

Curriculum vitae: **Andrew Bakun**

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Research Interests: Physical--biological interaction in the ocean. Environmental effects on the population dynamics of exploited fish populations. Role of small pelagic fishes in "wasp waist" ecosystems. Effects of climate variability on marine ecosystems and populations. Mechanisms for rapidly-evolving cross-generational adaptive responses in marine organisms. Development of systems for effective diagnosis and interpretation of marine ecosystem status and trends. Approaches for repair of disrupted marine ecosystem function.

Education:

BS (Oceanography), University of Washington, 1962.

MS (Physical Oceanography), University of Washington, 1968.

Masters research project: Vertical circulation in the North Pacific Ocean.

PhD (Physical Oceanography) Oregon State University, 1987.

Thesis title: Applications of maritime data to the study of surface forcing of seasonal and interannual ocean variability in eastern boundary regions. 226 pp.

Career History:

1962-64

Staff Scientist, R.V. Anton Bruun. U.S. Program in Biology for the International Indian Ocean Expedition. Managed comprehensive hydrography and nutrient chemistry program during nine cruises in the Indian Ocean. Participated in full range of biological collection activities; expedition diver.

1968-69

Oceanographer. Seattle Biological Laboratory, National Marine Fisheries Service, Seattle, Washington. Oceanographic party chief on fishery research cruises in Subarctic Pacific Ocean. Task Leader: "Salmon Oceanography".

1971-77

Oceanographer. Pacific Fisheries Environmental Laboratory, NOAA/NMFS/SWFSC, Monterey, California. Developed applications of information resources at Fleet Numerical Oceanographic Center to fisheries research and management (coastal upwelling indices, ocean transport indices, etc.).

1978-83

Supervisory Oceanographer. Pacific Fisheries Environmental Laboratory, NOAA/NMFS/SWFSC, Monterey, California. Task leader: "Fishery-Environmental Modeling and Forecasting".

1983-92

Director, Pacific Fisheries Environmental Laboratory, NOAA/NMFS/SWFSC, Monterey, California. Directed multi-disciplinary research program on effects of ocean variability on marine populations. Managed personnel, budget and operations.

1992-99

Senior Fisheries Resources Officer, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy. Senior expert in FAO Fisheries Department on environmental and climatic effects on fishery resource population dynamics and marine habitats.

- 1999 - 2001 **Directeur de Recherche (Poste d'Accueil), Institut de Recherche pour le Développement (IRD), Sete, France (participating in: French-South African VIBES Project, Cape Town, South Africa).** Research on environmental and climatic effects on fish population dynamics, focused particularly on coastal pelagic fish stocks. Participation in the VIBES and IDYLE Projects addressing scientific issues related to pelagic fisheries in the Benguela Current large marine ecosystem.
- 2001 - 2002 **Visiting Senior Scientist, International Research Institute for Climate Prediction (IRI), Lamont-Doherty Earth Observatory, Columbia University, New York, USA.** Development of an IRI programmatic focus on issues of climate-fisheries interaction. Research on effects of climate on marine resources and ecosystems.
- 2002 - 2004 **Chief Scientist, the Center for Sustainable Fisheries (CSF), Univ. Miami. Professor, Dept. of Marine Biology and Fisheries. Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida USA.**
- 2004 - present **Professor, Pew Institute for Ocean Science, Dept. of Marine Biology and Fisheries, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida USA.**

Selected International and National Scientific Advisory Positions:

- 1980 IOC-FAO "Group of Four" Experts on Ocean Science in Relation to Living Resources. *Intergovernmental Oceanographic Commission (IOC), of UNESCO & the Food and Agriculture Organization of the United Nations (FAO).*
- 1983 Chairman, Working Group on Environmental Studies and Monitoring, FAO Expert Consultation to Examine Changes in Abundance and Species Composition of Neritic Fish Resources (Costa Rica, 18-29 April, 1983).
- 1987-88 U.S. National Marine Fisheries Service (NOAA) Advisory Committee on Ecosystem Research.
- 1990 Implementation Team for 'Coastal Ecosystems' Component of the U.S. NOAA Coastal Ocean Program.
- 1984 & 1990 Representative of the Scientific Committee on Ocean Research (SCOR) to 1st and 3rd Sessions of the IOC-FAO Guiding Group of Experts on the Program of Ocean Science in Relation to Living Resources (OSLR).
- 1990 Regional Coordinator of Scientific Activities Related to Global Climate Change for NOAA-NMFS Southwest Fisheries Center and NOAA-NMFS Southwest Regional Office.
- 1991 Technical Advisory Committee for the U.S. NOAA Climate and Global Change Marine Ecosystems Response Program.
- 1984-1994 Chairman, IOC-FAO Guiding Group of Experts on the Program of Ocean Science in Relation to Living Resources (OSLR).
- 1984-92 Center Management Team, Southwest Fisheries Science Center (U.S. NMFS, NOAA).
- 1993 Chairman, Living Resources Panel for the Global Ocean Observing System (GOOS)

