APPENDIX E

REPORT OF THE WORKSHOP ON THE MANAGEMENT OF THE ANTARCTIC CRAB FISHERY

(La Jolla, California, USA, 26 to 28 April 1993)

REPORT OF THE WORKSHOP ON THE MANAGEMENT OF THE ANTARCTIC CRAB FISHERY

(La Jolla, California, USA, 26 to 28 April 1993)

OPENING OF THE MEETING

1.1 The Workshop was held at the Southwest Fisheries Science Center, La Jolla, California, from 26 to 28 April 1993. The Convener, Dr R. Holt (USA) chaired the Workshop.

1.2 The participants of the Workshop were welcomed by the Director of the Southwest Fisheries Science Center, Dr M. Tillman, on behalf of the US Government.

ORGANISATION OF THE MEETING AND APPOINTMENT OF RAPPORTEURS

1.3 The following were appointed rapporteurs:

Dr R. Holt, Agenda Items 1, 6, 7, 8 and 9;
Dr R. Otto (USA), Agenda Item 2 (i) to (iii);
Dr I. Everson (UK), Agenda Item 2 (iv);
Dr M. Basson (UK), Agenda Item 3;
Dr A. Rosenberg (USA), Agenda Item 4; and
Dr D. Agnew (CCAMLR Secretariat), Agenda Items 5 and 6.

A list of participants is given in Attachment A. A list of papers tabled at the meeting is given in Attachment B.

ADOPTION OF THE AGENDA

1.4 A draft agenda had been prepared by the Convener and the CCAMLR Secretariat. This agenda was adopted and is included as Attachment C.

BACKGROUND OF THE MEETING

1.5 Following notification to the Commission by the United States in 1991 of a potential new fishery for Antarctic crab *Paralomis* in Subarea 48.3 (CCAMLR-X, paragraphs 6.7 to 6.12), a fishery operated in Subarea 48.3 from July to November 1992.

1.6 The Scientific Committee had recommended that a conservative management strategy be followed in the development of the fishery for the species, and had recommended a series of measures to manage the fishery in this stage of its development.

1.7 The Commission requested the Scientific Committee to develop a Longterm Management Plan for the Exploratory Crab Fishery. This CCAMLR Workshop was asked to specify the data needed and the actions required to acquire the relevant information from the exploratory crab fishery that will allow the estimation of appropriate harvest levels and methods in accordance with Article II of the Convention, for review by the Scientific Committee (CCAMLR-XI, paragraphs 9.48 to 9.50).

OBJECTIVES OF THE MEETING

1.8 The objectives of the Workshop (SC-CAMLR-XI, paragraph 4.17) were:

(i) to design an approach to management of this fishery that will enable WG-FSA to measure:

(a) the productivity and abundance of the stock; and
(b) the effect of different harvest strategies;

(ii) to establish the types and scale of data necessary to implement the above approach to management; and

(iii) to establish reporting requirements for the fishery.

INFORMATION ON THE *PARALOMIS SPINOSISSIMA* STOCK

Biological Characteristics

2.1 A summary of the types of data discussed in this section, their methods of acquisition and priority for acquisition is given in Table 1.

2.2 The Workshop considered available information on *Paralomis* spp. contained in WS-Crab-93/4, 24 and 25 as well as WG-FSA-92/29. The working group noted that two species of *Paralomis* are found in Subarea 48.3. *Paralomis spinosissima* is of major concern as this was the target species during the 1992 fishery but *Paralomis formosa* is also found in abundance and may be of commercial interest in the future.

2.3 The two species have similar geographic distributions and are known from the Scotia Sea north to the Atlantic continental shelf waters of South America. They are not known from the eastern Atlantic or from Pacific Ocean waters. Available records summarized by Macpherson (WS-Crab-93/25) show *P. spinosissima* occurs in areas west of 34° longitude ranging north to 46°S latitude at depths of 132 to 824 m. *Paralomis formosa* ranges north to about 37°S latitude and is found at depths to 1 600 m. Records from a Spanish trawl survey in 1987 and 1991 show that both species occur to the south of South Georgia (56°S) (WS-Crab-93/19) but were not found at South Orkney or the South Sandwich Islands. Little is known of their abundance in areas outside Subarea 48.3. Suggestions for research on biological parameters and data collection expressed in this report largely apply to both species although only *P. spinosissima* is considered here.

2.4 The genus *Paralomis* is in the family Lithodidae, anomuran crabs closely allied to the hermit crabs. The family includes the genera *Lithodes* and *Paralithodes* which are commonly known as king or stone crabs and contain species that provide important commercial fisheries world wide. The genus *Paralomis* is known from all the World's oceans except the Arctic and is usually found at extreme depths. In the Southern Oceans members of the genus are, however, found in continental shelf and slope waters. *Paralomis granulosa*, for example, is harvested in Chile and to a lesser extent in Argentina as well as the Falkland Islands.

2.5 Anomurans differ from the true crabs (Brachyura) in that females lack spermathecae and cannot store sperm during mating and fertilize eggs at a later time. Female anomuran crabs mate and extrude eggs immediately after moulting with fertilization occurring during or immediately after extrusion. The abundance and size of mature males relative to that of females may be more important in fishery management of anomuran crabs than it is in the management of brachyurans. This is especially true if the moulting-mating season is relatively short. The correlation between moulting and mating times may also influence the timing of fishing seasons.

2.6 The Workshop considered available information on reproduction in *P. spinosissima* in Subarea 48.3 and noted the following:

(i) Size at maturity is probably lower at Shag Rocks than at South Georgia Island. Chela allometry indicates that males mature at about 66 mm carapace length at Shag Rocks and 75 mm at South Georgia Island. Differences in female size at maturity (based on the frequency of ovigerous specimens by size group) were less apparent; 50% of the females were carrying eggs at a size of 62 mm carapace length (data combined from both locations). The minimum and average sizes of ovigerous females were, however, smaller at Shag Rocks than at South Georgia Island. Determination of size at maturity was difficult due to the high frequency of rhizocephalan parasites. The size of ovigerous females is directly proportional to functional maturity. There was some discussion of the possibility that morphometric maturity as determined for males may not be directly equatable to the size at which males actually participate in mating and are hence functionally mature.

