New Zealand's Challenger Scallop Enhancement Company: from reseeding to self-governance

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1. INTRODUCTION

In the late 1970s, catches in the New Zealand twenty-year old Southern Scallop fishery collapsed as a result of overfishing. The government initiated an enhancement programme and controlled entry to the commercial fishery. It soon began shifting the costs of the enhancement programme to its commercial fishing beneficiaries. With the introduction of the Quota Management System for New Zealand fisheries, control of the enhancement programme was devolved to the commercial fishers, who had become the fishery quota owners. Subsequently, a range of other management functions, including harvest rules, providing for recreational fishery access, water quality assurance, research and compliance were progressively devolved. The Challenger Scallop Enhancement Company ("Challenger") was established by the quota owners as a vehicle for collective exercise of management and enhancement activities in the scallop fishery and has become a model for similar organisations in New Zealand.

2. HISTORY OF THE FISHERY PRIOR TO CHALLENGER

2.1 Description

The Southern Scallop fishery, which is also known as the Challenger Scallop fishery, is located at the top of New Zealand's South Island (Figure 1). The Southern Scallop Fishery Management Area covers 9 631 km^2 of sea space, approximately 2 000 of which are considered to be in harvestable areas. The fishery is managed under New Zealand's Quota Management System (QMS) and is the country's largest producer of the New Zealand scallop (*Pecten novaezelandiae*).

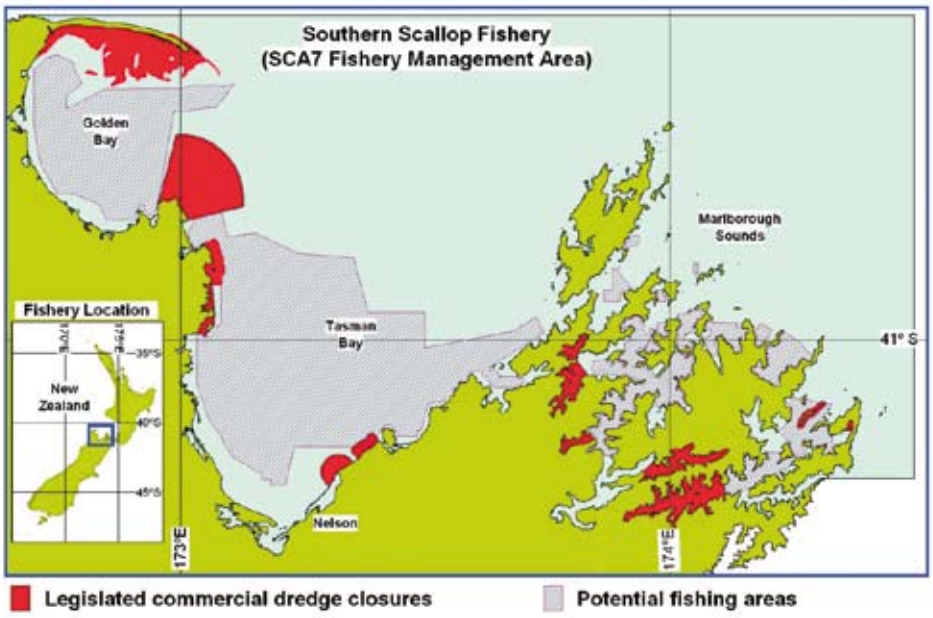
Scallops are harvested with a ring-bag dredge that is not fitted with teeth or a cutter bar and has low impacts on the benthic environment in comparison to many other dredge designs. The fish are harvested and landed the same day, alive and in the shell. Upon landing, they are sold to processors who remove the adductor muscle and gonad, which form the saleable product. With a limited domestic scallop market, the product is largely exported to Europe as frozen "roe-on" scallops.

The Southern Scallop fishery is shared with customary Maori and also recreational fishers who are permitted to harvest by hand (usually with underwater breathing apparatus) and by dredging.

2.2 Development and decline

Tasman Bay and its environs have been commercially dredged since the 1840s. Flat oysters (*Tiostrea chilensis*) were targeted in the 19th and early 20th centuries. In the middle of the 1900s, the green-lipped mussel (*Perna canaliculus*) began to feature in the harvest, as did the horse mussel (*Atrina zelandica*). In light of this dredging activity,

FIGURE 1
Map of the Southern Scallop fishery area

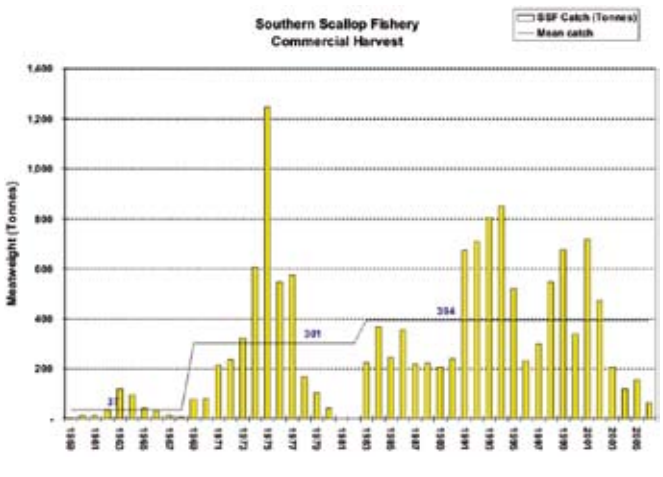


Note: Potential fishing areas surveyed annually.

commercial fishers are assumed to have landed scallops as a bycatch prior to official records, but such landings were not recorded.

