International Council for the
Exploration of the Sea

C.M.1980/E:60
Supplement No. 1

A PROPOSAL CONCERNING STUDIES OF COHO AND NATIVE SALMON INTERACTIONS IN FRANCE, WITH COMMENTS FROM THE WORKING GROUP ON THE INTRODUCTION OF NON-INDIGENOUS MARINE ORGANISMS

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PREFACE

At the 1980 meeting of the Working Group on the Introduction of Non-Indigenous Marine Organisms, reference was made by French participants to a proposal being prepared to introduce young coho salmon or salmon eggs to a stream in Brittany in 1980 or 1981, to study their interactions with Atlantic salmon (CM1980/E:60, page 13).

Because of the possible ecological implications of the proposed action, members of the Working Group requested that the proposal, when formalized, be submitted to ICES, in accord with the ICES Code of Practice concerning introduced species.

On July 25, 1980, a copy of the proposal for the field experiments was received by several members of the Working Group and transmitted to all members of the Working Group. Comments on the proposal were prepared by members of the Working Group most familiar with salmon, and were reviewed, amended, and approved by the Working Group through correspondence.

This document, a supplement to the 1980 Report of the Working Group, consists of the French proposal, in French (I) and English (II), an explanation of the proposal from Dr. Harache (III), and comments from the Working Group (IV). The document should serve as a basis for discussion and possible action by the parent committees of the Working Group during the 1980 Statutory Meeting of ICES.

I. PROJET D'ETUDE DES INTERACTIONS SAUMON COHO-ESPECES INDIGENES, DANS LE CADRE DU PROGRAMME SEA-RANCHING DU C.N.E.X.O.

INTRODUCTION

Depuis 1970, plusieurs millions d'oeufs de saumon coho ont été introduits en France à des fins d'élevage en captivité, soit en pisciculture d'eau douce, soit pour la production d'animaux élevés en fermes marines pendant une partie de leur cycle. La production actuelle de coho d'aquaculture a atteint environ 100 tonnes en 1980 et les caractéristiques de l'espèce laissent envisager des possibilités de développement de la production non négligeables sur les côtes franciases.

Un certain nombre de fuites accidentelles, généralement limitées, sont intervenues en plusieurs points du littoral sans qu'il soit possible de bien cerner les conséquences de l'introduction de cette nouvelle espece dans le milieu naturel.

Il existe très peu de références bibliographiques permettant d'apprécier les risques éventuels représentés par le coho pour les espèces indigènes et nous pensons qu'il est nécessaire de mettre en oeuvre un effort de recherche permettant de préciser le degré d'intéraction entre coho d'une part et saumon atlantique-truite de mer d'autre part, dans les zones où le risque de trouver ces 3 espèces dans le même type d'environnement existe. Cette proposition va dans le sens de la recommandation du groupe de travail sur"l'introduction des espèces non indigènes" du "Conseil International pour l'Exploration de la Mer" (Nantes 22-26 avril 1980) (cf. annexe 1).

LE PROJET "SEA RANCHING" DU CNEXO.

Le CNEXO a entrepris en 1980 un programme de recherche sur la technique du "Sea Ranching" en salmonidès migrateurs, consistant à tester les performances des espèces indigènes (saumon atlantique et truite de mer) dont les juvéniles produits en écloserie seront relachés dans un étang a marée apres conditionnement ou non (technique Hasler).

Le site retenu, étangs d Trébabu pres du Conquet (cf. annexe 2), sera équipé d'une petite pisciculture (fonctionnement partiel fin juillet 1980) permettant d'élever les juvéniles de migrateurs, et d'un dispositif de recapture des adultes lorsde leur éventuel retour au site de lâcher.

Les caractéristiques du site et son équipement dans le cadre du projet "Sea Ranching" pourraient être mises a profit pour tenter de préciser la nature des intéractions entre saumon coho et especes indigènes.

PROJECT D'ETUDE INTERACTION COHO-ESPECES INDIGENES.

1. Compétition en milieu lotique (ruisseau).

   1.1 Caractérisation des secteurs d'immersion compris entre le 3ème étang d'eau douce (le plus en amont) et la pisciculture:

   - largeur, profondeur (3 mesures sur 1 transert) tous les 15 m;
   - pente (niveau de géomètre);
   - vitesse du courant (moulinet OTT);
   - granulométrie superficielle.

