

1989/90 STOCK STATUS AND TAC ASSESSMENT FOR *CHAMPSOCEPHALUS GUNNARI* IN SUBAREA 48.3 (SOUTH GEORGIA)

Zh.A. Frolkina and P. Gasyukov

Abstract

The 1989/90 stock status and TAC assessment for *Champsoccephalus gunnari* in South Georgia subarea (48.3) has been made using the biostatistic material for 1982/83 to 1987/88 collected by Soviet scientists. VPA tuning has been made by the Laurec-Shepherd method (1985) using standardized fishing effort. For the beginning of the 1989/90 fishing season, the stock was assessed at 130.2 thousand tonnes and the TAC at 23.6 thousand tonnes.

Résumé

L'état du stock et l'évaluation du TAC de *Champsoccephalus gunnari* dans la sous-zone de la Géorgie du Sud (48.3) pour 1989/90 ont été effectués en se servant de matériaux biostatistiques recueillis par les scientifiques soviétiques de 1982/83 à 1987/88. La VPA a été ajustée par la méthode Laurec-Shepherd (1985) en utilisant l'effort de pêche standardisé. Pour le début de la saison de pêche 1989/90, le stock a été estimé à 130 200 tonnes et le TAC à 23 600 tonnes.

Резюме

Оценка состояния запаса *Champsoccephalus gunnari* в Подрайоне 48.3 (Южная Георгия) в течение сезона 1989/90 г. и оценка величины ТАС для этого запаса были сделаны на основе статистических промысловых и биологических данных по этому запасу за 1982/83 - 1987/88 гг., собранных советскими учеными. Настройка VPA была выполнена по методу Лорека-Шепарда (1985 г.) при стандартизированном промысловом усилии. Оценка величины запаса на начало промыслового сезона 1989/90 г. составила 130,2 тысячи тонн и величины ТАС - 23,6 тысячи тонн.

Resumen

La evaluación de la condición de las poblaciones de 1989/90 y de la capturas totales permisibles (TAC) de *Champsoccephalus gunnari* en la subárea de Georgia del Sur (48.3) se ha hecho utilizando material bioestadístico recopilado por los científicos soviéticos desde 1982/83 hasta 1987/88. El ajuste de VPA se ha realizado usando el método Laurec-Shepherd (1985) el cual utiliza esfuerzo de pesca estandarizado. Para el comienzo de la temporada de pesca de 1989/90, las poblaciones fueron evaluadas a 130.2 mil toneladas y el TAC de 23.6 mil toneladas.

1. BACKGROUND DATA

1.1 The Fishery

In 1988/89 fishing for *Champscephalus gunnari* was conducted over a short period from 1 October to 4 November 1988. Total catch for this time amounted to 21.4 thousand tonnes.

1.2 Age Composition of Catches

Data for the 1982/83 to 1987/88 seasons are taken from the document WG-FSA-89/5 of the Working Group on Fish Stock Assessment.

Age composition of the 1988/89 catch is calculated using an age/length key for the last quarter of 1988 and comprehensive measurements taken in October 1988. Data on age composition of catches are given in Table 1.

1.3 Catch-Per-Unit Fishing Effort and Fishing Effort

A Soviet BMRT (large refrigerator trawler) conducting fishing with bottom trawl was used in assessments as a standard type of fishing vessel. Relevant values of catch-per-unit-effort (CPUE) are taken from the Report of the Seventh Meeting of the Scientific Committee (SC-CAMLR-VII). There were no data for the 1986/87 season. An assumption was made that CPUE in that season was 3.0 tonnes per hour. CPUE for this type of vessel during the 1988/89 season was taken at 2.96 tonnes per hour.

Values for standardizing fishing effort are derived from the division of total catch-per-season by the value of catch-per-effort of a standard vessel.

Total catch, catch-per-unit-effort of standard vessels equipped with bottom trawls and standardized fishing effort by seasons are given in detail in Table 2.

1.4 Mean Fish Mass By Age

Information on average fish mass by age and fishing season from 1982/83 to 1987/88 was also taken from the document WG-FSA-88/5.

