第 29 回 UJNR 水産増養殖専門部会日米合同会議議事要録

第 29 回 UJNR 水産増養殖専門部会日米合同会議は、平成 12 年（2000 年）11 月 7 ～ 15 日に日本国三重県伊勢市及び沖縄県石垣市において開催された。

事務会議は、11 月 7 日の午前、伊勢市において開催された。引き続いて開催された本年度シンポジウムの主題は「病原生物と防疫」であった。

事務会議においては、はじめに日本側部会長中村保昭養殖研究所長が開会を宣言した後、米国側部会長 James P. McVey 博士を始めとする全ての米国側参加者に対し歓迎の意が述べられた。引き続き、日本側部会の水産庁資源生産推進部参事官　浮　永久（副部会長）、水族飼育技術懇談会　古川　厚（顧問）、中央水産研究所　松里寿彦（国内委員代理）、瀬戸内海区水産研究所　松岡正信（国内委員）、西海区水産研究所石垣支所　佐野元彦（国内委員代理）、日本海区水産研究所　小暮陽一（国内委員）、水産工学研究所　桑原久実（国内委員）、水産庁資源生産推進部　小林正裕（国内委員）、さけ・ます資源管理センター　浦和茂彦（国内委員代理）、養殖研究所　關　哲夫（副事務局長）、養殖研究所　藤井武人（事務局長補佐）、養殖研究所　鈴木　徹（事務局；研究交流担当）、養殖研究所　良永知義（事務局；出版担当）、養殖研究所　生田和正（事務局；出版担当）、松宮美穂子（同時通訳）の各参加者の紹介があった。

また、中村部会長より、本会議の開催趣旨に関して次のような挨拶が述べられた。

水産増養殖部会は、数多くの UJNR 諸活動の中でも最も活発に活動している部会であり、これはひとえに日米の研究者の努力の賜物である。世界の抱える多くの問題解決のために、ここに参集した者の役割はますます大きくなる。人口増加による 21 世紀の食糧・エネルギー危機が予想され、蛋白資源としての魚介類の飛躍的な増産が必要とされており、中でも水産増養殖が 21 世紀の食料生産に大きな役割を果たすと考えられている。

我が国の行政府においては、行政を効率的に推進する観点から企画・立案部門と事業実施部門を分離する大きな再編が予定されている。そのため、実施機関としての研究所は、組織の革新と予算の見直しに直面することとなる。

次年度は、本会議が進めている第５次５カ年計画の最終年度である。このため本会議では、第６次５カ年計画が協議されるが、安定的食糧生産、環境保全、持続的資源利用は 21 世紀に向けた大きな課題となっており、次期計画について十分な協議を望む。また、シンポジウムでは「病原生物と防疫」を主題としているが、今日魚介類の疾病は生産阻害要因としてだけでなく、資源・環境をも包含した世界規模の問題となっており、病害の予防・治療技術の開発、防疫対策の確立は緊急の課題となっている。これらの諸問題解決のため、活発な討議を期待する。

さらに、本日米合同会議では、西海区水産研究所石垣支所の竣工記念の意味も含め、これまで研究蓄積の少なかった「亜熱帯域における環境保全型増養殖研究の現状と課題」に関して、沖縄県石垣市にてサテライトシンポジウムを開催する予定である。また我が国の増養殖の現場を広く見聞していただくため、現地検討会として三重県の種苗生産と養殖生産現場及び石垣市の亜熱帯域の水産増養殖生産技術の視察が計画されている。

次に、米国側部会長 McVey 博士（NOAA、U.S. Sea Grant) より中村部会長を始めと

する日本側部会に対して、本会議の開催にかかる努力への感謝の意が述べられた。また、米国側部会の、Dr. Conrad V.W. Mahnken（副部会長、Northwest Fisheries Science Center）、Dr. William Heard（事務局長、National Marine Fisheries Service）、Mr. Dominic Preiswerk（副事務局長、NOAA）、Dr. James Sullivan（研究者交流担当、Hawaii Sea Grant College Program）、Ms. Janice A. Beattie（文献交換担当、NOAA Library）、Dr. Cheng-Sheng Lee（5 カ年計画担当、Oceanic Institute）、Dr. Charles E. Helsley（前 Director of the Hawaii Sea Grant College Program）、Ms. Jane Keller（出版担当、NOAA Oxford Laboratory）、Dr. Earl J. Lewis（NOAA Oxford Laboratory）、Dr. Reginald B. Blaylock（University of Southern Mississippi）、Dr. Paul Kilho Park（NOAA）の各参加者の紹介があった。

浮副部会長より、1998 年に仙台で UJNR との合同会議として開催された、バイオコスモスプロジェクト・ワークショップへの米国側部会の支援と参加に対して謝意が述べられ、会議の論文集が米国側に提出された。

この後書記の人選に移り、關副事務局長より生田事務局員が、McVey 部会長より Preiswerk 副事務局長が推薦され、了承された。

また、合同会議日程、事務会議の議事次第、文献交換リスト、研究者交流リスト、共同研究計画書、第 6 次 5 ヵ年計画案、シンポジウムプログラム、出席者名簿が提出された。

文献交換

鈴木委員より、1999 年 9 月より 2000 年 9 月までに出版された 180 の論文別刷りが、11 の研究所と１つの大学から収集されたことが報告され、そのリスト（添付資料Ⅵ）が米国側 Beattie 委員に提出された。また、このリストは、養殖研究所のホームページでも閲覧することができ、別刷りは後日 NOAA 中央図書館へ郵送されることが伝えられた。

Beattie 委員より、米国側で海面増養殖関連の 37 の別刷りが収集されたことが報告され、日本側に提出された（添付資料Ⅶ）。また、現在 NOAA 中央図書館は農務省と共同で増養殖に関する文献や情報の収集を続けており、インターネットで迅速に検索できるデータベースの確立に努めていることが述べられた。さらに、日本側と共同で UJNR のホームページを作製してきたことに触れ、文献データは益々多くの人々に利用されることになるだろうと報告した。

研究者交流

藤井事務局長補佐より、1999 年 9 月より 2000 年 8 月にかけて、33 名の研究者が UJNR 関連の業務で日本から米国を訪れたことが報告され、リスト（添付資料Ⅷ）が米国側に提出された。その内訳は、長期在外研究 1 名、研究集会参加 21 名、第 28 回 UJNR 合同会議参加 11 名であった。

Sullivan 委員より、研究集会参加を除き 6 名の研究者が UJNR 関連の共同研究のために、米国から日本を訪れたことが報告され、リスト（添付資料Ⅸ）が日本側に提出された。また、日米で真の共同研究が行われており、両国の密接な科学協力が科学技術の発展を促し、将来的には共同研究体制がそれぞれの研究機関の目標となるべきであることが述べられた。

共同研究

關副事務局長より、京都大学と福井県立大学において、3 名の米国側研究者とともにヒラメ増養殖に関する共同研究プロジェクトが推進されたことが報告された。

また、この共同研究プロジェクトに関して、日本側は農林水産省に研究予算を申請したが、本年は残念ながら棄却されたことを報告した。しかし、日本側では、政策的な緊急性等を勘案して研究計画を練り直し、この UJNR 共同研究のためにさらに予算獲得に努めることが述べられた。

McVey 部会長は、NOAA 中央図書館の Beattie 委員が永井育子養殖研究所情報係長（現東北区水産研究所八戸支所）と共同で UJNR ホームページの作製を行ってきたことを報告し、最終的な仕上げに日本側の更なる協力を要請し了承された。

また、McVey 部会長は、關副事務局長に対し、ヒラメ増養殖共同研究とそれに関する米国側研究者及び学生の訪日への協力に感謝の意を表した。さらに、日本側に対して、今回の米国貝類研究者カキ養殖場視察団の受け入れに関して謝意を述べた。また、UJNR 共同研究への予算申請努力についても謝意を表し、今後も 5 カ年計画の課題と調和を取りながら共同研究を進める必要があると述べた。

出版物

生田委員より、本第 29 回 UJNR 会議のプロシーディングは水産庁の予算支援によって養殖研報別冊として出版されることと、来年 4 月の研究機関の独立行政法人化に伴って養殖研報が廃刊になることから、本号をもって養殖研報別冊として出版されるのは最後になることが報告された。また、出版への予算支援に関して、浮副部会長へ感謝の意が述べられた。さらに、本プロシーディング原稿の投稿締め切りを 2000 年 12 月 31 日とし、原稿の取りまとめを日本側は養殖研究所の良永委員、米国側は NOAA の Keller 委員が行うことが提案され、了承された。

前 Hawaii Sea Grant College Program Director の Dr. Helsley より、第 28 回 UJNR 会議のプロシーディングは印刷中であり、11 月中には日本側へ届けられることが報告され、見本刷り 1 部が日本側へ提出された。

第６次５ヵ年計画

米国側から事前に提出された第 6 次 5 カ年計画案（別添資料 X）に関して、關副事務局長より、独立行政法人化によって 2001 年 4 月以降の日本側 UJNR 組織がどの様になるか不明であるため、日本側としてはさらに検討を続けたい意向を提案し、中村部会長もそれを支持した。

Dr. Lee は、McVey 部会長と Park 前事務局長による原案に基づいて策定された第 6 次 5 カ年計画案に関して、その基本概念を次のように説明した。将来予想される食糧危機のために、漁獲と養殖生産の拡大が必要であり、環境と調和した漁業と増養殖の協調がさらに重要となる。しかしながら、米国では、沿岸漁業と増養殖は未だ日本のように結合したものにはなっていない。したがって、両国にとって、太平洋域における生簀養殖、沖合養殖、生物多様性の保全等に関する共同研究と科学情報交換を推進する時期にきている。次期 5 カ年計画の終了までまだ 7 年という長い期間があるので、途中で柔軟な修正もあり得るだろう。

Dr.　Park は、最初に第 6 次 5 カ年計画の原案を作成した浮副部会長の努力に謝意を表するとともに、水産庁研究所の独立行政法人への移行と米国政府組織の改変が控えているので、第 6 次 5 ヵ年案を改良するよい機会ではないかと述べた。そこで、計画案を効率的に改良していくためには、両国側に明確な対応組織を設置するとともに、その作業スケジュールを策定する必要があり、本会議期間中にこの点に関して日本側と協議したい旨を提案した。

McVey 部会長は、石垣へ同行できないため、代理として Mahnken 副部会長をこの議論に参加させたいと要望し、了承された。

Dr. Sullivan は、Dr. Park の提案を支持し、日本側の新 UJNR 組織体制が未だ不明確であるため、次期 5 カ年計画の検討の継続を提案した。

中村部会長は、米国側の提案に答え、（１）来年 4 月に研究組織の新体制が確定次第、米国側に新 UJNR　5 カ年計画検討組織を報告する、（２）5 カ年計画は今決定せず、検討を続ける、（３）計画の検討経過は逐次米国側に報告し、最終案を第 30 回 UJNR 合同会議で示すことが述べられた。

McVey 部会長は日本側の提案を了承し、さらにダイナミックな 5 カ年計画が策定されることを望むと述べた。

現地検討会

關副事務局長は、11 月 9 日に予定されている三重県内のヒラメ養殖場と三重県尾鷲栽培漁業センターの視察に関して説明した。

西海区水産研究所石垣支所の佐野氏は、11 月 13 ～ 15 日に予定されている沖縄県石垣市でのサテライトシンポジウム及び(社)日本栽培漁業協会八重山事業所、沖縄県水産試験場、石垣支所、西表島マングローブ林、イリオモテヤマネコ保護センターの視察に関して説明した。

来年度の日米合同会議について

Dr.　Park より、第 30 回 UJNR 水産増養殖専門部会合同会議は、「増養殖対象種の生態と資源増殖」のテーマで、フロリダ州 Sarasota の Mote Marine Laboratory で開催され、会議と現地検討会は、Dr. Kenneth M. Leber によって企画されることを報告した。

McVey 部会長は、日本側に対し、第 29 回 UJNR 合同会議の主催と、特に第 6 次 5 カ年計画に関する活発な討議に関して感謝の意を表するとともに、以下のように事務会議閉会の辞を述べた。

米国では今、食料供給、雇用促進、一般経済に果たす増養殖の貢献について真剣に検討されている。米国商務省と NOAA は、増養殖産業の拡大と増養殖研究事業への支援を増加させ続けている。米国農務省、環境庁等、全ての米国連邦政府は、大統領の諮問機関である増養殖合同小委員会の下で新国家増養殖計画を策定しているところである。商務省は、米国排他的経済水域内での増養殖を規制する法律の策定を行っており、National Marine Fisheries Service はこの規正法を策定する５つの作業部会を後援し

ている。Sea Grant Program も、商務省国立規格技術研究所の先端技術プログラムの研究資源を用いて、沖合養殖、海洋循環システム、海洋資源増殖等、将来の増養殖産業を高度化する先端技術に対して研究予算を費やしている産業を助成するいくつかの作業部会を持っている。

過去 2 年間、NOAA の持続可能漁業建設チームは、将来の食糧危機に対処するため調和を持って統合されるべき、漁業管理、増養殖、沿岸漁業集合体の３つの主要領域についての展望を構築してきた。中村部会長が述べたように、日本も同じ方向に向かって進んでいる。そして、増養殖と環境との関わりが、最も強調されるべきであろう。増養殖の発展と沿岸域の他の様々な利用とのバランスをいかにとるかが極めて重要である。人間も含めた、様々な生命集合体の機能を考慮した調和的生態系を目指すという概念は、将来の沿岸資源の持続的生産の確立にとっての鍵となる。この方策概念は、UJNR を通じた共同事業によって培われて来たものである。もし、我々が UJNR の共同事業を通じて築いてきた基盤を活用し、今日本が経験している変革を考慮しつつ将来計画の検討をダイナミックに進めるならば、UJNR は日米両国の増養殖分野において沿岸資源管理方策を主導することができるだろう。

中村部会長と McVey 部会長は、事務会議のために予定されていた全ての議事が終了したことを確認し、第 29 回 UJNR 水産増養殖専門部会日米合同会議事務会議の閉会を宣言した。

日本国三重県伊勢市にて

2000 年 11 月 7 日

ジェームス　P.　マクベイ	中村保昭
米国側部会長	日本側部会長

Statement of the 29th Joint Meeting of the United States-Japan Cooperative Program in Natural Resources (UJNR) Aquaculture Panel Meeting

The Twenty-Ninth Joint Meeting of the UJNR Aquaculture Panel Meeting was held on November 7-15, 2000 in Ise and Ishigaki in Japan. The business meeting and the symposium were held in the morning of November 7-8, in Ise. The theme of the symposium was *Pathogenic organisums and disease prevention.*

Dr. Yasuaki Nakamura, Chair of the Japanese delegation, National Research Institute of Aquaculture (NRIA), opened the joint meeting by welcoming Dr. James P. McVey, Chair, and the entire U.S. delegation. He introduced the members of Japanese delegation: Dr. Nagahisa Uki, Vice Chair, Japan Fisheries Agency, Dr. Atsushi Furukawa, Adviser, Dr. Masanobu Matsuoka, National Research Institute of Fisheries and Environment of Inland Sea, Dr. Motohiko Sano, Ishigaki Tropical Station, Seikai National Fisheries Research Institute, Dr. Yoichi Kogure, Japan Sea National Fisheries Research Institute, Dr. Hisami Kuwabara, National Research Institute of Fisheries Engineering, Dr. Masahiro Kobayashi, Fisheries Agency, Dr. Shigehiko Urawa, National Salmon Resources Center, Dr. Tetsuo Seki, Deputy Secretary General, NRIA, Dr. Takehito Fujii, Associate Secretary General, NRIA, Dr. Toru Suzuki, Secretary for Scientific Exchange, NRIA, Dr. Tomoyoshi Yoshinaga, Secretary for Publications, NRIA, Dr. Kazumasa Ikuta, Secretary for Publications, NRIA, Dr. Toshihiko Matsuzato, National Research Institute of Fisheries Science, and Ms. Mihoko Matsumiya, Interpreter.

Dr. Nakamura then addressed the delegations with the following remarks:
This Aquaculture Panel is one of the most active panels in numerous UJNR activities. This has been made by the efforts dedicated by both American and Japanese Scientists. Those who have assembled here today will continuously play an important role for challenges to solve various problems of the world, such as energy and food shortage due to rapid and persistent population growth in the 21st century. Thus, high priority is being placed on drastic improvement in availability of fishery stock as an important source of protein, and it is expected that aquaculture will be a key contribution to global food production in the 21st century.
The next year marks the final year to fulfill joint meeting's strategy defined in the Fifth Five-Year Plan. At the same time, Japan's administrative system will be drastically reformed to improve its efficiency, which includes the separation of planning and operating functions. As operating bodies, most of the research institutes will face radical management reorganization and budgetary review.
In the present business meeting, the Sixth Five-Year Plan will be discussed. Stable food production, environmental conservation and sustainable use of resources are considered as significant challenges toward the 21st century. Thorough consideration and discussion in drafting the new Five-Year Plan should be requested, for development of aquaculture will surely help to tackle these challenges in the coming

century. In addition, “Pathogenic organisms and disease prevention” will be discussed in this Symposium. Nowadays diseases are not only obstacles to sound aquaculture production, but are also emerging as part of a global problem related to resources and environment. Thus, it is our urgent task to establish technologies for disease prevention and treatment as well as epidemic prevention.
In the present joint meeting, furthermore, a satellite symposium will take place in Ishigaki-city, Okinawa, on the less studied area of “Present status and prospects of environmentally friendly aquaculture and resource enhancement in tropical regions.” This symposium is a part of the commemorative events to celebrate the completion of Ishigaki subtropical station, Seikai National Fisheries Research Institute. Also, site visits will include an inspection of seed production and aquacultural production technology in application in Mie and Okinawa.

Dr. James P. McVey, Chair of the U.S. delegation, NOAA, thanked Dr. Nakamura and the Japanese delegation for their extensive efforts in organizing the meeting. He introduced the members of the U.S. delegation: Dr. Conrad V. W. Mahnken, Vice Chair, Northwest Fisheries Science Center, Dr. William Heard, Secretary General, National Marine Fisheries Service, Mr. Dominic Preiswerk, Deputy Secretary General, NOAA, Dr. James Sullivan, Secretary for Scientific Exchange, Hawaii Sea Grant College Program, Ms. Janice A. Beattie, NOAA Library, Dr. Cheng Sheng Lee, Secretary for Five-Year Plan, Oceanic Institute, Dr. Charles E. Helsley, former Director of the Hawaii Sea Grant College Program, Ms. Jane Keller, Secretary for Publications, NOAA Oxford Laboratory, Dr. Earl J. Lewis, NOAA Oxford Laboratory, Dr. Reginald B. Blaylock, University of Southern Mississippi, and Dr. Paul Kilho Park, NOAA.

Dr. Uki thanked the U.S. delegation for their assistance and participation in the Work Shop of Bio-Cosmos Project held in Sendai in 1998 as a joint conference with UJNR. He handed over proceedings of the workshop to the U.S. side.

Dr. Seki and Dr. McVey introduced the rapporteur, Dr. Ikuta of the Japan side and Mr. Preiswerk of the U.S. side, respectively.
An itinerary of the joint meeting, an agenda for the business meeting, a literature exchange list, a list of scientist exchange activities, an application for cooperative project of flounder aquaculture, a draft of the sixth five-year plan, a symposium program, and a list of participants are attached.

Literature Exchange Program
Dr. Suzuki reported that 180 reprints published since September, '99 through September, '00 were collected from 11 research institutes and one university. He handed over the list to Ms. Beattie (Appendix Ⅵ). The list can be seen also in the home page of National Research Institute of Aquaculture. Reprints will be sent to the NOAA library by mail.

Ms. Beattie reported that 37 reprints concerning mariculture were collected, and they

were handed over to the Japanese delegation (Appendix Ⅶ). She stated that NOAA library has made efforts to collect publications and information on aquaculture in cooperation with the U.S. Department of Agriculture to establish a data-base which can be quickly accessed by internet. As they have also established the UJNR home page in cooperation with the Japan side, the web site will be utilized by a greater number of people.

Scientist Exchange Program

Dr. Fujii handed over a list of the 33 Japanese scientists who visited the U.S. since September, '99 through August, '00 to carry out work under the UJNR Aquaculture Panel. The 33 scientists were composed of one for long-term stay, 21 for scientific conferences and symposiums, and 11 for the 28th UJNR Joint Meeting (Appendix Ⅷ).

Dr. Sullivan reported that 6 American scientists visited Japan to cooperate in activities pertinent to the UJNR, except for visiting conferences (Appendix Ⅸ). He stated that real collaboration has been carried out between Japan and the U.S. The close scientific cooperation between both countries is helping to promote science and technology. Dr. Sullivan stated that the goals of each scientific institution should be included in the planning of future collaborations.

Cooperative Studies Program

Dr. Seki reported that the UJNR cooperative research project on flounder aquaculture had been conducted in Kyoto University and Fukui Prefectural University with three scientists from the U.S.

With regard to this research project, he mentioned that the Japanese Panel had applied for a grant-in-aid from the Ministry of Agriculture, Forestry and Fisheries, but it was unfortunately rejected this year. He stated, however, the Japanese Panel would like to further improve the plan to fit urgent political demands and they will apply again for a budget for the UJNR.

Dr. McVey stated that Ms. Beattie, Director of the NOAA Central Library, is establishing the UJNR home page on the web site in cooperation with Ms. Ikuko Nagai, NRIA library(Hachinohe Branch, Tohoku National Fisheries Research Institute at present). He requested further assistance from the Japan side to finish the final accomplishment, and it was acknowledged.

Dr. McVey also thanked Dr. Seki for his cooperation and coordination for the visit of U.S. scientists and students to Japan for flounder enhancement research. He thanked the Japanese delegation for receiving the group of mollusk scientists who visited Japan from the U.S. for a field trip to see oyster aquaculture. He also appreciated the efforts of the Japanese side for applying for budget of the UJNR cooperative study. He stated that the cooperative study should be undertaken in harmony with topics of the five-year plan.

Publications

Dr. Ikuta stated that the 29th Proceedings will be published as a Supplement of the

Bulletin of National Research Institute of Aquaculture of which expense would be supported by Fisheries Agency, and this volume will be the last one as the Bulletin of NRIA, because the journal will be discontinued in association with the reorganization of Fisheries Research Institute in the following April. He thanked Dr. Uki for his special attention on this financial support. He suggested that Dec. 31, 2000 will be the deadline for the manuscripts, and it was acknowledged. For the 29th Proceedings, Dr. Yoshinaga, NRIA, and Ms. Keller, NOAA, will collect the manuscripts at the Japan side and the U.S. side, respectively.

Dr. Helsley, former Director of the Hawaii Sea Grant College Program, reported that the 28th Proceedings is at the publisher and will be sent to each participant by November. He handed over one sample copy of the Proceeding to the Japanese delegation.

Five-Year Plan

Concerning the draft of the sixth five-year plan offered from the U.S. Panel (Appendix X), Dr. Seki suggested that the Japan side would like to continue discussion of the five-year plan as the reorganization of the Japan UJNR panel will not be clear until April 1, 2001. Dr. Nakamura concurred with this.

