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RAPFISH, A RAPID APPRAISAL TECHNIQUE FOR FISHERIES, AND ITS APPLICATION TO THE CODE OF CONDUCT FOR RESPONSIBLE FISHERIES

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RAPFISH, A RAPID APPRAISAL TECHNIQUE FOR FISHERIES, AND ITS APPLICATION TO THE CODE OF CONDUCT FOR RESPONSIBLE FISHERIES

by

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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PREPARATION OF THIS DOCUMENT

This work was carried out at FAO, Rome, in 1999 while the author was a Visiting Scientist under the FAO Programme of Cooperation with Academic and Research Institutions.

This document describes the current status of the Rapfish technique, its application to the Code of Conduct for Responsible Fisheries, and presents a preliminary case study example. It may be used as background before preparing data for Rapfish ordinations of further case study fisheries in order to test the method, and with a view to subsequent publication in a Technical Report and elsewhere. It also serves as an introduction to Rapfish for those who wish to extend the scope of the method to other areas. The author will be glad to help anyone who wishes to implement the method (e-mail: tpitcher@fisheries.com).

The Code of Conduct for Responsible Fisheries was developed in 1995 by FAO. Its history and the rationale for its development can be seen on the FAO web site: http:\\www.fao.org.

Rapfish was developed in 1996 by a group working largely at the Fisheries Centre, University of British Columbia, Vancouver. Rapfish is described with an example in this document. The latest developments in the Rapfish technique may be found on the web site: http:\\fisheries.com.

Pitcher, T.J.
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ABSTRACT

The paper describes the basis and implementation of Rapfish, a non-parametric and multi-disciplinary ordination technique for comparing the status of fisheries. Ordinations using multidimensional scaling of a set of scored attributes are framed using a number of fixed reference points, including constructed best (=‘good’) and worst (=‘bad’) possible fisheries from sets of scored attributes. Ordination scores are rotated and scaled to provide a rating for each fishery from 0% (‘bad’) to 100% (‘good’). The document describes implementation of the method and how simulated data can be used to validate it. Previous work is briefly reviewed, and examples of ecological, technological, economic and social evaluations are presented, where status is evaluated in terms of sustainability. An ethical evaluation from a recent project is also described. The document describes the development of an additional Rapfish field that expresses compliance with the Code of Conduct for Responsible Fisheries, gives a preliminary worked example, and discusses how Rapfish can provide detailed evaluations sorted by a hierarchy of sectors, gear types, species and geographical areas. The technique, which is still under development, can make explicit a range of evaluations that underpin policy decisions in fisheries.

The FAO Fisheries Circular is a vehicle for distribution of short or ephemeral notes, lists, etc., including provisional versions of documents to be issued later in other series.

About the FAO Partnership Programmes

The Partnership Programmes, launched by FAO Director-General Jacques Diouf, are an innovative and dynamic means of extending the scope, impact and sustainability of technical cooperation, and promoting a wider participation of Member Nations, their institutions, experts and, above all, the beneficiaries themselves.

The four Partnership Programmes - the Programme for the Use of Experts for Technical Cooperation among Developing Countries and Countries in Transition (TCDC/TCCT), the Programme for Visiting Experts from Academic and Research Institutions, the Programme for the Use of Retired Experts, and the recently launched Young Professionals Programme - provide a strategic framework to broaden FAO's collaboration with Member Nations; enhance the cost-effectiveness of FAO's activities; and promote the national and collective self-reliance of developing countries through extensive use of their human and institutional capacities.

This work has been carried out under the auspices of the Programme for Visiting Experts from Academic and Research Institutions, which enables highly qualified academics and researchers from world-renowned institutions to collaborate with FAO. This enables FAO and the scientific institutions to benefit from each others expertise in common areas of concern, and enhances the value and quality of their respective work through increased collaboration. A total of 28 countries - as well as 5 regional and international institutions have already signed the programme or have endorsed it, and some 270 visiting scientists and researchers have made important contributions to FAO's work.

About the Fisheries Centre at the University of British Columbia

The Fisheries Centre at the University of British Columbia, Vancouver, Canada, was founded in 1993 to focus and promote multidisciplinary research on fisheries. Analytical tools developed in a broad spectrum of parent subjects, including biology, oceanography, economics, engineering, mathematics, sociology, planning and policy are employed in order to assess, evaluate and forecast the impacts of both human and natural processes on fishery resources, and the aquatic ecosystems in which fisheries are embedded.

Output from the Fisheries Centre encompasses academic research, sponsorship of public and professional seminars, research contracts, workshops and publications. Graduate teaching within the UBC Faculty of Graduate Studies, and professional training are integral parts of the work. The Centre maintains a fully international, multidisciplinary perspective, and aims to provides a forum for the foundation of concepts of fisheries management and development appropriate for the 21st century.

CONTENTS

Introduction

In conventional stock assessment, much effort goes into determining stock status relative to biological reference points, such as levels of fishing mortality, spawning biomass or age structure (Smith 1993), to obtain diagnostics that may give early warning of serious depletion or collapse. Increasingly, stock assessment relies upon the estimation of many stock parameters and requires extensive current and historical data measured from the fishery and from independent biomass surveys. There is, however, a mismatch between the complexity of these stock assessment models and the high degree of uncertainty inherent in fisheries research (Walters 1998). At the same time, extensive data requirements preclude the application of these models to many of the world's fisheries. Moreover, conventional stock assessment relates to the ecological, or occasionally, the economic sphere, and yet fisheries are in reality a multi-disciplinary human endeavour that has profound social, technological and ethical implications (McGoodwin 1990). Rapfish is a new multi-disciplinary rapid appraisal technique for evaluating the sustainability of fisheries.

This Circular describes Rapfish. The technique employs simple, easily-scored attributes to provide a rapid, cost-effective, and multi-disciplinary appraisal of the status of a fishery, in terms of sustainability (Pitcher et al., 1998a). Fisheries may be defined flexibly, from a broad scope such as all the fisheries in a country or lake, down to a narrower scope such as a single jurisdiction, a target species, a gear type or even individual vessels. A set of fisheries may be compared, or the time trajectories of individual fisheries may be plotted. The technique is still under development.

Ordinations of sets of attributes are performed using multi-dimensional scaling (MDS), a non-parametric method. Normally the ordination is performed in two dimensions and the MDS is followed by rotation to an orientation adopted as a convention (horizontal). Ordinations are bounded by reference points that simulate the best and worst possible fisheries using extremes of all the attribute scores, and these hypothetical 'good' and 'bad' fisheries define the extremes and the orientation of the horizontal axis. Fisheries are given a score of 0% to 100% along this axis. A second set of fixed reference points constructed from two half-way scores stabilizes the vertical dimension of the plot. Further constructed reference 'fisheries' with randomly allocated attribute scores define the size of differences among fisheries that might be regarded as significant.

Separate Rapfish ordinations may be performed using sets of pre-defined attributes in ecological, economic, technological, social and ethical disciplines (or 'fields' or 'components of sustainability'). More fields may be added as required for particular analyses. A combined ordination may also be performed, providing an unweighted conflation of the fields. In this document a new field is added to evaluate compliance with the Code of Conduct for Responsible Fisheries. Evaluation of the status of a fishery, in terms of sustainability, should be required in all of these disciplines before objective decision making can be performed. Previous attempts to do this (e.g. Lane and Stephenson 1997) have required extensive economic and biological data.

Within a field, attributes are chosen to reflect sustainability, and although intended to remain fixed so that different analyses may be compared, attributes may be refined or substituted as improved information becomes available. Most attributes are scored on a ranked scale, for example a five point scale from zero to 4. Intermediate scores are permitted because all scores are normalized before ordination. Candidate attributes whose extreme scores cannot be unequivocally regarded as 'good' or 'bad' should be dropped from the analysis. Discussion of attributes in a workshop venue makes explicit the values that define a particular field. Scores given to a particular fishery should be justified and documented for transparency.

The method may be used to diagnose emerging problems in fisheries; in other words to evaluate the 'health' of fisheries by making comparisons. It may also be used in hierarchical fashion, revealing more detail from results grouped by species, sector, gear type or geographical area.

In addition to providing a rapid assessment of status, the Rapfish method might be useful in a 'triage' of fisheries (Pauly 1999), to determine where limited management resources might be focused to greatest effect. It may also be used to track changes in a single fishery in an attempt to foresee problems before some combination of biological, economic or social effects leads to disaster. An important question is whether this technique can be used to diagnose key problems, (such as environmental change, overcapitalization or recruitment overfishing) early enough to give warning of impending trouble.

Methods and the Philosophy of Rapfish

While fisheries management is increasingly seen to be as much about managing human behaviour as about fish ecology (e.g. Jentoft 1998), apart from economics, most analyses of the human aspects of fisheries have been non-quantitative with little predictive or diagnostic power. Nevertheless, this human dimension is so intertwined with the gear, vessels, markets, biological and economic sustainability, management, allocation and the rebuilding of depleted and collapsed stocks, that the study of fisheries can be regarded as truly multi-disciplinary. Rapfish is a rapid appraisal technique designed to allow an objective multi-disciplinary evaluation, but it is not intended to replace conventional stock assessment for setting quotas etc.

Most agree that quantitative stock assessment is necessary, but some have questioned the need to quantify the status of a fishery in other respects, such as social and ethical or compliance with the Code of Conduct.

Pitcher and Power (in press) discuss this problem:

> In his 1623 book, Il Saggiatore ("the assayer"), dedicated to the newly-elected and scholarly Pope Urban 8th, Galileo wrote “The book of Nature is written in mathematical characters”. The urbane Pope, renowned for Bernini's embellishment of St. Peter's, received the book enthusiastically and on six occasions discussed it with Galileo in the Vatican garden. But a later book, “Dialogues concerning the two chief world systems”, which in 1632 painstakingly set out an unanswerable mathematical case that Earth revolves around the sun, forced the Pope by its explicitness to sanction trial by the Inquisition, and led to Galileo’s house arrest until his death in 1642. In fact, the absurd Papal decree that the Copernican view was a “mathematical supposition” serves today only to reinforce Galileo's point. Quantification is important.
>
> Quantification is useful. E.O. Wilson (1998) presents a vision of a powerful new synergy between the natural and social sciences, largely expressed though quantification, using examples such as evolutionary psychology (Wright 1994), a field that has recently been applied to fisheries management (Hart and Pitcher 1998). There is an unfortunate tradition in the arts that quantification in some way detracts from value. For example, the poet Keats thought that, by splitting white light into its constituent spectral wavelengths, Newton had compromised the beauty of the rainbow. Dawkins (1998) argues that this view is profoundly mistaken. Quantification can not only enhance the human sense of awe, but also may empower rational decision making in fields, such as politics, traditionally the province of oral suasion and advocacy.

And, after presenting the results of an ethical Rapfish analysis, Pitcher and Power conclude:

> In conclusion, can complicated things like fisheries be usefully represented by a simple ordination technique? Well, yes, if the simplification corresponds to an abstraction that can be used to make comparisons.
>
> First, the Rapfish technique forces us to make explicit the qualities we use to distinguish among fisheries, so that they may be used as attributes in the analysis. Downing (1991) shows how comparisons among apparently dissimilar objects can be performed using measured amounts of variables they share. In this case, comparisons among Canadian east and west coast fisheries are based on scores of nine ethical measurements in four subsets, each scored on 3- or 4- point range . Moreover, the analysis is given power, and its ethical dimension, by relating all differences to the best and worst possible scores obtainable. With only nine ethical attributes, the technique has surprising discriminatory power. There are 202,500 possible combinations of scores between a minimum score of 0 (0 on all attributes = the ‘bad’ point) and a maximum score of 32 (maximum on all attributes = the ‘good’ point), although since some attributes run from low to high and others from high to low, the total scores cannot be used directly (Note: the ordination technique takes care of this).

> Secondly, 'compare and contrast' is a powerful imperative. Like fisheries, humans are complicated and capricious things, yet ordination has been used to distinguish human religious traits by De Crescenzo (1988), who shows how egregious notables, saints and sinners, such as Pope Alexander 6th (the Borgia pope), Hitler, St. Francis, Ghandi, Byron and Napoleon can be plotted on axes of power and love. Human traits such as the hermit, scientist, poet, tyrant, rebel and miser ordinate on the same plot. In conclusion, both De Crescenzo's analysis and Rapfish do not disparage the real and important differences among individual humans or fisheries, but permit constructive evaluation through powerful comparisons.

Rapfish Scope: Definition and Scope of Attributes

The overarching principle used in designing attributes for a Rapfish analysis is sustainability, as for other fields such as ecology. Issues of justice and fairness have been used for the ethics analysis field, with sustainability as the guiding principle. By sustainability, I mean simply that the resource and its fishery can continue beyond the short term.

The number of attributes for an evaluation field is designed to maximise discriminating power in the ordination technique, where a rule of thumb is to have three times as many fisheries as attributes used to ordinate them (Stalans 1995). Criteria for choosing attributes are that they are easily and objectively scored, and that extreme values are easily ascribed to 'good' and 'bad' in relation to sustainability, and that scores are available for all the fisheries and time periods in the analysis. Annex Table 1 lists the attributes for ecological, technological, social and ethical fields that have been developed to date. Most of the indicators discussed in the literature (reviewed by FAO 1999) are represented in this list, with the exception of most of the detailed numerical single species stock assessment indicators (which could be given their own new evaluation field using Rapfish). The Rapfish list includes many more social and economic indicators than are generally presented. The existing set of attributes are not discussed further in this document.

Fixed reference points

To provide the ordination with fixed reference points, status is assessed relative to the best and worst possible fisheries that may be constructed from the set of attributes for each discipline. Two hypothetical fisheries, ‘Good’ and ‘Bad’, are simulated by choosing extreme scores for each attribute. Note that ‘good’ and ‘bad’ are evaluated in terms of sustainability of the fishery within the discipline. If these scores cannot easily be assigned to an attribute, then the attribute itself may not be useful for the RAPFISH analysis, and indeed many candidate attributes have been discarded over the past 3 years of development of Rapfish. The ‘Good’ and ‘Bad’ fisheries are generally plotted on the final ordination, and their positions are used to rotate the plot and to calculate percentage changes in status. Additional fixed reference points, expressing two half way scores that have the maximum mutual difference, are included in the ordination to ensure that new evaluations do not flip laterally to their mirror image (see below).

Random reference points

In addition, twenty random sets of attribute scores (‘random’ fisheries) are simulated for each discipline. Scores are chosen at random, along a continuous scale, from the ranges for each attribute. More than twenty random points might be chosen to improve statistical rigour, but there are limits because most ordination methods allow only about 100 data points to be included. The objective here is to show if differences among status evaluations are meaningful.

After pilot work, in which the random fisheries ordination positions were shown to be normally distributed about zero (Pitcher et al. 1998b), individual random fisheries have been replaced by the mean and 95% confidence limits. These are usually represented as crossed lines on the final ordination plot.

Rapfish Scope: Definition of Fisheries

The Rapfish method is very flexible about the scope of fisheries included in the analysis. For example, the ordination can be of a set of fisheries, or the trajectory in time of a single fishery, or both. Snapshots of a fishery in time may be taken at regular intervals such as every year or every five years, or at points when major shifts are known to have occurred. Points which plot very close together, or even fall at identical locations on the ordination will not disrupt the analysis.

Ordination Method for Rapfish

After pilot work using Principle Components Analysis produced arched, biased plots, non-parametric multidimensional scaling (MDS) (Kruskal & Wish 1978; Schiffman et al. 1981; Stalans 1995) has been employed. This is an ordination technique that can produce unbiased distance ‘maps’ of relative location (Clarke 1993). These maps may be rotated and shifted linearly with minimal disruption (Clarke and Warwick 1997).

A squared Euclidean distance matrix with attribute scores normalised using Z-values is employed because pilot work has shown this produces the least disruption to monotonicity (see below) . MDS for ratio data in two dimensions is carried out for all the fishery points including the ‘good’, ‘bad’ and 20 ‘random’ fisheries. We have used the SPSS statistical package (SPSS 1996). Goodness-of-fit is evaluated using stress values (values below 0.25 are considered acceptable by Clarke & Warwick, 1997).

Estimating Loadings of Attributes on the Rapfish Ordination Axes

The relationship of the 'Good' to 'Bad' ordination axis of fisheries with the original scored attributes can be determined, but is not as simple a procedure as with PCA. The X-axis may be taken as the dependent variable in a multiple regression with the normalised attributes as the independent variables. Regression coefficients that are significant show relationships of the original attributes to the sustainability axis. Because of the non-parametric nature of the MDS technique, these relationships hold only for an individual ordination and do not transfer to other analyses.

An alternative method is to use multiple correlation (e.g. in the canonical correlation package of Statistica, Statsoft, 1996). Such an analysis allows the interpretation of the meaning of derived axes from the attributes most highly correlated with them (Stalans, 1995). High positive correlations imply that when a particular attribute score was high for any fishery, it was likely to score high on an ordination axis. High negative correlations implied that low attribute scores were associated with high values on an ordination axis. It is important to remember, though, that the correlations cannot be interpreted singly, for they determine the MDS axes *jointly* (James and McCulloch, 1990).

This procedure is not illustrated in this Circular.

Clustering the Ordination

Cluster analysis of the ordinated points can be used to group the fisheries in a mathematically objective fashion. One technique promotes ‘clumpiness’ using the complete Euclidean distance rule (implemented, for example, using the *Statistica* package, Statsoft 1996). This creates clusters by identifying each member's furthest neighbours. The first four or five readily identifiable groups may be chosen as convenient, since there are no clearly accepted rules for defining what constitutes a mathematical ‘group’ in such investigations (Cooper and Weekes, 1983). Tools such as amalgamation schedules (e.g. in the *Statistica* package, Statsoft 1996) may be used to measure the amount of variation explained by creating more groups. If a new plot does not explain more variance by adding an extra group then the linkage distance is essentially the same (Statsoft, 1995). This procedure is not illustrated in this Circular.

Principles of Rapfish

The main principles and features underpinning the Rapfish technique are summarised here.

- Captures multivariate nature of fisheries
- Captures multidisciplinary nature of fisheries
- Attribute scores can be a mixture of binary, ordinal or ratio
- Defined best and worst possible scores provide fixed reference points for statistical ordination
- Defined best and worst possible scores need not be unrealistic
- Ordination technique makes no distribution assumptions (non-parametric, MDS)
- Attributes not clearly related to sustainability are eliminated early on
- Hierarchical analysis: overall view of status can be broken down into several levels of detail

- Hierarchical analysis by fishery: scores for a fishery can be broken down by species, gear type, community, or even individual vessels.
- Clarifies differences among fisheries
- Can show changes in status with time within a fishery
- Replicability
- Ease of correction
- Ease of updating without disruption
- Rapid technique
- Robust against disciplinary criticism
- Open publication of fishery scores
- Open publication of fisheries sources

Summary of Rapfish Procedure

Table 1 summarizes computational details of the procedure followed when using Rapfish.

1. Attributes of fisheries are scored for each discipline
   check scoring consistency among partners
   development phase: criterion is sustainability
   discard attributes not clearly related to good and bad criterion
   save min and max for each

2. Construct Reference Points for the ordination: (a) construct GOOD and BAD fisheries from the extremes of all the attribute scores. These points provide a reference direction for the horizontal dimension in the final ordination.
   fixes extremes of ordination along this axis

3. Construct Reference Points for the ordination: (b) MID POINTS - two extreme half way scores, the first mid-point is constructed with half of the attributes scored as 'bad' and the other half as 'good', the second mid point is the mirror image. These points provide reference direction for the vertical dimension in the final ordination.
   fixes extremes of ordination along this axis
   allows superimposition of new points onto an existing Rapfish ordination

4. Construct Reference Points for the ordination: (c) Construct 20 random ("UGLY") fisheries with random selection of attribute scores for each discipline. These reference points establish the size of meaningful differences on the ordination.

5. MDS ordination of fisheries in attribute space for each discipline
   Options in SPSS 7.0 and above are:
   Normalise – Z scores by attribute;
   Distance matrix - Euclidean distance squared;
   Ratio data option;
   Note stress score, stress <0.25 is a credible ordination
   Save Mean & S. Error of random fisheries

6. Conventions: (a) rotate ordination plot so 1st axis is at GOOD = 90 degrees and BAD = 270 degrees azimuth (i.e. horizontal – you can use the Solver in Excel to fit this)

7. Conventions (b): in the vertical dimension, the first of the two midpoints is set to positive (use logic statement in Excel).

8. Express each fishery as a score along the 1st axis - the percentage of 'bad' to 'good' distance
   Plot GOOD = 100% and BAD = 100% locations
   Plot each set of fishery points as a 2-dimensional Rapfish plot
   Option: plot randoms as a cross in a convenient location
   using 95% limits from standard errors
   Option: plot score on 1st axis fishery trajectories against time.
   Option: rank order of fisheries on 1st axis
   Option: plot ranks of fisheries

9. Use each pair of disciplinary ordination scores in a combined interdisciplinary MDS
   Compare scores and rank orders across ordinations

Table 1: Summary of the Rapfish Procedure for evaluation of a set of fisheries.

Published Rapfish Analyses

To date, seven Rapfish analyses have been published.

A preliminary introduction to the technique with a worked example from 26 world fisheries from commercial, subsistence, artisanal, and industrial sectors (Pitcher et al. 1998a);

A review of the technique (Pitcher and Preikshot, 1999);

Application to 24 small-scale artisanal fisheries from the tropics (Preikshot and Pauly 1998);

Evaluations of 32 African lake fisheries (Preikshot et al. 1998);

Evaluations of 29 world fisheries for sardine, Atlantic herring, Pacific herring and anchovy, including time series for 3 major herring fisheries (Pitcher et al. 1998b);

Comparison of the status of distant water USSR fleets on domestic fisheries in Mauritania and Senegal (Pitcher and Preikshot, 1998);

Evaluation of the ethical status of 42 Canadian Atlantic and Pacific coast fisheries (Pitcher and Power 1999).

Further work is in progress on the set of Canadian fisheries (preliminary results are presented as an example in this Circular), and pilot work has been carried out on Mexican and on Lake Malawi fisheries.

Validation of the Rapfish Technique using Simulated Fishery Data

The rapid appraisal of fisheries method using Multidimensional Scaling (MDS) depends upon the position of actual fisheries relative to the constructed ‘good’ or ‘bad’ fisheries, or a trajectory of a fishery in time moving towards or away from these reference points. The trajectory from good to bad should be monotonic. It would be useful to superimpose later Rapfish analyses on previous ones. This section investigates both of these problems using data from three simulated test fisheries.

Testing Monotonicity

The progression from ‘good’ to ‘bad’ must be monotonic for the evaluation of status to be credible. To test this, I simulated fisheries with ten attributes, each scored on a scale from zero to 4. The ‘good’ fishery (100%) and ‘bad’ (0%) fishery had all 4s or all zero scores respectively. I then simulated a fishery whose scores improved progressively by one unit in one attribute at a time. There is a large number of such fisheries following alternate paths one step at a time from ‘bad’ to ‘good’

First, I checked which MDS options gave the best results for this procedure. MDS scores from five different variants of the method are shown in Figure 1. The clearest monotonic trajectory is shown by the MDS using Euclidean distance squared, normalization by attribute using Z scores and, in Figure 1, using the ordinal data MDS option.

