

The evolution of co-management in the British Columbia red sea urchin fishery

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1. INTRODUCTION

Each of the major fisheries conducted by diving in British Columbia (BC) (geoduck/horse clam, red sea urchin, green sea urchin and sea cucumber) provides an example of harvesters taking steps to manage some aspect of their own activities. The BC sea urchin fisheries have been in this pro-active situation since the early 1990s, when the licence holders first formed associations. They instituted self-imposed individual quota programmes in the mid 1990s and subsequently began an ongoing collaboration with Fisheries and Oceans Canada (DFO) and coastal First Nations to assess and to manage sea urchin resources for long-term sustainability. This paper documents the development of the red sea urchin (*Strongylocentrotus franciscanus*) fishery in British Columbia and the evolution of the co-management relationship between the DFO and the Pacific Urchin Harvesters Association (PUHA).

2. THE RED SEA URCHIN FISHERY

Red sea urchins (*S. franciscanus*) are the largest sea urchin in the world and are found only along the rocky sub-tidal Pacific shores of North America. The bright red or burgundy animals graze on kelp and opportunistically on many other available organic materials (Photo 1). They are harvested for their gonad tissues, known as “uni”. Uni



PHOTO 1
Red sea urchin (*Strongylocentrotus franciscanus*)

PHOTO 2
Sea urchin uni presented as sushi



PHOTO 3
Sea urchin divers, vessel and harvest

is highly valued as a seafood delicacy. Photo 2 shows a typical presentation of uni as sushi.

Red sea urchins are individually hand picked by divers using SCUBA. The divers pick the urchins off the rocks and put them into a catch bag that is hauled to the surface and stored on the harvest vessel (see Photo 3). Each day, the product is delivered to a packer vessel or directly to a port, where it is loaded on trucks and delivered fresh to plants for processing, packaging and shipping. The yield of roe from a whole animal ranges from 5 to 15 percent of total body weight.

Sea urchins are of some importance to First Nations, who harvest them for food, social and ceremonial use. A small recreational fishery occurs for sea urchins in most coastal areas. Sea urchins have two primary predators, humans and sea otters. Sea otters are a concern as their number and distribution are increasing rapidly. The west coast urchin fishery has suffered severe declines due to sea otter predation. Sea otters are listed as “threatened” and are protected under the *Canadian Species at Risk Act*.

The commercial dive fishery for red urchins began in the 1970s and has grown rapidly since 1982. While stock assessments are undertaken in many areas, the

fishery continues to be managed under a precautionary regime that includes limited entry licensing, area licensing, a minimum size limit to allow several spawning years prior to harvest, a precautionary fixed exploitation rate of two to three percent of estimated biomass, area quotas and an individual quota (IQ) programme (see Sections 4 and 5). There are 110 licence eligibilities for this fishery. Individual licence quotas are set at 1/110th of the annual coastwide commercial total allowable catch (TAC) and harvesters are required to select one of two licence areas in which to fish (see Figure 1 for a map of fisheries licence areas in BC). The dividing line between the North and South Coast licence areas is at the northern end of Vancouver Island (Figure 1).

FIGURE 1
Map of red sea urchin licence areas in
British Columbia

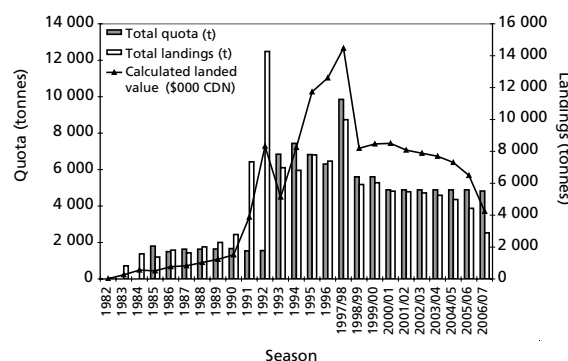


3. REGULATORY HISTORY OF THE FISHERY

Commercial fishing for red sea urchins began in 1971 in the southern portion of British Columbia. (Figure 2 presents landings data for the fishery. Comprehensive landings and licence data are presented in Table 1.) Harvesters were required to have a personal fishermen's registration card and a "C" licence vessel. "C" licences were limited in 1977, but so many licences qualified that there was no limiting impact on the red sea urchin fishery (Muse, 1998). The red sea urchins were included under the "Schedule II" species. The first significant landings for red sea urchins were 75 tonnes in 1978.

In 1983, a personal "ZC" licence was introduced for red sea urchins. A person could hold multiple "ZC" licences, one for each licensed vessel that qualified to fish red

FIGURE 2
Overview of annual red sea urchin applied quota, landings and effort for British Columbia, 1982 to date



Note: As reported on Validation & Harvest Logs. Value information from fish slip program, as reported in Canadian dollars per pound. 1982 to 1992 no limit fishery or TAC for South Coast only; 1993 coastwide TAC; 1994 to 1995 PUHA voluntary IQ programme; 1996 pilot IQ programme; 1997/98 18 month fishery; 2000/01 reduced size limit and TAC; 2003 to date, influence of Russian fishery; 2006/07 data preliminary.

