

Distribution and the resources of Sea Holly (*Eryngium maritimum* L.) on the western shore of the Gulf of Gdańsk

Katarzyna Żółkoś^{1a}, Renata Afranowicz^{1b}, Joanna Bloch-Orłowska^{1c},
Kamila Kozieł²

¹Department of Plant Taxonomy and Nature Conservation, University of Gdańsk, Al. Legionów 9, 80-441 Gdańsk, Poland, e-mail: ^abiokz@univ.gda.pl, ^bbiora@univ.gda.pl, ^cbiojo@univ.gda.pl

²Centre for Ecological Information and Education, Straganiarska 43-46, 80-837 Gdańsk, Poland, e-mail: ciece@ciece-gda.pl

Abstract: Studies on the distribution of Sea Holly were carried out in summer 2006 along a 150 km stretch of the western shore of the Gulf of Gdańsk, between Władysławowo and Świbno, including the Hel Peninsula. Besides our own research, all available historical and contemporary literature was analyzed to reconstruct changes of Sea Holly distribution that have taken place in the studied area since 1848. During the field research altogether 6480 individuals of *Eryngium maritimum* L. were found and 53% of them grew on a 2 km long section of the shore between Rewa and Mechelinki. Other populations of the species were observed on the Sobieszewo Island, the Hel Peninsula, between Westerplatte and Górkki Zachodnie and in Babie Doły. The greatest changes in Sea Holly distribution during the last 160 years have taken place at the base and in the middle part of the Hel Peninsula and from Mechelinki to Gdańsk. Vanishing of the species populations was mostly a consequence of transformations of coastal habitats, related to the development of towns and ports as well as to increasing tourist pressure. The results of investigations point out at an urgent need for monitoring and protection of the existing populations of *Eryngium maritimum*. At present, only one locality is under the law protection as a nature reserve ('Mechelińskie Łąki'), but even this one is highly threatened by tourist pressure. Hitherto protection of Sea Holly is insufficient and should be extended to the protection of all habitats suitable for the species.

Key words: *Eryngium maritimum*, the Gulf of Gdańsk, distribution, resources, law protection, anthropopressure

1. Introduction

In Poland, the occurrence of Sea Holly is limited to the narrow sandy shore of the Baltic Sea, where the species grows only on sandy dunes (Stasiak 1988). For years, because of its attractive outlook and ability to retain the shape and color, the plant was willingly picked up for bouquets and, besides amber and shells, it was treated as one of favorite "souvenirs from the seaside" (Kulesza 1928). In consequence, Sea Holly became a threatened species long time ago. The shore of the Gulf of Gdańsk was the first place in Europe where *Eryngium maritimum* L. had been taken under the law protection, due to 'The Police ordinance concerning Sea Holly' which had been in effect in Gdańsk since 1902 (Przypomnienie...1922). Similar regulation was edited in

Königsberg (contemporary Kaliningrad) in 1905, where the fine for the devastation of Sea Holly individuals was 150 marks (Hegi 1965). After the Second World War legal protection of the species in Poland has been ensured by further acts and ordinances, and due to the latest Ordinance of the Ministry of the Environment (Rozporządzenie... 2004) it is now under strict protection.

On the scale of the Gdańskie Pomorania region *Eryngium maritimum* has a status of a near threatened species – NT (Markowski & Buliński 2004). The greatest danger for the species, besides devastating and collecting its individuals, comes from an intensive human activity connected with the development and transformation of the coast. Consolidation of the seashore as well as dune stabilization and afforestation that

has taken place on a large scale since the sixties resulted in the disappearance of habitats suitable for Sea Holly.

The main aim of this research was to catalogue all existing localities of *Eryngium maritimum* on the western shore of the Gulf of Gdańsk, as well as to compare them with the published and unpublished data for the last 160 years. The authors discussed also the causes of changes in the distribution and population size of the species.

