



South Pacific Regional Fisheries Management Organisation

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SEA FISHERIES INSTITUTE in GDYNIA

**PRELIMINARY
REPORT FROM CRUISE ON BOARD OF F/V ALINA TO OPEN WATERS OF SOUTH-
EASTERN PACIFIC ON 09.08-07.09.2009**

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**GDYNIA
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1. INTRODUCTION

Studies on Chilean jack mackerel in South-Eastern Pacific were conducted under the National Fisheries Data Collection Programme, theme NP.- 09/A2/PC.

The Polish fishing fleet has been familiar with South-Eastern Pacific region since 1980s. The first attempts at its exploitation were made by m/t Profesor Bogucki. Later, in the years 1981-1984, Polish commercial fleet fished in the region based on the experience and support from the USSR fleet. The fleets fished for jack mackerel mainly in the vicinity of the Chilean 200 mile zone.

During this year's research period, 47 fishing vessels fished for Chilean jack mackerel and searched for its concentrations outside the 200 mile zone. The vessels are very large (up to over 140 metres in length), with main engines of high capacity, and with enormous freezing capacity of up to 400 tons of fish per day. Additionally, commercial success of fishing for jack mackerel is ensured by fish tanks with refrigerated water. When caught, fish are stored in tanks filled with refrigerated water at about 0°C. The largest vessels are equipped with tanks which may hold up to 1,000 tons of fish or production feed for 2 or 3 days.

In order to be able to fish for jack mackerel, a vessel's engine capacity must be enough to provide speed of over 5 knots for a trawler towing a trawl. Also, the use of appropriate fishing gear is of utmost importance, namely of large or small floating trawls manufactured from ropes and net fabric whose strength is similar to that of steel rope.

F/v Alina is one of 17 trawlers of the "Vigo" type manufactured in the 1990s in Spain for the Russian fleet. As the vessel is 105 metres long and 20 metres wide, there was room in the processing facilities to install 28 vertical freezing chambers. Thus, the vessel's freezing capacity is about 200 tons of fish per day. Additionally, the vessel was equipped with 4 tanks with capacity of 450 square metres each in which 400 tons of fish can be stored. The main engine has 8,050 horsepower and thus allows developing speed of over 5 knots when towing a trawl net. Fishing gear efficiently used by the vessel consists of a 102-1940 trawl whose vertical aperture is 60 metres and horizontal aperture is 140 metres. Appropriately selected codends with lumen of 50 mm allow taking 120 tons of fish out of the water at a time. The electronic equipment of the vessel also plays a significant role. It comprises leads, sonars, sack sensors, and gear to receive information from a satellite on surface temperature, concentrations of plankton, thermocline location, etc. which allow finding potential concentrations of jack mackerel.

2. MATERIAL AND METHOD

Biological and catch material was collected on board of f/v Alina between 09.08.2009 and 07.09.2009 in statistical subarea FAO 87.2.6.

During the cruise, the following data were collected:

Fishing date, time of commencement and completion of trawling, total trawling time, geographical location (longitude and latitude), fishing depth, distance from seabed (based on the map), trawling speed, water temperature at trawling depth (headline), and surface water temperature. Additionally, information was gathered on weather conditions, such as the state of the sea, strength and direction of wind. The information was entered into the fishing logbook and the ship's logbook.

Fishing data concerning the quantity of fish caught which remained on the ship's side were registered on the basis of information from a technologist and entered into the fishing logbook as such. In the case of discard, information were based on the material collected by the employee of the Sea Fisheries Institute from the conveyor belt with which discard was

disposed of or, in the case of large fish, taken out of the tank by the processing employee and put aside. Fish for mass measurements were collected from the conveyor belt which transported them to the grading machine.

Fish of the given species obtained in this way were measured. In the case of jack mackerel, the furcal length, or the so-called *longitudo furkalis* L_f , was measured (which denotes the length of the fish between the anterior extremity of the snout and the point where the caudal fin bifurcates) in accordance with the recommendations of the “Sampling manual. Jack mackerel migration study in Chile (phase I) 2007”. In case of other species of fish, their total length, or *longitudo totalis* L_t , was measured. The results of measurements were rounded to 1 cm down. During each measurement, the target was to measure at least 150 specimens of each species. Subsequently, specimens were selected for in-depth ichthyological analysis. Emphasis was placed on selecting 10 representatives of each length class. Ichthyological analysis comprised examining specimen length (L_f for jack mackerel and L_t for other species), weight – to the accuracy of 5 grams, sex, stage of gonad maturity according to the Maier’s scale, and the degree of stomach fullness on a 5 degree scale (0 – empty, 4 – full). In order to establish the age of fish under analysis later, otoliths were recovered.

The number of measured fish of respective species and the number of fish analysed will be presented in Table 1.

3. RESULTS

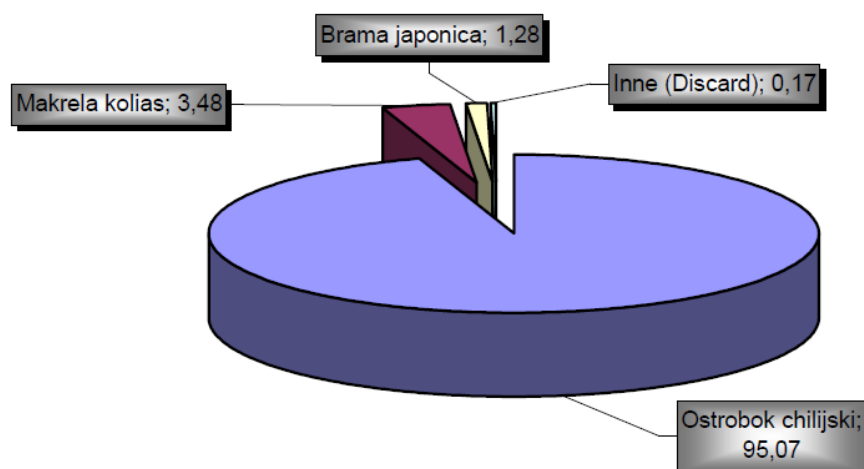
3.1. CATCH

During research f/v Alina performed 55 net hauls, of which 45 were floating trawl hauls and 10 hauls with a pair trawl from f/v Sirius (f/v Alina’s twin vessel).

3.1.1. Floating trawl chatching

In 45 floating trawl hauls, close to 1,904 tons of fish were caught, of which 95% were jack mackerel. The percentage species composition of catch with the use of floating trawl is presented in Figure 1.

Percentage species composition of catch with the use of pelagic trawl



PL	EN
Makrela kolias	Chub mackerel

Brama japonica	Brama japonica
Inne (Discard)	Discard
Ostrobok chilijski	Chilean jack mackerel

Figure 1. The percentage species composition of catch by f/v Alina with the use of floating trawl

Of the 45 floating trawl hauls, 7 were nil. As concerns other hauls, number 45 was the best as over 105 tons of fish were caught. The weight of catch by f/v Alina during research with the use of floating trawl will be presented in Figure 2. Analysis of fishing days in the period of research shows that the best day was 23.08.2009 when f/v Alina caught 257 tons of fish. In the period of research, the number of net hauls per fishing day ranged from 1 to 4, with the average of close to 2 per day.

Weight of catch of f/v Alina in individual pelagic trawl hauls

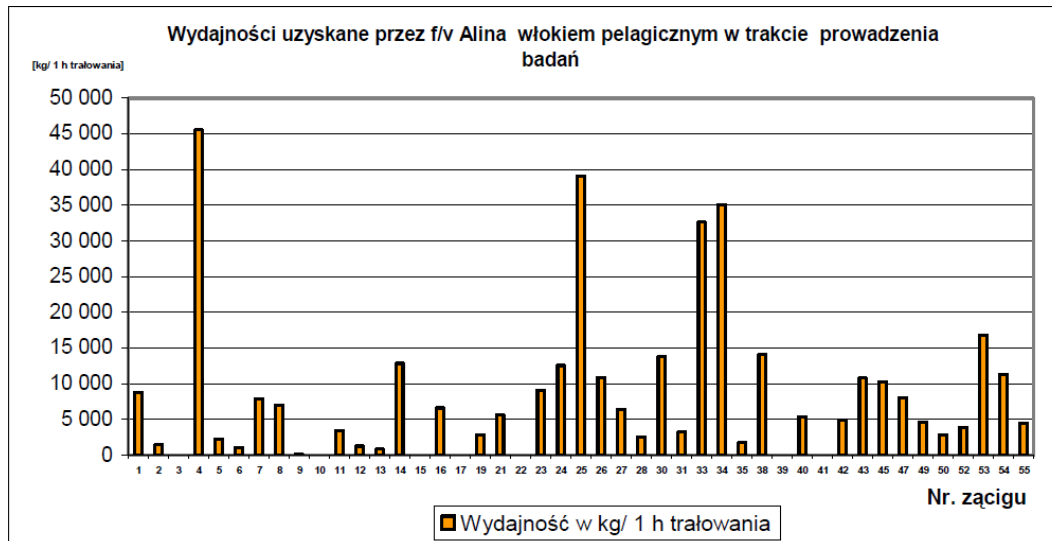


PL	EN
Masa połowu uzyskana przez f/v Alina w poszczególnych zaciągach włokiem pelagicznym	Weight of catch of f/v Alina in individual floating trawl hauls
[Masa połowu w kg]	[Weight of catch in kg]
Masa połowu	Weight of catch
Nr. zaciągu	Net haul No

Figure 2. The weight of catch in individual net hauls of f/v Alina with the use of floating trawl during the research period

The highest output was obtained from hauls at night. The average output per fishing day was 79.3 tones and 42.3 tones per haul. The average output per hour of trawling was: jack mackerel – 6,600.3 kg; Chub mackerel – 226.9 kg; *Brama japonica* – 95.1 kg. Fishing output for individual net hauls will be presented in Figure 3.

Output of f/v Alina using floating trawl in the period of research



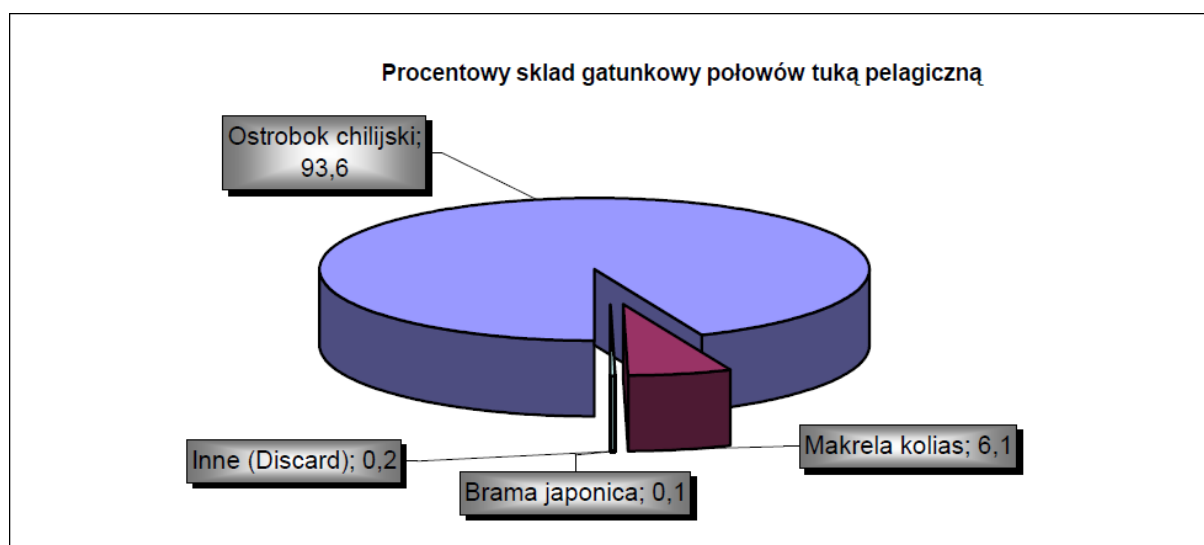
PL	EN
Wydajności uzyskane przez f/v Alina włokiem pelagicznym w trakcie prowadzenia badań	Output of f/v Alina using floating trawl in the period of research
[kg/ 1 h trałowania]	[Weight of catch in kg per 1 hour of trawling]
Wydajność w kg/ 1 h trałowania	Output in kg per 1 hour of trawling
Nr. zaciągu	Net haul No

Figure 3. Fishing output in kg per 1 hour of trawling of f/v Alina with the use of floating trawl during the research period

3.1.2. Pelagic trawl fishing

Pelagic trawl fishing was carried out using floating trawl “102-1940” whose vertical aperture is 60 metres and horizontal aperture is 140 metres, yet in this case trawlers f/v Alina and f/v Sirius were used as trawl boards (regular floating trawl fishing is carried out with the use of trawl boards). The distance between vessels during trawling ranged between 250 and 400 metres, depending on weather conditions and the length of rope used. During research, 10 such hauls were carried out, of which 6 with the net of f/v Alina and 4 with the net of f/v Sirius. Information provided by f/v Sirius and observations of f/v Alina show that the result of 4 hauls was nil and 6 were successful. The analysis of the species composition of catches, the weight of individual hauls, and fishing efficiency of f/v Alina will be presented below – Figures 4, 5, and 6.