TABLE 1

Overview of annual red sea urchin applied quota, landings and licenses for British Columbia, 1982 to date

Year	Licences issued	Vessels with landings	North Coast quota (t)	South Coast quota (t)	Total quota (t)	Total landings (t)	Calculated landed value (Can\$000) ⁴	Whole landed value from fish slips (Can\$/lb)
1982	C	4				45.4	15.9	0.16
1983	Z64	26				720.2	262.4	0.17
1984	Z85	32				1 377.0	555.8	0.18
1985	Z86	31		1 803.0	1 803.0	1 204.4	506.5	0.19
1986	Z103	49		1 500.0	1 500.0	1 582.0	773.7	0.22
1987	Z184	72		1 632.9	1 632.9	1 435.6	823.6	0.26
1988	Z184	81		1 632.9	1 632.9	1 763.8	1 032.4	0.27
1989	Z240	98		1 644.3	1 644.3	2 004.8	1 230.5	0.28
1990	Z188	86		1 667.0	1 667.0	2 439.7	1 508.7	0.28
1991	Z102	76		1 542.2	1 542.2	6 427.4	3 874.9	0.27
1992	Z108	102		1 553.6	1 553.6	12 479.9	8 326.6	0.30
1993 ¹	Z107	95	5 443.2	1 401.2	6 844.3	6 106.4	5 135.8	0.38
1994	Z110	95	5 896.8	1 542.7	7 439.4	5 959.8	8 247.7	0.63
1995	Z108	88	5 443.2	1 383.9	6 827.1	6 806.9	11 732.8	0.78
1996	Z109	77	5 359.7	1 264.6	6 305.1	6 466.4	12 607.4	0.88
1997/98 ²	Z110	82	8 149.8	1 701.6	9 851.4	8 738.2	14 465.2	0.75
1998/99	Z110	64	4 634.0	967.5	5 601.5	5 182.9	8 194.1	0.72
1999/00	Z110	58	4 634.0	967.5	5 601.5	5 282.6	8 464.4	0.73
2000/01	Z110	53	4 042.0	843.9	4 885.9	4 815.3	8 504.0	0.80
2001/02	Z110	48	4 042.0	843.9	4 885.9	4 782.5	8 079.9	0.77
2002/03	Z110	46	4 130.8	755.1	4 885.9	4 722.0	7 883.4	0.76
2003/04	Z110	44	4 130.8	755.1	4 885.9	4 593.5	7 696.3	0.76
2004/05	Z110	44	4 130.8	755.1	4 885.9	4 358.6	7 302.9	0.76
2005/06 ³	Z110	46	4 130.8	755.1	4 885.9	3 873.3	6 489.7	0.76
2006/07 ³	Z110		4 079.5	745.7	4 825.2	2 531.2	4 241.1	0.76

¹ South coast quota includes exploratory areas; North Coast quota new in 1993.

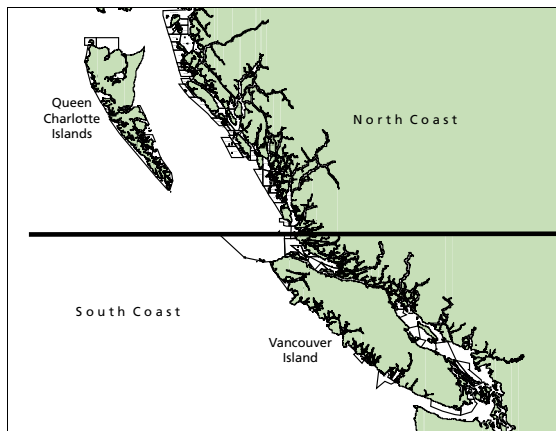
² Change in licensing from calendar year to market-driven year. The 1997/98 season ran from 01/01/97 to 06/30/98.

³ Recent information should be considered preliminary; current fishing season figures provided here in total but not in other tables.

⁴ Whole landed value from fish slips from 2002 to date is obtained through a subsample of annual submissions from fishermen.

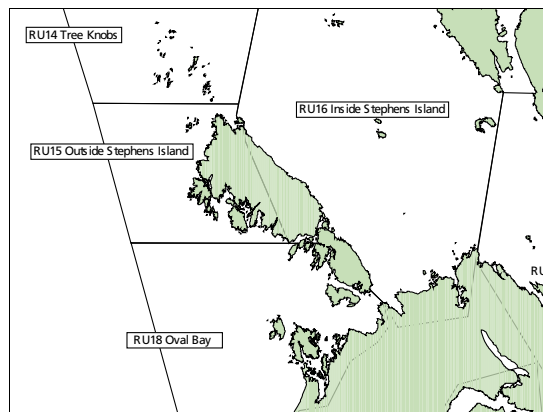
Note: (as reported on Validation & Harvest Logs) value information from fish slip programme, as reported in Can\$/lb. From 2002 to date, fish slip information from fishermen is subsampled to give a representative average annual value; as a result, any fluctuations in price per pound to the fishermen throughout the fishing season are not well reflected.

