
# PATAGONIAN SCALLOP FISHERY
# (VIEIRA PATAGONICA)

## Annual Surveillance Visit Report
## Required by the Marine Stewardship Council

## 2008-2009

## Report Nº 3

**Prepared for: Glaciar Pesquera S.A., Argentina.**

**Prepared by: Dr. R. Peter Pottinger, Organización Internacional Agropecuaria, Team Leader.**
**Dr. E.M. Morsan, Institute of Fisheries and Marine Biology "Alte. Storni". Argentina.**
**Dr. H.J. Cranfield, Seabed Processes Consultancy. New Zealand**
**Lic. Ma. E. Vidal, Organización Internacional Agropecuaria, Assistant Assessor.**

# Index

## 1. TITLE AND HEADING INFORMATION

**Title**

MSC Surveillance Visit 2009
REPORT for PATAGONIAN SCALLOP FISHERY

**Preface**

The information, opinions, and conclusions made in this report are the sole responsibility of Organización Internacional Agropecuaria. Advice was sought and provided by Dr. E.M. Morsan, Institute of Fisheries and Marine Biology "Alte. Storni"; Dr. H.J. Cranfield, Seabed Processes Consultancy.

**Certificate Number:** 010106/11

**Name and Address of Certification Body**

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**Date of Summary:** September 2009

## 2. GENERAL INFORMATION

**Name and contact information for the certified fishery**

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**General background about the fishery**

The Patagonian Scallop (Vieira Patagonica) Fishery was certified in November 2006 by the Organización Internacional Agropecuaria (OIA) following the Principles and Criteria of the Marine Stewardship Council (MSC). The MSC requires that certified fisheries must undergo at least an annual surveillance inspection in order to ensure that the certification is in place and the fishery is fulfilling the conditional requirements imposed in the original certification. The fishery has completed its third period of fishing activity. At the end of the five year certification period, the requirements of the MSC are that the Fishery must complete a re-certification before the anniversary date of the original certification, in order to ensure the uninterrupted use of the certificate and the MSC logo. If the Fishery fails a surveillance audit or re-certification, the use of the Certificate and the MSC logo can be revoked by the MSC or simply lapse. Re-certification review is simultaneous with the fourth surveillance audit, in October 2010.

The Patagonian Scallop fishery commenced in 1996, after a one year experimental fishing programme. Although young, the fishery, is of world importance, and is operated throughout, the year. It employs 4 high-tech, high-cost factory vessels (~50m long), landing up to 11.000 t of scallops muscle (IQF) obtained from 80.000 t of commercial size scallop (> 55 mm height). The production is exported to Canada, USA and the EEC. There is a clear spatial correspondence between the fishing grounds and oceanographic frontal system associated with the Argentinean Shelf (Bogazzi *et al.*, 2005). The main fishing area is located (39°S to 45°S; at depths of 90-120 m) is strongly influenced by the shelf break front. The beds are located on muddy-sand substrate. Each year, the fleet performs 31 to 54 fishing trips (each of 20-40 fishing days), during which 40-60 tows/day, using two Otter Nets (22m foot rope). The fishing gear is believed to be non-selective and has an efficiency of between 21-31% (Lasta and Iribarne, 1997). Towing speed averages 4.6 knots, and time of tows ranges from 12-17 min. Using these values, the fleet sweeps an area of about 7 $km^2$ per day. The ground and bed surface area of 37.000 and 13.000 $km^2$ respectively.

## 3. THE CERTIFICATION / ASSESSMENT PROCESS

**Dates of the Surveillance Visit**
Sunday 13 September- Tuesday 22 September, 2009. Mar del Plata (See Appendix I).
Friday 11 September, 2009. Buenos Aires.

**Members of the Surveillance team**

1) Dr. R.P. Pottinger, OIA Team Leader.
2) Dr. E.M. Morsan, Principle 1, Resource Biology and Ecology.
3) Dr. H.J. Cranfield, Principle 2, Environment.
4) Lic. Ma. E. Vidal, OIA, Assistant.

**Assessment Process**
This report represents the third annual surveillance, after OIA had notified the client Glaciar Pesquera S.A. where and when the Annual Surveillance Visit would take place. All Stakeholders who had expressed interest and contributed to the Full Assessment, First and Second Audits were directly contacted by e-mail and/or by telephone. As well the intention to conduct the Annual Surveillance Audit and the programme were posted on the MSC and OIA websites. A list of Stakeholders directly contacted is appended (Appendix II). Stakeholder opinion, including managers, scientists, industry and environmental NGO's was sought on the performance of the fishery in relation to any of the relevant conditions of the certification or other issues following the MSC's Principles and Criteria for Sustainable Fishing.

The Surveillance Team chosen, had all been involved in the Full Assessment process. Specifically it concentrated on review of:

1) Potential or actual changes in management systems.
2) Changes or additions/deletions to regulations.
3) Changes in scientific personnel, management and industry in order to evaluate impact on the management of the fishery.
4) Changes in the scientific base of information, including stock assessment.

No significant issues which could affect the sustainability and conduct of the fishery that require further investigation were identified, so procedures to embody such events were not required in the Assessment process.

The Surveillance Team audited compliance with, and progress and performance against certification conditions; documenting progress with justification for its judgment, following TAB Directive D-013, and MSC Fisheries Certification Methodology.

As all conditions accepted in the Client Action Plan are still in progress no re-scoring of all relevant performance indicators and scoring guideposts relating to the Conditions set in the Final Full Assessment Report was required.

**The inspection by the Surveillance Team (See Appendix I) involved**

**A.** In Mar del Plata: **Glaciar Pesquera S.A.**, CPN Gustavo Gallego acting on behalf of CPN Eduardo Gonzalez Lemmi President of Glaciar Pesquera S.A.. **INIDEP** (National Institute of Fisheries Research and Development) Coordinator Dr. Patricia Martinez acting on behalf Dr. Otto Wöhler, National Director for Fisheries Research and Acting Director of INIDEP; Lic. Mario Lasta, Chief, Patagonian Scallop Research Group and his team; and Dr. Claudia Bremec, CONICET-INIDEP, Benthic organism research. The **National University of Mar del Plata** scientists involved in research on Patagonian Scallop lead by Dr. Oscar Iribarne, including Dr. Marcelo Kittlein, simulation modelling scientist. **Prefectura Naval Argentina,** Prefecto Luis Pablo González, Ayudante Mayor Julio Alberto Bibbo, Cabo Primero Eduardo Barrios, Oficial Auxiliar Juan Pablo Cardiello. **Wanchese Argentina S.A.**, CPN Pedro Böhnsdalen and Captain Malcolm Daniels. Written comments were received and considered from **CeDePesca,** Ing. Ernesto Godelman.

**B.** In Buenos Aires: The **Federal Fishery Council** (Consejo Federal Pesquero, CFP), President Deputy, Ing. Marcelo Santos.

**General context**
This report is the Third Surveillance Audit of the Patagonian Scallop Fishery in Argentina.

**Scope and history of assessment**
The Assessment followed the MSC Certification Methodology (FCM) for Surveillance Report, version 6 and the TAB Directive, D-013.

The Fishery was certified as an MSC Sustainable Fishery in November 2006 and this Surveillance Audit is the third conducted on it.

**Stakeholder consultation**

**Glaciar Pesquera S. A**. CPN Gustavo Gallego and Captain Cesar Gabriel Camerucci, "Surf III".

In the absence of CPN Eduardo Gonzales Lemmi, President of Glaciar Pesquera S.A., CPN Gustavo Gallego received the Surveillance Team.

Captain Camerucci discussed with the Surveillance Team the fishing gear and methods used by Surf III, the vessel who operates from the port of Ushuaia. The two Glaciar Pesquera S.A. vessels, Surf I and III, are dry docked every two to three years. Both were docked in 2008. Surf I was docked for 5 months, from May until October. Surf III was docked in November 2008 to January 2009 (Note: if the vessels were dry docked immediately after the reproductive period and the vessels alternated between years it will possible to reduce the fishing period per each year to allow under conditioned scallops to recover biomass for harvest at a subsequent date).

Captain Camerucci stated that for the past two to three years Glaciar Pesquera S.A. has not searched for new scallop beds. Only one of the company vessels was involved in surveys to establish the biomass of the existing beds in 2008, conducted on behalf of INIDEP. INIDEP has conducted two surveys in 2008; one in April/May in the North, and one in July in the South.

One survey has been conducted in the North Sector by INIDEP in April/May 2009. The Southern survey by INIDEP is scheduled to start in October 2009. When a survey is delayed as in this case, the administration permits fishing with a catch of 50% of the previous year.

When the fishery commenced they exploited scallops south to 40-42 °S, although there were scallops of sufficient size to 47°S.

The catch of Vieira by each vessel per day is between 7-12 t of muscle / day; although Captain Camerucci indicated that catches recently had been around 5 t / day which is lower than 2002 (when the Surveillance Team was informed that 6 to 7 t was economic).

INDIEP surveys use a 2.5 m wide dredge. The companies used an otter net for the surveys on behalf of the CFP. Glaciar has recently bought material to allow INIDEP to build an experimental dredge for use in future surveys. The Surveillance Team sees merit in INIDEP calibrating the survey dredges against the otter net, but sees dredges as better for biomass estimates.

Until 1996 Glaciar worked with Nylon Nets but commenced to work exclusively with polyester netting in 2006. Polyester nets have reduced by-catch. There is a difference of opinion between captains. He stated that once a team learns how to operate a net efficiently it is difficult to change from one type to another as a change results in loss of efficiency.

In earlier years100 mm diamond mesh was used. Later 130 mm mesh was preferred and more recently has been increased to 140 mm and could increase to 160 mm, to allow better separation of immature from commercial size scallops.

The two companies utilize different designed nets. Both Wanchese S.A. and Glaciar Pesquera S. A. use parpalla to protect the bottom of the net against the sea floor. In the opinion of Captain Camerucci square mesh netting results in a cleaner catch of scallops. This rises a question of whether a small square mesh may be better that the large diamond mesh used at present.

Captain Camerucci can not identify hydroids which are not visible in the landed catch. However he expressed considerable interest in the importance of recruitment of scallops on hydroids and the need to establish reserves and enhance their survival in the fished areas.

Any developments in gear use that reduce by-catch are beneficial to preservation of habitat and reduction of sorting time. By-catch of fish in this fishery is negligible.

Canada and NZ are experimenting with escape devices for fish taken in otter nets. In NZ the otter net is used in the hoki fishery and in the *Zygochlamys* fishery of the Southwestern Otago Continental Shelf.

INIDEP consistently provide all scientific information obtained to the vessel captains. This information is more related to scallops than to the important aspects of by-catch. He felt that more feedback is required on by-catch issues related to settlement of scallop larvae. He thought that accumulation of shells from fishing activity on the sea bottom was deleterious to the fishery. It was pointed out by the Surveillance Team that the old shells are beneficial to maintain complexity of the seafloor and increase settlement surfaces.

He mentioned that there is a little by-catch of fish, although occasionally abadejo (kingclip) are taken.

In 2008 the CFP indicated that besides an On Board Observers, fishery Inspectors would be required during fishing voyages. This commenced in 2009 when OBO activity was reduced to 50% of fishing voyages (On Board Observers only collect samples and technical information for research while inspectors have authority to modify fishing activity and evaluate application of regulations).

**National Institute of Fisheries Research and Development (INIDEP, Directorate)**

The Surveillance Team had valuable discussion with Dr. Patricia Martinez, Coordinator acting on behalf Dr. Otto Wöhler, Director of the Institute and National Director of Research. Lic. Mario Lasta, Vieira Stock Assessment and Coordinator of the Scallop Research Programme. Dr. Claudia Bremec, Benthic scientist. Lic. Gabriel Blanco, On Board Observer Programme, and Dr. Maria. Ines Trucco, Geneticist.

Most publications authored by INIDEP scientists were circulated to the Surveillance Team two weeks prior to the reunion, and information presented in writing and orally at this meeting has been evaluated and considered in the findings of this annual surveillance audit.

The following topics were discussed:

1. Recruitment. For INIDEP recruitment is settlement on the bottom by:
    a. larvae (primary settlement);
    b. attachment of small bivalves on the shell of mature scallops (secondary settlement).

2. Hydroid research. Due to the unavailability of the research vessel, sampling was not possible and therefore hydroids were not studied over the past year.

Detection of the small bivalves stages is important in the management of the fishery. Development of sampling systems to assess hydroids offers an important alternative indicator for recruitment into

the fishery. Surveys by the BIP Capitan Canepa are expected to recommence about October-November, 2009. It is proposed that the BIP Capitan Canepa will conduct annual surveys of 15 days in the North Zone and 20 days in the South, sampling established stations. In addition, 6 day trips at bimonthly intervals will be conducted in the North Zone using gear which are more selective for biota other than scallops. This will provide opportunity to establish presence / absence of hydroids and other fauna to produce a map in order to superimpose hydroid distribution over areas with scallops. It was stated that hydroid presence is more noticeable in areas of low fishing pressure compared to heavily fished areas. There is a need to establish the abundance of hydroids in reserve areas more precisely.

The importance of examination of empty shells and living scallops for evidence of hydroids on them in fished areas was discussed.

In January / February and May, 2008, larger exclusion areas were gazetted in each bed to protect high concentrations of reproductive scallops (which would also reduce fishing damage to larvae settling on scallop shell) (CFP Resolution 05/09). These cumulated exclusion areas represent 5.4 % of the total beds. The proportion of protected areas varies widely between beds. Protection of high density is perceived to be of high importance to maximize reproductive opportunity.

The trimonthly meetings between INIDEP, CFP and the two companies fishing the resource were not occurring in spite of the benefits to the operation of the fishery.

3. The study by Dr. Bremec on the spat of *Zygoclamys patagonica* and other small bivalves, which is an important contribution to modelling of drift and dynamics of ocean currents associated with canyons.

4. The composition of fauna taken in On Board Observer samples from 1997-2002 which highlight differences between areas of high and low fishing effort.

5. While the overall number of species taken in samples is not dropping, the numbers of individuals in samples is decreasing. This may indicate a potential problem in the fishery. It was noted that the gear used for sampling on the commercial fleet in 2008 was different to those used on INIDEP vessels. Sampling of the Southern Area by the BIP Capitan Canepa in November, 2009, would be useful to obtain further evidence on the importance of the above trend.

6. The taxonomic status of *Zygochlamys* has been debated but INIDEP proposed to retain as the generic name.

7. The On Board Observer Programme. Lic. G. Blanco reported that the fleet completed 34 trips in 2008 and that these had 100% OBO coverage. Since March 2009 however, 25 trips have been made but only 12 with On Board Observers (48%). This presents a difficult problem in relation to the continuity of scientific sampling and conclusion for fishery management. Fisheries Inspectors now alternate with OBOs on fishing trips. No explanation of the reasons for these changes has been made. Fishery Inspectors can modify the fishing schedule but are not trained to take biological samples or make biological observations; such as sampling for paralytic toxins as required by SENASA. This could result in loss of market opportunity.

8. Daily catches. Expressed as muscle production are variable depending on conditions and the density of scallops. At present, catch levels are low ranging from 3-8 t per day. This contrasts

with catches of 15-16 tones per day on some beds in the past.

9. Genetics of the scallop resource within and between beds. The genetics scientists have developed a marker (ISSR) which defines high genetic variability within the species over the range of its distribution. From an evolutionary point of view it gives high survival value. Differentiation is higher in the Southern compared to the Northern Sector, which indicates an unidentified barrier restricts gene flow between them. The Southern stock is separate from the Northern stock. Two more beds on the mid and near coastal Continental Shelf which are not fished and Unit 12 are being tested with the marker. Dr. Daniel Ruzzante of Dalhousie University who is associated with this programme is developing a new micro satellite marker to determine gene flow between beds. 11 micro satellites have been developed from the samples provided to Dr. Ruzzante's group.

**Client Meeting**. CPN Gustavo Gallego and Dr. Oscar Iribarne, University of Mar del Plata.

CPN Gustavo Gallego received the Surveillance Team together with Dr. OSCAR Iribarne, University of Mar del Plata, and Lic. Mario Lasta, INIDEP.

