Co-operative management of the geoduck and horse-clam fishery in British Columbia

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1. INTRODUCTION

The geoduck and horse-clam fishery in British Columbia (B.C.) has been co-managed by the Underwater Harvesters Association (UHA) and Fisheries and Oceans Canada (DFO) since the introduction of individual vessel quotas in 1989. In 2005, the geoduck fishery had a landed value of CanS32.7 million, just under the landed value of wild salmon in B.C. of CanS32.9 millions (Ministry of Agriculture, Food and Fisheries, 2005). This paper will trace the development of the fishery and the evolution of the UHA as a self-governance institution.

2. THE GEODUCK AND HORSE-CLAM FISHERY

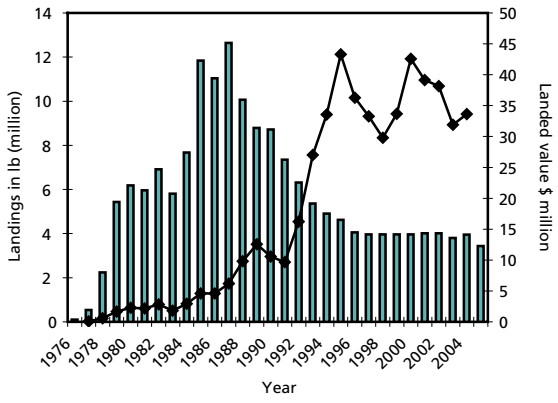
Geoducks (*Panopea abrupta*) are giant deepwater clams that range from Alaska to Baja, California. Graphically dubbed the "elephant trunk clam" by the Chinese due to its large, meaty siphon, geoduck is prized for its incredibly sweet flavour and crunchy texture. They are exported live and are extremely popular in Hong Kong, China and Japan, where these giant clams are considered a rare taste treat. The market in Asia is largely a high-end restaurant market.

Geoducks live buried up to 1 metre deep in sand and mud substrates from the lower intertidal to depths of at least 110 metres. Once dug in, geoducks remain in the same place. If they are removed, they are unable to rebury themselves and will die. They are long lived; the oldest clam aged through research funded by the UHA is 168 years old. Average ages of geoducks vary considerably from area to area, with the lowest mean age of 26.6 years in Georgia Strait and the oldest mean age of 60.4 years on the west coast of the Queen Charlotte Islands (Bureau *et al.*, 2002). Clams can reach a gross weight of 10 pounds, but generally average about 2 pounds.

Geoducks are harvested one at a time by hand by divers using surface supplied air. Divers use high-pressure water delivered through a hose and nozzle system (a "stinger") to loosen the sand around the clam, which allows the diver to remove the animal alive. The diver then places each clam into a bag attached to his waist. Once the bag is full, it is lifted to the surface where the crew bands (with rubber bands) the shell, to stop it from gaping and killing the clam, and places the clams in UHA-provided containers. The clams are kept moist and covered and are delivered, usually the same day, to processing plants in Vancouver. Once in Vancouver, the clams are sorted and packed for airfreight the next day to customers in Asia. When they reach their destination, the geoducks are placed live into saltwater tanks for distribution and sale.

Horse-clams, *Tresus capax* and *T. nuttallii,* are gaper clams that are often found in conjunction with geoducks. In 1992, Fisheries and Oceans Canada (DFO)

FIGURE 1
Historic geoduck landings and value



determined that there was insufficient data about horse-clam stocks on which to base a total allowable catch (TAC), and therefore the fishery was given a zero quota and catch only allowed as a bycatch when fishing for geoducks. Since that time, the bycatch of horse-clams has generally been less than 1 percent of the total catch of geoducks. Other than a bycatch of horse-clams, there are no fisheries interactions associated with the geoduck fishery. The only use of the deep water geoduck resource in B.C. is for commercial purposes. There are no recorded landings of geoducks in either First Nations or recreational fisheries in British Columbia.

Just about everything in the ocean is a predator for geoducks in their early life stages. However, once a geoduck has buried itself more than a quarter metre into the substrate, the primary predators are man and sea otters (although crab, starfish, sea worms, and flatfish do eat adult geoducks). Sea otters, which are listed in Canada as a threatened species, are a concern as their number and distribution is increasing rapidly.

