

The Stock Assessment Workshop for North Pacific Armorhead Shimizu, Shizuoka, Japan

27-29 March 2012

Meeting Report

Agenda Items 1-3:

1. Opening by Hitoshi Honda. One minutes silence for observance of 2011 Earthquake and Tsunami victims.
2. Welcome by Yuji Uozumi, Director General of the National Research Institute of Far Seas Fisheries.
3. Facilitator: Tomio Miyashita
 - a. Introduction of Participants (Appendix 1)
 - b. Rapporteurs: Masashi Kiyota(Japan), Inja Yeon(Korea), Siquan Tian (China), Loh-Lee Low (US)
 - c. Terms of Reference: The terms of reference was taken from the January 2010 8th Scientific Working Group of Multilateral Meeting on Management of High Seas in the North Pacific Ocean in Jeju (Inf-D7): It was proposed that a small ad hoc working group would be established, with the goal of completing the Armorhead stock assessment by the summer of 2010 with the purpose of making a set of recommendations on data collection and research needs. Japan offered to host the ad hoc working group in August or September of 2010 in Yokohama or Shimizu, Japan.
 - d. The workshop was finally organized after disruptions of schedule by the unfortunate Earthquake and Tsunami events in March 2011.
 - e. Adoption of Agenda: Appendix 2 shows the adopted agenda.

Agenda Item 4: Review of Available Data Set from Members

1. **Presentation #1:** Review of the biological information of North Pacific armorhead (Doc-1, presentation by Shiroh Yonezaki). This paper was a summary of previous documents (Inf-D1-6, by Yanagimoto and Nishimura) and other related information.

It reviewed the background of Japanese fisheries and biology of the species (distribution and migration, maturity and spawning, food and feeding habits, and population structure). Figure 1 below shows the general distribution and migration of North Pacific armorhead in the North Pacific Ocean. The adult fish (age 2+) return to settle over seamounts in the Emperor seamounts area after a migratory pelagic juvenile phase over a wide expanse in the North Pacific Ocean. The adult fish return fattened but do not seem to grow over the seamounts as they deplete their fat content over time (to about age 8+). The fisheries on North Pacific armorhead take place over the seamounts where the adult fish settle.

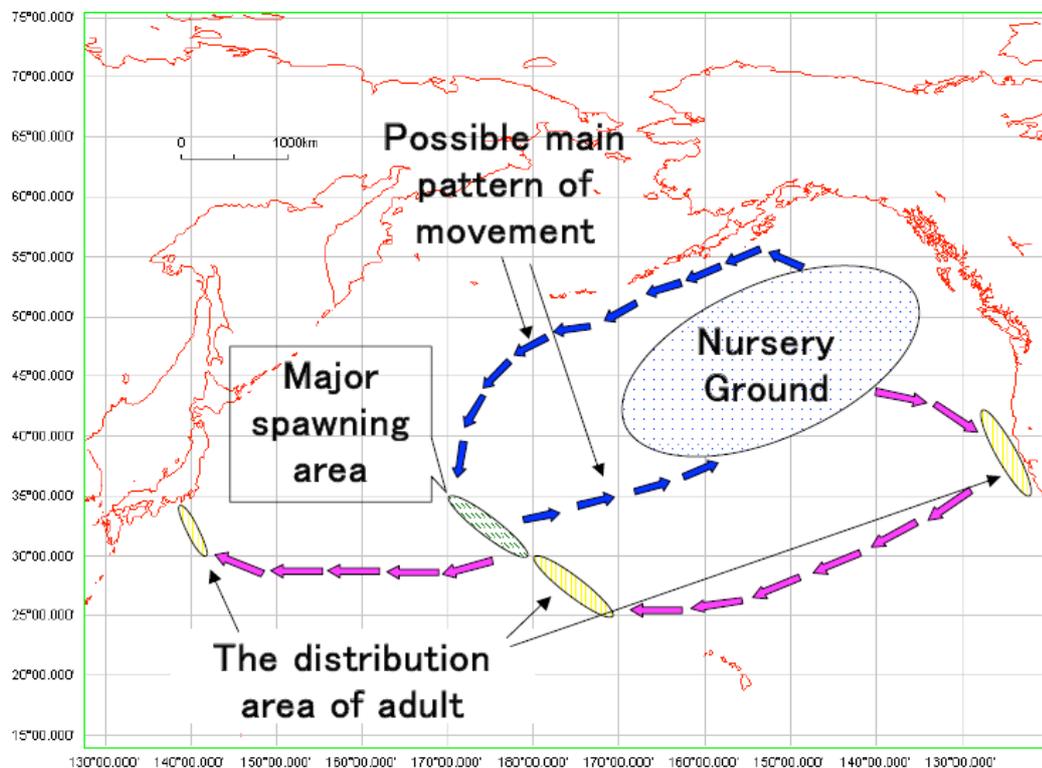


Fig. 1. Schematic distribution and possible migration pattern of North Pacific armorhead (from Inf-D2).