(ii) Field and subsequent microscopic observations of embryos being brooded by females during July 1992 suggest that mating probably occurs over substantial portions of the year. Developmental stages ranged from external eggs showing only the formation of blastodiscs, to those that had completed development and were in the process of hatching. Females carrying only the remnants of hatched eggs were also commonly encountered. While these observations are indicative of a protracted spawning period, in the absence of seasonal monitoring it is not clear whether spawning within the population occurs throughout the year . If there is a seasonal component to the frequency of spawning, its timing may influence spatial distribution of males relative to females and the frequency of moulting.

(iii) The number of newly fertilized eggs in *P. spinosissima* ranged from approximately 2 000 to 14 000 and increased exponentially with carapace length. The relationship between fecundity and size was compared to that for *Lithodes aequispina* from the Aleutian Islands. While fecundity in *P. spinosissima* is an order of magnitude lower than many other crab species, at any given size average fecundity in *P. spinosissima* is higher than that for *L. aequispina*. Participants noted that recruitment in other crab and crustacean populations is highly variable and not necessarily well related to population egg production. However, the importance of fecundity observations and their application to understanding stock/recruitment relationships should not be ruled out for *Paralomis* spp. Also, participants noted that it would be desirable to describe the relationship between numbers of brooded embryos and body size at later stages of embryologic development in order to estimate the number of larvae hatched.

(iv) Data on the diameter of oocytes relative to the developmental stage of brooded embryos indicated that spawning does not immediately follow hatching in *P. spinosissima*. If it is assumed that embryologic development lasts for one year and that vitellogenesis occurs at a roughly constant rate, then the spawning cycle may approach two years. This would be similar to spawning cycle of *L. aequispina* which has a similar depth range in the North Pacific, an embryologic period of one year, similar egg size and is capable of lecithotrophic larval development. The possibility that *P. spinosissima* has lecithotrophic, benthic larvae was discussed as this sort of life history may influence stock/recruitment relationships.

2.7 Apart from the above reproductive data and limited information on size frequency, participants noted that there was very little life history, ecological or demographic information available. Due to the limited area that has been fished and from which biological data has been collected, considerable attention should be given to areal differences in all parameters.

Distribution and Stock Identity

2.8 The Workshop considered data presented in documents WS-Crab-93/17, 19, 24 and 25 as well as WG-FSA-92/29. It was noted that the Spanish trawl survey of continental shelf and slope waters of the Scotia Arc encountered crabs only at South Georgia Island and Shag Rocks. It was agreed that CCAMLR Members should attempt to assemble existing, unpublished, information on the geographic distribution of crabs in the Southern Oceans.

2.9 Differences in mean size and the size at maturity between Shag Rocks and South Georgia Island suggest that discrete stocks may exist. Discussions indicated that comparative morphology and demographic studies were most generally used to identify stocks of crabs and that recent studies were proving the utility of genetic techniques in stock identification. Tagging studies have also been used to delineate stocks for the purposes of fishery management. It was generally agreed that differences in demographic characteristics were frequently sufficient to warrant separate treatment of populations inhabiting various grounds even if populations could be considered as parts of the same interbreeding unit (deme) genetically.

2.10 The Workshop suggested that in addition to biological and fishery data collection, oceanographic data also be collected. If this is available from other sources it should be interfaced with the biological data. Most crab populations show significant changes in size over time, which may be related to environmental factors. Data on seasonal water temperatures and probably current patterns are desirable. These data could be best obtained by established hydroacoustically released gear. Expendable Bathy Thermographs (XBTs) give a snap shot of conditions at a given time, but given the limited commercial effort, would probably be insufficient in quantity to provide a useful time series of data.

Demographic Characteristics

2.11 Participants agreed that information on size-specific growth, mortality and stock abundance was most important at the moment. At present these elements can most easily be estimated by analogy with other species and stocks. The interaction of reproductive and life history parameters with stock/recruitment relationships was discussed as was the importance of parasitism. Participants agreed that the acquisition of demographic information would be influenced by the selectivity of pots in the fishery. Comparative fishing experiments between pots with small and large mesh size and between pots and trawls were suggested.

Parasitism

2.12 Investigations during the experimental crab fishing study had indicated that in some areas a very high proportion of the *P. spinosissima* were parasitised by rhizocephalan*. Microsporidian infections were also found but at much lower incidence. The incidence of infection was greatest in small individuals of both sexes and was more prevalent at South Georgia than at Shag Rocks. These parasites were not found in *P. formosa* (WG-FSA-92/29). Incidence of rhizocephalans and microsporidians is probably underestimated as early stages of infection are cryptic.

2.13 The implications on the *P. spinosissima* population of this rhizocephalan infestation were considered in the study described in WS-Crab-93/7 and supported by more general models in WS-Crab-93/9. The following conclusions had been drawn in this study:

(i) the spawning stock of a population with a high prevalence of rhizocephalan infestation is likely to be below the spawning stock of an uninfected population;

(ii) the spawning stock ratio (exploited SSN**/unexploited SSN) decreases as fishing mortality increases when only healthy animals are harvested. This is also true in the absence of parasitism but the 'starting point' or the unexploited level of spawning stock is lower when there is any infestation; and

(iii) when healthy and parasitised animals are harvested the spawning stock ratio decreases less rapidly than is the case when only healthy animals are harvested and in some cases there may be an increase in the spawning stock for relatively low levels of fishing mortality.

---

* genus Briarosaccus class Cirripedia, phylum Crustacea

** SSN = Spawning Stock Number

2.14 It was noted that in modelling the situation it was important to take account of the recruitment dynamics of the parasite and host. This in turn meant it was important to determine the larval distribution and be able to determine stock identity.

2.15 Even though the rhizocephalan tends to cause feminisation in *P. spinosissima*, it was noted that there was a higher prevalence of parasitisation in males than females. During the field study presence of pleopods had been taken as diagnostic that the crab was female.

2.16 A significant proportion of the rhizocephalans were themselves infected by an undescribed species of isopod. The dynamics of this hyperparasitisation were unknown and merit analysis through extension of models in WS-Crab-93/7 and 9.

2.17 Even though the majority of the rhizocephalan infected *P. spinosissima* were smaller than the minimum size adopted in WG-FSA-92/29, it was agreed that destroying infected individuals is more likely to have an overall benefit to the crab population. It was considered that there was no chance of further infection if such crabs were crushed and returned directly to the sea.

2.18 Infection by the rhizocephalan is thought to occur during the immediate post-moult period. The externa, the external manifestation of the parasite, becomes visible some months later.

2.19 No information was available to indicate whether high levels of parasitisation were a localised or widespread phenomenon. Information on this topic could be obtained by analysis of data on infestation rates on a haul-by-haul basis taking account of the location of the catches.

