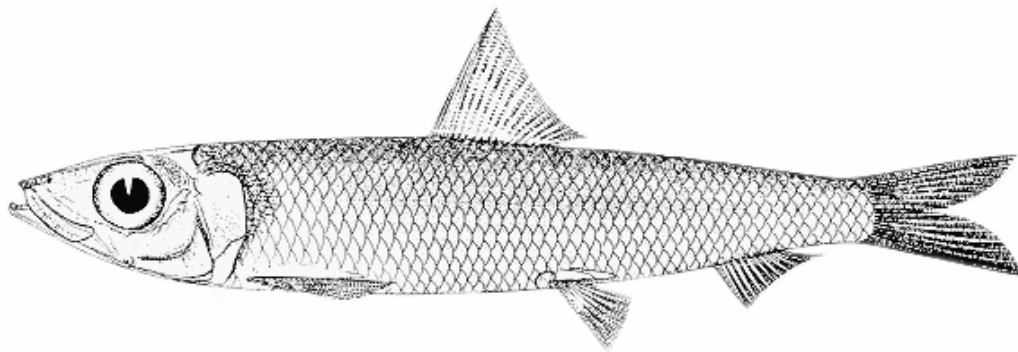


**An assessment of the fishery potential
for the redeye round herring (*Etrumeus
whiteheadi*) in the Eastern Cape**



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For the Eastern Cape Development Corporation

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Introduction

The redeye round herring (*Etrumeus whiteheadi*) is a common southern African endemic Clupeid (Heemstra & Heemstra 1993) that has been caught commercially in the pelagic fishery since 1958 (Van der Lingen 2003). Fishing effort has never been as focused on this species as it has been on other pelagic species such as anchovies and pilchards (Hutchings pers. comm. 2006, van der Lingen 2003) and consequently there is a general lack of literature regarding the redeye round herring (van der Lingen 2003). Relatively recent data obtained from hydro-acoustic surveys suggests that stocks are larger than once thought and that there is scope for the development of a dedicated redeye round herring fishery (van der Lingen 2003). This report forms a synthesis of published and unpublished information on the redeye round herring, providing background information on the species and exploring the potential for expansion of the fishery into the Eastern Cape.

Distribution

There is a single redeye round herring stock occurring over the continental shelf region from Walvis Bay on the west coast (Namibia) to about the Thukela River on the east coast (Armstrong *et al.* 1991, Heemstra & Heemstra 1993). Lower water temperatures along the east coast in winter are thought to allow this temperate species to extend its range northwards into the more tropical waters of KwaZulu-Natal (Armstrong *et al.* 1991). There is a tropical co-generic species, the east coast round herring (*Etrumeus teres*), found along the African east coast south to Durban (Heemstra & Heemstra 2003), and is thought to overlap distribution with the redeye round herring (Hutchings pers. comm. 2006, Mann pers. comm. 2006, van der Lingen pers. comm. 2006).

General biology

Feeding

Redeye round herring feed on zooplankton consisting mainly of euphassiids, decapods and large copepods (Roel & Armstrong 1991). Late juveniles and adults form dense shoals 15-20m from the sea bed during the day and rise into the upper water column to feed during the late afternoon. Once they reach the feeding zone the dense shoals disperse to feed during the night. At daybreak the fish coalesce into dense shoals and migrate back towards the sea bed (Roel & Armstrong 1991).



Growth

Typical of similar pelagic species, the redeye round herring is short lived and fast growing. Maximum size is reached at an age of 5.5 years and length of 205mm (Waldron *et al.* 1991) (Figure 1). Growth is fastest in its first two years, by which time the fish have almost reached 150mm in length.