1993	Coordinating Panel for the IOC-FAO OSLR Sardine-Anchovy Recruitment Project (SARP)
1993-94	Steering Committee, International Symposium on 'Assessment, Yield, and Long-term Sustainability of Large Marine Ecosystems of the Pacific', Qingdao, China, October, 1994
1994	Expert reviewer for the Intergovernmental Panel on Climate Change Working Group II draft chapter on 'Assessment of Impact Options for Fisheries' of the IPCC Second Assessment Report
1992-95	Representative of FAO Fisheries Dept. on FAO Interdepartmental Sub-group on Climate Change
1994-1998	SCOR Working Group 98 on Worldwide Large-scale Fluctuations of Sardine and Anchovy Populations (<i>ad hoc</i> member)
1996	Evaluation Panel, commissioned by the South African Foundation for Research Development, for the third 5-year phase of the Benguela Ecology Program (BEP-III).
1996	Evaluation Panel, commissioned by the Portuguese Ministry of Science, to review the programs of the Portuguese Institute for Fisheries and Marine Research and the Portuguese Naval Institute of Hydrography.
1998	Consultant: Strategy for Environmental Research and Monitoring for Ministry of Fisheries and Marine Resources, Namibia 1998-2002
1995-1999	International Large Marine Ecosystems (LME) Program Consultative Committee
1997-2000	Living Resources Panel for the Global Ocean Observing System (GOOS)
1999-2001	Comité Scientifique, Programme National Environnement Côtier (PNEC), France
2000-present	IGBP-GLOBEC "Focus 1" Working Group (on Retrospective Studies)
2001-2004	'Interdisciplinary Ocean Science of the Global Coastal Ocean' Study, Intergovernmental Oceanographic Commission, UNESCO
2003-2004	Steering Committee, International GLOBEC CLIOTOP (Climate and Oceanic Top Predators) Projec
2004-present	International Large Marine Ecosystems (LME) Program Consultative Committee

PUBLICATIONS LIST

- Weeks, S.J., A. Bakun, G.C. Feldman and O. Hoegh-Guldberg (submitted) Seasonality in coral bleaching susceptibility: Why 2006 predictions failed. *Limnology and Oceanography*.
- Bakun, A. (submitted) Challenges for SPACC Research in the 21st Century. *Small Pelagic Fish and Climate Change*. GLOBEC. Cambridge University Press.
- Alheit, J. and A. Bakun (submitted) History of international co-operation in research on small pelagic fishes. *Small Pelagic Fish and Climate Change*. GLOBEC. Cambridge University Press.
- Alheit, J. and A. Bakun (submitted) Population synchronies within and between ocean basins: apparent teleconnections and implications as to physical-biological linkage mechanisms. Special volume of *Journal of Marine Systems* dedicated to the GLOBEC Workshop on Impact of Climate Variability on Marine Ecosystems, Berlin, 4-8 Sept., 2006.
- Currie, B., K.R. Peard, V. Brüchert, K-C. Emeis, A.K. van der Plas, R. Endler, A.G.V. Salvanes, S.J. Weeks, A. Bakun, C. Chikwililwa, A. Goosen, R. Bahlo, H. Skrypzeck, J-O. Krakstad (submitted) Biogeochemical dynamics of hydrogen sulphide and methane in Namibian inner shelf sediments, with implications to the living marine resources. *African Journal of Marine Science*.
- Bakun, A. (in press) Linking climate to population variability in marine ecosystems characterized by non-simple dynamics: conceptual templates and schematic constructs. Special volume of *Journal of Marine Systems* dedicated to the GLOBEC Workshop on Impact of Climate Variability on Marine Ecosystems, Berlin, 4-8 Sept., 2006.
- Agostini, V.N., A. Bakun and R.C. Francis (2006) Larval stage controls on sardine recruitment variability: the balance between predation and food availability. *Marine Ecology Progress Series* (in press).
- Bakun, A. and S.J. Weeks (2006) Adverse feedback sequences in exploited marine ecosystems: Are deliberate interruptive actions warranted? *Fish and Fisheries* **7**: 316-333.
- Bakun, A. (2006) Fronts and eddies as key structures in the habitat of marine fish larvae: Opportunity, adaptive response and competitive advantage. *Scientia Marina* **70** (S2): 105-122.
- Bakun, A. (2006) Wasp-waist populations and marine ecosystem dynamics: navigating the “predator pit” topographies. *Progress in Oceanography* **68**: 271-288.
- Pauly, D., J. Alder, (“Coordinating Lead Authors”), A. Bakun, S. Heileman, K.-H. Kock, P. Mace, W. Perrin, K. Stergiou, U. R. Sumaila, M. Verrios, K. Freire and Y. Sadovy (“Lead Authors”), V. Christensen, K. Kaschner, M.-L. Palomares, P. Tyedmers, C. Wabnitz, R. Watson, and B. Worm (“Contributing Lead Authors”) (2005) Chapter 18: Marine Fisheries Systems. pp. 477-511. In: *Ecosystems and Human Well-being: Current State and Trends*. Millennium Ecosystem Assessment.
- Bakun, A. (2005) Regime Shifts, Ch. 25, pp. 971-1026 in *The Sea*, vol.13, Robinson, A.R. & Brink, K. (eds.) Harvard University Press, Cambridge, Massachusetts.
- Bakun, A. (2005) Seeking an expanded suite of management tools: implications of rapidly-evolving adaptive response mechanisms (e.g., “school-mix feedback”). *Bulletin of Marine Science* **76**: 463-483.
- E. K. Pikitch, C. Santora, E. A. Babcock, A. Bakun, R. Bonfil, D. O. Conover, P. Dayton, P. Doukakis, D. Fluharty, B. Heneman, E. D. Houde, P. A. Livingston, M. Mangel, M. K. McAllister, J. Pope, and K. J. Sainsbury. 2004. Response. *Science* **306**: 1892.
- E. K. Pikitch, C. Santora, E. A. Babcock, A. Bakun, R. Bonfil, D. O. Conover, P. Dayton, P. Doukakis, D. Fluharty, B. Heneman, E. D. Houde, J. Link, P. A. Livingston, M. Mangel, M. K. McAllister, J. Pope, and K. J. Sainsbury. 2004. Ecosystem-Based Fishery Management. *Science* **305**: 346-347.

