

綜合討論概要

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I. 一般評論與心得

本次研討會為國內首度舉辦有關魚類生殖與內分泌之會議。兩天來，來自全國各學術、教育、研究與試驗，農政機關、養殖業界及其他從事水產有關人員之熱心參與，出席會議人數逾 500 人次，是一次非常成功的研討會，亦是國內舉辦有關水產學術會議出席人員最多的一次，足見大家對魚類生產與繁殖之重視。有關魚類生殖與內分泌之基礎與應用範圍至為廣泛，本次研討會僅就重點方式介紹基礎概念與國內研究人員從事有關之魚類生殖與內分泌方面研究之部分成果。限於時間，無法涵蓋更多研討專題；但是，希望經過這次研討會之交流，今後大家應多互相切磋，交換經驗與心得，共同為我國臺灣地區漁業之發展而努力與貢獻。

II. 有關研討會內容之建議

1. 希望下次舉辦之研討會，涵蓋更多魚類種別，甚至包括蝦類等高經濟水產動物。
2. 邀請更多傑出的養殖業者作專題演講，介紹其實際養殖與內分泌應用之經驗。
3. 本屆會議為國內首度舉辦有關魚類生殖與內分泌之研討會，希望繼續舉辦類似之會議，以期在教育、學術、研究、試驗與實際養殖經驗交流上，能有更大貢獻。

III. 今後研究之方向與重點

由本次研討會籌備單位，提出下列七項有關魚類生殖與內分泌研究之重點；並經共同討論後，認為可作我國今後在該方面研究與發展之指引與方向。

1. 重要養殖魚類生殖生理與內分泌激素分泌型態資料之研究與整理

近年來，臺灣養殖漁業日益蓬勃，例如一般經濟魚類（鯉、鯪、草魚、鯰魚等）及高經濟魚類（石斑魚、鯛、嘉臘魚、虱目魚、鰻魚等；與正開發之烏魚、香魚、紅目鱸魚等養殖）；但對這些魚類之生殖生理及生殖內分泌素分泌型態，尚無完整之資料。例如必須先了解魚類之生殖季節週期變化，才能進一步以人工控制魚類生殖效率。因此，加強這方面之資料蒐集與研究，並建立完整性及系統化之資料庫，以供人工控制生殖之依據與參考。

2. 腦下垂體促性腺激素之製備與純化，生物活性檢定與生殖應用之標準化

臺灣地區養殖魚類普遍，種類亦多；例如鯪魚、草魚、鯉魚、鯰魚等一般魚類或鰻魚，在宰殺時，可以順便採取腦下垂體，製備磨碎液，或經粗製純化，並檢定其生物活性之高低，以作為催熟、排精、排卵之應用。目前民間使用之腦下垂體磨碎液，只是以

經驗估計其活性作生殖應用，並未定量其活性與標準化，因此應用效果不整齊或效果不佳。國內研究機構已建立以魚或雞精巢雄性素生成，作為促性腺激素之離體生物活性檢定，提供一簡便工具使用。促性腺激素製備品之定量與生物活性標準化，可供作一般經濟魚類或高經濟魚類（如石斑魚等）之催熟、排精與排卵應用；同時該種激素在魚類生殖應用所需之生物活性有種別之差異，亦待加強研究。

國內在純化與分離促性腺激素之研究，已有相當良好基礎；並正建立腦下垂腺存庫。這在基礎生殖生理與內分泌之探討與實際應用上，非常重要。

3. 加強魚苗培育及大量繁殖種苗

A. 冷凍精液保存

冷凍精液保存研究之成功，可幫助克服天然季節性生殖限制，而能隨時以人工受精繁殖魚苗；亦可解決雄性種魚來源獲取之困難，如鮭形石斑魚，在六歲齡以上才達性成熟，如能以冷凍方法保存精液，則可解決種源困難。

B. 性轉變

某些高經濟魚類，如黑鯛（先雄後雌），鮭形石斑魚（先雌後雄）；從事加速性轉變之研究，可降低種魚年齡。

4. 性別控制之研究

A. 吳郭魚之單性生殖及雄性養育

進行吳郭魚種與種之間的雜交，在某些雜交型式中，能產生全為雄性之後代。此種單性（雄性）後代之雜交種，其體型較大，生長快，繁殖效率高。

B. 改變染色體對數（chromosome sets）以控制性別

以化學、物理及照射方法，改變魚類配子染色體對數，以控制性別，一般而言，有三種方式：(1)誘導孤雌生殖（induced gynogenesis），即是在受精前後，精子之染色體活性被破壞；(2)誘導孤雄生殖（induced androgenesis），即是在受精前後，卵子之染色體被破壞；(3)誘導多倍體（induced polyploidy），即正常受精卵之早期分裂被干擾，而產生三倍體或四倍體。某些種別之孤雌生殖可產生完全為雌性之後代；而多倍體生殖之後代，則無生殖能力；因此其體型較大，同時，一如單性養殖，在養殖數目上可隨意控制，不會任其自然繁殖。孤雄生殖較少被研究，但在性別控制上，有其潛在應用性。國內在吳郭魚之單性生殖及泥鰱、鯪魚等孤雌生殖及三倍體生殖，正在發展當中。國外專家在鱒、鯉、鮭、鯰魚等之孤雌生殖及三倍體生殖亦正研究當中。