The Surveillance Team received 3 volumes, all INIDEP Technical Reports, scientific papers and all resolutions and formal discussions of the CFP over the past year.

Dr. Iribarne presented a summary of achievements. Highlights included:

1. Surveys completed on the North and South Sectors, 2008.

2. Development of information for all MUs along the Shelf Break Front.

3. Increasing knowledge on the relationship of fishing effort ("f") with community characteristics. No substantial changes are obvious.

4. Using a database of information collected during all surveys and from commercial fishing operations, simulation of stock assessments has been developed by application a surplus production model to estimate population parameters (carrying capacity and growth rate).

5. No new beds have been identified.

6. Study of fleet dynamics as an aid to identification of high density beds.

7. The importance of up- and down-wellings from the northward flowing, cold Malvinas current along the Shelf Break Front. This result in deposition of food and recruitment of scallops across the eastern edge of the Continental Platform in a swath no greater that 70 km wide.

8. The across bed variation is more important that South-North variation.

9. Development of an on-board measuring system by Lic. M. Lasta to allow vessel captains to record retained commercial sized scallop weight for on-board processing at any one time. This has high practical significance, as it eliminates the need for the conversion ratio used in the past for the estimates weight of scallops captured from the muscle weight. This indirect procedure has inherent errors associated with it. The new direct weighing system in development is highly

accurate.

10. It has been inferred from other scallop species that larvae could be planktonic up to 60 days. This is important to the recruitment process.

**Wanchese Argentina S.A.** CPN Pedro Böhnsdalen, General Manager and Captain Malcom Daniels.

Wanchese S.A. commenced exploratory surveys and gear development on the Patagonian scallop stock, initially in Uruguay waters in 1993-1994, before collaborating on an experimental programme for one year with the Argentine government in 1995, to establish grounds and beds before initiation of the commercial fishing programme in 1996.

During the establishment period 4 days of every fishing trip, were spent surveying the resource as far south as 43°. Captain Daniels said the deeper he trawled the larger the scallops.

For profitability, catches exceeding 5 t of scallop muscle per day are necessary. At the present daily catches of scallop are generally between 3 ½ - 4 ½ t which is not economic.

The representatives confirmed that the last Scallop Commission meeting between the companies, and the Management Authorities, was held in November, 2008. By regulation these should be held every 3 months.

The Company raised the issue of fishing the resource year round. They raised the question of why fish the quantity of scallop taken in 2006 that was then held in long-term storage before sale. They also raised the point of why fish the resource for two or more months immediately after reproduction in winter-spring, when a short closure would allow the biomass to increase and be available for capture at a later date?

Concern was expressed that the current low yields from fishing may indicate a collapse of the fishery in two or more years. Fishing pressure and production could be reduced. The Wanchese S.A. representatives suggested that the inclusion of an independent scientist on survey vessels to evaluate procedures. Note: The Management Plan states that each meeting should be followed by the report of the results of the meeting (the acta) unfortunately this step has been overlooked.

The Surveillance Team had a valuable discussion with Captain Daniels on the fishing gear and its use which was followed up by inspections of the nets on board the F.V. Erin Bruce, in port. New points explained to the Surveillance Team included:

1. Fishing stops in rough weather to reduce shell grit damage in the factory.

2. Floats are not used on the top line of the net to prevent fish entering.

3. The net opening is 5 feet deep closing to 3 feet on the bottom, buoyant aluminium doors used are easier to tow and spread. Wanchese S.A. set the net upwards to minimize by-catch and substrate entering the net. They regularly modify net settings to maintain the scallop catch as clean as possible, and the policy is to maintain catches in the bag at the half full level in order to prevent damage to the benthos and the nets by crushing.

The Surveillance Team recommends that the gear used by each vessel should be clearly described and their use during fishing defined and made available at the next Surveillance Audit (See Recommendation 3 in the Full Assessment Report).

**National Director of Fisheries Coordination and Deputy President of the Federal Fishery Council,** Ing. Marcelo Santos.

1. Regulations have not been substantially changed within the period under consideration.

2. Informal procedures were used to establish management measures. These measures have been reconsidered and consolidated into formal resolutions (See Appendix V).

3. Ing. Marcelo Santos, indicated that the CFP would like an index of recruitment which could be considered by CFP when deciding management strategy from year to year.

4. Each MU has a TAC established before commercial fishing is allowed to commence.

5. Surveys were conducted during 2009 to estimate the 2010 TACs by INIDEP's survey vessel the VIP Capitan Canepa, using dredges. In 2008 when the company vessels undertook responsibility for annual biomass surveys, otter nets were used (see Patagonia scallop Annual Surveillance Report, 2008).

6. Estimates were obtained using otter nets, rather than dredges.

7. The CFP reported that there has been no major pulse of recruitment, continuing the trend from 2002.

The regulation for fishing, presented in the 2008 Annual Surveillance Report, still applies.

**Prefectura Naval Argentina.** Prefecto Luis Pablo González, Ayudante Mayor Julio Alberto Bibbo, Cabo Primero Eduardo Barrios, Oficial Auxiliar Juan Pablo Cardiello, Prefectura Mar del Plata.

The Surveillance Team explained the assessment process to the officers and discussed their role in the Patagonian scallop fishery.

The companies and vessels involved have fully complied with the requirements of the law for operation of the fishery and the maintenance of the vessels to the standard required by survey. No transgressions have been recorded over the past year.

**Argentina Wildlife Fundation (FVSA),** Lic. Guillermo Cañete.

Lic. Cañete who was overseas apologized for his absence. A written report was not provided to the Surveillance Team.

**Centre for Defence of Fishing (CeDePesca)**, Ing. Ernesto Godelman.

Ing. Ernesto Godelman, the President of CeDePesca, was unable to meet with the Surveillance Team, and provided a report with the following points.

1.-Vemos con preocupación que no se están haciendo las reuniones periódicas con las empresas que establece del Plan de Manejo en el marco de la Comisión de seguimiento de la Pesquería.

2.- Los cilindros cribados que poseen los barcos para seleccionar y retener ejemplares comerciales para su procesamiento deberían tener agujeros fijos y no regulables ya que al cerrarlos podrían retener ejemplares no comerciales al regularse en menos de 53 mm de diámetro. La no realización de las reuniones arriba mencionadas dificulta la discusión de propuestas como ésta

3.-Es positivo que al inicio de año se establecieran mas y mayores áreas de exclusión pesquera en cada banco para proteger concentraciones de reproductores. Sin embargo, para adoptar esta medida no hubo participación de los actores al no reunirse la Comisión de seguimiento.

Each of these has been considered by the Surveillance Team in the Third Annual Audit.

## Methodologies

The Assessment followed the MSC Certification Methodology (FCM), version 6 and the TAB Directive, D-013.

## 4. RESULTS, CONCLUSIONS AND RECOMMENDATIONS

### General discussion of findings and statement confirming the status of the Certification

Historical fishery data is presented in the following table. The information has been sourced from INIDEP Technical Report N°8 (14pp) (Campodonico *et al.*, 2009). Four vessels; Miss Tide, Erin Bruce (Wanchese S.A.) 2009, Atlantic Surf I and Atlantic Surf III (Glaciar Pesquera S.A.) fished throughout that year.

| | Years | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Total biomass estimates | 287.345 | - | 474.839 | - | 314.830 | 386.487 | 304.993 | 275.646 | 374.369 | 441.325 | 899.962 |
| Commercial scallop biomass estimates | 148.208 | - | 277.444 | - | 157.708 | 124.058 | 97.584 | 145.777 | 210.300 | 309.086 | 646.345 |
| TACs | - | 34.000 | 51.220 | 32.521 | 34.234 | 16.045 | 34.357 | 43.218 | 49.124 | 54.910 | 41.398 |
| Vessels(n) | 3 | 3 | 3 | 3(Oct.4) | 4 | 4 | 4(Nov. 3) | 3 | 4 | 4 | 4 |
| Trips(n) | 31 | 36 | 33 | 33 | 38 | 37 | 34 | 28 | 54 | 37 | 34 |
| On Board Observers(%) | 22 | 16,7 | 36,6 | 42,4 | 63,1 | 59,9 | 67,8 | 100 | 100 | 100 | 100 |
| Muscle landings(t) | 3.417 | 5.012 | 5.112 | 5.546 | 6.325 | 6.018 | 5.890 | 5.535 | 11.256 | 7.522 | 8.242 |
| Whole scallop catches(t) | 28.441 | 42.700 | 36.513 | 38.961 | 50.967 | 42.969 | 42.065 | 39.522 | 80.400 | 53.726 | 58.867 |
| Days on trip (n% annual) | 794(72) | 938(85) | 891(81) | 850(73) | 1.279(87) | 1.198(82) | 1.138(78) | 835(76) | 1.157(79) | 852(69) | 879(61) |
| Days fishing (n% annual) | 652(59) | 783(71) | 775(71) | 724(62) | 1.075(73) | 968(66) | 901(62) | 652(59) | 912(62) | 660(53) | 723(41) |
| Nets(n) | 46.704 | 63.787 | 64.392 | 64.056 | 97.292 | 96.256 | 95.049 | 66.873 | 85.591 | 68.407 | 74.025 |
| Muscle yield(%) Average trawling time(min) | 12,72 | 11,74 | 14,55 | 17,79 | 14,05 | 11,49 | 12,24 | 12,66 | 14,37 | 14,5 | 15.33 |
| | 16,36 | 17,34 | 15,51 | 15,37 | 16,69 | 13,89 | 12,61 | 12,57 | 11,46 | 11,6 | 12.14 |

See Figure 1 to 6 for graphics on historical data.

During 2008 all four vessels fished throughout the year, and on average fished for 150 days each (41%).

During 2008, the On Board Observer Program covered 100% of the trips (36).

During 2008, 8.242 t of muscle was landed. This was higher than in 2007 (7.522 t).

In 2008 the number of fishing dates increased in comparison to 2007. All four vessels involved in the fishery were able to fish throughout the year.

Muscle production in 2008 increased compared to 2007. Indicators of fishing effort (days at sea, days fished, average time of each tow, number of tows) increased in 2008.

**CONDITIONS**
All the conditions apply to Principle 1.

**Principle 1. The resource.**

- **Condition 1**

**Performance Indicator 1.1.1.3**
The population dynamics of the species (including age at maturity, natural mortality, growth, and fecundity) are understood.

**Required Action**
Within a maximum of 4 years, starting from the certification of the fishery it will be necessary to study the variability of the natural mortality rate for each bed, within each MU.

**Comment on Certification**
The estimation of natural mortality is the most difficult task in marine resources studies, and any approach is imbued with uncertainty. But this parameter defines population dynamics and the harvesting strategy. An estimate of mortality has been made of the Patagonian scallop derived from an integrated model for the Reclutas bed (Valero, 2002), in addition to a study done by Lasta *et al.* (2001). The Assessment Team recommends estimating mortality from size structure and age structure of populations within the protected areas of each bed so that by the end of the certification period there is a good understanding of the spatial variation of mortality. Improved estimates of these population parameters will provide more comprehensive data for simulation modelling of the fishery and its management. Given the time span and the possibility of not having new cohorts to follow, it is important to realize that this comparison may not be fully possible or fully comparable within 4 years. Improved estimates of these population parameters will provide more comprehensive data for simulation modelling of the fishery and its management.

**Statement of progress**
Natural mortality has been estimated from catch at age data, obtained from grid pattern dredge surveys, 1998 onwards and auxiliary dredge information on fishery effort of the commercial fleet over this period of time. The size frequency of scallops was measured in samples of each research tow. 231, 5x5 nautical mile statistical boxes that had consistently high scallop densities, between 1998 and the present were selected for analysis. The density of each age category was estimated from the size data, using estimates of the Von Bertalantly growth rate on these beds. M was assumed to be constant over all age classes and time periods. While "f" was assumed to be a function of fishing effort and selectivity of the fishing gear. The precise recording of fishing effort allowed the estimation of the proportion of each box that was swept by fishing gear. Bayesian methods were used to estimate M from these data. Modal values of 0.31 year $^{-1}$ (95% CI, 0.14 - 0.51). The method will be extended to other beds as resource and time allow (Milessi *et al*., 2009c).

This procedure was used to compare 3 methods for indirect estimation of natural mortality. One of these methods (Arce, 2006) developed for marine invertebrates, was the most consistent with the direct estimate. This estimation shows a slow trend from North to South in the different Management Units (MU), using indirect methods. Growth parameters and maximum size have been analyzed as well as the natural mortality.

**Comment of Surveillance Visit**
The population dynamics of the species (including age at maturity, natural mortality, growth, and

fecundity) **are on target**.

- **Condition 2**

**Performance Indicator 1.1.3**
Appropriate reference levels have been developed for biomass and fishing mortality rate.
**Performance Indicator 1.1.6.1**
The overall population is at appropriate reference levels.

**Required Action**
In a maximum period of 1 year from the fishery certification, biological reference limits must be established based on the resource biology, regarding biomass and fishing mortality rate. Limit reference levels for each bed in each MU (to be considered in management decisions) will need to be initiated within the current certification period.

**Comment on Certification**
The use of a rotational management strategy overcomes many of the difficulties associated with a traditional fishery. Rotational fishing strategies in scallop fisheries have been modelled (Breen and Kendrick, 1997; Hart, 2003).

**Statement of progress**
The fishing process and its impact on stocks of the Patagonian scallop (*Zygochlamys patagonica*) fishery was investigated by Bogazzi (2008) in her Doctoral Thesis. Data and information utilized included:

1. historical data from commercial vessels and experimental fishing;
2. positional, catch and effort data, and additional information corresponding to fleet activity between 1995 and 2005;
3. interviews of fishermen; and
4. information from surveys of abundance.

The key components of the fishing process at different spatial scales were investigated:

1. fishermen decisions, particularly the decision of leaving a Fishing Opportunity (FO) which is being fished;
2. spatial patterns of allocation of fishing effort; and
3. trends in catch per unit effort (CPUE) as a consequence of abundance and the spatial allocation of fishing effort

Dr. Bogazzi concluded:

1. the spatial pattern of the resource are associated with three oceanographic frontal systems.
2. Trend of CPUE indicates the movement of the vessels inside a bed searching for areas with a similar density, which can be analyzed at different spatial scales using the objective information of fleet activities.

The large-scale fishing effort allocation shows sequential depletion: the fleet operated progressively more distant from the port. Two beds associated with the frontal system were the primary target of the effort throughout the fishery history. The sequence of effort allocation also occurs on the scale of the patches within beds. Fishing activity is concentrated on the densest patches. Over time patches in the original area are never occupied in the same spatial pattern. There is low spatial overlap between successive visits. The Bogazzi (2009) study indicates in some cases when vessels

change fishing within beds, an increase in production results.

From the beginning of the fishery, the trend of annual mean CPUE of main beds showed a slowly declining and a rebound associated with the recruitment of robust year classes. Value of CPUE is conditioned by the fishing intensity within any patch and the spatial overlapping of tows during one trip or consecutive trips, the activity in new patches and recruitment events of new cohorts to the fishery.

Appropriate reference levels have been developed which relate to biomass and fishing mortality rate (a new reference point based on availability of settlement surfaces is being developed, See Condition 3). The population appears to be largely driven by massive and irregular (spatially and temporally) pulses of requirement. Because of the high variability, fishing to a reference level is inappropriate. An adaptive fishing strategy based on biomass estimates is applied and follows a "loose" rotational fishing strategy.

Sedentary resources are highly vulnerable to serial depletion. Fishing commences on the densest patches, and continues on the next densest patches until the whole population has been fished. This leads to hyperstability in CPUE trends.

The experience gained from twelve years of fishing synthesizes the achievements since 1996 (Lasta, 2009):

1. beds have been identified as MUs;
2. a minimum legal size has been established of 55 mm of total height (4-6 years old). It is obligatory to return all individual smaller than 55 mm immediately to the sea;
3. "no-take" zones have been established in each MU to protect breeding stock, to preserve settlement habitat, and provide reference areas for research.
4. the ratio between juvenile and commercial sized scallops must be at least 1:1 before a MU can be fished;
5. the harvest rate is fixed at 0.4 (or less) of the commercial biomass.
6. the fishery is limited to four vessels;
7. the law establishes a Technical Commission composed of management, scientific and company representatives that analyze and monitor the fishery. It is required to meet every three months.