- Bakun, A. and S.J. Weeks. 2004. Greenhouse gas buildup, sardines, submarine eruptions, and the possibility of abrupt degradation of intense marine upwelling ecosystems. *Ecology Letters* **7**: 1015-1023.
- Weeks S.J., B. Currie, A. Bakun and K.R. Peard. 2004. Hydrogen sulphide eruptions in the Atlantic Ocean off southern Africa: Implications of a new view based on SeaWiFS satellite imagery. *Deep-Sea Research I* **51**: 153-172.
- Bakun, A. 2003. Potential relevance of a "loopholes" conceptual framework to research studies of fish population dynamics in the Mediterranean Sea. pp. 23–29 in F. Briand (ed.) Mediterranean Biological Time Series, *CIESM Monographs* **22**, (Monaco).
- Bakun, A., and K. Broad. 2003. Environmental loopholes and fish population dynamics: comparative pattern recognition with particular focus on El Niño effects in the Pacific. *Fisheries Oceanography* **12**: 458-473.
- Weeks, S.J., B. Currie and A. Bakun. 2002. Massive emissions of toxic gas in the Atlantic. *Nature* **415**: 493-494.
- Agostini, V.N. and A. Bakun. 2002. "Ocean Triads" in the Mediterranean Sea: Physical mechanisms potentially structuring reproductive habitat suitability (example application to European anchovy, *Engraulis encrasicolus*). *Fisheries Oceanography* **11**: 129-142.
- Bakun, A.. and Broad, K. (eds.) 2002. Climate and Fisheries: Interacting Paradigms, Scales and Policy Approaches. International Research Institute for Climate Prediction. Columbia University. Palisades, New York. 67 pp.
- Bakun, A. and K. Broad 2002. The IRI-IPRC Pacific Climate-Fisheries Workshop. *Fisheries Oceanography* **11**: 189-190.
- Bakun A. 2002. An empirical test for the existence of a generation-time-dependent mechanism for rapid adaptive response of fish populations to variations in ocean climate, predation or fishery exploitation. pp.. In: C.D. Van der Lingen, C. Roy, P. Fréon, M. Barange, L. Castro, L. Gutierrez, L. Nykjaer and F. Shillington (eds.) Report of a GLOBEC-SPACC/IDYLE/ENVIFISH workshop on spatial approaches to the dynamics of coastal pelagic resources and their environment in upwelling areas. *GLOBEC Report* **16**.
- Bakun, A. 2001. 'School-mix feedback': a different way to think about low frequency variability in large mobile fish populations. *Progress in Oceanography* **49**: 485-511.
- Bakun, A. and V. N. Agostini. 2001. Seasonal patterns of wind-driven upwelling/downwelling in the Mediterranean Sea. *Scientia Marina* **65**: 243-257.
- Cury P., A. Bakun, R.J.M. Crawford, A Jarre-Teichmann, R. A. Quiñones, L.J. Shannon, H. M. Verheye. 2000. Small pelagics in upwelling systems: patterns of interaction and structural changes in "wasp-waist" ecosystems. *ICES Journal of Marine Science* **57**: 603-618.
- Bakun, A. 1999. A dynamical scenario for simultaneous "regime-scale" marine population shifts in widely separated large marine ecosystems of the Pacific. pp. 2-26. In: K. Sherman and Q. Tang (eds.) Large Marine Ecosystems of the Pacific Rim: Assessment, Sustainability and Management. Blackwell Science Inc. Malden, Massachusetts. 465 pp.
- Bakun, A. and P. Cury. 1999. The "school trap": a mechanism promoting large-amplitude out-of-phase population oscillations of small pelagic fish species. *Ecology Letters* **2**: 349-351.
- Bakun, A., J. Csirke, D. Lluch-Belda and R. Steer-Ruiz. 1999. The Pacific Central American Coastal LME. pp. 268-280. In: K. Sherman and Q. Tang (eds.) Large Marine Ecosystems of the Pacific Rim: Assessment, Sustainability and Management. Blackwell Science Inc. Malden, Massachusetts. 465

pp.