Values of mean fish mass in the 1987/88 season were derived from the data collected to establish an age/length key.

Values of mean fish mass by age and fishing season are given in Table 3.

2. PARAMETERS

2.1 Natural Mortality Rate

The same value of natural mortality rate (0.35) was used as agreed at the Seventh Meeting of the Scientific Committee (SC-CAMLR-VII).

2.2 Age of Sexual Maturity

According to our data up to 90% of fish commence spawning for the first time at the age of 3 years; 2 year old spawning fish were observed only in 1984 but their numbers never exceeded 10%. The age of sexual maturity is considered to be 3 years.

3. VPA STOCK ASSESSMENT

The VPAs were tuned by using the Laurec-Shepherd method (Pope and Shepherd, 1985).

Computed values of the fishing mortality rate, abundance and biomass are given in Tables 4 to 6.

Shown below are coefficients of the correlation between fishing mortality rate and fishing effort for each age-group which were derived for and used in this analysis.

Age-Group	Coefficient of Correlation
1	0.52
2	0.75
3	0.92
4	0.60
5	0.72
6	0.66

The tuning of VPA for the first age-group was not successful, therefore its abundance in 1988/89 was estimated using the mean value over six recent years.

The VPA based on these data gives a biomass for *C. gunnari* at the beginning of the 1988/89 season of 103.0 thousand tonnes.

4. YIELD-PER-RECRUIT

The value of yield-per-recruit was calculated using Thompson and Bell's method. Rates of partial recruitment were used in the calculation which assumed that fish from the age of three years and over were fully represented in the catch. The values of rates of partial recruitment for other age-groups were derived by averaging results for the whole period (seven years). The relevant coefficients were as follows:

Age-Group	1	2	3	4	5	6
Rate of partial recruitment	0.07	0.37	1.0	1.0	1.0	1.0

Results of calculations are given in Table 7. The value of F_{MSY} was 0.72; the value of $F_{0.1}$ was 0.42.

5. TAC ASSESSMENT FOR THE 1989/90 SEASON

Calculation of the TAC assumes that:

- the mean mass of fish has remained at the 1988/89 level;

- the rates of partial recruitment for age-groups 1 and 2 were defined for the 1982/83 to 1987/88 seasons by applying rates of fishing mortality derived by the Laurec-Shepherd method; rates for other age-groups are assumed to be 1.0;
- the size of age-group 1 is the mean value taken over a number of years;
- the total fishing mortality rate for 1989/90 will be at a level of $F_{0.1}=0.42$; and
- as adopted by the WG-FSA in 1989, the values $F_{0.1}=0.313$ and $F_{max}=0.42$ were used.

Results of the TAC evaluation are given in Table 11.

Within these parameters, the stock size of *C. gunnari* at the beginning of the 1989/90 season in Subarea 48.3 is estimated at 130.2 thousand tonnes, while the TAC for this season is 28.6 thousand tonnes.

Values of TAC at $F_{0.1}=0.313$ and $F_{max}=0.42$ are given in Tables 9 and 10. If these values of F are used, TAC in 1989/90 will be 22.2 and 40.3 thousand tonnes respectively.

Acting upon a suggestion by Dr J. Beddington (UK), the second version of the calculation was carried out using the following set of catch-per-unit data: Country - USSR, Type of vessel - BMRT, Years - 1982/83 to 1988/89, Month - October. The data of this set are given in Table 11.

Results of VPA analyses based on these data are given in Tables 12 to 14 and the calculation of TAC appears in Tables 15 to 17. Assuming the biomass to be 136.6 thousand tonnes at the beginning of 1989/90, the following TAC were obtained:

if $F_{0.1} = 0.42$	TAC = 30.3
if $F_{0.1} = 0.313$	TAC = 23.6
if $F_{max} = 0.42$	TAC = 42.6

REFERENCES

- CCAMLR. 1989. Analyses carried out during the 1988 Meeting of the Working Group on Fish Stock Assessment. WG-FSA-89/5.
- POPE, J.G. and J.G. SHEPHERD. 1985. A comparison of the performance of various methods for tuning VPAs using effort data. *J. Cons. int. Explor. Mer*, 42: 129-151.
- RIVARD, D. 1983. Effects of systematic, analytical and sampling errors on catch estimates: a sensitivity analysis. In: DOUBLEDAY, G.W. and D. RICHARD (Eds). Sampling Commercial Catches of Marine Fish and Invertebrates. *Can. Spec. Publ. Fish. Aquat. Sci.*, 66: 114-129.

