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DEGRADATION OF BENTHIC COMMUNITIES USING DEMERSAL TRAWLING

SUMMARY

Bottom trawling is very present in the Montenegrin fisheries, primarily in the open sea. When applying this method important processes occur to the seabed, mainly destructive character. Inside the mesh not only the target species can be found but also large amount of non-commercial species of plants and animals. On this way as physical as biological structure of the seabed may be destroyed. The degree of impact depends of the type of gear that is used or the size of the mesh but also of the type of bottom on which the towing is done. Studies have shown muddy substrate as most susceptible to destruction. Raising particles from the bottom has a negative impact on species in the benthic communities.

The conducted research has shown that a large percentage of catch belonging to non-edible part. These values range sometimes up to over 50% of the catch. Most of this consists of invertebrates organisms that have not commercial value such as representatives of Echinodermata, Porifera, Bryozoa, Mollusca. Significant amount belong to immature fish specimens that had not reached market size or no market value.

Using of demersal trawl is just one way of destruction of the seabed and the life on it. Recently for collecting shellfish is used by dredge. The lack of information about this problem characterizes the Montenegrin fisheries.

Keywords: benthic communities, demersal trawling, Montenegrin coast, discard, biocoenosis of the coastal terrigenous ooze.

INTRODUCTION

Trawling fishery plays significant role in the open sea of the Montenegrin coast. During trawling, sea bottom is under strong destructive impact. If fishing is more intensive, negative impact is more strongly.

Heavy fishing disturbs muddy and sandy bottoms, causing dramatic changes in the structure of both the physical support system and the related biological assemblages. As synthesised by Pranovi et al (2000), "trawls scrape or plough the seabed, resuspend sediment, change grain size and sediment texture, destroy bed forms, and remove or scatter non-target species". Increase in the amount of suspended nutrients and organic matter can be added to these effects

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(Jones, 1992). Highly impacting bottom fishing (trawling, dredging) mainly affects shelf areas.

In general, muddy sediments, which form in high depositional areas with low external disturbance, are much more sensitive to trawling disturbance than more dynamic coarser sediments; trawl doors penetrate them more deeply than other sediments, with potentially greater effects on infaunal species (Ball, Munday and Tuck 2000). The study carried out by Pranovi et al (2000) on the short-term impact of this gear on the sea bottom revealed that it causes extensive damage, digging and furrowing the sediment to a depth of 6 cm. Experimental studies seem to conclude that trawling causes greater short-term disturbance on macro benthos in muddy areas than in sandy bottoms, although short-lived fauna associated with the former recovers quite rapidly (within two weeks) (Pranovi, Giovanardi and Franceschini 1998).

Negative effects on the structure of the macro benthos community were recorded what can lead increase in the abundance and biomass of taxa because of the increase in the trophic availability benefiting a few oportunistic scavenger species. Commercial exploitation appears to result in cumulative disturbance as evidenced by the higher biomass of scavenger Crustacea and Echinodermata at the expense of Porifera, Mollusca and Annelida. Commercial fishing may therefore be selecting epibenthic species most able to cope with physical disturbance by gear and endure the discard process.

Regarding to this problem in Montenegro there is not data. Until now shell fishing is not so intensive but in near future it will be more intensive but demersal fishing of the crustacean and fish is well present.

MATERIAL AND METHODS

Research of trawling impacts on benthic biocoenosis was part of the project "Biological resources, edible and non-edible, in trawling fishing at Montenegrin coast". Data collection was conducted during the summer months of 2009. by ten hauls along the open part of the coast line mainly in the biocoenosis of the coastal terrigenous ooze (Fig. 1).

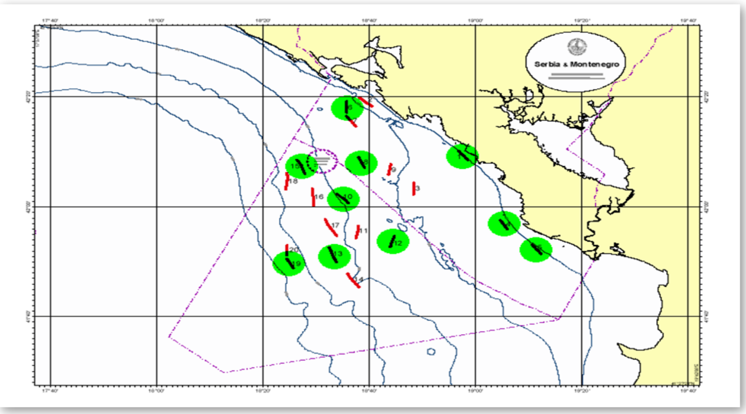

Figure 1. Positions of trawling (green circle)

Positions are randomly selected. Material was collected in depth range from 48 m up to 746 m (Tab. 1). The towing of the demersal trawl is carried out on positions where different types of solid substrates were present. The analysis included identification and measurement of the catch non-edible parts (various groups of invertebrates and juvenile fish). Main taxonomic groups were identified according to ERMS (2001) and measured on a commercial scale and calculated its percentage share of the total catch. Inorganic part of mash content (mainly anthropogenic waste) was subjected to measurement too.