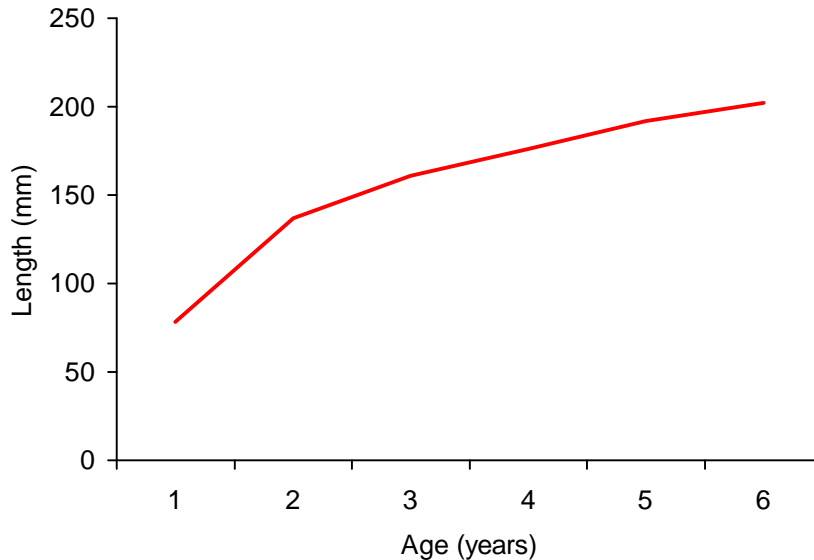


Figure 1. Length/age relationship for redeye round herring (adapted from Waldron *et al.* 1991).

Life history and reproduction

Redeye round herrings have an extended spawning period that peaks in the winter months (Armstrong *et al.* 1996, Roel & Melo 1990, Shelton *et al.* 1985). Eggs are pelagic and have been recorded throughout the fish's distribution range and seem to be most prolific along the 200m isobath, this is also the area where adults are most common (Roel & Melo 1990). Timing of spawning coincides with low pressure cells (cold fronts) and the associated winds cause a northwards advection of eggs and larvae up the west coast and a shoreward drift along the east coast (Roel & Armstrong 1991, Roel & Melo 1990). On the east and south coasts most of the 1-2 year old redeye round herring are found in the inshore region, as they grow older they migrate to deeper water offshore. Along the west coast the 1-2 year old fish migrate south with the southward moving Benguela counter currents (Roel & Armstrong 1991).

In this species 50% sexual maturity is reached at 145mm (Roel & Melo 1990), while 100% maturity is achieved between 160mm (Roel & Armstrong 1991) and 190mm (Roel & Melo 1990). This corresponds to an age of 2.5 years and 4.2 years respectively (Waldron *et al.* 1991) (Figure



1).

South African Fishery

History and current status of the fishery

Redeye round herring catches have been recorded in the pelagic fishery since 1958 (Figure 2) (Van der Lingen 2003). Catches have fluctuated between 10% and 30% of the total annual small pelagic catch (van der Lingen 2003). Fishing effort has never been as focused on this species as it has been for the other small pelagic species (anchovies and pilchards) and the fluctuations in catches can be correlated to changes in the Total Allowable Catch (TAC) for anchovies and sardines (van der Lingen pers. comm. 2006). For example the very high catch recorded in 1997 (92 200 tons) (Figure 2) was directly related to increased fishing effort being placed on the redeye round herring because the anchovy TAC for that year was zero (van der Lingen pers. comm. 2006). The drop in catches recorded between 1998 and 2005 (Figure 2) were as a result of an increase in the TAC for both pilchards and anchovies for those years (van der Lingen pers. comm. 2006). As pilchards and anchovies are easier species to catch the effort will turn to redeye round herrings when the TAC for small pelagics is increased.

There is a general lack of literature regarding the redeye round herring (van der Lingen 2003) and much of the published work on this species dates back to the 1980's and early 1990's (Crawford 1980, Shelton *et al.* 1985, Roel & Melo 1990, Roel & Armstrong 1991). More recently an unpublished MCM report suggests that although there is scope for the development of a dedicated redeye fishery other factors need to be considered before this is done (van der Lingen 2003). In the Draft Small Pelagic Policy, 2005 (DEAT 2005) the redeye round herring is described as an under utilised species.

