Plenary: Regional Impacts of Fortune and Favor

*What aspects of this scenario are particularly relevant for **Southern California**?*

- Closest to reality for this moment and next 2-3 years, as far as rebuilding stocks, the marketing situation has turned on its head due to tariffs. Marketing has been strongly affected by covid
- CPFV fleet HMS fishing has been exceptional, especially for P bluefin, wahoo, dorado, blue marlin
- For CPS fisheries precautionary management has excluded access to finfish stocks. But the markets need sustainable volume and our landings have been a shadow of traditional level recently. Maintaining access to CPS in the water right now is very important -- fishermen are seeing lots of sardines but can't catch because it's the southern stock. Any stock in waters below 62 degrees is subtracted. Species shift north is going to be a significant problem, including squid; the SC fleet will have diminished opportunity but we won't have access to fish shifting up from Mexico waters. Looking for help from the Council. Continuing constraint on our markets. Need more flexibility and science improvements.
- We have seen good fishing for HMS and other pelagic species. But nearshore species (e.g., barracuda) aren't doing as well as the pelagic species. So half day CPFV trips don't fare as well as long range trips. So it's uniform across all species.
- Related to less international trade; some bright spots in SC such as San Diego facilitating a lot of direct marketing; waterfront revitalization plays into that.
- Impacts on marketing and trade = we're already in it.
- SoCA could be in a good place in terms of range shifts
- SoCA is an extra prominent place in terms of extremely small scale fishing including semi-subsistence..
- More emphasis on eating local -- call out to pier and jetty fishing
- There is a long way to go on permitting and legislation to facilitate direct and local marketing.
- Fractured international relations could particularly affect HMS since the science and management occurs at the international level
- Climate shifts bring along ecosystem shifts as well, as much as we can loose fisheries there are also opportunities for new fisheries to be created. Like mentioned our geographic location really puts us in a center spot for the "best of both worlds" kind of fishing. With a shift in fisheries we could be either more dependent on other fisheries or become more independent.

*What parts of fishing or specific communities in **Southern California** might be most affected by developments in this scenario?*

- Different CPFV fleets and having to go offshore presents a challenge as far as maintenance and regulatory constraints. Recent tragedy of vessel fire will likely result in more regulation. Some boats will fall out of fleet and there's not the money to build new vessels. Fuel prices also increase costs if having to go far offshore. Covid social distancing is also an issue
- The smaller processors will be most impacted. The emphasis on direct marketing will cut them out and they will have to rely more on imports. Legislative developments will affect communities across the board.
- Fisheries that depend on international trade like spiny lobster, or processed overseas, will be affected if international trade is interrupted.
- Even the large processors will be affected if access is limited.
- The scenario indicates problems with weak stock management, which could be affected by ecosystem based managed; if the Council could adopt a more flexible approach managing on a complex level; consider stocks to coming up from Mexico
- Collaborate with industry on the science

*What specific storylines could you imagine happening in this scenario in **Southern California**?*

-
-

Plenary: Regional Impacts of Blue Revolution

*What aspects of this scenario are particularly relevant for **Southern California**?*

- So. CA has been identified as an aquaculture area, which will pose challenges particularly for CPFV fleet creating competition
- Biosecurity - spread of pathogens from aquaculture farms, and they may thrive more in warm environment
- Another challenge is military operations and as Navy advances blue engineering they are doing more operations that exclude fishers. Example of autonomous vehicle testing, exclusion from San Clemente Is. area.
- Commercial fleets will be impacted too by AOAs --
- also wind energy facilities will preclude fishing.
- Other types of energy facilities, which could have ecosystem impacts
- There are projects both at northern end of SCB and north…
- Transboundary issues are also relevant to US-Mexico, especially if stocks move across that boundary
- [Could be FaF] - greater pressure on coastal useful could affect success of local marketing. The benign climate could help with local markets, people will still visit them in winter months.
- This scenario worse than FaF in terms of consistent supply. As stocks shift north, there are regulatory constraints on the purse seine fleet to fish in those waters. And no options to obtain state limited entry permits. This will really hurt local processing, example of San Pedro berthing permits. All of this will need more regulatory flexibility - federal and local. Serious competition for port access -- how to do maintain traditional uses?
- If less interest in commercial fishing, there will be less investment in fishing related port infrastructure. That will lead to a loss of traditional fishing knowledge
- [FaF could spur more investment in fishing infrastructure]
- Example of Ventura mussel farms as a means to increase investment in port infrastructure; something similar could happen in San Diego [possible silver lining]

*What parts of fishing or specific communities in **Southern California** might be most affected by developments in this scenario?*

- Losing access to squid

- So. CA has a lot more small boat fisheries… and prevailing winds allow access to the islands; it's almost always coming off our beam. This region will favor those technologies for powering vessels such as wind and electricity. [State/national policies for net zero carbon.]

What specific storylines could you imagine happening in this scenario in ***Southern California****?*

- Marine mammals and sea turtles impose constraints on HMS fisheries. And HMS fisheries are targeting transboundary stocks we see a lot of importance. An uneven playing field in terms of regulations of foreign fisheries versus domestic
- Lack of regulation in foreign fisheries could hurt protected species stocks, creating a vicious circle -- although greater international cooperation could address this
- Legislative actions not based on concerns of harvesters or subject matter experts; in whose interest are those actions taken? How to connect?
- As marine mammal stocks continue to increase - possible interactions with fisheries (trap, etc) - it may have negative consequences on those fisheries - ie what the Dungeness crab fishery is experiencing this year,.
-

Plenary: Regional Impacts of Hollowed Out

*What aspects of this scenario are particularly relevant for **Southern California**?*

- Fish as boutique food … [Hubbs aquaculture operation for hamachi] High value low abundance fisheries a very real possibility. A $100 restaurant dinner for sardines. is another example of this possibility.
- Only markets that are very adaptable will survive. They will need to be flexible to process/market small volumes of different species
- Population density and gentrification on coast will add an extra level of pressure; coupled with changing consumer tastes will have a big impact ("fake meat" etc.) Sea level rise will also put pressure on coastal infrastructure. [Could be true for other urban coasts, Bay Area, Puget Sound]; impact on direct marketing
- Attracting new folks into commercial and recreational fishing is difficult. How many people will be ready, willing and able to jump into this industry/pastime? True in all scenarios but really brought into focus in this one. Particularly acute.