2. **Presentation #2:** The seamount groundfish (armorhead) fishery: background, stock status, and management issues (Inf-D8, presentation by Loh-Lee Low)
 This document is a briefing paper by the Scientific and Statistical Committee of the Western Pacific Regional Fishery Management Council. The United States Pacific Island Fisheries Science Center conducted 12 assessment cruises over Hancock Seamounts from 1985-1993 and none thereafter. The status and

abundance of the stock is dependent on pulses of strong and weak year classes. There were known strong recruitment events in 1992 and 2004. Since these strong recruitment pulses were fished off quickly, the stock has shown little evidence of recovery. Based on data available to the U.S. through 1993, the U.S. imposed a 6-year (1994-2010) moratorium on North Pacific armorhead fishing in the U.S. EEZ areas of the seamount areas. This moratorium has been recommended to be continued for another 6 years period.

3. **Presentation #3:** Status of data submission

- a. Summary Table of North Pacific armorhead catch and effort data by countries -- This summary table would show what types of data are available. The Interim Secretariat reported that summary tables have been submitted by Japan (WP-2J) and Korea (WP-2K). No summary data was submitted by Russia. This summary table will be needed. No summary data were submitted from China and the U.S. as both countries did not fish for North Pacific armorhead in the Southern Emperor and Northern Hawaiian Ridges (SE-NHR) seamount area.
- b. Footprint Data from fisheries -- The Interim Secretariat reported that footprint data were received from Japan and Korea (for 2010). The preliminary total catch (by Japan and Korea) for 2010 totaled 20,554 mt.

Agenda Item 5: Trial and Discussion on Stock Assessment Models

Presentation #1. Applications of stock assessment techniques and fishing control rules according to data quality (Inf-D9, presentation by Loh-Lee Low).

This presentation introduced the concept of standardizing assessment techniques based on data quality that was developed by the U.S. North Pacific Fishery Management Council. The concept introduces six tiers of data quality that would allow estimation of the various degrees of details about the population dynamics of the stocks. Tiers 1-4 describe various degrees of data quality on the population dynamics of age structures of the stocks. Tier 5 is based on reliable estimates of biomass and natural mortality. Tier 6 is based on reliable catch history. The key parameters needed for total allowable catch management are overfishing level (OFL), acceptable biological catch (ABC), and annual catch limit (ACL). ACL is to be set below the OFL. These estimates are calculated based on the population structure, its dynamics, and fishing control rules on the stocks.

Agenda Item 6: Application of Member's Data Sets to Stock Assessment

Presentation #1: Application of the non-equilibrium surplus production models to North Pacific armorhead in the southern Emperor and Northern Hawaiian Ridge (SE-NHR) seamounts (Doc-2-Rev2, presentation by Shiroh Yonezaki)

This paper responds directly to the main objective of this workshop. To assess the stock status of the stock, non-equilibrium surplus production models were applied to the all-nation catch data and Japanese trawl fishery catch-effort data that were collected at the SE-NHR seamounts from 1969-2010. GLM (generalized linear model) was applied to the Japanese fishery data to obtain standardized CPUE (catch per unit effort) from 1992-2010. Historical catch, nominal and standardized CPUE time series were applied to non-equilibrium surplus production models. The CPUE of the Japanese trawl fishery was used as the relative abundance index and the CPUE data series were further adjusted for different periods and standardization methods. Eight cases (series) of CPUE data sets were experimentally fitted to the model and reported in the paper.

The analyst also fitted data at the workshop for two other cases (Case 9 used 1993-2009 data that were standardized, and Case 10 is log catch and standardized CPUE data from 1992-2010 (Doc-2-Rev2-Appendix).

