Overview of New Zealand's Fisheries Science Peer Review Processes

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Introduction

Scientific peer review is probably most often thought of as being the process undertaken by science journals to review science articles prior to publication. However, this is only one aspect of scientific peer review, and it is in fact limited in several respects. For many reasons, this kind of peer review is inadequate for scientific information intended for use in support of government policy and regulatory decisions, particularly where these relate to risks to human health, or risks to the sustainability of natural resources and ecosystems.

Scientific journal peer review tends to be characterised by the following:

- Reviews typically take many months and sometimes years to complete, resulting in protracted delays between completion of the research and eventual publication;
- The purpose of journal peer review is not necessarily to reject scientific work that is exploratory, contentious, or tentative. In fact, many journals encourage the publication of such work, with the purpose of precipitating subsequent scientific debate, rather than rejecting novel ideas outright; and
- Journal peer reviewers are generally not required to review the risks associated with the possible use or misuse of the information in published articles.

In many cases, publication in a peer-reviewed scientific journal is simply the first step in a process of subsequent scientific counter-argument, alternative analyses and alternative interpretations, sometimes resulting in rejection of the conclusions in the original article.

In marked contrast, science intended to directly inform or support government policy or regulatory or management decisions (e.g. annual fisheries management decisions) needs to be peer reviewed against different requirements. This paper identifies and characterises those requirements, and explores how they have resulted in the evolution of the processes currently adopted for scientific peer review of fisheries research results in New Zealand. It also evaluates the pros and cons of the current processes, and how well they line up with the general principles of Science Quality Assurance (SQA) and peer review, and lists alternative approaches.

Requirements of Fisheries Science Peer Review Processes

The requirements for fisheries science information are unique in a number of ways. The most important of these can be summarised as the need:

- To produce **reliable** results; in a **sufficiently timely** manner; that have adequate **buy-in** from key stakeholders; to inform **annual** fisheries management decisions; to ensure **optimal use** of natural marine resources, meaning that they must balance both **economic benefits** and long-term **sustainability**.

Of these requirements, the need for **timeliness**, **buy-in** and the **annual** frequency of decision-making to ensure optimum use of fisheries resources is the key difference between

the demands on fisheries science peer review processes compared to processes for other types of science. The optimum way to manage fisheries is to tailor catches to track natural fluctuations in population abundance (numbers) or biomass (weight). Ideally, catch limits should move up and down at least annually or bi-annually as a function of population biomass and size structure. However, compromises must often be made in order to ensure cost-effectiveness of the frequency of data collection and analysis, and the arduous processes required to alter catch limits.

Typical scientific journal peer review processes are generally inadequate to deal with the requirements for rapid review. Depending on the extent to which stakeholder views are relevant and need to be accounted for in the science peer review process, as opposed to during a subsequent management advisory committee process, peer reviews may also need to be more inclusive, to facilitate consideration of alternative views about the interpretation and presentation of the science and to obtain adequate **stakeholder buy-in** to scientific research conclusions.

Unique Aspects of Marine Resources and Fisheries Science

In addition to having specific timeliness and risk evaluation requirements for peer review, marine resources and fisheries science have certain unique aspects which differ from many other science fields, and further dictate the need for tailored peer review processes:

Marine resources are the last wild resource that is commercially viable

Commercially-viable marine fisheries, which include fish, invertebrates such as shellfish, and some plants, are for the most part the last of the world's natural wild resources that are sufficiently abundant to provide significant food and livelihoods. Only a small number of natural, wild terrestrial species still support commercially-viable operations, and many of these are severely overexploited or endangered. Most of the wild terrestrial species that have supported commercial exploitation in the past are now either protected, or they are economically or biologically extinct.

New Zealand natural marine resources are a national public asset

One reason why most exploited terrestrial species are endangered or economically or biologically extinct is that they were not explicitly considered to be a long-term national asset. Or, if they were so considered, the question of their long-term sustainability was either ignored, or they were simply and naively thought to be inexhaustible. There was often no control on who could access them, and for what. Sustainable utilisation for food and livelihoods was rarely an explicit goal.

The situation with most marine resources is different, particularly more recently, as understanding of the limits on exploitation of such resources has increased. Typically, most fisheries management systems now explicitly recognise the need to manage for long-term sustainable exploitation - meeting the needs of the current generation, while attempting to ensure that the needs of future generations are not compromised. In this regard, marine species that are sufficiently productive to withstand fishing pressure, and that are managed to ensure that fishing pressure does not exceed

sustainable levels, provide the last harvestable wild resources that can contribute significantly to food security. As such, they form an important heritage for mankind. In particular, within country EEZs, they form an important public asset.

New Zealand's ITQ / QMS system awards a form of quasi-property right to commercial quota holders, in the form of a guaranteed right to harvest a percentage of a Total Allowable Commercial Catch, valid in perpetuity, and able to be sold or leased. This has resulted in substantial improvement in industry attitudes to sustainable exploitation, particularly for targeted stocks, and has resulted in reductions in fleet capacity and fishing mortality on many stocks towards long-term sustainable levels. There are some problems that are, however, not well addressed by such an ITQ system, particularly with regard to low productivity species, and to ecosystem impacts of fishing (such as protected species bycatch). Such systems cannot, of themselves, easily create incentives for sustainable exploitation of species that can take decades or centuries to re-generate, or to minimise ecosystem impacts that do not appear to reduce profitability, at least in the short-term.

Irregardless of how well the system is working, it does not negate the fact that marine resources are a national public asset that belongs to all New Zealanders. Fishers have a right only to catch a specified amount of fish to provide an essential food commodity for New Zealand, and to provide livelihoods and export earnings.

Marine resources are subject to substantial fluctuations in abundance

Most commercially-exploited marine species are highly productive – usually much more so than previously and currently exploited terrestrial species. High productivity also tends to result in significant annual fluctuations in abundance, which are exacerbated by fishing and oceanographic conditions. This poses problems for fisheries management, particularly when such management is based on setting a catch limit or total allowable (commercial) catch (TAC). Fisheries theory and practice shows that the most profitable way to manage fisheries in a sustainable manner is to vary TACs frequently, preferably annually, in order to track fluctuations in abundance. The advantages of tracking fluctuations are two-fold: first, when stock size increases, it ensures that opportunities for utilisation are not foregone; second, when stock size decreases, it ensures that the stock is not depleted to levels where long-term viability may be threatened. The potential for both foregone economic opportunities and sustainability risk and the ever-changing status of fish stocks means that appropriate scientific research needs to be conducted, and the results peer reviewed, at a frequency appropriate to the costs and benefits of closely tracking fish population size.

Evolution of the New Zealand Fisheries Science Peer Review System

In New Zealand, the science used to inform fisheries management or fisheries policy decisions is currently contracted and conducted almost exclusively outside of government departments. However, fisheries research peer review processes are run by in-house MFish scientists. The current system has continuously evolved over the past 25 years in two phases, in response to MFish fisheries management requirements. In the first phase from

about 1984 to 1995, fisheries science was mostly conducted in-house in the Fisheries Research Division (FRD) of what was then the Ministry of Agriculture and Fisheries (MAF). In 1995, the Ministry of Fisheries was split off from MAF (which then became the Ministry of Agriculture and Forestry) and most of FRD was merged into the CRI, NIWA, originally formed in 1992. A small Science Group was retained within MFish to oversee the science programme, with responsibilities for research programme planning (in cooperation with fisheries managers), review of individual research project design (as part of the research tendering process) and peer-review of interim and final research results and reports. This MFish Science Group grew from an initial staff of about 4 to a maximum complement of 17 (now 14), as a result of an increase in the number of species in the QMS from 26 species or species complexes and 156 stocks (populations) in 1986, to 97 species or species complexes and 633 stocks in 2010 (a 4-fold increase). There have also been substantial increases in international science obligations as involvement in existing regional Fisheries Management Organizations (CCAMLR and CCSBT), or in newly-established RFMOs (WCPFC and SPRFMO) have increased, as well as accelerating public concerns about the environmental effects of fishing on protected species, biodiversity and ecosystem integrity.

