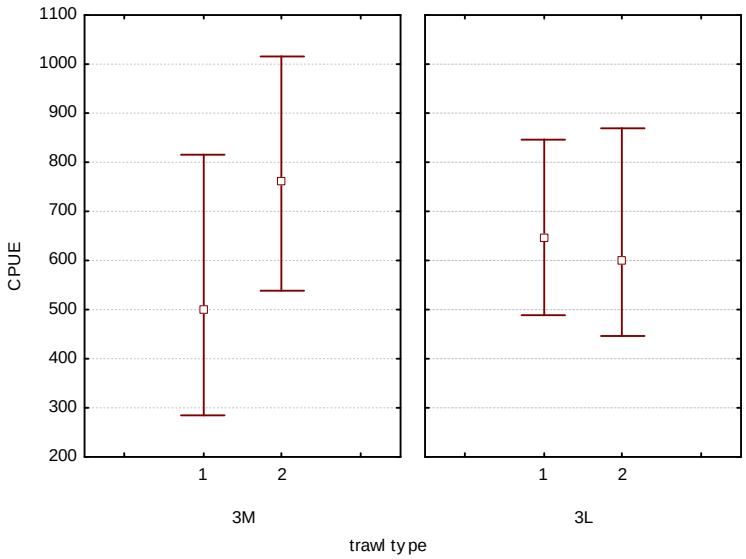

Figure 3. Shrimp CPUE in single (1) and double trawls (2) of Estonian vessels in 2006-2009. Median and quartiles.

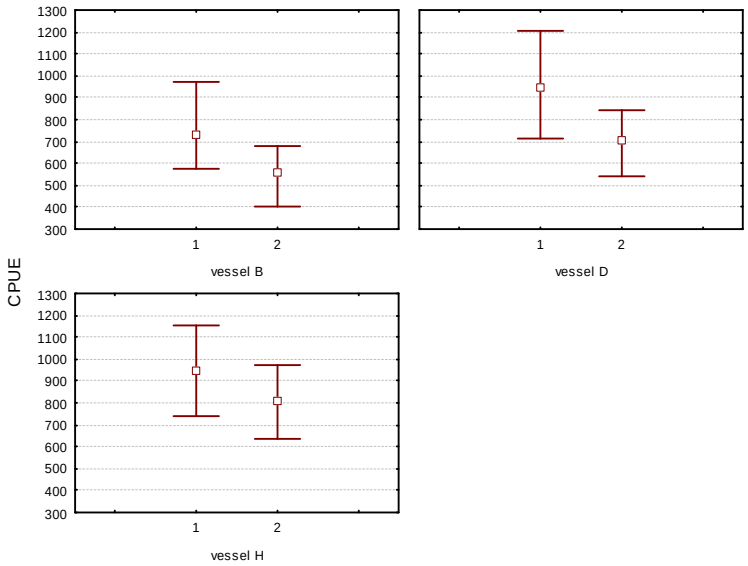

Figure 4. Shrimp CPUE of Estonian vessels in 3M by vessel in 2006-2008. 1st group – hauls taken during fishing trips when vessel was fishing in both divisions (1); 2nd group – hauls taken during fishing trip when vessel was fishing only in 3M (2). Median and quartiles.

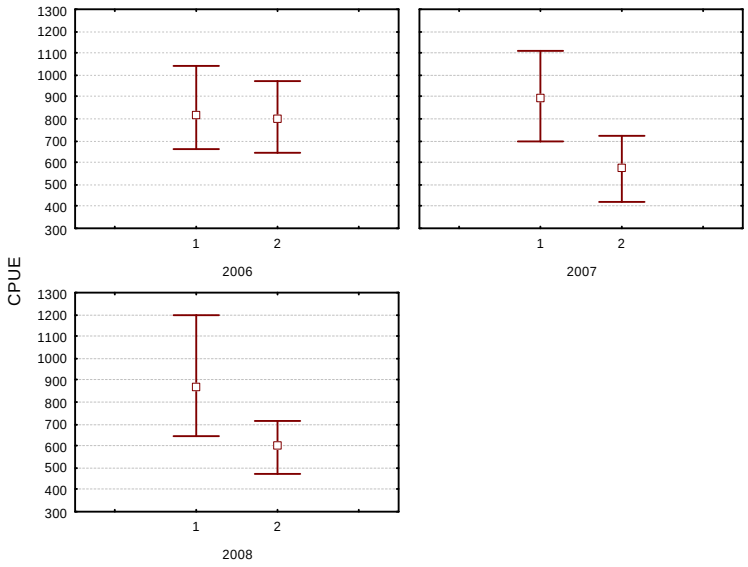

Figure 5. Shrimp CPUE of Estonian vessels in 3M in 2006-2008 by year. 1st group – hauls taken during fishing trips when vessel was fishing in both divisions (1); 2nd group – hauls taken during fishing trip when vessel was fishing only in 3M (2). Median and quartiles.

