

FLOUNDER AND TURBOT AS TOURIST ATTRACTIONS ON THE COAST OF THE POMERANIAN BAY, POLAND

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Abstract

Flounder (*Platichthys flesus* L.) and turbot (*Scophthalmus Maximus* L.) play important roles in Polish Baltic Sea fisheries, and both of these fish are very popular in all types of food establishments located along the Baltic coast. The aim of the study presented in this paper was to assay the proximate composition and nutritional qualities of fish obtained from Polish coastal fishers, and to gather information concerning fish consumption among tourists frequenting fish fry stands and restaurants while visiting this area of Poland. The study was conducted in the summer of 2010. The study material comprised 20 specimens of flounder and 16 of turbot that had been caught in the coastal waters of the Pomeranian Bay. Information regarding fish consumption and the availability of fish in food establishments located along the Western Pomeranian coast of the Baltic Sea was collected by conducting a survey among tourists in Świnoujście, Międzyzdroje, Dziwnów, Dziwnówek, Pobierowo, and Niechorze. The results of the analyses of fish samples indicated that the fat and protein content was significantly higher in the flounder assayed than in the turbot. The responses to the survey questions indicated that tourists consume much more fish during visits to coastal regions than they do on a day-to-day basis. They reported preferences for fish species caught by Polish Baltic Sea fishers, including flounder and turbot. Since turbot are in the post-spawning stage during the summer and the contents of fat and protein in them is low, consumption of this fish should be

promoted in the fall and winter periods when the meat of this fish is at its nutritional optimum. This could lead to a lengthening of the the Polish coast tourist season into the fall and winter periods, during which tourist-generated business is very slow.

Keywords

Flounder, turbot, Pomeranian Bay

Introduction

In addition to eating carp on Christmas Eve, it is also a tradition among Poles to eat fish when visiting the seaside in summer. Tourists spending their vacations on the Polish Baltic coast during summer consume fish at the many establishments offering fish dishes.

It is commonly known that eating fish is good for human health. The nutritional value of fish is determined by protein assimilability and fat content. Fish are rich in highly polyunsaturated fatty acids from the *n*-3 and *n*-6 families, which support proper body functioning and have prophylactic properties that contribute to good human health (Ziemiański and Budzyńska-Topolowska 1992; Budzyńska-Topolowska and Ziemiański 1993, Kolanowski and Świdorski 1997, Steffens 1997, Arts et al. 2001, Calder 2001). Essential unsaturated fatty acids (EUFA) play an especially important role in the human body, and the long-chain fatty acids EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid), in addition to preventing the occurrence of many illnesses, also support certain physiological functions (Ziemiański and Budzyńska-Topolowska 1992, Budzyńska-Topolowska and Ziemiański 1993). They have an impact mainly on the functioning of the circulatory and nervous systems (Connor et al., 1992, Arts et al., 2001).

The network of food establishments along the Polish Baltic coast is well developed and includes casual snack bars, restaurants, fast food outlets, and fish fry stands that have long been the main source of food for tourists visiting this area. Fish fry stands are unquestionably the greatest tourist attraction. Many tourists plan to spend their vacations near the sea in order to be able to eat fish everyday. Coastal fish fry stands offer their customers more than twenty species of fish prepared in various

ways – fried, grilled, or smoked. The Polish coastal region abounds in small, unique restaurants as well as in extensive restaurant chains that attract customers with low prices and quickly prepared meals. In order to beat the stiff competition and take advantage of the relatively short summer season, food establishments attempt to attract customers with special meal deals, new fish species, and competitive prices.

One of the most popular fish species at Polish Baltic coast fish fry stands and restaurants are flatfish – primarily flounder (*Platichthys flesus* L.) and turbot (*Scophthalmus maximus* L.).

Flounder (Photograph 1.) is exceptionally popular among tourists because of its wide availability, its tasty meat, and its relatively low price. During the summer season, it is available at virtually all food establishments located along the Polish coast. This species occurs mainly in European coastal zones of the Atlantic Ocean, in the Mediterranean Sea, and the Baltic Sea (Antoszek and Krzykowski 2003) where it inhabits waters to depths of 100 m. It often occurs in brackish waters and is known to migrate up rivers.



