

ITSQ in Chilean Fisheries: The Case of the Squat Lobster (*Pleuroncodes monodon*)

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Abstract. Among other mechanisms, the Chilean fishing act established a system of extraordinary fishing permits (EFP) to access the fisheries in stage of recovery or incipient stage of development. The EFP entitles its holder the right to catch during 10 years a fraction of the global annual quota. The right is obtained through auction where one tenth of the global quota is offered annually. Auction results show concentration of the ITSQ for squat lobster in few firms and there is also evidence of cooperation among them within this market. Although the fleet capacity is somewhat less than in previous periods under free access, the fishing season is now longer; fishing firms look for maximizing the value of the catch by distributing the fishing effort throughout the season to obtain the highest fishing yields. The fishery resource has kept high level of biomass since the ITSQ were introduced, but it is not possible to assert that there is a correlation between the two.

Keywords: individual transferable quotas, fishing rights, auction of fishing rights

1. The system of access to the Chilean industrial fisheries: background and characteristics

The present General Fishing and Aquaculture Law (GFAL) is the principal legal body regulating the Chilean activities exerted upon the hydrobiologic resources of the continental waters, the territorial sea, the exclusive economic zone (EEZ) and waters adjacent to the EEZ, according to national laws and international treaties. Its enforcement started in September 1991.

Its regulations rule both the artisanal fisheries and the industrial fishing; the latter identified by being intensive in capital and vertically integrated in its catch activities, fish processing and marketing and, in some cases, also horizontally integrated.

The GFAL recognizes the open access as the legal form to enter the fisheries, which is sustained by the *res nullius* principle, applicable to wild biological resources according to the Chilean Civil Code. Its reference in the GFAL should be understood within the historical frame of the most recent development of the national fisheries, in association with the changes of the economic policy.

During the 1970s, the country initiated deep economic reforms due to the liberalization of the markets, which were marked by a reprivatization process and minimization of the State role. In this sense, the open access to the industrial fisheries was observed as a mechanism strengthening the free competence between the economic agents. Thus, coinciding with a phase viewed as one of abundant resources, the fishing

industrial sector experimented a large growth with landings around 5.5 millions of annual tons towards the beginning of the second half of the 1980s. However, in the same epoch, programs were implemented to freeze the fishing effort, limiting the hull capacity of the fleet, for the major industrial fisheries in face of the evidence signaling situations or trends of full exploitation or overexploitation of the stocks.

Almost at the same time the GFAL study was initiated, which considered in essence one solution oriented by the market to allocate resources, that is, keeping the open access for those fisheries considered not to be fully exploited and a system of individual transferable catch share quotas for those which were in order to improve economic efficiency. This system gave permanent right to catch a fraction of a global quota, with an initial assignation recognizing historical rights, which could be freely transferable and partitioned. The right would operate upon a fishery unit defined for a particular species in a specific geographical area.

The law was approved, but its enforcement was deferred by the raising of a new government in 1990 with the purpose to modify it, given the opposition to the access limitation system, which was regarded as monopolizing the fishing benefits (Peña-Torres, 1997). The opposition came from fishing entrepreneurs willing to extend their operations to other fisheries and new investors with intention of entering the fishing business. Their entry to fully exploited fisheries could have only been achieved by purchasing the fishing rights to those which the law had assigned. There was also opposition of part of the fishers

unions facing the “privatization” of the fishing resources, which was seen as the cause of mayor unemployment. The overfishing risk argument, which would imply not closing the access to the fisheries, was opposed by those sustaining that the regulating authority had conservation measures such as temporal and geographical bans, minimum size catch, fishing gear restrictions and global quotas. The discussion concerning the constitutionality of the restriction to access and the allocation of exclusive rights of fishing was an important part of the debate. Finally, there was a political consensus concerning these matters, enabling the approval of the modifications of the original GFAL, and its enforcement in 1991.

On its central aspects the GFAL kept as a general regime the free entry to the industrial fisheries, even though regulated by the ruling authority. This authority should issue a fishing authorization to each vessel. The authorization includes the vessel features, the fishing gear and the fishery unit where it can operate; this system is associated with the concept of regulated open access described by Homans and Wilen (1997).

Additionally the GFAL stipulates other regimes of access to the industrial fisheries: i) the regime of full exploitation, defined as that stage in which there is no productive surplus of the resource relative to the levels of existing fishing capacity; ii) the regime of fisheries in recovery, applicable to fisheries reopened after they have been completely closed, during a period of at least three years; iii) the regime of incipient fisheries, applicable to those underexploited fisheries, whose catch levels have not reached a 10% of the total allowable catch (TAC).