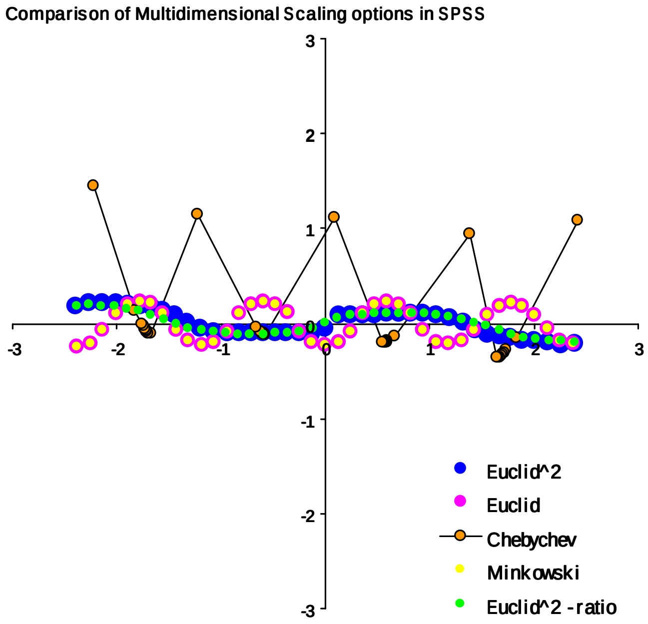


Figure 1. Illustrating the effect of five alternative MDS options on the ordination of a simulated fishery moving linearly from right to left.

Figure 2a shows the results from a Rapfish ordination of two simulated fisheries (small and large circles). Both of the trajectories are encouragingly monotonic. In this case the SPSS option for ratio data has been used, giving a more linear plot. The slightly greater width of the step sizes at the edge of the plot reflects, in part, the normalization of attribute scores, and partly the greater range of score possibilities in the centre of the plot. The two fisheries follow slightly different tracks because they differed in the scores with which they moved from bad to good. Note that, at the centre of the plot, a large number of possible combinations lead to the same total score and hence position on the x axis. The number of possible ways of achieving the same total score diminish as one approaches the 'good' and

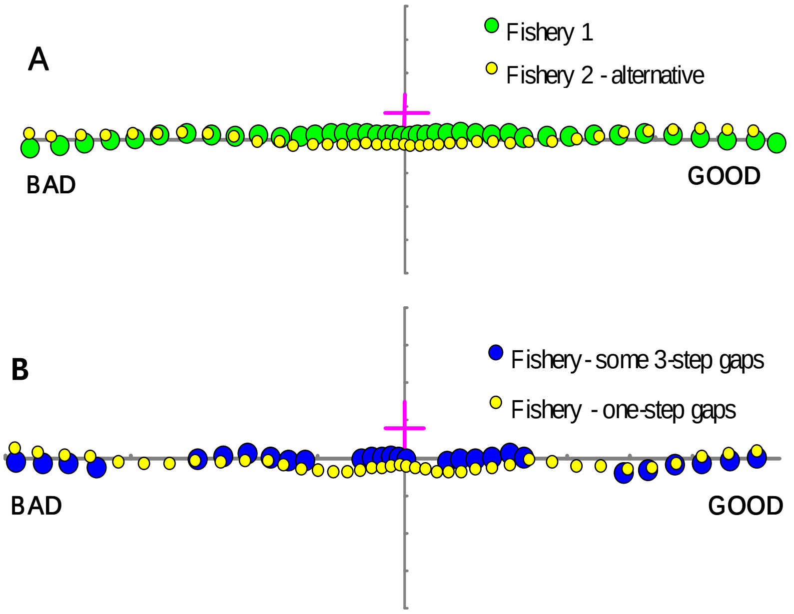


Figure 2. MDS ordinations of simulated fisheries, after rotation, between Good and Bad fisheries constructed as reference points.

'bad' locations, and each of those has only one possible set of scores (all good or all bad). The random ("ugly") fisheries are represented by the cross in the centre of the plot - they are normally distributed and the size of the arms of the cross is proportional to the 95% confidence limits on their standard errors. The cross has been displaced slightly vertically to make it visible: in fact it lies almost precisely at the centre of the ordination.

Figure 2b shows a RAPFISH ordination of a fishery exhibiting periodic large steps in status (3 steps – large circles). The 3-step jumps are reasonably linearly preserved relative to the reference fishery (small circles), although movement at the edges occupies more space than at the centre, probably on account of the Z transformation of the data. As mentioned above in both cases the 'random' fisheries (cross) lie close to centre of the plot, and this justifies our re-centering the fishery plots to the zero from the 'random' fisheries.

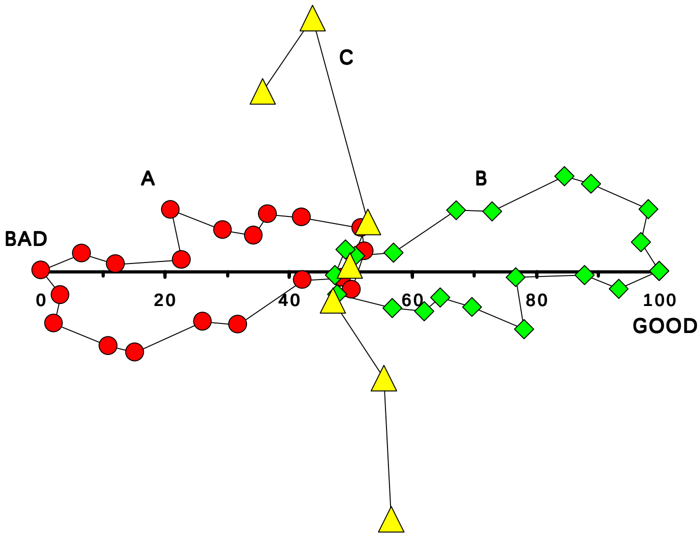


Figure 3. Rapfish ordinations of three simulated fisheries. Fishery A starts at 'bad' (=0%), improves to mid-way across the plot, and then returns to its starting point. Fishery B is a mirror image of A, starting at 'good' (= 100%). Fishery C changes its mix of attribute scores in ways that do not alter its status on the 'good' to 'bad' axis. For further details see text.

Simulated trajectories

Figure 3 illustrates a Rapfish ordination of three more simulated fisheries, together with the 'good' and 'bad' fisheries at the extreme ends of the horizontal axis, running from 0% to 100%. Simulated fisheries A and B each follow U-shaped curves on the plot. Fishery A starts at 'bad' (=0%), increases in status, remains at about the same level with some neutral changes in attribute scores at the centre of the plot, and then moves along a different trajectory back towards its starting point. Fishery B was simulated as the reverse of this trajectory. In each case, the Rapfish ordination in Figure 3 follows the intended path quite well. Fishery C was simulated with large changes in the scores of individual attributes, but very little overall change in status. Scores effectively were mirror images across the attributes. The resulting Rapfish ordination reflects these large changes normal to the sustainability axis. They are accompanied by almost no change along the sustainability axis.

Figure 4 shows the trajectories of the same three simulated fisheries assuming each point represents a successive time period (e.g. a year). The mirror images of fishery A and B are evident. The plot shows that they have almost the same status in years 8 to 12, while Fishery C shows almost no change in status with time. Comparison with Figure 3 suggests that there were large changes in fishery C that were not, however, reflected in changes in its sustainability.

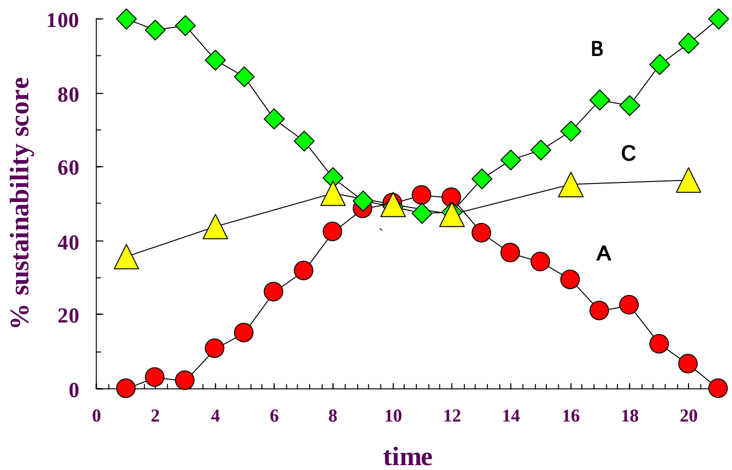


Figure 4. Projections of Rapfish ordination scores along the good to bad axis plotted against time for the 3 simulated fisheries of Figure 2. Time steps were assumed to be one year step between each data point.

Superimposing one Rapfish plot upon another

It would be useful if new fishery points could be overlaid on a single Rapfish ordination plot that has previously been completed. This would have the advantage that the maximum of about 100 data points in MDS would not limit Rapfish analyses.

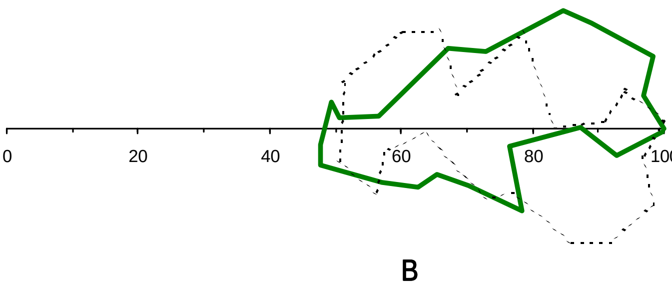


Figure 5. Two overlaid Rapfish ordinations of one of the three simulated fisheries, B, from Figure 3. Solid line shows original plot from analysis where all three simulated fisheries were included. Broken line shows plot from analysis in which fishery B data alone were included. There has been a vertical flip of the fishery position.

Without modification this is not possible, because small changes in the data can cause MDS ordinations to flip 180 degrees, forming approximate mirror images. In the horizontal dimension this problem is taken care of by always rotating so that 'Good' is at 90 degrees and 'Bad' at 270 degrees azimuth. But simulations show that a similar problem applies to the vertical dimension of the Rapfish plot. For example, Figure 5 shows an attempted overlay of Fishery B, ordinated separately (broken line) from its original analysis (solid line) in which it was included along with data from fisheries A and C. It is clear that there has been a vertical flip.

Vertical flips in MDS can also be caused by trivial changes. For example, Figure 6 shows fisheries A, B and C from Figure 3 above (solid lines). When Rapfish is repeated with 40 instead of 20 random values included, the three fisheries flip positions vertically (broken lines). Note, however, that the scores along the sustainability axis, from 'Bad' (= 0%) to 'Good' (=100%), are not much affected by the vertical flip.

To overcome this problem, it is necessary to construct some additional 'mid-range' fixed reference points in the analysis. When these fixed reference points are included, Rapfish analyses produce plots that approximately overlay one another.

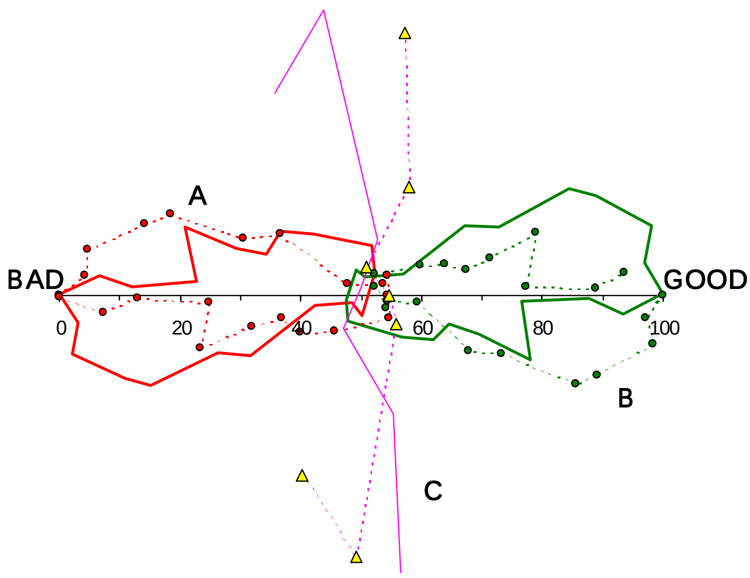


Figure 6. Two overlaid Rapfish ordinations of the three simulated fisheries from Figure 3. Solid line shows original plots from analysis. Broken lines shows plots from analysis that included twice as many random points. There has been a vertical flip of the fishery positions.

The first additional 'mid-range' reference point is constructed from half of the attributes being assigned a maximum (= 'Good') score and the other half a minimum (= 'Bad') score. The second additional reference point is constructed to have the opposite set of scores, a mirror image, as it were. All attributes set to one extreme score for the first reference point must be set to the opposite extreme in the other; there should be no overlap. There are a whole set of similar mid range points, but only two, one pair of opposites, need be chosen. These points define the extreme vertical extent at the centre of the Rapfish plot. By convention one of these reference points is chosen to always have a positive value. For the overlay of Rapfish

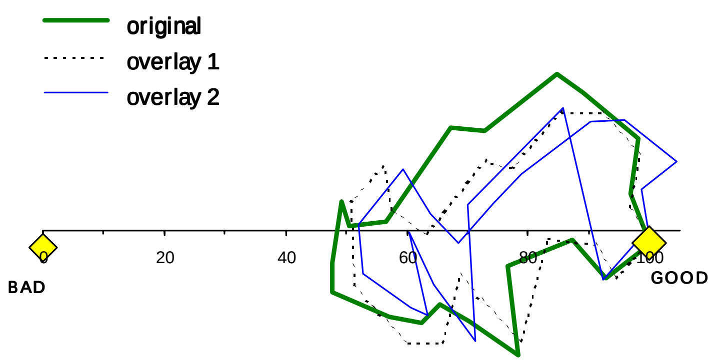


Figure 7. Two Rapfish ordinations overlaid on the original ordination of the simulated fishery B from Figure 3, where fisheries A and C were included with in the analysis (thick line). Broken and thin lines shows plots from analyses where fishery B data only was included with a different set of mid-range reference points and random scores. Note that one of the mid-range points was fixed as positive by convention.

plots to work, the same combination must be chosen for all analyses using this set of attributes.

Figure 7 shows some simulations in which the Rapfish ordination of Fishery B from Figures 3 and 5 (solid line) is ordinated in two further Rapfish analyses; on its own and with various other mid-way points and random values. The intended overlays are shown by broken and thin solid lines. On the whole, individual points are quite close to their original positions and the plot has been flipped back by the adoption of the new 'mid-points' convention. But it is clear that the vertical positions of two of the 21 individual points have 'flipped' in overlay 2. The circumstances in which these flips occur need further investigation, but the MDS algorithm is not sufficiently transparent to make this an easy task. The result is that we cannot be certain that overlays of individual points from a new analysis will be accurate in the y dimension, although the overall pattern of ordination points will be similar.

Fortunately, the time trajectory for the two overlays of Fishery B (Figure 8) are very similar to the original, so that it is unlikely that an overlay would lead to misleading results on the 'good to bad' axis.

Conclusions

The conclusion from these simulations is that Rapfish ordinations using MDS are monotonic for a specified set of MDS options, provided that suitable reference points are included in the ordination. The 'Good' and 'Bad' reference points provide a fixed scale from 0% to 100% and a fixed orientation for the horizontal axis, guarding against horizontal flips in the raw MDS output. The mid-range reference points guard against vertical flips of the whole analysis, and enable approximate overlays to be made. At present, there is no guarantee that individual data points will overlay accurately in the vertical dimension. Inclusion of both sets of reference points, however, means that ordination scores along the horizontal axis from good to bad are well behaved.

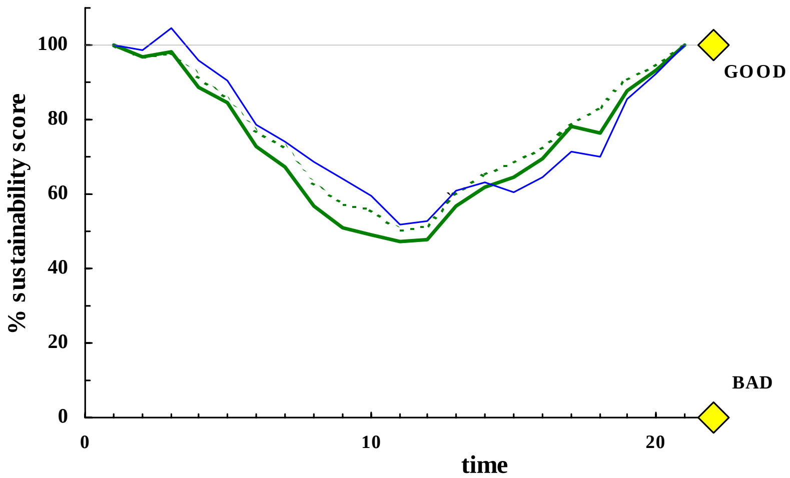


Figure 8. Plots on the 'Good' to 'Bad' axis of the overlay and original Rapfish scores from the simulated fisheries in Figure 7.

Leverage of Individual Attributes on Rapfish Ordinations

How much does each attribute influence the ordination scores of a fishery in the Rapfish technique? To answer this question, it proved necessary to adopt the full set of fixed reference points as discussed above, earlier attempts with only the two original fixed reference points at 'good' and 'bad' suffered from the MDS mirror image flipping problem (in about a quarter of cases).

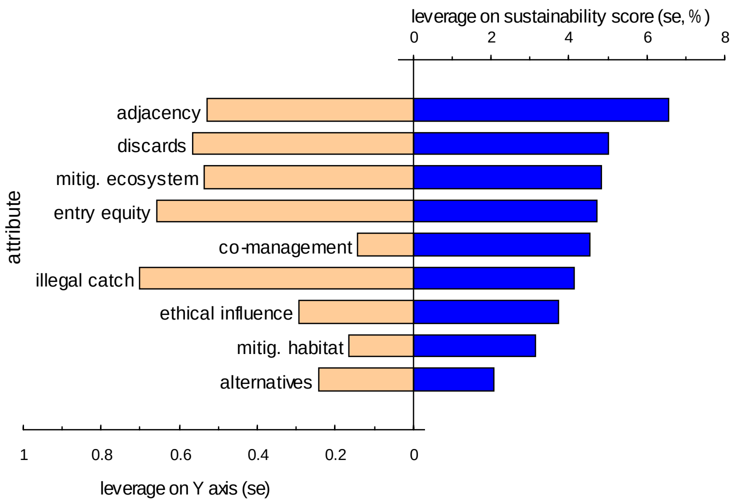


Figure 9. Leverage of nine ethical attributes on sustainability scores (along the 'Good' to 'Bad' axis) and Y axis scores for a Rapfish analysis of East coast Canadian fisheries. Leverage was calculated as standard errors of differences between scores obtained with and without the attribute)

We carried out a series of ordinations successively dropping each attribute out of the analysis. I used, as an example, data from an analysis of 18 fisheries from the east coast of Canada (Pitcher and Power, *in prep*.). For each of the nine ethical attributes, we calculated the sum of squares of the differences of the x- and y- scores compared to those obtained with the full set of attributes. This provided a standard error expressing the leverage of each attribute. Figure 9 shows the results for nine ethical attributes used in this work. The standard errors for the horizontal sustainability axis are shown on the right, those for the vertical, y-axis on the left of the plot. There is an approximate three-fold variation in leverage, from about 2% to 6.5 % on the x axis, and from 0.2 to 0.6 of a standard deviation on the vertical axis. The two sets of leverages on the two axes are not correlated (r^2=0.3). For example, for the 'adjacency' ethical attribute, this means that the sustainability score of fisheries is altered by about 13% with a likelihood of 95% (i.e. twice the standard error). For the attribute 'alternatives' the value is about 5%.

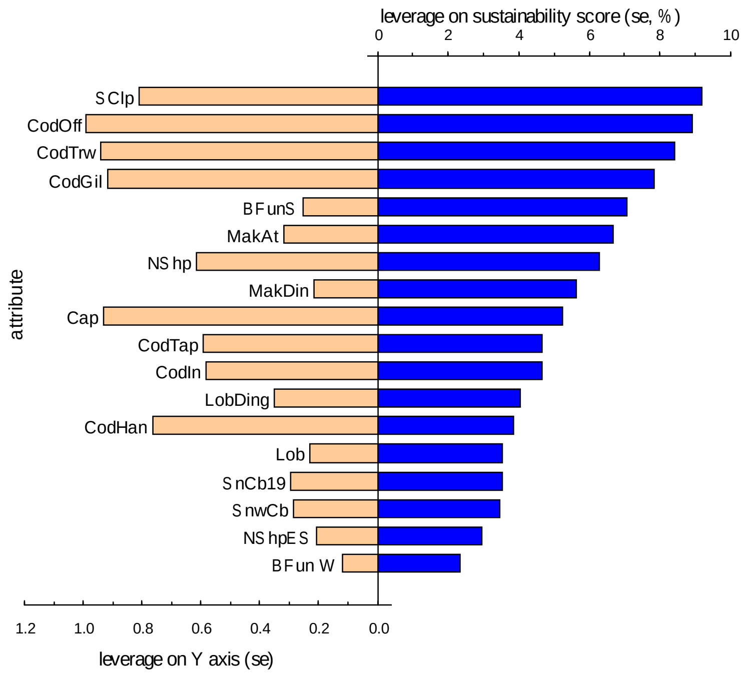


Figure 10. Overall effect of leverage of nine ethical attributes on 18 Canadian east coast fisheries on sustainability scores (along the 'Good' to 'Bad' axis) and Y axis scores for a Rapfish analysis of East coast Canadian fisheries. Plot values were calculated as standard errors of differences between scores obtained with all nine attributes compared to total of scores successively without each of the attributes in turn.

A similar calculation was carried out for the individual fisheries, to see which are most sensitive to the loss of attributes from the ordination. Figure 10 shows the results in order of influence of the sustainability score. For example, on the sustainability axis, the ordination positions of cod offshore, cod trawl, cod gillnet and scallop fisheries are influenced by 14 to 18% (twice the standard error) by the loss of an 'average' attribute in the analysis, while for fisheries like snow crab, shrimp and Bay of Fundy herring weir, the value is only about 3-6%.