FIGURE 3
Map of Red Urchin (RU) management areas
in British Columbia



Note: Each region of the coast, i.e. Queen Charlotte Islands, North Coast around Prince Rupert, Central Coast around Bella Bella, West Coast of Vancouver Island, and East Coast of Vancouver Island, is divided into small management areas. Each RU area is managed to a TAC. See Figure 2 for more detail.

FIGURE 4
Examples of Red Urchin (RU) management areas
on the North Coast of British Columbia



sea urchins. The number of vessels harvesting red sea urchins rose from four in 1978 to a height of 102 in 1992. There were 108 licences issued that year, although the largest number of licences (240) had been issued in 1989 (Table 1).

In 1991, the DFO limited the number of licences in the red sea urchin fishery to those harvesters who had landed 34 tonnes of red sea urchin from 1987 to 1989, recorded 20 days of harvest during this period, or landed 2.3 tonnes of red sea urchin in any year in the North Coast area during the same period. Aboriginal harvesters qualified under less restrictive guidelines. After several appeals, the number of licences qualifying to fish red sea urchins was set at 110. These licences were not transferable. Licences were eventually made fully transferable in 1996 at the time of the institution of the individual quota system.

Over this period, the South Coast was initially managed with a minimum size limit (100 mm test diameter [TD]), seasonal closures and some area TACs. Over time, more area TACs were created to spread effort (this trend continues to this day). Red urchin management areas, or RU areas, have been formally recognized as an important tool for managing the potential for localized overharvesting. RU area boundaries are described in the annual management plan and are attributed a TAC, the sum of which is equal to the Licence Area TAC. Figure 3 shows all red urchin management areas. Figure 4 provides a detailed example of the several red urchin management areas around Stephens Island on the North Coast.

In the North Coast, the regulations were less restrictive, with just a minimum size limit. In 1988, a maximum size limit of 140

mm TD was added to protect larger urchins, which were believed to provide shelter for juveniles. In 1993, the maximum size restriction was removed as it was learned that the larger urchins were not harvested due to market constraints. In 1993, TACs were instituted in the North Coast due to concern over the skyrocketing landings. Initial area quotas were largely arbitrary and precautionary and related to historical harvests.

Since 1995, the quotas for many areas have been based on fishery-independent survey information of sea urchin populations and catch data from mandatory harvest logs. Historically, area quotas in the South Coast were set at 5 percent of the surveyed biomass. This was then extrapolated to include areas where surveys were not conducted. As the fishery area expanded, quotas were based on estimates of standing stock determined through consultation with harvesters.

In 2000, the minimum size limit was reduced to 90 mm TD based on an industry request to match the market requirements. To compensate for this change and to

maintain the precautionary approach, a 12 percent reduction in TAC accompanied the reduction in size limit.

A modified surplus production model is used to estimate maximum sustainable yield (MSY) for red sea urchins. Total current biomass of red sea urchins is calculated biannually. These calculations are based on density estimates for red sea urchins (initially in the 100 to 140 mm TD range, more recently 90 to 140 mm TD), new survey results and changes to commercial bed area as estimated from digitized harvest charts provided by harvesters. A natural mortality rate of 0.10 is assumed and a correction factor of 0.20 provides a conservative harvest rate of approximately two percent (Campbell *et al.*, 1999b).

4. THE VOLUNTARY INDIVIDUAL QUOTA SYSTEM (1994 AND 1995)

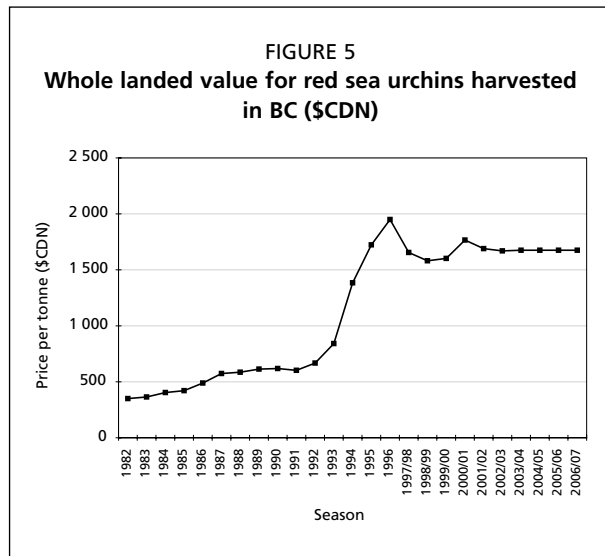
The red sea urchin fishery began a rapid expansion in 1987 as fishing effort and landings increased in the North Coast. These increases continued unabated in spite of the efforts of fishery managers to control the harvest (minimum/maximum size limit, area closures/rotations, licence limitations and seasonal closures) and culminated in 1992 with total landings of 12 480 t. In 1993, fishery managers instituted further controls by setting the North Coast total allowable catch at 5 443 t. In spite of all the fishery managers' efforts, the number of fishing days, number of divers and the catch per unit effort continued to rise over this period until January 1994. All this intense effort resulted in short "derby style" openings, poor prices, market gluts and shortages and harvesters operating with insufficient regard to weather and safety.

