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BIRD BYCATCH IN FISHING NETS IN LITHUANIAN COASTAL WATERS IN WINTERING SEASON 2001–2002

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Abstract. Bycatch of birds wintering in Lithuanian coastal waters in gillnets was investigated in the wintering season 2001–2002. Vulnerability of different bird species to entanglement in fishing nets as well as threat posed by nets of different mesh sizes to birds were identified. Steller's Eider and Red-throated and Black-throated Divers were found to be most threatened by inshore gillnet fisheries. Nets of larger mesh sizes, particularly salmon nets (>60 mm mesh size) pose the greatest threat to wintering birds. The most urgent bird conservation measures are proposed, and the possibility to manage inshore fisheries in bird-friendly manner with little adverse effects on fishermen community is discussed.
Key words: bird bycatch, fisheries, Baltic Sea, fisheries management

Introduction

Lithuanian coastal waters of the Baltic Sea have been recognised as an important wintering site for a number of waterbird species (Žalakevičius *et al.* 1995; Skov *et al.* 2000). Different human activities take place in the coastal zone. Some of them, however, have impacts on wintering birds and their habitats (Žydelis & Dagys 1997). Commercial gillnet fishery is a rather new activity in the Lithuanian inshore waters, which started in 1992. Possible impact of gillnet fisheries on wintering waterbirds was first identified by Dagys (1997). Later, a few studies emphasising the degree and significance of this problem followed (Žydelis & Skeiveris 1999; Žydelis 2001, 2002). A special project was initiated and conducted in the winter of 2001–2002 with the aim to prepare the preconditions for environmental management ensuring the best possible protection of wintering birds with minimal restrictions to fisheries and losses to the local community.

Material and methods

The study area included the inshore waters of the Baltic Sea up to the depth of 20 m (2–10 km off the coast; Fig. 1). Information about birds caught in fishing nets was collected during the period December 2001–April 2002. Six fisheries enterprises were contracted to provide data on bird bycatch in their nets. Fishermen provided data on all birds caught in gillnets during their usual fishing practices as well as information on the total fishing effort irrespective of whether any birds were caught. During this study, Red-throated and Black-throated Divers (*Gavia stellata*, *G. arctica*) were treated as one group, since they are treated in such a way during bird surveys due to difficulties in their identification in field conditions. The contracted fisheries enterprises operated small boats from various locations along the coastline. Each enterprise operated only one boat at a time. Four of the contracted fisheries enterprises operated in the inshore near Palanga, while another two – off the central and northern parts of the Curonian Spit. These areas were selected because important bird concentrations there overlap with zones of intensive fishery. Two special questionnaires (for fishing effort and bird bycatch) were designed and supplied to fishermen to facilitate data collection. The fishing effort was measured in *net meter days* (NMD), i.e. the sum of lengths of nets set over all days of fishing. As far as possible all birds recovered from nets were individually labelled and stored frozen for further accurate identification, measurement and other analyses.

Results

Fisheries

Six fisheries enterprises were contracted for different periods of time that varied from five months (the entire study period) to three months. The amount of gillnets set by each enterprise per one fishing trip (day) varied from 300 to 5,000 m, but most commonly, it