   1.2 Immersion, en juillet 1980, de 500 coho et 500 salar de taille comparable mais d'age différent, sur des secteurs préalablement définis, avec marquage différentiel par secteur (tableau 3).

1.3 Pêches électriques de contrôle fin septembre 1980 pour évaluer les paramètres croissance mortalité et dispersion. Etude des dévalaisons sur une année au niveau de la pisciculture dans un piège de contrôle.

1.4 Pêche électrique de contrôle en février 1981 pour effectuer un deuxième inventaire piscicole (croissance, mortalité, dispersion).

1.5 Etude de la dévalaison des smolts printemps 1981 par piégeage aval.

2. Compétition en milieu lentique (étang).

2.1 Choix de 2 étangs de même superficie isolés par des grilles amont et aval.

2.2 Immersion en septembre 1980 de:

- étang amont : 3 000 parrs de S. salar
- étang aval : 1 500 parrs de S. salar + 1 500 parrs de coho.

2.3 Contrôle en mars-avril 1981 des paramètres croissance-mortalité et pourcentage de smoltification puis marquage.

3. Etude de la migration marine du saumon coho.

Objectif: apporter des éléments de réponse aux questions suivantes:

+ Le coho revient-il à son point de lâcher, dans quelles proportions et avec quelle fiabilité (pourcentage de divagation)?

+ Où passe-t-il sa phase marine estuaire, zone côtière, migration courte ou longue, etc...?

Moyens:

+ Lâcher pendant 3 années consécutives d'environ 10 000 smolts de coho produits sur le site sous contrôle sanitaire dont 3 000 porteurs de marques étiquettes permettant de localiser les points le recapture en mer.

+ Piégeage des adultes lors du retour éventuel au site de lâcher.

CONCLUSION.

Le passage par une phase de recherche sur l'impact éventuel des saumons du Pacifique sur les espèces indigènes nous semble indispensable pour définir une position objective et éventuellement des mesures réglementaires, devant la pression croissante des projets de "Sea Ranching" privé ou collectif a partir d'espèces pacifiques.

Un tel programme pourrait se développer en association avec divers organismes français de recherche et ses résultats soumis à l'examen d'un comité scientifique de contrôle.

P. PROUZET Y. HARACHE

ANNEXE

PRESENTATION DU SITE EXPERIMENTAL.

Le site du Conquet (étangs de Kerjean) se situe sur la côte Nord du Finistère. Il est constitué d'une rivière de 6 km de long entrecoupée par des étangs. La surface en eau exploitable comprend 14 hectares d'eau saumâtre (1er étang) (5°/oo - 25°/oo) renouvelable par le jeu des marées, 2 hectares d'étangs d'eau douce (3 étangs) et 0,5 hectare de rivière dont la pente moyenne est de 1 %.

Hydrologie (tableau 1)

Paramètres	Débit l/s	T° °C	pH	O_2d' mg/l	% O_2 /sat	DBO_5 mg/l	NH_4 mg/l-N	NO_3 mg/l-N	NO_2 mg/lN	Ca mg/l	PO mg/l
Valeurs mini	45	3	7	8,7	75	0,6	0,02	3,35	0,001	18	0,18
Valeurs maxi	330	23	9	11,9	120	6,44	0,25	12,48	0,05	26	0,88

Les fortes valeurs des sels nutritifs permettent d'expliquer les phénomènes d'eutrophisation rencontrés en milieu lentique.

ETUDES MENEES SUR LE SITE.

- Etude physico-chimique (Mémoire d'I.U.T., 1979).
- Etude des populations de truites (D.E.A., 1979 et Maîtrise de Sciences et Techniques, 1980).

Sommairesdes résultats obtenus

La qualité hydrologique du site pourrait être améliorée par la mise hors circuit d'au moins un étang durant la période estivale et automnale de manière à limiter l'échauffement de l'eau et les zones d'eutrophisation.

La population de truites se caractérise par une faible densité mais par une forte croissance (analogue à celle des truites de la Nivelle) due en partie à la migration des truites en zone marine durant la période estivale.