Photograph 1. Flounder. Source - www.fishbase.org

Flounder reach lengths of approximately 50 cm at a maximum length of 60 cm. In the waters of the southern Baltic, flounder aged 6+ attain a length of approximately 35 cm and a weight of 600 g (Kuczyński 1992). The body of this fish is elongated, and its height is less than half of its length. It has a small oral cavity. Its scales are very small, and a portion of them are rough, bony plates, which are usually found along the lateral line and at the base of the fins. A row of elongated greenish or gold spots run along the length of the body, while dark brown or black roundish spots are located on the posterior end of the fish. In contrast to other flatfishes, the eyes are usually located on the right side in flounder (Krzykowski et al. 2001).

Flounder are generally benthic fish. Young fish usually feed exclusively on plankton and insect larvae, while adult fish feed on annelids, molluscs, crustaceans, and small fishes (www.fishbase.org). Flounder usually attain sexual maturity at age 3+. Spawning usually occurs in waters with significant salinity at temperatures ranging from 3 - 7°C, at depths from 30 to 300 m. In the southern Baltic Sea, spawning occurs between February to May (Antoszek and Krzykowski 2005).

Turbot (Photograph 2.) is a highly prized food fish thanks to the delicate taste of its meat and its high content of polyunsaturated fatty acids. Because of the high market price of turbot, it is the most valuable flatfish caught in the Polish part of the Baltic Sea. Turbot inhabit European coastal waters from Norway to the Mediterranean and Black seas and the waters off of the west coast of Africa to Morocco (Więcaszek et al. 1990). Turbot are found in the coastal zones to depths of about 100 m, where it inhabits either muddy or sandy bottoms. Depending on the region, spawning occurs in the spring and summer months at depths of 10 to 40 m. These fish can grow to 70 - 80 cm in total length with exceptional specimens reaching 1 m. The mean commercial weight is 1.5 – 2 kg (Person-Le Ruyet 2002). In the Baltic Sea, turbot reach a mean length of 55 cm. The turbot body is laterally and asymmetrically flattened, high, and practically oval in shape with a body height that is from 1.3 to 1.6 times body length. The eyes are placed on the left side of the body, and the dorsal fin begins on the head. The tail fin is rounded. Turbot are not covered

with scales, but with thickened bony nodules (Krzykowski et al. 2001). Spawning occurs from April to August (Nielsen et al. 2004).



Photograph 2. Turbot, photograph by K. Stepanowska

Study aims

The first aim of the study was to analyze the nutritional characteristics of flounder and turbot inhabiting the Pomeranian Bay, which are likely to be sold to consumers frequenting coastal food establishment in Western Pomeranian Voivodeship. The second aim of this study was to obtain information about fish consumption among tourists visiting selected coastal localities during summer.

Materials and methods

1. Fish measurements

The study material comprised twenty flounder specimens and 16 of turbot. The fish originated from catches conducted in the Polish coastal zone of the Pomeranian Bay in summer 2010. All of the fish were weighed (g), measured in cm for total length (l.t.), body length (l.c.), and head length. The sex of the fish was determined, as was the side on which the eye occurred. The results obtained were analyzed statistically with STATISTICA 9.0, (Statistica for Windows, StatSoft, Inc. 1984-2009), and characters were compared with the t-test for independent samples.

1. Analysis of proximate composition

All of the flounder and turbot were eviscerated, deheaded, and the fins and larger bones were removed. In order to obtain homogeneous samples, the flounder and turbot were ground and then homogenized. These samples were analyzed using the methods reported by Podeszewski and Stodolnik (1980) and expressed in percentage values:

- total protein – Kjeldahl method,
- raw fat – Soxhlet method,
- dry matter – sample drying at a temperature of 105 °C for 12 h,
- ash – calcination at a temperature of 550 °C for 10 h.

All determinations were performed in three repeats.