Under a full exploitation regime, the access can be temporally closed for a year which may be renewable, and, the fishing authorizations may be transferred with the vessel; at the same time the total fishing capacity in the fishery unit, measured in functional features of the vessel – length and hull capacity for purse-seine fisheries and length and engine power in trawl fisheries – is frozen. The declaration of full exploitation of a fishery unit can be obtained by absolute majority from the corresponding Zonal Fishing Council and the National Fishing Council, previous a technical report of the Undersecretary of Fisheries¹; whereas, the decision of closing access requires two thirds of the votes of such Councils.

Even though a disaffection of the foregoing described regime is possible, with a similar procedure returning to the general regime of regulated open access, it has not occurred; the regime of full exploitation has been annually

¹ The Undersecretary of Fisheries is the ruling organization of the fishing activity. The Zonal Councils and National Fishing Councils were created by the GFAL with the purpose of participation of the agents and institutions of the sector, with consultative and resolute faculties according to the subjects.

ratified as well as the closure of access to the fisheries in which it has been implemented. In this sense, a greater valorization of the closure of access as a mechanism to limit the overfishing risk is observed by the agents’ side; although it is likely seen as a mechanism that facilitates, up to a certain degree, the rationalization of the industry (i.e. the transference of the fishing authorizations has resulted in a major concentration of the industry), and allows the fishing authorization holders in the fishing management system a better negotiation position.

In the fishery regimes in recovery and incipient, the extraordinary fishing permits (EFP) system operates, which in essence assigns over a 10 years period individual transferable share quotas (ITSQ) expressed as a fraction of the annual global quota (AGQ) determined for the fishery. To establish any of these two regimes, the consultation of the corresponding Zonal Council and the approval by the absolute majority of National Council are required. These requirements are less demanding than to establish the regime of full exploitation.

In general, the access system to the industrial fisheries shows factors based upon the rights of use accordingly with the definition of Hannesson (1999), positioned between the open access and the right of property completely defined or non attenuated following Randall (1987). In the following sections, the characteristics and application of ITSQ in the squat lobster fishery are reviewed.

2. The system of individual transferable share quotas (ITSQ)

The ITSQ system is presently applied to four fishery units²: squat lobster (*Pleuroncodes monodon*) in the Central-south zone since 1992, yellow prawn (*Cervimunida johni*) in the same area starting in 1997, black cod (*Dissostichus eleginoides*) from the Southern zone since 1992, and orange roughy (*Hoplostethus atlanticus*) along the littoral since 1997. The first two are under the fishery regime in recovery and the other two under the incipient fishery regime.

The individual allocation of fractions of the AGQ is done by annual public auction-sale in which a 10% of the AGQ of the year is assigned, in batches of 1%; each batch is offered at the same minimum price. An extraordinary fishing permit (EFP) is granted to each beneficiary, which assigns the right to catch annually, for a period of 10

² A fisheries unit is “the set of activities of industrial fishing exerted over a specific hydrobiological species, in an specified area”. Therefore, a fishery unit does not necessarily cover all of the area of distribution of the species upon which exists industrial or artisanal fishing. That is the case of the black cod and the yellow prawn.

years, the product of the AGQ times the fraction assigned; in this case the right is upon a fixed fraction. Presently a grantee cannot bid over 50% of the total in each annual auction. In order to allow continuity of the procedure in time, such that only 10% of the AGQ is auctioned each year, the first assignment is done based on the 100 % of the AGQ; from these assigned fractions, each year thereafter 10% is abated successively so at the end of 10 years, the EFP becomes extinguished. This right is known as variable fraction³.

The grantee of the EFP could be an industrial fishing privateer or a person with vessels registered in his name or under a different right to the property; what is common is that the grantees are fishing firms, partially or totally vertically integrated, operating one or more vessels. The system does not impose direct regulations to the effort – although they are applicable to conservation measures such as closed season– therefore the grantees can decide upon the composition of inputs they consider most convenient. In this way, it considers one of the advantages of the individual quotas mentioned by Copes (1986), eliminating the deficiencies of limited entries by licensees, assuming that the agents will use the most economic configurations of fishing effort.

The allocation of these fishing rights by auctions is not sustained by the collection of rent, even though it could be an expected social goal. Primarily, the auction is justified in a context of a competitive economy oriented by the market, in which the competence to catch the fishing resource is moved to the competence for the exclusive right to fish. Undoubtedly it favors efficiency, but not equity in the event that those agents with less financial resources are left out of the market; partially it is ameliorated by the anticipated recollection for the society of the partial or total rent to be generated by such right.