- Schwartzlose, R.A., J. Alheit, A. Bakun, T. Baumgartner, R. Cloete, R.J.M. Crawford, W.J. Fletcher, Y. Green-Ruiz, E. Hagen, T. Kawasaki, D. Lluch-Belda, S.E. Lluch-Cota, A.D. MacCall, Y. Matsuura, M.O. Nevarres-Martinez, R.H. Parrish, C. Roy, R. Serra, K.V. Shust, N.M. Ward and J.Z. Zuzunaga. 1999. Worldwide large-scale fluctuations of sardine and anchovy populations. *South African Journal of Marine Science* **21**: 289-347.
- Bakun, A. 1998. The CEOS comparative analysis framework: Motivations and perceived opportunities. pp. 7-23. In: M.-H. Durand, et al. (eds.) *Global versus local changes in upwelling systems*. ORSTOM editions, Paris.
- Bakun, A. 1998. Ocean Triads and Radical Interdecadal Stock Variability: Bane and Boon for Fishery Management Science. pp. 331-358. In: T.J. Pitcher, P.J.B. Hart and D. Pauly (eds.) *Reinventing Fisheries Management*. Kluwer Academic Publishers, Dordrecht, Netherlands.
- Bakun, A., and J. Csirke. 1998. Chapter 6 - Environmental processes and recruitment variability. pp. 105-124. In: P.G. Rodehouse, E.G. Dawe, and R.K. O'Dor (eds.) *Squid Recruitment Dynamics: Influences on Variability Within The Genus Illex, as a Model, the Commercial Illex, Species and Influences on Variability*. *FAO Fisheries Technical Paper #376*.
- Bakun, A., C. Roy and S. Lluch-Cota. 1998. Coastal upwelling and other processes regulating ecosystem productivity and fish production in the western Indian Ocean. pp. 103-141. In: E. Okemwa, M. Ntiba, and K. Sherman (eds.) *Large Marine Ecosystems of the Indian Ocean: Assessment, Sustainability, and Management*. Blackwell Science Inc. Malden, Massachusetts.
- Bakun, A., P. Cury, M.-H. Durand, R. Mendelssohn, D. Pauly and C. Roy. 1998. CEOS: an international network working on climate and fisheries. pp. 1-5. In: M.-H. Durand, et al. (eds.) *Global versus local changes in upwelling systems*. ORSTOM editions, Paris.
- Durand, M.-H., P. Cury, R. Mendelssohn, C. Roy, A. Bakun and D. Pauly (eds.) 1998. *Global versus local changes in upwelling systems*. ORSTOM editions, Paris. 594 pp.
- Bakun, A. 1997. Northwest Pacific. pp. 74-78. In: *Review of the State of World Fishery Resources: Marine Fisheries*. *FAO Fisheries Circular 920*. FAO, Rome.
- Bakun, A. 1997. Northeast Pacific. pp. 79-83. In: *Review of the State of World Fishery Resources: Marine Fisheries*. *FAO Fisheries Circular 920*. FAO, Rome.
- Bakun, A. 1997. Global synchrony in fish population variations. pp. 134-135. In: *Review of the State of World Fishery Resources: Marine Fisheries*. *FAO Fish. Circular 920*. FAO, Rome.
- Hopkins, C.C.E., A. Bakun, M.N. Bruton, G. Hemple and J. Hunter. 1997. Benguela Ecology Programme Phase III. Evaluation Panel Report. FRD Programme Report Series 31. Foundation for Research Development. Pretoria, South Africa. 15pp.
- Bakun, A. 1996. *Patterns in the Ocean: Ocean Processes and Marine Population Dynamics*. University of California Sea Grant, San Diego, California, USA, in cooperation with Centro de Investigaciones Biológicas de Noroeste, La Paz, Baja California Sur, Mexico. 323 pp.
- Bakun, A. 1996. New concepts for understanding variability in small pelagic fisheries, Appendix 8 (p.1-9). In T. Do Chi and D.A. Kiefer (eds.) *Report of the Workshop on the Coastal pelagic Resources of the Upwelling System off Northwest Africa: Research and predictions*. FI:TCP/MOR/4556(A) Field Document 1. Food and Agriculture Organization of the United Nations, Rome.
- Bakun, A. 1996. Chapter 5. Conclusions. pp. 12-16. In T. Do Chi and D.A. Kiefer (eds.) *Report of the Workshop on the Coastal pelagic Resources of the Upwelling System off Northwest Africa: Research and predictions*. FI:TCP/MOR/4556(A) Field Document 1. Food and Agriculture Organization of the

United Nations, Rome.