*What parts of fishing or specific communities in **Southern California** might be most affected by developments in this scenario?*

- For CPFVs this will be extremely difficult because low catch will reduce demand
- Wetfish fleet has produced the majority of commercial seafood, based in San Pedro and Terminal Island. But these volume fisheries will not survive on very low catch limits. Economic importance of squid. Loss of fishing infrastructure, especially San Pedro.
- This scenario cold eliminate the CPFV fleet -- anglers monitor closely the catch and decide whether to go; also much fishing occurs in Mexico waters.
- HMS fisheries, highly variable conditions will particularly affect their occurrence.
- Further thought on Hollowed Out, related to Barb's comment: If local availability of popular species becomes less predictable, the higher prices which result when local catch declines may translate into increased demand and dependence on imports.
-
-

*What specific storylines could you imagine happening in this scenario in **Southern California**?*

- There is the possibility of fishing species to extinction as the fish and collapse of ecosystems as fish will be impacted from conditions from Climate Change which will be further exacerbated with more competition from fishermen and wildlife. Additionally, wildlife will have difficulty adjusting to extreme conditions due to lack of food. For continued survival, populations of wildlife will have to rely upon the good years of breeding as they may not be as successful during years where abundance is lacking. If this occurs over the long term, populations of marine wildlife will decline and face extinction.
- More offshore fishing in federal waters searching for fish -- an increase in fishing effort presents regulatory challenges
-
-

Plenary: Regional Impacts of Box of Chocolates

*What aspects of this scenario are particularly relevant for **Southern California**?*

- Flexibility is key. CPS fisheries fish on a complex [switching target]. Managers will have to develop flexible approach and work with industry on assessing stocks.
- Productive waters will be pushed against the coast, resulting in fishing nearshore; science will have to account for that.
- HAB/DA intensified will affect some fisheries more than others. D. crab clearest example.
- Vessel design -- at present vessels are specialized versus the old days of "combo vessels". This scenario may favor that approach combined with fuel efficiency.
- CPFV fishery, we've seen variability from year to year, vessels drop out in lean years and then capacity is limited when the fishery bounces back.
- Many of rules and regulations might have to be rewritten to help fishers adapt to possible new target species movement. Like was mentioned, more interactions with non targeted/protected species can be possible. This could lead to new gear design etc.
- For biologists and management in this region and elsewhere, a lot of difficulty and challenges in monitoring populations of fish and impact on populations if fish are using different geographical areas and behavior where fish are occurring is unpredictable. Collaborative management efforts outside of this region would be needed to ensure that sustainable fishing is occurring if fish not typically seen in this region show up in this area.
- On Box of Chocolates, if we're expecting more variability and more unusual events, does that make us want to think even more carefully about where alternative ocean industries (aquaculture, energy) occur? In other words, will our target species be moving around enough that we will think about needing to retain larger areas available to fishing? This may be a particular challenge in So. CA. Always seems to be whether new competing uses are going to impact existing uses, and how to reduce that impact but, it may be that they cut off existing uses under a shifting baseline
- Will wind farms act as FADs?
- How will more frequent/severe HABs affect fisheries? And if it closes down fisheries what do we do with those fishermen? What do we do for specialists when their fishery goes away?

- Already see commercial fishery dying over the past 20 years. And it will be a problem down the line. Permits are limited making it hard to jump in and out of different fisheries. Also, needing to switch between different gears is difficult - cost, etc.
- General observation based on Gary's comments (above): Greater uncertainty in fisheries may require a more flexible and rapid response regulatory regime in order to avoid inadvertently killing off fishing opportunity when conditions require quick adjustment.
- NEPA analysis - programmatic approach could be used to evaluate more flexible approaches. Perhaps more flexibility to make “in-season” changes.

*What parts of fishing or specific communities in **Southern California** might be most affected by developments in this scenario?*

-
-

*What specific storylines could you imagine happening in this scenario in **Southern California**?*

- Managers consider stock complexes and manage accordingly.
- Modernizing data collection -- example of electronic logbooks in CPFV fleet -- technologies to allow faster reaction times for fisheries and managers
- Our region becomes more similar to Mexico. This will require more cooperation with Mexico, because these will be the opportunities in the future. Much more dealing with transboundary management.

Other thoughts (not necessarily BoC):
Maintenance of processing capacity.
What about a world with greater bacterial resistance affecting fish products?
We are in an energy transition. It’s happening fast on land, especially in CA. It will affect power systems, refrigeration, and any other energy systems

Breakout 1: Implications for communities in Southern California

For each scenario:

1. *What will communities in SoCal be most concerned about?*
2. *What's happening that provides a potential upside for communities in SoCal?*

fortune & favor

Question 1:

- Nearshore fishing less attractive with the decline of kelp forests and related decline of fish species that use that habitat; as water warms, kelp recovery will be more difficult
- May need larger vessels to access farther offshore spp, possibly more of a distinction between nearshore and offshore fleets? Maybe loss of smaller vessels and loss of access to shorter trips?
- Drought may affect amount and types of nutrient runoff, consequently affecting nearshore stocks
- Increased tourism demand from folks escaping hot interior areas -- good for sport fishing, but increased competition for local resources
- Management needs to embrace new species (e.g. coming from south)

Question 2:

- More people interested in going fishing in the summers, when they're escaping inland heat

box of chocolates

Question 1:

- Becomes even more stressful to follow changing markets, adapt management processes
- More intense need for scientific monitoring so that we know whether species populations are increasing/decreasing or just moving; need for scientific flexibility in SoCal Bight

Question 2:

- Fishing businesses that are able to be flexible, could become ever more creative about marketing their seafood, create a rising interest in wild-caught seafood, maybe create foodie/dining experiences in coastal areas.
- Creativity in marketing could keep supply chain moving but with variety of species (more than the traditional "salmon, tuna" categories)

- As niche seafood becomes more popular, more accessible to local buyers, possible that prices on niche seafood comes down?

blue revolution

Question 1:

- Overall species decline is a concern, certainly in our ability to just have our fishing businesses survive
- Greater need to monitor stock status to assess whether historic West Coast species are surviving in their new/changed habitats/environments
- Need to revise and update our international relationships to account for different movements in species we manage -- current relationships may not address some of the challenges our species will face
- Possible big shift away from the seafood arm of food security -- fancier offshore species still available, but nearshore and frozen fish fillet species, or pier fishing species may be less abundant in SoCal (social equity concerns)

Question 2:

- Maybe brave new tech world will benefit us with more/better data that will help us better monitor our managed stocks
- We currently fish in Mexican waters for tropical species, so having those species move to CA/US waters would help us in requiring fewer and less complex permits for American boats
- Could new offshore energy areas serve as de facto MPAs that help rebuild/maintain declining stocks?

hollowed out :-(

Question 1:

- Losing these industries would also be a giant knowledge loss, any new fishermen coming in would come into a really grim situation, possibly not understanding what we've had in the past.
- Loss of infrastructure will be critical, especially b/c there's already a lot of gentrification pressure, so where do ocean-dependent industries go, just disappear?
- If we're not able to track species/populations, risking extinction and ecosystem collapse
- Popular uprisings based on loss of food security (collapse of public faith in governance)?

Question 2:

- Reduced ocean use, lower pressure on ocean, possible for recovery of some species that are most resilient to climate change? (This is a stretch.)
- Housing prices will decline
- Could aquaculture succeed in this scenario?

Breakout 1: Implications for Harvesters in Southern California

For each scenario:

1. *What will Southern California Harvesters be most concerned about?*
2. *What's happening that provides a potential upside for Southern California Harvesters?*

Challenges:

- Political climate
- Ability to adequately access stocks
- Loss of harbor infrastructure because landing volume doesn't justify allocating to fisheries including cold storage space. Volume fisheries /consistent supply underpin infrastructure provision
- Slow change and calm climate means more coastal development, gentrification crowds out fisheries (could be good for CPFV)
- Across scenarios, interannual fluctuations in abundance a reality already, it is a challenge for management, could become more extreme
- Self marketing technology to maintain power and freezers at home and ability to cut your own product project well into the future if certain regulatory constraints are relaxed.
- For CPFV external problems such as depressed economy or emission reduction requirements
- Climate induced interactions e.g. D crab fleet - humpbacks; management constraints
- Increasing struggles due to diminished harvest opportunity; northward range shifts limiting access; all sorts of follow on effects

Challenges:

- Having the flexibility to switch among targets and modify fishing strategies frequently
-

Opportunities:

- Golden opportunity for ecosystem based management focusing on stock complexes so fisheries can focus on abundant stocks when they are available. Ability to "roll with the punches."
- Some ports will have more opportunity based on experience with marketing different species.
- A way to expand the number of LE permits during boom times
- Call on the many top tier research institutions in So CA to find solutions to variable conditions
- Create/preserve open access fishing opportunities
- No CA fleets shift to more protected ports such as San Francisco or the SCB? But could be an opportunity in terms of rationale for more infrastructure

Cross-cutting thoughts

- Flexibility
- Lack of new entrants
- Flexibility in assigning quotas

- Stock variability

Opportunities:

- We are used to managing in this sort of scenario even with known challenges
- Pursuing subtropical/HMS, good prospect for obtaining live bait
- Most fishermen will be able to make ends meet; ports will be able to make investments in infrastructure
- Rockfish stock rebuilding will create more opportunity in combination with local markets, +affordable permits
- Things will go along fine except for politics hindering us; SCB is already really variable so maybe climate change won't be that different
- Science improvements, more adaptability, hope for more access to fish, growth in direct marketing for small scale fisheries but doesn't help volume fisheries; need to be alert to changing social values; overall benefits

- Need more support for regular stock assessments, and related science improvements
- Need to change the minds of the protectionists to allow more access to fish ~ the political climate ~ conversely, figure out a way to get the environmentalists to have "skin in the game" -- appeal to common interest in consuming seafood and possibility of making it a priority

Challenges:

- Ocean spaces used up for other uses; wind projects on edge of SCB; area closures for offshore rocket launches - uses we can't foresee that take up ocean space
- When major infrastructure gets diverted harbor districts will not be able to maintain it specifically for small vessels, less opportunity for a fishing opportunity
- Global protein demand spikes foreign fisheries and imports adversely impact domestic
- Transfer effect per above
- [Marketing new species]
- Increase in military testing taking up ocean space
- Fishing will not be allowed around floating structures due to anchors and cables [could we figure out a way to allow it?]
-

Opportunities:

- Upside of technology: one-day shipping of product; pressures will force people to adapt to more efficient systems suited for small producers
- New species appearing could present opportunities
- Progress in electronics and science leads to better understanding of when and where fish occur
- Increased rockfish availability backed up by ROV science to know which stocks are where
- Round herring is a CEBA1 species that shows up occasionally - demonstrates need for flexibility [Round herring are pretty common off San Diego nowadays, however they make lousy live bait as they usually don't survive in our bait tanks]

Challenges:

- Extreme weather events/tides destroying wetlands; resulting of armoring of coastline has harmed nearshore fisheries; will there be "staged retreat" for multi-million dollar properties or more armor
- Lost of habitat such as kelp forests and rocky reefs impacting nearshore fisheries
- Current analogy is Fort Bragg nearshore

Opportunities:

- Have to maintain to keystone species; send a life buoy to remaining species
- Avoid "long slow death" of fisheries; have to choose what infrastructure to save, and for what fisheries (we lose almost all commercial fisheries with many lobster, some salmon and live bait surviving)
- Extreme shocks could motivate radical action -- "pickled pyrosomes"
- Creatively in developing new markets for unused but periodically abundant species (e.g., red crab)

- Offshore facilities could function as FADs, habitat for rockfish; question of whether they can be accessed
- Tuna grow out pens offer a good example of challenges and opportunities of offshore facilities: worked great as FAD until fishing vessel ran into it!