5. 加強營養及生長生理之研究

營養為生長與生殖之基本要件。生殖系統之功能，雖由內分泌控制，但充分與平衡之營養，是所有細胞生長與功能所必須；在生殖季節期間，卵巢發育、卵黃生成、精子生成，及魚苗孵化與發育等現象，均依賴平衡之營養才能完成。營養影響生殖腺發育、功能及生殖效率甚大。目前養殖業所遭遇某些魚類之卵質差、受精率及孵化率低，其主因之一即是在生殖期間，營養欠足所致。因此，國內研究人員，在從事魚類生殖期間及魚苗生長期之營養方面研究有待加強。

6. 環境因子與生殖關係之研究

環境因子，如光照、溫度、水流速度等，影響生殖內分泌系統之功能，因而改變或控制生殖季節或效率。因此運用環境因子，可作為人工控制魚類生殖之工具。在甚多情況下，不需使用外源內泌素控制生殖。臺灣省水產試驗所及養殖業者適宜從事這方面之研究，同時在某些魚類之試驗上，已有初步成果。

7. 基礎研究、技術發展與實際應用之交流與整合

一般而言，學術研究機構多半從事基礎方面研究，水產試驗所偏重於實際應用技術探討，而養殖業者則實際養殖與經營。希望從事魚類生殖與內分泌研究與試驗專家學者，與現場養殖界多多聯繫、交流與溝通，或合作研究與試驗，則理論與實際、基礎與應用能相互結合；使魚類生殖與內分泌之基礎研究成果，實際應用於生殖技術。尤其是當今漁業界正面臨轉型期等諸多問題；確切掌握時機，共同努力，不僅可促進魚類科學之進步，而且對漁業生產之發展有所助益與貢獻。

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Summary of the Symposium Discussion

Chairman: P. W. Yuan, Department of Fisheries, Council of Agriculture, Executive Yuan.

Co-Chairmen: J. Y. L. Yu, Institute of Zoology, Academia Sinica.

C. M. Kuo, Institute of Fisheries Science, National Taiwan University.

S. H. Shih, Department of Biology, National Taiwan Normal University.

I. C. Liao, Tungkuang Marine Laboratory.

I. General Comments

Over 500 representatives from universities and colleges, research institutions, government administrations, aquaculture farmers, and others have participated in this symposium which was the first such meeting, ever held in Taiwan. The present symposium could only cover certain basic and practical aspects of fish reproduction and its endocrine control. However, it was evident that the symposium was a great success in terms of both the number of participants and the enthusiasm for participation in the discussion. The present symposium provided an opportunity for exchange of information, views, and experience in fish reproduction and its endocrine control. It also served as an educational program for the aquaculture farmers as well as for university and college students in zoology and fishery sciences to learn basic principles and concepts of this particular discipline. Furthermore, it provided a great occasion to review the current progress of the controlled reproduction of fish culture in Taiwan, and to formulate, through the discussion at the symposium, the proposals that would serve as guidelines for future researches and development in fish reproduction.

II. Suggestions to the Future Symposium

1. The scope of fish species could be expanded in next symposium, even including non-piscine aquatic species, such as shrimps.
2. The number of speakers could be increased for outstanding aquaculture farmers to speak on their experience in controlled reproduction and hormonal application in aquaculture.
3. It is hoped that the symposium be held more frequently for both educational purposes as well as for the exchange of views and experience among scientists and aquaculture farmers.

III. Proposed Guidelines and Direction for Future Researches and Development in Control of Fish Reproduction in Taiwan

The following seven subjects were proposed by the Symposium Discussion Panel. Following discussion, all these seven proposed subjects were agreed by the symposium.

participants as the guidelines for future researches and development in controlled reproduction of fish culture in Taiwan:

1. Researches on reproductive characteristics and hormonal secretion patterns of economically important fish species and non-fish aquatic species as well. Such basic information are important and useful for manipulation of their reproduction.
2. Studies on fish pituitary gonadotropins: molecular and biological properties have to be investigated to escalate the efficiency of hormonal application in control of fish reproduction; standardization of biological potency of fish and mammalian gonadotropic preparations are of paramount importance prior to application for control of fish reproduction.
3. Researches on culture and production of fries
 - a. Gamete preservation of economically important aquatic species to overcome the difficulties in obtaining the sexually mature animals.
 - b. Studies on sex reversal techniques to advance the onset of sexual maturity.
4. Studies on sex control and its application to fish culture.
 - a. Continuation of researches on monosex reproduction of tilapia.
 - b. Chromosome set manipulation in economically important fish species: induced gynecogenesis, androgenesis and polyploidy.
5. Investigations on interaction between nutrition and reproduction.
6. Researches on the effect of environmental factors on reproduction.
7. Emphasis on exchange of information and experience among scientists, aquaculture farmers, government administrations, and aquaculture-related industries, through symposium and news letters, to facilitate better communication and cooperation for promotion of the efficacy and efficiency in control of reproduction of fish and nonfish aquatic species.