Percentage species composition of catch with the use of pelagic trawl



PL	EN
Procentowy skład gatunkowy połowów tuką pelagiczną	Percentage species composition of catch with the use of pelagic trawl
Makreła kolias	Chub mackerel
Brama japonska	Brama japonska
Inne (Discard)	Discard
Ostrobok chilijski	Chilean jack mackerel

Figure 4. The percentage species composition of catch by f/v Alina with the use of pelagic trawl during the research period

Weight of catch in individual net hauls of f/v Alina with the use of pelagic trawl



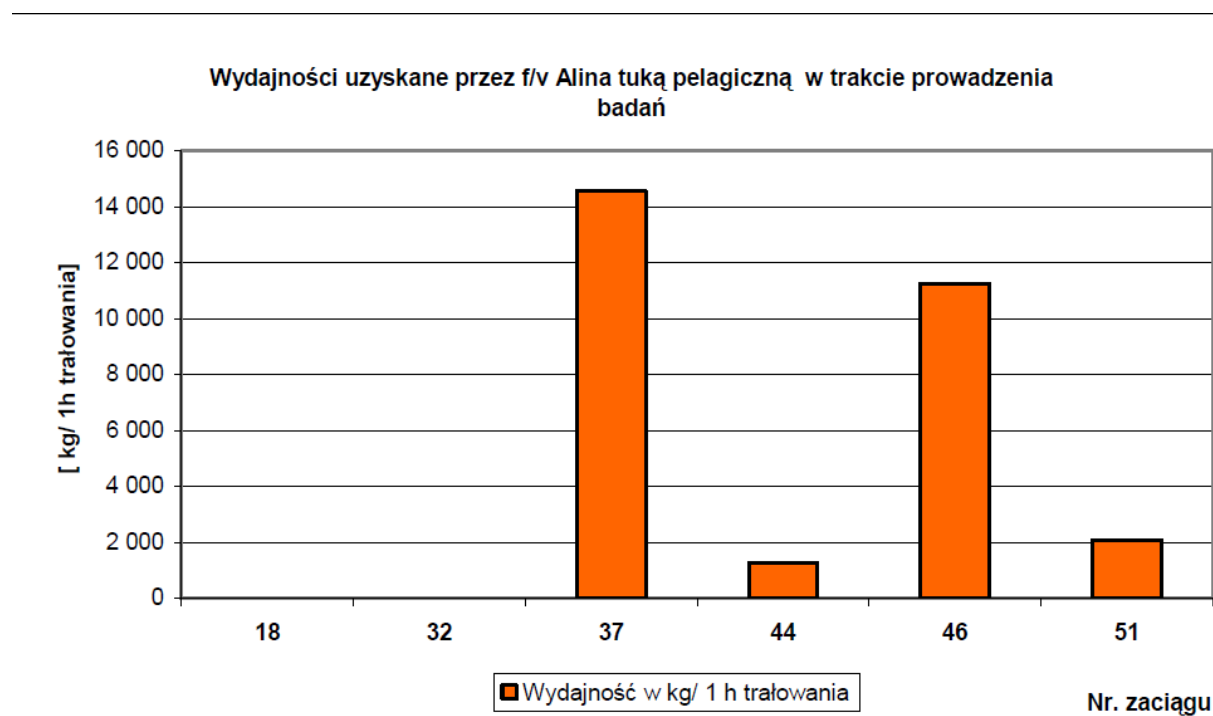
PL	EN
Masa połowu uzyskana przez f/v Alina w poszczególnych zaciągach tuką pelagiczną	Weight of catch in individual net hauls of f/v Alina with the use of pelagic trawl
Masa połowu [kg]	Weight of catch [kg]
Masa połowu	Weight of catch

Nr. zaciągu	Net haul No
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Figure 5. The weight of catch of f/v Alina with the use of pelagic trawl during the research period

Fishing with a pair trawl was carried out when the weather conditions were relatively good and only on the days when fish in the fishing ground was dispersed. Thanks to the specific use of the trawler as a very large trawl board which emits acoustic waves, small shoals of fish were directed into the trawl towed by vessels. When fishing in this manner, f/v Sirius caught about 90 tons of fish twice, at hauls No 29 and 36 (information provided by f/v Sirius). In the case of f/v Alina, hauls No 37 and 46 were most successful as over 60 tons of fish were caught and its output was about 11.3 and 14 tons per hour of trawling.

Output of f/v Alina using pelagic trawl in the period of research



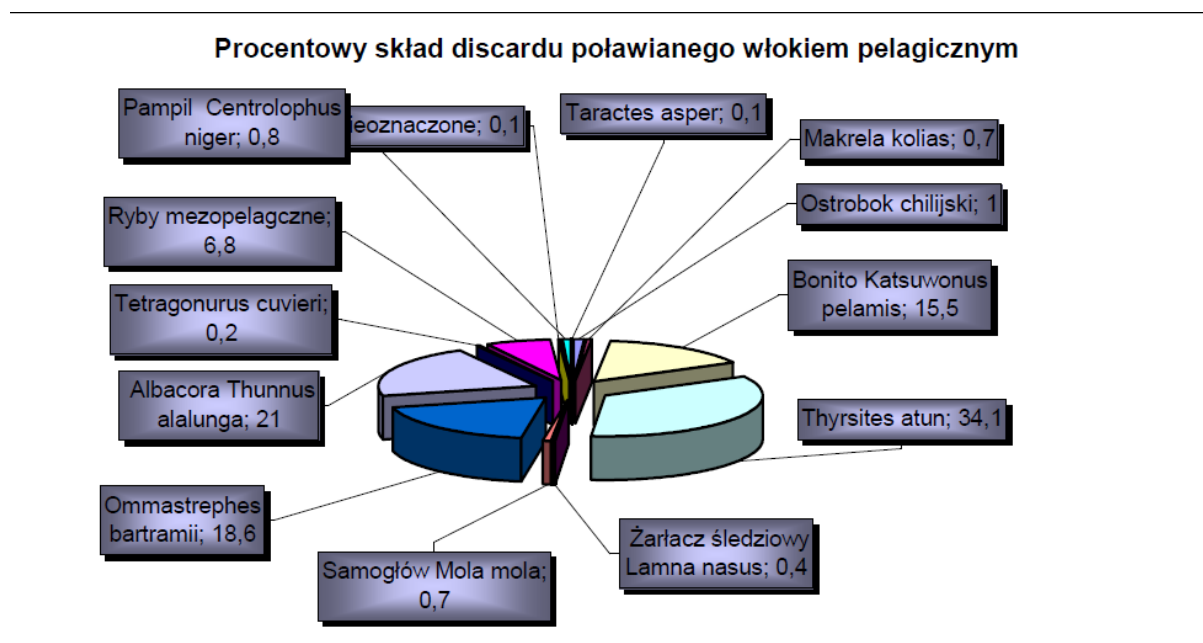
PL	EN
Wydajności uzyskane przez f/v Alina tuką pelagiczną w trakcie prowadzenia badań	Output of f/v Alina using pelagic trawl in the period of research
[kg/ 1 h trałowania]	[Weight of catch in kg per 1 hour of trawling]
Wydajność w kg/ 1 h trałowania	Output in kg per 1 hour of trawling
Nr. zaciągu	Net haul No

Figure 6. Output of f/v Alina when fishing with the use of pelagic trawl

3.1.3. Discard

During the research period, the total weight of discarded fish was over 3,500 kg, which translates into 0.17% of total weight of fish caught. 10 species of fish were determined, 1 species of squid, and 1 species was undetermined in discard. As concerns mesopelagic fish, fish which belong to this group were called this general name if they were not determined as a specific species due to extensive damage. The percentage composition of discard for fishing with the use of floating trawl is presented in Figure 7 and for fishing with the use of pelagic trawl – in Figure 8.

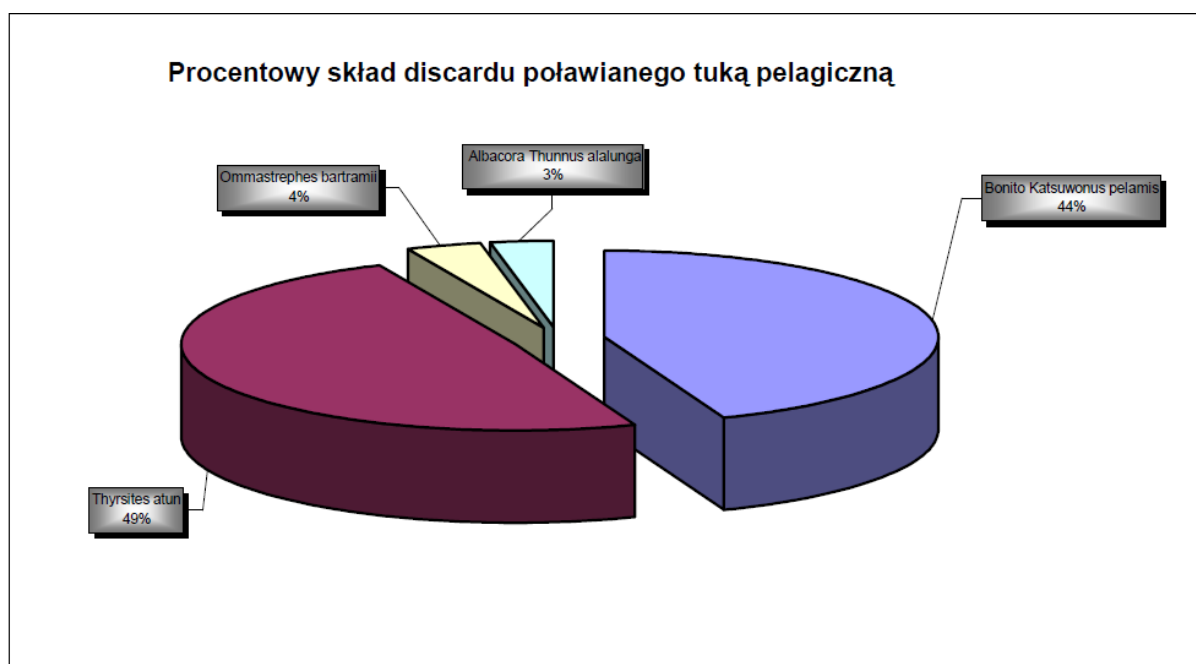
Percentage composition of discard caught using a floating trawl



PL	EN
Procentowy skład discardu poławianego włokiem pelagicznym	Percentage composition of discard caught using a floating trawl
Makrela kolias	Chub mackerel
Ostrobok chilijski	Chilean jack mackerel
Ryby mezopelagiczne	Mesopelagic fish
Pampil Centrolophus niger	Blackfish Centrolophus niger
Albacora Thunnus alalunga	Albacore Thunnus alalunga
Samogłów Mola mola	Ocean sunfish Mola mola
Bonito Katsuwonus pelamis	Skipjack Katsuwonus pelamis
Żarłacz śledziowy Lamna nasus	Porbeagle Lamna nasus
Nieoznaczone	Undetermined

Figure 7. Species composition of discard expressed as a percentage caught by f/v Alina using a floating trawl

Percentage composition of discard caught using a pelagic trawl



PL	EN
Procentowy skład discardu poławianego tuka pelagiczną	Percentage composition of discard caught using a pelagic trawl
<i>Albacora Thunnus alalunga</i>	Albacore <i>Thunnus alalunga</i>
<i>Bonito Katsuwonus pelamis</i>	Skipjack <i>Katsuwonus pelamis</i>

Figure 8. Species composition of discard expressed as a percentage caught by f/v Alina using a pelagic trawl

The species dominating discard in terms of weight were *Thyrsites atun*, skipjack, albacore, and *Ommastrephes bartramii*. The species most frequently found in discard were: *Ommastrephes bartramii*, (37 times per 55 hauls) *Thyrsites atun* (27 times), skipjack (25 times), and mesopelagic fish (22 times).

