West Coast whitebait fishing closed areas workshop

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Abstract

A review of the question of the usefulness of reserving waters for protection from exploitation in the whitebait fishery was undertaken at a small workshop.

Creation of reserves has social, fisheries management and conservation imperatives. Administration of reserves has costs for the Department of Conservation. Evaluation of the value of reserves as places where whitebait stocks are protected from exploitation is seen as difficult and costly, and has medium to long-term research requirements owing to variation in habitat conditions between sites, intra- and inter-seasonal variation in environmental conditions and in the size of the whitebait run, all of this made greatly more complex as a result of the multi-species composition of the fishery. It is suggested that DOC should:

1 Deal first with policy questions regarding the acceptance of the social function of reserves.

2 Conduct a preliminary survey of reserves and attempt to classify them according to their purpose and value for conserving whitebait populations.

3 Base decisions on the continuation of reserves on the results of these two undertakings.

Research priorities need to be structured around the environmental and habitat parameters that control whitebait populations and how these are affected by establishment of reserves.

1. Introduction

The Whitebait Fishing (West Coast) Regulations 1994 (NZSR 1994/66) include provisions for certain waters to be 'closed areas' (Regulation 5) (hereinafter referred to as reserves, for simplicity). These waters are listed in the First Schedule to the regulations. Some of the areas so listed had long been established as 'no-fishing areas', dating back to the time when first the Marine Department (disbanded in 1972) and later the Ministry of Agriculture and Fisheries (until formation of the Department of Conservation [DOC] in 1987) had statutory responsibility for managing the whitebait fishery. However, others of the reserves listed in the 1994 regulations were instituted by DOC, and additional areas were added to the list by DOC in 1995 amendments to the regulations.

The tacit reason for having reserves has generally been to ensure that there are some areas that are not subject to fisheries exploitation, this being viewed

as a means of ensuring the sustainability of production from the fishery. This approach can be exemplified, for instance, in closure to fishing of both Mahinapua Creek (a tributary of the Hokitika River) and the true left (south) bank of the Hokitika River from its confluence with Mahinapua Creek to the sea, which means that fish migrating from the sea upstream into Mahinapua Creek have access to the creek from the mouth of the river without threat of capture by whitebaiters. Similarly, reservation of the Hapuka Stream and wetland is enhanced by prohibition of fishing downstream of its confluence with the Turnbull River as far as the mouth of that river. However, to say that all reserves were established for entirely fisheries/conservation purposes is probably an oversimplification, and there are some instances in which sociological/political or personal imperatives seem to have been involved.

Maintenance of reserve status, as well as having assumed conservation/fisheries production benefits for the fishery, has costs to the administrating authority, in this instance DOC. Not all whitebait fishers accept the need for careful management of the fishery, nor do all respect the statutory protection offered to some waterways by their being declared closed waters (though the great majority do). Those few who have little concern for conservation and/or who actively flout the closure of areas by fishing within them, cause considerable public aggravation. This is particularly true amongst those who are concerned for protection of the fishery and adherence to the law, but also amongst others who are jealous that a few individuals are able to get away with exploiting the whitebait runs within the reserve areas.

DOC, with its statutory responsibilities, invests resources and effort in ensuring compliance with exclusions from fishing within reserves, and in apprehending those guilty of non-compliance, including violations of reserve status. As many of the whitebaiting rivers are in areas that are remote and difficult to get to, and as the area covered by the regulations is large, the costs of policing the fishery, including attention to the sanctity of the reserve areas, is substantial. Attention to the value of actually having reserves is therefore justified. In line with its need for efficiency and for careful stewardship of its limited financial resources, DOC appropriately initiated a review of the status and value of the whitebait reserves, including consideration of the prospect that it should evaluate the explicit contribution by the reserves to the conservation of the fishery and its component species.

Therefore DOC instituted a review of whitebait reserves and commissioned the National Institute of Water and Atmospheric Research (NIWA) to take the lead role in doing so. The review was undertaken in the form of a small, one-day workshop attended by: R M McDowall and R M Allibone, National Institute of Water and Atmospheric Research; P Gerbeaux, C Miller and G Butler, Department of Conservation, Hokitika; N Grainger, Department of Conservation, Westport: and R Sadler, Chairman, West Coast Whitebaiters' Association, Hokitika.