The answer to how efficient this ITSQ system could be depends on its economic features, in comparison to well defined rights; Peña-Torres (1999) states that *well defined* ITQ programs moderate resources dilapidation produced by competing for the catch. Based on Scott (1988), it is possible to approach *a priori* general evaluation of the features of these rights according to their exclusivity, duration, security and transferability.

The exclusiveness of the EFP is partial, since it is referred only to the right to catch the fishing resource hold by its titular, right of use, but not to manage it as suggested by Lane (1999), when he refers to this feature of the property right. This feature only allows the restriction of access and the consequent reduction in the fishing costs. The

³ In the case of incipient regime fisheries, the first auction could allocate a minimum of 90% of the AGQ; the remaining 10% are recognized, over a three-year period, as the historical right for those who have been operating in the fisheries.

level of exclusivity of the EFP may be increased by the assignation system through the auctions, because it could facilitate their concentration if there are no restrictions for the fractions to be auctioned by the same operator.

The duration of the right, although it lasts 10 years, becomes indefinite as the operator succeeds in adjudging rights of fishing in each of the annual auctions; even though the risk of not adjudging is always present, its level of participation could be reduced only temporarily by making, in the mean time, future adjustments upon the business.

The EFP security features puts in evidence its major weakness; by being granted upon a fishery unit, the right is likely to be undermined by thirds, or by the own tenants of EFP, operating in technoecologically interdependent fisheries under a different access regime in the same or other area in which the resource is distributed. The weakness is facilitated by the fact that the species may be caught as by-catch in other associated fisheries, which is restricted but it is not incorporated into the ITSQ system, or simply because the enforcement is not effective as eventually occurs. On the other hand, variations in the AGQ do not seem to be an important issue in the security of the system, since the adjustments are annual and are prior to the auction.

The transferability of the EFP does not have restrictions that affect its efficiency; they could also be divisible in low fractions of the global quota. As a result, the fractions to be auctioned are divided in small batches of one tenth, each tenth resulting in an EFP. Even with these features, the importance of the transferability will be very related with the industry's structure, with the size of the potential participants fractions that count with EFP and with the fishery's features. If this market does not prove to be dynamic, the auction markets then could have a more preponderant role in the EFP movement.

In a wider context the system should also be evaluated according to the desired goals that the fishery manager has designed. Although there is general agreement in that the ITQ system pursues the rational allocation of the productive factors, by effectively closing the access to the fisheries and the creation of rights of property, it should also be taken into account the specific goals for each situation.

In the Chilean case they seem to be varied; Peña-Torres (1999) states that the mechanism grants improved incentives for the auto-regulation so that the firms plan in the long term, improving the value of the catch with a better quality of it. The latter argument is also offered by Bernal and Aliaga (1999), complementing with the objective of achieving longer fishing seasons and less discarding; they emphasize the goals of recovering the

stocks from overexploitation, reduce the over capacity of fishing and prevent their future increment.

The following section presents aspects of the ITSQ system performance applied to the squat lobster fishery related to some of the goals above mentioned.

3. The ITSQ in the squat lobster fisheries

3.1 The fishery

The squat lobster fishery develops off the central-south littoral zone of Chile in depths of 100 to 300 meters; in the history of the fisheries three periods may be identified

(Fig. 1): i) a period of strong expansion and fall of the landings ending with the start of a total ban in 1980, that lasts until 1982; ii) a second period, in which the fishery was reopened in 1983 through 1988 with annual catch global quotas, during which the stock declined. Therefore, a new ban was enforced between 1989 and 1991. iii) A third period, the present one initiated in 1992, in which an annual global quota is applied with individual allocations.

During the first two periods there was open access; while in the third, along with the application of ITSQ, a catch season was established, between the months of April and September of each year. In this third period the