At the beginning of February 1994, the harvesters in the North Coast voluntarily stopped fishing and converged on the Moby Dick Hotel in Prince Rupert in an effort to reach an agreement to solve the predicament. Over the course of a week in February, the divers hammered out the framework for a "voluntary individual quota" (VIQ) system. The idea of a VIQ and also the impetus for the work stoppage and meetings, came from these working harvesters. This initiative was not driven by PUHA. The Association, in conjunction with the Province of BC, had earlier facilitated meetings to discuss the viability of an IQ system and had subsequently requested the adoption of an IQ system to the DFO based on a recommendation at the PUHA Annual General Meeting. PUHA did lead discussions, in conjunction with a representative from D&D Pacific Fisheries Ltd. (D&D is a private firm that supplies monitoring, observing and other fisheries management services to industry and to government.)

The opening meeting was not without controversy and disagreement. Many of the harvesters had experience with IQ systems due to their involvement in the geoduck fishery, which had adopted a DFO-sanctioned IQ programme in 1989. Others had observed the success of the geoduck divers; some had been involved as divers in the geoduck fishery before getting displaced by the rationalization under the geoduck IQ system. These displaced divers may have had some resentment and sought some of the same success for themselves. The dissenting group, a relatively small number, was composed of fishers who had none of the previously described experiences and had not yet secured their own licence in the red sea urchin fishery.

Everyone at the meeting could agree that the industry would not survive under existing conditions and that there was little opportunity to make any profits. It was unreasonable to travel all the way to Prince Rupert to fish for three or four days for low prices and to fish regardless of weather or safety. If a vessel had a breakdown or had a crew problem, the opportunity for that month was lost.

On the second day of meetings, it was agreed to pursue the VIQ system. During all the meetings, there was constant communication with harvesters and licence holders from 'down-south' who were not in attendance to garner their views and support. (All the harvesters lived in the South Coast, mostly on Vancouver Island.) After each day or session, the representatives would gather and summarize the proceedings and in



some cases come back with proposals based on the consultations as well as the South Coast input.

Once the agreement was made to proceed with the VIQ, the group developed the system to manage the programme. First, it was agreed that the remaining North Coast quota would be split evenly between the authorized “ZC” North Coast licence holders. Second, the quota could be transferred or leased between agreeable quota holders. To monitor the quotas, the group agreed to a system of off-load validation tracked by logbook and managed by D&D. The DFO fishery managers helped by making the validation logbook a condition of licence. Harvesters were required to notify (hail) D&D before

commencing fishing. A Can\$.01/kg levy, which fishers authorized the fish buyers to deduct and then pay to D&D on their behalf, was adopted. The product was validated at the first point of landing. The system was supported by the buyers and the packer vessels. This made it next to impossible for any vessel not to participate. They would have to arrange their own transportation off the fishing grounds and find a new buyer who was not supportive of the programme.

The immediate effects were increased prices, as harvesters started to focus more on quality than quantity and the fishery slowed considerably. (Price information is shown in Figure 5.) From the fishery managers’ points of view, the adoption of the programme “resulted in improved monitoring of catch and effort and a more orderly fishery” (Heizer *et al.*, 1997). The programme was expanded to the South Coast in the fall of 1994, which supported the belief that there were benefits for both parties due to the VIQ.

What happened over those few days in Prince Rupert was quite remarkable. The programme got the support of a fleet of harvesters (and processors), a system to track and to record the product was developed and finally the system and to collect the funds to manage it all was instituted within a week: this was astonishing.

5. THE DFO SANCTIONED INDIVIDUAL QUOTA SYSTEM (1996 TO DATE)

In late 1995, the DFO agreed to adopt an individual quota (IQ) system for 1996 on a two-year ‘pilot’ programme basis. The system included aspects of the VIQ system with some modifications and additions. The DFO was reluctant to sanction a IQ system prior to 1996 due to tangential political reasons involving native land claims issues, potential windfall profits for licence holders and the debate over IQ’s creating property rights. Under the DFO-sanctioned IQ programme, there was first an allocation of 2 percent of the TAC for First Nations food, social and ceremonial use. The remaining coast-wide TAC was equally divided among the recognized licence holders. This equal division differed from the VIQ in that the South Coast licence holders now received the same quota share as the North Coast licence holders.