Prior to the workshop, relevant personnel were circulated with a brief review paper compiled by NIWA that explored some of the issues involved in assessing the conservation value of the reserves; the intention was that this would form useful background to consideration of reserve issues. In addition

DOC compiled a summary analysis of areas in the West Coast Conservancy that are closed to fishing under the Whitebait Fishing Regulations.

This paper consists of an amalgam of the NIWA review, the DOC summary, and the results of discussions occurring during the workshop.

2. Species composition of the West Coast whitebait fishery

The New Zealand whitebait fishery depends on the exploitation of the juveniles of species of Galaxias returning to rivers from the sea as small juveniles about 45-55 mm long. At their return from the sea they are 4-6 months old (McDowall et al. 1993). In all parts of New Zealand the principal species in the fishery is the inanga - *Galaxias maculatus* (McDowall & Eldon 1980). However, other species participate in the fishery, which, particularly in West Coast rivers, also involves koaro *G. brevipinnis*, banded kokopu *G. fasciatus*, giant kokopu *G. argenteus*, and shortjaw kokopu *G. postvectis*, in their approximate order of abundance in the whitebait catch. For all practical purposes, the fishery can be regarded as depending on inanga, koaro and banded kokopu, with exploitation of the other species of incidental value to it (McDowall & Eldon 1980; McDowall 1984; Rowe et al. 1992). However, shortjaw kokopu, giant kokopu and banded kokopu are regarded as seriously to somewhat threatened species (in that order of threat), and are therefore of significant conservation concern (Molloy & Davis 1994). Exploitation of these species in the fishery creates some conflicts with conservation objectives, and the question of reserves, at least in theory, has implications for conservation issues.

3. Reserve areas and the rationale for their establishment or existence

It should be noted that whitebaiters were to some extent consulted prior to gazettal of the 1964 regulations, when the first reserves were formally established, and that there was then quite widespread local support for closure of some areas to fishing. This has continued to be the case, and it can be seen, below, that many of the reserves have local support.

Current whitebait fishing regulations list the following whitebait fishing reserves in the West Coast Conservancy of DOC:

a) Granite Creek: was given to the former Wildlife Service of the Department of Internal Affairs by Mike Jones when consent was given for the Kongahu Swamp (near Karamea) to be drained: this area was identified at that time as a potentially important whitebait (inanga) spawning area. Closure to whitebaiting dates to 1994 regulations.

b) Baker Creek (a tributary to the Karamea River estuary): area was set aside as a reserve to protect spawning grounds, dates to 1995 amendment to 1994 regulations.

c) Blackwater Creek (drains hills behind the Kongahu Swamp, Karamea): reasons for reservation are uncertain, but possibly to protect Granite Creek reserve; dates to 1995 amendment to 1994 regulations.

d) Bradshaws Creek (tributary of the lower Buller River): area of important wetlands, closed with public support; dates to 1995 amendment to 1994 regulations.

e) Bullock Creek (gazetted as a tributary of the Pororari River, though its connections to the Porarari are not as explicit as that): reservation appears to relate to local pressures as it is easy to fish the whole width of the creek; dates to 1995 amendment to 1994 regulations.

f) Punakaiki River tributaries: closed for `political' reasons; dates to 1995 amendment to 1994 regulations.

g) Mahinapua Creek (Hokitika): reserved to protect the fishery as it was easy to fish the whole width of the creek; prior to 1964 regulations fishing was permitted but restricted in Mahinapua Creek, and complete closure dates from the 1964 regulations.

h) Hokitika River, south bank from Mahinapua Creek to the sea: intention was to protect whitebait runs heading for Mahinapua Creek and closure dates from 1964.

i) Fishermans Creek (Hokitika River): reasons for reservation uncertain, but probably also relates to protection of Mahinapua Creek; also dates from 1964.

j) Ounatai Lagoon (a tributary of the Waitaha River): reasons for reservation are uncertain; dates to 1995 amendment to 1994 regulations.