The first recorded commercial landings of scallops occurred in 1959 during a survey to locate and map the Tasman Bay scallop fishery. Over the ensuing ten years, beds were found to cover grounds in Golden Bay and the Marlborough Sounds (Bull, 1989a). Catches and vessel numbers increased steadily through the 1960s and 70s (see Figure 2 and Table 1). Catch peaked in 1975 at 1 246 meatweight tonnes (adductor muscle and roe; nearly 10 000 tonnes shellweight) and the number of vessels peaked at 245 the following year (King and McKoy, 1984). Various effort controls were placed on fishers as the fishery was developed. Despite the compounding controls, catches rapidly declined to 41 tonnes in 1980 and 61 vessels and the fishery was closed for the following two years. Figure 3 shows relevant aspects of the fishery.

FIGURE 2
Commercial harvests from Southern Scallop fishery with the average shown from each of three periods



2.3 Recovery and enhancement

Following the closure, the fishery began to recover and was reopened to commercial fishing in 1983. Seasonal catch limits were established and the number of vessels was limited to 48 through non-transferable permits.

Trials of scallop spat-catching and seeding were carried out in the late 1970s by the Ministry of

TABLE 1
Landings, vessels, and TACC for Southern Scallops, 1959–2006

Year	AAC / TACC	Catch (tonnes meatweight)	Vessels landing scallops	Year	AAC / TACC	Catch (tonnes meatweight)	Vessels landing scallops
1959		2	1	1983		225	48
1960		14	6	1984		367	48
1961		13	4	1985		245	48
1962		36	6	1986		355	48
1963		119	17	1987		219	48
1964		95	22	1988		222	48
1965		42	18	1989		205	48
1966		31	21	1990		240	48
1967		13	26	1991		672	48
1968		8	14	1992	1 100	710	48
1969		78	25	1993	1 100	805	60
1970		80	34	1994	850	850	60
1971		215	49	1995	720	521	68
1972		236	67	1996	720	231	64
1973		321	83	1997	720	300	64
1974		606	96	1998	720	547	62
1975		1246	190	1999	720	676	60
1976		547	245	2000	720	338	61
1977		575	189	2001	720	716	57
1978		167	121	2002	747	471	59
1979		104	98	2003	747	206	59
1980		41	61	2004	747	118	40
1981		-	-	2005	747	158	36
1982		-	-	2006	747	65	31

Agriculture and Fisheries (MAF) in association with private organisations. These trials indicated that bottom seeding of juvenile scallops was likely to be viable. In 1982 Talley's Fisheries Limited and MAF carried out seeding trials in Golden Bay and the Marlborough Sounds. In 1983, MAF and the Overseas Fishery Co-operation Foundation of Japan embarked on a joint, pilot-scale seeding operation in the Golden Bay area (Bull, 1989b). Enhancement trials continued through the 1980s and enhanced scallops have formed a part of the annual commercial catch since 1986.

Juvenile scallops for seeding are recovered from two sources. First, some are captured in bags set on longlines. These are transferred from the bags to the beds in April each year ('primary spat'). Second, some attach themselves to the spat catching equipment outside of the bags and then fall to the sea floor beneath ('secondary spat'). Secondary spat are recaptured with a modified scallop dredge approximately four months after the primary spat harvest. A total of eight, 500 hectares, spat catching sites have been established, four each in Tasman and Golden Bays (see Figure 3) One site in each bay is available for use each year and catching efforts peaked in the 1990s at 90 long-lines of bags in each bay. Each source of juveniles

FIGURE 3
Spat catching sites in Golden and Tasman Bays and statistical reporting areas

PHOTO 1
Relevant aspects of the Tasman Bay scallop fishery Harvest of primary scallop spat
The 200 m backbone cable and the vertical dropper ropes, each with ten pairs of green spat catching bags, are raised from the water and the bags cut from the line. The primary spat are then removed for seeding in pre-selected areas.

PHOTO 2
View of a harvested spat bag
This shows a bag that has been washed and opened to show the primary spat contained within. The spat in this bag range from 5 to 15 mm in shell length. Up to 2000 spat may be harvested from each bag.

PHOTO 3
View of the deck of the company's 26 m flat-decked vessel
During secondary spat harvesting juvenile scallops are dredged from the seabed under the spat catching site, then stored on deck under salt water sprays until the vessel is loaded. They are then transported to the pre-selected seeding sites for released. Up to nine million juvenile scallops may be seeded in a day using this method.