The off-load validation component of the VIQ was retained, as well as the on-grounds monitor (OGM) for the North Coast. Harvesters were required to hail in to the D&D 24 hours prior to commencing fishing and subsequently to notify the D&D at least two hours prior to off-loading. Once fishing was terminated, harvesters had to notify the D&D when they were leaving the grounds. Any revenue generated from a licence quota overage exceeding 150 pounds was relinquished to the Crown. However, if the overage was less than 150 pounds, it could be transferred to another licence that was still actively fishing.

6. CONSULTATIVE PROCESS

A consultative process was initiated for the red sea urchin fishery in 1989 and is a major part of the planning for the commercial fishery. The primary consultative body for red sea urchins in BC is the Red Sea Urchin Sectoral Committee. This committee includes representatives from Fisheries and Oceans Canada, commercial licence holders, processors, First Nations, BC Ministry of Fisheries and the Sport Fishing Advisory Board (SFAB). Members of PUHA represent commercial fishers on this committee. The SFAB is representative of all parts of the recreational fishing community (such as the BC Wildlife Federation and the Sport Fishing Institute of BC). The Terms of Reference and current membership of the Sectoral Committee are available in DFO (2007).

The Sectoral Committee's primary mandate is to provide the Department with advice in respect to issues important to the management of the commercial red sea urchin fishery, such as developing harvest plans, scheduling research activities and investigating new management strategies. The Sectoral Committee is not a voting body but allows for the Department to receive a broad range of advice from First Nations, stakeholders and other concerned parties. The Department remains the decision-making authority regarding management of the fishery. The Sectoral Committee meets annually to review and provide advice regarding the proposed management plan.

Since the move towards more precautionary management in this fishery, commercial fishers and First Nations have collaborated with the Department to undertake research to better understand the resource. The Research Subcommittee of the Sectoral Committee meets annually to review, to discuss and to advise on stock assessments, recent surveys and future studies proposed for red sea urchins. The Sectoral and Research meetings are generally held together in the spring.

Integrated Fisheries Management Plans (IFMPs) were introduced to the Pacific Region in 1999 to provide a more uniform, integrated, stable and long-term framework for fisheries management. The IFMP planning process paves the way for Objective-Based Fisheries Management, wherein concepts such as "conservation", the "precautionary approach" and "ecosystem management" are translated into explicit and measurable goals.

Fishery managers and PUHA review the range of options available from the assessment and develop TACs for each red sea urchin management area that sum to the commercial licence area TACs. The schematic in Figure 6 gives an overview of the consultation and decision-making process. Resource Managers work closely with their colleagues in the Science Branch and red sea urchin stakeholder groups to: (a) assess the resource in BC, (b) review the annual fishing season and (c), prepare for upcoming harvests. The schematic gives a simplified view of the annual management planning process. For example, after conducting the post-season review and noting the new stock assessment survey information that is available, the lead Resource Manager will request that a research document outlining the change in area quotas be drafted for use in upcoming fishing seasons. Once this document is peer-reviewed, approved by DFO senior management and made publicly available, Resource Managers use the advice contained in it to draft and consult on the new management plan.

Five representative areas have been designated as experimental research areas and are closed to commercial fishing. Studies undertaken in these areas are a co-operative effort between Fisheries and Oceans Canada, PUHA and local First Nations. These studies include investigations into ecosystem interactions, optimal sea urchin population densities and the effects of various harvest strategies on kelp, abalone and sea urchins. These areas are listed in Table 2, along with the First Nations research partners.

Other areas have been closed following consultation with Aboriginal or sport fishing groups. Small area closures are one of the management tools used to provide harvesting opportunity to groups other than commercial harvesters. Following input from the Sectoral Committee, the draft management plan is distributed to