k) Oneone Creek (a tributary of the Wanganui River): closed with public support, dating to 1995 amendment to 1994 regulations.

l) Crikey Creek (tributary of Haast River); reasons for reservation uncertain, but probably relates to protection of low elevation wetlands; closure dates to 1995 amendment to 1994 regulations.

m) Nolans Creek: as for Crikey Creek.

n) Collier Creek (tributary of theTurnbull River): reserved to protect adult whitebait habitat; dates from 1995 amendment to 1994 regulations.

o) Hapuka River (enters joint estuaries of Okuru and Turnbull Rivers): is a large area of totally unmodified lowland wetland, reserved by initiative of the local population; dates from 1964.

p) Waiatoto River tributaries: closure of all tributaries provides protection of substantial tributaries including diverse and pristine habitats, though the diversity of species involved in the fishery was little understood at the time of closure (1964).

q) Cascade River tributaries Old Man Creek and Barn Creek: reserved at request from local whitebaiters on river, probably to protect pristine inanga habitats; dates from 1964 regulations.

r) Awarua River: closure from specified site, to protect pristine habitat; dates from 1995 amendment to 1994 regulations.

s) Yates Point to Puysegur Point: closed by Marine Department to prevent the spread of commercial fisheries into Fiordland National Park. Dates from 1964 regulations.

4. Some reserve management and administration issues

Various reviews of the regulations have been undertaken in the recent past, one of which investigated the question of closure of all tidal tributaries of rivers, a proposal that was supported by whitebaiters. However, this was not implemented owing to potential enforcement problems, and only a few creeks were included in the schedule, for either fishery protection or political reasons. Another suggestion was that the Director-General should have the power to close creeks at any time, but this was not implemented either.

DOC' s approach to compliance/enforcement of the sanctity of reserves is to target specific problem areas. It considers that having rangers on-site is the best method to increase the awareness of the regulations by fishermen and to show that DOC is actively enforcing the regulations. However, social problems arise with enforcement officers living in small communities when the compliance work is undertaken by DOC staff living in that area.

It appears that in general the whitebaiters wish to protect the fishery, be it for reasons of self-interest or conservation, and it is primarily the minority who create the compliance/enforcement problems. The West Coast Whitebaiters Association acknowledges that it has a role in voluntary regulation of the fishery and DOC is attempting to promote association membership and partnership between itself and the association. The possibility of

appointing honorary rangers was discussed at the workshop but it became evident that there would be real difficulties for honorary rangers who are involved in the fishery itself, and it was, for this reason, considered unlikely that any suitable volunteers would offer their services.

5. The role of sociology/ sentiment in having whitebait reserves

In the later years of its administration of the fishery, the Ministry of Agriculture and Fisheries increasingly distanced itself from 'people-management' aspects of whitebait fishing, and this was accentuated by a transfer of control of whitebait fishing structures built on rivers from the Ministry/DOC to regional councils. However, there is a widely agreed need for social aspects of managing the fishery to be acknowledged and included in all discussions. Much of the management of the fishery involves people issues and people behaviour management, owing to the fishery being based on competitive access to a limited and common resource of high value in a small area. This issue is accentuated by downstream fishers having earlier access than upstream fishers, to the upstream-moving shoals of whitebait. Moreover, whitebait fishers spend a lot of time watching what other whitebait fishers are doing!

There is also a socio-political aspect of having reserve areas, in the sense that there is a substantial whitebaiter sentiment in favour of having protected areas. Quite a few of the existing reserve areas were initiated by whitebaiters themselves. The most recent DOC review of management and regulation of the fishery, like others before it, included numerous suggestions from both whitebaiters and others that provisions for protecting the resource, including reserve areas, should be increased. A corollary of this is that any move to abandon protected areas is likely to generate substantial objection from whitebaiters, many of whom profess strong interest in conservation.

