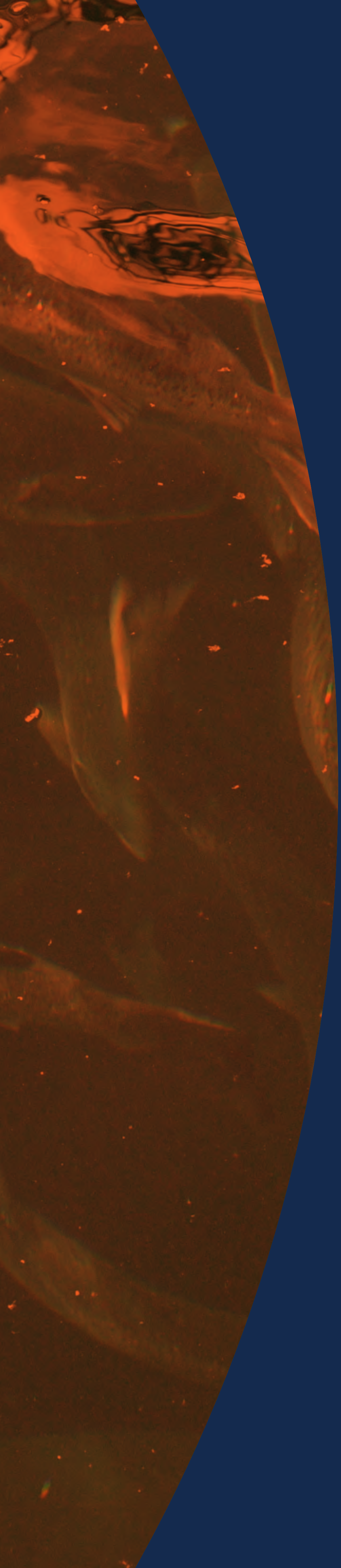

ANNUAL REPORT

CHILEAN SALMON ANTIBIOTIC REDUCTION PROGRAM

2022

EXECUTIVE SUMMARY

In 2019, the Chilean salmon farming industry and the Monterey Bay Aquarium Seafood Watch Program® launched the Chilean Salmon Antibiotic Reduction Program (CSARP), with the goal of reducing antibiotic use in that country's industry by 50% by 2025. This report provides a summary of CSARP activities, industry statistics, research, and data on antibiotic use for the 3 years from 2020 to 2022.

This report provides sector-wide transparency of the salmon farming industry, with a focus on the results and an analysis of the industry's use of antibiotics during the period. The analysis includes region-specific results and non-attributable, company-level data that provide particular insights into operational and regional decision-making. This information informs a discussion about the key factors that influenced the results.

Key Findings

- The COVID-19 global pandemic significantly disrupted demand from destination markets because of social and supply chain restrictions in 2020. But, the market recovered with historically high production volumes and prices in 2021–22. Chile remains one of the world's most important sources for farmed salmon, particularly for the export markets of the United States, Japan, and Brazil.

- Antibiotic use in the Chilean salmon farming industry increased during 2020–21 but decreased in 2022. The increase was driven by unusual environmental conditions, including more frequent harmful algal blooms and low oxygen levels that necessitated additional treatments. More favorable environmental conditions resumed in 2022, and the industry reduced antibiotic use by 7.5%.

- Since the start of CSARP, the partnership has reduced antibiotic use by 12% overall.

- This industry faces continued uncertainty from global climate change, and environmental conditions are likely to continue to be important to company-level decision-making on the use of antibiotics. But, the report also found significant variation in antibiotic reductions by region and company. These findings indicate that some companies are taking more aggressive action to reduce antibiotics than others, and certain regions and companies are more likely to use high levels of antibiotics—thus impeding progress toward reducing overall use.

- Overall, the data from 2017 to 2020 indicate that the industry is capable of significantly reducing the use of antibiotics. Achieving the goal of a 50% reduction hinges on further reductions, individual company accountability, and investments in new and innovative solutions.

Reducing the use of antibiotics is a complex challenge that requires industry action and collaboration with government, academia, and nongovernmental organizations. It is crucial to find solutions to this challenge to ensure the viability of the industry, livelihoods, and communities while safeguarding environmental health.

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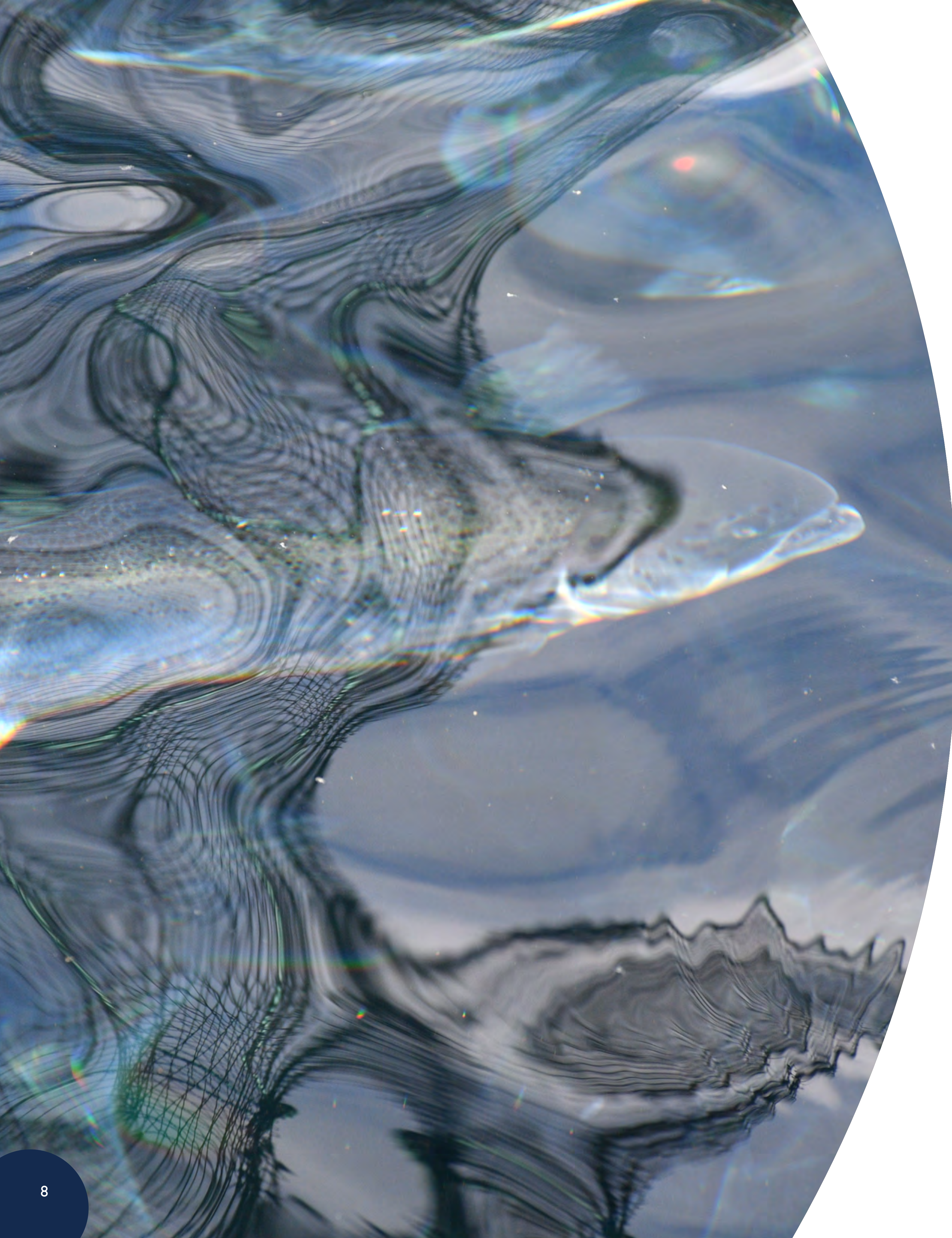
INTRODUCTION

Aquaculture is a rapidly growing sector that contributes significantly to global food security and economic growth. But, the intensive production methods used in aquaculture can spread diseases among aquatic organisms, and this can have significant economic and environmental consequences. Antibiotics are often used in aquaculture to prevent and treat these diseases, just like antibiotics are used in terrestrial livestock farming.

The Chilean salmon farming industry uses more antibiotics than any other country that farms salmon (e.g., Norway, Canada, Scotland, and the Faroe Islands territory of Denmark). The main cause for antibiotic use is the endemic bacteria *Piscirickettsia salmonis*, which causes the highest mortality during the marine phase of aquaculture and for which there are currently no effective vaccines. It is the leading cause of antibiotic therapy in Chile. The increased awareness about the risks and challenges of antibiotic use has prompted the industry and government to seek solutions.

In 2019, the Chilean salmon farming industry and the Monterey Bay Aquarium Seafood Watch launched the Chilean Salmon Antibiotic Reduction Program (CSARP), with the goal of reducing antibiotic use in that country's industry by 50% by 2025. This report summarizes CSARP activities and data on antibiotic use for the 3 years from 2020 to 2022. It provides industry statistics during that period and the trends related to farming production, species composition, and export markets. The report focuses on the analysis and results of the industry's use of antibiotics during 2020–22, and discusses the factors that influenced the results.



CHILEAN SALMON FARMING INDUSTRY 2020–22

Chilean farmed salmon production in 2022 reached 1,065,398 tons, which was greater than in 2021 (979,287 tons). Atlantic salmon remains the primary finfish resource produced, at 757,689 tons. The secondary species produced are coho salmon (241,446 tons) and rainbow trout (66,163 tons). Atlantic salmon, coho salmon, and rainbow trout have increased their harvests in 2022 compared to 2021 (Figure 1).

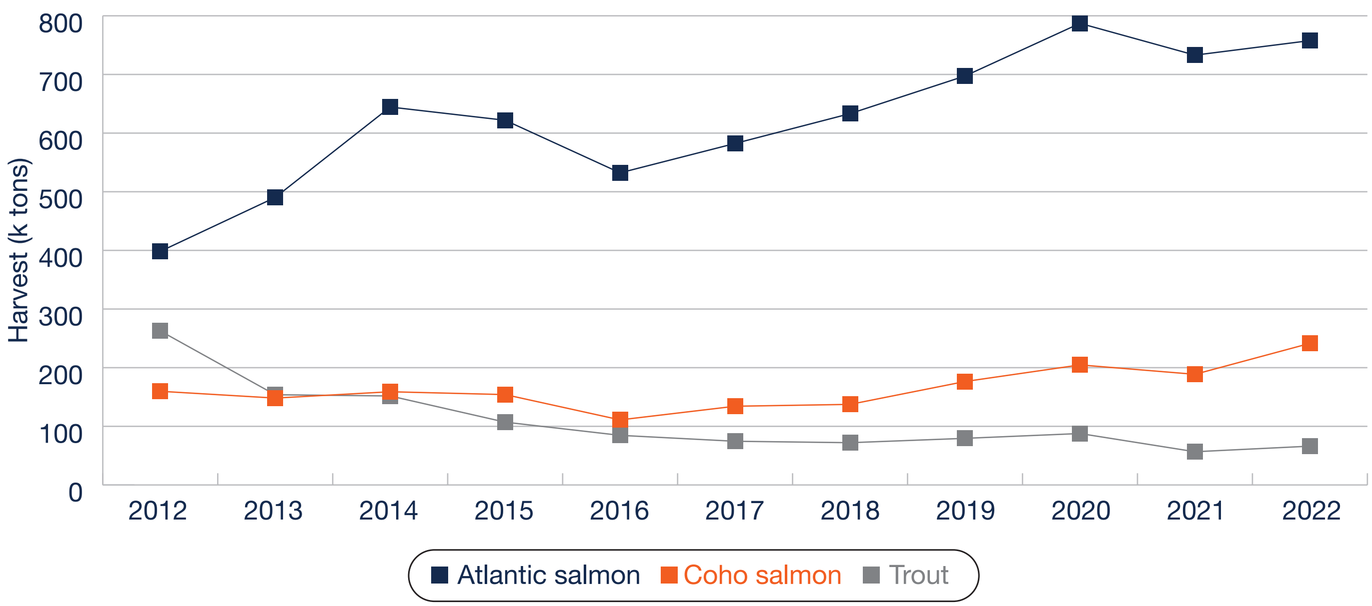


Figure 1: Atlantic salmon, coho salmon, and rainbow trout harvest evolution in Chile, 2012–22. (Source: Aduanas Chile.)

In 2022, salmon and trout were the third most important products for export from Chile, after copper and lithium. Overall, exports of salmon and trout represented 12.3% of Chile's total exports.

The value of salmon and trout exports in 2022 was USD 6.6 billion, an increase of 27.3% from 2021. The top three export markets for tons and value were the United States, Japan, and Brazil (Figure 2).

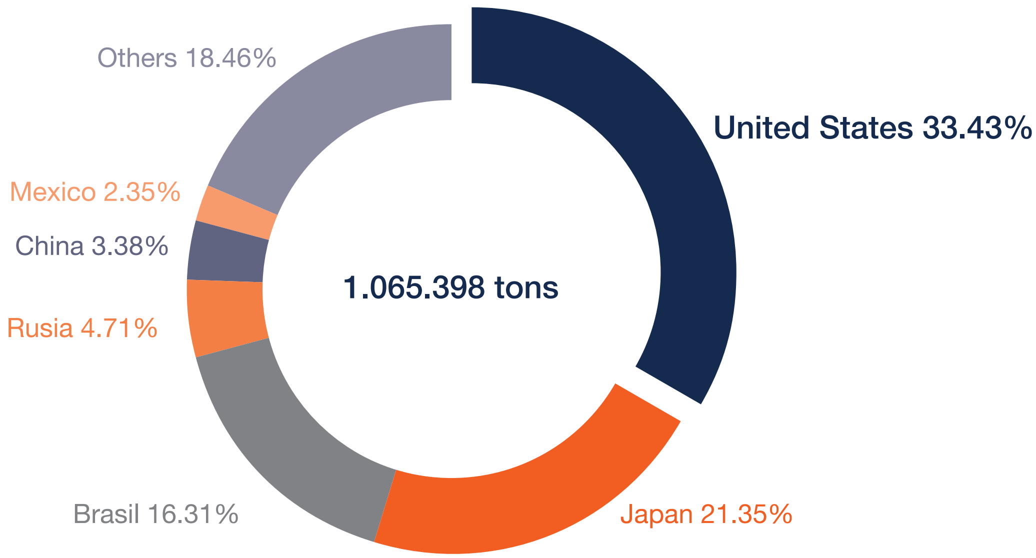


Figure 2: Export markets for Chilean farmed salmon in 2022. (Source: Aduanas Chile.))

In 2021, there was an increase in closed cycle mortality during the marine farming stage, particularly for Atlantic salmon (Figure 3). This was triggered by environmental events, primarily more frequent and widespread microalgae blooms that affected the Los Lagos and Aysén regions.

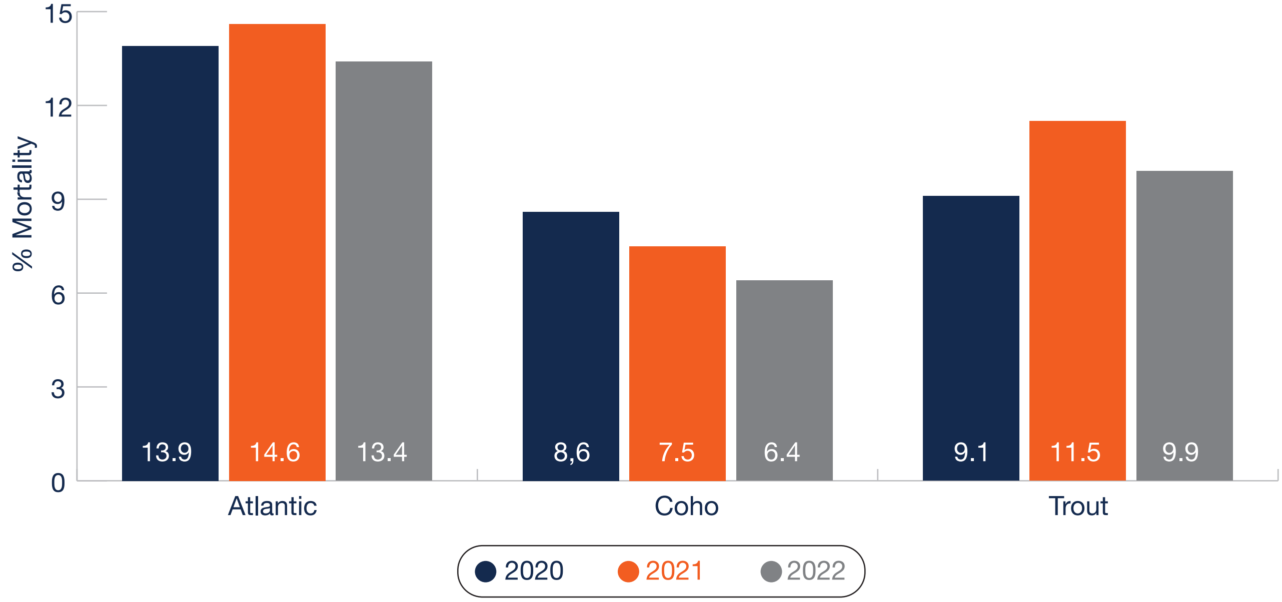


Figure 3: Mortality rates at closed cycle for Atlantic salmon, coho salmon, and rainbow trout for 2020–22. (Source: SalmonChile; Aquabench)

In 2022, when environmental conditions were more favorable for salmon culture, mortality rates were lower than in 2021. The leading causes of mortality were mechanical damage (e.g., blows, injuries, entangled fish) and the infectious disease caused by *Piscirickettsia salmonis* called "SRS." (Figure 4).