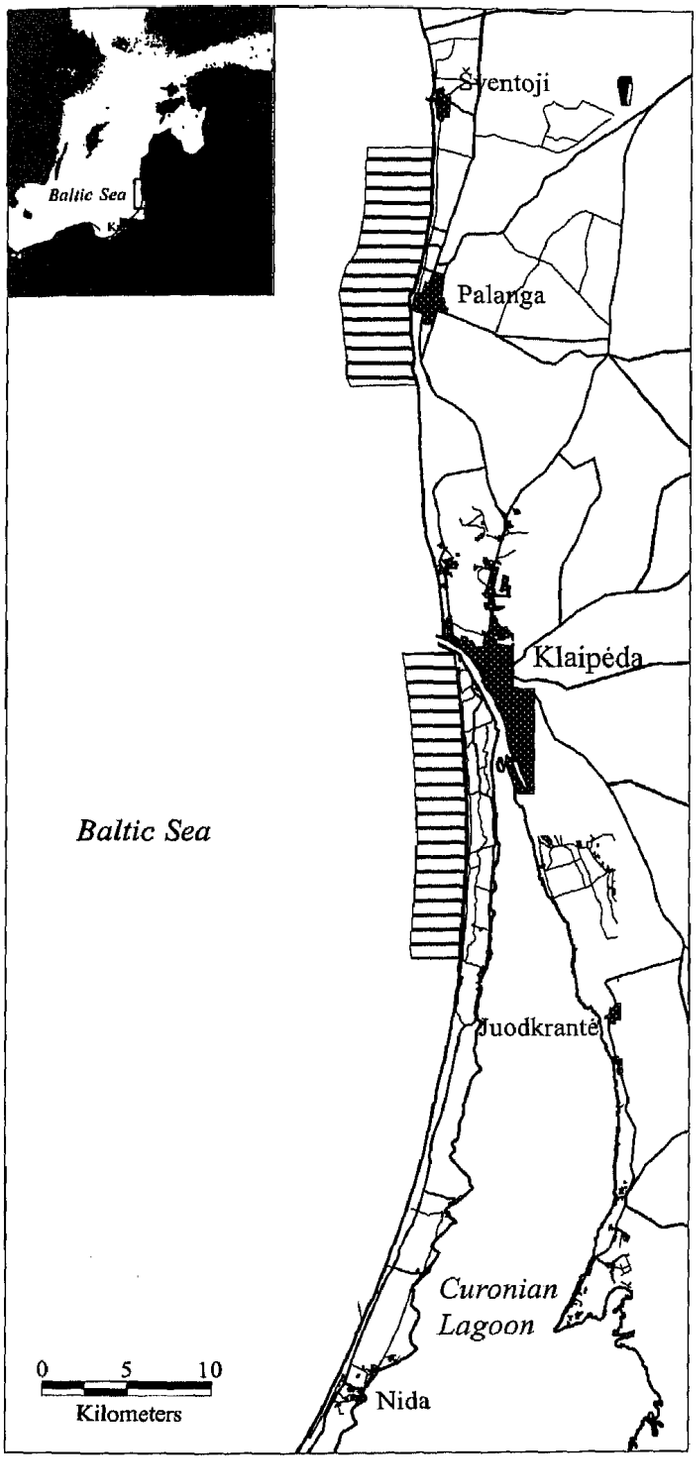

Figure 1. Lithuanian Baltic Sea inshore. Approximate fishing areas of the contracted fisheries enterprises are shaded.

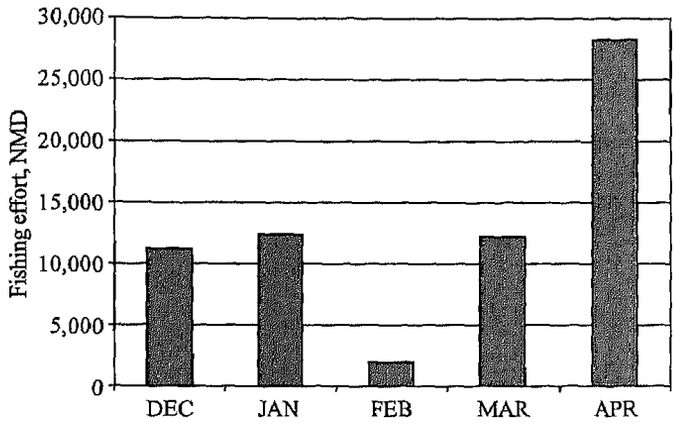

Figure 2. Mean monthly fishing effort of contracted fisheries enterprises.

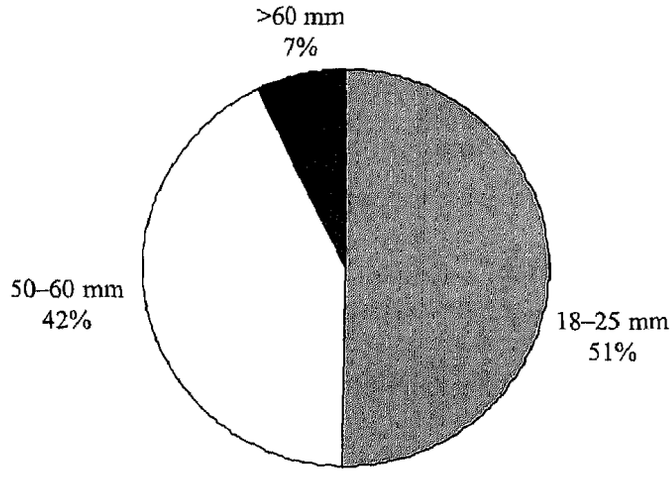

Figure 3. Composition of fishing effort according to the net mesh size.