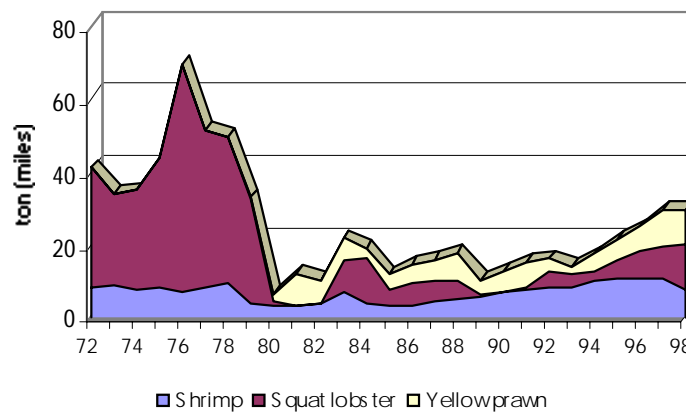


Fig. 1 Landings of small crustaceans, 1972-1998

exploitable biomass has kept an increasing trend, from 28,1 thousand tons in 1992 expanding, with oscillations, to 70,1 thousand in 1997 (FIP, 1998). This is reflected in the volumes of the fixed annual quotas, starting with 4 thousand tons in 1992, increasing to 5 thousand in 1995, to 8 thousand in 1996 and to 12 thousand in 1998; however for year 2000 this descends to 10 thousand tons due to increments in the exploitation rate of the stock.

The trawling fleet operating in the fishery tends to be rather homogeneous, with a mode in age between 32 a 37 years and engine power between 351 and 450 HP, without major technological innovations in catch and manipulation of it on board. The greatest number of vessels in the fishery was reached in 1986 with 30 units; after the reopening of the fisheries in 1992, the amount of vessels had been increasing up to 24 units in 1997 (Fig. 2); the mean power in the last years has maintained similar to that of the 1984-88 period, in the range of 400

to 450 HP. Besides the squat lobster, the fleet has technological capacity to operate upon both the yellow prawn and shrimp resources, which in fact occurs; therefore its activity is characterized as multispecies. This generates greater control difficulties, because these resources administratively represent different fishery units and are managed under dissimilar access regimes.

This technologic interdependency of the fleet also extends to the processing plants, even though there is differentiation concerning the markets. The production is oriented to the external market, where it competes with close substitutes; the industry is a price taker. The gross value generated is around 30 millions of dollars annually, representing a 4% of the export value of fishing products, excluding aquaculture; of that value approximately a 40 % corresponds to the squat lobster.

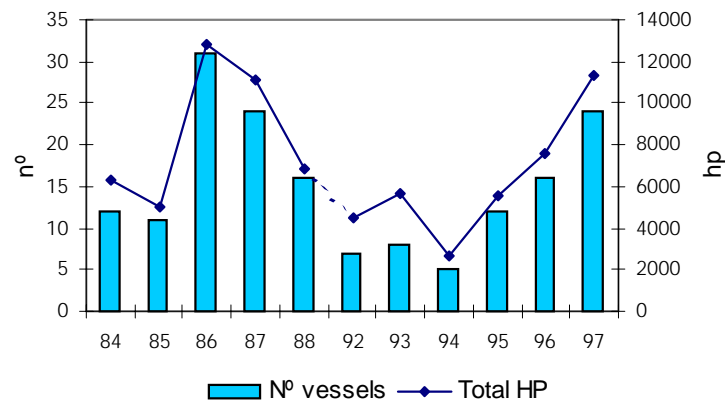


Fig. 2. Number of trawling vessels and power accumulated in the squat lobster fishery periods 1984-88 and 1992-97
Source: FIP, 1998

3.2 The auction market of EFP

The market is small relative to the number of potential participants; presently they represent about one third of the firms that compose the squat lobster and shrimp industry. They are heterogeneous in size, in levels of fishing specialization, in levels of activity integration and in their organizational structure; they are homogeneous in catch technology and crustacean processing.

A sole firm tends to concentrate around 50% of the AGQ, followed by three that cover 90% of such quota altogether; these levels of concentration originate in the first auction in which four firms participated, consolidating the 60% of the AGQ in one. Since the 1995

season, a stabilization in the structure of the participants in the AGQ is observed and the number of firms in the market, after an experiencing period and the restriction of the maximum to be auctioned by a firm –50% by auction. During this period a slight decline in the participation of the first firm occurred favoring the next three (Table 1); even though these firms have settled their position in EFP of variable fractions – those allocated in the first auction – that have been returned by the grantees and turned in to auction again. In this context the market of EFP transferences that could have functioned, did not. Throughout the span of the ITSQ system in this fishery only one transference, for a one percent fixed fraction of the AGQ, is recorded.