Presentation #2: Preliminary observer report of commercial trawl vessel in the Emperor Seamount area in 2010 (Inf-D10, presentation by Seok-Gwan Choi)

One scientific observer sampled aboard a Korean commercial fishing vessel (Oyang 96) that operated in the Emperor seamounts area in 2010 (25 Feb – 23 June, 2010). The vessel covered 4 seamounts (Colahan, Milwaukee, Kimmei, and Koko seamounts). The main species caught in 224 hauls was North Pacific armorhead. Haul durations averaged 5.5 hours. Catch rates varied by seamounts and were provided in the report. Catch rates of North Pacific armorhead averaged 1 mt/hr to 15 mt/hr. Other species caught were splendid alfonsino, scorpion fish, broad alfonsino, Pacific barrelfish, and Mirror dory. The report also included observations on VMEs. The following VMEs groups/species were observed in 11 out of 224 hauls -- Chrysogorgiidae, black corals, bamboo corals, basket stars, Cnidaria spp, and *Madrepora oculata*.

Agenda Item 7: Discussion on the Tentative Results of Stock Assessment

The fitting of 10 cases of data sets to the surplus production model reflects good work in progress. The results of data fitting generally showed poor fits to the model. These model runs suggest that it was difficult to estimate the surplus production parameters of the North Pacific armorhead stock at the SE-NHR seamounts using the non-equilibrium model. The analyst suggested that there were several possible reasons for the poor data fits – (i) large uncertainties in the accuracy of catch data in the early period of the fisheries, (ii) uncertainties in the annual harvest before reproduction, and (iii) unpredictable stock-recruit relationships due to sporadic pulse recruitments. The analyst concluded that other analytical approaches may have to be applied.

The ensuing discussions covered four main themes:

- (i) Use of surplus production model – this model may turn out to be not the best approach to analyze the catch-effort data.
- (ii) Data fitting – the discussions revealed that various other techniques of catch-effort standardization may be applied. It was not possible to evaluate these data fitting possibilities at this workshop for lack of time and more research. The analysts may wish to try these possibilities at a later time. Tsutomu Nishida suggested that it may be useful to fit surplus production models by specific seamounts if there is strong fidelity of the adults to seamounts. Of the 4 seamounts areas, three of them (Koko, Milwaukee, and Colahan) seem to show similar trends in CPUEs (Inf-D5, page 15), while one (C-H seamount) is different. He also suggested (Inf-D11) that pulse recruitment may reflect conditions of different ocean regimes and fuzzy logic analyses may be applied to surplus production modeling that reflects poor recruitment regimes versus high recruitment regimes.
- (iii) General observations from the data fitting results – The analyses were very useful showing these features of the North Pacific armorhead stock (a) clear indication of sporadic string pulse recruitment (in 1973, 1992, 2004, and possibly 2010), clear indications of extremely low recruitments in between pulse recruitment and for long periods of years, (c) the fisheries is dependent on strong recruitment pulses, (d) the fisheries can deplete the strong recruitment pulses within 1-3 years, (e) estimates of virgin

biomass and carrying capacity are highly variable between the 8 data fittings.

- (iv) Other analytical approaches -- If the participants can recommend some of these approaches commensurate to the biological characteristics of North Pacific armorhead (such as pulse recruitment, migration characteristics, settlement of adults over seamounts, fidelity of schools on seamounts, settlement of adults upon return of migration as fat fish and getting thinner over time, etc), then new data collection requirements and research may have to be defined by the scientists.

Agenda Item 8: Future Work Plans

The workshop did not try to develop a workplan for gathering the data elements and plan research for assessing North Pacific armorhead and associated species. Instead, the following items of information about the North Pacific armorhead were identified in the discussions to be potentially important for drafting future work plans:

1. From the Fisheries

- a. Accurate catch and effort data should be recorded and made available to analysts. Effort data should be determined for recording and be standardized.
- b. Auxiliary information about hauls, locations of fishing, fishing gear characteristics, and other gear/vessel attributes will be useful.
- c. Observer sampling of the catches for biological studies will be needed – length/size frequencies, spawning/egg production potential, food habits and diet through sampling of commercial catches, growth characteristics, etc.

2. From Research Surveys

- a. Design standard survey plans to estimate abundance and distribution of the stock
- b. Identify spawning locations and fidelity of spawning locations
- c. Identify sub stocks, if any
- d. Study tendency and characteristics for armorhead schools to aggregate – for spawning, for feeding, for avoidance of predators, etc.
- e. Measure recruitment pulses, strengths, and frequencies

- f. Study and track progression of year classes to follow the dynamics of the stock
- g. Update estimates of natural mortality, preferable by life stages/phases – adults, juveniles and other migrating phases

The workshop participants noted the following opportunities to assess the North Pacific armorhead in the next few years:

- a. Continue collect data from the fisheries through observers to track the dynamics of year class or classes that contribute to the higher catches in 2010. Japan has an observer program from 2009 and their data should be analyzed and reported to the Scientific Committee that will be established in the near future. Korea had an observer cruise in 2010 and further analyses of the data would be desirable for reported too.
- b. Analyze catch-effort and affiliated data from the fisheries to track the year classes noted in the item above.
- c. Explore analytical techniques, including further analyses of surplus production modeling experimented with at this workshop to better apply to existing North Pacific armorhead data.

