

SHORT NOTE

INFORMATION ON THE STATUS OF FJORD *NOTOTHENIA ROSSII*, *GOBIONOTOthen GIBBERIFRONS* AND *NOTOTHENIA CORIICEPS* IN THE LOWER SOUTH SHETLAND ISLANDS, DERIVED FROM THE 2000–2006 MONITORING PROGRAM AT POTTER COVE

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Abstract

The long-term monitoring program of demersal fish at inshore sites of the South Shetland Islands has continued at Potter Cove from 2000 to 2006, extending a continuous sampling period of 24 years which began in 1983, and at Harmony Cove in the summers of 2001 to 2003. The decline in trammel net catches of fjord *Notothenia rossii* and *Gobionotothen gibberifrons* in relation to the non-commercially fished *Notothenia coriiceps* is still evident. At Potter Cove, despite an overall increasing trend of *N. rossii* catches from 1991 to 2006, the actual levels are half of those found in the early 1980s, while those of *G. gibberifrons* have further declined and remain close to zero. At Harmony Cove, the relative abundance of *N. rossii* showed an increase in 2002 and 2003, whereas *G. gibberifrons* was absent in the catches. These trends are consistent with those observed in scientific cruises studying the offshore populations in a similar period. No recovery of the stocks of *N. rossii* and *G. gibberifrons* was observed, more than two decades after the end of the commercial fishery.

Résumé

Le programme de contrôle à long terme des poissons démersaux des sites côtiers des îles Shetland du Sud s'est poursuivi à l'anse Potter de 2000 à 2006, prolongeant la période d'échantillonnage qui a vu le jour en 1983 et qui s'étend désormais sur 24 années, et à l'anse Harmony, pendant l'été, de 2001 à 2003. Le déclin de *Notothenia rossii* et de *Gobionotothen gibberifrons* des fjords par rapport à *Notothenia coriiceps*, espèce n'ayant pas l'objet de pêche commerciale, est toujours apparent dans les captures au trémail. A l'anse Potter, malgré une tendance générale à la hausse des captures de *N. rossii* de 1991 à 2006, les niveaux actuels ne correspondent qu'à la moitié de ceux du début des années 1980. Quant à ceux de *G. gibberifrons*, ils ont encore diminué et restent proches de zéro. A l'anse Harmony, l'abondance relative de *N. rossii* indique une augmentation en 2002 et 2003, alors que *G. gibberifrons* est absent des captures. Ces tendances confirment celles observées dans les campagnes scientifiques étudiant les populations du large pendant la même période. Plus de vingt ans après la fin de la pêche commerciale, les stocks de *N. rossii* et de *G. gibberifrons* ne donnent aucun signe de récupération.

Резюме

Программа долгосрочного мониторинга демерсальной рыбы на прибрежных участках Южных Шетландских о-вов продолжала проводиться в бухте Поттер в 2000–2006 гг., и т.о. период непрерывного сбора данных, который начался в 1983 г., составил 24 года, а также в бухте Гармони в летние месяцы 2001–2003 гг. Все еще

заметно снижение полученных с помощью многостенных сетей уловов фьордовых *Notothenia rossii* и *Gobionotothen gibberifrons* по сравнению с уловами *Notothenia coriiceps* при некоммерческом промысле. В бухте Поттер, несмотря на общую тенденцию к увеличению уловов *N. rossii* в период с 1991 по 2006 гг., фактические объемы составляют половину тех, что наблюдались в начале 1980-х гг., а уловы *G. gibberifrons* продолжали сокращаться и по-прежнему близки к нулю. В бухте Гармони наблюдалось увеличение относительной численности *N. rossii* в 2002 и 2003 гг., но *G. gibberifrons* в уловах отсутствовала. Эти тенденции соответствуют тенденциям, наблюдавшимся в научных рейсах по изучению популяций в открытом море в тот же период. Восстановления запасов *N. rossii* и *G. gibberifrons* не наблюдается, хотя прошло более двух десятилетий после окончания коммерческого промысла.

Resumen

El programa de monitoreo a largo plazo de los peces demersales en aguas 'inshore' de las Islas Shetland del Sur ha continuado en Caleta Potter desde 2000 a 2006, abarcando así un período de muestreo ininterrumpido de 24 años iniciado en 1983, y en Caleta Armonía durante los veranos de 2001 a 2003. Todavía se observa una disminución en las capturas de *Notothenia rossii* y *Gobionotothen gibberifrons* con redes de trasmallo, en comparación con la especie *Notothenia coriiceps*, que no ha sido explotada comercialmente. A pesar del aumento general de las capturas de *N. rossii* desde 1991 a 2006 en Caleta Potter, el nivel actual de esta especie corresponde a la mitad del nivel a principios de la década de los 80, mientras que el nivel de *G. gibberifrons* ha seguido disminuyendo y está cercano a cero. La abundancia relativa de *N. rossii* en Caleta Armonía aumentó en 2002 y 2003, mientras que no se registraron capturas de *G. gibberifrons*. Estas tendencias guardan relación con las tendencias observadas en las campañas de investigación científica dedicadas al estudio de las poblaciones 'offshore' en un período similar. No se observó una recuperación de los stocks de *N. rossii* y *G. gibberifrons*, luego de transcurridas más de dos décadas desde la finalización de finalizó la pesca comercial.