PHOTO 4
Harvesting scallops on a commercial vessel
One of the two ringbag dredges has been raised above the sorting tray at the rear of the vessel. The dredge is emptied onto the table through its mouth (head-frame) and the scallops are then manually sorted into large 500kg capacity bags – one is visible in the foreground with its top open.

has occasionally failed, but not at the same time and not in both bays at once. Use of both bays and both primary and secondary spat has provided greater surety of successful spat production.

Operational improvements, fluctuations in wild scallop stocks and financial constraints have combined to encourage better tailoring of spat-catching efforts to anticipated needs. The number of lines used in each bay has decreased as the efficiency of spat catching and spat survival has improved. Tasman Bay has had low scallop productivity in recent years and spat catching has been suspended there since 2004. All spat catching efforts have been concentrated in Golden Bay, which went through a short period of poor productivity but is recovering quickly.

This enhancement program, combined with the broader QMS, has resulted in a higher level of sustained harvests. The annual commercial harvest since its introduction into the QMS in 1996 has averaged 468 meatweight tonnes or approximately 3 750 tonnes whole shellweight. This compares to an average of 305 meatweight tonnes during 1982–1991 (under controlled entry, but before QMS) and 301 tonnes average during the boom-and-bust of the pre-1981 fishery.

3. REGULATORY HISTORY LEADING UP TO CHALLENGER

3.1 Overview

New Zealand fisheries legislation has been re-written twice since the start of the commercial Southern Scallop fishery. The fishery was opened under the aegis of the *Fisheries Act of 1908*, which provided primarily for open access to fishing permits and regulatory controls on fishing gear and on times to control extraction. The Quota Management System (QMS) in the *Fisheries Act of 1983* replaced the 1908 Act, although implementation in the scallop fishery did not occur until 1992. The QMS was refined in the current iteration of the Fisheries Act, which was passed into law in 1996. This Act was not fully implemented until October 2001.

3.2 Open access and regulation, 1959 to 1977

In the years 1959 to 1963, access to the fishery was limited by MAF. Controls on the number of permitted vessels were removed in 1964, and the issuance of permits was unrestricted until July 1977. A moratorium on the issue of permits then halted new entrants into the fishery. During 1959 to 1977, regulatory controls were progressively added to manage harvest in the fishery. These controls included:

i. a 4-inch minimum size limit from 1964,
ii. a closed season from 1968,
iii. dredge number and size restrictions from 1971,
iv. fishing limited to daylight hours from 1975, and
v. fishing limited to 5 days each week from 1977.

Table 2 details these and other regulatory measures during the open access period.

During this period, commercial fishers were largely uninvolved in the management of the fishery. Decisions were made by the regulating authority with minimal input from the permit holders.

3.3 Restricted licensing and enhancement, 1978 to 1992

In June 1978, the fishery was declared a controlled fishery. Management fell to the Fisheries Licensing Authority, established under Section 101 of the *Fisheries Act of 1908*. Membership of the licensing authority included representatives of the fishers, which provided the first direct involvement of fishers in decision-making about the fishery. A moratorium was placed on the issue of new permits, and existing fishers were required to apply each year for a new permit. Permits were non-transferable. Applications were judged against criteria to test dependence on the fishery. Issued permit numbers rapidly declined from 189 in 1977 to 61 in 1980 (Buzz Falconer,

TABLE 2
Chronology of Regulations, 1959–1983

1959	First commercial landings of scallops.
1964	Control on the numbers of vessels permits removed. Four inch minimum size limit introduced. The size restriction was accompanied by a requirement to land the scallops alive and in a measurable condition which had the effect of prohibiting processing at sea. The use of underwater breathing apparatus was prohibited.
1968	An annual closed season from 1 March to 31 July was introduced.
1969	Fishers limited to using one 8 feet wide dredge or two 4 feet 6 inch wide dredges except in inner Pelorus Sound where fishers were limited to one 4 feet wide dredge.
1971	Locally registered boats permitted to use two 8 feet wide dredges.
1973	Inner Pelorus Sound dredge size raised to 6 feet wide.
1974	Processing restrictions forced a voluntary daily quota of 100 cases (437.5 kg mwt)[1] per week per boat.
1975	The annual closed season was altered to 15 February to 14 July. Fishing limited to 5 days in each week introduced. Minimum scallop size limit was metricated at 100 mm. 8 feet, 6 feet and 4 feet 6 inch wide dredge sizes metricated to 2.5, 2 and 1.4 m respectively.
1977	The closed season was extended to 31 July. The Southern Scallop Controlled Fishery was declared, new entrants prohibited and permit numbers reduced.
1979	A total season quota of 45 000 sacks (approx 132 tonnes mwt)[2] established for the season. A daily vessel quota of 55 sacks (approx 150 kg mwt) established for the season. Size limit removed but processing requirements defined an effective minimum harvest size of 80mm.
1980	The closed season extended from 1 November to 14 August. All boats permitted to use two 2.5 m wide dredges.
1981	Fishery closed to commercial fishing.
1983	Fishery reopened with 48 licences.