The results obtained were analyzed statistically with STATISTICA 9.0 (Statistica for Windows, StatSoft, Inc. 1984-2009). Significant differences were determined based on single factor analysis of variance and the LSD test.

2. Consumer survey

The survey was conducted in summer 2010 in selected coastal localities in Western Pomerania: Świnoujście, Międzyzdroje, Dziwnów, Dziwnówek, Pobierowo, and Niechorze. Forty tourists vacationing on the Baltic coast were chosen at random and asked to complete the survey questionnaire, which was the chosen study tool. The results obtained from the questionnaires were analyzed using Excel running in Windows.

Results

1. Fish measurements

The mean total length of the flounder and turbot analyzed did not differ; however, the body length of the fish analyzed was slightly higher in flounder. The head length and body height measurements of the turbot analyzed were highly significantly ($p \leq 0.01$) and higher than these values in flounder. The mean weight of turbot was highly significantly ($p \leq 0.01$) higher than in flounder. In the case of the flounder analyzed, only one fish was male and the eyed side of the fish was the right side in 75% of the fish examined. All of the turbot specimens examined were females

and the eyes were located on the left side. The mean values of the characters analyzed are presented in Table 1.

Table 1. The mean values of the characters analyzed are presented

Character	Flounder ±SD	Turbot ±SD
Total length, l.t. (cm)	31.13±0. 78	31.23±2. 17
Body length, l.c. (cm)	26.06±0. 81	25.31±1. 67
Heal length (cm)	7.64±0.3 3	9.31±0.8 1**
Body length (cm)	12.31±0. 51	18.20±1. 70**
Weight (g)	403.01± 37.36	528.27±1 13.49**

** - differences highly significant ($p \leq 0.01$)

2. Analyses of proximate composition of fish

The contents of fat and protein and other chemical ingredients in the fish analyzed were significantly higher in the meat of flounder as compared to that of turbot (Table 2).

Table 2. Proximate composition of flounder and turbot

COMPONENT (%)	flounder	turbot
Dry matter	28.01	18.44**
Fat	9.77	1.66**
Protein	17.22	15.83**
Ash	1.24	1.04**

** - highly significant differences ($p \leq 0.01$)

3. Consumer survey

The results of the survey questionnaire indicated that the respondents preferred consuming fish that originated from catches made by Polish fishers working the Baltic Sea (73%; Fig. 1).