At present the redeye round herring is not allocated a Total Allowable Catch (TAC) for each year, rather catches are regulated using a PUCL (Precautionary Upper Catch Limit) (van der Lingen 2003). The PUCL has been set at 100 000 tons per annum, this is 10% of the conservative estimate of stock size and has not been reached since the inception of the fishery in 1958 (Figure 2) (van der Lingen 2003). Most of the redeye round herring catch is recorded from February-May, there are two reasons for this:

- most of the pelagic fishing effort is concentrated on the west coast and this species is abundant along the west coast over the summer period,
- during this period trawlers would have to move further afield to locate anchovy or pilchard shoals, and so it is economically more viable to target redeye round herring shoals that are closer to the processing plants on the west coast (van der Lingen pers. comm. 2006, van der Lingen 2003).



There currently appears to be an eastward movement of pelagic fish stocks (anchovy, pilchard and redeye round herring). About 90% small pelagic fish are now found along the east coast, in contrast to this only about 20% of the populations were recorded in this area in 1987 (Hutchings pers. comm. 2006, Spies 2006 see appendix 1). This has implications for fish processing plants which were original positioned along the west coast to be as close as possible to the bulk of the pelagic shoals. If the current trend of eastward movement of small pelagic stocks continues, the cost of transporting wet fish from the south or east coasts for processing plants on the west coast will not be economically viable. Traditionally the pelagic fishery in the Eastern Cape has been very erratic and this has resulted in factories closing down and a reduction in the number of fishing vessels (Britz *et al.* 2001). If the trend towards an eastward movement of pelagic fish stocks continues, centres such as Port Elizabeth could find themselves in the middle of a fishery.

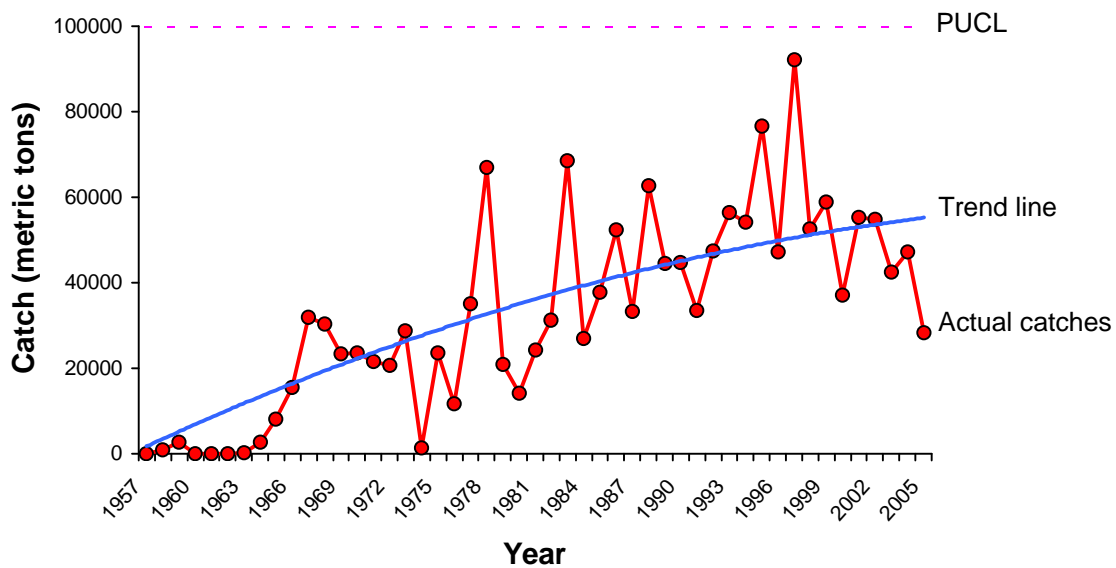


Figure 2. Annual redeye round herring catches in South Africa, 1957-2005 (data from MCM).