[1] 1 case ≅ 35 kg shellweight (gwt) ≅ 4.375 kg meatweight (mwt) (King & McKoy 1984)
[2] 1 sack ≅ 22 kg shellweight (gwt) ≅ 2.75 kg meatweight (mwt) (King & McKoy 1984)

fisherman and Chairman of Challenger Scallops, pers. com.). The majority of the controls on fishing effort established prior to the licensing authority were continued and many of those have survived to the current day. In 1979 and 1980, the size limit on scallops was temporarily removed and the season was shortened (Challenger, 1994a). The processors introduced a minimum size for purchase in an effort to ensure that scallops received from the fishers could be processed and sold.

In 1983, a replacement Fisheries Act passed. The law maintained the controlled fishery management regime for the Southern Scallop fishery and retained the cap of 48 non-transferable fishing licences. The 1983 Act also provided for the introduction of the QMS, but the QMS was not to be implemented in the Southern Scallop fishery for some years. In 1989, a reduced commercial size limit was introduced in conjunction with the establishment of three fishing areas in each of Tasman and Golden Bays, which were to be fished rotationally in successive years. Recreational fishers share the reduced size limit but are not subject to the rotational fishing regime.

Golden and Tasman Bays are managed under a rotational fishing strategy based on the Statistical Reporting Areas (Figure 3). The default strategy is as follows. In Golden Bay, one of the three statistical areas A, B or C is opened each year in turn. The open area is fished between July and February and then is reseeded in April. In Tasman Bay, statistical areas E, F and G/H are fished and reseeded in the same annual rotation. Sectors G and H are treated as one area because productivity tends to be lower and the main bed generally straddles the boundary between them. Sectors D and I are not included in the rotational system, because the bulk of the scallops they produce are slower growing and a lower proportion reach market condition. The default strategy is sometimes modified by Challenger on the basis of annual survey results to capture scallops that are found to be out of phase with the rotation and to provide for non-commercial fishing access.

3.4 Quota Management System, 1992 to present

The period 1992 to 1994 saw major changes in the legislation surrounding the fishery. Agreements reached earlier with industry representatives were codified in the *Fisheries*

Amendment (No. 2) Act of 1992. This act introduced the fishery into a modified form of the QMS under an annual allowable catch of 1 100 tonnes (meatweight). Of this, 576 tonnes were allocated as 12 tonnes of scallop quota to each of the 48 licence holders and 64 tonnes were allocated to Maori on an equal share to each of the 8 tribal groups (Iwi) located within the bounds of the fishery. The remaining 460 tonnes were held by the Crown. In 1994, a further 10 percent of the total quota was allocated to the 8 Iwi from the Crown holdings in accordance with the terms of the Treaty of Waitangi fisheries settlement. Introduction to the QMS removed the fishery from the vessel limitations of the controlled fishery regime. The allocation of new quota to Maori and a period of high catches led to a rapid expansion of the fleet to 60 vessels. The 1992 amendment also established a compulsory levy to fully fund the enhancement programme in accordance with a plan determined by the Minister of Fisheries.

The *Fisheries Amendment Act of 1995* integrated the scallop fishery quota system into the standard QMS provisions, removed the Crown quota, and set a total allowable commercial catch (TACC) of 720 tonnes. The 1992–1995 period also saw restructuring of fisheries administration into the Ministry of Fisheries (MFish) and simultaneous reform of its funding arrangements. This resulted in the current regime, which recovers the government's costs of the fisheries management attributable to commercial fishing through compulsory levies.

The 1992 implementation of the enhancement programme, with costs recovered through a specific levy and service delivered by the Ministry, did not fit into the accountability structures and redefined role of MFish. Contracting the enhancement services out to an external provider was an option consistent with the Ministry's new and wider purchasing roles (Arbuckle, 1999). This reform was to lead directly to the establishment of the Challenger Scallop Enhancement Company Limited ("Challenger").

4. INDUSTRY ROLE IN MANAGEMENT BEFORE CHALLENGER

In 1963, the New Zealand Fishing Industry Board ("NZFIB") was established with statutory powers to levy fishers and the authority to represent fishers to the Government. The Minister was required to consult the NZFIB before making a range of decisions, including the appointment of one of the five members of the Fisheries Licensing Authority and the declaration of a controlled fishery.

The Southern Scallop fishery was declared a controlled fishery in 1977. The appointment of a Southern Scallop permit holder to the Licensing Authority marked the first occasion when Southern Scallop fishers were directly involved in the management of the fishery. At about the same time, scallop fishers developed their own representative body, the Southern Scallop Licence Holders Association. This Association, together with the local Commercial Fishermen's Association, gained recognition by the NZFIB and MAF as representing the voice of the licence holders.

In June 1983, the Scallop Enhancement Steering Committee held its inaugural meeting. The Fisheries Management Division and the Fisheries Research Division of MAF, NZFIB, Scallop Processors Association, Golden Bay/Motueka Commercial Fishermen's Association, and the Southern Scallop Licence Holders Association were represented on that committee (Scallop Enhancement Steering Committee minutes, 1983). The Fishing Industry Board also established the NZFIB Southern Scallop Advisory Committee, which was comprised of representatives of the NZFIB, four local fishers' associations, the scallop processors and the Licence Holders Association.