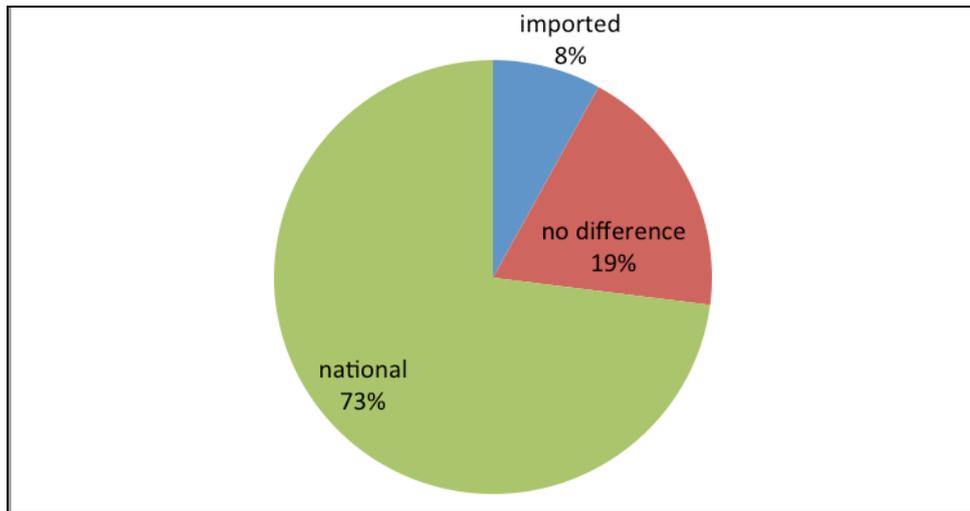


Fig. 1. Origin of fish preferred by survey respondents

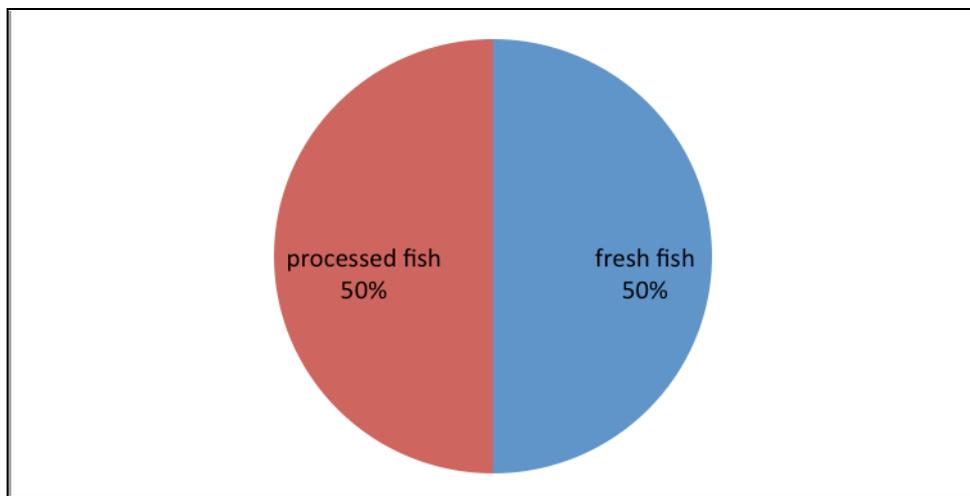


Fig. 2. Degree of processing of fish consumed by survey respondents

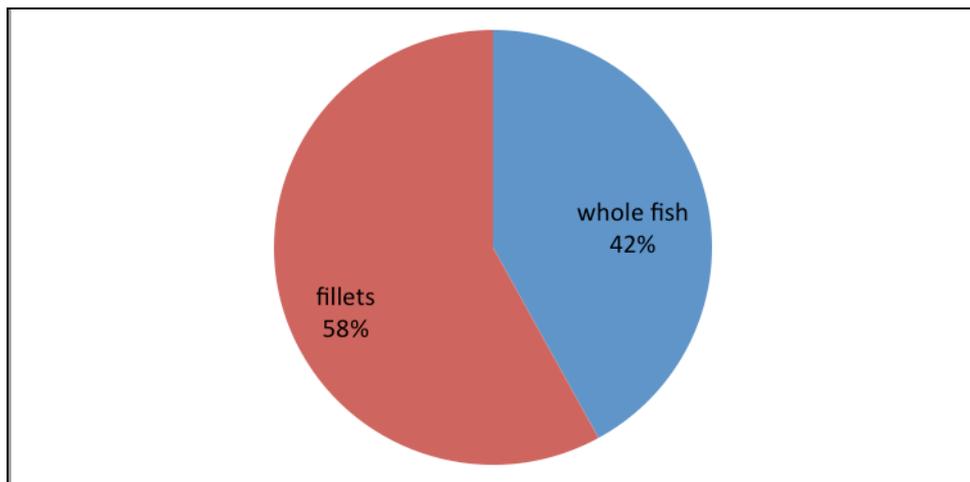


Fig. 3. Serving style preferred by survey respondents

Half of the respondents preferred fresh fish, while the other half preferred processed fish products (Fig. 2). With regard to fresh fishes, 58% of those surveyed preferred fillets, while 42% preferred whole fish (Fig. 3). Most of the respondents

(73%) reported that their fish consumption increases while vacationing at the seaside in comparison to that of the rest of the year (Fig. 4).