Dr. Lee explained conception of the draft of the sixth five-year plan that he completed from the original draft made by Dr. McVey and Dr. Park. For the food shortage projected in the future, magnification of fisheries and aquaculture production is required. Therefore cooperation between fisheries and aquaculture, harmonized with aquatic environment**,** will be much more important. In the case of the U.S., coastal fisheries and aquaculture are still quite separated unlike Japan. It is time to enhance cooperative studies and exchange scientific information on cage aquaculture, offshore aquaculture and preservation of aquatic bio-diversity in the Pacific area for Japan and the U.S. Since it could be as long as 7 years until the next five-year plan is completed, some modification may be acceptable along the way.

Dr. Park thanked Dr. Uki for his effort to draft the first five-year plan. He stated that it is a good time to improve the sixth five-year plan, because Japan Fisheries Agency will be reformed and the U.S. governmental system will be also changed. In order to undertake efficiently the improvement of the plan, it is necessary to develop a certain system for both sides to discuss the five-year plan and also finalize a time schedule for the completion of the plan. He asked the Japanese delegation to have further discussions on these points during this UJNR Meeting.

Dr. McVey suggested that Dr. Mahnken will join the discussion on behalf of himself because he will not go to Ishigaki and it was acknowledged.

Dr. Sullivan supported Dr. Park's suggestion that both sides should continue the planning phases of the five year plan because the new Japanese system for management of UJNR is still not clear.

Dr. Nakamura replied that the suggestions from the U.S. side indicated that (1) a new system for UJNR to manage the sixth five-year plan will be shown to the U.S Panel after the new organization is completed in the following April, (2) the five-year plan is not decided at present, and improvement of the plan will be continued, and (3) the process of acquiring the plan should be successively announced to the U.S. side, and the final plan will be shown at the 30th UJNR Meeting.

Dr. McVey acknowledged the suggestion from the Japanese side. He mentioned his aspiration to have a more dynamic five-year agenda.

Field Trip

Dr. Seki explained the schedule of the field trip in Mie to visit a flounder aquaculture facility and Owase Sea Farming and Aquaculture Center of Mie Prefecture on November 9.

Dr. Sano, Ishigaki Tropical Station, Seikai National Fisheries Research Institute, explained the schedule of satellite symposium and field trip in Ishigaki, Okinawa, to visit Yaeyama Station of Japan Sea Farming Association, Fisheries Station of Okinawa Prefecture, Ishigaki Tropical Station, and Mangrove Area and Wildcat Preservation Center in Iriomote Island from November 13 to 15.

Plans for Next Joint Meeting

Dr. Park stated that the 30th UJNR Aquaculture Panel Joint Meeting will be held in Mote Marine Laboratory, Sarasota, Florida with the theme of *Ecology of Aquaculture Species and Enhancement of Stocks.* Dr. Kenneth M. Leber is coordinating the meeting and field trip.

Dr. McVey thanked the Japanese delegation for hosting the 29th UJNR Meeting, and particularly for active discussion about the sixth five-year plan. He stated in his closing address:

In the United States, the contribution of aquaculture to food supply, enhancement of employment and general economy is seriously examined. The U.S. Department of Commerce (DOC) and NOAA have increased support for the expansion of the aquaculture industry and scientific effort in aquaculture. All of the U.S. Federal Agencies, i.e. USDA, EPA, are also working to make a new national aquaculture plan under the Joint Sub-committee on Aquaculture which is a consultative body of the White House. DOC is developing legislation to facilitate the conduct of aquaculture in the U.S. EEZ. The National Marine Fisheries Service has sponsored five workshops to develop a code of conduct for aquaculture in the EEZ. The Sea Grant Program also has conducted several workshops to bring resources of the DOC National Institute of Standards and Technology's Advanced Technology Program to the help of industry providing research budgets for advanced technologies, i.e. offshore aquaculture, marine recirculation systems, and marine fish enhancement, which will upgrade the aquaculture industries in the future.

Over the last two years, the Build Sustainable Fisheries Team of NOAA has

developed a vision on three major areas, such as management of capture fisheries, aquaculture, and coastal human fisheries communities, that must be integrated into a balanced approach to future food supply. As mentioned by Dr. Nakamura, Japan is moving in the same direction. Environmental implications of aquaculture should be strongly emphasized. How to balance aquaculture development with other uses of the coastal zone is very important. The concept of a balanced ecosystem approach which takes into consideration the roles of the different biotic communities, including the human role, is the key to sustainable production of the coastal resources in the future. This approach was furthered because of our cooperation through UJNR. If we take advantage of the foundations we have laid through UJNR collaboration, and we take into consideration the changes Japan is undergoing and we keep the planning process dynamic, UJNR can help to lead both our nations in the aquaculture area for how we manage the coastal resources in the future.

Dr. Nakamura and Dr. McVey announced that all business had been concluded. The 29th joint meeting of the UJNR aquaculture Panel Meeting was then adjourned.

November 7, 2000

Dr. James P. McVey	Dr. Yasuaki Nakamura
U.S. Chairman	Japanese Chairman

資　　料

Ⅰ　第 29 回 UJNR 水産増養殖専門部会日米合同会議事務会議挨拶

第２９回ＵＪＮＲ水産増養殖専門部会日米合同会議事務会議挨拶

水産庁養殖研究所　　中村 保昭

第２９回ＵＪＮＲ水産増養殖専門部会日米合同会議事務会議の開催に当たり、日本側を代表して一言ご挨拶を申し上げます。合衆国から参加の James P. McVey 部会長をはじめ皆様方には長い旅、大変お疲れ様でした。私は今年４月に日本側部会長を拝命しました中村保昭と申します。

先ず、昨年米国ハワイで開催されました第２８回日米合同会議で、我が国の使節団の受け入れに尽力された米国部会長 James P. McVey 博士をはじめ米国側の関係者に厚く御礼を申し上げます。この度、日米の関係者の方々をここ伊勢市にお迎えできましたことを大変喜んでいます。日本側を代表して心から歓迎します。

水産増養殖専門部会は、数多くのＵＪＮＲ諸活動の中でも最も活発に活動している部会であります。これは、ひとえに日米の研究者の努力の賜です。今後も、多くの問題点を解決する必要がありますので、ここにお集まりの方々の役割は、ますます大きくなると考えられます。さらに、世界的に人口が急増し、２１世紀へ向けて食料、エネルギー等の逼迫が予想される中、蛋白質源である魚介類の生産量を飛躍的に高めることが必要とされています。中でも、水産増養殖は２１世紀の世界の食糧生産に大きな役割を果たすものと考えられます。

一方、明年は本合同会議が第５次５ヶ年計画の最終年となります。また、我が国の行政システムは、行政を効率的に推進していくために、明年から、企画・立案部門と実施部門を分離する等、大きく変わります。このため、実施部門を担当する国の研究所の大部分は、予算や運営の形態を含め、組織が大きく変わります。

本事務会議では、第６次５ヶ年計画が協議されますが、安定的な食糧生産、環境の保全、持続的な資源の利用は、２１世紀に向けた大きな課題になっています。新たな世紀に向けての増養殖業の発展のために、次期計画について十分な協議をお願いします。また、シンポジウムでは「病原生物と防疫」を主題としています。今日では、魚介類の疾病は生産阻害要因としてばかりでなく、資源・環境も包含した世界規模の問題となっており、病害の予防・治療技術の開発、防疫対策の確立は緊急の課題となっています。これらの諸問題を解決するため、皆様方の活発な討議を期待いたします。

さらに、今回の日米合同会議ではこれまで研究蓄積の少なかった「亜熱帯域における環境保全型増養殖研究の現状と展望」と題して、遠く沖縄県石垣市においてサテライトシンポジウムを企画しました。当シンポジウムは昨年完成しました水産庁西海区水産研究所石垣支所の竣工記念行事の一環として行うものです。多数のご参加をいただき厚く御礼を申し上げます。また、現地検討会では、三重県において種苗生産と養殖生産現場の実状を、沖縄県においては亜熱帯域における水産生物の増養殖生産技術の理解を深めていただく予定です。各地の研究者との交流を活発に行っていただき、併せて合衆国から参加の皆様には、専門の分野のみならず我が国の風景、歴史、文化や生活の一端を知っていただければ幸いです。

最後に本会議の開催に大変努力された米国側及び日本側のＵＪＮＲ関係者に厚く御礼を申し上げます。この会議が友好的で実りの多いものになることを祈念して私の挨拶とします。なお、１３，１４日の石垣での現地検討会とシンポジウムにも同行させていただきますので、よろしくお願いいたします。

Opening Remarks for Yasuaki Nakamura

I would like to open Business meeting of The 29th Joint Meeting of the UJNR Aquaculture Panel by saying a few words on behalf of the entire Japanese panel. My name is Yasuaki Nakamura and I have an honor to serve as a chairperson of Japanese panel since this April. I would like to take this opportunity to thank American chairperson Dr. James P. McVey and all other participants from the American side for taking the trouble of traveling long way from the United States.

At the outset of this year's meeting, let me first of all express my deepest appreciation to Dr. James P. McVey and other American colleagues involved for their extensive efforts to receive us as Japanese delegates at The 28th Joint Meeting in Hawaii last year. To reciprocate your hospitality, we are indeed very happy to welcome American colleagues as well as Japanese colleagues here in Ise city. On behalf of the Japanese panel, I would like to extend my warmest welcome to our friends from the United States.

This Aquaculture Panel is one of the most active panels among other numerous UJNR activities. This has made only been possible thanks to dedicated efforts by both American and Japanese scientists. Those who have assembled today will continue to play an increasingly important role in meeting various challenges in the world, of which rapid and persistent population growth is likely to cause energy and food shortage in the 21 centuries. Thus, high priority is being placed on drastic improvement in availability of fishery stock as an important source of protein. Among all other measures, it is expected that aquaculture will be a key contribution to global food production in the 21 centuries.

Next year marks the final year to fulfill joint meeting's strategy defined in the Fifth Five-year plan. At the same time Japan's administrative system will be drastically reformed for improved efficiency which includes separation of planning and operating function. As operating bodies, most of the research institutes will face radical management reorganization and budgetary review.

In the business meeting this year, we will be discussing the Sixth Five-Year Plan. Stable food production, environmental conservation and sustainable use of resources are considered as significant challenges toward the 21 centuries. I should like to request your thorough consideration and discussion in drafting the new Five-Year Plan, for development of aquaculture will surely help tackle these challenges in coming centuries. I also look forward to your exchanges of opinions in the symposium with the theme of "Pathogenic organisms and disease prevention." Nowadays diseases are not only obstacles to sound aquacultural production, but is also emerging as a global problem related to resource and environment. Thus, it is our urgent task to establish technologies for disease prevention, treatment as well as epidemics prevention.

In this year's joint meeting, furthermore, a satellite symposium will take place in Ishigai-city, Okinawa, on the less studied area of "Present status and prospects of environmentally friendly aquaculture and resource enhancement in tropical region. This symposium is a part of the commemorative events to celebrate last year's

completion of Ishigaki subtropical station, Seikai National Fisheries Research Institute. I thank you for already showing great interests in participating this satellite event. Also, site visits will include an inspection of seed production and aquacultural production technology in application in Mie and aquacultural production technology in subtropics in Okinawa. We hope to see good exchanges with local scientists in respective locations. Especially for those who came from abroad, we will be more than happy if these field trips also serve as opportunities to appreciate Japan's natural beauty and experience our history and culture.

Lastly but not least, I should like to thank UJNR members in the U.S. and Japan who made this meeting possible. In ending my opening address I'd like to extend my sincere wishes for the great success of this meeting and deepened friendship among members.

On the final note, let me add that I will be joining you in site visit and symposium in Ishigaki, Okinawa, on 13th and 14th. Thank you for your attention.

Ⅱ　合同会議行事日程

第２９回 UJNR 水産増養殖専門部会日米合同会議行事日程
2000 年 11 月 6~17 日

11 月 6 日（月）
　　米国側参加者到着(関西国際空港にて出迎え)
13:00~15:30　日本側国内委員会(伊勢シティホテル)

11 月 7 日（火）
 9:30~12:00　日米合同会議事務会議(伊勢シティホテル)
11:00~13:00　受付
13:00~17:00　シンポジウム
18:00~20:00　懇親会

11 月 8 日（水）
 9:00~17:30　シンポジウム

11 月 9 日（木）
　　現地検討会（尾鷲）
 8:00　　ホテル出発
10:30~　　丸年水産(ヒラメ養殖場)視察
13:30~　　三重県尾鷲栽培漁業センター視察
18:00　　ホテル到着

11 月 10 日（金）
 8:30　　ホテル出発
　　京都市内観光

11 月 11 日（土）
　　京都市内観光

11 月 12 日（日）
 8:00　　ホテル出発
11:30　　関西空港より石垣へ出発

11 月 13 日（月）
　　現地検討会（石垣島）
 9:00　　ホテル出発
 9:45~10:45　グラスボートにて海底観察
10:45~11:45　沖縄県水産試験場八重山支場視察
12:00~13:15　昼食
14:00~15:20　西海区水産研究所石垣支所視察
15:30~16:30　(社)日本栽培漁業協会八重山事業場視察
17:00　　ホテル到着

11 月 14 日（火）
9:15~17:30　サテライトシンポジウム（石垣市、大濱信泉記念館）

11 月 15 日（水）

現地検討会（西表島）

8:30　石垣港桟橋集合
8:50　西表島小原港に向け出発
10:00~11:00　遊覧船
11:30~12:00　西表野生生物保護センター視察
12:20　昼食
14:00~14:40　星の砂浜見学
15:20~16:00　船浦港出発
16:00　石垣港到着

現地検討会（シュノーケリング）

8:15　ホテル出発
白保にてシュノーケリング
(青色珊瑚礁生態系観察)

12:00　ホテルへ向け出発

11 月 16 日（木）
大阪に向け出発

11 月 17 日（金）
離日

米国貝類増養殖視察団行事日程
2000 年 11 月 3~13 日

11 月 3 日（金）
　　米国貝類増養殖視察団到着（関西国際空港）
　　京都市内観光

11 月 4 日（土）
　　京都市内観光

11 月 5 日（日）
11:00　　広島到着
　　昼食
13:00~16:30　広島市内観光

11 月 6 日（月）
　　現地検討会
10:00　　瀬戸内海区水産研究所到着
10:00~12:00　研究発表会
　　昼食
14:00~　　カキ養殖場、カキ加工場見学
17:00~　　夕食会

11 月 7 日（火）
　　シンポジウム参加のため伊勢に向け出発

11 月 8 日（水）
9:00~17:30　シンポジウム

11 月 9 日（木）
　　現地検討会（迫間浦）
9:00　　ホテル出発
10:00~　　迫間浦漁師組合
　　密度流発生装置見学（大内氏説明）
　　見学（乗船）
　　討論会
11:40~　　養殖研究所に向け出発
　　昼食
13:00~　　討論会
　　1)環境問題
　　2)病理学関係
15:00　　ホテルに向け出発
16:00　　ホテル到着

11 月 10 日（金）

現地検討会

9:00　ホテル出発

10:30~　的矢カキ養殖場見学

12:00　昼食

13:30~　三重県科学技術振興センター水産技術センター視察

16:00　ホテル到着

11 月 11 日（土）

伊勢市内観光

9:00　ミキモト真珠島（鳥羽）に向け出発

12:00　昼食

13:00~　伊勢神宮内宮参拝

15:00　ホテル到着

11 月 12 日（日）

9:00　大阪に向け出発

正午頃　大阪到着

自由行動

11 月 13 日（月）

離日

The 29th Joint Meeting of UJNR Aquaculture Panel
Schedule for the Events

Nov. 6-17, 2000

Nov. 6 (Mon.)

U.S. Delegation Arrival(Pick up at Kansai International Airport)

13:00~15:30 Meeting of Japan UJNR Aquaculture Panel (Ise CityHotel)

Nov. 7 (Tue.)

9:30~12:00 U.S.-Japan Joint Business Meeting (Ise City Hotel)
11:00~13:00 Registration
13:00~17:00 Symposium
18:00~20:00 Welcome Reception

Nov. 8 (Wed.)

9:00~17:30 Symposium

Nov. 9 (Thu.)

Field Trip to Owase

8:00 Leave Hotel
10:30~ Marutoshi Suisan (Private Flounder Farming Company)
13:30~ Owase Fish Farming Center of Mie Prefecture
18:00 Arrive at Hotel

Nov. 10 (Fri.)

8:30 Leave Hotel for Kyoto
Sight-seeing in Kyoto

Nov. 11 (Sat.)

Sight-seeing in Kyoto

Nov. 12 (Sun.)

8:00 Leave Hotel for Kansai Airport
11:30 Depart from Kansai Airport to Ishigaki

Nov. 13 (Mon.)

Field Trip in Ishigaki Island

9:00 Leave Hotel
9:45~10:45 Sea bottom Observation by Glass Boat
10:45~11:45 Okinawa Prefectural Fisheries Experimental Station, Yaeyama Branch
12:00~13:15 Lunch (at Ishigaki Seaside Hotel)
14:00~15:20 Ishigaki Tropical Station of Seikai National Fisheries Research Institute
15:30~16:30 Yaeyama Station of Japan Sea Farming Association
17:00 Arrive at Hotel

Nov. 14 (Tue.)

9:15~17:30 Satellite Symposium (Ohama memorial, Ishigaki)

Nov. 15 (Wed.)

Field Trip in Iriomote Island

8:30	Meet at the Pier in Ishigaki Port
8:50	Leave Ishigaki Port for Ohara Port at Iriomote Island
10:00~11:00	Pleasure Boat
11:30~12:00	Iriomote Wildlife Preservation Center
12:20	Lunch in Iriomote Hot Spring
14:00~14:40	Sandy Beach (It's famous for star shaped sand)
15:20~16:00	Leave Funaura Port
16:00	Arrive at Ishigaki Port

Field Trip(Snorkeling)

8:15	Leave Hotel
	Snorkeling at Shiraho (Observation of blue corral reef ecology)
12:00	Leave for Hotel

Nov. 16 (Thu.)

Leave for Osaka

Nov. 17 (Fri.)

Leave Japan

U.S. Shellfish Delegation

Nov. 3~13, 2000

Nov. 3 (Fri.)
U.S. Shellfish Delegation Arrival (Kansai International Airport)
Sight-seeing in Kyoto

Nov. 4 (Sat.)
Sight-seeing in Kyoto

Nov. 5 (Sun.)
11:00 Arrive in Hiroshima
Lunch
13:00~16:30 Sight-seeing in Hiroshima City

Nov. 6 (Mon.)
Field Trip
10:00 Arrive at National Research Institute of Fisheries and Environment of Inland Sea
10:00~12:00 Research Seminar
Lunch
14:00~ Visit places for the aquaculture and processing of oysters
17:30~ Dinner party

Nov. 7 (Tue.)
Leave for Ise to join the Symposium

Nov. 8 (Wed.)
9:00~17:30 Symposium

Nov. 9 (Thu.)
Field Trip to Hazamaura
9:00 Leave Hotel
10:00~ Hazamaura Fishermen's Cooperative
Density Current Generating System
Introduction (by Mr. Ouchi)
Observation (by ship)
Discussion
11:40~ Leave for National Research Institute of Aquaculture
Lunch
13:00~ Discussion
1) Environmental Problem
2) Pathology
15:00 Leave
16:00 Arrive at Hotel

Nov. 10 (Fri.)

Field Trip

9:00 Leave Hotel

10:30~ Matoya Oyster Farming Institute

12:00 Lunch

13:30~ Mie Prefectural Fisheries Technology Center

16:00 Arrive at Hotel

Nov. 11 (Sat.)

Sight-seeing in Ise

9:00 Leave Hotel for Mikimoto Pearl Island (Toba)

12:00 Lunch

13:00~ Naiku(Ise Shrine)

15:00 Arrive at Hotel

Nov. 12 (Sun.)

9:00 Leave Ise for Osaka

before Noon Arrive in Osaka

Free Time

Nov. 13 (Mon.)