The main roles of MFish scientists throughout this process have been to formulate research programmes to address management needs, oversee the execution of research projects, chair Science Working Groups that provide constructive input and review of statistical sampling designs, analytical methods and the validity of the conclusions based on the results. With the exception of junior support staff such as Science Officers, MFish scientists must be highly-qualified individuals, preferably with considerable hands-on experience in the scientific methods they will be required to review. They do not need to be the utmost in terms of technical competence, but they need to be sufficiently adept and competent to be able to steer Science Working Group meeting towards a consensus conclusion where possible, and must be able to critically identify where debates may be tending away from impartial, robust and reliable science.

"Unique" Attributes of New Zealand's Fisheries Science Peer Review Process

Necessity for timeliness of research results

Science Working Groups (SWGs) usually conduct peer review of research data and analyses well in advance of most Final Research Reports (FRRs), or Fisheries Assessment Reports (FARs), or Aquatic Environment and Biodiversity Reports (AEBRs) being formally published. This is intentionally designed to ensure that such reports are not produced until there has been an opportunity to review results, and correct or improve analyses, and ensure the validity of the conclusions, before such reports are used to inform fisheries management decisions, and become publically available. The key elements (validity of data, analyses and conclusions) that are likely to be useful in informing fisheries management advice are reviewed by SWGs and summarised into Working Group reports that are then incorporated into a four-volume compendium of Fisheries Assessment Plenaries (2 Plenary documents per year). These Plenary reports, which are signed off by the Chief Scientist, then become the primary source of scientific information for fisheries management purposes. The FRRs, FARs and AEBRs are subsequently finalised and published, and provide all of the methodological details that support the summary Working

Group / Plenary reports. Similarly to traditional journal peer review processes, these FRRs, FARs and AEBRs are then reviewed internally by MFish scientists under a separate process, often several weeks or months after the corresponding Plenary reports have been published and used to inform fisheries management decisions.

This system is necessitated by the need for timeliness of scientific analyses and robust and reliable conclusions to inform annual fisheries management decisions. In highly productive (and therefore highly fluctuating) fish stocks, a system that relied on the production and refinement of comprehensive final reports prior to the use of science advice in management decisions could mean that, by the time this process was completed, the stock in question had already fluctuated from a low or moderate level to a high level (resulting in lost utilisation opportunities), or from a moderate or high level to a low level that needs to be acted upon quickly to avert any sustainability risk.

Necessity for reliability of research results

Fisheries management decisions impact on both livelihoods and resource sustainability. While stock assessments and other types of marine research are characterised by high uncertainty, it is very important that they are as unbiased as possible (i.e. the median or other central estimate is as close as possible to the truth, irrespective of the uncertainty which may surround this estimate). Uncertainty can be dealt with by including it in risk evaluations; bias is much more difficult to address and can lead to erroneous or disastrous management decisions. SWG peer review processes therefore need to be designed to minimise the chance that results may be biased.

(Fisheries) SWGs provide much more than peer review of final research results

The problem with limiting review to final research reports, whether they are FRRs, FARs, AEBRs, or candidates for primary scientific publication, is that the opportunities to influence the statistical design of the data collection protocol, the methods used to analyse the data, and the validity of conclusions generated from the data and analyses are extremely limited. All of these aspects are critical to producing reliable research results. Inappropriate project design or analytical methods or conclusions can doom a science project to failure, or result in biased results, if not detected and corrected early. The MFish SWG process pre-empts these potential difficulties by being involved at all stages of the process, through a sequential process of *staged peer review*. In general, SWGs evaluate survey designs and data collection protocols and recommend refinements that ensure statistically-valid data collection methodologies from the start. SWGs then evaluate analyses of data at an early phase and provide constructive guidance on improved analytical methodologies. Finally, SWGs ensure that all conclusions are adequately supported by the data and analyses underlying them.

SWGs are constituted to be highly inclusive

Industry scientists, eNGO participants and others are included in SWG process. This facilitates buy-in into MFish SWG processes, and encourages development of concensus views on the validity and reliability of scientific results. SeaFIC scientists and other national and international scientists they contract are generally very supportive of MFish SWG processes. Some of the international scientists employed by SeaFIC have stated that the MFish SWG process is superior to other fisheries science assessment processes in other countries, in which they participate.

An important advantage of the inclusive approach of the SWGs (i.e. meetings open to all interested participants) is that everyone, even non-technical participants, has a chance to have their views about the validity and reliability of the scientific results heard and seriously considered. This means that they are less likely to challenge the scientific results by, for example, producing alternative interpretations of the data and presenting these as competing analyses to fisheries managers or the Minister of Fisheries. Where possible, deliberations about scientific analyses and conclusions are reached by consensus amongst technical experts, including industry, academic, tangata whenua and eNGO technical experts. When this is not possible, the MFish Chair has the prerogative to make an "executive" decision based on all points of view expressed in SWG meetings. Most conclusions are agreed by consensus. The need to head off end-runs is particularly important in a system where timely management or regulatory actions may be needed.

In recognition of the success of this inclusive approach, when members of the fishing industry independently commission their own research, in most cases they willingly subject it to the three phases of the MFish SWG process that apply for most major types of fisheries research: evaluation of research design, evaluation of analytical methods, and evaluation of the extent to which the resulting conclusions are supported. This is particularly true of the Deepwater Group (DWG), Paua Management Company, Rock Lobster Management Group and Foveaux Strait Oyster Group, and others.

While high inclusivity does encourage buy-in, it inevitably results in some degree of trade-off between independence and impartiality of the peer review process. While all technical experts involved in SWGs are expected adopt a "hats-off" approach to meetings (i.e. to participate as experts who are not advocating for particular outcomes based on vested interests), advocacy is nevertheless evident in some discussions, due to conflicts of interest in cases where scientific research results are likely to have significant economic or environmental impacts. Not surprisingly, when results are contentious, participants with vested interests have complained about the quality of the chairing of meetings and the foundations for the SWG conclusions that are reached. This tends to be an issue in only a few instances that primarily relate to SWGs that deal with low productivity species (such as orange roughy), or with environmental effects of fishing, both of which can potentially result in outcomes for fishing industry or environmental interests that are unfavourable in the short term. Under such circumstances, working group Chairs are required to make a scientific judgment regarding the best estimate of stock status or environmental impact, and it

is to be expected that stakeholder advocates will criticise the role or competence of the Chair.

The best way to deal with such issues is to a) provide a strong mandate and clear terms of reference to Working Group Chairs regarding the management of conflicts of interest, and b) where concensus cannot be achieved, and scientific impartiality is prejudiced, to submit the issue to a more independent peer review process, usually involving a panel of overseas experts.