Stock size

Using data obtained from hydro-acoustic surveys, redeye round herring stocks were estimated to be between 1-2 million tons for the period 1998-2000 (van der Lingen 2003). Prior to this stock biomass estimates were lower because hydro-acoustic surveys were directed at the more inshore species of pilchards and anchovies. Stocks may in fact be larger than this estimate, but more extensive hydro-acoustic surveys need to be undertaken, especially in deeper water along the



continental shelf (Hutchings pers. comm. 2006). These surveys also indicated that although redeye round herring biomass increased off the west coast in summer, the bulk of the biomass during both winter and summer was recorded off the south coast (van der Lingen 2003). Marine and Coastal Management (MCM) hydro-acoustic surveys (2002 and 2003) extended up the east coast as far east as Port Alfred. During these surveys redeye round herring were recorded at up to 80g.m^{-2} , in the area between Port Alfred and Port Elizabeth. Between Cape Town and Mossel Bay concentrations of up to 800g.m^{-2} were recorded. Due to the scale at which these biomass estimates were recorded it is not possible to equate these to a possible catch estimate. However what this information does tell is that the redeye round herring do occur off the Eastern Cape coast, but fewer and probably smaller shoals are encountered here than are encountered on the southern Cape's Agulhas Bank (van der Lingen pers. comm. 2006).

Gear and fishing techniques

Redeye round herrings are targeted opportunistically when anchovies and/or pilchards are not present. Consequently they are caught with the same gear as is used for these other small pelagic fish. As a general rule it is the large trawlers (600t) that operate with very large purse-seine nets (400 fathoms long by 90 fathoms deep) (Figure 3a) that have the greatest success when it comes to catching this species (Hutchings pers. comm. 2006). However, smaller nets (230–260 fathoms long and 37.5–55 fathoms deep) have been used successfully (van der Lingen 2003). Shallow purse-seines have the disadvantage of closing over the back of a diving shoal. The redeye round herring is a strong swimmer and more difficult to catch than pilchards and anchovies (van der Lingen 2003, Hutchings pers. comm. 2006). Redeye round herring shoals tend to congregate in the late afternoon as they rise into the upper surface column for overnight feeding. Once in the feeding zone they disperse until early morning when shoals congregate again before descending for the day. Successful skippers are able to time net deployment to coincide with when fish form their densest shoals (Roel & Armstrong 1991, Hutchings pers. comm. 2006).

Previous attempts to target this species on the South African south coast during the day (when shoals are formed near the bottom), used very deep seine nets (200 fathom) and a modified paired stern trawl (Figure 3b), however both these methods proved ineffective (van der Lingen 2003).



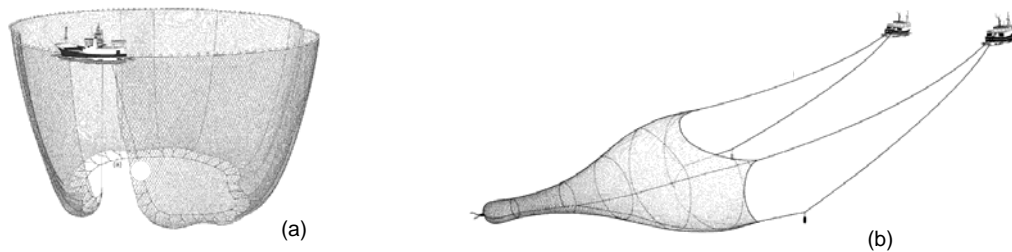


Figure 3. (a) Purse-seine, (b) paired stern trawl.

A problem to fishing the redeye round herring along the Eastern Cape coast is the warm water temperatures experienced over summer. The upper temperature tolerance for this species is thought to be about 20°C (Waldron *et al.* 1991). Redeye round herring are thought to exist for the entire year in the eastern coastal regions of the Eastern Cape, but during warm water conditions in summer they will remain below the thermocline until temperatures drop in the upper water column.

Bait fishery

At present there is no dedicated bait fishery associated with the redeye round herring. In KwaZulu-Natal the east coast round herring is targeted by line anglers to use/sell as bait (Mann pers. comm. 2006). Recently an exploratory permit was issued to target the east coast round herring in Natal. This permit was granted under certain conditions, some of these are:

- only a small purse-seine will be used,
- net deployment will only be from a ski-boat,
- a total catch of 100 tons per annum,
- to avoid conflict with other rights holders there is to be no fishing during the annual 'sardine run' .