varied between 600 and 2,000 m. The nets were left set for one day before being retrieved or checked unless suddenly deteriorating weather conditions forced fishermen to retrieve nets earlier or leave them unchecked for a day or two. The total number of fishing days of all contracted fisheries enterprises during the study period was 265. The total fishing effort was 357,653 NMD, i.e. on the average, one fishing enterprise set 1,350 m of gillnets per one fishing trip (day).

Fishing effort by fisheries enterprises differed considerably in different months (Fig. 2). It was lowest in February and highest in April. The contracted fisheries enterprises operated for only 1–5 days in February. Such a low fishing intensity in February was determined by adverse weather conditions, such as frequent storms or strong unfavourable winds.

Depending on the target fish species, gillnets of various mesh sizes (from 18 to 120 mm) were used by the fisheries enterprises. Overall, nets with small mesh size (18–25 mm) used for catching smelt (*Osmerus eperlanus*) and Baltic herring (*Clupea harengus*) comprised the major part of the total fishing effort (51%) followed by medium-sized (50–60 mm) cod (*Gadus morhua*) nets (42%; Fig. 3). Large mesh size nets (>60 mm) used primarily for catching salmon (*Salmo salar, S. trutta*) were used more often only in December, when they comprised almost a half of all the fishing effort (Fig. 4). Cod nets were used intensively in December, March and April, while small mesh size nets predominated in January and February, but were also used intensively in March and April (Fig. 4).