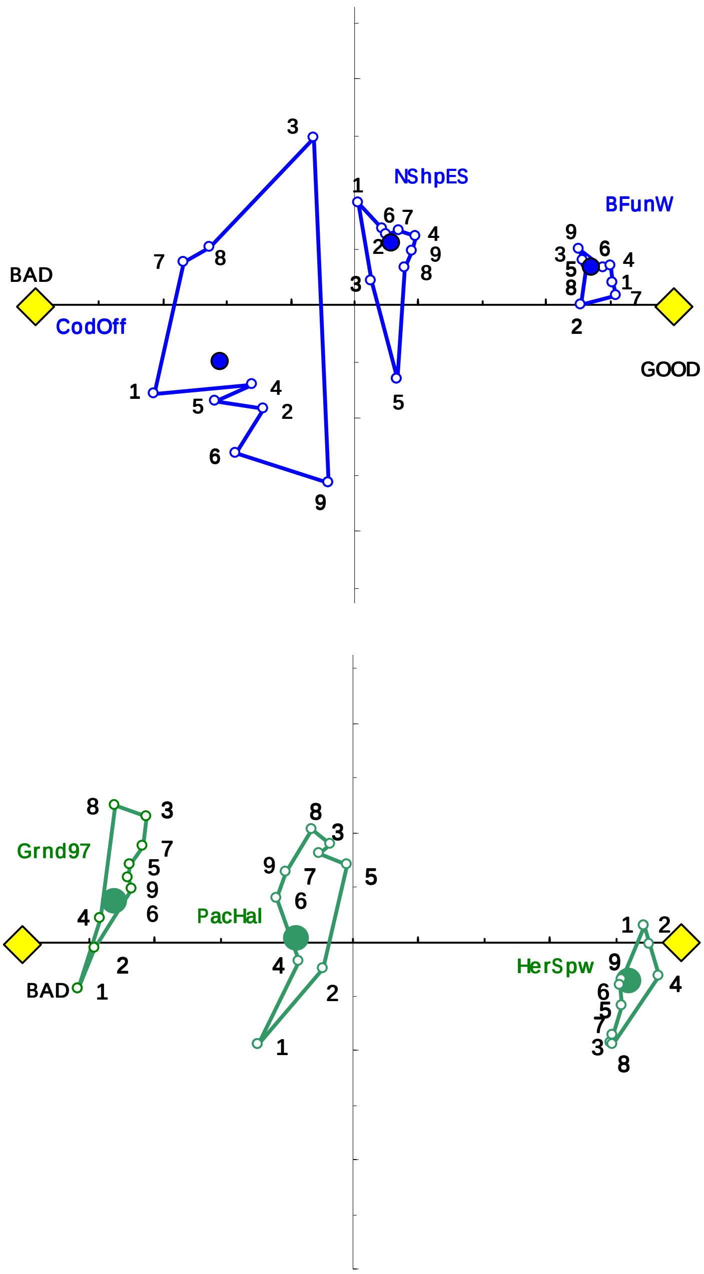


Figure 11. Rapfish plots showing the leverage of nine ethical attributes on 3 examples of Canadian east coast fisheries (11a, top), and three Canadian west coast fisheries (11b, bottom) on two-dimensional Rapfish plots. Solid circles show the fishery positions when all nine attributes are included. Solid lines join the Rapfish scores obtained when individual attributes (numbered points) are dropped from the analysis.

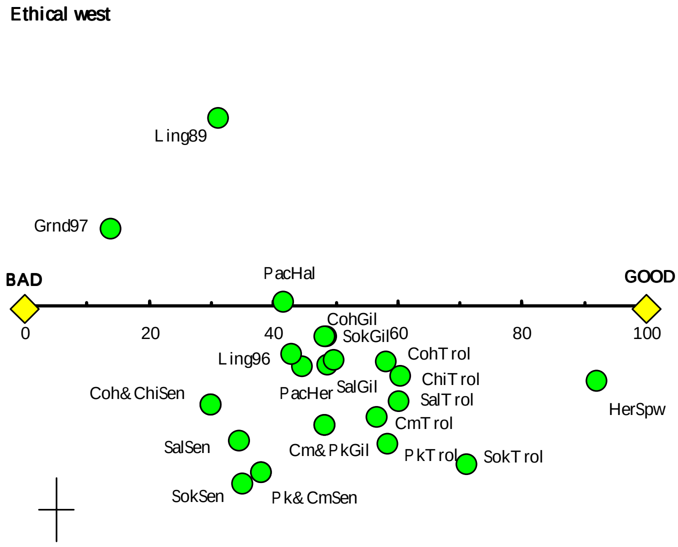
We can ask how this variation from the individual attributes affects the plotted positions on the Rapfish ordination. Figures 11a and b show this for six example fisheries. Large circles show the ordination positions when all nine attributes are included in the analysis. Solid lines join the plotted positions of these fisheries when individual attributes are dropped from the analysis. Numbers indicate the attributes dropped at each point (their identity need not concern us for the purposes of this discussion). In this plot the vertical axis shows from -3 to +3 standard deviations, the normal extent of Rapfish positions. In all cases the position along the sustainability axis is affected by the loss of individual attributes far less than the vertical position on the y axis. The cod offshore fishery shows quite large changes, especially for attributes 3, 9 and 6. The other five fisheries shown as examples exhibit far less variation. Note that the polygons do not overlap, meaning that rank order of the three fisheries along the sustainability axis remains the same in all cases.

Representing the Results of Rapfish Ordinations

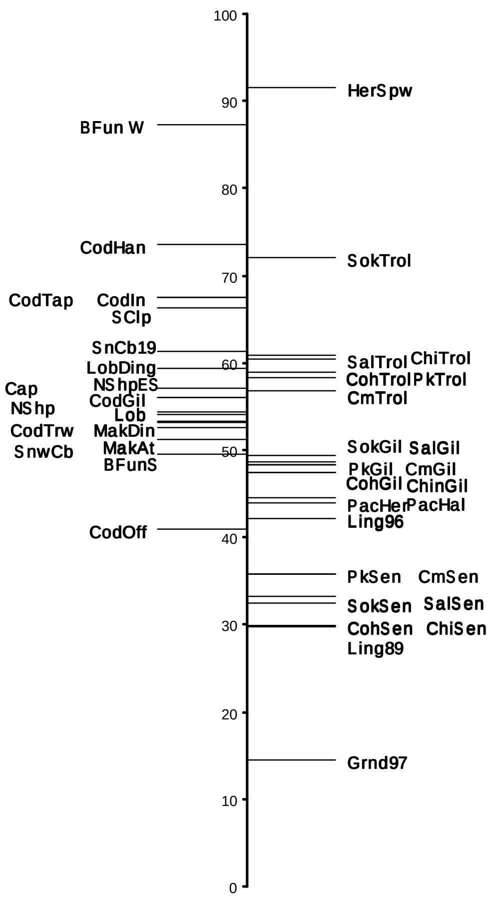
Figure 12 (below) depicts five ways of presenting the results of Rapfish ordinations. The two dimensional ordination plot in Figure 12a provides the most detailed information; other ways lose information about the vertical position. A time trajectory of scores is shown in Figure 12c. Figure 12b graphs the Rapfish scores along the ‘good’ to ‘bad’ axis only, in this version swung vertically to allow side-by-side comparison of two sets of fisheries. Figure 12d is a table presenting similar information, where rank orders replace actual Rapfish scores, attention is drawn to fisheries falling into upper and lower quartiles, and rank orders in different Rapfish evaluation fields may be compared. Finally, Figure 12e illustrates a kite drawn by joining the Rapfish scores plotted along the axes of a regular polygon (here a pentagon). Each axis represents one Rapfish evaluation field. The kite diagram can hence be used to summarise and compare scores from different Rapfish evaluation fields. Kite diagrams can be used to present a hierarchy of Rapfish analyses, as described later in this document.

Figure 12. Examples of different ways of presenting Rapfish results, as discussed in the text.

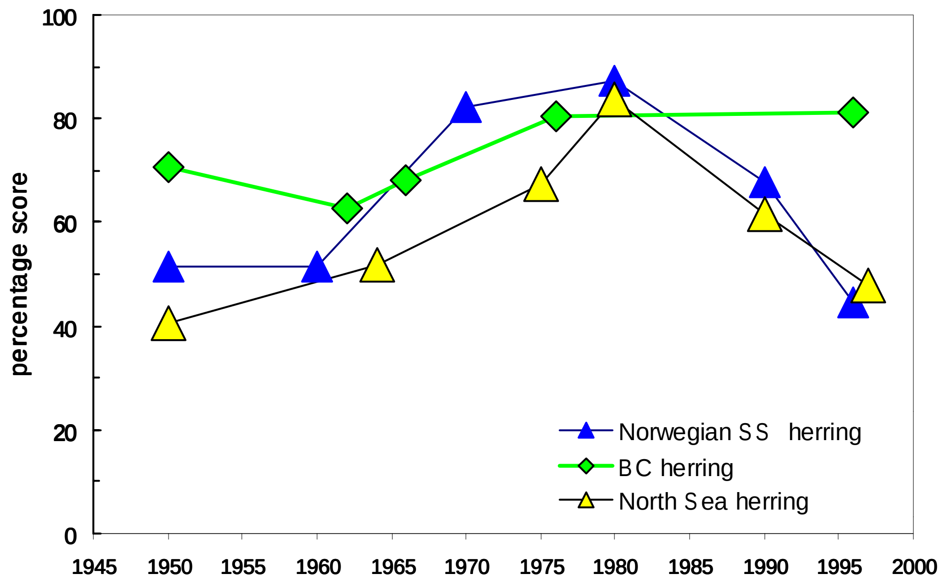
a. Two-dimensional ordination plot



b. One dimensional ordination plot



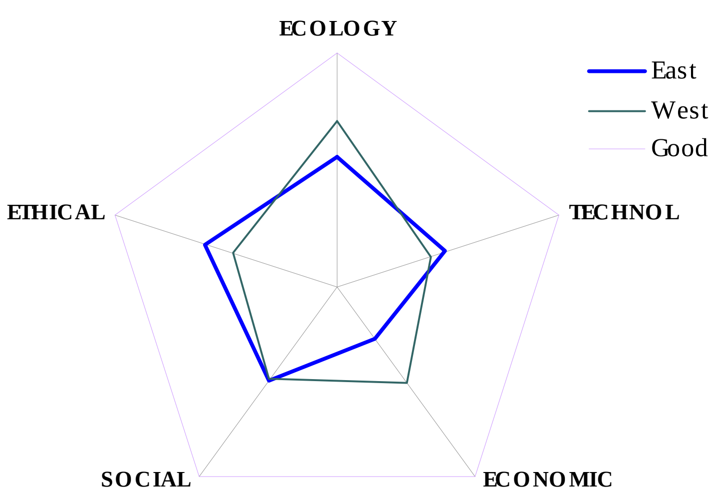
c. Time trajectory of status



d. Rank order table

Fishery	*quartiles*	Ecological	Economic	Social
Halibut		1	23	28
Shrimp (northern), E. Scotian Shelf Trawl		2	28	24
Salmon, Sockeye, Troll		3	18	9
Herring spawn-on-kelp		4	1	1
Salmon, Chum, Troll		5	13	6
Salmon, Pink, Troll		6	21	8
Salmon, Chum, Gillnet		7	14	21
Salmon, Pink, Gillnet		8	22	19
Salmon, Sockeye, Gillnet		9	19	18
Salmon, Chinook, Gillnet		10	9	22
Herring, 1996	*upper*	11	24	16
Salmon, Troll		12	17	4
Salmon, Gillnet		13	16	23
Salmon, Chinook, Troll		14	11	5
Lingcod, 1989, SoG		15	30	25
Salmon, Chum, Seine		16	5	37
Mackerel, Dingwall (NS)		17	34	3
Salmon, Coho, Troll		18	8	7
Caplin (NF)		19	41	13
Salmon, Pink, Seine		20	10	35
Lingcod, 1996		21	15	40
Salmon, Sockeye, Seine		22	6	34
Mackerel (Atlantic)		23	42	27
Lobster (Atlantic)		24	29	14
Salmon, Coho, Gillnet		25	12	20
Herring, Zone 4WX, Seine (NS)		26	27	29
Scallops		27	33	11
Crab (Snow), Area 19 (NS)		28	26	2
Lobster, Dingwall (NS)		29	25	17
Herring, Zone 4WX, Weir (NS)		30	20	10
Salmon, Seine		31	7	39
Shrimp (northern) (NF)	*lower*	32	32	31
Salmon, Chinook, Seine		33	3	38
Crab (Snow)		34	31	12
Groundfish trawl		35	2	33
Salmon, Coho, Seine		36	4	36
Northern Cod (2J3KL), Handlines		37	36	15
Northern Cod Inshore		38	35	30
Northern Cod (2J3KL), Traps		39	38	26
Northern Cod (2J3KL), Gillnet		40	37	32
Northern Cod (2J3KL), Trawls (otter)		41	40	41
Northern Cod Offshore		42	39	42

e. Kite diagram to summarize and compare status different fields



Rapfish and the Code of Conduct for Responsible Fisheries

Stimulated in 1993 by the poor state of some of the worlds most valuable fisheries (Doulman 1998), the Code of Conduct for Responsible Fisheries (FAO 1995) sets out to ensure the benefits of fisheries for future generations by encouraging responsible fishing practices. Its ten objectives succinctly listed in Article 2 are admirably clear in scope and intention. The Code's overall goal is intrinsically linked to food security for the world's poor and to sustainable economic benefits. It was evident to those who drafted the Code that fundamental structural changes to the ways in which fisheries are prosecuted are required if the benefits to human society of fisheries are to be sustainable, an observation that has been echoed by many others concerned with fisheries (e.g. Pitcher & Pauly 1998).

Reporting to the Committee on Fisheries (COFI), FAO is mandated to monitor progress, and assist with implementation of the Code (Clause 4.2). This requirement clearly implies a way of evaluating compliance of a State's fishery regulations with the Code. In February 1999, COFI reported that progress in doing this has been quite slow (COFI/1999/INF:6), as was expected (Doulman 1998). The same clause includes a requirement to monitor the effects of the implementation of the Code on fisheries, a much larger task that has been interpreted in its widest sense as the evaluation of sustainability indicators (FAO 1999).

However, by no means all sustainability indicators, particularly those in the economic and stock assessment areas, are covered explicitly by the Code. Therefore while such work on indicators is obviously of great value, it is difficult to show how this expresses compliance with the Code, except in very general fashion. In this work to define a Rapfish field that expresses compliance with the Code of Conduct, an attempt has been made to use only those features that are explicitly mentioned in the Code. The other Rapfish evaluation fields, described above, already cover most of the published indicators.

Accordingly, in order to express the dual aims of article 4.2, the Rapfish fields for the Code have been split roughly equally into scores that express the intended effects of the implementation of fishing regulations, and scores that express the actual effects of those regulations on fisheries.

Unfortunately, much of the detail contained in the body of the Code is written in a way that makes systematization and scoring of compliance rather difficult. While some clauses relate to very specific points, others cover almost every fishery management device ever invented, and in addition many items are repeated. It has been noted several times that it seems impossible to use the clauses of the Code as they stand in a quantitative evaluation (e.g. Caddy 1996). I have tried therefore to abstract the sprit of each of the themes while retaining a similar overall balance of emphasis among the clauses.

As in Caddy (1996), the scope of this evaluation for scoring compliance by individual capture fisheries concentrates on Article 7, dealing with fisheries management, since its scope is explicitly multidisciplinary and covers all of the devices, issues and instruments that could implement the aims of Article 2 for capture fisheries. Most of Article 12 detailing fisheries research in support of the Code's objectives is also covered more briefly in Article 7. The four other substantive articles (Doulman 1998) cover different aspects of fisheries: Article 8 on Fishing Operations; Article 9 on Aquaculture; Article 10 on Coastal Area Management; and Article 11 on Post-harvest Practices and Trade;

One of the Code's 'hidden strengths' is said to be that it is voluntary (Edeson 1996). Given the good-faith negotiations required for wide agreement on matters that have national sensitivities, the Code of Conduct is bound not to be perfect. Indeed, Clause 4.3 expresses the means for its own revision. But the Code is the general instrument that has received international agreement under COFI and the number of signatories is growing (Doulman 1998). The aims and spirit of the Code expressed in Article 2 ensure its importance in the development of world fisheries.

Scoring Overall Compliance with the Aims of the Code of Conduct

Checklist

Caddy (1996) published a checklist designed to evaluate compliance with the Code. The list includes a total of 193 questions over Articles 7, 8, 10, 11 and 12. There are 108 questions for Article 7, 21 of which apply only to fisheries that raise trans-boundary issues. Most of the questions are scored as 'yes' or no', although some allow for half scores. The questionnaire has been distributed to FAO member States, but I have not seen any case studies using this checklist. The list of questions is thorough and expresses almost all of the scorable Code features, and has been used as the basis for the present work. Rapfish differs in that it can demonstrate differences among fisheries with the same score, and, in the scheme outlined below, can extract status ratings for different features of the Code in a hierarchical fashion, as well as an overall status rating like the list. Moreover, for fisheries entered in sufficient detail by sector and gear, various groupings and hierarchical analyses become possible.

Article 2 – the Code Objectives

A suggestion for a simple way to examine the perception of a State's overall progress in implementing the Code would be to ask States to give themselves ratings between one and ten for each of the ten objectives of Article 2. This score out of 100 would be intended to cover the aggregate of a countries fisheries rather than individual fisheries, unlike the work outlined in the present document. Scores could be drawn up for a time prior to the Code, say, for 1990, for the present day, and for five years in the future after present initiatives had been fully implemented.

Code Clause	#	Features
2.a	1	Aim for responsible fishing, with all biological, technical, economic, social, environmental , community aspects addressed
2.b	2	Implement national policies of responsible conservation
2.c	3	Use appropriate management measures (= instruments)
2.d	4	Aim for international agreements and conformity
2.e	5	Promote cooperation for conservation, management and development
2.f	6	Prioritize food security and quality for local communities
2.g	7	Protect environment for living aquatic resources
2.h	8	Promote fair trade with no barriers
2.i	9	Research fisheries and their ecosystems
2.j	10	Provide standards of conduct for all involved in the fisheries sector

Table 2. Summary of the ten clauses of Article 2 of the Code of Conduct for Responsible Fisheries.

Either the total score could be added up, or, if many countries were to be compared where the same score could be achieved in different ways, a Rapfish ordination may be performed. Averages of the scores from a group of respondents would be the best way of obtaining values for a State. Self-scoring clearly encourages optimism, but this would apply to all participants, and it might be interesting to compare scores from government and non-government sources in each country.

Extraction of Rapfish attributes and fields for compliance with Article 7

It is important to remember that Rapfish is designed for comparison among a group of fisheries, or the status of a fishery sampled at intervals over time. The statistical ordination method underpinning Rapfish requires approximately 3 times as many fisheries as attributes. This means that ordination fields with 7-10 attributes are ideal for dealing with 10-30 fisheries, bearing in mind that the analysis may include around 20 fisheries constructed from random attribute scores.

Individual attributes for the Rapfish analysis have been very largely based on Caddy's (1996) abstraction of checklist questions from the Code. The Caddy check list has saved much time in the preparation of this work, especially in those cases where a single clause of the Code covers a large number of different management devices. The material has been re-arranged in appropriate subsections to express intentions or effects, with attempts to avoid the Code's repetition but retain a similar overall balance of focus. The list also needed much reduction from the 108 questions under Article 7 to adapt it for use in Rapfish.

Subfields for the Code Rapfish field

The substructure of the Rapfish evaluation fields has been a rather difficult task. The 8 sub-sections of Article 7 are: General; Management Objectives; Management Framework and Procedures; Data Gathering and Management Advice; Precautionary Approach; Management Measures; Implementation and Financial Institutions (see Figure 13). One attractive possibility from the point of view of simplicity and congruence with the Code was to retain this substructure, but this aim was compromised by a number of problems. First, the substance of 7.1 - General - is largely, but not completely, repeated elsewhere in Article 7 (and is repeated elsewhere in the Code, notably in Articles 6 and 10). Secondly, Clause 7.8 appears to be expanded into the entire Article 8 and is very similar to 7.7.5. Thirdly, it is hard to retain the Code's substructure while at the same time partitioning the analysis among intentions and effects, as required by Article 4.2. And finally, the logic for inclusion of some fishery management devices under some of the headings is not at all obvious to a fishery scientist.

In summary, the substructure of Article 7 has been rationalized into six Rapfish fields for evaluation purposes. Each field is ordinated separately, can then be summarised by a separate score and the results expressed on six-pointed kite diagram. In addition, the six ordination scores expressing the six fields can themselves be used as single values in a Rapfish field for the Code of Conduct, which can become a sixth field in a general Rapfish analysis alongside the existing ecological, economic, social, technological and ethical fields.

To score management intentions, I set up Rapfish fields for Management Objectives (7.2) and Framework (from 7.3, 7.5 and parts of 7.1 not picked up again). I have retained section 7.5, the Precautionary Approach, even though its components could all fit elsewhere, because of its importance as a new management concept in fisheries. After some agonizing, I moved some issues from 7.6 and 7.2 to this category. Together, these first three fields aim to evaluate management intentions as expressed in the Code.

The remaining 3 Rapfish fields aim to score the effectiveness of actions made under the spirit of the Code. "Stocks fleets and gear" covers most of the conventional fisheries management tools from 7.6. The social and economic attributes from 7.6 and 7.7 have been pulled out as a separate field. The final field is Monitoring, Control and Surveillance (MCS), largely from Code 7.7.

Questions for the Code Rapfish fields

Comments, repetitions, mergers and expansions of the Code clauses, based on the Caddy check list, are shown Annex Table 2. This is an extract from a spreadsheet used as a working document to attempt to distill the Code into Rapfish attributes, shown at the right hand side of the table.

The next stage was to express each attribute as a scorable question. Questions are designed, as far as possible, to be answered in reasonably objective fashion, although it is inevitable that some scores will differ among different respondents partly on account of differences in interpretation as discussed by Caddy (1996). One strength of Rapfish is that it can make explicit and also use such differences, and it is hoped that the technique will include the facility to enter a range of scores for each attribute in the near future.

The questions are listed Annex Table 3, which also shows the fixed reference points used in Rapfish to express the worst and best possible scores attainable. The table also indicates the principal and subsidiary Code clauses that are captured by each attribute. The overall structure of the scheme and many of the individual items have been modified after feedback from FAO staff, but the precise wording of the questions can very likely be improved upon. Questions for the Code evaluation fields are provisional at this stage and comments for improvement are welcomed.

Mapping of the Code subsections onto the six Rapfish fields is illustrated below in Figure 13.

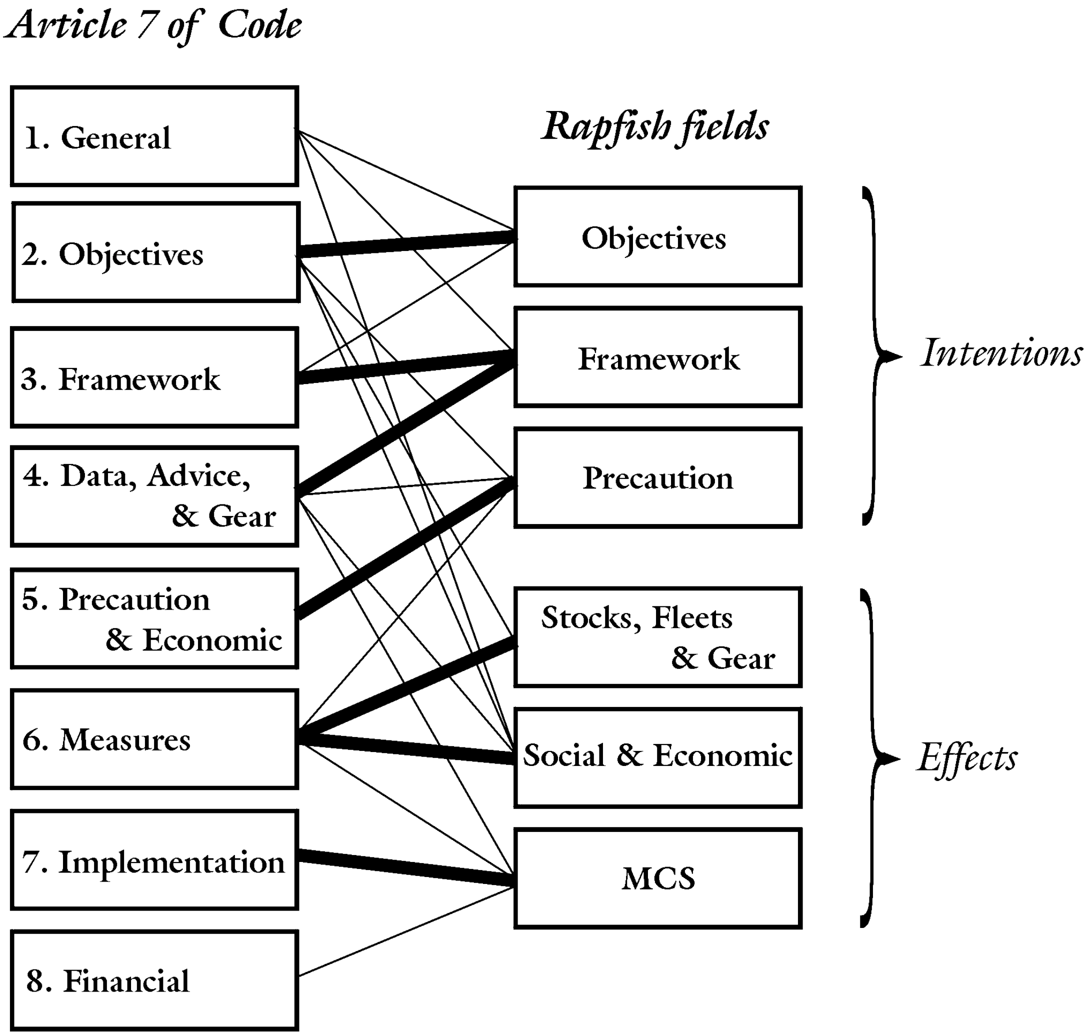


Figure 13. Diagram illustrating how the sub-sections of Article 7 of the Code of Conduct for Responsible Fisheries map onto the Rapfish analysis fields. Thick lines show the main linkages and thin lines express minor linkages.