Leave Japan

Ⅲ　事 務 会 議 議 事 次 第

第 29 回ＵＪＮＲ水産増養殖専門部会日米合同会議
事務会議議事次第

平成 12 年 11 月 7 日
伊勢シティホテル

１．開会の辞　9:30-9:50
中村　保昭（日本側部会長）

２．委員の紹介　9:50-10:10
日本側：中村　保昭（日本側部会長）
米国側：James P. McVey（米国側部会長）

書記の選人

３．文献交換　10:10-10:20
日本側：鈴木　徹
米国側：Janice A. Beattie

４．研究者交流　10:20-10:30
日本側：藤井　武人
米国側：James Sullivan

５．共同研究　10:30-10:40
日本側：關　哲夫
米国側：James P. McVey

６．出版物　10:40-10:50
日本側：生田　和正
米国側：Charles E. Helsley

７．第６次５ヶ年計画　10:50-11:10
日本側：關　哲夫
米国側：Cheng Sheng Lee

８．現地検討会　11:10-11:20
關　哲夫

９．第 30 回日米合同会議について　11:20-11:30
Paul Kilho Park

10．閉会の辞　11:30-11:40
James P. McVey（米国側部会長）

The 29th Joint Meeting of The UJNR Aquaculture Panel

Ise City Hotel, Mie, Japan
November 7, 2000

Business Meeting Agenda

1. Opening Remark 9:30- 9:50
   Dr. Yasuaki Nakamura (Chairperson, Japan/UJNR Aquaculture Panel)

2. Introduction of Panel Members 9:50-10:10
   Japan/Panel Dr. Yasuaki Nakamura
   (Chairperson, Japan/UJNR Aquaculture Panel)
   U.S./Panel Dr. James P. McVey
   (Chairperson, U.S. /UJNR Aquaculture Panel)
   Election of Rapporteur

3. Literature Exchange 10:10-10:20
   Japan/Panel Dr. Toru Suzuki
   U.S./Panel Ms. Janice A. Beattie

4. Scientists Exchange 10:20-10:30
   Japan/Panel Dr. Takehito Fujii
   U.S./Panel Dr. James Sullivan

5. Collaborative Study 10:30-10:40
   Japan/Panel Dr. Tetsuo Seki
   U.S./Panel Dr. James P. McVey

6. Proceedings 10:40-10:50
   Japan/Panel Dr. Kazumasa Ikuta
   U.S./Panel Dr. Charles E. Helsley

7. The Sixth Five-Year Plan 10:50-11:10
   Japan/Panel Dr. Tetsuo Seki
   U.S./Panel Dr. Cheng Sheng Lee

8. Field Trips 11:10-11:20
   Japan/Panel Dr. Tetsuo Seki

9. Announcement of The 30th Joint Meeting in U.S. 11:20-11:30
   U.S./Panel Dr. Paul Kilho Park

10. Closing Address 11:30-11:40
    Dr. James P. McVey (Chairperson, U.S. /UJNR Aquaculture Panel)

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Nov. 2000

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(March, 2001)

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Ⅵ　交 換 文 献 リ ス ト（日本側部会作成）

LITERATURE EXCHANGE FROM JAPANESE AQUACULTURE PANEL, UJNR, TO THE UNITED STATES PANEL, UJNR

(from September, 1999 to September, 2000)

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Ⅷ　日本側研究者交流リスト

日本側研究者交流リスト
List of Japanese Scientist Exchange
(Sep. 1, 1999 - Aug. 31, 2000)

Name: Tomonari Akamatsu
Affiliation: National Research Institute of Fisheries Engineering
Place: Tokai University Pacific Center, Honolulu, Hawaii.
Contents: 1st International Symposium on Aqua Bio-Mechanisms
Date: Aug. 27-Sep. 1, 2000
氏名：赤松友成
所属：水産工学研究所
渡航先：東海大学　パシフィックセンター, ホノルル, ハワイ州
目的：第 1 回アクアバイオメカニズム国際シンポジウム
期間：平成 12 年 8 月 27 日－ 9 月 1 日
派遣費：科技庁・重点基礎

Name: Yuichi Kotani
Affiliation: National Research Institute of Fisheries and Environment of Inland Sea
Place: Southampton, New York
Contents: 3rd International Conference on Molluscan Shellfish Safety
Date: June 18-26, 2000
氏名：小谷祐一
所属：瀬戸内海区水産研究所
渡航先：ニューヨーク州, サウサンプトン市
目的：第３回貝類の安全管理に関する国際会議
期間：平成 12 年６月 18 日～ 26 日
派遣費：科技庁・重点基礎

Name: Yukihiko Matsuyama
Affiliation: National Research Institute of Fisheries and Environment of Inland Sea
Place: Southampton, New York
Contents: 3rd International Conference on Molluscan Shellfish Safety
Date: June 18-26, 2000
氏名：松山幸彦
所属：瀬戸内海区水産研究所
渡航先：ニューヨーク州, サウサンプトン市
目的：第３回貝類の安全管理に関する国際会議
期間：平成 12 年６月 18 日～ 26 日
派遣費：科技庁・重点基礎

Name: Toshinobu Terawaki
Affiliation: National Research Institute of Fisheries and Environment of Inland Sea
Place: New Bedford, Massachusetts

Contents: Investigation on Effect of Spilled Oil for Seagrass Bed
Date: Aug. 19-27, 2000
氏名：寺脇利信
所属：瀬戸内海区水産研究所
渡航先：マサチューセッツ州, ニューベッドフォード市
目的：海草藻場に及ぼす沿岸油濁の影響に関する調査
期間：平成 12 年８月 19 日～ 27 日
派遣費：広島大学

Name: Takashi Minami
Affiliation: Japan Sea National Fisheries Research Institute
Place: Atlantic Beach, North Carolina
Contents: Fourth International Symposium on Flatfish Ecology
Date: Oct. 16-25, 1999
氏名：南卓志
所属：日本海区水産研究所
渡航先：ノースカロライナ州，アトランティックビーチ
目的：第 4 回カレイ類の生態に関する国際シンポジウム
期間：平成 11 年 10 月 16 日～ 10 月 25 日
派遣費：自費

Name: Masachika Maeda
Affiliation: Japan International Research Center for Agricultural Sciences
Place: Washington DC.
Contents: Science Meeting at NOAA on the Circulating System of Aquaculture
Date: May 13 - 22, 1999
氏名：前田昌調
所属：国際農林水産業研究センター
渡航先：ワシントン市
目的：閉鎖循環養殖に関する会議
期間：平成 11 年５月 13 日～ 22 日
派遣費：マリノフォーラム 21

Name: Masachika Maeda
Affiliation: Japan International Research Center for Agricultural Sciences
Place: Hawaii Oceanic Institute
Contents: Microbial Control of the Aquaculture Environment
Date: Aug. 20 - 26, 2000
氏名：前田昌調
所属：国際農林水産業研究センター
渡航先：ハワイ海洋研究所
目的：養殖環境の微生物制御ワークショップ
期間：平成 12 年 8 月 20 日～ 26 日
派遣費：ハワイ海洋研究所

Name: Takahiro Matsubara
Affiliation: Hokkaido National Fisheries Research Institute
Place: Seattle, Washington
Contents: 4th International Symposiu m on Fish Endocrinology
Date: July 31-Aug. 3, 2000
氏名：松原孝博
所属：北海道区水産研究所
渡航先：ワシントン州, シアトル
期間：平成 12 年 7 月 31 日～ 8 月 3 日
目的：第 4 回魚類内分泌国際シンポジウム
派遣費：自費

Name: Kazuhiko Mochida
Affiliation: Hokkaido National Fisheries Research Institute
Place: Seattle, Washington
Contents: 4th International Symposium on Fish Endocrinology
Date: July 31-Aug. 3, 2000
氏名：持田和彦
所属：北海道区水産研究所
渡航先：ワシントン州, シアトル
目的：第 4 回魚類内分泌国際シンポジュウム
期間：平成 12 年 7 月 31 日～ 8 月 3 日
派遣費：自費

Name: Katuyuki Numaguti
Affiliation: National Research Institute of Fisheries Science
Place: Seattle, Washington
Contents: 92nd Annual Meeting of the National Shellfisheries Association
Date: Mar. 18-25, 2000
氏名：沼口勝之
所属：中央水産研究所
渡航先：ワシントン州, シアトル
目的：第 92 回国際介類学会年次総会
期間：平成 12 年 3 月 18 日～ 3 月 25 日
派遣費：自費

Name: Masataka Satomi
Affiliation: National Research Institute of Fisheries Science
Place: Los Angeles
Contents: ASM 100th General Meeting
Date: May 19-27, 2000
氏名：里見正隆
所属：中央水産研究所
渡航先：ロサンジェルス
目的：米国微生物学会第 100 回大会

期間：平成 12 年 5 月 19 日～ 5 月 27 日
派遣費：自費

Name: Fuminari Itoh
Affiliation: National Research Institute of Fisheries Science
Place: Seattle, Washington
Contents: 4th International Symposium on Fish Endocrinology
Date: July 29-Aug. 5, 2000
氏名：伊藤文成
所属：中央水産研究所
渡航先：ワシントン州, シアトル
目的：第４回国際魚類内分泌学シンポジウム
期間：平成 12 年 7 月 29 日～ 8 月 5 日
派遣費：自費

Name: Yoh Yamashita
Affiliation: Tohoku National Fisheries Research Institute
Place: Atlantic Beach, North Carolina
Contents: Fourth International Symposium on Flatfish Ecology
Date: Oct. 16-28, 1999
氏名：山下洋
所属：東北区水産研究所
渡航先：ノースカロライナ州, アトランティックビーチ
目的：第４回国際異体類シンポジウム
期間：平成 11 年 10 月 16 日～ 10 月 28 日
派遣費：科技庁・重点基礎

Name:Yutaka Okumura
Affiliation: Tohoku National Fisheries Research Institute
Place: Southampton, New York
Contents: 3rd International Conference on Molluscan Shellfish Safety
Date: June 19-23, 2000
氏名：奥村　裕
所属：東北区水産研究所
渡航先：ニューヨーク州，サウサンプトン市
目的：第３回貝類の安全管理に関する国際会議
期間：平成 12 年 6 月 19 日～ 6 月 23 日
派遣費：科技庁・重点基礎

Name:Toshiyuki Suzuki
Affiliation: Tohoku National Fisheries Research Institute
Place: Southampton, New York
Contents: 3rd International Conference on Molluscan Shellfish Safety
Date: June 19-23, 2000
氏名：鈴木敏之

所属：東北区水産研究所
渡航先：ニューヨーク州，サウサンプトン市
目的：第３回貝類の安全管理に関する国際会議
期間：平成 12 年 6 月 19 日～ 6 月 23 日
派遣費：科技庁・重点基礎

Name: Yoh Yamashita
Affiliation: Tohoku National Fisheries Research Institute
Place: Mote Marine Laboratory, Sarasota, Florida; Texas A & M University, Corpus Christi, Texas
Contents: Meeting for the 2nd UJNR International Symposium on Stock Enhancement and Sea Ranching; Collaborative Studies on Ecophysiology Modeling for Stock Enhancement of Coastal Fishes.
Date: Aug. 14-25, 2000
氏名：山下洋
所属：東北区水産研究所
渡航先：フロリダ州サラソタ市, およびテキサス州コーパスクリスティ市
目的：UJNR 第 2 回資源増強と海洋牧場に関する国際シンポジウム開催のための会合, および沿岸性魚類の資源の増強のための生態生理学的モデリングに関する共同研究
期間：平成 12 年 8 月 14 日～ 8 月 25 日
派遣費：科技庁・二国間協力

Name: Masaya Katoh
Affiliation: Seikai National Fisheries Research Institute
Place: Baton Rouge, Louisiana State
Contents: Annual Meeting of General Comparative Biology
Date: Jan. 4-17, 2000
氏名：加藤雅也
所属：西海区水産研究所
渡航先：ルイジアナ州, バトンルージュ
目的：総合比較生物学年会
期間：平成 12 年 1 月 4 日～ 1 月 17 日
派遣費：科技庁・重点基礎

Name: Shigehiko Urawa
Affiliation: National Salmon Resources Center
Place: Auke Bay Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, Juneau, Alaska
Contents: International Symposium on Recent Changes in Ocean Production of Pacific Salmon; NPAFC Annual Meeting
Date: Oct. 23 - Nov. 4, 1999
氏名: 浦和茂彦
所属: さけ・ます資源管理センター
渡航先： アラスカ州　ジュノー市、国立海洋水産研究所オークベイ研究所
目的: 北太平洋サケ類の海洋における生産の最近の変化に関する国際シンポジウム；

NPAFC 年次会議
期間: 平成 11 年 10 月 23 日～ 11 月 4 日
派遣費： 水産庁

Name: Takashi Yada
Affiliation: National Research Institute of Aquaculture
Place: Hawaii Institute of Marine Biology, University of Hawaii, Kaneohe, Hawaii
Contents: Studies on Immunity Activation Mechanism by Hormon in fish
Date: Dec. 1, 1999-Oct. 31, 2000
氏名：矢田崇
所属：養殖研究所
渡航先：ハワイ大学ハワイ海洋生物学研究所, カニオへ市
目的：魚類のホルモンによる免疫活性機構の研究
期間：平成 11 年 11 月 1 日～ 12 年 10 月 31 日
派遣費：科技庁・長期在外研究

Name: Hirohiko Kagawa
Affiliation: National Research Institute of Aquaculture
Place: Seattle, Washington
Contents: 4th International Symposium on Fish Endocrinology
Date: July 30-Aug. 6, 2000
氏名：香川浩彦
所属：養殖研究所
渡航先：ワシントン州, シアトル
目的：第 4 回国際魚類内分泌学シンポジウム
期間：平成 12 年 7 月 30 日～ 8 月 6 日
派遣費：水産庁

Name: Kouichi Okuzawa
Affiliation: National Research Institute of Aquaculture
Place: Seattle, Washington
Contents: 4th International Symposium on Fish Endocrinology
Date: July 30-Aug. 9, 2000
氏名：奥澤公一
所属：養殖研究所
渡航先：ワシントン州, シアトル
目的：第 4 回国際魚類内分泌学シンポジウム
期間：平成 12 年 7 月 30 日～ 8 月 9 日
派遣費：水産庁

Name: Kazumasa Ikuta
Affiliation: National Research Institute of Aquaculture
Place: Seattle, Washington
Contents: 4th International Symposium on Fish Endocrinology
Date: July 30-Aug. 5, 2000

氏名：生田和正
所属：養殖研究所
渡航先：ワシントン州, シアトル
目的：第 4 回国際魚類内分泌学シンポジウム
期間：平成 12 年 7 月 30 日～ 8 月 5 日
派遣費：水産庁

Name: Takuma Nakasone
Affiliation: National Research Institute of Fisheries Engineering
Place: Honolulu, Hawaii
Contents: 28th UJNR Aquaculture Panel Meeting
Date: Nov. 6-17, 1999
氏名：仲宗根琢磨
所属：水産工学研究所
渡航先：ハワイ州，ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会
期間：平成 11 年 11 月 6 日－ 11 月 17 日
派遣費：科技庁・重点基礎

Name: Marcy N. Wilder
Affiliation: Japan International Research Center for Agricultural Sciences
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting, UJNR Aquaculture Panel
Date: Nov. 8-15, 1999
氏名：マーシー　N. ワイルダー
所属：国際農林水産業研究センター
渡航先：ハワイ州，ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
派遣費：水産庁

Name: Masahito Yokoyama
Affiliation: National Research Institute of Fisheries Science
Place: Honolulu, Hawaii
Contents: 28th UJNR Aquaculture Panel Meeting
Date: Nov. 7-17, 1999
氏名：横山雅仁
所属：中央水産研究所
渡航先：ハワイ州，ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 7 日～ 11 月 17 日
派遣費：自費

Name: Takeshi Murai
Affiliation: Seikai National Fisheries Research Institute
Place: Honolulu, Hawaii

Contents: 28th UJNR Aquaculture Panel Meeting
Date: Nov. 9-14, 1999
氏名：村井武四
所属：西海区水産研究所
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会
期間：平成 11 年 11 月 9 日～ 11 月 14 日
派遣費：自費

Name: Megumi Minagawa
Affiliation: Seikai National Fisheries Research Institute
Place: Honolulu, Hawaii
Contents: 28th UJNR Aquaculture Panel Meeting
Date: Nov. 9-14, 1999
氏名：皆川恵
所属：西海区水産研究所
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会
期間：平成 11 年 11 月 9 日～ 11 月 14 日
派遣費：自費

Name: Kunihiko fukusho
Affiliation: National Research Institute of Aquaculture
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：福所邦彦
所属：養殖研究所
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日
派遣費：科技庁

Name: Hiroko Ishioka
Affiliation: National Research Institute of Aquaculture
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：石岡宏子
所属：養殖研究所
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日
派遣費：私費

Name: Hirohiko Kagawa
Affiliation: National Research Institute of Aquaculture
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：香川浩彦
所属：養殖研究所
渡航先：ハワイ州, ホノルル市
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日
派遣費：科技庁・重点基礎

Name: Hiromi Ohta
Affiliation: National Research Institute of Aquaculture
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：太田博巳
所属：養殖研究所
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日
派遣費：科技庁・重点基礎

Name: Ichiroh Nakayama
Affiliation: National Research Institute of Aquaculture
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：中山一郎
所属：養殖研究所
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日
派遣費：水産庁

Name: Kazuo Ikuta
Affiliation: National Research Institute of Aquaculture
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：生田和生
所属：養殖研究所
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合

期間：平成 11 年 11 月 6 日～ 11 月 17 日
派遣費：水産庁

Name: Takashi Yada
Affiliation: National Research Institute of Aquaculture
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：矢田崇
所属：養殖研究所
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日
派遣費：科技庁

Name: Hiroshi Fushimi
Affiliation: Fukuyama University
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：伏見裕
所属：福山大学
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name: Shin-ichiro Kawai
Affiliation: Kobe College
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：川合真一郎
所属：神戸女学院
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name: Masahiko Koiso
Affiliation: Japan Sea-Farming Association
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：小磯雅彦
所属：日本栽培漁業協会
渡航先：ハワイ州, ホノルル

目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name: Keiichi Mushiake
Affiliation: Japan Sea-Farming Association
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：虫明敬一
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name: Katsunobu D. Sakai
Affiliation: Hokkaido Fish Hatchery
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：酒井克信
所属：北海道さけます孵化場
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name:Youichi Seto
Affiliation: Toyama Prefectural Fisheries Research Institute
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：瀬戸陽一
所属：富山県水産試験場
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name:Tetsuya Hirano
Affiliation: Ocean Research Institute of Tokyo University
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：平野哲也
所属：東京大学海洋研究所
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name: Jun Shoji
Affiliation: Kyoto University
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：庄司潤
所属：京都大学大学院
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name:Tetsuo Teranishi
Affiliation: Hokkaido Fish Hatchery
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：寺西徹夫
所属：北海道さけます孵化場
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name: Atsushi Furukawa
Affiliation: Colloquium on Aqua-Breeding Technique
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：古川厚
所属：水族繁殖技術懇話会
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name: Masaru Fujiya
Affiliation: Towa Kagaku Co., Ltd.
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：藤谷超
所属：東和科学(株)
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name: Akihiko Hara
Affiliation: Hokkaido University
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：原彰彦
所属：北海道大学
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name: Keiji Hirose
Affiliation: Japan Sea-Farming Association
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：広瀬慶二
所属：日本栽培漁業協会
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name: Izumi Nakamura
Affiliation: Toyama Prefectural Fisheries Research Institute
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：中村泉
所属：京都大学
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
期間：平成 11 年 11 月 6 日～ 11 月 17 日

Name: Yada Osamu
Affiliation: Hitachi Air Conditioning Systems Co., Ltd.
Place: Honolulu, Hawaii
Contents: The 28th Annual Meeting of UJNR Aquaculture Panel
Date: Nov. 6-17, 1999
氏名：矢田修
所属：日立空調システム(株)
渡航先：ハワイ州, ホノルル
目的：第 28 回 UJNR 水産増養殖専門部会年次会合
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IX　米国側研究者交流リスト

The list of the U.S. scientists visited Japan in 2000

1. James Sullivan
   Planning 29th UJNR meeting

2. Dave Jenkins
   Study of culture techniques

3. Heather Hamlin
   Study of culture techniques

4. John Miller
   Testing juvenile flounder model

5. Todd Kellison
   Flounder cannibalism study

6. Dave Eggleston
   Flounder cannibalism study

7. Timothy Targett
   Flounder growth study

8. C. Austin Farley
   Pearl oyster mortality study

9. Dorothy Howard
   Pearl oyster mortality study

(These 9 people visited Japan along with 6 projects.)

X　第６次５ヶ年計画

UJNR 水産増養殖専門部会
第６次５ヶ年計画
（案）

UJNR Aquaculture Panel
The sixth Five-Year Plan（2002-2006）
（Tentative）

２００２年	「貝類・藻類の増養殖と栽培漁業」	日本
２００３年	「甲殻類の増養殖と病害防除」	米国
２００４年	「魚類の増養殖と栽培漁業」	日本
２００５年	「増養殖場の環境保全と環境収容力」	米国
２００６年	「海洋牧場」	日本

2002	"Aquaculture and stock enhancement of algae and filter feeders"	JAPAN
2003	"Aquaculture and pathobiology of crustaceans"	U.S.
2004	"Aquaculture and stock enhancement of finfish"	JAPAN
2005	"Ecosystem and carrying capacity of aquaculture ground"	U.S.
2006	"Building agricultural and sustainable fisheries through aquaculture, wild stock enhancement, and habitat management"	JAPAN

The Sixth Five-Year Plan of the UJNR Aquaculture Panel, 2002-2006

Integrating aquaculture and fisheries technologies to optimize value from coastal and exclusive economic zone (EEZ) resources sustainably requires a continuing dialogue nationally and globally, in addition to focusing on the ongoing and future thrusts in the fields of superior strain production, management, stock enhancement, disease prevention and mitigation and pollution abatement. We also need to coexist with other major maritime activities, which include defense, merchant marine and ocean mining, to share the limited oceanic regions in space and time. In the present Sixth Five- Year Plan, we continue to endeavor exchanging information comprehensively on the basic science, early life history included, practical techniques, and the governance infrastructure to enhance aquaculture and fisheries.

(1) Aquaculture and stock enhancement of algae and filter feeders (Japan,2002)

Nutrient dynamics, nitrogen in particular, superior strain production, diets, material cycling, early life history, estimating sustainable carrying capacity, disease mitigation, carbon dioxide sequestration.

(2) Aquaculture and pathobiology of crustaceans (U.S.,2003)

Shrimp culture pathobiology on viral, bacterial, protozoan and other disease agents in toto, optimal brine shrimp feed production system, lobster and crab aquaculture optimization, healthy aquaculture pond preparation, prevention of pond-generated diseases that may affect wild stock.

(3) Aquaculture and stock enhancement of finfish (Japan,2004)

Technological adaptability of emerging high-value finfish to aquaculture, population dynamics, relationship between carrying capacity and stock enhancement, optimization of favorable ground creation. Continuing genetic population improvement and management.

(4) Ecosystem and carrying capacity of aquaculture ground (U.S.,2005)

Nearshore and offshore aquaculture infrastructure improvement between prefectural/state and national jurisdiction, code of cooperative conduct for the various industrial components, holistic land-nearshore-offshore ecosystem elucidation to estimate carrying capacity of aquaculture ground, harmful algal blooms and carbon dioxide sequestration, submerged, offshore cage system to coexist with navigational Freedom, EEZ offshore aquaculture sites, integration of aquaculture into ecological and economic models, energy and nitrogen flow in the aquacultural ecosystem.

(5) Building agricultural and sustainable fisheries through aquaculture, wild stock

enhancement, and habitat management（Japan, 2006）

Integrating aquaculture and fisheries technologies to optimize value from coastal resources, zoning for aquaculture, use of biotechnology in aquaculture and effects on natural population, public perception improvement, offshore and recirculating technologies for pollution mitigation and abatement.