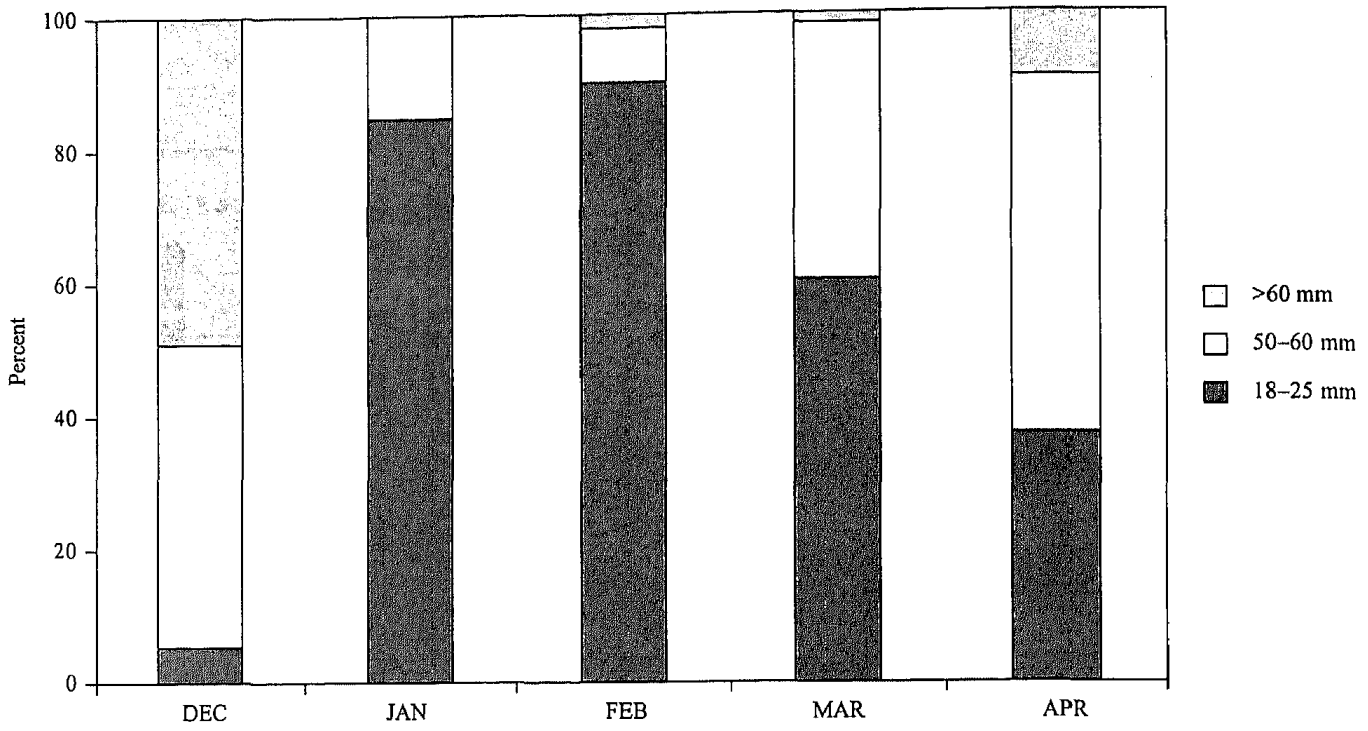

Figure 4. Changes in the composition of fishing effort according to the mesh size over the study period.

Bird bycatch

Overall, 219 birds were recovered from gillnets by the six contracted fisheries enterprises during the study period. Long-tailed Ducks (*Clangula hyemalis*) clearly predominated among the net casualties. They comprised 61% of all birds reported by fishermen (Fig. 5A). Red-throated and Black-throated Divers and Velvet Scoters (*Melanitta fusca*) were the next most common casualties, comprising 14% and 11% of all recovered birds, respectively. Species composition of birds entangled in gillnets off the Curonian Spit coast and the Palanga coast was slightly different. Although Long-tailed Ducks predominated in both areas, Steller's Eiders (*Polysticta stelleri*) were caught only in the Palanga inshore, while Common Scoters (*Melanitta nigra*) were caught only in the Curonian Spit inshore, where these species comprised 7% of all casualties in the respective regions (Figs 5B, 5C). Velvet Scoters were entangled in gillnets much more frequently off the Curonian Spit coast than the Palanga coast.

In order to compare entanglement of birds of different species and in different nets, the *entanglement rate* was calculated as the number of birds entangled per 1,000 NMD. The number of birds reported by fishermen as well as the entanglement rate in different months are presented in Figure 6. The highest entanglement rate was recorded in December, when, on the average, 2.3 birds were entangled per 1,000 meters of gillnets per day. The lowest entanglement rate was recorded in January and April (0.5 and 0.4 birds/1,000 NMD, respectively).

For all species combined, the mean entanglement rate during the study period was 0.61 birds/1,000 NMD, i.e. one bird was entangled in approximately 1,640 m of nets set per day. Entanglement rate differed considerably among species of wintering birds. It was highest in Long-tailed Ducks (0.37 birds/1,000 NMD), Velvet Scoters (0.15 birds/1,000 NMD) and divers (0.08 birds/1,000 NMD). Entanglement index in other species of wintering birds did not exceed 0.02 birds/1,000 NMD (Table 1). However, the entanglement rate of different species does not reflect the real vulnerability of these species to entanglement in fishing nets since it does not take into consideration the abundance of birds of different species in the fishing areas of the contracted fisheries enterprises. In order to account for differences in abundance, the entanglement rate of different species was divided by their relative abundance, expressed as the mean number of birds (in thousands) wintering in the investigated fishing areas (Table 1). Thus was obtained a relative measure of vulnerability of different species of wintering birds to entanglement in gillnets – *relative vulnerability index*. It must be noted that this index was particularly high for divers – they appeared to be more than ten times more vulnerable to entanglement in fishing nets than the next most vulnerable species – Long-tailed Duck (Table 1). While divers were unquestionably very vulnerable to entanglement, it is likely that such a high vulnerability index partly resulted from underestimation of their wintering numbers. Being ichthyophagous, divers often stay in deeper areas further off the coast, where they are more likely to be