Table 1: Age composition of *C. gunnari* in Subarea 48.3 (millions of specimens).

Age-Group	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
1	25.97	98.63	5.28	21.64	6.92	8.60	10.25
2	162.20	167.08	18.20	39.62	207.12	12.42	128.89
3	428.08	120.92	47.05	34.01	276.94	70.06	14.47
4	68.13	76.11	12.71	1.89	19.31	35.51	9.18
5	24.97	21.54	1.80	0.67	4.21	25.16	11.49
6	8.55	4.31	0.54	0.13	0.70	6.85	2.31

Table 2: Total catch, catch-per-unit-effort of a BRMT type vessel and standardized fishing effort by fishing seasons.

Fishing Seasons	Total Catch	CPUE	Fishing Effort
1982/83	128.2	7.12	18 006
1983/84	80.0	5.42	14 760
1984/85	14.2	4.44	3 187
1985/86	11.1	(3.0)*	3 700
1986/87	71.1	2.73	26 044
1987/88	34.5	1.99	17 387
1988/89	21.4	2.94	7 279

* Adjusted value

Table 3: Average fish mass (in grams) for *C. gunnari* by age-groups (Subarea 48.3).

Age-Group	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
1	29.70	35.80	23.40	29.70	24.90	17.70	23.40
2	87.80	97.20	79.00	87.80	81.90	70.60	79.00
3	175.80	189.00	163.30	175.80	167.40	151.00	163.30
4	291.80	308.00	276.00	291.80	281.20	260.50	276.00
5	430.20	448.90	411.90	430.20	418.00	393.80	411.90
6	585.20	605.50	565.20	585.20	571.80	545.30	565.20

Table 4: Fishing mortality rates of *C. gunnari* in Subarea 48.3 (tuning VPA by Laurec-Shepherd method).

Age-Group	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
1	0.06161	0.29848	0.00649	0.04278	0.09002	0.00990	0.02003
2	0.58273	0.83807	0.09608	0.07167	0.86721	0.27265	0.23587
3	1.56944	1.67471	0.74571	0.30896	1.24851	1.07525	0.71682
4	1.15659	2.73048	1.07049	0.06656	0.34443	0.61637	0.45455
5	1.59551	2.82028	0.70454	0.15913	0.24392	1.34540	0.49858
6	1.37595	2.77424	0.88668	0.11275	0.29403	0.98007	0.47628

Table 5: Abundance (millions of specimens of *C. gunnari* in Subarea 48.3 (tuning VPA by Laurec-Shepherd method).

Age-Group	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
1	514.21	449.08	967.72	611.65	95.02	1034.88	612.09
2	428.05	340.71	234.80	677.55	412.97	61.20	722.07
3	613.55	168.43	103.85	150.30	444.44	122.26	32.83
4	114.02	90.00	22.24	34.72	77.76	89.86	29.40
5	35.52	25.27	4.13	5.37	22.89	38.83	34.19
6	13.05	5.08	1.06	1.44	3.23	12.64	7.13
Total	1718.400	1078.570	1333.805	1481.033	1056.319	1359.671	1437.710

Table 6: Biomass (thousands of tonnes) of *C. gunnari* in Subarea 48.3 (tuning VPA by Laurec-Shepherd method).