- Bakun, A. 1996. Climate variability and regime shifts in eastern boundary upwelling current systems. pp. 14-26. In: M.J. O'Toole (ed.) *The Benguela Current and Comparable Eastern Boundary Upwelling Ecosystems*. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH. Eschborn, Germany .
- Caddy, J.F. and A. Bakun. 1995. Marine catchment basins and anthropogenic effects on coastal fishery ecosystems. p. 119-133. In: *Effects of riverine inputs on coastal ecosystems and fisheries resources. FAO Fisheries Technical Paper #349*. FAO, Rome.
- Bakun, A. 1995. Global climate variations and potential impacts on the Gulf of Guinea sardinella fishery. pp. 60 -84. In: F.X. Bard and K.A. Korentang (eds.) *Dynamics and Use of Sardinella Resources from Upwelling off Ghana and Ivory Coast*. ORSTOM Editions. Paris. 438 pp.
- Bakun, A. 1995. A dynamical scenario for simultaneous "regime-scale" marine population shifts in widely separated LMEs of the Pacific. pp. 47-72. In K. Sherman and Q. Tang (eds.) *The Large Marine Ecosystems of the Pacific Rim*. IUCN, The World Conservation Union, Gland, Switzerland. 168 pp.
- Cury, P., C. Roy, R. Mendelssohn, A. Bakun, D.M. Husby, and R.H. Parrish. 1995. Moderate is better: nonlinear climatic effect on California anchovy (*Engraulis mordax*). pp. 417-424. In: R.J. Beamish (ed.). *Climate Change and Northern Fish Populations. Canadian Special Publication in Fisheries and Aquatic Science 121*: 739 pp.
- Caddy, J.F. and A. Bakun. 1994. A tentative classification of coastal marine ecosystems based on dominant processes of nutrient supply. *Ocean and Coastal Management*, **23**: 201-211.
- Bakun, A. 1993. The California Current, Benguela Current, and Southwestern Atlantic Shelf Ecosystems: A comparative approach to identifying factors regulating biomass yields. p. 199-224. In *Large Marine Ecosystems —Stress, Mitigation, and Sustainability*. K. Sherman, L. M. Alexander, and B. Gold (eds.). American Association for the Advancement of Science.
- Fraga, S., and A. Bakun. 1993. Climate change and harmful algal blooms: The example of *Gymnodinium catenatum* on the Galician Coast. pp. 59-65. In: T.J. Smayda and Y. Shimizu (eds.) *Toxic Phytoplankton Blooms in the Sea*. Elsevier Science Publishers, New York.
- Bakun, A., V. Christensen, C. Curtis, P. Cury, M.H. Durand, D. Husby, R. Mendelssohn, J. Mendo, R. Parrish, D. Pauly, and C. Roy. 1993. The Climate and Eastern Ocean Systems project. *Naga, The ICLARM Quarterly* **15**(4): 26-30.
- Bakun, A. 1992. Global greenhouse effects, multi-decadal wind trends and potential impacts on coastal pelagic fish populations. *ICES Marine Science Symposia* **195**: 316-325.
- Bakun, A. and C.S. Nelson. 1991. Wind stress curl in subtropical eastern boundary current regions. *Journal of Physical Oceanography* **21**: 1815-1834.
- Bakun, A. and R.H. Parrish. 1991. Comparative studies of coastal pelagic fish reproductive habitats: the anchovy (*Engraulis anchoita*) of the southwestern Atlantic. *ICES Journal of Marine Science* **48**: 343-361.
- Bakun, A. 1990. Global climate change and intensification of coastal ocean upwelling. *Science*, **247**: 198-201.
- Bakun, A. and R.H. Parrish. 1990. Comparative studies of coastal pelagic fish reproductive habitats: the Brazilian sardine (*Sardinella aurata*). *J. Cons. Explor. Mer.* **46**: 269-283.
- Bakun, A. 1989. Mechanisms for density-dependent growth of anchoveta: alternatives to impact on the

- regional-scale food supply. pp. 235-243. In D. Pauly, P. Muck, J. Mendo and I. Tsukayama (eds.). *The Peruvian Upwelling Ecosystem: Dynamics and Interactions*. International Center for Living Aquatic Resources Management (ICLARM), Manila. 438 pp.
- Bakun, A. and R. Mendelsohn. 1989. Alongshore wind stress 1953-82: correction, reconciliation and update through 1986. pp. 77-81. In: D. Pauly, P. Muck, J. Mendo and I. Tsukayama (eds.). *The Peruvian Upwelling Ecosystem: Dynamics and Interactions*. International Center for Living Aquatic Resources Management (ICLARM), Manila. 438 pp.
- Bakun, A. 1989. L'océan et la variabilité des populations marines. pp. 155-187. In: J.P. Troadec (ed.), *L'Homme et les Écosystèmes Halieutiques*. Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER), Paris.
- Bakun, A. 1989. Recruitment in fishery resources and its relation to environment: Accessible pathways to greater insight. pp. 25-34. In: *Memorias del Simposio Internacional de los Recursos Vivos y las Pesquerías en el Pacífico Sudeste, Viña del Mar, Chile, 9-13 mayo, 1988*. Rev. Pacífico Sur (Número Especial). Comisión Permanente del Pacífico Sur (CPPS).
- Bakun, A. 1987. Monthly variability in the ocean habitat off Peru as deduced from maritime observations, 1953-84. pp. 46-74. In: D. Pauly and I. Tsukayama (eds.) *The Peruvian Anchoveta and Its Upwelling Ecosystem: Three Decades of Change*. International Center for Living Aquatic Resources Management (ICLARM), Manila. 351pp.
- Bakun, A. 1986. Local retention of planktonic early life stages in tropical reef/bank demersal systems: the role of vertically-structured hydrodynamic processes. pp. 15-32. In: D. Pauly and A. Yañez-Arancibia (eds.) *IOC/FAO Workshop on Recruitment in Tropical Coastal Demersal Communities*. IOC Workshop Report 40 (Supplement). UNESCO, Paris. 323pp.
- Bakun, A. 1986. Definition of environmental variability affecting biological processes in large marine ecosystems. pp. 89-108. In: K. Sherman and L.M. Alexander (eds.) *Variability and Management of large Marine Ecosystems*. AAAS Selected Symposium 99. American Association for the Advancement of Science, Wash., D.C. 319 pp.
- Mason, J.E., and A. Bakun. 1986. Upwelling index update, U.S. West Coast, 33°N - 48°N latitude. NOAA Tech. Memo. NMFS-SWFC-67. 81pp.
- Bakun, A. 1985. Comparative studies and the recruitment problem: Searching for generalizations. *CalCOFI Reports* **26**: 30-40.
- Bakun, A. 1984. Report of the Working Group on Environmental Studies and Monitoring. pp. 41-54. In: G.D. Sharp and J. Csirke (eds.) *Reports of the Expert Consultation to Examine Changes in Abundance and Species Composition of Neritic Fish Resources*. *FAO Fisheries Report #291*(1). 102pp.
- Parrish, R.H., A. Bakun, D.M. Husby, and C.S. Nelson. 1983. Comparative climatology of selected environmental processes in relation to eastern boundary current pelagic fish reproduction. pp. 731-778. In: G.D. Sharp and J. Csirke (eds.) *Proceedings of the Expert Consultation to Examine Changes in Abundance and Species Composition of Neritic Fish Resources*. *FAO Fisheries Report #291* (2,3). 1224pp.
- Bakun, A. and R.H. Parrish. 1982. Turbulence, transport, and pelagic fish in the California and Peru Current systems. *CalCOFI Reports* **23**: 99-112.
- Bakun, A., J. Beyer, D. Pauly, J.G. Pope, and G.D. Sharp. 1982. Ocean sciences in relation to living resources. *Canadian Journal of Fisheries and Aquatic Science* **39**:1059-1070.
- Parrish, R.H., C.S. Nelson, and A. Bakun. 1981. Transport mechanisms and reproductive success of fishes in the California Current. *Biological Oceanography* **1**: 175-203.