Example of a Rapfish analysis from Canadian Fisheries

Data from 42 Canadian fisheries that have been subjected to Rapfish evaluation is presented here by way of an example. For this document, the results should be taken as a preliminary worked example and, with the exception of the ethical analysis which is in press (Pitcher and Power, *in press*), they do not at the time of writing (August 1999) represent definitive and final results.

Data for the Fisheries Evaluated

In the Rapfish technique, a fishery entity may be defined as required for the ordination: it may be a species or gear type, a region, or even a single fishing vessel (Pitcher *et al.* 1998). Table 3 lists the 42 fishery entities used in this Rapfish analysis, 24 from British Columbia and 18 from the east coast of Canada, with a few notes on each.

For the east coast, the cod fishery was scored in 6 ways: 4 individual gear types and inshore and offshore components. Snow crab, shrimp, lobster and mackerel fisheries were each represented by two entities, the east coast total and by individual community or regional fisheries. In British Columbia, the salmon fishery was split into 18 entities: three gear types (gill nets, troll and seine nets) combined by species, and five species each with three gear types (pink, chum, sockeye, chinook and coho salmon, each with seine, troll and gill net gear). Herring are represented on the east coast by the Bay of Fundy seine fishery and the ancient fixed gear weir fishery, and on the west coast by the BC herring roe fishery and by the spawn-on-kelp fishery, which does not generally kill the fish.

East Coast Fisheries (Atlantic)	**Notes**
Capelin (NF)	Seasonal beach gear and trap fishery
Crab (Snow)	Trap fishery
Crab (Snow), Area 19 (NS)	Has experimental full co-management agreement
Herring, Zone 4WX, Seine (NS)	Seine fishery for herring
Herring, Zone 4WX, Weir (NS)	Traditional fixed gear fishery since 1700s.
Lobster (Atlantic)	Lobster trap fishery, small inshore boats
Lobster, Dingwall (NS)	One community/region of the lobster fishery
Mackerel (Atlantic)	Purse seine fishery
Mackerel, Dingwall (NS)	One community/region of the mackerel fishery
Northern Cod (2J3KL), Gillnet	Gillnets, mainly inshore, NOTE disastrous collapse of cod fishery in early 1990s
Northern Cod (2J3KL), Handlines	Handlines, traditional, mainly inshore, idem
Northern Cod (2J3KL), Traps	Inshore traditional traps since 1700s, idem
Northern Cod (2J3KL), Trawls (otter)	Otter trawls, mainly offshore, idem
Northern Cod Inshore	Inshore small-scale sector: traps, handlines, gillnets, small boats, idem
Northern Cod Offshore	Offshore industrial sector: large boats, idem
Scallops	Scallop draggers
Shrimp (northern) (NF)	Trawls
Shrimp (northern), E. Scotian Shelf Trawl	One community/region of the shrimp fishery
West coast fisheries (Pacific)	
Groundfish trawl	Otter trawls, > 30 spp *Sebastes*, vessel/area/species quotas and observers recently, history of irresponsible behaviour documented
Halibut	Long lines, full ITQs recently
Herring spawn-on-kelp	Spawn on kelp fronds set in net ponds, most fish escape alive. Largely Aboriginal, traditional
Herring, 1996	Seines and mechanised gillnets, only roe from inshore spawners, openings a few hours
Lingcod, 1989, SoG	No regulations, large recreational catch, pre collapse
Lingcod, 1996	Disastrous collapse, now protected in southern BC
Salmon, Gillnet	High-tech nylon gill nets, very restricted openings
Salmon, Seine	Large high-tech drum seine vessels, large corporations, idem
Salmon, Troll	High-tech trolled lines of hooks. Small vessels, owner drivers, idem
Salmon, Chinook, Gillnet	NOTE also large recreational catch of chinook, and major transboundary issues. Some chinook hatcheries
Salmon, Chinook, Seine	Ditto
Salmon, Chinook, Troll	Ditto
Salmon, Chum, Gillnet	Low value, much enhanced through hatcheries
Salmon, Chum, Seine	Ditto
Salmon, Chum, Troll	Ditto
Salmon, Coho, Gillnet	Major collapse over past 5 years. NOTE also large recreational catch of coho. Some coho hatcheries. Closed in 1998.
Salmon, Coho, Seine	Ditto
Salmon, Coho, Troll	Ditto
Salmon, Pink, Gillnet	Low value, much enhanced through hatcheries
Salmon, Pink, Seine	Ditto
Salmon, Pink, Troll	Ditto
Salmon, Sockeye, Gillnet	High value, very restricted openings, major sectoral and transboundary conflicts.
Salmon, Sockeye, Seine	Ditto
Salmon, Sockeye, Troll	Ditto

Table 3. Fisheries in the Rapfish ordination, with brief notes on some of their features. Details of data sources for these fisheries are provided in Annex Table 4.

For the purposes of graphical presentation in this document, the 42 fisheries have been simplified, after the Rapfish procedures, down to 13 representing a range of interesting contrasts. Ordination scores for component sectors and gear types have been averaged. The simplified fisheries are, for the East coast: capelin; mackerel; herring; cod; shrimp; lobster; and snow crab area 19. And for the West coast: halibut; groundfish trawl; salmon; ling cod; herring; herring roe-on-kelp. Averaging in this way provides a further level of hierarchical analysis in Rapfish.

For all the attributes in each of five disciplines (ecology, technology, economics, social and ethical), fishers, scientists, managers, and other experts were asked to provide responses for each fishery (see Annex Table 4). Other information was collected from published literature, especially government documents. Ethical scores were refined by twelve members of the 'Fisheries Ethics' project team [a research project funded by the Canadian Social Sciences and Humanities Research Council lead by Dr Harold Coward from the University of Victoria, BC, Canada]. Scores were adjusted for consistency by the authors (see Annex Table 5). Note that on the west coast, data for rainbow/steelhead or individual community fisheries for was not obtainable. Recreational fisheries have not been included in this analysis. To serve as an example, for the Code of Conduct, at this stage, preliminary scores have been assigned by Tony Pitcher and Melanie Power only (Annex Table 6).

For replicability, to enable mistakes to be corrected and to enable improvements in scoring to be made, it is most important to document and list all data sources and scores assigned. In this case, Annex Table 4 lists the sources that were consulted for data on these Canadian fisheries. Updating and correction of attribute scores is a basic principle of the Rapfish method.

Results and Discussion

Ordination plots from the Rapfish evaluation fields.

The numerical Rapfish results for each of the five ordinations are tabulated in Annex Table 7. Two dimensional Rapfish plots for the simplified groups of fisheries described above are shown in five parts below as Figure 14. Figure 15 illustrates results from scoring the six ordination fields for the Code of Conduct Rapfish analysis for the same set of Canadian fisheries. East coast (Atlantic) fisheries are represented by triangles; west coast (Pacific) by diamonds or circles. The x-axis runs from ‘bad’ (status = 0%) to ‘good’ (= 100% status). Y axes have been scaled to spread the fishery points. The cross indicates standard errors of the randomly selected fisheries. Note that at the time of writing the full version of the Ethical analysis is in press by Pitcher and Power (1999).

Detailed discussion and interpretation of the plots in Figures 14 and 15 are not presented here, but the reader will note that the graphs conveniently show how fisheries may occupy different relative positions, interpreted as status within each evaluation field. In this case, it is to be noted that the results are based on provisional attribute scores for the fisheries.

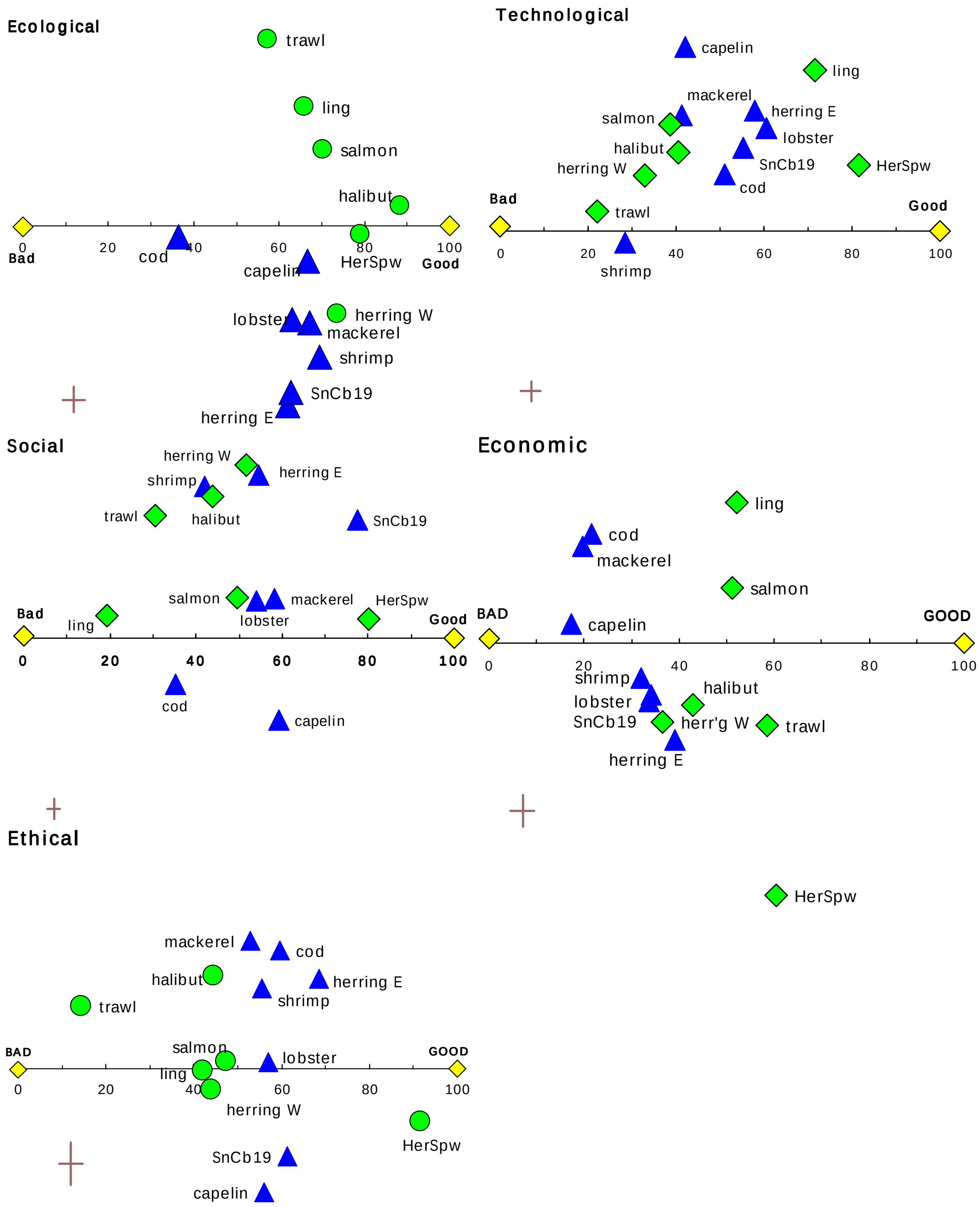


Figure 14. Rapfish ordinations in the five standard evaluation fields for the Canadian fisheries set out in Table 3 and simplified as described in the text**.** Triangles show Atlantic fisheries, circles show Pacific fisheries. Note that results are from a preliminary analysis using provisional attribute scores.

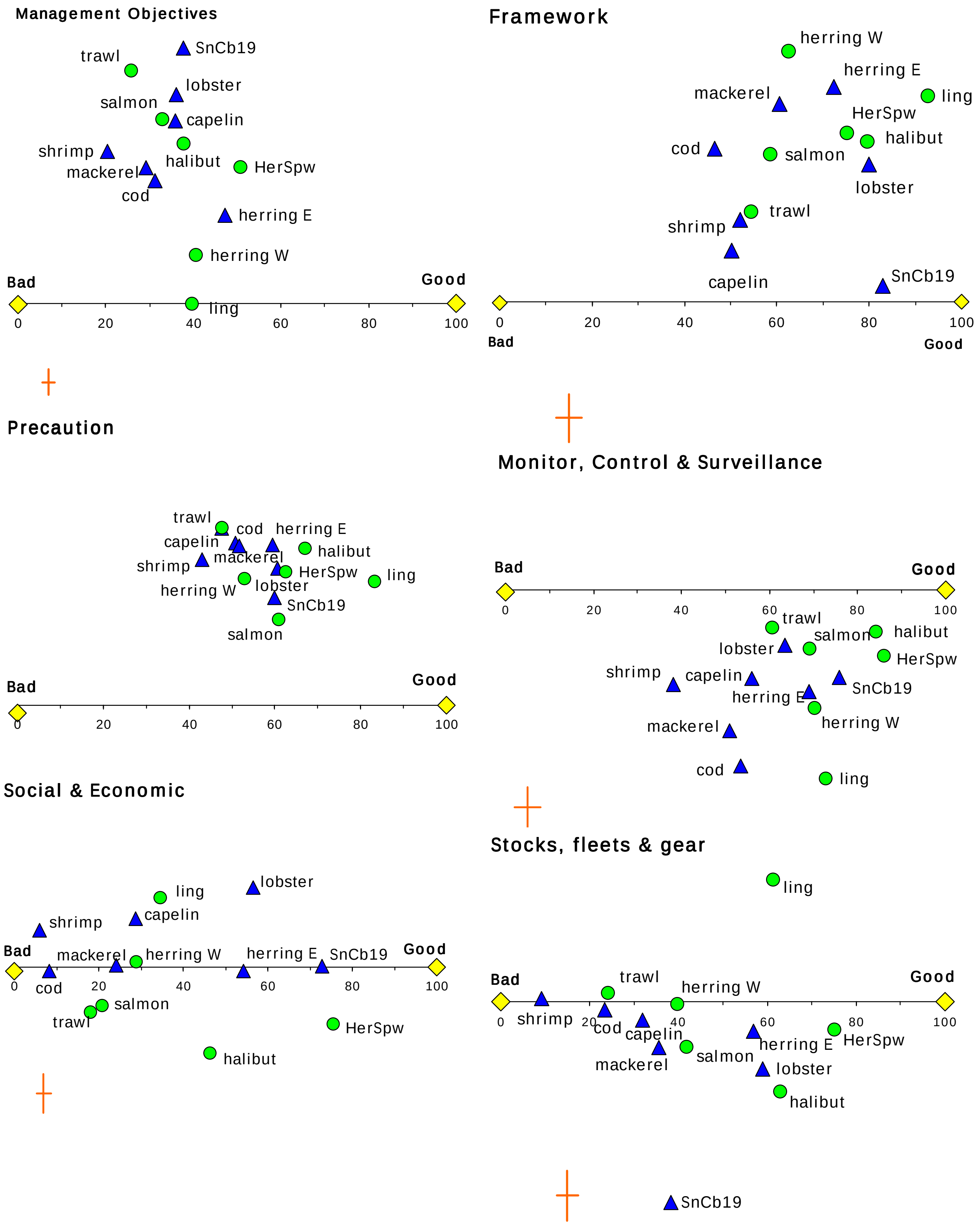


Figure 15. Rapfish ordinations for evaluation of six aspects of compliance with the Code of Conduct for Responsible Fisheries for the Canadian fisheries set out in Table 3 and simplified as described in the text. Triangles show Atlantic fisheries, circles show Pacific fisheries. Note that results are from a preliminary analysis using provisional attribute scores.

Overall analysis using kite diagrams and examples of hierarchical extraction of information

A simple comparison of East and West coast Canadian fisheries is shown using summary scores for all the six Rapfish fields in a kite diagram (Figure 16), which also shows the total Rapfish score over all fields in the legend. The two kite areas are similar, indicating that the fisheries on two coasts are of similar overall status, but the different kite shapes are indicative of important differences. This summary diagram is presented in order to demonstrate below how Rapfish can be used to reveal a hierarchy of detail.

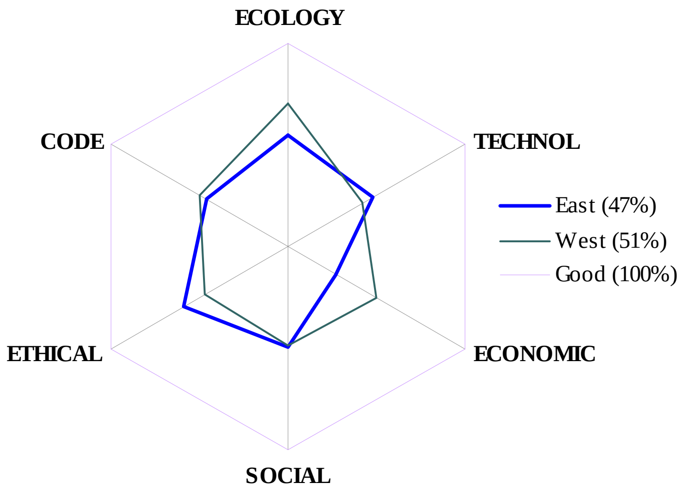


Figure 16. Hexagonal kite diagram summarizing average status scores of Canadian Atlantic and Pacific fisheries for six Rapfish evaluation fields. Overall averages shown at the right. Outer rim of hexagon represents 100% status scores: centre represents 0%.

The kite, based on average scores from all the ordinations, shows Atlantic fisheries as scoring higher than Pacific fisheries in the technological sustainability and the ethical fields, and lower in ecological economic sustainability. Scores for the Code if Conduct and for the ethical field are about the same. It might be rather disappointing to fishery managers in Canada to find that, overall, both sets of fisheries achieve only about 50% of the maximum possible rating. Note that these findings apply only to the selection of fisheries used in the analysis and would only be representative of all east and west coast fisheries if the selection were representative. Values plotted on the kite diagrams can be subjected to normal statistical tests (e.g. A t-test over all fields shows that difference between east and west coast ratings is non significant t = 0.91, P>0.1). Concordance could be quantified by calculating residuals.

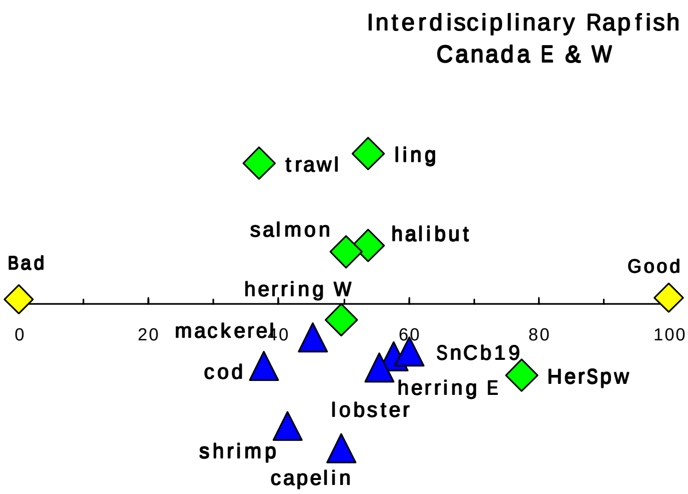


Figure 17. The interdisciplinary Rapfish ordination plot for Canadian Atlantic and Pacific fisheries, using all six major disciplines (fields).

The overall interdisciplinary ordination, based on the two ordination scores from each of the six fields for the simplified set of results used here, is shown in Figure 17. Fisheries from the two coasts fall in different clusters, an observation that may be formalized using cluster analysis (this topic will be expanded in the Technical Report).

We can now focus attention, for example, upon the top and bottom fisheries from each coast. More detailed ratings for the two top (BC herring spawn on kelp and Atlantic area 19 snow crab) and two bottom scoring (Atlantic cod and BC groundfish trawl) fisheries can obtained by drawing their overall kites (Figure 18).

In Figure 18, the kites for the two top rating fisheries are larger and more symmetrical than the lower ones, indicating a degree of balance of status among the different fields. (Note balance could be quantified by calculating a centre of gravity for the kite, or by calculating Coefficients of

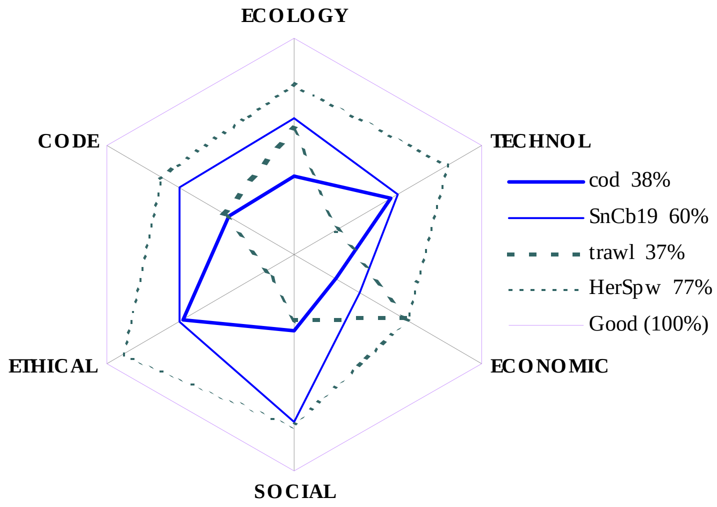


Figure 18. Kite diagram of six Rapfish evaluation fields showing status scores of the two top and two bottom scoring Canadian Atlantic and Pacific fisheries.

Variation). Both of these high rated fisheries are unusual; the spawn-on-kelp fishery is largely operated by Aboriginal peoples in BC and exported to the Japanese market. Herring are led or brought into net ponds set inshore and furnished with kelp fronds on which to spawn. This is a modern variant of a traditional aboriginal method for harvesting herring roe. Most herring escape from the net pound alive after spawning in this fishery. The other high-scoring fishery, for snow crab in Cape Breton, is unusual because of the operation of an experimental full co-management system between DFO and the local community, leading to a high rating of this fishery in the social Rapfish field. It also gains high scores on those part of the Code of Conduct fields (see below, Figure 24).

The kites for the lowest scoring fisheries in the Code analysis, the two trawl fisheries, have similar areas that reflect similar overall scores within 1% of each other. The kite shapes are, however, very different, indicating considerable differences among the ratings except for the Code and social sustainability fields.