Agenda Item 9: Other Matters

The participants are appreciative for the Japanese Party for hosting the North Pacific armorhead stock assessment workshop and for having analysts available to run surplus production runs with alternative data sets.

Agenda Item 10: Adoption of the Record of the Workshop

The report of the meeting was adopted by the participants.

Agenda Item 11: Closing of the Meeting

The workshop was closed by the facilitator on March 29 at 3pm.

Appendix 1 – List of Participants

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Appendix 2 – Adopted Agenda

The Stock Assessment Workshop for North Pacific Armorhead Shimizu, Shizuoka, Japan March 27 – 29, 2012

Meeting Venue: National Research Institute of Far Seas Fisheries
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Meeting Period: March 27-29, 2012

Contact: Dr. Hitoshi HONDA
Dr. Shiroh YONEZAKI

Agenda

1. Opening of meeting
2. Appointment of Facilitator and Rapporteur
3. Adoption of Agenda
4. Review of Available Data Sets from Members
5. Trial and Discussion on Stock Assessment Models
6. Application of Member's Data Sets to Stock Assessment
7. Discussion on the Tentative Results of Stock Assessment
8. Future Work Plans
9. Other Matters
10. Adoption of the Record of the Workshop
11. Closing of meeting

Appendix 3 – List of Documents

Documents

- Armorhead WS 2012 Doc-1: Review of the biological characteristics and fisheries information for stock assessment of the North Pacific armorhead.
- Armorhead WS 2012 Doc-2-Rev2: Application of the non-equilibrium surplus production model to North Pacific armorhead in the Southern Emperor and Northern Hawaiian Ridge (SE-NHR) seamounts.

Working Papers

- Armorhead WS 2012 WP-1: Provisional Agenda
- Armorhead WS 2012 WP-2J: Summary table for the Japanese data
- Armorhead WS 2012 WP-2K: Summary table for the Korean data

Information Documents

- Armorhead WS 2012 Inf-D1: Review of the Japanese fisheries in the Emperor Seamount area.
- Armorhead WS 2012 Inf-D2: Review of the biological information of pelagic armorhead *Pseudopentaceros wheeleri*.
- Armorhead WS 2012 Inf-D3: The preliminary results of the Japanese scientific observer survey in the Northwest Pacific Seamounts area during 2005-2008.
- Armorhead WS 2012 Inf-D4: Preparation and reconfirmation of existing data sets for potential armorhead stock assessment.
- Armorhead WS 2012 Inf-D5: A review of Japanese statistics of the North Pacific armorhead bottom fisheries - Technical aspects of catch and effort data sets of the North Pacific armorhead fisheries made from Japanese commercial bottom fisheries and research vessels, and preliminary approach to planning and evaluation of practical stock assessment methodology for the North Pacific armorhead using existing Japanese data sets.
- Armorhead WS 2012 Inf-D6: Information describing the North Pacific armorhead (*Pseudopentaceros wheeleri*) fisheries relating to the North Western Pacific Regional Fishery Management Organization.
- Armorhead WS 2012 Inf-D7: 8th Scientific Working Group of Multilateral Meeting on Management of High Seas in the North Pacific Ocean.
- Armorhead WS 2012 Inf-D8: The seamount groundfish (armorhead) fishery: Background, stock status and management issues.
- Armorhead WS 2012 Inf-D9: Presentation on application of stock assessment techniques and fishing control rules according to data quality.

Armorhead WS 2012 Inf-D10: Preliminary observer report of commercial trawl vessel in the Emperor Seamount area in 2010.

Armorhead WS 2012 Inf-D11: Some consideration to conquer the difficulties facing in the current non-equilibrium surplus production model analyses (PM) for the North Pacific armorhead. Also paper on Fuzzy logic analyses for the spawner-recruitment relationship of bigeye tuna (*Thunnus obesus*) in the Indian Ocean incorporating the environmental regime shift (*Ecological Modelling* 203:132-140, 2007).