

Cristian M. Canales

Pontificia Universidad Católica de Valparaíso
Avda. Altamirano #1480, Valparaíso, Chile
+56-032-2274256
cristian.canales.r@pucv.cl



Position: Associate Professor. School of Marine Science. Pontificia Universidad Católica de Valparaíso (PUCV). Chile
(<http://www.cienciasdelmar-pucv.cl/>)

Qualifications :

- Doctor in Marine Sciences. Barcelona University, Spain, 2016. Thesis title: "Population structure and spatio-temporal modelling of biological attributes and population dynamic of nylon shrimp (*Heterocarpus reedi*) off central Chile (25°-36°S)" (<http://www.tdx.cat/handle/10803/400612>)
- Master degree in Statistics. University of Valparaíso (<http://www.deuv.cl/>), Valparaíso, Chile, 2006. (Thesis title: "Distributions of cumulative damage applied to fisheries data modeling")
- Industrial Engineer. Federico Santa María Technical University (<http://www.industrias.usm.cl/>), Valparaíso, Chile, 2001. (Thesis title: "Stochastic model formulation as management tool for squat lobster exploitation in a long term horizon")
- Fisheries Engineer. Pontifical Catholic University of Valparaíso (http://www.ucv.cl/p3_carrera/site/pags/20031229175739.html), Chile, 1993. (Thesis title: "Fishing power estimation of a purse seine fleet at northern of Chile 1986-1990")

Prior job: Head of Stock Assessment Department (1996-2016). Fisheries Development Institute (IFOP). Supervising the stock assessment's work in different Chilean fishery resources. Conduct of stock assessment work. Review and improvements of technical procedures. Uncertainty modeling in stock assessment advice for the management of the main Chilean fisheries.

Other charges:

- Chair of Jack Mackerel Scientific Committee (2010-2012) (Chile)
- IFOP delegate at Regional Fisheries Council in Chile (2005-2010)
- National Scientific Coordinator in pelagic fisheries. South Pacific Regional Fisheries Management Organization SPRFMO (2007-2008)
- Head of Chilean Stock Assessment Team. Jack Mackerel Subgroup (JMSG), SPRFMO. (2007-2016) (<http://www.southpacificrfmo.org/>)

Head of programs on Stock assessment:

Several reports of Stock Assessment and management advice for Chilean Fisheries:

- Squat lobster and Shrimp 1997-2002, 2013 (length-based model)
- Jack Mackerel 2003-2016 (age-based model)
- Swordfish 2004-2009 (age-based model)
- Common Hake 2008-2009 (age-based model)
- Chilean Hoki 2008-2009 (age-based model)
- Anchovy and sardines 2003-2012, 2014-2016 (length & age based model)
- Urchin and clams (2014-2015)
- King-crab and crab (2014-2015)

Teacher and academic experience:

- Teacher in Stock Assessment Courses.

Exploitation of deep-sea fisheries in the South-Oriental Pacific. International Course at Pedro Ruiz Gallo University, Lambayeque, Peru, 2008.

Fisheries Workshop. Technical Assistance. Institute of Fisheries Research (IIP). Maputo, Mozambique, 2009.

1th Course of Stock Assessment. Costa Rica University, San Jose, Costa Rica, January 2010.

2th Course of Stock Assessment. National University of de Costa Rica, Puntarenas, Costa Rica, November 2010.

(<https://sites.google.com/site/evaluaciondestockuna2010/>)

Diplomate in Fishery Economy, Guayaquil, Ecuador. Pontifical Catholic University of Valparaíso, April 2011.

(<https://sites.google.com/site/cursoguayaquil/>)

Master in Aquatic Resources Management. Pontifical Catholic University of Valparaíso. Valparaíso, Chile, 2012-2013.

Course of Generalized Lineal Model (GLM). Instituto Nacional de Pesca (INP), Guayaquil, Ecuador. July 14-17th, 2014.