6. Determining the effectiveness of whitebait fishing reserve areas

DOC wishes to determine the effectiveness of having reserves, primarily in terms of sustainability of the fisheries, though the department also has a role in protecting threatened freshwater fish species that are a part of the fishery (shortjaw kokopu, giant kokopu, banded kokopu). Management issues relat-

ing to production/catch in the fishery probably apply primarily to inanga, since this is substantially the dominant species in the catch (> 90% in most rivers) whereas for the other species, it is more likely that the management imperatives for DOC relate more to their threatened, or near-threatened status, and therefore to their conservation. Moreover, is possible that for some, perhaps many, of the reserves their primary value is for protection of inanga, since many of the reserved streams are at low elevations where inanga alone are abundant. However, this is not universally true, as some reserves, such as Bradshaws Creek in the Buller River, Content Creek and Hindley Creek in the Waiatoto River, and perhaps Hapuka Creek in the Okuru-Turnbull River system, involve extensive areas of forested/lowland streams and swamps and may have substantial value for other species such as giant kokopu. In addition, some reserves may function as much to provide unimpeded access by whitebait to upstream habitats (outside reserves) that are important to koaro, banded kokopu and shortjaw kokopu, as they do to provide actual undisturbed habitat for whitebait species to live in. Thus the roles of reserves in whitebait protection are quite diverse, complicating any effort to evaluate their effectiveness.

There are clearly other conflicts of goals within DOC with regard to the role of reserve areas, such as whether there is any purpose in excluding whitebait fishing from areas that will 6 months later serve as whitebait spawning grounds, i.e. the connection between exclusion of fishing from an area, and the use of the area for whitebait spawning, is elusive. Therefore, before it is possible to evaluate the effectiveness of reserves, it is critical that their roles be identified. This would seem to require a reserve-by-reserve evaluation of the potential protective value of each, across all five species, and through the various life stages that might use them.

In addition to all this, it is not known whether the reserve areas (if reservation does increase the number of whitebait that run into them) then act as redistribution centres for more widespread habitats and populations in each catchment where the reserves are established. This should enhance the value of reserve areas. Nor is it known whether and to what extent there is invasion of areas within or beyond the limits of the reserves before the beginning of the fishing season, or a major increase in fish numbers in the catchments after the whitebait fishing season has closed. This would tend to reduce the ultimate value of the reserves. Thus, all of these factors have the potential to substantially alter (both positively and negatively) the significance assigned to reserves as contributing to sustainability of the fishery.

An initial objective of DOC in evaluating reserves must therefore be to establish its intentions in having reserves, and to undertake an initial qualitative survey to determine which objectives and to what extent, each reserve might fulfil.

7. What to measure in evaluating reserves

To demonstrate that reserves have conservation/fishery-sustainability value it is necessary to show that some important dimension of the fish populations in streams/wetlands set aside as reserves are greater than they would be if the streams had not been reserved. Determining what 'population dimension' should be measured is not simple.

From an overall perspective, because of the lowland/wetland focus of most of the reserves, it seems that the chief (though not sole) beneficiary from reserves is the inanga, this also being by far the most productive species in the fishery. From a fisheries management perspective, therefore, it makes sense that the prime focus of reserves, if instituted as facilities to ensure fishery sustainability, is the inanga. For other species it is more likely that most management actions are focused on the conservation of threatened or near threatened species, and that different management strategies will apply.

A basic focus of the objective of ensuring sustainability of the fishery probably ought to be to ensure the migration to sea of the greatest possible number of whitebait larvae.

Measuring larval output is likely to pose substantial practical difficulties, as when they hatch the larvae are very tiny (> 10 mm long) and would be difficult to catch quantitatively. In practice, this focus might usefully be shifted back somewhat in the fish's life cycle to determining number of eggs spawned and fertilised. This, in turn, could be estimated by determining the relationship between fish size and fecundity, and sex ratio, and using the size distribution of the spawning population as a surrogate for fecundity and, in turn, larval production. Since the reserves are waters from which fishing is excluded, this measure of their effectiveness could, in theory, be that they 'fill' with fish more when they are reserves than they would if they weren't, and that this will result in the production of more whitebait eggs/larvae, i.e. reserves are effective if the prohibition on fishing results in more adults rearing/growing larger, and thereby producing more eggs in such streams than if they weren't reserves.