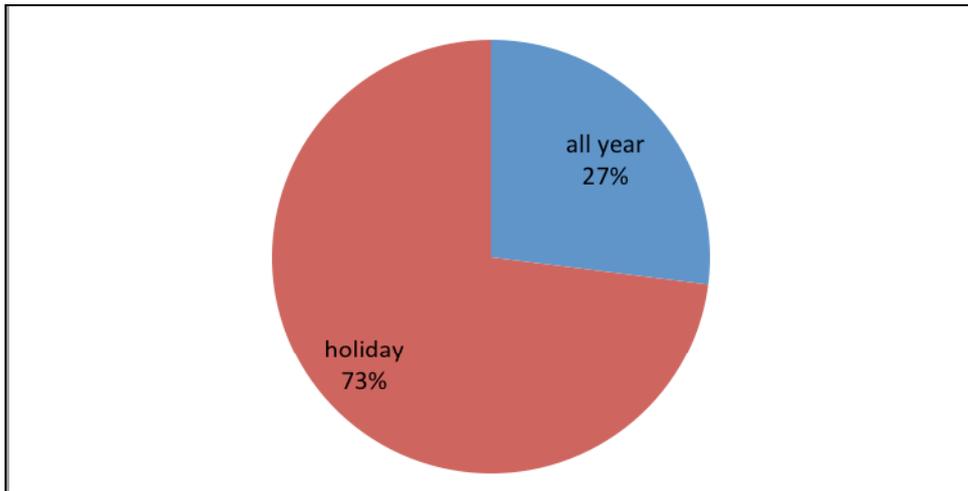


Fig. 4. Period of intense fish consumption among survey respondents

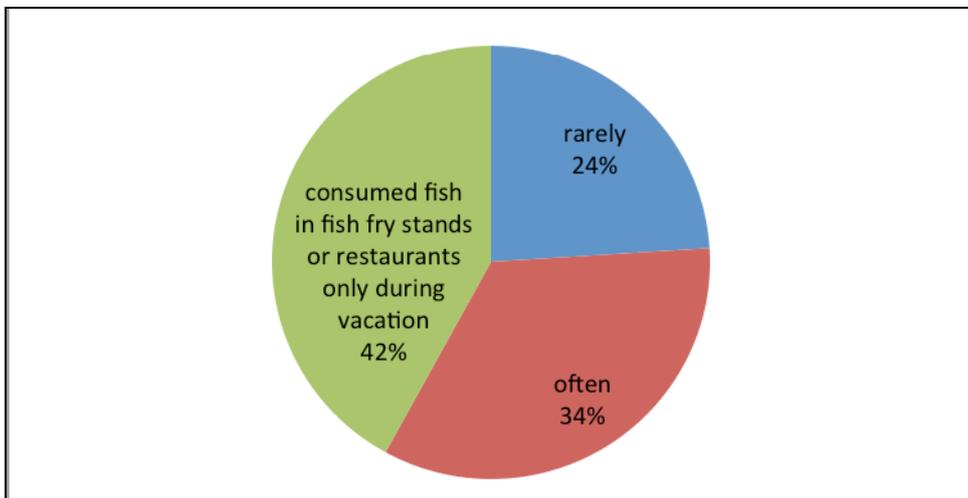


Fig. 5. Frequency of fish consumption at food establishments among survey respondents

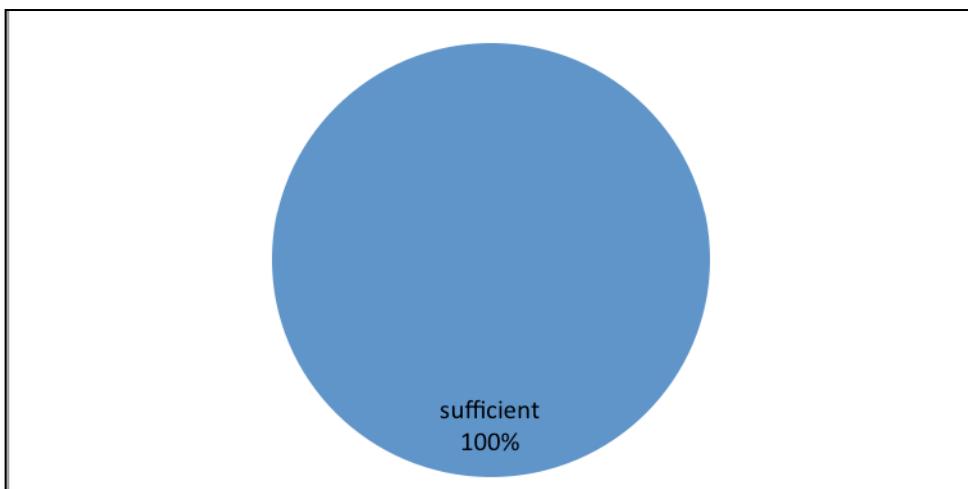


Fig. 6. Availability of food establishments serving fish in localities on the Polish coast