While the Ministry retained responsibility for the delivery of the enhancement programme, it discussed management of the programme and subsequent harvesting decisions with the Steering Committee. Fishers' vessels and crews were also used by the programme during the annual spat-seeding season. Trial harvests of enhanced stocks began in 1986. By early 1988, the Ministry was pressing for the beneficiaries of the programme to assist with its funding. A voluntary levying system was introduced that year and most

permit holders contributed. The small proportion of fishers who were reluctant to pay a share was identified to other participants, which generally resulted in payment (G.J. Ivey, Administration Manager, Central Region, Ministry of Fisheries, pers. comm.).

The *Fisheries Amendment (No. 2) Act of 1992* replaced the NZFIB Southern Scallop Advisory Committee with a statutory "Southern Scallop Fishery Advisory Committee", which consisted of representatives of scallop quota owners, processors, and Maori interests, together with a representative of the Ministry. The committee was established to advise the Minister of Fisheries on: allowable catches, seasons, exemptions to quota holding limits, the enhancement programme, levies, area and duration of closures, minimum sizes and regulations to be made for the fishery. Allocation of quota to Iwi at this time resulted in Maori representation within the industry representative groups.

5. THE CHALLENGER SCALLOP ENHANCEMENT COMPANY

5.1 Creation of Challenger

With the establishment of the mandatory levy under the 1992 Act, it became apparent to the industry that they would need to provide an alternate funding and administrative structure to protect fishing and management rights. The Challenger Scallop Quota Holders Association was formed for this purpose in December 1993 (Arbuckle, 1999).

In 1993, the Ministry of Fisheries reform was looming. Its new role would not be compatible with direct delivery of enhancement services. The opportunity for the quota holders to be the external contractor to provide those services was established. The quota owners were already paying for the services through a compulsory levy. They believed that they could lower costs so they had incentives to create a structure that could not only deliver those services but also one that would have sufficient credibility and accountability for the Ministry to contract with it.

The structure chosen was a limited liability public company, the Challenger Scallop Enhancement Company Limited, incorporated in May 1994. Its board of directors was drawn from the industry representatives on the statutory Southern Scallop Advisory Committee. Shares in the company were limited to the amount of quota in the fishery and ownership of the shares was constitutionally limited to the owners of Southern Scallop quota at the rate of one share per 100kg of Southern Scallop quota owned. The company's shares were fully subscribed (Challenger, 1994b).

Challenger enhanced its capacity to meet the opportunity for devolution by attracting a Chief Executive (Michael Arbuckle) from within the Ministry of Fisheries. He had been directly involved in creating the framework for service delivery under which Challenger would function. The company moved rapidly to secure a contract to deliver enhancement services as a service provider to the Ministry.

Over the next two years, Challenger developed the devolved fisheries management model by using the framework established specifically for it in the two Fisheries Acts. It developed a formal plan for the enhancement of the scallop fishery, which the Minister of Fisheries approved under the Southern Scallop provisions of the amended 1983 Act. The Minister also appointed Challenger as the organisation to deliver the plan, again under the provisions of the amendment.

5.2 Restructuring in 1996

In early 1996, Challenger redesigned its harvest management strategy by creating a civil contract between itself and every quota owner, permit holder, processor and vessel master. The suite of identical contracts signed each year establishes the rules for fishing, including *inter alia*: earliest start and latest finish dates for the season, area closures, documentary requirements, and limits on daily catches, area catches and scallop sizes.

The rules for each year are developed after information is gathered in the annual biomass survey. Negotiations are also held with recreational fishing groups to establish

areas that might be suitable for recreational harvest. Approval for the annual rules is obtained at a general meeting of the company, to which all prospective participants are invited and granted speaking rights. Until 2000, the Minister of Fisheries endorsed the rules before they were implemented and some of the rules (e.g. earliest and latest dates for fishing, Marlborough Sounds catch limit, and area closures) were implemented by regulation. Since 2000 that process has been changed so that annual endorsement of the Minister is no longer required.

Beginning in 1998, a Memorandum of Understanding (MOU) between the Ministry of Fisheries and Challenger specifies requirements for the provision of information by Challenger to the Minister to "ensure that the Minister receives sufficient information, in a timely manner, on which to base decisions regarding the setting of sustainability and other management measures in the Southern Scallop Fishery." The MOU establishes standards for the information required and an audit process to ensure that the delivery of research information is timely and that the information is of sufficiently high quality (Arbuckle, 2000).

