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Bycatch rates in the West Greenland shrimp fishery, 1975–2010.

by

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Abstract

Bycatch in the West Greenland shrimp fishery from 1977 to 1984 was logged almost entirely as 'commercial' species, i.e. Atlantic cod, Greenland halibut and redfishes. Between 1984 and 2010 the 'commercial' proportion steadily declined, to about 10%. The 'commercial' bycatch is almost all redfish. Bycatch of *Pandalus montagui* has only been logged in recent years; recorded quantities fluctuate greatly between about 0.1% and 1% of the catch of *P. borealis.*

Introduction

The evolution of rates of finfish bycatch over time in the West Greenland fishery for Northern Shrimp *Pandalus borealis*, as indicated by captains' logbook records, has been analysed including data up to mid- to late November in 2010. In the course of evaluations of the sustainability of the fishery concerns have been expressed over the retained bycatch of the striped pink shrimp *P. montagui*. Its bycatch rate relative to the catch of the target species *P. borealis* is therefore also presented for the few years in which it has been separately reported.

Material and Methods

Available material consisted of logbooks from the fishery, keyed into machine-readable files. Types of catch, and their treatment, are identified in the logbooks by standard 3- and 4-character codes. They were grouped as follows:

- 'MR..', 'MS..', 'PR..', 'PS..', and 'AES' were grouped as shrimp catch, regardless of whether they were recorded as discarded.
- 'AES' was taken to represent striped pink shrimp.
- 'COD' and 'GHL' were treated as Atlantic cod and Greenland halibut.
- 'RED' and 'REB' were considered redfish; 'PED' was deemed to be a keying error for 'RED' and also treated as redfish.
- a range of other species were grouped as 'Other Commercial' species; they comprised Atlantic halibut, monkfish, rat-tails, (American) plaice, unspecified flatfish, catfish, wolffish, lumpfish, pollock, round-nosed grenadier, skates, and unspecified groundfish. 'Other Commercial' could therefore include some cod as unspecified groundfish, and also some Greenland halibut among the unspecified flatfish.

- all other species, including 'FIN'—unspecified finfish—were grouped as 'Other', i.e. non-commercial species. This group could therefore include commercial species not specified in the recording; also species, such as capelin and sand-lance, for which there are in some places commercial fisheries; and some invertebrates commercially fished in West Greenland, such as snow crab.

Logbook records of shrimp catches before 2004 were corrected for overpacking using the factors listed in assessment documents.

Bycatch rates were expressed as relative to the total shrimp catch. Redfishes dominated, so 3 different rates were calculated: a redfish rate, an overall rate for 'commercial' species, and an overall rate. Redfish bycatch was so dominant that it was also plotted relative to other bycatch groupings, to see whether its proportion of the bycatch had changed much over time.

Results and Discussion

The analyses here presented are of data recorded under two constraints. One is the lack of space for recording bycatch in the paper logbooks, which precludes detailed records, including records of the size of the fish caught and thereby of their number, and severely limits the amount of detail on the sorts of fish bycaught. The other is the general absence of objective weights for bycatch, either collectively or by sort; the weight data depends on a subjective estimate, usually the captain's.

There were no bycatch records in the files for 1975 or 1976, although shrimp catches had been recorded, so these analyses start in 1977. Something odd happened in 1999, in respect of either the recording or the keying of the data, which caused the bycatch records to be limited to a small amount of Greenland halibut and the data for that year was to such a degree inconsistent with the preceding and following years that 1999 was dropped. All other years were retained in the analysis.

Until the mid-1980s the recorded bycatch was almost exclusively of commercial species, and almost all of that was redfish (Fig. 1). This could well have been due to a belief that only bycatch of commercial species was important enough to record or report. After 1984 reporting of unspecified and non-commercial species began, and the proportion of total bycatch consisting of identified commercial species dropped abruptly from 100% in 1982–4 to about 70% in 1985–6. It has continued to fall steadily since then at an average rate of about 1.4 percentage points a year to reach about 20% in the most recent years. However, this has been a decreasing proportion of a more nearly constant total, and the reported bycatch rate of unspecified and non-commercial fishes has correspondingly increased. Recorded total bycatch since the turn of the century has been near 0.7% of the shrimp catch except in 2007 when it was about double that, largely due to a more than doubling of the unspecified and non-commercial.

Bycatch of commercial species was initially almost all redfish. The first records, from 1977–9, show bycatch rates of 13–21% averaging 98% redfish. After that, the rate of total bycatch dropped precipitously to range from 1.5 to 3% for two decades until about 2000. But records continued to show almost exclusively redfish, although cod did compose 15% of the commercial-species bycatch in one year, 1982. (Smaller increases in the cod fraction, in 1987–91 and in 2008, reflected short-lived, and minor, resurgences of the cod stock.) Between 1984 and 1987 redfish dropped to only about 70% of the commercial-species bycatch, more because of a drop in redfish bycatch than an increase in other species. Subsequently, the redfish proportion of the commercial-species bycatch has gradually worked its way back up again, although without regaining its former monopoly, and has recently fluctuated close to 95%. However, in 2010 the redfish proportion has dropped to 60%, owing to a decrease in redfish, and an increase in Greenland halibut, bycatches, to 25% and 236% of their means for the previous 10 years.

