

REPORT OF THE NAFO SPECIAL SESSION ON STOCK DISCRIMINATION ON FINFISH AND SQUID IN THE NORTHWEST ATLANTIC

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The Special Session on Stock Discrimination was held under the auspices of the Standing Committee on Fisheries Science (STACFIS) of the NAFO organisation at the Bedford Institute of Oceanography, on September 8-10, 1982. The meeting was convened by T.D. Iles (Canada) who chaired the four sessions on September 8 and 9 and the discussion and summary session held on the morning of September 10.

A total of 28 contributed papers were read and there were two presentations of research material. Appendix 1 lists the 28 papers presented; of these 27 are now available as NAFO SCR documents and enquiries can be made to the NAFO Secretariat at the Bedford Institute of Oceanography, P.O. Box 1006, Dartmouth, N.S., Canada B2Y 4A2.

Over fifty scientists attended and interest was maintained at a high level throughout perhaps because of the wide range of subject matter and the variety of theoretical and methodological views and approaches.

For example, individual finfish species that were dealt with included cod, haddock, silver hake, grenadier, herring, redfish, Greenland halibut, and saury. Anadromous species were not considered so that this represents an opportunity to compare the marine finfish situation with that dealt with, for example, at the Stock Concept International Symposium sponsored by the Great Lakes Fishery Commission and held at Ann Arbor, Michigan in October 1980 (Can. J. Fish. Aquat. Sci. 38: (12). Dec. 1981). In addition, several invertebrate species were the subject of papers, to include *Illex* squid, scallops (*Placopecten* sp., *Pecten* sp., *Chlamys* sp. and *Argopecten* sp.), lobster, snow crab, and mussel. There were two keynote speakers, Dr. Carl Templeman (Canada) on the general issue of stock discrimination, and Dr. Carl Sinderman (USA) on the use of parasites. Several papers dealt with methodology and data analysis with particular reference to the validity of statistical procedures in discrimination studies.

GENERAL CONSIDERATIONS

- (a) There was considerable discussion on the biological nature of fish stocks and it was generally agreed that the important criteria were those of genetic isolation, geographic distribution and the self-sustaining capability of fish stocks. It was these that underlined their management importance; that individual stock units of a commercial species could be vulnerable to exploitation effects quite independently of other stock units and that stocks should therefore be the unit for resource protection and conservation. The corollary of this is that exploitation patterns for a particular species should take into account its stock structure and the degree of intermixture of fishing areas. This also led to a conclusion of major importance for future research programs that can be highlighted as a recommendation; that studies should be directed more towards spawning concentrations, that is, at the time of reproductive isolation where stock units are segregated from each other.
- (b) There was little questioning of the fact that most commercially exploited marine species are subdivided into stock units, but it became obvious that the degree to which this occurred varied greatly from species to species. At one extreme, there is Atlantic saury (and possibly others) with, apparently, a single unit throughout its range; at the other extreme herring is divided into a large number of stock units. There were a number of instances where the degree and even the kind of subdivision of a species (or species group) is in doubt. This was perhaps particularly the case for invertebrate species and it was generally agreed that the development of a general theory of marine "fish" stocks should account for invertebrates as well. The common biological factor that united vertebrate and invertebrate forms was the existence of the larval stage in both and it was generally accepted that the dynamics of larval dispersal, aggregation and retention had to be more thoroughly understood if a general stock theory was to emerge.

(c) Many different areas of biological expertise were drawn on amongst the contributions to the meeting and it became clear that in many instances conclusions suggested by one methodology needed support from other, independent sources to carry conviction. This led to the recommendation that the multidisciplinary approach to Stock Discrimination be encouraged and that, in particular, there should be more involvement on the part of population geneticists.

(d) It became obvious during discussion periods that a proper balance should be sought between biological insight and the use of standard (and often packaged) statistical procedures that are applied in a general "discriminatory" manner to analyse bodies of data. A review of these procedures was presented by Dr. R. Misra (Canada) during the discussion session. This review demonstrated to the biologists present that greater understanding of the theory underlying statistical analysis is needed to avoid error in drawing conclusions. That many commonly used techniques can involve a high degree of subjective choice, that spurious correlations can be generated in discriminatory analysis by the use of large numbers of characters, that meristics and morphometrics may require different approaches, that "maximizing" procedures to increase correlation coefficients do not necessarily maximize reality, and that standard statistical packages may not have universal validity i.e. be immediately applicable to any data set merely because it can be set out in an acceptable format, were all points unfamiliar to many biologists that give food for thought.

(e) It was generally agreed that the scope of the contributions, taken together, was such as to consist of a valuable compendium of current information and opinion on stock discrimination in marine commercial species. It was unanimously agreed to propose that a recommendation be made that authors be invited to submit contributions to be considered for publication by NAFO in an appropriate primary form.