The annual TAC for geoducks is set at a maximum of 1.2–1.8 percent of the estimated current biomass. The biomass is calculated by applying the estimated densities (in kg/m^2) times the estimated bed area. The TAC is calculated annually to adjust for advances in understanding of bed size and geoduck densities. The total catch and value of the geoduck fishery is shown in Figure 1 and the data underlying the chart are presented in Table 1.

3. REGULATORY HISTORY OF THE FISHERY

The geoduck fishery in British Columbia began in 1976 when the Department of Fisheries and Oceans Canada issued seven permits to experimentally harvest geoducks in the Strait of Georgia. Licensing was introduced in 1977, and from 1977 to 1979 the number of licences increased from 30 to 101. In mid-1979, due to concerns about increasing effort and harvest levels, DFO imposed a moratorium on new licences and instituted the requirement for a logbook that recorded fishery activities and catches. In 1981, DFO limited the number of licences in the geoduck and horse-clam fishery to those who were authorized to fish for geoduck and horse-clams by commercial of diving and who had marketed a minimum of 13 500 kg of both species in any combination during 1978 or from 1 January 1979 to 31 December 1980. A limited entry programme was formalized in 1983. The effect of the moratorium and the licence limitation programme was to reduce the number of licences to 52 initially, and to 55 after successful appeals. Licence fees paid to the government for the geoduck licence were $10 annually from 1983 through to 1995.

In 1979, total allowable catches within two management areas (north and south) were introduced into the fishery. Each area was opened to all licence holders as a competitive fishery at the beginning of the year and closed when the TAC was taken. Over the next few years, the coast was divided into more areas to spread effort, but the openings were still derby-style fisheries. The result was a typical race for the fish, regardless of weather or safety. Reporting mechanisms were poor, catch would be focused in areas that were easy to reach and TACs were regularly exceeded. Supply gluts associated with each new opening were common and most of the product had to be processed and frozen.

TABLE 1
Geoduck quota, harvests, licences and value

Year	Licences issued	Coastwide quota		Total landings		Total value
		(lb)	(t)	(lb)	(t)	Can$ million
1976	7	no quota		97 002	44	N/A
1977	30	no quota		540 898	245	0.09
1978	54	no quota		2 239 950	1 016	0.56
1979	101	8 000 000	3 629	5 429 886	2 463	1.68
1980	95	8 000 000	3 629	6 186 067	2 806	2.29
1981	52	6 176 000	2 801	5 961 405	2 704	2.15
1982	52	6 500 000	2 948	6 910 800	3 134	2.76
1983	54	6 500 000	2 948	5 810 913	2 635	1.80
1984	54	6 600 000	2 994	7 678 465	3 484	2.92
1985	55	6 550 000	2 971	11 838 624	5 370	4.74
1986	55	8 775 000	3 980	11 035 396	5 005	4.30
1987	55	9 345 000	4 239	12 643 298	5 735	6.20
1988	55	8 575 000	3 890	10 068 830	4 567	9.77
1989	55	8 800 000	3 992	8 784 247	3 985	12.56
1990	55	8 800 000	3 992	8 722 366	3 956	10.55
1991	55	7 425 000	3 368	7 346 864	3 333	9.48
1992	55	6 311 250	2 863	6 313 748	2 864	16.16
1993	55	5 362 500	2 432	5 365 420	2 434	26.77
1994	55	4 950 000	2 245	4 908 523	2 227	33.72
1995	55	4 621 650	2 096	4 624 330	2 098	43.28
1996	55	4 058 175	1 841	4 059 917	1 842	36.26
1997	55	3 960 000	1 796	3 960 083	1 796	33.30
1998	55	3 960 000	1 796	3 960 755	1 797	29.78
1999	55	3 960 000	1 796	3 960 676	1 797	32.79
2000	55	3 960 000	1 796	3 960 979	1 797	40.63
2001	55	4 015 000	1 821	4 015 334	1 821	43.49
2002	55	4 015 000	1 821	4 019 398	1 823	38.51
2003	55	3 795 000	1 721	3 802 142	1 725	32.81
2004	55	3 960 000	1 796	3 961 978	1 797	35.66
2005	55	3 437 500	1 559	3 438 214	1 560	32.66

At the urging of the Underwater Harvesters Association, the DFO adopted an individual vessel quota (IVQ) system in 1989. The fishery has operated under IVQs ever since. Although licences can be transferred, the quota may not be split for sale or lease. Up to three licences may be fished from a single vessel. Unharvested quotas may not be carried over into the next fishing year. Small quota overages (200 lbs or less) may be transferred to another vessel that has not harvested its entire quota. Larger quota overages (201 lbs or more) are sold and the proceeds relinquished voluntarily to the UHA.