2.20 The prevalence of rhizocephalan parasitism undoubtedly influences demographic characteristics and stock recruitment relationships in any stock that may be defined. This host-parasite interaction should be more extensively modelled to predict its influence on demographic characteristics and yield.

ASSESSMENT METHODS

3.1 Various assessment methods that have been used in other crustacean fisheries and that may be applicable to the *P. spinosissima* and *P. formosa* fishery in Subarea 48.3 were identified. The methods can be grouped as follows:

depletion methods;
change-in-ratio and index-removal methods;
size/length-based assessment analyses;
calibration of abundance indices;
production models; and
yield-per-recruit.

These methods, with the exception of yield-per-recruit, are discussed in turn and their main assumptions, data requirements and outputs are summarised in Table 2. For all of the assessment methods described below estimates of uncertainty of current stock status should be made and sensitivity to underlying assumptions and data quality should be explored.

3.2 These methods can be divided into two groups. The first group (depletion, change-in-ratio, index-removal, size/length-based assessment, and production model methods) require that the fishery substantially reduces the population from the study area since it is the change in the population due to known removals that is the basis of the estimation. The second group does not require that the fishery reduce the population size.

Depletion Methods

3.3 Depletion methods (also referred to as Leslie-De Lury methods) can, in theory, be applied to aggregated data over a whole fishing season or several years to obtain estimates of total population size. In the context of the crab fishery at South Georgia, it is at this stage more appropriate and feasible to consider local depletion models applied to data at a finer temporal and spatial scale.

3.4 Local depletion models use commercial catch-per-unit-effort (CPUE) and cumulative catch data to estimate local population densities in relatively small areas. These density estimates can then be used to extrapolate to a population size over a larger area if data on distribution of the stock are available. The main assumptions are that CPUE is proportional to the density and that the population is closed over the period considered in the analysis. The second assumption can often be relaxed though additional information may be required.

3.5 It is important that an appropriate measure of effort is used when constructing CPUE. Soak time of pots may, for example, have to be taken into account if there is any relationship between catch per pot and soak time or if there is any sign of saturation. The aggregated data on catch per pot and average soak time presented in WS-Crab-93/24 seem to show some form of saturation in catch rate at a soak time of around 30 hours. Saturation can be due to many effects, for example, degradation of bait, and is usually determined from field studies.

3.6 Ideally, catch/effort data should be on as fine a spatial and temporal scale as possible. This is particularly relevant in this case because the level of effort is currently relatively low. Data at a coarse scale of, for example, 10-day periods by gridsquare (1° longitude by 0.5° latitude) may disguise any depletion occurring at a finer scale.

3.7 Some participants felt sceptical about the possibility of detecting any depletion effects, even on a local scale. Firstly, this is because there is a possibility that spawning and moulting are protracted for this species. Secondly, there is a single vessel in the fishery and it would tend to avoid depletion. The first issue can be addressed by developing a variation of the standard depletion method to take growth and recruitment into account, though this would clearly require additional information.

3.8 The second issue could be addressed by using an experimental approach. One possibility may be to request the fishing vessel(s) to do repeated sampling by settings of many strings in a relatively small area over a short period of time. Catch/effort data from this type of 'fishing experiment' may be very valuable for estimation of local density from depletion methods. From the point of view of a fishing vessel, this may be feasible over a period of one week or less since it is not in a vessel's interest to continue fishing once catch rates have dropped to very low levels. However, repeated sampling may generate emigration from the area.

3.9 It was noted that the assumption of constant catchability may not be realistic in this new fishery where fishermen are still in a process of learning. As long as the analysis is applied to data over a short time-period (one or two weeks rather than the entire season, for example) this should not be a problem.

3.10 Extrapolation from estimates of local density to larger areas should be done with great care as topology, substratum characteristics, depth, etc. may vary considerably between areas containing crab. Only areas of similar physical characteristics should be included in extrapolation, perhaps creating a need for more study areas. In some cases it may not be appropriate to extrapolate at all because of factors such as movement or migration of crabs and changes in size of animals by area (and/or depth).

Change-In-Ratio (CIR) and Index-Removal (IR) Methods

3.11 Descriptions of the CIR and IR methods and their application to snow crab are given in WS-Crab-93/10. Both these methods require some form of survey, either by appropriate trawl gear or pots, to randomly sample animals before and after the fishery. Total removals (i.e., total catch) is also required.

3.12 The CIR method uses the random samples to obtain estimates of the proportions of legal and sub-legal sized crabs before and after fishing. These proportions and the total removals are then used to estimate the population size and the number of legal-sized crabs before fishing, as well as catchability coefficients. The IR method uses estimates of catch rates before and after fishing from the random samples and the total removals to estimate the same parameters as the CIR method. It is also possible to combine estimates from the two methods as indicated in WS-Crab-93/10.

3.13 Both these methods are based on the assumption that the population is closed. The CIR method further assumes that all legal sized animals have the same probability of being caught. The IR method assumes that the probability of capture does not vary within or between surveys. As in the case of the depletion method, there are ways of relaxing these assumptions.

3.14 Most of the comments made with respect to the depletion method also apply to these two methods. The main difference is, however, that additional information from fishing at random locations is required for CIR and IR whereas the commercial fishery may not be prosecuted at random locations. There may be some advantage in looking at the feasibility of requesting the commercial vessel(s) to carry out fishing at random locations.

3.15 It would be particularly useful if estimates of population size from both the CIR/IR and depletion methods could be obtained. These estimates could also be combined with appropriate weighting (by, for example, inverse variance) to possibly improve the precision of the estimates.

Size/Length-based Methods

3.16 There are various methods that fall within this category. Length-based cohort analysis (or Jones method) is basically a deterministic model that uses catch in numbers by size class with estimates of growth rate, natural mortality and terminal fishing mortality to estimate population size. The main assumption which generally limits the use of this method is that the population is in equilibrium. The deterministic nature of this method means that it can, in theory, be applied to a single year’s data though results would obviously be interpreted with great caution.

3.17 Length-converted catch curves are used to estimate total mortality. They require data and assumptions similar to those required for length-based cohort calculations. With a virgin population, length-converted catch curves can potentially be used to estimate natural mortality.

3.18 The length-based De Lury method (Conser, 1992) uses time series of indices of population numbers, by at least two size classes, and total catches together with some description of growth and mortality to estimate population sizes and fishing mortalities by size class. This method estimates parameters using a likelihood criterion.