- Bakun, A., and R.H. Parrish. 1980. Environmental inputs to fishery population models for eastern boundary current regions. pp. 67-104. In: G.D. Sharp (ed.) Workshop on the Effects of Environmental Variation on the survival of Larval Pelagic Fishes, Lima, Peru, 20 Apr. - 5 May, 1980. *IOC Workshop Report #28*: 323pp.
- Bakun, A., C.S. Nelson, and R.H. Parrish. 1979. Determination of surface drift patterns affecting fish stocks in the California Current upwelling region. pp. 7-21. In: Papers Submitted to the Joint IOC/WMO Seminar on Oceanographic Products and the IGOS Data Processing and Services System, *IOC Workshop Report #17*, Intergovernmental Oceanographic Commission, UNESCO, Paris. 572pp.
- Bakun, A. 1978. Coastal upwelling off western North America, 1975. pp. 141-149. In: Ocean Variability: Effects on U.S. Marine Fishery Resources - 1975, U.S. Dept. of Commerce NOAA Technical Report *NMFS Circular #416*. 350pp.
- Bakun, A. 1978. Guinea Current upwelling. *Nature* **271**: 147-150.
- Seckel, G.R., A. Bakun, and R.H. Parrish. 1978. Large-scale atmospheric circulation and the west coast upwelling regime in 1976/77 and 1977/1978. Ch.7, pp. 1-12. In: Proceedings of the Third Annual Climate Diagnostics Workshop, U.S. Dept. of Commerce, Wash., D.C.
- Bakun, A. and C.S. Nelson. 1977. Climatology of upwelling related processes off Baja California. *CalCOFI Reports* **19**: 107-127.
- Wooster, W.S., A. Bakun, and D.R. McLain. 1976. The seasonal upwelling cycle along the eastern boundary of the North Atlantic. *Journal of Marine Research* **34**:131-141.
- Ingraham, W.J., A. Bakun, and F. Favorite. 1976. The physical oceanography of the Gulf of Alaska. pp. 789-922. In: Environmental Assessment of the Alaskan Continental Shelf, 11. Environmental Research Laboratories, Boulder, CO.
- Bakun, A. 1976. Coastal upwelling off western North America, 1974. pp. 12.1-12.6. In: The Environment of the United States Living Marine Resources, 1974. MARMAP Contribution No. 104, U.S. Dept. Commerce.
- Bakun, A. 1975. Daily and weekly upwelling indices, west coast of North America, 1967-73. U.S. Dept. of Commerce NOAA Technical Report *NMFS Special Scientific Report, Fisheries #693*. 114pp.
- Walsh, J.J., and A. Bakun. 1975. Species and productivity transients in an upwelling ocean. pp. 8-17. In: The Biological Significance of Species Transients in Natural Resource Systems. The Institute of Ecology, Univ. Wisconsin, Madison.
- Bakun, A., D.R. McLain, and F.V. Mayo. 1974. The mean annual cycle of coastal upwelling off western North America as observed from surface measurements. *Fisheries Bulletin* **72**: 843-844.
- Bakun, A. 1973. Coastal upwelling indices, west coast of North America, 1946-71. U.S. Dept. of Commerce NOAA Technical Report *NMFS Special Scientific Report, Fisheries #671*. 103pp.
- Favorite, F., A. Bakun, and W.B. McAlister. 1971. Oceanography. International North Pacific Fisheries Commission Annual Report - 1969:1 02-108.
- Ryther, J.H., J.R. Hall, A.K. Pease, A. Bakun, and M.M. Jones. 1966. Primary organic production in relation to the chemistry and hydrography of the western Indian Ocean. *Limnology and Oceanography* **11**: 371-380.