Area licensing was instituted concurrently with IVQs. The coast is divided into three areas, the north coast (all areas north of Vancouver Island), the west coast of Vancouver Island, and the waters between Vancouver Island and the mainland of B.C. (see Figure 2). Licences are distributed to the three areas such that the TAC from each area is equal to the vessel quota multiplied by the number of licences in the area. The UHA assigns specific licences to areas based on

FIGURE 2
Map of British Columbia fishing areas

historic participation in the area. When a licence needs to be moved, a lottery "draw from a hat" for licence holders who want to move is held.

In 2006, there were 41 "beneficial owners" of the 55 geoduck and horse-clam licences. These 55 licences are fished off 39 vessels that have an average length of 37 ft (11.3 m). Each vessel must have three crew: one tenderman who looks after the divers and two divers. The crewing requirements are specified in worker safety regulations of the mandatory worker's compensation system in B.C. Of the 39 vessels in the fishery, 14 are licensed for other fisheries, 12 of which are also dive fisheries (for red urchins, sea cucumbers and green urchins). Annual licence fees were increased in 1995 to $3 615 and to $3 530.80 in 1997 and 1998. Since 1999, the annual fee for a licence has been based on a formula that is CanS252 per tonne of product authorized for harvest under the licence, minus CanS1 000. In 2006, the annual licence fee was CanS6 144.20.

Under the IVQ/co-management system, the Minister of Fisheries and Oceans maintains complete authority over the fishery and the issuance of licences. The reality, however, is that the DFO relies heavily on the industry to successfully understand and manage the fishery.

4. THE FORMATION AND OPERATION OF THE UNDERWATER HARVESTERS ASSOCIATION

The Underwater Harvesters Association was formed in 1981 to represent the interests of divers in consultations with the DFO. The concept at the time was to represent the interests of all dive fishers, regardless of which fishery they were involved with. It was a non-profit association of fishers with dues of $50 a year to cover the costs of meetings. Meetings were held to formulate common positions on fisheries management issues so that the leadership could go to DFO with a united front.

One issue taken up by the association was to recommend that the geoduck fishery be managed through an individual vessel quota (IVQ) system. IVQs were seen by a few visionary licence holders to solve the problems associated with "derby" fisheries, including erratic product supply, TAC overruns, safety concerns created by an underwater race for fish, and the economic consequences of missing a "starting-gun" fishery opening. Under the derby style fishery, the profitable live market in China, which demands a steady year-round supply of live animals, could not be successfully serviced.

After much discussion, all 55 licence holders were polled by the DFO on the move to IVQs and on a quota allocation agreement. The vote showed 80 percent of licence holders supported equal quotas, with each licence holder allocated 1/55th of the annual TAC. Those few licence holders who did not support the IVQ system rejected it because they disagreed with equal quota allocations. Since the IVQ system had a strong level of support and the fishery was new and small, the DFO agreed in 1988 to implement IVQs for 1989, but with conditions. The primary condition was that the industry pay for the incremental costs associated with monitoring catches to ensure quotas were not exceeded. This required the licence holders to raise the funds to pay for the monitoring programme.

The fund raising mechanism, which is still in existence today, is a membership fee for purchase of the required logbook from a provincially-registered non-profit society called the UHA Research Society. A renewed UHA Research Society (or UHA) was registered in November 1988 for the specific purpose of representing geoduck licence holders in an agreement with the government to contract for third-party monitoring services. The full members of the UHA are geoduck and horse-clam licence holders. Associate members are other individuals or companies with a direct interest in the geoduck and horse-clam fishery, who are generally fishers and geoduck exporters who are not licence holders.

The only inducement to pay fees to the UHA stems from licence conditions that require all landings to be independently monitored and to be reported in logbooks in a

prescribed format. These services and logbooks are only readily available through the independent port monitoring company hired by the UHA. The fee is collected when the licence holder "buys" their logbook for the season, which is only available from the UHA.