3.19 Catch-at-size analysis (CASA) is similar to the length-based De Lury method but requires further information as indicated in Table 2.

3.20 All the size-based methods of assessment require relatively large amounts of detailed data and cannot really be applied to the crab fishery around South Georgia at this early stage.

3.21 These size-based methods also focus on the need to estimate growth parameters. Estimates of growth rates are also required for estimating other quantities such as yield. Since it is not possible to directly age crabs, other methods, for example, length frequency analyses have to be used. There are many problems associated with length frequency analyses although they have been applied to data from other crab fisheries. The first problem is that commercial data from pots are unlikely to be representative of the whole population. Ideally random samples from trawl catches or, possibly, from fine-meshed pots should be used. It may be feasible to use some fine-meshed pots on strings of commercial pots.

3.22 The second problem is that there is often a large degree of variability in the relationship between size and age because not all animals moult every year. A given cohort may exhibit a bi-modal or multi-modal distribution of sizes. As in the case of many other crustacean and fish species, the size distributions at older age classes overlap thus obscuring any modes at larger size in length frequency distributions.

3.23 Two of the most promising methods for obtaining good growth data are tagging studies and holding of pre-moult animals. These methods generally provide information on moult increments by size. Information on moult frequency by size is far more difficult to obtain.

3.24 There are clear advantages in starting tagging experiments at this early stage of the fishery. It is important to note that the design and extent of such an experiment would depend on its main purpose. If the main purpose of a tagging experiment is to obtain information on growth (rather than estimating the population size, for example) then it would be appropriate to do intense tagging in a small area and return at a later stage to try and recover tagged animals. Such data would be useful even if the percentage of returned tags is low. Concern was expressed as to the feasibility of using tagging methods given the current low levels of effort in the fishery.

3.25 It was pointed out that tagging can produce reduced moult increments and high incidental mortality. Holding tank experiments are also advisable.

Calibration of Abundance Indices

3.26 The calibration of abundance indices include the following two methods. The first consists of using the catch rates (catch-per-pot) and some estimate of the effective area fished by a pot to calculate the population density and then extrapolate over a 'fishable' area. The main problem with this method is estimating the effective area fished by a pot. Since pots are baited, crabs are effectively attracted and the gear is therefore not passive. Furthermore, the area of attraction may well depend on the orientation of the string relative to currents and migration 'routes' of crabs. This method is not generally recommended for assessment unless the effective area fished can be estimated in a direct way by, for example, using radio-tagged crabs.

3.27 The second method consists of using a trawl to estimate density by the swept-area method and then doing comparative fishing trials to relate catch rates of traps to the density estimated by the trawl. For this purpose, it is best to estimate the gear efficiency of the trawl (e.g., by mounting a camera on the trawl). However, in some cases it may be acceptable to use the trawl density estimates uncorrected for gear efficiency (i.e., minimum trawlable biomass) as has been used for other crustacean fisheries.

3.28 There are various types of appropriate gear for crab surveys, including 'Nephrops' trawls and beam trawls. A type of 'snow plough' gear (Maynard and Conan, 1985) which employs a camera to photograph crabs lifted off the bottom and pushed up against a grid, for easy counting and measuring, has also been employed with success. The use of camera sleds in conjunction with line transect type survey methods could also be investigated.

3.29 Research surveys, independent of the commercial fishery, are of great value for comparison with other assessment methods based on the commercial data. Even if the likelihood of surveys for this fishery seems remote at this stage, it should be borne in mind as an assessment and monitoring method for the future.

Production Models

3.30 Production models, like depletion models, use changes in indices of abundance such as CPUE to estimate population size. This method has been applied to Dungeness crabs (Stocker and Butler, 1990[1]). These methods work best where there is some contrast in the data and therefore many of the comments regarding the depletion methods and the relatively low current level of effort would also apply to production models.

Other *Ad Hoc* Methods

3.31 One of the *ad hoc* methods used in WG-FSA-92/29 for estimating appropriate catch levels (rather than population size) was to consider comparable species. This method is fraught with difficulties, as recognised by the WG-FSA, and is not recommended now that more information has been obtained.

MANAGEMENT APPROACHES

Harvesting Regimes

4.1 The goal of management of the Antarctic crab resource is preventing the reduction of the stock below the level at which the stock will be able to produce the maximum sustainable yield on a continuing basis. Working paper WS-Crab-93/5 reviews the management methods applied to crab stocks in other areas. In general, there are two primary categories of regulations controlling harvesting: (i) indirect controls on mortality through regulated minimum legal size, seasonal closures and prohibitions on harvesting females; and (ii) direct mortality controls through catch or effort limits.

4.2 The Workshop noted that controls on the size of the animals landed, prohibition on retaining female crabs and seasonal closures during peak spawning or moulting periods are very widely used for regulating crab fisheries. These measures have the advantage of being applicable even when information on the population dynamics of the resource is quite limited. For example, with the data available from the first year of fishing around South Georgia, minimum legal sizes have been determined which are expected to allow male crabs at least one mating year before they are vulnerable to the fishery. The justification for the prohibition of retaining females can be based on the basic biology of the animal, though further work is needed in the future to ensure that reproductive

1 Stocker and Butler. 1990. *Fish. Res*., 9: 231-254.

success is not impaired due to the reduction of the adult male population. Determining the appropriate timing of seasonal closures will require additional information on the life history of these crabs, in particular the seasonal patterns in moulting and spawning.

4.3 The Workshop participants also noted that size, sex and seasonal regulations would not restrict the expansion of the fishery and hence are termed ‘indirect controls’. In order for the development of the fishery to be geared to the collection of information necessary for conserving the resource, further controls on fishery expansion are required. The experience in Alaskan crab fisheries is that in those areas where direct controls on the mortality, through catch limits, have not been imposed, fishing mortality appears relatively high. Therefore, the Workshop recommends that both indirect and direct control measures be applied to the Antarctic crab fishery.

4.4 It was noted that the combination of direct and indirect controls can mean that catch limits need not be set precisely or conservatively, since the indirect controls should protect the stock from reproductive failure in the short-term even if the catch is too high to be sustainable in the longterm. However, if the catches exceed the longterm sustainable level, the fishery will be affected by having greater sensitivity to variations in recruitment, lower average catch rates, and greater proportion of the catch with new shells and thus low meat quality.