2. Material and methods

The inventory of *Eryngium maritimum* localities was carried out in the summer 2006. About 150 km of the coast, from Władysławowo, through the Hel Peninsula to Świbno on the Sobieszewo Island, was inspected. For the first time the research included the whole western shore of the Gulf of Gdańsk, altogether with all special areas (managed by the Polish Army, ports and the summer residence of the President of Poland). All coastal habitats, not only those preferred by the species, were taken into account.

During the field studies, quantity resources of Sea Holly populations were estimated. As the species is a clonal perennial plant, developing a rosette of basal leaves with inflorescence shoot, it is often difficult to distinguish separate specimens. Therefore, each clearly distinctive cluster of basal leaves was treated as an “individual”, although, it has been anticipated that not always it would correspond to an individual plant in strict biological terms. Precise localities of particular individuals were established by geographic coordinates, with the use of GPS equipment. Those coordinates were used to prepare the distribution map of the species.

Additionally all available historical and contemporary literature was analyzed to reconstruct changes of Sea Holly distribution that have taken place on the shore of the Gulf of Gdańsk since the year 1848 (Klinggräff 1848) till now (authors' own unpubl. data). As a result, maps of distribution of the species in four time periods were given: I – from 1848 to 1934, II – in the year 1957, III – from 1972 to 1988 and IV – in the year 2006. On the maps an estimated frequency of occurrence of the species, according to a three-step scale of quantity (A – frequent, B – rare, C – doubtful data) is given.

3. Results and discussion

3.1. Distribution of *Eryngium maritimum* between the years 1845 and 2006

Historical data complemented by the results of our own research allowed investigating changes in distribution of *Eryngium maritimum* on the western shore of the Gulf of Gdańsk during the last 160 years. Analyzed data have been divided into four periods, which differed

significantly in the distribution and quantity of Sea Holly.

I – years 1848-1934. The earliest information on *Eryngium maritimum* on the western shore of the Gulf of Gdańsk was given by Klinggräff (1848). The author informed about the frequent occurrence of that species on the beach in Gdańsk. As there is no detailed information, the location of that population is not precise (Fig. 1-I). There are also other old sources referring to the occurrence of Sea Holly: Klinggräff (1881, after Herweg 1914) described frequent presence of that plant on the seaside part of the Hel Peninsula, while Graebner (1894-1895, after Abromeit *et al.* 1898) mentioned rare occurrence of Sea Holly on the Hel Peninsula and in the surroundings of Władysławowo. Abundance of the species on the beach between Sopot and Orłowo was noted by Bail (1906, after Lubliner-Mianowska 1958), and between Orłowo and Gdynia by Preuss (1911) and Herweg (1914) (see Fig. 1-I). Infrequent occurrence of the species near Krakowiec (east of nowadays Gdańsk-Stogi district) was given by Preuss (1911). Also on the shore in Sopot some specimens were mentioned by Herweg (1914), but it was the last mention on the existence of *Eryngium maritimum* in that locality.

After the First World War Chrzanowski (1920) described occurrence of Sea Holly at the mouth of a ravine on the Oksywie Hillock, while Pawłowski (1921) noted the species on the seaside part of the Hel Peninsula between Władysławowo and Hel, also between Puck and Rzucewo, Mechelinki and Oksywie, Oksywie and Gdynia and finally, between Gdynia and Orłowo. The frequent occurrence of *Eryngium maritimum* on the Hel Peninsula described Urbański (1933). The author noted also the species occasionally – in the parts of the shore between Puck and Rzucewo, Mechelinki and Oksywie and in the surroundings of the Oksywie Hillock. At the same time, Kulesza (1934) gave the information about a rich occurrence of Sea Holly on the shore between Puck and Rzucewo.

The most abundant population in those years was the one between Rewa and Mechelinki. It covered a 1.5 km long stretch of the shore and consisted of 'thousands of specimens' (Kulesza 1924a, b). A similar description may be also found in the paper of Urbański (1933).