Detailed data on individual hauls, i.e. fishing dates, time of commencement and completion of trawling, total trawling time, geographical location (longitude and latitude), location of commencement and completion of trawling, fishing depth, distance from seabed, trawling speed, water temperature at trawling depth, surface water temperature, and weight and composition of catch will be presented in Table 2 – Information on catches. Distribution of individual net hauls will be presented in Maps 1 and 2. Map 1 concerns research period between 9 and 31 August and Map 2 – the period between 1 and 7 September. Analysis of fishing grounds shows that fishing started in the area of 98° West longitude and ended at 116° West longitude. Latitudinally, fishing was carried out between 34 and 37° South latitude. Preliminary calculations show that the area in which search for concentrations of jack mackerel took place during the research period was 50,000 square miles. Search moved from East to the West.

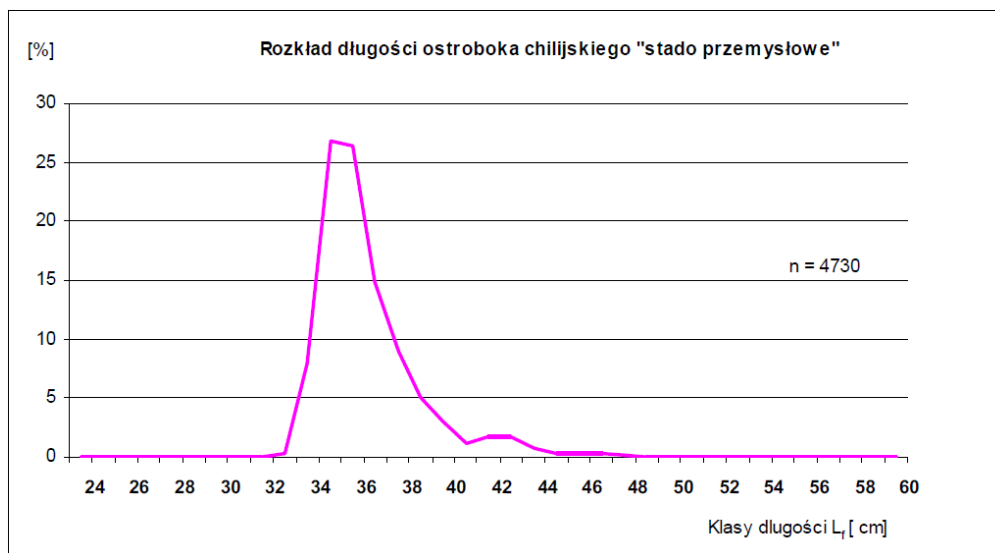
4. BIOLOGICAL STUDIES:

4.1. Chilean jack mackerel *Trachurus murphyi*

Commercial fish stocks

Effort of f/v Alina was targeted at catching Chilean jack mackerel and this species largely dominated the catch. Fish of the species were present in all successful hauls. Mass measurements of commercial stock fish revealed presence of specimens whose furcal length ranged between 24 and 53 cm. Distribution of length in the commercial fish stock will be featured in Figure 9.

Distribution of the length of Chilean jack mackerel in the commercial fish stock



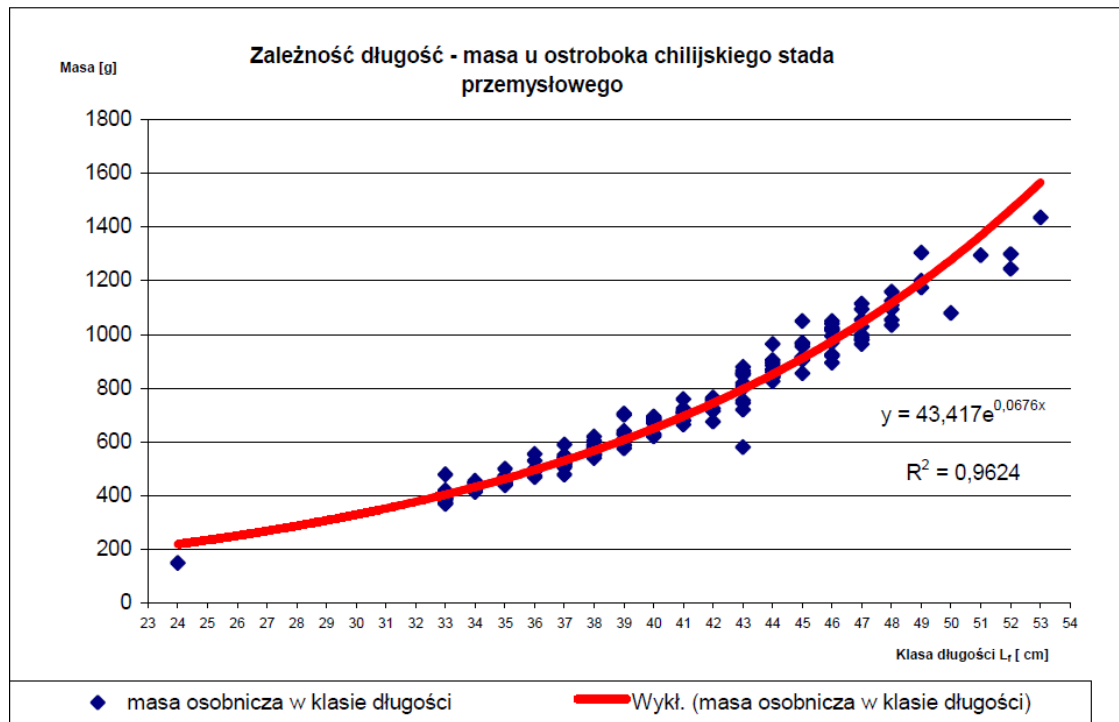
PL	EN
Rozkład długości ostroboka chilijskiego „stado przemysłowe”	Distribution of the length of Chilean jack mackerel in the commercial fish stock
Klasy długości L_f [cm]	Length classes L_f [cm]

Figure 9. Distribution of length of Chilean jack mackerel in the commercial fish stock

Catches from the commercial fish stock were dominated by specimens of furcal length of 35 and 36 cm, which made up for over 52% of measured fish.

The data on classes of length and weight of jack mackerel in the commercial stock were used to calculate the exponential relationship of length and body weight, as presented in Figure 10.

Relation of length to weight of Chilean jack mackerel in a commercial fish stock

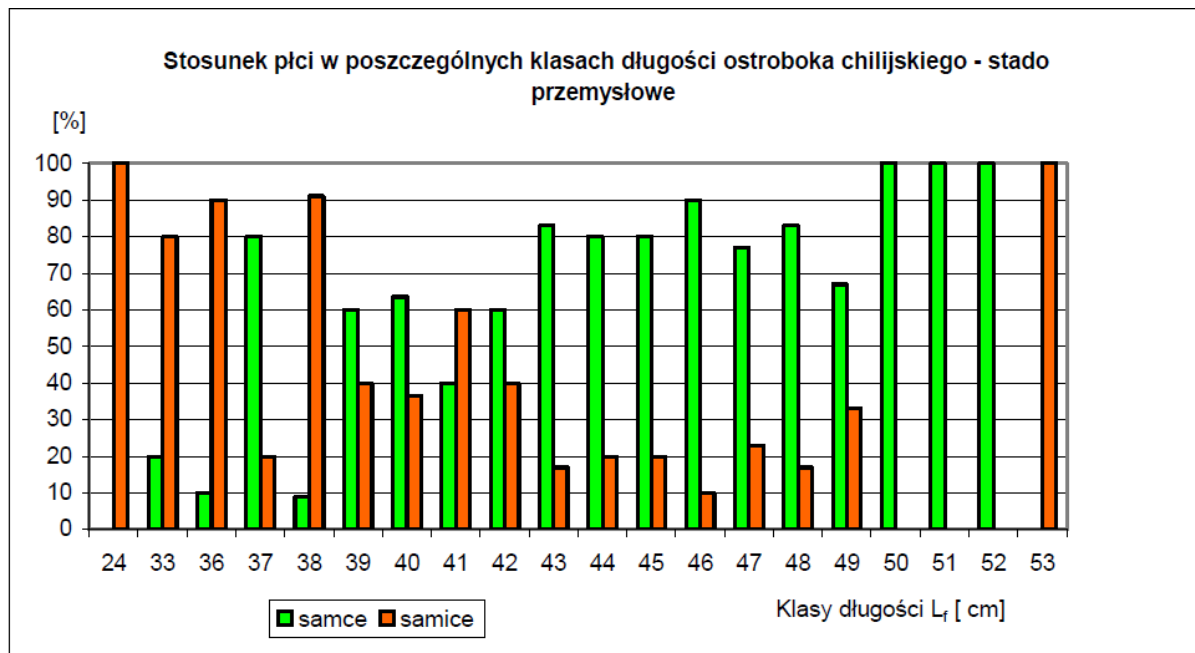


PL	EN
Zależność długość – masa u ostroboka chilijskiego stada przemysłowego	Relation of length to weight of Chilean jack mackerel in a commercial fish stock
Masa [g]	Weight [g]
Klasa długości L_f [cm]	Length class L_f [cm]
masa osobnicza w klasie długości	Individual weight in the given length class
Wykł. (masa osobnicza w klasie długości)	Exp. (individual weight in the given length class)

Figure 10. Relation of length to weight of Chilean jack mackerel

Results of analysis of specimens subject to detailed examination show that the stock was dominated by females which comprised 59.5% of examined specimens and the remaining 40.5% were males. Figure 11 presents the relation of sexes in individual length classes. It shows that there were more females among smaller fish and more males among larger ones.

Relation of sexes in individual length classes of Chilean jack mackerel in the commercial fish stock



PL	EN
Stosunek płci w poszczególnych klasach długości ostroboka chilijskiego – stado przemysłowe	Relation of sexes in individual length classes of Chilean jack mackerel in the commercial fish stock
samce	males
samice	females
Klasy długości L_f [cm]	Length classes L_f [cm]

Figure 11. Percentage relation of sexes in individual length classes

Analysis of gonad maturity stage revealed that vast majority of specimens had gonads in resting stage or at the onset of the developing stage during research. A scanty number of specimens had gonads in the spent stage. The percentage share of respective stages of development will be featured in Figure 12 for males and Figure 13 for females.