Breakout 1: Implications for fishery scientists / researchers in Southern California

For each scenario:

1. *What will scientists be most concerned about?*
2. *What's happening that provides a potential upside for scientists?*

Fortune and Favor

Question 1:

- Similar to status quo (?) In that case, questions will be very similar to those of interest today; continuum of what is happening today, w/o major divergence from current questions of interest
- Might be a bit different; continued steady warming under this scenario => more species coming up from Mexico might require more international collaboration and agreements. More discussion of who owns rights to which stocks. Only just beginning, and will become more challenging over time if range shifts become more pronounced. Heatwaves like the recent one becoming more frequent could increase this dynamic.

- Upside to stability: not chaotic => predictable, planning for the future is more straightforward in this than other scenarios
- Long term, would have empirical evidence to back up that range shifts are occurring, if this in fact plays out.

Box of Chocolates

Question 1:

- Unpredictability tends to make science reactive to new developments
- Fewer point estimates; more range estimates that quantify uncertainty (case in point: what is the threshold for "overfished" or "overfishing" if the results of an assessment are stated as a probabilistic range?)
- Challenges of communicating and interpreting risk for management become greater with increase in uncertainty
- Perceptions gap between science findings and fishermen's experience may improve due to greater availability of information to fill knowledge gap
- Need for more flexibility and faster regulatory reaction times to changing conditions

Question 2:

-

- Need for innovative gears, bycatch mitigation techniques, help industry evolve to accommodate necessary changes
- How is gear developed here? Information on species behavior, in conjunction with current technology, inform fishing in a more productive, less detrimental way than current practices

Question 2:

- Currently don't have good valuation of community impacts of local markets. We don't currently have good information on direct/local markets and if they become more important in this scenario, getting that info will be more critical to really understanding impacts on fishing communities.

Blue Revolution

Question 1:

- Much of currently used science may need updating.
- Stock assessments are currently used for stock status determination; as conditions change, the data in the past may not be as useful for capturing the status quo.
- May see the ocean used in different ways by resources and user groups. E.g. is abundance suffering, or have fish moved elsewhere? A range shift might be misconstrued as a decline in abundance.
- Scientists are likely to be asked to determine the impacts of aquaculture and offshore wind energy development on fisheries.

Hollowed Out

Question 1:

- Scientists asked to provide greater resolution in terms of oceanic conditions
- Less money => less support for science => less work for scientists
- Less work for fisheries scientists, but more work for others who study the ocean
- Research on which stocks can be successfully exploited (and research on THOSE stocks)
- Given so much variability, where are we currently?
- How will food webs be affected is a question of interest under this scenario.

- Not familiar yet with the impacts of new technology on fisheries => need to research the impacts
- Greater international coordination, cooperation information sharing in the interest of understanding the world versus self-interested science by individual countries
- Range compression leads to more data available(?)
- If aquaculture is able to raise fish that are currently overfished, might reduce pressure on scientists to answer questions on wild stock status
- More competing uses in the ocean might make it harder for scientists to do data collection (e.g. due to areas with new dedicated uses becoming offlimit to NOAA research vessels)
- Likely more interest in a higher degree of spatial resolution in scientific conclusions

Question 2:

- Demand for new science may increase (e.g. shift to aquaculture science): more opportunities for scientists, given need for new science.
- New expertise may be needed to answer questions that were not part of the past discussion.

Question 2:

- More demand for ecosystem science (E.g. “Are we on the verge of ecosystem collapse?”)
- Economic expertise needed to quantify relationship between food web status and value of sustainable fisheries (or absence thereof)

Breakout 2: Potential actions for communities in Southern California

For each scenario:
*If you knew this scenario was going to be the future, what should communities do now? What should they consider doing in this scenario in future? (i.e. identify **actions** to prepare for this situation, to ensure it happens, or to avoid it happening).*

- make sure the science can support future needs in tracking status of stocks in the future
- fishing communities will need to develop suite of flexible approaches which will depend on accurate and informative science on abundance and stock health (eg looking at higher buffers in stock TACs) this may require higher tradeoffs between conservation and access
- more creative patterns for how we are managing species with the introduction of new species; while still maintaining conservative approaches for the current managed species
- look for opportunities to engage the fleet and improvise data collection; opportunities to fill data gaps; collaborative efforts with NGOs and the industry to fill key data gaps
- developing thresholds and limits for monitored and actively managed species (e.g., marine heat wave and appropriate actions that fisheries can take to respond beyond current management limits) adding in fishery independent variables into the process
- using possible benefits of deeper water provided by offshore development planning (i.e. aquaculture and

- Increase efforts or further develop new marketing of local available, familiar and mainly new seafood this will be critical for the greater fluctuations in availability
- includes the points in Fortune and Favor
- develop management structure that tracks the movement of stocks along the coast
- develop permit banking system for trading or loaning permits in specific areas while maintaining the overall harvest limits; provides more “real-time” accessibility to moving/ stocks (harvest trading; geographic banking units)
- provide more flexibility for fisheries to optimize fishing activity with changing conditions (e.g, crop insurance?? revisit established time frames for fisheries regulations -- permit timelines, stock threshold limits)
- need to build more bridges between the industry, fishers and management on improved public understanding of existing, changing future conditions and stock availability) [bigger role for Sea Grant]
- reframe the “climate change” discussion to remove the taboos to the idea
- consider the individual incentives for recreational anglers to find ways to increase their participation

wind energy) to see that they most benefit possible growth of nearshore kelp ecosystems
- fostering/improving relationships with Mexico to use in helping address immigration of southern species for future management
- improve or further develop marketing of local available, familiar seafood
- find ways to maintain the institutional knowledge of participants in all sectors to capture the shifting baselines [more Sea Grant involvement]
- baseline data (inventory) for current coastal infrastructure similar to the habitat maps to see current and future capabilities
-

- find ways to maintain the institutional knowledge of participants in all sectors to capture the shifting baselines [more Sea Grant involvement]
- baseline data (inventory) for current coastal infrastructure similar to the habitat maps to see current and future capabilities