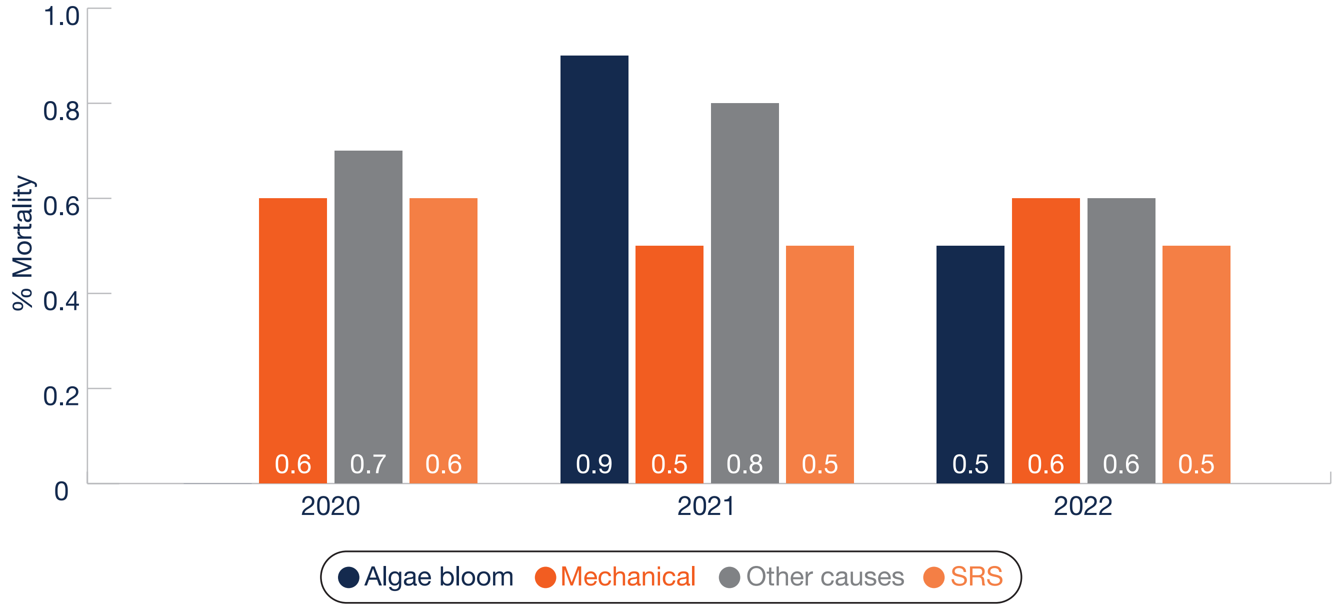
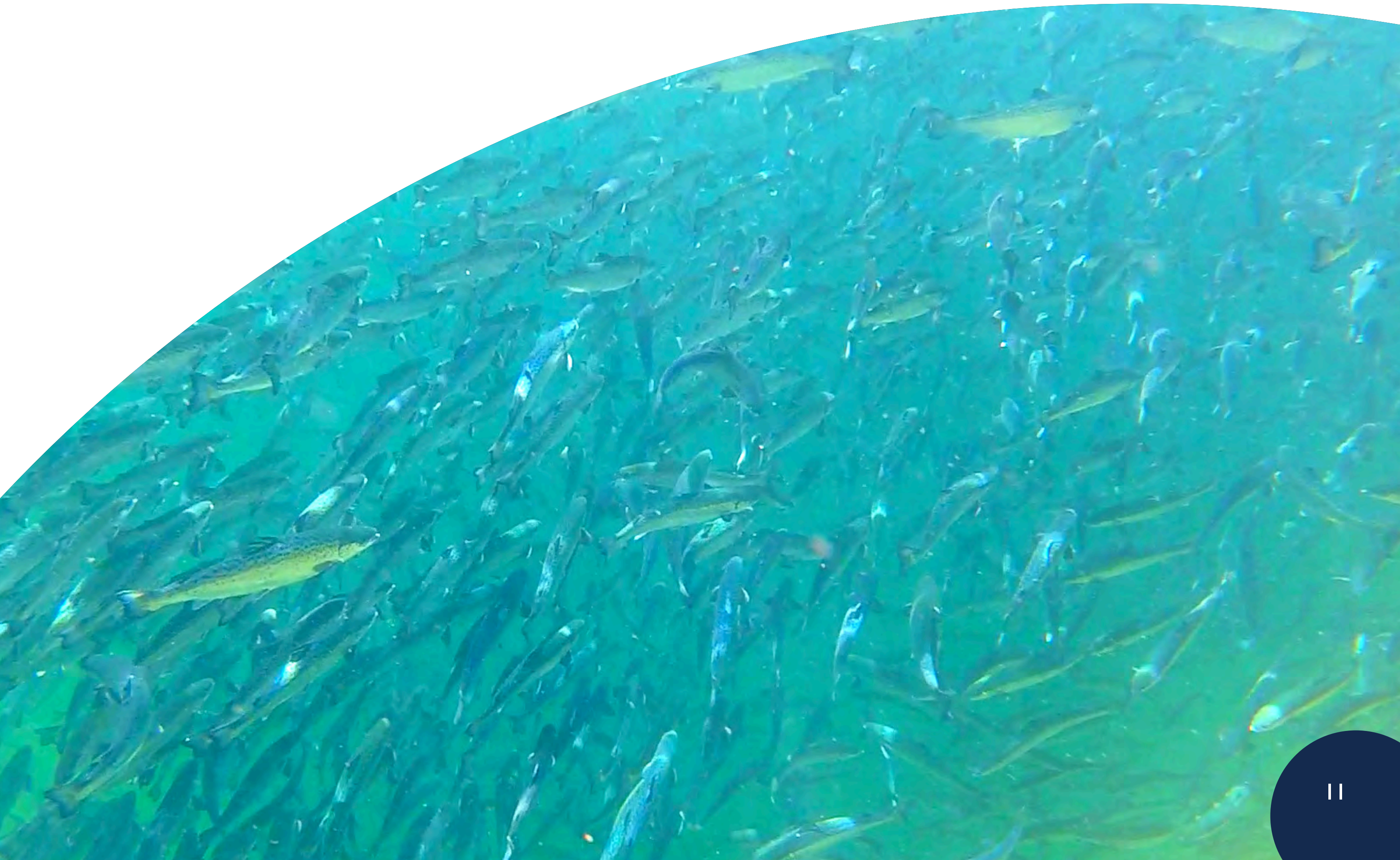


Figure 4: Mortality rates at closed cycle for leading causes, 2020–22. (Source: SalmonChile).



Antibiotic Use in the Chilean Salmon Farming Industry 2020–22

Company and Production Data

The data included in this report represent 17 salmon farming companies in Chile. The biomass produced by the project partners is equivalent to more than 90% of national production, with more than 95% of Atlantic salmon and coho salmon and 50% of rainbow trout.

The companies participating in the data analysis during 2020–22 are Cermaq, Cooke, Yadrán, AquaChile, Marine Farm, Multi X, Salmones Austral, Salmones Blumar, Salmones Camanchaca, Ventisqueros, Caleta Bay,[1] Australis, Mowi, Novaustral, Salmones Aysén, Salmones de Chile, and Invermar.[2]

The data set analyzed by CSARP from 2017 until June 2022 represented more than 5 million tons of harvested salmon, 1,330 close production cycles, and 22,200 cages. The biomass analyzed in 2020–22 comprised approximately 75% Atlantic salmon, 20% coho salmon, and 5% rainbow trout (Figure 5). The evolution of the harvested biomass (tons) analyzed at the country level for 2020–22 is presented in Figure 6.

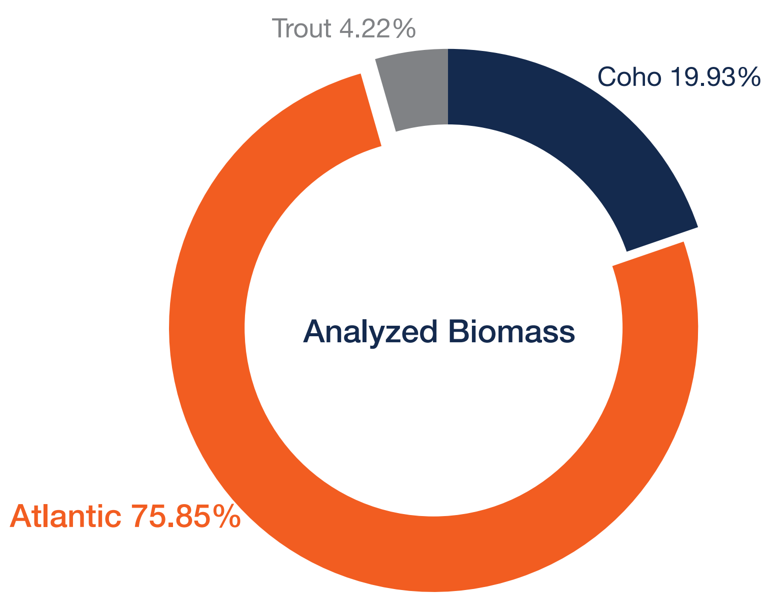


Figure 5: Species distribution of analyzed biomass during 2020–22.

1 Only partial data in 2022.
2 Data in 2021 only.

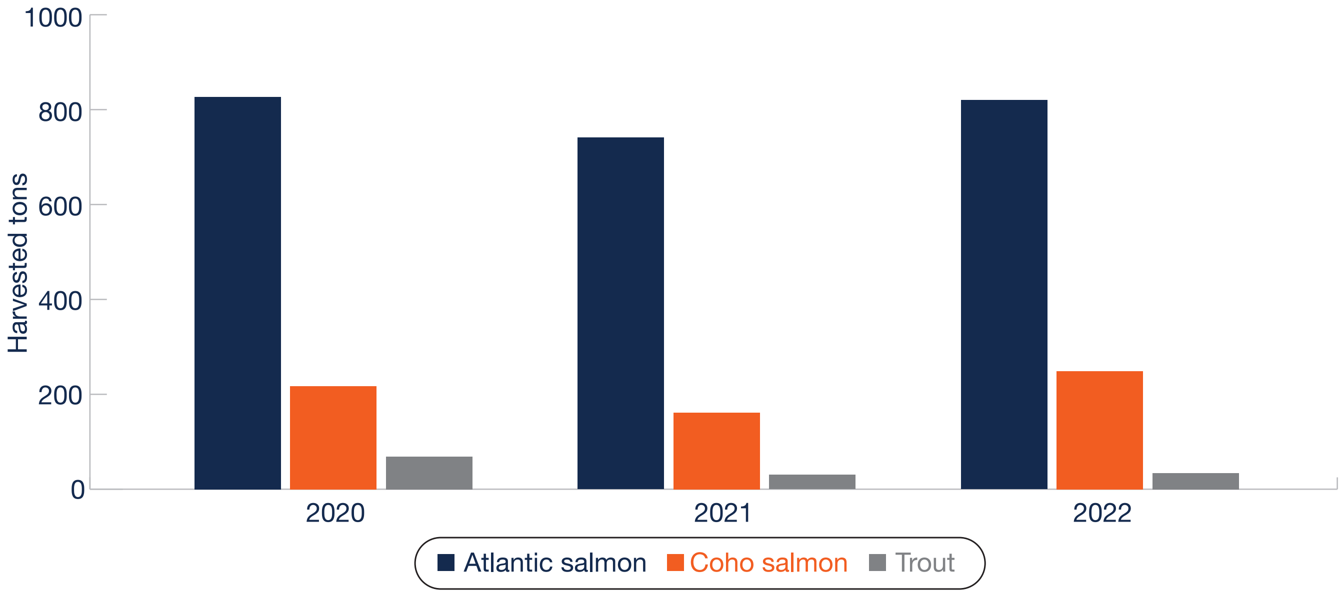


Figure 6: Annual biomass by species during 2020–22. (Source: CSARP)

Antibiotic Use Data Collection and Methods

Companies submitted data on antibiotic usage in 2020 and 2022. The data included antibiotic usage from the closed cycle[3] at the site level. Data submissions were curated to ensure accuracy. Data were coded to safeguard confidentiality and to comply with antitrust regulations. Data were validated by comparing different public and private sources of antibiotics consumption information (e.g., Sernapesca, global salmon initiative report, sustainability reports of companies).

Metrics

Different metrics were used in this report, mainly to explain the consumption of antibiotics at different levels, from the country level to the neighborhood level. The most important indicator is the antibiotic consumption index (Spanish acronym: ICA), which is a standard of the amount of active antibiotic ingredient used to harvest 1 ton of live-weight salmon. ICA has been determined at the country, region, neighborhood, company, and species levels. Another relevant indicator is the frequency of use at the cage level, which indicates the number of times a cage has been treated in a culture cycle. This indicator has been used at the country, region, and species levels. Antibiotic Impact indicators have been incorporated in this report.

The baseline used is salmon harvested in 2017. Additional metrics, such as treatment frequency, were recorded and considered to track progress and to measure impact. The baseline ICA was established at 412.8 grams/harvested ton, with a 50% reduction by 2025 defined as 206 grams/harvested ton.

The distribution of the frequency of the ICA at the level of cycles and region was used to categorize the antibiotic consumption levels (very high, high, medium, low, and no antibiotics). The 75th and 50th percentiles were obtained for these data, and the consumption distribution for the Los Lagos and Aysén region was used as a model. The categorization is summarized in Table 1 (The main antibiotic consumption indicators are explained in Appendix 1).

3 In general, a cycle is considered closed when the last fish has been harvested from the farm. In this case, all the harvested fish, regardless of the month or year of the harvest, will correspond to the year of the last fish harvested at the farm

Table 1: Categorization of antibiotic consumption for ICA levels.

Category	ICA
Very High	More than 600 g/ton
High	400 to 600 g/ton
Medium	180 to 400 g/ton
Low	Less than 180 g/ton
No antibiotics	0

Results

In 2020, CSARP published its first report on progress toward the 50% antibiotic reduction goal, and that report indicated a significant decline in antibiotic use from 2017 to 2019. The data provided for 2020 to 2022 in this report show a large increase in the consumption of antibiotics during 2020 and 2021, and a slight decrease during 2022. With respect to 2017 as the program's reference point, the decrease to the year 2022 is 12% (Figure 7).