Grille

▽ Piège

Vanne automatique

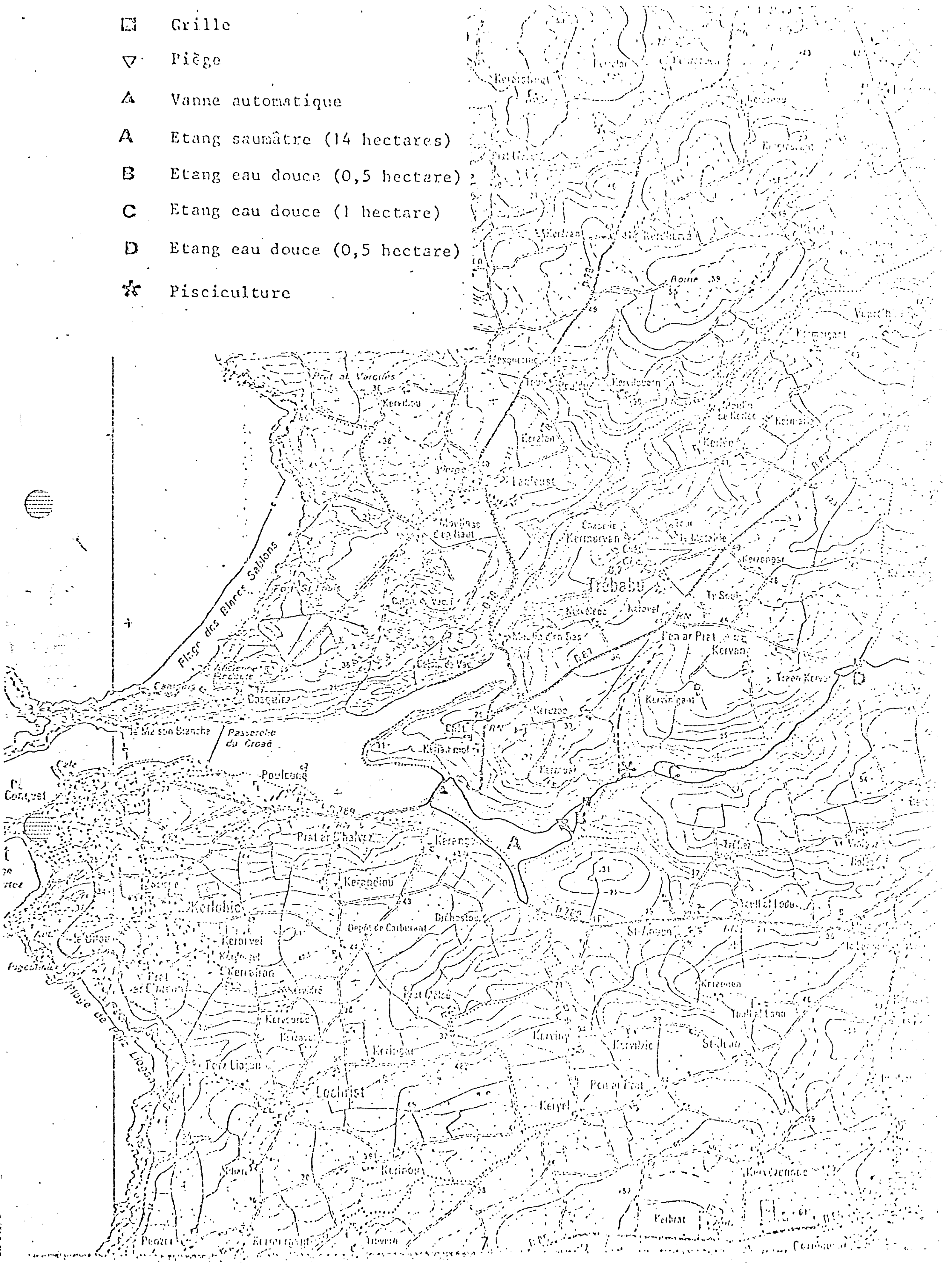
A Etang saumâtre (14 hectares)

B Etang eau douce (0,5 hectare)

C Etang eau douce (1 hectare)

D Etang eau douce (0,5 hectare)

Pisciculture



II. (TRANSLATION) STUDY PROJECT ON THE COHO SALMON - INDIGENOUS SPECIES INTERACTIONS WITHIN THE FRAMEWORK OF THE SEA-RANCHING PROGRAM OF C.N.E.X.O.