ＸＩ　　シンポジウムプログラムと講演要旨

第２９回ＵＪＮＲ水産増養殖専門部会日米合同会議
シンポジウム「病原生物と防疫」

平成１２年１１月７日～８日
伊勢シティホテル

平成１２年１１月７日（火）

開会の挨拶：中村保昭　日本側部会長（養殖研究所長）　13:00-13:10
Jim Hall（Minister-Counselor for Science, U.S. Embassy）　13:10-13:20

セションⅠ：魚介類の健康管理と病害防除
（座長：C. Mahnken・吉水 守）

1. NOAA/DOC における養殖計画と活動　13:20-13:40
   James P. McVey（NOAA, Natl. Sea, Grant）
2. 持続的養殖生産確保法の制定　13:40-14:00
   藤井恭治（水産庁栽培養殖課）
3. 水生動物の健康管理：診断研究室の役割と最新の診断手法　14:00-14:25
   Richard A. French・Salvatore Fransca Jr.（Univ. of Connecticut）
4. Red snapper 養殖における健康管理　14:25-14:50
   R.B. Blaylock・R.M. Overstreet ・J.M. Lotz（Univ. of Southern Mississippi）
5. サケ科魚類のヘルペスウイルス病：疫学と防除　14:50-15:15
   吉水 守（北海道大）

― 休憩 ―

セションⅡ：魚類の疾病(1)
（座長：G. Kurath・中井敏博）

1. 亜熱帯水域の養殖海産魚の疾病　15:35-16:00
   佐野元彦・皆川 恵(西水研)・杉山昭博(沖縄水試)・中島員洋(養殖研)
2. 魚類ノダウイルスの培養法の確立と VNN 研究への応用　16:00-16:25
   中井敏博・岩本季典（広島大）・森　広一郎・有元　操（日栽協）
3. マダイのイリドウイルス病　16:25-16:45
   中島員洋・栗田　潤・伊東尚史・井上　潔・反町　稔（養殖研）
4. IHN ウイルスに対する DNA ワクチンの効果　16:45-17:05
   G. Kurath・S. Corbeil（USGS Western Fisheries Research Center）・
   E.D. Anderson（Univ. of Maine）・S. E. LaPatra（Clear Springs Foods, Inc.）

― 懇談会 ―　18:00-

平成１２年１１月８日（水）

セションⅡ：魚類の疾病(2)

（座長：J. G. Williams・飯田貴次）

5. IHN ウイルスゲノムの M2 遺伝子産物により誘導される宿主細胞のアポトーシス　9:00- 9:25
   畑山 誠（北海道孵化場）・鈴木邦夫(北海道中央水試)・坂井勝信（北海道孵化場）
6. *Vibrio vulnificus* の Type Ⅳピリの遺伝子解析と細胞外分泌機能の解析及びそれらの病原性における役割　9:25- 9:50
   Mark S. Strom・Rohinee N. Paranjpye（NOAA, Natl. Marine Fish. Service）
7. ギンザケの冷水病　9:50-10:10
   熊谷 明（養殖研）
8. アユの冷水病に対するワクチンの効果　10:10-10:30
   R. Md. Hubibur（養殖研）・中西照幸（日本大）・乙竹　充（養殖研）

（座長：M. S. Strom・乙竹　充）

9. 春から夏に Snake River に遡上するマスノスケ親魚の回帰に及ぼす *Renibacterium salmoninarum* の影響　10:30-10:55
   John G. Williams（NOAA, Natl. Marine Fish. Service）
10. 魚類の非特異的生体防御活性に及ぼすストレスの影響　10:55-11:20
    飯田貴次・黒木順子（宮崎大）

（座長：J. L. Bartholomew・良永知義）

11. 養殖トラフグのヤセ病　11:20-11:45
    小川和夫・横山 博（東京大）
12. ニジマスにおける *Ceratomyxa shasta* 抵抗性に関する免疫遺伝学的機構　11:45-12:05
    J. L. Bartholomew・M. J. Whipple(Oregon State Univ.)・G. Thorgaard（Washington State Univ.）・D. E. Campton（U.S. Wildlife Service）

― 昼食 ―

13. 単生類寄生虫 *Neoheterobothrium hirame* 感染によるヒラメ貧血症　13:00-13:20
    良永知義・釜石 隆・瀬川 勲（養殖研）

セションⅢ：無脊椎動物の疾病

（座長：G. Messick・中島員洋）

1. Blue crab の疾病　13:20-13:45
   Gretchen Messick（NOAA, Natl. Ocean Service）

2. 疾病，害虫，捕食生物の移入とそれらが漁業ならびに養殖に及ぼす影響　13:45-14:10
   Frederick G. Kern（NOAA, Natl. Ocean Service）

3. クルマエビ種苗生産における PAV の防除　14:10-14:35
佐藤 純・虫明敬一・森 広一郎・有元 操・今泉圭之輔（日栽協）

4. 種苗生産施設における生物学的制御による貝類健苗性向上の試み　14:35-15:00
R.A. Elston（Aqua Tec./ Pacific Shellfish Inst.）・R.M. Estes（Univ. of Washington），A. Gee（Pacific Lutheran Univ.）・R. P. Herwig（Univ. of Washington）・K. Kinnan（Aqua Tec./ Pacific Shellfish Inst.）・S. Rensel（Pacific Lutheran Univ.）

― 休憩 ―

（座長：R. A. Elston・小川和夫）

5. カキ稚貝病（Juvenile Oyster Disease:JOD）とその防除対策　15:15-15:40
Earl J. Lewis Jr.（NOAA, Natl. Ocean Service）

6. 養殖アワビの萎縮症候群（Withering Syndrome ）とオキシテトラサイクリン経口投与による防除法の開発　15:40-16:00
Carolyn S. Friedman・George Trevelyan・Thea T. Robbins・James D. Moore・Ray Fields・Jeffrey D. Shields・Ronald P. Hedrick（California Dept. Fish & Game and Dept. Medicine & Epidemiol.）

7. 二枚貝における *Perkinsus* spp. の病原性　16:00-16:25
Shawn M. McLaughlin（NOAA, Natl. Ocean Service）・Mohamed Faisal（College of William and Mary, Virginia Inst. Marine Science）

8. 海産無脊椎動物の疾病に関する分子生物学的アプローチ　16:25-16:45
G. R. Vasta（Center of Marine Biotechnol., Univ. of Maryland Biotechnol. Inst.）

閉会の挨拶：James McVey　米国側部会長（NOAA, Sea, Grant）　16:45-16:55

Symposium on Pathogenic Organisms and Disease Prevention
UJNR / Aquaculture Panel, 29th Joint Meeting

Ise City Hotel, Mie, Japan
November 7- 8, 2000

Tuesday, November 7, 2000

Welcome to symposium : Dr. Yasuaki Nakamura 13:00-13:10
(Chairperson, Japan/UJNR Aquaculture Panel)
Dr. Jim Hall 13:10-13:20
(Minister-Counselor for science, U.S. Embassy)

Session Ⅰ: General management and control (Chairs: C. Mahnken & M. Yoshimizu)

1. The NOAA / DOC Aquaculture Initiative 13:20-13:40
   James P. McVey (NOAA)
2. Establishment of "The law to ensure sustainable aquaculture production" 13:40-14:00
   Kyoji Fujii (Fisheries Agency)
3. Aquatic animal health: the role of diagnostic laboratories and advanced diagnostic tools 14:00-14:25
   Richard A. French, Salvatore Frasca Jr. (Univ. of Connecticut)
4. Health management in red snapper, *Lutjanus campechanus*, culture 14:25-14:50
   R.B. Blaylock, R.M.Overstreet, J.M. Lotz
   (Univ. of Southern Mississippi)
5. *Oncorhynchus masou* virus disease : Epidemiology and its control strategy 14:50-15:15
   Mamoru Yoshimizu (Graduate school of Hokkaido Univ.)

(Coffee Break)

Session Ⅱ: Fish diseases (1) (Chairs: G. Kurath & T. Nakai)

1. Diseases of cultured marine fish in subtropical areas of Japan 15:35-16:00
   Motohiko Sano, Megumi Minagawa(Seikai Natl. Fish. Res. Inst.),
   Akihiro Sugiyama(Okinawa Pref. Fish. Exp. Sta.),
   Kazuhiro Nakajima (Natl. Res. Inst. Aqua.)
2. Establishment of a culture system for piscine nodaviruses and its application to VNN study 16:00-16:25
   Toshihiro Nakai, Tokinori Iwamoto (Univ. of Hiroshima),
   Koh-ichiro Mori, Misao Arimoto (Jpn Sea-Farming Assn.)
3. Red sea bream iridoviral disease in Japan 16:25-16:45
   Kazuhiro Nakajima, Jun Kurita, Takafumi Ito,
   Kiyoshi Inouye, Minoru Sorimachi (Natl. Res. Inst. Aqua.)
4. Efficacy of a DNA vaccine against infectious hematopoietic necrosis virus 16:45-17:05
   G. Kurath, S. Corbeil (USGS Western. Fish. Res. Center),
   E.D. Anderson (Univ. of Maine), S.E. LaPatra (Clear Springs Foods Inc.)

Reception 18:00-

Wednesday, November 8, 2000

Session Ⅱ: Fish diseases (2) (Chairs: J.G.Williams & T. Iida)

5. Apoptosis of host cells induced by M2 gene product of IHN viral genome 9:00- 9:25
   Makoto Hatakeyama (Hokkaido Fish Hatchery),
   Kunio Suzuki (Hokkaido Cent. Fish. Exp. Sta.),
   Katsunobu Sakai (Hokkaido Fish Hatchery)
6. Characterization of components of Type Ⅳ pili and Type Ⅱ extracellular secretion in *Vibrio vulnificus* and determination of their role in virulence 9:25- 9:50
   Mark S. Strom, Rohinee N. Paranjpye
   (NOAA, NW Fish. Science Center)
7. Cold-Water disease of salmon in Japan 9:50-10:10
   Akira Kumagai (Natl. Res. Inst. Aqua.)
8. Development of vaccine against coldwater disease in ayu, *Plecoglossus altivelis* 10:10-10:30
   M. Habibur Rahman(Natl. Res. Inst. Aqua.), Teruyuki Nakanishi (Nihon Univ.), Mitsuru Ototake(Natl. Res. Inst. Aqua.)

(Chairs: M. S. Strom & M. Ototake)

9. Potential impacts of *Renibacterium salmoninarum* on adult returns of Snake River spring-summer run chinook salmon 10:30-10:55
   John G. Williams (NW Fish. Science Center)
10. Stress impairs non-specific defense activity of fish 10:55-11:20
    Takaji Iida, Junko Kurogi (Univ. of Miyazaki)

(Chairs: J. L. Bartholomew & T. Yoshinaga)

11. Emaciation disease of cultured tiger puffer, *Takifugu rubripes* 11:20-11:45
    Kazuo Ogawa, Hiroshi Yokoyama (Univ. of Tokyo)
12. Immunogenetics of *Ceratomyxa shasta*, resistance in rainbow trout 11:45-12:05
    J.L. Bartholomew, M.J. Whipple (Oregon State Univ.), G. Thorgaard (Washington State Univ.), D.E. Campton (U.S. Fish & Wildlife Serv.)

(Lunch)

13. Anemia of Japanese flounder caused by the monogenean, *Neoheterobothrium hirame*, infection 13:00-13:20
    Tomoyoshi Yoshinaga, Takashi Kamaishi, Isao Segawa
    (Natl. Res. Inst. Aqua.)

Session Ⅲ: Invertebrate diseases (Chairs: G. Messick & K. Nakajima)

1. Potential diseases of blue crabs 13:20-13:45
   Gretchen Messick (NOAA, Natl. Ocean Serv. Center)
2. Introduced diseases, pests, predators, and their impact on natural fisheries and aquaculture systems 13:45-14:10
   Frederick G. Kern (NOAA, Natl. Ocean Serv. Center)

3. Control of Penaeid Acute Viremia (PAV) in seed production of *Penaeus japonicus* 14:10-14:35
   Jun Satoh, Keinosuke Imaizumi, Keiichi Mushiake, Koh-ichiro Mori, Misao Arimoto(Jpn sea-farming Assn.)

4. Probiotic approach to enhance health of hatchery produced shellfish seed 14:35-15:00
   R.A. Elston(Aqua Tec./ Pacific Shellfish Inst.), R.M. Estes(Univ. of Washington), A. Gee(Pacific Lutheran Univ.), R. P. Herwig(Univ. of Washington), K. Kinnan (Aqua Tec./ Pacific Shellfish Inst.), S. Rensel (Pacific Lutheran Univ.)

(Coffee Break)

(Chairs: R. A. Elston & K. Ogawa)

5. Juvenile oyster disease (JOD): What we know and management strategies 15:15-15:40
   Earl J. Lewis, Jr. (NOAA, Natl. Ocean Serv. Center)
6. Development of an oral administration of oxytetracycline to control losses due to withering syndrome in cultured red abalone, *Haliotis rufescens* 15:40-16:00
   Carolyn S. Friedman, George Trevelyan, Thea T. Robbins, James D. Moore, Ray Fields, Jeffrey D. Shields, Ronald P. Hedrick (California Dept. Fish & Game and Dept. Medicine & Epidemiology)
7. Pathogenesis of *Perkinsus* spp. in bivalve mollusks 16:00-16:25
   Shawn M. McLaughlin (NOAA, Natl. Ocean Serv. Center)
   Mohamed Faisal (College of William and Mary, Virginia Inst. Marine Science)
8. Molecular approaches to understanding and diagnosing disease in marine invertebrates:disease resistance, pathogen adaptations, and molecular probes for parasitic protista (*Perkinsus* spp.) and toxic dinoflagellates (*Pfiesteria* spp.) 16:25-16:45
   Gerardo. R. Vasta (Unv. of Maryland Biotecnol. Inst.)

Closing Remark : Dr. James McVey 16:45-16:55
(Chairperson, US/UJNR Aquaculture Panel)

Ⅰ-１. The NOAA/DOC Aquaculture Initiative

James P. McVey
National Sea Grant College Program
National Oceanic and Atmospheric Administration
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The advancements and accomplishments of the new NOAA/DOC aquaculture effort will be summarized in terms of purpose, vision, goals and funding. A short summary of funded projects will be provided and an overview of the program management strategy will be presented. The NOAA Strategic Plan for sustainable fisheries, which includes a strong aquaculture component, will be described and suggestions made as to how to connect with ongoing international programs like the UJNR Aquaculture.

Ⅰ- 2. ESTABLISHMENT OF "THE LAW TO ENSURE SUSTAINABLE AQUACULTURE PRODUCTION"

Kyoji Fujii
Fisheries Agency

Introduction

In 1999, "the Law to Ensure Sustainable Aquaculture Production"was established as a legal framework to promote "Sustainable Aquaculture" in Japan. In this law, two issues are identified as major factors which may obstruct the establishment of a structure of sustainable aquaculture production. One is the problem of deterioration in the environmental condition of aquaculture grounds cased by aquaculture itself, and the other is that of damage caused by infectious fish diseases, especially, by serious exotic diseases that have not occurred in Japan.

Outline of the Law

The Law consists of two major elements, the system of "aquaculture ground improvement program", and the measures to prevent diffusion of "the specific diseases (i.e. designated infectious diseases of aquatic animals and plants subjected to aquaculture, whose occurrence has not been confirmed, or only locally confirmed in Japan, and, which could inflict serious damage on aquatic animals and plants subjected to aquaculture when diffused.)". The former is the framework to promote voluntary and autonomous tackling of the problem of deterioration in the environmental condition of aquaculture grounds by fishery cooperative associations which have a license to engage in aquaculture. The latter is the regulations pertaining to occurrence of the specific diseases, such as prefectural governor's orders to limit or prohibit transfer of the cultured aquatic animals or plants.

Ⅰ- 3. Aquatic Animal Health : The Role of Diagnostic Laboratories and Advanced Diagnostic Tools

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The aquaculture industry is driven by demand for finfish and shellfish products and limited by the availability of natural stocks. The industry relies on intensive culture practices in which disease management is the foremost limitation and is often a leading cause of economic loss and aquaculture failures. The University of Connecticut, Department of Pathobiology is an established diagnostic laboratory with expertise in aquatic animal health, diagnostics and research. Strengths exist in the disciplines of pathology, toxicology, parasitology, microbiology, immunology, molecular biology and vaccinology. The following are representative cases of department's role in diagnostic medicine, applied research, and the development of advanced diagnostic methods.

Case Ⅰ: Development of a multiplex PCR for detection of *Haplosporidium nelsoni* (MSX), *Haplosporidium costale* (SSO), and *Perkinsus marinus* (Dermo) in the eastern Oyster, *Crassostrea virginica*. The monitoring of cultured oyster populations for pathogens is presently infrequent due to a dependence on traditional, time consuming, diagnostic assays. A multiplex polymerase chain reaction (MPCR) has been developed which rapidly detects the protozoan parasites, *Perkinsus marinus* (Dermo), *Haplosporidium nelsoni* (MSX) and *Haplosporidium costale* (SSO), which infect the cultured oyster, *Crassostrea virginica*. Conventional diagnostic methods (histopathology and Ray/Mackin fluid thioglycollate assay) for *H. nelsoni, H. costale* and *P. marinus* respectively were compared to the MPCR. Ninety-one adult oysters were collected and subjected to all three assays. The Ray/Mackin assay detected *P. marinus* infections in 64% of oysters and MPCR revealed infections in 80%. Histological examination detected 40% of oysters infected with *Haplosporidium* plasmodia. The MPCR was able to differentiate between the two *Haplosporidium* plasmodia, detecting 10% of oysters infected only with *H. nelsoni*, 40% with only *H. costale*, and 35% with mixed infections of *H. nelsoni* and *H. costale*. These results indicate the MPCR is a more sensitive assay for the detection of *P. marinus* and is able to detect and differentiate between the two *Haplosporidium* species. The MPCR is useful at low infection intensity, by being able to detect pathogen DNA at concentrations as low a 10fg, for *H. nelsoni* and 1pg for both *H. costale* and *P. marinus*.

Case Ⅱ: Epizootiology, pathology and molecular characterization of a myxosporean associated with parasitic encephalitis of farmed Atlantic salmon (*Salmo salar*) in Ireland. During seasonal epizootics of disease and mass mortality in

the summers of 1992, 1993 and 1994 on a sea-farm in Ireland, Atlantic salmon smolts suffered from an encephalitis associated with an unclassified parasite 6-8 weeks after transfer to sea. In order to monitor disease, determine the onset and anatomic distribution of parasites and encephalitis, and to identify and fully characterize the pathogen, smolts were observed and necropsied from affected sites at 1-3 day intervals for 2 months after transfer to sea netpens. Clinical disease was characterized by circling or gyrating swimming, in appropriate postures in the water column, stacking on pen floors, and periods of apparent unconsciousness. Foci of parasites with and without attendant encephalitis were detected in histologic sections of brain and spinal cord 1-2 weeks before clinical signs; the parasite was detected as early as 26 days post-introduction. The parasite's ultrastructure was consistent with a histozoic presporgonic multicellular developmental stage of a myxosporean, located between axons. No mature spores were identified. In the absence of detectable sporogony, PCR, Southern blot hybridization, DNA sequencing and *in situ* hybridization were used in concert to characterize the parasite. The parasite is a neurotropic species of the genus Myxobolus, with sequences identical to those of *M. cerebralis*.

Case Ⅲ: Assessment of the Cause and Extent of Morbidity and Mortality of American Lobsters (*Homarus americanus*) in Long Island Sound. Mortalities of the American lobster, *Homarus americanus*, in Long Island Sound have severely increased. As a result, the U.S. Department of Commerce has declared the fishery a disaster, and the regional lobster industry has been critically damaged. Necropsies were performed on individual lobsters collected from Long Island Sound. Gross and histopathologic examination, hematology, microbiology, virology, parasitology and toxicology were performed on affected lobster. Gross observations of 'sick' lobsters included lethargic/ limp behavior, discoloration of meat, viscera and hemolymph, coagulopathy and hemocytopenia. Bacteriologic findings included isolation of *Vibrio* spp. and spirochetes but no common pathogen. No *Aerococcus* spp. have been isolated. Toxicology included tests for metals, chlorinated pesticides and polychlorinated biphenyl's, and polycyclic aromatic hydrocarbons including malathion. Toxicology has been unremarkable. Histologic examination of all organ systems and associated tissues revealed a systemic inflammatory disease affecting multiple tissues, but primarily the nervous system. Associated with lesions was a protozoan parasite morphologically characterized as an amoeba, tentatively a paramoeba species. Presently, the immediate cause of death is presumed to be the paramoebiasis. Investigations are focused on the parasite and identified climatic and anthropogenic stressors to determine whether the parasite is the primary cause of mortalities or physiologic stress is a contributing factor. In addition, molecular probes and new diagnostic methods and tools are being developed to assess the health of the lobster and better define the molecular systematics of the newly identified protozoan parasite and other pathogens of the lobster.

Ⅰ-４. Health management in red snapper, *Lutjanus campechanus*, culture

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The Gulf Coast of Mexico Marine Stock Enhancement Program is using the red snapper to investigate the role of aquaculture technology as part of an overall management scheme. In our two-pronged approach, we assessed diseases and parasites through all life history stages of wild snapper. Then, we identified the parasites of wild fish that were potential risks to the culture system and minimized those risks through a comprehensive quarantine and monitoring program. Of over 30 species of parasites from wild specimens, some are direct threats, depending on conditions. Those from captive broodstock include an apparently harmless gall bladder myxosporean and two potentially destructive monogeneans. Some broodstock with equilibrium problems were infected with fungi that perforated the swim bladder and kidney. Several common bacteria infected snapper, but none is considered a primary disease agent. Cultured larvae have been free of infectious diseases, but cultured juveniles are susceptible to *Anyloodinium ocellatum*, a common parasitic dinoflagellate that can be controlled with careful administration of copper sulfate. Systemic granulomatosis and overall morbidity, perhaps due to an unidentified nutritional deficiency, were problems initially. Funded through National Marine Fisheries Service Grant No. NA96FL0446.

Ⅰ- 5. *Oncorhynchus masou* virus disease：Epidemiology and its control strategy

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Oncorhynchus masou virus (OMV) is a herpesvirus isolated from salmonid fish in Japan. Distribution of salmonid herpesvirus is known in USA and Japan. Herpesviruses isolated in USA are classified to serotype 1 and in Japan are serotype 2. OMV disease (OMVD) is an oncogenic and skin ulcer conditions. The susceptible fish species are kokanee salmon (*Oncorhynchus nerka*), masu salmon (*O. masou*), coho salmon (*O. kisutch*) and rainbow trout (*O. mykiss*). Economic losses are recognized among kokanee salmon, coho salmon and rainbow trout.

At the beginning of 1980's, OMV distributed widely in northern part of Japan and infected species was masu salmon. From 1988, OMV was isolated from coho salmon and OMVD was a major problem in pen culture of coho salmon in Tohoku district. From 1991, OMVD was found in rainbow trout in Hokkaido and from 1998, re-immerging OMVD was found in rainbow trout cultured at central part of Japan. Now, OMVD has become a major problem in pond culture of rainbow trout in these areas.

OMV was sensitive to ultraviolet irradiation and iodophore treatment, and was inactivated in fertilized eggs. Although, detection of OMV in carrier fish was difficult by using a PCR, this virus replicated and appeared into ovarian fluid at mature stage. All eggs and facilities were disinfected by iodophore just after fertilization and again eggs were disinfected at the early-eyed stage. Eggs and fry were cultured under a virus free environment. We were able to avoid the outbreak of OMVD of masu salmon, kokanee salmon, coho salmon and rainbow trout in Hokkaido and Tohoku district. Formalin killed OMV vaccine is testing to prevent a vertical transmission.

Ⅱ- 1. Diseases of cultured marine fish in subtropical areas of Japan

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The aquaculture in Okinawa, the subtropical part of Japan, mainly produces kuruma prawn, seaweed, pearls and marine fishes. In 1998, it earned a total of 6.2 billion yen, accounting for 30.2% of the total amount of annual fishery production in Okinawa prefecture.

The marine fish aquaculture in this area mainly includes red seabream *Pagnus major*, spangled emperor *Lethrinus nebulosus*, estuary cod *Epinephelus malabaricus* and cobia *Rachycentron canadum*. The estuary cod is an especially promising candidate to promote the fish aquaculture industry in this area.

However, red seabream iridoviral disease, edwardsiellosis, pseudotuberculosis, gliding bacterial disease, white spot disease and skin fluke disease are the most common problems in Okinawa's cultured fish. In the seed production, gliding bacterial disease, epitheliocystis-like disease and white spot disease can sometimes cause a large mortality rate among the larvae and juveniles. The red seabream iridoviral disease seriously damages aquaculture production. As a result of experimental infection with the virus, red seabream and estuary cod were found to be highly sensitive, and spangled emperor and cobia were less so. It corresponded with the occurrence of the disease in the net cages. In infected estuary cod, basophilic enlarged cells, which is associated with blood vessels in organs such as the spleen, appeared to be similar to those found in infected red seabream. Viral multiplication was observed in the enlarged cells. The cohabitant experiment with the infected fish reveals that horizontal transmission occurs in the estuary cod. To control red seabream iridoviral disease in estuary cod, further studies are needed to define the disease process including a study of the relationship between the host defense mechanism and the virus.