Role of MFish scientists is to ensure "best available science" for the Minister of Fisheries

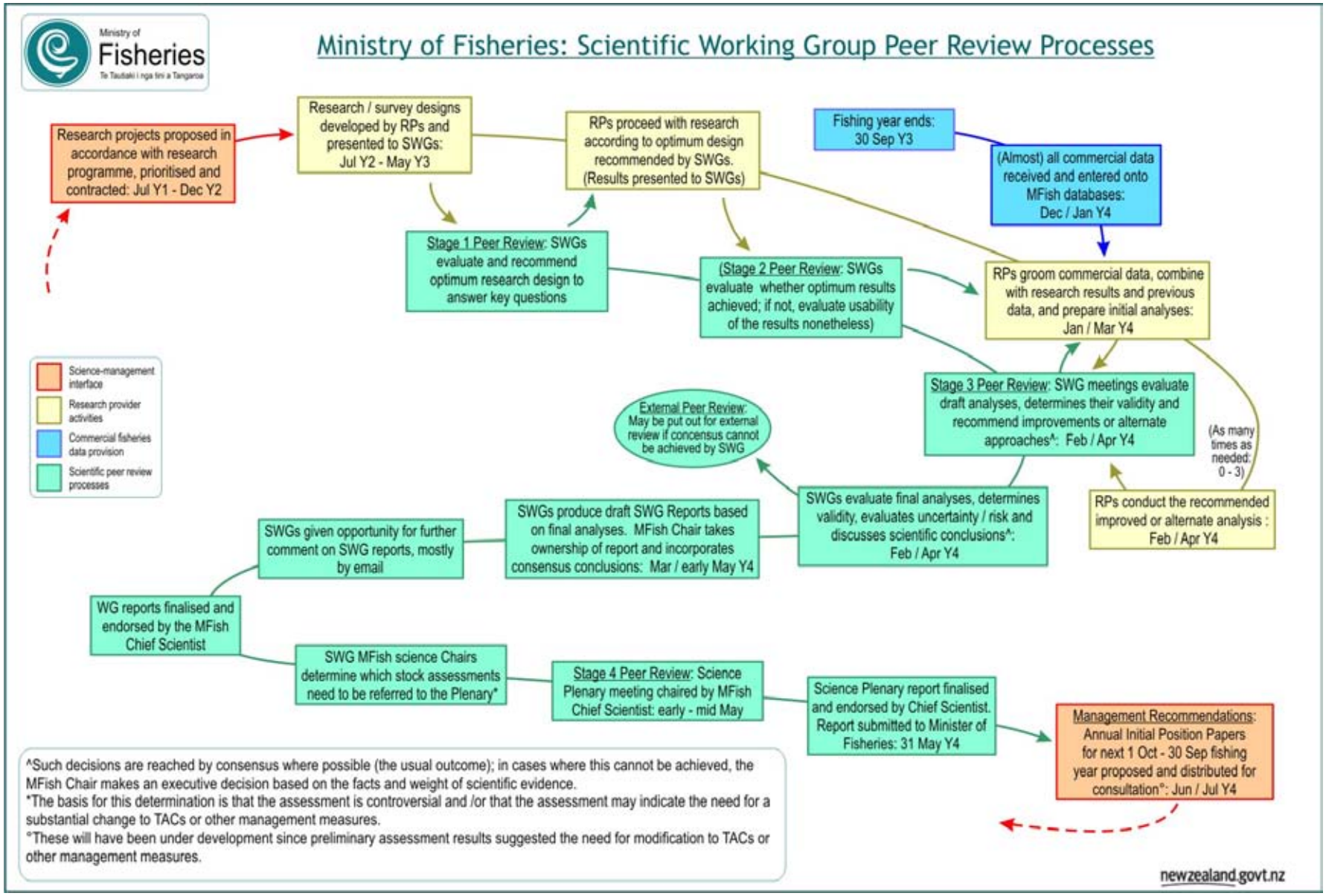
Stakeholders groups, be they industry or environmental NGOs, may have an advocacy role that results in a bias towards either utilisation or sustainability. These advocacy roles constitute a degree of conflict of interest in the context of peer review, and need to be actively managed by science experts with no affiliation to, and no preference for, the views of any stakeholder group. The role of MFish science chairs is to ensure that data collection, analyses and conclusions are as impartial as possible, and that results are therefore not biased towards the preferences of any stakeholder advocacy group. Biased science may have short-term "benefits" to certain sectors, but will also have later negative repercussions.

Decisions about "best available science" do not reside with a single individual

Another advantage of the SWG process is that no individual scientist(s) is "blamed" for a scientific assessment that may be considered by some to be overly-optimistic or overly-pessimistic. Rather, scientific assessments are a group decision. Even in cases where the MFish science chair needs to make an executive decision, this will be a decision that is supported by some, if not the majority, of the working group, and dissenting members have the opportunity to have their views recorded. This frees individual analysts from any pressure to consciously or unconsciously bias analyses in an overly-optimistic or overly-pessimistic manner. It contributes to ensuring that the science is as unbiased as possible.

The Annual New Zealand SWG / Fisheries Management Cycle

A schematic diagram of the current annual New Zealand Science Working Group and fisheries management cycle is shown in Figure 1.


Ministry of Fisheries
Ministry of Fisheries: Scientific Working Group Peer Review Processes
Research projects proposed in accordance with research programme, prioritised and contracted: Jul Y1 - Dec Y2
Research / survey designs developed by RPs and presented to SWGs: Jul Y2 - May Y3
RPs proceed with research according to optimum design recommended by SWGs. (Results presented to SWGs)
Fishing year ends: 30 Sep Y3
(Almost) all commercial data received and entered onto MFish databases: Dec / Jan Y4
Stage 1 Peer Review: SWGs evaluate and recommend optimum research design to answer key questions
(Stage 2 Peer Review: SWGs evaluate whether optimum results achieved; if not, evaluate usability of the results nonetheless)
RPs groom commercial data, combine with research results and previous data, and prepare initial analyses: Jan / Mar Y4
Science-management interface
Research provider activities
Commercial fisheries data provision
Scientific peer review processes
Stage 3 Peer Review: SWG meetings evaluate draft analyses, determines their validity and recommend improvements or alternate approaches^: Feb / Apr Y4
External Peer Review: May be put out for external review if concensus cannot be achieved by SWG
(As many times as needed: 0 - 3)
SWGs evaluate final analyses, determines validity, evaluates uncertainty / risk and discusses scientific conclusions^: Feb / Apr Y4
RPs conduct the recommended improved or alternate analysis : Feb / Apr Y4
SWGs produce draft SWG Reports based on final analyses. MFish Chair takes ownership of report and incorporates consensus conclusions: Mar / early May Y4
SWGs given opportunity for further comment on SWG reports, mostly by email
WG reports finalised and endorsed by the MFish Chief Scientist
SWG MFish science Chairs determine which stock assessments need to be referred to the Plenary*
Stage 4 Peer Review: Science Plenary meeting chaired by MFish Chief Scientist: early - mid May
Science Plenary report finalised and endorsed by Chief Scientist. Report submitted to Minister of Fisheries: 31 May Y4
Management Recommendations: Annual Initial Position Papers for next 1 Oct - 30 Sep fishing year proposed and distributed for consultation°: Jun / Jul Y4
^Such decisions are reached by consensus where possible (the usual outcome); in cases where this cannot be achieved, the MFish Chair makes an executive decision based on the facts and weight of scientific evidence.
*The basis for this determination is that the assessment is controversial and /or that the assessment may indicate the need for a substantial change to TACs or other management measures.
°These will have been under development since preliminary assessment results suggested the need for modification to TACs or other management measures.
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For most fish stocks, the fishing year is 1 October to 30 September (and for others, it is 1 April to 31 March, so the timeframes mentioned below are appropriately adjusted for these stocks). Data collected from commercial fisheries via various recording systems (fishers' logbooks, Monthly Harvest Returns (MHRs) and Licensed Fish Receiver Returns (LFRRs) are generally not in a usable form until the following December or January. This means that research providers cannot begin their analyses until this time (which happens to coincide with the period when most New Zealanders take their long holidays). Most stock assessment SWGs do not begin convening until February or March, in order to give research providers adequate time to "groom" data (i.e. to verify the validity of individual records, correct or delete erroneous or incomplete records, and select those records needed for particular analyses). They then produce preliminary analyses of the raw data to present to the appropriate SWG, which provides feedback and guidance on refining the treatment of the data and analytical methods, which are then presented at one or more subsequent SWG meetings. A final SWG meeting is required to ensure that the conclusions are justified by the data and analyses and to write the Working Group or Plenary report.