CONCLUSIONS

Bluefin Tuna was not subject to discussion, nor indeed were any of the large pelagic species so that no conclusions of direct relevance to SCRS could be drawn. However it is worth considering what kind of evidence would be both necessary and sufficient to allow a working hypothesis to be set up. For example, the existence of quite separate spawning areas with its own typical seasonal spawning period would, for other marine species, be considered strong indications of stock discreteness. If, for example, it was maintained that separation was not complete, or was being eroded by genetic leakage, it could be asked how, evolutionarily, separate spawning areas could have arisen in the first place.

Recent suggestions that "organismal" and "molecular" evolution are uncoupled (Can. J. Fish. Aqu. Sci. 38: (12)) not only qualify the relevance of electrophoretic analysis of allelic proteins, but question the basis on which much of evolutionary-ecological arguments are carried out.

This is not to suggest that the issue is or can be resolved at this time, only that a full review of evidence from a wide range of research fields is called for.

Appendix 1			SCR Doc.	Title	Author(s)
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1. 82/IX/79	Stock discrimination in marine fishes.	W. Templeman	10. 82/IX/90	Parasites of natural tags for marine fish: a review.	C.J. Sinderman
2. 82/IX/75	Vertebral averages of juvenile cod (<u>Gadus morhua</u>) from eastern Newfoundland and Labrador as indicators of stock origin.	W.H. Lear R. Wells	11. 82/IX/97	The parasites of Northwestern Atlantic herring (<u>Clupea harengus</u> L.)	S. McGladdery
3. 82/IX/76	Geographical distribution of haddock on the Scotian Shelf.	J.S. Scott	12. 82/IX/102	Pattern recognition: partitioning in morphological hyperspace.	J.M. McGlade
4. 82/IX/89	Discrimination of the cod stock complex in Divisions 2J+3KL based on tagging.	W.H. Lear	13. 82/IX/83	Meristic variation in beaked redfishes, <u>Sebastes mentella</u> and <u>S. fasciatus</u> , in the Northwest Atlantic.	I-Hsun Ni
5. 82/IX/81	An analysis of the stock structure of silver hake, <u>Merluccius bilinearis</u> , in NAFO Subareas 5 and 6.	F.P. Almeida	14. 82/IX/82	Meristic variation in golden-redfish, <u>Sebastes marinus</u> , in the Northwest Atlantic.	I-Hsun Ni
6. 82/IX/94	On discrimination of the silver hake stock of the Nova Scotia Shelf (4W) and South-western Slope of the Grand Bank (30).	V.A. Rikhter A.S. Noskov Yu. S. Grinkov	15. 82/IX/91	On the stock identity of short-finned squid (<u>Illex illecebrosus</u>) in the Northwest Atlantic	E.G. Dawe M.C. Mercer W. Thelfall
7. 82/IX/98	Discrimination of possible silver hake (<u>Merluccius bilinearis</u>) stocks on the Scotian Shelf.	D.E. Waldron G. Drescher C. Harris	16. 82/IX/104	Population structure of the squid <u>Illex illecebrosus</u> .	T. Amaratunga
8. 82/IX/93	Variability of morphometric and meristics features of the North Labrador grenadier, <u>Coryphaenoides rupestris</u> Gunn; related to their linear growth.	P.I. Savvatimsky	17. 82/IX/106	Evaluation of the stock question for four species of scallops.	G. Robert M. Sinclair M. Heller
9. 82/IX/92	Vertebral number as method of separating out populational groups of haddock in the Newfoundland subarea.	V.P. Shestov	18. 82/IX/86	Discrimination of Atlantic snow crab, <u>Chionoecetes opilio</u> , populations: a problem of management application.	K. Davidson R.W. Elner J. Roff

<u>SCR Doc.</u>	<u>Title</u>	<u>Author(s)</u>
19. 82/IX/107	The quest for lobster stock boundaries in the Canadian maritimes.	A. Campbell R.K. Mohn
20. 82/IX/85	The genetic structure of mussel populations in eastern Canadian waters.	L.M. Dickie
21. 82/IX/88	The logistic model for determining size at maturity in species differentiation and stock discrimination for Northwest Atlantic redfishes.	I-Hsun Ni E.J. Sanderman
22. 82/IX/78	Stock identification studies of Greenland halibut (<u>Reinhardtius hippoglossoides</u>) in the Northwest Atlantic from tagging experiments.	W.R. Bowering
23. 82/IX/96	Distribution of Greenland halibut from the Greenland-Canadian population.	A.K. Chumakov V.P. Serebryakov
24. 82/IX/84	Population structure and management units of redfishes (<u>Sebastes</u> sp.) on the Scotian Shelf.	T.J. Kenchington
25. 82/IX/87	Reproductive cycles of redfishes in southern Newfoundland waters.	I-Hsun Ni W. Templeman
26. 82/IX/80	Discrimination of spawning groups of herring, <u>Clupea harengus</u> , along the coast of Maine.	J.J. Graham B.J. Joule C.L. Crosby D.W. Townsend
27. 82/IX/103	Tagging studies on Scotian Shelf herring.	W.T. Stobo
28. 82/IX/95	Data on distribution of the Northwest Atlantic saury, <u>Scomberesoc saurus</u> (Walb.), for evaluation of the unity of their population.	A.A. Nesterov