The biomass that supports current catches and the immediate future of the fishery is due to the cohorts recruited in 1999-2000 and 2000-2001 (now aged 8 to 9 years). Recorded maximum size is around 90 mm shell height, and recorded maximum age is 10 years (few individuals are older than 8 years or higher than 80 mm) (Ciocco *et al*., 2006). Surveys from 2001 (9 in total), show little recruitment. The fishery appears to be sustained by irregular massive recruitment events. Should this trend continue, the fishery will decline (Technical Report N° 29, 2009; N° 49, 2008; N° 62, 2008).This situation suggests a precautionary approach in the management the resource (Technical Report N°63, 2008).

Modelling of fishing mortality rate for Sectors and MUs is on-going. This has been improved over the past year (Kittlein, 2009; Milessi *et al.,* 2009c).

**Comment of Surveillance Visit**

The target for this condition is to establish reference points for every MU and manage the fishery so each population is at an appropriate level. This goal will be achieved in this fishery by developing a rotational fishing strategy.

- **Condition 3**

**Performance Indicator 1.1.5.3**
The assessment, including any assumptions, has been appropriately tested by simulation or other methods and considers uncertainties which are reflected in management advice.
**Performance Indicator 1.1.5.4**
The assessment evaluates the consequences of harvest strategies and evaluates the status of the fishery relevant to reference levels.
**Performance Indicator 1.1.6.1**
The overall population is at appropriate reference levels.

**Required Action**
Within a maximum period of 4 years from the fishery certification, the precision of the estimates in the stock evaluation must be improved, taking into account the uncertainty of the initial data and testing of the sensitivity of the results. Development of the possible changes in exploitable biomass, relative to the catch strategy currently applied, under different fishing scenarios will need to be initiated within the current certification period.

**Comment on Certification**
Although biomass estimates are precise, the estimate of catch from landed meat weight by a single estimate of meat weight-green weight conversion coefficient is very imprecise and has no estimate of variability. Precision of catch estimation should be investigated and improved methodology developed. The consequence of the present harvest strategy can be evaluated from only 6 years catch data, so simulation studies must be initiated to evaluate their effects over long periods with different scenarios to test sensitivity to assumptions made and imprecision of parameter estimates.

**Statement of progress**
*Settlement of scallops.* The primary settlement of scallops on the hydroids *Symplectoscyphus subdichotomus* was discovered in 2008 (Bremec *et al.,* 2008). The importance of this finding in a recruitment limited fishery has been recognized by the CFP who want INIDEP to analyze the by-catch samples of the On Board Observer Programme to develop an index of hydroids abundance. CFP want INIDEP to explore the use of this index as a new population reference point. The Sub Secretariat of Fisheries has recently reduced the On Board Observer coverage of the scallop fishery by about 50%. The resultant reduction in by-catch samples makes achievement of this objective, namely the development of such a unique biological reference point, very difficult.

*Estimating the total catch.* The use of muscle landings based on the Conversion Coefficient (CC) and the current estimate of catch is not a good measure in this fishery for estimation of biomass caught and landings. Bogazzi (2009) studied the variability of muscle weight using a Generalized Linear Model considering 6 parameters (year, semester, bed, scallop size, year-semester and year-bed interactions).

The linear model fitted the relation between muscle weight and the covariate values and explained 42% of the variability. The muscle weight varies annually, seasonally, by area and scallop size. Consequently, to be useful the CC should include that variability and additionally the variability associated with onboard catch processing. A fixed CC value is not appropriate to back-calculate the commercial scallop biomass processed from muscle landings data.

It is proposed (Bogazzi, 2009) to replace indirect estimates of catch biomass with direct weighing on-board of commercial scallop entering the factory.

*Simulation of population assessment.* The catches from all survey and fishing vessels from the inception of the fishery have been summarized in 5x5 nautical mile statistical boxes (Kittlein, 2009). These spatial time-series were explored using a surplus production model to estimate population parameters (carrying capacity and growth rate) using Bayesian statistic. Kittlein predicted the biomass from 2009 (which was close to the median value of K in each box) to 2018 utilizing different policy strategies. The development of Kittlein's model by krigging will extend it to areas were reliable time series of data are unavailable.

The Assessment that the fishery is at appropriate reference levels, that it evaluates the consequences of harvest strategies and evaluates the status of the fishery relevant to reference levels, including assumptions has been appropriately tested by simulation methods (Kittlein, 2009) or other methods (Bogazzi, 2009) and considers uncertainties which are reflected in management advice.

**Comment of Surveillance Visit**
The commercial biomass of the Southern Sector has almost doubled over the past year. Scallop density on the ground is reduced by reduction of high density patches. There is a risk that increased fishing pressure will be spread more widely and thus reduce settlement habitat in this sector. Much of the biomass is in the 8 to 9 years old age classes (life expectancy of scallops is 13 years in northern; Lomovasky 2008), so fishing in the near future with only average recruitment may be unsustainable.

**Work on this condition is ahead of target and is ongoing.**

- **Condition 4**

**Performance Indicator 1.3.1**
There is adequate information on the population structure and reproductive capacity of the resource.
**Performance Indicator 1.3.2**
The age/sex/genetic structure of the resource is monitored to detect significant impairment of reproductive capacity.

**Required Action**
Within a maximum period of 1 year from the fishery certification, the relative fecundity per size or weight must be established for each bed, and within a maximum period of 2 years from the fishery certification, a study on the oceanographic variables involved in relation to recruitment must commence. Additionally, within a maximum period of 3 years after the certification of the fishery correlation over time with the changes in size, age and sex structures of each bed must commence in order to evaluate the impact of the fishery on the reproductive capacity of the stock.

**Comment of Certification**
No relationship has yet been established between local stocks and recruitment in populations of *Z. patagonica*, and little relationship has been found between parental stock and recruitment in scallops in general. Hence "conventional wisdom" tends to dismiss the importance of a stock-recruitment relationship in scallops with most variation in recruitment being attributed to effects of environmental variation on larval mortality and settlement. Nevertheless, McGarvey *et al.* (1993), found egg production was correlated with recruitment in two Georges Bank populations of *Placopecten magellanicus* and this correlation was stronger and held more widely among other populations when egg production of older (larger) scallops alone was considered. They concluded that the two scallop populations may be reproductively self sustaining stocks. Furthermore, recent

modelling of larval dispersal in the Caribbean concluded that marine populations must rely on mechanisms enhancing self-recruitment rather than depend on distant 'source' populations (Cowen *et al.,* 2002). There is sufficient doubt about the relationship between stock and recruitment in scallops to make investigation of fecundity of *Z. patagonica* a sensible precautionary approach to management of this new fishery. The fecundity data will provide input to simulation models of the fishery and its management.

**Statement of progress**

*Larval movement.* Spatial variability in adult abundance and recruitment of scallops is strongly related to variability in the position of the front and high chlorophyll a concentrations (Mauna *et al,.* 2008). Study of 18 years of intra-seasonal variability in sea surface temperatures shows far greater complexity than has been previously recognized (Franco *et al.,* 2008). The complexity of these currents may act to concentrate and retain larvae in the front and maintain them close to their preferred settlement areas. The potential movement of larvae is being studied by Lagrangian stochastic modelling (Franco, 2009).

INIDEP could develop new insights on the effects of current action on larval distribution along the Shelf Front by examining the Multibeam images of scallop beds to establish how the currents are distributing fine sediments on the seafloor. Linear sand structures may reveal the presence of helical circulations that can be potent forces in distribution and retention of plankton close to the seafloor.

***Population*** *structure*. Milessi has describes population structure of each MU, using the size frequency distributions obtained from 1999 to 2007.

***Sex ratio.*** Campodonico *et al.* (2009) have presented an analysis of sex ratios in relation to the intensity of fishing activity for each MU. Sex was identified by macroscopic or microscopic observation. The sex ratio is slightly skewed towards males. The female index was 45.83 (0.9 females: 1 male). The female index has no relationship with latitude and fishing effort.

*Genetic studies.* Scallops from twelve beds located on MU's 1-1, 1-2, 2, 3, 4, 5, 6, 7, 9, 12, 13 and Ushuaia were analysed with Inter Simple Sequence Repeats (ISSRs), a PCR-based technique, which showed that this molecular marker yielded good results in assessing genetic variability. Genetic distance coefficients showed three main barriers to genetic flow. The patterns of genetic structure are consistent with the oceanography of the area but show restricted flow between individual scallop populations (Trucco and Lasta, 2009).

**Comment of Surveillance Visit**

The age structure of the population, inferred from size distribution is understood. Studies on the fecundity of scallops in each MU along the Shelf Break have yet to be completed. This should be given higher priority. The gametogenic cycle has been studied. There is a need to emphasize change in size, age and sex structure of each bed, including fecundity to allow evaluation of the impact of the fishery on the reproductive capacity of the stock.

**In summary apart from studies on fecundity, research on Condition 4 is considered to be on target.**

**RECOMENDATIONS**
Recommendations apply to all three Principles

**B. Principle 2. The environment**

- **Recommendation 1**

To continue with studies on the requirements for settlement and commence studies on morphology and larval development. To study the rate of settlement, for example by means of measurement of the prodisoconchas and the environmental factors that govern the recruitment of the species. These studies will contribute to knowledge on the factors affecting larval settlement and, therefore recruitment intensity, which is important for prediction of production from the different beds. It is difficult to firmly establish the stock-recruitment relationship for this species. There are a number of factors involved, but it is necessary to identify these. The uncertainty of reproductive success mediated by environmental variability may also make the relationship between fecundity and recruitment more difficult to unravel but other scientific investigations suggest it is likely to prove important. These data will provide input in simulation modelling of the fishery and its management.

**Performance Indicator 1.1.1.2**
The life history of the species is understood.
**Performance Indicator 1.1.1.6**
Information on the relationship of recruitment to parental stock is understood.

**Statement of progress**
The work outlined in the previous year has been amplified and published (Bremec *et al.*, 2008). Most spat settle on hydroids (*Symplectoscyphus subdichotomus*), smaller numbers settle on sponges and polychaete tubes encrusting adult scallops. Analysis of species on which spat could settle, show a cluster of species with variable abundance of hydroids (higher in samples with spat), scallops, and predators. This study included a site with numerous attached spat. This site had lower densities of potential predators and had hardly been fished in comparison with other sites close by. The availability of primary settlement surface should be monitored in biomass surveys and on board observers samples and areas with dense patches of hydroids should be protected from trawling. The primary settlement of scallop larvae on hydroids (Bremec *et al.,* 2008) has a potential to limit recruitment. Thus recruitment could be proportional to the density of hydroids and other filamentous substrates, rather than to the reproductive capacity of the scallop population. This may allow the development of a new concept in population reference points, e.g. a reference biomass level for hydroids in commercial by-catch or survey samples. NOTE. On board observers could develop a qualitative estimate of the abundance of hydroids in the biological samples.

*Larval biology.* The Patagonian scallop larva and the duration of larval period remain also unkonwn. Waloszek & Waloszek (1986) estimated settlement size at about 0,2 mm. Later, Schejter *et al*. (2007) provided a detailed description of recently settled spat, with measures of prodissoconch, and proposed a planktotrophic development. A preliminary report summarizes what is known of reproduction (Campodonico *et al*, 2008), and what is unknown such as oocyte diameter whether the scallop is a serial or partial spawner, and proposes a study of these features (Pascual and Zampatti, 2009).

**Comment of Surveillance Visit**
The results obtained by Dr. Bremec suggests that this area of research be given higher priority.

The data suggest the importance of maintaining stocks of hydroids and other filamentous substrates in the benthic fauna which can be protected from trawling by: 1) modification of the fishing gear to reduce contact with the sea floor and minimizing benthic by-catch, 2) temporary closure of areas with dense patches of hydroids and other filamentous substrates, 3) use of reserve areas to allow hydroids and other filamentous substrates to develop in the absence of fisheries, 4) increasing the number of MUs, following a rotational fishing strategy to allow regeneration between fishing episodes.

- **Recommendation 2**

Carry out estimations and keep registers of incidental mortality during the different fishing activities as a consequence of recapture and discard of juveniles or the process of cooking juveniles fixed on the shells of commercial size scallops that are processed. This will permit understanding of the fishing activities which cause significant mortality of juveniles that currently are not taken into account for evaluation of the impact of fishing on the stock at population level, nor for the estimation of allowable catches. These data will provide input in simulation modeling of the fishery and its management.

**Performance Indicator 1.1.2.1**
Fishery removals are recorded / estimated (including landings, discards and incidental mortality).

**Statement of progress**
See Surveillance Report N° 2.

The authorities replaced the On Board Observers by Inspectors reinforcing the control on the fleet operations. This measure halved the observer coverage.

**Comment of Surveillance Visit**
Reduction of biological or ecological information that supports the ecosystem understanding is undesirable.

- **Recommendation 3**

The selectivity of the fishing gear (otter net) could possibly be improved using large square mesh to evaluate whether the by-catch of other invertebrates, juvenile scallops and non living material could be reduced.

**Performance Indicator 1.1.2.6**
Selectivity is known for the fishery (including incidental catches).
**Performance Indicator 3.2.2.1**
The fishing gears, methods and practices suitable for harvest of the target species have been examined with regard to their adverse impacts on habitat (especially in critical or sensitive zones), their rates of capture of non-target animals and incidental impacts on target animals. The gears with least impacts and non-target catches are used and/or prevented by other management measures.
**Performance Indicator 3.2.7.2**
The operations of the fishery are conducted so as to minimize (to the degree practical) the mortality of discarded non-target catch. Fishermen and others in the industry take reasonable measures, beyond the formal management requirements, to minimize such mortality.

**Statement of progress**
Each company is attempting to improve nets and their use in order to minimize by-catch and reduce costs associated with this. INIDEP has commenced trialing new gear designs to limit fishing impacts on the environment.

**Comment of Surveillance Visit**
The Surveillance Team are pleased to note that INIDEP and the two companies involved in the fishery, understand the problems of the fishery and are attempting to improve the gear used.

- **Recommendation 4**

Initiate studies on the application of analytical models and elaborate conceptual and quantitative models that permit demonstration that the management methods applied to the fishery are appropriate (without substantial changes in the biomass and capture), integrating survey evaluations with the commercial fleet data on an appropriate map. Periodically evaluate the F value stipulated. This recommendation aims to predict yields in different fishing scenarios in order to apply management actions which contribute to the sustainability of the fishery. The use of a rotational management strategy overcomes many of the difficulties associated with a traditional fishery. Rotational fishing strategies in scallop fisheries have been modelled (Breen and Kendrick, 1997; Hart, 2003). Similarly, the use of predictive models for rotational fishing as it was applied to the *P. magellanicus* fishery (See Hart, 2003) should be investigated.

**Performance Indicator 1.1.5.1**
There is a scientifically-rigorous stock assessment methodology that is relevant to the biology of the target species and the nature of the fishery. The assessment uses all available relevant data.

**Statement of progress**
The spatial time series of catch and effort from the inception of the fishery is being explored using a surplus production model (Schaefer's model) to estimate population parameters using Bayesian statistics (Kittlein, 2009). The model uses all available relevant data and with krigging can fill gaps in the information do extend analysis large areas. The model can be developed to predict yields and biomass to test effects of different management regimes (including national fishing) on sustainability.

**Comment of Surveillance Visit**
The study is well advanced.

- **Recommendation 5**

Study the genetic structure for each bed with the objective to determine the source-sink relationship and its correlation with the fishing activity. This will allow application of protection measures or creation of no-take zones, with the aim to maintain the genetic diversity of the stock and improve the settlement of larvae in the different beds.

**Performance Indicator 1.3.2**
The age/sex/genetic structure of the resource is monitored to detect significant impairment of reproductive capacity.

**Statement of progress**
Analysis of variation in Inter Simple Sequence Repeats, showed clear differences between beds at the extremes of distribution and barriers to gene flow (Trucco and Lasta, 2009).

**Comment of Surveillance Visit**
This recommendation partially overlaps with condition 4.

Funding of this research needs to be maintained in order to fully explore the application of possibilities arising from it.