INTRODUCTION

Since 1970 several million coho salmon eggs have been introduced into France with the intention of raising them in captivity either in fresh water or by using "marine farms" during a part of their life cycle. The actual production of coho from aquaculture was about 100 tons in 1980 and the characteristics of the species suggest the development of a not inconsiderable production along the French coasts.

Even though a certain number of accidental escapes, generally limited, have occurred at several places along the shore, it has not been possible to determine the consequences of the introduction of this species into the natural environment.

There are very few bibliographic references which could enable us to predict the eventual risks presented by the coho salmon towards indigenous species, and we think it advisable to design a project to discover the degree of interaction between the coho on the one hand and Atlantic salmon and sea trout on the other, in areas where there exists the chance of finding these three species in the same type of environment. This proposal is in accord with the recommendation of the I.C.E.S. working group on the "Introduction of Non-Indigenous Species" (Nantes, 22-26 April, 1980; cf. appendix 1).

"SEA-RANCHING" PROJECT/CNEXO.

This year (1980) CNEXO has undertaken a research program on the technique of "sea-ranching" of migratory salmonids. It consists of testing the performances of indigenous species (Atlantic salmon and sea trout) by releasing hatchery produced juveniles into tidal ponds with and without prior conditioning (Hasler technique).

The chosen site, the ponds of Trébabu near Conquet (cf. appendix 2) will have been equipped with a small fish culture facility (partially functional by the end of July, 1980) for raising the migratory juveniles, and a device for recapturing the adults at the time of their eventual return to the release site.

The characteristics of the site and its equipment in the framework of the "Sea-Ranching" project should be beneficial for the attempt at determining the nature of the interactions of coho salmon and indigenous species.

STUDY PROJECT OF COHO - INDIGENOUS SPECIES INTERACTION.

1. Competition during the fresh water (stream) phase.

   1.1 Characterization of the immersion areas included between the third fresh water pond (the farthest upstream) and the fish culture facility:

   - size, depth (3 measures along one transect) every 15 m;
   - slope (on the geometric level);
   - current velocity (OTT flow meter)
   - basic or simple sediment particle sizing.

   1.2 Immersion, in July, 1980, of 500 coho and 500 salar of comparable size but different ages, in the above described sections, with different marking according to section (table 3).

   1.3 Electrofishing at the end of September, 1980, to evaluate the parameters of growth, mortality and dispersion. Study of downstream migrations during a year by trapping in the area of the fish culture facility.

1.4 Electrofishing in February, 1981, for a second fishery inventory (growth, mortality, dispersion).

1.5 Downstream migration study of 1981 spring smolts by downstream trapping.

2. Competition in the pond phase.

2.1 Choice of two superficially similar ponds isolated by up stream and down stream grilles.

2.2 Immersion in September, 1980, in:

- the up stream pond: 3,000 S. salar parrs
- the down stream pond: 1,500 S. salar parrs and 1,500 coho parrs.

2.3 Sampling in March-April, 1981, for the parameters of growth, mortality and percentage of smoltification after marking.

3. Study of Coho Salmon marine migration.

Objective: Supply answers to the following questions:

+ Does the coho return to its point of release; in what proportions and with what reliability (percentage of them going astray)?
+ Where do they stay during the marine-estuary phase; the coastal area; is the migration short or long; etc. .....?

Methods:

+ The release, in three consecutive years, of about 10,000 coho smolts produced at the site under controlled sanitary conditions. 3,000 will have marking tags providing for the notation of the recapture areas in the sea.
+ Capture of adults at the time of their eventual return to the release site.

CONCLUSION.

The completion of a phase of research on the eventual impact of Pacific salmon on indigenous species seems, to us, indispensable in order to define an objective position and, eventually, regulatory measures, in the face of growing pressure for private or collective "Sea-Ranching" projects beginning with Pacific species.

Such a project could develop in connection with several different French research agencies and its results be examined by a scientific monitoring committee.

(signed:) P. Prouzet Y. Harache

APPENDIX

PRESENTATION OF THE EXPERIMENTAL SITE.

The Conquet site (Kerjean ponds) is located on the north coast of Finistère. It has a 6 km river interrupted by ponds. The surface area of exploitable water is 14 hectares of brackish water (the first pond) (5 o/oo - 25 o/oo) renewable by tidal action; 2 hectares of fresh water ponds (3 ponds) and 0.5 hectares of stream whose average slope is 1%.