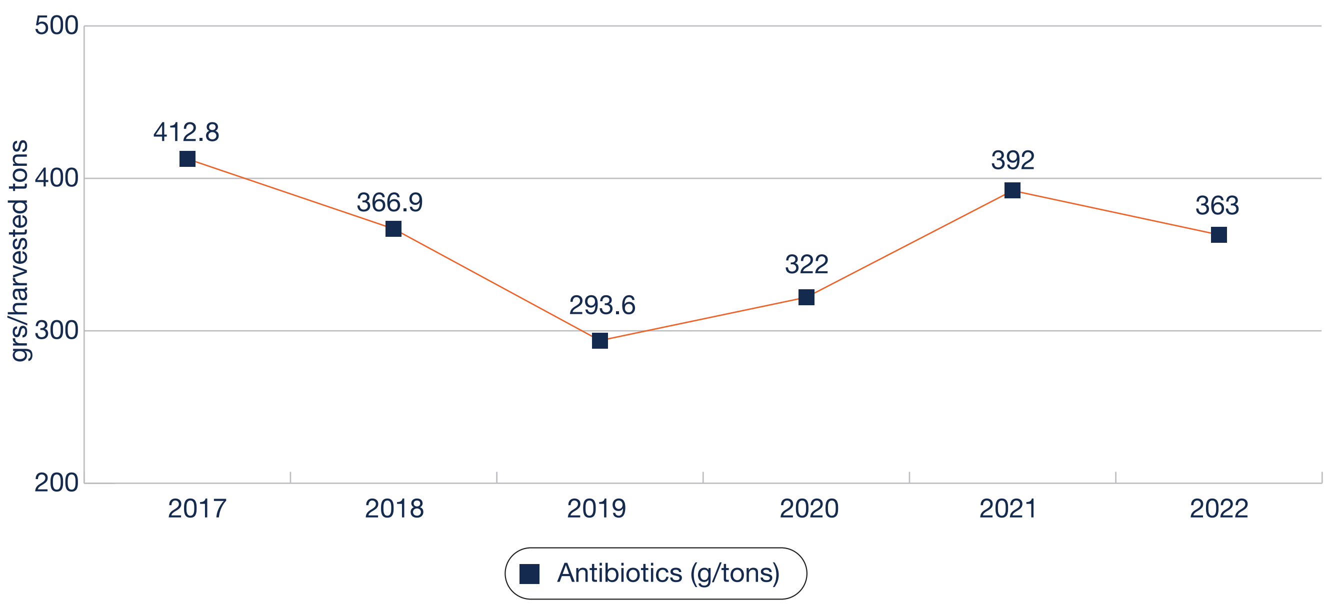


Figure 7: Antibiotic consumption expressed in grams per harvested ton at the industry level during 2017 to 2022. (Source: CSARP)

A similar trend is observed when analyzing the frequency of cage treatments between 2020 and 2021, showing an increase to a maximum of 2.44 treatments per cage (Figure 8).

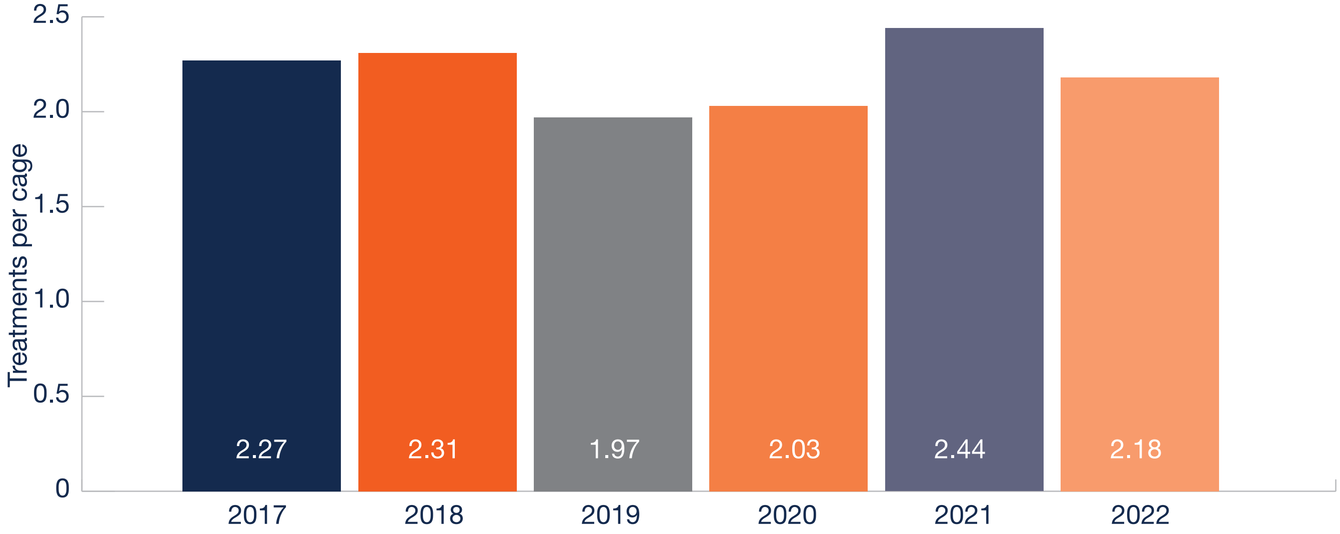


Figure 8: Frequency of treatment of cages at the industry level for 2017 to 2022.(Source: CSARP)

In 2022, 22.6% of the reported sites declared no use of antibiotics during the entire cycle. This value is the highest observed during the three years of analysis. In contrast, 2021 had a lower proportion of antibiotic-free sites, with only 18.5% of reported cycles (Figure 9). Most antibiotic-free sites correspond to coho salmon farms in the Los Lagos region and Atlantic salmon farms in the Magallanes region.

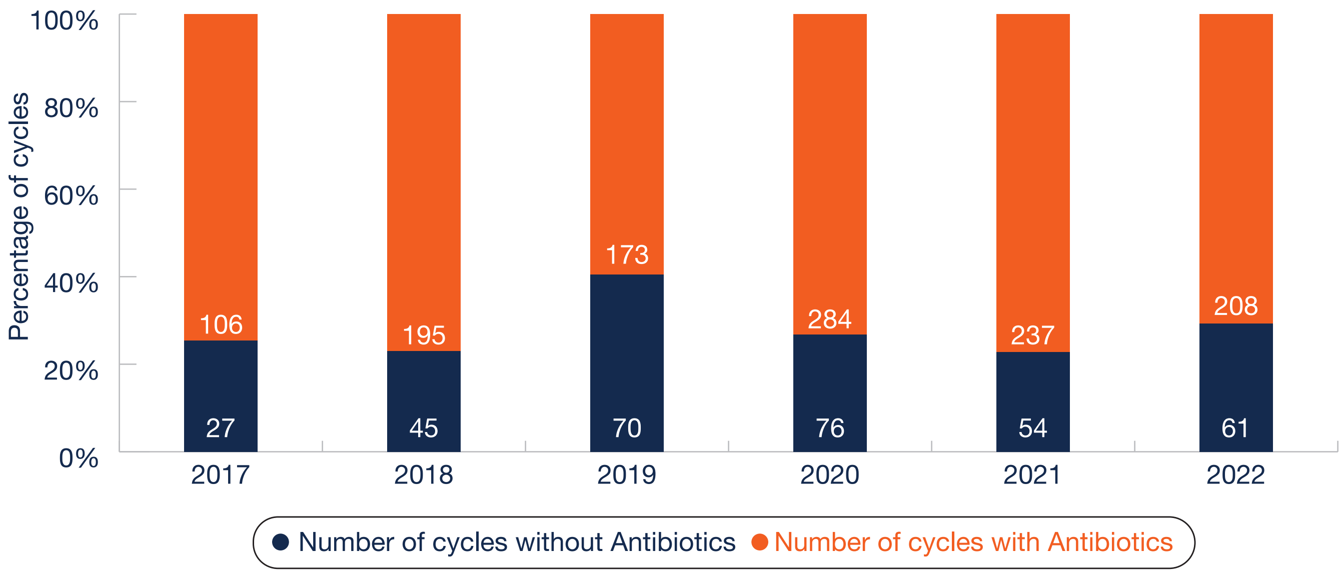


Figure 9: Proportion of cycles with and without antibiotics at the industry level for 2017 to 2022.

The evolution of antibiotics consumption at the species level is summarized in Figure 10. Atlantic salmon continues to be the species with the highest consumption of antibiotics in Chile, with 458 g/harvested ton reported for 2022, which is slightly lower than the value observed in 2021 (Figure 10A). For coho salmon, in 2022, an antibiotics consumption of 97 g/harvested ton was observed; this is 2.5 times higher than in 2019 (Figure 10C). Although rainbow trout represents only 5% of the national production, it shows a continuous decrease through 2021, but 2022 registered an increase in consumption to 52 g/harvested ton (Figure 10B).

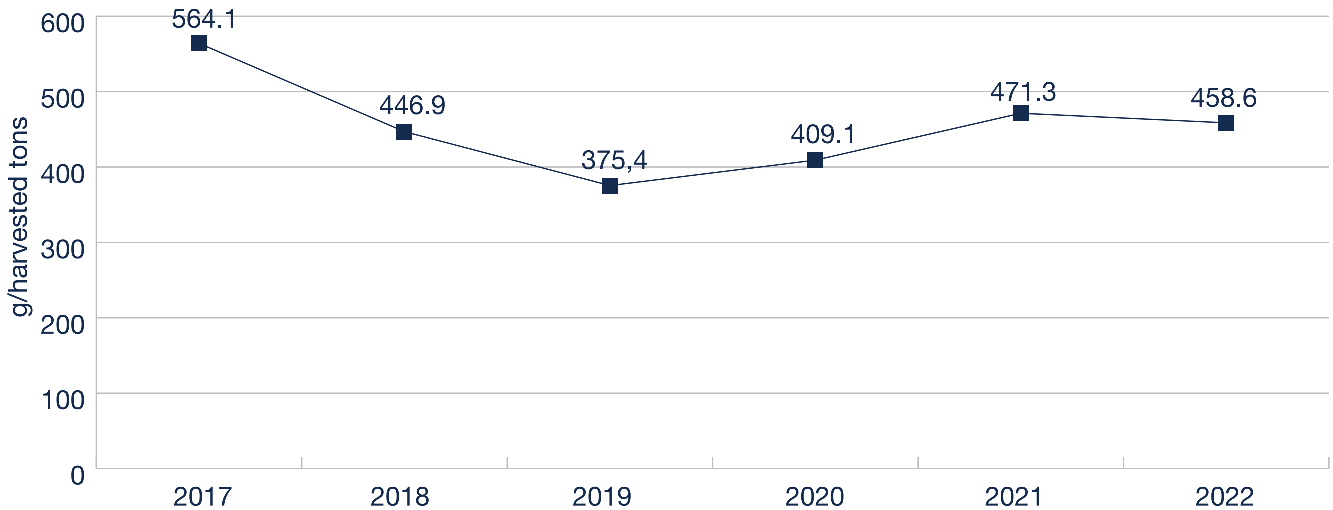


Figure 10 (A) Atlantic salmon

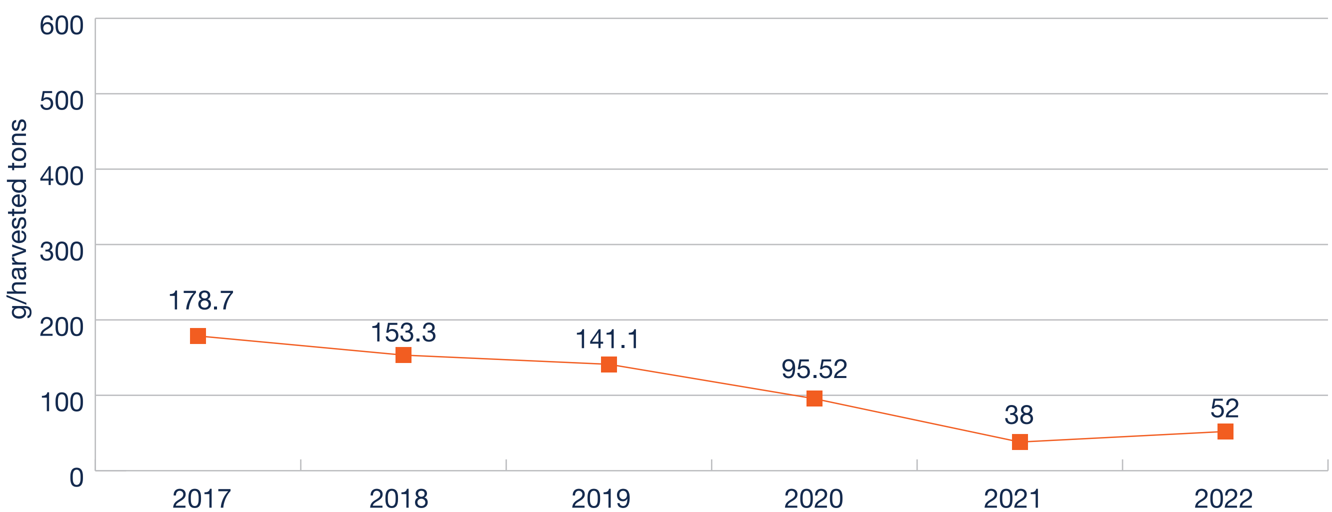


Figure 10 (B) Rainbow trout

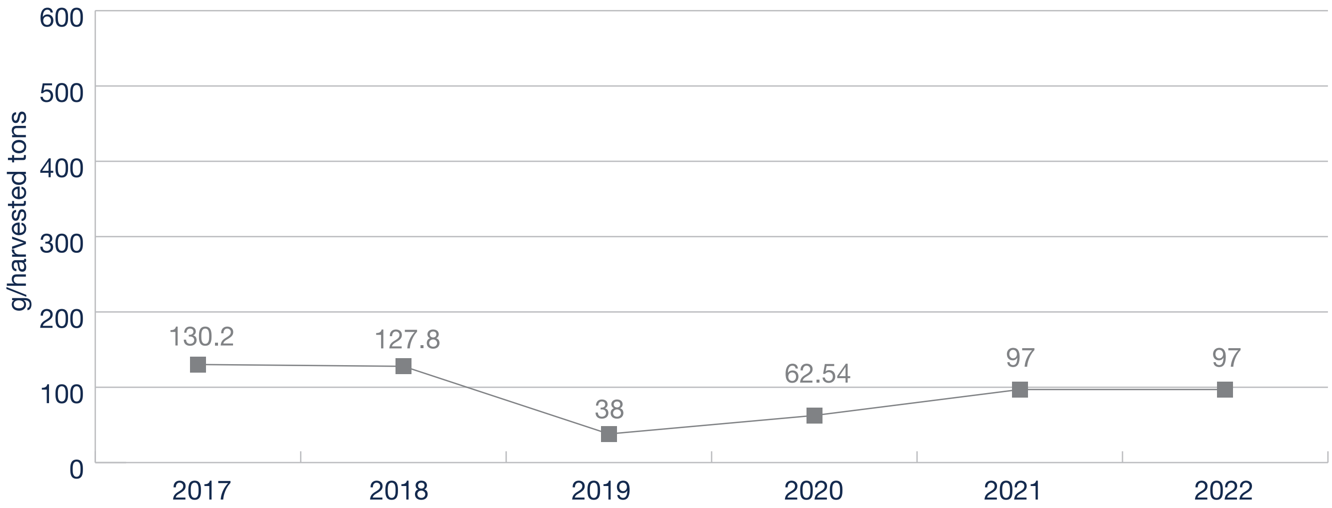


Figure 10 (C) Coho salmon

Figure 10: Antibiotic consumption for 2017 to 2022 expressed in g/harvested ton of A) Atlantic salmon, B) Rainbow trout , and C) Coho salmon.

Figure 11 displays antibiotics consumption levels for three regions. The Aysén region (Region X) registers the highest consumption of antibiotics reported for the cycles corresponding to 2022, reaching 483 g/harvested ton, which is the highest reported during the last five years of analysis. The Los Lagos region (Region XI), at 396 g/harvested ton in 2022, is the region with the highest consumption of antibiotics in the seawater stage. Meanwhile, the Magallanes region (Region XII) registers a significant decrease in antibiotics consumption, reaching 27 g/harvested ton during 2022, which is the lowest recorded value in that region from 2017 to 2022.