Hearsay suggests that the redeye round herring is not as good a bait species as the east coast round herring (van der Lingen pers. comm. 2006). This may however be as a result of redeye round herring not being caught specifically for bait and not chilled/frozen on capture (Hutchings pers. comm. 2006).



Utilisation of catch and market trends

Fish meal/canning fishery

The main use for redeye round herrings is for its inclusion into fish meal. Oil extraction and canning of this species have not produced high quality products (Hutchin pers. comm. 2006, Malherbe pers. comm. 2006). However, if caught by vessels with cooling facilities canning is a possibility (van der Lingen, 2003). Raw fish give about a 23% yield of fish meal *i.e.* about 4350kg of raw fish is needed to produce 1000kg of fish meal. The worldwide demand for fish meal has increased dramatically in the last three years as a result of an increased demand for fish food in the Asian aquaculture industry coupled with poor fish catches in the South American (esp. Peruvian) and Scandinavian fisheries. Current world market fish meal prices fluctuate between R6000-R6500 per ton, depending on the rand/USD exchange rate, because of this it is expected that at least 50% of the fish meal being produced in South Africa this year will be exported (Malherbe pers. comm. 2006). In contrast to this about 15-20% of fish meal produced in South Africa in 2005 was exported and 10% of South Africa's production was exported in 2004. On the local market, fish meal is fetching R5800 per ton. Due to the growing demand for fish meal it is anticipated that there will still be a world wide demand for fish meal even when Peruvian and Scandinavian fish stocks recover (Malherbe pers. comm. 2006).

Bait Fishery

Currently individual east coast round herring in KwaZulu-Natal are retailing at R3-R4 per fish supplied to recreational fishermen. Although relatively small amounts of fish are being sold it is probably the highest price paid per weight for pelagic fish any where in the world (van der Lingen pers. comm. 2006). As yet no figures are available on how much is being caught (van der Lingen pers. comm. 2006).

Fishery options in the Eastern Cape

Fishing rights for small pelagics have been allocated for the next ten years, therefore to immediately obtain rights and a quota for small pelagics in the Eastern Cape will not be possible (van der Lingen pers. comm. 2006). However, there are two other options to consider if wanting to exploit the redeye round herring in the Eastern Cape:

- apply for an exploratory fishing permit,
- form an agreement/partnership with an existing rights holder.



Experimental fisheries, new fisheries and exploratory fishing permits

An exploratory fishing permit can be awarded to an individual who has seen an opportunity for utilizing an under exploited resource, and has approached MCM with a proposal on how to exploit the resource. Experimental fisheries form part of the 'establishment of a new fishery' process set out by MCM. The 'establishment of a new fishery' is a department (DEAT:MCM) driven initiative that will call for interested applicants who would like to tender for participation in the experimental fishery.

New and experimental fisheries

The Department of Environmental Affairs and Tourism, branch Marine and Coastal Management has released a final version policy document for the establishment of new fisheries in South Africa (Appendix 2, DEAT 2006). In this final policy the Department has described a new fishery as:

'A new fishery is a regulated fishery that exploits a resource or part of a resource that has not previously been managed by the state as a commercial fishery. It also includes previously unexploited resources, under exploited resources that had hitherto been a bycatch of another fishery, or fully exploited or even overexploited resources that had hitherto not been subject to any management control' (DEAT 2006).

The 'New Fisheries Policy' lays out a three-phased development framework outlining the steps to be taken when developing a new fishery, part of this framework includes an experimental fishery.

The three phases of the process are:

- Phase 0, an information gathering phase (possibly including an exploratory fishery),
- Phase 1, an implementation of experimental fishery phase,
- Phase 2, a commercial fishery phase.

More detail of the steps within each of these phases appear in the 'New Fisheries Policy' appended to this document (DEAT 2006, Appendix 2).