As part of its institutional redesign, Challenger also changed its funding mechanism. New Zealand law provides for commodity levies, a mechanism by which groups of primary producers can establish a levy to fund activities such as marketing and research on their joint behalf. Such commodity levies are designed to provide funding for club benefits and to avoid free-rider problems by requiring all producers of the commodity to pay the levy struck under a commodity levy order. The empowering levy order has a life of 5 years but may be extended if the primary producers required to pay it support its renewal in a ballot held before expiry. Once a commodity levy is authorised, unpaid levies can be made subject to additional levies and are recoverable as a legally enforceable debt. In 1996, the company sought and received the requisite approval of its shareholders to establish a commodity levy on commercially harvested Southern Scallops. The levy may be struck as high as 25 percent of the landed value (ex-vessel or wharf price) of scallops. The levy has varied between 14 percent and 20 percent and was 20 percent for 2006. With the establishment of the commodity levy, the government was able to withdraw its statutory levy set under the scallop-specific amendment. Challenger now sets a business plan and budget annually by majority vote in a general meeting of its shareholders. It then seeks approval to strike a levy rate sufficient to fund that budget, again by simple majority but among all prospective levy payers. These are the same individuals who are qualified by quota ownership to own shares in Challenger. Continuing support for levies has been evident through its renewal in 2002 and again in an expanded form in 2007.

Until the *1996 Fisheries Act* was implemented, the currency of Southern Scallop ITQs was measured in kilograms of permanent quota. Every sale of quota generated a series of actions by Challenger upon notification of the transaction. If the transfer of shares would change who was qualified to join, Challenger would extend an offer to a newly-qualifying prospective shareholder to accept a shareholding in the company. Challenger would also initiate removal of any no-longer qualifying shareholder. With the implementation of the 1996 Act, the currency of ITQs went from 720 000 kg of quota in the scallop fishery to 100 000 000 quota shares that generated 720 000 kg of annual catch entitlement (ACE) each year. Under the 1996 changes, ACE trades separately from the generating quota shares. ACE could be counted against fish taken by the quota owner or sold to another fisher. This change led to an amendment of Challenger's constitution to provide for one share per quota owner but with voting rights at company meetings tied to quota shares owned on the day of the meeting. Voting rights were later defined as the number of quota shares owned seven days prior to the meeting.

5.3 Further devolution of authority to Challenger

In 1998, Challenger developed a new enhancement plan. Challenger received Ministerial approval as the organisation appointed to implement that new plan under the 1996 Act. Scientific modelling of the fishery that incorporated rotational harvest and enhancement of the fishery came to several conclusions (Breen and Kendrick, 1997). The fishery could be subject to over-fishing under a constant catch strategy. The fishery was more stable, but still susceptible to over-fishing, under a constant proportion of biomass catch strategy Rotational fishing was highly stabilising, and enhancement together with rotational fishing was considered to be the most stable strategy. That study found that the rotation and enhancement strategy would also withstand the extraction of 10 percent of the recruited biomass under the non-rotational harvests by recreational and customary Maori users.

Breen and Kendrick's (1997) study underpinned the further devolution of harvest management functions to the company. In 2000, the season start and finish dates were set on a permanent basis and the Minister withdrew from regulating the Marlborough Sounds catch limits and rotational area closures. In 2002, a total allowable catch was set at 827 tonnes, with 40 tonnes each allocated to Mäori customary fishing and to recreational fishing. Having agreed that the rotational harvest regime rather than the TACC was the proper management tool to ensure sustainability of the fishery, the Minister set the TACC at 747 tonnes, well in excess of the anticipated average annual harvest. The species is also one of only three listed in the Third Schedule of the Fisheries Act that permits adjustments of the TAC within a quota year (1 April to 31 March for this fishery), should information indicate that such a course is desirable.

The Minister's agreement marked a significant change in the role of enhancement in the fishery. Enhancement had originally been the response to a collapsed fishery that delivered sustainability requirements. Now, enhancement was no longer a required activity (Drummond, 2002) but rather one of a range of discretionary tools available to Challenger to achieve its management goals for the fishery.

The Breen and Kendrick findings also underpinned a Ministerial decision to list the fishery in the Sixth Schedule of that Act, which permits the return to the sea of scallops that are likely to survive return, not wanted by the fisher, and would otherwise be required to be kept and sold.

6. CHALLENGER'S COMPREHENSIVE ROLE

Challenger is responsible for delivering most management functions in the Southern Scallop fishery, subject to Ministry of Fisheries oversight though the accounting functions for quota and ACE transactions are performed by FishServe, as described by Harte (this volume).

Challenger finances an annual survey of the biomass of the stock that it manages. The sampling structure for this survey generates data that are over three times as detailed as the preceding government surveys. Each year Challenger selects a science provider to design the survey to meet the requirements of the MOU. Following Ministry agreement on the methodology and design, Challenger undertakes the sampling itself and delivers the raw results to the science provider for analysis and reporting to the level required under the MOU. That report is then delivered to the Ministry. Apart from using the report for its own purposes, the Ministry is asked to confirm that it is satisfied that the report is sufficiently scientifically robust to properly inform decision making in the fishery.

Challenger's managers take more detailed information from the survey and use it together with the report to create a draft harvest strategy for the upcoming season, which is presented to directors for approval. A strategy will include proposals regarding:

i. areas to be closed to commercial fishing under the rotational fishing programme,

ii. areas to be closed to commercial fishing to provide for good recreational fishing,
iii. acatch limit for the Marlborough Sounds (which is not managed under rotation),
iv. ACE shelving (see discussion below), and
v. daily and weekly commercial catch limits.