4.5 More specifically, a minimum legal landing size for both *P. spinosissima* and *P. formosa* should be applied. Only legal sized male crabs should be retained in the catch, except if an experimental strategy for reducing parasite infestation is attempted (paragraph 4.8). No seasonal closure can be recommended at present until more biological data become available. Investigation of yield/recruitment and maturation processes may influence the setting of minimum sizes in the future.

4.6 In the future, a catch limit should be calculated based on analysis of the available data to determine both an assessment of biomass (virgin and current) and the maximum proportion of the exploitable stock that can be harvested on a sustainable basis. There is no reliable assessment of stock biomass currently available (see Section 3 above).

Approaches to Management

4.7 The Workshop discussed additional approaches to management which should yield substantial new information as well as improve conservation of the crab resource. To reduce the number of crabs below the minimum legal size which are caught, a minimum mesh size or the requirement for an escape port in the pots should be considered. In addition, to prevent lost pots from continuing to kill crabs, a biodegradable or galvanic time release device which opens the traps should be required. Reducing the number of crabs caught and then discarded should improve conservation. There is some evidence that crabs caught and then discarded may not die immediately after capture and so mortality due to handling can be substantially underestimated. Additional studies on handling mortality are desirable.

4.8 The Workshop discussed the management implications of modelling studies of the parasite infestation of *P. spinosissima* (WS-Crab-93/7 and 9). Harvesting of the infected crabs may reduce the prevalence of the parasite in the population and so improve the reproductive potential of the stock (the parasite renders an infected crab sterile). One possibility discussed was the destruction of any infected crabs caught, irrespective of crab size. The Workshop recommended that the feasibility of this be investigated.

4.9 In order to obtain more information on the dynamics of the parasite infection as well as on the response of the crab stock to different levels of harvest, the Workshop recommended that the fishing area might be divided into differential fishing zones. In one zone, the catch would be much smaller than in the other. Each zone would be further partitioned so that in one part, sub-legal size parasite infected *P. spinosissima* would be destroyed and in the other part they would not. Pots in an experimental management regime should enable capture of parasitised crabs.

4.10 The Workshop recognised that such an experimental management regime would not be an ideal statistical experiment since replicate treatments would not be possible. However, it was the consensus of the participants that substantial information could be obtained in this way, even if a formal statistical test would not be feasible, particularly if the system was operated over several fishing seasons.

4.11 Finally, the Workshop discussed multispecies implications of the developing crab fishery. There are two concerns: (i) that crabs may be important prey items for other species in the area of the fishery; and (ii) that there is a by-catch in the crab fishery which is likely to impact other stocks. There is, at this stage, no real evidence to suggest that either of these concerns warrant additional restrictions with respect to the development of the fishery or its subsequent management.

DATA AND REPORTING REQUIREMENTS

5.1 Table 1 summarises basic biological, demographic and distributional data required for a more complete understanding of *Paralomis* spp. and to enable more sophisticated use of the methods discussed under Agenda Item 3. These data may not necessarily be obtainable from the commercial fishery but if they can be obtained this will usually require the presence of observers.

WS-Crab-93/6 describes some biological and catch/effort data that may be obtained from the fishery without the use of observers.

5.2 The logbook issued by the US to the vessel engaged in fishing in 1992 and 1993 for recording haul-by-haul catch and effort details (WS-Crab-93/16) currently contains the following:

Cruise Descriptions:
cruise code, vessel code, permit number, year.
Pot Descriptions:
pot shape, dimensions, mesh size, funnel attitude,
number of chambers, presence of an escape port.
Effort descriptions
date, time, latitude and longitude of the start of the set;
number of pots set, number of pots lost, depth, soak time;
bait type.
Catch Descriptions
retained catch in numbers;
catch of regulated fish, if present.

5.3 To these, the Workshop suggested that the following should be added:

number of pots on the line;
spacing of pots on the line;
by-catch of all species, irrespective of regulated status; and
incremental record number, for linking with sample information.

5.4 If a management strategy involving the destruction or utilisation of parasitised undersized males and parasitised females were to be imposed it would be important that the numbers of crabs in these categories were recorded on the catch and effort logbook.

5.5 Currently, commercial vessels are required to measure a subsample of 35 crabs (all species combined) each day, although there is no specific guidance about the way the catch should be sampled. A random sampling strategy is extremely important if the resultant data are to be a representative, statistically robust sample of the catch.

5.6 Crabs could be sampled by (i) taking 35 crabs from the whole catch over the day, (ii) taking 35 crabs randomly from the total catch of a single line, or (iii) taking 35 crabs from a number of pots on a line. The former two methods suffer from the likelihood of bias by selection by fishermen, and the latter produces imprecise estimates due to aggregation by the pots - (crabs might aggregate by sex, size or parasitic infection, for instance).

5.7 As long as the likelihood of aggregations is recognised and considered in statistical analyses (cluster sampling, analysis of inter-pot variance) the latter method is likely to prove most reliable in this fishery. It has the additional advantage that it is likely to be the least disruptive of fishing activities. Pots typically contain less than 35 crabs, so a number of pots may have to be sampled.

5.8 Accordingly, the Workshop recommends that crabs are sampled from the line hauled just prior to noon, by collecting the entire contents of a number of pots spaced at intervals along the line so that at least 35 specimens are represented in the subsample.

5.9 The logbook for recording biological data (WS-Crab-93/14) currently contains the following:

Cruise Descriptions:
- cruise code, vessel code, permit number

Sample Descriptions
- date, position

Data
- species, sex, length for 35 individuals.

5.10 The Workshop suggested that the subsample should be linked to the line information by including:

line number; and
position of the start of the set,

and that the following additional information should be collected:

presence/absence of rhizocephalan parasites;
a record of the destination of the crab: kept, discarded, destroyed; and
a record of the pot number from which the crab comes.

5.11 Paragraphs 5.2 to 5.10 above discuss the data which should be collected by commercial vessels fishing for crab. Paragraph 7 of Conservation Measure 60/XI requests that the Workshop decide which of these detailed data should be reported to CCAMLR and in what form. The conservation measure sets minimum guidelines for this in its paragraph 5: (i) fine-scale data with a resolution of at least 1° longitude by 0.5° latitude by 10 day period; and (ii) species, size and sex composition of a subsample.

5.12 The Workshop agreed that data at the finest scale possible would be desirable for good assessment and management of the fishery according to the methods outlined under Agenda Items 3 and 4. However, the Workshop did not agree on the precise format of data to be submitted to CCAMLR.

5.13 Dr Holt expressed the opinion that since a single vessel was engaged in the fishery, haul-by-haul data containing precise positional and depth information would be considered confidential and could not be submitted to CCAMLR except in summary form.