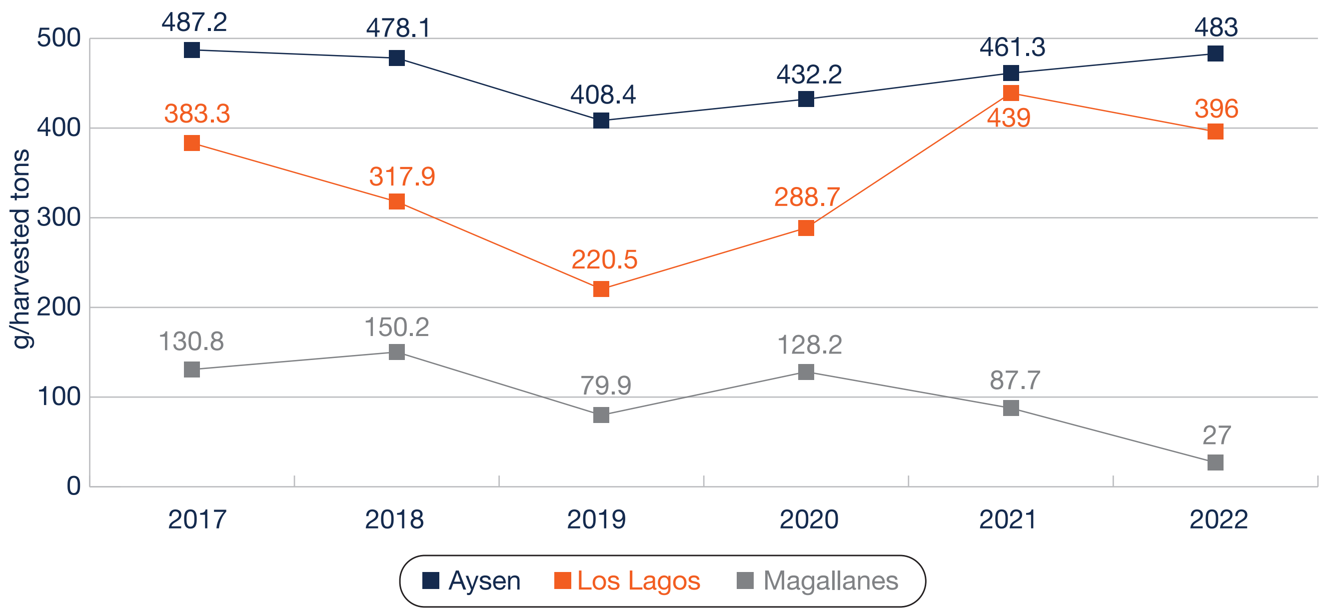


Figure 11: Antibiotic consumption expressed in g/harvested ton for three regions during 2017 to 2022.

Figure 12 shows the frequency of cage treatments for these three regions for 2020–22. An increase has been observed in Los Lagos region during 2022. But, the Aysén region, with a frequency of almost three cages treated per cycle, reaches the highest value (3.05) within the three regions. For the Magallanes region, 2022 registers a frequency of 0.21, which is the lowest recorded during the analysis period for all the studied regions.

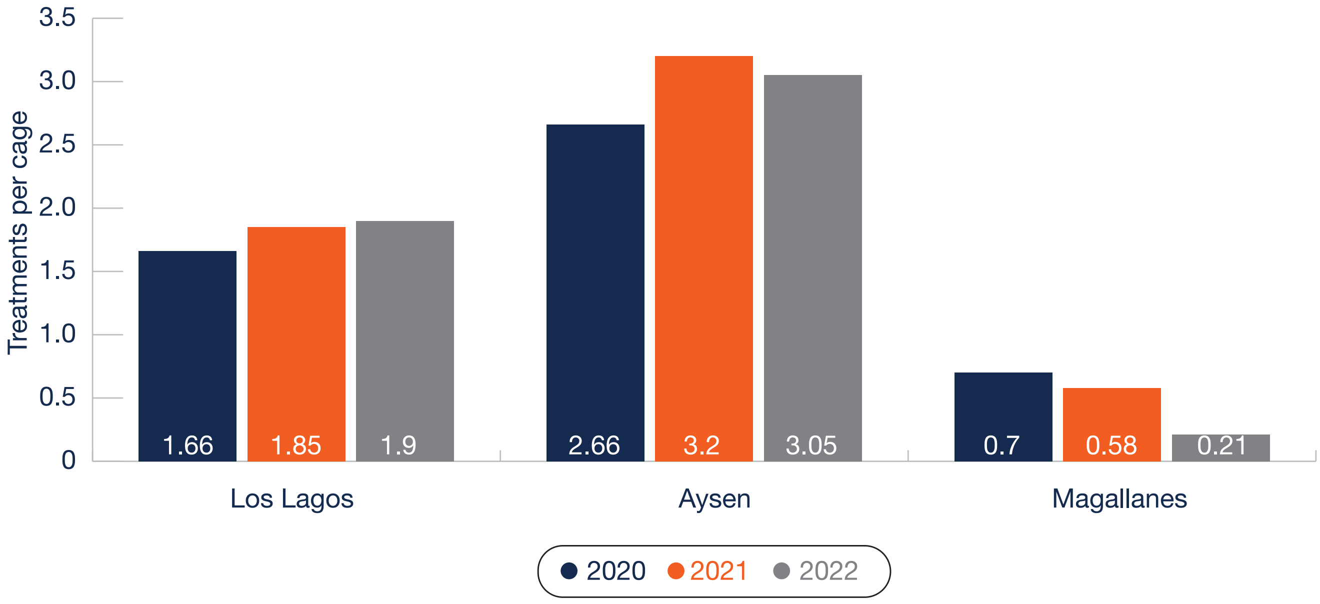


Figure 12. Frequency of antibiotic treatment of cages at the regional level for three regions during 2020–22.

At the neighborhood level[4], the areas with the highest consumption are located in the Aysén region. The neighborhoods with the lowest consumption are located in the Magallanes region, including the only neighborhood where all its cycles have been developed without antibiotics.

In the Los Lagos region, the neighborhoods with the highest consumption are in central Chiloé and the Comau and Reñihue Fiords. The neighborhoods with minor consumption correspond to Neighborhood 3A in the Calbuco area and Neighborhood 12B in Chiloé. For those neighborhoods that were open as of December 2022 (i.e., without completing their productive period and before the coordinated mandatory fallowing periods), consumption is below that of closed neighborhoods during 2020–22.

In the Aysén region, the neighborhoods with the highest consumption are sited in the northern part of the region, in the northern Guitecas zone and the continental zone corresponding to the Yacaf and Melimoyu areas. The neighborhoods with the lowest consumption are located in the 26th and 29th Neighborhoods, with consumptions considered low. The neighborhoods open to December 2022 are at levels under 500 ICA.

4 The neighborhood or group of salmonid concessions (ACS) is called the set of geographically related aquaculture concessions for salmon farming that share a productive period in common, coordinated fallowing periods of 3 months.

The Magallanes region has the lowest antibiotic consumption, standing out for having the only neighborhoods free of antibiotic consumption. Most neighborhoods are in the low consumption category, except 49A, 49B, and 45. The neighborhoods open as of December 2022 are in the low consumption category of antibiotics.

The consumption results at the neighborhood level can be consulted in Figures 13–18 at a closed season and open season, and in each figure's accompanying table. The figures represent the consumption of the neighborhood according to consumption category (very high, high, medium, low, and no antibiotics) for those neighborhoods whose production periods were finished between 2020 and 2022 (Figures 13–15). The active neighborhoods, which have not yet closed their productive period or have their fallowing coordinating periods (open season) are represented in Figures 16–18.

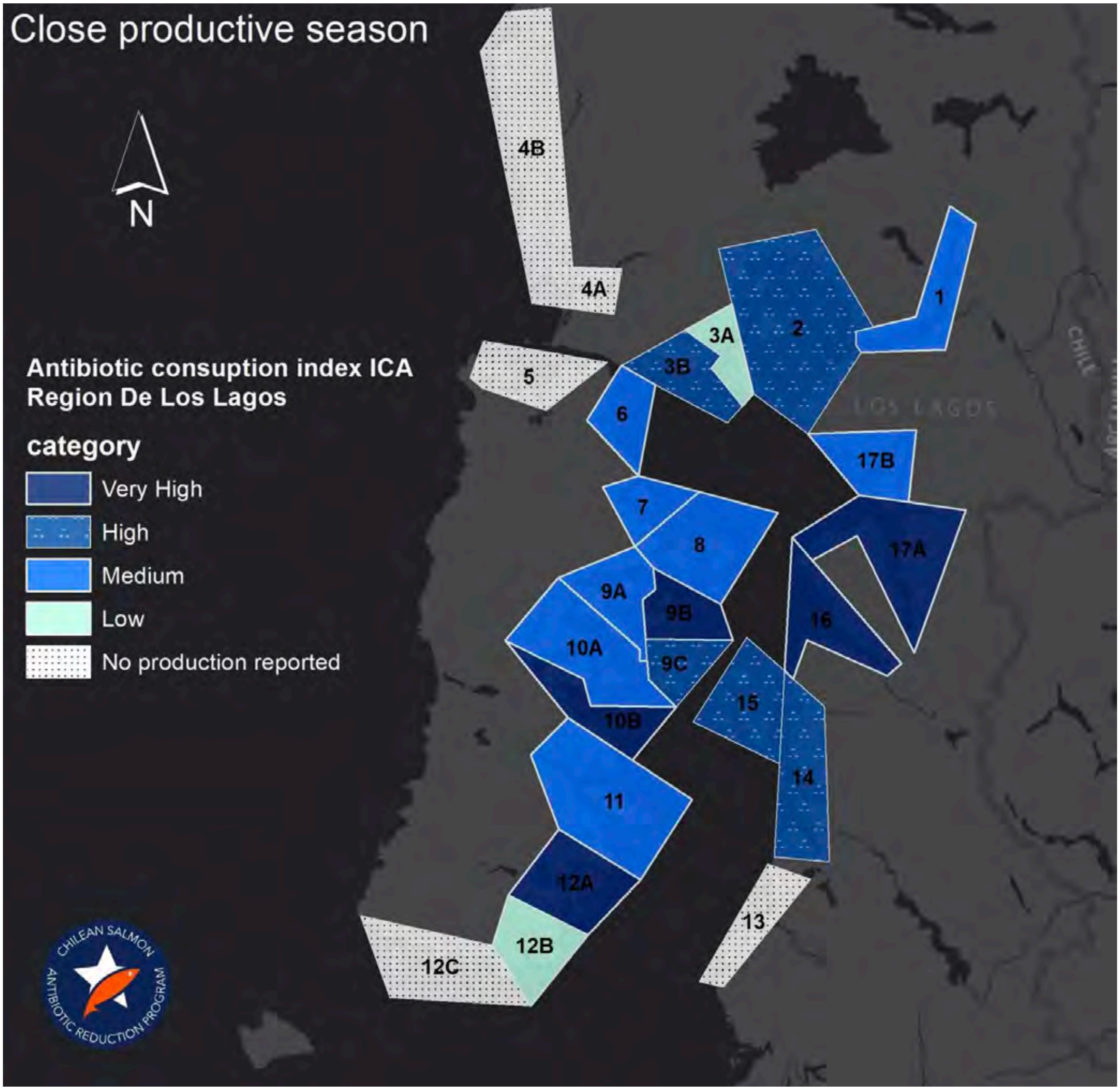


Figure 13: Antibiotic consumption at the neighborhood level in the Los Lagos region, closed period 2020–22.

Los Lagos region		
Neighborhood	ICA	Cycles
1	223,4	27
2	490,5	34
3A	22,0	15
3B	400,2	8
6	204,0	2
7	358,5	10
8	378,6	11
9A	340,8	12
9B	748,6	5
9C	453,0	5
10A	362,9	15
10B	798,8	9

Los Lagos region		
Neighborhood	ICA	Cycles
11	319,4	20
12A	626,3	6
12B	139,3	1
14	503,4	5
15	402,1	1
16	665,5	7
17A	696,6	14
17B	315,9	21

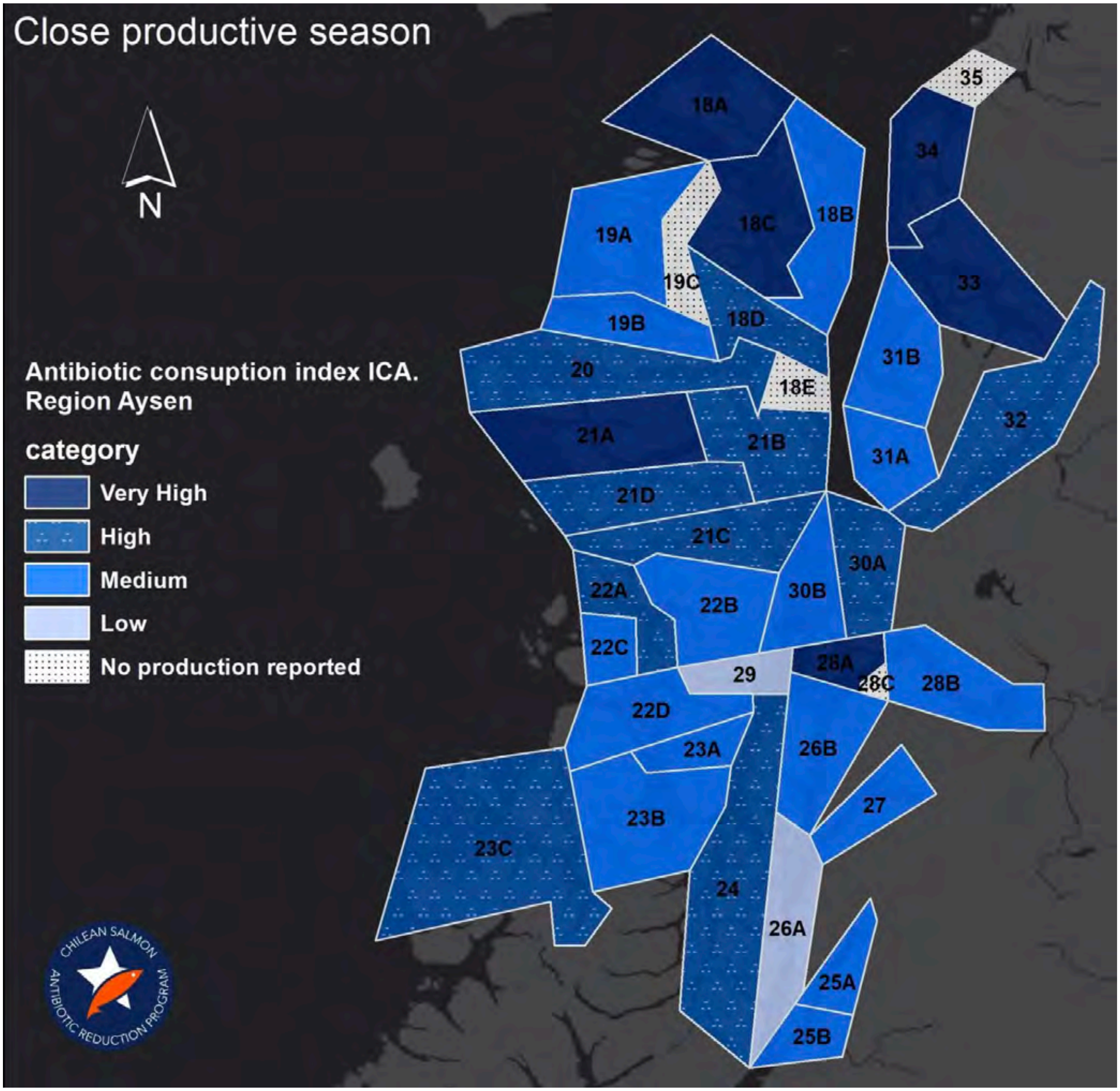


Figure 14: Antibiotic consumption at the neighborhood level in the Aysén region, closed period 2020–22.