Age-Group	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
1	15.272	16.077	22.645	18.166	2.366	18.317	14.323
2	37.583	33.117	18.549	59.489	33.823	4.320	57.043
3	107.861	31.833	16.959	26.423	74.399	18.462	5.362
4	33.271	27.720	6.138	10.131	21.867	23.410	8.114
5	15.283	11.346	1.703	2.311	9.568	15.292	14.083
6	7.635	3.074	0.600	0.843	1.846	6.892	4.028
Total	216.906	123.167	66.593	117.362	143.869	86.693	102.953

Table 7: Yield-per-recruit for *C. gunnari* in Subarea 48.3.

Fishing Mortality Rates	Y/R	Fishing Mortality Rates	Y/R
0.00	0.0	0.60	0.0637
0.02	0.0064	0.62	0.0639
0.10	0.0268	0.64	0.0640
0.20	0.0433	0.66	0.0641
0.30	0.532	0.68	0.0642
0.32	0.0547	0.70	0.0642
0.34	0.0580	0.72	0.0643
0.36	0.0571	0.74	0.0642
0.38	0.0581	0.76	0.0642
0.40	0.0590	0.78	0.0642
0.42	0.0600	0.80	0.0641
0.44	0.0606	0.82	0.0641
0.46	0.0612	0.84	0.0640
0.48	0.0617	0.90	0.0636
0.50	0.0622	1.00	0.0630

Table 8: Calculation of TAC for *C. gunnari* in Subarea 48.3 for the 1989/90 season ($F_{0.1}=0.42$) (tuning VPA by Laurec-Shepherd method).

Age-Group	M	W	FD	N	B	Y
1	0.3500	23.400	0.0726	612.09	14.323	0.363
2	0.3500	79.000	0.3708	422.78	33.400	4.083
3	0.3500	163.300	1.0000	401.92	65.634	19.224
4	0.3500	276.000	1.0000	11.30	3.118	0.913
5	0.3500	411.900	1.0000	13.15	5.416	1.586
6	0.3500	565.200	1.0000	14.63	8.271	2.423
Total				1475.88	130.162	28.593

Table 9: Calculation of TAC for *C. gunnari* in Subarea 48.3 for the 1989/90 season ($F_{0.1}=0.313$) (tuning VPA by Laurec-Shepherd method).

Age-Group	M	W	FD	N	B	Y
1	0.3500	23.400	0.0726	612.09	14.323	0.272
2	0.3500	79.000	0.3708	422.78	33.400	3.099
3	0.3500	163.300	1.0000	401.92	65.634	15.019
4	0.3500	276.000	1.0000	11.30	3.118	0.714
5	0.3500	411.900	1.0000	13.15	5.416	1.239
6	0.3500	565.200	1.0000	14.63	8.271	1.893
Total				1475.88	130.162	22.235

Table 10: Calculation of TAC for *C. gunnari* in Subarea 48.3 for the 1989/90 season ($F_{0.1}=0.645$) (tuning VPA by Laurec-Shepherd method).

Age-Group	M	W	FD	N	B	Y
1	0.3500	23.400	0.0726	612.09	14.323	0.554
2	0.3500	79.000	0.3708	422.78	33.400	6.037
3	0.3500	163.300	1.0000	401.92	65.634	26.816
4	0.3500	276.000	1.0000	11.30	3.118	1.274
5	0.3500	411.900	1.0000	13.15	5.416	2.213
6	0.3500	565.200	1.0000	14.63	8.271	3.379
Total				1475.88	130.162	40.273

Table 11: CPUE (tonnes/hours) in Subarea 48.3 for *C. gunnari*, OTB. Monthly catch $\geq 75\%$ (<75% in brackets).

Month	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Jul		2.372	4.442			1.675	
Aug						1.969	
Sep			(0.263)		2.875	(1.944)	
Oct	5.556	8.444	(4.0)*	2.358	2.992	2.018	3.207
Nov		4.820			(0.389)	(1.185)	(1.299)
Dec		(0.402)			3.117	(0.192)	
Jan	4.451	(0.408)			2.080	(0.387)	
Feb	10.740	6.828			2.255	(0.306)	
Mar	9.519	4.667			2.355	(0.594)	
Apr	7.683				2.268		
May	4.699			1.422	2.804		
Jun	1.457	4.955			2.821		

* Interpolated

Table 12: Population numbers (millions of specimens) of *C. gunnari* (Laurec-Shepherd method).