Stage of gonad maturity in analysed male specimens of Chilean jack mackerel in the commercial fish stock according to Maier's scale (%)

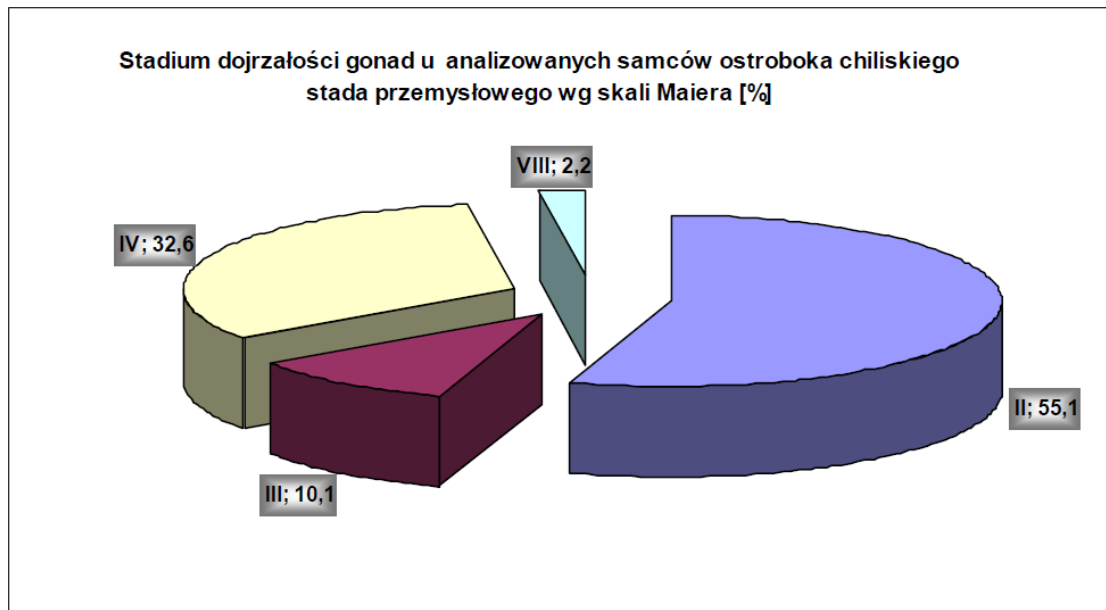


Figure 12. Percentage share of respective stages of gonad maturity in male specimens of Chilean jack mackerel

Stage of gonad maturity in analysed female specimens of Chilean jack mackerel in the commercial fish stock according to Maier's scale (%)

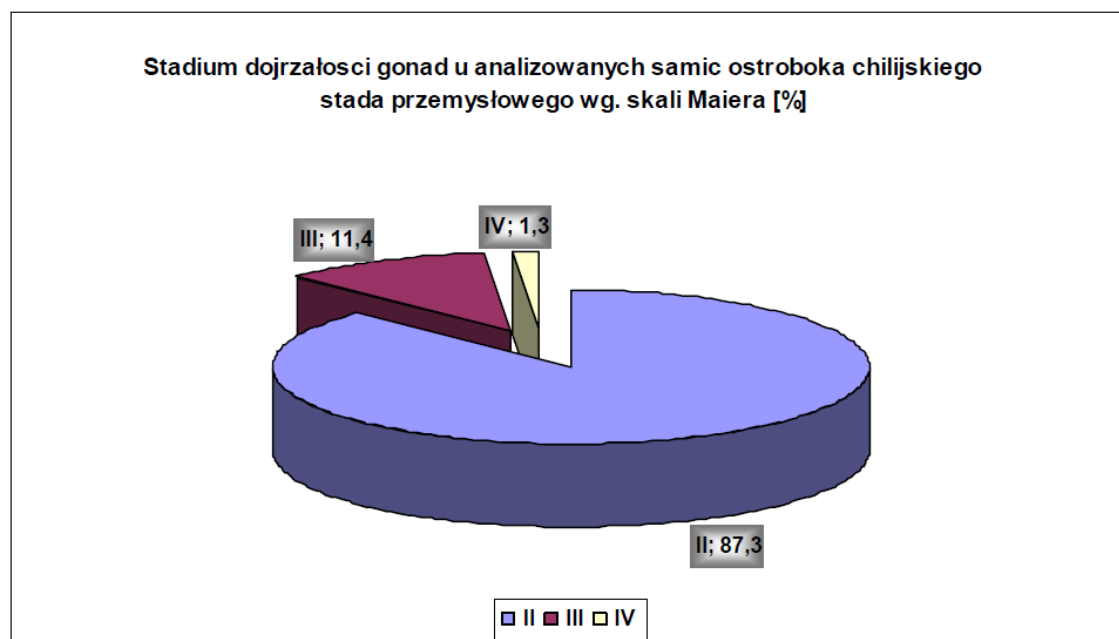


Figure 13. Percentage share of respective stages of gonad maturity in female specimens of Chilean jack mackerel

Analysis of the degree of stomach fullness in jack mackerel in the commercial fish stock presented in Figure 14 may prove low intensity of feeding. Close to 60% of fish had empty stomachs.

Degree of stomach fullness in analysed specimens in the commercial fish stock of Chilean jack mackerel

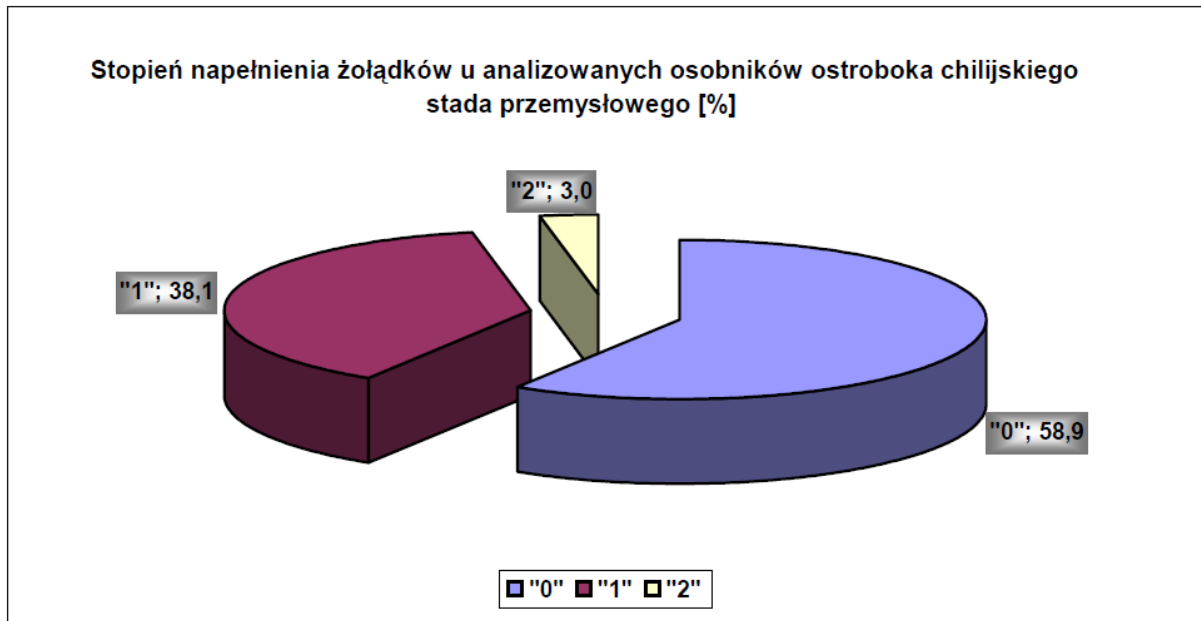
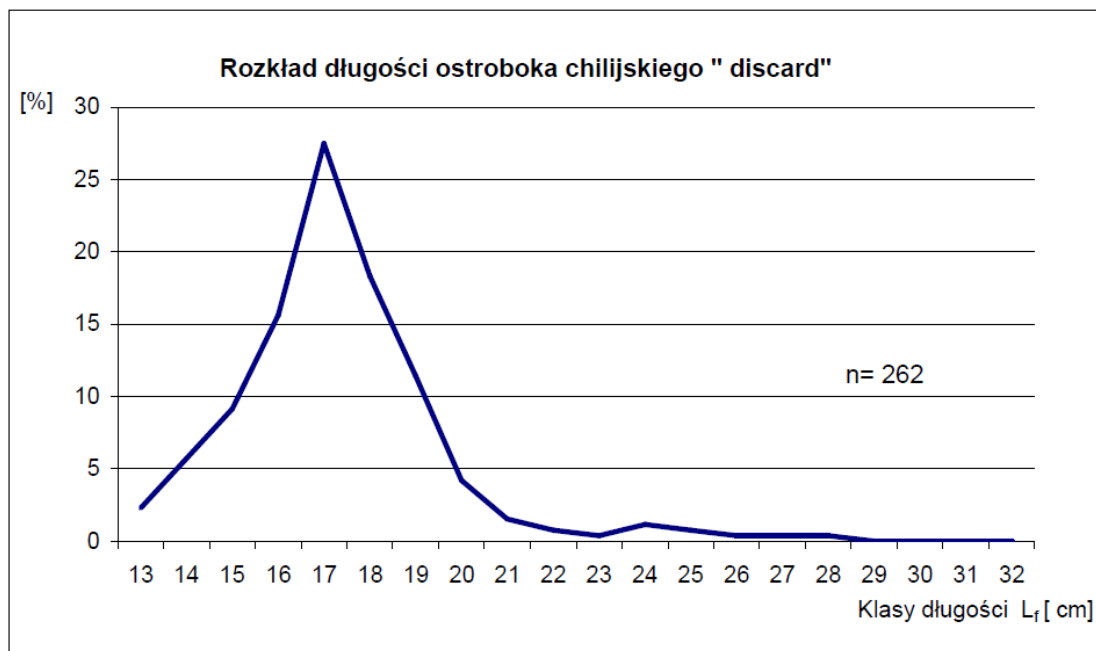


Figure 14. Degree of stomach fullness in analysed specimens in the commercial fish stock of Chilean jack mackerel

Discard

In case of discarded jack mackerel, specimens were discovered whose length ranged between 13 and 28 cm. Discard of this species was noted for two hauls: haul No 9 and 55. Distribution of length of discarded Chilean jack mackerel will be featured in Figure 15.

Distribution of length of discarded Chilean jack mackerel



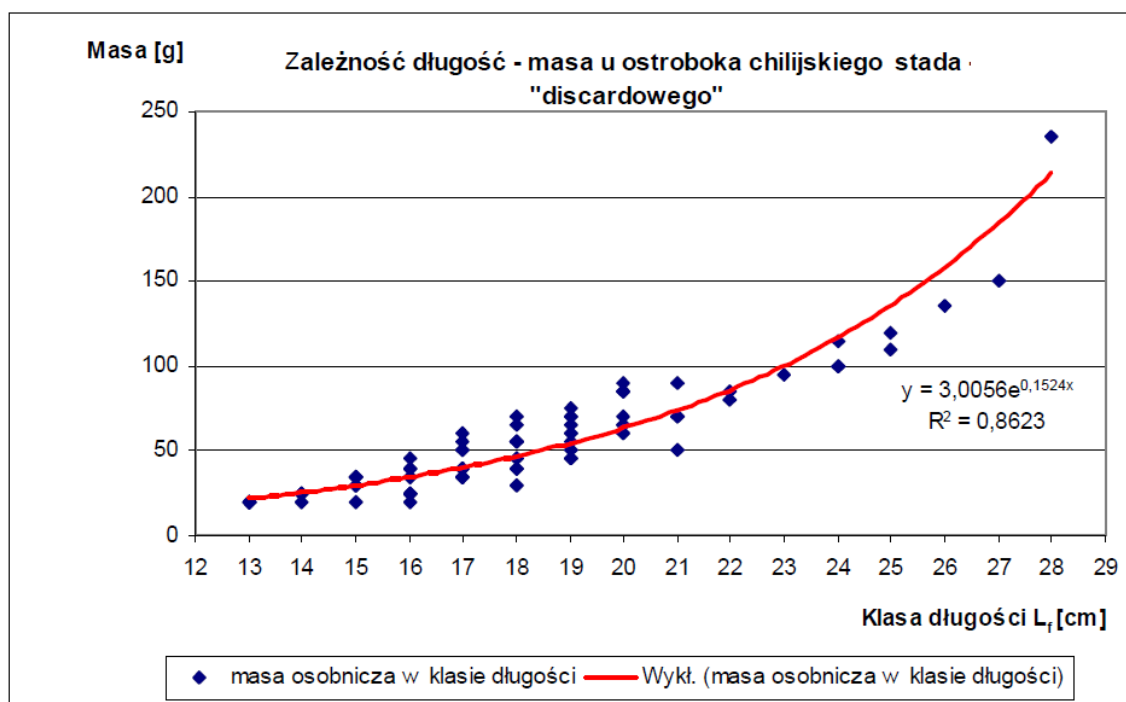
PL	EN
Klasy długości L_f [cm]	Length classes L_f [cm]

Figure 15. Distribution of length of discarded Chilean jack mackerel

This part of jack mackerel stock was dominated by specimens whose furcal length was 16-18 cm, with visible frequency peak at 17 cm. The three length classes comprised a total of over 61% of measured specimens.

The data on length classes and weight of discarded jack mackerel specimens were used to calculate the exponential relationship of length and weight, as presented in Figure 16.