Therefore, one of these outcomes may be that reserves generally, or some reserves in particular, have a significant role in the sustainability of egg output. Acceptance of 'egg output' as such a measure, based on cumulative fecundity of populations, begs the question of whether there is plenty of spawning habitat available to the populations, and thus whether or not the availability of spawning habitat might limit populations. Furthermore, making a link from this finding to arguing for a role of reserves in sustaining the whitebait fishery involves a whole series of assumptions related to presently unquantified numerical connections between the number of eggs produced and the number of whitebait that migrate back into rivers from the sea about six months later. Insofar as life at sea of whitebait is virtually unknown, is presently inaccessible and is likely to remain so, making that linkage is something of a necessary 'act of faith'.

8. Protocols for estimating the value of reserves

One obvious, but over-simplistic way to determine the value of reserves would be to compare egg production in reserve and non-reserve streams. In practice this won't work, because it will be impossible to find 'comparable', let alone 'identical' habitats for comparisons. Similarly there could be comparisons of populations in the same streams over different years under regimes with reserves in place or not. However, again, there are difficulties, as run size and escapement will vary greatly from year to year, and this will affect 'population dimensions'. Furthermore, natural perturbations such as floods and droughts may vary widely within habitats and between years. Therefore differences in annual run size or differences in perturbation may be the critical elements in determining differences in 'population dimensions' between years rather than differences due to reservation or not.

There are further difficulties that compound these problems, that relate to what is limiting population dimensions, and specifically whether the populations are controlled by inherent characteristics of the species and its ecology ('deterministic' factors like carrying capacity, food availability, predation, etc.) or by unpredictable fluctuations in the environment ('stochastic' factors such as floods and droughts). It is possible, for instance, that the number of whitebait entering reserve streams always greatly exceeds the streams' carrying capacity, i.e. whether the run is large or small, there may always be overpopulation, always plenty of recruits, with heavy juvenile mortality, and the final 'population dimensions' may be roughly the same-the population is controlled by density-dependent characteristics of the population/habitat, and egg output is not greatly variable from season to season. And it is also possible that the same would apply even if fishing was allowed. If that was true, invoking reserves may do no more than make increasing numbers of fish available to the reserve stream, resulting in higher natural mortalities - the stream may not need to be reserved to be fully populated each season. But what happens, year by year, may depend partly on habitat stability/perturbation, and it is possible that in some years (perhaps in all years), 'population dimensions' leading to egg production are below habitat carrying capacity (whatever that is) and are ultimately determined by stochastic factors such as habitat perturbation (floods, droughts, etc.)..

Alternatively, recruitment variation may mean that in some years carrying capacity is not reached, and there are varying 'population dimensions', populations may compensate by having lower juvenile mortality, better growth rates, and higher individual fecundity; there would be some population response to lack of full capacity, this always probably strongly influenced by perturbation.

All of the above argument becomes irrelevant if overlying perturbation of habitats strongly affects the populations. While it seems intuitively possible that recruitment is always (or usually) excessive, it is unlikely that density-dependent factors will always control 'population dimensions'. Thus, in prac-

tice, it is possible that density-dependent controls may determine maximum population size and be the usual ultimate controllers of the populations. However, sometimes (or perhaps often, or even usually), perturbations (stochastic effects) are the proximate population controllers. With a climate like that of the West Coast, it seems intuitive that perturbation will profoundly affect whitebait populations.

Which of these mechanisms applies and how they function will influence how effective reserves are in supporting recruitment into the populations. The greater the juvenile over-recruitment and consequential density-dependent mortality, the less will be the value of the reserve areas in recruitment. If 'population dimensions' (such as egg production) are independent of recruitment rates (density-dependent), then it is possible that the reserves have no value at all, i.e. juvenile mortalities may reduce populations to a roughly consistent level, year by year, as long as there is enough recruitment to reach that level. Whether a reserve is effective then depends, in part, on whether or not fishing activity reduces recruitment below the level needed to reach that equilibrium population level. If 'population dimensions' in the reserve habitats are dependent on recruitment, then the effectiveness of reserves becomes reduced.

