Submission to the Board of Enquiry into the relocation of salmon farms in the Marlborough Sounds.

John Leader and Des Boyce.

Statement of interest.

My full name is John Peter Leader, and my address is 66 Lakings Road, Blenheim. I am a retired biologist with more than fifty years of experience. I hold the degrees of BA from Cambridge University and PhD from Bristol University, and I have carried out research and teaching at the Universities of Bristol, Aberystwyth, Auckland and Otago. I have carried out considerable research on the effect of environmental variables on the physiology of animals, including many marine organisms, and have an extensive series of publications on these topics. In addition I have supervised many postgraduate students in this field. While employed at the University of Otago, I played a major role in the redesign of the Public Aquarium at Portobello, and managed it after its reopening. Since moving to Blenheim I have completed, with my colleagues Pierro Rocco, and my wife, Dr Jennifer Bedford, a semiquantitative study of the mesoplankton in Queen Charlotte Sound and the Tory Channel, work which is currently being prepared for publication. In addition I am a member of the expert group assisting the Ministry of Primary Industries on methods to expedite the resilience of the scallop fishery in the top of the South Island. I am also secretary of the Marlborough Recreational Fishers Association, a body whose aim is to comment of matters of concern to the recreational fishermen in the Marlborough Sounds.

Des Boyce, residing at 181 Taylor Pass Road, Witherlea, has been resident in Marlborough for many years and has been deeply involved with developments in the Sounds for the past forty years. He was a foundation member of the combined divers group which was instrumental in establishing the Marine Reserve at Long Island in Queen Charlotte Sound. and was a founder member of SoundFish, a group of experts, representative of the recreational, commercial and customary fishers, set up to offer advice to the local Council and Government on matters of concern. As a member of the Marlborough Recreational Fishers Association he has for many years been an expert consultant on the scallop fishery in the top of the South Island (SCA7). For many years he held a commercial operator’s ticket to operate his own boat to assist in tourist activities and carried out survey work and conservation activities for the Department of Conservation.

Submission:

Allow us to say at the outset that we are not opposed to aquaculture in general nor to salmon farming specifically. Within living memory native fish stocks throughout the world have become depleted to a degree that many species are approaching total extinction, and farmed fish now make up more than half of the yoyal harvest. Farmed species will become increasingly important as a source of fish. However, it is our considered opinion that NZ King Salmon [NZKS] should not be allowed to relocate their farms according to the plans they have proposed, for a number of reasons.

The Conservation Council of New Brunswick, in considering the impact of aquaculture activities on the environment, proposed that such farming should be judged by five tests of sustainability. These were:

1. that it does not degrade the environment on which it is dependent.

2. that it is in harmony with other economic, cultural and social activities that use the same natural resources.

3. that it does not diminish the ability of future generations to use the same resources.

4. that it invests in local communities and decision making is local.

5. that it produces a reasonable and relatively stable net income to both producers and society by using natural resources on a long-term recoverable basis.

We submit that NZKS, in spite of its public braggadocio, fails to meet any of these criteria. Furthermore, there is a number of technological solutions already available which can satisfy these demands and which are currently in use or near completion.

1. As we, in our Submission to the Environmental Protection Agency concerning King Salmon's earlier application[1], argued, in common with many other submitters, this proposal calls for an entirely unjustified appropriation of public space, in which the rights of other individuals to enjoy the special qualities of the Sounds, are curtailed without compensation, and which rewards the public with pollution of the sea floor, unsightly structures and noise. The recent experience of the environmental damage sustained in Tasmania's Macquarie Harbour, where extensive pollution of the sea floor has led to instructions from the Australian Environment Protection Agency for destocking of salmon farms there, and which shows reprehensible abandonment of the stewardship of the operators, is a clear demonstration that operation of such poorly managed farms, in shallow and slowly moving water, creates an unsightly and long lasting degradation of the environment. Even by their optimistic standards, the farm sites to be abandoned by NZKS will take up to ten years to return to anything like their original state. In addition it is not clear, from the documents available to us, who will

provide the expert independent services necessary to ensure compliance with any imposed conditions. If, as seems likely, this burden will fall on Marlborough District Council, then this is an additional and unwelcome cost for local ratepayers.

2. In their earlier application to the Environmental Protection Agency, King Salmon stated that they had examined in great detail all possible sites for salmon farms in the Sounds, and had identified the only suitable sites. After just a few years they now seek permission to move their farms to new sites, different from those previously proposed, and which have been identified as prohibited for farming activities by the District Council. This shows a cynical and blatant disregard for local body regulations. Limitations on farming have been imposed for very good reasons, to allow preservation of precious local values, and should not be lightly cast aside, particularly when they use a government department, apparently obsessed with a profit motive, to override local opinion.