Hydrology (Table 1)

Parameters:	Flow l/s	T °C	pH	O_2d' mg/l	$\%O_2$ /sat	DBO_5 mg/l	NH_4 mg/l-N	NO_3 mg/l-N	NO_2 mg/lN	Ca mg/l	PO mg/l-N
Min. values:	45	3	7	8.7	75	0.6	0.02	3.35	0.001	18	0.18
Max. Values:	330	23	9	11.9	120	6.44	0.25	12.48	0.05	26	0.88

The high values of nutrient salts explain the phenomena of eutrophication encountered in the pond environment.

STUDIES CONDUCTED AT THE SITE.

- Physico-chemical study (Mémoire d'I.U.T., 1979)
- Trout population study (D.E.A., 1979 and Maîtrise de Science et Techniques, 1980).

Summaries of results obtained

The hydrologic quality of the site could be improved by placing at least one of the ponds outside the circuit during the summer and autumn period so as to limit the heating of the water and eutrophication zones.

The trout population is characterized by low density but good growth (analogous to the trout at Nivelle) due in part to the migration of the trout to the marine zone during the summer time.

III. INTERACTION OF COHO SALMON WITH INDIGENOUS SPECIES -- PROPOSAL OF FIELD STUDIES IN BRITTANY.

(An explanation of the proposal by Dr. Harache)

BACKGROUND

CNEXO has undertaken in 1980 an experimental program on "Sea Ranching" with indigenous species (S. salar and S. trutta) on a site situated at the extreme west of Brittany:

- This projects includes the equipment of a small freshwater system and tidal lagoon with:
  - . a hatchery for producing the smolts,
  - . trapping facilities
- The objectives of this program will be:
  - . assessing the results of release-recapture with local species,
  - . assessing the possibilities of winter extensive production of parrs and presmolts in freshwater impoundments and a backish water pond.

Due to the characteristics of the site, the proximity of the research center (15 km west of COB) and the equipments being installed in 1980, it appeared interesting to add to this main program a side and limited experimentation for studying:

- The interactions between coho and local species fry and parrs in various freshwater types of environment.
- The migration pattern of coho salmon in the sea.

In spite of several major escapes from hatcheries or sea cage facilities, no information is available about the marine behavior of this species.

PROPOSED EXPERIMENTAL PROGRAM

1 - Site characteristics (see annex).

2 - Competition during the freshwater phase (O. kisutch - S. salar).

+ Introduction of 2 000 fingerlings of each species of comparable size (8-12 cm) but different age (0+ and 1+) in different sectors of the freshwater system, including ponds and stream. Every fish will be branded accorded with the sector of release. Investigation will be conducted by electrofishing (twice a year) and downstream trapping. The various informations will be used to characterize the specific niches of each species according with the habitat (slope, depth, water velocity, substrat, etc...) using the scientific approach developped by PROUZET (1979).

Starting in 1981 eggs and fry of both species will be introduced in the stream to test the competition at early stages.

+ A more fundamental study of interactions in the early stages between coho atlantic salmon and brown trout fry will be undertaken in 1981 at INRA (Institut National de la Recherche Agronomique - St-Pée-sur-Nivelle) in artificial laboratory streams.

3 - Migration routes at sea.

Release during the spring of 1981, 82 and 83 of 10 000 0-age coho smolts with polyethylene tags, together with groups of Atlantic salmon and sea trout. The releases will occur directly in the brackish water pond.

4 - Origin of the fish released.

- All fish used in these experiments will be issued from specifically selected stocks of coho among populations presenting a high resistance to kidney disease.

- All eggs will be treated with erythromycin at water hardening and with wescodyne before shipment and at arrival.

- All fish will be reared in a new hatchery under strict sanitary control by the Laboratoire de Pathologie des Animaux Aquatiques which will carry on routine examination for any pathogens.

The present study is proposed for a duration of 5 years, and its execution will be controlled by a French scientific committee of several experts from different research organisations. In addition to this program, close attention will be devoted to the sites where escapes are known to have occurred to gather as much informations about the behavior of cohos in the French environment.