Table 1. Percent participation of the first four firms in the EFP market

Nº of firms	1995	1996	1997	1998	1999	2000
1	58.0	56.0	54.5	54.5	51.5	48.5
2	71.0	70.0	70	70.0	68.0	66.0
3	80.9	81.2	81.5	81.8	81.8	79.4
4	90.3	90.4	91.5	91.6	90.7	88.8
Firms in the market	9	9	9	8	9	10
New firms	3				1	1

The concentration levels in this market are comparable with the EFP auctions markets of other fisheries; by example, in the case of the black cod fisheries, although the first firm participates in a lower percentage, the first four reach a similar level to that in the squat lobster (Table 2). Even though the transference market has functioned, 47 in the span of the system, as a product of firm fusion and eventual transactions to cover catch quotas in national and international waters. In the case of

the yellow prawn fisheries and orange roughy the participation between firms is more even. In relation to the amount of firms in these markets, in the fisheries of black cod and orange roughy they match the existing total of the industry; they have both in common a high technological level, high investment and greater operational complexity in the catch process compared to the crustacean fisheries.

Table 2. Percent participation of the first four firms in EFP markets for the 2000 season.

N° of firms	Black cod	Yellow prawn	Orange roughy
1	41.9	21.9	28.7
2	64.4	42.6	48.4
3	80.7	56.0	66.1
4	91.2	67.9	82.8
Firms in the market	7	9	6

In any case, it is not noticeable that the ITSQ system in these fisheries would have produced or is producing a structural change in them; what in fact is common in the fishing industry where there is vertical integration is that the number of firms tend to be reduced because they look to establish bigger scales of production.

In the Chilean fishing industry there exists a trend to increase the levels of concentration that have been expedited by closing access programs in which the fishing authorizations are transferable. For example, in the common hake fishery, the first three firms concentrate 75% of the AGQ (Cerdeira *et al.*, 1998) or in the northern pelagic fishery in which two industrial congregates concentrate 90% of the landings. It is clear that the levels of concentration in the industry are not only peculiar of the ITQ programs. In front of possibilities of transferable rights, that undertake value according to the effectiveness of the closing of the fishery, the firms will try to reduce the external costs of fishing and secure the levels of production and the markets; besides the improvement of their position of lobby in the management of the fishery.

Auction prices of the catch rights for the squat lobster, expressed in US\$ per ton, have been fluctuating in the

nine years of life span. In figure 3, the first auction line represents the resulting price of each year, considering the remaining fraction of the EFP once annually discounting 10% of the first allocation and the global annual quota. The line of annual auction represents the auction price per ton each year; this price would remain the same in each of the following nine years if the AGQ did not change. Finally, the accumulated price represents the resulting value of each year, that is obtained by combining the first auction and the one annually realized with the variations of the AGQ.

Price variations are not attributable to one factor in particular; although there are no evidences that they vary with the final product price or with the auction minimum-bidding price, since both show small changes. Bernal and Aliaga (1999) suggest that at the beginning of the system there were optimistic expectations upon future increments of the stock, consequently the AGQ, and a trend to control a dominant fraction of the AGQ. In fact, a firm took a dominant position being followed by the rest, justifying the high initial price of the quota that afterwards showed an important decrease with increasing AGQ.

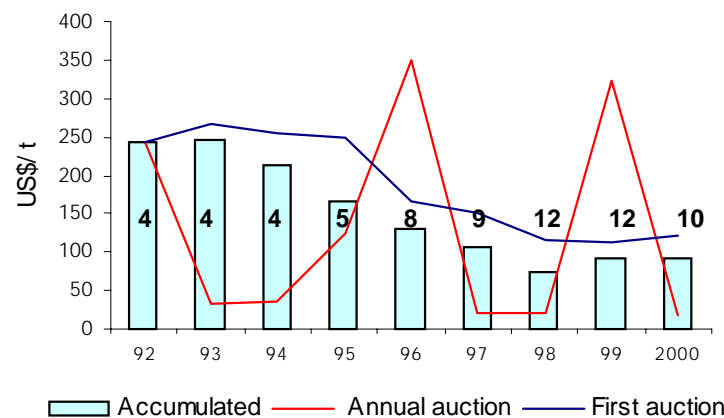


Fig. 3. Squat lobster quota prices auctioned during the fishing seasons of 1992-2000 (Numbers in bars correspond to AGQ in thousands ton)

There is also evidence of cooperation among firms present in the market, with agreements on prices, which result to be close or similar to the floor price; or price increments with low variability, obeying increments of the AGQ, or, eventually, to maintain the exclusion levels in the auction market. In all the accumulated prices each year there follows a decreasing trend, situating them between 90 US\$ and 100 US\$ per ton for the present levels of AGQ.

In short, the market shows low levels of competence; more over, it could be guessed that firms would try to maximize monopolized benefits of the industry, balancing the flow of net marginal benefits generated by the right with the marginal cost of acquiring it. This way, the prices would be reflecting only a part of the rent of the resource⁴.