In the first year of the IVQ programme, several licence holders refused to join the UHA and to pay their share of monitoring costs. The members who did participate had to pay an extra assessment to compensate. In the second year, the success of the IVQ programme and peer pressure resulted in full participation of all licence holders in the UHA. Although membership in the UHA is not legally mandatory, all licence holders have joined every year since the second year of the programme.

Over time, the UHA has taken on more responsibility for managing the fishery. What started as a non-profit association to collect fees and hire independent monitors has evolved into a sophisticated operation with an annual budget in excess of CanS2 million that performs a number of functions, including:

i. Hiring an independent company to monitor all landings and to provide a full time on-grounds monitor for the two zones on the North Coast and on the West Coast of Vancouver Island;
ii. Paying the salaries of four DFO employees involved in geoduck and horse-clam fishery management and science;
iii. Funding DFO enforcement for geoduck and horse-clam specific activities;
iv. Undertaking an extensive programme of surveys and biosampling (over 35 percent of the geoduck bed area in B.C. has been surveyed by the UHA and over 14 000 biosamples taken and aged);
v. Implementing a full paralytic shellfish poisoning (PSP) sampling programme in the North Coast and a partial programme in the South Coast, where there is no government testing to ensure that PSP-free harvests;
vi. Providing safety information and on-grounds safety equipment, particularly for incidents of decompression sickness (bends);
vii. Enhancing geoduck stocks through an extensive programme of seeding and supporting research and development of geoduck culture techniques;
viii. Undertaking an active programme of generic marketing for "Geoduck from Canada" and promoting the product to the public at large as healthy, safe, environmentally sustainable, and well-managed; and
ix. Representing the interests of the industry with other industry organizations and government agencies.

About 30 percent of the total UHA budget is spent on the independent third party fishery monitoring programme, 22 percent on research and management, and 20 percent on enhancement. The remainder is used for various projects such as marketing, PSP sampling and administration.

Until 2003, all activities that required the UHA to provide funding to the DFO and all activities that DFO required of UHA for the management of the fishery were specified in a series of one to five year "collaborative agreements" or contracts. At any given time, the UHA would have had six or seven active contracts with the DFO. In 2003, the UHA signed a five-year "Joint Project Agreement" with the DFO, which comprehensively outlines all the responsibilities of both the DFO and the UHA in co-managing the geoduck and horse-clam fishery. The agreement has an Annual Work Plan attached to it, which provides detail on the activities for the year and the cost commitments of both the DFO and the UHA. For 2006, the total cost to the DFO of managing the fishery was estimated to be Can$771 053, with Can$291 853 contributed directly by the UHA, which leaves Can$479 200 contributed by DFO. This contribution by the DFO is about 70 percent offset by geoduck and horse-clam licence fees paid to the government, which in 2006 amounted to Can$336 000. For 2006, the total cost to the UHA of co-managing the fishery and carrying out the above

activities (including the contribution to the DFO) was about Can$2.3 million. This is funded by a UHA membership fee of just over Can$40 000 per licence in 2006.

Some of the programmes and costs assumed by the UHA have been requirements imposed by the DFO, such as landings monitoring and on-grounds fishery observers. Most programmes, however, have been implemented by the Association through enlightened self-interest. For example, the survey and biosampling programme is seen by fishers as necessary to improve the biological data used for setting TACs. The industry has been told that this data simply would not be available if research were left to the DFO. Prior to UHA funding for surveying and biosampling, the DFO did not do any surveys or biosampling. All estimates of biomass were based on fishery dependant data. Without fishery independent data, TACs would be set at lower levels because of the precautionary approach taken by the DFO to managing fisheries. PSP sampling programmes grew out of a desire to expand areas of harvest for live product into areas not covered by government sampling programmes.

Two of the most progressive programmes undertaken by the UHA are the enhancement programme and the generic marketing programme. The enhancement programme has been fully funded by the UHA with no government assistance, except a small contribution in the initial stages to help design a planting machine. The objective of the enhancement programme is to plant one million small geoducks into the common property of the ocean each year. The average weight of a grown geoduck is about two pounds. If all the planted geoducks were to survive, these planted geoducks would mature to be about one-half of annual commercial harvests. To date, survival rates have ranged from 20 to 80 percent, and with improved technology and techniques the survival rates should consistently reach the higher end of this range. In addition, the UHA has acquired a deep water geoduck aquaculture tenure and will be growing geoducks from seed on that tenure. The UHA will use the proceeds to help fund UHA activities.