Virtually nothing is known about any of these questions for inanga (much the best known whitebait species), let alone for any other of the four species in the fishery.

In practice, it could be possible to determine 'population dimensions' (population size and growth rates giving information on potential egg production/ fecundity) in summer/early autumn (before reproductive outmigrations of inanga, when populations should have stabilised, with most juvenile mortality having occurred), between years, with and without reserve status. However, for this to have any meaning, there would need to be fishing pressure applied to the reserve stream in some years, and this pressure would probably need to be significant, and catch recorded. This would seem to be difficult to achieve in any reserved water. Possibly some easily accessible and manageable water like Mahinapua Creek could be studied, and this would require that the streams be experimentally fished by the research agency. (Does DOC wish to encourage fishing in Mahinapua Creek in the interests of conducting research on the value of reserves, with the ultimate possibility that fishing would later be prohibited again, having invested substantial resources in trying to stop poaching there?)

Thus, what is needed (and it seems to be high-risk research) is a prolonged series of 'pre-reserve' studies (3-5 years or more depending on the extent of between-year variation) of population dynamics to establish a 'background' level of population size/variation (in which there is significant exploitation of the run into the experimental stream). This would then need to be followed by an equally prolonged series of studies under reserve conditions. Then, if useful results are achieved, the next issue is whether or not these results can be extrapolated to other streams/reserves.

9. Suggested DOC reserve management response

1. To address questions relating to the validity of gazetted reserves and ask critical questions about their purpose, whether they serve (1) biological/conservation imperatives, (2) sociological imperatives, or a combination of the two.

2. Make policy decisions about the extent to which sociological objectives in reserves are acceptable and, if so, whether some costs in meeting these objectives are justified.

3. Having done that, classify the reserves according to the biological basis for their justification (such as to protect access to upstream habitats, allow local escapement; provide undisturbed rearing/feeding/maturation habitats for fish stocks; protect spawning grounds);

4. Make decisions about whether maintenance/continuation of individual reserves is justified.

10. Suggested DOC research priorities

1. Make decisions about the role of research, particularly with regard to which species of whitebait it is anticipated benefits chiefly from research.

2. Determine the effect of fishing and other forms of 'predation' and mortality on population densities in representative habitats with the objective of identifying mechanisms causing mortality. Specifically, develop some generalisations regarding the extent to which population dimensions are determined by exploitation/predation/population density and habitat parameters, as opposed to habitat perturbations such as floods and droughts or by a mixture of the two. This would have to be seen as a long-term (5 years?) programme that examined a small range of representative habitats.

3. Determine the role of population densities in controlling individual fish growth rates and fecundity with the goal of identifying what controls total population egg output.

4. Great care would need to be exercised in the choice of study habitats to permit extrapolation of data 'locally' obtained to the more general situation, though modelling would allow the exploration of the effects of different 'egg productivity' regimes. So crucial is the choice of study

sites that it might be justifiable to first revert to re-examination of the question of 'typical' or 'ideal' habitat for inanga (Sagar 1993) - to determine what habitat types are responsible for most 'egg output'. It may not be that the habitat that produces the most rapid growth and highest individual fecundity is the key to high egg production, especially if such habitats are relatively sparse in area. Large areas of more mediocre habitat may be more important than small areas of high-quality habitat to overall, cumulative egg output.

A possible outcome from this research could be that there is so much escapement from fishing, either during the season or after fishing has ceased, that reserves have no biological/fisheries justification. Answers to these questions are bound to vary geographically and/or with the type of river and methods of fishing, with changing fishing intensity, and with patterns of floods and other river factors, and therefore need some study. These issues, too, would need at least some preliminary investigation.

In the final analysis, then, the issue for DOC becomes deciding whether having reserves is justifiable:

- partly as a social measure to meet the preferences of whitebaiters/public in general, and to foster some conservation mentality;
- in the assumption that they must offer some value (though this could be untrue), even though this value cannot be easily demonstrated; and
- given that managing the reserve status of the various streams is an inconvenience, can be costly, and leads to a certain amount of anarchic behaviour amongst the whitebaiters.

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