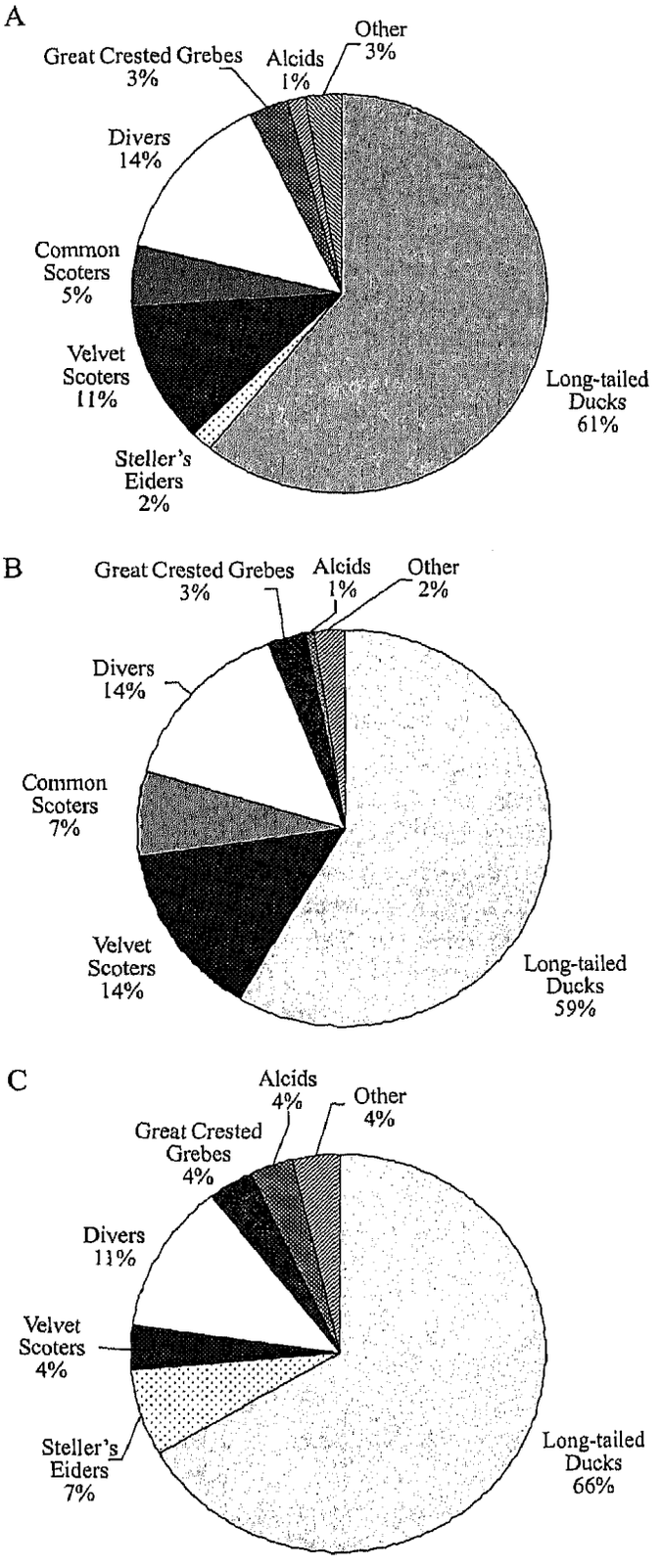

Figure 5. Species composition of birds recovered from fishing nets. A – overall, B – off the Curonian Spit coast, C – off the Palanga coast.

overlooked during surveys from the coast. Their tendency to winter dispersedly and to spend a lot of time diving may also have contributed to underestimation of their numbers. Among other species, Long-tailed Duck was the most prone to entanglement in gillnets followed by Steller's Eider and Great Crested Grebe (Table 1). The threat posed by gillnets of different mesh sizes to wintering birds was evaluated by calculating the entanglement rate for three mesh size ranges of nets: 18–25 mm, 50–60 mm, and >60 mm. It was revealed that, although accounting for over a half of all bird casualties (Fig. 3), gillnets of small mesh size (18–25 mm) were the least dangerous to birds, with the entanglement rate of 0.35 birds/1,000 NMD. Gillnets with mesh size of 50–60 mm were almost twice as effective at catching birds – their entanglement rate was 0.62 birds/1,000 NMD. The most dangerous to birds were gillnets with large mesh size (>60 mm), since their entanglement rate was 1.80 birds/1,000 NMD, i.e. they were almost three times more effective at catching birds than nets with medium-sized mesh and more than five times more effective than nets with small-sized mesh.