- **Recommendation 6**

Initiate studies to establish if the primary settlement occurs on the shells of the adults or if the presence of juveniles is the result of secondary settlement from another substrate. Although bushy bryozoa and hydroids have not been recorded in fishery-trawl or survey-dredge by-catch, many of the echinoid groups present in the by-catch feed on bryozoa in other areas hence bryozoa and hydroids may be more important in the benthos than their representation in the by-catch suggests. Fishing is likely to destroy emergent bushy bryozoa or hydroids more rapidly than other benthos (Collie *et al*., 1997; 2000). If primary settlement of scallops is on such filamentous substrates in Argentina as it is elsewhere, then fishing by reducing this substrate will have an effect on recruitment. If primary settlement is on the shells of adult scallops alone, the removal of adult scallops by fishing will likewise affect recruitment and fishing mortality will operate equally on cohorts of small juveniles as well as adults. If primary settlement is on filamentous substrates, fishing gear could be modified to reduce its impact on the seafloor and damage to filamentous benthos and help sustain recruitment. If primary settlement is on adult scallops recruitment will probably be best sustained by rotational fishing that maintains high adult populations locally.

**Performance Indicator 2.1.1.2**
The habitat requirements of the target species, in particular the settlement habitat of juveniles, are known.

**Statement of progress**
Studies (Bremec *et al.*, 2008) have established that the primary settlement of larvae occurs mainly on hydroids. The major secondary settlement phase by 3-4 mm bivalves occurs on live and dead shell.

**Comment of Surveillance Visit**
As primary settlement appears to be on filamentous substrates, fishing gear should be modified to reduce its impact on the seafloor and damage to filamentous benthos and help sustain recruitment. If primary settlement is on adult scallops recruitment will probably be best sustained by rotational fishing that maintains high adult populations locally. Establishment of reserves of sufficient size regularly located over the fishery to protect settlement on hydroids and reduction of fishing pressure over the same areas could be helpful to the primary settlement process.
**This merits high priority.**

- **Recommendation 7**

Quantitatively study the ecological relations in the benthic community. Scallops dominate biomass and production in the benthos. Gut contents show they ingest mainly diatoms and some dinoflagellates. Investigation of gut contents of other suspension feeders could identify whether they are competing for the same resource and investigation of the isotope signal of carbon in scallops (adults and juveniles) and the other suspension feeders could show the proportion of benthic and plankton algal production and plankton.
These data can be modelled to develop an understanding of how present fishing is likely to indirectly alter benthic energy flow and dynamics and how management can minimize the effects on the food web and productivity.

**Performance Indicator 2.1.1.3**
Information is available on the position and importance of the target species within the food web.

**Statement of progress**
The hypothesis that changes in scallop density can influence the composition and structure of the food web continues to be investigated. Trophic relationships and their connection with frontal variability were researched by Mauna *et al.* (2008a, 2009). They sampled 10 species of macro-invertebrates in two transects normal to the front. They analyzed $C^{13}$, $N^{15}$ and C/N ratio in two suspension feeders, one deposit feeder, five intermediate predators and one top predator. Initial analysis found changes up the food web as expected, as well as changes in scallop isotopic signature across the front.

**Comment of Surveillance Visit**
Botto *et al.* (2006) work on the trophic position of Patagonian scallop within the food web needs to be continued.

- **Recommendation 8**

Annually tabulate the quantitative data from the by-catch collected for each bed, by the On Board Observer Programme and the research surveys, comparing these with the 1995 data base. Compare the quantitative by-catch data obtained from the trawls in fished areas with those obtained from trawls in non-fished zones within the same bed, which are collected in the annual research surveys. The testing of these data will show whether benthic habitat regenerates in the absence of disturbance by fishing. Regeneration of benthic habitat on fishing-disturbed-seafloor is linked to increasing productivity of fisheries on this habitat (Cranfield *et al.*, 2001). Such habitat regeneration is likely to follow a succession that is partly determined by distance from sources of propagules and partly by period without disturbance hence habitat recovery can be facilitated by rotational fishing (Cranfield *et al.*, 2004). If benthic habitat does recover here, analysis of the data will be useful in determining length of rotation cycle and sizes of areas and usefulness of MPA's in a rotational fishery management plan.

**Performance Indicator 2.1.1.5**
There is information available on the recovery rate of the ecosystem from fishery related impacts.

**Statement of progress**
By-catch sampled by On Board Observers from commercial trawls continues to be monitored and analyzed. Bremec *et al.* (2009 a) has compared biomass and composition of by-catch on all MUs

between 2006 and 2007. Escola *et al.* (2009) analyzed the by-catch data from five MUs between 1997 and 2002. The biomass of eight major taxa over this period was compared in principle component analysis and the significance of detected differences tested for significance. Large variations occurred in the biomass of the group of by-catch between years and between MUs. These were not related to differences in fishing effort. Nevertheless there seemed to be a short-term response to intense fishing in one year, leading to reduced by-catch biomass in the next. Although echinoderm by-catch did not change significantly, ophiuroids and echinoids were grouped together as one major taxon and previous studies (Schejter *et al.,* 2008) found ophiuroids increased and echinoids decreased with increasing fishing pressure. The sessile sponge fauna decreased from 1997 to 2002.

Bremec *et al.* (2009 b) analyzed the by-catch of the dredge surveys estimating biomass in 2006 and 2007. 90 epibenthic taxa were identified and numbers compared between years. The authors concluded there had been no loss of species between MUs over the two years but a decrease in number of taxa per individual sample was apparent in all MUs.

Sanchez *et al.* (manuscript submitted, 2009) used a Pickard dredge to sample benthos at 3 pairs of sites between 39°S and 44°S, 3 heavily fished and 3 relatively unfisahed in 2005 and 2006. They compared their catch with by-catch of commercial trawls at the same sites in the same years. The dredge caught a wider range of species than the trawl, which exclusively caught some of the rare species because of the much greater area it swept. Analysis showed great internal similarity and heterogeneous composition in the no-fishing samples compared to samples from the fished areas. The much wider range of species caught by the dredge suggest dredge investigations could be a very productive method of exploring changes in the benthos caused by fishing.

*Recovery rate of ecosystem.* A comparison between disturbed and undisturbed areas of one fishing ground considering not only the Patagonian scallop but also the benthic community, the levels of disturbance and changes in species biomass, was studied by Schejter *et al.* (2008). In this study the authors compared composition, structure and biomass of the species assemblage in the MU 3 (in areas subjected to fishing effort within the exclusion area, between 1998 and 2002). No differences in species richness or species composition were detected between areas in the study period but a differentiation between the fishing ground and exclusion area was described by the authors after 1998. Based on analysis of species (dis)similarities this differentiation could be attributed to an increase in predators biomass (Volutidae) and the detritivore ophiuroid *Ophiactis asperula*, a decrease in the fragile species (*Sterechinus agassizii*) and the target species of the fishery.

**Comment of Surveillance Visit**
The analysis of the On Board Observer data should be extended to include all of the early years of the fishery, and extend the analysis of the biomass survey data in the same way so that long term systematic changes in by-catch biomass and the composition can be analyzed.

- **Recommendation 9**

Estimate the biomass of the non-target species for each systematic group and for each bed, each year, and evaluate the annual changes. Experimentally estimate the discard mortality for the principle species in the by-catch and consider it in the management system. One aim of the fishery should be to reduce mortality and by-catch of non-target species so benthic habitat is less modified, trophic webs preserved and the productivity of the fishery maintained (Cranfield *et al.,* 2001). Discarded by-catch is a major problem in fisheries world-wide but this figure could be reduced by

25 to 64% by modifying fishing gear (Hall and Mainprize, 2005; Harrington *et al*., 2005). The components of by-catch, mechanisms of their capture and their subsequent mortality need to be measured so improvements can be measured in investigations of methods of reducing by-catch and by-catch mortality.

**Performance Indicator 2.1.3.1**
Information is available on the nature and extent of the non target species caught, or otherwise killed, by the fishery. This includes all non target species – invertebrates, fish, mammals, reptiles, birds etc.
**Performance Indicator 2.1.3.2**
Information is available on the extent and survivability of the discarded by-catch.
**Performance Indicator 3.2.1.3**
Catch levels are set to prevent significant capture of non-target species.
**Performance Indicator 3.2.7.2**
The operations of the fishery are conducted so as to minimize (to the degree practical) the mortality of discarded non-target catch. Fishermen and others in the industry take reasonable measures, beyond the formal management requirements, to minimize such mortality.

**Comment of Surveillance Visit**
The Surveillance Team recommends that the survivability of by-catch returned to the sea after sorting be tested experimentally.

A statement on progress on this recommendation would be helpful for the Surveillance Team Fourth Annual Audit.

- **Recommendation 10**

In addition to tabulation of the biomasses of by-catch for each group, each year (Performance Indicator 2.1.1.5, and 2.1.3.1), it is necessary to evaluate the usefulness of the fragile, long-lived species, which could suffer damage from the fishing gear and classification methods, as indicators of the impact of the fishery on the marine habitat. The echinoids are long-lived species (Bremec and Echeverria, 2005) and are frequently found in the by-catch of the fishery (Bremec *et al*., 2003). Because of their fragility they are very sensitive to all fishing activity around the world. By focusing study of the effects of fishing on especially fragile benthic species, deleterious changes in the benthic habitat can be more rapidly identified and improvements can be more rapidly identified and enumerated in investigations of methods of mitigating these effects.

**Performance Indicator 2.1.4**
Strategies have been developed and implemented within the fisheries management system to address and restrain any significant negative impacts of the fishery on the ecosystem.

**Statement of progress**
The primary settlement of scallop larvae on hydroids (Bremec *et al.,* 2008) has a potential to limit recruitment. Thus recruitment could be proportional to the density of hydroids rather than to the reproductive capacity of the scallop population. This may allow the development of a new concept in population reference points, e.g. a reference biomass level for hydroids in commercial by-catch or survey samples. Note: On board observers could develop a qualitative estimate of the abundance of hydroids in the biological samples.

Microscopic examination of old scallop shell recovered by On Board Observers and from INIDEP Survey dredges may provide some indication of colonization by hydroids which are known to provide the mayor substrate for scallop larvae settlement.

While the On Board Observer sampling protocol to record fragile taxa in the by-catch has been modified to record this by-catch, there is a need to evaluate changes in the biomass of these taxa.

**Comment of Surveillance Visit**
The 50% reduction in coverage of all fishing trips with On Board Observers could seriously limit the development of indicators for recruitment through settlement on hydroids and possibly other filamentous substrates.

- **Recommendation 11**

Study the consequence of removal of target species on ecosystem structure by modelling the energy flow. This recommendation is linked to recommendation 7.

**Performance Indicator 2.1.5.2**
The impacts on ecosystem structure and function from removal of target stock(s) are known.

**Statement of progress**
See Recommendation 7.

**Comment of Surveillance Visit**
See Recommendation 7.

- **Recommendation 12**

Compare the benthic by-catch from reserve areas within each bed with those from fished areas and analyze systematic changes; and in particular, study how the recruitment of the species dependent on scallop shells for settlement have been affected. Modelling energy flow through the benthic ecosystem will indicate the relative importance of each species and how the trophic web is likely to be affected by fishery removals of different species. These studies should be used in mitigation studies of the effects of gear modification and use of rotational fishing to let benthic habitat recover and maintain productivity of the fishery.

**Performance Indicator 2.1.5.3**
The impacts on ecosystem structure and function from removal of non-target stocks are known.

**Statement of progress**
This has been reported in by Schetjer *et al.* (2008). See Recommendation 8.

**Comment of Surveillance Visit**
See Recommendation 8.

- **Recommendation 13**

Consider a more extensive use of video cameras to investigate the role of the scallops within the structure of the benthic habitat. Remote underwater video allows direct observations of the effect of fishing on the benthic habitat in addition to the indirect studies analyzing changes in by-catch. Observations of trawls in operation have shown that visibility on the seafloor allows capture of good images and use of a high resolution camera should enable specific identification of benthos. More extensive use of this system could allow direct comparison of fished seafloor, seafloor in reserve areas that has been fished and unfished reserve areas so giving direct evidence of fishery impacts on habitat structure. These observations can be applied in modifying fishing gear to reduce its impact on the seafloor as well as directly testing the effect of rotational fishing on seafloor habitat.

**Performance Indicator 2.1.5.4**
Fishery impacts on habitat structure are known.

**Comment of Surveillance Visit**
Adequate video camera facility is necessary to advance research on this recommendation. See Recommendation 8.
There has been no progress reported in the area to the Surveillance Team.

- **Recommendation 14**

Study the need for increased budgets for management, control (authorities) and scientific research for regular presentation to the relevant authorities. Communication of results in this fishery is good but one of the issues identified by the team was the lack of opportunity and lack of budget for scientists to brief management, control authorities and fishers in plain language the results and implications of their research. Facilitation of this communication will result in more cohesive management and greater understanding of its importance.

**Performance Indicator 3.1.7.1**
Adequate funding is provided for management.
**Performance Indicator 3.1.7.2**
Adequate funding is provided for research.

**Comment of Surveillance Visit**
Glaciar Pesquera S.A. is funding research outside of INIDEP, such as in the University of Mar del Plata. See Surveillance Report 2007. It would be helpful to the Certification process if financial information on annual funding of projects was available.

- **Recommendation 15**

Analyze the usefulness of the current reproductive and experimental reserve areas, the necessity for relocation and/or establishment of new ones. No-take zones already exist in this fishery. Their effectiveness in excluding fishing, providing unmodified areas of seafloor for benthic comparisons with fished areas, and effectiveness in providing local sources of scallop larvae and propagules of other benthos, and the optimum size should be evaluated. These data can then be utilized in establishing new closed areas within the rotational fishing management regime to optimize

production of the fishery.

**Performance Indicator 3.2.5**
The management system has considered no-take zones as a means to control exploitation.

**Statement of progress**
Schejter *et al.* (2008) have investigated the usefulness of no-take zones relative to fished areas by analyzing the effect of dredging on density of scallops and benthic organisms.
More "no-take" reproductive zones have been gazetted, but the effectiveness of these and evaluation of effective reserve size relative to fished areas has not been established.

**Comment of Surveillance Visit**
There is a need to further study the effectiveness of these "no-take" zones for reproductive enhancement.

- **Recommendation 16**

The fishery undertake systematic trials measuring the effects of fishing operations on catch of scallops, size range of scallops and quantities and composition of by-catch and use this information to agree on long term gear modifications.

**Performance Indicator 3.2.7.1**
The operations of the fishery are conducted so as to minimize (to the degree practical) the capture of non-target animals, particularly those which cannot be released alive.

**Statement of progress**
See Recommendation 3.

**Comment of Surveillance Visit**
See Recommendation3.

**Principle 3. The management**

The management system of the Argentine Patagonian Scallop Fishery (Vieira Patagonica, *Zygochlamys patagonica*) is evolving in response to the certification of this Fishery under the MSC Principles and Criteria. These changes have been positive and will improve the management, yield/performance and sustainability of the fishery in the long term.
The Surveillance Team has identified two main areas where changes have occurred since evaluation of the fishery.

1) Changes in the Research System.

Dr. Otto Wöhler continues to be the National Director of Research, and has been appointed as the Acting Director of INIDEP.

The financial support from Glaciar Pesquera S.A. has been formalized with the University of Mar del Plata through an agreement. Funding is directed to the University of Mar del Plata science team. Operational costs of the research are paid by Glaciar Pesquera S.A.

INIDEP research vessels recommenced survey activities in 2009. The North sector beds were surveyed in March- April and the South Sector beds will be surveyed in October - November 2009.

The CFP and INIDEP, financed by the Federal Government guarantee the financial support for the stock assessment for all Argentine fishery resources, including the Patagonian scallop fishery. This policy encourages industry to fund research in the Universities and other Institutes. The new management plan established by CFP Resolution N° 04/2008, however requires that every vessel in the Scallop Fishery will be available to undertake up to 20 days of investigation on the resource each year, or pay for the equivalent effort by INIDEP research vessels. The Sub-Secretariat of Fisheries has reduced the % converge of trips by On Board Observers to 50% and substituted Fisheries Inspectors.