The UHA generic marketing programme is also very progressive. Core branding issues for the UHA are positioning "Geoduck from Canada" as a high quality, delicious, sustainable, healthy, safe product that is available live and available year-round, and that meets customer specifications well beyond regulatory requirements. For example, a geoduck on a restaurant plate in Shanghai can be tracked back to the day, area and vessel from which it was harvested.

Unlike many other industry-funded marketing efforts, there is no separate or legislated requirement to remit funds from the sale of fish for generic marketing. The licence holders decide on an annual basis what level of support they will provide for generic marketing. Matching funds are then sought from Federal Government export marketing development programmes. All Canadian geoduck exporters are either full or associate members of the UHA and all have access to UHA promotional materials and activities.

Each year, the UHA has two annual general meetings to report on activities and discuss issues. The general meeting in the fall also approves a budget and fees for the following year. At the general meeting held in late spring, elections are held and audited financial statements are approved, as required by the statute covering non-profit societies. The UHA currently has eight elected Directors (including the President), all of whom are licence holders in the fishery. During the year, UHA directors may make decisions on redirecting funds within the overall budget. However, since the fees for the year are set in advance, every attempt is made to stay within the overall budget for the year. There are a number of subcommittees in the UHA to deal with fishery management, research, enhancement and other activities. Regular communication is maintained through a monthly newsletter. A small, but important, indicator of the importance of communication is the self-imposed requirement that all members have a fax machine or, more recently, e-mail. If something important happens, the UHA has the ability to contact all the members within a few hours.

5. EVALUATION OF IVQS AND CO-MANAGEMENT

5.1 Fishery value

Evaluation of the success of the UHA as a self-governance institution cannot be separated from an evaluation of the impact of quotas. The original version of the UHA allowed the 55 licence holders in the fishery to develop majority support for IVQs with equal quotas. Since then, the development of the UHA has been strongly linked with the success of the IVQ programme. The effects of both are assessed here.

The largest effect of IVQs was the ability to service a live market with consistent year-round supply and thereby substantially increase the landed value of the product. Figure 3 shows the changes in average landed prices over time. As previously illustrated in Figure 1, while the overall landings of geoduck have declined since 1986 and then stabilized in 1995, the value of the fishery increased substantially and now fluctuates with market conditions. The average landed price of geoduck was CanS0.17/lb in the first year of the fishery. The landed price in 2005 averaged CanS9.50/lb.

The geoduck market has changed from largely frozen neck meat to live clams. In 1989, 39 percent of geoducks were exported either as processed fresh products or live. By 1994, the percentage sold live rose to 99 percent. Currently, as much as possible, geoducks are sold as live product.

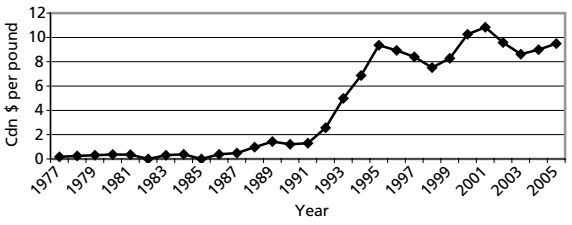
The target market has also changed. In 1989, the first year of IVQ management, 37 percent of geoduck exports went to Japan, 33 percent to Hong Kong and 26 percent to the United States. At present, over 95 percent of geoducks harvested in Canada are exported with over 90 percent of exports going to greater China. The negative side to these market developments is the recent reliance on one market, China. When, as in 2003, the Chinese market collapsed due to an unforeseen event such as severe acute respiratory syndrome (SARS), the effects are not dampened by strength in other markets. On the other hand, fishers and processors work together to time harvests to meet lower market demands and to mitigate the impact on the industry. In addition, the UHA could respond quickly to marketing challenges and redirected marketing efforts to revitalize markets in China.

With improvement in landed prices and gross revenues per licence, the value of licences increased substantially. However, few licences trade and the sale prices are unconfirmed. Muse (1998) cited one anecdotal report of a licence being sold in the mid 1990s for $1.5 million. Despite the value of the fishery and the financial returns, it is impossible to obtain bank financing for the purchase of a licence. Licence issuance is at the absolute discretion of the Minister of Fisheries and Oceans and therefore cannot be considered property in any way. This lack of certainty around licences (and also quotas) means that the value of geoduck licences is below comparable business investments.