Relation of length to weight of Chilean jack mackerel in discard



PL	EN
Zależność długość – masa u ostroboka chilijskiego stada „discardowego”	Relation of length to weight of Chilean jack mackerel in discard
Masa [g]	Weight [g]
Klasa długości L _f [cm]	Length class L _f [cm]
masa osobnicza w klasie długości	Individual weight in the given length class
Wykł. (masa osobnicza w klasie długości)	Exp. (individual weight in the given length class)

Figure 16. Relation of length to weight of discarded Chilean jack mackerel

Analysis of material revealed that over 61% of analysed fish were females and close to 39% were males. In case of males, close to 58% of analysed specimens had gonads in the juvenile stage and the remaining 42% – in the resting stage. In case of females, 46% of analysed specimens had gonads in the juvenile stage and 53% – in the resting stage.

Figure 17 presents the degree of stomach fullness in analysed specimens of discarded Chilean jack mackerel. Only 22.5% of specimens had no chyme in the stomach.

Degree of stomach fullness in analysed specimens of discard stock of Chilean jack mackerel (%)

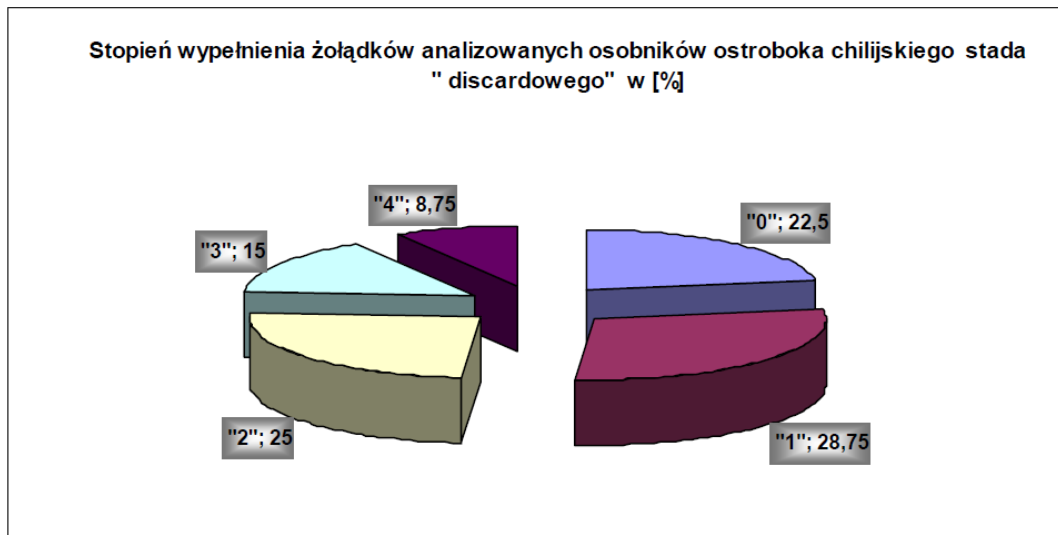


Figure 17. Degree of stomach fullness in analysed specimens of discarded Chilean jack mackerel

4.2. Chub mackerel *Scomber japonicus*

Commercial fish stock

Similar to jack mackerel, chub mackerel was found in almost all successful hauls, except for haul No 2.

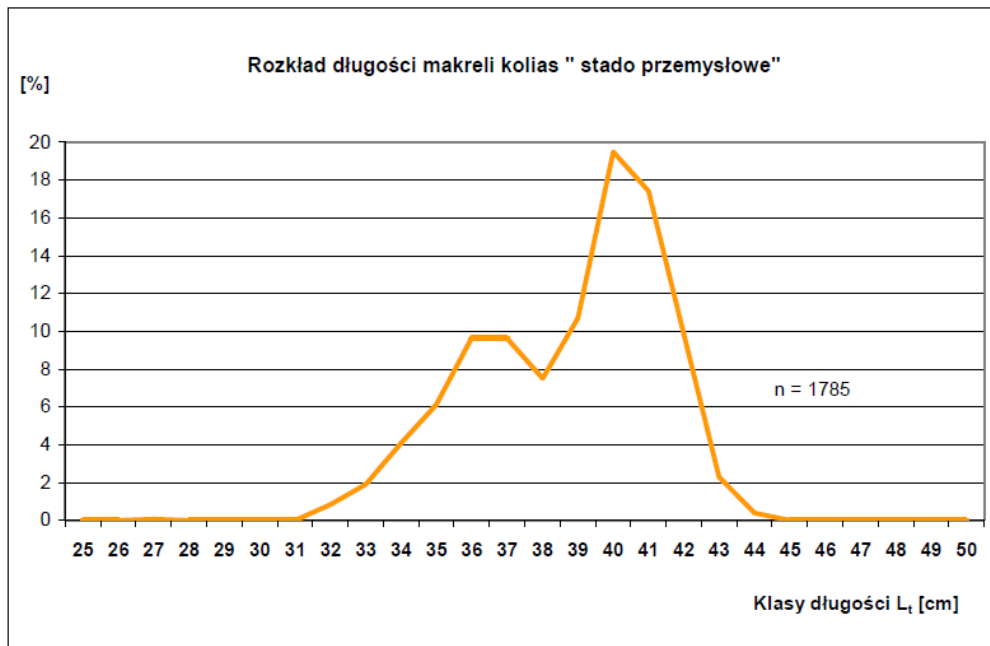
Mass measurements of commercial stock this species revealed presence of specimens whose total length ranged between 24 and 44 cm. Figure 18 presents distribution of length of chub mackerel in the commercial stock.

Two frequency peaks are visible. The first lower one at fish length of 36-37 cm and the second high one at values of 40-41 cm. In the case of the first peak, fish 36-37 cm long constitute 19.2% of the total number of measured specimens and in the case of the second peak, fish 40-41 cm long make up for 36.8%.

Based on data gathered during in-depth analysis, the exponential relationship of length and weight of chub mackerel in the commercial fish stock was calculated. It will be featured in Figure 19.

Detailed ichthyological analysis of chub mackerel specimens in the commercial stock revealed that 57.7% of analysed fish were male and 42.3% were female.

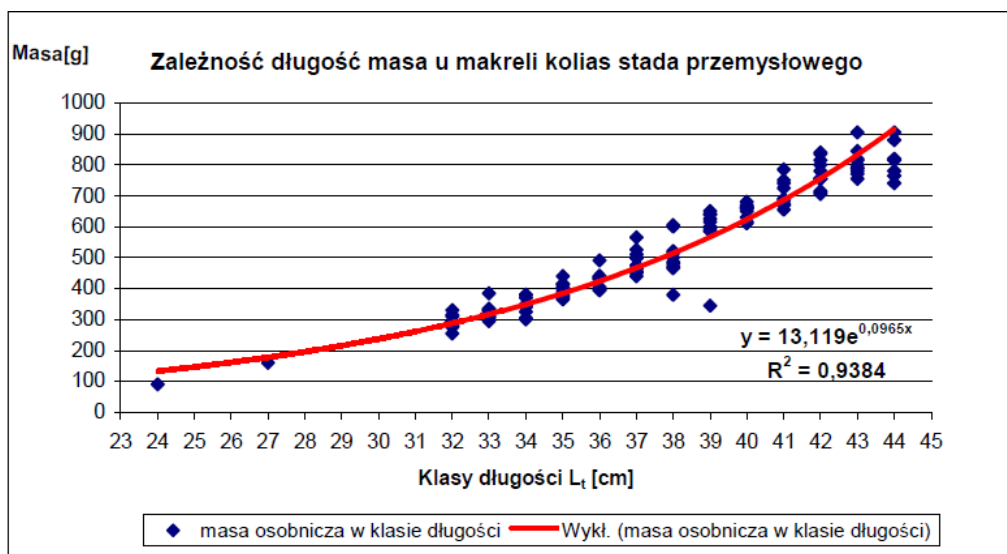
Distribution of length of chub mackerel in the commercial stock



PL	EN
Klasy długości L_f [cm]	Length classes L_f [cm]

Figure 18. Distribution of length of chub mackerel in the commercial stock

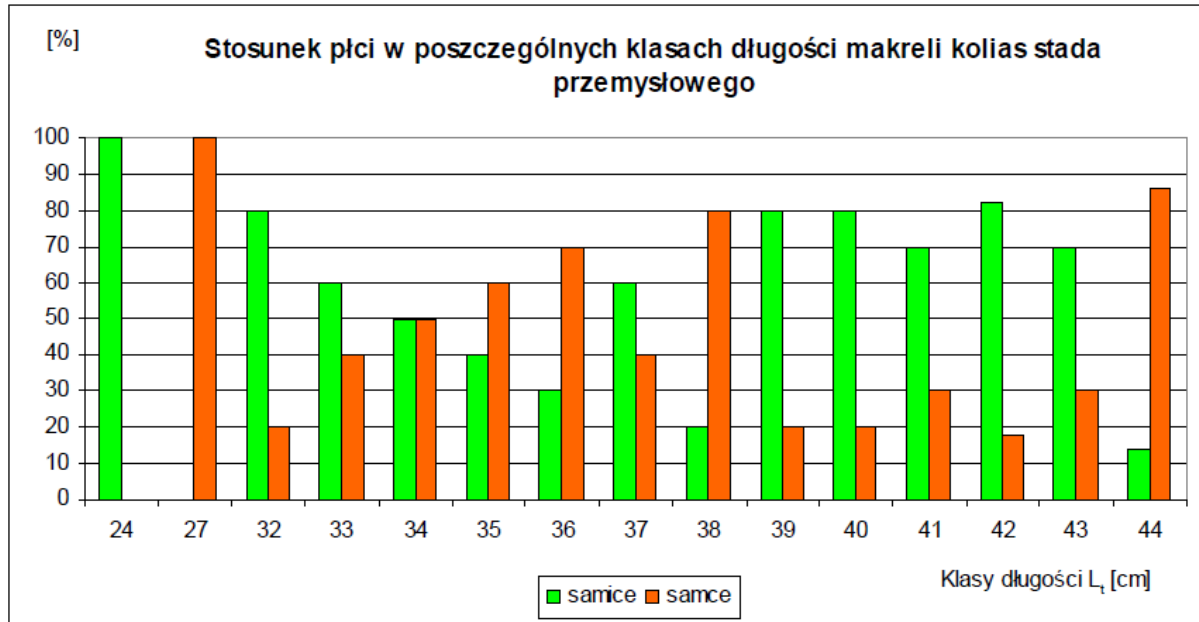
Relation of length to weight of chub mackerel in the commercial stock



PL	EN
Zależność długość masa u makreli koliaś „stada przemysłowego”	Relation of length to weight of chub mackerel in the commercial stock
Masa [g]	Weight [g]
Klasy długości L_f [cm]	Length classes L_f [cm]
masa osobnicza w klasie długości	Individual weight in the given length class
Wykł. (masa osobnicza w klasie długości)	Exp. (individual weight in the given length class)

Figure 19. Relation of length to weight of chub mackerel in the commercial stock

Figure 20 presents the relation of sexes in individual length classes. The diagram presented below suggests that this situation differs from the situation of jack mackerel, where domination of one sex occurred e.g. in case of smaller or larger fish. The nature of differences occurring here is rather random.