IV. COMMENTS FROM THE INTRODUCTIONS WORKING GROUP ON THE FRENCH PROPOSAL CONCERNING STUDIES OF COHO AND NATIVE SALMON INTERACTIONS

A. BACKGROUND

1. France has imported annually since 1971 several hundred thousand coho eggs. Fish have undoubtedly escaped, but the consequences are uncertain. Some were deliberately released. In ecological time scales this is a short period and it may take both the fish and scientific observers time to establish a pattern of events. French agencies are currently engaged in limited monitoring.

2. The numbers of farmed coho are increasing. Research emphasis is being placed on establishing French brood stocks to ensure a supply of eggs for the future. If successful, the latter should reduce the disease risk associated with wild egg imports to zero. However, the increase in farming activity and escapes to be expected from it may favor unwanted ecological effects.

3. The farming activity is in Northwest Brittany and in the Bay of Cherbourg. This is close to Southwest England and the southern part of the Republic of Ireland, both centres of breeding populations of Salmo salar and Salmo trutta.

4. The current objective of the French industry is to culture coho to market size. No existing French law forbids this. There are French laws which prohibit or may regulate the release of coho into natural waters, fresh or salt. However, if ranching coho appeared attractive these laws might be altered to allow ranching.

B. LIMITATIONS OF PRESENT COMMENTS

1. No members of the Working Group have seen the area and in particular the stream where it is proposed to conduct most of the work.

2. As the French paper is of very recent origin (July 25, 1980), there has been no time to discuss and clarify with the French workers aspects of their proposals.

3. A desk evaluation of the project by French scientists as requested in the ICES Code of Practice has not been made available.

C. COMMENTS ON THE FRENCH PROPOSALS

1. With the growth of the French coho farming activity the Working Group welcomes this initiative in principle.

2. The proposals do not indicate if the projects will continue for long enough for observations to be meaningful. Reference to releases in 1983 imply that work will be ongoing until 1985 and perhaps later. Some of our subsequent reservations, if accepted, would extend the program over a longer period. A statement indicating in principle that the work must be conducted over several years would be helpful.

3. Releases of fish in the stream should satisfy the requirements that all or most will be caught by electric fishing and a downstream migrant trap. The value of releasing tank reared coho parr in this stream system is questioned.

4. It would be useful if more information describing the ecology, hydrology, geography, etc., of the stream and its watershed were forthcoming, including information on existing fish production and distribution, as well as a description of the program of research on the other species.

5. The annual release of 10,000 tank reared "0" coho smolts beginning in 1981 is viewed with apprehension. We estimate some 0.1-20 percent as the possible range of returns -- i.e., 10-2,000 spawning condition fish. If a figure of 20% is allowed for straying, some 2-400 mature fish will ascend other rivers in each of 3 successive years. Although we accept that such figures are notional, we consider they could be realistic, and that with the current state of limited knowledge, the risks associated with such numbers of spawning fish are too great. The rate of escape from each of the 3 coho sea cage sites probably does not equal this rate of release. In addition it is known that escapes from cages often stay in the vicinity of cages and are caught later.

We feel that such a deliberate release of coho smolts should not be contemplated until the results from freshwater are available and their interpretation agreed upon.

As an alternative we suggest the use of monosex coho for initial release experiments if it can be shown satisfactorily that a very high rate of efficiency of conversion of females to males can be achieved -- e.g., 98% or more. In 10,000 fish this would represent 100 females. Using a maximum of 20 percent for the rate of return and 20 percent straying, some 4 females might stray to other rivers -- a figure which is likely to be within the probability of events at the commercial sites.

Details of the upstream migrant trapping system should be made available.

6. The ICES Code of Practice on introductions calls for projects like this to be reviewed by ICES. However, although ICES has an Introductions Working Group, the Council has not formally determined how such submissions

should be dealt with internally. This should now be discussed; problem areas should be considered -- such as whether all such proposals will be considered from a desk review of the data, or whether field visits are necessary.

D. CONCLUSIONS

1. The stream tank experiments are wholly endorsed.
2. More information is required on the stream site -- e.g., ecology, fishery potential, and ability to catch released fish.
3. Releases of smolt populations with heterosexual potential should not be contemplated until results from freshwater are available and their interpretation agreed upon. Releases of monosex populations of smolts could be considered if evidence were available to show high efficiencies of conversion to one sex.
4. ICES should act promptly to establish an internal mechanism for reviewing proposals such as this.