Bycatch rate overall was over 10% in the earliest records (Fig. 2). It dropped sharply to little over 1% in the early 1980s. Over the next two decades the total bycatch increased irregularly and slowly, reaching about 2½% by the late 1990s, while the bycatch of commercial species stayed more or less constant at about 1%; the proportion that was recorded as commercial species thus continually declining. At the end of the 1990s, apparently coindicent with the introduction of sorting grids, the bycatch rates of both commercial and non-commercial species dropped by a factor of 2 or slightly more. Since then, the recorded bycatch of commercial species has continued to decline, while

the total bycatch has stayed more nearly constant at about 1% of the shrimp catch. The most recent results show bycatch recorded as being of commercial species at about 20% of the total.

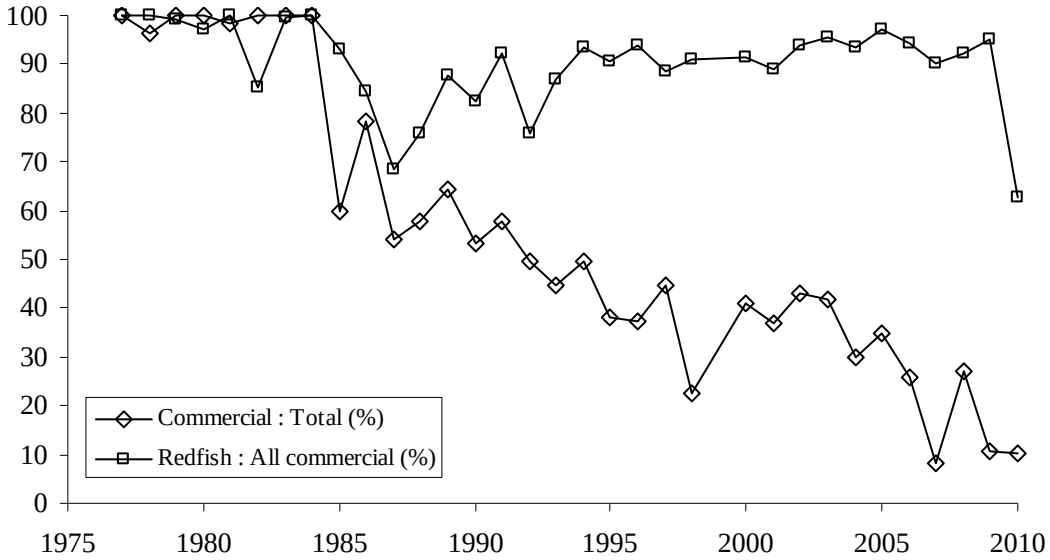

Fig. 1. Composition of bycatch in the West Greenland shrimp fishery 1977–2010: redfish as a proportion of all commercial species and commercial species as a proportion of all bycatch.

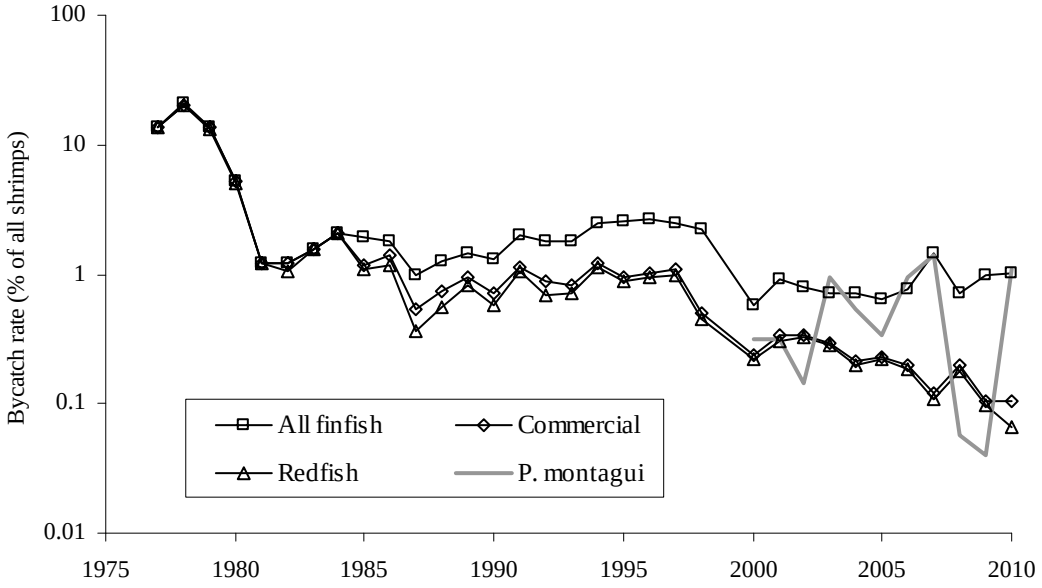

Fig. 2. Bycatch rates relative to catch of all Pandalid shrimps, in the West Greenland shrimp fishery 1977–2010, from fishermen's logbooks.