5.14 It was pointed out that since the fishery was in its early stage, there were certain management measures that could be taken which would not demand data of as fine a resolution as the haul-by-haul data for the current year. As the fishery proceeded an increase in precision might be necessary as management and assessment methods became more sophisticated.

5.15 It might also be possible to report data using methods which retained a sufficient degree of detail to be used in the assessment and management, but which did not reveal the commercially confidential details. Translocation/transformation of position, categorisation of depth and aggregation of data by areas smaller than 1° longitude by 0.5° latitude were examples of these.

5.16 Prof. J. Beddington (UK) expressed the view that since the highest resolution of these data was haul-by-haul and many of the assessment and management methods were most efficient when the finest scale data are available for use, haul-by-haul data should be reported. Although the types of categorisation suggested in paragraph 5.15 could perhaps eventually be used in management, it would not be possible to decide on the appropriateness of these scales until haul-by-haul data had been examined.

5.17 Examples from other crab fisheries indicated that on the east and west coast of the US some haul-by-haul data are provided for management analyses. However, such data is kept confidential to protect commercial operators. In other cases only aggregated data are reported.

5.18 In view of these differences, the Workshop was unable to provide a unanimous recommendation for the data reporting requirements of Conservation Measure 60/XI, paragraph 7.

ADVICE TO THE SCIENTIFIC COMMITTEE

Management Measures

6.1 Following the management approaches adopted at CCAMLR-XI, the fishery should continue to be managed by both indirect and direct controls on harvesting:

Indirect: limits on retention of crab by size, sex (males only) and in the future possibly season (the 3S approach).

Direct: catch limits for each season, initially set as a precautionary measure and refined as data become available.

6.2 The use of galvanic time releasers or biodegradable devices, which effectively destroy the pot long before normal decay processes would, will reduce the effects of ghost fishing should pots be lost from a line and should be considered.

6.3 Adoption of a minimum mesh size and/or the inclusion of an escape port (usually a metal ring set into the side of the pot) in pots should be considered following research on mesh or port selectivity, to better select only crabs of harvestable size and reduce the number of discards (paragraph 4.7).

6.4 Harvesting or destruction of parasitised crabs of all ages and sexes may reduce the prevalence of parasitism in the population, and should be considered (paragraph 4.8). In this regard, use of pots with smaller mesh or escape port sizes would catch more parasitised crabs, but would expose small unparasitised crabs to the high wind chill factors on deck, with a consequent possibility of discard mortality.

6.5 The Workshop recommended the use of depletion methods, the change-in-ratio and index-removal methods and the analysis of length frequency distribution methods for assessment purposes at this stage (paragraphs 3.3, 3.11 and 3.21).

6.6 The Workshop recommended that the possibility of designing an experimental approach to harvest strategies should be considered, for instance, one in which local depletion of the population is encouraged over a short period of time or a survey is conducted before and after the fishing season (paragraphs 3.8 and 3.11).

6.7 A further experimental approach would be to divide Subarea 48.3 into several crab management areas. Different levels of fishing effort would then be applied to the different areas (by imposition of area-specific catch limits), and/or they could receive different parasite management strategies or mesh size strategies as discussed in paragraph 4.9.

Data Requirements

6.8 There are a number of biological phenomena which require investigation (Table 1). Much of the biological data required, by Table 1, could be obtained by observers on commercial vessels. In this case, the Workshop suggested that pots with finer mesh or escape ports should be added to lines of commercial pots to collect crabs of all sizes (paragraph 3.21).

6.9 Fine-meshed pots or small escape port pots will also provide data on the overall length frequency of the population. Despite the difficulties in interpreting these length frequencies to estimate growth and natural mortality (paragraph 3.17) the Workshop recognised that a large dataset collected at the start of the fishery (when the population is still in a virgin state) would have the potential to be extremely valuable in the future when other factors required for its interpretation (such as moult frequency and size increments) are better understood.

6.10 Additional information which observers could collect includes data on discard mortality. However, in crabs, discard mortality may not be evident until some months after the catching incident, because damage may result in an inability to moult rather than immediate death, and consequently discard mortality studies should be of long duration.

6.11 The Workshop agreed on the data that should be collected by commercial vessels fishing for crab. These are given in Section 5. The Workshop was unable to provide a unanimous recommendation for the data reporting requirements of Conservation Measure 60/XI, paragraph 7.

OTHER BUSINESS

7.1 Recognising that very little information concerning Antarctic crabs is available, Dr A. Paul (USA) suggested that it would be useful for CCAMLR to maintain an ongoing bibliography for these species.

ADOPTION OF THE REPORT

8.1 The report was adopted.

CLOSE OF THE MEETING

9.1 In closing the meeting, the Convener thanked all participants for their hard work and cooperation during the meeting. He congratulated the participants for producing critical information requested by CCAMLR.

9.2 He also thanked the Secretariat for their high standards of professionalism and hard work in making sure the meeting ran smoothly and efficiently.

9.3 Finally, he expressed appreciation to the staff of the Southwest Fisheries Science Center for their support during the meeting.

9.4 The Convener then closed the meeting.

Table 1: Research needs for *P. spinosissima* and *P. formosa*.

Knowledge Required	Sources	Priority
<u>Reproductive Dynamics</u>		
Number of eggs extruded by size of crab	Lab analyses	High[a]
Number of eggs hatched by size of crab	Lab analyses	High
Incubation period by season and duration [estimated: 1year]	Tank holdings, tagging, seasonal monitoring	High
Female mating frequency by season [estimated:1-2 years]	Tank holdings, tagging, seasonal monitoring	High
Percent carrying fertilized eggs by season and size of crab	Catch sampling	High
Egg hatching location by season and depth	Research survey, catch sampling	Low
Larvae location by season and depth	Research survey	Low
Duration of larval stage	Research survey, lab holdings	Low
Proportion maturity by size	Catch sampling	High[a]
<u>Growth Dynamics and Mortality</u>		
Growth rate	Catch data, length frequency	High
Moult increment by season and size	Tank holdings, tagging	High
Duration of intermoult period by season and size	Lab studies, tagging, radioisotope studies	High
Allometry of chela (estimation of size at maturity)	Commercial observer, research survey	High[a]
Mortality (by size)	Catch monitoring, length frequency analysis, tagging	Med
<u>Host-Parasite Interaction</u>		
Reproductive output of rhizocephalan	Tank holdings	Med
Brooding period of rhizocephalan	Tank holdings	Med