Using the kite diagram approach, details of the Rapfish analysis of the Atlantic trawl fishery can be expanded by moving down the hierarchy. For example, if we now extract the scores for the four gear sectors of the Atlantic cod fishery (Figure 19) we see the large difference in pattern between the three mainly small-scale and inshore gears (gill nets, handlines and traps) and the primarily large-scale offshore trawl fishery. Similarities are high scores on technological and ethical fields, and low scores on economic sustainability and on the Code. Inshore gears have medium scores on ecology and social axes.

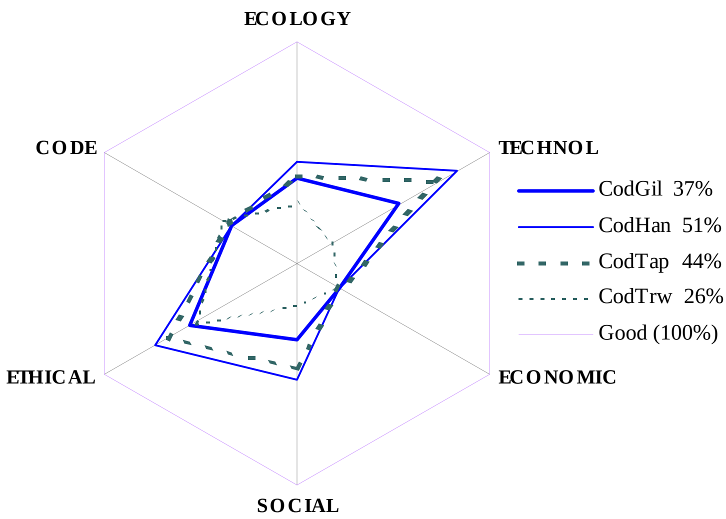


Figure 19. Kite diagram of six Rapfish evaluation fields showing status scores of Canadian Atlantic cod fisheries by gear type.

As a final example, Pacific salmon are expanded out by gear type in Figure 20. The three gears in decreasing order of Rapfish status are troll, gill and seine. All 3 are similar on the economic axis and close on ecology and the Code of Conduct, but show large differences in social, ethical and technological status. It is evident how a diagram like this might be useful in policy decisions. A recent buy-back scheme implemented by the Canadian Government in an attempt to reduce the salmon fleet capacity has had the effect of increasing the proportion of the seine sector, which is increasingly a large-scale corporate and metropolitan enterprise, at the expense, particularly of the owner-operated troll gear sector, largely from small coastal communities.

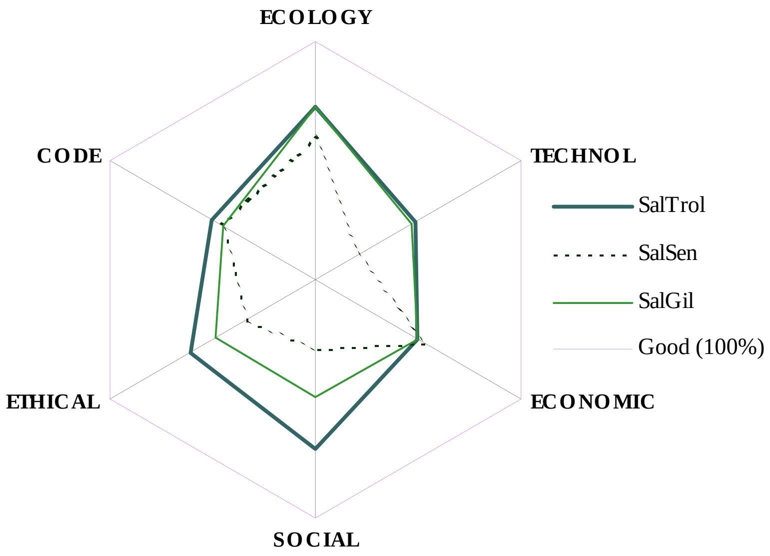


Figure 20. Kite diagram of six Rapfish evaluation fields showing status scores of Canadian Pacific salmon fisheries by gear type.

The provision of further information need not always involve kite diagrams. For example, in the kite in Figure 16, the social sustainability ratings for East and West coast fisheries appear to be the same, but this conceals some important differences. We can see this in Figure 21, which shows a frequency histogram of scores for the social sustainability Rapfish analysis, along the usual 0% to 100% status axis. East coast scores are above the line and West coast scores below the line. Although the means are similar, the distribution of status scores across the fisheries is rather different. Atlantic coast fisheries have an even spread, whereas on the Pacific coast there are groups of fisheries with high, medium and low social status.

Analysis of Status under the Code of Conduct

This section shows how we can examine Rapfish scores under the six Code of Conduct fields using kite diagrams. The kites are drawn so that the three Rapfish fields expressing 'intentions' are at the top, and the three field expressing 'effects' are at the bottom of the hexagon.

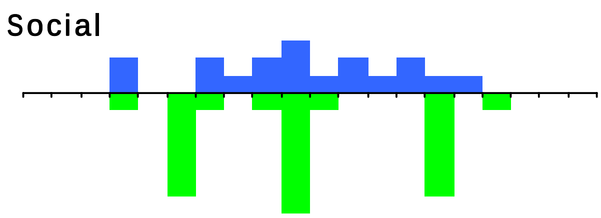


Figure 21. Frequency histogram of Rapfish social status scores for Canadian Atlantic (above line) and Pacific (below line) fisheries.

Figure 22 shows the ratings for the Canadian Atlantic and Pacific fisheries. The overall rating under the Code is in the legend. Status under the 'intentions' fields of Objectives, Framework and Precaution are surprisingly low, considering that Canada has strongly supported the development of the Code. (But please note that these results are based on preliminary sets of scores for the Code attributes).

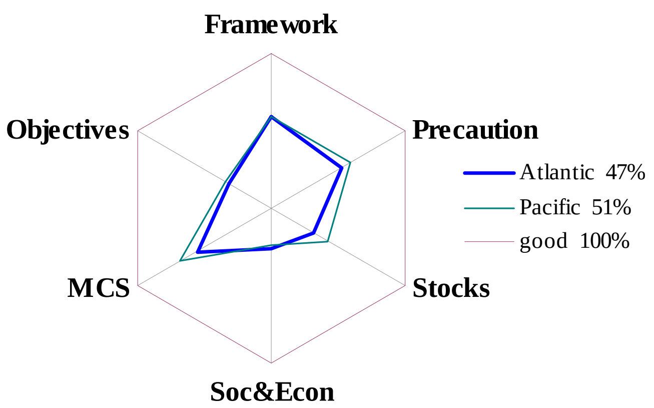


Figure 22. Hexagonal kite diagram summarizing average status scores of Canadian Atlantic and Pacific fisheries for six Code of Conduct Rapfish evaluation fields. Overall averages shown at the right.

For evaluations under the fields that are meant to express the effects of the Code, these Canadian fisheries have high scores for "MCS", but low averages for the "Social and Economic" and "Stock, fleets and gear".

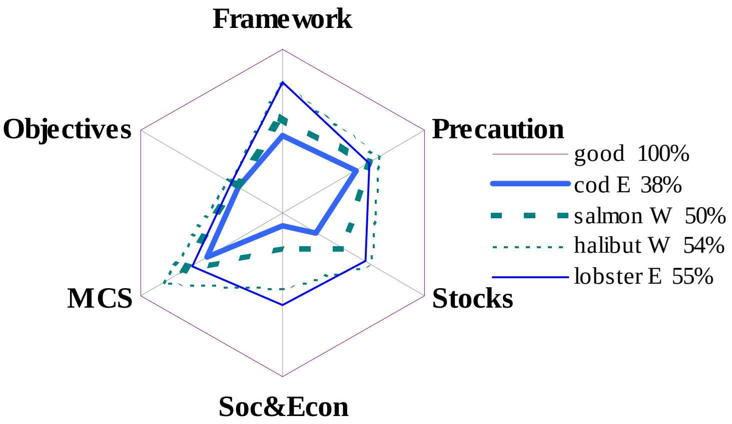


Figure 23. Kite diagram of Rapfish Code of Conduct evaluation fields showing status scores of four selected Canadian fisheries.

A 'Code' kite for some individual fisheries extracted from the set is shown in Figure 23. All show the high MCS scores seen in the left leaning tail of the kite. The Atlantic cod fishery (ranks 33 to 38 in Table 4 below) scores very poorly on the “social” and “stocks” axes, not surprisingly since it has undergone a major collapse. Pacific salmon (ranks between 8 and 37 in Table 4) has a similar shaped kite to cod, but with higher scores. Pacific halibut (rank 4) and Atlantic lobster (ranks 6 and 7) score much higher than average, but have kites of the same overall shape except for high scores on the Framework field.

Two high and two low scoring fisheries in the Code Rapfish analysis are compared in the kite in Figure 24. The kites' shapes reflect scores more evenly distributed among the axes for Atlantic snow crab area 19 (rank 5) and Pacific herring roe-on-kelp (rank 1). The snow crab fishery scores much lower on the ‘stocks, fleets and gear’ field. Both score very highly on the ‘framework’, ‘social and economic’ and MCS axes. Both low scoring fisheries, the Atlantic shrimp (rank 40) and Pacific groundfish trawl (rank 33) have kites of similar shape to the averages in Figure 22, although the latter rates highly under MCS largely on account of a compulsory 100% observer scheme.

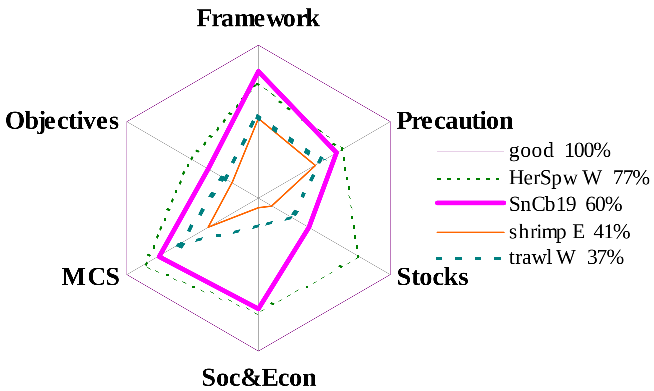


Figure 24. Kite diagram of Rapfish Code of Conduct evaluation fields showing status scores of the two top and two bottom scoring Canadian Atlantic and Pacific fisheries.

It can be concluded that the kite diagrams based on the Rapfish analysis can be employed to describe compliance with the sets of attributes extracted from the Code of Conduct in a hierarchical and detailed fashion, as with the main Rapfish field discussed above.

Analysis of Rankings

Fisheries may be compared using the Rapfish evaluation scheme in other ways. For example, where the original attribute scores are subject to a high degree of uncertainty, it may be desirable to examine the rank order of fisheries rather than the use the percentage status values.

The first column in Table 4 lists the rank orders of the fisheries in the Canadian example under the Code of Conduct for Responsible Fisheries evaluation field. The rank order of each fishery under each of the other five Rapfish analysis fields is listed in columns alongside.

RANK ORDERS	**Code**	**Ecolog.**	**Technol.**	**Econ.**	**Social**	**Ethical**
Herring spawn-on-kelp	1	4	2	1	1	1
Herring, Zone 4WX, Weir (NS)	2	30	4	20	10	2
Lingcod, 1996	3	21	5	15	40	33
Halibut	4	1	29	23	28	31
Crab (Snow), Area 19 (NS)	5	28	12	26	2	8
Lobster, Dingwall (NS)	6	29	7	25	17	11
Lobster (Atlantic)	7	24	7	29	14	18
Salmon, Chinook, Troll	8	14	14	11	5	9
Salmon, Coho, Troll	8	18	16	8	7	13
Salmon, Sockeye, Troll	10	3	11	18	9	4
Herring, Zone 4WX, Seine (NS)	11	26	26	27	29	24
Salmon, Troll	12	12	18	17	4	10
Herring, 1996	13	11	31	24	16	32
Salmon, Chum, Troll	14	5	15	13	6	15
Salmon, Pink, Troll	15	6	17	21	8	12
Salmon, Chinook, Seine	16	33	38	3	38	41
Salmon, Coho, Seine	16	36	40	4	36	40
Salmon, Chinook, Gillnet	18	10	20	9	22	27
Salmon, Sockeye, Seine	19	22	36	6	34	38
Salmon, Coho, Gillnet	20	25	22	12	20	28
Salmon, Sockeye, Gillnet	21	9	24	19	18	25
Salmon, Seine	22	31	35	7	39	37
Salmon, Gillnet	23	13	19	16	23	26
Salmon, Chum, Seine	23	16	37	5	37	36
Salmon, Pink, Seine	23	20	39	10	35	35
Salmon, Chum, Gillnet	26	7	21	14	21	29
Salmon, Pink, Gillnet	27	8	23	22	19	30
Crab (Snow)	28	34	9	31	12	23
Mackerel (Atlantic)	29	23	25	42	27	22
Mackerel, Dingwall (NS)	29	17	30	34	3	20
Caplin (NF)	31	19	27	41	13	17
Northern Cod (2J3KL), Trawls (otter)	32	41	42	40	41	21
Groundfish trawl	33	35	34	2	33	42
Northern Cod Offshore	34	42	41	39	42	34
Northern Cod (2J3KL), Traps	35	39	3	38	26	5
Northern Cod Inshore	36	38	10	35	30	6
Northern Cod (2J3KL), Handlines	37	37	1	36	15	3
Northern Cod (2J3KL), Gillnet	38	40	13	37	32	16
Scallops	39	27	28	33	11	7
Shrimp (northern) (NF)	40	32	32	32	31	19
Shrimp (northern), E. Sct Shelf Trawl	40	2	33	28	24	14
Lingcod, 1989, SoG	42	15	5	30	25	39

Table 4. Rank orders of Canadian fisheries in the Code of Conduct RAPFISH ordination, alongside rank orders from five other analysis field. Italics indicate east coast fisheries. Horizontal lines show upper and lower quartiles of Code analysis. See Table 3 for further information about fisheries.

Table 5 indicates that Rapfish rankings under the Code are weakly correlated with social, ecological and economic analysis fields, most strongly with the latter, which is surprising given the lack of explicit economic indicators in the Code.

	Ecological	Technol.	Economic	Social	Ethical
Technical	0.08				
Economic	0.34	-0.15			
Social	0.46	0.55	-0.03		
Ethical	0.05	0.64	-0.36	0.68	
Code	0.36	0.26	0.52	0.35	0.12

Table 5. Correlations among rank orders of 42 fisheries analyzed by Rapfish in six fields. Shaded cells are non significant at the 5% level. (Spearman non-parametric correlations).

The overall correlation analyses conceal some important features however. For example, the top ranking fishery, Pacific herring roe-on-kelp, is always in the top 4. Significantly more fisheries always appear in the lower quartile than by chance (Table 6). Note, however that the BC trawl fishery ranks second economically yet bottom ethically, and is in the lower quartile in all the other analysis fields.

	Ecological	Technol.	Economic	Social	Ethical
Upper quartile	3	5	2	5	5
Lower quartile	7	4	7	3	3

Table 6. Number of fisheries in upper and lower quartiles of Code rankings (11 fisheries in each quartile) that also fall in same location in other Rapfish evaluation fields. Shaded cells = non significant according to Chi square.

In general, however, the correlations among the different Rapfish evaluation fields are quite low. The highest correlation, between the Social and Ethical fields, has a coefficient of determination of only 46%. These results suggest that, at least for this data set, the Rapfish analysis fields express different aspects of fishery status.

Conclusions

This FAO Circular shows some of the ways in which a rapid evaluation technique, Rapfish, can be used in a hierarchical fashion to improve the resolution of advice that can be evaluated when policy decisions are made for fisheries.

An evaluation field for the Code of Conduct for Responsible Fisheries has been added to the five previous evaluation fields; ecological, economic, social and technological sustainability and ethical status. The application of the Code of Conduct is a provisional draft, and comments for improvements are welcomed. The Code Rapfish field provides a framework for partitioning compliance of a fishery with the both the spirit and much specific detail of the Code into status scores for intentions and effects. Each of these is broken down further into 3 fields that map onto sections of Article 7 of the original Code.

A worked example applied to Pacific and Atlantic fisheries in Canada is described.

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ANNEX

Annex Table 1. Attributes currently used in Rapfish analyses for ecological, technological, economic, social and ethical evaluation fields. (Revised January 1999 by tjp & mp).

	Scoring	Good	Bad	Notes
Ecological analysis				
Exploitation status	0; 1; 2; 3	0	3	FAO-like scale: under- (0); fully- (1); heavily- (2); or over-exploited (3) [can consult FAO website for status]
Recruitment variability	0; 1; 2	0	2	COV: low <40% (0); medium 40-100% (1); or high >100% (2)
Trophic level	number	High	Low	average trophic level of species in catch
Change in trophic level	0; 1; 2	0	2	Is trophic level of fisheries sector decreasing: no (0), somewhat, slowly (1); rapidly (2).
Migratory range	0; 1; 2	0	2	# of jurisdictions encountered during migration (includes international waters): 1-2 (0); 3-4 (1); >4 (2)
Range collapse	0; 1; 2	0	2	Is there evidence of geographic range reduction: no (0); a little (1); a lot, rapid (2).
Size of fish caught	0; 1; 2	0	2	Has average fish size landed changed in past 5 years; no (0); yes, a gradual change (1); yes, a rapid large change (2).
Catch before maturity	0; 1; 2	0	2	percentage caught before maturity: none (0); some (>30%) (1); lots (>60%) (2)
Discarded by-catch	0; 1; 2	0	2	percentage of target catch: low 0-10% (0); medium 10-40% (1); high >40% (2)
Species caught	0; 1; 2	0	2	includes species caught as by-catch: low 1-10 (0); medium 10-100 (1); high >100 (2)
Primary production	0; 1; 2; 3	3	0	g C/m^2/year: low 0-50 (0); medium 50-90 (1); high 90-160 (2); very high >160 (3)
Economic analysis				
Price	0; 1; 2; 3; 4; 5	5	0	$/tonne of landed product for time of data point; >$250 (0); 250-900 (1); 900-1500 (2); 1500-3000 (3); 3000-5000 (4); >5000 (5)
Fisheries in GDP	0; 1; 2	2	0	Importance of fisheries sector in national economy: low(0); medium (1); high(2)
GDP/Person	$/capita	High	Low	in region (country, province, etc) of fishery
Limited entry	0; 1; 2	2	0	includes informal limitations: almost none (0); some (1); lots (2)
Marketable right	0; 1; 2	2	0	marketable right/quota/share? none (0); some (1); full ITQ (2)
Other income	0; 1; 2; 3	0	3	in this fishery, fishing is mainly: casual (0), part-time (1); seasonal (2); full-time (3)
Sector employment	0; 1; 2	0	2	employment in formal sector of this fishery: <10% (0); 10-20% (1); >20% (2)
Ownership	0; 1; 2	0	2	profit from fishery mainly to: locals (0); mixed (1); foreigners (2)
Market	0; 1; 2	0	2	market is principally: local/national (0); national/regional (1); international (2)
Subsidy	0; 1; 2	0	2	Are subsidies (including hidden) provided to support the fishery?: no (o); somewhat (1); large subsidies (2).
Sociological analysis				
Socialization of fishing	0; 1; 2	2	0	fishers work as: individuals (0); families (1); community groups (2)
Fishing community growth	0; 1; 2	0	2	Growth over past ten years: <10% (0); 10-20% (1); >20% (2).
Fishing sector	0; 1; 2	0	2	households in fishing in the community: <1/3 (0); 1/3-2/3 (1); >2/3 (2)
Environmental knowledge	0; 1; 2	2	0	Level of knowledge about environmental issues and the fishery: none (0); some (1) ; lots (2)
Education level	0; 1; 2	2	0	education level compared to population average: below (0); at (1); above (2)

Conflict status	0; 1; 2	0	2	level of conflict with other sectors: none (0); some (1); lots (2)
Fisher influence	0; 1; 2	2	0	strength of direct fisher influence on actual fishery regulations: almost none (0); some (1); lots (2)
Fishing income	0; 1; 2	2	0	fishing income as % of total family income: <50%; 50-80%; >80%
Kin participation	0; 1	1	0	do kin sell and/or process fish? no (0); yes (1)
Technological analysis				
Trip length	days	Low	High	average days at sea per fishing trip
Landing sites	0; 1; 2	0	2	are landing sites: dispersed (0); somewhat centralised (1); heavily centralised (2)
Pre-sale processing	0; 1; 2	2	0	processing before sale, ex. gutting, filleting: none (0); some (1); lots (2)
Use of ice	0; 1; 2; 3	3	0	none (0); some (1); sophisticated (ex. flash freezing, champagne ice) (2); live tanks (3)
Gear	0; 1	0	1	gear is: passive (0); active (1)
Selective gear	0; 1; 2	2	0	device(s) in gear to increase selectivity? few (0); some (1); lots (2)
Power gear	0; 1	0	1	is gear power-assisted? no (0); yes (1)
FADS	0; 0.5; 1	0	1	are FADS: not used (0); bait is used (0.5); used (1)
SONAR	0; 0.5; 1	0	1	is SONAR used? no (0); sounders are used (0.5); yes (1)
Vessel size	0; 1; 2	0	2	Average length of vessels: <8 m (0); 8-17 m (1); >17 m (2)
Catching power	0; 1; 2	0	2	Have fishers altered gear and vessel to increase catching power over past 5 years?: no (0); somewhat (1); a lot, rapid increase (2).
Gear side effects	0; 1; 2	0	2	Does gear have undesirable side effects (e.g. cyanide, dynamite, trawl); no (0); some (1); a lot (2).
Ethical analysis				
Adjacency and reliance	0; 1; 2; 3	3	0	geographical proximity & historical connection: not adjacent/no reliance (0); not adjacent/some reliance (1); adjacent/some reliance (2); adjacent/strong reliance (3)
Alternatives	0; 1; 2	2	0	alternatives to the fishery within community: none (0); some (1); lots (2)
Equity in entry to fishery	0; 1; 2	2	0	is entry based on traditional/historical access/harvests? not considered (0); considered (1); traditional indigenous fishery (2)
Just management	0; 1; 2; 3; 4	4	0	inclusion of fishers in management: none (0); consultations (1); co-mgmt/gov't leading (2); co-mgmt/comm. leading (3); genuine co-mgmt with all parties equal (4)
Influences – ethical formation	0; 1; 2; 3; 4	4	0	structures which could influence values: strong negative (0); some negative (1); neutral (2); some positive (3); strong positive (4)
Mitigation – habitat destruction	0; 1; 2; 3; 4	4	0	Attempts to mitigate damage to fish habitat: much damage (0); some damage (1); no ongoing damage or mitigation (2); some mitigation (3); much mitigation (4)
Mitigation – ecosystem depletion	0; 1; 2; 3; 4	4	0	Attempts to mitigate fisheries-induced ecosystem change: much damage (0); some damage (1); no damage or mitigation (2); some mitigation (3); much mitigation (4)
Illegal fishing	0; 1; 2	0	2	illegal catching/poaching/transshipments: none (0); some (1); lots (2)
Discards & wastes	0; 1; 2	0	2	discard and waste of fish: none (0); some (1); lots (2)

Annex Table 2. Extracts from a spreadsheet providing a summary of clauses in Article 7 of the FAO Code of Conduct for Responsible Fisheries, their relation to the checklist drawn up by Caddy (1996), and the Rapfish fields and attributes abstracted from them. Notes are working comments used in selecting and prioritizing scorable Rapfish attributes. Cy # = reference number in Caddy 1996. For further discussion, see text.