Fishery Assessment Working Groups in 2010

There are currently 14 Fishery Assessment Working Groups (FAWGs), 10 of which deal with species or species groups.

Deepwater Working Group
Hoki Working Group
Middle Depth Working Group
Northern Inshore Working Group
Southern Inshore Working Group
Shellfish Working Group
Highly Migratory Species Working Group
Rock Lobster Working Group
Eel Working Group
Antarctic Working Group
Marine Recreational Working Group
Aquatic Environment Working Group
Stock Assessment Methods Working Group
Data Working Group

(see Appendix 2 for a list of these working groups and their responsibilities)

Terms of Reference (ToR) for Fishery Assessment Working Groups were first drafted in 1989, and have continued to evolve, with regular updates as processes are changed or refined. Those applying in 2009-10 are shown in Appendix 3. The current ToR relate primarily to the tasks to be conducted by working groups, and less to the principles by which they should work. In particular, the sections on Overall Purpose, Preparatory Tasks and Technical Objectives relate entirely to the tasks to be conducted by working groups. However, there has been a move towards explicit incorporation of wording relating to some of the principles of science quality assurance and peer review.

Evaluation of the Current ToR for FAWGs

Scientific Quality Assurance: The protocols for working groups require that "*Methods of analysis must be sound*", and refer to the need to determine: "*the acceptability of the analyses under review; the way forward to address any deficiencies; the need for any additional analyses; and choice of base case models and sensitivity analyses to be presented*". Groups are also required to "*maintain high standards of professional integrity and science ethics*". While determinants of scientific information quality (such as objectivity, accuracy, impartiality, lack of bias) are not mentioned, the intention is clearly for working groups to review, at least, the technical quality of information, analyses and assessments. The one aspect of scientific information quality that is provided for, although not explicitly required to be tested at working group meetings, is that of reproducibility. This is, to some extent, dealt with by requiring methods of analysis to be reviewed, but is also catered for by requiring that "*All data upon which analyses presented to the Working Groups are based are required to be provided to the Ministry*".

Expertise and Independence: There is explicit recognition of the need for suitably experienced scientific experts to constitute most of the membership of the working groups, and for some of these to be independent from the work to be reviewed. Working groups are required to "*draw on the best available expertise, and will encourage and seek peer review*". Participation is required of at least one senior MFish scientist as the Chair; scientists representing research providers; and "*Other scientists not conducting analytical assessments to act in a peer review capacity*". Working group participants are further expected to facilitate "*an atmosphere of honesty, openness and trust*", which could be interpreted as requiring scientific impartiality.

Openness and Transparency - Working group protocols require them to "*operate with openness and transparency*". There is an undertaking to make all working group papers available, at least to participants, although this is balanced by a confidentiality requirement for draft papers that have not yet been reviewed and finalised. A record of recommendations, conclusions and action items is also made available after each meeting. In practice, all inputs and outputs from these working groups are available to any interested party, and most final research reports and working group products are publically available.

A further aspect of transparency is the requirement to document alternative views and disagreements. Chairs of working groups are required to try to achieve consensus but, failing this, to "*document the extent to which agreement or consensus was achieved, and record and attribute any residual disagreement in the meeting notes*".

Separation of Science and Fisheries Management decisions: It is noted that working groups "*do not make management recommendations or decisions (this responsibility lies with MFish Fisheries Management and the Minister of Fisheries)*". However, this is complicated by the fact that working groups are also intended to include "*Representatives of relevant MFish Fisheries Management teams*". Over time, particularly as the fishing industry has increasingly direct-purchased research under initiatives such as the Adaptive Management Programmes which ran from to 1991 to 2007, there has been increasing participation by industry scientists and science advocates. While fostering inclusiveness, this has also had the inevitable consequence of blurring the separation between science and management on certain contentious issues.

Conflicts of Interest: Although there are no stipulations regarding management of conflicts of interest, working group participants are asked to declare any relevant affiliations. Potential conflicts of interest are therefore made evident, and can be managed if the need arises.

Many of the obligations relating to science quality assurance have been made the direct responsibility of the Chair (with input from the working group, particularly the technical experts). The Chair is further responsible for: "*setting the rules of engagement; promoting full participation by all members; facilitating constructive questioning; focussing on relevant issues*". This has had substantial implications for the dynamics of these working groups, particularly as participation has become increasingly inclusive of industry scientists and representatives of commercial stakeholder organisations and environmental non-governmental organisations.

Essentially, Fishery Assessment Working Group meetings are now open to anyone who expresses an interest in participating. The Ministry of Fisheries also has no system of management advisory committees analogous to the Regional Fishery Management Councils in the United States, at which management implications of scientific information can be separately debated. The FAWGs are therefore sometimes seen as the only opportunity afforded to stakeholder representatives to potentially influence management outcomes in a forum where open debate is permitted. Predictably, as scientific information has become increasingly important for informing management decision making, so the interest in participating in science working group meetings has escalated.

The inclusion of industry and eNGO representatives, with a direct interest in management or policy outcomes, on science working groups raises challenges relating to management of conflicts of interest, and creates a tension between stakeholder representatives seeking to exploit scientific uncertainty to achieve different management outcomes. It is the role of the Chair to detect, evaluate and manage these tensions and conflicts of interest. This results in pressure on, and criticism of, Chairs required to act as gatekeepers and final arbiters on all matters of science quality assurance, and to make judgements on bias, impartiality and the appropriate 'base-case' upon which to base science advice. In recent years, this has only been a problem for certain contentious issues, with the Chairs of the Deepwater and Aquatic Environment Working Groups having to make unpopular and disputed rulings on the status of low productivity stocks, and on fishery-induced mortality of protected species, respectively.

Evaluation of the Current NZ Fisheries SQA and Peer Review Processes against International Principles

It is not the purpose of this report to conduct an in-depth review of the extent to which the current Ministry of Fisheries Assessment Working Groups comply with the guidelines for scientific information quality and peer review. However, some observations can be made on how these groups function in relation to the recommended principles:

- The origin of the MFish FAWGs predates the first published national guidelines for quality of scientific information by a decade. These working groups have continued to evolve since then without anything as comprehensive as the guidelines developed in the United Kingdom, European Union, Canada or the USA. There has also, to date, been no move towards cross-government guidelines on the quality of scientific information. There are many reasons for this, but two are worth noting. Firstly, no New Zealand government has faced a crisis of public confidence of the magnitude and severity of the

crises that faced the United Kingdom over mad-cow disease, Europe over dioxins or Canada over the collapse of northern cod. Secondly, New Zealand governments have favoured an approach of 'enabling measures' (see Parliamentary Commissioner 2002) in preference to regulation, and have tended to try to work with industries to encourage implementation of effective measures. Nonetheless, it is interesting to note how the Terms of Reference for the working groups (Appendix 3) have evolved to incorporate some of the key principles that have been adopted elsewhere.