PL	EN
Stosunek płci w poszczególnych klasach długości makreli kolas stada przemysłowego	Relation of sexes in individual length classes of chub mackerel in the commercial fish stock
samice	females
samce	males
Klasy długości L_t [cm]	Length classes L_t [cm]

Figure 20. Relation of sexes in individual length classes

Stage of gonad maturity in analysed female specimens of chub mackerel in the commercial fish stock according to Maier's scale (%)



Figure 21. The percentage share of respective stages of gonad maturity in female specimens of chub mackerel in the “commercial fish stock according to Maier’s scale”

Stage of gonad maturity in analysed male specimens of chub mackerel in the commercial fish stock according to Maier’s scale (%)

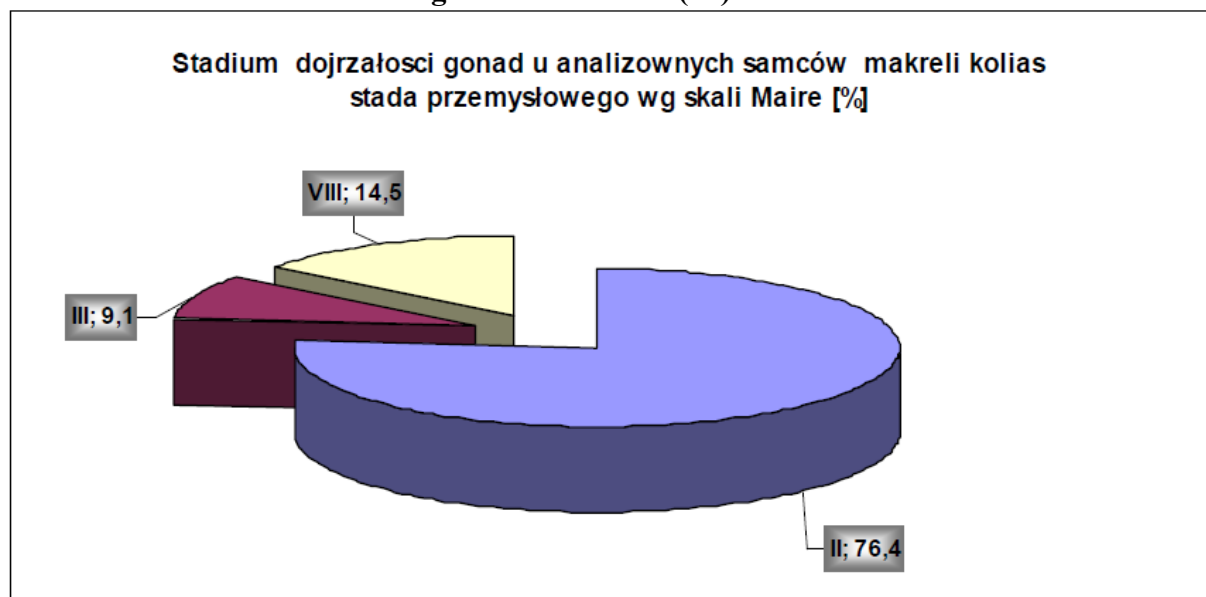


Figure 22. The percentage share of respective stages of gonad maturity in male specimens of chub mackerel in the “commercial fish stock according to Maier’s scale”

Figures 21 and 22 present the percentage share of respective stages of gonad maturity. It shows that the great majority of fish had gonads in the resting stage and 33 % of female specimens had gonads in the spent stage, while approximately 9 % of male specimens had gonads at the onset of the developing stage. In general, gonads of male specimens were less advanced in the maturity stage than the female specimens’ gonads.

Figure 23 presents the degree of stomach fullness in chub mackerel in the “commercial fish stock”.

Degree of stomach fullness in analysed specimens of the commercial fish stock of chub mackerel in (%)

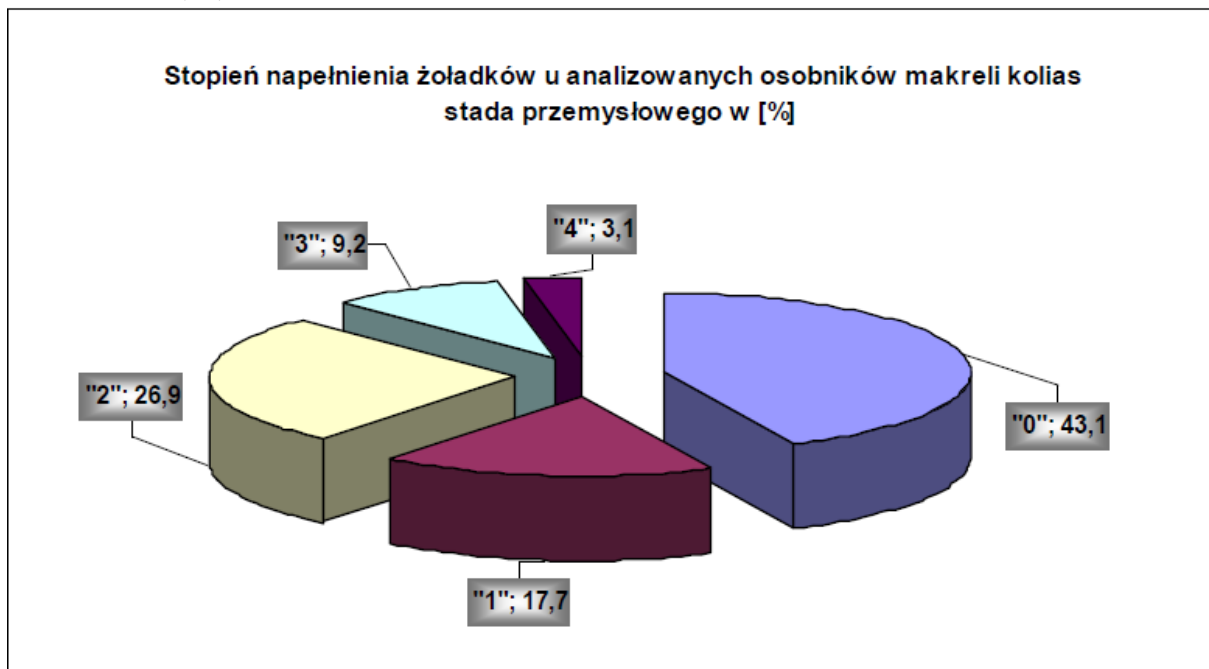
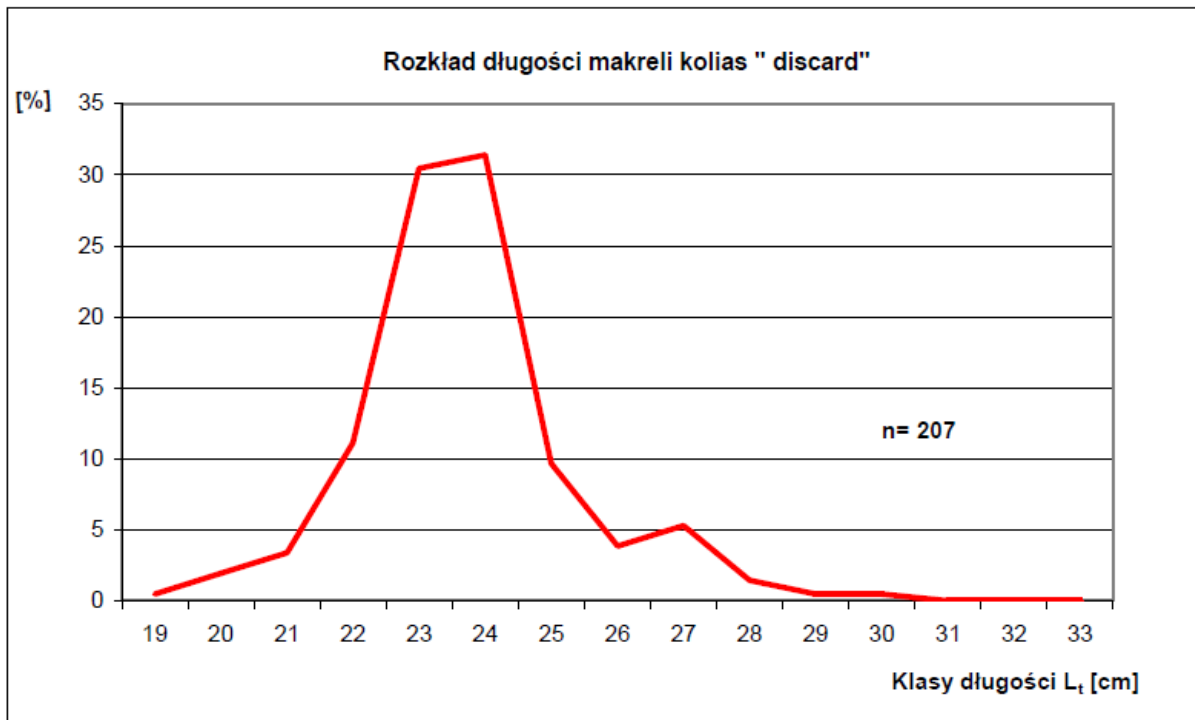


Figure 23. Degree of stomach fullness in chub mackerel – “commercial fish stock”

It suggests that fish of this species consumed food with a low intensity – ingesta has been observed in nearly 57 % of fish, 44.6 % of which are degrees 1 and 2 of stomach fullness.

„Discard”

The discard of this species has been noted in one net haul: number 9. Mass measurements of this species in discard revealed presence of specimens whose total length ranged between 19 and 30 cm. Figure 24 presents the distribution of length of discarded chub mackerel.

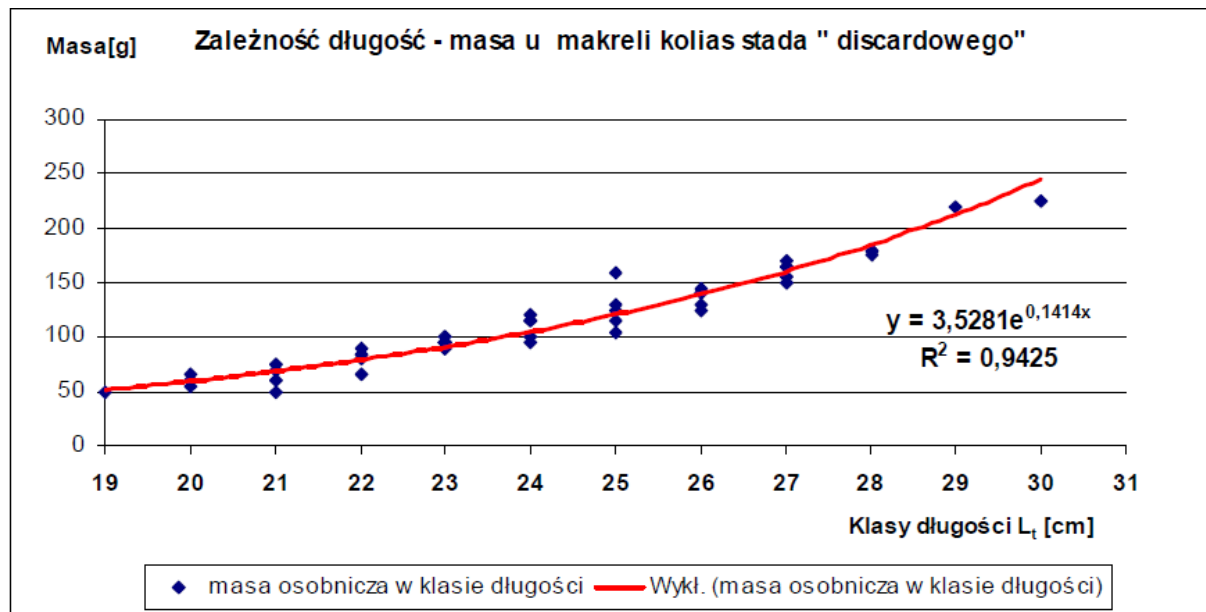


PL	EN
Rozkład długości makreli koliaś „discard”	Distribution of length of discarded chub mackerel
Klasy długości L_t [cm]	Length classes L_t [cm]

Figure 24. Distribution of length of discarded chub mackerel

The distribution presented above is of single-peak character: specimens of 23-24 cm are dominant, constituting nearly 62 % of the measures fish.

Based on the data acquired in the course of an in-depth analysis of discarded chub mackerel, a weight-length relation has been prepared and is presented in figure 25.



PL	EN
Zależność długość – masa u makreli kolas stada „discardowego”	Relation of length to weight of chub mackerel in discard
Masa [g]	Weight [g]
Klasa długości L_t [cm]	Length class L_t [cm]
masa osobnicza w klasie długości	Individual weight in the given length class
Wykł. (masa osobnicza w klasie długości)	Exp. (individual weight in the given length class)

Figure 25. Relation of length to weight of chub mackerel in discard

Male specimens constituted nearly 51 % of analysed fish and female specimens – 49 %. Analysis of the material revealed that 97 % of fish had gonads in the resting stage (“2”) and only 2 % in the juvenile stage (“1”) – one specimen, male.

Figure 26 presents degrees of stomach fullness in discarded chub mackerel.