[a] Some data are already available for this item (WS-Crab-93/24 and WG-FSA-92/29)

Table 1 (continued)

Knowledge Required	Sources	Priority
Fine-scale prevalence of rhizocephalan	Catch sampling	High
Host susceptibility characteristics	Lab experiments	Med
Effect of parasite on growth	Lab experiments	Low
Incidence of hyperparasitisation	Catch sampling	Med
Effect of hyperparasitisation	Catch sampling, lab experiments	Med
Parasite larval duration	Lab experiments	High
Intensity of symbiotic egg predators	Catch sampling	Med
<u>Distribution and Stock Identity</u>		
Depth range by sex, size, reproductive condition, parasitic infestation, substratum type	Commercial observer, research survey	High
Geographic distribution	Exploratory survey	High
Larval dispersion	Plankton survey (old plankton records)	Low
Stock identity	Morphometrics genetics (mitochondrial DNA)	Low

Table 2: Assumptions and data requirements of assessment methods.

Method	Data Requirements	Main Assumptions	Outputs
Depletion methods	• Catch • And appropriate measure of effort to construct CPUE; or • Some other INDEX of abundance	• Closed* population • CPUE is proportional to population size	• Population size (or local abundance) • Catchability coefficient • Exploitable rate (fishing mortality) • Fishing power of gear • Possible estimate of recruitment
Change-in-ratio (CIR) and Index-removal (IR)	• Random samples before and after fishing • Total catches	• Closed population • CIR: all animals have same probability of being captured • IR: probability of capture does not vary within or between surveys	• Population size • Catchability coefficient • Exploitable rate (fishing mortality) • Fishing power of gear • Possible estimate of recruitment
Length-based cohort analysis	• Catch in numbers by size class • Growth rate • Natural mortality • Terminal fishing mortality	• Closed population • Equilibrium population	• Population numbers by size class • Fishing mortality by size class
Length-converted catch curves	• Abundance in numbers by size class • Growth rate • Age at full recruitment	• Equilibrium population • Closed population	• Total mortality Z = F + M
Length-based De Lury (Conser, 1992)	• Index of population size in numbers by size class over time • Total catch over time • Growth (parameters or description) • Natural mortality	• Closed population	• Population numbers by size class • Fishing mortality by size class • Catchability coefficient(s)
Catch-at-size analysis	• Index of population size in numbers by size class over time • Total catch over time • Growth (parameters or description) • Natural mortality • Probability distribution for length-at-age • Selectivity coefficient	• Closed population	• Population numbers by size class • Fishing mortality by size class • Catchability coefficient(s)
Calibrating index of abundance	• Index of abundance • Estimate of calibration factor • Catchability coefficient	• Various - depends on the type of index	• Population size • Exploitation rate
Production models	• Catch and effort data	• Various - depends on model used	• Population size • Parameters relating to growth/ recruitment and "carrying capacity"

* Closed to known immigration and emigration.

ATTACHMENT A

LIST OF PARTICIPANTS

Workshop on the Management of the Antarctic Crab Fishery
(La Jolla, California, USA - 26 to 28 April, 1993)

P. ARANA	Escuela de Ciencias del Mar Universidad Católica de Valparaíso Casilla 1020 Valparaíso Chile
M. BASSON	Renewable Resources Assessment Group Imperial College 8, Prince's Gardens London SW7 1NA United Kingdom
J. BEDDINGTON	Renewable Resources Assessment Group Imperial College 8, Prince's Gardens London SW7 1NA United Kingdom
P. DUFFY	Golden Shamrock Inc. Fishermans Terminal West Wall Building #218 Seattle, Wa. 98199 USA
R. ELNER	Canadian Wildlife Service PO Box 340 Delta, BC Canada V4K 3Y3 USA
I. EVERSON	British Antarctic Survey High Cross, Madingley Road Cambridge, CB3 0ET United Kingdom
M. FOGARTY	NOAA, NMFS Woods Hole, Ma. 02543 USA

D. HANKIN

Department of Fisheries
Humboldt State University
Arcata, Ca.
USA

J. HOENIG

Dept. of Fisheries and Oceans
PO Box 5667
St. John's, Newfoundland
Canada
USA

R. HOLT

Antarctic Ecosystem Research Group
Southwest Fisheries Centre
PO Box 271
La Jolla, Ca. 92038
USA

G. JAMIESON

Pacific Biological Station
Nanaimo, BC
Canada V9R 5K6
USA

A. KURIS

Dept. Biological Sciences
University of California
Santa Barbara, Ca. 93106
USA

JANG UK LEE

National Fisheries Research and
Development Agency
65-3 Sirang-ri, Kijang-up, Yangsan-kun
Koyng-Nam
Republic of Korea

L.J. LOPEZ ABELLAN

Centro Oceanográfico de Canarias
Instituto Español de Oceanografía
Apartado de Correos 1373
Santa Cruz de Tenerife
España

S. OLSEN

Institute of Marine Research
PO Box 1870
N-5024 Bergen
Norway

R. OTTO	NMFS Kodiak Laboratory PO Box 1638 Kodiak, Ak. 99615 USA
A. PAUL	Institute of Marine Sciences University of Alaska P.O. Box 730 Sewad, Ak. 99664 USA
J. REEVES	Alaska Fisheries Science Center 7600 Sand Point Way N.E. Bldg 4, Seattle, Wa. 98115 USA
V. RESTREPO	University of Miami 4600 Rickenbacker Cswy. Miami, Fl. 33149 USA
A. ROSENBERG	NOAA, NMFS 1335 East-West Highway Silver Spring, Md. 20910 USA
M. TILLMAN	NOAA, NMFS PO Box 271 La Jolla, Ca. 92038 USA
G. WATTERS	US AMLR Program NMFS PO Box 271 La Jolla, Ca. 92038 USA

SECRETARIAT:

D. AGNEW (Data Manager) R. MARAZAS (Secretary)	CCAMLR 25 Old Wharf Hobart Tasmania 7000 Australia

ATTACHMENT B

LIST OF DOCUMENTS

Workshop on the Management of the Antarctic Crab Fishery
(La Jolla, California, USA - 26 to 28 April 1993)