- These working groups have an unbroken 25 year history of reviewing scientific information and providing information and advice to fisheries managers, spanning a period that has seen adoption of a quota management and ITQ system and the transfer of most government science capabilities to independent research providers. Over this time, these groups have evolved in response to increasing management requirements for timely information on a rapidly increasing number of quota managed stocks, to be as efficient as possible under the circumstances.
- They have also changed from consisting of only government scientists and invited external, independent scientists in 1986, to being open to participation of virtually any interested party since about 1992 <check>. In addition to Ministry and research provider scientists, these SWGs now include regular participation by the scientists from the Seafood Industry Council (SeaFIC), commercial fishery management organisations, tangata whenua and environmental NGOs, depending on the research being reviewed. Fisheries managers often attend reviews of stocks under consideration for management review each year. In fact, anyone can attend in a participatory or observer capacity.
- The Ministry's SWGs have therefore evolved to maximise ***Inclusiveness***, not only of scientific experts, but also of stakeholder organisations, fisheries managers, tangata whenua and environmental NGOs. While preliminary drafts are protected by confidentiality agreements (to prevent the quoting of un-reviewed and potentially incorrect information), most final research reports, working group minutes and reports, independent peer review reports and final management advice papers to the Minister are publically available, and usually posted on the Ministry's website. Subject to some confidentiality provisions, original data can also readily be obtained. These working groups therefore also maximise ***Transparency and Openness***.
- The main driver of the evolution towards the way in which these groups are currently constituted and function has been the need for rapid annual review of an increasing number of research projects due, in part, to the increased number of species in the QMS. The workload has increased steadily both as a result of a continual increase in the number of species under quota management, and as a result of a substantial increase over the past decade in research related to international fisheries science obligations, protected species interactions, environmental impacts of fisheries and other ecosystem considerations. For example, the Fisheries Assessment Working Groups listed in Appendix 2 conducted about 80 <check> ½ to 1 day SWG meetings in 2009-10, reviewing information for 215 fishstocks or related environmental issues <check>. These working groups are therefore also constituted to maximise ***Timeliness***, and the focus of these review groups on information intended to inform management advice each year maximises ***Relevance***.
- This emphasis on maximising inclusiveness, timeliness, transparency and openness has resulted in trade-offs against ***Independence*** and ***Impartiality***, and the resultant inclusion of potential conflicts of interest at working group meetings. The fact that these are not causes for concern for most SWG meetings is strong testimony to the successful evolution and maturity of the SWGs.
- However, for stock assessments of low productivity species such as orange roughy, oreos and cardinalfish, and particularly for reviews of more recent scientific work on protected species impacts (sea lion and seabird mortality), benthic impacts (impacts of

trawling on coldwater coral ecosystems) and other environmental effects of fishing, stakeholder group advocacy and conflicts of interest have been apparent in some working group meetings, and adversarial attitudes have characterised a number of these debates.

- A further consequence of advocacy and adversarial debate in some working groups is that working group Chairs then become the gatekeepers of objectivity, impartiality and management of conflicts of interest (see FAWG Terms of Reference in Appendix 3). Under circumstances of strongly divided views, this places SWG Chairs in the position of having to determine the most unbiased scientific conclusions based on weight of evidence. It is therefore not surprising that substantial criticism is directed at the Chairmanship of working groups where there is contention and dispute over the interpretation of scientific results and conclusions that are counter to the objectives or belief systems of same stakeholder groups.

Fisheries Research & Assessment Peer Review Levels

Despite the long history of SWGs, and the emphasis on fostering integration, cooperation and inclusiveness, there is sometimes a need for additional, independent peer review processes. In situations where the SWG process may be compromised by divided opinions, sector advocacy or conflicts of interest, or simply where there is a need to call on additional expertise, the Ministry of Fisheries employs alternative peer review mechanisms. These options include, in escalating degree of expertise and independence:

- Special technical meetings of the FAWGs, with the usual participants and the Chair, to provide for intense and free-ranging scientific debate of a novel, complex or contentious issue;
- Technical workshops with broader participation to fully explore complex or novel scientific issues, including invitation of external independent experts to facilitate or inform the workshops;
- Contracted independent expert peer review panels, fully independent of all those involved in conducting the research, stakeholder groups, Ministry scientists and fisheries managers; and
- Some combination of the above processes, perhaps as sequential steps, such as a broadly participatory workshop to canvas opinions and information, followed by an independent external expert review of this information.

Examples of additional peer reviews conducted by the Ministry of Fisheries over the period 2000 - 2010 using the above peer review processes options are listed in the table below.

Year	Project / Programme	Review Conducted By
2009-10	Independent review of the Cooperative Gamefish Tagging Programme (Workshop, followed by independent report)	Dr John Gunn (Australian Antarctic Division, Australia), Dr Kurt Schaefer (Inter-American Tropical Tuna Commission, USA), Dr Pat Turner (National Marine Fisheries Service, USA)
	Independent review of Sea lion Bayesian model and management strategy evaluation	Independent review currently being commissioned

	Independent expert review of seabird semi-quantitative (Level 2) risk assessment approach	Independent review being commissioned, potentially in two stages, including experts from CSIRO, Australia
	International independent expert review of sea lion necropsy methodology and results	Independent review being commissioned using international panel of wildlife pathologists
	Independent expert review of Paua research diver programme	Vivian Haist (Haist Consultancy)
2008-09	CCAMLR Antarctic bottom fishing: NZ impact assessment	Prepared by Ministry of Fisheries scientific staff; reviewed by the CCAMLR Scientific Committee
	Expert Panel Review of blue cod potting survey in New Zealand	Dr Peter Stephenson (DoFWA), Dr George Sedberry (NOAA), Dr Vivian Haist (Haist Consultancy)
	Chatham Rise ORH spawning plume estimates	Patrick Cordue (Innovative Solutions Ltd)
	Seamount Risk Assessment Workshop	MFish Science, NIWA and invited international Experts (CSIRO, Australia)
	NZ SPRFMO Bottom Fishery Impact Assessment	Prepared by MFish science staff; published for public comment; then Submitted to the SPRFMO Science Working Group for review
	Review of FAR on Information to support Foveaux Strait oyster fishery plan	Discussion and review of report by Keith Michael (NIWA) chaired by Dr Martin Cryer (MFish) including Dr John Cranfield (Seabed Processes Consultancy), Dr Glen Carbines (Stock Monitoring Services), Dr Ian Tuck, Dr John McKoy and Dr Don Robertson (NIWA)
	Workshop: Review of eel biology, management, research	MFish and NIWA scientific staff
	Snapper Assessment Technical Review	MFish Northern Inshore Working Group special technical workshop - MFish, NIWA, SeaFIC, Industry
2007-08	Special Technical Workshop to review methods and options for catch sampling	Chaired by MFish; scientists from MFish, NIWA and SeaFIC; representatives from Commercial Stakeholder Organisations
	Independent expert review of estimation and use of Maximum Sustainable Yield reference points	Independent Expert Panel: Dr Anne Hollowed (Alaska Fisheries Centre, NOAA), Dr Martin Dorn (Alaska Fisheries Centre, NOAA), Dr André Punt (University of Washington, CSIRO)
2006-07	Review of orange roughy ageing protocol	Seven experienced orange roughy agers from New Zealand, Australia and Chile reviewed methodology and developed a new agreed ageing protocol
	International independent expert reviews of the first draft of the Harvest Strategy Standard	Dr Peter Shelton (Dept of Fisheries and Oceans, Canada), Dr Tony Smith (CSIRO, Australia), Dr Rick Methot (NOAA Fisheries, USA)