Aysén region		
Neighborhood	**ICA**	**Cycles**
18A	889,9	4
18B	324,6	3
18C	663,0	12
18D	503,6	8
19A	295,0	8
19B	336,6	5
20	424,4	7
21A	634,8	8
21B	577,3	12
21C	489,7	14
21D	519,9	4
22A	488,5	3

Aysén region		
Neighborhood	**ICA**	**Cycles**
22B	209,6	3
22C	395,9	2
22D	228,6	9
23A	290,5	3
23B	390,0	3
23C	553,7	5
24	415,9	6
25A	291,7	8
25B	329,5	9
26A	53,0	4
26B	285,3	5
27	367,6	3

Aysén region		
Neighborhood	**ICA**	**Cycles**
28A	606,5	7
28B	346,1	9
29	134,9	2
30A	429,9	10
30B	198,8	4
31A	287,7	2
31B	317,9	8
32	497,3	20
33	603,1	9
34	1044,9	10

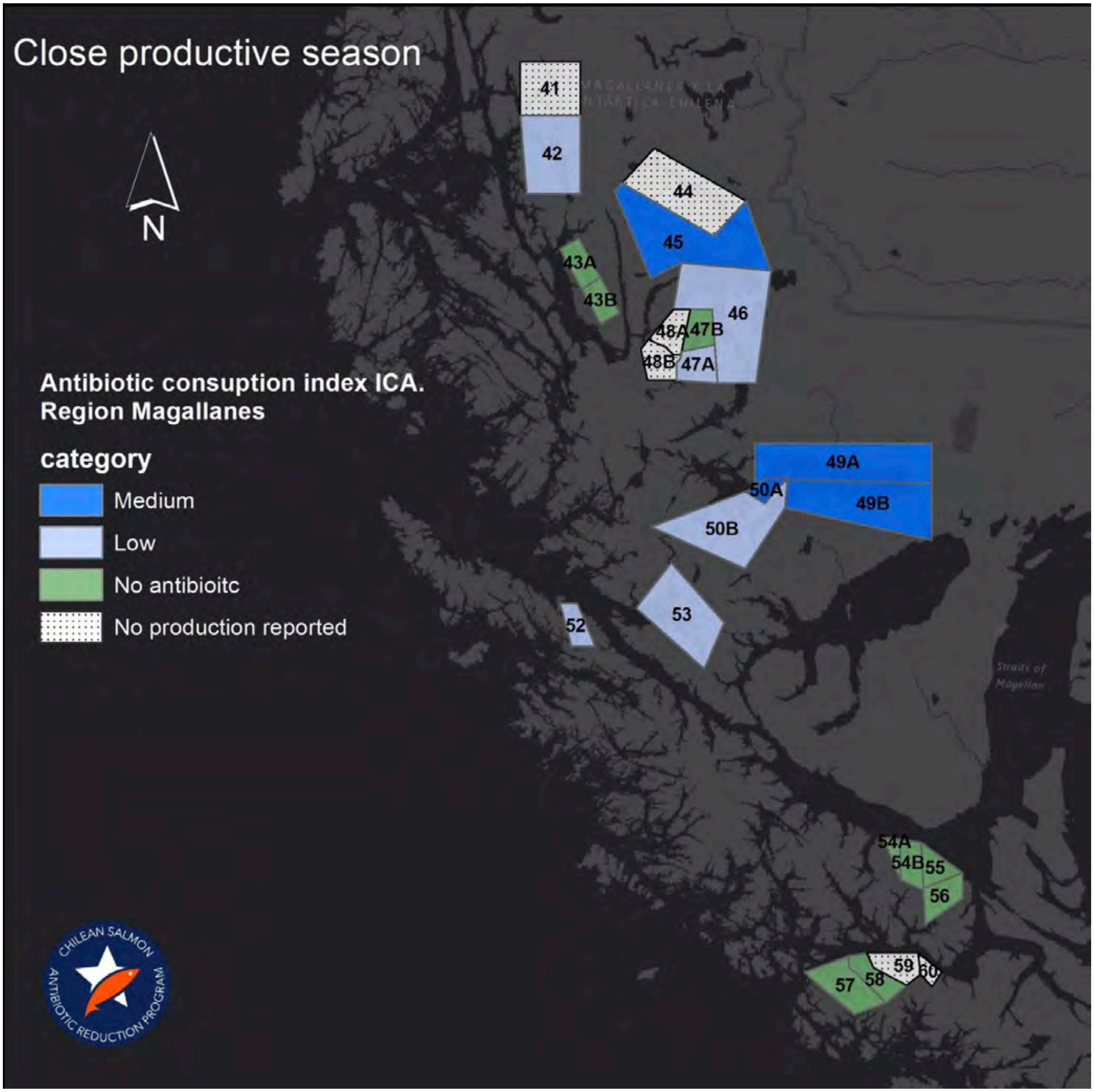


Figure 15: Antibiotic consumption at the neighborhood level in the Magallanes region, closed period 2020–22.

Magallanes region		
Neighborhood	**ICA**	**Cycles**
42	123,1	3
43A	0,0	3
43B	0,0	2
45	290,0	2
46	32,3	3
47A	170,0	3
47B	0,0	1
49A	209,9	6
49B	196,8	3
50A	304,9	4

Magallanes region		
Neighborhood	**ICA**	**Cycles**
50B	130,5	8
52	68,1	4
53	135,5	2
54A	0,0	1
54B	0,0	1
55	0,0	1
56	0,0	9
57	0,0	1
58	0,0	1

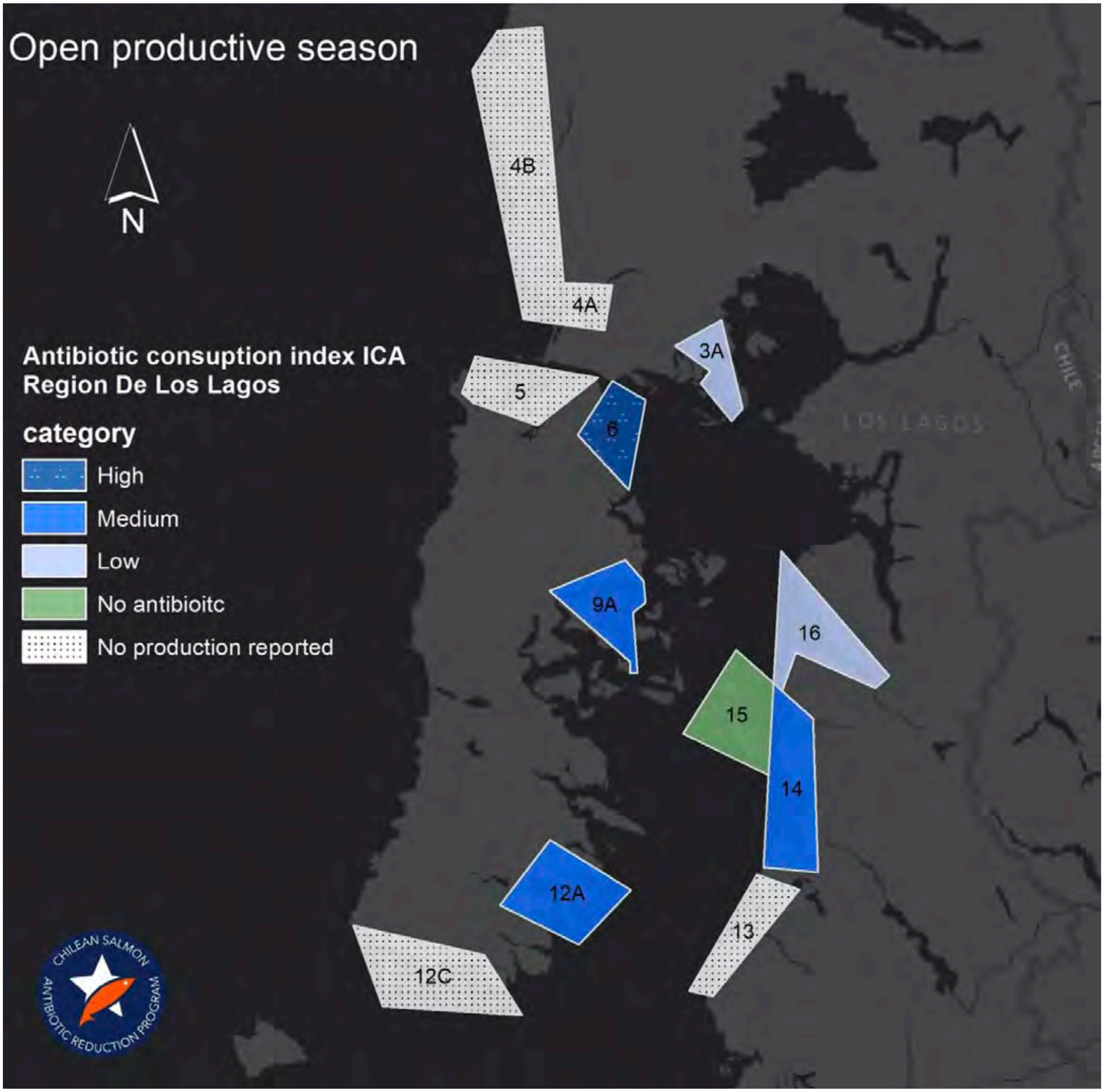


Figure 16: Antibiotic consumption at the neighborhood level in the Los Lagos region, open periods in 2022.

Los Lagos region		
Neighborhood	**ICA**	**Cycles**
3A	16,7	6
6	522,0	1
9A	242,2	11
12A	334,0	4
14	223,8	2
15	0,0	1
16	72,8	3

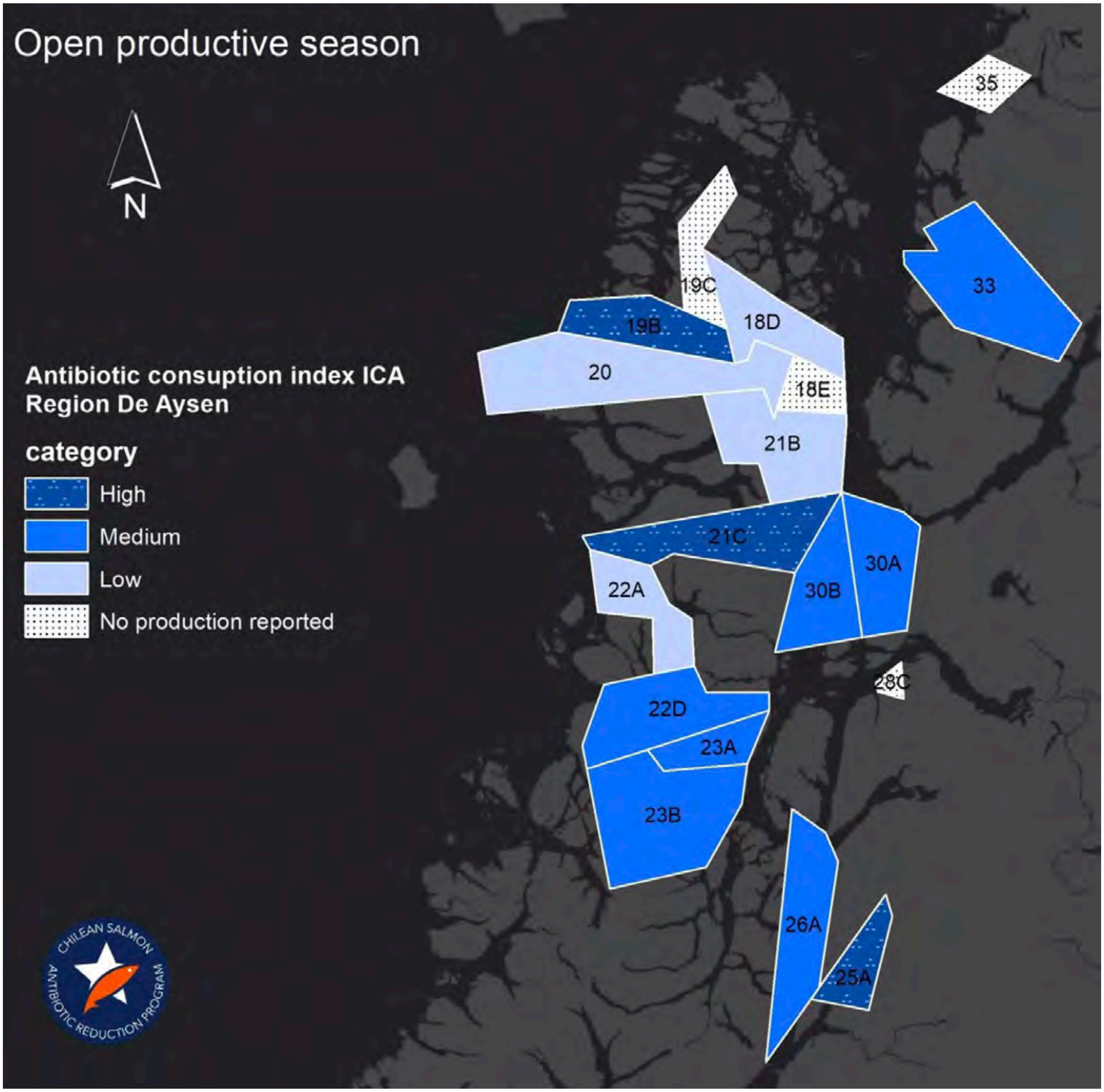


Figure 17. Antibiotic consumption at the neighborhood level in the Aysén region, open periods in 2022.

Aysén region		
Neighborhood	ICA	
Cycles 18D	12,4	2
19B	479,2	2
20	91,6	2
21B	68,0	3
21C	414,0	11
22A	111,5	1
22D	216,5	4
23A	304,4	1
23B	320,0	2
25A	559,8	2

Aysén region		
Neighborhood	ICA	Cycles
26A	194,9	3
30A	279,2	6
30B	258,9	1
33	190,9	2

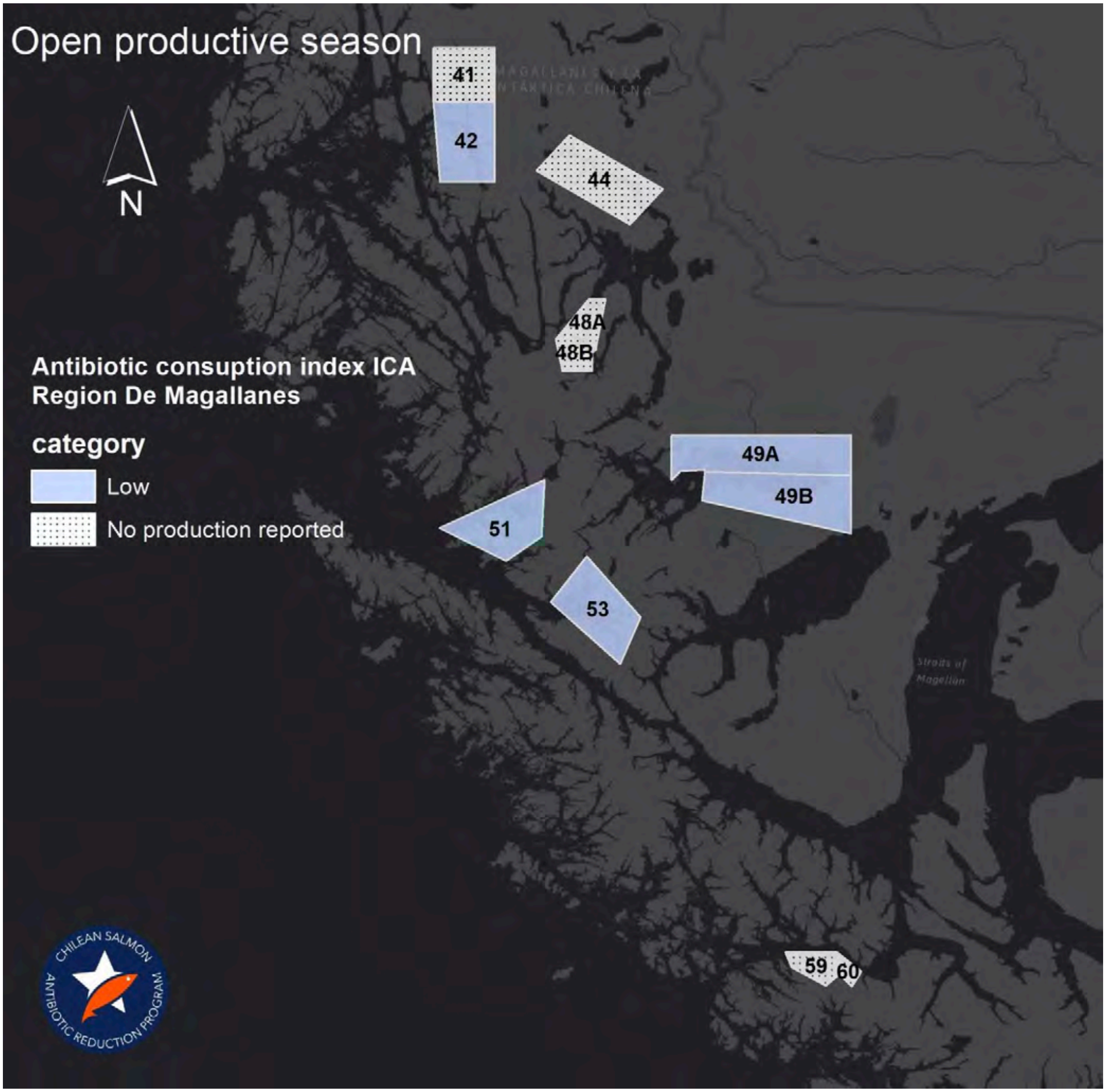


Figure 18: Antibiotic consumption at the neighborhood level in the Magallanes region, open periods in 2022.

Magallanes region		
Neighborhood	**ICA**	**Cycles**
42	11,4	2
49A	2,7	2
49B	1,0	5
51	41,3	3
53	28,8	8

This report has incorporated some indicators that can reflect the intensity of antibiotic use at the industry and crop-cycle levels. The day of treatment indicator represents the number of days that a cycle has had at least one cage received antibiotic treatment. For 2021, an average of 59 days of treatment was reported at the production-cycle level; for 2022, this indicator dropped to 57 days (Figure 19). The maximum number of days in treatment reported by a farm was 319.