By the thirties of the 20th century, Sea Holly occurred abundantly on the shore fragment between Mechelinki and Sopot (see Fig. 1-I). The development of the Gdynia Port and increasing reputation of Sopot as a spa resulted in the afflux of people and increased anthropopressure on the seashore. In consequence, habitats and populations of *Eryngium maritimum* were destroyed, which was described by Pawłowski (1921): ‘The audience... without knowledge of law regulations, took a fancy for unknown and interesting plant and begun to destroy it (...). Bunches of leaves or even whole plants in hands

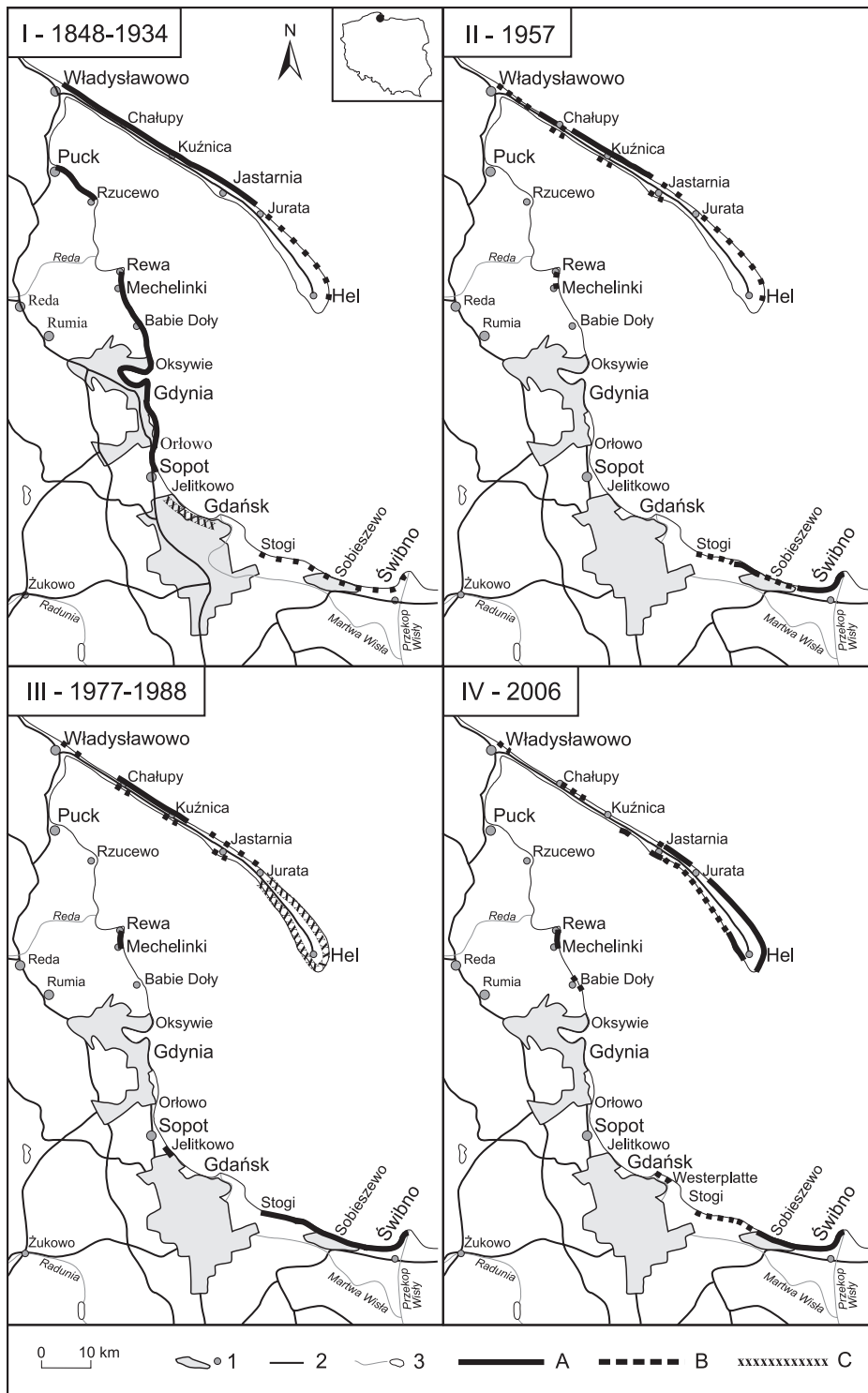


Fig. 1. Distribution of *Eryngium maritimum* on the western shore of the Gulf of Gdańsk
 Explanations: 1 – localities, 2 – roads, 3 – rivers and lakes; species frequency of occurrence: A – frequent, B – rare, C – doubtful data

of ladies, whose enjoyed gifts from the sea and admired the seaside landscape, were not a rare view’. Such incidents were described also in other notes from that time. Kulesza (1928) noticed absence of the species in the surroundings of Gdynia at the food of Kamienna Góra (Rocky Mountain); that locality wasn’t also confirmed by Lilpop (1931). The evident reduction in the number of individuals between Orłowo and Gdynia

and their random occurrence in the surroundings of the Redłowo Hillock was detected by Lilpop (1931).

II – year 1957. After the Second World War the distribution of Sea Holly on the shore of the Gulf of Gdańsk was investigated by Lubliner-Mianowska (1958). She also prepared the map of distribution of the species. Similarly as in the interwar time, *Eryngium maritimum* occurred only on the seaside part of the Hel

Peninsula near Chałupy, Kuźnica and north-west of Jastarnia (Fig. 1-II). The author noted also the rare occurrence of the species in the surroundings of Władysławowo and Jastarnia. Due to the lack of access to the shore fragment between Jurata and Hel, she based her description on personal information from the local inhabitants and she evaluated resources of the species as infrequent. Lubliner-Mianowska (1958) as a first noted single individuals of Sea Holly on the gulfside part of the Hel Peninsula near Chałupy, Kuźnica and Jastarnia. She also noticed that in the fragment of shore between Rewa and Mechelinki the number of individuals of the species decreased comparing to description by Kulesza (1924a, b). In the fragment between Stogi and Świbno she found *Eryngium maritimum* in varied abundance (see Fig. 1-II).