2) Changes in the Administrative System.

Implementation of a precautionary management approach has resulted in changes in the Administrative System of the Fishery.

An estimate of the Biologically Acceptable Catch is required before fishing can commence. This will normally require a research survey, unless INIDEP can provide provisional approval based on known biological indicators. In such a case, the CFP will establish a TAC following a precautionary approach. (Art. 6 of Resolution CFP Nº 4/2008).

The minimum size limit for capture remains at a 55 mm height. When the size frequency of landings has more than 50% undersized scallops for two consecutive days, the vessel must move to another fishing area (Art. 14 of Resolution CFP Nº 04/2008).

The biomass captured is calculated by transformation of scallop muscle weight using a conversion factor of 7.14. This conversion factor has remained unchanged. Catch data from 1995 to 2008 is presented on Figure 6.

The production of muscle and the MU fished, must be reported daily to the National Direction of Fishing Coordination daily. It is communicated by e-mail. Vessels are also required to present a detailed capture report after each fishing trip.

The Satellite monitoring system of the fleet allows more accurate enumeration of the weight of scallops landed from each MU. Catch data are compared with the final trip report of each vessel and electronic track records. When fishing straddles the boundary between two MUs, the CFP proportionally allocates catch by analyzing the track of the vessel.

The National Direction of Fishing Coordination monitors fishing activities and capture in each MU continuously. They advise both INIDEP and fishing vessels when 90% of the CMP has been caught. When the catch exceeds 70%, a precautionary approach is applied to prevent overfishing of the CMP. Catch is tracked electronically with colour markers: between 70 and 90% green; from 90 to 99.9% yellow; and more than 100% red. Vessels are ordered to cease fishing before catches reach 100% in any MU. Special attention is given to monitoring small beds as a daily catch is more likely to surpass the established CMP.

The authority notifies the Coastguard. The Coastguard informs all captains who must then stop fishing that unit. The Coastguard controls the closure and the fishing. The fishing companies also notify their captains.

Resolution CFP 04/2008 established the Scallop Commission. The commission includes 2 members of INIDEP, 2 members of the Management Authority and 1 representative from each of the fishing companies. Meetings of the Scallop commission provide a mechanism for fishing companies to present their ideas on management of the resource. The commission meets quarterly.

Since November, 2008 the scallop Commissions has not meet. This audit has reviled many areas of common interest that merit consideration at these meetings.

If a new bed is found, the vessel must inform to the National Direction of Fishing Coordination (SAGPyA) and INIDEP in writing within 5 days (Art. 11 of CFP Resolution 4/08). The vessels are allowed to fish in the newly discovered area for 60 consecutive days. The catch taken in such areas outside the MUs are not included in the CMP.

The CFP have established an IQ (individual quota) for each vessel (39% to each company) and each MU. (CFP Resolution 14/08). The quotas assigned for the period 01/07/08 to 30/06/09 one given in Disposicion 29/2009 (North Sector) and Disposicion 101/2009 (South Sector).

Exclusion areas and their location, establishes as Reproductive Reserves within the MUs are presented in CFP Resolution 05/09 (See Appendix V).

**The statistics of the fishery for 2008 are presented in the official INIDEP Technical Report 8/09, 14pp.**

INIDEP completed biomass evaluations for both the North and South Sectors, for which the results have been published in:

INIDEP Informe de Campaña Nº 16, 2009, 32pp.
INIDEP Informe Tecnico Oficial Nº 49, 2008, 16pp.
INIDEP Informe Tecnico Oficial Nº 63, 2008, 20pp.
INIDEP Informe Tecnico Oficial Nº 26, 2009, 16pp.

The CFP established new exclusion areas to protect the reproductive stock. The extension of these areas varies amongst MUs but as a whole they cover 5.4 % of the total area with scallops (See Appendix V).

**Overall recommendations**

Biomass surveys and TACs for 2008-2009. Discussion with INIDEP scientists indicated that the surveys conducted in 2008 using the vessels of Glaciar Pesquera S.A. and Wanchese S.A. utilized otter nets rather than dredges. Surveys in 2009 (since March) have been conducted for all MUs in the North Sector, provisional TACs (50% of the previous years TAC's) set, until surveys of the South Sector are conducted in late 2009. The TAC's for May 2009-April 2010 are detailed for:

1. The North Sector (23804 tones): Resolution 11/2009; Disposicion 3/2009.
2. The Southern Sector (43277 tonnes).

The authorizations for the South Sector per vessel are detailed in Disposicion 29/2009-DNCP-Pesca

The company vessels surveyed all of the MUs in 2008. The commercial fishing vessels are higher powered than the INIDEP vessels, and used Otter trawl nets. Both these factors will affect the estimates relative to those obtained by survey dredges for both targeted and by-catch species. Catches can even differ between vessels. The Surveillance Team received no information about comparability with previous surveys. The surveys in 2009 are being conducted by INIDEP's BIP Capitan Canepa.

- **Recommendation 17**

**Performance Indicator 3.4.2.4**
The management system is subject to periodic external reviews.
**Performance Indicator 3.4.2.5**
The management system responds to the results of assessments and reviews. Study the feasibility for and adoption of better external reviews of the management system and the incorporation of the results obtained in decision making. External reviews of the management system are important because they provide regular objective overviews of how the system is performing and readily identify areas in which performance can be improved. In one sense the MSC certification process has provided a major external review and the next review 3 years out will do the same again.

**Comment of Surveillance Visit**
Both research and management show clear signs of response to Annual Surveillance Audits.

3) Glaciar Pesquera S.A. Corporate Social Responsibility.

The Glaciar Pesquera S.A. Department of Corporate Social Responsibility continues sponsoring the social programmes mentioned in the previous Surveillance Report:

a. The Self-sufficient Food Production Programme
b. The Ñandeyará Programme (Rescue of street-kids)
c. The Habitat Improvement and Human Development Programme
d. The "Grameen" Micro-credits Programme
e. The Social Construction Store Programme

This fishing company does not process Patagonian Scallop in Argentina. It balances loss of added value production in the local economy by returning profits.

**Issues identified**
Interactions with the Client and the scientific teams involved in the research have been excellent, cordial and productive. The scientists have been responsive to all suggestions by the Surveillance Team.
It would assist the Surveillance Team if the Scientific Team investigating the fishery reported progress of the research in relation to the original conditions established by the OIA Assessment Team during Certification.

Notification of the problem with timely surveys to establish the biomass estimates and TACs has revealed the necessity for the Client to fully inform the Certifier of any change affecting the sustainability of the fishery immediately at the time of such event. Biomass estimates for 2009 are still to be made for Southern Sector Beds. Following a precautionary approach the CFP has

established TAC's for the first 6 months of 2009 set at 50% of last years TAC's for each unit fished. The Surveillance Team propose in the future that the first day of the surveillance visit be devoted to consideration of all fishery related data (biomass estimates, TACS, capture records for each MU in the fishery) in order to establish trends and to track how the fishery is responding to management. Such data will be required in advance of the visit by the Surveillance Team members. This request recognizes the value of receiving most of the scientific information in advance this year. To improve consideration of material the Surveillance Team proposes that a day be devoted to consideration of any questions arising during the surveillance visit before retiring to write the report.

**Active Management by the Fishery Client**

The Surveillance Team considered the "active management" by Glaciar Pesquera S.A. as a factor in judging the adequacy of the client's performance in meeting conditions. Normally this analysis is applied to unmet conditions, but is considered in this Surveillance Report because the client is one of two companies fishing the resource, and is not the Management Authority nor has direction of Research which rests with INIDEP.

The Assessment Team set 4 Conditions in the Full Assessment Report, highly reliant on decision of the Management Authority (CFP) and dependent on INIDEP which is part of SAGPyA, the Argentine Ministry of Agriculture and Fisheries.

- The fishery client does not have control over internal factors associated with the fishery, apart from operative control of Glaciar Pesquera S.A. vessels.
- The CFP and INIDEP develop the strategy for management and research respectively (particularly stock assessment of the fishery).
- The fishery client has assisted change in management and research planning by grants for research in Universities, nationally and internationally; thus enhancing collaboration of these investigations with INIDEP scientists.

As a result the fishery has surpassed the expectations of the Surveillance Team, not only in relation to the Conditions set, but also in encouragement of research on many of the recommendations made. No breach of any of the certification conditions has been observed and the fishery appears well set to meet the standards set by the MSC's Principles and Criteria for Sustainable Fishing.

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**c. Federal Fishing Council Resolutions and Acts related to Patagonian Scallop Fishery, since October 2008, consulted by the Surveillance Team.**

Resolution CFP 1/09
Resolution CFP 2/09
Resolution CFP 3/09
Resolution CFP 4/09
Resolution CFP 5/09
Resolution CFP 11/09
Resolution CFP 14/08
ACTA CFP N° 10/2009
Regulation 3/09
Regulation 29/09
Regulation 101/09

# 6. APPENDIX

**I.** Stakeholder Interview Schedule and Stakeholders consulted.

## A. Buenos Aires

### Friday 11th September

- 17.00 – 19.00 Ing. Marcelo Santos, President Deputy of the Federal Fishery Council (CFP) and National Director of Fishery Coordination.

## B. Mar del Plata

### Sunday 13th September

- 18.00 Assembly of the Surveillance Team in Mar del Plata.

### Monday 14th September

- 08.30 – 09.30 Team discussion.
- 10.00 – 12.00 CNP Gustavo Gallego and Captain Camerucci Cesar Gabriel, Glaciar Pesquera S.A. Client Company.
- 12.00 – 13.00 Lunch.
- 13.00 – 17.00 Team discussion.

### Tuesday 15th September

- 08.30 – 09.30 Team discussion.
- 10.00 – 11.00 Dr. Patricia Martínez, INIDEP, Coordinator; Lic. Mario Lasta, INIDEP Coordinator of the Patagonian Scallop Research Programme.
- 11.00 – 12.00 Dr. Claudia Bremec, INIDEP, Benthic Scientist.
- 12.00 – 13.00 Lic. Gabriel Blanco, INIDEP, On Board Observer Representative; Dr. Ma. Ines Trucco, INIDEP, Genetic Scientist.
- 13.00 – 14.00 Lunch.
- 14.00 – 16.00 Dr. Oscar Iribarne, Univ. de Mar del Plata; CNP Gustavo Gallego, Glaciar Pesquera S. A.
- 16.00 – 19.00 Team discussion.

### Wednesday 16th September

- 09.00 – 13.00 Team discussion.
- 13.00 – 14.00 Lunch.
- 14.00 – 17.00 CNP Pedro Böhnsdalen and Captain Malcolm Daniels, Wanchese Argentina S.A.
- 17.00 – 18.00 Dr. Marcelo Kittlein, Dr. Oscar Iribarne, Univ. of Mar del Plata; Lic. Mario Lasta, INIDEP.
- 18.00 – 19.00 Team discussion.

**Thursday 17th September**

- 09.00 – 11.00 Team discussion.
- 11.30 – 13.00 Prefecto Luis Pablo González, Ayudante Mayor Julio Alberto Bibbo, Cabo Primero Barrios Eduardo, Oficial Auxiliar Juan Pablo Cardiello. Prefectura de Mar del Plata.
- 13.00 – 16.00 Visit to Miss Tide to evaluate gears and examine the factory system.
- 17.00 – 20.00 Team discussion.

**Friday 18th September**

- 08.30 – 20.00 Team discussion.

**Saturday 19th September**

- 09.00 – 20.00 Report writing.

**Sunday 20th September**

- 08.30 – 19.00 Report writing.

**Monday 21st September**

- 09.00 – 13.00 Report writing.
- 14.30 – 16.00 Lic. Mario Lasta and Dr. Oscar Iribarne
- 16.00 – 19.00 Action Plan considerations.

**Tuesday 22nd September**

- 09.00 – 18.00 Team review of report.
- Surveillance Team returns to Buenos Aires.

**II.** List of Stakeholders contacted by e-mail in regard to the Patagonian Scallop Fishery 3rd Annual Surveillance Visit 2009.

Glaciar Pesquera S.A.
Wanchese Argentina S.A.
SSPyA (Sub-Secretariat of Fisheries and Aquaculture)
SAGPyA Secretariat of Agriculture, Livestock, Fisheries and Food
FFC (Federal Fishery Council)
PNA (Argentine Prefecture)
INIDEP (National Institute of Fisheries Research and Development)
CENPAT – National Patagonian Research Institute
UNMdP (National University of Mar del Plata)
CONICET - Technical and Scientific Federal Council
FVSA (Argentina Wildlife Foundation)
CEDEPESCA Center for Defense of Fishing
CAIPA Fishing Industry Chamber
Custom's Agent - "Shepherd and Associates"
Secretariat of Environment and Sustainable Development
Directorate of Fishing, Río Negro Province
National Direction of Fishing Coordination

**III.** Client Action Plan 4th Year.

# ACTION PLAN 4th YEAR

BY GLACIAR PESQUERA S.A.

DATE: 22 September, 2009

GLACIAR PESQUERA S.A.: CONTADOR EDUARDO GONZALEZ LEMMI

This action plan follows the conceptual considerations of the previous action plan (2008), with only minor modifications in order to ensure continuity with the Conditions set by the Surveillance Team, within the capability of the research resources available.

CONDITION 1

**Required Action**: Within a maximum of 4 years, starting from the certification of the fishery it will be necessary to study the variability of the natural mortality rate for each bed, within each management unit.

*Year 1 (milestone 1)*

Identify a) areas within each bed associated with the Continental Shelf Break Front, in which fishing effort is negligible and define the position of each for the particular year,
**Status: Completed.**

b) Identify beds, which have good records of Total Mortality (Z), Fishing mortality (F) in each of the above beds.
**Status: Completed for three management units.**

*Year 2 – 3 (milestone 2)*

a) Z, F and M will be estimated for each of the statistical sampling boxes (each approximately 67 $km^2$) located in each bed (1.2 – previously known as MdQ bed, 2 - previously known as Reclutas, 3 - previously known as San Blas). These results will permit estimation of variability of these parameters within the spatial distribution of the resources in the three beds located at the northern sector of the fishery.
**Status: Completed for three management units (1.2, 2 and 3). There are 9 important fishing areas within the shelf break front, management units 1.2, 2 and 3 and 5, 6, 7, 8, 9 and 10 (management unit 4 has no fishing significance). The first group constitutes a Northern continuous concentration, and the second group a Southern concentration, which have the same biological characteristics, suggesting that these two ecological zones are relevant to the calculation of Z, F and M rather the calculation of these for the administrative management units. Z and F for Management units in the Southern ecological zone: 5, 6, 7, 8, 9 and 10, will be established within a year. M has been calculated for all beds within the Self Break Front (Milessi, 2009c)**

b) Sex ratio in relation to intensity of fishing activity, will be

estimated, which will also allow:

i) Growth studies to establish age-size relationship in each of the remaining beds along the shelf break front.

ii) Studies of relative fecundity per size or weight (samples have already been taken) within the shelf break ecological zones.

**Status: b i) Have been completed. ii) Is still in progress. There is a need to incorporate data from the Southern ecological zone MUs (5, 6, 7, 8, 9 and 10) in relation to fecundity and age-size relationship. The resources available were insufficient for the magnitude of this task.**

c) Documentation of all information obtained into a scientifically acceptable standard.

**Status: It is ongoing. Considerable scientific publication has been achieved for this fishery. See References.**

*Year 4-5 (milestone 3)* Prepare a paper on the variability of natural mortality rate for each bed located in the vicinity of the Continental Shelf Break Front and summarize all other relevant results.

**Status: In progress.**

CONDITION 2

**Required Action**: In a maximum period of 1 year from the fishery certification, biological reference limits must be established based on the resource biology, regarding biomass and fishing mortality rate. Limit reference levels for each bed in each management unit (to be considered in management decisions) will need to be initiated within the current certification period.

*Year 1 and 2 (milestone 1)* Calculate variation in the parameters for the following key biological reference points.

a. size/age at first maturity

**Status: Completed for three management units.**

b. age on each of the major Shelf Break Front Beds.