Keywords: commercial fishing, Nototheniidae, fjord fish, South Shetland Islands, CCAMLR

Introduction

The effects of commercial exploitation of finfish on Antarctic fish populations are well known (Kock, 1992). Around the South Shetland Islands (Subarea 48.1), the fishery operated from 1978/79 to 1989/90. A decrease in recruitment to the inshore subpopulations of *Notothenia rossii* and *Gobionotothen gibberifrons* in the South Shetland Islands was observed and attributed to the effects of the offshore commercial fishery in the area in the late 1970s (Barrera-Oro et al., 2000).

Monitoring of fish in inshore sites in the South Shetland Islands has continued in the austral summers from 2000 to 2006 at Potter Cove (PC), thus extending a continuous sampling period of 24 years which began in 1983, and from 2001 to 2003 at Harmony Cove (HC). By updating analyses of relative abundances of the nototheniids mentioned at these localities, this study aims to provide information on the status of the inshore populations of *N. rossii*, *N. gibberifrons* and *N. coriiceps*.

Materials and methods

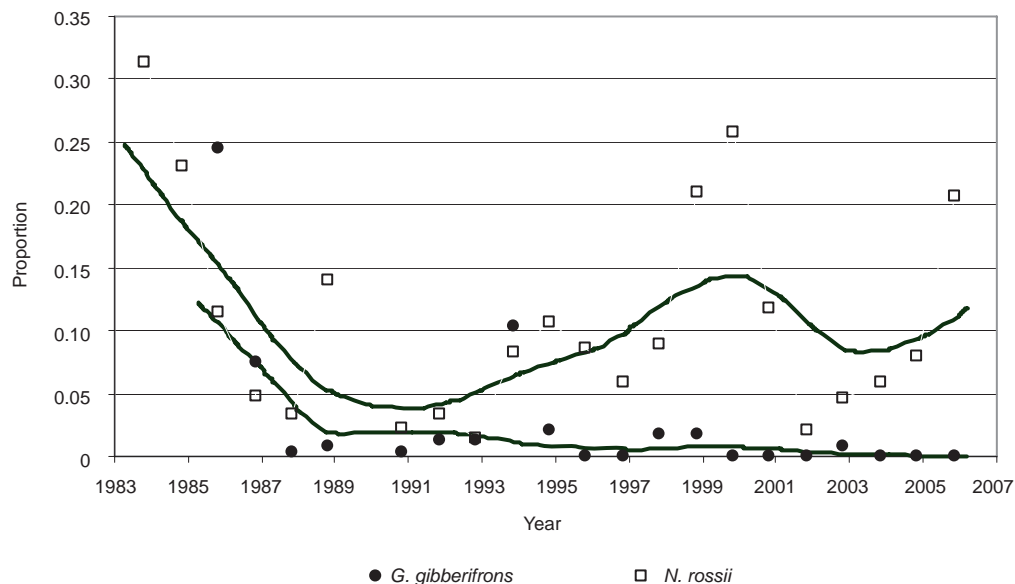
Fish were caught in two localities in the South Shetland Islands: at Potter Cove, King George/25 de Mayo Island, mainly in spring-summer from 2000 to 2006 and Harmony Cove, Nelson Island, in February 2001–2002 and March 2003. Precise locations and sampling are described in Barrera-Oro et al. (2000). Data from approximately 5 161 specimens (4 346 from PC and 815 from HC) of *N. coriiceps*, *N. rossii* and *G. gibberifrons* (this species was not recorded at HC) collected in 450 trammel net hauls (425 from PC and 25 from HC) are included in a single analysis of the total period from 1983 to 2006, applying the statistical methodology described previously (Barrera-Oro et al., 2000). The method uses *N. coriiceps* as a reference species to assess relative abundances of *N. rossii* and *G. gibberifrons*, which are analysed by fitting an ANOVA model and described using smoothing techniques.

Results and discussion

The results of one-way ANOVAs carried out separately for total and relative abundances per

Table 1: Results of the ANOVAs performed on total and relative catches of fish at Potter Cove.