There were few records of catches of *P. montagui* before 2000. The West Greenland shrimp fishery targets *P. borealis*, and there is ostensibly no directed fishery for *P. montagui*; its presence in catches of *borealis* is said to reduce the price obtainable and excludes the catch from some markets. Some fleet segments, notably the coastal

fleet, record no *montagui* in logbooks, all their logbook entries being bulk *Pandalus*, even though this fleet segment clearly does fish in areas where *montagui* can be encountered. Catches of bulk shrimps landed in Greenland are sampled at the point of sale and the proportions of *borealis* and *montagui* are measured; while the *montagui* is included in the sale, albeit at a lower price, the quota drawdown is only the amount of *borealis* in the catch, but the logbook records are never corrected. Among the offshore fleet, practice appears to vary, with some vessels recording *montagui* in logbooks with unconvincing rarity. This complicates the interpretation of the raw statistics on the bycatch rate of *montagui*, which since 2000 appears to have fluctuated, more erratically than the bycatch of finfish, between about 0.04% and 1.4% of the total catch of Pandalid shrimps.

Although the bycatch of, and the effect of bottom-trawl fisheries on, hard corals and sponges have become a general concern in recent years and can be significant considerations in the evaluation of the sustainability of bottom-trawl fisheries—mitigative measures being also included in the Greenland management plan for the shrimp fishery—the available logbook records of these bycatches will not support any analysis.

These results must be qualified by the observation that the recording, and possibly also the keying, of the data have not been consistent over time. For example, the coverage of logbooks has not been uniform, but was extended to the smallest shrimp vessels, under 50 tons, only in the late 1990s. (Their catches, however, even in aggregate, being relatively small.) Also, the recording of bycatch is regarded as a subsidiary activity in completing logbook entries; there is little instruction on how to do it and less control on how it is done, so there is little consistency in defining different classes of bycatch, or when to record individual species or when to record aggregate weights. Smaller bycatch rates, as well, might induce fishermen to record less detail about the bycatch. Therefore, changes in proportions of the bycatch recorded might be deceptive. The keying of the data has been transferred from one institution to another in the course of this period; this may have caused the apparent omission of bycatch records in 1999.

The gear used has changed over time. Among other things, ground gear has been developed and brought into use that can fish effectively on a wider range of bottoms; this might well have had some effect on both the rate and composition of bycatches. Sorting grids to reduce bycatch have been introduced to trawl fisheries, and have been made mandatory for the W. Greenland shrimp fishery, although dispensations were long granted to smaller vessels for safety reasons. Grids were introduced in or shortly before 2000 and were reported (STACFIS report on NAFO website) as being mandatory in that year. A distinct drop in bycatch rate can be seen from 1987–88 to 2000. Bycatch rates are probably also affected by the catch rate of the target species; if it is low, then other things being equal bycatch rates relative to catch of the target species might be expected to be higher.

Bycatch is not often weighed. The logbook entry is usually the result of a subjective visual estimate. An EU project to verify the quantity of bycatch and the accuracy with which it is reported—by both captain and observer—found from observations, including the weighing of bycatch, by a scientific assistant of 166 hauls on 7 vessels in NAFO Divs 1B–1E in 2006–07, that reports by captain and observer tended to agree on the bycatch weight, but not necessarily at the correct value, that the presence of the scientific assistant probably affected the estimates made by the captain and the observer, and that the weighed bycatches were on average larger—at 1.2–3.2% of the shrimp catch—than logbook reports on average indicate (Sünksen 2007).

Conclusions

Logbook-reported total bycatch of finfish in recent years is about 1% of shrimp catch, and shows no trend upwards or downwards in recent years. The proportion of bycatch identified as being of commercially fished species is now about 20%, or about 0.2% of shrimp catch; this proportion has steadily decreased for the last two decades, but has little room to decrease any more; nearly all of it has been redfish in most recent years, with an exception in 2010.

The introduction of sorting grids appears to have had some effect in reducing bycatches, both of identified commercially fished species and of other, and unspecified, species. Reporting of bycatch in logbooks is based on subjective estimates and probably subject to errors, which may be large and which probably incorporate a bias.

The reported bycatch of striped pink shrimp *Pandalus montagui* is usually below 1% of the total shrimp catch, but fluctuates erratically, and is certainly under-reported, as some fleet segments report none. Measures to safeguard the stock of *P. montagui* would necessarily include the improving of catch records.

References

SÜNKSEN, K. 2007. Discarded by-catch in shrimp fisheries in Greenlandic offshore waters 2006–2007. NAFO SCR Doc. 07/88, Ser. No. 5474. 12 pp.