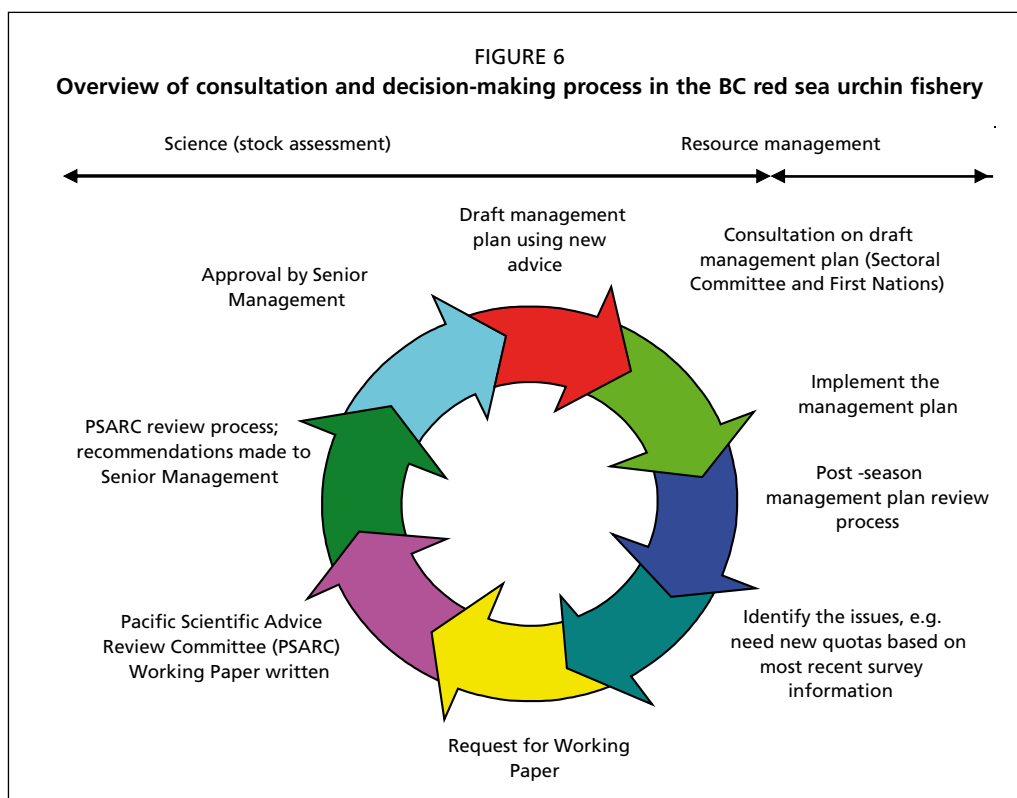


TABLE 2
Red sea urchin special management areas, or experimental research areas in British Columbia

Area	Location	Partners
2	Cumshewa Inlet and Louise Island	PUHA, DFO, Haida Fisheries Program
7	West Price Island	PUHA, DFO, Kitasoo Fisheries Program
23	South east coast of Vargas Island	PUHA, DFO
24	Alert Bay	PUHA, DFO
24	Clayoquot Sound	PUHA, DFO

Note: Research areas are established in collaboration with PUHA and local First Nations. Area refers to Pacific Fishery Management Area, defined by regulation as specific portions of the BC coastline.

First Nations and other stakeholders (*i.e.*, commercial industry representatives) for review and comment at least 30 days prior to the Department's internal finalization process. Stakeholder input to the draft management plan is finalized prior to 1 May. The final management plan (see DFO 2006), which incorporates advice received from stakeholders, is approved in the Pacific Region and published four weeks prior to the fishery opening.

7. PACIFIC URCHIN HARVESTERS ASSOCIATION

The Pacific Urchin Harvesters Association (PUHA) was incorporated under *The Societies Act of British Columbia* in 1992 to represent the 110 red sea urchin licence holders. The goals and objectives of the association are:

- i. ensuring sustainability
- ii. maximizing economic value and
- iii. community awareness and knowledge.

The association generally represents the interest of the harvesters in consultation with DFO.

The fund-raising mechanism used by the association to raise funds is membership fees for the purchase of the harvest validation logbook. The validation logbook is required by DFO as a condition of licence. Until 2003, all licences were activated

under this programme. Recently, some licensees have not participated due to market constraints. Also, some licences that were purchased from the commercial fishery for the Aboriginal Fisheries Strategy were not allocated to a First Nations Band during the season and were therefore not fished. The annual budget and work plan are approved at the Annual General Meeting along with the new season management plan.

Since its incorporation, the PUHA has taken on increasing responsibility for the management of the fishery. These functions include the following.

- i. Hiring an independent company to monitor all landings, to provide and manage an on grounds monitor for the North Coast and to report to the DFO as information is required to manage the fishery.
- ii. Paying the salary of a DFO stock assessment scientist.
- iii. Undertaking biomass surveys and experimental management research in collaboration with the DFO and First Nations Fisheries Programmes.
- iv. Consulting with other fisheries organization on over-arching industry issues.
- v. Developing and instituting a programme of international generic sea urchin marketing of “sea urchin from Canada”.
- vi. Consulting with Fish Safe BC and distributing safety and educational information to members.
- vii. Providing recommendations on fishing area boundaries, area closures and area quotas for preparation of the annual fish management plan.
- viii. Providing in-season recommendations on area openings and closures based on weather, roe quality and market.
- ix. Funding and developing the technology to spawn and rear sea urchins for enhancement.
- x. Consulting with sea urchin processors on market, transportation and logistics, international trade issues and in-season fishing activities.

Since 2003, the DFO requirements for the management of the fishery have been outlined in a “Joint Project Agreement” (JPA) that describes the responsibilities of both the DFO and PUHA in co-managing the red sea urchin fishery. The JPA provides details of the activities to be undertaken for the year and the cost commitments of both parties. This agreement provides for catch validation at designated landing ports, in-season collection and compilation of harvest log data, collection of biological samples, an on-grounds monitor (OGM) to attend the remote North Coast fishery for a majority of the fishing season and a year-end summary report of the fishery. These activities are financed by a PUHA membership fee of Can\$5 500 per year. In addition, licence holders must pay an annual licence fee of Can\$530.