The analysis of the adjudging values of the EFP for the fishery indicate that these could be situated at maximum levels of 235 US\$ to 250 US\$ per ton (Arellano, 1998), similar to the prices of the first auction, if the fleet operated only upon the squat lobster; Posada (2000) estimated maximum prices to pay between three to four times the adjudging prices per ton if the fleet also operated in the associated yellow prawn and shrimp fishery units of the same geographical area. In both studies the prices are referred to fixed fractions of the AGQ within the range in which it has varied.

The relationship of prices of the quota to shore prices (ex-vessel price) has been mentioned in Hatcher and Robinson (1999) as an index to measure the strength of the property right; this ratio in the case of EFP of the squat lobster have fluctuated between 0.6 and 1.8 times, being lower at present. This would suggest that the right is weakening; besides the structural feature that the EFP market presents, the explanation to this seemed weakness could also be found in the joint effect of the security of the right, that is, if the agents visualize that it is erosionable, and in its definite span feature.

In the life span the auction system has generated annually fiscal incomes of 0.94 million US\$, approximately equivalent to 8% of the total value generated by the fishery; which in turn correspond to 95% of the direct fiscal income of the fishery considering the addition payment of the fishing patent. Among the transaction costs of a fishery those associated with the information and maintenance of the resource (i.e., knowledge and assessment procedure of the resource, that would allow to diminish its levels of uncertainty), are given great

⁴ All fishing vessel must pay annually the fishing patent according to its gross tonnage, independent of the access regime; in the case of the squat lobster the mean has fluctuated around 10 US\$ per ton landed, in addition to the EFP prices. The primary goal of this patent is to finance research programs for the management of fisheries through the Fisheries Research Fund (FRF).

importance for the management and exploitation decisions. At present, the FRF allows a sustained assessment program for the squat lobster by a sum near the 11% of the collected funds from patents and auctions, besides the programs of annual follow-up of the fishery with funds of the general fiscal budget.

Although the funds generated by auctions are not reinvested directly in the fishery, like those from fishing patents, it is possible that they sum up more than the transaction costs related to the control and surveillance of the fishery, as well as the costs of distribution of rights; if so, the net rent generated by the resource would be shared between society and the private agent. Leaving aside the distribution issue, in this case the ITSQ system would be currently avoiding that such rent had been dissipated, as it would occur in those fisheries with open access (Anderson, 1986; Hanesson, 1993).

3.3 Operational performance of ITSQ

One of the arguments in favor of the system is that the ITQ facilitates the rationalization of the fishing capacity; in the case of the squat lobster fishery, it is not quite conclusive in either sense. During the first years of the system the fleet capacity –taking as indicators the number of vessels and the trawling power–, had lower levels as compared to the previous period in which there existed free access to the fishery. Lately, the number of vessels and their power had increased continuously even though they have not overcome the levels of the previous period; this would be justified by the increments in AGQ, up to three times the quota at the beginning of the system, and also by the ITSQ introduction in 1997 in the yellow prawn fishery of the same geographical area. However, according to the findings of Posada (2000), who used a cost-minimization criterion, the fleet could be reduced by 30% if it operated in both fisheries and also in the shrimp fishery.

The operation of the fleet concerning the squat lobster presently extends during the whole fishing season starting in April, distributing the fishing effort more efficiently than in the previous periods in which there was free access; following Bernal and Aliaga (1999) in the last of the periods under free access the global quota was consumed in only six days. The same was achieved for the yellow prawn. At present, in the shrimp fishery, for which only an AGQ is fixed, the distribution of the effort is determined by fractionating the quota in the year in which is done by the ruling authority.

The fishing intention for squat lobster is concentrated towards the months of July through September, period in which greatest catches and best effort yields occur (Fig. 4), with greater vulnerability of the larger sizes, thus

indicating a behavior in which there is a trend to maximize the value of the catch and not its volume. The catch in the other two associated fisheries behaves similarly: the highest catch is produced in the second quarter of the year and at the beginning of the last, meanwhile for the shrimp they tend to produce highest catch and yields in the first and last quarters.

The described behavior is quite coincident with Wilen and Homans' statements (1997) in the sense that, when there is

certainty in the rights to catch, the rent generation is produced on the side of the market given by the quality improvements of the products and the development of markets rather than by saving in inputs. Thus justifying the size reached by the fleet in the squat lobster fishery, which operates sacrificing the carrying capacity per fishing trip to improve the catch manipulation, and the fishing intentionality described.