**Status: Completed for three management units.**

*Year 2 – 3 (milestone 2)* A preliminary model for the Rotational Fishing Strategy (RFS) will be further developed.

**Status: Developed for two management units and currently being extended. This is ongoing as the model is upgraded year to year as new information is available. The progress has exceeded the expectation of the Surveillance Team.**

*Year 4 - ∞ (milestone 3)* Refinement of the Rotational Fishing Strategy model year by year. This is an "exceptional circumstance" as models by their nature need to be upgraded as new quantitative data became available. It is an ongoing process.

**Status: On target and in progress.**

CONDITION 3

**Required Action:** Within a maximum period of 4 years from the fishery certification, the precision of the estimates in the stock evaluation must be improved, taking into account the uncertainty of the initial data and testing of the sensitivity of the results. Development of the possible changes in exploitable biomass, relative to the catch strategy currently applied, under different fishing scenarios will need to be initiated within the current certification period.

*Year 2-3 (milestone 1)* Within two years a Stock Evaluation Model will be developed using geostatistical techniques.
**Status: Achieved.**

*Year 4 (milestone 2)* Analysis of changes that may occur in exploitable biomass under different fishing scenarios will be completed, but it will be an on-going revisable project.
**Status: Already under development and well advanced exceeding expectations.**

CONDITION 4

**Required Action:** Within a maximum period of 1 year from the fishery certification, the relative fecundity per size or weight must be established for each bed, and within a maximum period of 2 years from the fishery certification, a study on the oceanographic variables involved in relation to recruitment must commence.
Additionally, within a maximum period of 3 years after the certification of the fishery correlation over time with the changes in size, age and sex structures of each bed must commence in order to evaluate the impact of the fishery on the reproductive capacity of the stock.

*Year 1 (milestone 1)* Development of methodology without production of definitive results in order to prepare an Oceanographic Model which will estimate
a) larval drift.
**Status: In progress.**

b) the potential of genetic mixing / isolation between management units.
**Status: In progress. Two ecological zones are relevant to this analysis rather the calculation of these for all of the 13 exploited administrative management units.**

*Year 2-5 (milestone 2)* Annual sampling following the techniques developed in milestone 1 above, culminating in a definitive model in year 5 from the certification of the fishery. Sample data tabulated ready for analysis and inclusion in the definitive model each year.
**Status: On target.**

*Year 4- ∞ (milestone 3)* Within a four year period an International – Argentine group will commence development of markers which will allow establishment of between beds variation in scallop genetics.
**Status: In progress.**

Signed: CNP Eduardo Gonzalez Lemmi
Date:

## **IV.** Figures and Tables

***Figure 1.*** Muscle production by fishing day for vessel trip.

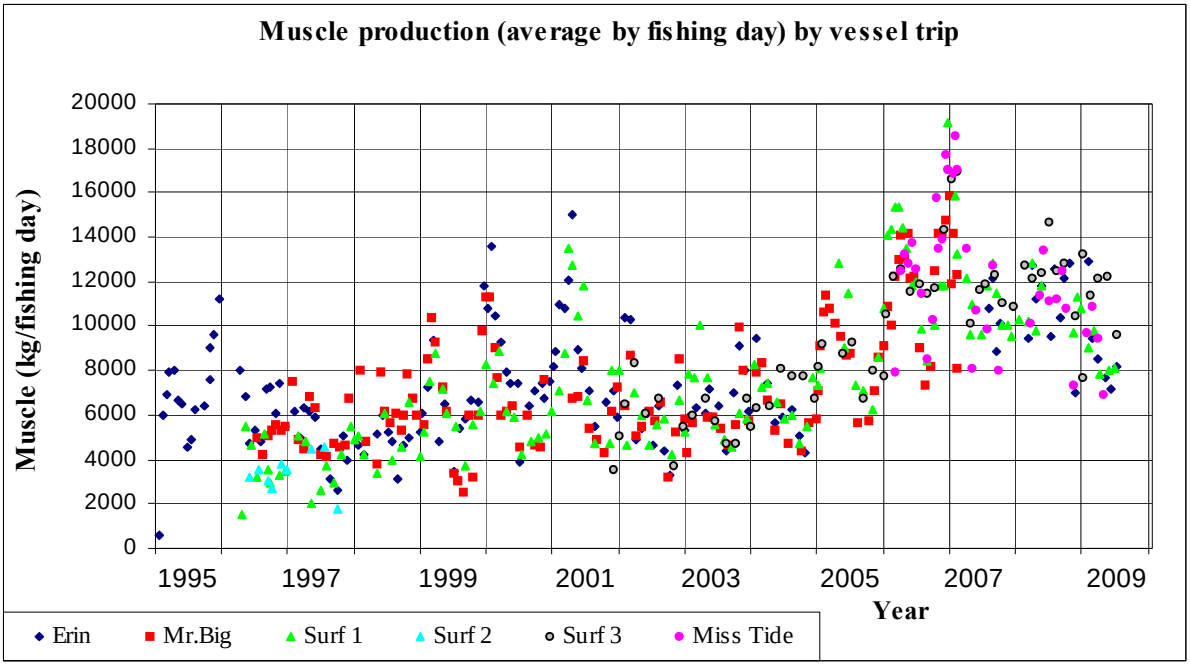


***Figure 2***. Annual muscle production (t) for fleet and vessel.

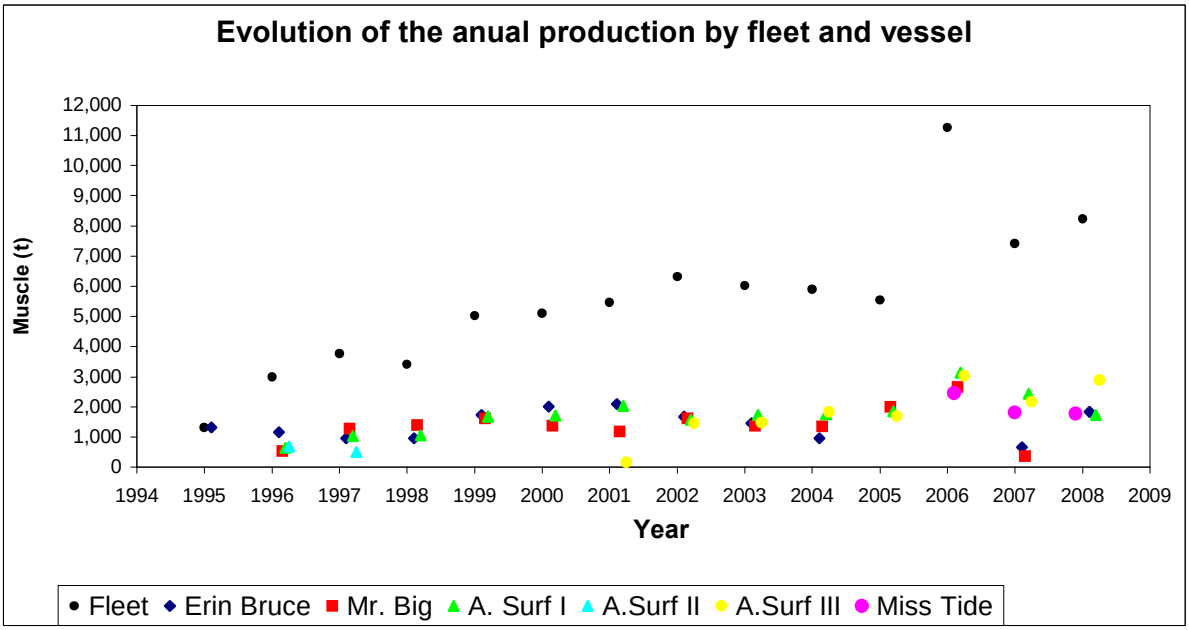

***Figure 3.*** Muscle landing (kg) for vessel trip.

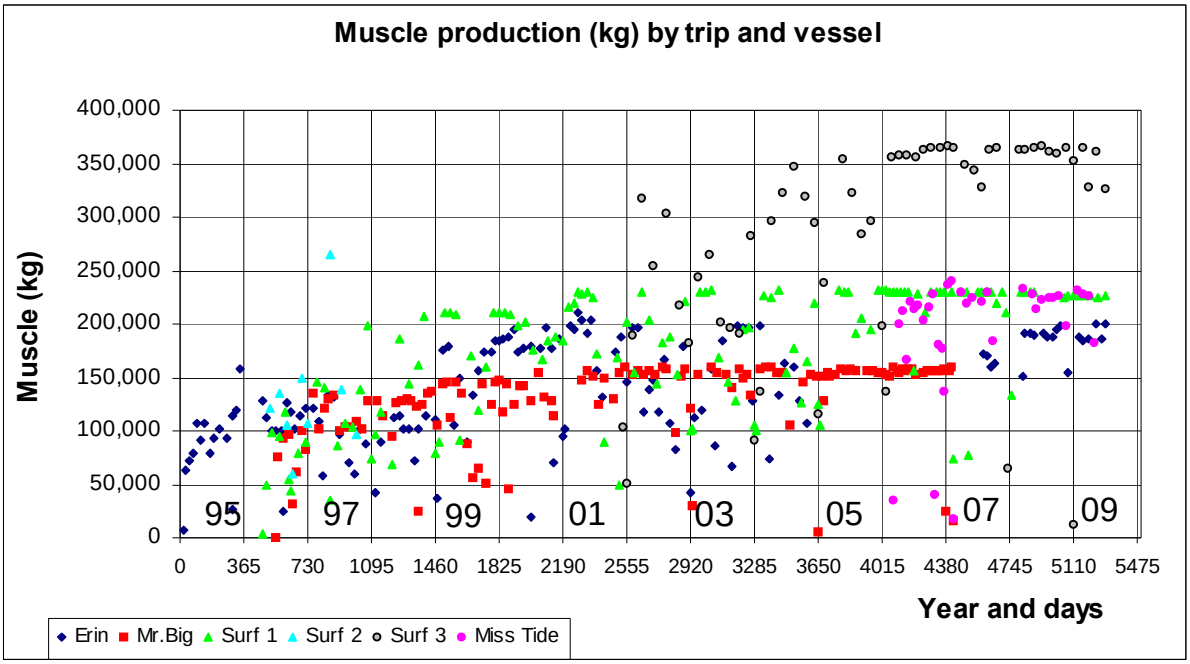


***Figure 4.*** Annual fishing activity (fishing days in days, NOT time at sea) for fleet and vessel.

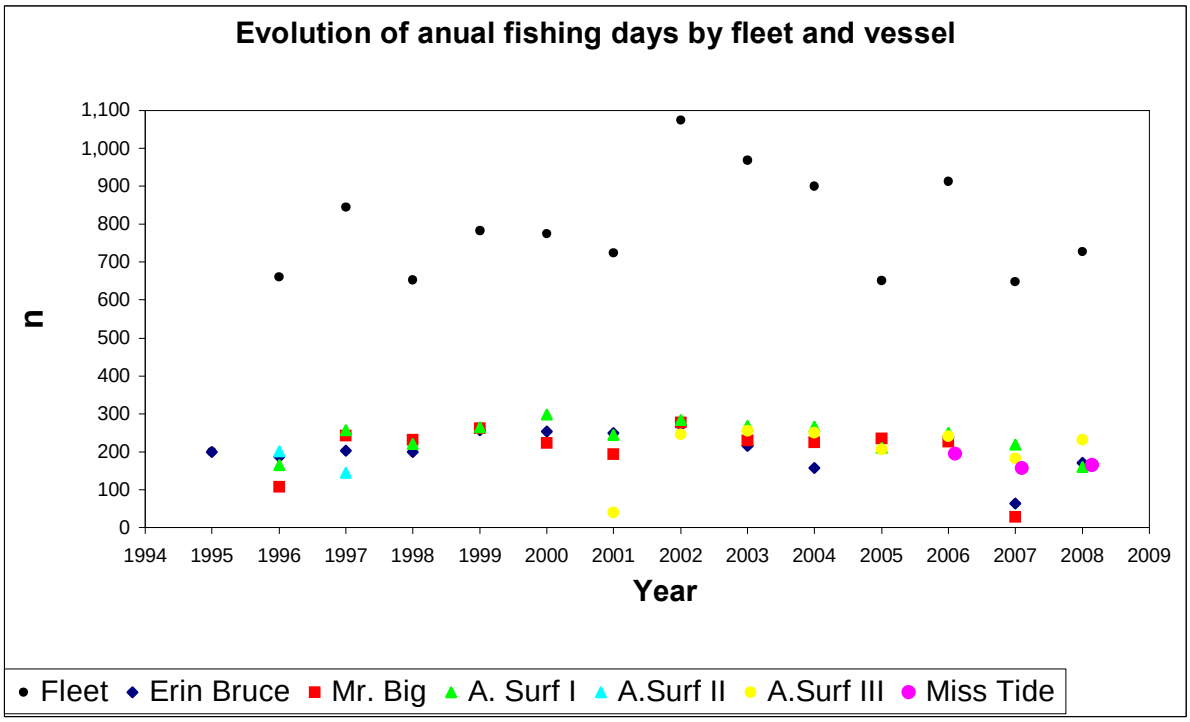

***Figure 5.*** Annual muscle production for fleet and vessel (average and SD)

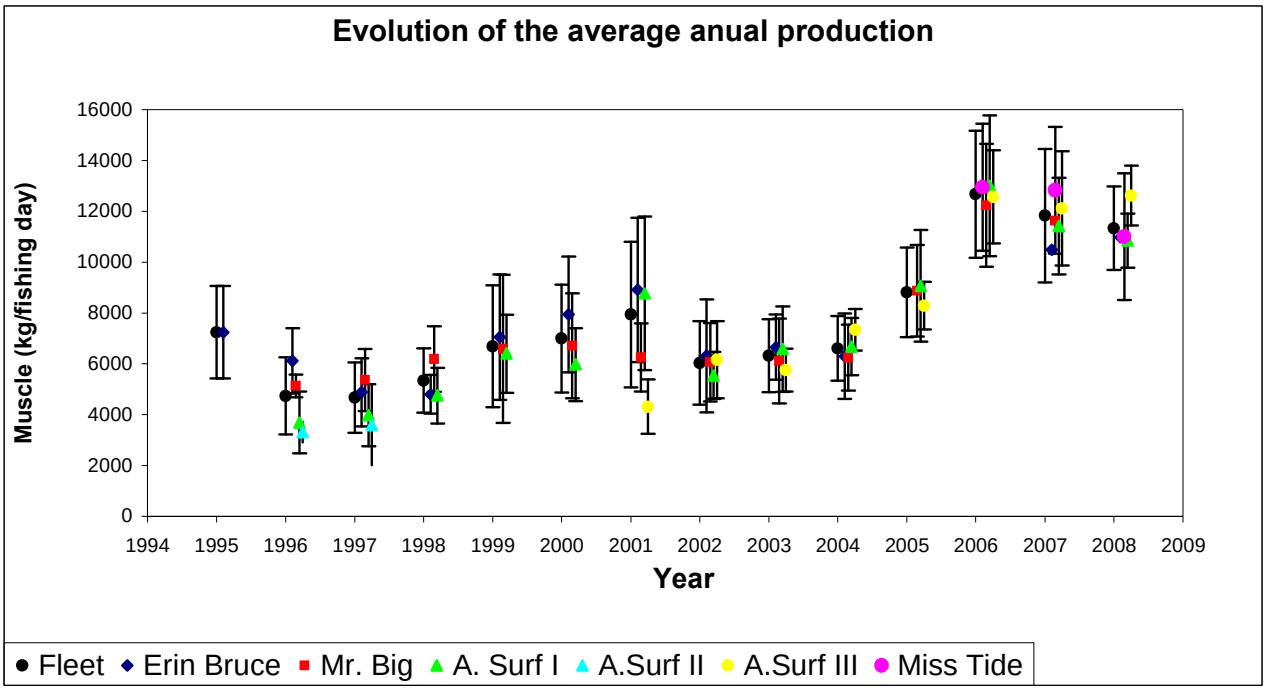


***Figure 6.*** Muscle production (t), commercial scallop catch (t) and fishing effort (nets)

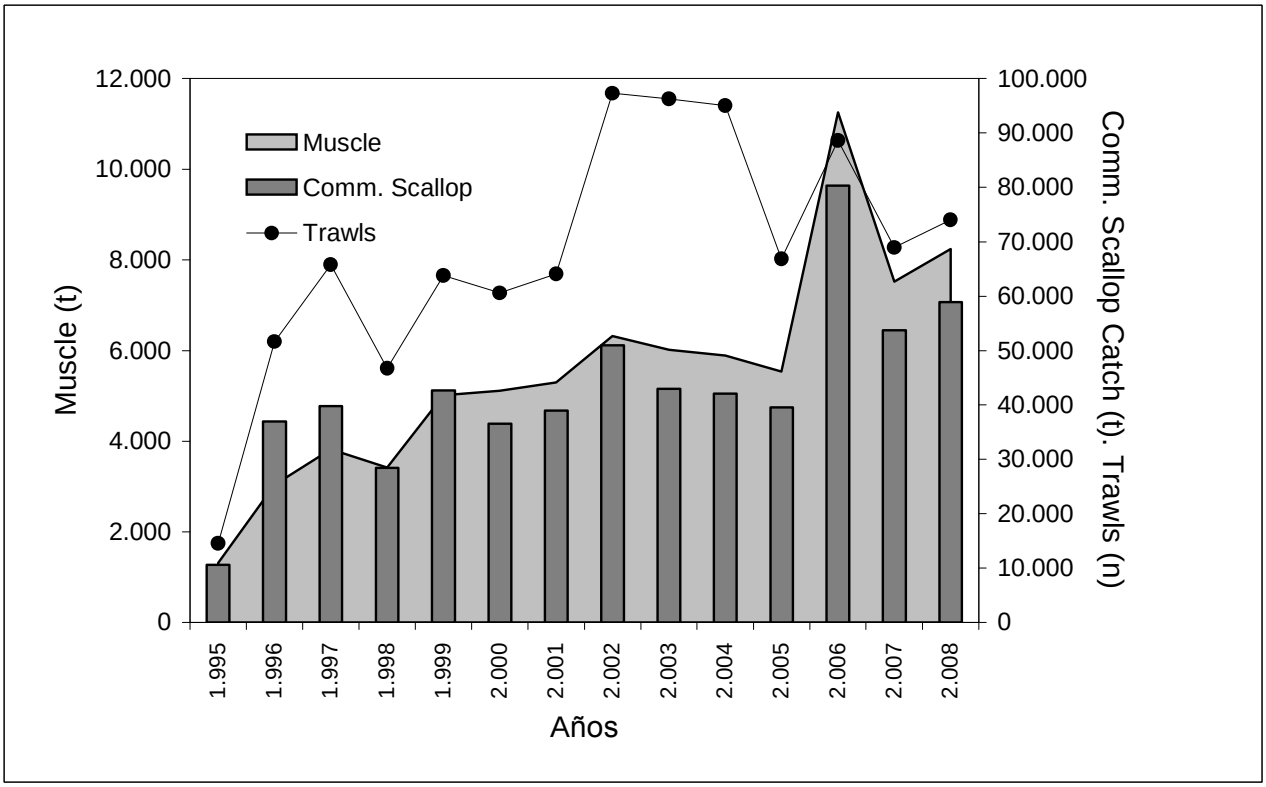

***Figure 7.*** Fleet. January to September 2009.

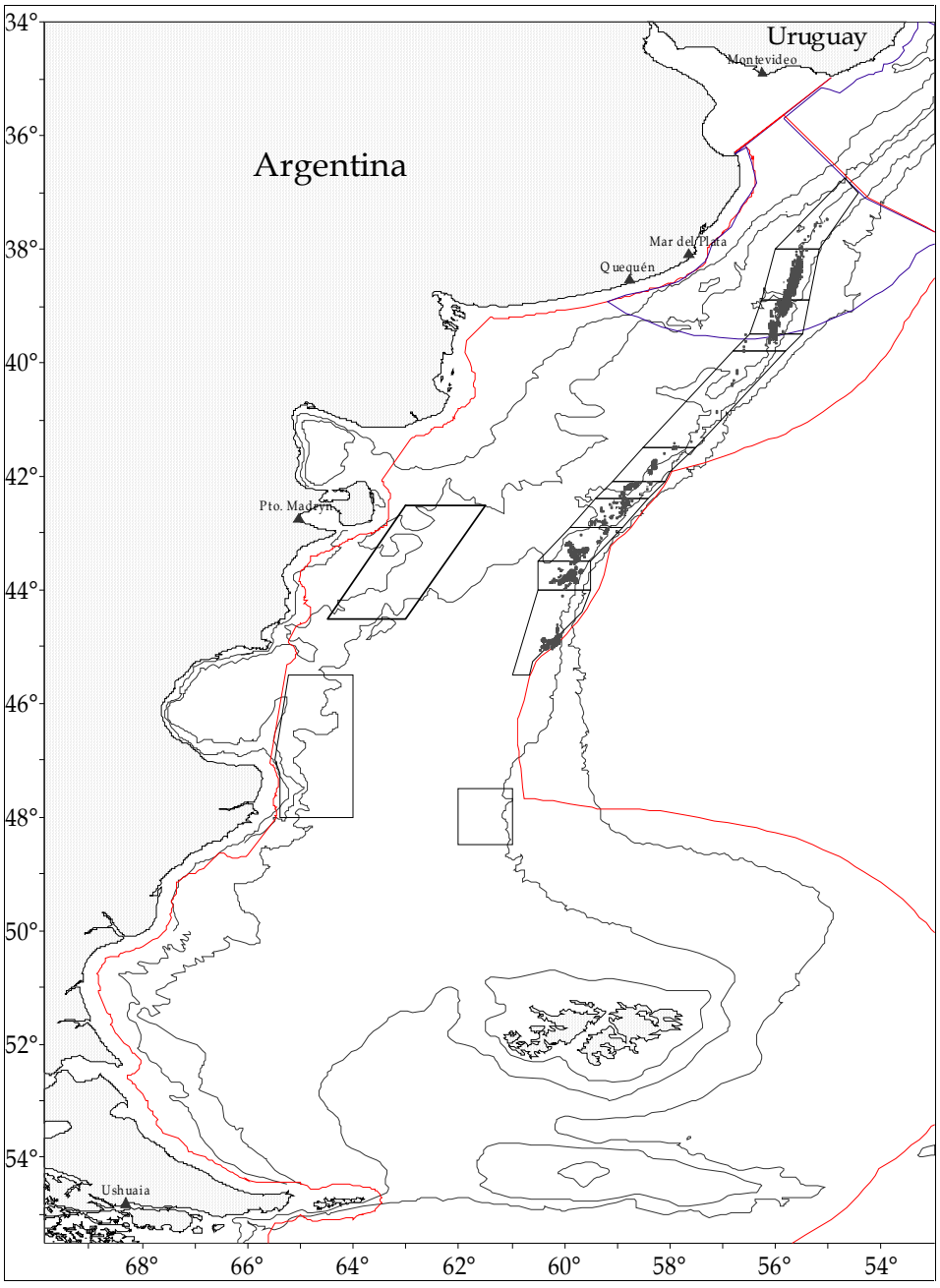

***Figure 8***. Atlantic Surf I. January to September 2009.

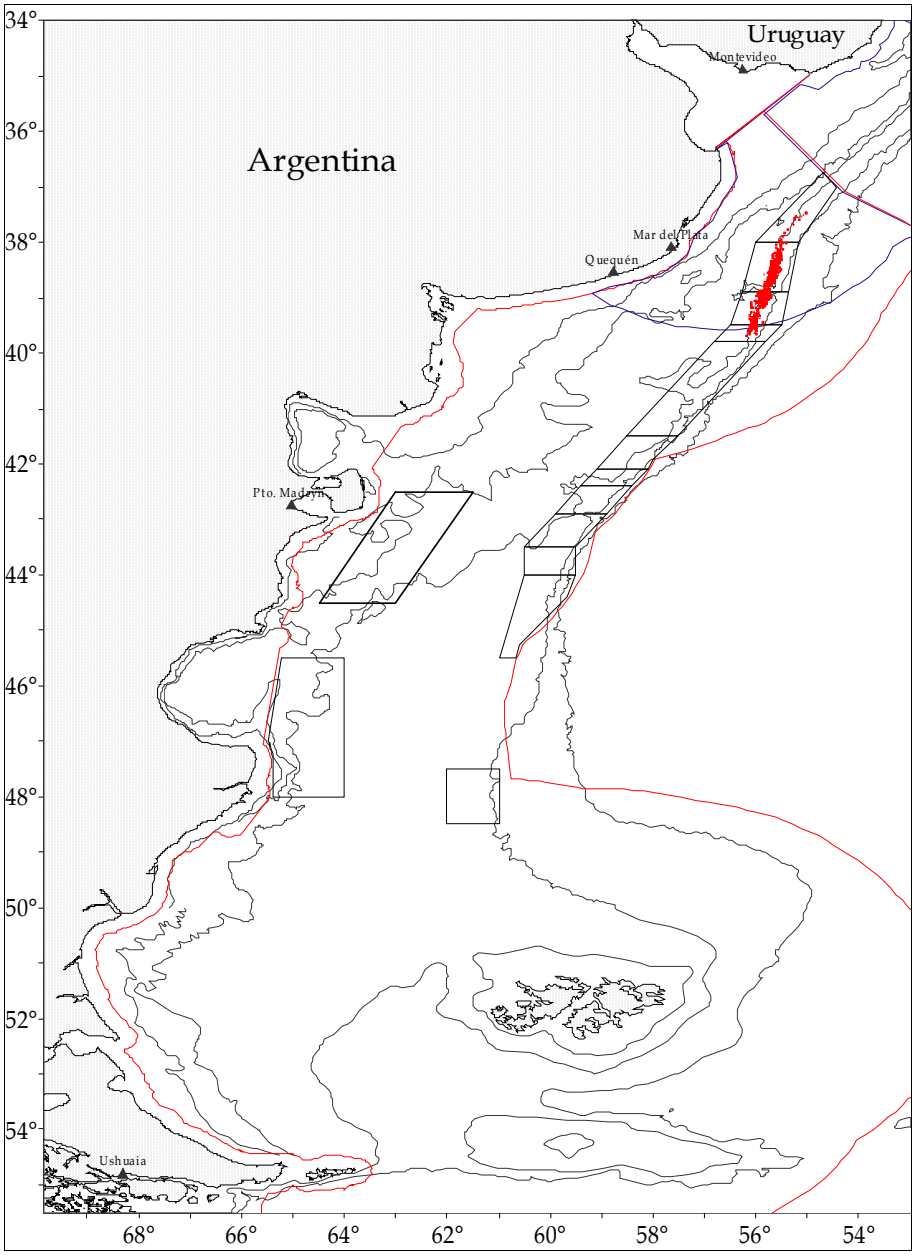

***Figure 9.*** Atlantic Surf III. January to September 2009.

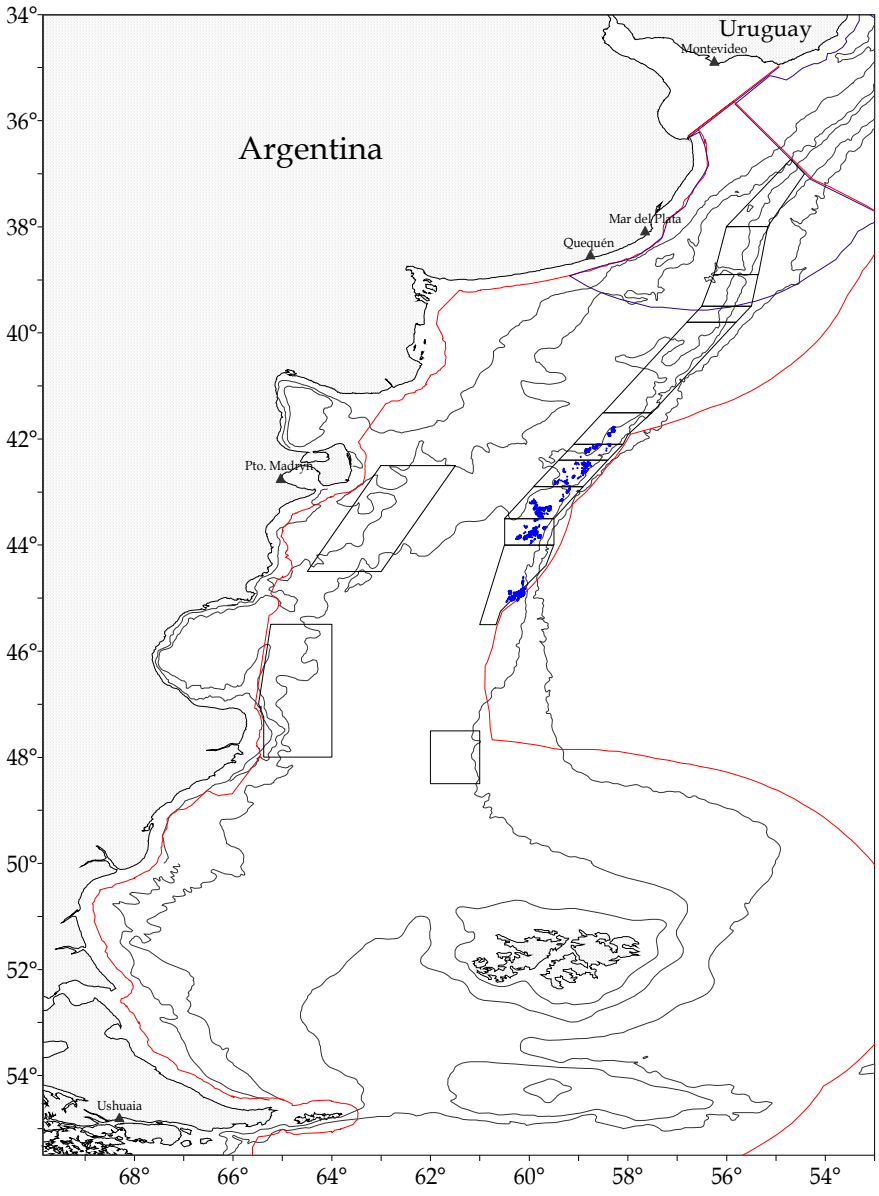

***Figure 10***. Erin Bruce. January to September 2009.

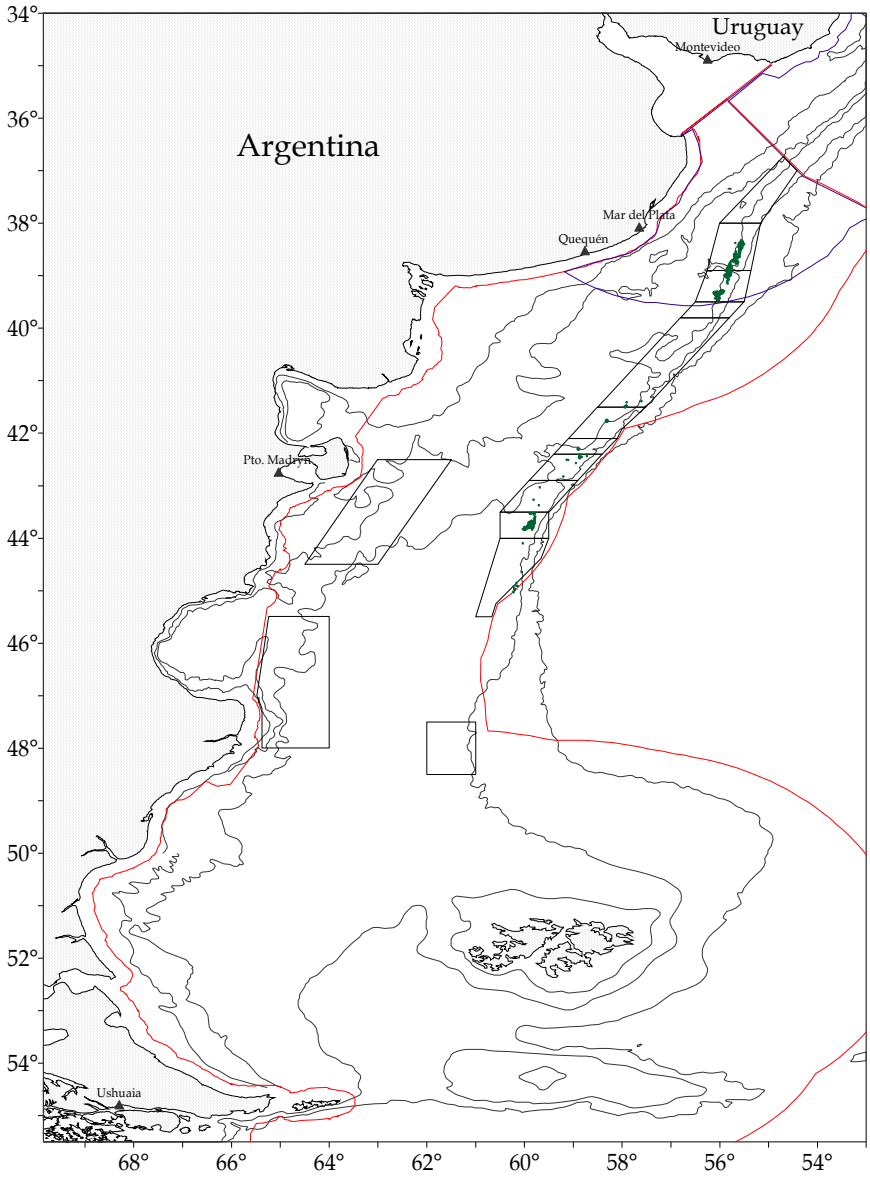

***Figure 11***. Miss Tide. January to September 2009.

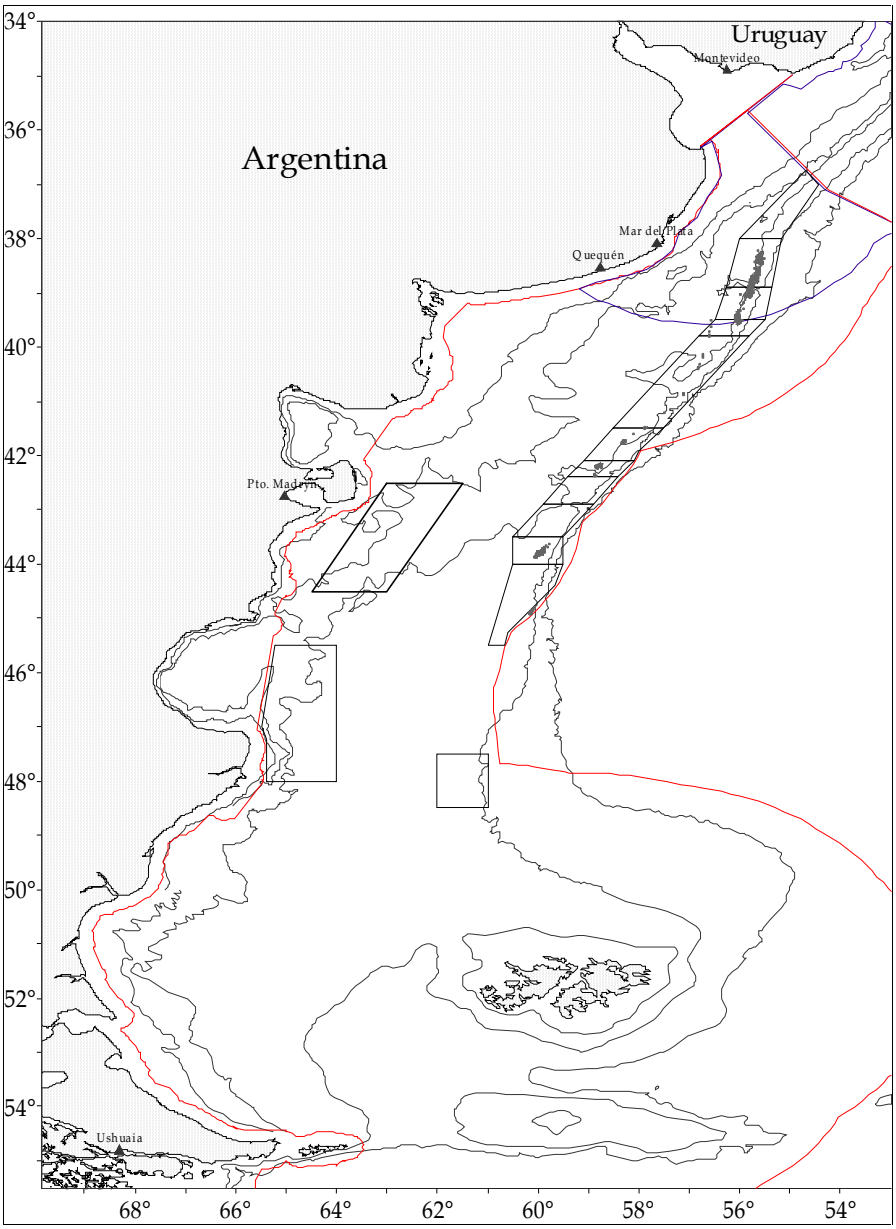

***Table1*** . TAC allocations by the CFP.

| Barco | SN | Fuera SN | SS | Fuera SS | Total por barco | % |
|---|---|---|---|---|---|---|
| **Miss Tide** | 3.015 | 0 | 2.812 | 381 | 6.208 | 19.17 |
| **Erin Bruce** | 6.204 | 0 | 1.963 | 0 | 8.816 | 25.22 |
| **Atlanic Surf I** | 7.674 | 0 | 394 | 0 | 8.8067 | 24.91 |
| **Atlantic Surf III** | 0 | 0 | 6.865 | 3.080 | 9.946 | 30.71 |
| **Total por Sector** | **16.892** | **0** | **12.034** | **3.462** | **32.388** | |
| **%** | 52.16 | 0 | 37.15 | 10.69 | | |

Toneladas de Vieira entera commercial
Factor de Conversion Patagonica: 7.14

| Barco | SN | Fuera SN | SS | Fuera SS | Total por barco |
|---|---|---|---|---|---|
| **Miss Tide** | 422.2 | 0 | 393.8 | 53.4 | 869.5 |
| **Erin Bruce** | 868.9 | 0 | 274.9 | 0 | 1143.8 |
| **Atlanic Surf I** | 1074.7 | 0 | 55.1 | 0 | 1129.8 |
| **Atlantic Surf III** | 0 | 0 | 961.5 | 431.4 | 1392.9 |
| **Total por Sector** | **2365.9** | **0** | **1685.4** | **484.8** | **4536.1** |

Toneladas de callo desembarcado

***Table 2.*** Estimated biomass (t) by research trip.

| | Northern Sector | | | Southern Sector | | |
|---|---|---|---|---|---|---|
| | Total scallop | Commercial scallop | TAC | Total scallop | Commercial scallop | TAC |
| 1995 | | | | | | |
| 1996 | | | | | | |
| 1997 | | | | | | |
| 1998 | 287345 | 148208 | | | | |
| 1999 | | | 15500 | 131800 | 96000 | 18500 |
| 2000 | 320319 | 161940 | 13420 | 154520 | 115504 | 37800 |
| 2001 | 273794 | 173669 | 17521 | | | 15000 |
| 2002 | 209026 | 93493 | 13700 | 105804 | 64215 | 20534 |
| 2003 | 302017 | 76031 | | 84470 | 48027 | 16045 |
| 2004 | 210408 | 57486 | 14045 | 94585 | 40098 | 20312 |
| 2005 | 206409 | 120128 | 33624 | 69237 | 25649 | 9594 |
| 2006 | 246391 | 154649 | 33897 | 127978 | 55651 | 15227 |
| 2007 | 140632 | 107169 | 31926 | 300693 | 201917 | 22984 |
| 2008 | 183307 | 151490 | 39878 | 716655 | 490855 | 39286 |
| 2009 | 115532 | 81672 | 21754 | | | 19644 |

**V.** Regulations
http://www.infoleg.gov.ar

**Consejo Federal Pesquero**

**PESCA**

**Resolución 5/2009**

**Establécense áreas de exclusión de la actividad pesquera como reservas reproductivas en las unidades de manejo de vieira patagónica.**

Bs. As., 12/3/2009

VISTO la Resolución Nº 4 de fecha 22 de mayo de 2008 del registro del CONSEJO FEDERAL PESQUERO, y

CONSIDERANDO:
Que por la Resolución citada en el Visto se establecieron medidas de administración para la pesquería de vieira patagónica (Zygochlamys patagonica) con el objeto de mantener la sustentabilidad de la pesquería.

Que en dicha oportunidad se coincidió en la necesidad de actualizar las áreas de exclusión pesquera con fines de Reservas Reproductivas que habían sido establecidas mediante la Resolución Nº 150 del Registro de la entonces SECRETARIA DE AGRICULTURA, PESCA Y ALIMENTACION, de fecha 19 de marzo de 1996.

Que el INSTITUTO NACIONAL DE INVESTIGACION Y DESARRROLLO PESQUERO, por Nota INIDEP Nº 0412, de fecha 27 de febrero del corriente año, ha elevado una propuesta de actualización de las áreas de reserva reproductiva de vieira patagónica (Zygochlamys patagónica).
Que dicha propuesta contempla el establecimiento de áreas de reserva reproductiva donde deberían evitarse los arrastres de fondo en algunas Unidades de Manejo del recurso, y la eliminación de otras áreas de exclusión que fueran establecidas con fines de estudios experimentales ya realizados, orientadas a la protección y conservación de cierta fracción reproductiva de la población.