Ⅱ-２. Establishment of a culture system for piscine nodaviruses and its application to VNN study

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All genotypic variants of piscine nodavirus, the causative agent of viral nervous necrosis (VNN) in cultured larval and juvenile marine fish, was culturable in a fish cell line SSN-1 which was derived from striped snakehead fish. However, one problem in practical use of the SSN-1 cell line was that this cell line is composed of a mixed population of cells, this causing irregularity in cell constitution and inconsistency in the cytopathic effects (CPE) expression even if cultured at identical conditions. This was overcome by cloning SSN-1 cells, and a cell clone (E-11) obtained was highly useful for isolation and cultivation of all piscine nodaviruses due to its stable, clear CPE expression. Virus titration and growth experiments using the E-11 cell line clearly revealed differences in the optimal growth temperature among 4 genotypes; 25 to 30C for RGNNV, 20 to 25C for SJNNV, 20C for TPNNV, and 15 to 20C for BFNNV. The temperature-dependency of virus strains strongly suggests that genetic variations may come from adaptation to the host fish environment whether it is natural or artificial. As another application of E-11 cells, a simple, rapid and sensitive procedure to detect the virus was established by pre-cultivating virus in cells prior to RT-PCR amplification. This culture system must be useful for the future studies of piscine nodaviruses and VNN.

Ⅱ- 3. Red sea bream iridoviral disease in Japan

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The first outbreak of red sea bream iridoviral disease (RSIVD) caused by red sea bream iridovirus (RSIV) was recorded among cultured red sea bream (*Pagrus major*) mainly among juvenile around Shikoku Island, Japan, in 1990. However, the related mortalities of market-sized fish have also been reported. Since 1991, the disease has caused mass mortalities of cultured marine fish. It is known that the RSIVD occurred among 28 cultured marine fish species in the western part of Japan.

The diseased fish were lethargic and showed severe anemia, petechiae of the gills, and enlargement of the spleen. The disease was histopathologically characterized by the appearance of enlarged cells that were deeply stained with Giemsa solution in the spleen, heart, kidney, liver and gills.

Recently, we have developed an immunofluoresence test with a monoclonal antibody (MAb) and a PCR assay for rapid diagnosis of the disease. The indirect immunofluorescence test with a MAb is commonly used for rapid diagnosis of RSIV infected fish in the field. For effective control measures, we have developed a formalin-killed vaccine which shows a significant effect in red sea bream under both experimental and field conditions. The vaccine was also effective in other cultured marine fish such as the yellowtail (*Seriola quinqueradiata*). The vaccine is now commercially available in Japan for red sea bream and yellowtail.

Ⅱ-４. Efficacy of a DNA Vaccine Against Infectious Hematopoietic Necrosis Virus

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Infectious hematopoietic necrosis (IHN) virus is a significant salmonid pathogen for which there is no commercially available vaccine. Traditional vaccines based on attenuated virus strains, inactivated virus, protein subunits, or peptides are not in current use due to concerns regarding safety and/or efficacy. A DNA vaccine containing the glycoprotein gene of IHNV has been shown to stimulate a protective immune response in rainbow trout (Oncorhynchus mykiss) fry and immature adults when administered at very low doses. An optimal dose of 0.1 ug DNA, injected intramuscularly in 1g fry, provides nearly complete protection against a virulent virus challenge. In our continuing investigation of the efficacy of this vaccine we have found that it protects rainbow trout fry against challenge with heterologous IHNV strains including a very severe IHNV strain, 220-90, and other strains from North America, Japan, and France. In a study of various vaccine delivery methods six routes of immunization were tested in fry. Both intramuscular injection and cutaneous particle bombardment using a gene-gun elicited near complete protection, while intraperitoneal injection provided partial protection. Finally, a study of the duration of protection is in progress and indicates that significant protection is still provided against viral challenge one year after vaccination, although the protection is not as complete as that observed at earlier timepoints. Together these data contribute toward our ultimate goal of developing an effective vaccine for protection of salmonids against IHN virus.

Ⅱ- 5. Apoptosis of host cells induced by M2 gene product of IHN viral genome

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Infectious hematopoietic necrosis (IHN) virus causes salmonid hosts to damage hematopoietic organs and, therefore, to bring about high mortality expressing severe anemic gill and kidney as a typical sign. Since we found that IHN virus-infected rainbow trout demonstrated apoptotic response to circulating lymphocytes detected by DNA fragmentation and TUNEL (terminal nucleotidyl transferase-mediated deoxyUTP nick end labeling), this apoptosis was suggested to be important in the pathology of IHN. We, first of all, attempted to focus our attention on M2 gene having shorter RNA sequence chosen out of genomic genes (G, L, M1, M2, N and NV genes), to investigate IHN viral protein responsible for the apoptosis. M2 gene DNA, produced from IHN viral RNA by reverse transcription (RT)-PCR amplification, was ligated into E. coli plasmid vector. Following the insertion of M2 gene DNA to the vector, recombinant M2 protein was prepared from E. coli transformant. When lymphocytes and cultured cells were incubated with the M2 protein, ca. 200 base pair-ladder was determined. Further, when anti-M2 protein rabbit polyclonal IgG was supplemented with the incubation, DNA ladder formation was strong inhibited. The action of M2 protein was a kind of nonspecific nuclease because of digestion of salmon testis DNA into nucleotide oligomers. The M2 gene, therefore, could be termed 'nuclease gene'. Thus, IHN viral RNA genome included a nuclease gene as a tool for virulence to injure chromosomal DNA of the host tissue cells. These findings claim that the M2 gene product implicated in the apoptosis of host cells should be incorporated as a major mechanism into the pathology of IHN. The administration of the M2 protein by immersion, nevertheless, showed no vaccine effect on rainbow trout alevin infected with IHN virus.

Ⅱ-６. Characterization of Components of Type Ⅳ Pili and Type Ⅱ Extracellular Secretion in *Vibrio vulnificus* and Determination of Their Role in Virulence

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Vibrio vulnificus is a motile, Gram-negative, curved rod-shaped bacterium with a single polar flagellum. It is a naturally occuring, free-living inhabitant of estaurine and marine environments throughout the world, with a preference for tropical to sub-tropical climates. Currently, *V. vulnificus* is divided into two distinct biotypes based on phenotypic and host-range differences. Biotype 1 strains produce indole and ornithine decarboxylase, exhibit several immunologically distinct lipopolysaccharide (LPS)types, and are typically associated with shellfish colonization and human illness. Biotype 2 strains are negative for indole and ornithine decarboxylase production, express a common LPS type, and cause infections in a variety of marine vertebrates, particularly in cultured eels where it has caused significant economic losses in Japan. Although biotype 2 strains primarily cause infections in marine vertebrates, they are capable of causing opportunistic infections in mammalian hosts, including humans. Proven and suspected virulence determinants that may contribute to the ability of *V. vulnificus* to cause a severe and rapidly disseminating septicemia in susceptible hosts are the same for both biotypes. These include a polysaccharide capsule, several exoenzymes, and the ability to adhere to mucosal surfaces. Therefore, while our work has focused on biotype 1 strains, the results may be significant for biotype 2 strains as well.

We have cloned and characterized four genes encoding products related to components of the type Ⅳ pilus biogenesis and general secretory (type Ⅱ)pathways by complementation of a type Ⅳ leader peptidase (Pi1D)mutant of *Pseudomonas aeruginosa* with a *V. vulnificus* genomic library. One of the genes (*vvpD*)encodes a protein homologous to PilD and other members of the type Ⅳ peptidase family, which completely restores this activity in a *P. aeruginosa* mutant deficient in the expression of PilD. The other genes (*vvpA-C*)encode homologs of type Ⅳpilus biogenesis components. These are the type Ⅳpilin protein subunit(VvpA) and two proteins essential for assembly of type Ⅳ pili(VvpB and VvpC). Phenotypic characterization of a *V. vulnificus vvpD* mutant showed that VvpD is required for the expression of surface pili. This mutant is also unable to secrete at least three extracellular degradative enzymes; the localization of one of these (cytolysin)to the periplasmic space indicates that these proteins are normally exported via the type Ⅱ secretion pathway. Loss of VvpD results in significant decreases in CHO cell cytotoxicity, adherence to HEp-2 cells, and virulence in a mouse model. Capsule formation and serum resistance are not affected in the *vvpD* mutant, indicating that in addition to capsule, virulence of *V. vulnificus* requires type Ⅳpili and/or extracellular

secretion of degradative enzymes.

The sequence of *vvpA* shows that it encodes a typical type Ⅳ pilin subunit gene, homologous to pilins from *Pseudomonas aeruginosa*(PilA)and *Vibrio cholerae* (MshA or PilA). To determine the distribution of the pilus biogenesis genes in *V. vulnificus* isolates, clinical and environmental isolates(from oysters)were compared for the presence of *vvpA* and *vvpD*. Although the different strains exhibit considerable polypmorphism in the location of these genes on the *V. vulnificus* chromosome, *vvpA* and *vvpD* are highly conserved in both clinical and environmental isolates. This suggests that type Ⅳpili may play an important role in pathogenesis as well as in persistence of the organism in its natural environment.

Ⅱ- 7． Cold-Water Disease of Coho Salmon in Japan

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A large number of coho salmon（Oncorhynchus kisutch） eggs have been imported annually from the Pacific coast of North America. Outbreaks of cold-water disease in coho salmon in Japan occurred only in the fry originating from the imported eggs which showed positive for Flavobacterium psychrophilum, despite the fact that the eggs were disinfected with 50 ppm povidone-iodine for 15 min.

Experimental infection of eggs with F. psychrophilum was successful only by immersing the fertilized eggs in a suspension of the bacteria at a concentration of 1.0 x 108 CFU/mL before water-hardening. F. psychrophilum was isolated from the egg contents and the viable bacterial counts ranged from 103 to 107 CFU/g. Observation on the frozen sections of the infected eggs at eyed stage stained by IFAT revealed that many F. psychrophilum cells were located within the eggs. It was concluded that F. psychrophilum entered the eggs during water-hardening stage. The povidone-iodine treatment was ineffective to eliminate F. psychrophilum from the experimentally infected eggs.

Introducing the domestic eggs into the hatcheries instead of the imported eggs was effective for controlling the disease.

Ⅱ-８. Development of vaccine against coldwater disease in ayu, *Plecoglossus altivelis*

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Flavobacterim psychrophilum, is the etiological agent of coldwater disease causing serious losses in farming as well as in natural population of ayu *Plecoglossus altivelis*, which is one of the most important freshwater fishes in Japan as a food and also for recreational angling. However, no commercial vaccine has been available for the prevention of coldwater disease in ayu. Thus, we investigated the potency of oil adjuvants, Montanidae ISA 206, 264, 266 and 763A, and a squalene emulsion, to enhance the response of ayu to formalin killed bacterin (FKB) made from the pathogen. Ayu were challenged 4 weeks after vaccination by an intramuscular injection with live pathogenic *F. psychrophilum*. Mortalities of fish injected with FKB combined with any of the adjuvants showed that the adjuvanted vaccines had significantly higher ($P<0.05$) potencies than the FKB vaccine alone or sterile distilled water. Moreover, adjuvanted vaccines produced significantly higher antibody titer than the FKB vaccine without adjuvant. From these investigations it may be concluded that the use of oil adjuvants provides enhanced protection against coldwater disease in ayu compared to the use of FKB alone.

Ⅱ-９. Potential Impact of *Renibacterium salmoninarum* on Adult Returns of Snake River Spring-summer Chinook Salmon

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The smolt-to-adult return rate of wild Snake River spring-summer chinook salmon (*Oncorhynchus tshawytscha*) averaged greater than 4% during the mid-to late 1960s when only four dams existed on the lower Snake and Columbia Rivers. After construction of four additional dams in the late 1960s to mid-1970s, return rates decreased to generally less than 2% coincident with increased mortalities to downstream migrant fish. Extensive efforts between the mid-1970s and mid-1990s improved conditions in the hydropower system to the extent that juvenile survival rates are now as high as those observed in the 1960s, however, adult returns have remained low. One of the primary candidates for a mechanism that limits stock recovery is infection of fish by Renibacterium salmoninarum, the causative agent for bacterial kidney disease (BKD). Renibacterium salmoninarum is found in a high percentage of chinook salmon smolts that migrate through the hydropower system. Stress resulting from passage through bypass systems at dams, when fish are loaded into barges for transportation, or from interactions between wild fish and large numbers of larger hatchery chinook salmon and steelhead may decrease immune systems sufficiently to increase losses to BKD. The smoltification process may also lower immune system functions in fish. Finally, chinook salmon with higher levels of Renibacterium salmoninarum appear more susceptible to predation. As research has shown that the majority of juvenile chinook salmon successfully migrate out of the Columbia River, mortalities affecting adult return rates occur primarily in the ocean. Little ocean sampling has occurred, therefore, direct empirical evidence linking disease to decreased populations does not exist. Changes in ocean conditions, and releases of large numbers of hatchery that may impact conditions as fish arrive in the ocean, are a couple of other hypotheses to account for the observed decreased adult returns.

Ⅱ- 10. Stress Impairs Non-specific Defense Activity of Fish

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Because tilapia, Oreochromis niloticus are aggressive, within a few hours post-transferring two fish with different sizes into an aquarium, large fish always became dominant, and charged, chased and rammed subordinate small fish. The cortisol and glucose concentrations in the plasma of the subordinate were significantly increased than those of the dominant, indicating that the subordinate was stressed. The number of neutrophils that migrated to the swim bladder, where formalin-killed bacterial cells were injected, was significantly decreased in the subordinate, and their phagocytic and respiratory burst activities were both reduced. In vitro, cortisol suppressed isolated neutrophil defense activities, such as chemotactic, phagocytic and respiratory burst activities, in a dose-dependent manner. Cortisol also suppressed in vitro degranulation of tilapia eosinophilic granular cells, which are thought to contain neutrophil migrating factor(s) in their granules. Peritoneal implantation of cortisol to tilapia damaged the defense activities of their neutrophils and eosinophilic granular cells, and then artificial challenge with Edwardsiella tarda revealed elevated susceptibility of the cortisol-implanted fish to edwardsiellosis.

The results obtained from the present study suggest that secreted cortisol under stressful conditions directly impairs the non-specific cellular defense in tilapia, and therefore the stressed fish fails to defeat invading microorganisms.

Ⅱ- 11. Emaciation disease of cultured tiger puffer, *Takifugu rubripes*

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A new disease characterized by serious emaciation has been spreading among cultured tiger puffer, *Takifugu rubripes*, in Japan. Hitherto unknown myxosporeans have been collected from the intestine of emaciated fish and described as *Myxidium fugu*, *Myxidium* sp. and *Leptotheca fugu*. Two hyperparasitic microsporeans were often found in the plasmodia of *M. fugu* and *L. fugu*, but their pathogenic effects to host myxosporeans remains to be clarified. These myxosporean infections had some exceptional features. First, they showed no clear seasonality in their development, and mature spores were rarely observed. Secondly, two of them (*M.* sp. and *L. fugu*) are histozoic in the intestine of the host. Thirdly, they probably transmit directly from fish to fish. Histologically, *M. fugu* showed minimal pathogenicity. On the other hand, in *M*. sp. infection, the epithelium was detached and cellular debris accumulated between the epithelium and lamina propria. In *L. fugu* infection, infiltrated macrophages surrounded plasmodia, and resultant parasite-macrophage aggregates moved to the lamina propria to form macrophage centers. These host responses caused the basement membrane of the epithelium to be discontinuous, leading to epithelial decomposition. When *L. fugu* was infected with a hyperparasitic microsporean, these pathological changes tended to be more severe. It is evident histologically that *M* sp. and *L. fugu* with or without the hyperparasitic microsporean were highly pathogenic to the host fish, and this strongly suggests that they are the causative agents of the emaciation disease.

Ⅱ- 12. IMMUNOGENETICS OF *Ceratomyxa shasta* RESISTANCE IN RAINBOW TROUT

J.L. Bartholomew[*1], M.J. Whipple[*1], G. Thorgaard[*2] , and D.E. Campton[*3]
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One of the best documented examples of heritable resistance in fish are populations of salmon and trout that have evolved in the presence of the parasite *Ceratomyxa shasta*. Resistance to *C. shasta* occurs naturally, as the parasite acts as a selection factor on salmonids throughout enzootic regions. However, the immune mechanisms which contribute to resistance or susceptibility have not been determined. The paper describes research to identify immunogenetic mechanisms of resistance to *C. shasta* in rainbow trout (*Oncorhynchus mykiss*) by exploiting the strong differences in resistance that occurs naturally among populations. To determine how resistance is inherited, two strains of rainbow trout, a *C.shasta* -resistant (Klamath), and a *C.shasta*-susceptible (Cape Cod) strain were used as broodstock to produce progeny of the two strains and the reciprocal crossbred F1s. Results of natural exposures to the parasite demonstrated that resistance was a dominant trait in the F1 progeny. To provide material for genetic mapping and assist with determining the mode of inheritance, the F1 progeny were reared to sexual maturity (age 2 years) and 30 backcross families were produced from those fish and challenged by natural exposure to the parasite. To examine the strains was examined using *C. shasta*-specific DNA probes in an *in situ* hybridization assay. These results combined with observations of the pathology in chronically infected fish indicate that control of parasitism may involve multiple mechanisms, the primary being an early barrier to invasion or replication.

In addition to characterization of resistance in the outbred strains, differences in resistance to the parasite have been documented in homozygous clonal rainbow trout lines produced by androgenesis and gynogenesis at Washington State University. Use of these characterized strains will facilitate studies on genetic mapping and quantitative trait locus analysis.

Ⅱ- 13. Anemia of Japanese flounder caused by the monogenean, *Neoheterobothrium hirame* infection

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Recently, severe anemia has been observed frequently in both wild and cultured Japanese flounder, *Paralichthys olivaceus*, in Japan. We studied the anemia to clarify its causative agent. The anemia was hematologically characterized by considerably low hemoglobin concentration, appearance of many immature erythrocytes and abnormal staining in the cytoplasm (vacuolation or weak staining) of erythrocytes. The blood-feeding monogenenan, *Neoheterobothrium hirame*, was observed at high prevalences in flounder groups in which many anemic fish were contained. Experimental challenges with the parasite successfully created anemia in fish. By the challenges, hemoglobin concentrations decreased depending on the challenge doses and abnormal immature erythrocytes and mature erythrocytes were generated. The hematological characteristics in the experimentally challenged fish were similar to those in wild or cultured anemic flounder. These clearly demonstrate that *N. hirame* is the causative agent of the anemia.

Ⅲ- 1． Potential Diseases of Blue Crabs

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Blue crabs *Callinectes sapidus* are caught in the wild and sold either as hard or softshell crabs. Hard crabs are steamed and eaten by picking the tender white meat from the shell. Softshell crabs, a popular seafood choice in Japan, are caught as pre-molts and held in tanks until they shed their old exoskeleton, exposing a very soft new shell. Diseases in both wild populations and in crabs contained in holding facilities can cause mortalities, decreased fecundity, or decrease in demand. Some of the most detrimental disease agents include viruses, bacteria, fungi, and various protozoans.

Several viruses including RLV-RhVA combinations and BFV are found in wild and captive crabs. Shell disease caused by chitinoclastic bacteria, and systemic bacterial infections can be exacerbated by captivity or water quality. *Lagenidium callinectes* is a fungus that can affect crab fecundity. Various protozoans cause disease in wild blue crabs but often may not become patent until held in artificial environments such as holding facilities or shedding tanks. Some of the most pathogenic protozoans infecting blue crabs include microsporidans; sarcomastigophora: *Paramoeba* and *Hematodinium*; and ciliates: *Mesanophrys chesapeakensis* and *Lagenophrys.* Crab diseases can be influenced by host and environmental parameters and some may be pre-patent until exposed to stress factors.

Ⅲ- 2. Introduced Diseases, Pests, Predators, and Their Impact on Natural Fisheries and Aquaculture Systems

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Increasing numbers of transfers and introductions of marine fish and shellfish are occurring worldwide. With the movement of these species into new environments, there is also the increased risk of introducing associated diseases, pets, and predators. The impacts associated with the movement of marine species are both detrimental and beneficial. Not as well documented is the impact that diseases have on the recipient native marine species. There is even less documented evidence of their impact on the habitats into which they have been introduced. State, National, and international efforts now exist to prevent the concomitant introduction of pathogens, parasites, pests, predators, and other biological entities. The Office International des Epizooties(OIE)has identified a number of reportable fish, crustacean, and molluscan diseases. Diseases of oysters have had disastrous effects on oyster populations around the world. Viral diseases of salmonids are an increasing problem. Recently, new viral diseases have impacted the international shrimp aquaculture industry. Specific examples of oyster, fish, and shrimp disease introductions will be discussed, as well as their impacts on marine fisheries and aquaculture systems. Examples are:(1)reduced growth, or death of native species;(2)competition with native species;(3)effects on human health;(4)effects on other human activities; and(5)habitat destruction.

Ⅲ- 3. Control of penaeid acute viremia (PAV) in seed production of Penaeus japonicus

Jun Satoh[*1], Keiichi Mushiake[*2], Koh-ichiro Mori[*2], Misao Arimoto[*2], and Keinosuke Imaizumi*[1]
*1 Shibushi Station of Japan Sea-farming Association
*2 Kamiura Station of Japan Sea-farming Association

This study was aimed to establish the control measures of penaid acute viremia (PAV) in seed production process of Penaeid japonicus. In seed production of kuruma prawn, spawners are completely depended on wild-captured broodstock in Japan. The prevalence of PRDV (penaeid rod-shaped DNA virus), which is the causative virus of PAV, was examined in wild-captured brooders by PCR (polymerase chain reaction) from 1996 to 1998. As a result, PRDV was detected from ovary of female prawn at the highest value (10.1 %, 96/955). And PAV occurred in the juveniles obtained from PCR-positive spawners. These results strongly suggested that infection source of PRDV was wild broodstock. As a control measure, the selection of brooders by detection of PRDV from ovary before spawning was carried out to prevent PRDV from horizontal transmission, but PAV broke out in juveniles. At the same time, PRDV was more detectable from receptaculum seminis after spawning. PAV did not occur when segregation of eggs was performed based on the detection of PRDV from receptaculum seminis of brooders after spawning. These results indicate that thus selection of eggs should be done in the hatchery.

Ⅲ- 4. Probiotic approach to enhance health of hatchery produced shellfish seed

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Bacterial diseases of intensively cultured larval and juvenile shellfish cause significant losses in hatcheries and nurseries. In addition, chronic bacterial infections are a significant cause of bivalve seed losses post-planting. From commercial hatchery case histories, a number virulent juvenile oyster bacterial pathogens have been isolated, characterized and pathogenicity confirmed by challenge procedures.