Once the Board has approved the draft strategy, Challenger consults with commercial fishery participants, recreational scalloping representatives, customary Maori fishers, Government agencies, environmental organisations and the general public. The Ministry is also invited to comment on the draft strategy and attends all of the consultation meetings. Copies of the draft harvest strategy and the survey report are made available to interested parties prior to the meetings and detailed tow-by-tow survey information is presented and discussed at the meetings. Discussion of the draft strategy at the meetings, negotiated agreements over recreational access and written comments received are considered by Challenger. Improvements to the harvest strategy are incorporated into the final recommendations and approved by Challenger's directors for presentation to a company meeting with a view to obtaining final shareholder approval for the strategy. Challenger also uses the data to estimate potential annual harvest from the fishery, which informs the annual business planning, budgeting and levy setting.

The biomass survey and estimate of potential harvest are used to implement limits on aggregate catching rights (ACE) in the fishery. Because the TACC does not constrain catch in this fishery in the absence of some other mechanism, the available ACE generally exceeds by a significant margin the capacity of the areas to be fished to produce scallops. This does not present a sustainability problem in a rotational fishery, but many efficiency incentives that otherwise exist are lost. This leads to over-capitalisation and a race to catch at the start of the season. Challenger manages this risk by setting an in-house limit on the catching rights available in the fishery at a level a little below the estimated potential harvest for the year. This is implemented by agreeing on a cap with the quota owners, who then transfer a proportional share of their ACE to Challenger in a process known as "ACE shelving". Challenger holds the ACE on behalf of the quota owners, which makes it unavailable for fishing.

Catch in the fishery seldom approaches the in-house limit until late in the season, when the bulk of the catch has been taken, the costs of fishing have risen significantly and many vessels have left for more profitable opportunities. At this point, the ACE is generally released back to quota owners to reduce the costs of access to ACE when other fishing costs have risen. The quota holders have agreed to this mechanism in their contract with Challenger.

The bottom that is dredged for Southern Scallops is also dredged for oysters. Because oyster dredging would impact Challenger's reseeding and rotation programme, Challenger moved in 1996 to resolve this conflict. Challenger encouraged the oyster dredge quota holders to form the Challenger Oyster Management Company. Because many of the Southern Scallop quota holders also dredge for oysters, strong reasons to cooperate existed. Management of the oyster fishery by a similar organisation provides a framework for delivering broader management objectives, including avoiding unnecessary dredging of scallop grounds.

Challenger has also negotiated an agreement with recreational harvesters of Southern Scallops. Among other terms, that agreement allows recreational harvesters to access areas that are closed to commercial harvesting. A process of consultation and sharing of responsibility for management with the recreational group led to an invitation to its Chairman to become a permanent observer on the Challenger Board. This invitation was accepted. In 2005, Challenger's constitution was modified to provide an additional directorship filled by the recreational representative.

Challenger is also responsible for purchasing and providing services for the monitoring of natural biotoxins. The Southern Scallop fishery biotoxin management plan provides for the collection by Challenger and its subcontractors of water and shellfish samples required for analysis. Challenger directly purchases the analysis services from approved laboratories. The results are forwarded directly to the public health and regulatory authorities responsible for declaring the scallops safe to eat and for audit of the sampling programme. Challenger has been able to make significant cost savings by managing the programme directly and by sampling more frequently during peak harvest times than the regulatory programme requires. This reduces the volume of product at risk of being unsafe to eat should toxins be present.

Challenger has also taken a lead role in protecting the value and extent of ITQ rights in the face of attempts to reallocate fishing space to aquaculture interests. Challenger has successfully argued that the expansion of aquaculture must be integrated with the fisheries. Estimates of the loss of production from the Southern Scallop fishery as a result of fishing areas already reallocated to aquaculture interests amount to between 3 percent and 5 percent and further applications being considered in 2007 and 2008 represent a potential loss of production totalling between 12 percent and 18 percent (Ministry of Fisheries, 2007).

Harvests in the fishery have shown a continuing decline since 2002. This cycle began with large spat falls in 1997/98, which were followed by evidence of shellfish starvation in Tasman Bay and the Marlborough Sounds and then repeated natural spat failures. Both enhanced and unassisted spat that settled in the fishery failed to thrive and harvest condition was consistently poor, particularly in Tasman Bay. Challenger responded by stalling the rotation in Tasman Bay to permit fishing on seeded stock that was growing very slowly and to permit other areas to lie undisturbed for longer than normal. Fishing, when it did occur, was extremely light and in short, controlled periods. Despite these measures, Tasman Bay continued to decline and the scallop biomass in 2006 was the lowest observed in any survey. Only one small area had reasonable numbers of fish in good quality and Challenger agreed not to fish that area to permit recreational access to those fish. In 2005 and 2006 surveys, Golden Bay appeared to be recovering with significant numbers of spat growing. Approximately 50 percent of that fish was a product of reseeding. The first harvest of those scallops is expected in 2007, when a reversal of the declining trend in catches is anticipated. Tasman Bay continues to show no signs of recovery. Challenger has continued to carefully husband the scallop resource and to share it with other users, despite the financial hardships suffered by the company and its shareholders.