2005-06	Independent expert review of the Snapper 7 assessment	Dr Mark Maunder, IATTC
	Expert peer review of acoustic survey methods for orange roughy.	Workshop chaired by MFish Chief Scientist, but included independent experts from Australia, Canada and South Africa
	International independent expert review of methods and data used in orange roughy stock assessments, Part 1.	Dr John Annala, Gulf of Maine Research Institute, Portland, Maine, USA, chair; Prof Douglas Butterworth (Marine Resourse Assessment and Modelling group, University of Cape Town, South Africa); Dr Tony Smith, (CSIRO, Australia)
	International independent expert review of methods and data used in orange roughy stock assessments, Part 2.	Dr John Annala, Gulf of Maine Research Institute, Portland, Maine, USA, chair; Prof Douglas Butterworth (Marine Resourse Assessment and Modelling group, University of Cape Town, South Africa); Dr Tony Smith, (CSIRO, Australia)
2000-04	Several reviews of research tenders concerned with modified or new trawl and acoustic survey designs	Dr George Rose (Memorial University of Newfoundland)

Alternative SQA and Peer Review Systems

The following provides a possibly-incomplete list of the peer review processes used to evaluate the science developed to inform government policy, regulations and decision-making, with focus on New Zealand situations.

i) Science used to inform government decisions is primarily conducted in-house; i.e. within civil service government departments. Prior to the 1980s this was in fact the predominant model. However, in the late 1980s and early 1990s, New Zealand adopted a model of splitting science provision off from government departments, primarily into CRIs. The two main government departments that have retained or developed in-house expertise are the Department of Conservation (DoC) and MAF Biosecurity. Peer review follows a number of approaches including little or minimal review, in-house review, and external and independent review.

ii) Science used to inform government decisions is conducted exclusively, or almost exclusively, outside of government departments, as are most, if not all aspects of peer review processes. In this model, CRIs, universities and other research providers generally have some form of in-house quality assurance process(es). In addition, government departments may call upon additional experts or panels of experts to conduct independent peer review of the work submitted to the department.

iii) Science used to inform government decisions is conducted exclusively, or almost exclusively, outside of government departments, but peer review processes are run by departmental scientists through some form of Science Working Groups (SWGs). This is the model currently in use in New Zealand for fisheries and aquatic environment research. Both MFish and DoC utilise this process for science that is likely to inform fisheries management decisions.

iv) Other mixes of in-house and external science and peer review processes, with variable numbers of layers of review depending on the importance of the issue and the size of the country.

It is anticipated that the above list will be further elaborated and refined by the Expert Workshop on Peer Review Process Options to be held on 10 June.

Constraints on alternative processes

Given the imperative for timely scientific analyses to support timely management decisions, it is not feasible to conduct peer review of such analyses in the primary scientific literature, and not particularly appropriate either (although reviews of innovative analytical methods can be and are subject to such review and, as a result, are continually refined). Fully independent peer reviews conducted by specially appointed committees may be required for contentious issues, but are also time consuming. Any alternative approach that delays review by more than a few weeks is similarly not feasible or desirable for the bulk of the assessment reviews, particularly where these are updated or repeat assessments, and the methodology is well tested. Adopting slower processes would essentially require fisheries management decisions to be based on information that is a year to 18 months out of date. Given the dynamic nature of fish stock size, which can fluctuate markedly over the course of a few years, and the strong industry and managerial requirements for rapid and responsive management systems, this would be inadvisable, particularly for highly-fluctuating stocks.

Appendix I. Species in the New Zealand Quota Management System

List of species / species groups managed under the New Zealand Quota Management System (QMS) in 2010, with relative contributions to total reported (live weight, metric tons) catch over the period 1 October 1989 to 30 December 2008. (Reported catch estimates are somewhat lower than actual landed catch for most species.)

These 93 species / groups accounted for 97% of the total reported catch over the period. In addition to the QMS species, the New Zealand commercial fishing industry reported an additional 315,468 t (3%) catch of 603 other species codes (minor by-catch, invertebrate or unidentified species). Customary, recreational or charter-boat catches were not reported over this period, but are substantial for some inshore species such as blue cod, kahawai, kingfish, snapper and trevally. Recreational catches were estimated in 1999-00 to be about 25,000 t per year.

Scientific Name	Common Name	Catch
Macruronus novaezelandiae	Hoki	3,448,596
Nototodarus sloanii, N. gouldi	Arrow squid	1,029,277
Trachurus sp.	Jack mackerel	688,610
Micromesistius australis	Southern blue whiting	564,363
Thyrsites atun	Barracouta	465,387
Hoplostethus atlanticus	Orange roughy	464,340
Genypterus blacodes	Ling	351,592
Pseudocyttus, Allocyttus, Neocyttus spp.	Oreos	350,667
Merluccius australis	Hake	222,476
Scomber australasicus	Blue mackerel	187,461
Pseudophycis bachus	Red cod	181,242
Seriolella punctata	Silver warehou	177,991
Squalus acanthias	Spiny dogfish	140,641
Pagrus auratus	Snapper	131,616
Katsuwonus pelamis	Skipjack tuna	126,783
Ostrea chilensis	Dredge oyster	120,532
Nemadactylus macropterus	Tarakihi	105,174
Thunnus alalunga	Albacore tuna	86,310
Soles and flounders	Flatfish	80,634
Arripis trutta	Kahawai	78,201
Seriolella brama	Blue warehou	66,886
Pseudocaranx dentex	Trevally	65,353
Kathetostoma giganteum	Giant stargazer	63,193
Chelidonichthys kumu	Red gurnard	61,779
Jasus edwardsii	Rock lobster	59,587
Galeorhinus galeus	School shark	58,183
Apogonidae	Black cardinalfish	55,150
Hyperoglyphe Antarctica	Bluenose	51,564
Beryx splendens, B. decadactylus	Alfonsino	50,409
Lepidopus caudatus	Frostfish	48,687
Parapercis colias	Blue cod	45,769
Seriolella caerulea	White warehou	44,282
Emmelichthys nitidus	Redbait	43,677
Rajidae, Arhynchobatidae	Skates	34,823
Rexea solandri	Gemfish	31,848
Mustelus lenticulatus	Rig	31,583
Helicolenus spp.	Sea perch	28,014
Austrovenus stutchburyi	Cockle	25,096
Haliotis iris, H. australis	Paua	23,059
Anguilla australis, A. reinhardtii	Freshwater eels	21,649