Lubliner-Mianowska (1958) confirmed disappearance of localities at the seashore between Puck and Rzucewo and from Mechelinki through Oksywie, Gdynia, Redłowo, Orłowo, Sopot, Jelitkowo, Gdańsk to Stogi (see Fig. 1-II). The absence of the species between Mechelinki and Stogi was probably connected with the continued transformation of the seashore (development of shipyard industry and ports in Gdańsk and Gdynia) as well as with the intensive stabilization of the shore (by willow and pine plantings) made by the Maritime Office. Also the beaches of the Tri-City (Gdańsk, Gdynia, Sopot) became ones of the most popular places for holidays and were visited on a massive scale by tourists from the whole Poland. At the same time the seashore on the Sobieszewo Island was only slightly changed and for that reason, areas of those populations of *Eryngium maritimum* didn't shrink. Similarly, controlled and limited access to the Hel Peninsula resulted in relatively small changes in the distribution and resources of Sea Holly populations.

III – years 1977-1988. In the 70's and 80's of the 20th century the distribution of Sea Holly was studied by few scientists, whose synthetic results are given in Fig. 1-III. On the seaside part of the Hel Peninsula shore, between Chałupy and Kuźnica, the number of individuals of the species was still large (Ćwikliński 1979; Nowakowska 1980; Stasiak 1988). Similarly as in the 50-ties, the species was rarely noted in the surroundings of Władysławowo, Jastarnia and Jurata (Banaś 1977; Ćwikliński 1979; Nowakowska 1980). On the gulfside shore of the peninsula some individuals were found near Chałupy, Kuźnica and Jastarnia (Banaś 1977). However, in all publications from that time there is no information about occurrence of *Eryngium maritimum* on the seaside and gulfside of the shore between Jurata and Hel, as that area was inaccessible for both tourists and researchers.