Table 1. Coordinates of the trawl hauls with emphasis on depth and duration

Positions	Coordinates				Depth (m)	Duration (min)
	Begining		End			
	N	E	N	E		
1	42°08.99	18°58.23	42°10.16	18°57.14	48,15	30
4	42°00.06	19°03.09	41°58.65	19°04.22	58	30
5	41°55.79	19°06.50	41°54.37	19°07.87	60,1	30
6	42°20.20	18°34.70	42°20.81	18°32.67	115,5	30
8	42°09.45	18°33.11	42°08.60	18°34.66	171,5	30
10	42°03.05	18°36.18	42°01.81	18°37.10	162	30
12	41°51.12	18°43.16	41°52.57	18°43.45	117	30
13	42°13.60	18°24.16	42°10.91	18°25.08	258,5	60
15	42°02.07	18°25.94	41°59.51	18°25.94	349	60
19	41°52.95	18°24.42	41°50.85	18°24.753	746	60

RESULTS AND DISCUSSION

The study comprised ten positions with different types of substrates such as mud and sand in the biocoenosis of the coastal terrigenous ooze. Analysis of contents of the mash, based on the percentage content of certain groups is shown in Figure 2.

Participation of inorganic catch ranged from 6,49% (position 14) to maximum 58,39% (position 1). The inorganic part was mainly anthropogenic origin and it was dominated by tires and plastic bottles. As for the non edible parts, its share in the total catch was in the range from 6,12% (item 10) to 35,67% (position 12). The non edible part was dominated by invertebrate’s group echinoderms. Within this group as the most numerous was species of sea lilies (*Antedon mediterranea*), while the highest percent-weight participation had species sea cucumber *Parastichopus regalis*. Catch is contained other invertebrates group such as Ascidiea, Bryozoa, Mollusca, Cnidaria. As for the fish that belong to non edible part it was difficult to do their determination because the fishermen stood on the market also the specimens which size do not meet commercial standards. As part of the non edible mesh’s content can be found high amount of leaves of *Posidonia oceanica*.

One of the problems that occur in the fishing industry is that the whole non-edible (by-catch) portion returns back into the sea. In this way, discarded biomass can lead to changes in ecosystem structure favouring certain species that feed on animals recovered (Moranta et al, 2000). Fishing may favour individual species in two ways by removed their predators from environment or increases the amount of available food by returning discard into the sea.

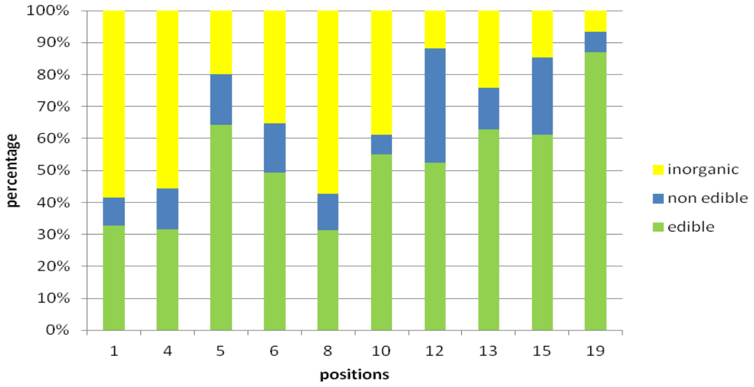

Figure 2. The percentage share of edible, non edible and inorganic part of the catch by demersal traw

The level of this impact depends on one hand, on the physical characteristics of the gear (materials and weights) and the conditions of its utilization (speed and duration) and, on the other, on the type of sediment and the benthic biocenoses on it (Hall, 1999). Indirect effects on the seabed is reflected by size of the stress that benthos is exposed (Jones, 1992). Trawling is responsible for raising large amounts of sediment and its suspension in the water column. These clouds of mud have a negative effect on fish but also negatively affect production of benthic communities. However, the exact consequences of this phenomenon are not known. Besides leading to disproportion in animal components of biocenoses trawling is the main reason of regression that occur in the meadows of *Posidonia oceanica* (Martin et al, 1997). In this way disturbed community, which used to be a shelter for large numbers of fish and their spawning place, cease to be (Sanchez-Jerez & Ramos-Espla 1996). Fish lose their natural habitat, and gradually comes to reducing their populations. Unfortunately we have no data that would detail out this problem but few studies are conducted in France and Italy, where it was done comparing the situation between *Posidonia* meadows in areas where fishing is allowed and protected areas where fishing by demersal traw is prohibited (Buia et al, 1999; Harmelin-Vivien 2000; Francour 1999) and obtained results show decreasing mean weight, density and biomass of fish in exploited areas.

