While both regions are located within the Humboldt Current System (HCS), there are significant differences on how they are affected by ENSO. In Sechura (North), El Niño is synonymous with devastating floods and negatively affects scallop fisheries while favouring fishermen extracting migrating tropical species. In Pisco (South), the same climatic event results in a scallop boom, causing a short-lived economic wellbeing for diving fishermen while small pelagic ones are negatively affected. Climate variability can thus results in "winners" as well as "losers", these differences being accentuated by differential social, economic and political environments. However the research findings suggest that common attributes to the response of communities can be identified across study areas even though impacts might differ. These attributes are not only related to what people actually did in terms of their changing livelihood practices, but also to the role of institutions and social networks in promoting or inhibiting adaptation to climate variability. The research provides one of very few detailed studies on the impact of ENSO events on artisanal fishing communities in Peru and the results presented will contribute to the challenge of designing adaptive management strategies in a highly fluctuating and uncertain environment such as the HCS. This research is part of the project CENSOR which aim is to understand the implications of climate variability on the artisanal fishing sector in Peru and Chile (www.censor.name).

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HCS060 - Sustainable fisheries through improved management and policies

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Peru's fisheries resources support one of the country's most important economic activities and provide fundamental environmental services. The Peruvian anchoveta remains the largest single stock fishery in the world. The occurrence of El Niño Southern Oscillation drives extreme fishery resource volatility. Combined with the expansion of fishing and processing capacity and deficient sector governance, this volatility has resulted in resource depletion, extensive marine ecosystem change, widespread environmental degradation and dissipation of resource rents and loss of socials and economic benefits. Meeting these challenges will require an open and transparent participatory process to: i) substantially increase net benefits from the sector by reducing capacity and effort in the fishing sector in line with natural productivity and maximum economic yield; ii) improve sector governance and equitable benefit distribution; iii) issue effective environmental regulations with independent oversight of enforcement; iv) strengthen the sectors research capacity to support an ecosystem approach to management of fisheries and coastal resources; v) establish a system of Marine Protected Areas; and vi) revise and modernize the sectors regulatory framework.

Invited paper: HCS216 - Interdecadal variability of anchovy abundance and overcapacity of commercial fleets in Peru

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Keywords: Fishery management; fishing effort; overcapacity, interdecadal scale

Historical data of catches and conventional stock abundance estimates during the last decades indicate that pelagic fish populations inhabiting upwelling ecosystems undergo large interdecadal variations in abundance which amplitude is equal, if not higher, than the amplitude of interannual variability. Paleontological records of scale deposition in anaerobic sediments indicate that this interdecadal variability existed long before exploitation. The pattern of variability displays alternation of periods of high and low abundance that were termed "pseudo-cycles" because their periodicity is irregular. The mean period varies between 20 and 90 years according to the population (species and region), and for a given population the internal variation of the period is in the order of 30%. In the case of the Peruvian anchoveta population, the mean duration of the cycle is 40 years but it varies at least between 30 and 60 years. This cycle to cycle variability is difficult to estimate and even more to predict because 1) few realisation of the pseudo-cycles are available (here only 3); 2) the process(es) responsible for this pattern of variability are largely ignored; 3) the recent global warming might impact on the anchovy population dynamics.

Small pelagic fisheries, as any other fisheries, suffer from overall overcapitalisation due to many factors such as the tragedy of the common and the positive feedback between overexplotation and overcapitalization (Ludwig's ratchet - Decrease in abundance due to exploitation requires more effort,

therefore more capitalization, to catch the remainder of the stock, which then declines further, and so requires more effort (Ludwig, 19xx; Mangel et al. 2000). But small pelagic fisheries suffer from an additional overcapitalisation problem, which is the phase displacement between investment and fish abundance (Fig. 1). Because there is a lag between profit and actual realisation of investment (accumulation of benefits, decision making process, factory or boat building delay), investment remains very high when the exploited stock enter in the declining phase of their interdecadal pseudo-cycle. At that time, a large part of the heavy investment are not yet redeemed and must be either reformed, sold at low coast or maintained at expense in expectation of a better period that is likely to be waited for decades. Here we document this situation in the case of the Peruvian anchoveta fleet from a bibliographical review of economical reports on investment/disinvestment and from the presentation of new evidences of overcapacity of the fleet and processing factories (indices).

Presently the anchovy stock of Peru is a state of high abundance since the end of the 80s, despite some strong interannual variability due to El Niño events. Therefore a decrease in abundance is expected within the next few years. Due to the present overall overcapacity of the pelagic fleet worldwide (including Peru at present time), it will be difficult this time to sell boats to other countries as during the previous stock collapse during the 70s. Therefore a crisis with high economical and political tensions is expected. In order to limit its effect a drastic reduction of the fishing and processing capacity is recommended. Ideally this capacity should be at least halved. The minimum but urgent measure is to prevent new investment.

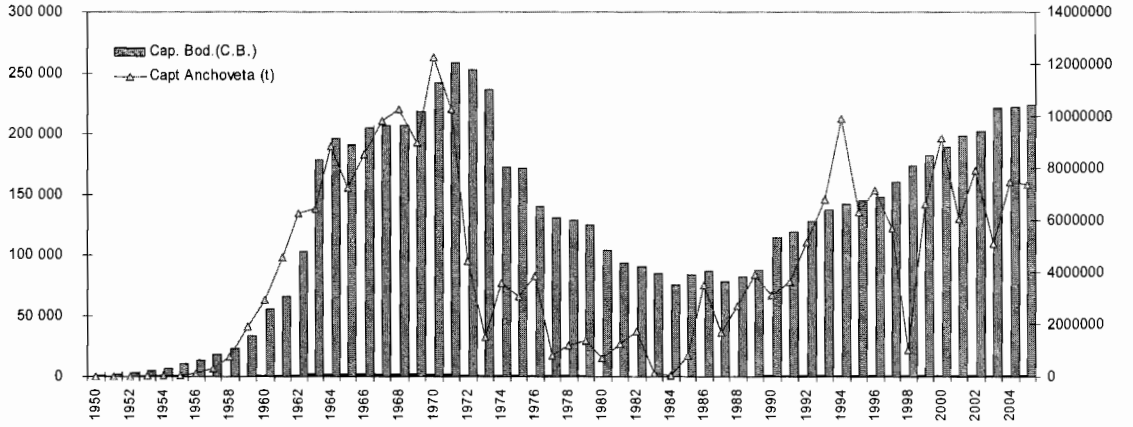

Figure 1. Time series of anchovy catches and fleet loading capacity (CB).

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