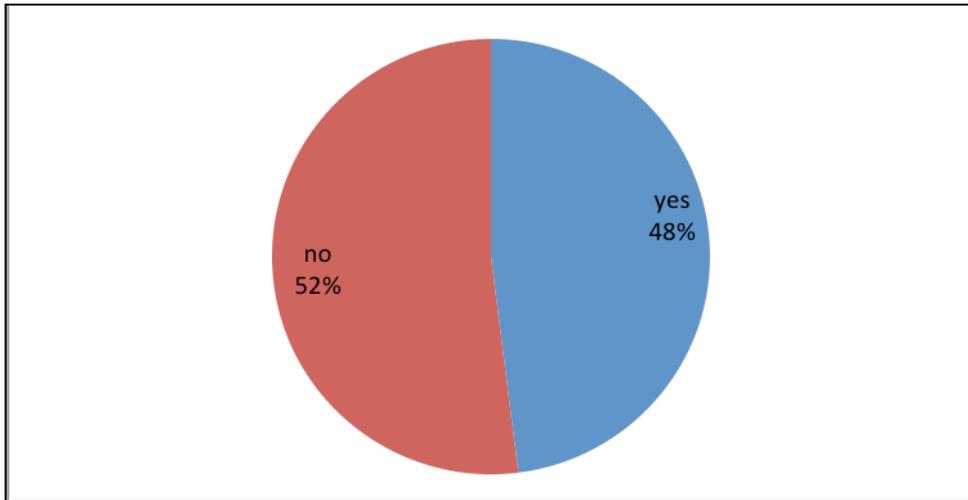


Fig. 7. Impact of establishment interior decor on choice by survey respondents

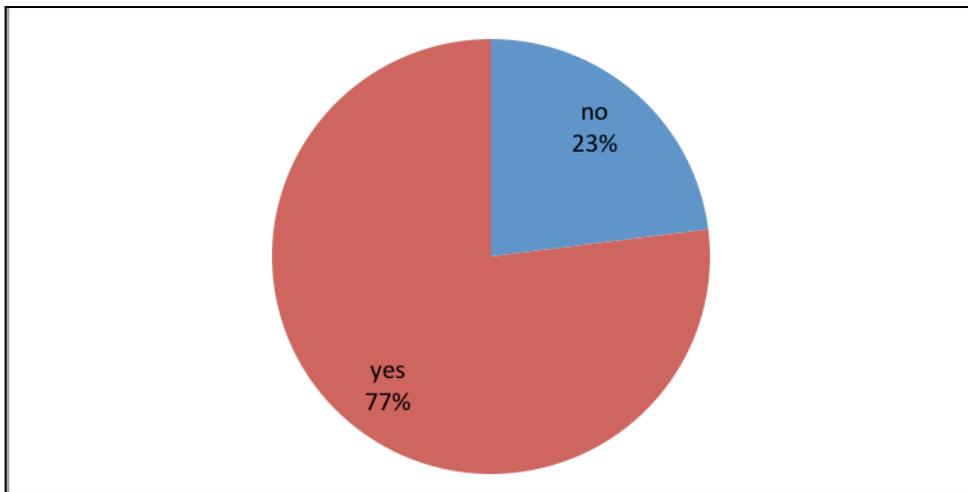


Fig. 8. Impact of establishment price on choice by survey respondents

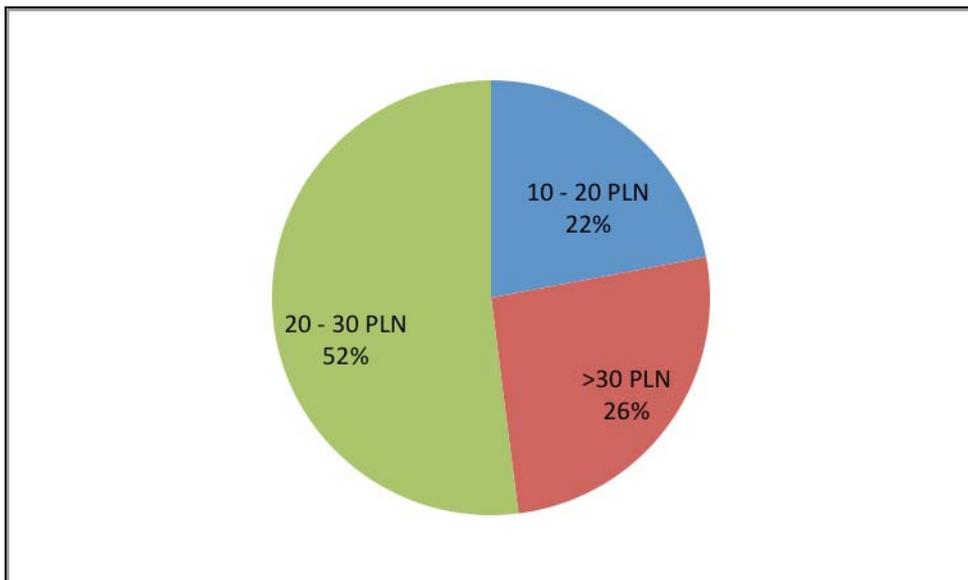


Fig. 9. Amount budgeted per person for fish consumption by survey respondents

This is also confirmed by the fact that 42% of those surveyed declared that they consumed fish in fish fry stands or restaurants only during vacation, while 34% of those surveyed declared that they consumed fish in food establishments “often” (Fig. 5). All of the respondents concluded that the number of food establishments is sufficient (Fig. 6). The most decisive factor in choosing a food establishment was price (77%) (Fig. 7 and 8), and for 52% of respondents it should be within the 20 - 30 pln range (Fig. 9).

Discussion

The content of various nutritional components in fish and their mutual ratios fluctuate continually. Factors such as the physicochemical properties of ambient waters, fish age and size, fish condition, and diet all impact the proximate composition of fish (Alexis et al. 1986, Fauconneau et al. 1995).