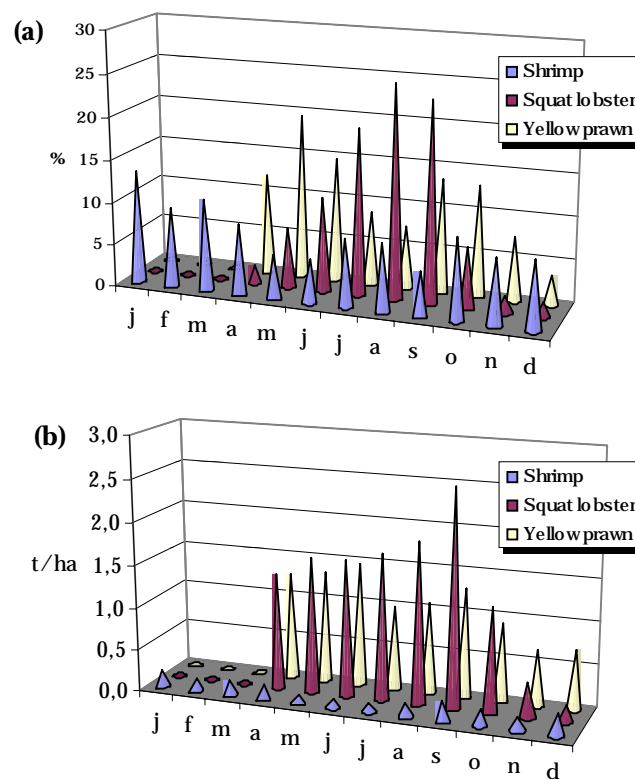


Fig. 4. Monthly distribution of the catches (a) and fishing yields (b) of crustacean fisheries.
Source: UnderSecretary of Fisheries

On the other hand Bernal and Aliaga (1999) affirm that fishing intentionality towards larger sizes of squat lobster avoids the possibility of discarding; besides, their catches show unimportant levels of by catch fauna, which would not be a problem for the associated fisheries. However, the issue requires greater analysis, since present regulations allows by catch landings up to a 10% weight of the target species (i.e. squat lobster, yellow prawn or shrimp) over the ITSQ but imputed to the AGQ taking away the strength to the exclusivity of the right. Auto-regulation, which is cited as an incentive of the systems of closing access, has not been applied to this fishery. The responsibility and costs of vigilance and control still relay on the government enforcing entity.

In relation with the squat lobster conservation, which maintains high biomass levels, it cannot be said that there exist a direct relationship with the system of ITSQ; recent assessments of the stock have recommended diminishing the AGQ, even though it could not necessarily be due only to fishing intensity but also to retrospective adjustments applied in the procedures of such assessments. In the case of the yellow prawn fishery the situation has been less promising; once the fishery was open with ITSQ the fishing yields fell below 60% in the second year of operation, therefore the AGQ had to be fixed at 10% of the initial figure when the fishery was opened under the individual quotas system.

There is not a generalized opinion on the subject; from the conservation standpoint, the most frequent argument,

among others, is that an effective closure of the fishery would suffice, complemented by the fractionation of the global quota in the season, and with biological banning programs or other measures. That is a convincing argument integrating the set of crustacean associated fisheries. Nevertheless, the efficiency of the features observed with the introduction of the ITSQ system are not less important, and persisting upon them seems to be convenient.

4. Final considerations

The management systems that incorporate ITSQ are recent in Chilean fisheries; the first ones that were applied are now in their ninth year of function. One of them is the case of the squat lobster fishery, which shows evidence of efficiency increments, denoted by improvements in the yields and product quality, and a better planning of the fishing operations and processing. This has had positive impacts in maintaining the market and in employment continuity.

As in all new experience, a periodical evaluation is required in order to improve quality of the right given by the EFP, according to the fishery goals of biological and socioeconomic sustainability. Critical aspects for the system are 1) the treatment of the bycatch and 2) associated fisheries not under the same regime of access; both facilitate the vulnerability of the exclusiveness and the security of the EFP by insufficient accomplishment of the regulations, thus, affecting their value.

There is no evidence that the auction price of the quotas has a direct relationship with the stage of the resource, which is not coincident with the argument of Hannesson (1999) in that the more productive stocks make more valuable the catch quota. Among other likely reasons, it is possible that it occurs because of a lack of competition in the auction market, transgression of regulations, uncertainties in the stage of the resource or a combination of all of them. In order to ameliorate these causes Cerda et al. (1999) proposed management procedures integrating in operational models the monitoring and control, stock assessment, economic analyses under different "states of nature", to assist in decision making and as a communication element with the agents.