1th Invertebrate Stock Assessment course CESIM 2014. IFOP, Valparaíso, Chile, June 2014.

<https://sites.google.com/site/cursoevaluacioncesim2014/>

Workshop: Stock Assessment of macarel (*Scomber japonicas*) in Ecuador. Instituto Nacional de Pesca, Guayaquil, Ecuador, 17-23 th july, 2014. Chair and reviewer.

Course of Principles in Fishery Biology. FAO International Consultant. Mar del Plata, Argentina, November 3-7 th, 2014.

Stock Assessment Workshop: Stock Assesment of Brazilian flathead fish (*Percophis brasiliensis*) at litoral ecosystem northern 39°S, Argentina. Instituto de Investigación y Desarrollo Pesquero (INIDEP), Argentina. 5-10 th july, 2015. Chair and reviewer.

Review meeting: Stock Assesment Review of South Occidental Atlantic Hoki (*Macruronus magellanicus*), Argentina. Instituto de Investigación y Desarrollo Pesquero (INIDEP), Argentina. 16-20 th may, 2016. Chair and reviewer.

- Teacher adviser of several thesis (Bsc and Msc) at the Pontifical Catholic University of Valparaíso, University of Concepción and Federico Santa María Technical University, Chile

Participation in workshops and conferences.

- Chilean Orange Roughy Stock Assessment Workshop (CORSAW, Valparaíso, Chile 2004). Invited Scientist: Mr. Chris Francis (NIWA) and Dr. Doug Butterwood.
- Chilean Hoki Stock Assessment Workshop (CHSAW, Valparaíso, Chile 2005). Invited Scientist: Mr. Chris Francis.
- Seventh Meeting of the United Nations Open-ended Informal Consultative Process (ICP). Discussion Panel: "Lessons Learned from Implementation of Ecosystem Approaches at the National Level in Developing States" Expositor: Ecosystem approach in the research and management of the Chilean fisheries (C. Canales). New York, 12-16 june, 2006

- Common Hake Stock Assessment Workshop (CHASAW, Valparaíso, Chile 2006). Invited Scientist: Dr. Martin Dorn (NOAA) and Dr. Tore Stromme (IMR).
- Stock Assessment Review Workshop of Swordfish (Valparaíso, Chile 2006). Invited Scientist: Dr. Tom Polachek (SCIRO).
- Stock Assessment Review of Jack Mackerel (Valparaíso, Chile 2007). Independent Experts: Dr. Tom Polachek (SCIRO) and Mr. Chris Francis (NIWA).
- Stock Assessment Review of Common Sardine and Anchovy (Valparaíso, Chile 2007). Independent Experts: Dr. Jose de Oliveira (CEFAS) and Larry Jacobson (NOAA).
- Jack Mackerel Stock Assessment Workshop (JAWS, Valparaíso, Chile 2008). Invited Scientist: Dr. Jim Ianelli (NOAA) and Dr. Mark Maunder (IATTC)
- Chilean Jack Mackerel Workshop (FAO, Santiago, Chile 2008). Invited Scientist: Dr. Jim Ianelli (NOAA), Dr. Pablo Abaunza (IEO, Spain) and Dr. Tore Stromme (IMR)
- Jack Mackerel Assessment Methods Workshop. SPRFMO, Lima, Peru 2009.
- Stock Assessment Workshops: Anchovy from northern Chile and southern Peru (Lima, Peru 2005-2010). IFOP-IMARPE
- Assessment Simulation Task Team Meeting (1). SPRFMO, Callao, Peru 2010.
- Pacific Ocean Perch and Petrale Sole Stock Assessment Review Meeting. STAR Panel. Seattle, USA, 20-24 June, 2011.
- Chilean Hake Stock Assessment Workshop, CHASAW 2011. Invited Experts. Dr. Martin Dorn (NOAA) & Robin Forrest (DFO-MPO). May 2011, Viña del Mar, Chile.
- Chilean Hoki Stock Assessment Workshop, CHSAW2011. Invited Experts. Dr. Terrence Quinn II (UA- Alaska) & Sean Cox (SFU- Canada). July 2011, Viña del Mar, Chile.
- Chilean Hoki Data Review Meeting, CHODAR2011. Independent Experts. Dr. William Clark (IPHC) & Chris Wilson (NOAA). December 2011, Viña del Mar, Chile.
- Chilean Hoki Stock Assessment Review Meeting, CHOSAR2012. Independent experts. Dr. Ian Stewart (NOAA) & Dana Hanselman (NOAA). June 2012, Viña del Mar, Chile.
- Workshop on Stock Assessment Model Validation (<https://sites.google.com/site/stockassessmentmodelvalidation/>). Hotel