The suite of functions performed by Challenger (in conjunction with FishServe) includes almost the entire set of management functions normally provided by fisheries management agencies. It has implemented a sophisticated resource survey, reseeding and rotational program with a degree of efficiency that would be difficult for any government agency. It has negotiated resolutions of conflicts with both recreational users and other commercial users of the same area. These kinds of conflicts are often the most intractable of management problems faced by fisheries management agencies. Challenger shows that with the correct incentive structures in place, devolution of responsibility for management functions can result in efficient and effective management.

7. EVALUATION OF CHALLENGER AS A SELF-GOVERNANCE INSTITUTION

In 2000, before the current stock declines, Arbuckle (2000) identified four indicators that the fishery was performing well under the Challenger management model.

i. The high level of agreement reached amongst industry participants and between different sectors that utilise the scallop resource.
ii. Recruited stock biomass indicators show a stabilising and positive trend over time.

iii. Pre-recruit stock biomass indicators also show a corresponding increase over time.
iv. The analysis of implicit discount rates in the fishery by Akroyd *et al*. (1999) concluded that their convergence over time with real interest rates (expressed as inflation-adjusted Government 90-day bill rates) compared favourably with the divergence from that rate by another poorly performing New Zealand scallop fishery.

Arbuckle rated the first indicator as by far the best measure of performance and described the other three independent measures as providing further evidence in support of the cross-sector agreement. Note also the comparison of implicit discount rates in the fishery (iv. above) is confounded by distortions in the reported value of ACE as a result of the novel TACC and the related shelving of ACE in some years.

Stock biomass in the Challenger fishery is subject to environmental factors that are beyond the control of either Challenger or the Government and create high variability in both exploited and unexploited fisheries. In the Challenger case, such externalities have resulted in a continuous decline in stock abundance between 2001 and 2006 when the first indication of improving biomass has been observed. Not withstanding the more recent decline in biomass, average landings have been higher under rotational management. Between the reopening of the fishery in 1982 and the beginning of rotational fishing in 1989, the fishery averaged 272 tonnes of harvest a year. Since rotational harvest began, it has averaged 435 tonnes a year.

The continued, nearly unanimous, support by the quota owners for the levying process and by all fishery participants for the harvest management rules is a strong indicator that the rights' owners value retaining management control within Challenger. Not withstanding the downturn in the fishery, the unpopular adoption of a real-time harvest vessel location monitoring system by Challenger and high costs associated with defending quota rights, support for levying was re-affirmed in 2006. Votes associated with 95 percent of the participating quota rights were cast in favour of renewal of the levy for a further 5 years.

Support for the management programme is also evident from the recreational groups and the Ministry of Fisheries. External observers also view the model employed by Challenger positively.

8. LESSONS FROM THE CHALLENGER EXPERIENCE

The success of Challenger provides several lessons about the role of government, industry and science in effective self-governance of fisheries. Arbuckle (2000) identified three key government innovations in the framework for management that contributed to the successfully devolved management model. Those innovations were: (a) flexibility over prescription, (b) empowerment over coercion and (c), accountability over control.

Drummond (2002) described the role of stock enhancement in the management framework. He noted five key phases as being distinguishable: (a) applying technology and developing management capability, (b) aligning rotational fishing with enhancement, (c) legislative reform, (d) collective action and (e), a consensus approach. Whereas enhancement had been seen as a response to a collapsed fishery, it subsequently became a supplementary and discretionary component of the management framework.

Successful development of Challenger was built on some strong internal direction by the industry. The long history of increasing industry investment in management contributed a sense of responsibility. A closed group of beneficiaries was created by the introduction of the controlled fishery. The desire to attempt enhancement in a collapsed fishery created a unique opportunity. Strong leadership from within the fishing industry helped to develop the capacity and structures required for devolution of the management from government. The theme of strong and capable leadership was

continued through the Challenger Board and its choice of founding CEO to manage the company and fishery through increasing devolution of management authority.

Communication between government and industry is an integral component of the confidence building that precedes devolution of managerial responsibility. Government requires confidence that the group has a genuine understanding of fisheries management concepts. A pre-requisite for that confidence is successful communication between the government and stakeholder managers. This paper argues that the successful devolution of management for the scallop fishery was contingent on the permit holders (later ITQ rights holders) developing

i. an understanding of the language and concepts of fisheries management sufficiently well to share meaningful discussions with the government fisheries management body,
ii. a positive view of the opportunities for improved value that could be obtained from the fishery under a devolved management structure, and
iii. A willingness to accept the risks inherent in taking responsibility for managing the fishery.

The success of Challenger is not due to any single factor. The biology of the Southern Scallop made re-seeding a strategy that attracted both industry and government attention. Subsequent contributions by science helped establish the role of rotation in efficient management. Industry took an active role in defining a new approach to management and accepted responsibility for implementation. Government brought a flexible approach to management that permitted devolution of responsibility to industry.

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