The redeye round herring is certainly considered an under exploited resource (van der Lingen 2003), although it can not be considered a bycatch of the small pelagics fishery as it is targeted at certain times of the year. The stock is protected by a PUCL that has never been achieved, and this suggests that there is scope for a new fishery, especially in the Eastern Cape where there is very little effort concentrated on catching redeye round herrings. Although van der Lingen (2003) regards the redeye round herring as under exploited he does not necessarily consider the initiation of a dedicated fishery to be a viable option, for the following reasons:



- the fishery would have a by catch of adult pilchards (already allocated a TAC),
- the development of a new fishery will result in a general increase in effort and, if the new fishery proves to be unsustainable then there will be pressure to move the capacity allocated to the new fishery to other species (e.g. pilchard/anchovies), thus possibly over fishing these stocks,
- the ecosystem impacts of a redeye round herring fishery on other commercially important species, both consumptive and non-consumptive, are not known (e.g. snoek, hake, seals, cetaceans),
- preliminary modeling suggests that further exploitation of redeye round herring stocks may have indirect trophic effects, negatively influencing horse mackerel abundance.

For the above reasons it seems unlikely that MCM will initiate the 'establishment of a new fishery' for redeye round herring.

Exploratory fishing

*'This refers to a situation in which an entrepreneur has approached the Department with an original idea to utilize an unexploited or **underexploited** resource'* (DEAT 2006, Appendix 2). Exploratory fishing permits are issued for a limited time and/or catch volume. Stipulations are that a desk top study (Phase 0 step 1 of the 'new fisheries' framework) of the species concerned is undertaken and that if the permit is granted then relevant biological data must be collected. Other stipulations prior to the permit being issued include, previous fishing experience, vessel ownership and fishing gear. The allocation process is closed and there is no guarantee to right of entry into an experimental phase or commercial phase if a new fishery is initiated. The contribution of the exploratory fishing entrepreneur will be taken into account if the process proceeds beyond the exploratory fishery (DEAT 2006, Appendix 2). Redeye round herring are underexploited (van der Lingen 2003) and could qualify for an exploratory fishing permit.

Agreement with an existing rights owner

Assuming access to a fish processing plant in the Eastern Cape is a less complicated and perhaps economically safer approach for exploiting the redeye round herring would be to 'sponsor' a trawler to operate in the Eastern Cape. The trawler would have to already fish for an existing pelagic fishing rights holder so that quotas are not in question. The processing plant would then purchase wet fish from the rights holder at a market related rate. Current redeye round herring price may reach as much as R260 per ton (Malherbe pers. comm. 2006). The wet fish price is usually about 4% of the current fish meal price (R6000 - R6500 per ton).



Assuming processing facilities, there are a number of advantages to proceeding this route rather than applying for an exploratory fishing permit:

- start up time will be reduced,
- initial capital outlay will be less (no trawlers/equipment would need to be purchased),
- if the venture fails, only employees on the processing side of the operation will be affected,
- a permit holder is not limited to catching redeye round herrings but can also target pilchards, thus possibly boosting catches,
- the 'sponsored trawler' can be used to establish if it is possible to harvest redeye round herrings in enough quantities to make an operation viable in the Eastern Cape,
- biological information needed for obtaining an 'exploratory permit' or 'establishing a new fishery' can be collected,
- If the trend towards the eastward movement of pilchard and anchovy stocks continues (Hutchings pers. comm. 2006, Spies 2006, Appendix 1), then there will be an incentive for trawlers to operate in the Eastern Cape. There will also be a need for processing plants on the southern and east coasts.

Bait fishery

Considering the retail price (R3-R4) received per fish sold into the recreational fishing industry in KwaZulu-Natal, it is certainly worth investigating a similar type of fishery in the Eastern Cape. The fishery would be very small compared to a fish meal fishery, and subsequently would have less impact on redeye round herring stocks. Considering that the redeye round herring is regarded as underexploited, an application to MCM for an exploratory fishing permit would be justified. Alternatively the bait fishery could be developed as a side line to the fish meal industry. For a bait fishery to be successful it is absolutely critical that landed fish be chilled/frozen as soon as possible. Quality of this particular species deteriorates very quickly when not chilled/frozen soon after capture (Hutchings pers. comm. 2006, Mann pers. comm. 2006).