Discussion

Although gillnet fishing in Lithuanian inshore waters of the Baltic Sea started only in 1992 (Maksimov & Toliušis 1996), over the last decade it has become an important source of income and employment for the local community. After initial rapid increase, the number of fisheries enterprises has remained rather stable over the last six years (Fig. 7). Annual fishing effort, on the contrary, has nearly tripled during the same period – from 4,960,000 NMD in 1996 to 14,680,000 NMD in 2001 (Fig. 7), indicating that fishing enterprises have greatly increased their annual fishing effort. However, the official fish catch statistics shows that fish catches have not followed such a rapid increase in fishing effort (Kontautas *et al.* 2002). Total annual fish catches have less than doubled during the same period (Fig. 7) suggesting a decrease in fishing efficiency. On the other hand, the threat to wintering birds posed by gillnets, identified by Dagys (1997), is likely to have increased in proportion to the increase in fishing effort, i.e. roughly tripled. This suggests that there is an urgent need for implementation of measures aimed at protection of wintering birds. Furthermore, the aforementioned fall in fishing efficiency indicates that there is a possibility to manage inshore gillnet fishery in such a way as to provide maximum benefits for birds with minimum financial losses for fishermen. This could be achieved by implementing very specific regulations of fishing effort, e.g. restrictions of use of certain gear types (mesh sizes) in certain locations and/or periods, regulation of the overall fishing effort, etc. Implementation of alternative fishing techniques or use of modified traditional

Table 1. Entanglement rate, relative abundance and relative vulnerability index of the species most commonly entangled in gillnets.

Species	Entanglement rate, birds/1,000 NMD	Relative abundance, 1,000s birds	Relative vulnerability index
Gavia arctica/stellata	0.08	0.06	1.33
Podiceps cristatus	0.02	0.5	0.04
Polysticta stelleri	0.02	0.3	0.07
Melanitta fusca	0.15	5.6	0.03
Clangula hyemalis	0.37	3.4	0.11