- find ways to maintain the institutional knowledge of participants in all sectors to capture the shifting baselines [more Sea Grant involvement]
- baseline data (inventory) for current coastal port infrastructure similar to the habitat maps to see current and future capabilities
- consider forage fish roles and determine most critical domestic or international needs (eg aquaculture over direct consumption)
- double down on understanding baseline data for ocean zone planning and understanding the role and uses of fishing groups in those waters and ensure they are represented (commercial, CPFVs, small use fleet) so that their activities are accounted for and maintained prior to “yachtification”

- find ways to maintain the institutional knowledge of participants in all sectors to capture the shifting baselines [more Sea Grant involvement]
- baseline data (inventory) for current coastal port infrastructure (similar to the habitat maps) to see current and future capabilities
- develop permit banking system for trading or loaning permits in specific areas while maintaining the overall harvest limits; provides more “real-time” accessibility to moving/stocks (harvest trading; geographic banking units)
- increase our understanding of the ecological basis of the nearshore and offshore ecosystems to determine top down or bottom up importance to identify the least damaging opportunities for future consumption

- fostering/improving relationships with Mexico to use in helping address immigration of southern species for future management
- increase efforts to market immigrating species (to fishers, consumers)
- ensure that wildlife management is effectively protecting species dependent on fish species
- monitoring wildlife dependent on fish species
-

- consider forage fish roles and determine most critical domestic or international needs (eg. aquaculture over direct consumption)
- insure that wildlife management is effectively protecting species dependent on fish species
-

Breakout 2: Potential actions for Harvesters in Southern California

For each scenario:
*If you knew this scenario was going to be the future, what should harvesters do now? What should they consider doing in this scenario in future? (i.e. identify **actions** to prepare for this situation, to ensure it happens, or to avoid it happening)*

fortune and favor

- marketing
- co-management
- recruiting new commercial fishery participants
- reduce financial and social barriers to entry to fishery participation (government role)
- more balanced approach in international HMS management: EPO-WCPO, US-Mexico, example is Pacific bluefin allocation to US, need >=1,000 mt for ranching to be viable
- Look to Japan to understand managing across aquaculture, artisanal, industrial fisheries

box of chocolates

- More rapid and better access to data
- Use fishermen to collect data to support real time management;
  - involve them in survey design;
  - subsidize sensor installation on FVs (high res sonar for stock assessment) - involve fishermen in data interpretation (leverage knowledge);
  - customize installations fitted to vessel characteristics for consistent data (feasibility?) - corroborate with catch;
  - data confidentiality issues need to be carefully thought out
  - connect human observers with EM (observers focus on bio sampling (example of need for otoliths); EM focus on compliance monitoring)
  - innovation to automate interpreting bio samples (e.g. otolith reading)
- When new species appear ...

blue revolution

- Get fishermen involved in aquaculture; need to bridge the divide (overcome fishermen's perceptions); fishermen become the "sea ranchers"
- Work on market niche differentiation of wild caught versus aquaculture
- Harvesting shellfish growing on offshore installations
- Industry involvement in siting decisions
- Science-informed reduce unknowns about siting decisions
- Understanding Ensenada "fishery ecosystem": fish pens, artisanal fishermen, CPS harvesters
- Fishermen could get maritime jobs on other ocean sectors
- Explore methods to "close life cycle loop"
- Australia: bluefin ranching knowledge

hollowed out

- Fishermen involved in habitat restoration projects including invasive species (lionfish example)
- Fishermen reduce costs, new markets, new fisheries
- Innovating fish processing, preparation for new / unutilized species; examples include blue shark, opah
- Outreach to underserved communities to learn food preferences
- Food banks and other institutional settings (USDA policies)
- What if there's no fish to catch?
    - Fishermen could get maritime jobs on other ocean sectors
    - Affiliated onshore work
    - Ocean education

All scenarios

- Summarizing
    - marketing
    - co-management
    - recruiting new commercial fishery participants
    - reduce financial and social barriers to entry to fishery participation (government role)
- Marketing
    - Greater support for sustainable harvest among fishermen to find common cause with environmentalists and the public.
    - Take environmentalists out on fishing boats to get buy in.
    - Educate the public about what [commercial] fishing is about. Not just innovative gears but existing gears. (MB co-op example).
    - Similar to ecotourism; take the dockside market a step further into taking people out on the fishing boats. But issues with safety, liability.

    - The dockside market is a (safer) opportunity for the public to interact with fishermen.
    - Media role
    - Commercial fishermen could speak to recreational fishing groups
    - Aging of the fleet -- ag and land grant colleges; ways to bring young people into the fishery or make them aware. Junior colleges could have classes on commercial fishing and commercial fishermen could speak at high schools
- Co-management / citizen-science
    - fishermen are out on the water much more than scientists so there is a data gathering opportunity. Would require an education effort. Examples include the groundfish surveys that informed stock rebuilding.
    - Greater collaboration with scientists on research and management using the exempted permit process
    - Embed process: Document and allow for small fisheries targeting research when fishing
    - Manage at the complex level
- New entrants
    - Upsell fishing as a career, reaching out to disadvantaged communities; first have to get people interested in fishing; reinstate public perception that fishing is an honorable profession
    - It is very expensive to buy in many fisheries these days -- address the many barriers to entry; asset value of LE permits
    - Big money in fisheries is gone so it's hard to find crew; in many cases one-man boat
    - Government subsidies needed - engines and fuel / government buys permits …? (facilitates collective ownership)
    - Co-op approaches to permits -- community ownership of limited entry permits / catch shares / fishing limits (gear, quota, etc.); mechanism to transition to this model
    - New approaches shouldn't detract from existing investments
    - Collectively owned permit / quota leasing

Breakout 2: Potential actions for fishery scientists/researchers in Southern California

For each scenario:
*If you knew this scenario was going to be the future, what should scientists do <u>now</u>? (i.e. identify **actions** to prepare for this situation, to ensure it happens, or to avoid it happening)*

Fortune and Favor

- Need to be more aggressive in collaborations with Mexican colleagues (e.g. INAPESCA). If we expect more fish and local abundance in our waters, need to collaborate w/ international partners to determine allocation available to U.S. fleet.
- Species move north in predictable ways (e.g. albacore have moved from SD in the early 20th century to the PNW -- but not sure if this was predictable before it happened?)
- Change in general in fisheries science is complicated because it results in a period of uncertainty in the signal we think we are seeing; can be hard to get everyone onboard, given inherent uncertainty during period of change. Would be good to reduce the period of inaction due to the presence of uncertainty. Better statistical methods for quantifying uncertainty in the presence of limited data on changing conditions could help adapt to change.
- Predictive modeling could help determine if we are in "fortune and favor" world versus other scenarios.
- If we know we are in Fortune and Favor, scientists might be asked to consider what management