NEWSLETTER ARTICLES AND CITEABLE ABSTRACTS

- Bakun, A. 1995. Coastal upwelling and other large-scale processes of physical-biological linkage in the western Indian Ocean (Abstract). pp. 145-146. In: E. Okemwa, M.J. Ntiba and K. Sherman (eds.) Status and Future of the Large Marine Ecosystems of the Indian Ocean. IUCN, The World Conservation Union, Gland, Switzerland. 201 pp.
- Bakun, A. 1995. Rapporteur's Report of Session 2: "Development of Ecosystems Change and Component Models of LMEs". pp. 5-6. In K. Sherman and Q. Tang (eds.) The Large Marine Ecosystems of the Pacific Rim. IUCN, The World Conservation Union, Gland, Switzerland. 168 pp.
- Bakun, A., A.D. MacCall, and R.H. Parrish. 1990. Impacts of climate change on fisheries. (Abstract A52A-07) *EOS-Trans. Amer. Geophys. Un.* **71**: 1263.
- Bakun, A. 1989. Similar themes within SARP and TRODERP. (Abstract: Annex III, p. 9) In: Workshop to Define IOCARIBE - TRODERP) Proposals. IOC Workshop Rep. 60: 28pp. + 4 Annexes.
- Boehlert, G.W., and A. Bakun. 1986. Local recruitment in isolated island and bank ecosystems. (Abstract L042-01) *EOS-Trans. Amer. Geophys. Un.* **67**: 991.
- Bakun, A., and R.H. Parrish. 1986. Comparative climatology of coastal pelagic fish habitats: the Brazilian sardinella. (Abstract L042-07) *EOS-Trans. Amer. Geophys. Un.* **67**: 991.
- Parrish, R.H., and A. Bakun. 1986. Comparative climatology of coastal pelagic fish habitats: the southwest Atlantic anchovy. (Abstract L042-08) *EOS-Trans. Amer. Geophys. Un.* **67**: 991.
- Bakun, A. 1983. Comparative studies: offshore transport and the spawning habitat of the Peruvian anchoveta. (Abstract 42B-11) *EOS-Trans. Amer. Geophys. Un.* **56**: 1108.
- Bakun, A. 1983. Specific problems of research and monitoring. (Abstract: Annex IV, pp. 2-3) In: Workshop on the IREP Component of the IOC Programme on Ocean Science in relation to Living Resources (OSLR). IOC Workshop Rep. 33: 17pp. + 8 Annexes.
- Parrish, R.H., and A. Bakun. 1979. Record swordfish landings preceded by anomalously low upwelling indices in the California Current region. *Coastal Oceanography and Climatology News* **1**(2): 13.
- Parrish, R.H., and A. Bakun. 1979. Strong rockfish year class predicted to enter California recreational and commercial fisheries in 1981. *Coastal Oceanography and Climatology News* **1**(3): 33-34.
- Bakun, A. 1975. Wind driven convergence-divergence of surface waters in the Gulf of Alaska. (Abstract 0-77) *EOS-Trans. Amer. Geophys. Un.* **56**: 1108.
- Bakun, A. 1974. Properties of 6-hourly upwelling index series off western North America. (Abstract 0-3) *EOS-Trans. Amer. Geophys. Un.* **55**: 1132.
- Bakun, A. 1972. Climatology of upwelling off California. (Abstract 0-30) *EOS-Trans. Amer. Geophys. Un.* **52**: 850.
- Bakun, A. 1972. The PEG upwelling index off Oregon during 1972. CUE Notes (Newsletter of IODE Coastal Upwelling Experiment), No.10.