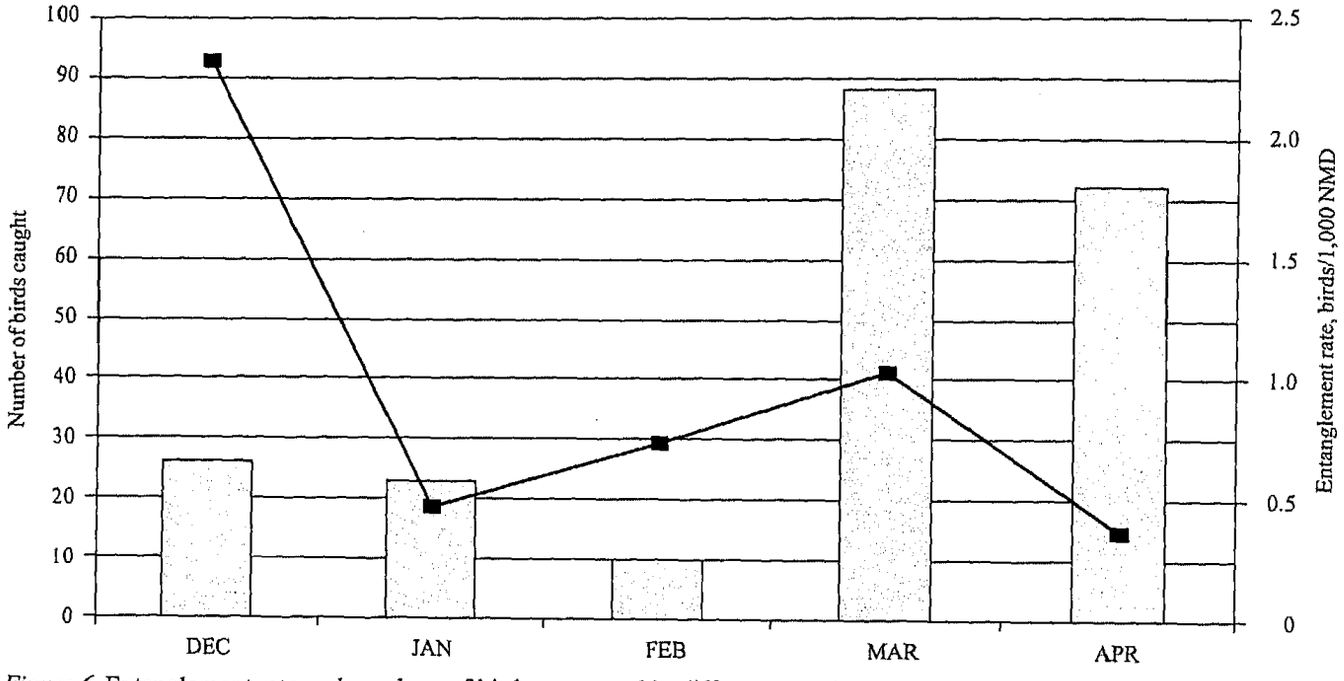

Figure 6. Entanglement rate and numbers of birds recovered in different months.

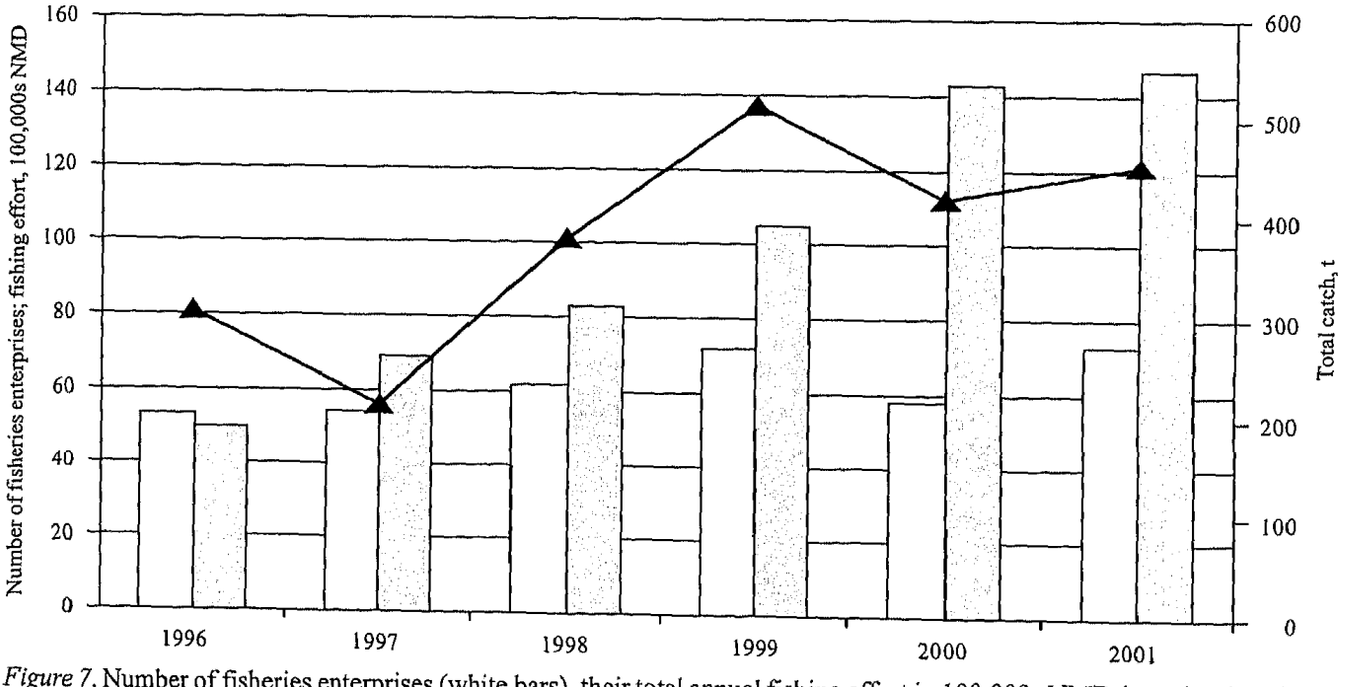

Figure 7. Number of fisheries enterprises (white bars), their total annual fishing effort in 100,000s NMD (grey bars) and total annual catch in tones (line) in 1996–2001 (data from Kontautas *et al.* 2002)

gear may also be a possibility to improve bird wintering conditions.