Mora moro	Ribaldo	20,514
Callorhinchus milii	Elephant fish	19,215
Ostrea chilensis	Dredge oyster	18,843
Metanephrops challenger	Scampi	16,723
Mugil cephalus	Grey mullet	16,543
Pecten novaezelandiae	Scallop	16,205
Dipturus innominatus	Smooth skate	16,093
Zeus faber	John dory	15,746
Evechinus chloroticus	Kina	13,643
Sardinops neopilchardus	Pilchard	12,073
Parika scaber	Leatherjacket	11,535
Hydrolagus bemisi	Pale ghost shark	11,090
Latridopsis ciliaris	Blue moki	10,489
Prionace glauca	Blue shark	9,607
Plagiogeneion rubiginosum	Rubyfish	9,191
Xiphias gladius	Swordfish	8,356
Cyttus traverse	Lookdown dory	8,299
Ovalipes catharus	Paddle crab	6,366
Thunnus maccoyii	Southern bluefin tuna	5,939
Seriola lalandi	Kingfish	5,914
Perna canaliculus	Green-lipped mussel	4,326
Thunnus obesus	Bigeye tuna	3,754
Thunnus albacores	Yellowfin tuna	3,504
Paphies australis	Pipi	3,470
Odax pullus	Butterfish	3,323
Lampris guttatus	Moonfish	2,813
Zygochlamys delicatula	Queen scallop	2,531
Centroberyx affinis	Red snapper	2,191
Isurus oxyrinchus	Mako shark	1,924
Lamna nasus	Porbeagle shark	1,627
Nemadactylus douglasi	Porae	1,616
Girella tricuspidata	Parore	1,565
Latris lineate	Trumpeter	1,398
Paphies subtriangulata	Tuatua	1,217
Aldrichetta forsteri	Yellow-eyed mullet	931
Hyporhamphus ihi	Garfish	338
Mactra murchisoni	Large trough shell	312
Thunnus orientalis	Pacific bluefin tuna	237
Jacquinotia edwardsii	Giant spider crab	209
Ibacus alticrenatus	Prawn killer	182
Panopea zelandica	King clam	163
Spisula aequilatera	Triangle shell	138
Stichopus mollis	Sea cucumber	118
Engraulis australis	Anchovy	102
Tetrapturus audax	Striped marlin	38
Bassina yatei	Frilled venus shell	21
Mactra discors	Trough shell	20
Atrina zelandica	Horse mussel	18
Austrofucus glans	Knobbed whelk	15
Lithodes murrayi, Neolithodes brodiei	King crab	14
Dosinia anus	Ringed dosinia	14
Holothurian unidentified	Sea cucumber	5
Dosinia subrosea	Silky dosinia	1
Total reported catch of all Species in the QMS 1989 – Dec 2008		**10,203,003**

Appendix 2. Ministry of Fisheries Science Working Groups

List of 2010 Ministry of Fisheries science working groups and their responsibilities.

Fisheries Assessment Working Groups

Deepwater Working Group

Orange roughy	Black oreo
Smooth oreo	Black cardinalfish

Hoki Working Group

Hoki

Middle Depth Working Group

Arrow squid	Dark ghost shark	Ribaldo
Barracouta	Pale ghost shark	Silver warehou
Blue warehou	Hake	Southern blue whiting
Frostfish	Ling	White warehou
Gemfish	Lookdown dory	

Northern and Southern Inshore Working Groups

Alfonsino	Jack Mackerel	Rubyfish
Anchovy	John dory	School shark
Bluenose	Kahawai	Sea perch
Blue cod	Kingfish	Skates
Blue mackerel	Leatherjacket	Snapper
Blue moki	Parore	Spiny dogfish
Butterfish	Pilchard	Sprats
Elephant fish	Porae	Stargazer
Flatfish	Red cod	Tarakihi
Garfish	Red gurnard	Trevally
Grey mullet	Red snapper	Trumpeter
Groper	Rig	Yellow-eyed mullet

Shellfish Working Group

Cockles	Kina	Triangle shell
Deepwater crab	Paddle crab	Ringed dosinia
Dredge oysters	Paua	Silky dosinia
King clam	Pipi	Scallop
Green-lipped mussel	Red crab Queen scallops	Scampi
King crab	Deepwater tuatua	Surf clam
Frilled Venus shell	Giant spider crab	Toheroa
Knobbed whelk	Trough shell	Tuatua
Sea cucumber	Large trough shell	Horse mussel

Highly Migratory Species Working Group

Tunas	Billfishes	Swordfish

Rock Lobster Working Group

All rock lobster stocks

Eel Working Group

Freshwater eels

Antarctic Working Group

All research related to New Zealand fishing activities in the CCAMLR Area

Other Science Working Groups

Marine Recreational Working Group

All research related to marine fisheries monitoring, survey, catch and effort estimation and assessment.

Aquatic Environment Working Group

- Protected species interactions and mortality estimates (including seals, sea lions, dolphins and seabirds)
- Evaluation of bycatches and trophic interactions
- Assessment of benthic impacts of fishing
- Evaluation of other impacts of fishing

Stock Assessment Methods Working Group

- Oversee and evaluate stock assessment methods
- Make recommendations on the standardisation of methodology
- Review Operational Guidelines to give effect to the Harvest Strategy Standard

Fisheries Data Working Group

- Identify the data used for stock assessment purposes
- Review systems for collection of new data
- Report on new information that may impact on the interpretation of data used for stock assessment purposes
- Provide advice on methods, systems and conditions of release of data
- Report on changes to data collection systems

Appendix 3. Terms of Reference for Fisheries Assessment Working Groups

The following Terms of Reference for Fishery Assessment Working Groups applied in 2010.

Overall Purpose

For fish stocks managed within the Quota Management System, as well as other important fisheries in which New Zealand engages:

To assess, based on scientific information, the status of fisheries and fish stocks relative to MSY-compatible reference points and other relevant indicators of stock status; to conduct projections of stock size under alternative management scenarios; and to review results from relevant research projects.

Fisheries Assessment Working Groups (FAWGs) evaluate relevant research, determine the status of fisheries and fish stocks and evaluate the consequences of alternative future management scenarios. They do not make management recommendations or decisions (this responsibility lies with MFish Fisheries Management and the Minister of Fisheries).

Preparatory Tasks

1. Prior to the beginning of the main sessions of FAWG meetings (January to May and September to November), MFish fisheries scientists will produce a list of stocks for which new stock assessments or evaluations are likely to become available prior to the next scheduled sustainability rounds. FAWG Chairs will determine the final timetables and agendas.

2. At least six months prior to the main sessions of FAWG meetings, MFish fisheries managers will alert MFish science managers and the Chief Scientist to unscheduled special cases for which assessments or evaluations are urgently needed.

Technical Objectives

3. To review any new research information on stock structure, productivity, abundance and related topics for each fish stock under the purview of individual FAWGs.

4. To estimate appropriate MSY-compatible reference points[1] for selected fish stocks for use as reference points for determining stock status, noting the approved Harvest Strategy Standard.

5. To conduct stock assessments or evaluations for selected fish stocks in order to determine the status of the stocks relative to MSY-compatible reference points[1] and associated limits, noting the "Guide to Biological Reference Points for the 2009-10 Fishery Assessment Meetings", and the approved Harvest Strategy Standard.

6. In addition to determining the status of fish stocks relative to MSY-compatible reference points, and particularly where the status is unknown, FAWGs should explore the potential for using existing data and analyses to draw conclusions about likely future trends in biomass levels and/or fishing mortality (or exploitation) rates if current catches and/or TACs/TACCs are maintained, or if fishers or fisheries managers are considering modifying them in other ways.