8. EVALUATION OF INDIVIDUAL QUOTA SYSTEM AND CO-MANAGEMENT

The adoption of the voluntary individual quota system, independent of government prompting or support, is quite astounding. To get a group representing 110 licences to discuss, develop and institute a self-governance programme is a difficult (and some would say an almost impossible) task. What set the stage in this case was the absolute desperation of the harvesters and the recognition that something had to change. The harvesters recognized the potential for higher prices and safer fishing conditions. They had experienced the success, either directly or indirectly, of a similar system in the geoduck fishery and there had been preliminary deliberations and forums to explore options to better manage the sea urchin fishery. The time was right and the grassroots harvesters seized the moment. Government could not have acted so quickly. Simply by its nature, government is not nimble enough to quickly react to change. In addition, the cost to government would have been considerably higher to implement the same programme.

The immediate benefits of the VIQ for the harvesters were increased prices, a stable fishery and safer operating conditions. The DFO benefited from the slower, more

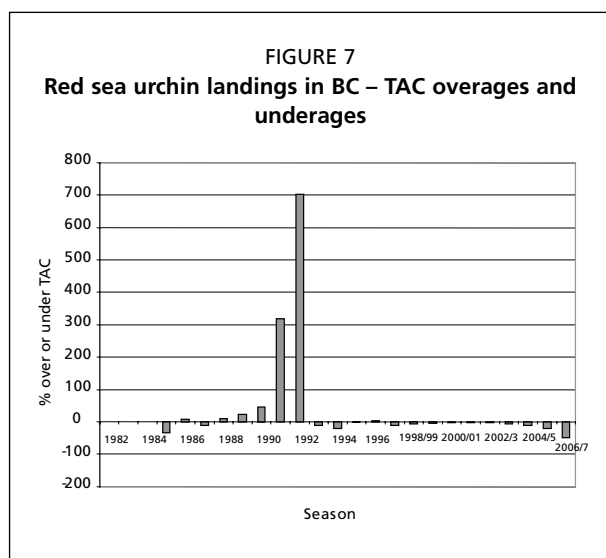


TABLE 3
Red sea urchin stock assessment projects to date
(broadbrush surveys)

Area	Survey	Year
1	Langara Island	1994
2	Rennell Sound	1995
3, 4	Dundas Island Group	2003
4	Stephens Island	1995
5	Banks Island	1997
5	Beaver Pass	2002
6	Price Island	1995
6	Laredo Channel	2000
6, 106	Campania Island	1994, 2004
7	Heiltsuk (Bella Bella) area	1994, 1995, 1996, 1997
7	Price Island	2001
8	Fitz Hugh Sound	2001
11/111	Cape Sutil	1996
12	Queen Charlotte Strait	1994, 1995, 2004
12, 13	Kelsey Bay	1999
12	Deserters Group	2000
12	Robson Bight	2001
13, 14	Campbell River	2002
14	Comox, Denman Island	1999
18	Gulf Islands, Cowichan	1998, 1999
23,123	Barkley Sound	2003
24/124	Tofino	2000
27	Cape Sutil	1996

Note: Area refers to Pacific Fishery Management Area, defined by regulation as specific portions of the BC coastline.

orderly fishery with provision of better data and figures supplied in a timely fashion, which resulted in significantly improved management. In the years prior to the VIQ, coastwide TACs were often exceeded (see Figure 7). More regularly, area TACs were exceeded, but in the years following the implementation of the VIQ, the service provider was able to mitigate some of these overages in-season by recommending that other areas be closed before the TAC had been reached. Under this system, the coastwide TACs have not been exceeded since 1993.

On the research side, PUHA established a research fund in 1995 and now co-ordinates vessel and diver participation in surveys with First Nations communities. The DFO, PUHA and First Nations joint stock assessment activities continue coast-wide through biomass transect surveys, experimental harvest sites and selected study sites. DFO develops the survey protocol and conducts the data analysis. The main survey goals are to estimate density, size frequencies, growth and recruitment potential of red sea urchins and to prove and/or adjust quotas accordingly. See Table 3 for a list of such assessment projects.

With the improvement in landed prices and a more stable fishery, the value of the licences increased substantially. Prior to 1996, licences traded in the Can\$15 000–25 000 range. This increased with the adoption of the Individual Quota system to over Can\$200 000. Currently licence values have settled back to the Can\$100 000 range due to a decline in the Japanese market. Before the IQ system, licences were not transferable, although they did trade under various trust agreements or even a handshake. Having the licences transferable added a level of security not present before the IQ system, which added

value and opened opportunities to new entrants who would not have undertaken the risk before transferability. There is still a level of uncertainty surrounding a sea urchin licence, as the licence is issued at the absolute discretion of the Minister of Fisheries and Oceans and therefore cannot be considered property nor can it be secured by a financial institution. This lack of certainty means the value does not reflect the value of the return or the investment as it would in other businesses.