3. The most persuasive argument, however against allowing King Salmon to move their farms to new sites is that they are proposing to continue to use 'third-world' practices. These primitive methods are increasingly being abandoned in favour of more environmentally acceptable approaches.

a). It is now well established that a better practice is to farm fish away from inshore waters, where, no matter how well flushed it may be, fish may be exposed to excessively high temperatures and low oxygen levels.

b). The Sounds are also frequently subject to toxic blooms of blue-green algae, as a result of eutrophication, mainly from human activity.

c). The extensive development of mussel farms means that there is little room for further expansion if the industry is successful.

d).the predicted progressive rise in water temperature will increasingly marginalise production.

e). There is the risk of escaping fish interbreeding with wild fish, and of disease spreading throughout the local populations In the Sounds.

f). Anything less than scrupulous husbandry will lead to the congregation of predatory animals such as sharks and seals, and, in the long-term, disturbance to the ecosystem.

NZKS make much of the fact that they wish to move their pens to high flow sites where any detritus, uneaten food and faecal matter, can be distributed over a wider area than at present. However while stating that no additional water space will be occupied by the pens they propose a substantial increase in stocking rate, which will obviate this claim by greatly increasing the amount of waste to be dispersed. In addition, their diagrams of current flow around the pens, particularly in regard to the Waitata site, shows that inward flow past the pens is greater than the outward flow. Hence waste

will flow back and forth around the pens, gradually accumulating and adding to benthic deposits.

4. There are two generic solutions which offer ideal solutions to these problems, and which are used in different variations throughout the world. Of these, open-ocean aquaculture is now a well–established commercial practice. As James Langan has pointed out:

“there is sufficient rationale for pursuing the development of open ocean cage culture. Favourable features include ample space for expansion, tremendous carrying capacity, reduced conflict with many user groups, lower exposure to human sources of pollution, the potential to reduce some of the negative environmental impacts of coastal fish farming, and optimal; environmental conditions”.

In addition, in countries where there is limited space inshore, or where environmental concerns are taken seriously, open ocean farming can be a highly profitable and environmentally acceptable solution. A representative bibliography of open ocean aquaculture techniques is given in Appendix A.

As the Table below indicates, a number of countries now utilise open ocean aquaculture methods.

Table 1. Countries in which commercial open ocean fish farming is undertaken.[From ***Wikipedia-Open Ocean Aquaculture. E –experimental, C-commercial] Information up to 2012.***

Location	Species	Status	Comment
Australia	**Tuna**	**C**	**10000 tonnes per year**
California	**Striped bass, California yellowtail, Pacific halibut**	**E/C**	**Off oil platform**
China	**Finfish, scallops**	**E**	**Small scale experiments.**
Croatia	**Tuna**	**C**	**8 offshore cages (1998)**
Cyprus	**Sea bass, sea bream**	**C**	**8 offshore cages (1998)**
France	**Seabass, seabream**	**C**	**13 offshore cages (1998)**
Germany	**Seaweed, mussels**	**E**	**Trials using wind farms.**
Greece	**Seabass, seabream**	**C**	
Hawaii	**Amberjack, Pacific threadfin**	**C**	
Italy	**Seabass, seabream, tuna**	**C**	
Japan	**Tuna, mussels**	**C**	**Commercial tuna ranching**
Malta	**Seabass, seabream, tuna**	**C**	**3 offshore cages**
Mexico	**Tuna**	**C**	
Morocco	**Tuna**	**C**	
New Hampshire	**Atlantic halibut, cod, haddock, flounder**	**E/C**	**Experimental**
New Zealand	**mussels**		
Panama	**Tuna**	**C**	
Puerto Rico	**Cobia, snapper**	**C**	
Spain	**Seabass, seabream**	**C**	
Turkey	**Seabass, seabream**	**C**	
Washington	**Sablefish**	**C**	
Taiwan	**Cobia**	**C**	**3000tonnes (2001)**

In its application NZKS states that there are no commercial fish farming operations in the open ocean. When it was pointed out that this was not true, they fell back on the argument that open ocean farming was only practised in regions protected from high energy wave action, which is also untrue. In fact there is a number of different approaches to open ocean farming. The core technology is now well understood, and the advantages are clear. The fish can be exposed to a high flow of clean, well-oxygenated, cool sea water, while food waste and faeces are dispersed over a wide area. The principal obstacle, the potentially high wave energy of the open ocean can be overcome in several ways, for example by firmly anchoring pens to the sea floor or by enabling the pens to sink when exposed to storm conditions. Feeding can be accomplished using electronically controlled hoppers, thus reducing the servicing costs. Carefully chosen sites can be selected which would use the waste products to fertilise the surrounding area, a form of multitrophic aquaculture in which nothing is wasted, since it encourages the growth of filter feeders and macroalgae. In Europe there is considerable interest in combining fish farms with offshore wind farms using the solid bases of these structures as existing anchorage sites. There is now an extensive literature on the basic technology and a range of designs and procedures. For example, the Norwegian-based company, Salar, one of the world's largest producers of organic salmon, producing last year over 110,000 tonnes of fish, uses anchored pens in open ocean, which are 68 metres deep, a diameter of 110 metres and containing 250000 m^3 water. Kampachi Farms, a Malaysian company is experimenting with a submersible .free-floating cage of 132 m^3 in which most parameters can be controlled from a shore-based station.