Box of Chocolates

- Need to be louder about need to fund research for EBM and EBFM b/c traditional stock assessment frameworks may be most vulnerable (to being not able to give good mgmt advice) under this scenario
- Evolve how we're using information so that we're not so focused on single stock management.
- May be a need for scientists to be able to communicate what answers these new capabilities can provide. Potential for scientists to deliver more real-time information; managers need to figure out how to make use of this effectively in management to quickly take advantage of what we are seeing now and hedge for significant change around the corner.
- New technology for better monitoring creates an opportunity for scientists to translate predictions and models into usable products for management, etc.
- Scientists are needed with strong coding skills for creating graphical user interfaces and analyzing large amounts of data
- Fisheries management needs to adapt and operate differently

measures would be helpful to maintain the best of all possible worlds..

- CalCOFI asked the same question: What are we doing now, and what do we need to do in the future? Stated goal: Translate data on hand into more user-friendly product (temperature, species, abundance, harmful algal blooms, etc). More “uncrewed” data collection going forward.
- Economics and social science considerations: More focus on local and direct markets to understand value and impacts of management on communities would be useful to assessing economic impacts.
- Emphasize the importance of management.
- Managers need to really focus on management that allows for flexibility and efficiency to address changing management needs; less management may be needed in this scenario.
- “Framework changes” rather than major management changes.

- Need to consider how to take volatility and uncertainty in conditions into account when determining regulatory limits, given underlying healthy stock conditions
- Need to be able to think more about how to adjust inseason management between Council meetings to maintain opportunity in the face of rapid change
- Adaptive management process at the Council is ongoing, taking into account what is known about stock conditions and how management should respond. But adaptive management is more about having a system of learning from changing conditions, and making management more responsive to rapidly changing conditions in a more automatic fashion. Truly adaptive management also involves taking on additional management risk in order to create more opportunities for learning from what is happening.

Blue Revolution

- Train / hire new expertise needed (e.g. aquaculture)
- Determine effects of new tech (aquaculture, offshore wind energy, etc) on ecosystem and fisheries
- Range compression suggests studying which species are affected, species ability to adapt to a smaller range, impacts on population size, behavioral effects, how different species are affected, possible need for marine protected areas or other management measures, affects on fisheries that target species whose ranges were compressed (e.g. would shrinking fishing grounds lead to more conflict on the water between fishing vessels and fisheries that have less potential fishing area available)
- Scientists need to consider changes in fishery-dependent data, and fisheries independent data may also be affected. May need to extrapolate into areas no longer available to be surveyed (e.g. if alternate use makes traditional survey techniques infeasible)
- New technologies may be needed to survey areas where traditional methods don't work
- Science may require more collaboration between groups of scientists who study different ocean uses (energy, aquaculture, capture fisheries, etc)
- International regulations need to be adjusted to balance opportunity for domestic fishermen in the face of regulation against foreign fisheries which may be regulated differently. Under this scenario, may be important to implement restrictions on imports from

Hollowed Out

- Consider work to more fully utilize the available catch (e.g. parts of fish not traditionally considered as food)
- Southern California's diversity and restaurant culture is conducive to experimentation
- Increase value of the catch through better marketing (e.g. to high-end consumers) or better product handling
- Need good science to keep management updated on the limits to which marine resources can be exploited in the face of deteriorating environmental conditions
- Less money for science, more money for other scientists, move towards uncrewed monitoring (get more resolution in monitoring of ocean conditions at lower cost)
- May be harder to send out crewed vessels to monitor ocean conditions, further supporting uncrewed approach
- From management perspective, need to think of "wild harvest" as a collective user group, rather than "swordfish fisherman", "groundfish fisherman", etc. The portfolio approach to fishing creates challenges for fishermen to adapt to greater uncertainty in which species are available.
- Need for food web / ecosystem approaches to support need for fishermen to move in and out of different fisheries in order to survive
- Flexibility between fisheries raises question of possible need for a pan-fishery permit that gives right to participate in multiple fisheries in years when primary species is in decline and another is on the rise

countries with less conservatively managed fisheries sooner rather than later.
- Need to balance regulations affecting import fisheries versus food security needs
- Need to consider the implications of range shifts (e.g. highly migratory species)
- What can be done now in international context? One option: Informally start conversations and collaborations with scientists in other countries with shared fishery interests…
-

- Congress has considered a federal infrastructure bill for years. West Coast distribution of communities into large urban areas interspersed with small ports with bad roads and poor digital resources begs question of what is needed for physical and digital resource upgrade to support market access to fishing ports.
- In Gulf of Alaska, some management policies inadvertently encourage fishermen to take out large loans to target certain species; consider the effect management regulations have on incentivizing fishermen to take on debt. Heavily-indebted fishermen invested in targeting a particular species or narrow range of species sets the stage for a future management dilemma, if changing conditions result in fishermen being unable to catch enough fish to service the loans.
- Encourage aquaculture development for native species with declining populations

Breakout 3: Looking Across Scenarios - Communities Priority Actions

Review your suggested actions across all 4 scenarios. What does this tell you about the priorities for Southern California communities to prepare for these futures?

Which suggested actions seem to work across all or most scenarios?

- Maintain institutional knowledge
- Science & data - understanding baselines and where we're going so we can monitor changes and identify tipping points and manage in real time (as much as possible); include non-standard data, e.g. historical/industry/traditional/citizen science knowledge
- Strengthen international relations, especially w/ Mexico since we'll be seeing more warm water spp.
- Marketing as a category of action - it will look a bit different depending on scenario
- Develop policy for shifting stocks to be more ready for when they do shift
    - Make access privileges geographically mobile to track w/ species movement
- Given offshore and shoreline develop, ensure all stakeholders participate in decision making so where such development is put is beneficial for the most
- Modernizing data sets/collection to support fast-paced decision-making

What actions are important to do because they prevent the worst-case situation?