In the locality between Rewa and Mechelinki the population size increased comparing to the situation in the 50's, but still it was not as large as in the interwar time (Banaś 1977; Ćwikliński 1979).

A new locality, with quite abundant population of Sea Holly, was found in the surroundings of Jelitkowo (Śliwińska 1977; Ćwikliński 1979). Appearance of that population was probably a consequence of ceased afforestation of that part of the shore. Yet, it was rather an ephemeral population, which finally disappeared because of the increasing pressure by tourists (Stasiak 1988). At the same time, frequent occurrence of the species was noted by Ćwikliński (1979) between Stogi and Świbno, presumably due to the significant limitation of dune afforestation by the Maritime Office.

IV – year 2006. Information from the last period include data about the distribution of Sea Holly in the whole studied area, also in parts inaccessible so far – managed by the Polish Army, ports of Gdańsk and Gdynia and the the summer residence of the President of Poland. Our research was the first such detailed study of that part of the shore.

At present, most abundant population exists between Rewa and Mechelinki. Similarly like during the interwar time (Kulesza 1924a, b) thousands of individuals were noted along ca. a 2 km stretch of the shore.

On the Hel Peninsula *Eryngium maritimum* occurs mostly on the seaside of the shore between Jastarnia and Jurata and from ca. 2 km east of Jurata to the tip of the peninsula (Fig. 1-IV). Similarly abundant occurrence was found along ca. a 5 km section of the gulfside part of the shore, northeast of Hel towards Jurata as well as near Jastarnia and on a small, 0.5 km long stretch of the coast between Jastarnia and Kuźnica (see Fig. 1-IV). The species was less common in the surroundings of Władysławowo, southeast of Chałupy and on the gulfside shore, 4.5 km northwest of Hel to Jastarnia. The decrease in the population size or even its disappearance observed at the base and in the middle part of the Peninsula was mainly connected with an intensive development of tourism infrastructure (development of the existing resorts and building new ones, along with accompanying facilities, and bringing foreign substrates to the beaches) as well as with the increase in direct pressure from tourism and leasing of beaches and dunes by local communities for small gastronomy and playgrounds (see also Łabuz 2007).

In Stogi and Górki Zachodnie the number of individuals decreased comparing to the 70's and 80's (see Fig. 1-IV). In Stogi, the changes were connected mainly with new industry investments, such as Gdańsk Container Terminal. *Eryngium maritimum* is still frequent on the shore of the Sobieszewo Island, especially close to Górki Wschodnie and Świbno.

Several dozen of individuals were found on the beach in Babie Doły. That locality hadn't been mentioned after the Second World War and it is probably the same as locality described by Chrzanowski (1920) as: "the mouth of ravine on the Oksywie Hillock". Moreover, a new locality, not described before, was found on Westerplatte,

where few individuals of Sea Holly appeared along a small, 0.3 km stretch of the shore.

3.2. Resources of Sea Holly in particular localities

Along a 150 km section of the studied shore, altogether 6480 individuals of *Eryngium maritimum* were noted. The most abundant population was at the locality Rewa – Mechelinki, where 3381 specimens were found and they occupied a 2 km long stretch of the shore (Table 1). The second one, concerning the number of individuals, was population on the Sobieszewo Island, where 1408 individuals of Sea Holly were found along a 12 km long part of the shore. In the whole area of the Hel Peninsula (about 71 km of the coast) 1369 individuals of the species were noted. In the section from Westerplatte through Stogi to Górkki Zachodnie 287 individuals occurred. The smallest population was in Babie Doły, where only 35 individuals of *Eryngium maritimum* were noted on a 0.4 km long stretch of the shore (see Table 1).