According to Kuczyński (1992), the following characters have an impact on the evaluation of the nutritional quality of flatfishes: body size, proximate composition, and fluctuations in fish weight throughout the year. In choosing fish to eat, consumers usually choose larger individuals since they contain more protein, fat and other nutritionally valuable ingredients. The general division of fish nutritional quality is based on its contents of fat and protein; according to this division, there are four types of fish (Sikorski 1992):

- lean and very rich in protein,
- lean and rich in protein,
- moderately fat and rich in protein,
- fat and poor in protein.

The minimal legal length of flounder for commercial sale is on the eastern Baltic coast is 21 cm, and 23 cm on the western Baltic coast (Council Regulation (EC) no. 2187/2005 ...). The flounder in the current study were larger with a total length fluctuating from about 29.2 cm to 32.5 cm. These values indicate that the flounder used in this study significantly exceeded the minimum length required for commercial fish.

The mean total length of the turbot caught was 31.23 cm, and reflects the minimum landing size which is 30 cm (Council Regulation (EC) no. 2187/2005 ...). According to a study by, tourists prefer fish that weigh more than 250 g because they have more meat and are better consumer value compared to smaller fish. The fish obtained from fishers reflected these requirements as the mean weight of the flounder specimens examined was 403 g, and 528 g for turbot.