Degree of stomach fullness in analysed specimens of discard stock of chub mackerel in (%)

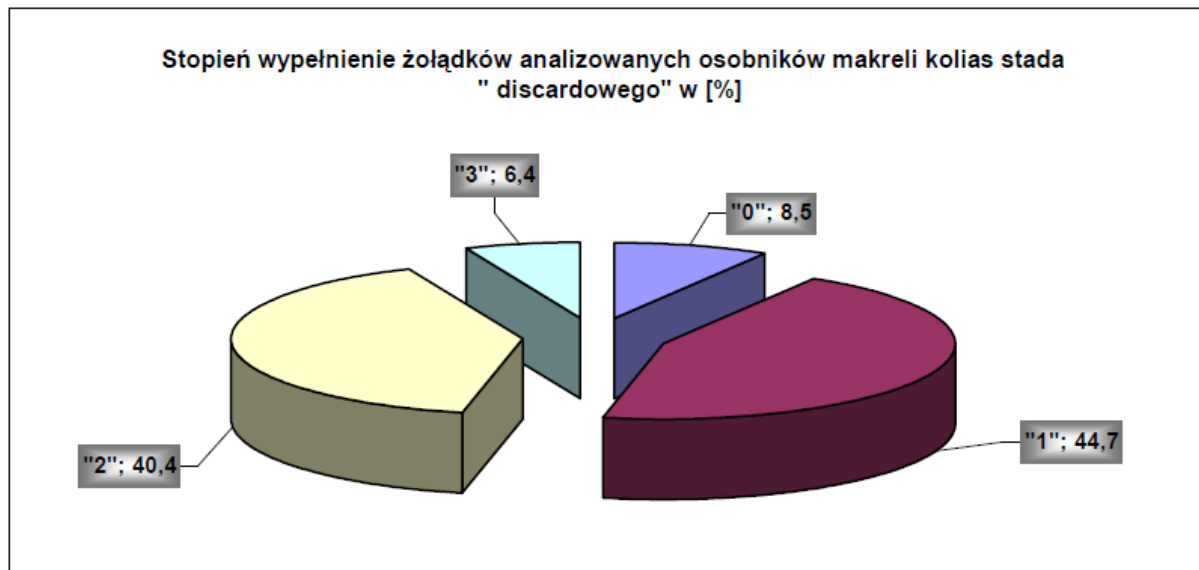


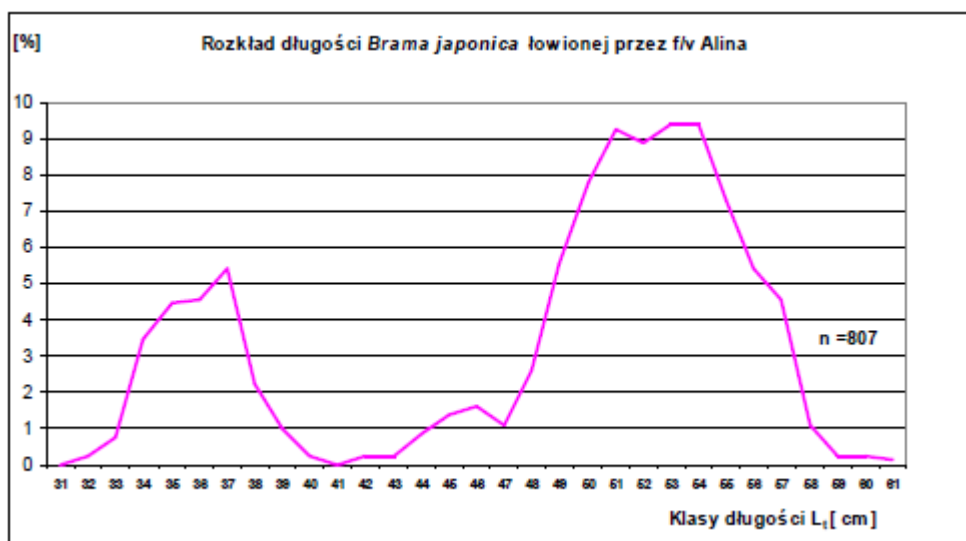
Figure 26. Degrees of stomach fullness in discarded chub mackerel

It shows that younger fish were feeding more intensively. Only 8.5 % of empty stomachs were noted and almost 85 % of stomachs were filled with ingesta – between 1 and 50 % (degrees 102).

4.3. *Brama japonica*

Fish of this species were frequently present in the hauls, out of the total number of 43 successful hauls (both with floating trawls and pelagic trawl). It has not been found in 11 net hauls (numbers 5, 6, 32, 33, 34, 37, 46, 51, 53, 54, 55).

Mass measurements of this species revealed presence of specimens whose length ranged between 32 and 61 cm L_t . Figure 27 presents the distribution of length of fished *Brama japonica*.



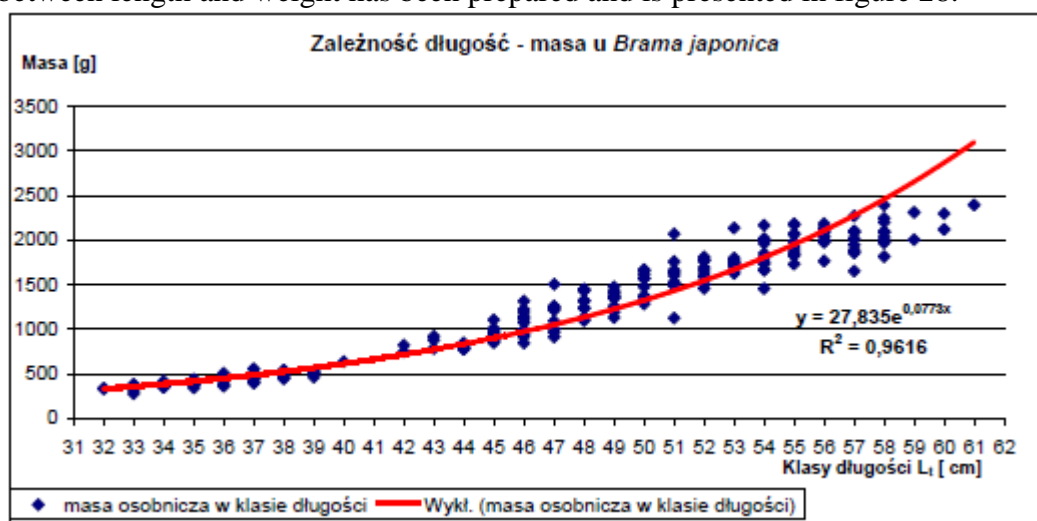
PL	EN
Rozkład długości <i>Brama japonica</i> łowionej przez f/v Alina	Distribution of length of <i>Brama japonica</i> fished by f/v Alina

Klasy długości L_t [cm]	Length classes L_t [cm]
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Figure 27. distribution of length of fished *Brama japonica*.

The figure shows two frequency peaks: one at values of 36-37 cm and the second, more expanding, with values between 51 and 54 cm. In case of the first peak, both classes constitute 10 % of measured fish, while in the second one they reach 37 %. One of the most striking information is a fact that there are no specimens with the length of 41 cm in the distribution of length.

Based on the data acquired in the course of an in-depth analysis of *Brama japonica*, a relation between length and weight has been prepared and is presented in figure 28.

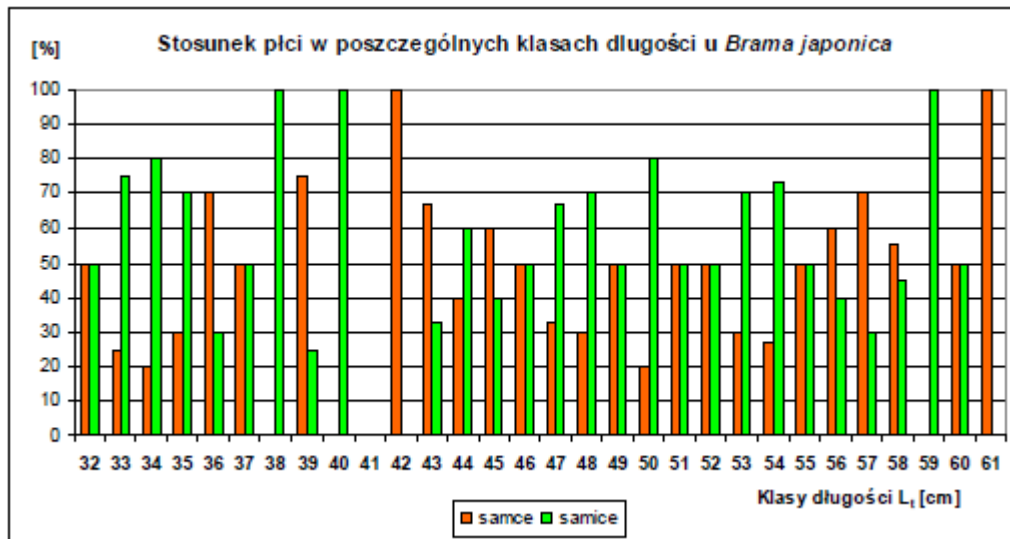


PL	EN
Zależność długość – masa u <i>Brama japonica</i>	Relation of length to weight of <i>Brama japonica</i>
Masa [g]	Weight [g]
Klasa długości L_t [cm]	Length class L_t [cm]
masa osobnicza w klasie długości	Individual weight in the given length class
Wykł. (masa osobnicza w klasie długości)	Exp. (individual weight in the given length class)

Figure 28. Relation of length to weight of *Brama japonica*

It has been established that among the analysed specimens share of female specimens amounts to 57 % and male specimens – to nearly 43 %.

Similarly to the case of previous species, a relation of sexes in individual length classes has been prepared for *Brama japonica* as well. It is presented in Figure 29.



PL	EN
Stosunek płci w poszczególnych klasach długości u <i>Brama japonica</i>	Relation of sexes in individual length classes of <i>Brama japonica</i>
samce	males
samice	females
Klasy długości L_t [cm]	Length classes L_t [cm]

Figure 29. Relation of sexes in individual length classes

As in case of chub mackerel, no particular dominations of sexes have been observed in individual length classes and marginal differences are rather of a random nature.

Figures 30 and 31 present stages of gonad maturity of *Brama japonica* according to Maier's scale for male and female specimens, respectively.

Stage of gonad maturity in male specimens of *Brama japonica* according to Maier's scale (%)

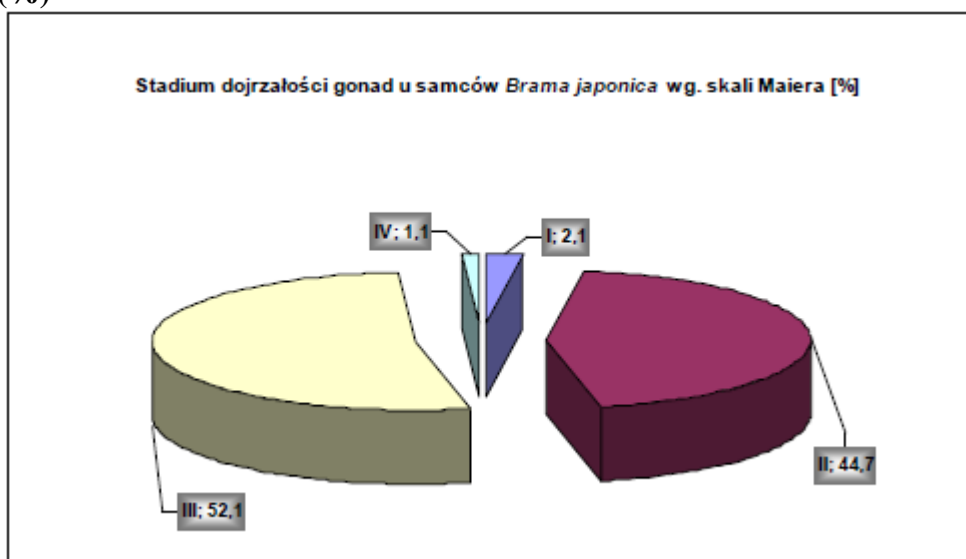


Figure 30. Stage of gonad maturity in male specimens of *Brama japonica* according to Maier's scale

Stage of gonad maturity in female specimens of *Brama japonica* according to Maier's scale (%)

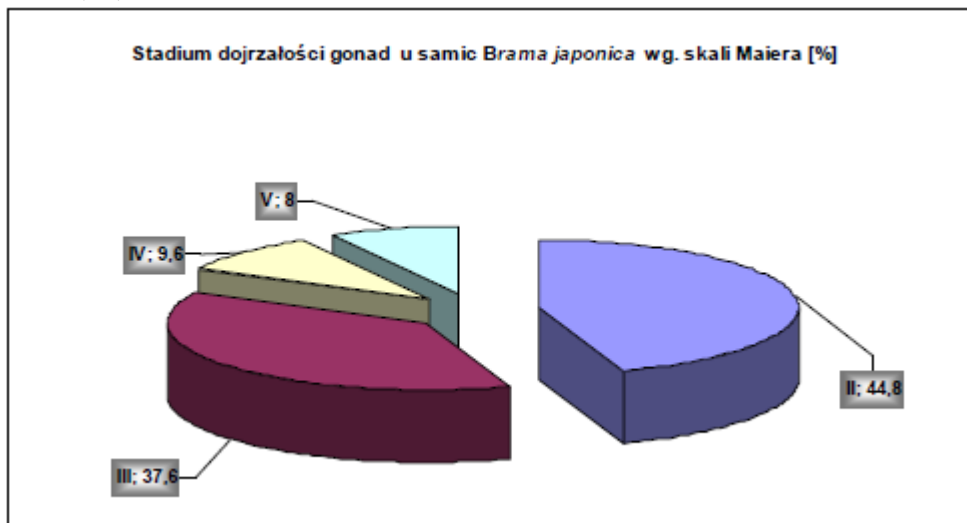


Figure 31. Stage of gonad maturity in female specimens of *Brama japonica* according to Maier's scale

In case of fish of this species it is possible to observe clear indications of preparation for spawning. Although nearly 45 % of both male and female specimens still have gonads in the initial stage, over 50 % of male specimens and almost 38 % of female specimens with gonads in the developing stage may point to the preparations for spawning. This is also confirmed by an 8 % share of female specimens in stage 5, i.e. before spawning.