Article	code#	Cy #	Checklist item	Notes on potential Rapfish attribute
General	**7.1**			
	7.1.1	a	best scientific evidence?	(unscoreable)
	7.1.1	b	sustainable, optimal aims?	(unscoreable)
	7.1.1	c	long term?	(unscoreable)
	7.1.2	a	stakeholders indentified?	see Framework 4
	7.1.2	b	stakeholders consulted?	Code says "try" to consult
	7.1.3	a	coop over transboundary fish	see Framework 5 also
	7.1.3	b	international commission?	
	7.1.4	a	coop in regional body	see Framework 5
	7.1.4	b	meet and collect data	
	7.1.4	c	pop analysis updated coop and regular	
	7.1.4	d	sci recommends reflected in regs?	
	7.1.4	e	regulations respected?	respected?
	7.1.6	a	all may attend meetings?	see Framework 5
	7.1.6	b	timely access to meeting minutes?	
	7.1.7	a	M S C and enforce measures exist?	see MCS
	7.1.7	b	effective?	
	7.1.8	a	measures to elim excess capacity?	see Management 1
	7.1.8	b	effective?	
	7.1.9		assessment transparent	see Framework 5
	7.1.9		management transparent	repeated elsewhere
	7.1.9		decision-making transparent	repeated elsewhere
	7.1.10		laws disseminated?	unscoreable?
Management Objectives	**7.2**			Management Objectives
	7.2.1	a	best sci evidence?	repeats 7.1.1.a
	7.2.1	b	environmental and economic qualifiers?	should be split? Does 'qualified' mean modified?
	7.2.1	c	formal ref points stock size established?	1. formal stock reference points?
	7.2.2		(see sections below)	many many things included in one para!
	7.2.2 a		excess capacity defined?	see also 7.1.8
	7.2.2 a		excess capacity avoided?	2. fleet capacity?
	7.2.2 b		economics promote responsible fishery?	a major debating point if it can?
	7.2.2 c		small-scale fishers interests ok?	3. small-scale fisheries interests?
	7.2.2 d		biodiversity conserved?	4. biodiversity protected?

	7.2.2	e		depleted stocks rebuilt?	5. depleted stocks restored?
	7.2.2	f		environ impacts IDd, rectified	6. human environmental impacts?
	7.2.2	g		pollution and waste minimised?	confuses these two
	7.2.2	g		ghost catch minimized	7. "wise' fishing gear ?
	7.2.2	g		Environ safe and cost effective fishing?	confuses the two
	7.2.3			impacts on assoc species assessed?	8. ecosystem interactions ?
	7.2.3			environmental factors evaluated?	9. environmental influences?
Framework and Procedures	**7.3**				Framework (data & procedures)
	7.3.1		a	whole stock area?	
	7.3.1		b	Previous agreed management consid?	
	7.3.1		c	all removals and biol unity?	confounds two things -all 'removals' good
	7.3.1		d	sci evid for total stock area?	
	7.3.1		e	all removals and biol unity?	almost identical to C
	7.3.1		f	area of whole life cycle considered?	1. all removals covers most of these?
	7.3.2			Intl regs compatible?	2. compatibility of measures?
	7.3.3			a plan?	3, long-term objectives ?
	7.3.3			plan subscribed to?	agreed?
	7.3.4			intl coop on info exchange	merge with internal transparency
	7.3.4			on fisheries research	
	7.3.4			on fisheries management	
	7.3.4			on fisheries development	
	7.3.5			consult with non-fishery bodies	likely causes problems
	7.1.2			from above	4. all stakeholders? See 7.1.2
	7.1.9			from above	5. transparency ? See 7.1.9 and 7.4.7
Data Gathering &	**7.4**				
Management Advice	7.4.2			research on resource?	covered essentially under Precaut
	7.4.2			research on climate & env?	covered essentially under Precaut
	7.4.2			research on socio-economics?	see 7.4.5
	7.4.3			res on cost-benefits?	see 7.2.2. and attribute 1 under management
	7.4.3			res on alternative mangmt strategies?	
	7.4.4			stats maintained and detailed	6. statistics verified?
	7.4.5			soc, economic institutional info from res?	7. social, economic & institutional ?
	7.4.6			format of intl data agreed?	see Framework 2
	7.4.6			intl data timely?	see Framework 2
	7.4.7			data confidential when needed?	
Precautionary Approach	**7.5**				Precautionary Approach
	7.5.1		a	pc used?	precautionary approach in plan?
	7.5.1		b	no info used as excuse	uncertainty explicit ?
	7.5.3	a		target ref points established?	target ref. points ?
	7.5.3	b		limit ref points established?	limit ref. points ?

	7.5.3		fishery status meas. in rel to ref pts?	ref points in already
	7.5.3		mgmt action agreed in rel to status	
	7.5.4	a	new fishery precautionary	uneccessary if other precaut points adopted.
	7.5.4	b	gradual and info for a new one?	new fisheries developed gradually
	7.5.4		early precaut on anew?	uneccessary if other precaut points adopted.
	7.5.4		info for impact assessment	
	7.5.4			changes examined with regard to long-term sustainabilty (as with a new fishery) - repeated
	7.5.5	a	contingency plans?	see below
	7.5.5	b	contingency for natural impacts?	contingency environment?
	7.5.5		contingency for fishing impacts?	contingency fishing ?
Management Measures	**7.6**			Management Measures
	7.6.1		allowed fishing fit stock status?	
	7.6.2		open access?	access control effective? To MCS
	7.6.3	a	fleet capacity measured?	
	7.6.3	b	measures to reduce fleet capacity?	excess capacity reduced? See 7.2.2
	7.6.3			irresponsible phased out?
	7.6.5		regs to min conflicts?	avoids inter-sectoral conflict? To Social
	7.6.6		Indig. local communities considered?	indigenous peoples respected? To Social
	7.6.6		(above separated out)	local fishing communities needs met? To Social
	7.6.7		cost effective & social impact	cost effectiveness of changes evaluated To Social
	7.6.7		(above separated out)	social impact of changes evaluated To Social
	7.6.8		measures under continuous review?	continuous review ? To Precaut
	7.6.8		review procedures established?	to Precaut
	7.6.8		revise mgmt procs?	to Precaut
	7.6.9	a	minimise waste and discard?	
	7.6.9		minimise non target spp	
	7.6.9		impacts on endangered spp or dep spp	into ecosystem
	7.6.9	b	Fish size regs?	goes into gear attributes
	7.6.9		mesh size or gear regs	by-catch minimised?
	7.6.9		discards	discards minimised?
	7.6.9		closed season	ghost fishing minimised?
	7.6.9		closed areas	no-take areas ?
	7.6.9		areas reserved for a sector?	why? If not 7 below
	7.6.9		protect juveniles or spawner	juveniles and spawners protected?
	7.6.9	c	good gear developed?	'wise' gear employed See 7.2.2.
	7.6.10		ID depleted and rebuild them?	depleted stocks rebuilt. See 7.2.2.
Implementation	**7.7**			Implementation (MCS)
	7.7.1		legal framework for fish mang?	who will deny this?
	7.7.2	a	laws that provide sanctions?	4. Sanctions also see 7.6.2

	7.7.2	b	laws adequate severity?	
	7.7.2	c	laws stop transgressor fishing?	
	7.7.3		MCS scheme?	all atts to cover this
	7.7.3		observer programme	1. observers effective??
	7.7.3		inspection scheme	2. catch inspection working?
	7.7.3		vessel monitoring scheme	3. vessel monitoring effective?
	7.7.4	a	can pay for these laws?	
	7.7.4		agreement to finance?	
	7.7.4		agreement on relative benefits?	
	7.7.4	b	cost recovery possible?	cost recovery
	7.7.4		agreement on cost recovery?	
	7.7.5	a	consistent with intl law	
	7.7.5	b	non-flag vessels deterred?	4 non flag vessels deterred?
Financial Institutions	**7.8**			
	7.8.1		banks don’t encourage flags of convenience.	see 7.7.5. MCS 4

Annex Table 3. List of Attributes for Rapfish implementation of Article 7 of the Code of Conduct for Responsible Fisheries, implemented as a series of scorable questions. Table shows attribute scores for fixed reference points used in the analysis for the best (= 'good') and worst (= 'bad') possible fisheries. Also shown are the principal clauses in the Code to which each question refers (See also Annex Table 1).

Management Objectives		**Reference Points**		**Code Clauses**	
	SCORES INTENTIONS OF MANAGEMENT	BAD	GOOD	**main**	**other**
attributes					
1	Are formal reference points for the fish stock in this fishery identified using best science available? No (0); partially(1); completely (2).	0	2	7.2.1	7.1.1
2	Is present fleet capacity calculated? No (0); calculated (1); target capacity defined (2); measures to reduce capacity implemented (3). (score 3 in the unlikely event that fleet fishing capacity would be within safe limits with no time or space restrictions)	0	3	7.2.2	7.1.8
3	Are small scale fishers considered in plan? No (0); considered but not consulted (1); consulted informally (2); institutional structures for ongoing consultation (3); plus up to an extra point if small-scale fisher's opinions often acted upon. (max 4)	0	4	7.2.2	7.1.2
4	Impacts of fishery on biodiversity allowed for in plan? No (0); some impacts assessed (1); most impacts assessed and mitigated (2); full impacts mitigated in management plan (3)	0	3	7.2.2	7.2.3
5	Does the management plan aim to restore depleted stocks in this fishery? No (0); slowly (1); rapidly (2)	0	2	7.2.2	7.1.1
6	Are human impacts (pollution, waste) on the fishery habitat identified? No (0); partially identified (1); identified and plan includes measures to mitigate (2); complete mitigation in plan (3)	0	3	7.2.2	7.2.1
7	Is fishing gear mandated by the management plan to avoid by-catch of non-target species, environmental and habitat damage? No (0); in part (1); totally (2)	0	2	7.2.2	7.4.2
8	Are ecosystem linkages with this fishery made explicit in the management plan? No(0); identified (1); made fully explicit (2); & adverse ecosystem impacts minimised (3)	0	3	7.2.3	7.3.1
9	Are environmental influences on this fishery made explicit in the management plan? No(0); identified (1); made fully explicit (2); & adverse impacts minimised (3)	0	3	7.2.3	7.2.1
Framework (data & procedures)					
	SCORES WAYS INTENTIONS ARE IMPLEMENTED				
Attributes		BAD	GOOD		
1	Are total & complete removals from this stock over the whole stock area and over whole life cycle accounted for in assessment? No (0); somewhat (1); mostly with a few omissions (2); almost completely (3).	0	3	7.3.1	7.4.2
2	Are management measures compatible with those of other jurisdictions concerned with this stock? No (0); in part(1); almost completely (2). (Score 2 if not applicable to this fishery, eliminate attribute if not applicable to any other fisheries in analysis)	0	2	7.3.2	7.1.3
3	Does the management plan have clearly stated long-term objectives? No(0); in part (1); absolutely clear (2).	0	2	7.3.3	7.1.1
4	Are all the stakeholders in this fishery resource identified and considered? No, only government interests (0); score one for each group represented: large-scale industry; small-scale fishers; local communities; conservation, recreational and public groups. (Max = 4). (Score max if one group genuinely does not apply).	0	4	7.1.2	7.1.6
5	Are data, management process and decision-making open and transparent, including any international aspects? No, closed except to management (0); informed only when necessary (1); regularly consulted (2); participation in decisions (3); full co-management in decision-making (4).	0	4	7.1.9	7.1.6
6	Are timely, complete and reliable statistics collected and verified? No(0); collected partially (1); collected almost complete (2); plus timely - i.e. available in less than 6 months (3); plus attempts at verification (4); almost totally satisfactory verification (5)	0	5	7.4.4	7.1.4
7	Are social, economic and institutional factors related to sustainability evaluated with data? No(0); score one point for each, plus additional point for interdisciplinary analysis (4)	0	4	7.4.5	7.4.2

		BAD	GOOD		
Precautionary Approach					
SCORES PRECAUTIONARY INTENTIONS AND ACTIONS					
Attributes					
1	Is precaution explicitly enshrined in legislation, and is applied to management of this fishery stock? No(0); in legislation (1); and applied to this stock (2).	0	2	7.5.1	
2	Is uncertainty, including lack of appropriate information, quantified and used to restrain fishing that might otherwise occur? No(0); in part (1); a great deal (2); plus add one point for full quantification of uncertainty (3)	0	3	7.5.1	7.4.3
3	Are stock-specific target reference points estimated and employed? No(0); estimated (1); & actively employed (2); working almost totally satisfactorily (3)	0	3	7.5.3	7.2.1
4	Are stock-specific limit reference points estimated and employed? No(0); estimated (1); & actively employed (2); working almost totally satisfactorily (3)	0	3	7.5.3	7.2.1
5	Are there viable contingency plans to restrict fishing in the event of an environmental emergency? No (0); plan exists (1);a good plan with rapid-acting triggers exists (2); almost completely satisfactory plan and triggers in place (3)	0	3	7.5.5	
6	Are there viable contingency plans to restrict fishing in the event of an unforeseen emergency caused by excess fishing ? No (0); plan exists (1);a good plan with rapid-acting triggers exists (2); almost completely satisfactory plan and triggers in place (3)	0	3	7.5.5	
7	Are management instruments under continuous review? No(0); infrequently and informal review (1); formal review (2); formal review every year (3).	0	3	7.6.8	7.1.4
8	Are no-take areas of sufficient size to work, established, policed and monitored as an insurance? Add up to one one point for effective policing; add up to one point for effective monitoring. No (0); no-take areas less than 1% of EEZ (1); 1-5% of EEZ (2); 5-10% (3). (max 5)	0	5	7.6.9	
9	Are plans in place to restrict fishing if species linked through the ecosystem to the target(s) of this fishery become threatened? Add up to one point for effective monitoring of potentially endangered species. No(0); informal plans (1); formal plans in place, tested with simulations (2). (max 3)	0	3	7.2.2	7.2.3

		BAD	GOOD		
Stocks, fleets and gear					
SCORES RESULTS OF MANAGEMENT					
attributes					
1	Is excess fleet capacity being reduced? No (0); partially with a long way to go (1); a great deal (2); completely effectively (3)	0	3	7.6.3	7.2.2
2	Are fishing methods known to be harmful to habitats, to create by-catch problems, or whose high fishing capacity is difficult to control, being phased out? No(0); partial phasing out (1); substantial, effective and monitored plans for phasing out (2)	0	2	7.6.3	7.2.2
3	Is by-catch of non-target species minimised? Score up to an extra point for the introduction of gear technology designed to reduce by-catch. Score an extra point if such devices are mandatory. No, there are serious problems with by-catch (0); some attempts to assess and reduce by-catch (1); reduction of by-catch is a priority and there is considerable action to reduce it (2); almost completely successful reduction of by-catch (3). (Max 5)	0	5	7.6.9	7.2.3
4	Are discards minimised? Score up to an extra point if discards are effectively reported, or banned. No (0); some attempt to reduce discards (1); almost completely effective reduction of discards (2). (max 3)	0	3	7.6.9	7.2.3
5	Is gear designed to minimise ghost fishing if lost? No (0); partially (1); effectively (2).	0	2	7.6.9	7.2.2
6	Is the fishing of juveniles and spawners restricted to safe levels? Add up to an extra point for effective monitoring of under-age and spawner removals. No (0); partially (1); almost completely satisfactorily (2) (Max 3)	0	3	7.6.9	7.2.2
7	Are depleted stocks being rebuilt? No (0); the intention is to rebuild, but its not very effective (1); effective rebuilding (2); almost completely satisfactory rebuilding of stocks (3).	0	3	7.6.10	7.2.2

		BAD	GOOD		
Social & Economic					
	SCORES RESULTS OF MANAGEMENT				
Attributes		BAD	GOOD		
1	Is the fishery managed so as to minimise conflict among different sectors? No (0); partially (1); almost completely effective (2)	0	2	7.6.5	7.1.9
2	Are Indigenous Peoples rights and needs being met? No (0); established and partially met (1); almost fully respected (2)	0	2	7.6.6	7.4.5
3	Are the needs of local fishing communities being met? No (0); identified and partially met (1); almost completely met (2)	0	2	7.6.6	7.1.6
4	When a change to the management of the fishery is made, is its cost-effectiveness evaluated? No (0); evaluated, but little modification of change (1); plans are modified according to the results (2).	0	2	7.6.7	7.2.2
5	When a change to the management of the fishery is made, is its social impact evaluated? No (0); evaluated, but little modification (1); plans are modified according to the results (2).	0	2	7.6.7	7.4.2
6	Is funding for the research and the MCS programme obtained by cost recovery from the industry? No (0); partially (up to 50%) (1); substantially, 50 - 90% (2); fully (more than 90%) (3).	0	3	7.7.4	7.4.3
Monitoring, Control & Surveillance (MCS)					
	SCORES RESULTS OF MANAGEMENT				
Attributes		BAD	GOOD		
1	On a five point scale, how effective is the observer scheme? No scheme (0) to almost fully effective (4)	0	4	7.7.3	7.1.7
2	On a five point scale, how effective is the catch inspection scheme? No scheme (0) to almost fully effective (4)	0	4	7.7.3	7.4.4
3	On a five point scale, how effective is the vessel monitoring scheme? No scheme (0) to almost fully effective (4)	0	4	7.7.3	7.4.4
4	Are non-flag vessels fishing illegally in the area of this fishery? No (0); occasionally (1); often (2); a great deal - half as much as legal vessels (3); almost as much as, or more than legal vessels (4). If no information available, score 4.	4	0	7.7.5	7.7.1
5	On a five point scale, how effective is control of access in stopping illegal fishing ? Not at all effective (0) to almost fully effective (4)	0	4	7.6.2	7.8.1
Total	**43 attributes scored in 6 evaluation fields**				

Annex Table 4: Sources of Information for Canadian Fisheries.

Sources for Specific Attributes for all fisheries:

Exploitation Status – Atlantic fisheries: FAO Table I: "State of Exploitation, total production and nominal catches by selected species groups fished in the Northwest Atlantic (FAO Statistical Area 21), in metric tonnes, years 1950-94." www.fao.org/waicent/faoinfo/fishery/publ/circular/c920/tab1.htm

Exploitation Status – Pacific fisheries: FAO Table XI: "State of Exploitation, total production and nominal catches by selected species groups fished in the Northeast Pacific (FAO Statistical Area 67), in metric tonnes, years 1950-94." www.fao.org/waicent/faoinfo/fishery/publ/circular/c920/tab11.htm

Recruitment Variability – FishBase 1997 and 1998

Trophic Level – FishBase 1997 and 1998

Primary Production – *Philip's Atlas of the Oceans*

GDP/Person – Statistics Canada (No. 13-213-PPB)

Atlantic Fisheries:

Species	Location	Symbol on Plots	Period	Sources
Capelin	Newfoundland	Cap	Mid-1990s	G. Brothers; Carscadden; Cashin (1993); DFO website; E. Johnson; SSR 96/23; M. Morris; B. Neis; R. Ommer
Crab (Snow)	Atlantic coast	SnwCb	Mid-1990s	G. Brothers; E. Dawe; B. Neis; R. Ommer; Res Doc 97/08; SSR 96/15; J. Tremblay
Crab (Snow)	Area 19, Cape Breton	SnCb19	Mid-1990s	B. Adams; R. Ommer; SSR C3-01
Herring – Seine	Bay of Fundy	BFunS	Mid-1990s	R. Ommer; Pitcher et al
Herring – Weir	Bay of Fundy	BFunW	Mid-1990s	R. Ommer; Pitcher et al
Lobster	Atlantic coast	Lob	Mid-1990s	Canadian Fisheries Landings; FRCC 95 R21; SSR C2-03; R. Ommer; D. Pezzack; J. Tremblay
Lobster	Dingwall, Cape Breton	LobDing	Mid-1990s	FRCC 95 R21; K. Fitzgerald; R. Ommer
Mackerel	Atlantic coast	MakAt	Mid-1990s	Canadian Fisheries Landings; F. Grégoire; R. Ommer;
Mackerel	Dingwall, Cape Breton	MakDin	Mid-1990s	F. Grégoire; K. Fitzgerald; R. Ommer;
Northern Cod – Gillnet	Newfoundland	CodGil	1991	Cashin (1993); S. Guénette; E. Johnson; B. Neis (1992); R. Ommer; SSR 96/45E
Northern Cod – Handline	Newfoundland	CodHan	1991	Cashin (1993); S. Guénette; E. Johnson; B. Neis (1992); R. Ommer; SSR 96/45E
Northern Cod – Trap	Newfoundland	CodTap	1991	Cashin (1993); S. Guénette; E. Johnson; B. Neis (1992); R. Ommer; SSR 96/45E
Northern Cod – Inshore	Newfoundland	CodIn	1991	Cashin (1993); S. Guénette; E. Johnson; B. Neis (1992); R. Ommer; SSR 96/45E
Northern Cod – Otter Trawl	Newfoundland	CodTrw	1991	G. Brothers; Cashin (1993); S. Guénette; E. Johnson; B. Neis (1992); R. Ommer; SSR 96/45E
Northern Cod – Offshore	Newfoundland	CodOff	1991	G. Brothers; Cashin (1993); S. Guénette; E. Johnson; B. Neis (1992); R. Ommer; SSR 96/45E
Scallops	Maritimes	Sclp	Mid-1990s	G. Brothers; R. Ommer; G. Roberts
Shrimp (Northern)	Atlantic coast	NShp	Mid-1990s	G. Brothers; DFO website; R. Ommer; D. Parsons; *Canadian Fisheries – Responsible Fisheries Summary*; SSR 96/17; SSR C2-05;
Shrimp (Northern)	Eastern Scotian Shelf Trawl	NShpES	Mid-1990s	P. Koeller; R. Ommer; Press Release NR-M-98-13E; SSR C3-15

Pacific Fisheries:

Species	Location	Symbol on Plots	Period	Sources
Groundfish – Trawl	British Columbia	Grnd97	Mid-1990s	A. Beattie; R. Bonfil
Halibut	British Columbia	PacHal	Mid-1990s	A. Beattie; C. Sporer
Herring	British Columbia	BC96	Mid-1990s	*1998 Integrated Management Plan: Roe Herring*; S. Mackinson; Pitcher et al;
Herring Spawn-on-kelp	British Columbia	HerSpw	Mid-1900s	*1998 Management Plan: Herring Spawn-on-kelp*; S. Mackinson; Pitcher et al; C. Sporer; *The 1996 British Columbia Seafood industry year in review*; G. Thomas;
Lingcod	Strait of Georgia, BC	Ling89	1989	S. Martell
Lingcod	British Columbia	Ling96	Mid-1990s	S. Martell
Salmon – Gillnet	British Columbia	SalGil	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Seine	British Columbia	SalSen	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Troll	British Columbia	SalTrol	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. McKee; C. Sporer; J. Sutcliffe; C. Young
Salmon – Chinook, Gillnet	British Columbia	ChinGil	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Chinook, Seine	British Columbia	ChiSen	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Chinook, Troll	British Columbia	ChiTrol	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. McKee; C. Sporer; J. Sutcliffe; C. Young
Salmon – Chum, Gillnet	British Columbia	CmGil	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Chum, Seine	British Columbia	CmSen	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Chum, Troll	British Columbia	CmTrol	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. McKee; C. Sporer; J. Sutcliffe; C. Young
Salmon – Coho, Gillnet	British Columbia	CohGil	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Coho, Seine	British Columbia	CohSen	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Coho, Troll	British Columbia	CohTrol	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. McKee; C. Sporer; J. Sutcliffe; C. Young
Salmon – Pink, Gillnet	British Columbia	PkGil	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Pink, Seine	British Columbia	PkSen	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Pink, Troll	British Columbia	PkTrol	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. McKee; C. Sporer; J. Sutcliffe; C. Young
Salmon – Sockeye, Gillnet	British Columbia	SokGil	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Sockeye, Seine	British Columbia	SokSen	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. Sporer; J. Sutcliffe; C. Young;
Salmon – Sockeye, Troll	British Columbia	SokTrol	Mid-1990s	ARA Consulting Group Inc. (1996); BC Salmon Marketing Council website; C. McKee; C. Sporer; J. Sutcliffe; C. Young

Annex Table 5 (part 1). Draft scores used for Canadian fisheries in the five 'Rapfish' fields. Sources of scores documented in Annex Table 4 and discussed in the text.