Conclusion

Redeye round herring can be considered an under exploited resource, however the ramifications of a dedicated fishery on the stock and on other consumptive and non-consumptive resources are not known. The present stock control method of setting a PUCL seems to be a conservative way of protecting a stock that is not very well researched and that forms a portion (up to 30%) of the catch of a large pelagic fishery. There is reason to believe that there is a viable industry surrounding the exploitation of this species in the Eastern Cape. However the greatest challenge will be to catch enough fish to make this industry economically viable there are a number of reasons for this:

- redeye round herring are most abundant in deep, cool water associated with the continental shelf,
- redeye round herring do not always form dense shoals, aggregations at a depth where they can be caught are formed late in the day or early in the morning before vertical migrations are undertaken,
- warm surface water temperatures in summer discourage fish from moving above the thermocline,
- redeye round herring are strong swimmers and are often able to avoid nets that would easily catch pilchards or anchovies.

In conclusion there are two options suggested to exploiting the redeye round herring in the Eastern Cape:

- Apply for an exploratory fishing permit for the Eastern Cape, if granted and if the fishery proves viable this would be a good platform from which a new fishery could be initiated. Both fish processing for fishmeal and a small bait fishery could be considered. This application would motivate for an exploratory fishery on the basis that the redeye round herring is underexploited.
- Encourage an existing pelagic fishery permit holder to operate in the Eastern Cape and initially develop the fish processing (fishmeal or bait) side of the industry. If successful this could be used as a platform to launch an exploratory or new fishery.



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Appendix 1

Article appearing in 'The Herald' – 23 August 2006

www.theherald.co.za/herald/2006/07/10/news/n10_10072006.htm

Difficult times facing west coast fishing industry, plants

By Derrick Spies

THE pelagic fishing industry on the west coast could be facing difficult times as research indicates an eastward migration among pilchards and anchovy stocks.

This is the warning from Marine and Coastal Management researcher Dr Larry Hutchings who said there had been a significant change in the pelagic fish distribution along the coastline, with the number of pilchards in particular found east of Cape Agulhas increasing from around 20 per cent of the population in 1987 to making up nearly 90% in 2005.

Hutchings said it was not possible to single out a specific reason for the shift, but rather believed it could be attributed to a number of factors. "One could be a depletion of stocks on the west coast, because the stocks in this area have been over fished," he said.

Hutchings said this was because most of the packaging plants were based on the west coast, and it was more cost effective to harvest schools of fish closer to the plants.

"The running costs of a vessel are high, so the less they have to travel between where the catch is and the processing plant, the better the return."

Hutchings said there could, however, be other reasons for the migratory pattern.

"We have also noticed that there has been a much higher number of fish spawning (breeding) east of Cape Agulhas since 1998, and this trend has continued as all subsequent adult fish return to the area where they were born to spawn."

Hutchings said this resulted in the fish replenishing the schools on the east coast, while fewer fish bred on the west coast.

He also pointed out that recent climate changes could be playing an important role in the movement.

"There has been a marked increase in sea temperature on the west coast, varying between



0,5°C and 1°C, which is quite significant in terms of the marine ecosystem preferred by these fish," he said.

Hutchings said pilchards and anchovies were known to prefer cooler pockets of water.

The shift eastwards had also been noticed among the west coast rock lobster, said Hutchings, with the population between Port Nolloth and Saldanah Bay dropping from some 80% of the total catch in 1968/69 to less than 10% of the total catch in 2004/05.

At the same time, lobsters caught between Cape Point and Gans Bay, on the south coast, had gone from 10% of the total in 1968/69 to roughly 60% of the catch in 2004/05.

"What we need to determine is whether this is merely a temporary shift, or if this trend will continue into the foreseeable future, as it has a direct impact on the fishing industry," he said.

If the migration eastwards is a permanent trend, it might mean fish processing plants would have to relocate to the south coast as well, in order to maximise their productivity and reduce shipping costs.



Appendix 2