Figure 32 presents degrees of stomach fullness in analysed specimens of *Brama japonica*.

Degree of stomach fullness in analysed specimens of *Brama japonica* in (%).

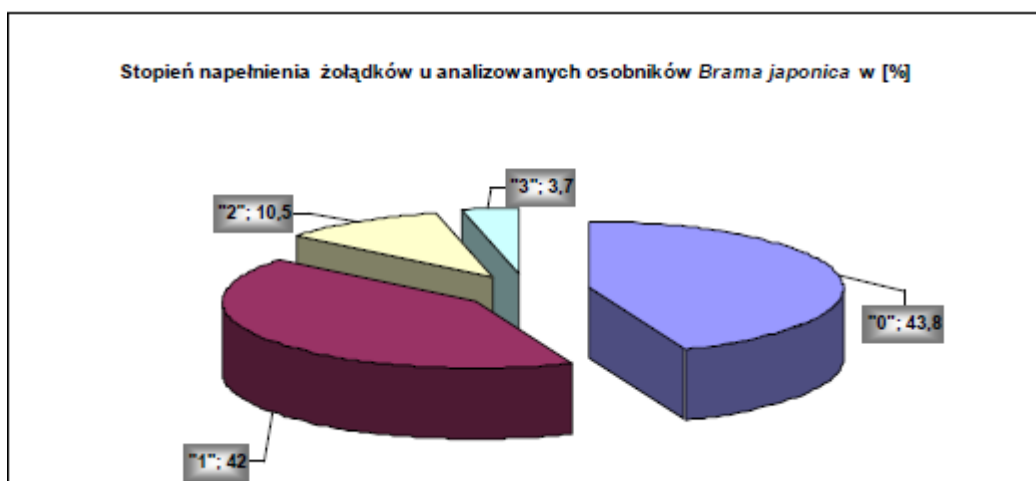


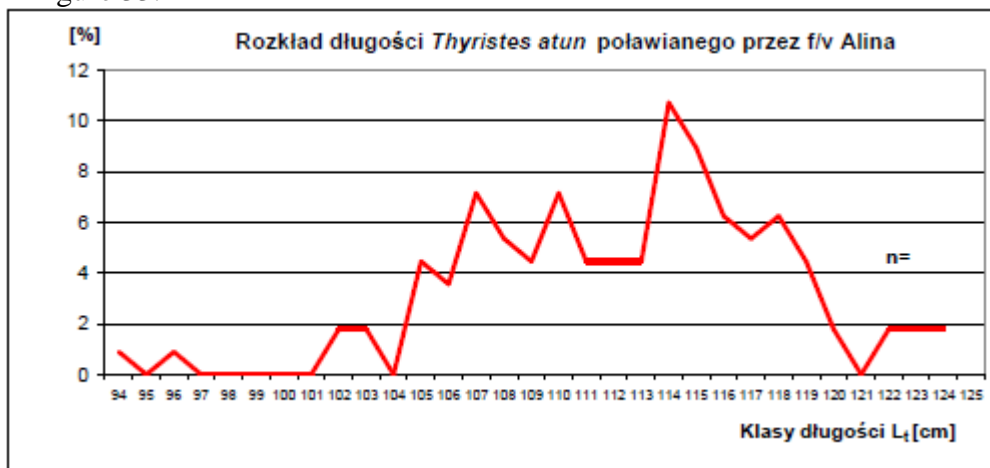
Figure 32. Degree of stomach fullness in *Brama japonica*

The analysed fish have not been feeding very intensively, which is clearly confirmed by nearly 44 % share of specimens with empty stomachs and 42 % with stomachs filled only to a small degree (1).

4.4. Other species of fish

Thyristes atun

This species was most common in by-catch. Caught specimens measured from 94 to 124 cm. A total of 112 specimens were measured, while 225 were caught. The measurements made served as a basis for preparing the distribution of length of *Thyristes atun*, which is presented in Figure 33.

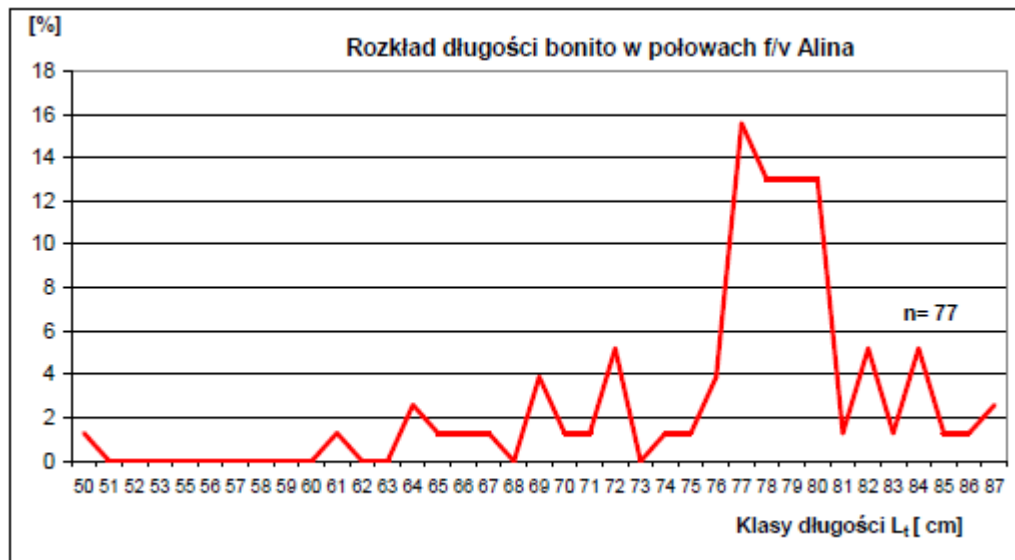


PL	EN
Klasy długości L_t [cm]	Length classes L_t [cm]

Figure 33. Distribution of length of *Thyristes atun* in f/v Alina catch

Skipjack *Katsuwonus pelamis*

Fish of this species were recorded in 25 net hauls. Caught specimens measured from 50 to 87 cm. A total of 77 fish of this species were measured, while the catch of 143 was recorded. The collected materials were used to prepare the distribution of the skipjack length which is presented on Figure 34.



PL	EN
Klasy długości L_t [cm]	Length classes L_t [cm]

Figure 34. Distribution of skipjack length in f/v Alina catch

Albacore *Thunnus alalunga*

Fish of this species were recorded in 11 net hauls. Seven specimens of this species were measured, while the catch of 52 was recorded. The length of measured fish fluctuated between 73 and 111 cm. The fact that so little fish of this species were measured resulted from the method of fish supply via a system of pipes to the processing facility to the tank before the sorting facility, where large fish were broken or even divided into pieces. Therefore, it was possible to count and estimate the mass of caught albacores, but impossible to measure them precisely.

Porbeagle *Lamna nasus*

This shark occurred only in one net haul No 16. It was 102 cm long and weighted 11.71 kg. It was probably a female.

Ocean sunfish *Mola mola*

This species was recorded in two net hauls No 13 and No 34. The specimen caught in the first haul was 68 cm long and weighted around 11 kg, while the specimen in the second haul weighted 12 kg.

Tetragonurus cuvieri

Specimens of this species were recorded in 3 net hauls No 19, 21 and 28. The haul No 19 included two specimens 68 and 59 long which weighted 1550 g and 1020 g, respectively. The haul No 21 included one specimen 51 cm long which weighted 715 g. The haul No 28 included two fish from that species, which were 61 and 60 cm long and weighted 1065 and 1350 g, respectively.

Blackfish *Centrolophus niger*

This species was observed in one net haul No 28. Two specimens were recorded. They were 102 and 105 cm long and weighted 12.01 kg and 12.5 kg, respectively.

Taractes asper

Specimens of this species were recorded in 3 net hauls number 28, 43 and 50. The haul No 28 included two specimens 37 and 35 long which weighted 525g g and 440 g, respectively. The haul No 43 contained one specimen which was 38 cm long and weighted 605 g, while the specimen caught in the haul No 50 was 37 cm long and weighted 705 g.

Ommastrephes bartrami squid

Cephalopods from this species were the most often recorded organisms in discard. The most common specimens were those with small mantles (up to 20 cm), although some specimens had mantles more than 50 cm long and weighted almost or over 5 kg.

5. CONCLUSIONS

1. The area of search and fishing for Chilean jack mackerel over a month-long research period covered around 50 000 square miles. Finding a fish concentration and successful fishing in such a vast area requires the cooperation of fishing vessels being in the fishing ground and the technological support in the form of sonars, echo sounding tools and the transfer of information about hydrological conditions in the searched area.
2. Jack mackerel concentrations during the research period demonstrated a clear tendency f moving from the East to the West.
3. Night net hauls proved to be significantly more efficient in the analysed period.
4. Fishing with a pair trawl were a bold experiment which proved that fish dispersed during the day may be efficiently caught using this method. However, such type of fishing should be performed using a significantly larger fishing tool which would use the potential of power and possibilities of both vessels (trawlers with 8 000 KM engines).
5. The Chilean jack mackerel dominated the catch and accounted for 95% of the weight of caught fish.
6. Species which can be additionally used commercially while fishing for Chilean jack mackerel include chub mackerel and *Brama japonica*. Despite considerable commercial values, other species in the discard occur too seldom to be the basis for production.
7. The catch of jack mackerel was dominated by specimens of furcal length of 35 – 36 cm.
8. The majority of analysed fish, namely, jack mackerel, chub mackerel and *Brama japonica* had gonads in resting stage.
9. Degree of stomach fullness in analysed fish points to a low intensity of feeding or low availability of feed.

Table 1 – Data concerning collected biological material

No	Species	Number of specimens of a given species subject to mass measurements	Number of specimens of a given species subject to detailed analysis
1	Chilean jack mackerel <i>Trachurus murphyi</i> (L)	4730	168
2	Chilean jack mackerel <i>Trachurus murphyi</i> (Discard)	262	80

3	Chub mackerel <i>Comber japonicus</i> (L)	1785	130
4	Chub mackerel <i>Scomber japonicus</i> (Discard)	207	47
5	<i>Brama japonica</i>	807	219
6	Skipjack <i>Katsuwonus pelamid</i>	77	0
7	<i>Thyristes atun</i>	112	0
8	Porbeagle <i>Lamna nasus</i>	1	0
9	Albacore <i>Thunnus alalunga</i>	7	0
10	<i>Tetragonurus cuvieri</i>	5	0
11	Ocean sunfish <i>Mola mola</i>	1	0
12	Blackfish <i>Centrolophus Niger</i>	2	0
13	<i>Taractes asper</i>	4	0
	TOTAL	8000	644