O'Higgins, Viña del Mar, 11th to 13th of December, 2012. Independent expert Chris Francis (New Zealand)

- SPRFMO, Jack Mackerel Assessment Workshop:
 - Chilean Jack Mackerel Workshop, 30 June - 4 July 2008 in Santiago, Chile.
 - Jack Mackerel Assessment Methods Workshop, 4-8 May 2009 in Lima, Peru.
 - 1st Assessment Simulation Task Team, 6-9 April 2010 in Lima, Peru.
 - 2nd Assessment Simulation Task Team, 16-20 August 2010 in Seattle, USA.
- Stock Assessment Workshop of Pinchagua (*Opisthonema spp.*) at Ecuadorian waters. Instituto Nacional de Pesca, Guayaquil, Ecuador, 25-27 marzo, 2013.
- Chilean Clam Stock Assessment Workshop (CHCSAW) 2013. 24th-26th September 2013. IFOP, Valparaíso, Chile.
- Stock assessment review meeting: Common Sardine and Southern Blue Whiting. Independent experts. Dr. Tom Polacheck (Australia) & Chris Francis (New Zealand). 2-6th December 2013. Valparaíso, Chile.
- Workshop on Biological Reference Points for Chilean Fisheries. Viña del Mar, Chile, 9-13th December 2013. Independent experts: Dr. Carmen Fernandez (ICES-Spain), Dr. Malcom Haddon (CSIRO-Australia), Dr. Martin Dorn (NOAA-USA), Dr. Mike Sissenwine (NOAA-USA), Dr. William Clark (IPHC-USA), Dr. Neil Klaer (CSIRO-Australia) & Dr. Shijie Zhou (CSIRO-Australia) (<https://sites.google.com/site/brpforchileanfisheries/home>).

Working Papers presented at Scientific Committee of South Pacific Regional Fishery Management Organization (SPRFMO)

Canales C. & R. Serra, 2008. Updated status of the Chilean jack mackerel stock. Fifth SWG Meeting. SPRFMO-V-SWG-11. Guayaquil, Ecuador, 2008.

Serra R., & C. Canales, 2009. Updated status of the Chilean jack mackerel stock. Eighth SWG Meeting. SPRFMO. SP-08-SWG-JM-08. Auckland, New Zealand, 2008.

Canales C. & R. Serra, 2009. Interpretation of biological-fishing indicators of jack mackerel exploited off central-southern Chile. Eighth SWG Meeting. SPRFMO. SP-08-SWG-JM-10. Guayaquil, Auckland, New Zealand, 2008.

Ianelli, J. C. Canales, R. Oliveros, A. Sepulveda, R. Serra, 2010. Report from the assessment simulation task team workshop on using the joint jack mackerel assessment model (JJM). Ninth SWG Meeting. SPRFMO. SWG-09-JM-02B. Viña del Mar, Chile, 2010.

Canales. C. L. Caballero & A. Aranís. 2008. Catch per Unit Effort of Jack Mackerel (*Trachurus murphyi*) of the purse seine fishery off south-central Chile (32°10' – 40°10' S) 1981-2005. CHJMWS pap #10. Jack Mackerel Workshop, FAO, Santriago, Chile, 2008.