Prevention and control strategies for bacterial pathogens in hatcheries and nurseries must include routine sanitation of system surfaces, water filtration, brood stock sanitation and maintenance of low dissolved organic levels. Antibiotics have been used in experimental settings but are not routinely used on production scale systems due to cost as well as risk of producing resistant strains. A program to select and test probiotic strains of bacteria, as an alternative to antibiotic use, is underway and results to date will be presented.

Bacterial pathogens were first screened by comparing whole cell fatty acid profiles. Based on this evaluation, most pathogens were consistent or close to the *Vibrio* genus but probiotic candidates represented a variety of bacterial genera. Selected representative isolates were further characterized using biochemical criteria and 16s rDNA sequencing.

Candidate probiotic bacteria are first tested in agar plate inhibition tests. Strains showing inhibition to isolated pathogens are tested for haemolytic activity and pathogenicity to shellfish seed. Candidates passing these tests are then tested for inhibition of mortality and morbidity response in laboratory pathogen challenges.

Research supported in part by Saltonstall-Kennedy program（National Marine Fisheries Service, U.S. Department of Commerce） grant to Pacific Shellfish Institute, Olympia, Washington.

Ⅲ- 5. Juvenile Oyster Disease(JOD): What We Know and Management Strategies

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Juvenile oyster disease(JOD)is first believed to have been observed in cultured oysters, *Crassostrea virginica*, from the northeastern United States in 1984. By 1990, the disease was found in *C. virginica* cultured in Marine, Massachusetts, Rhode Island, New York, New Hampshire, and Connecticut. Examination of feral juvenile oysters showed <4% prevalence of gross signs of disease. Oysters infected by JOD exhibit gross characteristics such as cessation of growth in previously fast growing juveniles 5-30 mm in shell length, development of a conchiolinous ring on the inner valve surface that may totally envelop the oyster tissue, mantle recession, and formation of shell checks (indicating a pause in growth)that correlate to the size of the oysters at disease onset. Mortalities of 60 to 100% are common and of a rapid onset in first-year oysters. Histological examinations of JOD-infected oysters reveal 2-to 6-μm singular inclusion bodies, with Feulgen-positive nuclei found focally in vacuoles within healthy mantle epithelial cells. These bodies progress in size and number to form large ulcers in mantle epithelium. No specific organism has been identified as the causative agent although protists and various bacteria have been investigated. Transmission studies have shown the disease to be infectious, with the infective agent able to occasionally pass through a 5-μm-pore-size filter, but not a filter of 1-μm pore size. Incubation period is three to seven weeks depending on water temperature. High water flow as used in some upweller systems reduces, but does not eliminate infection and resulting mortality. The most effective management strategies include spawning oysters early to allow juveniles to grow above the size where they are most heavily affected by the disease, and development of strains of oysters resistant to JOD.

Ⅲ- 6. Development of an oral administration of oxytetracycline to control losses due to withering syndrome in cultured red abalone, *Haliotis rufescens*

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Withering syndrome(WS)is a chronic and fatal disease of wild and cultured abalone, *Haliotis spp*. causing significant losses to commercial farmers and wild populations. The transmissibility of WS was tested by cohabitation of black abalone with WS and those without WS. Control abalone(+WS)died at a steady rate from week 1-41 with 92% cumulative mortality, while controls without WS experienced 12.5% mortality due to handling stress. Clinical signs of WS (mantle retraction and pedal muscle atrophy) were first observed ~21 weeks after initiation of the study in the experimentally infected animals followed by mortalities from week 36-46. Like animals exposed in the field, mortality of experimentally infected animals was rapid and high (79%). Microscopic examinations revealed numerous Rickettsiales- like procaryotes(RLPs)in digestive tissues accompanied by an atrophy and degeneration of the digestive gland only in abalone with WS. We observed an inverse correlation between RLPs and survival($p<0.01$), and between RLP and condition of the digestive gland($P<0.01$)and foot($P<0.01$). These data suggest a role of the RLPs in WS. We subsequently determined that intramuscular injections of oxytetracycline were effective in treating the RLP infections and reducing or preventing associated losses. The causative agent of WS is an obligate intracellular bacterium(RLP), recently described as "*Candidatus* Xenohaliotis californiensis". In order to control losses due to this disease in abalone culture facilities, we are in the process of developing an oral administration of oxytetracycline. WS-positive, red abalone(~90g)were placed (n=147each) into tanks(6 control and 6 treatments)and held at ~14-16℃. Experimental animals were fed a diet containing oxytetracycline for two weeks, while control animals were fed kelp. After the treatment, an El Nino event was simulated by turning off the flow of seawater to the 12 tanks during the day to produce an elevation of water temperatures from ~15℃to ~18℃. After two months of daily temperature fluctuations, the animals were returned to ambient conditions. Two weeks after the final feeding of the medicated treatment, five abalone were sampled from each tank for histology and drug residue analysis. In addition, moribund animals from various tanks were sampled after 3 months. To date, we have observed significant reductions in the intensity of bacterial infections in both the postesophagus and digestive gland two weeks and four months after a two week treatment($p<0.05$ and $p<0.001$, respectively). Losses of treated abalone (6.45%)were also significantly less than those in the unmedicated, control treatment(36.30%; $p<0.0001$). In addition , the

biomass of treated animals exceeded（16.55kg）those of control animals（11.14kg, a 48% increase in total biomass）10.6 months after a single treatment. All trials were conducted under the guidance of the FDA/CVM though their Aquaculture Investigational New Animal Drug program（INAD #9332）. We are presently beginning larger scale trials and establishing residue data for use in determination of a withdrawal time for this treatment regime.

Ⅲ- 7． Pathogenesis of *Perkinsus* spp. in Bivalve Mollusks

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Sporozoa of the genus *Perkinsus* have been associated with high mortality rates among mollusks of commercial importance around the world. *Perkinsus marinus* infections have contributed to severe declines of the eastern oyster *Crassostrea virginica* along the Atlantic and Gulf coasts of the United States including the Chesapeake Bay. Severe mortalities of other commercially important bivalves associated with *Perkinsus* spp. include *P. olseni* in abalone in Australia; *P. atlanticus* in cultured clams in Spain, Portugal, and Italy; *P. quqwadi* in Japanese scallops in Canada; and *Perkinsus* sp. in cultured clams in Korea. Recently, *Perkinsus* spp. emerged as a potential threat to softshell clams(*Mya arenaria*), another economically and ecologically important mollusk of the Chesapeake Bay. Indeed, two distinct species of *Perkinsus* were isolated from infected softshell clams, one closely related to *P. marinus* and the other recently described as a new species, *P. chesapeaki*. The histopathology of *Perkinsus* species infections vary among infected hosts. For example, *P. marinus* in oysters causes large abscesses. The parasites destroy the epithelium, and infiltrating protozoal cells in the digestive tract are able to multiply within hemocytes and become rapidly systemic. Damage to the oyster is caused mainly by lysis of affected tissues due to extracellular products, mainly serine proteases, secreted by the parasite. *Perkinsus* spp. in softshell clams are typically localized in the gills and encapsulated in discrete cysts; however, large abscesses may be found in most tissues in advanced cases and may interfere with normal metabolic processes. The widespread tissue lysis often observed in oysters heavily infected with *P. marinus* has not been observed in softshell clams infected with *Perkinsus spp*. The ability of pathogenic protozoa to damage tissue depends partially upon the production of lytic enzymes and adhesion molecules collectively known as virulence factors. In this study, we identified extracellular proteins(ECP)secreted by the two softshell clam *Perkinsus* species and compared the ECP of the two isolates with those of an oyster-derived isolate of *P. marinus*, P-1. The proteolytic activities of softshell clam *P. marinus* were found to be serine protease in nature, similar to those of P-1; however, P-1 showed significantly higher proteolytic activity. Conversely, *P. chesapeaki* ECP lacked proteolytic activities and was more highly lipolytic. The difference in enzyme activities observed among the three *Perkinsus* spp. provides a possible explanation for differences observed in *Perkinsus* spp. infections in clams and oysters. Additional studies to compare the proteolytic activities of the oyster and softshell clam isolates with those secreted by *P. atlanticus* in cultured Mediterranean

clams in Spain are underway. These studies provide important insights into invertebrate cellular defense mechanisms and host/parasite interactions which will enhance the development of improved disease prevention and management strategies for cultured and feral bivalve mollusks. Histocytological methods and other techniques recommended for screening of broodstock of aquacultured species for *Perkinsus* spp. and other diseases will be reviewed.

Ⅲ- 8. Molecular Approaches to Understanding and Diagnosing Disease in Marine Invertebrates: Disease Resistance, Pathogen Adaptations and Molecular Probes for Parasitic Protista (*Perkinsus* spp.) and Toxic Dinoflagellates (*Pfiesteria* spp.)

Gerardo R. Vasta
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Viral, bacterial, fungal and protozoan epizootic diseases are recognized as significant factors detrimental to the marine ecosystem, and the successful exploitation of natural and cultivated stocks of marine shellfish from coastal areas around the world. Currently, established methods for the control of disease in vertebrates, such as rational vaccination programs, can not be applied to invertebrate species. Further, the basic problem when considering enhancing disease resistance in marine invertebrates through transgenic approaches, is the identification of the suitable target gene(s). Specific and sensitive diagnostic molecular tools for early detection of pathogens in the host and the environment will aid in controlling disease through appropriate management strategies. In order to address the immediate need for a reliable diagnostic assay we developed a polymerase chain reaction (PCR)-based assay for the diagnosis of *Perkunsus marinus*, a protistan parasite of the eastern oyster, in oyster tissues selecting an intergenic, non-transcribed spacer (NTS) between the 5S and small subunit ribosomal RNA (SSU rRNA) genes as the target nucleotide sequence. The PCR-based assay is species-specific and can detect a single *P. marinus* trophozoite in 30 mg of oyster tissue, indicating that this diagnostic methodology is not only faster, but also more reliable than the current FTM assay. We implemented a similar approach to develop a sensitive and specific PCR-based assay for the detection of *P. piscicida*, a heterotrophic dinoflagellate that has been associated to massive fish mortalities and health problems in watermen working along the lower Eastern Shore of the Chesapeake Bay, and presumed to affect larval and juvenile shellfish. Based on genetic information, the PCR assay uses primers designed on the *P. piscicida* NTS and SSU regions, yielding an amplicon of 429 bp. We have been routinely applying this assay for the identification of *P. piscicida* in environmental water and sediment samples. Although it is a very sensitive technique for the detection of specific sequences in complex DNA mixtures, the PCR amplification can be inhibited by substances present in soil and sediments. In order to verify the amplification of the target sequence in sediment samples, we developed an internal standard that uses the same priming sites selected for the PCR-based assay for *P. piscicida*, but yields an amplicon of different size. PCR co-amplification of this internal standard in serial dilutions of sediment samples confirmed the presence of inhibitors of Taq polymerase, and revealed the lowest dilution at which the PCR amplification takes place. Thus, the inclusion of internal standards is critical for

avoiding false negative results in the routine detection of *P. piscicida* in environmental samples［Supported by grants NOAA NA46RG0091, NIEHS 1PO1 ES09563; and ECOHAB NA860P0492）

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ＸⅡ　　サテライトシンポジウムプログラムと講演要旨

第２９回ＵＪＮＲ水産増養殖専門部会日米合同会議
サテライトシンポジウム
「亜熱帯域における環境保全型増養殖研究の現状と展望」

平成１２年１１月１４日
大濱信泉記念館（沖縄県石垣市）

開会の辞　9:15-9:45

（座長：D. R. Hewitt・阿部和雄）

石垣支所における増養殖研究：現状と方向　9:45-10:15
皆川　恵（西水研石垣）

日本亜熱帯域の沿岸資源生物の多様性　10:15-10:45
栗原健夫・加藤雅也（西水研石垣）・小林正裕（水産庁）・
水戸啓一（北水研）

－休　憩－

（座長：R. Blaylock・加藤雅也）

ハワイ沖合での垂下式生簀における Pacific　threadfin の養殖試験　11:00-11:30
Charles Helsley (Univ. Hawaii Sea Grant Program)

疾病、害虫、捕食生物の移入とそれらが漁業ならびに養殖に及ぼす影響　11:30-12:00
Frederick Kern (NOAA, Natl. Ocean Sev. Center)

－ 昼　食 －

ポスターセッション　13:30-15:00

（座長：C. Helsley・小菅丈治）

オーストラリアにおける環境保全型養殖:現状と将来方向　15:00-15:30
David Hewitt (Australian Fresh Corporation, Bribie Aquaculture Res. Center)

アジアにおけるマングローブに優しい養殖　15:30-16:00
Jurgene Primavera (Aquaculture Department, Southeast Asian Fish. Development Center)

（座長：F. G. Kern・輿石裕一）

アメリカの亜熱帯、熱帯地域における資源培養の現状と概要　16:00-16:30
Kenneth Leber (Center for Fisheries Enhancement, Mote Mar. Lab.)

サンゴ礁海域における栽培漁業の現状と将来　16:30-17:00
村越正慶（沖縄栽漁セ）

（座長：K. Leber・村井武四）

総合討論　17:00-17:30

懇親会（石垣グランドホテル）　19:00-

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1．琉球列島におけるスイショウガイ科クモガイの養殖と個体群動態
上野信平・毛利詩乃（東海大海洋）・梶原健次・宮平和法（平良市栽セ）・濱口恵一（東海大海洋）

2．体内に自家果樹園を持つサンゴ礁域の自給自足者・・・シャコガイ
岩井憲司・玉城信（沖縄水試八重山）・村越正慶（沖縄栽漁セ）

3．ふ化イカ放流によるコブシメ資源増殖の試み
山下貴志・岡雅一・浜崎活幸・大角伸一・與世田兼三（日栽協八重山）

4．沖縄におけるシラヒゲウニの栽培漁業
渡辺利明（沖縄水試）・大城信弘（沖縄栽漁セ）

5．石垣島の礁池におけるクロナマコ個体群の生態
西濱士郎（西水研石垣）・水戸啓一（北水研）

6．セディメンテーションがハナヤサイサンゴの遺伝子発現に与える影響
橋本和正（西水研石垣）・萱野英子（東大工）・萱野暁明（農水省）・澁野拓郎・阿部寧・高田宜武（西水研石垣）

7．サンゴ幼生の放流によるサンゴ礁の修復：そのコンセプトと予備的研究
林原毅（西水研石垣）・岩尾研二（阿嘉島臨海研）・皆川恵（西水研石垣）

8.マレーシアマングローブ汽水域における底魚類の生態
木曽克裕（西水研石垣）・Mahyam Mohammad-Isa・Muhammad-Fadzil Haron (Fish. Res. Inst., Dept. Fish., Malaysia)

9．日本および台湾のウナギの遺伝的集団構造
加藤雅也（西水研石垣）・小林正裕（水産庁）・栗原健夫（西水研石垣）・水戸啓一（北水研）

10．藻食性魚類による採食が大型褐藻の藻場に及ぼす影響
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11．体表粘液に見いだされる雌特異タンパク（ビテロジェニン）を利用したカンパチとキハダの雌の選別
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13．日本栽培漁業協会におけるクロマグロ種苗生産の現状
手塚信弘・升間主計・神保忠雄・小磯雅彦・鶴巻克己（日栽協奄美）・難波憲二（広島大）

Satellite Symposium on Present Status and Perspectives of Environmentally-Friendly Aquaculture and Resource Enhancement in Tropical Regions
UJNR / Aquaculture Panel, 29th Joint Meeting

Ishigaki City, Okinawa
November 14, 2000

Opening Remarks 9:15-9:45

(Chairperson: D. R. Hewitt and K. Abe)

Ishigaki Tropical Station Aquaculture and Resource Enhancement Studies: Present Status and Direction 9:45-10:15
Megumi Minagawa (Ishigaki Trop. Stn., Seikai Natl. Fish. Res. Inst.)

Diversity of Coastal Fishery Resources in Subtropical Japan 10:15-10:45
Takeo Kurihara, Masaya Katoh, Masahiro Kobayashi and Kei-ichi Mito (Ishigaki Trop. Stn., Seikai Natl. Fish. Res. Inst.)

(Coffee Break)

(Chairperson: R. Blaylock and M. Katoh)

Hawaii Offshore Aquaculture Experience of Growing Pacific Threadfin (moi) in Submerged Sea Cages 11:00-11:30
Charles Helsley (Univ. Hawaii Sea Grant Program)

Introduced Diseases, Pests, Predators, and their Impact on Natural Fisheries and Aquaculture Systems 11:30-12:00
Frederick Kern (NOAA, Natl. Ocean Sev. Center)

(Lunch)

Poster Session 13:30-15:00

(Chairperson: C. Helsley and T. Kosuge)

Environmentally Friendly Aquaculture in Australia: Present Status and Future Directions 15:00-15:30
David Hewitt (Australian Fresh Corporation, Bribie Aquaculture Res. Center)

Mangrove-Friendly Aquaculture in Asia 15:30-16:00
Jurgene Primavera (Aquaculture Department, Southeast Asian Fish. Development Center)

(Chairperson: F. G. Kern and Y. Koshiishi)

Status and Outlook of Marine Stock Enhancement in Tropical and Subtropical Regions of the USA 16:00-16:30

Kenneth Leber (Center for Fisheries Enhancement, Mote Mar. Lab.)

The Present State and Future Aspect of Sea Farming in Coral Reef Regions 16:30-17:00

Masayoshi Murakoshi (Okinawa Pref. Sea-Farming Center)

(Chairperson: K. Leber and T. Murai)

Discussion 17:00-17:30

Welcome Dinner (Ishigaki Grand Hotel) 19:00-

Poster Session

1. Spider Shell, *Lambis lambis* (L.) (Gastropod: Strombidae) Mariculture and Population Dynamics in the Ryukyu Islands, Japan
Shinpei Ueno, Shino Mouri (Tokai Univ.), Kenji Kajiwara, Kazunori Miyahira (Hirara City Sea-Farming Center) and Keiichi Hamaguchi (Tokai Univ.)

2. Giant Clams in Coral Reef Regions, or Autotrophic Shells Building on an "Orchard" in their Own Body
Kenji Iwai, Shin Tamaki (Yaeyama Branch, Okinawa Pref. Fish. Exp. Stn.) and Masayoshi Murakoshi (Okinawa Pref. Sea-Farming Center)

3. Stock Enhancement Trials of Giant Cuttlefish *Sepia latimanus* off the Coast of Ishigaki Island, Japan
Takashi Yamashita, Masakazu Oka, Katsuyuki Hamasaki, Shin-ichi Ohsumi and Kenzo Yoseda (Yaeyama Station, Japan Sea-Farming Ass.)

4. Stock Enhancement of Sea Urchins *Tripneustes gratilla* in Okinawa
Toshiaki Watanabe (Okinawa Pref. Fish. Exp. Stn.) and Nobuhiro Ohshiro (Okinawa Pref. Sea-Farming Center)

5. Population Ecology of a Black Sea Cucumber *Holothuria atra* in Coral Reef Lagoon of Ishigaki Is.
Shirou Nishihama (Ishigaki Trop. Stn., Seikai Natl. Fish. Res. Inst.) and Kei-ichi Mito (Hokkaido Natl. Fish. Res. Inst.)

6. Effects of Sedimentation on Gene Expression of the Scleractinian Coral *Pocillopora damicornis*
Kazumasa Hashimoto (Ishigaki Trop. Stn., Seikai Natl. Fish. Res. Inst.), Eiko Kayano (Tokyo Univ.), Toshiaki Kayano (Ministry of Agriculture, Forestry and Fisheries), Takuro Shibuno, Osamu Abe and Yoshitake Takada (Ishigaki Trop. Stn., Seikai Natl. Fish. Res. Inst.)

7. Coral Reef Restoration by Enhancing Coral Recruitment through Larval Seeding: the Concept and Preliminary Studies
Takeshi Hayashibara (Ishigaki Trop. Stn., Seikai Natl. Fish. Res. Inst.), Kenji Iwao (Aka-jima Mar. Sci. Lab.) and Megumi Minagawa (Ishigaki Trop. Stn., Seikai Natl. Fish. Res. Inst.)

8. Demersal Fish Fauna under Different Levels of Developmental Activity in Mangrove Areas of West Coast Peninsular Malaysia
Katsuhiro Kiso (Ishigaki Trop. Stn., Seikai Natl. Fish. Res. Inst.), Mahyam Mohammad-Isa and Muhammad-Fadzil Haron (Fish. Res. Inst., Dept. Fish., Malaysia)

9. Genetic Structure of the Japanese Eel (*Anguilla japonica*) from Japan and Taiwan
Masaya Katoh (Ishigaki Trop. Stn., Seikai Natl. Fish. Res. Inst.), Masahiro Kobayashi (Fishery Agency), Takeo Kurihara (Ishigaki Trop. Stn., Seikai Natl. Fish. Res. Inst.) and Kei-ichi Mito (Hokkaido Natl. Fish. Res. Inst.)

10. Impact of Grazing by Herbivorous Fishes on Large Brown Algal Bed
Setsuo Kiyomoto and Taku Yoshimura (Seikai Natl. Fish. Res. Inst.)

11. Successful Selection of Female Greater Amberjack and Yellowfin Tuna using a Female-Specific Protein (Vitellogenin) in Body Surface
Akihiro Takemura (Ryukyu Univ.), Masaei Kanematsu, Masakazu Oka, Satoshi Shiozawa, Kazuhisa Teruya and Hiroyuki Takeuchi (Yaeyama Station, Japan Sea-Farming Ass.)

12. Bone Abnormality of Hatchery-Reared Yellowfin Tuna *Thunnus albacares*
Hirofumi Shimizu (Ishigaki Trop. Stn., Seikai Natl. Fish. Res. Inst.) and Satoshi Shiozawa (Yaeyama Station, Japan Sea-Farming Ass.)

13. Present State on Seedling Production of Bluefin Tuna (*Thunnus thynnus*) in JASFA
Nobuhiro Tezuka, Shukei Masuma, Tadao Jinbo, Masahiko Koiso, Katsumi Tsurumaki (Amami Station, Japan Sea-Farming Ass.) and Kenji Nanba (Hiroshima Univ.)

Ishigaki Tropical Station Aquaculture and Resource Enhancement Studies: Present status and Direction

Megumi Minagawa
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The high degree of biodiversity is the character of the subtropical regions but at the same time leads to difficulty in studies of ecosystem, ecology and biology. Ishigaki Tropical Station, a branch of the Seikai National Fisheries Research Institute in Nagasaki, opened in 1994 to support fisheries in the regions from the view point of studies. The station consists of five sections including one related to aquaculture and resource enhancement. Each section cooperates closely with the other to conduct basic studies on ecosystem, environments, and fisheries. Studies by the Aquatic Ecology and Marine Environment Sections concerning the structure of ecosystems and environments are applied to resource management and enhancement and aquaculture in the other three sections. The primary goals of the Aquaculture and Resource Enhancement Section are as follows: 1) to develop techniques for evaluation, preservation, and rehabilitation of coral reefs as nurseries with a focus on sea grass and coral, 2) to study the ecology of hatchery-reared juveniles to enhance the resources of important species such as the grouper, *Plectropomus leopardus*, emperors (Lethrinidae), and the mud crab, *Scylla serrata*, 3) to improve aquaculture techniques by fish disease and broodstock studies. This presentation is an introduction to the ongoing research at Ishigaki Tropical Station and a discussion of future studies required for sustaining the aquaculture and natural resources in the subtropical regions of Japan.