Gillnet fishing effort at the Lithuanian coast varies considerably according to gear type used, localities and in different periods of the year (Kontautas *et al.* 2002). Fishing effort depends primarily on the target fish species at a given period of the year, accessibility of the area to fishermen and weather conditions (fishing is not possible in stormy weather or during icing of the sea). On the other hand, wintering bird abundance and distribution are also very uneven at the Lithuanian coast, which was also reflected in the species composition of bird bycatch along the Curonian Spit and the coast of Palanga (Fig. 5). Different species have specific distribution in the coastal waters and different numbers (Žalakevičius *et al.* 1995; Žydelis & Dagys 1997; Žydelis 2002). Wintering bird abundance varies in the course of wintering season and between years. This suggests that fisheries impact on wintering birds is not uniform throughout bird wintering season at different parts of the Lithuanian coast, and may notably vary from year to year. Therefore, in order to achieve substantial improvement of bird wintering conditions, and to come up with specific bird bycatch mitigation measures, a variety of interacting factors must be evaluated.

The present study revealed that different species of birds wintering in Lithuanian inshore differ in vulnerability to threats posed by gillnet fisheries. When deciding upon bird conservation priorities, species conservation status as well as vulnerability must be taken into consideration. Therefore, Red-throated and Black-throated Divers and Steller's Eider must be given conservation priority in Lithuanian inshore. Being pursuit-feeding ichthyophagous birds, divers are particularly vulnerable to entanglement, although specific surveys of distribution and abundance of divers are needed in order to assess more accurately their real vulnerability to fishing nets and to define locations of their highest aggregations. Steller's Eider, although less prone to entanglement in fishing nets than Long-tailed Duck, is a globally threatened species, and its small population size, restricted wintering distribution, tendency to feed in very dense flocks and overlap of its wintering site in Lithuanian inshore with intensive fishery zone make this species particularly vulnerable and its conservation priority especially high.

Different levels of threat posed by nets of different mesh sizes to wintering birds, identified during this study, suggest that greatest attention must be given to nets of larger mesh sizes (>50 mm) when restrictions on fishing gear are developed. Salmon nets (>60 mm) were found to be particularly dangerous to birds, and therefore certain restrictions (seasonal or spatial) are likely to be needed in order to minimise threat posed by these nets to most vulnerable species.

Considering the above, restrictions on medium and large mesh size gillnets in the most important wintering areas of divers and Steller's Eiders during the most dangerous period (March and April, as identified during this study) are needed most urgently in Lithuanian inshore of the Baltic Sea. Such restrictions should be specific enough not to cause fishermen considerable decrease in profits from fishing and, therefore, be better accepted and better complied with by fishermen.

So far very few measures have been identified and implemented in order to minimise bird bycatch in gillnets. Melvin *et al.* (1999) elaborated novel tools to reduce seabird bycatch in gillnet fisheries in Puget Sound (Washington, USA), which were subsequently adopted in fisheries regulations. Melvin *et al.* (1999) identified three complementary tools to reduce bird bycatch: gear modification, bird abundance-based fishery opening, and time-of-day restrictions. Suitability of such measures for mitigation of bycatch of seaducks and other waterbirds wintering in Lithuanian inshore should be assessed in future. Constant monitoring of bird bycatch in gillnets and further investigations are also needed in order to prepare more detailed recommendations for bird-friendly fisheries management, use of alternative fishing methods or modified traditional fishing gear.

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Paukščių priegauda statomuosiuose žvejybiniuose tinkluose Lietuvos Baltijos jūros priekrantėje 2001–2002 metų žiemojimo sezonu

M. Dagys, R. Žydelis

Santrauka

Žiemojančių paukščių priegauda statomuosiuose žvejybiniuose tinkluose Lietuvos Baltijos jūros priekrantėje buvo tirta 2001–2002 metų žiemą. Buvo nustatytas skirtingų paukščių rūšių jautrumas žvejybos poveikiui, bei skirtingų akių dydžių tinklų pavojingumas paukščiams. Statomieji tinklai didžiausią pavojų kėlė sibirinėms gagoms ir juodakakliams bei rudakakliams narams. Pavojingiausi paukščiams buvo didesnio akytumo, ypač lašišiniai (>60 mm), statomieji tinklai. Straipsnyje pasiūlytos reikalingiausios paukščių apsaugos priemonės, bei aptartos galimybės reguliuoti žvejybą paukščiams palankiu būdu, bet su kuo mažesniu neigiamu poveikiu žvejų bendruomenei.

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