Source	Sum of squares	Degrees of freedom	Mean square	F	P
(a) <i>Notothenia rossii</i> , total catches					
Years	19.8835	20	0.994173	14.6162	<0.00001
Error	59.3803	873	0.068019		
(b) <i>Gobionotothen gibberifrons</i> , total catches					
Years	9.8124	20	0.49062	42.9468	<0.00001
Error	9.9731	873	0.01142		
(c) <i>Notothenia coriiceps</i> , total catches					
Years	32.4684	20	1.623422	11.8377	<0.00001
Error	119.7232	873	0.137140		
(d) <i>Notothenia rossii</i> , relative catches					
Years	53439.18	20	2671.959	7.2979	<0.00001
Error	316700.16	865	366.1273		
(e) <i>Gobionotothen gibberifrons</i> , relative catches					
Years	14296.5242	20	714.826	21.3430	<0.00001
Error	28033.11	837	33.49237		


 Figure 1: Expected catches of *Notothenia rossii* and *Gobionotothen gibberifrons* relative to the catches of *Notothenia coriiceps*, by catch date (Epanenchikov kernel, bandwidth = 0.15), together with the observed split-year mean values.

haul at PC as response variables and the time factor (years) were highly significant (Table 1). The non-parametric regression of the relative catches of *N. rossii* and *G. gibberifrons* per haul and their means by each year are presented in Figure 1. It should be noted that these estimates have been smoothed and may consequently be biased.

A previous study at PC, from 1983 to 1999, showed a significant declining trend in the observed catches of *N. rossii* and *G. gibberifrons* relative to those of *N. coriiceps* (Barrera-Oro et al., 2000).

The observed relative abundances of *N. rossii* and *G. gibberifrons* declined from values of over 20% in 1985 to values of less than 5% in 1988. Since then, *G. gibberifrons* has remained at low levels, while *N. rossii* shows oscillations suggesting a possible recovery, with an increasing trend from 2002 to 2006 (Figure 1).

At HC, the observed mean of the relative abundance of *N. rossii* in the split-years 1995/96,

2000/01, 2001/02 and 2002/03 (0.05, 0.085, 0.203 and 0.275 respectively) show a similar increase, particularly over the last two years.

These observations are consistent with results from bottom trawl surveys in the area (summarised in Barrera-Oro et al., 2000; Jones et al., 2001, 2003; Kock et al., 2002). Since 1998, cruise results from the whole South Shetland archipelago show an extremely slow recovery of *N. rossii* from 1998 to 2003 and a declining trend in *G. gibberifrons* (Jones et al., 1998, 2001, 2003; Kock et al., 2002). This last finding is supported by the low proportion of juvenile *G. gibberifrons* (less than 30 cm) caught offshore (Kock et al., 2002).

It is important to note that these offshore cruises included the northeast shelf of King George/25 de Mayo Island, very close to the main inshore sampling sites: PC on King George/25 de Mayo Island and HC on Nelson Island.

Conclusions

The present results show that over the last six years the condition of these species has remained basically as described in Barrera-Oro et al. (2000). At PC, despite the increasing trend in *N. rossii* catches from 1991 to 2006, the actual levels are half of those found in the early 1980s, while those of *G. gibberifrons* remain close to zero. No recovery of the stocks of *N. rossii* and *G. gibberifrons* has been observed, more than two decades after the end of the commercial fishery.

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References

- Barrera-Oro, E.R., E.R. Marschoff and R.J. Casaux. 2000. Trends in relative abundance of fjord *Notothenia rossii*, *Gobionotothen gibberifrons* and *Notothenia coriiceps* at Potter Cove, South Shetland Islands, after commercial fishing in the area. *CCAMLR Science*, 7: 43–52.
- Jones, C.D., K.-H. Kock and S. Wilhelms. 1998. Results from the 1998 bottom trawl survey of Elephant Island and the lower South Shetland Islands (Subarea 48.1). Document *WG-FSA-98/15*. CCAMLR, Hobart, Australia: 31 pp.
- Jones, C.D., K.-H. Kock, D. Ramm, J. Ashford, S. Wilhelms, T. Near, N. Gong and H. Flores. 2001. Results and standing stock biomass estimates of finfish from the 2001 US AMLR bottom trawl survey of the South Shetland Islands (Subarea 48.1). Document *WG-FSA-01/33 Rev. 1*. CCAMLR, Hobart, Australia: 46 pp.
- Jones, C.D., K.-H. Kock, J. Ashford, A.L. DeVries, K. Dietrich, S. Hanchet, T. Near, T. Turk and S. Wilhelms. 2003. Standing stock, biology, diet and spatial distribution of demersal finfish from the 2003 US AMLR bottom trawl survey of the South Shetland Islands (Subarea 48.1). Document *WG-FSA-03/38*. CCAMLR, Hobart, Australia: 40 pp.
- Kock, K.-H. 1992. *Antarctic Fish and Fisheries*. Cambridge University Press, Cambridge: 359 pp.
- Kock, K.-H., C.D. Jones, J. Appel, G. von Bertouch, D. Doolittle, M. la Mesa, L. Pshenichnov, R. Riel, T. Romeo, S. Schöling and L. Zane. 2002. Standing stock estimates of finfish biomass from the 2002 *Polarstern* bottom trawl survey around Elephant Island and the South Shetland Islands (Subarea 48.1) with some notes on the composition of catches taken north of Joinville Island–D'Urville Island. Document *WG-FSA-02/24*. CCAMLR, Hobart, Australia: 42 pp.

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