Age-Group	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
1	775.08	730.78	1547.81	860.82	152.01	1709.92	962.74
2	519.53	450.13	367.81	934.77	505.46	86.88	1030.47
3	676.07	192.60	147.45	209.10	536.50	151.47	43.20
4	128.07	98.22	28.65	53.91	100.86	120.35	39.68
5	39.05	27.33	5.79	7.89	31.25	46.46	46.14
6	14.48	5.51	1.41	2.15	4.27	15.73	9.61
Total	2152.273	1504.570	2098.923	2068.641	1330.349	2130.806	2131.836

Table 13: Fishing mortality for *C. gunnari* (Laurec-Shepherd method).

Age-Group	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
1	0.04343	0.18656	0.00434	0.03242	0.05944	0.00641	0.01362
2	0.49232	0.61607	0.06476	0.05524	0.70510	0.19866	0.17176
3	1.42909	1.40530	0.50609	0.22909	0.99468	0.83951	0.53843
4	1.04464	2.33147	0.78931	0.04548	0.27515	0.45877	0.34230
5	1.45775	2.46185	0.48992	0.11357	0.18621	1.07603	0.37344
6	1.25145	2.39811	0.64041	0.07964	0.23089	0.76847	0.35819

Table 14: Population biomass for *C. gunnari* (thousands of tonnes), (Laurec-Shepherd method).

Age-Group	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
1	23.020	26.162	36.219	25.566	3.785	30.266	22.528
2	45.615	43.753	29.057	82.072	41.397	6.134	81.407
3	118.854	36.401	24.078	36.759	89.810	22.872	7.055
4	37.370	30.252	7.909	15.732	28.361	31.351	10.952
5	16.798	12.268	2.384	3.396	13.061	18.295	19.004
6	8.473	3.338	0.799	1.259	2.444	8.578	5.430
Total	250.129	152.173	100.445	164.784	178.858	117.495	146.376

Table 15: Projections for 1989, $F_{OPT}=0.313$, *C. gunnari* (Laurec-Shepherd method).

Age-Group	M	W	FD	N	B	Y
1	0.5000	23.400	0.0640	962.74	22.528	0.352
2	0.5000	79.000	0.3629	576.03	45.506	3.863
3	0.5000	163.300	1.0000	526.38	85.957	18.415
4	0.5000	276.000	1.0000	15.29	4.221	0.904
5	0.5000	411.900	1.0000	17.09	7.040	1.508
6	0.5000	565.200	1.0000	19.26	10.887	2.332
Total				2116.79	176.140	27.376

Table 16: Projections for 1989, $F_{OPT}=0.42$, *C. gunnari* (Laurec-Shepherd method).

Age-Group	M	W	FD	N	B	Y
1	0.5000	23.400	0.0640	962.74	22.528	0.471
2	0.5000	79.000	0.3629	576.03	45.506	5.095
3	0.5000	163.300	1.0000	526.38	85.957	23.603
4	0.5000	276.000	1.0000	15.29	4.221	1.159
5	0.5000	411.900	1.0000	17.09	7.040	1.933
6	0.5000	565.200	1.0000	19.26	10.887	2.990
Total				2116.79	176.140	35.250

Table 17: Projections for 1989, $F_{OPT}=0.645$, *C. gunnari* (Laurec-Shepherd method).