Diversity of Coastal Fishery Resources in Subtropical Japan

Takeo Kurihara[*1], Masaya Katoh[*1], Masahiro Kobayashi[*2] and Kei-ichi Mito[*3]

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In subtropical Japan, coastal fishery resources have high diversity in terms of 1) species number, 2) genetic variations, and 3) morphological variations. We stress such high diversities in edible molluscs. We will present the high species number of venus clams, the genetic variation of a giant clam, and the diverse morphology of a turban snail.

Such diversities can cause various problems in coastal fisheries in subtropical Japan. First, high species number may lead to complicated inter-species interaction, and thus the resources of not a single species but multiple species need to be simultaneously managed. Second, genetic variation among local populations might mean that there is little gene flow among these populations, and that the abundance of each of population might be determined by not among-population migration but local environmental factors; thus, the resource of each local population need to be separately managed. Finally, the populations that show only morphological variation with no genetic variation perhaps need to be simultaneously managed, since the abundance of each population might be affected by among-population migration; in this case, however, it should be carefully concerned that genetic variation

Hawai'i Offshore Aquaculture Experience of Growing Pacific Treadfin (*moi*) in Submerged Sea Cages

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Although Hawai'i has been a leader in aquaculture research and development in the Pacific for several decades, no offshore aquaculture activity has been undertaken primarily because our offshore waters tend to be quite rough. The Hawaii Open Ocean Aquaculture Project (HOARP), a joint project between University of Hawai'i (UH) Sea Grant, Safety Boats Hawai'i, and the Oceanic Institute, began in 1998. An OceanSpar SeaStaion 3000 sea cage was ordered in the fall of 1998 and grownout operations commenced in April 1999.

Pacific threadfin *Polydactylus sexfilis*, locally known as *moi*, was chosen as the test species. The brood stock spawned in early February 1999 and 70,000 70-d-post-hatch juveniles (5-7 cm BL) were transferred to the cage in mid April. A special nursery cage was placed inside the main cage to contain the small juvenile fish and was used for approximately 4 wk, until the fish had reached sufficient size that they could no longer escape from the outer net.

Pacific threadfin are surf zone fish and one goal of the demonstration was to determine how these shallow water fish would grow at deeper depths. The top of the cage was at approximately 12 m depth during the growout of the fish. Although the fish are naturally adapted to very shallow water, they performed well at the greater depth.

Feeding was accomplished by means of a tube (10 cm in diameter) connected to the surface. A slurry of the water and pelletized feed was introduced for several hr each d. Feed was supplied to the growing fish at a rate of several percent of total fish mass/d. Divers monitored the feeding which was terminated when a slight rain of pellets began to reach the bottom of the cage. Harvesting began in late August of 1999, about 4.5 mo after the fish were introduced into the cage, and continued on an incremental basis until October when the harvest of fish was completed.

The experiment successfully demonstrated the feasibility of growing *moi* at depths of 15 to 30 m and showed that this could be done in an economically viable way with no adverse environmental impact to water column, the sea floor, or the nearby coral reefs.

Introduced Diseases, Pests, Predators, and Their Impact on Natural Fisheries and Aquaculture Systems

Frederick G. Kern

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Increasing numbers of transfers and introductions of marine fish and shellfish are occurring worldwide. With the movement of these species into new environments, there is also the increased risk of introducing associated diseases, pets, and predators. The impacts associated with the movement of marine species are both detrimental and beneficial. Not as well documented is the impact that diseases have on the recipient native marine species. There is even less documented evidence of their impact on the habitats into which they have been introduced. State, National, and international efforts now exist to prevent the concomitant introduction of pathogens, parasites, pests, predators, and other biological entities. The Office International des Epizooties (OIE)has identified a number of reportable fish, crustacean, and molluscan diseases. Diseases of oysters have had disastrous effects on oyster populations around the world. Viral diseases of salmonids are an increasing problem. Recently, new viral diseases have impacted the international shrimp aquaculture industry. Specific examples of oyster, fish, and shrimp disease introductions will be discussed, as well as their impacts on marine fisheries and aquaculture systems. Examples are:(1)reduced growth, or death of native species; (2)competition with native species;(3)effects on human health;(4)effects on other human activities; and (5)habitat destruction.

Environmentally Friendly Aquaculture in Australia: Present Status and Future Directions

David R Hewitt
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Australia has faced, and will continue to face, tightening of regulations for the discharge of aquaculture wastewater. The largest cluster of tropical aquaculture operations in Australia occurs adjacent to the Great Barrier Reef where concerns regarding nutrient input has led to strict regulation of point source discharges such as aquaculture.

This has led major industry associations to develop codes of practice which have the ultimate long term goal of achieving nil tangible impact to water quality. These codes of practice are supported by research programs that enhance the ability of aquaculture to become environmentally friendly. Treatment of wastewater from aquaculture and the development of recirculating systems are programs with this focus.

Aquaculture wastewater treatment has been addressed by research examining; the ability of mangrove creeks to assimilate shrimp farm waste, the ability of constructed wetlands to remove nutrients in shrimp farm discharge water, the use of water recirculation in shrimp farms and the use of fish and substrates to remediate wastewater.

Recirculation systems have a smaller requirement for land and water which is particularly important for freshwater systems in a dry continent such as Australia. Waste from recirculating systems tends to be in a more concentrated form and is therefore amenable to economical treatment. Improvements in RAS technology eg ozone, oxygen injection, floating bead filters, moving bed biofilters etc are revolutionising aquaculture and this technology is being taken up by industry in Australia.

Aquaculture feeds for carnivorous species are still heavily reliant on fishmeal and fish oil. Australian aquaculture has aimed to become more environmentally friendly by reducing this reliance through determining the nutrient requirements of the major aquaculture species and substituting other proteins for fishmeal. This research has identified suitable substitutes and in one case this has already resulted in lower feed cost. Deficiencies in plant proteins have been identified and are being addressed through plant breeding.

Australia has hope in the future for a large tropical aquaculture industry, good sites are available but permits will depend on a demonstrated no net change to the environment. For these reasons bioremediation will become ever more important. Research to reduce the use of fishmeal will continue, with more emphasis on improving plant proteins. The rise in the popularity of organic produce and a backlash against antibiotics will stimulate research into probiotics, immunostimulants and

selective breeding for disease resistance. Despite the huge improvements possible through molecular biology and genetically modified organisms it is not yet clear how this technology will be accepted and utilised in the future.

Mangrove-Friendly Aquaculture in Asia

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Asia, in particular Southeast Asia, has the greatest concentration (35%) of the world's 18 million hectares of mangroves as well as the widest expanse (around one million ha) of brackishwater culture ponds. But the risk of clearcutting mangroves for aquaculture development remains high in the region where the beginnings of brackishwater pond culture (in Madura or Java, Indonesia) can be traced. Therefore there is a need to make brackishwater pond culture more environmentally sustainable. Mangrove-friendly aquaculture (MFA) technologies currently practised throughout Asia range from the traditonal *gei wai* in Hong Kong and *tambak* in Indonesia, to the state-initiated silvofisheries in Indonesia, mixed mangrove-shrimp farm systems in Vietnam, aquasilviculture in the Philippines, and mangrove pens in Malaysia. These technologies are evaluated as to aquaculture and silviculture practices (cultured species, production levels, natural species diversity), harmonious/conflicting requirements of cultured animals and mangrove flora, and how they affect the basic resource function (forestry and fisheries products) and regulatory or ecological function (nursery, coastal buffer, nutrient recycling, wildlife habitat, etc.) of the mangrove ecosystem.

Status and Outlook of Marine Stock Enhancement in Tropical and Subtropical Regions of the USA

Kenneth M. Leber
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Stocking fish produced in hatcheries has been used for over a century as a method to supplement coastal fishery yields in the USA. In spite of its long history of use, the science underlying this branch off fisheries management has not been very far developed. Aware of the criticisms of past approaches to stock enhancement, researchers around the world now are attempting to develop a better understanding of the effectiveness and potential of using hatchery organisms to increase coastal fish stocks. In the tropical and subtropical regions of the USA- Hawaii, Texas and Florida- biologists are working hard to make the outcome of marine enhancement more successful and more predictable. Research in Hawaii has shown that pilot release experiments are crucial to understanding optimal release strategies needed to maximize stocking effectiveness. Hawaii researchers have also shown that surplus production potential is available to boost striped mullet stocks well beyond current abundance levels in nursery habitats. Texas has the largest of all programs that stock marine fish in the USA. Great progress has been made there in boosting production capabilities of red drum and spotted sea trout, and biologists are now working to develop a better understanding of the effects of habitat on growth of stocked fish. Florida has recently modified its strategic plan for stocking to incorporate an adaptive management approach that should increase stocking effectiveness several fold. Recent experimental releases in Florida indicate that even small-scale fish releases can make a large contribution to recruitment of inshore stocks. There appears to be exceptional potential to enhance some marine fisheries, but there is still much to learn in this branch of fisheries science. As fishery managers rush to incorporate new marine aquaculture technology in their stocking plans, those who use a responsible and adaptive approach will make the most rapid progress in achieving their goals.

The Present State and Future Aspect of Sea Farming in Coral Reef Regions

Masayoshi Murakoshi
Okinawa Prefectural Sea Farming Center, Motobu, Okinawa 905-0212, Japan

This report illustrates the present state of sea farming in Okinawan waters, and suggests a prospect of its activity, with special reference to coral reef regions in its own territory, as well as in other related waters of surrounding areas. The full-scale activity of sea farming has not so long history in the waters concerned. It seems realized after the establishment of institutions in 1980s. The sea farming in Okinawan waters is apparently estimated in the following three categories, from the viewpoint of developing intensity. (1) The first, or the most primitive condition is characterized by an unstable production of seeds. (2) The second one still needs the technical development of intermediate rearing, prior to the release of seeds. (3) The other one demands the technical development of release, as a final step of sea farming operations.

The sea farming in Okinawan waters should be executed in close relation to mariculture in the wide sense. Additionally, the sustainable exploitation of coral reef must be always considered. It means apparently the necessity of natural conservation of coral reef regions. The conservation should achieve a favorable progress, depending upon a topographical development of local utilization and necessary technologies. Actually, suitable activity inside lagoons may be the sea farming of algae and such invertebrates as shells, crustaceans and echinoderms, and the mariculture of phytophagous fish (in a lower trophic level) such as a spinefoot, *Siganus* sp.. The activity outside lagoons should be resistible to strong wind waves caused by typhoons or monsoons, and the appropriate system of offshore culture is to provide an efficient mariculture operations. In such operations, the intermediate rearing of seeds for release, and the mariculture of hypertrophic or carnivorous fishes may be programed. Besides, the culture system should be integrated with marine-algal farming in its surrounding area for elimination of environmental overload. Such a sustainable exploitation, then, should be evolved by further exploitation of efficient foods for cultured animals and artificial reefs as a preferable habitat for marine life.

Finally, international cooperation should not be negligible as one of the most important role played by Okinawa fishery activity performed in a typical area of coral reefs. The local fishery is to voluntarily lead the fishery industry of developing countries in a similar situation, which may adapt its technologies in their own way. In this connection, it may be useful to establish several number of technological centers for production and distribution of seeds for maricuture. Seeds produced in such a core institution may be effectively distributed to neighboring countries within the block area concerned. This hopeful project, however, must follow a full arrangement of international quarantine system, and probably starts, if realized, with distribution of seeds exclusively for maricuture.

Spider Shell, *Lambis lambis* (L.) (Gastropod : Strombidae) Mariculture and Population Dynamics in the Ryukyu Islands, Japan

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The spider shell, *Lambis lambis* is one of the most common species on coral reefs. Though the number of the snail is not few and the snail is important for marine products, the dynamics of the species are unclear.

Surveys were carried out from June 1998 to Aug. 1999 at the sea grass bed in Amitori Bay on Iriomote Island in the Ryukyu Islands of Japan. The research site (100 × 100m) consisted of 100 quadrates (10 × 10m). All the snails in the area were marked with a tag and painted.

The snail were concentrated in the sea grass bed. Though the number of adult snails was stable two hundred every month, the number of immature and the juvenile snails varied monthly and increased from Sept. to Nov. This population increase was the result of snail births during the spawning season (Mar. to Oct.).

Snail population depletion was mainly attributed to predation by another animals, e.g.. *Conus marmoratus marmoratus*, *Conus textile* and *Calappa gallus*. The number of dead snails was balanced in the year by births, enabling the area to maintain the snail population in status quo. Therefore if we release the juvenile of the snail in the field, the population of the snail hardly increase in size. As the growth of the snail is quickly, the snail is suitable for the mariculture.

Giant Clams in Coral Reef Rregions, or Autotrophic Shells Building on an "Orchard" in their Own Body

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This poster summarizes the life history and mariculture of the giant clams in coral reef regions. The tridacnid clams are peculiar by evolving a final autotrophic system. The clams may be represented here by the boring clam, *Tridacna corcea*. Acutually, six species of giant clams have been reported from Okinawan waters. Among them, commercially important shells are of 3 species, including the boring clam, mentioned above. The other two are the frilled clam, *Tridacna squamosa*, and the smooth giant clam, *Tridacna derasa*.

According to consecutive contributions of embryology on shells from Palau waters by Wada in 1940s, those clams are protandrically hermaphoditic. Another characteristic is their life with symbiotic algae (zooxanthella), as referred above. The clams are autotrophic by ingestion of the algae, which live in the mantle cavity of their host shell, and the algae may intake ammonia excreted in nitrogen metabolism by the host shell. Such a metabolic system is based directly on the solar energy, and it seems to be very ecologically clean in a production process from vegetal nutrient to animal proteins.

Concerning the aspect of mariculture, the giant clam seed production has been investigated in leading institutions in the south Pacific regions such as Okinawa, Palau, Australia, Philipineses and Solomon. Regarding the seed production methods,the most interesting topics of the methods may be given as follows. Zooxanthella are observed as active in their symbiotic relationship with the host shell that grow to a larval stage two weeks after hatching. Larvae with symbiotic algae are rather easily reared without feeding in either condition on the land or in the sea. After all, the giant calms may be the ideal marine life for maricuture executed in every coral reef region toward the coming 21st century.

It was noted that the Yaeyama Branch, Okinawa Prefectural Fisheries Experimental Station, developed recently a remarkable seed production technology for the smooth giant calm, a large-sized clam without boring behavior. It results a production up to a level of million seeds by year, which includes seeds of boring and frilled clams. Besides, their technological development on intermediate and adult-stage rearing brought the local fishery operation in considerable profits.

Stock Enhancement Trials of Giant Cuttlefish *Sepia latimanus* off the Coast of Ishigaki Island, Japan

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The aim of this study is to elucidate the possibility of stock enhancement of giant cuttlefish *Sepia latimanus* through releasing the newly hatched larvae obtained from captive broodstock. A total number of 371,686 larvae marked with Arizarin Red S in the cuttlebone were released in Nagura Bay from 1992 to 1994 and in Urasoko Bay from 1992 to 1999. The cuttlebones were collected to investigate the rate of marked cuttlefish in landings from the fish market between 1992 and 2000. In addition, the same investigation was carried out for the cuttlebones landed on the sand beach of Urasoko Bay from 1997 to 2000. Furthermore, the rate of marked cuttlefish in landings from the small trap-nets set in the releasing site of Urasoko Bay and in the none-releasing site of Kabira Bay between 1998 and 2000. The annual number of cuttlebones collected from the fish market and the beach of Urasoko Bay varied from 668 to 2,324 and from 35 to 145, respectively. The rate of marked cuttlebone of 1.92-3.45 % in Urasoko Bay was higher than that of 0-0.17 % in fish market. On the contrary, the rate of marked cuttlefish and the number of landings in the releasing site of Urasoko Bay were obtained 3.80 % and 447, respectively. No marked cuttlefish of 197 specimens were caught in Kabira Bay during research periods. The released cuttlefish grew up to commercial size, which ranged from 235 to 369 mm in mantle length. These results indicate that the newly hatched larvae of this species can be survived and grown up around releasing site. We concluded that stock enhancement of cuttlefish could be found the possibility through releasing the newly hatched larvae in restricted coastal sea area.

Stock Enhancement of the Sea Urchins, *Tripneustes gratilla*, in Okinawa

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The sea urchin, *Tripneustes gratilla*, was harvested heavily during 1970's in Okinawa. As a result, the annual catch of the sea urchin declined rapidly from 1,500-2,000 tons in mid 1970's to less than 500 tons in late 1970's. The Okinawa Prefectural Government started a project for the stock enhancement of the sea urchin in 1995. Our purpose in the project is to clarify the effect of the fishery on the sea urchin population and to recover the stock with restocking and fishery management.

The sea urchins are harvested mainly in summer, from June to September. In May, before the fishing season, the population consisted of two year-classes. In September, after the fishing season, most of the sea urchins in the old year class disappeared. The fishing size was more than 70mm in test diameter. 10-20mm juveniles reared in tanks grew to the fishing size in 10 months after release in the sea. The release size was considered to be more than 10mm in test diameter form the survival rates of the released juveniles and the juvenile microhabitats.

The major spawning season of the sea urchin is from September to December. The large sea urchins in the young year class mature, as well as those in the old year class. One of the effective measures to secure the spawner is to close the fishing season before September. Most of the sea urchins in the young year class escape being harvested and part of them grow to a mature size.

Population Ecology of a Black Sea Cucumber *Holothuria atra* in Coral Reef Lagoon of Ishigaki Is.

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The black sea cucumber *Holothuria atra* is one of the most abundant animals in coral reef lagoons around Indo-West Pacific coastal area. Although its commercial value as Beche-de-mer (dried sea cucumber) is low, its role as deposit feeder in coastal ecosystem must be important. In this study, we investigated the distribution and abundance of *H. atra* in the lagoon of Ishigaki Island, and found that the population was stable both spatially and temporally. *H. atra* is mainly distributed on sandy bottom and in seagrass bed. Another abundant sea cucumber, *Stichopus chloronotus* was distributed rather deeper and more seaward area than *H. atra*, and seemed to prefer hard bottom, such as pebble bottom and surface of dead coral. Size composition of *H. atra* was also stable and show little seasonal change, however, individuals undergoing fission and dwarfs with evidence of fission were observed from November to February, suggesting that *H. atra* reproduced asexually. This species is often covered by sand, and the habit has been considered to be adaptation to exposure to the sun. This hypothesis was examined through detail comparison of distribution pattern of sand-covered and uncovered individual, and no evidence supporting this hypothesis was found.

Effects of sedimentation on gene expression of the scleractinian coral *Pocillopora damicornis*

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Coral reef communities around Okinawa have been suffering red soil sedimentation in the past decades, but the cause of coral tissue death following sedimentation is not known. In order to identify the cause, we analyzed gene expression of a coral under sediment loading using the differential display technique. Four-centimeter branches of the scleractinian coral *Pocillopora damicornis* were exposed to 500ppm of reddish silt-clay for four hours. Total RNA was extracted from the branches using a commercially available AGPC-based RNA extraction kit. Following the DNase treatment, first-strand cDNA synthesis was performed. The cDNA was then amplified in a PCR mixture containing an arbitrary primer (10-mers). The PCR products were visualized on an 6% denaturing polyacrylamide gel. There were several bands appearing only in the control or in the sediment-treated sample, which imply that sedimentation changes the pattern of gene expression of the coral. The sequences and deduced functions of these candidate bands will be discussed.

Coral Reef Restoration by Enhancing Coral Recruitment through Larval Seeding: The Concept and Preliminary Studies

Takeshi Hayashibara[*1], Kenji Iwao[*2], Megumi Minagawa[*1]
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Coral reefs are important for propagation and preservation of fisheries resouces in tropical and sub-tropical areas. However, coral communities have declined drastically over the last two decades, because of human activities, predator outbreaks, and bleaching events. Therefore, the need for artificial restoration of coral communities has increased sharply in recent years. After the 1980s, it became widely known that many reef corals spawn huge amount of gametes synchronously once a year in many places in the world. This feature suggests the possibility that larval seeding might be used as a strategy for the restoration of coral communities.

We developed a spawning induction technique for Acroporid corals, which are consistently abundant in coral communities. Using the larvae obtained in a laboratory, we are investigating the mechanisms of settlement, suitable condition for substrata, how to find the larval maturity and the factors affecting the survival and growth of settled polyps. Our recent studies show that the planulae of *Acropora* settle and metamorphose on artificial substrata that have been immersed in the sea for more than one month. They avoid settlement on upward surfaces that are exposed to high light intensity and tend to settle in the darker areas. This fact conflicts with findings that hermatypic corals require sunlight. The survival rates of the polyps that settled on artificial substrata were examined in the sea for one year. Higher mortality was observed until the sixth month, which was attributed to herbivorous fishes on exposed surfaces and sessile organisms on the protected surfaces. These results suggest that an improvement in the artificial substrata would raise coral survival rates during the early polyp stages. Microscopic observation suggests that the cnidae of planulae are used in settlement and that the cnida composition will be a useful indicator of larval maturity.

If a restoration technique for coral communities were to be established, it would be possible to recover and create new habitats and maintain and enhance the existing tropical coastal resources. It would also contribute to the conservation of biodiversity, which is recognized internationally as being essential to the global environment.

Demersal Fish Fauna under Different Levels of Developmental Activity in Mangrove Areas of West Coast Peninsular Malaysia

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Mangrove forests on the West Coast of Peninsular Malaysia have been developed at different levels of activity. This study focuses on the abundance by weight and distribution of fish fauna collected at three mangrove estuaries with differing levels of activity. The selected study areas were Sungai Sangga Besar in Matang, Sungai Merbok in Merbok and Sungai Dinding in Lumut. The mangrove forests in Matang are well-managed reserve areas, but in Merbok, mangrove forests have been partially cleared for aquaculture and agriculture activities. As for mangrove forests in Lumut, areas have been poorly managed and most of the area has been cleared for the development of towns, industry, prawn farming and a naval base.

In this study, data were obtained based on sampling carried out during flood tides for two hours from November 1998 to October 1999. Sampling areas were concentrated within the coastal and brackish waters of three river mouths. Sampling gear consisted of sink gill nets (two jointed nets with three layers of mesh 45 mm in minimum mesh, 30.2 m in length, and 1.8m width). During each sampling period, fish were recorded according to species and weighed to the nearest gram.

Four sampling operations were successfully carried out at the study areas. Studies in the river mouth showed that Matang mangrove area harbors the highest number of species and individuals (21 species - 134 individuals) followed by Lumut (19 species - 80 individuals) and Merbok (14 species - 35 individuals). In the brackish water areas of the rivers, Matang mangrove area showed the highest number of species and individuals (22 species - 342 individuals) followed by Merbok (18 species - 78 individuals) and Lumut (6 species - 38 individuals). This study showed that highest variety of species, density of individuals, and value of catch in weight were observed in the river mouth and brackish water areas of a well-managed part of the Matang mangrove. However, this was not the case for the poorly managed areas of Lumut where fewer varieties of species and low catch in weight were observed especially in the river mouth. In a semi-managed area of Merbok, higher densities of the individuals were observed in the brackish water areas of the river, but densities were lower in the river mouth.