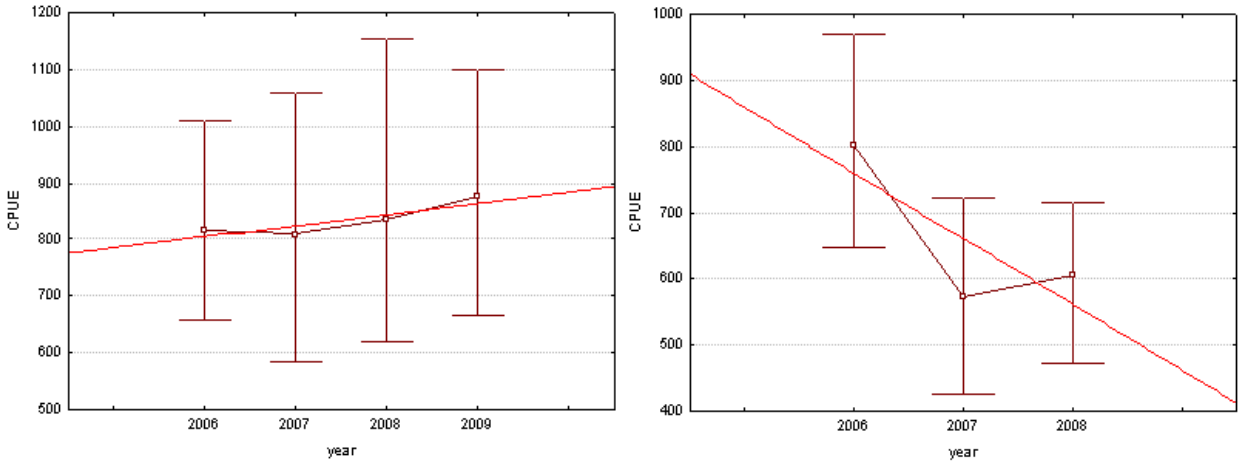

Figure 6. Shrimp CPUE of Estonian vessels in 3M. 1st group – hauls taken during fishing trips when vessel was fishing in both divisions (left); 2nd group – hauls taken during fishing trip when vessel was fishing only in 3M (right). Median and quartiles.

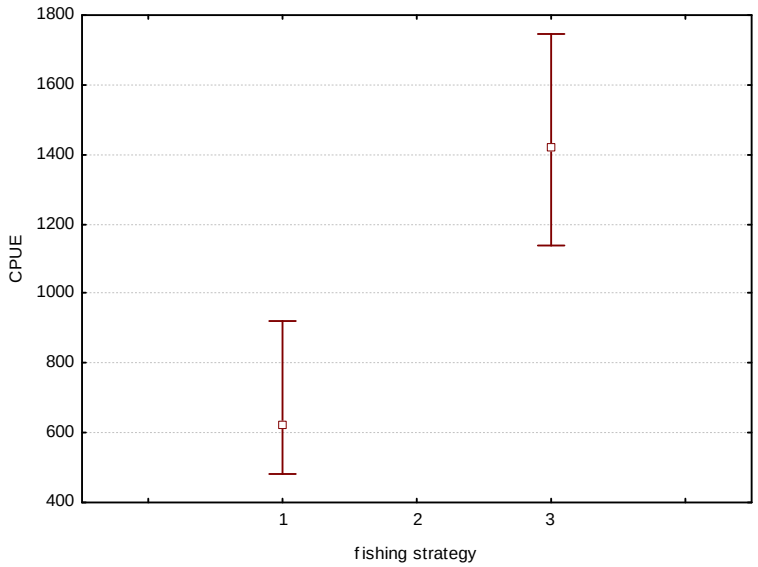

Figure 7. Shrimp CPUE of Estonian vessels in 3L. 1 – fishing in both divisions 3L and 3M in 2007-2009. 3 – fishing only in 3L in 2010. Dataset consists of CPUE from August, September and October. Median and quartiles.