Bottom fishing has deeply affected some endemic invertebrate species, such as the endemic sponge *Axinella cannabina* (De Ambrosio, 1998) and echinoderms *Antedon mediterranea*, *Astropecten irregularis pentacanthus*, *A.platyacanthus*.

The use of hydraulic dredges to catch warty venus (*Venus verrucosa*), a species inhabiting detritic or sandy bottoms and *Posidonia* beds, was banned in Italy in 1992 because of the extensive damage it inflicted. In the southwestern Adriatic, the smooth scallop (*Chlamys glabra*) fishery operating on coastal detritic bottoms inside the Gulf of Manfredonia makes big discards, 395 kg from only an hour's dredging, principally of green sea urchins (*Psammechinus microtuberculatus*), molluscs and crustaceans (Vaccarella et al, 1998).

Although there is no information on the effects of deep sea trawling on muddy bottoms in the Mediterranean (or anywhere else in the world), the few authors touching on the subject warn of the extreme vulnerability of such sea beds to physical perturbations. It appears that recovery rates are much slower and the impacts of trawling may be very long lasting (many years or even decades) in deep water, where the fauna is less adaptable to changes in sediment regimes and external disturbances (Jones, 1992; Ball et al, 2000).

Trawling and dredging can also play a role affecting the intensity and duration of naturally occurring seasonal hypoxic crises in some places. These fishing practices, carried out in hypoxic conditions in the Adriatic, can exacerbate the summer killings of young shellfish. Trawling can also remove large-bodied, long-lived macrobenthic species and subsequenty reduce the bioturbation zone (Ball et al, 2000). This could increase the danger of eutrophication and result in longer recovery rates (Rumohr et al, 1996). On the other hand, studies carried out on muddy seabed off the Catalan coast (north-western Mediterranean) showed that otter trawling operations produce short-term changes in the biomass of taxa within the trawled area.

These results suggest that fishing disturbance may cause shifts in the benthic community structure that particularly affect mobile scavenging species, probably the most food-limited group in muddy seabed environments.

Ecosystem changes, in any case, should be avoided and the effect of fishing on bottoms and associated communities should be strictly monitored. Bottom trawling in eutrophic areas, prone to anoxia, is a matter of special concern: fishing practices should be significantly limited, at least in the most critical areas and/or seasons.

CONCLUSIONS

The use of trawl in demersal fisheries has multiple negative effects on wildlife of the sea floor. The exact effects of this process are not fully tested because in our country has not conducted any detailed research, and an insufficient number of projects dealing with these issues in the region.

It is known however that non-selective fishing net from the ocean floor collect organisms that are builders of benthic biocenose and have no commercial value. They include representatives of numerous groups of invertebrates and juvenile fish, which did not reach commercial size. Besides animal components trawl is in violation of the vegetable component. This primarily refers to the area where the present *Posidonia oceanica*, whose development are prevented by particles of suspended sediments.

Own studies have shown that the proportion of the by-catch move up to 36%, which means that one third of the catch content is unusable for food and being separated from their natural habitat.

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DEGRADACIJA BENTOSNIH ZAJEDNICA UPOTREBOM PRIDNENIH KOČA

SAŽETAK

Pridneno kočarenje je veoma zastupljeno u crnogorskom ribarstvu, prvenstveno na otvorenom moru. Prilikom primjene ove metode veoma važni procesi se dešavaju na morskom dnu, uglavnom destruktivnog karaktera. Unutar mreže se mogu naći ne samo ciljne vrste već i velika količina nekomercijalnih vrsta biljaka i životinja. Ovim putem se narušava kako fizička tako i biološka struktura morskog dna. Stepen uticaja zavisi od vrste alata koji se koristi, veličine okca na mreži kao i od vrste podloge po kojoj se mreža povlači. Istraživanja su pokazala da je muljevita podloga najviše podložna destrukciji. Podizanje čestica sa dna ima negativan efekat na vrste u životnoj zajednici.

Sprovedeno istraživanje je pokazalo da veliki procenat ulova pripada nejestivom dijelu. Te vrijednosti se krecu i preko 50% sadržaja mreže. Većina tog sadržaja pripada beskičmenjačkim organizmima koje nemaju tržišnu vrijednost kao što su predstavnici bodljokožaca, sundjera, briozoa, mekušaca. Značajan udio pripada nezrelim ribljim jedinkama koje nijesu dostigle tržišnu veličinu ili nemaju tržišnu vrijednost.

Korišćenje pridnene mreže je samo jedan način narušavanja morskog dna I života na njemu. U zadnje vrijeme zastupljeno je i sakupljanje školjkaša pomoću dredje. Nedostatak podataka o ovom problemu je karakteristika crnogorskog ribarstva.

Ključne riječi: pridnene zajednice, kočarenje, crnogorsko primorje, prilov, biocenoze obalnih terigenih muljeva