Fishery	Abbreviation	**ECOLOGICAL**	exploitation status	recruitment variability	trophic level	change in T level	migratory range	range collapse	catch < maturity	discarded bycatch	species caught	primary production	**ECONOMIC**	price	GDP/person (1000s)	limited entry	marketable right	other income	sector employment	ownership	market	subsidy
Caplin (NF)	Cap	1	1.0	1.0	3.3	2.0	1.0	0.5	0.0	1.0	0.0	2.0		200	18.0	1.0	0.0	2.0	1.0	0.0	2.0	0.5
Crab (Snow)	SnwCb	2	0.5	2.0	2.3	2.0	0.0	0.0	1.0	0.0	0.0	1.0		8000	18.0	2.0	1.0	1.5	2.0	0.0	2.0	0.5
Crab (Snow), Area 19 (NS)	SnCb19	3	0.5	2.0	2.3	2.0	0.0	0.0	1.0	0.0	0.0	2.0		8000	20.0	2.0	1.0	1.5	2.0	0.0	2.0	0.5
Herring, Zone 4WX, Seine (NS)	BFunS	4	1.0	1.0	3.0	2.0	0.0	0.0	1.0	0.0	0.0	1.0		90	20.0	2.0	1.0	1.0	2.0	0.0	2.0	0.5
Herring, Zone 4WX, Weir (NS)	BFun W	5	0.0	1.0	3.0	2.0	0.0	0.0	2.0	0.0	0.0	1.0		115	20.0	2.0	1.0	0.0	1.0	0.0	2.0	0.5
Lobster (Atlantic)	Lob	6	1.5	1.0	2.6	2.0	0.0	0.0	1.0	0.0	0.0	2.0		9525	18.0	2.0	1.0	1.5	2.0	0.0	2.0	0.5
Lobster, Dingwall (NS)	LobDing	7	1.5	1.0	2.6	2.0	0.0	0.0	1.0	1.0	0.0	2.0		11000	20.0	2.0	1.0	1.5	2.0	0.0	2.0	0.5
Mackerel (Atlantic)	MakAt	8	0.5	1.5	3.7	2.0	0.0	0.5	1.0	0.0	0.0	2.0		350	19.0	0.0	0.0	1.5	2.0	0.0	0.0	0.5
Mackerel, Dingwall (NS)	MakDin	9	0.5	1.5	3.7	2.0	0.0	0.0	1.0	0.0	0.0	2.0		300	20.0	2.0	0.0	1.5	2.0	0.0	0.0	0.5
Northern Cod (2J3KL), Gillnet	CodGil	10	3.0	1.5	3.8	2.0	0.5	2.0	1.5	1.0	0.5	2.0		600	17.0	1.0	0.0	1.5	2.0	0.0	1.0	2
Northern Cod (2J3KL), Handlines	CodHan	11	3.0	1.5	3.8	2.0	0.5	2.0	1.0	0.0	0.0	2.0		650	17.0	1.0	0.0	1.5	2.0	0.0	1.0	2
Northern Cod (2J3KL), Traps	CodTap	12	3.0	1.5	3.8	2.0	0.5	2.0	1.5	0.0	0.5	2.0		600	17.0	1.0	0.0	1.5	2.0	0.0	1.0	2
Northern Cod (2J3KL), Trawls (otter)	CodTrw	13	3.0	2.0	3.8	2.0	1.0	2.0	2.0	1.5	1.0	2.5		400	17.0	2.0	1.0	2.0	1.5	1.0	2.0	2
Northern Cod Inshore	CodIn	14	3.0	1.5	3.8	2.0	0.5	2.0	1.3	0.0	0.5	2.0		635	17.0	1.0	0.0	1.5	2.0	0.0	1.0	2
Northern Cod Offshore	CodOff	15	3.0	2.0	3.8	2.0	1.0	2.0	2.0	1.5	1.0	2.5		400	17.0	2.0	1.0	2.0	1.5	1.0	2.0	2
Scallops	SClp	16	1.0	1.0	2.0	2.0	0.0	0.0	1.0	0.0	0.5	2.5		18000	19.0	2.0	1.0	2.0	2.0	0.0	2.0	0.5
Shrimp (northern) (NF)	NShp	17	0.0	1.0	2.7	2.0	0.0	0.0	1.0	0.5	1.0	2.0		2830	18.0	2.0	1.0	2.0	0.0	0.5	2.0	0.5
Shrimp (northern), E. Scotian Shelf Trawl	NShpES	18	0.0	0.0	2.7	2.0	0.0	0.0	0.0	0.5	1.0	2.0		4000	20.0	2.0	1.0	2.0	0.0	1.0	1.5	0.5
Groundfish trawl	Grnd97	19	2.5	1.0	3.5	1.0	1.0	0.0	0.5	2.0	1.5	3.0		140	27.0	2.0	2.0	1.5	0.0	0.5	1.5	0.5
Halibut	PacHal	20	1.0	0.0	3.5	1.0	0.5	0.0	0.0	0.5	0.0	3.0		1000	27.0	2.0	1.0	1.5	0.0	0.0	2.0	0.5
Herring, 1996	PacHer	21	1.0	1.0	3.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0		2000	27.0	2.0	1.0	2.0	0.0	0.0	2.0	0.5
Herring spawn-on-kelp	HerSpw	22	1.0	1.0	2.5	1.0	1.0	1.0	0.0	0.0	0.0	3.0		38000	27.0	2.0	2.0	1.5	2.0	0.0	2.0	0
Lingcod, 1989, SoG	Ling89	23	3.0	1.0	4.2	1.0	0.0	0.0	1.5	1.0	0.0	3.0		1590	23.0	0.0	0.0	1.5	0.0	0.0	0.0	0.5
Lingcod, 1996	Ling96	24	1.0	1.0	4.2	1.0	0.0	2.0	1.5	1.0	0.0	3.0		2700	27.0	0.0	1.0	1.5	0.0	0.0	0.0	0.5
Salmon, Gillnet	SalGil	25	1.4	1.0	3.7	1.0	1.5	0.0	0.5	1.0	0.0	3.0		2700	27.0	2.0	1.0	1.5	0.0	0.0	0.8	1
Salmon, Seine	SalSen	26	2.0	1.0	3.7	1.0	1.5	0.0	1.5	1.5	0.5	3.0		1550	27.0	2.0	1.0	1.5	0.0	1.0	0.8	1.5
Salmon, Troll	SalTrol	27	2.0	1.0	3.7	1.0	1.5	0.0	0.5	0.5	0.0	3.0		2630	27.0	2.0	1.0	1.5	0.0	0.0	0.8	1
Salmon, Chinook, Gillnet	ChinGil	28	2.0	1.0	4.0	1.0	1.2	0.5	0.0	1.0	0.0	3.0		2750	27.0	2.0	1.0	1.5	0.0	0.0	0.0	1
Salmon, Chinook, Seine	ChiSen	29	2.0	1.0	4.0	1.0	1.2	0.5	1.5	1.5	0.5	3.0		1875	27.0	2.0	1.0	1.5	0.0	1.0	0.0	1.5
Salmon, Chinook, Troll	ChiTrol	30	2.0	1.0	4.0	1.0	1.2	0.5	0.5	0.5	0.0	3.0		2000	27.0	2.0	1.0	1.5	0.0	0.0	0.0	1
Salmon, Chum, Gillnet	CmGil	31	0.0	1.0	3.4	1.0	1.6	0.0	0.5	1.0	0.0	3.0		715	27.0	2.0	1.0	1.5	0.0	0.0	0.0	1
Salmon, Chum, Seine	CmSen	32	0.0	1.0	3.4	1.0	1.6	0.0	1.0	1.5	0.5	3.0		770	27.0	2.0	1.0	1.5	0.0	1.0	0.0	1.5
Salmon, Chum, Troll	CmTrol	33	0.0	1.0	3.4	1.0	1.6	0.0	0.5	0.5	0.0	3.0		1110	27.0	2.0	1.0	1.5	0.0	0.0	0.0	1
Salmon, Coho, Gillnet	CohGil	34	3.0	1.0	4.0	1.0	1.8	1.0	0.5	1.0	0.0	3.0		1500	27.0	2.0	1.0	1.5	0.0	0.0	0.0	1
Salmon, Coho, Seine	CohSen	35	3.0	1.0	4.0	1.0	1.8	1.0	1.0	1.5	0.5	3.0		1440	27.0	2.0	1.0	1.5	0.0	1.0	0.0	1.5
Salmon, Coho, Troll	CohTrol	36	3.0	1.0	4.0	1.0	1.8	1.0	0.5	0.5	0.0	3.0		2840	27.0	2.0	1.0	1.5	0.0	0.0	0.0	1
Salmon, Pink, Gillnet	PkGil	37	0.0	2.0	3.6	1.0	1.0	0.0	0.5	1.0	0.0	3.0		530	27.0	2.0	1.0	1.5	0.0	0.0	2.0	1
Salmon, Pink, Seine	PkSen	38	0.0	2.0	3.6	1.0	1.0	0.0	1.0	1.5	0.5	3.0		540	27.0	2.0	1.0	1.5	0.0	1.0	2.0	1.5
Salmon, Pink, Troll	PkTrol	39	0.0	2.0	3.6	1.0	1.0	0.0	0.5	0.5	0.0	3.0		680	27.0	2.0	1.0	1.5	0.0	0.0	2.0	1
Salmon, Sockeye, Gillnet	SokGil	40	1.0	1.0	3.6	1.0	2.0	0.0	0.5	1.0	0.0	3.0		3580	27.0	2.0	1.0	1.5	0.0	0.0	2.0	1
Salmon, Sockeye, Seine	SokSen	41	1.0	1.0	3.6	1.0	2.0	0.0	1.0	1.5	0.5	3.0		3410	27.0	2.0	1.0	1.5	0.0	1.0	2.0	1.5
Salmon, Sockeye, Troll	SokTrol	42	1.0	1.0	3.6	1.0	2.0	0.0	0.5	0.0	0.0	3.0		6880	27.0	2.0	1.0	1.5	0.0	0.0	2.0	1
GOOD	Good	43	0.0	0.0	4.2	1.0	0.0	0.0	0.0	0.0	0.0	3.0		38000.0	27.0	2.0	2.0	0.0	0.0	0.0	0.0	2
BAD	Bad	44	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.5	1.0		90.0	17.0	0.0	0.0	2.0	2.0	1.0	2.0	0

Annex Table 5 (part 2). Draft scores used for Canadian fisheries in the five 'Rapfish' fields.

Fishery	Abbreviation	**SOCIAL**	socialisation of fishing	fishing sector	environmental knowledge	education level	conflict status	fisher influence	fishing income	kin participation	**TECHNOLOGICAL**	trip length	landing sites	pre-sale processing	use of ice	gear	selective gear	power gear	FADS	Sonar	Average Boat Size	catching power	gear side effects	**ETHICAL**	Adjacency & Reliance	Alternatives	Equity in Entry	Just Management	Influences in Ethical Formation	Mitigation of Habitat Destruction	Mitigation of Ecosystem Depletion	Illegal Fishing	Discards & wastes
Caplin (NF)	Cap		2.0	1.0	0.0	1.0	0.5	0.0	1.0	1.0	1	1.0	0.0	0.0	0.0	1.0	0.5	1.0	0.0	1.0	1.0	0.0	0		2.0	0.5	0.5	0.5	3.0	2.5	2.0	1.5	1.0
Crab (Snow)	SnwCb		0.0	0.0	0.0	1.0	0.5	2.0	2.0	1.0	2	2.0	0.0	0.5	1.0	0.0	1.0	0.5	0.5	1.0	1.0	0.0	0		2.0	1.0	0.5	1.0	3.0	2.0	0.5	1.0	1.0
Crab (Snow), Area 19 (NS)	SnCb19		2.0	0.0	0.0	1.0	0.5	2.0	2.0	1.0	3	1.0	2.0	0.5	1.0	0.0	1.0	0.5	0.5	0.5	1.0	0.0	0		2.0	1.0	0.5	4.0	3.0	2.0	1.0	1.0	1.0
Herring, Zone 4WX, Seine (NS)	BFunS		0.0	0.0	0.0	1.0	1.0	1.0	2.0	0.0	4	1.0	1.0	1.0	2.0	1.0	0.0	1.0	0.0	1.0	1.0	0.0	0		2.0	2.0	0.5	1.0	3.0	1.5	1.5	1.0	2.0
Herring, Zone 4WX, Weir (NS)	BFun W		2.0	0.0	0.0	1.0	1.0	2.0	0.0	0.0	5	1.0	1.0	1.0	1.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0		3.0	2.0	1.0	3.0	3.0	2.5	2.0	0.0	0.0
Lobster (Atlantic)	Lob		0.0	1.0	0.5	1.0	0.0	1.0	1.0	1.0	6	1.0	0.0	0.5	1.0	0.0	1.0	0.5	0.5	1.0	1.0	0.0	0		2.0	1.0	1.0	1.0	3.0	1.0	1.5	1.0	1.0
Lobster, Dingwall (NS)	LobDing		0.0	1.0	0.5	1.0	0.0	1.0	1.0	0.0	7	1.0	0.0	0.5	1.0	0.0	1.0	0.5	0.5	1.0	1.0	0.0	0		2.5	0.5	1.0	1.0	3.0	1.5	1.5	1.0	1.0
Mackerel (Atlantic)	MakAt		1.0	0.0	0.0	0.5	2.0	2.0	1.0	1.0	8	1.0	1.0	1.0	1.0	1.0	0.5	1.0	0.0	1.0	1.0	0.0	0		2.5	1.0	1.0	0.5	3.0	1.0	0.0	0.5	1.0
Mackerel, Dingwall (NS)	MakDin		2.0	1.0	0.0	1.5	0.0	0.0	1.0	1.0	9	1.0	2.0	1.0	1.0	1.0	0.5	1.0	0.0	1.0	1.0	0.0	0		2.5	1.0	1.0	1.0	3.0	1.0	0.5	1.0	1.0
Northern Cod (2J3KL), Gillnet	CodGil		1.0	2.0	0.0	1.0	1.5	0.0	1.0	1.0	10	5.0	0.0	1.0	1.0	0.0	0.5	0.5	0.0	1.0	1.0	1.0	0		2.0	0.5	1.0	0.0	3.0	2.0	2.0	1.0	2.0
Northern Cod (2J3KL), Handlines	CodHan		1.5	2.0	1.0	1.0	1.0	0.0	1.0	1.0	11	1.0	0.0	1.0	1.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0		3.0	0.5	1.0	0.0	3.0	2.0	2.0	1.0	0.0
Northern Cod (2J3KL), Traps	CodTap		1.0	2.0	1.0	1.0	1.0	0.0	1.0	1.0	12	1.0	0.0	1.0	1.0	0.0	0.5	0.5	0.0	0.0	0.0	0.5	0		3.0	0.5	1.0	0.0	3.0	2.0	2.0	1.0	1.0
Northern Cod (2J3KL), Trawls (otter)	CodTrw		0.0	1.5	0.0	1.5	2.0	1.5	2.0	0.0	13	10.0	2.0	2.0	2.0	1.0	0.0	1.0	0.0	1.0	2.0	1.0	1		1.0	2.0	1.0	0.0	3.0	1.0	2.0	0.0	2.0
Northern Cod Inshore	CodIn		1.0	2.0	0.5	1.0	1.5	0.0	1.0	1.0	14	2.5	0.5	1.0	1.0	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0		3.0	0.5	1.0	0.0	3.0	2.0	2.0	1.0	1.0
Northern Cod Offshore	CodOff		0.0	1.5	0.0	1.5	2.0	1.5	2.0	0.0	15	10.0	2.0	2.0	2.0	1.0	0.0	1.0	0.0	1.0	2.0	1.0	1		1.0	2.0	0.0	0.0	3.0	1.0	2.0	0.0	2.0
Scallops	SClp		2.0	0.0	0.0	1.0	0.5	2.0	1.0	0.0	16	12.0	2.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	2.0	0.0	1		1.5	0.0	1.0	1.0	3.0	1.0	3.0	0.0	1.0
Shrimp (northern) (NF)	NShp		0.0	1.0	0.0	1.0	1.0	1.0	2.0	0.0	17	30.0	1.0	2.0	1.0	1.0	2.0	1.0	0.0	1.0	2.0	0.0	1		1.0	0.5	0.5	0.0	3.0	2.0	2.0	0.0	1.5
Shrimp (northern), E. Scotian Shelf Trawl	NShpES		0.0	0.0	0.0	0.5	0.0	1.0	2.0	0.0	18	4.0	2.0	0.0	1.0	1.0	2.0	1.0	0.0	1.0	1.0	0.0	1		2.5	1.0	1.0	1.0	2.0	2.0	2.0	1.0	1.5
Groundfish trawl	Grnd97		0.0	0.0	0.0	1.0	2.0	1.0	2.0	0.5	19	7.0	2.0	1.0	2.5	1.0	0.5	1.0	0.0	1.0	2.0	1.0	1		0.5	1.5	0.0	1.5	1.0	0.0	0.0	1.0	2.0
Halibut	PacHal		0.0	0.0	0.0	1.0	1.0	1.5	1.5	0.0	20	7.0	2.0	0.5	1.5	1.0	1.0	1.0	0.5	1.0	1.0	0.5	0		1.0	2.0	0.5	2.0	1.0	1.5	1.0	0.5	1.0
Herring, 1996	PacHer		0.0	0.0	0.0	2.0	1.0	1.0	2.0	0.0	21	5.0	2.0	2.0	2.0	1.0	1.0	1.0	0.0	1.0	1.5	1.0	0		1.0	1.0	0.5	1.5	1.0	1.0	1.0	0.5	0.5
Herring spawn-on-kelp	HerSpw		2.0	0.0	1.0	1.0	1.0	1.5	0.0	0.0	22	1.0	2.0	2.0	0.0	0.5	2.0	0.0	0.5	1.0	0.0	0.0	0		3.0	0.5	1.0	3.0	3.0	3.0	3.0	0.0	0.0
Lingcod, 1989, SoG	Ling89		0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	23	7.5	0.0	0.0	3.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0		0.5	1.0	1.0	1.0	2.0	0.0	1.0	1.0	2.0
Lingcod, 1996	Ling96		0.0	0.0	0.5	0.0	1.0	0.0	0.0	0.0	24	7.5	0.0	0.0	3.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0		1.0	0.5	0.5	0.5	1.5	1.0	1.0	0.5	1.0
Salmon, Gillnet	SalGil		1.0	0.0	0.0	1.0	1.0	0.5	1.0	0.5	25	2.0	1.5	1.0	1.0	0.0	0.5	0.5	0.0	1.0	1.0	1.0	0		0.6	1.0	0.5	1.0	1.5	1.7	1.7	0.5	0.9
Salmon, Seine	SalSen		0.0	0.0	0.0	0.0	1.5	1.0	1.5	0.0	26	1.0	2.0	0.0	0.5	1.0	0.0	1.0	0.0	1.0	2.0	1.5	0		0.5	1.5	0.0	0.5	1.0	0.7	1.7	0.5	1.1
Salmon, Troll	SalTrol		1.5	0.0	0.5	2.0	0.5	0.0	0.5	1.0	27	5.0	1.5	0.5	1.5	1.0	1.2	1.0	0.5	0.5	1.0	0.0	0		2.0	1.0	0.5	1.5	2.0	1.9	2.3	0.0	0.4
Salmon, Chinook, Gillnet	ChinGil		1.0	0.0	0.0	1.0	1.0	0.5	1.0	0.5	28	2.0	1.5	0.5	1.0	0.0	0.5	0.5	0.0	1.0	1.0	1.0	0		1.0	1.0	0.5	1.0	1.5	1.5	1.5	0.5	1.0
Salmon, Chinook, Seine	ChiSen		0.0	0.0	0.0	0.0	1.5	1.0	1.5	0.0	29	1.0	2.0	0.0	0.5	1.0	0.0	1.0	0.0	1.0	2.0	1.5	0		0.5	1.5	0.0	0.5	1.0	0.5	1.5	0.5	1.5
Salmon, Chinook, Troll	ChiTrol		1.5	0.0	0.5	2.0	0.5	0.0	0.5	1.0	30	5.0	1.0	0.5	1.5	1.0	1.0	1.0	0.5	0.5	1.0	0.0	0		2.5	1.0	0.5	1.5	2.0	2.0	2.0	0.0	0.5
Salmon, Chum, Gillnet	CmGil		1.0	0.0	0.0	1.0	1.0	0.5	1.0	0.5	31	2.0	1.5	0.5	1.0	0.0	0.5	0.5	0.0	1.0	1.0	1.0	0		0.0	1.0	0.5	1.0	1.5	2.0	2.0	0.5	1.0
Salmon, Chum, Seine	CmSen		0.0	0.0	0.0	0.0	1.5	1.0	1.5	0.0	32	1.0	2.0	0.0	0.5	1.0	0.0	1.0	0.0	1.0	2.0	1.5	0		0.5	1.5	0.0	0.5	1.0	1.0	2.0	0.5	1.0
Salmon, Chum, Troll	CmTrol		1.5	0.0	0.5	2.0	0.5	0.0	0.5	1.0	33	5.0	1.0	0.5	1.5	1.0	1.0	1.0	0.5	0.5	1.0	0.0	0		1.0	1.0	0.5	1.5	2.0	2.0	2.0	0.0	0.5
Salmon, Coho, Gillnet	CohGil		1.0	0.0	0.0	1.0	1.0	0.5	1.0	0.5	34	2.0	1.5	0.5	1.0	0.0	0.5	0.5	0.0	1.0	1.0	1.0	0		1.0	1.0	0.5	1.0	1.5	1.5	1.5	0.5	1.0
Salmon, Coho, Seine	CohSen		0.0	0.0	0.0	0.0	1.5	1.0	1.5	0.0	35	1.0	2.0	0.0	0.5	1.0	0.0	1.0	0.0	1.0	2.0	1.5	0		0.5	1.5	0.0	0.5	1.0	0.5	1.5	0.5	1.5
Salmon, Coho, Troll	CohTrol		1.5	0.0	0.5	2.0	0.5	0.0	0.5	1.0	36	5.0	1.0	0.5	1.5	1.0	1.0	1.0	0.5	0.5	1.0	0.0	0		2.5	1.0	0.5	1.5	2.0	1.5	2.0	0.0	0.5
Salmon, Pink, Gillnet	PkGil		1.0	0.0	0.0	1.0	1.0	0.5	1.0	0.5	37	2.0	1.5	0.5	1.0	0.0	0.5	0.5	0.0	1.0	1.0	1.0	0		0.0	1.0	0.5	1.0	1.5	2.0	2.0	0.5	1.0
Salmon, Pink, Seine	PkSen		0.0	0.0	0.0	0.0	1.5	1.0	1.5	0.0	38	1.0	2.0	0.0	0.5	1.0	0.0	1.0	0.0	1.0	2.0	1.5	0		0.5	1.5	0.0	0.5	1.0	1.0	2.0	0.5	1.0
Salmon, Pink, Troll	PkTrol		1.5	0.0	0.5	2.0	0.5	0.0	0.5	1.0	39	5.0	1.0	0.5	1.5	1.0	1.0	1.0	0.5	0.5	1.0	0.0	0		1.0	1.0	0.5	1.5	2.0	2.0	2.5	0.0	0.5
Salmon, Sockeye, Gillnet	SokGil		1.0	0.0	0.0	1.0	1.0	0.5	1.0	0.5	40	2.0	1.5	0.5	1.0	0.0	0.5	0.5	0.0	1.0	1.0	1.0	0		1.0	1.0	0.5	1.0	1.5	1.5	1.5	0.5	0.5
Salmon, Sockeye, Seine	SokSen		0.0	0.0	0.0	0.0	1.5	1.0	1.5	0.0	41	1.0	2.0	0.0	0.5	1.0	0.0	1.0	0.0	1.0	2.0	1.5	0		0.5	1.5	0.0	0.5	1.0	0.5	1.5	0.5	0.5
Salmon, Sockeye, Troll	SokTrol		1.5	0.0	0.5	2.0	0.5	0.0	0.5	1.0	42	5.0	1.0	0.5	1.5	1.0	2.0	1.0	0.5	0.5	1.0	0.0	0		3.0	1.0	0.5	1.5	2.0	2.0	3.0	0.0	0.0
GOOD	Good		2.0	0.0	1.0	2.0	0.0	2.0	2.0	1.0	43	1.0	0.0	2.0	3.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0		3.0	2.0	1.0	4.0	3.0	3.0	3.0	0.0	0.0
BAD	Bad		0.0	2.0	0.0	0.0	2.0	0.0	0.0	0.0	44	30.0	2.0	0.0	0.0	1.0	0.0	1.0	1.0	1.0	2.0	1.5	1.0		0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.5	2.0

Annex Table 6 (part 1). Scores used for Canadian fisheries in the Code of Conduct 'intentions' Rapfish field. (NOTE: these are preliminary scores for use in the example only, and have yet to be moderated by other experts.)