5.2 Fishing costs

There are no data on changes in fishing costs associated with the move to IVQs, area licensing, and co-management. Indirect evidence is available. The number of divers and vessels used in the fishery has been reduced. In 1988, the last year of competitive fishing, 233 divers fished from 56 vessels (more than 55 due to licence transfers in-season) for an average of just over four divers a vessel (Muse, 1998). By 1997 there were 86 divers fishing off 42 vessels, about the same number as today (39 vessels). This is a consequence of both decreases in catch and the elimination of the race for fish. By eliminating the capital costs of 16 vessels from the fleet as a whole, the total investment in catching capacity and

FIGURE 3
Geoduck historic price per pound



the overall fleet costs of maintaining that catching capacity (e.g. repairs and insurance) in the fleet have been reduced. Variable costs associated with fishing have not declined, because vessels now fish a longer period of time for less product each day and because the other variable costs of fishing are associated with catch volume. A vessel with two quotas attached to it fishes twice as long and has twice the variable costs.

On the other hand, the costs associated with managing the fishery have gone up considerably and been redistributed from government to the UHA membership. Prior to IVQs, the costs of fishery management were completely borne by the government. When IVQs were introduced in 1989, the UHA annual membership fee to recover monitoring costs was CanS4 700. In 2006, the annual fee for UHA membership was just over CanS40 000. In summary, while most industry participants would agree that overall costs have risen, the increase in value of the fishery and the improvements in management have warranted these costs.

5.3 Fishery management and enforcement

Fishery management has been significantly improved through industry-funded catch monitoring, support to DFO programmes, and improved research. Enforcement of catch limits has been dramatically improved. In the five years prior to IVQs and cost recovery, TACs were regularly exceeded. In 1985, the TAC was exceeded by 81 percent. As shown in Figure 4, after the introduction of IVQs, catch has been within 1 percent of the TAC.

Fishers are supporting further enforcement activities to protect their interests against poaching. A particular concern is if poached product that does not meet the requirements of the Canadian Shellfish Sanitation Programme were to get to market and make someone ill, the market could be devastated.

FIGURE 4
Geoduck TAC overages

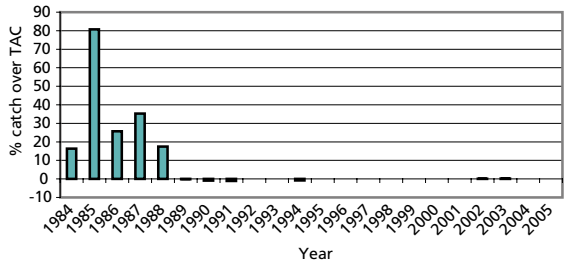
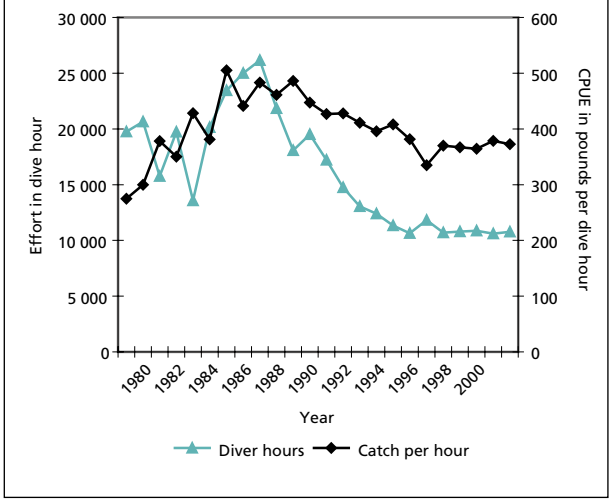


FIGURE 5
Effort and catch per unit effort



Because of the high value of the fishery, fishers are able to make considerable investments in the future of the fishery, including long-term research studies and an enhancement programme to increase stock biomass.

5.4 Fishing effort

Effort, as measured in diver hours, has declined and then stabilized since the introduction of IVQs. However, so has catch. The trend in catch per unit effort, measured as pounds per diver hour, shows modest decline, as shown in Figure 5.