Canales. C. & R. Serra. 2008. Chilean jack mackerel stock assessment model. CHJMWS pap #20. Jack Mackerel Workshop, FAO, Santiago, Chile, 2008.

Canales. C. & R. Serra. 2009. The develop of jack mackerel stock assessment in Chile. SP-07-SW-JM-SA-INF-07. Jack mackerel assessment methods workshop. Lima, Peru, 2009.

Canales C. & R. Serra, 2009. Approach to the implementation of hypothesis. A proposal for the Chilean jack mackerel integrated stock assessment. SP-07-SWG-JM-SA-04. Jack mackerel assessment methods workshop. Lima, Peru, 2009.

Canales C., 2010. Stock assessment with simulated data "like" Chilean jack mackerel. ASTT-04. 1st Assessment Simulation task team meeting. Lima, Peru, 2010.

Canales C., 2012. Jack Mackerel Biological Reference Points (BRP). SWG-11-JM-01. XI Meeting of the Science Working Group. Lima, Peru, 2012.

Saavedra, J.C, L. Caballero & C. Canales, 2012. Analysis of the CPUE in the Jack Mackerel Fishery in centre-southern Chile. SWG-11-JM-06. XI Meeting of the Science Working Group. Lima, Peru, 2012.

Canales C., 2012. Estimating the catchability for acoustic surveys. The case of a small pelagic in the Southern of Chile. Working Paper #1. Workshop on Stock Assessment Model Validation. Instituto de Fomento Pequero. 13 pages.

Canales C., 2012. Quality of abundance indices used in the stock assessment of anchovy in northern of Chile. Working Paper #2. Workshop on Stock Assessment Model Validation. Instituto de Fomento Pequero. 6 pages.

Canales C., 2012. Residual analysis in a stock assessment model. Working Paper #3. Workshop on Stock Assessment Model Validation. Instituto de Fomento Pequero. 7 pages.

Canales C. & M.J. Zuñiga, 2012. Estimation of acoustic catchability and natural mortality of sardine in the central southern Chile. Working Paper #4. Workshop on Stock Assessment Model Validation. Instituto de Fomento Pequero. 4 pages.

R. Serra & Canales C., 2012. Improving models: stock assessment scenarios. Case of the northern anchovy. Working Paper #5. Workshop on Stock Assessment Model Validation. Instituto de Fomento Pequero. 4 pages.

C. Canales & M.J. Zuñiga, 2012. Estimation of growth parameters in common sardine. Working Paper #6. Workshop on Stock Assessment Model Validation. Instituto de Fomento Pequero. 3 pages.

R. Serra & Canales C., 2012. Changes in Chilean jack mackerel abundance: contraction v/s change of distribution. Working Paper #7. Workshop on Stock Assessment Model Validation. Instituto de Fomento Pequero. 10 pages.

Canales. C., 2013. Harvest control rule for the recovery of the jack mackerel stock at the South Eastern Pacific. SC-01-05, 1st Meeting of the Scientific Committee SPFRMO, La Jolla, United States of America, 21-27 October 2013.

Canales. C., 2013. Impact of using different weight-at-age by fleet in the Jack mackerel stock assessment. SC-01-06, 1st Meeting of the Scientific Committee SPFRMO, La Jolla, United States of America, 21-27 October 2013.

C.Canales, I.Payá , J.C. Quiroz, R. Tascheri, R. Wiff , F. Espíndola, F. Contreras, E. Leal & D. Bucarey, 2013. Exploring the impact of resilience (steepness) on Biological Reference Points in main Chilean fisheries. Working Paper. Review of biological reference points (Maximum Sustainable Yield) in the national fisheries. Document 26 (IFOP_BRP2013: Doc 26) . Instituto de Fomento Pesquero. 7 pages.

Canales C., 2014. Harvest control rule for Jack mackerel rebuilding - A preliminary evaluation. SC-02-JM-09. 2th Meeting of the Scientific Committee SPFRMO, Honolulu, Hawaii, United States of America, 1-2 October 2014.