WS-CRAB-93/1	AGENDA
WS-CRAB-93/2	LIST OF PARTICIPANTS
WS-CRAB-93/3	LIST OF DOCUMENTS
WS-CRAB-93/4	THE ANTARCTIC CRAB FISHERY: EXTRACTS FROM CCAMLR-XI AND SC-CAMLR-XI Secretariat
WS-CRAB-93/5	MANAGEMENT AND ASSESSMENT OPTIONS FOR THE CRAB FISHERY AROUND SOUTH GEORGIA M. Basson and D.D. Hoggarth (UK)
WS-CRAB-93/6	DATA REQUIRED FOR IMPLEMENTATION OF MANAGEMENT OPTIONS M. Basson and J.R. Beddington (UK)
WS-CRAB-93/7	A PRELIMINARY INVESTIGATION OF THE POSSIBLE EFFECTS OF RHIZOCEPHALAN PARASITISM ON THE MANAGEMENT OF THE CRAB FISHERY AROUND SOUTH GEORGIA M. Basson (UK)
WS-CRAB-93/8	UNCERTAINTY, RESOURCE EXPLOITATION, AND CONSERVATION: LESSONS FROM HISTORY Donald Ludwig, Ray Hilborn and Carl Walters (USA)
WS-CRAB-93/9	MODELLING CRUSTACEAN FISHERIES: EFFECTS OF PARASITES ON MANAGEMENT STRATEGIES Armand M. Kuris and Kevin D. Lafferty (USA)
WS-CRAB-93/10	CHANGE-IN-RATIO AND INDEX-REMOVAL METHODS FOR POPULATION ASSESSMENT AND THEIR APPLICATION TO SNOW CRAB (*CHIONOECETES OPILIO*) Xucai Xu, Earl G. Dawe and John M. Hoenig (USA)
WS-CRAB-93/11	RELATIVE SELECTIVITY OF FOUR SAMPLING METHODS USING TRAPS AND TRAWLS FOR MALE SNOW CRABS (*CHIONOECETES OPILIO*) John M. Hoenig and Earl G. Dawe (USA)

WS-CRAB-93/12 GROWTH PER MOLT OF MALE SNOW CRAB *CHIONOECETES OPILIO* FROM CONCEPTION AND BONAVISTA BAYS, NEWFOUNDLAND
David M. Taylor and John M. Hoenig (USA)

WS-CRAB-93/13 LESLIE ANALYSES OF COMMERCIAL SNOW CRAB TRAP DATA: A COMPARATIVE STUDY OF CATCHABILITY COEFFICIENTS
John M. Hoenig, Earl G. Dawe, David M. Taylor, Michael Eagles and John Tremblay (USA)

WS-CRAB-93/14 COMMERCIAL VESSEL CCAMLR SUBSAMPLE LOGBOOK
(USA)

WS-CRAB-93/15 COMMERCIAL VESSEL DAILY ACTIVITY LOGBOOK
(USA)

WS-CRAB-93/16 COMMERCIAL VESSEL FISHING EFFORT LOGBOOK
(USA)

WS-CRAB-93/17 GRAPHICAL PRESENTATIONS OF PRELIMINARY DATA COLLECTED ABOARD THE F/V *PRO SURVEYOR* IN 1992
(USA)

WS-CRAB-93/18 BIOLOGY OF BLUE CRAB, *PORTUNUS TRITUBERCULATUS* IN THE YELLOW SEA AND THE EAST CHINA SEA
Lee Jang-Uk and An Doo-Hae (Republic of Korea)

WS-CRAB-93/19 NOTA SOBRE LA PRESENCIA DE *PARALOMIS SPINOSISSIMA* Y *PARALOMIS FORMOSA* EN LAS CAPTURAS DE LA CAMPAÑA "ANTARTIDA 8611"
L.J. López Abellán and E. Balguerías (Spain)

WS-CRAB-93/20 DEMOGRAPHY OF THE KOREAN BLUE CRAB, *PORTUNUS TRITUBERCULATUS* FISHERY EXPLOITED IN THE WEST COAST OF KOREA AND THE EAST CHINA SEA
Lee Jang-Uk and An Doo-Hae (Republic of Korea)

WS-CRAB-93/21 A BRIEF EXPLOITATION OF THE STONE CRAB *LITHODES MURRAYI* (HENDERSON) OFF SOUTH WEST AFRICA, 1979/80
R. Melville-Smith (South Africa)

WS-CRAB-93/22 QUANTITATIVE STOCK SURVEY AND SOME BIOLOGICAL AND MORPHOMETRIC CHARACTERISTICS OF THE DEEP-SEA RED CRAB *GERYON QUINQUEDENS* OFF SOUTH WEST AFRICA
C.J. De B. Beyers and C.G. Wilke (South Africa)

WS-CRAB-93/23	A SYSTEM-OF-EQUATIONS APPROACH TO MODELING AGE-STRUCTURED FISH POPULATIONS: THE CASE OF ALASKAN RED KING CRAB, *PARALITHODES CAMTSCHATICUS* Joshua A. Greenberg, Scott C. Matulich and Ron C. Mittelhammer (USA)
WS-CRAB-93/24	PLOTS OF SOUTH GEORGIA ISLAND CRAB DATA R.S. Otto (USA)
WS-CRAB-93/25	EXTRACT FROM: MACPHERSON, E. 1988. REVISION OF THE FAMILY LITHODIDAE SAMOUELLE, 1819 (CRUSTACEA, DECAPODA, ANOMURA) IN THE ATLANTIC OCEAN. *MONOGRAFÍAS DE ZOOLOGÍA MARINA* VOL. 2: 9-153

OTHER DOCUMENTS

WG-FSA-92/29	A PRELIMINARY REPORT ON RESEARCH CONDUCTED DURING EXPERIMENTAL CRAB FISHING IN THE ANTARCTIC DURING 1992 (CCAMLR AREA 48) Robert S. Otto and Richard A. MacIntosh (USA)

ATTACHMENT C

AGENDA

Workshop on the Management of the Antarctic Crab Fishery
(La Jolla, California, USA - 26 to 28 April 1993)

1. Opening of the Meeting
   (i) Review of the Meeting Objectives
   (ii) Adoption of the Agenda

2. Information on the *Paralomis spinosissima* stock
   (i) Biological Characteristics
   (ii) Distribution, Stock Identity
   (iii) Demographic Characteristics
   (iv) Parasitism

3. Assessment Methods

4. Management Approaches
   (i) Harvesting Regimes
   (ii) Approaches to Management

5. Data and Reporting Requirements

6. Advice to the Scientific Committee
   (i) Longterm Management Plan for the Crab Fishery
   (ii) Data Reporting Requirements

7. Other Business

8. Adoption of the Report

9. Close of the Meeting.