- Make science a priority - to support good decision making and to prevent population collapses
- Develop policy for shifting stocks to be more ready for when they do shift
    - Make access privileges geographically mobile to track w/ species movement
- Strengthening international relations and collaborations
- Harvest insurance to prevent total industry decline

What actions are important because it enables a good future?

- Passing down institutional knowledge to new generations
- Following sea level rise guidance wrt infrastructure

- Continue to engage industry in management given likely fast-paced decision making;
    - ensure/increase transparency in decision making
- Diversifying fishing portfolios to allow for flexibility; and flexible management to allow for diversification

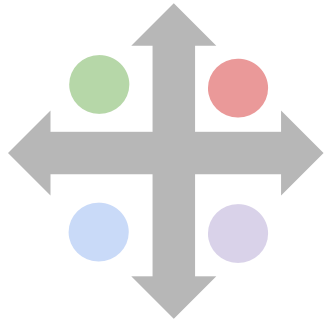
What actions help build flexibility to cope with the future?

- Diversifying fishing portfolios to allow for flexibility; and flexible management to allow for diversification
- Science & data - understanding baselines and where we're going so we can monitor changes and identify tipping points and manage in real time (as much as possible); include non-standard data, e.g. historical/industry/traditional knowledge
- Improving and modernizing data management including data collection and data distribution to support better decision making
- Ensuring proper infrastructure exists coast wide to accommodate range shifts

What should you stop doing given these scenarios?

- Avoiding acknowledging cause of potential scenarios
- Relying on single species to make a living
- Allowing for monopolization of fisheries by a few participants who are vertically integrated
- Expecting market stability
- Overfishing

Breakout 3: Looking Across Scenarios - Fishery Manager Priority Actions



Review all the suggested actions across all scenarios. What does this tell you about the priorities for Southern California fishery managers to prepare for these futures?

Which suggested actions seem to work across all or most scenarios?

- Build stocks' statuses to levels where we're not managing overfished species; however, we may not be able to avoid collapse of certain stocks;
- Have a management framework that allows for more inseason and interannual flexibility, use more data inseason, respond inseason;
- Broaden fishing portfolios -- how can management make it easier for fishermen to work in multiple fisheries?
- Understanding of stock status, dealing with international management, need to expect more interactions and engagement with multiple nations and within RFMOs;
- How can management foster an environment for innovative research: gear development, stock assessment advances
- EFPs take soooo long to develop new/revised gear types -- how can we speed that up? Also, can we make the EFP decision-making process more efficient, sort of narrow down the minutiae that the Council has to consider? Maybe Council doesn't have to weigh the merits of each application, but NMFS to develop a program under which industry participants could apply directly to NMFS under broad parameters, not getting Council into nitty gritty.
- Be more visionary about programmatic analyses, NEPA/ESA/etc; provide more education about how to deal with uncertainty and risk?
- Aquaculture -- if we're going to pursue that off our coast, how can it be designed so that it better incorporates local fishing businesses? Prioritize native species? Offshore tuna ranches fed with local forage fish?
- How can the Council rethink its own process so that it's less clunky -- are there actions that can be taken via short online meeting in between the ponderous five in-person meetings per year, hopefully shortening those in-person meetings?

- Permit banking, permit leasing, some sort of pan-Federal permit system so that when some stocks are low in some years, fishermen who target those stocks can flex into other fleets. Also need more flexibility between areas so that fishing effort can be moved around to where stocks are distributed in any particular year.
-

What actions are important to do because they protect us from the worst outcomes ~~prevent the worst-case situation~~?

- Outreach to underserved communities -- Council needs better outreach. What are food preferences, what is their vision for the future? How can we rethink the species and cuts of fish that we're marketing?
- Do more work towards ecosystem-based fisheries management, better understanding of ecosystem interactions to more clearly understand where and how species are moving, how productivity is changing?
- Management needs a foundational plan/belief/goal as far as what it is that they want to accomplish through management. They need that foundation to keep in perspective what their management actions are doing, prevent too much political influence pushing them from one action to another. <u>It is there, if we look at MSA, particularly OY sustained over time, connection with communities emphasized over time</u>. <u>Maybe the Council needs to come up with some big picture goal, state-of-the-union, key priorities at the beginning of each new management cycle, not just "we're doing it again because the calendar has moved forward," but what goals are we trying to meet this time?</u> (Take the NEPA **Purpose and Need** discussion seriously, not turn-the-crank.)

What actions are important because it enables a good future?

- Finish the Swordfish Management and Monitoring Plan
- Managers really need to start learning to think outside the box -- we've always done it this way, so we're going to do it that way again next year, push the boundaries of what we do or we're never going to find anything that works better than what we've been doing. If you don't do this, there's always going to be more work than there's time to do it.
- Look for more ways to work with SeaGrant, leverage relationships with/through SeaGrant

What actions help build flexibility to cope with the future?

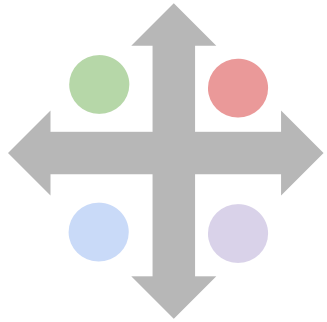
- All of the above
- Real-time monitoring, better data, monitoring equipment on the vessels
- Identify the science needs that will help us manage the way we want/need to manage, allow us to be flexible.

- How to take risks so that we're learning from those risks -- do we have the science in place to help us understand and learn from our risks?

What should you stop doing given these scenarios?

- Stop being reactive all the time and start looking ahead
- Stop giving in to political pressure and getting distracted from the main missions, stop taking actions without taking into full scope of fishery, or multiple fisheries, into account
- Stop taking single-species, or single-FMP actions without understanding the interacting effects of those actions on other fisheries
- Stop being so devoted to doing things the same way that we've always done them.

Breakout 3: Looking Across Scenarios - Fishery Science Priority Actions



Review your suggested actions across all scenarios. What does this tell you about the priorities for Southern California fishery scientists to prepare for these futures?