More than half of the whole number of found individuals (52.3%) occurs in the locality Rewa – Mechelinki (Fig. 2). At the same time, it is the most concentrated population of all found – almost 1700 individuals per 1

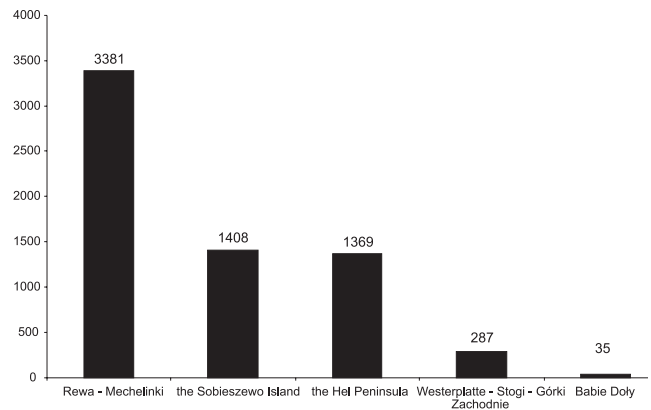


Fig. 2. Percentage of Sea Holly individuals in particular localities on the western shore of the Gulf of Gdańsk

those localities is under the law protection as a nature reserve. That population is located along a 1.2 km part of the shore between Rewa and Mechelinki, within ‘Mechelińskie Łąki’ reserve. The reserve has been established in year 2000. Despite such a law protection, that population is highly endangered due to inadequate security measures for the reserve employed by its

Table 1. Number of *Eryngium maritimum* individuals in particular localities of the studied area in 2006

Locality	Number of individuals	Approximated length of the shore in the locality (km)	Mean number of individuals per kilometre
Rewa – Mechelinki	3381	2.0	1690
the Sobieszewo Island	1408	12.1	116
the Hel Peninsula	1369	71.0	19
Westerplatte – Stogi – Górkki Zachodnie	287	9.5	30
Babie Doły	35	0.4	87

km (Table 1). In the next two sections of the shore – the Sobieszewo Island and the Hel Peninsula – 20% of all individuals noted during field research were found in each one. Still, their density of cover differs significantly. On the peninsula, Sea Holly was randomly distributed along 71 km of the shore, while on the island, there were 116 individuals per kilometre over a 12 km distance. In the locality Westerplatte – Stogi – Górkki Zachodnie less than 5% of whole number of individuals were found and the mean value was 30 specimens per kilometre. The population in Babie Doły was the smallest one, it constituted only 0.5% of the whole number of noted individuals but at the same time it was quite concentrated – 87 individuals per km (see Table 1, Fig. 2).

4. Summary and conclusions

The results of investigations point out at an urgent need for monitoring and protection of existing populations of *Eryngium maritimum*. At present, only one of

manager and disrespecting the prohibition on free moving along the protected area by tourists. Increased penetration of the reserve results in the devastation of dune grass communities, where Sea Holly grows, by both walkers and drivers, as well as in collecting and destroying individuals of the species. Moreover, fences, barriers and information tables are systematically destroyed. In consequence the most abundant and concentrated population of *Eryngium maritimum* on the shore of the Gulf of Gdańsk may completely disappear in the nearest future.

Most of the other existing populations of Sea Holly are also highly threatened by anthropopressure. Small populations on the seaside shore of the Hel Peninsula (in the surroundings of Władysławowo and Chałupy) as well as on the gulfside shore close to Hel, Jastarnia and Kuźnice are rather unstable and exposed to intense pressure of tourism. Similar situation is observed in Babie Doły and between Stogi and Górkki Wschodnie. Presently, the most stable and least threatened seem to

be populations on the Sobieszewo Island, on the seaside part of the Hel Peninsula shore between Jurata and Hel and in Westerplatte, as they are situated further from towns or close to military areas. Similar situation describes Łabuz (2007) from the middle part of the Polish coast.

Changes that have taken place in the studied area during the last 160 years indicate that hitherto protection of the species is insufficient and ineffective. Thus, according to law regulations of the European Union (Council Directive... 1992) it should be expanded on more effective protection of all habitats that are suitable for the species.

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