Age-Group	M	W	FD	N	B	Y
1	0.5000	23.400	0.0640	962.74	22.528	0.718
2	0.5000	79.000	0.3629	576.03	45.506	7.547
3	0.5000	163.300	1.0000	526.38	85.957	33.012
4	0.5000	276.000	1.0000	15.29	4.221	1.621
5	0.5000	411.900	1.0000	17.09	7.040	2.704
6	0.5000	565.200	1.0000	19.26	10.887	4.181
Total				2116.79	176.140	49.783

Liste des tableaux

- Tableau 1: Composition par âge de *C. gunnari* dans la sous-zone 48.3 (en millions de spécimens).
- Tableau 2: Capture totale, capture par unité d'effort d'un navire de type BRMT et effort de pêche standardisé par saisons de pêche.
- Tableau 3: Masse moyenne des poissons (en grammes) pour *C. gunnari* par groupes d'âge (sous-zone 48.3).
- Tableau 4: Taux de mortalité par pêche de *C. gunnari* dans la sous-zone 48.3 (VPA ajustée par la méthode Larec-Shepherd).
- Tableau 5: Abondance (en millions de spécimens) de *C. gunnari* dans la sous-zone 48.3 (VPA ajustée par la méthode Larec-Shepherd).
- Tableau 6: Biomasse (en milliers de tonnes) de *C. gunnari* dans la sous-zone 48.3 (VPA ajustée par la méthode Larec-Shepherd).
- Tableau 7: Rendement par recrue de *C. gunnari* dans la sous-zone 48.3.
- Tableau 8: Calcul de TAC pour *C. gunnari* dans la sous-zone 48.3 pour la saison 1989/90 ($F_{0.1}=0,42$) (VPA ajustée par la méthode Larec-Shepherd).
- Tableau 9: Calcul de TAC pour *C. gunnari* dans la sous-zone 48.3 pour la saison 1989/90 ($F_{0.1}=0,313$) (VPA ajustée par la méthode Larec-Shepherd).
- Tableau 10: Calcul de TAC pour *C. gunnari* dans la sous-zone 48.3 pour la saison 1989/90 ($F_{0.1}=0,645$) (VPA ajustée par la méthode Larec-Shepherd).
- Tableau 11: CPUE (en tonnes/heure) dans la sous-zone 48.3 pour *C. gunnari*, OTB. Captures mensuelles $\geq 75\%$ ($< 75\%$ entre parenthèses).
- Tableau 12: Taille de la population (en millions de spécimens) de *C. gunnari* (méthode Larec-Shepherd).
- Tableau 13: Mortalité par pêche pour *C. gunnari* (méthode Larec-Shepherd).
- Tableau 14: Biomasse de la population pour *C. gunnari* (en milliers de tonnes), (méthode Larec-Shepherd).
- Tableau 15: Projections pour 1989, $F_{OPT}=0,313$, *C. gunnari* (méthode Larec-Shepherd).
- Tableau 16: Projections pour 1989, $F_{OPT}=0,42$, *C. gunnari* (méthode Larec-Shepherd).
- Tableau 17: Projections pour 1989, $F_{OPT}=0,645$, *C. gunnari* (méthode Larec-Shepherd).

Список таблиц

- Таблица 1: Возрастной состав запаса *C. gunnari* в Подрайоне 48.3 (в миллионах особей).