Which suggested actions seem to work across all or most scenarios?

- Communication and collaboration between scientists, managers and general public is essential. The fishermen and conservation authorities have a common interest in resource conservation, as sustainable management helps ensure the fisherman's source of livelihood.
- Work with industry to develop local markets, to reduce dependence on imports and improve domestic food security
- Managers and scientists need to share knowledge, rather than keeping it to themselves or within their own colleague groups
- NOAA Storytelling for Scientists workshop (last week) emphasized the importance of scientists writing their papers and communicating their findings in a way that reaches the general public at a level they can understand.
- Fishermen spend 280 or so days at sea per year, versus 20 days to two months at sea for scientists. Suggests the possibility of asking fishermen to assist in data collection, to support science and management decisions.
- Same approach used to encourage fishermen to trust NMFS observers is an approach that might be adapted to getting better communication between scientists and the general public and industry. Generally speaking, more connectivity between different parts of the fisheries science and management process could be helpful.
- New survey and data collection needs are an overarching concern across the four scenarios. E.g. Hollowed Out scenario may not only impede fisheries, but also traditional data collection. Different scenarios pose different data collection needs, and possibly different strategies for collecting data. New technologies mentioned in several scenarios could also help make management more agile.
-

What actions are important to do because they prevent the worst-case situation?

- Improved data collection and more flexible, rapid-response management can help head off the worst-case scenarios that may emerge with rapidly changing conditions. Need to ensure decisionmaking keeps up with the pace of change.

-

What actions are important because it enables a good future?

- Figure out how to bring back younger fishermen. Media can play a vital role. Have to make a convincing case that hard work, incursion of debt, and cost investment in starting a fishing career will be rewarded with fishing success and financial return on investment.
- Provide adequate funding to support the investment in new approaches. E.g. EBFM is not adequately funded to implement it well. Need to replace unicorns with qualified expertise. Also need to overcome inertia in current reliance on single-species assessment.
- Many other countries have effectively developed aquaculture to supplement wild harvest (e.g. salmon aquaculture in Norway, bluefin tuna farming in Australia).
- Management needs to change their approach for science to change. Leadership needs to be on board in order to support the necessary science. Consumers of science can help lead the direction of science producers to address emerging challenges.
- There is a great deal of ecosystem science going on, but managers are not sure of how to utilize the information in their decision process. It's not clear how emerging science should be incorporated into the management process. The current scope of decisionmaking is geared towards single-species management or related-species group management, rather than an overarching ecosystem approach.
- Council and regulatory process is set up to support Magnuson-Stevens Act approach, which mandates single-species management. May require new interpretations of existing law, or revision of laws to support a shift to ecosystem-based approach.

What actions help build flexibility to cope with the future?

- Need to plug ecosystem based management more, given evolution from single-species management to overarching, cross-species management of the ecosystem. Prioritizing people with a focus on ecosystem approaches is a first step.
- Scientists need to recognize fishermen as the primary users of fish stocks.
- Think of effects of pollution on climate change.
- Need to address regulation at an international level, not U.S. only. Hold other countries responsible for their environmental impacts; a U.S.-only approach to ecosystem and environmental impacts related to shared stocks creates an unlevel playing field.

- With range shifts, need to collaborate with Mexico; HMS requires wider international collaboration. The need for more extensive collaboration comes up across many scenarios. Existing collaborations should be adjusted to enable more rapid adjustment to quickly changing conditions.
-

What should you stop doing given these scenarios?

- Move away from studying individual species without considering ecosystem context. Move away from studying ecosystem without considering human context.
- Reconcile or replace traditional single-stock approach to assessment with emerging needs for ecosystem-based assessment approach. Many fishermen have multiple permits, which makes them intrinsically dependent on multiple stocks.
-

Breakout 3: Looking Across Scenarios - Harvester Priority Actions

Review your suggested actions across all scenarios. What does this tell you about the priorities for Southern California harvesters to prepare for these futures?

Which suggested actions seem to work across all or most scenarios?

- Attract new entrants
- Co-management and cooperative research - involve fishermen
- Adequate funding (for co-management and cooperative research)
- Better predictive modeling of interannual fluctuations in species abundance and availability to allow fisherman to advance plan
- Improve international relations (esp. Mexico)
- Government assistance of activities that support
    - science and management
    - To act proactively and avoid disaster
    - Upgrade sensing technology
    - Bridging financial support when stocks are at low levels
    - Financial support more generally
    - Infrastructure maintenance and upgrades -- (funding for dredging)
    - USDA support similar to that for agricultural products
- Innovate co-management -- more efficient meetings / decision making process! (pros/cons of online meetings)

What actions are important to do because they prevent the worst-case situation?

- Global shift to net zero carbon emissions including carbon sequestration. Explore enhancing phytoplankton
- Without disproportionate burden to any particular user group
- Job training for fishermen that would allow them to use their boats for other purposes
- Leverage fishermen's knowledge

What actions are important because it enables a good future?

- Permit flexibility, no matter how achieved - more socioeconomic considerations in decision making, especially in crisis situations
- New entrants: Job training and marketing of fishing as a way of life
- Marketing fish and fisheries to the public in a positive light (Seafood Watch program as an example)
    - Communicate what we are about and fisheries that do great things
    - Fishermen as conservationists
    - Product promotion - branding (similar to MSC but on a local/regional scale)
    - How do you beat the public perception that our fisheries aren't well managed? (e.g., terminology - overfished vs. depleted)

What actions help build flexibility to cope with the future?

- Longer term thinking about port infrastructure; for example, ports that may become unusable if storms are more frequent and severe. In the SCB Ventura is the main example but also Oceanside.
- Allow more species flexibility
    - e.g., allow some commercial harvest of recreational only species -- but avoid recreational fishermen selling fish (like Pacific bluefin
    - Newly occurring species
        - Wahoo
        - Southern sardine
        - Round herring
        - Incidental catch
    - Consistency of supply with variable catch (species)
- "Permit banks" -- community organizations (combine with co-management concepts)
- Accommodate more geographically mobile fishing strategies

What should you stop doing given these scenarios?

- Static permits / inflexible regulations
- Management workload