With dive fishing, divers have a limited amount of bottom time. With steady work, divers harvest an average of about 380 pounds (170 kilos) an hour. The impact of IVQs on effort has been to allow fishers to time fishing to meet market demands. They can exert more effort when demand is high (i.e. Chinese New Year and the winter "hot pot" season) and less effort when demand is low (the 2003 SARS crisis in China). The market dictates the amount of harvesting effort, not the race for fish.

6. DISCUSSION

The geoduck and horse-clam fishery in British Columbia is an example of a co-management success story. The following factors have contributed to this success:

i. A small number of licences and licence holders;
ii. Leadership within the community of licence holders and industry knowledge of the success of the New Zealand move to IQ management;
iii. A small base of support within government for moving to IVQs;
iv. A new fishery with little political interference;
v. A simple fishery with no competing users of the resource (other than sea otters and other natural predators);
vi. A fishery where the market potential for a live product with a higher price was recognized and could be realized;
vii. A fishery with a recognized problem of catches exceeding TACs; and
viii. The safety consequences of a race for fish underwater (which meant that even the fishers' union could see the benefits to workers from the move to IVQs).

All of these factors contributed to the transition from a limited entry, competitive fishery and associated style of management to an IVQ/co-management structure. Once IVQs and industry involvement in fishery management were in place, the continued development of the UHA and its programmes could proceed because of the increased fishery value and the incentives for cooperative activities under the assured resource access afforded by IVQs.

As with any business, there are always new challenges and opportunities. For the geoduck industry, these include: (a) uncertainty associated with government policy and regulation, (b) biological uncertainty related to the resource and (c), challenges and opportunities associated with the market place.

The greatest challenge of government policy is security of access to resources. In negotiating the current Joint Project Agreement between the UHA and DFO, the DFO refused to allow a clause that would commit the Minister of Fisheries and Oceans to continue to limit the number of commercial licences to 55. The DFO cited the Minister's absolute discretion over licensing matters. Another concern is the ability of the provincial government to alienate aquatic lands with wild geoduck resources for other purposes, including shellfish aquaculture. In neither instance is there a written policy that would provide certainty to commercial harvesters of geoduck and horse-clams. In an ironic twist, any negative impact on geoduck stocks from an aquatic land lease (such as a log dump, fish farm, or floating lodge) would not be considered under the federal *Canadian Environmental Assessment Act* because the fishery is well managed and not a conservation concern. Governments are making aquatic land use decisions without a guiding policy on resource or fishery alienation. Any change in commercial fishery access by either federal or provincial governments could seriously undermine the co-operative behaviour of the existing licence holders.

Biological uncertainty is always a factor in fisheries management. Relative to many other fisheries, the geoduck fishery in B.C. is data rich largely because of industry investments in research. Data and scientific knowledge will continue to be refined to provide better information on stocks and stock dynamics. Risk management and the implementation of precautionary management are always matters of debate between the regulators and the regulated. In the geoduck and horse-clam fishery, the industry and government are working together to improve the scientific basis for managing the fishery.

Market uncertainty is an area that often seems to be beyond the control of fishers. The UHA has recognized that this is not the case. What fishers do, what they catch, where and when they catch it, how it is treated, consistency in meeting customer demands, and how the fishery presents itself to the world, are all important factors in marketing fish products. There are circumstances beyond the industry's control, such

as SARS. But the more important question is: how does the industry manage such crises? Other market impacts will be felt from increases in supply due to aquaculture and the harvesting of close substitute clams in other parts of the world. Because all of the exporters of geoduck from Canada are either full or associate members, the UHA presents a consistent and united market message to its customers.

This year (2007) is the nineteenth year of operations for the UHA Research Society as a non-profit association in a fishery managed through a system of IVQs and industry co-management. This voluntary organization has worked because harvesters see that their fishery and the industry is better off with the association. It has also worked because association members have, to a large extent, control over the association and the flexibility to changes activities and priorities. UHA is not burdened or restricted by government regulations that might be required if the association were mandatory. The potential problem is that the factors leading to the cooperative behaviour of harvesters might be undermined by government actions or other outside influences. Hopefully, the nineteen years of cooperation portends a successful future for the UHA and its co-operative management.

7. LITERATURE CITED

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