Dominant species in the river mouths of Merbok and Matang were similar, and Ariidae, Sciaenidae, Dasyatidae and Mugilidae were found to be the dominant fish species. However, in the river mouth of Lumut, Tetradontidae and Leiognathidae were the dominant species. Ariidae was found in all the three rivers, and Sciaenidae and Engraulidae were absent in mangrove areas of Lumut. Monacanthidae species were observed only in the mangrove area of Lumut, but not in the other two rivers.

Genetic Structure of the Japanese Eel (*Anguilla japonica*) from Japan and Taiwan

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Recent decline of glass eel catches in East Asia has caused serious problems in eel aquaculture in Japan and Taiwan. Seeds for aquaculture depend totally on natural glass eels. Artificial propagation from eggs to glass eels has not succeeded yet. The spawning site of the Japanese eel appears to be west of the Mariana Islands in the North Pacific and eels travel several thousand kilometers for spawning. The leptocephalous larvae travel back to freshwater habitats in Taiwan, mainland China, Korea and Japan. The limited spawning area may imply that the Japanese eel has one large panmictic population in entire East Asia. However, synchronized spawning of eels occurs during at least three consecutive new moon periods from May to July. Moreover, previous allozyme study of recruiting glass eels that were collected along the East Asian coasts shows clinal changes of allele frequencies at two loci. Therefore, genetic differentiation may present among eel populations due to temporal segregation and/or selection. We compared frequency difference of each RAPD band to investigate genetic structure of the Japanese eel in East Asia. Twenty-seven 10-base random primers were used for DNA amplification through PCR. Eighteen primers produced bands and intra-specific genetic variation has been revealed. We will select only primers which produce stable banding patterns to compare glass eel populations from Taiwan and Japan (south to north: Kagoshima, Ibaraki and Miyagi). Preliminary results showed that frequencies of most RAPD bands were similar among the four locations. An 1100 bp band amplified by the primer OPA10 was absent in Miyagi samples and present in the remaining populations at different frequencies (0.11-0.24). Before we conclude uniqueness of the Miyagi samples, other primers that showed the stable bands need to be examined. These data can be used for effective resource management.

Impact of Grazing by Herbivorous Fishes on Large Brown Algal Bed

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The seaweed beds broadly existing from cold to subtropical waters, play important roles for coastal marine animals. For example, they are consumed as a food by abalone and sea urchin, and provide settlement places, refuges and foraging grounds for crustaceans such as spiny lobster. *Panuliurs longipes*, one of the important spiny lobster for coastal fisheries along Nansei-Shoto, uses red algal beds as a nursery ground. The grazing by benthic herbivore such as sea urchin or top shells are well known factor for disappearance of seaweed bed and its continuation ("Isoyake"), and the algal beds can be restored by removing these benthic herbivore in many places. Further, a sudden change in physical environments like approach of high temperature water mass to coast is also thought to cause damage to the algae. But there might exist another factor responsible for the disappearance of seaweed bed.

In autumn 1998, the leaves of most *Ecklonia kurome* in the algal beds disappeared along the 2 km coast of Nomozaki, Nagasaki Prefecture, southwest Japan. We found in our field examination conducted next year that grazing by herbivorous fishes, *Calotomus japonicus* and *Siganus fuscescens*, was responsible for this phenomenon, and in situ VTR revealed that all leaves of *E. kurome* were consumed or bit off by these two species only in 2 hours.

In tropical waters, herbivorous fishes are one of the dominant herbivore, but only a little attention is paid on effect of herbivorous fish to macro brown algae in temporal waters. The damage by herbivorous fish seemed to be done abruptly in a large scale so that it may be more serious than that by benthic herbivore. Although it would be possible that the grazing by herbivorous fishes play major role in Isoyake which become grave problems in various part of Japan in recent years, we don't have enough information about their effects. So, more research is needed on the ecology and population dynamics of herbivorous fishes, in order to elucidate their effects on seaweed bed.

Successful Selection of Female Greater Amberjack and Yellowfin Tuna Using a Female-Specific Protein (Vitellogenin) in Body Surface

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Sex and ovarian condition of the grater amberjack (*Seriola dumerili*) and the yellowfin tuna (*Thunnus albacares*) were estimated with a female-specific protein (vitellogenin, VTG) appearing in body surface. VTG levels in the body surface were measured by enzyme-linked immunoassay (ELISA) or dot blot analysis using rabbit anti-amberjack VTG antibody. VTG could be detected in the body surface of the mature females but not that of the males or the immature females of both species. In greater amberjack, annual fluctuation of body surface VTG was correlated well with that of serum VTG. These results suggest that occurrence of VTG in body surface reflects sex and ovarian maturity in certain teleost fishes. Therefore, VTG in body surface, like that in the blood circulation, becomes a useful tool for sexing and estimation of gonadal maturation of certain fishes.

Bone Abnormality of Hatchery-Reared Yellowfin Tuna (*Thunnus albacares*)

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Little research exists on bone abnormality of hatchery-reared yellowfin tuna. The symptoms and appearance of the abnormality have not been explained. We intend to explain the tendency toward abnormal bone formations and to show the rates of occurrence in hatchery-reared yellowfin tuna.

For the study, 298 larvae of yellowfin tuna were used from 2-30 days after hatching. Their total lengths were 3.1 mm to 40.8 mm. They were reared at Yaeyama Station of the Japan Sea-Farming Association in May and June 1997. The fish were reared in water temperature of 27℃ and were fed on S-type rotifers from day two and L-type rotifers, *Artemia*, larvae, minced larva·frozen fish eggs, and frozen fish eggs. Each body part was measured after these fish were properly fixed in 5% formalin. All specimens were stained with alizarine red S for bone and with alcian blue 8GX for cartilage; they were then cleared with an enzyme solution according to a method developed by Dingerkus and Uhler (1977). The formation of abnormal bones was observed under a substance microscope, and the symptoms were classified and described.

Bone abnormality was only observed in fish that were more than 14 days old. The bone was undeveloped in fish younger than 14 days. The occurrence of bone abnormalities in 186 fish over 14 days after hatching was 54.3%. Abnormalities occurred at the following rates: 27.7%, upper jaw; 3.0%, lower jaw; 91.1%, neural spine; 12.9%, haemal spine; 8.9%, dorsal pterygiophore; 1.0%, anal pterygiophore; and 1.0%, centrum. Abnormalities of the neural spine occurred most frequently with a rate of 91.1%. Abnormal parts occurred around the 2nd, 15th, and 25th neural spine.

Abnormality of the haemal spine occurred only in the first half of the 18-27th haemal spine, and abnormalities were not observed in the latter half of the haemal spine. Moreover, neural spine abnormalities often occurred with other symptoms.

Present State on Seedling Production of Bluefin Tuna (*Thunnus thynnus*) in JASFA

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Japan Sea-Farming Association (JASFA) has developing the technology for seedling production of bluefin tuna at Amami Station in southwestern part of Japan since 1994.

The larvae on 3-11 days after hatching (DAH) ate 85-580 rotifers per day. The amounts of oxygen consumption in the larvae were 0.035-8.2 $\mu l\text{-}O_2 \cdot individual^{-1} \cdot min^{-1}$ from 1 to 29 DAH. The balance of energy in the larvae to be calculated from these values was positive until 8 DAH but it turned negative on 11 DAH. The larvae became to feed the newly hatched larvae of Japanese parrot fish as diet after the rotifer from 10 DAH. The balance of energy calculated from the amount of the newly hatched larvae became positive from 10 DAH until 20 DAH. But it became negative on 25 DAH again when the larvae fed only the newly hatched larvae. We actually fed the shred of sand lance to the larvae and juveniles from about 20 DAH. Therefore the balance also turned positive after 25 DAH.

These results suggest the importance to change the diet suitable for the larvae and juveniles with their growth. The sequence of diets suitable for rearing the larvae and juveniles of bluefin tuna is L-type rotifer for the larvae on 3-10 DAH, newly hatched Japanese parrot fish for the larvae on 10-20 DAH and shred of sand lance for the larvae and juveniles after 20 DAH. Amami Station succeeded to produce from 1,000 to 15,000 juveniles (40-60mm TL) in these several years using this sequence of diets.

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ＸⅣ　UJNR 水産増養殖専門部会日米代表補正打合せ

ＵＪＮＲ水産増養殖専門部会日米代表補正打合せ

2000 年 11 月 13 日

米国側出席者

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Dr. Conrad Mahnken（UJNR 米国側副部会長）
Mr. Dominic Preiswerk（UJNR 米国側副事務局長）
Dr. James Sullivan（Hawaii Sea Grant Science Advisor）

日本側出席者

中村　保昭（UJNR 日本側部会長）
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中山　一郎（中央水産研究所　企画調整部）
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開催場所: 石垣グランドホテル
趣旨: 本打合せは、UJNR 水産増養殖専門部会の将来に関して協議するため開催された。

UJNR 水産増養殖専門部会の将来

予算の見通し

・米国側は、会議の冒頭、日本側の UJNR 予算削減の可能性があること、更に米国側も NOAA の研究予算からの配分額が未確定であることから UJNR は岐路に立たされていると言明した。
・これに対し日本側は、UJNR の予算が、来る独立行政法人化による構造改革で必ずしも縮小されるとは限らないことを説明し、現在の UJNR に対しては、農林水産省と科学技術庁が予算措置を講じていることを付け加えた。
・米国側は日本の新政府の構造改革がどのような様相となるかを知るためには一層の情報が必要であると述べた。
・日本側は、組織改変後も養殖研究所の役割は変わらないであろうと述べた。
・米国側は、UJNR の３つの組織、すなわち増養殖、海洋構造物、沿岸海洋環境科学工学（CEST)が現在十分な活動を行っているけれども、発足以来 36 年を経て、UJNR 全体が見直されつつあることを表明した。
・日本側としては、政府に対し、UJNR の重要性を主張し続けること、および UJNR が資金基盤を失えば、再開することは不可能であることを表明した。また、かつて石油流出の際の油の除去や真珠貝の病気の問題等に際し、UJNR が有益な役割を果たしたことを付け加えた。
・米国側は、部会が存続できなければ、以後に、復活することは困難であるとの意見に同意した。更に、UJNR の有用性の例（海産魚病の国際的索引充実)を挙げ、米国側は、日本側以上に UJNR からの利益を受けていると付け加えた。
・これに対し、日本側は、利益は相互に共有されていると述べた。

・地球問題に関する日米共同事業のコモンアジェンダ*と日米科学技術協定(UJST)は、最も関心の高い問題に焦点を当てている重要案件であるが、その中で UJNR 活動は高い評価を得ており、公知されていると述べた。また、米国政府は、UJNR の存在を周知しているが、過小評価していると述べた。
・日本側は、たとえ将来的に予算が縮小されても、UJNR の機能は存続できる、しかしながら規模の縮小や参加者の制限が要求される可能性のあることを示唆した。更に日本側は、今後 UJNR 活動を維持していくため、双方の組織とも最大の努力が必要であることを強調した。また UJNR はいかに価値のあるものであるかを納税者に説明する必要性と、この点における宣伝不足を指摘した。

UJNR 水産増養殖専門部会の基本方針
・米国側は、UJNR の重要事項についての論議を事務会議の議題に付加できると提案した。
・日本側は、最優先事項として「研究協力」を強調し、次に「情報交換」をあげた。
・米国側は、これに対し、「文献交換」は、検索しがたい論文あるいは、特定の論題に特異的なものに限るべきであり、主要な鍵となる問題に目標を定めるべきである。「情報交換」は、最近ではより容易になっているので時代の変化に対応してこの項目を変更しても良いと付け加えた。
・日本側は、UJNR 水産増養殖専門部会の成果を５年ごとに評価する必要があることを述べ、過去にこのような評価が実施されたか意見を求めた。評価には 1)毎年 2)中間期 3)５年の３段階があるが、日本では、養殖研究所および UJNR 水産増養殖専門部会が５年ごとに目標を設定しているので、５ヶ年単位の視点を持つことが重要であると主張した。
・米国側は、いくつかの UJNR 会議は、他よりも強い影響力を持っているのでこれを参考として、日米両国は限りある予算を重点化すべき分野を明確にする必要があると述べた。

科学政策
・日本政府は、今後の増養殖研究において次の４つの分野を重点目標としていると説明した。1)我が国周辺水域の資源を適切に管理する体制の整備 2)資源水準に応じた効率的漁業経営の確立 3)国民のニーズに即した安全で高品質な水産物の供給 4)漁業後継者の育成と漁業地域の活性化。
  また、UJNR 水産増養殖専門部会は、これらの４課題における役割を見出すことに目標を置くべきであると述べた。
・これに対し米国側は、以下の４課題の重要性が増し、最近の増養殖の役割が変化していると述べた。1)新技術の開発 2)沿岸地域社会の経済的実践力 3)持続可能な増養殖システム 4)EEZ 問題（排他的経済水域）。
・日本側は、両国政府が重視している内容は類似していると論評した。
・米国側は、この目的を果たすために UJNR が組織網を構築する働きを持ち、この活力は、個々人に依存していると論評した。

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*1993 年に開始され、日米両国政府、公的機関および非政府組織が地球的規模の問題解決のために(１)健康の推進と人類の発展(２)世界の安定への挑戦(３)地球環境の保護(４)科学技術の発達、の４分野に焦点を絞って活動している。

次段階への目標
・米国側は、これまでの UJNR の実績を示すリストを作り上げるべきであると述べた。
・日本側は、共通の重要分野についても合意されるべきであることを付け加えた。
・米国側は、上記事項の実施が素晴らしい最初の一歩となることに同意した。

結論
・NGO 参加の観点から、米国側は大学や民間機関の UJNR への貢献を推進してきた。将来の部会（シンポジウム）に民間機関が招かれるべきかどうか、日本側の回答が求められた。
・日本側としては、民間機関の参加を充実するため最大限努力すると述べた。
・米国側は、米国と日本の民間養殖部門との間には重要な結びつきがあり、特に挙げられることとしては、ヒラメにおける協力関係があると述べた。
・日本側は、これに同意し、UJNR 水産増養殖専門部会の継続の重要性を改めて強調した。また両国は継続のため苦心するべきであると述べた。
・これに対し、米国側は、UJNR が時代の変化に対応して作り直されなければならないことを付け加えた。
・両国側は、これら最終 2 項目に合意したのち閉会した。

Compensative Meeting between Japanese and U.S. UJNR Aquaculture Panel Administration

November 13, 2000

U.S. members present:

Dr. Rene Eppi, U.S. Executive Secretary of Marine Resources and Engineering Coordinating Committee, UJNR
Dr. Conrad Mahnken, U.S. Vice Chair UJNR Aquaculture Panel
Dominic Preiswerk, U.S. Deputy Secretary General UJNR Aquaculture Panel
Dr. James Sullivan, Hawaii Sea Grant Science Advisor

Japanese members present:

Dr. Yasuaki Nakamura, Japan Chair UJNR Aquaculture Panel
Dr. Tetsuo Seki, Japan Deputy Secretary General UJNR Aquaculture Panel
Dr. Ichiro Nakayama, Research Planning and Coordination Section NRIFS
Dr. Hiroshi Sako, Research Planning and Coordination Section NRIFS

Location: Ishigaki Grand Hotel

Purpose: This meeting was called to discuss the future of the UJNR Aquaculture Panel.

The Future of UJNR Aquaculture

Future Funding

The U.S. side opened the meeting by stating that the future of UJNR was at a crossroads due to the possible cuts in Japanese UJNR funding and the uncertainty in the amount of future U.S. allocations from NOAA's research budget.

The Japanese side explained that Japan's UJNR budget may not necessarily decrease due to the upcoming restructuring. It added that the Ministry of Agriculture, Forestry and Fisheries (MAFF) and the Science and Technology Agency (STA) currently fund Japanese UJNR.

The U.S. side said that more insight was needed as to how the new Japanese government restructuring will look.

The Japanese side said that the role of NRIA will not change, but the organizational structure will.

The U.S. side said that only 3 UJNR marine panels are currently fully “active”. These are Aquaculture, Marine Facilities, and Coastal Environment Science Technology (CEST). After 36 years, the UJNR is being reassessed as a whole by the U.S.

The Japanese side replied that it continues to state the importance of UJNR to their government and that if UJNR loses its funding, it will not be possible to restart. It also added that UJNR has been useful in the past with examples being oil spill clean up and pearl oyster disease problems.

The U.S. side agreed that if panels were to be discontinued it would be difficult to revive them. It also gave more examples of UJNR utility (genetic stock structuring) and added that the U.S. has benefited from UJNR more than the Japanese.

The Japanese replied that the benefits are mutual.

The U.S. side mentioned that the Common Agenda and U.S. Japan Science and Technology Agreement (UJST) focus on hot issues. It added that, in both the Common Agenda and UJST, UJNR activities are highlighted and advertised. It also said that the U.S. government knows that UJNR exists, however there is a lack of appreciation.

The Japanese side said that even if the future budgets are downsized, UJNR Aquaculture can still be functional. However it may require scaling back and limiting the number of participants.

The Japanese side emphasized that a maximum effort is needed by the respective organizations to keep UJNR Aquaculture going. There is a need to explain to the taxpayer how UJNR is valuable. It suggested a lack of advertising on its part.

UJNR Aquaculture Administration

The U.S. side suggested that the business meeting could possibly be expanded to discuss the priorities of UJNR.

The Japanese side emphasized research cooperation as a primary priority. It said that the next highest priority should be the exchange of information.

The U.S. side responded that the literature exchange should only be for hard-to-find articles or topic-specific pieces and that key issues should be targeted. It added that information exchange has become easier over the years and that perhaps the charter should be altered to reflect the changing times.

The Japan side said that the role of the UJNR Aquaculture panel needs to be evaluated every five years to assess the panel's achievements. It also asked if such evaluations have been performed in the past. It suggested that there be three scales of evaluation: 1) annual, 2) middle span, 3) five years. Emphasis is placed on a five year timetable because NRIA and UJNR Aquaculture in Japan are evaluated every five years.

The U.S side said that some UJNR meetings have more impact than others. It stated

that both sides need to identify areas where limited resources can be focused.

Science

The Japanese side explained that the Japanese government is targeting future aquaculture research on four key areas:

1) Sustainable utilization of fisheries resources and furtherance of responsible fisheries.
2) Rationalization of fisheries production system and establishment of feasible fishery management.
3) Establishment of processing and marketing system to meet industry and consumer demands.
4) Creation of attractive living zones with fisheries as core industry.

It said the objective should be to find a role for UJNR Aquaculture on these four points.

The U.S. side stated that the role of U.S. aquaculture has changed to incorporate these four themes:

1) development of new technology.
2) economic viability of coastal communities
3) sustainable aquaculture systems
4) EEZ issues

The Japanese side commented that the emphases of both governments are similar.

The U.S. side commented that UJNR builds networks and that the vitality of the panel depends on individuals.

Next Steps

The U.S. side said that a list describing the achievements of UJNR Aquaculture should be compiled.

The Japanese side added that common areas of importance also needed to be agreed upon.

The U.S. side responded affirmatively, that this was a good first step.

Conclusions

The U.S. side stated that, in terms of NGO participation, the U.S. has been encouraging university and private sector contributions. It asked if private sector should be invited to participate in future panel meeting (symposia). It asked for the Japanese reaction.

The Japanese said that Japan will attempt to maximize their efforts to increase private sector involvement.

The U.S. side stated that there are important connections between U.S. and Japanese aquaculture private sectors. Specifically mentioned was flounder cooperation.

The Japanese side agreed and emphasized again the importance of continuing the UJNR Aquaculture Panel. It said that both sides must struggle to continue.

The U.S. side added that UJNR must be tailored to reflect the changing times.

Both sides agreed to these two final points. The meeting was then closed.

ＸＶ　その他

ＵＪＮＲ水産増養殖専門部会
歴代日本側三役と米国部会長名簿

合同会議	日本側			米国
	部会長	副部会長	事務局長	部会長
第 1 回(1971)	古川 厚	――	田中 二良	William N.Shaw
第 2 回(1972)	古川 厚	――	田中 二良	William N.Shaw
第 3 回(1974)	古川 厚	――	田中 二良	William N.Shaw
第 4 回(1975)	古川 厚	――	小金澤 昭光	William N.Shaw
第 5 回(1976)	佐藤 重勝	――	菅野 尚	William N.Shaw
第 6 回(1977)	佐藤 重勝	――	菅野 尚	William N.Shaw
第 7 回(1978)	佐藤 重勝	藤谷 超	菅野 尚	William N.Shaw
第 8 回(1979)	佐藤 重勝	藤谷 超	菅野 尚	William N.Shaw
第 9 回(1980)	須田 明	藤谷 超	能勢 健嗣	William N.Shaw
第 10 回(1981)	須田 明	藤谷 超	能勢 健嗣	Conrad Mahnken
第 11 回(1982)	花村 宣彦	藤谷 超	能勢 健嗣	Conrad Mahnken
第 12 回(1983)	多々良 薫	藤谷 超	能勢 健嗣	Conrad Mahnken
第 13 回(1984)	多々良 薫	藤谷 超	能勢 健嗣	Conrad Mahnken
第 14 回(1985)	佐藤 重勝	菅野 尚	和田 浩爾	Conrad Mahnken
第 15 回(1986)	池田 郁夫	菅野 尚	和田 浩爾	Conrad Mahnken
第 16 回(1987)	能勢 健嗣	小金澤 昭光	和田 浩爾	Conrad Mahnken

合同会議	日本側			米国
	部会長	副部会長	事務局長	部会長
第 17 回(1988)	菅野 尚	小金澤 昭光	和田 浩爾	Conrad Mahnken
第 18 回(1989)	菅野 尚	小金澤 昭光	和田 浩爾	Conrad Mahnken
第 19 回(1990)	阪口 清次	原 武史	廣瀬 慶二	Conrad Mahnken
第 20 回(1991)	高木 健治	原 武史	廣瀬 慶二	James P. McVey
第 21 回(1992)	高木 健治	月舘 潤一	伊藤 克彦	James P. McVey
第 22 回(1993)	田中 邦三	嶋津 靖彦	伊藤 克彦	James P. McVey
第 23 回(1994)	田中 邦三	嶋津 靖彦	伊藤 克彦	James P. McVey
第 24 回(1995)	畔田 正格	嶋津 靖彦	浮 永久	James P. McVey
第 25 回(1996)	畔田 正格	嶋津 靖彦	浮 永久	James P. McVey
第 26 回(1997)	上北 征男	中村 保昭	福所 邦彦	James P. McVey
第 27 回(1998)	加藤 守	安永 義暢	福所 邦彦 松里 寿彦 (12 月～3 月)	James P. McVey
第 28 回(1999)	加藤 守	安永 義暢	福所 邦彦	James P. McVey
第 29 回(2000)	中村　保昭	浮 永久	反町 稔	James P. McVey