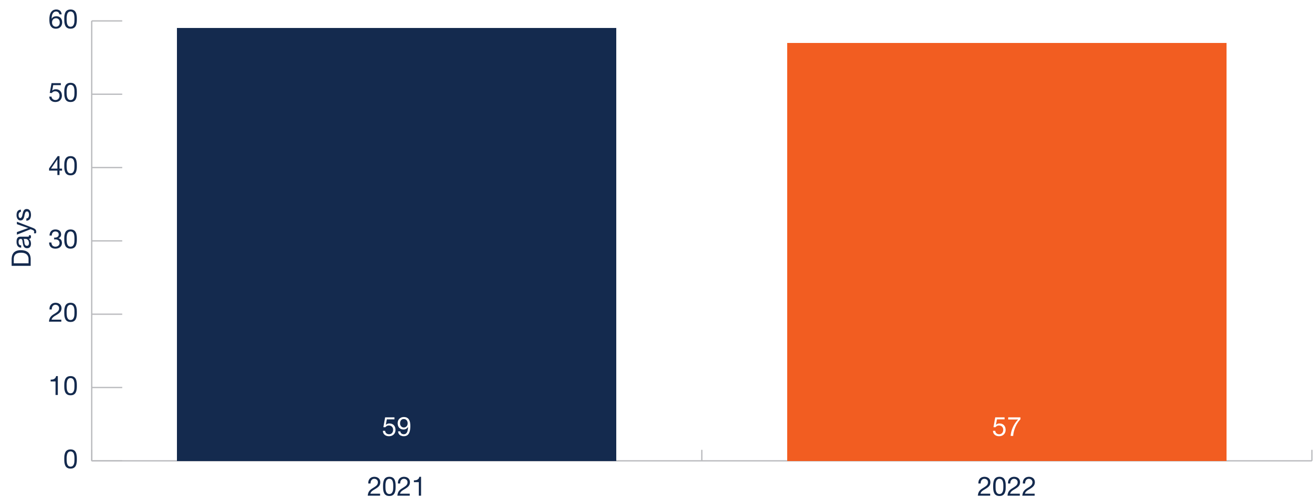


Figure 19: Average number of days of treatment at site level per cycle, industry level, for 2021 and 2022.

According to the data collected, considering the total tons of antibiotics used annually, divided by 365 days, more than one ton of active ingredient of antibiotics was consumed daily in the industry during 2021 and 2022[5] (Figure 20).

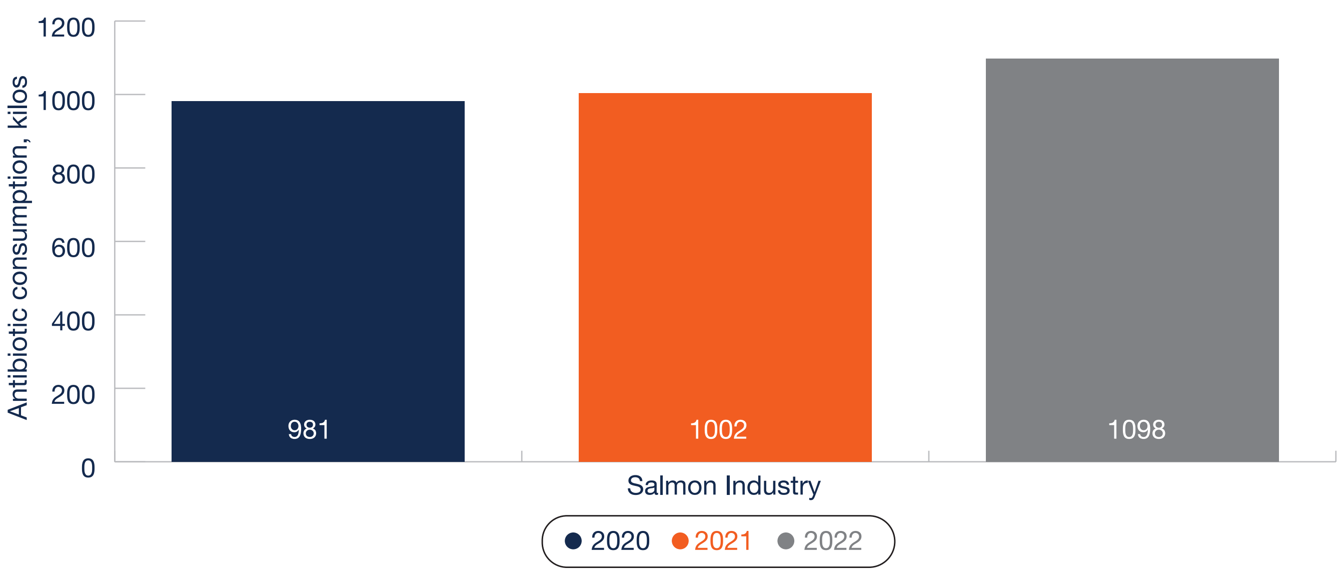


Figure 20: Net antibiotic consumption in active compound per day at the industry level for 2020–22.

5 The data on days of treatment was incorporated into the database during the years 2021 and 2022, with no data for the year 2020.

The standardization of the net consumption of antibiotics considering the number of cycles (that is, the annual consumption of antibiotics in kilos, prorated by the number of cycles reported for that year and divided by 365) corresponds to a minimum of 3.4 kilos of antibiotics of daily consumption per site and a maximum of 4.3 kilos of the active ingredient in 2021 (Figure 21). The farm with the highest consumption recorded more than 10,000 kilos of active ingredient antibiotics in its growing cycle. But, it should be emphasized that almost 20% of crop cycles were reported to have no consumption of antibiotics.

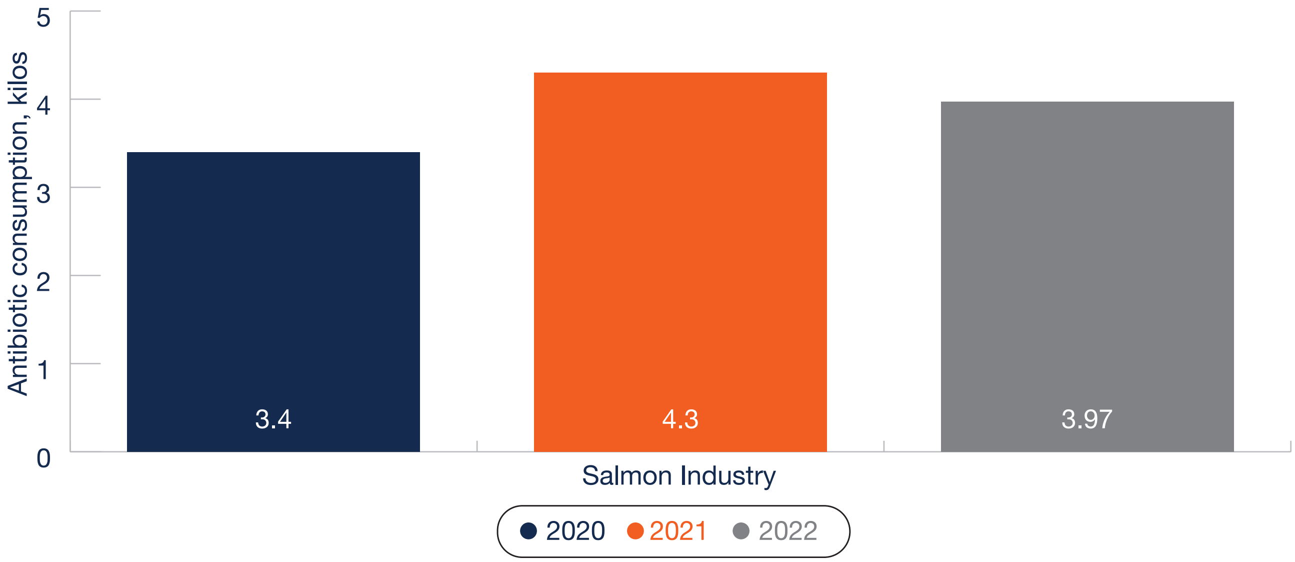


Figure 21: Standard net antibiotic consumption (active compound) per day at the industry level for 2020–22.

Of the 796 cycles analyzed for the period 2020–22, 45 cycles exceed an ICA of 1.000, while the site with the highest consumption registers an ICA of 2.828, in the Aysén region. A total of 409 cycles (51.5%) were reported with consumption above 220 g/ton, while 387 cycles (48.5%) were reported with consumption below 220 g/ton. A total of 193 cycles were reported as harvesting without using antibiotics during the period.

During the last few years, Sernapesca has implemented a voluntary certification, “Program for Optimizing the Use of Antimicrobials” (Spanish acronym: PROA). The program certifies those sites that follow specific criteria for the restricted use of antibiotics. Of a total of 222 reported closed cycles that state that they do or do not belong to PROA, 31% belong to PROA. On average, for 2020 and 2021, the sites that have signed up for PROA have an ICA of less than 200 g/ton (Table 2).

Table 2: Number of cycles and ICA for sites not certified and certified by PROA for 2021–22.

	2021		2022	
PROA	Cycles	ICA	Cycles	ICA
NO	165	481,4	174,0	431,2
YES	57	186,5	81,0	199,5

The data at the company level are coded and summarize the evolution of consumption expressed in grams of antibiotics in active principle (ICA) per ton harvested during the cycle (Figure 22).

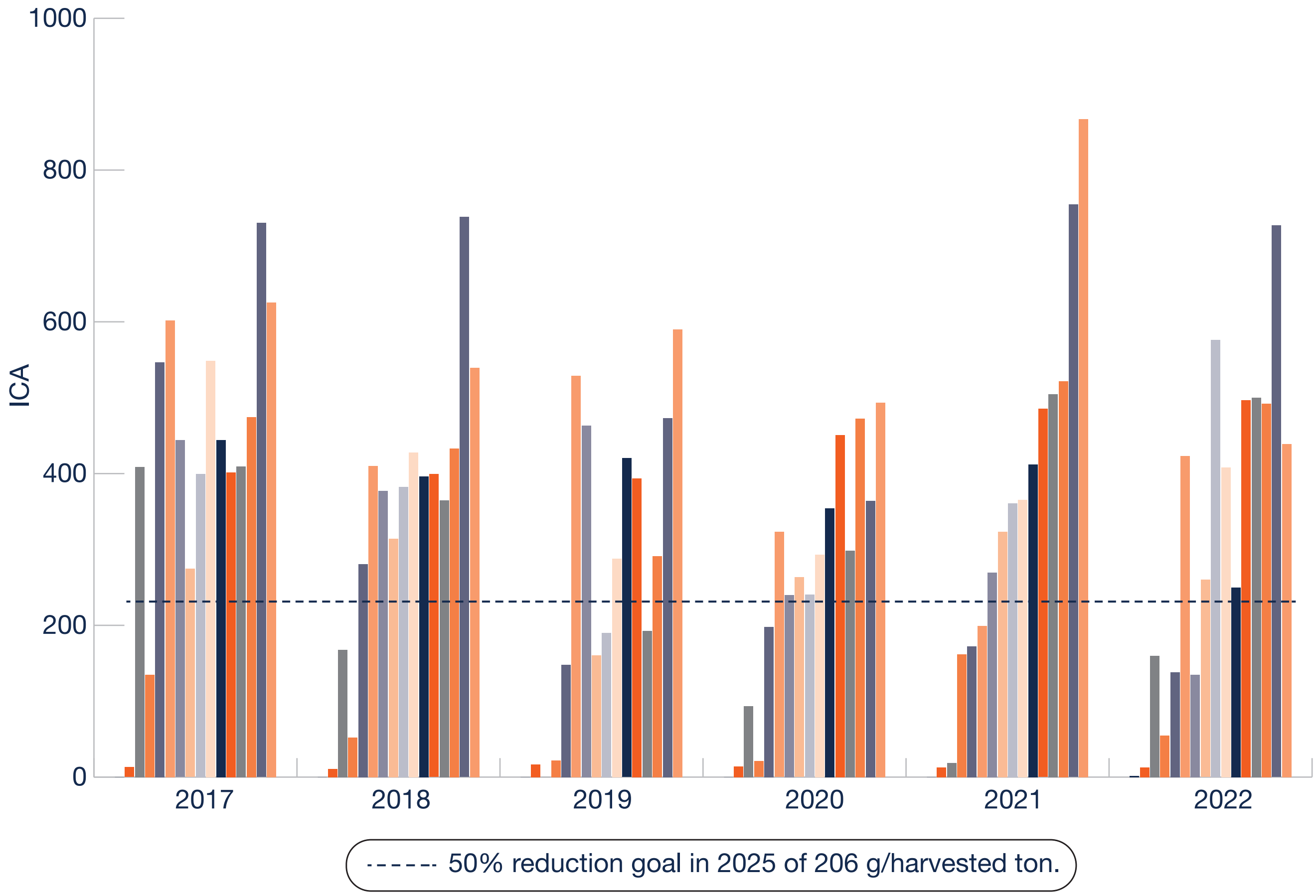


Figure 22: Antibiotic consumption index (ICA) at the company level. The dotted line indicates the 50% reduction goal in 2025 of 206 g/harvested ton.

ICA is a standard measure that allows a comparison of antibiotic consumption standardized to tons harvested. Consequently, it does not consider the company's size or the total volume harvested. But, based on the data provided in this report, it is crucial to consider that the ICA may vary by region and cultivated species, because the location of the farms and cultivated species may influence the company's ICA.

During the 6 years of data analyzed, there are different realities regarding the antibiotic consumption rate. Figures 23 to 26 display the evolution of ICAs by companies belonging to CSARP program (16 companies), located in the Los Lagos region to the Magallanes. Only six companies are below an ICA of 206 (the 2025 goal at the industry level); however, they represent around 20% of national production. Since 2019, six companies have progressively increased their consumption of antibiotics, and at least eight companies have consumed over 400 g/harvested ton, which is considered high. Only one company has an ICA over 600, which is considered a very high indicator.

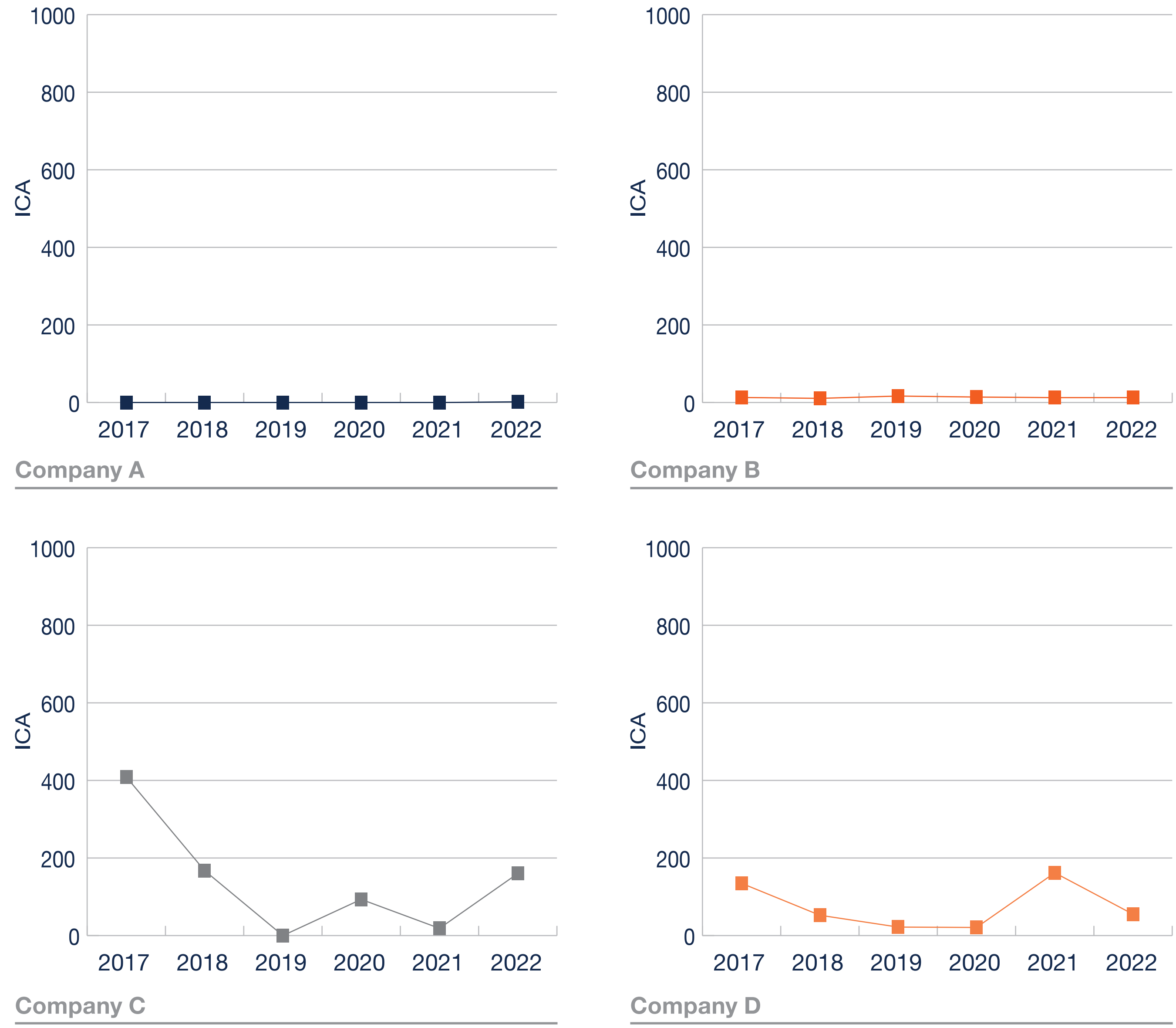


Figure 23: ICA evolutions for companies A–D, 2017–2022.