UNPUBLISHED FORMAL REPORTS

- Bakun, A. 2001. "One fish, two fish, red fish, blue fish"—heuristic cartoons illustrating the operation and some implications of the school-mix feedback mechanism. Paper made available to participants at the IRI/IRD/SPC Workshop on Application of Climatic Data to Fisheries, Noumea, New Caledonia, Nov. 2000. 12 pp (color photocopy).
- Bakun, A. 1999. Some conceptual and hypothetical considerations offered as input to discussions of an ichthyoplankton and zooplankton monitoring in support of fisheries management in the northern Benguelan marine ecosystem. International Workshop on Zoo- and Ichthyoplankton Monitoring in the Benguela Current Ecosystem off Namibia. Swakopmund Namibia, 17-19 February, 1999. 8 pp.
- Bakun, A. 1998. Global Climatic Teleconnections and Fisheries Ecology: A Perspective (with Comments on the Benguela System). International Symposium on Environmental Variability in the South-East Atlantic, Swakopmund, Namibia, 30 March - 1 April, 1998. 10 pp.
- Yoder, J., A. Bakun and D. McGillicuddy. 1998. Structure over Large Distances and Long Times. OEUVRE -- Ocean Ecology: Understanding and Vision for Research. Biological Oceanography Program, National Science Foundation. Posted on Internet at http://www.joss.ucar.edu/joss_psg/project/oce_workshop/oeuvre/
- Shannon, L.V., J. Alheit, A. Bakun, T. Gammelríd, J. Hunter, M.J. Orren, M.J. O'Toole, and P. Woodhead. 1998. Strategy for Environmental Research and Monitoring for Ministry of Fisheries and Marine Resources, Namibia 1998-2002.
- Troadec, J.-P., A. Bakun and A. Cruzado. 1997. Evaluation of Instituto de Investigação das Pescas e do Mar (IPIMAR). Report of the International Evaluation Committee to the Portuguese Ministry of Science and Technology. Lisbon, Portugal. 92 pp.
- Bakun A. , A. Cruzado and J.-P. Troadec,. 1997. Evaluation of Instituto Hidrográfico. Report of the International Evaluation Committee to the Portuguese Ministry of Science and Technology. Lisbon, Portugal. 4 pp.
- Gommes, R., G. Farmer and A. Bakun. 1997. An El Niño - Southern Oscillation primer (ENSO) - August 1997. FAO, Rome. 7 pp.
- Bakun, A. 1996. 5. Conclusions: A brief analysis of scientific issues. pp. 12-16. In: T. Do Chi and D. Kiefer (eds.) Workshop on the Coastal Pelagic Resources of the Upwelling System of Northwest Africa: Research and Predicitons. Field Document 1 - FI:TCP/MOR/4556(A). FAO, Rome.
- Bakun, A. 1996. Update on understanding the Effects of Climatic Changes on Fishing. International Fishmeal and Oil Manufacturers Association, Annual Meeting, Cape Town, South Africa , November, 1996. 13 pp.
- Bakun, A. 1994. Preliminary Discussion: Development of Appropriate Oceanographic Inputs to a Comprehensive Research/Management Programme for a Mesopelagic Fishery in the Gulf of Oman. Working Paper W94/2. Working Group on Mesopelagic Resources, Gulfs Committee for Fisheries Management and Development. 6 pp.
- Csirke, J. and A. Bakun. 1993. Aspectos principales del ciclo vital y reclutamiento del calamar *Illex argentinus* y su posible relacion con procesos ambientales en el Atlantico Sudoccidental. For: X° Simposio Cientifico y Tecnológico de la Comisión Técnica Mixta del Frente Marítimo, Montevideo, Uruguay, Nov-Dec'93.
- Alheit, J. and Bakun, A. 1991. Reproductive success of sprat (*Spratus spratus*) in German Bight during 1987. Theme session on the Sardine-Anchovy Recruitment Project (SARP). 79th ICES Statutory Meeting, La Rochelle, France, 26 September-2 October, 1991. 12 pp.
- Bakun, A. , Alheit, J. and Kullenberg, G. 1991. The Sardine-Anchovy Recruitment Project: rationale,

- design and development. Theme session on the Sardine-Anchovy Recruitment Project (SARP). 79th ICES Statutory Meeting, La Rochelle, France, 26 September-2 October, 1991. 18 pp.
- Bakun, A., Roy, C., and Cury, P. 1991. The comparative approach: Latitude dependence and effects of wind forcing on reproductive success. Theme session on the Sardine-Anchovy Recruitment Project (SARP). 79th ICES Statutory Meeting, La Rochelle, France, 26 September-2 October, 1991. 12 pp.
- Alheit, J. and A. Bakun. 1989. Fishery science and oceanographic research in the Mediterranean. Paper prepared at request of FAO for distribution at: The 19th Session of the General Fisheries Council for the Mediterranean (GFCM), Livorno, Italy, February, 1989. 12pp., 12 figs., 5 tables.
- Bakun, A. 1989. Global warming and the coastal ocean upwelling system. University of California Global Climate Change Workshop No. 1 "Global Climate Change and Its Effects on California", Davis, CA, July, 1989. 7pp.
- Smith, P.E. and A. Bakun. 1989. Lasker gates between mixing events from the French border region to the Canary Islands - 1988 and 1989 and interannual and seasonal changes of the wind indices 1967-89. Proceedings of the Joint Meeting of the Spanish-Portuguese SARP and the IOC Ad-hoc Expert Consultation on SARP, La Jolla, CA, 30 October - 3 November, 1989.
- Bakun, A. 1987. Applications of maritime data to the study of surface forcing of seasonal and interannual ocean variability in eastern boundary regions. Ph.D. Thesis, Oregon State University, Corvallis, Oregon, USA. 226 pp.
- Bakun, A., M. Hayes, K. Henry, D. Huppert, and R. McInnis. 1983. Preliminary report on effects of 1982-83 El Niño on Pacific Coast Salmon Fisheries. 23 pp.
- Bakun, A. 1979. Coastal meteorological data needs for fisheries management. AMS Workshop on Environmental Data in Coastal Regions, Boston, Nov. 1979. Committee on Meteorology of the Coastal Zone, American Meteorological Society . 8pp.
- Seckel, G.R., A. Bakun, and R.H. Parrish. 1979. Climate impact on the fisheries of the eastern North Pacific. Proceedings of the 14th Pacific Science Congress. Khabarovsk, USSR.
- Bakun, A., and W.B. McAlister. 1969. Vertical circulation in the North Pacific Ocean. International North Pacific Fisheries Commission Document No. 1194. 22pp., 10 figs., 2 tables.