Canales C. 2014. Biological reference points for Chilean fisheries - the case of Jack mackerel. SC-02-JM-10. 2th Meeting of the Scientific Committee SPFRMO, Honolulu, Hawaii, United States of America, 1-2 October 2014.

Canales C. 2014. CPUE of Jack mackerel in the center-south area off Chile 1983-2014. SC-02-JM-11_rev1. 2th Meeting of the Scientific Committee SPFRMO, Honolulu, Hawaii, United States of America, 1-2 October 2014.

Canales C. 2015a. Likelihood profile as diagnostic tool and of data's importance used in JJM model. SC-03-JM-04. 3th Meeting of the Scientific Committee SPFRMO, Port Vila, Vanuatu, September 2015: 10 pp

Canales C. 2015b. Risk of overfishing and over-exploitation of Chilean jack mackerel when its population structure is uncertain. SC-03-JM-05. 3th Meeting of the Scientific Committee SPFRMO, Port Vila, Vanuatu, September 2015: 14 pp

Canales C. 2015c. Update of CPUE of Jack mackerel (*Trachurus murphy*) at center south area off Chile 1983-2015. SC-03-JM-07. 3th Meeting of the Scientific Committee SPFRMO, Port Vila, Vanuatu, September 2015: 17 pp

Canales C. 2016a. Assessing the Parsimony in the Jack mackerel stock assessment model (JJM). SC-04-JM-06. 4th Meeting of the Scientific Committee SPFRMO, The Hague, Kingdom of the Netherlands, October 2016: 8 pp

Canales C. 2016b. Reviewing the weighting factors used in the Jack mackerel stock assessment. SC-04-JM-07. 4th Meeting of the Scientific Committee SPFRMO, The Hague, Kingdom of the Netherlands, October 2016: 7 pp

Publications

Albornoz, V. & C. Canales, 2002. Planificación de la Conservación y Explotación del Langostino Colorado usando un Modelo de Optimización Estocástica No-Lineal con Recurso". *Información Tecnológica* 13 (4), 183-190.

Albornoz, V., C. Canales & R. Fazzi, 2005. Modelo de Optimización en Apoyo a la Toma de Decisiones para el Cálculo de una Cuota de Captura Anual del Langostino Amarillo". *Investigaciones Marinas* 34 (1) 15-21.

Albornoz, V. & C. Canales, 2006. Total allowable catch for managing squat lobster fishery using stochastic nonlinear programming. *Computers & Operations Research* 33, 2113-2124.

Albornoz, V. & C. Canales, 2008. Manejo de pesquerías. Cuotas de captura. In: A. Ramos, A. Alonso-Ayuso, G. Pérez (Eds.). *Optimización bajo Incertidumbre*. Biblioteca Comillas. Publicaciones de la Universidad Pontificia Comillas, Cap. 19, pp. 405-413. ISBN 978-84-8468-251-6.

Canales C. & P. Arana (2009). Performance of two sampling designs used to evaluate demersal crustaceans with the swept area method. *Lat. Am. J. Aquat. Res.*, 37(2): 211-219, 2009

Canales C. & P. Arana (2009). Growth, mortality, and stock assessment of the golden crab (*Chaceon chilensis*) population exploited in the Juan Fernández archipelago, Chile. *Lat. Am. J. Aquat. Res.*, 37(3): 313-326, 2009.

Canales C. & P. Arana (2010). Standardization of the catch per swept area (CPUA) for direct stock assessment cruises of nylon shrimp (*Heterocarpus reedi*) (1998-2006). *Lat. Am. J. Aquat. Res.*, 38(3): 387-402, 2010.