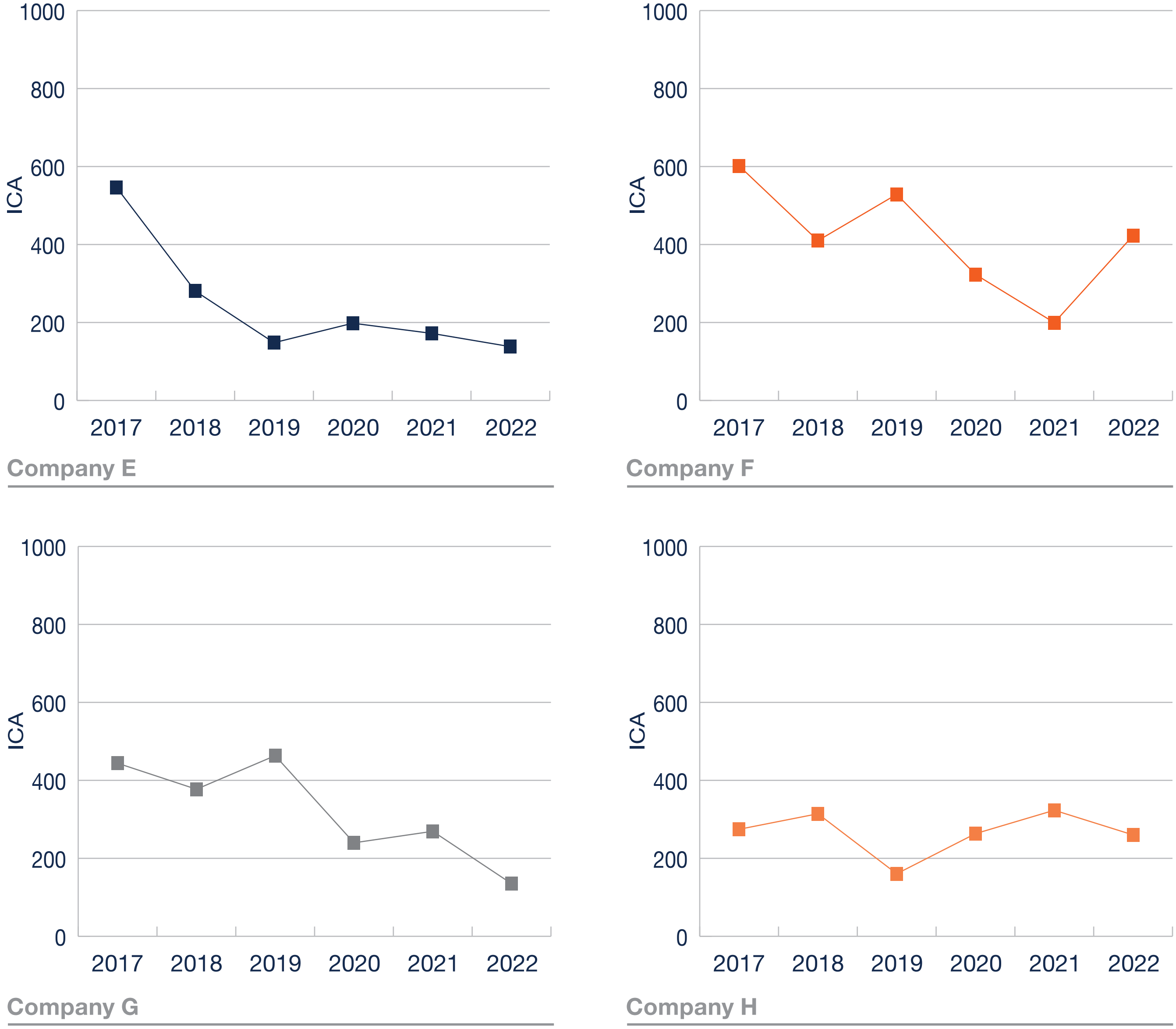
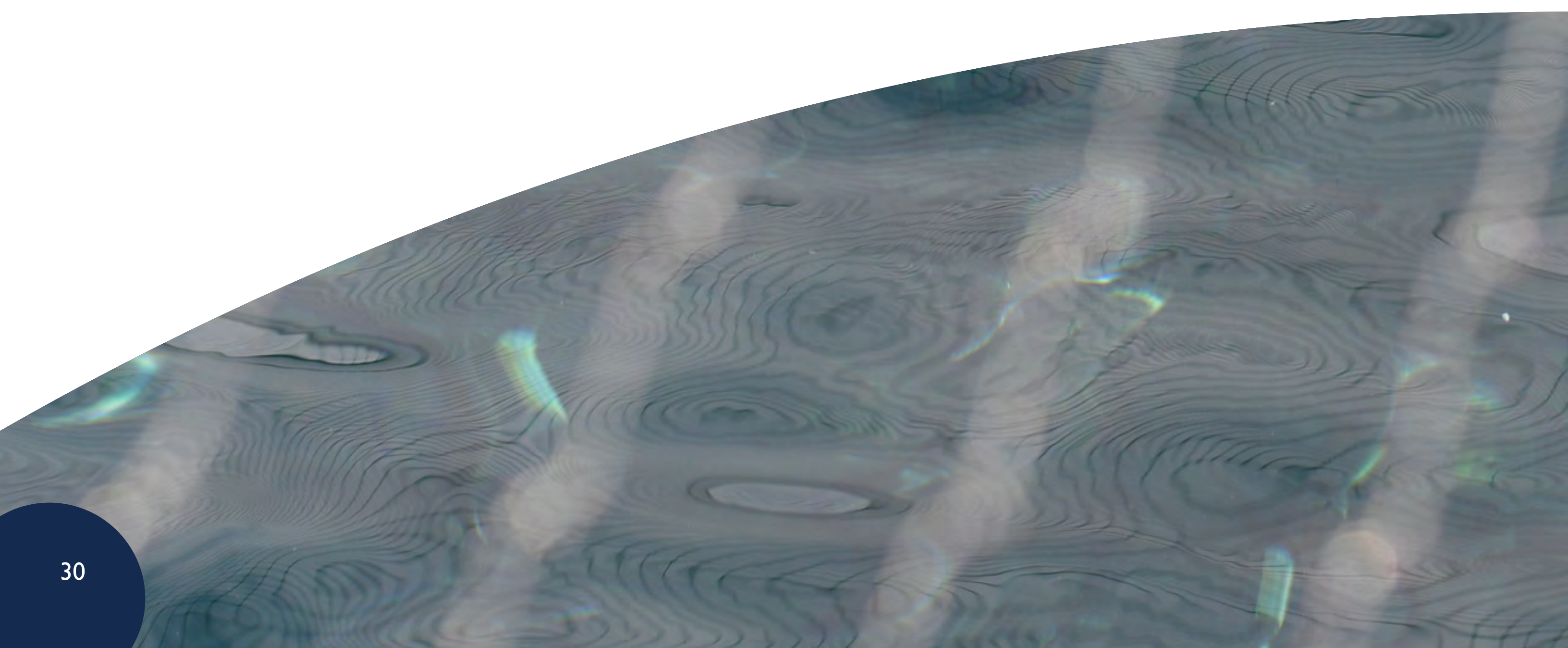
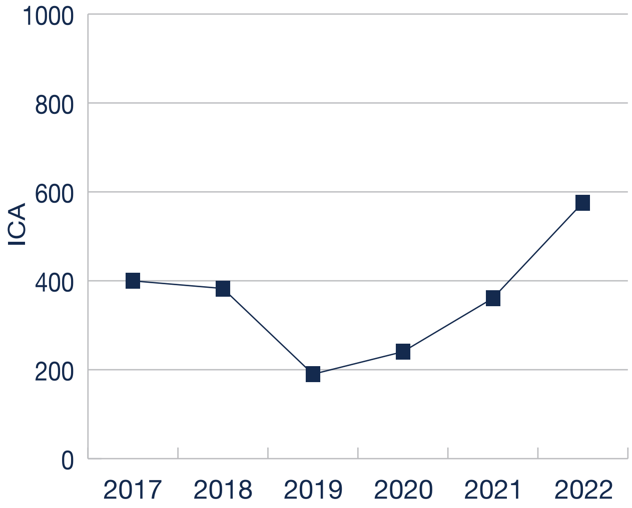
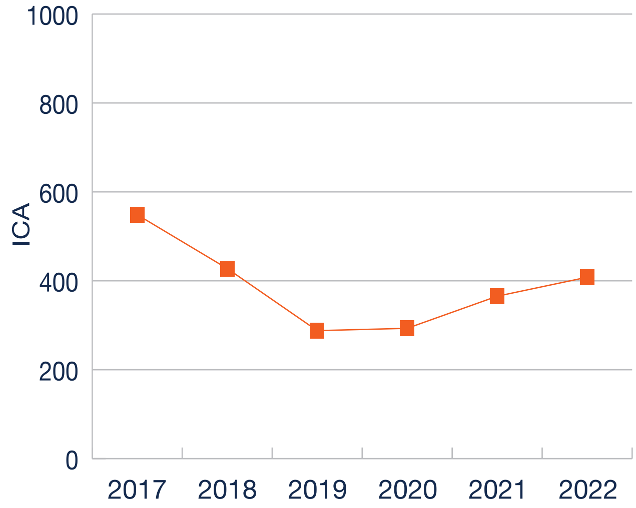


Figure 24: ICA evolutions for companies E–H, 2017–2022.

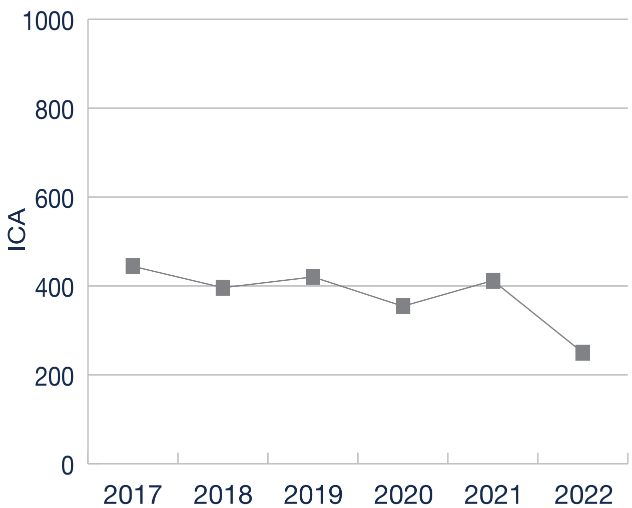




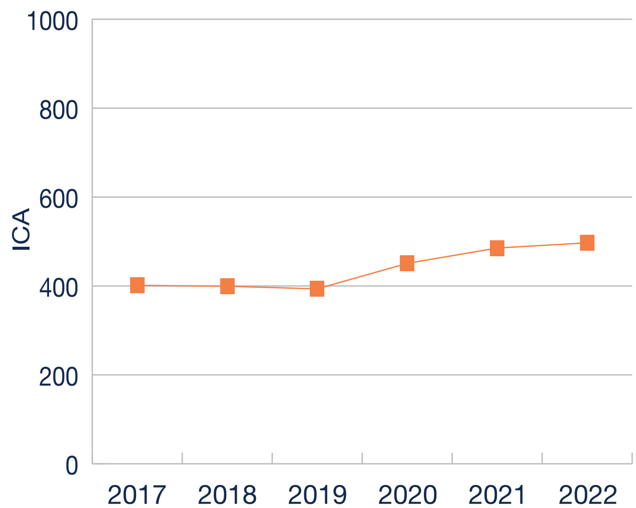
Company I



Company J

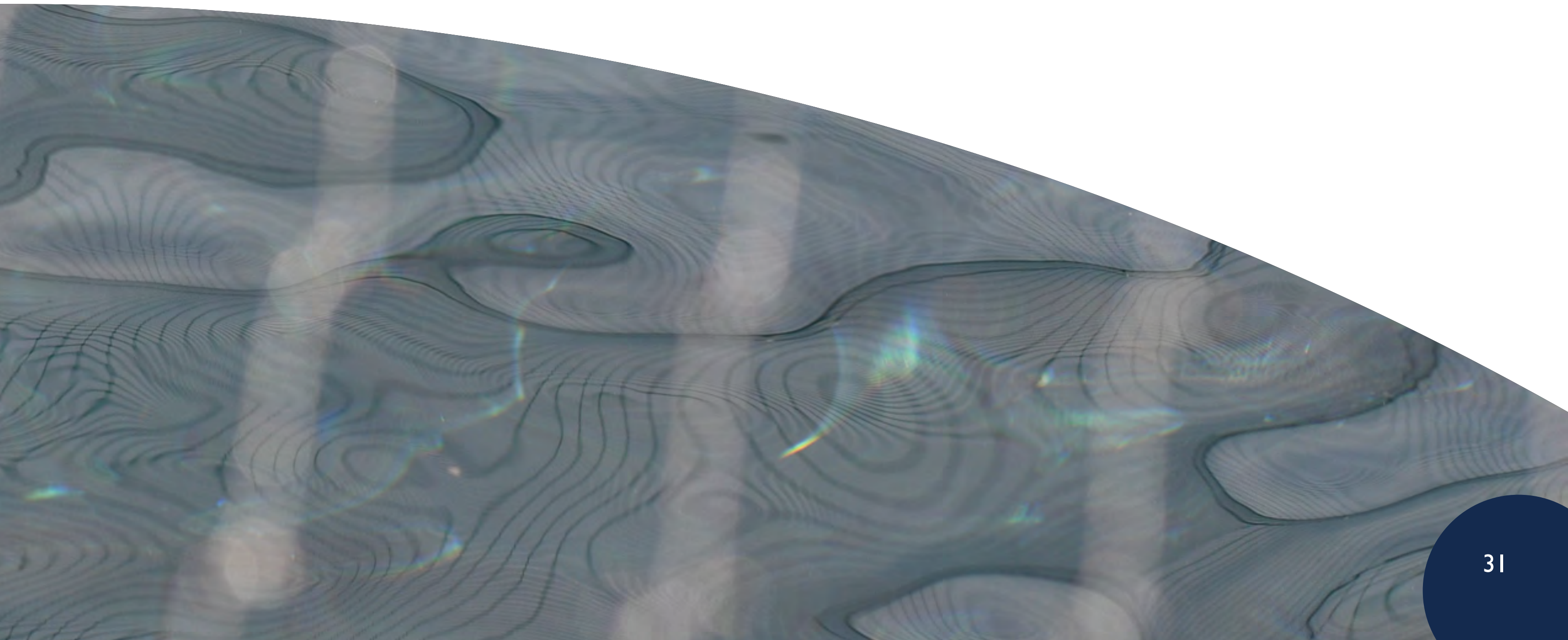


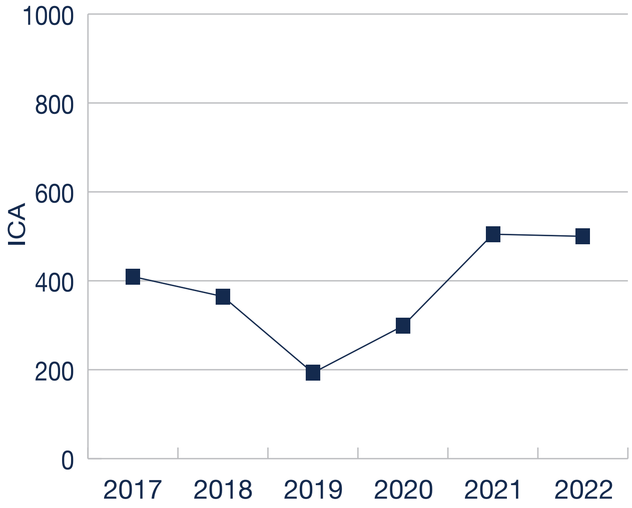
Company K



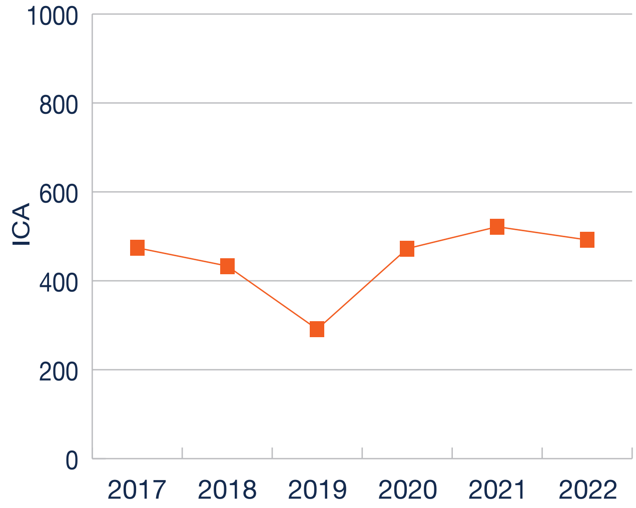
Company L

Figure 25: ICA evolutions for companies I–L, 2017–2022.