- Таблица 2: Общий вылов и улов на единицу промыслового усилия по данным судна типа БМРТ и стандартизированное промысловое усилие по промысловым сезонам.
- Таблица 3: Средний вес (г) особей *C. gunnari* по возрастным группам (Подрайон 48.3).
- Таблица 4: Уровни промысловой смертности *C. gunnari* в Подрайоне 48.3 (VPA настроена методом Лорека-Шепарда).
- Таблица 5: Численность (миллионы особей) *C. gunnari* в Подрайоне 48.3 (VPA настроена методом Лорека-Шепарда).
- Таблица 6: Биомасса (тысячи тонн) *C. gunnari* в Подрайоне 48.3 (VPA настроена методом Лорека-Шепарда).
- Таблица 7: Вылов на единицу пополнения *C. gunnari* в Подрайоне 48.3.
- Таблица 8: Вычисление величины ТАС для *C. gunnari* в Подрайоне 48.3 на сезон 1989/90 г. ($F_{0,1}=0,42$) (VPA настроена методом Лорека-Шепарда).
- Таблица 9: Вычисление величины ТАС для *C. gunnari* в Подрайоне 48.3 на сезон 1989/90 г. ($F_{0,1}=0,313$) (VPA настроена методом Лорека-Шепарда).
- Таблица 10: Вычисление величины ТАС для *C. gunnari* в Подрайоне 48.3 на сезон 1989/90 г. ($F_{0,1}=0,645$) (VPA настроена методом Лорека-Шепарда).
- Таблица 11: СРУЕ (тонны/час) в Подрайоне 48.3 для *C. gunnari*, донный оттертрал. Ежемесячный вылов $\geq 75\%$ ($< 75\%$ в скобках).
- Таблица 12: Численность популяции (миллионы особей) *C. gunnari* (метод Лорека-Шепарда).
- Таблица 13: Коэффициент промысловой смертности для *C. gunnari* (метод Лорека-Шепарда).
- Таблица 14: Биомасса популяции *C. gunnari* (тысячи тонн) (метод Лорека-Шепарда).
- Таблица 15: Прогноз на 1989 г., $F_{ОРТ}=0,313$, для *C. gunnari* (метод Лорека-Шепарда).
- Таблица 16: Прогноз на 1989 г., $F_{ОРТ}=0,42$, для *C. gunnari* (метод Лорека-Шепарда).
- Таблица 17: Прогноз на 1989 г., $F_{ОРТ}=0,645$, б для *C. gunnari* (метод Лорека-Шепарда).

Lista de las tablas

- Tabla 1: Composición de edades de las capturas de *C. gunnari* en la Subárea 48.3 (millones de especímenes).
- Tabla 2: Pesca total, esfuerzo captura por unidad de un navío de tipo BRMT y esfuerzo de pesca estandarizado por temporadas de pesca.

- Tabla 3: Masa de peces promedio (en gramos) de *C. gunnari* por grupos de edades (Subárea 48.3).
- Tabla 4: Índices de mortalidad por pesca para *C. gunnari* en la Subárea 48.3 (ajuste de VPA de acuerdo al método Laurec-Shepherd).
- Tabla 5: Abundancia (millones de especímenes) de *C. gunnari* en la Subárea 48.3 (ajuste de VPAd de acuerdo al método Laurec-Shepherd).
- Tabla 6: Biomasa (miles de toneladas) de *C. gunnari* en la Subárea 48.3 (ajuste de VPA de acuerdo al método Laurec-Shepherd).
- Tabla 7: Valores de rendimiento-por-recluta para *C. gunnari* en la Subárea 48.3.
- Tabla 8: Cálculo del TAC para *C. gunnari* en la Subárea 48.3 para la temporada 1989/90 ($F_{0.1}=0.42$) (ajuste de TAC de acuerdo al método Laurec-Shepherd).
- Tabla 9: Cálculo del TAC para *C. gunnari* en la Subárea 48.3 para la temporada 1989/90 ($F_{0.1}=0.313$) (ajuste de VPA de acuerdo al método Laurec-Shepherd).
- Tabla 10: Cálculo del TAC para *C. gunnari* en la Subárea 48.3 para la temporada 1989/90 ($F_{0.1}=0.645$) (ajuste de VAP de acuerdo al método Laurec-Shepherd).
- Tabla 11: CPUE (toneladas/hora) en la Subárea 48.3 para *C. gunnari*, OTB. Capturas mensuales $\geq 75\%$ ($< 75\%$ en paréntesis).
- Tabla 12: Población (millones de especímenes) de *C. gunnari* (método Laurec-Shepherd).
- Tabla 13: Mortalidad por pesca para *C. gunnari* (método Laurec-Shepherd).
- Tabla 14: Biomasa de la población de *C. gunnari* (miles de toneladas), (método Laurec-Shepherd).
- Tabla 15: Pronóstico para 1989, $F_{OPT}=0.313$, *C. gunnari* (método Laurec-Shepherd).
- Tabla 16: Pronóstico para 1989, $F_{OPT}=0.42$, *C. gunnari* (método Laurec-Shepherd).
- Tabla 17: Pronóstico para 1989, $F_{OPT}=0.645$, *C. gunnari* (método Laurec-Shepherd).