7. Where appropriate and practical, to conduct projections of likely future stock status using alternative fishing mortality (or exploitation) rates or catches and other relevant management actions, based on input from the FAWG, fisheries plan advisers, and fisheries managers, noting the approved Harvest Strategy Standard.

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[1] MSY-compatible reference points include those related to stock biomass (i.e. B_{MSY}), fishing mortality (i.e. F_{MSY}) and catch (i.e. MSY itself), as well as analytical and conceptual proxies for each of the three of these quantities.

8. For stocks that are deemed to be depleted or collapsed, to develop alternative rebuilding scenarios based on input from the FAWG, fisheries plan advisers, and fisheries managers, noting the approved Harvest Strategy Standard.

9. For fish stocks for which new stock assessments are not conducted in the current year, to review the existing Fisheries Assessment Plenary report text on the "Status of the Stocks" in order to determine whether the latest reported stock status summary is still relevant; else to revise the evaluations of stock status based on new data or analyses, or other relevant information.

Working Group Reports

10. To include in the Working Group report information on commercial, Maori customary, non-commercial and recreational interests in the stock; as well as all other mortality to that stock caused by fishing, which might need to be allowed for before setting a TAC or TACC.

11. To provide information and advice on other management considerations (e.g. area boundaries, by-catch issues, effects of fishing on habitat, other sources of mortality, and input controls such as mesh sizes and minimum legal sizes) required for specifying sustainability measures.

12. To summarise the stock assessment methods and results, along with estimates of MSY-compatible references points and other metrics that may be used as benchmarks for assessing stock status.

13. To review, and update if necessary, the "Status of the Stocks" sections of the Fisheries Assessment Plenary report for all stocks under the purview of individual FAWGs (including those for which a full assessment has not been conducted in the current year) based on new data or analyses, or other relevant information.

14. Where practical, to complete (and/or update) the Status of Stocks template provided on pages 30-31 of the 2009 May Plenary document, following the associated instructions on pages 30-33 of that document.

15. It is desirable that full agreement amongst technical experts is achieved on the text of the FAWG reports, particularly the "Status of the Stocks" sections. If full agreement amongst technical experts cannot be reached, the Chair will determine how this will be depicted in the FAWG report, will document the extent to which agreement or consensus was achieved, and record and attribute any residual disagreement in the meeting notes.

Working Group Input to the Plenary

16. To advise the Chief Scientist, Ministry of Fisheries, about stocks requiring review by the Fishery Assessment Plenary and those stocks that are not believed to warrant review by the Plenary. The general criterion for determining which stocks should be discussed by the Plenary is that new data or analyses have become available that alter the previous assessment, particularly assessments of recent or current stock status, or projections of likely future stock status. Such information could include:

- new or revised estimates of MSY-compatible reference points, recent or current biomass, productivity or yield projections
- the development of a major trend in the catch or catch per unit effort
- any new studies or data that extend understanding of stock structure, fishing patterns, or non-commercial activities, and result in a substantial effect on assessments of stock status

Membership and Protocols for all Science Working Groups

17. Membership of Working Groups is open to all interested parties who agree to the following standards of participation. Participants must commit to:

- participating in the discussion
- resolving issues

- following up on agreements and tasks
- maintaining confidentiality of Working Group discussions and deliberations (unless otherwise agreed in advance, and subject to the constraints of the Official Information Act)
- adopting a constructive approach
- avoiding repetitions of earlier deliberations
- facilitating an atmosphere of honesty, openness and trust
- having respect for the role of the Chair
- listening to the views of others, and treating them with respect

18. Key roles are:

- Chair: MFish scientist – required. The Chair is an active participant in Working Groups, who also provides technical input, rather than simply being a facilitator. The Chair is responsible for: setting the rules of engagement; promoting full participation by all members; facilitating constructive questioning; focussing on relevant issues; reporting on Working Group recommendations, conclusions and action items, and ensuring follow-up; and communicating with the MFish Chief Scientist, relevant MFish Fisheries Management staff, and other key stakeholders
- Research providers – required (may be the primary researcher, or a designated substitute capable of presenting and discussing the agenda item)
- Other scientists not conducting analytical assessments to act in a peer review capacity
- Representatives of relevant MFish Fisheries Management teams

19. Working Group participants will be asked to declare any relevant affiliations.

20. *Working Group papers:* Working group papers will be posted on the MFish website prior to meetings if they are available. However, it is also likely that many papers will be tabled during the meeting due to time constraints. Working Group papers are "works in progress" whose role is to facilitate the discussion of the Working Groups. They often contain preliminary results that are receiving peer review for the first time and, as such, may contain errors or preliminary analyses that will be superseded by more rigorous work. **For these reasons, attendees must agree not to release information contained in Working Group papers to external media. In general, Working Group papers should never be cited.** Exceptions may be made in rare instances by obtaining permission in writing from the MFish Chief Scientist and the authors of the paper.

21. Participants who use Working Group papers inappropriately, or who do not adhere to the standards of participation, may be requested by the Chair to leave a particular meeting or, in more serious instances, to refrain from attending one or more future meetings.

22. Meetings will take place as required, generally January-April and July-November for FAWGs and throughout the year for other working groups (AEWG, BRAG, Marine Amateur Fisheries and Antarctic Working Groups).

23. A quorum will be reached when the Chair (a Ministry of Fisheries scientist), the designated presenter, and three or more other participants are present. In the absence of a quorum, the Chair may decide to proceed as a sub-group, with outcomes being taken forward to the next meeting at which a quorum is formed.

24. The Chair is responsible for deciding, with input from the entire Working Group, but focussing primarily on the technical discussion and the views of technical expert members:

- The acceptability of the analyses under review
- The way forward to address any deficiencies
- The need for any additional analyses
- Contents of Working Group reports
- Choice of base case models and sensitivity analyses to be presented
- The status of the stocks

25. The Chair is responsible for facilitating a consultative and collaborative discussion.

26. Working Group meetings will be run formally, with agendas pre-circulated, and formal records kept of recommendations, conclusions and action items.

27. A record of recommendations, conclusions and action items will be posted on the MFish website after each meeting has taken place.

28. Other principles guiding the operation of all MFish Science Working Groups include:

- Data upon which analyses presented to the Working Groups are based must be provided to MFish in the appropriate format and level of detail in a timely manner (i.e. the data must be available and accessible to MFish; however, data confidentiality concerns mean that such data are not necessarily available to Working Group members)
- Methods of analysis must be sound
- Working Groups will seek to draw on the best available expertise, and will encourage and seek peer review
- Working Groups will maintain high standards of professional integrity and science ethics
- Working Groups will operate with openness and transparency

29. The outcome of each Working Group round will be evaluated, with a view to identifying opportunities to improve the process. The Terms of Reference may be updated as part of this review.

30. MFish scientists and science officers will provide administrative support to the Working Groups.

Record Keeping

31. The overall responsibility for record-keeping rests with the Chair of the Working Group, and includes:

- To keep notes on recommendations, conclusions and follow-up actions for all Working Group meetings, and to ensure that these are available to all members of the Working Group and the Chief Scientist, Ministry of Fisheries in a timely manner. If full agreement on the recommendations or conclusions cannot readily be reached amongst technical experts, then the Chair will document the extent to which agreement or consensus was achieved, and record and attribute any residual disagreement in the meeting notes.
- To compile a list of generic assessment issues and specific research needs for each Fishstock or species or environmental issue under the purview of the Working Group, for use in subsequent research planning processes.