The cost of the VIQ system was a Can\$.01/kg levy, based on validated weight at the landing port. The system was simple and effective and met all the requirements of harvesters and the DFO. Table 4 outlines the development of the Dockside Monitoring Programme requirements under the VIQ and IQ system. In 1996, with the

TABLE 4
Dockside Monitoring Program costs, requirements and progression

Voluntary IQ 1994:	No DFO requirements for data reporting Validation logbook (catch data only) Computerized database (catch data only) Landing tax
Voluntary IQ 1995:	No DFO requirements for data reporting Validation logbook (catch data only) Computerized database (catch data only) NEW on-ground monitoring (OGM) NEW harvest charts provided to fishermen NEW landing data voluntarily reported to DFO NEW collection of association and monitoring fees prior to fishing
Pilot IQ program 1996:	Official dockside monitoring program (DMP) Extensive computerized database (catch and harvest data) DFO catch and harvest data reporting (daily, weekly, annually) Non-compliance reporting On-ground monitoring
Additional requirements:	1999/2000 in-season harvest chart bed coding (GIS spatial capturing) 2003/2004 in-season service provider (DMP) certification (Canadian General Standards Board) 2004/05 abalone presence indicator added to harvest log 2006/07 Fishers Identification Number (FIN) added to harvest log

implementation of the DFO-sanctioned IQ, the costs doubled to Can\$.02/kg. Costs rose again in 2000 to Can\$.0225/kg and to Can\$.025/kg in 2003. In summary, costs have more than doubled since the adoption of the IQ system and the Government continues to push more cost requirements to the industry. Recent court decisions have ruled that the use of the resource to fund the Government's science and management activities is illegal and this caused turmoil in the DFO as it struggles to develop new policies to address the funding issues. PUHA has requested a full appropriation from Parliament for all fisheries science and management activities across Canada.

Industry cost recovery undoubtedly benefits both parties under the IQ system. More flexibility for the fishers provides greater financial returns and it is acceptable for industry to support and share the expenditures to facilitate these programmes. The ever-increasing requirements and costs pushed onto industry are of concern, however. There needs to be a balance between the costs and benefits and there should be some limit related to the value of the fishery.

9. DISCUSSION

The red sea urchin fishery demonstrates a successful example of co-management that originated through a voluntary programme by industry that evolved into a government-sanctioned individual quota system. The success was influenced by the following factors.

- i. A small fishery, with a fixed set of licence holders, who shared a common concern for the economic and safety values of the industry.
- ii. An organized fishers' association that represented the broad interests of the group and that was able to facilitate the development, implementation and management of the system.
- iii. A small base of local government management support for the programme.
- iv. A new and simple fishery with no outside competing influences for the resource.

- v. A fishery with the typical problems of a derby style ‘race for fish’ – TAC overages, loss of economic value and loss of vessels and lives.

As with any business enterprise, there are always new challenges and opportunities. Generally, the current challenges can be divided into three categories.

- i. *The market*: Since 2004, the sea urchin market has suffered negative effects from a Russian illegal, unregulated and unreported (IUU) sea urchin fishery in the Kurile Islands where Japan and Russia have a jurisdictional dispute. IUU fisheries are a Can\$5 billion problem worldwide and the global community needs to implement measures to control these fisheries. They are destructive both to the resource upon which they prey and to the legitimate fisheries with which they interfere. The “Ocean to the Plate” strategy, where fisheries management focuses on the market and the potential economic returns once conservation concerns are addressed, is important to the continued economic viability of the fishery.
- ii. *Government Policy and Regulation*: Security of access is a current concern of the red sea urchin fisheries and many other fisheries across Canada. Security of access is necessary to encourage sustainable fishing practices and to develop the proper business climate for economic and social success. Long term jobs and healthy coastal communities come from strong businesses and business investment. Industry requires a framework that allows it to compete in the global market for food products by providing long term operational sustainability.
- iii. *Scientific knowledge*: This underpins all fisheries management and needs to continue to develop collaboratively with government, industry and coastal communities. A continuing healthy resource is the foundation for a healthy fishery. How to fund these important undertakings given the negative impacts of the Russian IUU fishery on licence holders is a current challenge. Certainly, PUHA feels that the DFO should consider allocating some resources to help the industry navigate this troubled water. Predation by sea otters continues to be a challenge and is probably the greatest threat to the sustainability of the fishery.

The red sea urchin fishery has been a leader in co-management and sustainable fisheries practices. Industry and government need to continue to work together cooperatively and collaboratively, with mutual respect and understanding, to address the ever-changing challenges of both partners.

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