NZKS has attempted to make much of the fact that a majority of submitters to the Board have been supportive of the application. Closer examination however reveals that most of the supporters of the proposal are either employees of NZKS or financially dependent on it. This is short-sighted on their part, since inshore aquaculture in an already crowded space offers virtually no possibility for further expansion. Indeed, at the hearing in 2013 before the Environmental Protection Agency, NZKS projected a large increase in employment opportunities which later evaporated. On the other hand, transfer to open ocean aquaculture offers the possibility of almost unlimited growth, and a consequent substantial increase in employment opportunities, bringing new skills and higher wages.. NZKS suggests that such technologies are ten years away and will be considered then. We submit that the technology is available now and NZKS should be instructed to move their operation to the open ocean, where their production, and hence profits, can be greatly enhanced, in a sustainable way, and one which would please all concerned.

5. It is however our opinion that an even better solution is offered by land-based recirculating aquaculture systems (RAS). In systems of this kind salmon are grown in large tanks but the system is a completely closed circuit. Sea water driven to the optimum temperature for growth can be oxygenated and its composition precisely controlled. After passage through the pens, the water, containing waste products and faecal matter can be passed though beds containing in turn filter feeders, such a mussels and clams, thus providing a second and lucrative crop, and then perhaps to

further tanks growing macroalgae, followed by filtering to remove remaining solid waste, before being returned and recirculated. The solid waste could be bagged and sold as fertiliser, generating a further revenue stream. Such multi-trophic RAS are already being exploited in Europe and Canada. Wright, for example, has presented a design which is theoretically capable of producing 1000 tonnes of 5 kg fish and 750 tonnes of fillets per annum. Such a system would need an establishment cost of about $US12 million and a running cost of $US6 million (2010 pricing, and could return between $US 5 million and $US13 million. These figures could be obtained from a land footprint of 24 x 67 metres. The analysis by Wright and Arianpoo is so detailed in its consideration of both design and operational features that we attach it as an Appendix (Appendix B), together with bibliographic references to other material on RAS. To us the exciting opportunity offered by such systems is the employment opportunities it offers. Instead of low paid labourers, such systems would employ innovative and well paid engineers and biologists, in a clean industry, on a small footprint, which could generate many innovative downstream developments. In a world which is increasingly interested in properly sourced food, the premium which such a production method would attract could be well worth the initial expenditure. Sited on waste land, it would overcome almost all the objections to inshore farming. In fact, the influential Norwegian investment bank, DNB Markets, earlier this year reported that as operational and licence costs of traditional pen-based farms rise, economies of scale make large land-based fish farms an attractive and financially viable alternative. DNB estimated that land-based salmon production will reach 150,000 tonnes by 2020. If this is the case then production from inshore pens will lose appeal to purchasers, no matter how clever the marketing. We submit that moving to land is environmentally friendly, unobtrusive and profitable.

6. NZKS advertises claims about the quality of their fish products which are at best duplicitous and at worst incorrect. The rising cost of fish meal and fish oil means that these predatory fish are fed a diet of chicken offal and soy (which incidentally almost certainly contains an amount of genetically modified material) as well as antibiotics and pesticides which are incorporated into the flesh of the fish. The red colour of the fish, which their advertisements claim is due to their being raised ‘in the pristine waters of the Sounds’ is actually due to the addition, in the food, of astaxanthin, extracted from cultures in Nelson. In addition, they have clearly demonstrated by the high mortality they have experienced, year after year, that they are incapable of good management practice. A land-based farmer who lost 20% or more of his stock would soon be out of business. It is really unacceptable for NZKS to acknowledge that the area under some of the recently disused pens will be anoxic for up to ten years.

7. In the course of our study of the mesoplankton in the Sounds we have been keeping records of water temperature at depths of one, five and ten metres, over the past three years. Each summer for long periods water temperatures exceed 17degrees C in the Tory Channel, and this is confirmed in published records of the Marlborough District Council. This is approaching the upper lethal temperature for salmon, and undoubtedly stresses them in crowded conditions, and which, in combination with falling oxygen levels as the temperature rises, probably partly accounts for the still

unexplained excessive mortality experienced in successive years. The Company is well advised in its plans to build a pet food industry!

There is already good evidence for a steady increase in temperature of ocean waters, and a diminished buffering capacity caused by the rise in dissolved carbon dioxide. Thus a situation will arise where the salmon, near their upper lethal limit already, are likely to be exposed to even greater stress, with higher mortality, in the future. That will leave no recourse other than to move the pens again, to cooler sites.

8. Conclusion.

In summary, we submit that moving the existing salmon farms to new high flow sites, in contravention of the District plan, is likely to prove a merely temporary expedient, and it will become necessary to move the pens again in a few years. **In our opinion the Board should instruct NZKS to relocate to better sites, in the open ocean, outside the Sounds, while developing the technology for land based aquaculture.**

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We wish to

appear in person before the Board.

Appendix 1. Partial Bibliography of Open Ocean Aquaculture.

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Appendix 2. Partial Bibliography of Recirculating aquaculture systems (RAS)

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