B. B. Collette, K. E. Carpenter, B. A. Polidoro, M. J. Juan-Jordá, A. Boustany, D. J. Die, C. Elfes, W. Fox, J. Graves, L. R. Harrison, R. McManus, C. V. Minte-Vera, R. Nelson, V. Restrepo, J. Schratwieser, C.-L. Sun, A. Amorim, M. Brick Peres, C. Canales, G. Cardenas, S.-K. Chang, W.-C. Chiang, N. de Oliveira Leite, Jr., H. Harwell, R. Lessa, F. L. Fredou, H. A. Oxenford, R. Serra, K.-T. Shao, R. Sumaila, S.-P. Wang, R. Watson, E.

Yáñez. (2011). High Value and Long Life—Double Jeopardy for Tunas and Billfishes. *Science Magazine* VOL 333: 291-292, 2011.

Canales C. & P. Arana, 2012. Estimating yellow squat lobster (*Cervimunida johni*) biomass by applying a generalized linear model to catch records per swept area in central Chile. *Lat. Am. J. Aquat. Res.* 40(2):316-334, (2012).

Albornoz V & C. Canales, 2013. A nonlinear optimization model for obtaining a total allowable catch quota of the Chilean jack mackerel fishery. *Journal of Applied Operational Research* (2013) 5(4), 153–163.

Deroba, J., D. Butterworth, R. Methot, J. De Oliveira, C. Fernandez, A. Nielsen, S. Cadrin, M. Dickey-Collas, C. Legault, J. Ianelli, J. Valero, C. Needle, J. O'Malley, Y. Chang, G. Thompson, C. Canales, D. Swain, D. Miller, N. Hintzen, M. Bertignac, L. Ibaibarriaga, A. Silva, A. Murta, L. Kell, C. de Moor, A. Parma, C. Dichmont, V. Restrepo, Y. Ye, E. Jardim, P. Spencer, D. Hanselman, J. Blaylock, M. Mood, P. Hulson. 2014. Simulation testing the robustness of stock assessment models to error: some results from the ICES Strategic Initiative on Stock Assessment Methods. *ICES J. Mar. Sci.* (2015) 72(1): 19-30.

Canales C.M., J.B. Company & P.M. Arana, 2016a. Spatio-temporal modelling of the maturity, sex ratio, and physical condition of nylon shrimp *Heterocarpus reedi* (Decapoda, Caridea), off Central Chile. *Fish. Res.*, 179 (2016) 1–9.

Canales C.M., J.B. Company & P.M. Arana, 2016b. Population structure of nylon shrimp *Heterocarpus reedi* (Crustacea: Caridea) and its relationship with environmental variables off Chile. *Lat. Am. J. Aquat. Res.*, 44(1): 144-154.

Canales C.M., J.B. Company & P.M. Arana, 2016c. Using a length-based stock assessment model to evaluate population structure hypotheses of nylon shrimp *Heterocarpus reedi* (Decapoda, Caridea) exploited off central Chile. *Fish. Res.*, 183 (2016) 360-370.

Hernández L, R. Soto & C. Canales, 2016d. Reproducción del camarón carabalí *Trachypenaeus byrdi* (Burkenroad, 1934) en la parte interna del Golfo de Nicoya, Costa Rica. *Rev. Mar. Cost.*, 8(1): 79-93.

Canales, C. M., C. Hurtado, C. Techeira. 2018. Implementing a model for data-poor fisheries based on steepness of the stock-recruitment relationship, natural mortality and local perception of population depletion. The case of the kelp *Lessonia berteroa* on coasts of north-central Chile. *Fish. Res.*, 198 (2018) 31–42.

Technical skills

- Quantitative modeling for Stock Assessment in fisheries resources.
- Modeling in Statistics and Operations Research
- Programming language: ADMB, MATLAB, SCILAB and R
- Stochastic simulation.

Languages

English (100% writing, 80% conversation)

References

Dr. Jim Ianelli (NOAA), Dr. Martin Dorn (NOAA), Dr. Chris Francis (NIWA), Dr. Terrence Quinn (UAF-USA), Dr. Mark Maunder (IATTC-USA), Dr. Ana Parma (CENPAT).