According to Kunachowicz et al. (1998), 100 g of the edible parts of flounder contain a mean fat content of 1.8% and protein content of 16.5%. In turn, Cięglewicz (1954) and Konarzewski et al. (1968) reported that the percentage shares of fat and protein in flounder range from 0.3 to 6.3% and 16.8 to 17.0%, respectively, and that the composition of these components varies substantially throughout the year. The fat and protein content of flounder depends on the intensity of feeding and whether or not the fish have spawned, which happens from February to May (Antoszek and Krzykowski 2005). Flounder are the least attractive to consumers in the post spawning period. During the intense feeding period after spawning, flounder gain weight which results in increasing fat and protein contents. Catching flounder during this period is the most profitable since the nutritional qualities of this fish are highly valued by consumers. The flounder used in the current study were obtained from fishers that were working in early September during intense feeding. The values of fat and protein content recorded at 9.77% and 17.22%, respectively, permit classifying flounder as moderately fat fish rich in protein (Sikorski 1992). These results of flounder proximate composition determinations might indicate that the fish were preparing for the winter season by feeding. The fat and protein content of the fish analyzed permit concluding that flounder caught in September are nutritionally ideal for consumers.

The proximate composition of turbot published at www.licz-kalorie.pl is as follows: 100g of the edible parts of turbot comprise 18.88% protein and 2.76% fat, and the information posted on www.ile-kalorii.pl is nearly identical at 18.88% protein and 2.73% fat. The values for the protein and fat content of the fish analyzed in the current study were different. The content of protein was 15.83%, while that of

fat was barely 1.66%. These values permit classifying the turbot examined as lean with a high protein content (Sikorski 1992). The fish analyzed in the current study were obtained from fishers working the Pomeranian Bay during late summer. Such a low fat value resulted from the fish being caught in September when they had recently spawned; turbot inhabiting the Bay of Pomerania spawn from mid June to mid July. All of the specimens caught were females, and certainly a portion of fat deposits in these fish had been spent on the production of eggs and spawning.

As coastal tourism has grown steadily from the early nineteenth century, so too has the consumption of fish in coastal communities. Increased tourism might also be one of the main income sources of food establishments and other businesses providing services to tourists in coastal areas (Piotrowski and Bąk 2009). The survey conducted as part of the current study indicated that tourists visiting the Baltic coast often choose to eat local specialties. One of the reasons that fish are so popular during summer is the availability of fresh fish products and establishments where these can be eaten. As the results of the survey confirm, in excess of 40% of respondents declared that they consumed fish only during family vacations to the seaside. The results of a public opinion survey conducted by TNS OBOP in 2001 indicate that tourists vacationing on the Polish Baltic coast usually choose whole fried fish and that they associate fillets exclusively with frozen fish products (<http://www.tnsglobal.pl/>). The results of the survey conducted for the current study were very different. These respondents declared a clear preference for fish. Fish and fish products are among the more costly food items. The vacation period, however, encourages taking advantage of tourism services, one of which is undoubtedly food establishments offering fish specialties, and this demands paying higher prices. Confirmation of this phenomena could be the results of the survey which indicated that tourists budget from 20 to 30 pln daily for fish dishes. Of course, this is not a strict rule since 26% of respondents declared a willingness to spend more than 30 pln. In one of the most expensive hotels in the seaside resort of Międzyzdroje, a main course of fried turbot costs more than 80 pln (www.hotel-amber-baltic.pl). However, tourists view fried fish as a significant attraction without which they cannot imagine a

vacation to the Polish seaside. One of the reasons that fried fish stands are so popular is their accessibility and the fact that fishers deliver catches directly to them. Marketing specialists believe that increased consumption or interest in given products also stems from well-organized food establishments that specialize in selling specific products. Competitive prices, pleasant staff, and interesting interior design all help owners of food establishment to attract customers (www.consumerpsychologist.com). The results of the research permit concluding that price and interior design both have a significant impact when tourists are choosing an establishment in which to dine.

Conclusions

To summarize, the best period for consuming flounder from the Polish coastal regions is summer, when these fish have long since spawned and are feeding intensively. With turbot, this period is during the months following the intense summer-fall feeding period and still relatively a long time before spring-summer spawning. Promoting the consumption of turbot, which is considered a delicacy, during the period of its highest nutritional value could help to increase the tourist attractiveness in the winter season of coastal communities, in which business is very slow at this time of year.

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