	Fishery	Abbreviation	**Management Objectives**	formal stock reference	fleet capacity?	small-scale fisheries	biodiversity protected?	depleted stocks restored?	human environmental	'wise' fishing gear ?	ecosystem interactions ?	environmental influences?	**Framework (data &**	all removals?	compatibility of measures?	long-term objectives ?	all stakeholders?	transparency ?	statistics verified?	social, economic & institutional ?	**Precaution**	precautionary approach in	uncertainty explicit ?	target ref. points ?	limit ref. points ?	contingency environment?	contingency fishing ?	continuous review ?	no-take areas ?	endangered species?
East coast (Atlantic)	Caplin (NF)	Cap	1	2	2	3	0	1	0	0	0	1	1	1	1	1	2	2	3	1	1	2	2	3	2	0	1	2	0	0
	Crab (Snow)	SnwCb	2	2	2	3	0	0	0	0	0	1	2	2	1	2	3	2	2	1	2	2	2	3	2	1	2	2	0	0
	Crab (Snow), Area 19 (NS)	SnCb19	3	2	2	4	0	0	0	1	0	1	3	2	1	2	4	4	3	3	3	2	2	3	2	1	2	3	1	0
	Herring, Zone 4WX, Seine (NS)	BFunS	4	2	2	3	0	1	1	1	1	1	4	3	2	2	3	2	3	1	4	2	3	3	2	1	2	2	0	0
	Herring, Zone 4WX, Weir (NS)	BFun W	5	2	2	3	0	1	1	2	1	2	5	3	2	2	4	3	3	1	5	2	3	3	2	1	2	2	1	0
	Lobster (Atlantic)	Lob	6	2	2	3	0	0	1	2	0	0	6	3	2	2	3	3	5	1	6	2	2	3	3	1	2	2	1	0
	Lobster, Dingwall (NS)	LobDing	7	2	2	3	0	0	1	2	0	0	7	3	2	2	3	3	5	2	7	2	2	3	3	1	2	2	1	0
	Mackerel (Atlantic)	MakAt	8	2	2	2	0	0	0	1	1	0	8	2	2	2	3	2	2	1	8	2	2	3	2	0	2	2	0	0
	Mackerel, Dingwall (NS)	MakDin	9	2	2	2	0	0	0	1	1	0	9	2	2	2	3	2	2	1	9	2	2	3	2	0	2	2	0	0
	Northern Cod (2J3KL), Gillnet	CodGil	10	2	2	2	0	1	0	1	0	0	10	1	2	1	2	2	2	0	10	2	3	2	2	1	1	2	0	0
	Northern Cod (2J3KL), Handlines	CodHan	11	2	2	2	0	1	1	2	0	0	11	1	2	1	2	1	1	0	11	2	3	2	2	1	1	2	0	0
	Northern Cod (2J3KL), Traps	CodTap	12	2	2	2	0	1	1	2	0	0	12	1	2	1	2	1	1	0	12	2	3	2	2	1	1	2	0	0
	Northern Cod (2J3KL), Trawls (otter)	CodTrw	13	2	2	2	0	1	0	0	0	0	13	1	2	1	2	2	3	1	13	2	3	2	2	1	1	2	0	0
	Northern Cod Inshore	CodIn	14	2	2	2	0	1	1	1	0	0	14	1	2	1	2	1	1	0	14	2	3	2	2	1	1	2	0	0
	Northern Cod Offshore	CodOff	15	2	2	2	0	1	0	0	0	0	15	1	2	1	2	2	3	1	15	2	3	2	2	1	1	2	0	0
	Scallops	SClp	16	1	1	2	0	0	0	0	0	0	16	1	2	1	3	2	2	1	16	2	2	2	2	0	1	1	0	0
	Shrimp (northern) (NF)	NShp	17	1	1	3	0	0	0	0	0	0	17	1	2	1	2	2	3	1	17	2	2	2	2	0	1	1	0	0
	Shrimp (northern), E. Scotian Shelf Trawl	NShpES	18	1	1	3	0	0	0	0	0	0	18	1	2	1	2	2	3	1	18	2	2	2	2	0	1	1	0	0
West Coast (Pacific)	Groundfish trawl	Grnd97	19	2	3	2	0	0	0	0	0	0	19	2	1	1	2	2	4	0	19	2	3	2	2	0	1	2	0	0
	Halibut	PacHal	20	2	3	2	0	1	0	1	0	1	20	3	2	2	3	3	5	1	20	2	3	3	3	0	2	3	1	1
	Herring, 1996	PacHer	21	2	2	1	1	1	1	1	1	1	21	3	2	2	2	2	3	0	21	2	3	2	2	0	1	3	1	1
	Herring spawn-on-kelp	HerSpw	22	2	3	3	1	1	1	2	1	1	22	3	2	2	3	3	4	1	22	2	3	3	2	0	2	3	1	1
	Lingcod, 1989, SoG	Ling89	23	1	1	2	0	0	0	0	0	0	23	0	2	0	0	0	0	0	23	0	0	0	0	0	0	1	0	0
	Lingcod, 1996	Ling96	24	2	1	2	0	2	1	1	1	1	24	3	2	2	4	4	5	0	24	2	3	3	3	3	3	3	2	1
	Salmon, Gillnet	SalGil	25	2	3	2	0	0	1	1	0	0	25	2.5	1	1.5	2	2	3	0	25	2	2	2	3	1	2	3	1	0
	Salmon, Seine	SalSen	26	2	3	2	0	0	1	0	0	0	26	2.5	1	1.5	2	2	3	1	26	2	2	2	3	1	2	3	1	0
	Salmon, Troll	SalTrol	27	2	3	2	0	1	1	1	0	0	27	2.5	1	1.5	2	2	3	0	27	2	2	2	3	1	2	3	1	0
	Salmon, Chinook, Gillnet	ChinGil	28	2	3	2	0	1	1	0	0	1	28	2.5	0.5	1.5	2	2	4	0	28	2	2	2	3	1	3	3	1	0
	Salmon, Chinook, Seine	ChiSen	29	2	3	2	0	1	1	0	0	1	29	2.5	0.5	1.5	2	2	4	1	29	2	2	2	3	1	3	3	1	0
	Salmon, Chinook, Troll	ChiTrol	30	2	3	2	0	1	1	1	0	1	30	2.5	0.5	1.5	2	2	4	0	30	2	2	2	3	1	3	3	1	0
	Salmon, Chum, Gillnet	CmGil	31	2	3	2	0	0	1	0	0	0	31	2.5	2	2	2	2	3	0	31	2	2	2	2	1	2	3	1	0
	Salmon, Chum, Seine	CmSen	32	2	3	2	0	0	0	0	0	0	32	2.5	2	2	2	2	3	1	32	2	2	2	2	1	2	3	1	0
	Salmon, Chum, Troll	CmTrol	33	2	3	2	0	0	0	1	0	0	33	2.5	2	2	2	2	3	0	33	2	2	2	2	1	2	3	1	0
	Salmon, Coho, Gillnet	CohGil	34	2	3	2	0	1	0	0	0	1	34	2.5	0.5	1.5	2	2	4	0	34	2	2	2	3	1	3	3	1	0
	Salmon, Coho, Seine	CohSen	35	2	3	2	0	1	1	0	0	1	35	2.5	0.5	1.5	2	2	4	1	35	2	2	2	3	1	3	3	1	0
	Salmon, Coho, Troll	CohTrol	36	2	3	2	0	1	1	1	0	1	36	2.5	0.5	1.5	2	2	4	0	36	2	2	2	3	1	3	3	1	0
	Salmon, Pink, Gillnet	PkGil	37	2	3	2	0	0	0	0	0	0	37	2.5	2	2	2	2	3	0	37	2	2	2	2	1	2	3	1	0
	Salmon, Pink, Seine	PkSen	38	2	3	2	0	0	0	0	0	0	38	2.5	2	2	2	2	3	1	38	2	2	2	2	1	2	3	1	0
	Salmon, Pink, Troll	PkTrol	39	2	3	2	0	0	0	1	0	0	39	2.5	2	2	2	2	3	0	39	2	2	2	2	1	2	3	1	0
	Salmon, Sockeye, Gillnet	SokGil	40	2	3	2	0	0	1	0	0	1	40	2.5	0.5	1.5	2	2	4	0	40	2	2	2	3	1	3	3	1	0
	Salmon, Sockeye, Seine	SokSen	41	2	3	2	0	0	1	0	0	1	41	2.5	0.5	1.5	2	2	4	1	41	2	2	2	3	1	3	3	1	0
	Salmon, Sockeye, Troll	SokTrol	42	2	3	2	0	0	1	1	0	1	42	2.5	0.5	1.5	2	2	4	0	42	2	2	2	3	1	3	3	1	0
	GOOD	Good	43	2	3	4	3	2	3	2	3	3	43	3	2	2	4	4	5	4	43	2	3	3	3	3	3	3	5	3
	BAD	Bad	44	0	0	0	0	0	0	0	0	0	44	0	0	0	0	0	0	0	44	0	0	0	0	0	0	0	0	0

Annex Table 6 (part 2). Scores used for Canadian fisheries in the Code of Conduct 'effects' Rapfish field. (NOTE: these are preliminary scores for use in the example only, and have yet to be moderated by other experts.)

	Fishery	Abbreviation	**Stocks, fleets and**	excess capacity reduced?	irresponsible phased out?	by-catch minimised?	discards minimised?	ghost fishing minimised?	juveniles and spawners	depleted stocks rebuilt	**Social & Economic**	inter-sector conflict?	indigenous peoples ?	local communities ?	cost effectiveness ?	social impact ?	cost recovery ?	**MCS**	observers effective??	catch inspection working?	vessel monitoring	non flag vessels deterred?	access control effective?
East Coast	Caplin (NF)	Cap	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	2	1	0	3
(Atlantic)	Crab (Snow)	SnwCb	2	0	0	1	1	2	2	1	2	1	0	1	1	0	0	2	1	2	2	0	2
	Crab (Snow), Area 19 (NS)	SnCb19	3	0	0	1	2	2	3	1	3	2	0	2	2	2	1	3	2	3	3	0	4
	Herring, Zone 4WX, Seine (NS)	BFunS	4	1	0	1	2	1	2	1	4	1	0	1	1	1	1	4	1	2	3	0	3
	Herring, Zone 4WX, Weir (NS)	BFun W	5	3	2	1	3	2	3	1	5	2	0	2	2	2	1	5	2	3	3	0	4
	Lobster (Atlantic)	Lob	6	2	1	2	2	2	3	2	6	2	0	2	2	1	1	6	1	3	3	1	3
	Lobster, Dingwall (NS)	LobDing	7	2	1	2	2	2	3	2	7	2	0	2	2	1	1	7	1	3	3	1	3
	Mackerel (Atlantic)	MakAt	8	1	0	1	1	1	2	1	8	1	0	1	2	0	0	8	0	1	3	1	2
	Mackerel, Dingwall (NS)	MakDin	9	1	0	1	1	1	2	1	9	1	0	1	2	0	0	9	0	1	3	1	2
	Northern Cod (2J3KL), Gillnet	CodGil	10	1	0	0	0	0	1	0.5	10	0	0	1	0	0	0	10	0	1	1	0	3
	Northern Cod (2J3KL), Handlines	CodHan	11	1	0	0	0	1	1	0.5	11	0	0	1	0	0	0	11	0	1	1	0	3
	Northern Cod (2J3KL), Traps	CodTap	12	1	0	0	0	2	2	0.5	12	0	0	1	0	0	0	12	0	1	1	0	3
	Northern Cod (2J3KL), Trawls (otter)	CodTrw	13	2	1	0	0	1	1	0.5	13	0	0	0	2	0	0	13	0	2	3	0	3
	Northern Cod Inshore	CodIn	14	1	0	0	0	1	2	0.5	14	0	0	1	0	0	0	14	0	1	1	0	3
	Northern Cod Offshore	CodOff	15	2	1	0	0	0	1	0.5	15	0	0	0	2	0	0	15	0	2	3	1	3
	Scallops	SClp	16	1	0	0	0	0	2	0	16	1	0	1	0	0	0	16	0	1	1	1	2
	Shrimp (northern) (NF)	NShp	17	0	0	1	0	0	1	0	17	1	0	0	0	0	0	17	0	1	1	1	1
	Shrimp (northern), E. Scotian Shelf Trawl	NShpES	18	0	0	1	0	0	1	0	18	1	0	0	0	0	0	18	0	1	1	1	1
West Coast	Groundfish trawl	Grnd97	19	1	0	1	1	0	1	0.5	19	0.5	0	0	1	0	1	19	2	2	3	1	3
(Pacific)	Halibut	PacHal	20	2	1	2	3	2	3	2	20	2	0.5	0.5	2	0	2	20	3	3	4	0.5	4
	Herring, 1996	PacHer	21	1	1	1	2	1	1	1	21	1	0.5	0.5	1	0	1	21	2	2	3	0	4
	Herring spawn-on-kelp	HerSpw	22	2	2	3	3	2	3	2	22	2	2	1	2	2	1	22	3	3	4	0	4
	Lingcod, 1989, SoG	Ling89	23	0	0	0	0	0	0	0	23	0	0	0	0	0	0	23	0	0	0	0	0
	Lingcod, 1996	Ling96	24	3	2	2	2	0	2	2	24	2	0	1	1	1	0	24	1	2	4	0	4
	Salmon, Gillnet	SalGil	25	1	1	1	2	0	3	1	25	0	0.5	0	1	0.5	0	25	2	2	3	0	2
	Salmon, Seine	SalSen	26	1	0	1	1	0	3	1	26	0	0.5	0	1	0.5	0	26	2	3	4	0	3
	Salmon, Troll	SalTrol	27	2	1	2	3	1	3	1	27	0	0.5	1	1	0.5	0	27	2.5	3	3	0	3
	Salmon, Chinook, Gillnet	ChinGil	28	1	1	1	2	0	3	1.5	28	0	0.5	0	1	0.5	0	28	2	2	3	0	3
	Salmon, Chinook, Seine	ChiSen	29	1	0	1	1	0	3	1.5	29	0	0.5	0	1	0.5	0	29	2	3	4	0	3
	Salmon, Chinook, Troll	ChiTrol	30	2	1	2	3	1	3	1.5	30	0	0.5	1	1	0.5	0	30	2.5	3	3	0	3
	Salmon, Chum, Gillnet	CmGil	31	1	1	1	2	0	3	1	31	0	0.5	0	1	0.5	0	31	2	2	3	0	2
	Salmon, Chum, Seine	CmSen	32	1	0	1	1	0	3	1	32	0	0.5	0	1	0.5	0	32	2	3	4	0	3
	Salmon, Chum, Troll	CmTrol	33	2	1	2	3	1	3	1	33	0	0.5	1	1	0.5	0	33	2.5	3	3	0	3
	Salmon, Coho, Gillnet	CohGil	34	1	1	1	2	0	3	1.5	34	0	0.5	0	1	0.5	0	34	2	2	3	0	2
	Salmon, Coho, Seine	CohSen	35	1	0	1	1	0	3	1.5	35	0	0.5	0	1	0.5	0	35	2	3	4	0	3
	Salmon, Coho, Troll	CohTrol	36	2	1	2	3	1	3	1.5	36	0	0.5	1	1	0.5	0	36	2.5	3	3	0	3
	Salmon, Pink, Gillnet	PkGil	37	1	1	1	2	0	3	1	37	0	0.5	0	1	0.5	0	37	2	2	3	0	2
	Salmon, Pink, Seine	PkSen	38	1	0	1	1	0	3	1	38	0	0.5	0	1	0.5	0	38	2	3	4	0	3
	Salmon, Pink, Troll	PkTrol	39	2	1	2	3	1	3	1	39	0	0.5	1	1	0.5	0	39	2.5	3	3	0	3
	Salmon, Sockeye, Gillnet	SokGil	40	1	1	1	2	0	3	1	40	0	0.5	0	1	0.5	0	40	2	2	3	0	2
	Salmon, Sockeye, Seine	SokSen	41	1	0	1	1	0	3	1	41	0	0.5	0	1	0.5	0	41	2	3	4	0	3
	Salmon, Sockeye, Troll	SokTrol	42	2	1	2	3	1	3	1	42	0	0.5	1	1	0.5	0	42	2.5	3	3	0	3
	GOOD	Good	43	3	2	5	3	2	3	3	43	2	2	2	2	2	3	43	4	4	4	0	4
	BAD	Bad	44	0	0	0	0	0	0	0	44	0	0	0	0	0	0	44	0	0	0	4	0

Annex Table 7. Results of the MDS Rapfish ordination on the six analysis fields for 42 Canadian fisheries, and for various summary groups discussed in the text. Values for sustainability axes only, as percentage of the best possible. Note that these results are not intended to be definitive - final improvements to the input data will alter values somewhat.

Fishery	Ecological	Technol.	Economic	Social	Ethical	Code of C	Combined
Cap	66.7	42.1	17.3	59.3	56.1	41.7	49.7
SnwCb	58.1	60.3	31.8	60.5	51.1	42.3	50.1
SnCb19	62.8	55.4	34.2	77.5	61.3	61.2	60.1
BFunS	64.0	43.1	33.5	42.3	49.4	50.7	47.1
BFun W	60.2	72.9	44.6	66.9	87.4	68.9	68.5
Lob	65.0	60.4	32.3	58.4	54.4	59.2	55.9
LobDing	60.8	60.4	35.2	49.8	59.4	59.3	55.0
MakAt	65.5	43.6	15.8	44.6	52.5	41.8	41.6
MakDin	68.7	39.1	23.3	72.0	53.3	41.8	48.7
CodGil	38.9	53.0	21.8	34.2	55.9	33.9	36.9
CodHan	45.7	84.0	21.9	52.3	73.6	34.3	50.6
CodTap	39.4	73.9	21.8	47.6	67.5	35.0	44.3
CodTrw	26.7	18.0	20.6	18.7	53.0	38.8	25.9
CodIn	41.0	59.4	21.9	39.6	67.4	34.8	42.5
CodOff	26.7	18.0	20.6	18.7	40.7	37.4	26.3
SClp	63.7	41.5	29.7	65.4	66.4	31.4	51.1
NShp	59.1	30.7	30.5	35.0	54.0	28.1	37.7
NShpES	79.9	26.1	33.4	49.1	57.1	28.1	45.2
Grnd97	57.4	22.0	58.6	30.4	14.5	38.5	37.0
PacHal	88.5	40.5	42.9	43.8	44.5	63.1	53.7
PacHer	73.7	32.9	36.5	51.8	43.9	49.2	49.7
HerSpw	79.0	81.7	60.3	80.0	91.5	71.0	77.4
Ling89	70.5	71.5	32.1	48.1	29.9	7.7	35.4
Ling96	65.9	71.5	52.2	19.3	42.1	64.1	53.7
SalGil	72.2	46.5	49.2	49.2	48.6	44.4	50.7
SalSen	59.8	19.8	53.1	28.8	33.3	44.9	42.3
SalTrol	72.8	48.7	49.2	71.1	60.4	50.3	56.1
ChinGil	74.0	45.6	52.6	49.2	48.3	47.7	51.4
ChiSen	58.6	19.8	55.6	28.8	29.8	48.2	41.8
ChiTrol	71.3	49.5	52.5	71.1	60.8	52.7	56.1
CmGil	77.6	45.5	52.1	49.2	47.5	43.8	51.4
CmSen	69.6	19.8	55.3	28.9	35.8	44.4	44.0
CmTrol	79.0	49.4	52.2	71.0	56.8	49.0	58.0
CohGil	64.8	45.4	52.3	49.3	48.3	46.6	50.1
CohSen	56.4	19.8	55.5	28.9	29.8	48.2	41.2
CohTrol	67.3	49.3	52.7	71.0	58.4	52.7	55.6
PkGil	77.0	45.3	44.5	49.3	47.5	43.3	50.9
PkSen	66.4	19.8	52.6	29.0	35.9	44.4	43.7
PkTrol	78.7	49.2	44.6	70.9	58.9	48.9	57.5
SokGil	74.3	45.2	46.1	49.3	49.4	46.0	51.1
SokSen	65.5	19.8	53.8	29.0	32.4	47.0	44.4
SokTrol	79.7	55.8	47.4	70.9	72.1	51.7	59.8
Good	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Bad	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUMMARY GROUPS							
capelin	66.7	42.1	17.3	59.3	56.1	41.7	49.7
herring E	62.1	58.0	39.0	54.6	68.4	59.8	57.8
mackerel	67.1	41.3	19.6	58.3	52.9	41.8	45.1
cod	36.4	51.0	21.4	35.2	59.7	35.7	37.7
shrimp	69.5	28.4	32.0	42.1	55.6	28.1	41.5
lobster	62.9	60.4	33.7	54.1	56.9	59.3	55.4
SnCb19	62.8	55.4	34.2	77.5	61.3	61.2	60.1
halibut	88.5	40.5	42.9	43.8	44.5	63.1	53.7
herring W	73.7	32.9	36.5	51.8	43.9	49.2	49.7
trawl	57.4	22.0	58.6	30.4	14.5	38.5	37.0
salmon	70.3	38.6	51.2	49.7	47.4	47.5	50.3
ling	65.9	71.5	52.2	19.3	42.1	64.1	53.7
HerSpw	79.0	81.7	60.3	80.0	91.5	71.0	77.4
EAST	55.2	49.0	27.2	49.6	58.9	46.5	46.5
WEST	70.8	42.3	50.2	48.7	46.7	50.5	50.5