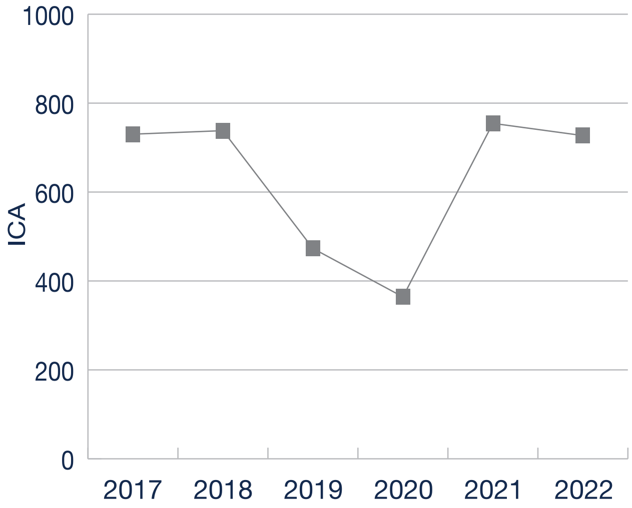




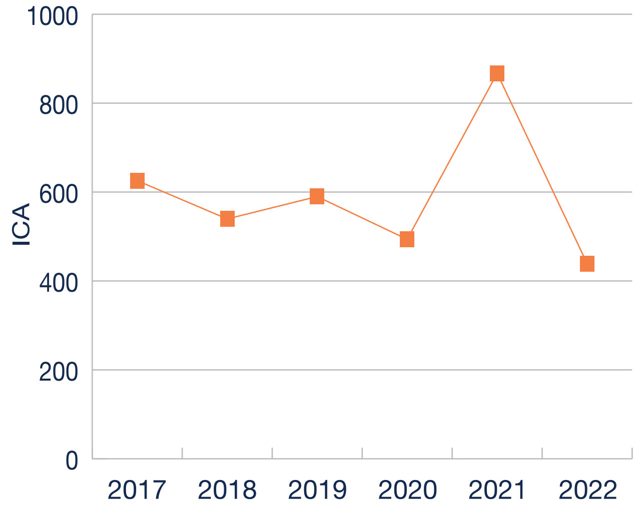
Company M



Company N

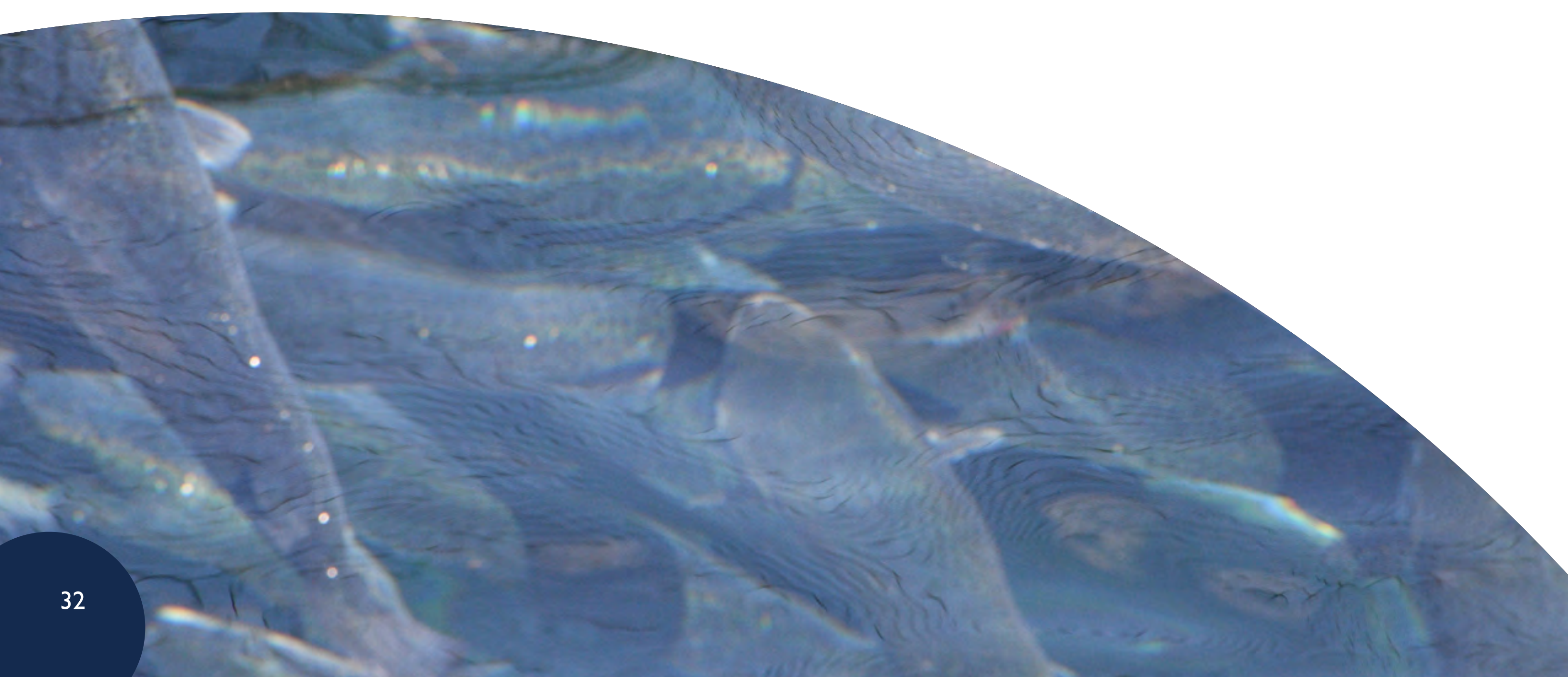


Company O



Company P

Figures 26: ICA evolutions for companies M–P, 2017–2022.



DISCUSSION

Aquaculture is crucial to feeding the growing global population, supporting livelihoods and economic development. Emerging science is showing connections between antibiotic use and challenges such as water pollution, the contamination of nontarget organisms, and the global health threat posed by antibiotic-resistant bacteria. There is an urgent need to collect data and conduct scientific research to better understand the impacts of antibiotic use in aquaculture globally. These initial steps can inform effective and science-based strategies for managing antibiotic use to ensure the health of animals, humans, and the environment.

In Chile, the farmed salmon industry has demonstrated comprehensive data collection on antibiotic usage through their participation in CSARP. This report and its findings provide transparency and accountability that is missing from many other aquaculture commodities.

The findings show that antibiotic use in the Chilean salmon farming industry increased during 2020–21 but decreased in 2022. Since the start of CSARP in 2019, the partnership has reduced antibiotic use by 12% overall. These results were influenced by several notable factors, including the COVID-19 global pandemic and climate change. Individual company decision making varied considerably, and certain regions are more likely to use high levels of antibiotics. The data indicates that the industry is capable of significantly reducing the use of antibiotics but further reductions, individual company accountability, and investments in new solutions are needed to achieve the 50% reduction goal.

Global Climate Change and Antibiotic Use

Global climate change can significantly affect aquaculture operations, including the proliferation and spread of diseases. Changes in water temperature, salinity, and nutrient levels can alter the ecology of aquatic systems, making them more susceptible to disease outbreaks. For example, warmer water temperatures can increase the prevalence of bacterial and viral infections in fish. Changes in nutrient levels can lead to the growth of harmful algal blooms that can cause illness or death in aquatic animals.

Global climate change has significantly affected the Chilean aquaculture industry in recent years. One of the most significant impacts has been the occurrence of more frequent harmful algal blooms (HABs), which have caused mass mortality events in farmed salmon and other fish species. HABs occur when changes in water temperature and nutrient levels create favorable conditions for the growth of certain types of algae. These algae can produce toxins harmful to fish and can decrease oxygen levels, which stress fish and predispose them to diseases including SRS, the leading bacterial disease of salmon farming in Chile. Changes in water temperature and oxygen levels have also led to disease outbreaks and increased mortality rates in farmed fish.

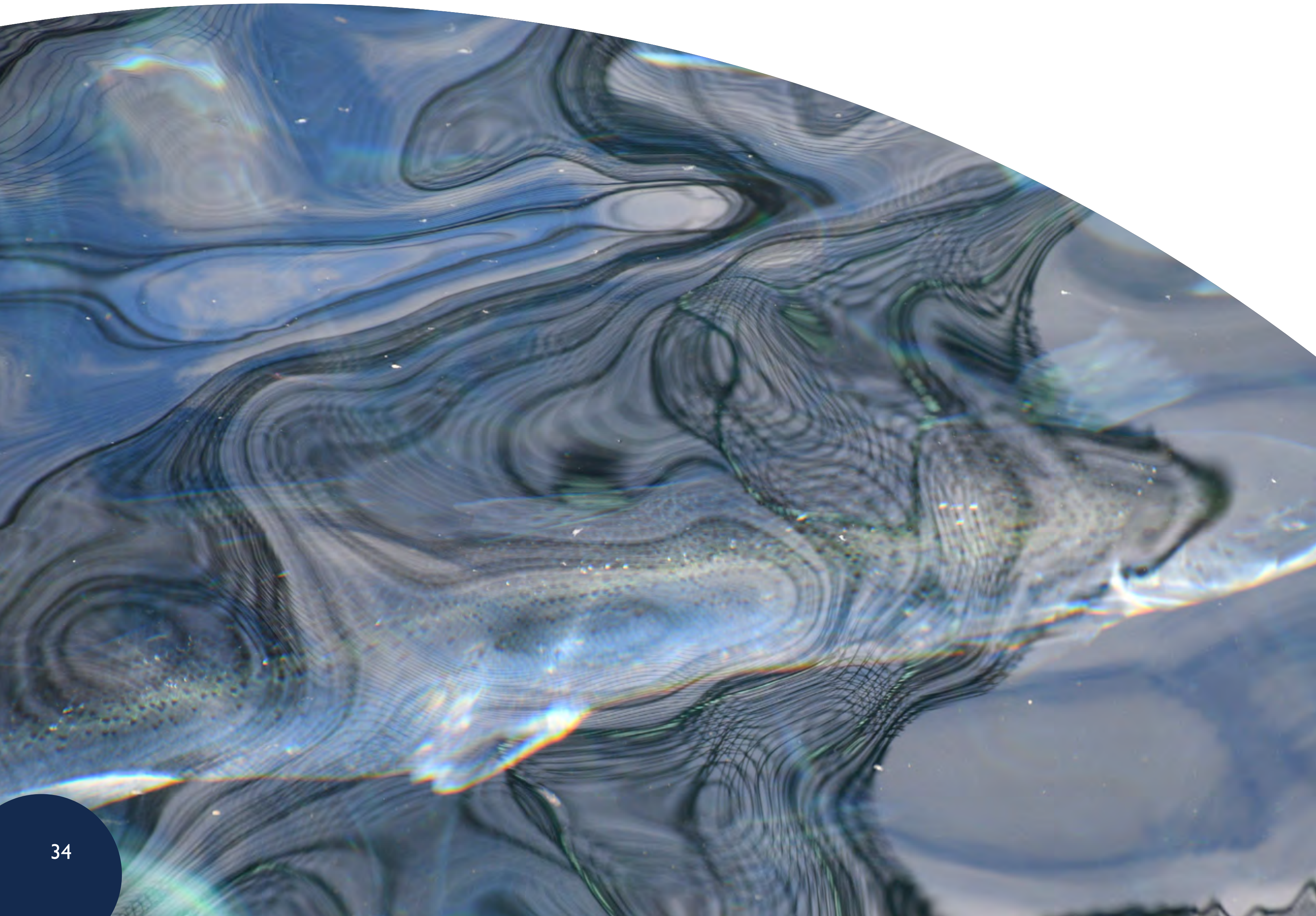
The industry faces continued risks from climate change. According to the most recent predictions, the probability of having an El Niño event during winter (June–August 2023) is almost 50%, while the probability of having an El Niño during spring (September–November) exceeds 60% (Servicio meterológico de Chile). Historically, El Niño events have caused environmental disruptions in the salmon industry related to harmful algal blooms, and caused significant variations in rainfall.

Antibiotic Use, Variations, and Company Efforts

This report summarizes antibiotic usage across the industry according to the same metrics and methodology and provides new insights into company and operational decision making. The findings show that some companies have made reductions consistent with the CSARP goal while other companies continue to use high levels. As noted above, regional and site-level conditions are likely to drive decision making, but the data indicate that some companies have not reduced antibiotic usage. A lack of company-specific long-term antibiotic reduction policies may be a contributing factor and ongoing challenge. Companies with high and very high antibiotic consumption rates represent more than 50% of national production. These companies must make reductions in order for CSARP to achieve the 50% reduction goal.

Achieving the Goal

Reducing the use of antibiotics is a complex challenge that requires industry action and collaboration with government, academia, and nongovernmental organizations. More effort and reinforcement of commitments at the company level are needed to reach the goal and reduce the potential impact of the use of antibiotics on different scales. It is crucial to find solutions to this challenge, to ensure the viability of the industry, livelihoods, and communities while safeguarding environmental health.



APPENDIX 1: Antibiotic Consumption Indicators

ICA: The antibiotic consumption index at closed cycle (CC): The amount of principle active antibiotics (g) used at the end of the production cycle (after harvesting), divided by the harvested fish biomass (t) at the farm level.

Frequency of use: The number of times that a farm received antibiotic treatment during the production cycle. A value higher than 1 indicates that all cages have received more than one treatment, whereas a value of 0.5 indicates that half the cages were treated.

ICAB: The antibiotic consumption index at the neighborhood level is the amount of antibiotics used in all farms producing in a neighborhood at the same time (same production period) divided by the harvested biomass in the neighborhood. The duration of the production period ranges from 21 to 24 months, and it follows a 3-month fallowing period before stocking new fish.

REFERENCES

ADUANA. Servicio Nacional de Aduanas. ADUANA Chile. Retrieved 1 April from www.aduanal.cl

AQUABENCH. (2022). Aquabench Newsletter. Balance industria del salmón año 2021: Disminución en pesos de cosecha, biomasa cosechada y productividad, los indicadores destacados del año 2021. Aquabench. www.aquabench.com

CSARP. (2020). Annual Report CSARP-2020. The Chilean salmon antibiotic reduction program M. B. Aquarium. www.csarp.cl

Farias, D. R., & Ibarra, R. (2023). Understanding the use and impact of antibiotics in aquaculture. M. B. Aquarium.

INTESAL. (2023). INTESAL SalmonChile, La Salmonicultura en datos. INTESAL. www.infosalmonchile.cl

METEOCHILE. Servicio de Metereológico Chile. Servicio de Metereológico Chile. Retrieved 22 January from www.meteochile.gob.cl

SALMON, C. D. (2023). Informe de Exportaciones de Salmón y Trucha, Cierre año 2023. www.consejodelsalmon.cl