Incorporation of the fisheries units associated to the system of ITSQ requires changes in the legislation; the same is necessary to extend this or other system of individual fishing rights to other fisheries. Even though sectors of the industry strongly support the individual quotas mechanism, changes to the legislation to extend it to other fisheries has not been approved by Congress. The opposition raised towards the mentioned modifications has been founded and summarized in uncertain, distributive and ideological factors traced by Hannesson

(1997). However, an alternative mechanism is not seen in the short term to improve efficiency in several overcapitalized fisheries. The point is to achieve understanding in an initial system that, after a learning period, has the facility to evolve through successively improved stages.

References

- Anderson, L.G. The Economics of Fisheries Management. The Johns Hopkins University Press, 1986.
- Arellano, P. Evaluación del valor de adjudicación de los permisos extraordinarios de pesca en la pesquería de langostino colorado (*Pleuroncodes monodon*). Tesis de Ingeniero Pesquero, Escuela de Ciencias del Mar, Univ. Católica de Valparaíso. 114 p., 1998.
- Bernal, P. and B. Aliaga. ITQs in Chilean fisheries. In A. Hatcher and K. Robinson (eds.), *The Definition and Allocation of Use Rights in European Fisheries*. CEMARE Miscellaneous Publication n° 46, 267 p., 1999
- Cerda, R., M. Arredondo, G. Martínez, y E. Yáñez.. Evaluación bioeconómica de la pesquería industrial y artesanal del recurso merluza común en la zona centro-sur. Informe Proyecto FIP 95-16., 1998
- Cerda, R., P. Pavez, M. Urbina, E. Yáñez, T. Melo y L. Arancibia. Estrategias de explotación y puntos biológicos de referencia en la pesquería de merluza común (*Merluccius gayi*) de la zona centro-sur de Chile. *Estud. y Doc.* 14/99, Univ. Católica de Valparaíso, 60 p., 1999.
- Copes, P. A Critical of the Individual Quota as a Device in Fisheries Management. *Land Economics* Vol. 62. N° 3, 278-291, 1986.
- FIP. Evaluación indirecta del stock de langostino colorado de la zona centro-sur. Fondo de Investigación Pesquera, Informe Técnico FIP-IT/97-22. 1998.
- Hannesson, R. Bioeconomic Analysis of Fisheries. Fishing News Books, 138 p., 1993.
- Hannesson, R. The Political Economy of the ITQs. In E.K. Pickitch, D. Huppert, and M.P. Sissenwine (Eds.), *Global Trends: Fisheries Management*. American Fisheries Society Symposium 20, 328 p., 1997.
- Hannesson, R. Fishing rights: their form, scope and limitations. In A. Hatcher and K. Robinson (eds.),

The Definition and Allocation of Use Rights in European Fisheries. CEMARE Miscellaneous Publication n° 46, 267 p., 1999.

Homans, F.R. y J.E. Wilen. A model of Regulated Open Access Resource Use. *Journal of Environmental Economics and Management* 32, 1-21., 1997.

Lane, D. Applications of rights-based fisheries: experiences and consequences. In A. Hatcher and K. Robinson (eds.), *The Definition and Allocation of Use Rights in European Fisheries.* CEMARE Miscellaneous Publication n° 46, 267 p., 1999.

Peña-Torres, J. The Political Economy of Fishing Regulation: The Case of Chile. *Marine Resource Economics*, Volume 12, pp.253-280., 1997.

Peña-Torres, J., J. Barton y R. Fuentes. Desafíos de Política Pesquera en Chile: Opciones más allá de la coyuntura. *Estudios Públicos*, 75 (invierno 1999),229-272., 1999.

Posada, M. Estimación del precio de adjudicación de CIT en la pesquerías de langostino colorado y langostino amarillo mediante una aplicación de programación lineal. Tesis de Ingeniero Pesquero Escuela de Ciencias del Mar, Univ. Católica de Valparaíso (en prensa). 2000.

Randall, A. Resource Economics. 2nd Edition, John Willey and Son, 434 p., 1987.

Scott, A. Development of Property Rights in the Fishery. *Marine Resource Economics*, Volume 5, pp. 289-311., 1988.

Wilen, J.E. and F.R. Homans. Unrevealing Rent Losses in Modern Fisheries: Production, Market, or Reregulatory Inefficiencies? In E.K. Pickitch, D. Huppert, and M.P. Sissenwine (Eds.), *Global Trends: Fisheries Management.* American Fisheries Society Symposium 20, 328 p., 1997.