Que las áreas de exclusión pesquera de diferentes tipos han sido aceptadas y utilizadas en el manejo de pesquerías porque ofrecen protección a ambientes y especies vulnerables y a las etapas críticas de sus ciclos de vida.

Que asimismo, estas áreas, reducen la mortalidad global de los recursos mediante la asignación de refugios para las poblaciones explotadas directamente o por by-catch e incrementan las tasas de reclutamiento.

Que por todo lo expuesto resulta conveniente complementar las medidas de administración para la pesquería de vieira patagónica (Zygochlamys patagonica) establecidas en la Resolución Nº 4 de fecha 22 de mayo de 2008 del registro del CONSEJO FEDERAL PESQUERO, incorporando a las mismas el establecimiento de las Areas de Exclusión de la Actividad Pesquera como Reservas Reproductivas en las Unidades de Manejo de la especie.

Que el CONSEJO FEDERAL PESQUERO es competente para el dictado de la presente de conformidad con el artículo 9º, incisos a) y f) y el artículo 17 de la Ley Nº 24.922.
Por ello,

EL CONSEJO FEDERAL PESQUERO
RESUELVE:
**Artículo 1º** — Establécense las Areas de Exclusión de la Actividad Pesquera como Reservas Reproductivas en las Unidades de Manejo de vieira patagónica (Zygochlamys patagonica) que se detallan en el ANEXO I de la presente resolución.
**Art. 2º** — Prohíbese la captura de vieira patagónica (Zygochlamys patagónica) en las áreas establecidas en el artículo 1º de la presente.
**Art. 3º** — Las infracciones a la presente Resolución serán sancionadas de conformidad con lo establecido por la Ley Nº 24.922.
**Art. 4º** — La presente resolución entrará en vigencia al día siguiente de su publicación en el Boletín Oficial.
**Art. 5º** — Comuníquese, publíquese, dése a la Dirección Nacional del Registro Oficial y archívese. — Juan C. Braccalenti. — Francisco J. Romano. — Héctor M. Santos. — Juan A. López Cazorla. — Jorge O. Khoury. — Omar M. Rapoport. — Daniel E. Lavayén. — Carlos A. Cantú. — Luis Baqueriza.

ANEXO I

Areas de Exclusión de la Actividad Pesquera como Reservas Reproductivas en las Unidades de Manejo (UM) de vieira patagónica (Zygochlamys patagónica):

| UM | Latitud | Longitud | Area Polígono (km2) | Area Banco (km2) | Area RR (km2) | % Area RR en Banco |
|---|---|---|---|---|---|---|
| 1.1 | 37°28'00 | 55°04'00 | 7.534 | ---- | 25 | ---- |
| | 37°31'00 | 55°04'00 | | | | |
| | 37°31'00 | 55°01'00 | | | | |
| | 37°28'00 | 55°01'00 | | | | |
| 1.2 | 38°27'00 | 55°37'00 | 7.661 | 2.458 | 43 | 1,75 |
| | 38°31'00 | 55°37'00 | | | | |
| | 38°31'00 | 55°41'00 | | | | |
| | 38°27'00 | 55°41'00 | | | | |
| 2 | 39°20'00 | 56°00'00 | 5.670 | 1.893 | 216 | 11,41 |
| | 39°20'00 | 55°52'00 | | | | |
| | 39°30'00 | 55°52'00 | | | | |
| | 39°30'00 | 56°00'00 | | | | |
| 3 | 39°44'00 | 56°13'00 | 2.855 | 605 | 42 | 6,94 |
| | 39°48'00 | 56°13'00 | | | | |
| | 39°48'00 | 56°17'00 | | | | |
| | 39°44'00 | 56°17'00 | | | | |
| 4 | 40°43'00 | 57°00'00 | 15.960 | ---- | 52 | ---- |
| | 40°47'00 | 57°00'00 | | | | |
| | 40°47'00 | 57°05'00 | | | | |
| | 40°43'00 | 57°05'00 | | | | |

| UM | Latitud | Longitud | Area Polígono (km2) | Area Banco (km2) | Area RR (km2) | % Area RR en Banco |
|---|---|---|---|---|---|---|
| 5 | 41°47'00 | 58°06'00 | 5.666 | 1.856 | 62 | 3,32 |
| | 41°53'00 | 58°06'00 | | | | |
| | 41°53'00 | 58°10'00 | | | | |
| | 41°47'00 | 58°10'00 | | | | |
| 6 | 42°12'00 | 58°31'00 | 2.877 | 622 | 23 | 3,7 |
| | 42°15'00 | 58°31'00 | | | | |
| | 42°15'00 | 58°34'00 | | | | |
| | 42°12'00 | 58°34'00 | | | | |
| 7 | 42°29'00 | 59°15'00 | 4.525 | 1.417 | 41 | 2,89 |
| | 42°33'00 | 59°15'00 | | | | |
| | 42°33'00 | 59°19'00 | | | | |
| | 42°29'00 | 59°19'00 | | | | |
| 8 | 43°21'00 | 59°47'00 | 5.368 | 1.627 | 40 | 2,46 |
| | 43°25'00 | 59°47'00 | | | | |
| | 43°25'00 | 59°43'00 | | | | |
| | 43°21'00 | 59°43'00 | | | | |
| 9 | 43°46'00 | 60°04'00 | 4.516 | 2.481 | 60 | 2,42 |
| | 43°52'00 | 60°04'00 | | | | |
| | 43°52'00 | 60°00'00 | | | | |
| | 43°46'00 | 60°00'00 | | | | |
| 10 | 44°49'00 | 60°13'00 | 13.080 | 786 | 39 | 4,96 |
| | 44°53'00 | 60°13'00 | | | | |
| | 44°53'00 | 60°17'00 | | | | |
| | 44°49'00 | 60°17'00 | | | | |
| 11 | 48°06'00 | 61°26'00 | 8.544 | --- | 37 | ---- |
| | 48°10'00 | 61°26'00 | | | | |
| | 48°10'00 | 61°22'00 | | | | |
| | 48°06'00 | 61°22'00 | | | | |
| 12 | 47°18'00 | 64°48'00 | 29.410 | --- | 37 | ---- |
| | 47°22'00 | 64°48'00 | | | | |
| | 47°22'00 | 64°52'00 | | | | |
| | 47°18'00 | 64°52'00 | | | | |
| 13 | 44°22'00 | 64°11'00 | 27.490 | --- | 39 | ---- |
| | 44°26'00 | 64°15'00 | | | | |
| | 44°26'00 | 64°11'00 | | | | |
| | 44°22'00 | 64°15'00 | | | | |

Ubicación de las Areas de Exclusión de la Actividad Pesquera como Reservas Reproductivas (círculos en negro) en las Unidades de Manejo (UM) de vieira patagónica (Zygochlamys patagónica)